Environment Agency

# River Habitat Survey in Britain and Ireland

## Field Survey Guidance Manual: 2003 Version (2022 Reprint)

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# CONTENTS

# GLOSSARY OF ACRONYMS

| | |
|---|---|
| CFMP | Catchment Flood Management Plan |
| GQA | General Quality Assessment |
| EA | Environment Agency |
| EHSNI | Environment and Heritage Service, Northern Ireland |
| EU | European Union |
| H&S | Health and Safety |
| NGR | National Grid Reference |
| OS | Ordnance Survey |
| GPS | Global Positioning System |
| PPE | Personal Protection Equipment |
| RBMP | River Basin Management Plan |
| RHS | River Habitat Survey |
| RQO | River Quality Objective |
| SEPA | Scottish Environment Protection Agency |
| SERCON | System for Evaluating Rivers for Conservation |
| SNH | Scottish Natural Heritage |
| SNIFFER | Scotland and Northern Ireland Forum for Environmental Research |
| UK | United Kingdom |

# ICONS USED TO PROMPT SURVEYORS

- Rare feature
- Photograph in photo gallery
- Reminder of survey approach
- Video to be used in training
- Health and safety issue

# ACKNOWLEDGEMENTS

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# PART ONE – INTRODUCTION AND GENERAL GUIDANCE

**Preamble**

1.1 River Habitat Survey (RHS) is a method designed to characterise and assess, in broad terms, the physical structure of freshwater streams and rivers. The field survey element does not require specialist geomorphological or botanical expertise, but recognition of vegetation types and an understanding of basic geomorphological principles and processes are needed.

1.2 RHS is carried out along a standard 500m length of river channel. Observations are made at ten equally spaced spot-checks along the channel, whilst information on valley form and land-use in the river corridor provides additional context.

1.3 The underlying need for any observational method such as RHS is confidence in the survey data. This means consistent recording of features by competent, well-trained, and accredited surveyors as well as checks on subsequent data-entry onto the computer database.

1.4 The field survey has been designed, tested and improved as a result of extensive use on rivers in the UK since 1994. The 2003 version represents the first major overhaul of the form design, revision of some component elements, and updating of the guidance manual, since 1997. The major differences between the 1997 and 2003 versions are summarised in Appendix 7.

1.5 Improvements in the contents and design of the form and the supporting guidance have been necessary to remedy weaknesses in the consistency of recording.

1.6 The 2003 version addresses a number of these weaknesses by:

- providing more comprehensive definitions and guidance;
- including a greatly expanded photographic section;
- using a more user-friendly 'icon' system that highlights difficult features, health and safety issues and rare features, all of which need particular attention;
- introducing more stringent requirements for recording grid references and photographic information;
- introducing a mandatory health and safety risk assessment component;
- including a logical cross-check list to help minimise the chances of incomplete recording.

1.7 The importance of consistent recording, and also completing all elements of the survey form, is paramount. Incomplete forms, and those with inadequate details of site location or photographic evidence, will not be acceptable, and not entered onto the RHS database. There is an underlying principle that any unusual feature, or any aspect which a surveyor is uncertain about, should be recorded as a special note and a photograph taken to provide supporting evidence whenever possible.

1.8 Surveyor accreditation is needed for data to be entered onto the RHS database. This means surveyors attending a training course using the 2003 version, and passing an accreditation test.

1.9 The RHS database contains field observations, map-derived information and photographs from more than 4600 RHS baseline survey sites visited in 1994-96 and over 12,000 subsequent surveys. The 1994- 96 baseline network comprised a geographically representative cross-section of streams and rivers, selected on a stratified random basis, with the 10km grid squares of the Ordnance Survey as a sampling framework.

1.10 An overview of the physical condition of streams and rivers in the UK and Isle of Man was published in 1998,[1] using the baseline data.

1.11 Since then, surveys have been used for a number of purposes, including: determining the catchment characteristics of several rivers in the UK; identifying the attributes of known top quality 'benchmark' sites; investigating possible species–habitat relationships; and providing input to environmental impact assessment.[2] An educational CD-ROM has also been produced, using a simplified version of the RHS database.[3]

1.12 RHS has also been tested in other European countries such as Finland, France, Austria, Portugal (Madeira), Italy and Slovenia with a view to adapting the survey for local conditions. Cross-comparison between RHS and other methods for surveying river hydromorphology in Europe has also been carried out,[4] with a view to producing standard guidance on techniques for assessing the physical characteristics of watercourses.[5]

1.13 The European Water Framework Directive has had a major influence in the development of RHS. Indeed, the prototype of the survey was developed in anticipation of the requirements of such a Directive as long ago as 1992.

1.14 The uses and sampling strategy for RHS depend on the purpose of gathering the survey information. Given its primary objective of context-setting, RHS can be used in general surveillance as well as sitespecific surveys.[6] What it cannot do, and never was intended to do, is to provide the level of detail needed for specialised survey work for specific plant and animal groups. Nevertheless, RHS can provide a consistent framework within which aquatic macro-invertebrate, macrophyte, fish and geomorphological surveys can be set.

1.15 Although RHS conforms with the basic requirements for the draft guidance standard on assessing the hydromorphological characteristics of rivers,[5] additional information on floodplain features and hydrology is also required for full compliance.

1.16 RHS also helps to provide information on river structure, vegetation character and land-use required for SERCON (System for Evaluating Rivers for Conservation), an assessment system that has scoring systems for several attributes in relation to determining the nature conservation value of rivers.[7]

### Scope of the manual

1.17 Guidance is provided on the fieldwork survey element of the core RHS method only. It does not cover map-based information gathering or additional modules such as the one being developed for gathering specialist geomorphological information. Details on this module, and the links with other surveys, can be obtained from rhs@environment-agency.gov.uk.

1.18 The manual does not detail how to undertake preparatory work prior to a survey, gaining landowner permission, or how to link RHS to other surveys that may be carried out in tandem with RHS. All these aspects need to be planned and agreed between the commissioning organisation and the surveyor well before fieldwork is carried out.

1.19 The core method described is a UK one and is designed specifically for conditions in Great Britain and Ireland. Development of European versions of RHS is continuing. Further details can be obtained from rhs@environment-agency.gov.uk.

1.20 The contents of the guidance are linked to the sequence of questions on the 2003 Survey form and are largely self-explanatory. Special icons are used to highlight issues requiring particular attention, such as when health and safety issues may be of special significance, features that are particularly rare in the UK, and where photos or videos help to illustrate features.

1.21 Essential equipment for undertaking RHS field surveys includes: survey forms in a waterproof document holder; laminated spot-check key; ranging-pole; range-finder; digital or a slide transparency camera; global positioning system for recording locational data and a mobile telephone (or other means of communication) in case of emergency. If the planned means of communication is by mobile phone, it is important to check that there is an adequate signal in the area being surveyed.

### Health and safety

1.22 It is imperative that all surveys are conducted in conditions which are safe for surveyors (Appendix 1). A health and safety assessment is an integral part of the survey and the form must be completed before embarking on the survey, and attached with the completed survey forms.

1.23 The Environment Agency Lone Working Guidance (Appendix 2) must be followed and surveyors **must never** put themselves in a position in which they are not in control. This applies to all surveyors working for, or commissioned by the Environment Agency (EA), Scottish Environment Protection Agency (SEPA) Environment and Heritage Service, Northern Ireland (EHSNI) and Scottish Natural Heritage (SNH).

1.24 In areas of high risk, it is strongly recommended that a team of two undertakes a survey.

1.25 Not starting, or abandoning a survey when the risk is too high should be the principle that applies throughout.

### Access and permissions

1.26 Whenever practicable, permission from landowners and occupiers should be obtained before surveys are carried out. This is not always feasible or possible, so if challenged RHS surveyors should be polite, courteous and provide an explanation of what they are doing and why, and on whose authority. In some instances, this may mean having to return to do the survey if the landowner requires further clarification as to the purpose of the work. Identification must be carried by surveyors at all times. Surveyors should comply with disinfection requests from landowners.

1.27 Surveyors can offer to provide information to landowners if they are interested in receiving it.

### Preparatory work

1.28 Experience suggests that some RHS surveyors, no matter how experienced, can still overlook channel modifications. It is therefore recommended that some preparatory briefing is undertaken before visiting the site. For example, looking at the river planform and river name on a map will provide clues as to whether the watercourse has undergone historical channel management. Documentation of past flood defence works is also a source of invaluable information. Such information will help provide context for site characterisation, but should NOT over-ride field observations.

### The survey form

1.29 The RHS survey form is four pages long and is accompanied by a separate two-page spot-check key. The health and safety form is integral to the survey and should not be detached. It is recommended that a clipboard or "Weather-writer" is used, and a waterproof laminated version of the spot-check key taken into the field at all times.

1.30 Surveyors are required to record the presence, absence, and in some cases the number or extent, of specific features. Four basic types of records are made:

- counting the **number** of certain features within the whole 500m site (riffles, pools, unvegetated and vegetated point bars, and artificial features);
- **ticking boxes** (✓) to indicate whether a feature is absent, present or extensive;
- **entering a two-letter acronym** for features in the spot-check section;
- taking **measurements** of the channel such as height, width and depth.

1.31 Where there is a choice of features to be scored, but only a single entry is allowed, boxes on the survey form are either 'shadowed' (❑) or have emboldened edges (☐).

### General site and surveyor information

1.32 Information about the surveyor, general site characteristics and details about when and how the survey has been undertaken are entered in Section A on Page 1 of the survey form. ☠ For most accurate recording, it is best to survey from both the river and the bank, but the overriding importance of health and safety issues will determine precisely how the survey is undertaken.

1.33 Section B requires information on the general valley shape and valley-floor to be recorded.

1.34 Most of the information in both Sections A and B of the form can be completed on arrival at a site, or at the end of the survey, as appropriate.

1.35 The actual number (**including zero**) of riffles, pools, unvegetated and vegetated point bars is recorded in Section C. This is best done by keeping a cumulative record of the number of these individual features when walking between spot-checks, and then tallying them up on completion of the survey.

1.36 Section D on page 1 requires the number of different types and extent of artificial structures to be recorded. As with counting riffles (Section C), a cumulative record is made during the survey and a tally made on completion of the survey. Again, zero must be recorded if none are present.

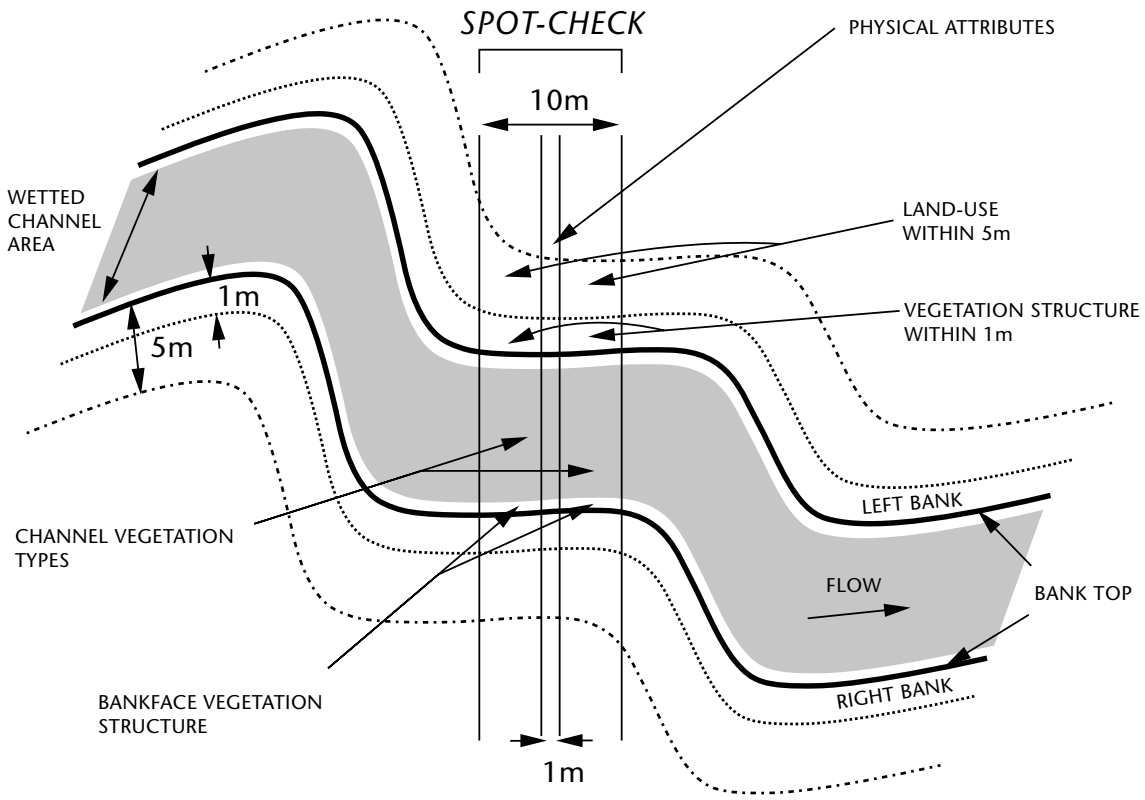
### Spot-checks

1.37 Spot-checks are designed to record predominant channel, bank and river corridor features at 10 locations spaced evenly along the 500m RHS site. Data for spot-checks are entered on page 2 of the form.

