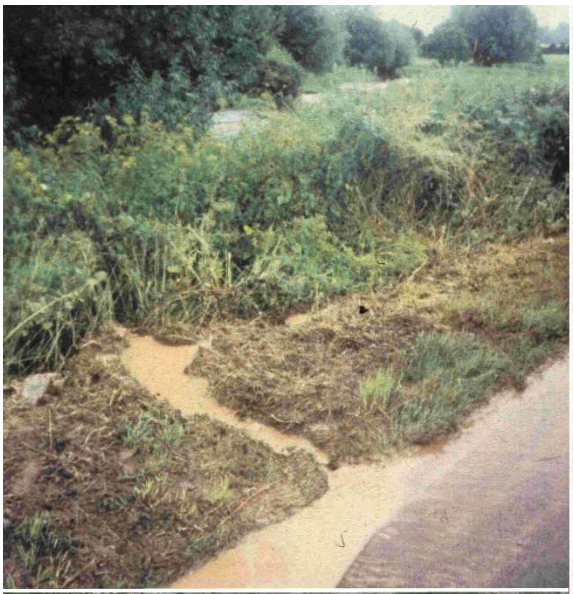
Mud Spotter

Survey Description and Guidance

2024 version




Modular River Survey

Queen Mary University of London

cartographer

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1. AIM AND SCOPE OF THE SURVEY

The Mud Spotter survey records mud being transported by water into river channels during or shortly after rainfall (maximum 24 hours). It records the location, type, and size of the water-mud source on the river bank. It also records the amount of water and concentration of mud in the water being delivered into the river at the time of survey.

Mud is fine (silty) sediment, similar in size to flour, and so it mixes freely with the water in which it is transported, colouring it and reducing its transparency.

Identifying the points at which mud enters a river and the size of the mud inputs is important because (i) the pollutant load associated with river sediments is strongly associated with these fine sediment particles, (ii) excessive amounts of mud, regardless of its contaminant load, can clog coarser river beds and so can damage their permeability and mobility, and (iii) in many cases the most contaminated and largest mud inputs result from human activities, and so could be reduced with enormous benefit to the river ecosystem.

If applied along a length of river, the Mud Spotter survey locates the distribution and sizes of mud source to that river length. If applied repeatedly through time, it tracks the changing magnitude and spatial pattern of mud inputs. The combination of time and space information on mud inputs highlights the most important and potentially damaging mud inputs and whether they are persistent sources or have a varying impact through time. All of this information helps to highlight the locations where resources can most cost-effectively be applied to reduce siltation and sediment pollution problems along the surveyed river length.

Each Mud Spotter survey records information for a single mud source. In summary, the Mud Spotter survey:

(i) is applicable across urban, suburban and rural areas
(ii) is a 'wet weather' survey and so should be carried out either during or within 24 hours of a rainfall event.
(iii) records the location where muddy water is being delivered into a river
(iv) records the type of source from which the muddy water is being delivered
(v) records the amount of water coming from the source into the river at the time of survey
(vi) records the mud content of the water coming from the source into the river at the time of survey.

2 TYPES OF MUD SOURCE INCLUDED IN THE SURVEY:

Five types of mud source are identified in the Mud Spotter survey: (i) disturbed bank face, (ii) overland flow, (iii) ditch, (iv) pipe, (v) culvert (Figure 1). Each of these delivers potentially muddy water from a source on or within the river bank into the river. In order to identify the type of source, take account of evidence at the bank face (from the water edge at the time of survey up to the bank top) and, where necessary for clarification, explore up to 10 m back from the bank face.

