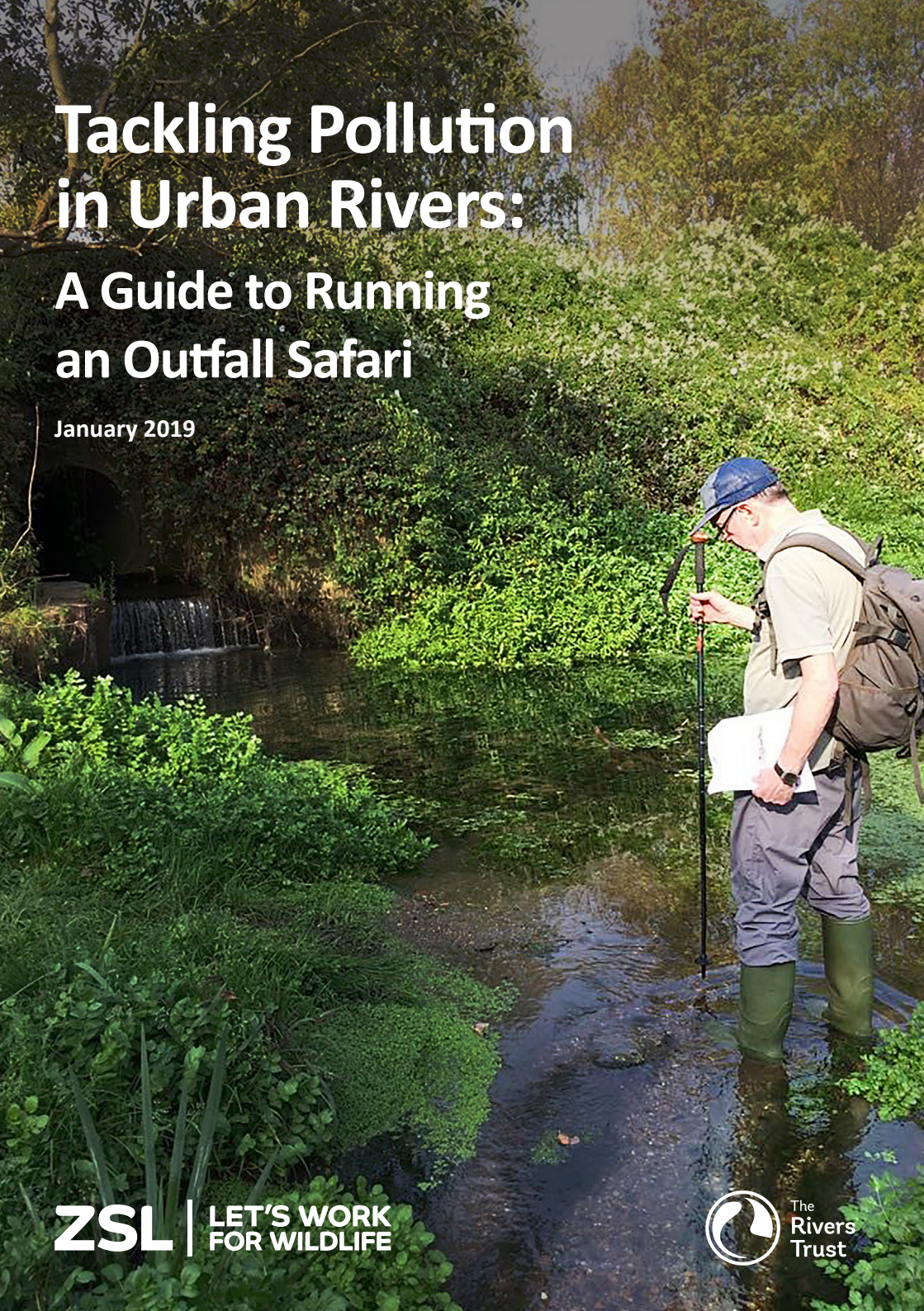
Tackling Pollution in Urban Rivers:

A Guide to Running an Outfall Safari

January 2019



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Background

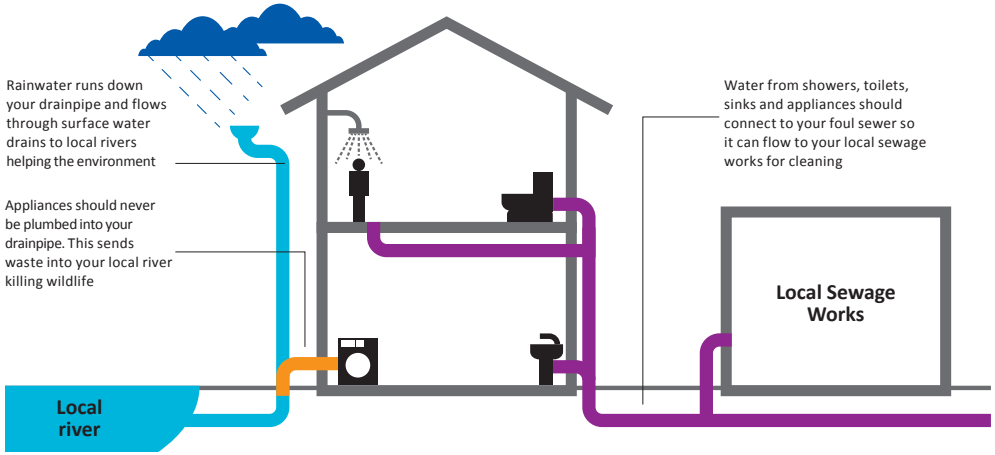
Introduction

One of the major threats to water quality in urban rivers is misconnected pipes. These send pollution into rivers via the surface water drainage system and compromise the biodiversity and amenity value of our waterways. In partnership with Thames Water, the Environment Agency (EA), fellow NGO's and communities in Greater London, the Zoological Society of London (ZSL) has developed an innovative, citizen science method for locating, assessing the impact of, and reporting on these polluted surface water outfalls (PSWOs). This method is known as the Outfall Safari.

The Outfall Safari was first created by the Citizen Crane project steering group (Crane Valley Partnership, EA, Thames Water, Friends of the River Crane Environment (FORCE), Frog Environmental and ZSL) and used on the River Crane in May 2016. Since then, Outfall Safaris have taken place on over 140km of river in Greater London and the approach has been adopted by other UK-based environmental NGOs. In order to support the spread of the Outfall Safari method and drive improvement in urban water quality across the country, ZSL and The Rivers Trust have created this guide and package of resources to assist environmental NGOs and water companies. The documents are available to download from the Catchment Based Approach (CaBA) website **catchmentbasedapproach.org/learn/outfall-safari-guide/** and ZSL page **zsl.org/londons-rivers**.

Check your home is connected right

Wastewater from sinks, showers and appliances may be polluting your local river.



Quick Guide

What?

Surface water outfalls are the discharge point of pipes that convey rainfall run-off into rivers. However, outfalls can also be a source of chronic pollution in urban rivers when wastewater makes its way into the surface water system via misconnections. Outfall Safari is a systematic method to survey outfalls for pollution that is being discharged into the river.

Why?

Polluted surface water outfalls (PSWOs) can reduce dissolved oxygen and increase ammonia and phosphate levels, which can damage the natural environment. The earlier PSWOs are reported to the water company and the regulator, the sooner they can be investigated, and the pollution stopped.

Who?

An Outfall Safari is a partnership project that involves the regulator, the water company, a host environmental NGO, the Catchment Partnership and volunteer citizen scientists.

Where?

The Outfall Safari survey method can be used anywhere there is a dual drainage system i.e. separate surface water and foul water drainage systems.

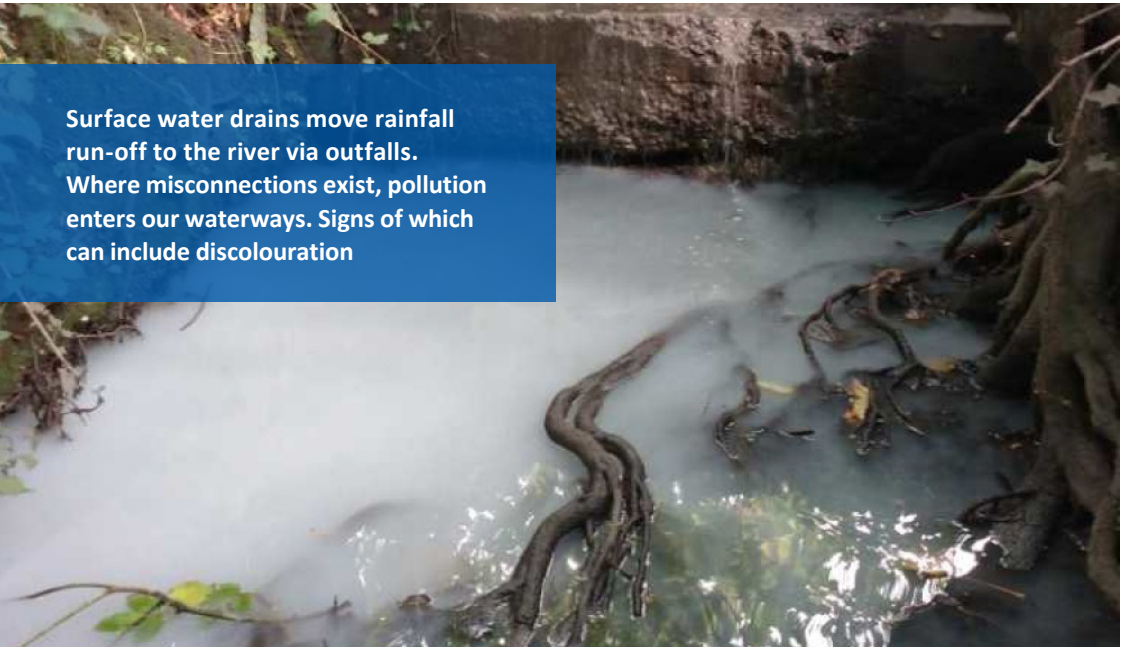
How?

In dry weather only, trained volunteers walk the riverbanks with a mobile app that allows them to geolocate, photograph and assess outfalls for evidence of pollution. The assessment gives outfalls a score between zero and 20. The higher the score, the greater the visible impact of the outfall – more points indicates more pollution.
Data are sent directly to a database for analysis and reporting to the regulator and water company.