1.38 Spot-checks should be located at regular (approximately 50m) intervals along the site. **To do this consistently each surveyor should calibrate their stride length beforehand to identify how many of their paces represent 50m**. Rangefinders can be used for calibration too. It is best to use small strides – this tends to allow features between spot-checks to be observed and noted more comfortably. Adjustments may be needed, especially in difficult terrain because it may not always be possible to access the channel at precisely every 50m. Make a note on the form when this happens.

1.39 At each spot-check information relating to the channel, banks and adjacent land is recorded. This includes: predominant channel substrate and flow-type; habitat features; modifications to the channel and banks; channel vegetation types; vegetation structure of the banks and banktop; and land-use. Physical features (Section E) are assessed using a 1m wide "transect" across the channel, while all other elements in Sections F and G are assessed within a 10m wide transect across the river (Figure 1).

## Figure 1 Diagram showing dimensions for spot-checks




1.40 In Sections E and F, spot-check entries are abbreviations. Each entry must use the relevant unique two-letter abbreviation (e.g. BO = boulder; RI = reinforced bank). All abbreviations are listed as prompts on the form and are detailed in the spot-check key. Most are easily learnt by surveyors, but having a laminated copy of the spot-check key in the field allows double-checking in cases of doubt.

1.41 For boxes in Sections E and F with emboldened borders, only a single entry is allowed. This is for recording the **predominant** feature only, even though there may be more than one present. Do not spend long deliberating over which option is the predominant one. Initial reaction is the quickest, and usually the best, method.

1.42 In boxes without emboldened borders more than one entry is allowed; for example, bank modification may include both resectioning [RS] and reinforcement [RI].

1.43 Section G provides a list of channel vegetation types; those present are recorded as either a '✓' provided they cover at least 1% of the channel area, or as an '**E**' if more than one third of the channel area within the 10m wide transect is covered. Records have to be made for each spot-check, including 'none' or 'not visible'. The end column also has to be completed to provide an overview of the presence and extent of each vegetation type throughout the site as a whole.

1.44 The primary reason for recording at spot-checks is to bring greater consistency of data collection. Each spot-check column should be completed in sequence. In most instances each spot-check should take no more than two minutes to complete, particularly since all emboldened boxes and most of the others too, will have just a single entry. For rivers with complex structure, spot-check recording may take a little longer – conversely, uniform watercourses will take less time.

1.45 **It is essential that all boxes in Sections E and F (and at least one in Section G) are completed at each spot-check before moving to the next one. It is not possible to complete an acceptable RHS survey if any of the boxes in Sections E and F do not have entries. Figure 2 shows a completed spot-check section of the RHS form.**

## Figure 2 Example of a completed page 2 of the 2003 RHS form

SITE REF. EXAMPLE 3.2 | **RIVER HABITAT SURVEY: TEN SPOT-CHECKS** | **Page 2 of 4**

Spot-check 1 is at: upstream end ☑ downstream end ☐ of site (tick one box)

**E PHYSICAL ATTRIBUTES** (to be assessed across channel within 1m wide transect)

| When boxes 'bordered', only one entry allowed | 1 GPS | 2 | 3 | 4 | 5 | 6 GPS | 7 | 8 | 9 | 10 | GPS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LEFT BANK** | Ring EC or SC if composed of sandy substrate | | | | | | | | | | |
| **Material** NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | EA | EA | EA | EA | EA | EA | EA | EA | EA | EA | |
| **Bank modification(s)** NK, NO, RS, RI, PC(B), BM, EM | No | No | No | No | No | RS/RI | RI | RS | No | No | |
| **Marginal & bank feature(s)** NV, NO, EC, SC, PB, VP, SB, VS, NB | No | No | No | EC | EC | No | No | No | (EC) | No | |
| **CHANNEL** | GP- ring either G or P if predominant | | | | | | | | | | |
| **Channel substrate** NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR | GP | GP | (G)P | (G)P | GP | GP | GP | GP | GP | SI | |
| **Flow-type** NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR | RP | SM | SM | SM | RP | SM | RP | RP | RP | NP | |
| **Channel modification(s)** NK, NO, CV, RS, RI, DA, FO | No | No | No | No | No | No | No | No | No | No | |
| **Channel feature(s)** NV, NO, EB, RO, VR, MB, VB, MI, TR | No | No | No | No | No | No | No | MI | MI | No | |
| **For braided rivers only: number of sub-channels** | | | | | | | | | | | |
| **RIGHT BANK** | Ring EC or SC if composed of sandy substrate | | | | | | | | | | |
| **Material** NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | EA | EA | EA | BI | BI | BI | FA | EA | EA | EA | |
| **Bank modification(s)** NK, NO, RS, RI, PC(B), BM, EM | No | No | No | RI | RI/RS | RS | RS | PC | PC(B) | PC(B) | |
| **Marginal & bank feature(s)** NV, NO, EC, SC, PB, VP, SB, VS, NB | No | No | SC | No | SB | SB | No | No | No | No | |

Enter channel substrate(s) not occurring as predominant in spot-checks but present in >1% of whole site. ↑

**F BANKTOP LAND-USE AND VEGETATION STRUCTURE** (to be assessed over a 10m wide transect)

**Land-use: choose one from BL, BP, CW, CP, SH, OR, WL, MH, AW, OW, RP, IG, TH, RD, SU, TL, IL, PG, NV**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| LAND-USE WITHIN 5m OF LEFT BANKTOP | IG | IG | IG | SH | SH | RP | RP | TH | BP | BP |
| LEFT BANKTOP (structure within 1m) B/U/S/C/NV | U | U | U | C | C | S | S | C | C | S |
| LEFT BANK-FACE (structure) B/U/S/C/NV | U | U | S | B | B | B | B | C | C | C |
| RIGHT BANK-FACE (structure) B/U/S/C/NV | C | C | C | B | B | B | B | U | U | B |
| RIGHT BANKTOP (structure within 1m) B/U/S/C/NV | C | C | C | U | U | B | B | U | C | U |
| LAND-USE WITHIN 5m OF RIGHT BANKTOP | OR | OR | RP | RP | RP | SU | SU | IG | IG | IG |

**G CHANNEL VEGETATION TYPES** (to be assessed over a 10m wide transect: use E ( ⩾ 33% area), ✓ (present) or NV (not visible)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | | | | | | | | | | | |
| Liverworts/mosses/lichens | | | | ✓ | | | | | | | |
| Emergent broad-leaved herbs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Emergent reeds/sedges/rushes/grasses/horsetails | ✓ | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ |
| Floating-leaved (rooted) | | | | | | | | | | | ✓ |
| Free-floating | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Amphibious | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | | ✓ |
| Submerged broad-leaved | | ✓ | E | ✓ | E | ✓ | E | E | ✓ | ✓ | E |
| Submerged linear-leaved | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | ✓ |
| Submerged fine-leaved | E | ✓ | ✓ | ✓ | | ✓ | | E | ✓ | ✓ | E |
| Filamentous algae | ✓ | E | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |

Use end column for overall assessment over 500m, including types not occurring in spot-checks (use ✓, E or NV) →

### Sweep-up information

1.46 Page 3 of the form is designed for recording general information by means of a 'sweep-up' checklist. This is usually best done when walking back along the RHS site following completion of the spot-checks. The sweep-up represents an assessment of the extent of features over the whole 500m length, and will include those features not occurring at the spot-checks. **Since the sample length is 500m and the ten-spot-checks are 50m apart, it is important to include the remaining 50m of the sample length in the sweep-up assessment. This means walking an extra 50m beyond the tenth spot-check and taking a GPS reading**.

1.47 Features in the sweep-up are recorded by entering a '✓' for those present in at least 1% of the site and 'E' for those extending more than 33% along the site. This type of recording is used in Sections H and I to provide information on land-use and bank profiles. Some features may be important, even if they do not extend 1% along an RHS site. Such features include underwater tree roots, and all such categories are marked with an asterisk (*) to highlight they are special cases, and can be recorded as present even if they do not occur along ≥1% of the site.

1.48 Information on trees (Section J) is recorded in a tick box format, with categories for the distribution pattern of trees along each bank, and whether associated features such as 'underwater tree roots' or 'large woody debris' are absent, present or extensive along the channel as a whole.

1.49 The extent (absence, presence or extensive occurrence) of specific channel features is recorded in Section K. The check-list represents a range of flow-types and river channel features that are readily identified in the field. An assessment of their presence, absence and overall extent enables a broad picture of river character to be established. The five features marked by an *asterisk (e.g. *free fall flow) can be recorded as 'present' even if they do not occur along at least 1% of the site.

### Channel dimensions, influences and special features

1.50 Page 4 of the form contains Section L – channel dimensions. These are measured at one location within the 500m. Ideally, that location should be in a straight or uniform reach (i.e. not on a sharp bend), with clearly defined banks and preferably across a riffle. If riffles are not present in the site, a uniform location with clearly defined banks should be used. Channel dimensions do not have to be measured at a spot-check.

1.51 Guidance on how to measure the channel is included in the spot-check key. Where it is safe to do so, the bankfull width, wetted water width and water depth should be recorded, preferably using the ranging pole. A rangefinder will be needed for estimating the width of larger rivers, and these instruments should be calibrated regularly.

1.52 Page 4 also establishes the absence, presence (✓) or extensive occurrence (E) of the following: 'features of special interest' (Section M); 'notable nuisance plants' (Section O); and alders, including diseased trees (Section Q). Features marked by an *asterisk (e.g. *leafy debris) can be recorded as 'present' even if they do not occupy at least 1% of the site.

1.53 Section N requires surveyors to record whether or not the channel is choked with vegetation. This is important since RHS might be carried out at times when plant growth in rivers is at its greatest.

1.54 Section P contains text prompts to assist surveyors in describing the overall characteristics of the site, as well as providing a space for noting other relevant observations. Additional relevant observations are encouraged and these should be included on a separate sheet, provided that the mid-site grid reference is clearly marked on it.

1.55 Section R contains seven cross-check prompts to ensure that all parts of the survey form have been completed correctly.

### Suitable conditions and season

1.56 ☠ **RHS should never be carried out during flood (spate) flows** because there are major safety risks involved. High water levels and turbidity will also obscure many of the features RHS is designed to record and give a false impression of flow-types compared with those expected under dry-weather conditions. If a prolonged period of heavy rain occurs, a survey should be delayed until both water level and clarity, return to acceptable levels.

1.57 In some lowland UK rivers abundant growth by emergent and bankside vegetation in summer will obscure some channel features. Surveys during this period should be avoided: May and June are considered the most suitable months. Upland rivers with little or no emergent vegetation are suitable for surveying over a much longer season.

1.58 If, for special reasons, surveys have to be carried out during non-optimal months, interpretation of the results will need to take full account of seasonal aquatic and bankside vegetation growth.

1.59 Likewise, in countries with different climatic conditions from the UK, surveys should be ideally carried out when aquatic vegetation growth is evident, but not excessive, and water levels are not high.

### Quality control

1.60 Each RHS form must be checked for completeness. A simple set of questions is included as a checklist in Section R of the form. These should be used to check the completion of relevant components of the form, and the boxes on the right of the form should be ticked after checks have been made. 💡 An extra two minutes for quality control at the end of each survey is invaluable, because incomplete forms will be returned, and a re-survey may be needed.

1.61 It is important that completed RHS forms are legible, the pages stapled together **with a site reference clearly marked on all pages**. If an extra sheet is used for additional observations, make sure this is similarly marked and firmly attached.

1.62 Of equal importance is the need to clearly label all photographs, and ensure they match the references given on page 1 of the form.

### Contact for enquiries

1.63 Queries and further information on this manual should be addressed to: rhs@environment-agency.gov.uk

## REFERENCES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# PART TWO – THE HEALTH AND SAFETY FORM, SPOT-CHECK KEY AND 2003 RHS FORM

- **Site Health and Safety Assessment**
- **Spot-check Key (2003 Version)**
- **River Habitat Survey Forms (2003 Version)**

| RIVER HABITAT SURVEY 2003 VERSION: SITE HEALTH AND SAFETY ASSESSMENT | | | |
|---|---|---|---|
| Site Number[1]: | Site Ref: | River Name: | Date: |
| Grid References/Co-ordinates: | Spot 1[2]: | Mid-site: | End of site[2]: |
| Surveyor Name: | | Accredited Surveyor Code: | |
| [1] Leave blank if new site. | | [2] Optional | |

| Weather Conditions: |
|---|
| Flow Conditions: |

| **Site details:** (enter comments or circle if applicable and give details) | **Risk Level (Low/Mod/High)** |
|---|---|
| Access and Parking:<br>(entry & exit) | |
| Conditions: comment on ground stability, footing, exposure/remoteness | |
| Obstacles/Hazards: fencing, stiles, dense vegetation, steep bank | |
| Occupied/Unoccupied: people, livestock, animals | |
| Activities/Land-use: agriculture, woodland, residential, industrial, construction, recreational | |
| Risk if lone-working | |

**IF THERE ARE ANY HIGH RISKS OR MORE THAN THREE MODERATE RISKS DO NOT CONTINUE WITH THE SURVEY.**

**Weil's Disease (*Leptospirosis*)**

Instructions to card holders

1. As infection may enter through breaks in the skin, ensure that any cut, scratch or abrasion is thoroughly cleansed and covered with a waterproof plaster.
2. Avoid rubbing your eyes, nose and mouth during work.
3. Clean protective clothing, footwear and equipment etc. after use
4. After work, and particularly before taking food or drink, wash hands thoroughly.
5. Report all accidents and/or injuries, however slight.
6. Keep your card with you at all times.