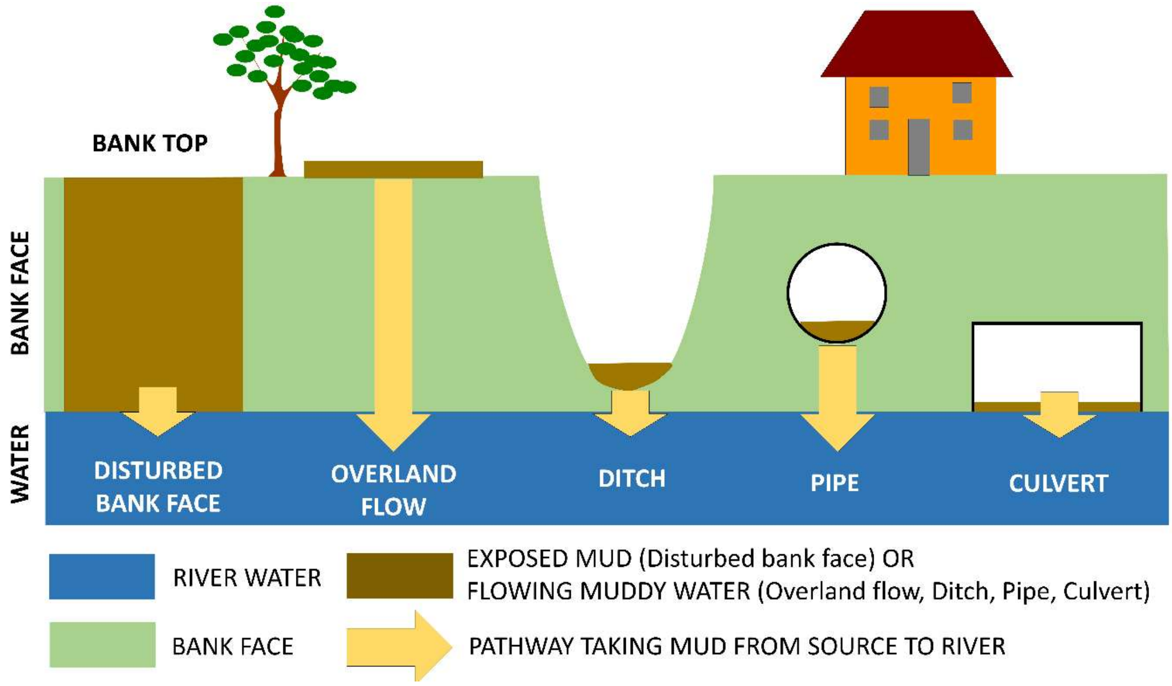

Figure 1: The five types of muddy water source recorded by Mud Spotter

Figure 1 presents a schematic view of a bank face (green) viewed from the opposite bank of a river (blue) with a house and tree on the bank top and the five types of Mud Spotter mud-water source located on the bank face and bank top. The yellow arrows indicate the pathways that muddy water takes from each source to the river, the brown areas locate the source of the mud or muddy water. Water flows directly over/through four of the sources into the river but the fifth source (disturbed bank face) may only deliver mud when the river water laps or scours the base of the disturbed area of the bank face.

2.1 DISTURBED BANK FACE.

This source type includes all locations where bare sediment is exposed directly to the water in the river channel. Rivers move their position in the landscape by eroding their banks, so this source type may be created by the river eroding its banks and is completely natural. However, many human and animal activities disturb bank faces, and so it is important to distinguish between natural and human/animal-induced bare sediment exposure on river banks.

(i) Natural bank erosion. Exposure of bare areas of the bank face as a result of erosion by the river. Naturally eroded banks have areas of the bank face that are bare (unvegetated). In the bare areas, the sediments are often crumbling. The bare areas may extend across all or only parts of the bank face (Figure 2) but there should be no major evidence of earth works, vehicle disturbance, human or animal trampling causing the bare sediment exposure. Sometimes it may be difficult to distinguish banks that are being naturally eroded or have been artificially reshaped by earthworks or dredging (Figure 3) so look at the explanation in (ii) below to distinguish natural erosion from earth works.

(ii) Earth works / dredging. In this case exposure of bare sediment results from the deliberate addition, dredging, or reprofiling of the bank face and/or adjacent river bed (by humans and machinery). If the machinery is there then the artificial nature of the bare bank face is obvious, but artificially created banks can gradually recover and naturalise (Figure 3) so record what you see not what you may know about past works on a river bank.

Figure 2: Natural bank erosion. The photographs were all taken when the river flow was low and so none of the photographs show muddy water in the river next to (i.e. entering the river from) the eroding banks.