What are polluted surface water outfalls and why are they a problem?

Pollutants move from land to rivers by a variety of different pathways. One significant pathway is via the surface water drainage network. For those urban areas which are served by two drainage networks, one set of pipes conveys foul waste to a sewage treatment works and the other sends surface water (rainfall run-off) to the nearest river via an outfall. These surface water outfalls are visible discharge points that are generally more than 20cm in diameter. When household appliances and washing facilities (such as washing machines, dishwashers and toilets) are incorrectly plumbed in, or 'misconnected' into the surface water drains, their wastewater ends up in rivers via outfalls (described as polluted surface water outfalls or PSWOs). This contributes to elevated phosphate and ammonia levels that chronically degrade rivers. When surface water drains are polluting, evidence such as grey fungus (commonly known as sewage fungus), sanitary products and discoloured water can be seen at the outfalls. The term 'misconnection' can also include cross-connections between foul and surface water drains, where the two systems should be separate.

Misconnected wastewater pipework is not the only way that surface water outfalls convey pollution to our rivers. Blockages in the foul sewers, caused for example by a build-up of fat or wet wipes, can also pollute rivers by causing foul wastewater to back up in the sewers and drain into the surface water network and then to rivers. Misconnections are distinct from one-off pollution incidents, such as blockages or other network defects.



Surface water drains move rainfall run-off to the river via outfalls. Where misconnections exist, pollution enters our waterways. Signs of which can include discolouration

How can we measure the scale of the polluted outfall problem?

The Outfall Safari is a low-cost method to prioritise outfalls for inclusion in water company plans, to inform catchment management decisions, and to raise misconnection awareness.

The aims of the Outfall Safari are:

- To record and map the dry weather condition of surface water outfalls in rivers;
- To assess and rank the impact of the outfalls and report those that are polluting to the regulator (for example, EA) and water company (for example, Thames Water);
- To build evidence on the scale of the PSWO problem and drive an increase in investment to resolve it; and
- To engage communities with their local rivers and inspire change.

Thames Water agree with the Environment Agency those outfalls which require strategic long-term investigation

The organisation and delivery of an Outfall Safari involves the following steps:

1. Identify the catchment that will be surveyed and involve key partners (the regulator, the relevant water company, and other environmental NGOs that could support the project).
2. Advertise the project, recruit volunteers and host an Outfall Safari training session in the local area.
3. Setup a means by which the volunteers and host NGO can communicate throughout the Outfall Safari so that survey locations and dates can be agreed. For example, Facebook or WhatsApp. This will avoid stretches of river being missed or surveyed twice.
4. Volunteers carry out the surveys from the bankside – only when the weather has been dry for 48 hours. The data inputted via the app are sent directly from the river to a database for analysis by the host NGO. Inaccessible sections of bankside can be surveyed in-channel by the host NGO, regulator and/or water company.
5. NGO prepare a report of the Outfall Safari for the regulator and water company, the format of which should be agreed beforehand to suit the water company and regulator's requirements. Share the findings of the Outfall Safari with the volunteers.

Who are the key partners for an Outfall Safari project?

Key partners for an Outfall Safari project include the water company, the regulator and the Catchment Partnership. An Outfall Safari is a collaborative process that requires endorsement from all these key partners to be successful.

It is critical to undertake Outfall Safaris in consultation with the water company and regulator because the assessment form and reporting thresholds may need to be adapted to suit local requirements. This is difficult to do once the survey has started so should be agreed with all stakeholders beforehand. Furthermore, the regulator and water company not only take a role in the training of volunteers but are the bodies responsible for resolving PSWOs. Whilst environmental NGOs and volunteers can gather evidence on the location and extent of the problem, NGOs and volunteers are not able to trace and resolve pollution sources. The active involvement of the regulator and water company from the outset is therefore essential to achieving this.

In Greater London, Thames Water is the water company responsible for most outfalls, the remainder being in private ownership or the responsibility of the Highways Agency or Local Authority. Thames Water has a process in place for PSWOs identified through Outfall Safaris. Once a PSWO is reported to Thames Water, their Network Resolution Team or Local Operations Team work to trace the source of the pollution. The aim of the Network Resolution Team is to address polluted outfalls as soon as possible and determine whether a catchment is suffering from few misconnections and/or other pollution sources or whether the pollution is caused by widespread misconnections, which would require a strategic long-term investigation through the Surface Water Outfall Programme (SWOP). This has been developed in conjunction with the regulator (the EA) to resolve polluted outfalls that suffer from widespread diffuse pollution sources. If the pollution is caused by few sources, Thames Water will aim to resolve it as soon as possible. The amount of work Thames Water can do to remove pollution from outfalls is, however, limited by the budget allocated to the problem.

During their investigations Thames Water do not have the powers to enforce rectification of misconnections they find and rely on the cooperation of homeowners and businesses to help remedy the problem. The power to enforce currently sits with Local Authorities under the Building Act 1984. Thames Water report that approximately 90% of property owners fix problem plumbing voluntarily. The remainder are passed to Local Authorities for enforcement.