**Lyme Disease**

1. Dress appropriately with skin covered up.
2. Regularly inspect for ticks when in the field.
3. Check for, and remove, any ticks as soon as possible after leaving the site.
4. Seek medical attention if bitten by a tick.

# RIVER HABITAT SURVEY 2003 VERSION: SPOT-CHECK KEY Page 1 of 2

## PHYSICAL ATTRIBUTES (SECTION E)

### BANKS

**Predominant bank material**

**NV** = not visible

**BE** = bedrock
**BO** = boulder
**CO** = cobble
**GS** = gravel/sand
**EA** = earth (crumbly)
**PE** = peat
**CL** = sticky clay

**CC** = concrete
**SP** = sheet piling
**WP** = wood piling
**GA** = gabion
**BR** = brick/laid stone
**RR** = rip-rap
**TD** = tipped debris
**FA** = fabric
**BI** = bio-engineering materials

**Bank modifications**

**NK** = not known
**NO** = none

**RS** = resectioned (reprofiled)
**RI** = reinforced
**PC** = poached
**PC(B)** = poached (bare)
**BM** = artificial berm
**EM** = embanked

**Marginal and bank features**

**NV** = not visible (e.g. far bank)
**NO** = none

**EC** = eroding cliff (**EC** if sandy substrate)
**SC** = stable cliff (**SC** if sandy substrate)

**PB** = unvegetated point bar
**VP** = vegetated point bar

**SB** = unvegetated side bar
**VS** = vegetated side bar

**NB** = natural berm

### CHANNEL

**Predominant substrate**

**NV** = not visible

**BE** = bedrock
**BO** = boulder
**CO** = cobble
**GP** = gravel/pebble (**G** or **P** if predominant)
**SA** = sand
**SI** = silt
**CL** = clay
**PE** = peat
**EA** = earth
**AR** = artificial

**Predominant flow-type**

**NV** = not visible
**FF** = free fall
**CH** = chute
**BW** = broken standing waves (white water)
**UW** = unbroken standing waves
**CF** = chaotic flow
**RP** = rippled
**UP** = upwelling
**SM** = smooth
**NP** = no perceptible flow
**DR** = no flow (dry)

**Channel modifications**

**NK** = not known
**NO** = none

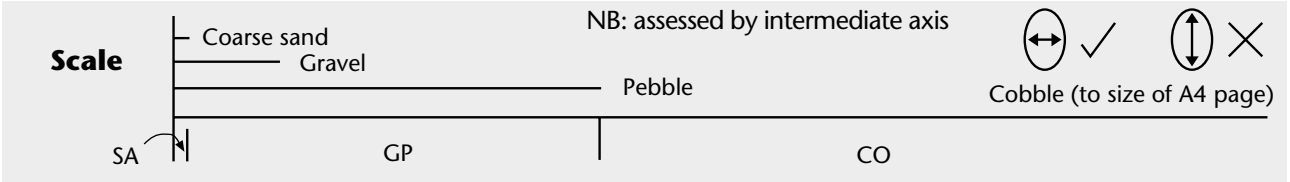
**CV** = culverted
**RS** = resectioned
**RI** = reinforced
**DA** = dam/weir/sluice
**FO** = ford (man-made)

**Channel features**

**NV** = not visible
**NO** = none

**EB** = exposed bedrock
**RO** = exposed boulders
**VR** = vegetated rock
**MB** = unvegetated mid-channel bar
**VB** = vegetated mid-channel bar
**MI** = mature island
**TR** = Trash (urban debris)

| FLOW-TYPES | DESCRIPTION |
|---|---|
| **FF: Free fall** | clearly separates from back-wall of vertical feature ~ associated with waterfalls |
| **CH: Chute** | low curving fall in contact with substrate ~ often associated with cascades |
| **BW: Broken standing waves** | white-water tumbling waves must be present ~ mostly associated with rapids |
| **UW: Unbroken standing waves** | upstream facing wavelets which are not broken ~ mostly associated with riffles |
| **CF: Chaotic flow** | a chaotic mixture of three or more of the four fast flow-types with no predominant one obvious |
| **RP: Rippled** | no waves, but general flow direction is downstream with disturbed rippled surface ~ mostly associated with runs |
| **UP: Upwelling** | heaving water as upwellings break the surface ~ associated with boils. |
| **SM: Smooth** | perceptible downstream movement is smooth (no eddies) ~ mostly associated with glides |
| **NP: No perceptible flow** | no net downstream flow ~ associated with pools, ponded reaches and marginal deadwater |
| **DR: No flow (dry)** | dry river bed |



## RIVER HABITAT SURVEY: SPOT-CHECK KEY



**LEFT** **Banks are determined by looking downstream** **RIGHT**

### CHANNEL MODIFICATION INDICATORS

One or more of the following may be indicative of resectioning:

1. Uniform bank profile
2. Straightened planform
3. Bankfull width/bankfull height ratio <4:1
4. Uniform/low energy flow-types
5. No trees/uniformly-aged trees along bank
6. Intensive/urban land-use

### LAND-USE WITHIN 5m OF BANKTOP (SECTION F) & 50m (SECTION H)

**BL** = Broadleaf/mixed woodland (semi-natural)
**BP** = Broadleaf/mixed plantation
**CW** = Coniferous woodland (semi-natural)
**CP** = Coniferous plantation
**SH** = Scrub & shrubs
**OR** = Orchard
**WL** = Wetland (e.g. bog, marsh, fen)
**MH** = Moorland/heath
**AW** = Artificial open water
**OW** = Natural open water
**RP** = Rough unimproved grassland/pasture
**IG** = Improved/semi-improved grassland
**TH** = Tall herb/rank vegetation
**RD** = Rock, scree or sand dunes
**SU** = Suburban/urban development
**TL** = Tilled land
**IL** = Irrigated land
**PG** = Parkland or gardens
**NV** = Not visible

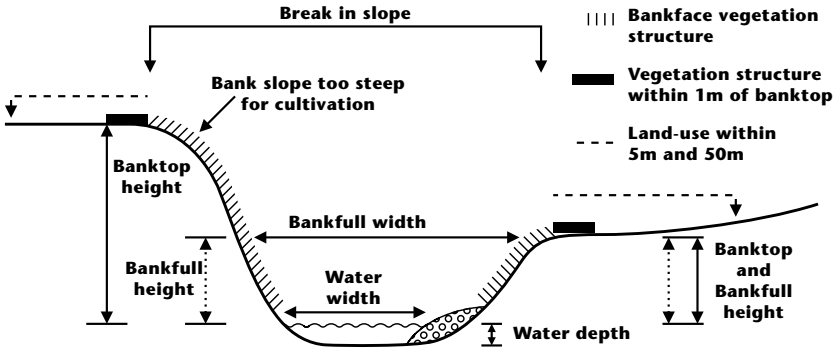
### BANKTOP AND BANKFACE VEGETATION STRUCTURE To be assessed within a 10m wide transect (SECTION F)

| | | | vegetation types |
|---|---|---|---|
| bare | B | bare earth/rock etc. | bryophytes |
| uniform | U | predominantly one type (no scrub or trees) | short/creeping herbs or grasses |
| simple | S | two or three vegetation types | tall herbs/ grasses |
| complex | C | four or more types | scrub or shrubs |
| | | | saplings and trees |

### Channel dimensions guidance (Section L)

- Select location on uniform section.
- If riffle is present, measure there. If not, measure at straightest and shallowest point.
- **Banktop** = first major break in slope above which cultivation or development is possible.
- **Bankfull** = point where river first spills on to floodplain.

**Cross-section of channel showing definitions used to define where spot-check recording and channel dimensions measured**




ENVIRONMENT AGENCY

**EMERGENCY HOTLINE 0800 80 70 60**

24 hour free emergency telephone line for reporting all environmental incidents relating to air, land and water.

## RIVER HABITAT SURVEY 2003 Version

Page 1 of 4

### A FIELD SURVEY DETAILS

Site Number: (leave blank if new site)

Site Reference:

Spot-check 1 Grid Ref:

Spot-check 6 Grid Ref:

End of site Grid Ref:

Reach Reference:

River name:

Date / /20 Time:

Surveyor name:

Accredited Surveyor code:

Is the site part of a river or an artificial channel? River ❑ Artificial ❑

Are adverse conditions affecting survey? No ❑ Yes ❑

If yes, state .....

Is bed of river visible? barely or not ❑ partially ❑ ±entirely ❑

Is health and safety assessment form attached? Yes ❑ No ❑

Number of photographs taken: ☐

Photo references:

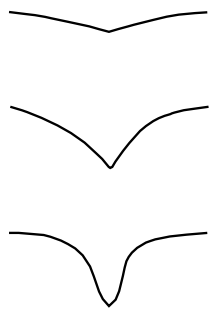
Site surveyed from: left bank ☐ right bank ☐ channel ☐

❑ **When options shown with 'shadow boxes', tick one box only**

**LEFT banks determined by facing downstream RIGHT**

### B PREDOMINANT VALLEY FORM (within the horizon limit) (tick one box only)

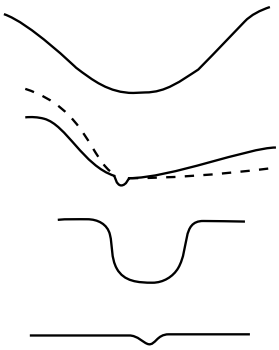
(tick one box only)



❑ shallow vee

❑ deep vee

❑ gorge



❑ concave/bowl

❑ asymmetrical valley

❑ U-shape valley

❑ no obvious valley sides

Distinct flat valley bottom? No ❑ Yes ❑

Natural terraces? No ❑ Yes ❑

### C NUMBER OF RIFFLES, POOLS AND POINT BARS (enter total number in boxes)

| | | | |
|---|---|---|---|
| Riffle(s) | ☐ | Unvegetated point bar(s) | ☐ |
| Pool(s) | ☐ | Vegetated point bar(s) | ☐ |

### D ARTIFICIAL FEATURES (indicate total number of occurrences of each category within the 500m site)

If none, tick box ☐

| | Major | Intermediate | Minor | | Major | Intermediate | Minor |
|---|---|---|---|---|---|---|---|
| Weirs/sluices | | | | Outfalls/ intakes | | | |
| Culverts | | | | Fords | | | |
| Bridges | | | | Deflectors/ groynes/croys | | | |
| Other - state | | | | | | | |

**Is channel obviously realigned?** No ❑ **Yes, <33% of site** ❑ **≥33% of site** ❑

**Is channel obviously over-deepened?** No ❑ **Yes, <33% of site** ❑ **≥33% of site** ❑

**Is water impounded by weir/dam?** No ❑ **Yes, <33% of site** ❑ **≥33% of site** ❑

| SITE REF. | **RIVER HABITAT SURVEY: TEN SPOT-CHECKS** | **Page 2 of 4** |
|---|---|---|

Spot-check 1 is at: upstream end ❑ downstream end ❑ of site (tick one box)

**E PHYSICAL ATTRIBUTES** (to be assessed across channel within 1m wide transect)

| **When boxes 'bordered', only one entry allowed** | **1 GPS** | 2 | 3 | 4 | 5 | **6 GPS** | 7 | 8 | 9 | 10 | **GPS** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LEFT BANK** | Ring EC or SC if composed of sandy substrate | | | | | | | | | | |
| **Material** NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | | |
| **Bank modification(s)** NK, NO, RS, RI, PC(B), BM, EM | | | | | | | | | | | |
| **Marginal & bank feature(s)** NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | | |
| **CHANNEL** | GP- ring either G or P if predominant | | | | | | | | | | |
| **Channel substrate** NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR | | | | | | | | | | | |
| **Flow-type** NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR | | | | | | | | | | | |
| **Channel modification(s)** NK, NO, CV, RS, RI, DA, FO | | | | | | | | | | | |
| **Channel feature(s)** NV, NO, EB, RO, VR, MB, VB, MI, TR | | | | | | | | | | | |
| **For braided rivers only: number of sub-channels** | | | | | | | | | | | |
| **RIGHT BANK** | Ring EC or SC if composed of sandy substrate | | | | | | | | | | |
| **Material** NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | | |
| **Bank modification(s)** NK, NO, RS, RI, PC(B), BM, EM | | | | | | | | | | | |
| **Marginal & bank feature(s)** NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | | |

Enter channel substrate(s) not occurring as predominant in spot-checks but present in >1% of whole site. ⟵

**F BANKTOP LAND-USE AND VEGETATION STRUCTURE** (to be assessed over a 10m wide transect)

**Land-use: choose one from BL, BP, CW, CP, SH, OR, WL, MH, AW, OW, RP, IG, TH, RD, SU, TL, IL, PG, NV**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| LAND-USE WITHIN 5m OF LEFT BANKTOP | | | | | | | | | | |
| LEFT BANKTOP (structure within 1m) B/U/S/C/NV | | | | | | | | | | |
| LEFT BANK-FACE (structure) B/U/S/C/NV | | | | | | | | | | |
| RIGHT BANK-FACE (structure) B/U/S/C/NV | | | | | | | | | | |
| RIGHT BANKTOP (structure within 1m) B/U/S/C/NV | | | | | | | | | | |
| LAND-USE WITHIN 5m OF RIGHT BANKTOP | | | | | | | | | | |

**G CHANNEL VEGETATION TYPES** (to be assessed over a 10m wide transect: use E ( ≥ 33% area), ✓(present) or NV (not visible)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | | | | | | | | | | |
| Liverworts/mosses/lichens | | | | | | | | | | |
| Emergent broad-leaved herbs | | | | | | | | | | |
| Emergent reeds/sedges/rushes/grasses/horsetails | | | | | | | | | | |
| Floating-leaved (rooted) | | | | | | | | | | |
| Free-floating | | | | | | | | | | |
| Amphibious | | | | | | | | | | |
| Submerged broad-leaved | | | | | | | | | | |
| Submerged linear-leaved | | | | | | | | | | |
| Submerged fine-leaved | | | | | | | | | | |
| Filamentous algae | | | | | | | | | | |

Use end column for overall assessment over 500m, including types not occurring in spot-checks (use ✓, E or NV) ⟵

| SITE REF. | **RIVER HABITAT SURVEY : 500m SWEEP-UP** | **Page 3 of 4** |
|---|---|---|

## H LAND-USE WITHIN 50m OF BANKTOP

Use ✓ (present) or E (≥ 33% banklength)

| | L | R | | L | R |
|---|---|---|---|---|---|
| Broadleaf/mixed woodland (semi-natural) (BL) | | | Natural open water (OW) | | |
| Broadleaf/mixed plantation (BP) | | | Rough/unimproved grassland/pasture (RP) | | |
| Coniferous woodland (semi-natural) (CW) | | | Improved/semi-improved grassland (IG) | | |
| Coniferous plantation (CP) | | | Tall herb/rank vegetation (TH) | | |
| Scrub & shrubs (SH) | | | Rock, scree or sand dunes (RD) | | |
| Orchard (OR) | | | Suburban/urban development (SU) | | |
| Wetland (e.g. bog, marsh, fen) (WL) | | | Tilled land (TL) | | |
| Moorland/heath (MH) | | | Irrigated land (IL) | | |
| Artificial open water (AW) | | | Parkland or gardens (PG) | | |
| | | | Not visible (NV) | | |

## I BANK PROFILES

Use ✓ (present) or E (≥ 33% banklength)

| **Natural/unmodified** | L | R | **Artificial/modified** | L | R |
|---|---|---|---|---|---|
| Vertical/undercut | | | Resectioned (reprofiled) | | |
| Vertical with toe | | | Reinforced - whole | | |
| Steep (>45°) | | | Reinforced - top only | | |
| Gentle | | | Reinforced - toe only | | |
| Composite | | | Artificial two-stage | | |
| Natural berm | | | Poached bank | | |
| | | | Embanked | | |
| | | | Set-back embankment | | |

## J EXTENT OF TREES AND ASSOCIATED FEATURES

*record even if <1%

| **TREES** (tick one box per bank) | Left | Right |
|---|---|---|
| None | ☐ | ☐ |
| Isolated/scattered | ☐ | ☐ |
| Regularly spaced, single | ☐ | ☐ |
| Occasional clumps | ☐ | ☐ |
| Semi-continuous | ☐ | ☐ |
| Continuous | ☐ | ☐ |

| **ASSOCIATED FEATURES** (tick one box per feature) | None | Present | E (≥33%) |
|---|---|---|---|
| Shading of channel | ☐ | ☐ | ☐ |
| *Overhanging boughs | ☐ | ☐ | ☐ |
| *Exposed bankside roots | ☐ | ☐ | ☐ |
| *Underwater tree roots | ☐ | ☐ | ☐ |
| Fallen trees | ☐ | ☐ | ☐ |
| Large woody debris | ☐ | ☐ | ☐ |

## K EXTENT OF CHANNEL AND BANK FEATURES

(tick one box for each feature) *record even if <1%

| | None | Present | E(≥33%) | | None | Present | E (≥33%) |
|---|---|---|---|---|---|---|---|
| *Free fall flow | ☐ | ☐ | ☐ | Exposed bedrock | ☐ | ☐ | ☐ |
| Chute flow | ☐ | ☐ | ☐ | Exposed boulders | ☐ | ☐ | ☐ |
| Broken standing waves | ☐ | ☐ | ☐ | Vegetated bedrock/boulders | ☐ | ☐ | ☐ |
| Unbroken standing waves | ☐ | ☐ | ☐ | Unvegetated mid-channel bar(s) | ☐ | ☐ | ☐ |
| Rippled flow | ☐ | ☐ | ☐ | Vegetated mid-channel bar(s) | ☐ | ☐ | ☐ |
| *Upwelling | ☐ | ☐ | ☐ | Mature island(s) | ☐ | ☐ | ☐ |
| Smooth flow | ☐ | ☐ | ☐ | Unvegetated side bar(s) | ☐ | ☐ | ☐ |
| No perceptible flow | ☐ | ☐ | ☐ | Vegetated side bar(s) | ☐ | ☐ | ☐ |
| No flow (dry) | ☐ | ☐ | ☐ | Unvegetated point bar(s) | ☐ | ☐ | ☐ |
| Marginal deadwater | ☐ | ☐ | ☐ | Vegetated point bar(s) | ☐ | ☐ | ☐ |
| Eroding cliff(s) | ☐ | ☐ | ☐ | *Unvegetated silt deposit(s) | ☐ | ☐ | ☐ |
| Stable cliff(s) | ☐ | ☐ | ☐ | *Discrete unvegetated sand deposit(s) | ☐ | ☐ | |
| | | | | *Discrete unvegetated gravel deposit(s) | ☐ | ☐ | |

| SITE REF. | **RIVER HABITAT SURVEY : DIMENSIONS AND INFLUENCES** | **Page 4 of 4** |
|---|---|---|

## L CHANNEL DIMENSIONS (to be measured at one location on a straight uniform section, preferably across a riffle)

| LEFT BANK | | CHANNEL | | RIGHT BANK | |
|---|---|---|---|---|---|
| Banktop height (m) | | Bankfull width (m) | | Banktop height (m) | |
| Is banktop height also bankfull height? (Y or N) | | Water width (m) | | Is banktop height also bankfull height? (Y or N) | |
| Embanked height (m) | | Water depth (m) | | Embanked height (m) | |

If trashline lower than banktop, indicate: height above water (m) = width from bank to bank (m) =

Bed material at site is: consolidated ❑ unconsolidated (loose) ❑ unknown ❑

Location of measurements is: riffle ❑ other ❑ (state)

## M FEATURES OF SPECIAL INTEREST Use ✓ or E (≥ 33% length) *record even if <1%

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| None | ☐ | Very large boulders (>1m) | ☐ | Backwater(s) | ☐ | Marsh(es) | ☐ |
| Braided channels | ☐ | *Debris dam(s) | ☐ | Floodplain boulder deposits | ☐ | Flush(es) | ☐ |
| Side channel(s) | ☐ | *Leafy debris | ☐ | Water meadow(s) | ☐ | Natural open water | ☐ |
| *Natural waterfall(s) > 5m high | ☐ | Fringing reed-bank(s) | ☐ | Fen(s) | ☐ | Others (state) | ☐ |
| *Natural waterfall(s) < 5m high | ☐ | Quaking bank(s) | ☐ | Bog(s) | ☐ | | |
| Natural cascade(s) | ☐ | *Sink hole(s) | ☐ | Wet woodland(s) | ☐ | | |

## N CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No ❑ Yes ❑

## O NOTABLE NUISANCE PLANT SPECIES Use ✓ or E (≥ 33% length) *record even if <1%

| | | bankface | banktop to 50m | | bankface | banktop to 50m |
|---|---|---|---|---|---|---|
| None ☐ | *Giant hogweed | ☐ | ☐ | *Himalayan balsam | ☐ | ☐ |
| | *Japanese knotweed | ☐ | ☐ | *Other (state)..... | ☐ | ☐ |

## P OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

**Major impacts:** landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing mining - quarrying - overdeepening - afforestation - fisheries management - silting - waterlogging - hydroelectric power

**Evidence of recent management:** dredging - bank mowing - weed cutting - enhancement - river rehabilitation - gravel extraction - other (please specify)

**Animals:** otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

**Other significant observations:** if necessary use separate sheet to describe overall characteristics and relevant observations

## Q ALDERS (tick one box in each of the two categories ) *record even if <1%

*Alders? None ❑ Present ❑ Extensive ❑

*Diseased Alders? None ❑ Present ❑ Extensive ❑

## R FIELD SURVEY QUALITY CONTROL ( ✓ boxes to confirm checks)

Have you taken at least two photos that illustrate the general character of the site and additional photos of any weirs/ sluices and major/intermediate structures across the channel? ☐

Have you completed all ten spot-checks and made entries in all boxes in E & F on page 2? ☐

Have you completed column 11 of section G (and E if appropriate) on page 2? ☐

Have you recorded in section C the number of riffles, pools and point bars (even if 0) on page 1? ☐

Have you given an accurate (alphanumeric) grid reference for spot-checks 1, 6 and end of site (page 1)? ☐

Have you stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)? ☐

Have you cross-checked your spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key? ☐

# PART THREE – DEFINITIONS AND DETAILED GUIDANCE

**RHS form page 1: Field Survey Details, Valley Form, Riffles etc. and Artificial Features**

## SECTION A: FIELD SURVEY DETAILS

### Site number

For RHS database entry purposes only. Every site will be given a unique reference number when entered on the RHS database. **Leave blank**. For re-surveyed sites, enter original number (if known) followed by (R) to indicate repeat survey.

### Site reference

Surveyors should enter their own unique reference number/name for the site, and replicate it on the left hand corner on each page of the form. 💡 Photos should also contain the same reference number.

### Spot-checks 1, 6 and end of site grid reference/co-ordinates

In the UK, using a GPS, it is essential to record a 10 figure NGR (national Ordnance Survey grid reference) for spot-checks 1 and 6 (the mid-point); a reminder to do so is given in the spot-check columns on page 2 of the form. The grid reference for spot-check 1 is required to ensure re-surveys start at the same locations as the original surveys. The grid reference for spot-check 6 is required to calculate distance from source, site gradient and other map-derived data. 💡 It is also essential to record a grid reference for 50m beyond spotcheck 10 (where the site ends). Use 1:10,000 or 1:25,000 scale maps to provide a cross-check for the grid references and whenever possible annotate the site boundaries on a 1:25,000 scale map.

Alternatively, record latitude and longitude. If there is no GPS signal, or only a poor one, enter an 8-figure reference from a 1:25,000 scale map.

***Reach reference (optional).***

Record the reference of the reach (if any). Reaches can be defined as part of a sampling strategy for Catchment Flood Management Plans (CFMPs), Catchment Abstraction Management Strategies (CAMS), River Basin Management Plans (RBMPs) or SERCON assessments.

### River name

Enter name appearing on River Quality Objective (RQO) map. If not named, or even depicted, on these maps, use name given on 1:50,000 scale maps, or more detailed scale if available. Use the name appearing on the map, including Welsh or Gaelic names. Include alternative names if two are given on the map. Unnamed headwater tributaries should be categorised as such, but refer to the named mainstream watercourse (e.g. tributary of.....Eden). In these cases it is not necessary to enter the words 'Afon' or 'River'.

### Date/time

The time of survey, as well as the date, is important because this could be useful regarding significant observations (e.g. pollution) and in relation to gauged river flow information.

### Surveyor name/Accredited surveyor Code

All accredited surveyors have an individual code. Surveyor name and code must be entered on the form to comply with the RHS accreditation scheme. Names on the survey forms should match those on the surveyor's accreditation certificate. Only surveys from accredited surveyors will be entered on the RHS database.

### Is the site part of a river or an artificial channel?

Artificial channels are canals, dykes, ditches and drains constructed entirely by human activity. Natural rivers that have been extensively modified by human activity should be recorded as 'rivers' (e.g. navigation course of the Thames, concrete-lined urban streams). **Tick one box only**. 📷 A1a,b,c,d.

### Are adverse conditions affecting survey?

**Surveys should not be carried out in spate conditions**. ☠ Take full account of the risk assessment carried out before embarking on a survey. Do not enter the channel if the water is turbid. 💡 Beware too that weather conditions can affect both safety and the accuracy of survey results – examples of conditions adversely affecting survey include: strong winds and heavy rain (affects flow-type assessment and recording on the field sheets); overgrown channels (where vegetation may hide some features). **Tick one box only**.