Figure 3: River banks artificially reprofiled (earthworks/dredging). D and E show one or two river banks less than a month after earth works, whereas F shows reprofiling that has just been completed. A, B and C show the same location 2, 10 and 22 months after bank reprofiling has been completed and illustrate that you need to record what you see. Whereas the artificial nature of the exposed banks is clear after 2 months, by 10 months the bare bank on the left still looks artificial but the one on the right is showing the irregular form of a naturally eroding bank, and by 22 months only the bank on the right is bare, it appears to be displaying natural erosion and so should be recorded as natural bank erosion. The photographs were all taken when the river flow was low and so none of the photographs show muddy water in the river next to (i.e. entering the river from) the eroding banks.

(iii) <u>Poaching</u>. In this case bare areas of the bank face show dense and obvious effects of disruption as a result of trampling by animals or humans. Dense footprints or slide marks from feet should be obvious (Figure 4).

(iv) <u>Vehicle disturbance.</u> Disruption of the bank face by the passage of motorised vehicles or bicycles is very similar to poaching but here the dense and obvious effects of disruption should be in the form of wheel tracks.

Figure 4: Bank poaching by animals. In A and B, pigs are in the act of breaking up a bank face by trampling. The end effect of this is shown in C and D. In E, the effects of animal trampling is more localised – confined to where the animals have accessed the river. B is the only picture showing mud entering the river from the poached bank and this water is translucent.

2.2 OVERLAND FLOW

Overland flow, as its name suggests, is water that transports mud to a river by flowing overland (not in a ditch or other channel) and then spilling over the river bank top into the river. In terms of the source of the muddy water, two main types of overland flow are recorded.

(i) Flow from an impermeable surface. This is water draining off a sealed surface such as concrete or asphalt and so is typically water draining off a road, sealed pavement/footpath or sealed car park. Figure 5 D and G show muddy water flowing off an impermeable road surface into a river.

(ii) Flow from any other surfaces. This includes all other surfaces including bare fields (Figure 5 A, B), grassland (Figure 5 E,F) or unsurfaced roads, tracks or paths (Figure 5 C).

Figure 5. Overland flow draining across bare fields (A, B), grassland (F, E), and unmade track (C), and impermeable road surfaces (D, G). Note that the mud concentrations in the water vary: clear (E), translucent (F, D), opaque (G).

2.3 DITCH

Ditches are artificial channels that are usually deep, narrow (< 5 m wide) and straight, and are often obviously maintained (dredged, cleared of vegetation). They are created to remove excess water from the land. In other words, mud is transported to the river by water flowing in an open-topped artificial channel. Some ditches only flow in wet weather (Figure 6 A) whereas others may flow virtually all of the time (Figure 6 C) but they are distinguished from natural streams by their regular and usually deep cross profile. Some natural streams may have a deep and apparently artificial cross profile, but this is usually because their channel has been dredged to improve drainage. This is another example of recording what you see rather than what you know.

Figure 5. Three examples of ditches. While A and B are clearly artificial rather than natural channels, C could be a straightened natural stream. However, this stream has clearly been deepened, straightened and cleared of vegetation to ensure that it drains water artificially, so acts more as an artificial ditch than a natural channel – this is a case where you need to make a decision on the basis of what the channel looks like as it drains into the river you are surveying. The only photograph taken shortly after rainfall is A and it shows translucent water entering the river from a normally dry ditch.

2.4 PIPE

Mud is transported to the river by water flowing within a fully enclosed pipe (Figure 6). In this case, the water within the pipe has no contact with the sediments surrounding the pipe.

Figure 6. Pipes delivering clear (D), coloured (grey tinge) (B), translucent (C) and opaque (E) water to the river.

2.5 CULVERT

Mud is transported to the river in water flowing through a closed-top culvert, where the bed is composed of sediment particles that can interact with the flowing water (Figure 7).

Figure 7. Culverts delivering clear (B, C) and translucent (A) water to the river.

3. INFORMATION GATHERED DURING A MUD SPOTTER SURVEY

3.1 General Information

The following general information is collected.