Examples of previously polluted surface water outfalls on the Hogsmill River, London, that have been successfully remediated by Thames Water. See discoloured water cleaned up and sewage debris is no longer collecting at the outfall

The EA were instrumental to developing the Outfall Safari methodology and, in London, supporting in-channel survey work. The EA also agree which outfalls go on the SWOP list with the water company and are responsible for investigating pollution not related to misconnections, for example illegal discharges of chemicals. Working with the regulatory team in the local area is key to understanding what they need from the Outfall Safari, for example reporting requirements. The Catchment Coordinators will usually be the first point of contact to help engage their colleagues in other teams: the Environment Management Land and Water team, who lead on the regulation of water pollution, and Watercourse Inspectors who can be a useful source of information regarding access, especially for in-channel surveys.

Catchment Partnerships include many of the river's relevant stakeholders, who should be made aware of the project during the earliest stages. The Outfall Safari can be promoted through the Catchment Partnership, which facilitates volunteer recruitment.
The Catchment Partnership should also be furnished with the complete survey dataset so that it can be used to inform future river management decision-making.

What are the limitations of the Outfall Safari?

Before any Outfall Safari starts, all volunteers should attend a training session that covers information on what PSWOs are and instruction on how to assess each outfall using the project app. However, there are still elements of subjectivity in the assessment process that are difficult to entirely eliminate. This may lead to some inconsistencies but clear training at the outset and ongoing communication between the volunteers and the host NGO throughout the Outfall Safari should mean that any major discrepancies are avoided.

Each outfall should be assessed just once over the course of an Outfall Safari, and an entire catchment will likely be surveyed within a two-month period, depending on the weather. The Outfall Safari results therefore represent a snapshot in time – an audit of how outfalls, within the study area, were behaving during the survey. Those outfalls that only pollute intermittently therefore may not be detected as a problem at the time of the survey and could cause more serious problems than the impact scores suggest.

As a result, the Outfall Safari method has the potential to underestimate the scale of the PSWO problem. Similarly, the time at which an outfall is assessed could affect the impact seen. For example, if a school is the source of the misconnection, but the outfall is assessed over the school holiday period, then the pollution that is discharged to the river during term time could be missed.

Lastly, areas of very overgrown vegetation can obscure views of outfalls or prevent access to parts of the riverside. In this situation, staff from the host NGO and/or the regulator may be able to lead an in-channel survey of the section where riverside access is restricted. However, if the vegetation is overgrown to such an extent that it obscures the entirety of the banks then it is still possible that outfalls could be missed and the scale of the PSWO problem be underestimated. To avoid this, those sections of the river could be re-visited at a later date when the vegetation has died back (winter months) or in the initial stages of spring re-growth.

Running a Survey

Cost and time requirements for an Outfall Safari

To give the host NGO an idea of the likely costs involved in organising and running an Outfall Safari, an outline of days required for each activity is presented below. Based on ZSL experience organising Outfall Safaris in London, the budget is approximately £6,500. This budget is for an Outfall Safari that surveys approximately 30km of river. This budget is also based on an NGO that has experience working with volunteers and has established relationships with the Catchment Partnership, regulator and water company. The costs are likely to be higher when carrying out the first Outfall Safaris as the contacts need to be established, the project app setup and the report template put together. Overall, the first Outfall Safari will constitute a larger body of work and budgets should reflect this.

Activity	Days
Promote project and recruit volunteers	2
Training events (x2)	2
Preparation and planning of training events	1
Production of handouts for volunteers	2
Planning details of the survey	1
Co-ordination of the survey	4
Lead in-channel sections of the survey	4
Data handling and report production	6
Materials (handouts)	Days N/A but cost approximately £100
Travel expenses	Days N/A but cost approximately £100

When timing an Outfall Safari, it is important to bear in mind that dry weather is a survey requirement. Rain and high-water levels can wash away evidence of pollution and mask background misconnection issues. Surface water outfalls are designed to convey rainfall into the watercourse. During periods of higher than normal rainfall the greater volume of water flowing through the outfalls can wash away signs of pollution such as grey fungus and rag and dilute the discolouration often associated with pollution. Therefore 48 hours of no or only light rain in the catchment is needed before conducting any survey work. Based on this restriction, it is suggested that approximately two months are set aside to complete an Outfall Safari to allow for days when surveys will have to be postponed due to weather. The time required will also change depending on the area of the catchment that needs to be surveyed.

Training

Once the catchment has been identified and the partnership between NGO, water company and regulator established, the volunteer recruitment can begin, and the actual survey dates be arranged.

Partnership with other environmental NGOs and/or Catchment Partnership hosts that may have an existing pool of enthusiastic citizen scientists can help with volunteer recruitment.

Volunteers interested in taking part in an Outfall Safari should attend a training session, delivered by the host NGO, the water company and regulator. A template PowerPoint presentation and handout are included within this package of resources (see **Appendix 1 and 2**). The training session should include:

- An overview of water quality issues in the catchment;
- Information on surface water outfalls and how they become polluted;
- Information on the local water company and how they address PSWOs;
- Instruction on how to assess each outfall using the project app and how to upload information to the database; and
- A health and safety briefing and signing of the risk assessment.