### Is bed of river visible?

A number of factors can affect whether a surveyor can see the bed of the river. Even under low flow conditions, the bed of wide or very deep rivers will only be partially visible, at best. Dense growth of freefloating macrophytes or planktonic algae may similarly obscure the bed from view, even when flows are very low. Use common sense, but as a guide, ✓ the 'barely or not' box if 0-33% of the bed visible; ✓ the 'partially obscured' box if 33-95% visible, and ✓ the '± entirely' box if ≥95% of bed visible. 📷 A3a,b.

### Is health and safety assessment form attached?

A health and safety assessment must be completed before starting the survey. 💡 A separate form must be filled in (see Appendix 1 for details, and form in Section 2). **Tick one box only** – if the 'No' box is ticked, reasons for not completing, and attaching, the form should be given. The ☠ icon is shown in this manual to remind surveyors of common health and safety issues.

### Photography (general)

**A PHOTOGRAPHIC RECORD OF THE SITE IS ESSENTIAL TO AID INTERPRETATION OF DATA, AND AS A RECORD OF THE SITE FOR FUTURE REFERENCE**. At least two photos must be taken, and any others for clarification purposes. Sufficient photographs should be taken to illustrate the general character of the site. In more inaccessible sites it may be necessary to seek a vantage point that will provide the most comprehensive view. It may be necessary to take more than two photographs to effectively illustrate general character. Avoid taking photos directly into the sun.

💡 Photographs of channel modifications and special features should also be taken. **It is essential that all 'major' structures are photographed to enable interpretation of potential impacts to be made**.

A good quality digital camera is recommended. The quality of digital photographs required will depend upon their intended use. For inclusion on the RHS database, a 1024x768-pixel picture with a standard JPEG compression (100-150kbyte) is required. For inclusion in printed documents, additional photographs at a higher resolution (e.g. 2048x1536 TIFF or JPEG) are recommended.

💡 If you are unsure about an unusual or unfamiliar feature, take a photograph for reference and make accompanying notes. **Enter the number of photographs taken in the box**. Photographs that include, in the foreground, a chalk-board showing the site reference, will ensure photographs and site survey forms always correspond. **Enter on the form the references used** during survey to ensure the correct photographs are matched with the sites surveyed. **It is the responsibility of the surveyor to check that the photographs and site numbers match**.

### Site surveyed from

For wide and deep rivers, surveys might only be able to be carried out from one bank only, although for best results each bank would need to be walked. The same applies for rivers flowing through gorges. For shallow rivers a survey can be carried out easily from both sides of the channel, or by accessing the watercourse. ☠ Beware of health & safety issues. Insert ✓ in one or more boxes to indicate where site has been surveyed from.

## SECTION B: PREDOMINANT VALLEY FORM (within the horizon limit)

Profile diagrams are drawn on the form for guidance. **Valley form** refers to the shape of whole valley landform within which the RHS site is situated. It is assessed in the context of the horizon. It is the predominant valley form viewed by the surveyor when looking from the river to the mid-distant horizon. If you are unsure about a particular valley form, photograph and make a note or a sketch with an evaluation of distances. **Tick one box only**.

### Shallow vee

Overall valley side slopes <30° from floor to top (horizon). B1a,b, E1Pb.

### Deep vee

Overall valley side slopes >30° – 80° from floor to top (horizon). B2a,b, J1b.

### Gorge

Steep (>80° to vertical), rocky, valley sides with narrow valley bottom. B3a.

### Concave/bowl

Gently curving slopes that do not have a distinct glaciated U-shape. B4a.

### Asymmetrical valley

Valley sides are different, shallow on one side and steep on the other. B5a.

### U-shape valley

Steep valley sides rising from a flat valley floor that characterises a glacial valley. B6a, C1a.

### No valley-sides obvious

No obvious valley sides in near- to mid-horizon. B7a,b, A1a.

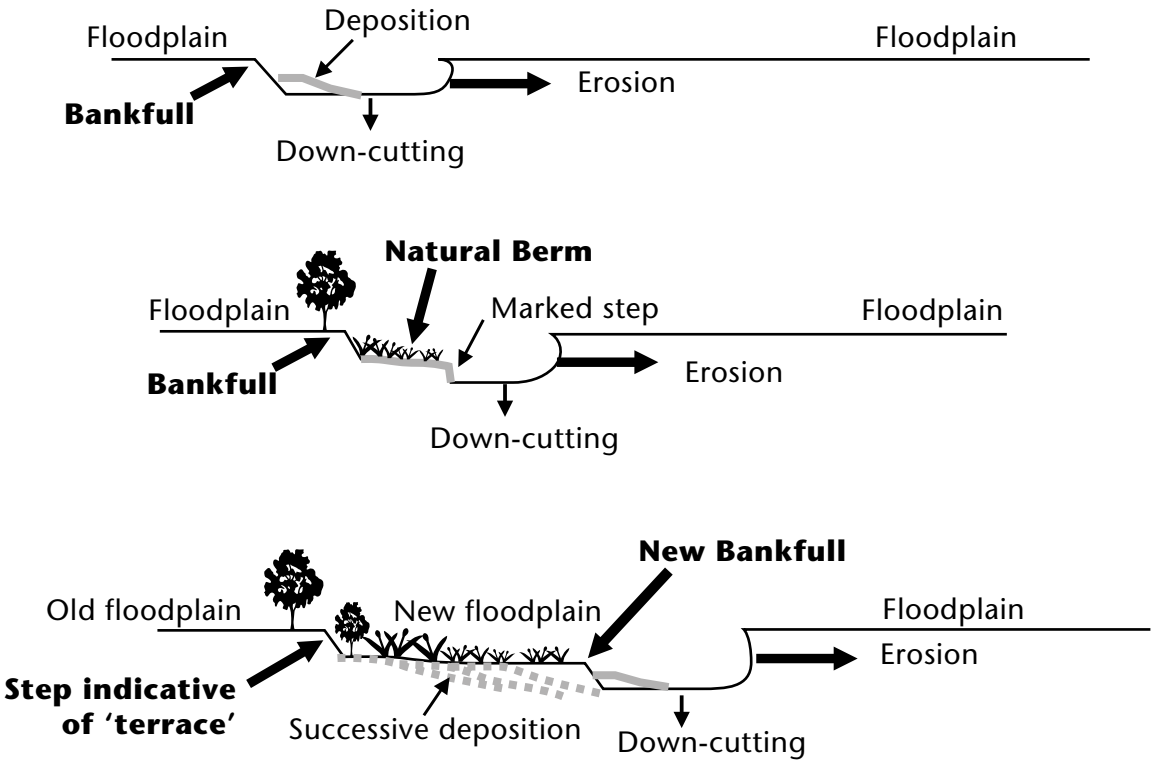
### Distinct flat valley bottom?

Flat area of valley into which water would spill during floods. If not obvious, record 'No'. Always tick 'No' box if no valley sides obvious. B1a,b, B2a,b, B5a, B6a, B7a,b, B8a,b, M1c.

### Natural terraces?

Distinct geomorphological features on a river valley floor forming steps or breaks in slope produced as the river erodes downwards. Characteristic of moraine-filled glaciated valleys. See Figure B1. B9a,b.

## Figure B1 Sequence of natural berm and terrace formation



## SECTION C: NUMBER OF RIFFLES, POOLS AND POINT BARS

For analytical purposes, the **numbers** of riffles, pools, unvegetated and vegetated point bars need to be recorded. This is best done as a cumulative tally between spot-checks. 💡 Always give the actual numbers, including zero. The tally can be recorded alongside the boxes, or at the top or bottom of page 2, and at the end of the survey the total number is transferred to the relevant boxes in Section C.

### Riffle(s)

Habitat feature characterised by:

- shallow, fast-flowing, water with a distinctly disturbed surface, over
- **unconsolidated** gravel-pebble, or cobble, substrate
- predominant flow-type, '**unbroken standing waves**'.

Riffles recorded in Section C must occupy:

- most of the wetted channel width, and
- be no longer than five times the river width.

Riffles create a distinct 'bubbling' sound. 📷 C1a,b,c, E5Db.

💡 Does not include unbroken standing waves associated with bedrock or solid peat/clay substrates.

Continuous 'unbroken standing wave' flow-type does not constitute discrete riffles. 💡 To be recorded as discrete individual features, a contrasting flow-type must separate each riffle. Riffles naturally occur at intervals equivalent to 5-10 times the channel bankfull width.

💡 In well-vegetated streams, aquatic vegetation sometimes creates unbroken standing waves by constricting or obstructing flow, or cause fine sediment deposition that raises the riverbed. **Do not record such examples as riffles**.

### Pool(s)

Pools are scour/erosion features.

Habitat feature characterised by:

- distinctly deeper parts of the channel that are usually no longer than **one to three times the channel's bankfull width**.
- where the hollowed river bed profiles are sustained by scouring.

Typical locations for pools include:

- the outside of tight meanders,
- downstream from natural bedrock outcrops (e.g. downstream from waterfalls or chutes where 'plunge pools' are formed), and
- below some weirs, where both downward and lateral erosion creates a typical scour pool.

Due to their self-scouring nature, associated flow-types can vary across the pool, and include upwelling, and even no perceptible flow when there is circulating current. See Figure C1. 📷 C2a,b,c, C1b, E5Bb, I1a, M3a, M4a,b.

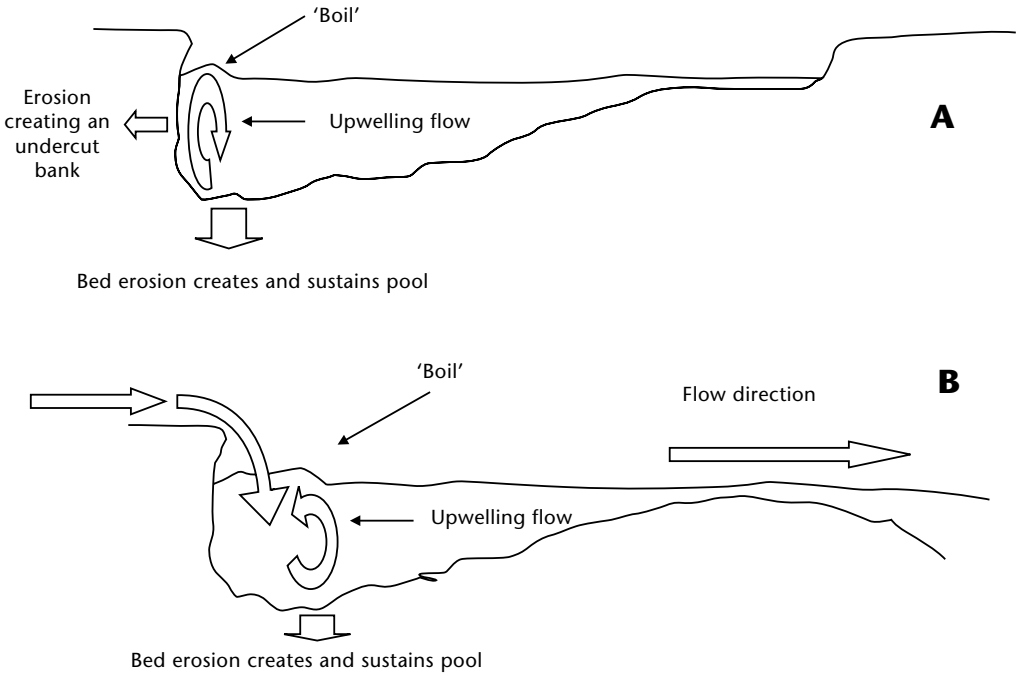
💡 Deep water impounded upstream of natural (bedrock), or artificial (weir) obstructions does NOT constitute a pool.

Even where the river bed is visible, pools are difficult to identify with absolute certainty. Do not spend time agonising over detail, but be consistent in your assessment. If in doubt, take photographs and seek advice for future surveys.

## Figure C1 Pool character at:

**A: tight meander bend (cross-section);**

**B: waterfall or weir (long-section)**




### Unvegetated point bar(s) (PB)

A distinct depositional feature:

- composed of unconsolidated river bed material
- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of tight meanders in actively eroding/depositing rivers.
- classified as 'unvegetated' if <50% of the surface area has plant cover. 📻 B1b, C1b, C3a,b,c, I1a,b.

Constituent material of point bars is primarily sediment that has been transported from upstream; it is generally not derived locally. 💡 This contrasts with slumped banks recorded in Section I.

### Vegetated point bar(s) (VP)

A distinct depositional feature:

- composed of consolidating river bed material.
- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of distinct meander bends, usually on rivers that are less active than where 'unvegetated' bars are found.
- classified as 'vegetated' if ≥50% of surface area has plant cover, often showing a successional sequence from bare shingle to even some scrub.

Constituent material as for unvegetated point bars.

Moss cover on bars is included as part of the vegetation cover, as this indicates stability. 📻 C4a,b,c.