(i) Surveyor name
(ii) Survey date and time
(iii) River name
(iv) Location/reach name
(v) Site name
(vi) Location of Source (GPS – NGR or WGS84 Latitude/Longitude)
(vii) Photograph 1 (to help fix the location for follow-up surveys. Take a broad photograph of the mud source in its setting to include details of opposite bank face and bank top.
(viii) Photograph 2 (to illustrate the source and the flow and mud content of the water coming from the source at the time of survey.
(ix) Comments: text field to provide any details or queries the surveyor wishes to raise.

(i), (ii) and (vi) to (viii) are compulsory.

If you are surveying on behalf of a group or you are aiming to develop a comprehensive set of surveys for a river reach or network, fields (iii), (iv) and (v) provide a way of coding your surveys to allow the Mud Spotter data base to be searched once the data is entered, so it is worthwhile agreeing a system for completing these fields prior to survey.

Photographs (vii) and (viii) are extremely important. Field (vii) plus the location field (iv) allow the source to be relocated and field (viii) allows the survey to be quality checked and, if necessary, the flow and mud content can be edited.

3.2 Weather Conditions (at the time of survey)

As mentioned in section 1, Mud Spotter is a wet weather survey and should be conducted during or within 24h of the end of a rainfall event. Therefore, the survey requires responses to the following:

(i) Rainfall intensity (at the time of survey). Enter one of the following: No rain, Drizzle, Light rain, Heavy rain, Torrential rain.
(ii) If raining at the time of survey, time since rain started (hrs). Enter the number of hours.

3.3 Source Details

Use the descriptions and photographs in section 2 as guidance to enter the following details. **Your source will be one of five types, and for the disturbed bank face and overland flow types you need to assign a subtype.**

(i) SOURCE TYPE: Enter one of the following - Disturbed Bank Face, Overland Flow, Ditch, Pipe, Culvert
(ii) SOURCE SUB-TYPE (only required if the source type is Disturbed Bank Face or is optional for Overland Flow). For Disturbed Bank Face the subtypes are: Earthworks/Dredging, Vehicles, Poaching (by humans or animals), Natural bank erosion. For Overland Flow the subtypes are flow coming from: a field, unsurfaced track/yard, surfaced road/car park, other. You can also record an approximate GPS for the furthest visible location/source of the overland flow).

3.4 Mud Source Size

Your source needs to be assigned a size of Small, Medium or Large according to Figure 8.

Note that:
For source type Disturbed Bank Face, the size relates to the width of the disturbed area of the bank face approximately half way up the bank face from the bank top to the river water surface at the time of survey.
For source type Overland Flow, the size relates to the width of the water spilling over the bank top at the time of survey.
For source type Ditch, the size is the ditch width at the mid point between the bed of the ditch and the bank top (where the bank top position is the point at which water would spill out of the ditch onto the adjacent bank top area).
For source types Pipe and Culvert, the size is the maximum width of the pipe or culvert opening.