During the training, groups of volunteers (at least in pairs) can be assigned lengths of the river to survey and timescales agreed. Each section of river should be assigned a lead surveyor, who will be the key contact for the host NGO. It should be the lead surveyor's responsibility to report back to the host NGO if any stretches of the river were inaccessible and require an in-channel survey. It is important that this process is established to avoid sections of river being missed or surveyed twice.

The host NGO should ensure that volunteers are aware of the likely timescales for misconnections to be resolved. The expectation should be that serious issues will see immediate action, and others will inform long term work programmes.

Volunteers should also be made aware of the wildlife that could be present in, next to or near the rivers that will be surveyed and how they can avoid causing disturbance and/or harm. For example, care must be taken to avoid impacts on any breeding birds and their nests.

Dry weather - 48 hours of no (or only light) rain in the catchment is essential before conducting any Outfall Safari survey work.

Too much surface water will:

Mask background misconnection issues;

and

Wash away evidence of pollution such as grey fungus

Health and safety considerations

Most of the survey work can and should be safely conducted from the riverside path, with the occasional need to enter the river to properly assess and photograph outfalls. Surveyors should not go into the river if it is deeper than wellington boot depth (approximately 35cm) and should assess conditions of the river before entering it. In some reaches of the river, where it flows through private land or is inaccessible from the banks, the surveys can be conducted in-channel (with more stringent health and safety rules) and led by the host NGO, water company and/or regulator. Waders, stabilising poles and lifejackets should be used by in-channel survey teams.

All survey teams (bankside and in-channel) should have appropriate personal protective equipment (PPE) for the site at which they are working (such as sturdy footwear) and be cautious on the river bank where there is a risk of trips, slips and falls. Volunteers should be advised not to touch the outfalls, regardless of whether signs of pollution are visible or not. All survey teams should also carry with them the volunteer handout to help with ranking the impacts of each outfall, a smart phone or tablet loaded with the project app for data entry, at least one fully charged mobile phone in case of emergency and a walking pole (or similar) to part vegetation such as brambles. Long trousers are recommended in case of brambles and/or stinging nettles.

Additional health and safety risks that volunteers should be made aware of include the potential presence of giant hogweed *Heracleum mantegazzianum* and exposure to Weil's disease. Giant hogweed is an invasive non-native species that contains a toxic sap that can result in severe burns and contact with the plant must be avoided. Volunteers should be shown images of giant hogweed so that they are able to identify it. Weil's disease is a bacterial infection (also known as leptospirosis) which can be caused by contact with contaminated water. Volunteers should be made aware of the potential risks, the precautions that they can take (cover up cuts and abrasions for example) and to contact their doctor if concerned or showing signs of infection.

The above and any other site-specific hazards should be presented in a risk assessment that is made available for survey participants to read and sign during the training session.

The Outfall Safari should be conducted predominately from the bankside. In difficult to access areas, in-channel work may be required, led by the NGO, regulator and/or water company. Lifejackets, waders and stabilising poles are required safety equipment

After the training

Groups of volunteers are free to conduct the survey of their reach when convenient to them, within the survey period, provided the weather has been dry. A means by which the volunteers and host NGO can communicate should be setup to help with further coordination of survey dates and reaches. Some flexibility is required as rain can often interfere with survey dates and it is important to the management and motivation of volunteers that the host NGO is easily contactable. A closed/private Facebook group, for Outfall Safari participants only, works well for this. The group provides a forum for the host NGO to monitor progress (ensuring that there is no overlap in survey area or missed sections), for volunteers to arrange the details of surveys, and for any questions or issues that crop up to be shared. Volunteers can be invited to join the closed group after the training and once they have completed their reach, they should share the start and end locations on it, as well as any inaccessible areas.

Data Capture and Handling

Outfall assessment method

For each outfall, whether it is polluted or not, an assessment form should be completed in the project app. The app should be free to download and openly available (for example EpiCollect 5 or Survey123 - further details on these are available in later sections of the guide). The app allows for remote data collection and upload (on GPS-enabled smart phones or tablets) and a web portal to access and download the data.

It is important that volunteers complete only one assessment form per outfall. Multiple assessment forms will need to be removed from the dataset by the host NGO before analysis (more information on data management is available in later sections of the guide).

The assessment form (on the project app) contains ten questions (see **Table 1**) and was developed collaboratively with Thames Water and the EA (based on Good Practice Document – Investigation and rectification of drainage misconnections, by Water UK and EA, 2009, freely available online). The answers are then converted into an impact score. It is possible (and easy) to add additional questions to the survey form via the project app (EpiCollect 5 or Survey123) to suit local requirements, however, questions 8 and 9 must be included to calculate the total impact score.

The users of the app will need to keep in mind the answers that they input into the app and the associated impact scores for each outfall to know whether the total overall score is equal to or exceeds the threshold for reporting directly from the river. In the case of Greater London, it was agreed with Thames Water that this threshold is ten. More detail on this reporting procedure is provided below. To assist volunteers and avoid missing outfalls that exceed the 'reporting from the river threshold', it is possible to integrate the scoring function into the project app Survey123 (more information on the project apps is available in **Appendix 3 and 4**).