In certain circumstances a sequence from unvegetated to vegetated bars may progress further, so that over time they may become 'natural berms' (see E; Marginal and Bank Features).

## SECTION D: ARTIFICIAL FEATURES

Indicate the number of artificial features in each category (major, intermediate or minor) occurring within the site. **Use the tally system (as in Section C) and add up the total at the end of your survey, and enter the number in the appropriate box.** 💡 **Insert ✓ in the box to indicate 'none' if no artificial features are present**.

💡 **You should take a photograph of any major or intermediate structure across the channel, with, if possible, a ranging pole alongside**. Take pictures upstream and downstream of the structure if it appears to be causing a significant change in river character (e.g. a dam). If a structure contains features of interest (e.g. fish ladder in major weir), make a note in Section P, as well as taking a photograph. 💡 Photographs of weirs should be taken since the height, design and construction material will determine the impact on the river.

**If you are unsure about the nature of a structure, take a picture and send it with the form**.

Figure D1 shows in plan-form the range of 'major', 'intermediate' and 'minor' artificial features that need to be recorded.

### Weirs and sluices across river channels

**Major**: any permanent, ±water-tight, fixed (but can be adjustable to control flow), weir/sluice structures. Typically made of concrete, cemented boulders, wood or metal **extending across the entire width of the channel**. Weirs and sluices can be used for controlling water level or water flow, abstracting water or trapping sediment. (**Exclude rubble/loose stone weirs**.) 📷 D1a,b,c,d.

**Intermediate**: semi-permeable, fixed, structures controlling water levels; **extending across the entire width of the channel but permeable enough to allow some water to flow through them**. Commonly made from loose rubble, inter-locked boulders and, less commonly, logs. 📷 D1e,f.

**Minor**: small, permeable, and usually temporary structures across the river channel, often made from stones, cobbles or pebbles by children. They often get dislodged by large spates. 📷 D1g.

**Composite weirs** should be recorded as a single structure. These are a series of weir crests close to each other, and linked with concrete aprons and/or side-walls so that there is no natural bank material between the weir crests. 📷 D1a,d.

**Weirs that have completely collapsed**, and only extend partially across the channel (and therefore do not control water levels upstream), should be recorded as 'groynes', and a note made in Section P. (📷 D6b).

### Culverts

Arched, enclosed or piped structures, constructed to carry water under roads, railways and buildings. Commonly made from concrete, but may be constructed from brick, metal or other building materials. Culverts either carry the full river flow through a single arch, or through multiple arches.

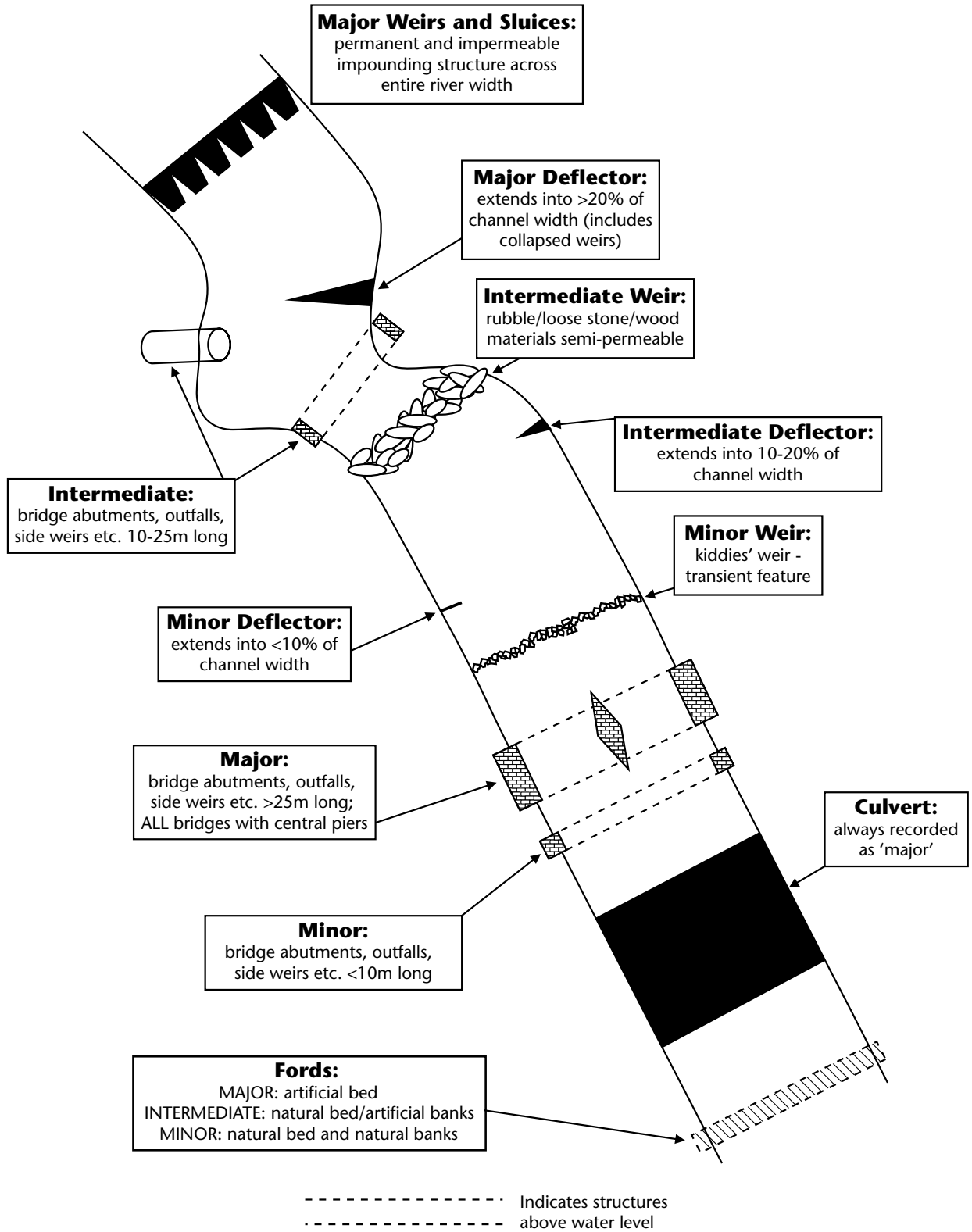
☠ **Do not enter any culverts**.

Some culverts may be a kilometre or more long, passing under fields, roads, residential and industrial areas. In such cases the location of many RHS spot-checks may have to be estimated from maps obtained previously. Entries for spot-checks in a culvert will normally simply enable 'CV' to be recorded as the modification, and the appropriate land-use noted. All other entries should be 'NV' (not visible) or 'NK' (not known) as appropriate unless the culvert is short and a clear view can be gained without entering it, or compromising the safety of the surveyor. 📷 D2a.

### Bridges

**Major**: road or rail bridges of any width, **with one or more in-channel supports**, **OR** wide bridges with bank abutments extending along ≥25m of bank-length. Banks are often resectioned or reinforced immediately upstream and downstream of a major bridge. Photographs are essential for interpretation of potential impacts of the in-channel supports. D3a,b, D5b.

## Figure D1 Illustrated definitions of artificial features



**Intermediate**: road or rail bridges **without any in-river supports**, and with bank abutments occupying 10-25m of the bank. 📷 D3c.

**Minor**: all road/rail bridges lacking in-river supports, and with bank abutments occupying <10m of the bank. Also includes all bridges, irrespective of width, with no abutments on the bank, such as viaducts. 📷 D3d,e, Na.

### Outfalls/intakes

Outfalls and intakes mark points of discharge to, or abstraction from, watercourses. They are classified according to size, so this means that associated aprons, wing-walls and bank protection measures are included as part of the structure. Examples include abstraction intakes, sewer discharges, side weirs and sluices.

**Major**: permanent structures occupying ≥25m of bank-length. 📷 D4a.

**Intermediate**: permanent structures occupying 10-25m of bank-length. 📷 D4b.

**Minor**: permanent structures occupying <10m of bank-length. Includes flap valves on feeder streams. 📷 D4c.

💡 Do not include agricultural land drainage pipes (typically <150mm diameter).

### Fords

Permanent crossing places for vehicles or machinery. 💡 Do not record sites where animals, but no vehicles, cross a river. 📷 D5e.

**Major**: crossing place with bed comprising artificial material which causes significant ponding of water upstream. Banks may be natural or artificial. Can be rubble infill (farm track) or a road crossing (e.g. tarmac, concrete). 📷 D5a.

**Intermediate**: shallow crossing with banks made from artificial material, but bed material is natural. May cause slight ponding of water upstream.

**Minor**: shallow crossing with no artificial bank or river bed material. Ponding effects will be negligible. 📷 D5c,d.

### Deflectors/groynes/croys

Artificial structures that are installed part way across the channel to deflect currents away from eroding banks or help create more in-channel habitat diversity. Most often installed flush with the bank toe to deflect flow from one side of the channel to the other, but may be also installed in mid-channel. Can be made from a variety of materials, including rocks, logs, sheeting, gabions, wooden/heather hurdles, posts and wire, and occasionally wooden stakes. Note: This includes collapsed weirs.

**Major**: extends across ≥20% of channel width. 📷 D6a,b.

**Intermediate**: extends across 10-20% of channel width. 📷 D6c,d.

**Minor**: extends across <10% of channel width. 📷 D6e.

If it is clear that these structures have been installed for habitat/fishing enhancement, note in Section P. **It is recommended that all deflectors are photographed since their impact/ purpose varies greatly according to their height and material, not just their extension across the channel**.

**Other**

Other structures (e.g. boat moorings, walls, jetties, fishing platforms) should be recorded as follows:

**Major**: occupying ≥25m of bank-length or ≥ 20% of channel width. 📷 D6g.

**Intermediate**: occupying 10-25m of bank-length or extends across 10-20% of channel width. 📷 D6f

**Minor**: occupying <10m of bank-length or extends across <10% of channel width.

💡 **It is important only to record distinct structures as opposed to bank modifications for buildings and revetments** (covered in Section E).

**Is channel obviously realigned?**

Only record 'yes' if you are sure. Common sense is required, but re-aligned channels are typically straight, and exhibit the same characteristics of resectioned (and often over-deepened) channels. See below.

**Important** – See Technical Update 2009 – Channel Resectioning.

**Tick one box only**. 📷 D7a,b, Na,b – for comparison see B1b, B5a, B6a, B7a, C4a, D7c.

**Is channel obviously over-deepened?**

Only record 'yes' if you are sure. Channel-deepening is frequently undertaken in tandem with bank resectioning. Diagnostic signs of over-deepened channels include:

1. uniform (and sometimes evenly stepped) bank profile;
2. no trees/uniformly-aged trees or saplings along banktop;
3. bankfull height often atypically high compared with bankfull width: ratio of width to depth commonly <4:1.

**Important** – See Technical Update 2009 – Channel Resectioning.

**Tick one box only**. 📷 D7a, D8a, D8b, D8c, E2Aa.

**Is water impounded by weir/dam?**

If a weir or dam is present, indicate if water in the site is affected partly (<33% of its length) or predominantly (≥33% of its length) by artificial channel impoundment. You will need to include the effects of weirs or dams located downstream from the site if appropriate. Effects of impoundment include water velocity reductions (creating ponded water) and increased water depth. **Tick one box only**. 📷 D9a, D1b,c, D5a.

### RHS form page 2: Sections E, F & G – Spot-checks

**It is essential to indicate on the form whether spot-check one (1) is at the upstream or downstream end of the site; tick one box only.**

💡 Ten spot-checks must be completed at regular intervals (c50m) along the 500m site.

At each spot-check, stand on the bank and look across the channel and indicate **in each box, in each column**, the material, modifications and features present. In shallow rivers, and **where safe to do so**, surveyors may choose to enter the channel to improve accuracy of recording bed character and features of the opposite bank. ☠ **Risk assessment is vital before entering the channel**.