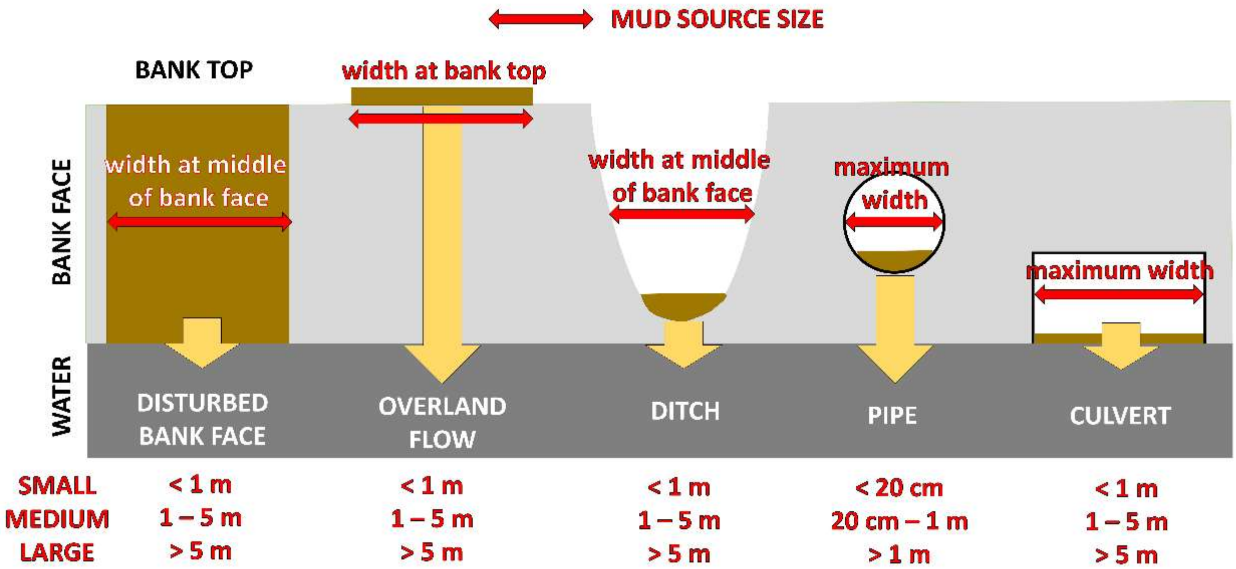

Figure 8. Mud source size.

3.5 Flow of Water from Mud Source (at time of survey)

The flow of water from your source at the time of survey needs to be assigned a size of: None (i.e source is dry), Small, Medium or Large flow according to Figure 9.

Note that:
For source type Disturbed Bank Face, you should estimate the width of the muddy water next to the disturbed bank face (i.e. it will not be wider and is highly likely to be narrower than the area of the disturbed, bare bank face.
For source type Overland Flow, you should estimate the approximate depth of the muddy water spilling over the bank top.
For source types Ditch, Pipe and Culvert, you should estimate the depth of the water flowing out of the source as a proportion of the maximum depth of water that could flow out of the source.

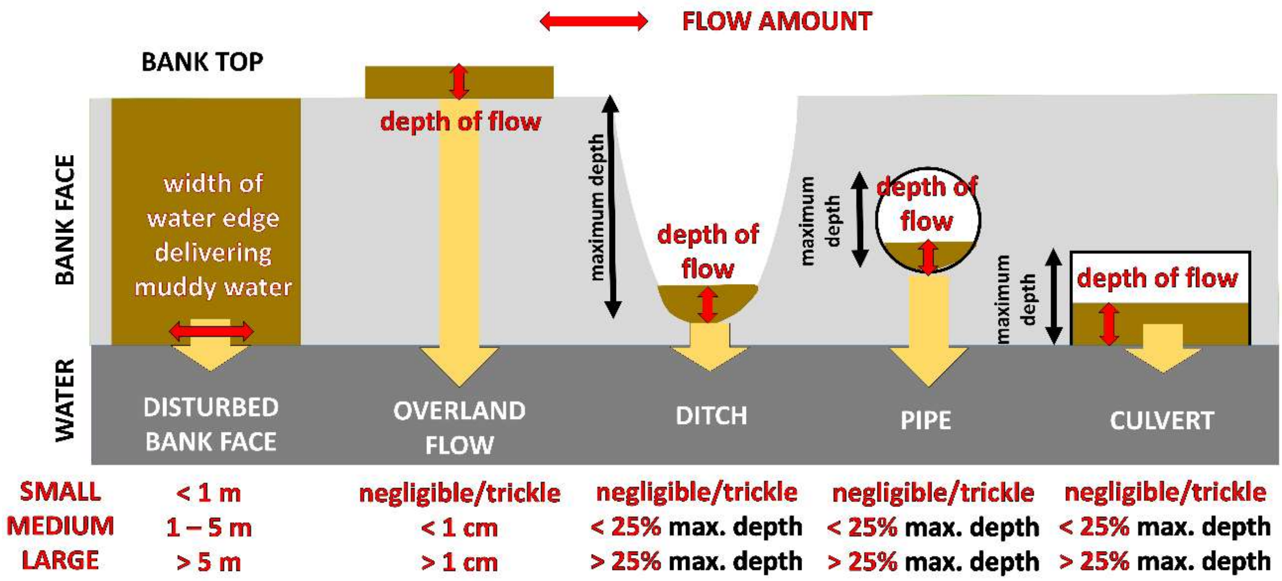

Figure 9. Flow of water from the mud source at the time of survey.