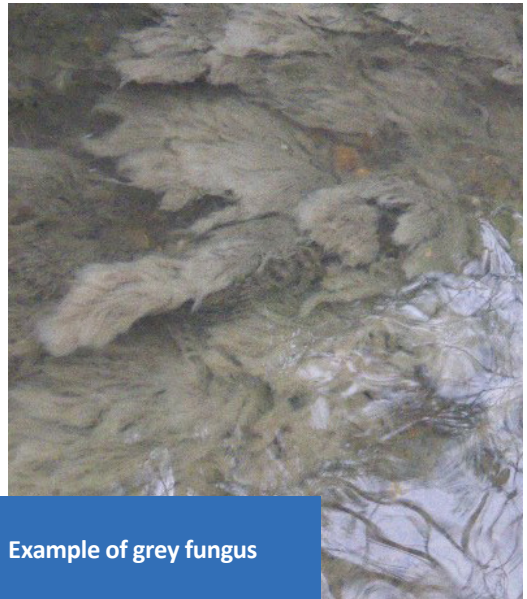
Table 1: Assessment form

Question	Options (if applicable)	EA Score (if applicable)
1. Volunteer name		
2. Date of survey		
3. GPS location		
4. Photo of the outfall		
5. Description of the nearest landmark		
6. Which bank is the outfall on		
7. Ranking of the flow coming out of the outfall	a) No flow b) Trickle c) Low flow d) Moderate flow e) High flow	
8. Ranking of the visual impact of the outfall	a) No visible effect b) Within 2m of outfall c) Impact 2m to 10m from outfall d) Impact 10m to 30m from outfall e) Impact greater than 30m from outfall	a) 0 b) 2 c) 4 d) 6 e) 10
9. Ranking of the aesthetics of the outfall	a) No odour or visible aesthetics b) Faint smell, slight discolouration c) Mild smell, mild discolouration, small coverage of grey fungus d) Strong smell, strong discolouration, large coverage of grey fungus and/or litter e) Gross smell, gross sewage	a) 0 b) 2 c) 4 d) 6 e) 10
10. Other signs of pollution		

Table 2: Tips for completing the assessment form

Question	Guidance
1. Volunteer name	It is important that volunteers include their names so that if the host NGO has any queries whilst processing the data, they know who they should contact.
3. GPS location	Volunteers should stand as close as (safely) possible to the outfall when recording the GPS location. Occasionally there can be issues with the accuracy of the GPS, which is why it is good to emphasise the importance of including other location details in the assessment form.
4. Photo	Clear photos of the outfall and associated impact help with processing and quality control of the data. It is best to take photos using the mobile device's camera first, and then load them in to the survey app. This is because they will be stored at a higher resolution, and they are also backed up in case of a problem with survey data upload.
5. Location details	It is helpful to be as descriptive as possible of the nearest landmark – what is the nearest road or identifiable building to the outfall, how many other outfalls can be seen from this location, is the surveyor standing on the same bank as the outfall, etc. If the surveyor is near a residential area, the nearest house number is also useful. The more location detail that is provided, the easier it is for follow up action to be taken on a PSWO.
6. Bank the outfall is on	This should be left or right as the surveyor stands looking downstream.
7. Flow coming out of the outfall	The categories for this section are quite subjective therefore use photographs as a guide (see examples below), as well as these approximations: • Trickle: <0.1l/s or enough to fill a teacup in a minute • Low flow: between 0.1l/s and 1.0l/s or enough to fill a bucket in a minute • Moderate flow: 1.0l/s to 2.0l/s or more than a bucket full each minute • High flow: clearly >2.0l/s or more than a bath tub in a minute Volunteers should still assess outfalls with no flow.
8 & 9. Extent of the visual impact of the outfall, Aesthetics of the outfall	Question 8 is about how far from the outfall that signs of pollution can be seen. Signs of pollution include: • Grey fungus (grey, tufty growth on the river bed) • Foam or scum on the surface of the river • Plume of discoloured water • Sewage related debris, such as sanitary products ('rag') See photographs below. There might not be a perfect fit, but select the category that most closely matches what is there.
10. Description of other forms of pollution	This section is free text and can be used to describe pollution that is not covered by earlier questions. If other forms of pollution are seen, volunteers should include information such as what is the colour of the water, is oil or fat present and if so, what colour is the fat, is food waste present, are silt/construction materials present, etc. If other forms of debris (not necessarily sewage debris) have collected at an outfall grate and so are clogged (or becoming clogged), then this can be noted in this section too. Clearance of this debris should be actioned by the water company.

Flow coming out of the outfall – clockwise from top left – trickle, low flow, moderate flow. Include examples like this in your volunteer training material



Example of grey fungus

Once the assessment form is complete, it must be saved before the next form is started. On doing this, the app should show a 'data saved successfully' message and give the user the option to upload the entry. An internet connection is not required to fill in the forms and collect data. Forms can be stored on the app and uploaded in a batch to the database when next connected to the internet.