💡 **All boxes in sections E and F must be completed (i.e. entries made in ALL boxes in the column representing an individual spot-check) before moving on to the next spot-check. At least one box in Section G must also have an entry for each spot-check. Each entry must be made clearly using the unique abbreviations shown in the spot-check key and described below.**

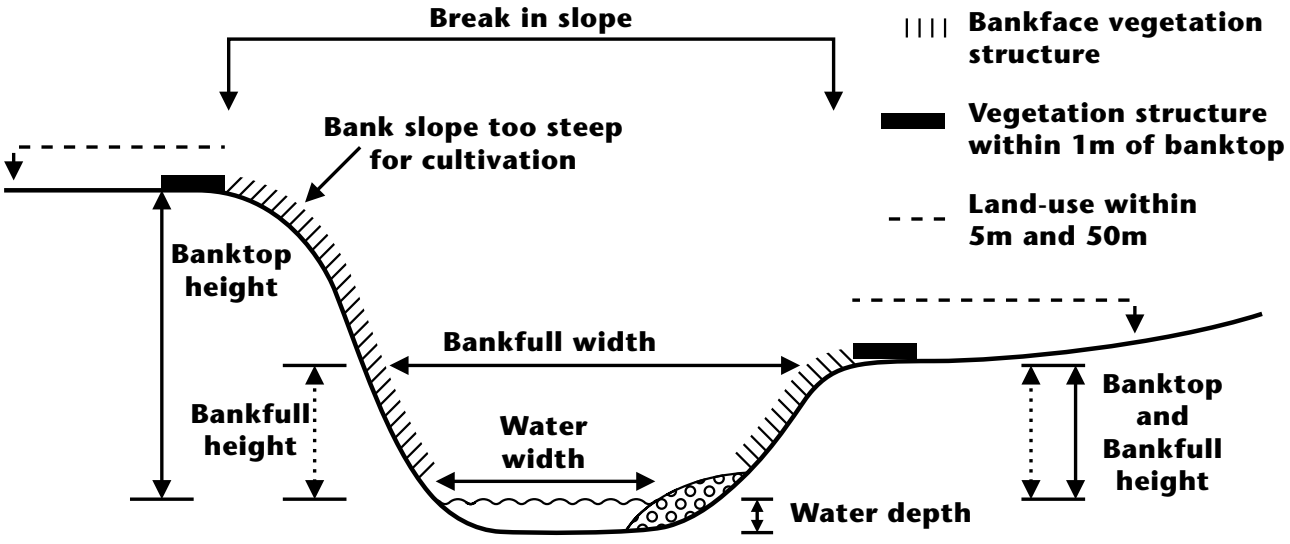
#### Bank

Permanent side to the river channel. For recording purposes (see Figure E1) the bank starts at the water's edge (and **excludes** marginal depositional features such as bars) and gives way to the 'banktop' where the break of slope allows cultivation or development to take place.

#### Left and Right banks

'Left' and 'right' banks are determined by facing **downstream**.

### Figure E1 Cross-section of channel showing definitions used to define where spot-check recording and channel dimensions measured




**For physical attributes (E), use a transect 1m wide at each spot-check across the channel. For land-use, vegetation structure and channel vegetation types (Sections F and G on page 2), use a 10m wide transect, at the same location (see Figure 1).**

💡 Only one entry per box is allowed for recording predominant bank material.

More than one channel or bank **feature or modification** can be recorded at a spot-check. In these cases, use a diagonal line to include a further entry in the box.

Only one entry per box is allowed for recording both **predominant channel substrate and flow-type**.

Only one entry per box is allowed for recording **land-use and bank and banktop vegetation structure**.

For **channel vegetation**, occurrences of all types are entered into appropriate boxes.

**GPS readings are required at spot-check 1, 6 and 50m beyond spot-check 10.**

## SECTION E: PHYSICAL ATTRIBUTES OF BANK AND CHANNEL

**To be assessed over a 1m wide transect of bank and channel at each spot-check. Refer to spot-check key and Figure 1.**

### BANK MATERIAL

**As boxes are emboldened, only a single entry per box is permissible (i.e. the predominant material of the whole bankface within the 1m wide spot-check).**

**Not visible (NV)**

Self-explanatory. This entry may need to be used for inaccessible far banks on wide rivers, especially when the banks are covered in vegetation, and cannot be given close inspection. Should be also used when a spotcheck is located at a culvert.

**Bedrock (BE)**

Exposure of solid rock. E1Aa,b, C2b, E5Ab, M3a.

**Boulder (BO)**

Large rocks ≥256mm in diameter (larger than head size) that can be loose, embedded or interlocked. When boulders are imported, record as 'rip-rap' material (RR), and reinforced (RI) bank modification. E1Ba,b.

**Cobble (CO)**

Loose rock material 64-256mm in diameter (half-fist to large head size). Often associated with glacial deposits. E1Ca,b.

**Gravel/sand (GS)**

Combined category. Loose material, comprising: coarse gravel, (including pebbles 16-64mm in diameter); fine gravel (2-16mm in diameter); and sand (<2mm in diameter). Often associated with glacial and fluvial deposits. E1Da,b,c, E3Aa.

**Earth (EA)**

Soil comprising mainly crumbly loam material, **but not predominantly composed of clays (see clay – CL)**. A jab with a ranging pole will leave no distinct hole, or one with ragged or crumbling edges. E1Ea,b, I1b.

**Peat (PE)**

Material formed almost entirely of organic matter derived from decayed vegetation under water-logged conditions and therefore usually associated with heaths and bogs. Peat is normally dark brown or black. E1Fa.

**Sticky clay (CL)**

Distinctive, solid and cohesive soil material. Compared with earth (EA), it is sticky when rubbed between finger and thumb. A jab from a ranging pole will produce a neat, smooth, conical hole. E1Ga, FV1a, I1a, I2a.

## ARTIFICIAL MATERIALS

💡 When recorded as bank materials, they will also be noted as reinforced (RI) in bank modifications.

### Concrete (CC)

Cemented bankface reinforcement that forms a solid revetment with no gaps or fissures. 📷 E1Ha,b, A1c, E2Cb, E7Cc.

### Sheet piling (SP)

Vertical, inter-locking, steel sheets protecting the bankface. Includes corrugated iron. 📷 E1Ia.

### Wood piling (WP)

Wooden poles, or horizontal/vertical planks protecting the bankface (most often the lower half or toe of the bank only). 📷 E1Ja,b.

### Gabion (GA)

Stones in wire baskets; installed to protect banks from erosion. 📷 E1Ka.

### Brick/laid stone (BR)

Bank protection that includes any cemented walls, including brick walls, and also regimented, un-cemented, laid stones characteristic of riverside walls in the Lake District and limestone dales. 📷 E1La,b,c.

### Rip-rap (RR)

Boulders (normally quarried and approximately ± square and of similar size) purposely tipped or laid along the bankface to protect it from erosion. Rip-rap is often along the toe of the bank only. Includes un-cemented blockstone and boulders compacted into the bank with vegetated soil between. E1Ma,b,c,d, I6a.

### Tipped debris (TD)

Discarded material from, for example, farming, mineral extraction and building works. Includes: rubble, metal, wood, old cars and excavated soils and other minerals. Location on the bank may be un-intentional, or to provide extra bank protection. If providing bank protection, reinforcement (RI) should be recorded in bank modification.

If in doubt, enter miscellaneous artificial materials here (e.g. tyres) and take a photograph. 📷 E1Na,b,c,d.

### Fabric (FA)

Synthetic (usually permeable geo-textile) bank protection fabric often used in conjunction with soil back-fill. Always non-biodegradable, with the prime function of bank support and protection from erosion. Includes materials such as plastic, and proprietary products such as 'enkamat' and 'nicospan'. 📷 E1Oa.

### Bio-engineering materials (BI)

Live or dead plants (or non-synthetic materials) used to protect banks from erosion, and often to create/restore bankside and marginal habitat. Typical materials include live willow stakes and spiles, dead brushwood faggots, bio-degradable matting and planted reeds. When used in combination with synthetic fabrics (FA), record whichever has the dominant surface area. 📷 E1Pa,b,c,d,e.

## BANK MODIFICATION(S)

**Boxes are NOT emboldened, so more than one entry per box is permissible (e.g. if the bank is reprofiled with toe reinforcement, enter RS/RI).**

### Not known (NK)

If you are unsure whether or not a bank has been modified, record NK. You can consult river management records to assess if the reach has been previously engineered. If so, make additional notes. Enter 'NK' for spot-checks in culverts.

### None (NO)

No **obvious** modifications visible. See NK above, and guidance below for signs indicative of resectioning. It may be that subtle changes are missed at a site on the first spot-checks, but later ones show clearer signs of modification. Under such circumstances, modifying earlier spot-check records is permissible if, on closer subsequent inspection, signs are evident. To do so, review spot-checks whilst completing the sweep-up on the return leg of the survey.

### Resectioned (reprofiled) bank (RS)

Bank profile modified (but not necessarily reinforced), often to accommodate flood flows, flood defence or other maintenance machinery. Recent re-profiling will produce a relatively smooth, uniformly angled, bank slope. If either the top or the bottom of a resectioned bank is reinforced, enter both RS and RI. A1a, D8a,b,c, E2Aa,b, E3Da, I6b.

NB One or more of the following clues may be indicative of resectioning:

1. **uniform (and sometimes evenly stepped) bank profile**;
2. **no trees/uniformly aged trees/saplings along banktop**;
3. bankfull height often atypically high compared with bankfull width – width to height ratio <4:1 not uncommon;
4. intensive agricultural/urban land-use;
5. straightened river channel.

Typically bank re-sectioning is carried out in tandem with channel deepening; the former alone results primarily in characteristics 1 and 2 above, whilst bank and channel resectioning can also result in characteristics 3-5.

Figure E2 illustrates a typical flood defence/channel modification sequence.

**Important** – See Technical Update 2009 – Bank Resectioning.

### Reinforced bank (RI)

Whole or part of bank artificially strengthened for bank protection purposes. Examples include concrete, sheet piling, corrugated iron, wood piling, gabion, brick/laid stone, rip-rap, and if clearly for bank reinforcement purposes, tipped debris (see Bank Material descriptions above). E1Ha,b, E1Ia, E1Ja,b, E1Ka, E1La,b,c, E1Ma,b,c,d, E1Oa, E1Pa,b,c,d,e.

### Poached bank (PC)

Bank significantly trampled or puddled by livestock. Includes banks heavily trampled as a result of human activity such as picnic spots, canoe access points and fishing spots dug into the bank.

Add (**B**) after PC (i.e. **PC(B)**) if the bank is predominantly bare due to poaching i.e. <50% vegetation cover. E2Ba,b,c,d, I5b, P1a.

### Artificial berm (BM)

Artificial two-stage channel created when either: a) a bank has been excavated laterally at a level above dryweather water level, but below the banktop; or b) an over-wide channel has artificial ledges constructed to reduce the low-flow width. This modification creates a distinct stepped or shelf appearance when first constructed, but may become less evident over time. Mention in Section P if the berm is part of river rehabilitation works. 📻 E1Hb, E2Ca,b,c,d, F18b.

### Embanked (EM)

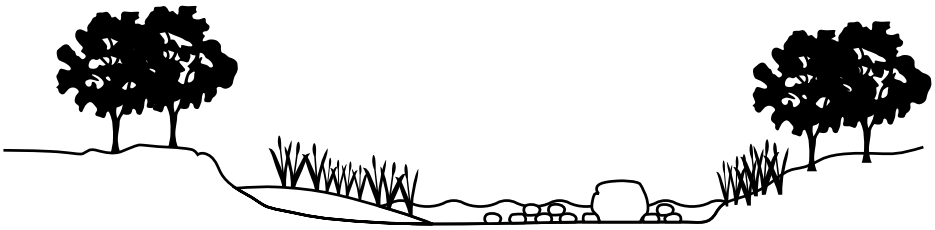
Artificial raising of bank. A variety of materials can be used, including earth, natural stone or walls of concrete or brick. 💡 Only recorded at a spot-check when it forms an integral part of the bank. Do not include embankments set back from the immediate banktop; these are accounted for in the 'sweep-up', Section I. 📻 E2Da,b.

**Note on bank modifications: if you are sure, beyond reasonable doubt, that there are no obvious signs of bank modification, then record 'NO' (none); if in doubt, record 'NK' (not known). Beware: some bankfaces will appear 'natural' even though they have been resectioned previously. Use the prompts listed above to help make up your mind whether to record 'NK' or 'NO'. See Figure E2.**

**Important** – See Technical Update 2006 – Embankments.

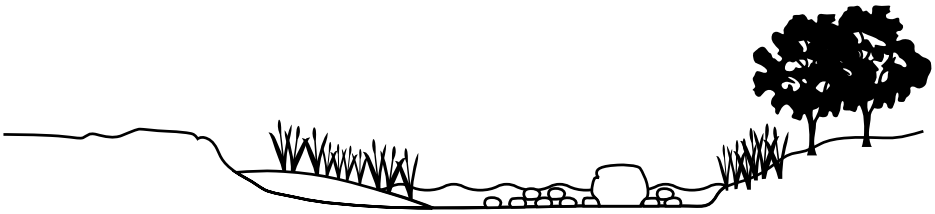
## Figure E2 Sequence of channel modifications for flood defence

**River unmodified**

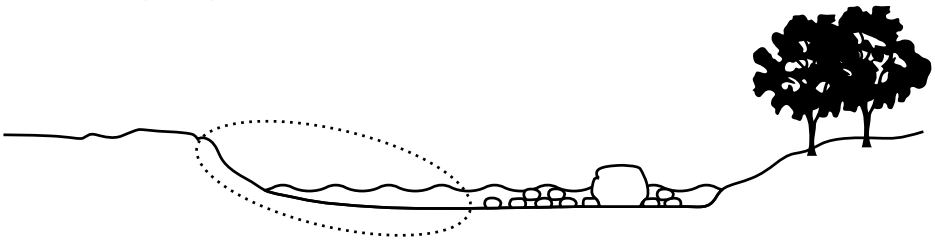


**Note: bankfull height/channel bankfull width ratio >1:4**

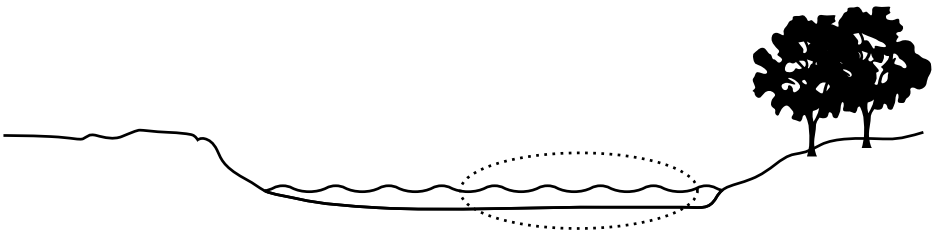
**Trees removed from one bank to allow machine access**