3.6 Mud Concentration in Flowing Water (at time of survey)

You only complete this survey field if there is water flowing from the source at the time of survey, using the four levels of water clarity in Figure 10 and further supporting clarity information in some of the photographs shown in Figures 5, 6 and 7.

Note that;
For source type Disturbed Bank Face, water is unlikely to be actually flowing from the source, so you need to record the mud concentration in the water that is lapping against the bank face.

For all other source types, record the water clarity as it issues from the source.

The flowing water needs to be assigned to one of four clarity levels:
(i) Clear (i.e. water is clear and colourless)
(ii) Coloured (i.e. water is clear but is coloured)
(iii) Translucent (i.e. water is cloudy but it is possible to see through it)
(iv) Opaque (i.e. water is so cloudy that you cannot see through it)

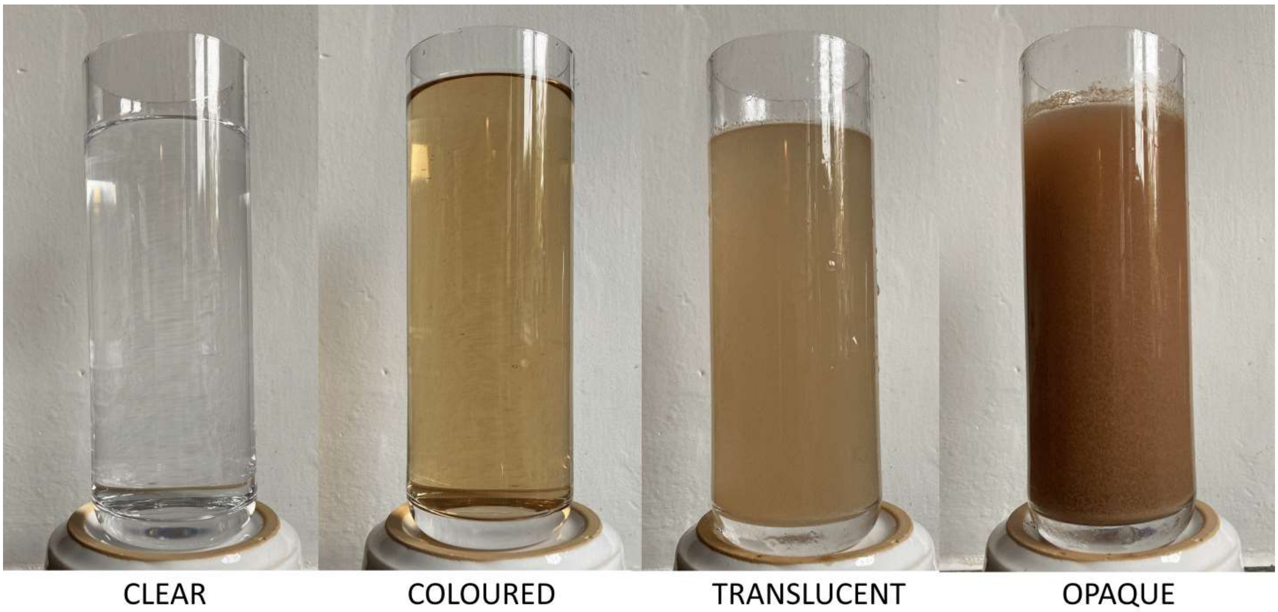

Figure 10: Water clarity scale

NOTE: If you find it difficult to judge water clarity, you could consider sampling the water using a transparent container suspended into the water on a string. Once retrieved, the container could be held against a white sheet to assess the clarity. **IT IS CRUCIAL THAT YOU ONLY DO THIS IF IT IS COMPLETELY SAFE – i.e. YOU AVOID ENTERING THE WATER OR ACCESSING UNSTABLE / SLIPPERY PARTS OF THE BANK.**