Aesthetics of outfall – clockwise from top left – visible foam/scum on the surface of the river, sewage-related debris or 'rag', and plumes of discoloured water from outfalls

Other forms of pollution (not misconnection related) such as oil should be separately recorded for further investigation by the regulator

Conversion of outfall assessments to impact scores

To assist with prioritisation of the PSWOs, the EA provided a method of converting the assessment data to a numeric impact score for each outfall. These scores are shown under EA score (if applicable) in **Table 1**. The scores for extent of visual impact of the outfall and the score for aesthetics of the outfall are combined to a single total impact score. Therefore, the maximum impact score that an outfall can be assessed as is 20 (i.e. the most polluted).

The approach taken for Greater London (in agreement with Thames Water and the EA) is that it is assumed that those outfalls that score zero are not polluted and those that score one-three show minimal signs of pollution. It is also assumed with reasonable confidence that any outfall that scores four or more is a pollution issue. All outfalls that are assessed (including those that score zero) should be contained within the database of results and the total number of outfalls assessed stated in the survey report. However, the approach taken for Greater London (in agreement with Thames Water and the EA) is that only those outfalls that score four or more (i.e. are considered a pollution problem) need to have all their details included in the report. The location, national grid reference, bank side (left or right), outfall score and photo for all outfalls that score four or more should be summarised in a table in the survey report. These outfalls are earmarked for further investigation by the water company and the regulator. For those outfalls that score ten or more, a specific reporting procedure is in place with the EA and Thames Water, which is explained below.

The thresholds and reporting procedure can be adapted to suit local requirements. As part of the early involvement of the regulator and the water company, the approach to reporting should be agreed - whether the approach for Greater London is adopted or whether this needs to be adapted to suit the local scenario. Ideally, outfalls showing any signs of pollution (i.e. scores more than zero) would be investigated, however, those thresholds must be decided jointly with the water company and regulator and will likely depend on resource availability for further investigation.

Reporting procedure for impact scores of ten or more

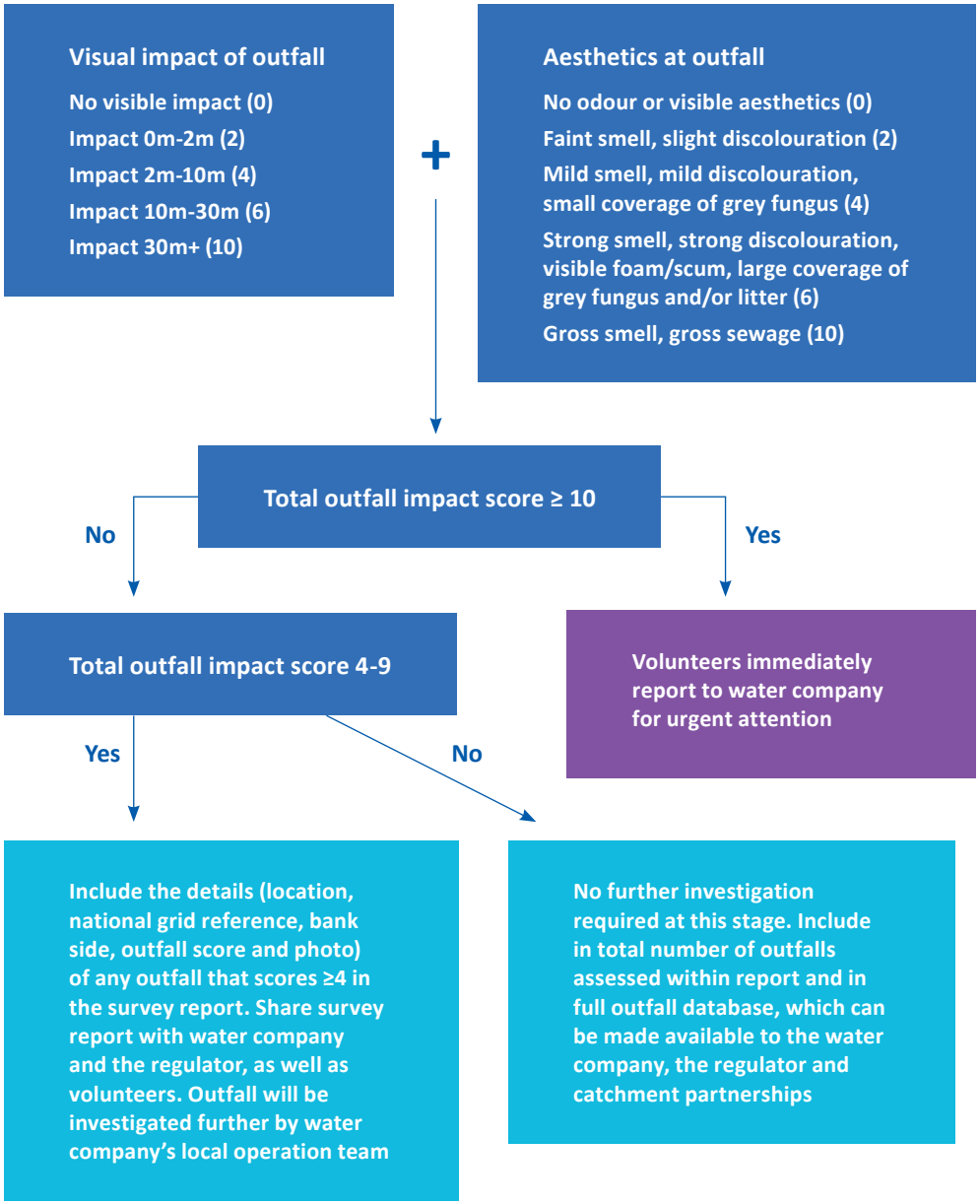
Outfalls that score ten or higher i.e. 'a greater than 10m impact zone' and 'strong smell, strong discolouration, large coverage of grey fungus and/or litter' suggest a pollution problem that requires urgent attention. In this case, the water company should be notified of this pollution incident at the time of finding it (i.e. from the river). In the case of Thames Water, the relevant number is 0800 316 9800. The water company should report the incident to the EA. The EA should only be contacted directly when a major incident is occurring. The number is 0800 807 060. The volunteer should provide the following information when reporting pollution from the river:

- That they are a trained volunteer helping with an Outfall Safari;
- A description of the visual extent and aesthetic impact;
- That they have a photo of the pollution that will be included in a report on the survey;
- The GPS location (if possible) and the bank that the outfall is on (left or right, looking downstream); and
- Any additional description of the pollution.

The water company will provide a reference number, and this should be passed onto the host NGO for inclusion in the survey report.

A commonly encountered problem for previous Outfall Safaris has been that outfalls that score ten or higher have not been called in at the time of the survey, either because volunteers have not remembered to do so (not prompted by the project app) or potentially because of a reluctance to call the water company. Instead, highly polluted outfalls have had to be retrospectively called in by the host NGO during data processing. This could be several weeks after the event itself, and any rainfall in that time could have washed signs of the pollution away. As the highest scoring polluted outfalls have the greatest potential to cause damage to the ecology of the river, any delays to remediate these increase the risk of harm. It is therefore recommended that during training the importance of this reporting procedure is emphasised and data are regularly checked by the host NGO to ensure it is being implemented.

Quick guide to the Outfall Safari method adopted in Greater London



The project app – EpiCollect 5 vs Survey123

The two survey form platforms (EpiCollect 5 and Survey123) that have been used to date are both suitable for designing an Outfall Safari mobile data collection app. They each have their pros and cons, which are summarised in **Table 3**. If the host NGO (or other lead organisation who will be preparing the report) is an existing ESRI user, or if they would like to share the survey results alongside other online GIS data, then Survey123 is probably the best option as it is fully integrated with ESRI ArcGIS Online. If the host NGO does not already use GIS and does not have any requirement to overlay the survey data with other GIS layers, restrict access to the data, or publish the results in an online map then EpiCollect is probably the best option as it is free and more straightforward to setup as a standalone product.

Once the host NGO has selected which project app they will use, refer to **Appendix 3** for advice on how to setup and manage EpiCollect 5 or refer to **Appendix 4** for advice on how to use Survey123. Both appendices are available to download from the CaBA and ZSL websites and include volunteer instructions as well as data management guidance. The host NGO will need to check the data and remove any duplicate data entries, ensure that photos are of sufficient quality, and results correlate with the photos. This can be done in different ways, depending on which data collection platform is used.

A case study of the Alfreton Brook Outfall Safari in Derbyshire can be found in **Appendix 5** and a report template in **Appendix 6** (also online). ArcGIS Online Resources (**Appendix 7**) are available too and access to this can be requested from the CaBA website.

Table 3: Comparison of EpiCollect 5 and Survey123 mobile survey app development platforms

Theme	Consideration	EpiCollect 5 (Imperial College)	Survey123 (ESRI)
COST	**Cost**	Free	Requires ArcGIS Online license (£120 p.a. for charities)
	Open Source	Yes	No
	Other cost:benefit considerations	Simple data collection system – no added GIS benefits	Part of a much bigger desktop and online GIS and data management platform which is central to the CaBA support programme
SETUP	**Importing the template**	Import .json form template to EpiCollect five website	Install Survey123 Connect and import.xlsx form template
	Designing and editing the form	Edit forms in web browser – simple interface	Edit forms in Excel – familiar interface
END USER	**Downloading app**	Volunteers need to find and download app from app store / play store	Share survey URL with volunteers and they will be prompted to download app
	Opening survey	search for project name to open survey in app	No extra step – see above
	Mobile platforms supported	MacOS, Android	Windows, MacOS, Linux, Android
	Using app	Works offline, simple to use	Works offline, simple to use
DATA	**Manage Survey and Quality Assure Data**	Can view and edit data in simple EpiCollect5 map viewer but can't overlay own data. Need to download to use and edit in own GIS	Easy to check coverage and share map with volunteers to flag gaps. Can produce more sophisticated maps and filter data by volunteer, etc.
	Mapping and sharing survey data	Basic map interface to view survey results. No overlay of other data and can't 'plug' data in to other online mapping platforms without downloading	Fully integrated with ArcGIS Online – data is already available as an online GIS layer and can be shared with different permissions
	Sharing data	If you make the survey public then the data are public too. Can't restrict access	Can be shared with different permissions for separate audiences – e.g. restricted public view and detailed private view

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