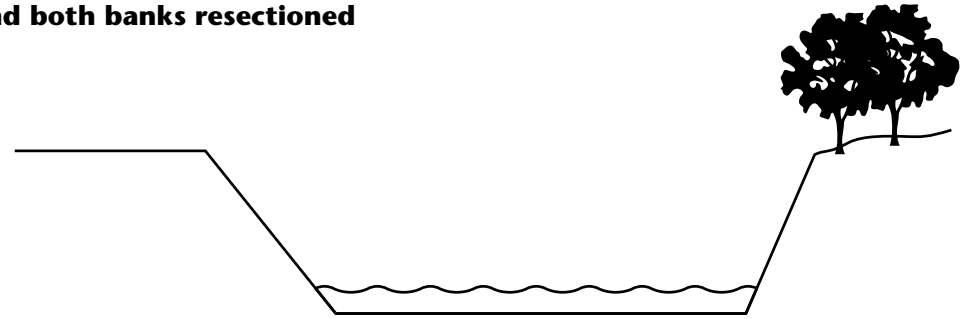
**Marginal features (bars) removed**



**Boulders removed**



**Trapezoidal channel excavated/ bed and both banks resectioned**



**Note: bankfull height/channel bankfull width ratio <1:4**

## MARGINAL AND BANK FEATURE(S)

Recording relates purely to 'cliffs' (bank features), and 'bars' (depositional marginal features). See Figure E3 for location of bar features. 💡 **Boxes are NOT emboldened, so more than one entry per box is permissible**.

### Not visible (NV)

Self-explanatory. Use for culverts and if the far bank and margin are obscured by large mid-channel structures or impenetrable vegetation. 💡 Beware overgrown channels in late summer where vegetation may also mask features.

### None (NO)

No **obvious** features. Record only when there is a clear view of the bank and marginal areas of the spotcheck, AND no features are present.

### Eroding cliff (EC)

Bankface profile is **predominantly** vertical, near vertical, or undercut, with a minimum height of 0.5m, and showing a 'clean' face (<50% cover of mosses, ferns and other vegetation). The angle of the cliff will depend on bank substrate; clay or cohesive earth banks are often almost vertical; sandy ones are rarely this steep. Other clues: turf overhanging cliff, turf in channel, recently fallen trees, leaning or over-hanging fence posts.

If the eroding cliff is composed of sandy soil, sands and/or gravels put a circle around (EC). 📻 B1b, E1Da, b,c, E1Ea,b, E3Aa,b.

### Stable cliff (SC)

Bankface profile is **predominantly** vertical, near vertical, or undercut, with a minimum height of 0.5m, and without obvious signs of recent erosion. Mosses, ferns and other vegetation on the bankface usually cover ≥50% of the bankface. Some clay banks may have little or no vegetation, but are nevertheless stable. 📻 E3Ba,b, E5Fa, FV1a.

⚐ If the stable cliff is composed of sandy soil, sands or gravels put a circle around (SC).

💡 **Vertical rock faces should not be recorded as 'SC'**. The purpose of recording 'cliffs' is to identify the instream sources and character of sediments that may be transported downstream, and those riverine features associated with active erosion.

### Unvegetated point bar (PB)

A distinctive depositional feature:

- composed of unconsolidated river bed material.
- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of a distinct meander bend in actively eroding/depositing rivers.
- classified as 'unvegetated' if <50% of the surface area has plant cover. 📻 B1b, C1b, C3a,b,c, I1a,b.

Constituent material of point bars is primarily sediment that has been transported from upstream; it is generally not derived locally. This contrasts with slumped banks recorded in Section I.

### Vegetated point bar (VP)

A distinctive depositional feature:

- composed of consolidating river bed material.

- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of distinct meander bends, usually on reaches of rivers that are less-active than where 'unvegetated' bars are found.
- classified as 'vegetated' if ≥50% of surface area has plant cover, often showing a successional sequence from bare shingle to scrub, and may include mosses. C4a,b,c.

Constituent material comprising the bars is as for unvegetated point bars.

**Unvegetated side bar (SB)**

A distinctive depositional feature:

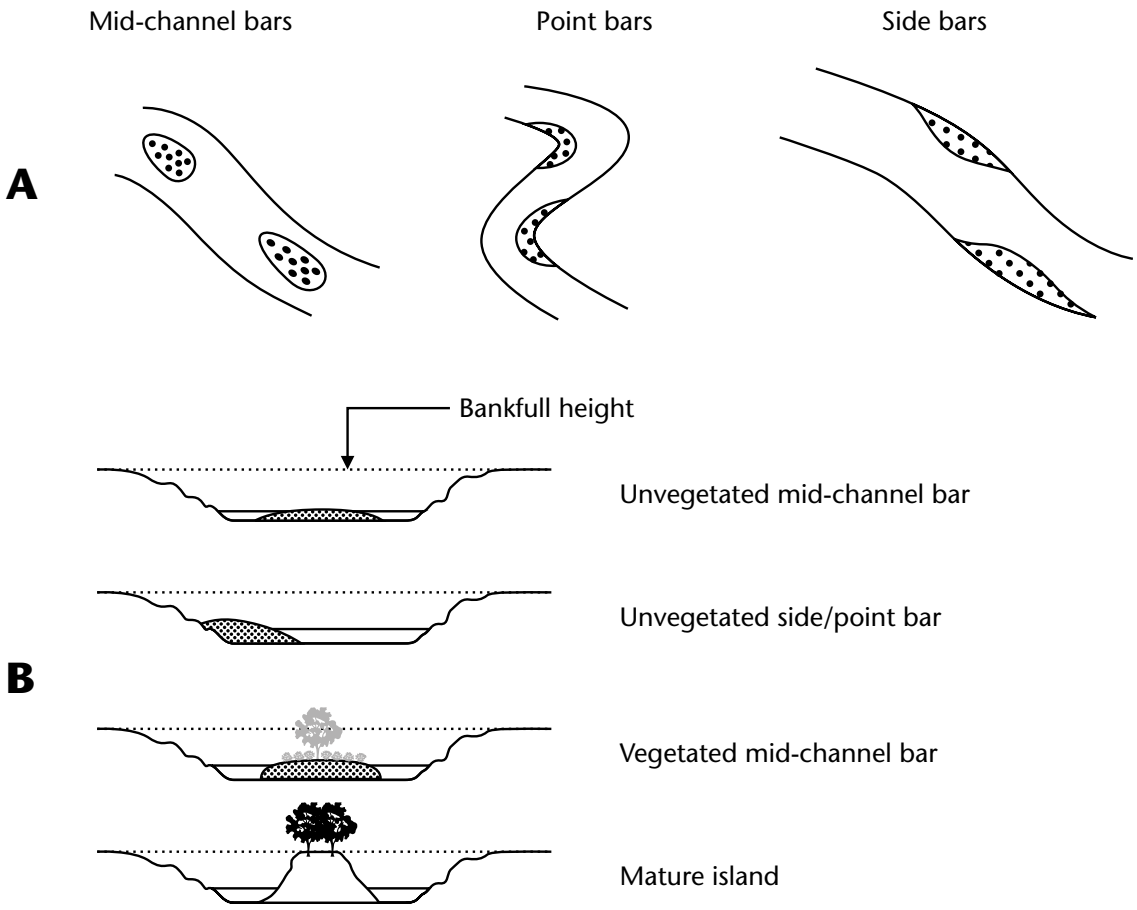
- composed of unconsolidated sediment located along the margins of rivers.
- exposed at low flow, usually with a shallow slope into the water.
- 'unvegetated' when <50% of the total surface area has plant cover.
- found in locations other-than the inside of distinct bends.

Material similar to that described for unvegetated point bars. E3Ca.

**Figure E3 Location of bar features recorded in RHS:**

**A – planforms**

**B – cross-sections**




**Vegetated side bar (VS)**

A distinctive depositional feature:

- composed of consolidating sediment along the margins of rivers.
- exposed at low flow, usually with a shallow slope into the water.

- 'vegetated' when ≥50% of the total surface area has plant cover.
- found in locations other-than inside of distinct bends. 📷 E3Da.

Material comprising the bars is as described for unvegetated point bars.

May show a successional sequence from bare shingle, herbs and mosses, to scrub.

In certain circumstances the successional sequence from unvegetated bars to vegetated bars may progress further, so that over time vegetated bars may become 'natural berms'. Here sediment may stop accumulating, and erosion may begin. A key difference between a 'bar' and a 'natural berm' is the former has a gradual slope into the water; the latter has a distinct steep face.

Bars are depositional features, primarily composed of material transported down the river channel, and deposited on the river bed. River bed material can be carried long distances (many kilometres), or very short distances, depending on the size of the material and the energy of the river. A gravel-bed river will usually have gravel bars; a sand-bed river will have sand bars.

💡 Point or side bars composed of silt are extremely unlikely to occur in UK rivers. **Silt is not considered to be a substrate of distinct 'bars'; if silt is the predominant substrate in spot-checks, record SI; if discrete silt deposits are present record these as 'present' in Section K, and if large expanses of silt occur record as 'extensive' in Section K**. If the silt forms distinct deposits resembling bars, note this in Section P, as these deposits are often signs of channels recovering from over-widening as a result of engineering works.

Over time, some continuous silt deposits along river margins may become stable, and resemble 'bars'. When they become vegetated and have accreted sufficient sediment to be exposed during dry-weather flow, they should be recorded as 'natural berms'. 💡 If in doubt, take a photograph.

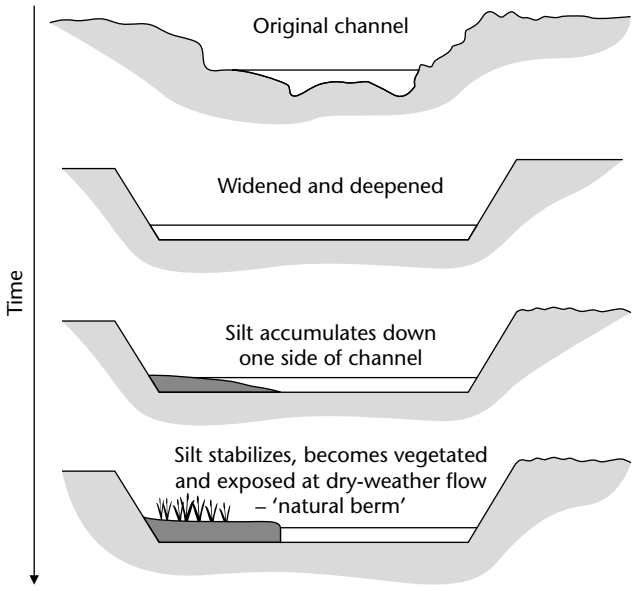
**Important** – See Technical Update 2009 – Silt Deposits.

### Natural berm (NB) 🏳

A relatively rare feature that is transitional between a depositional bar and a terrace on the floodplain (see Figures E4 & B1). Not to be confused with an **artificial berm** (see definition and check against river management records [see Figure I1]). Natural berms can occur in: (i) actively meandering channels; or (ii) recovering rivers naturally restoring a low-flow channel width following over-widening. They can also occur as a transitional feature if channel straightening downstream results in downcutting and channel narrowing produces increased gradient.

To qualify as a natural berm, the profile must have a marked step, or a composite profile with ridges representing a series of deposition/incision events. Natural berms develop through deposition (or incision) processes and over time often attract further sediment deposition. If formed on the inside of a meander they may also have a point bar features at the water's edge.

**Figure E4 Cross-sections showing formation of 'natural berm' following recovery from channel over-widening**



They are usually vegetated, making them relatively stable and attracting further deposition. Depending on location and age, the vegetation may comprise bankside herbs, grasses and reeds, or a mixture of these with willow and alder saplings. As 'mature bank or riparian' vegetation becomes established, and the berm becomes higher in relation to the river bed (either by channel down-cutting or further deposition on the berm), old berms then become the new 'bankface' and 'banktop' (see Figure B1). Natural berms do not develop from bank erosion features such as slumping/slips. E3Ea, b, c, d, e.

**Natural berms are difficult to determine precisely, and when recorded, should be photographed for subsequent confirmation.**

## CHANNEL SUBSTRATE

The ranging pole should be used to prod the river bed to determine the **predominant** channel substrate. In some cases a thin layer of silt, especially during low flows, can cover coarser substrates; in such instances, **the underlying substrate should be recorded**, together with a note that silt is present as an overlying deposit (in Section P).

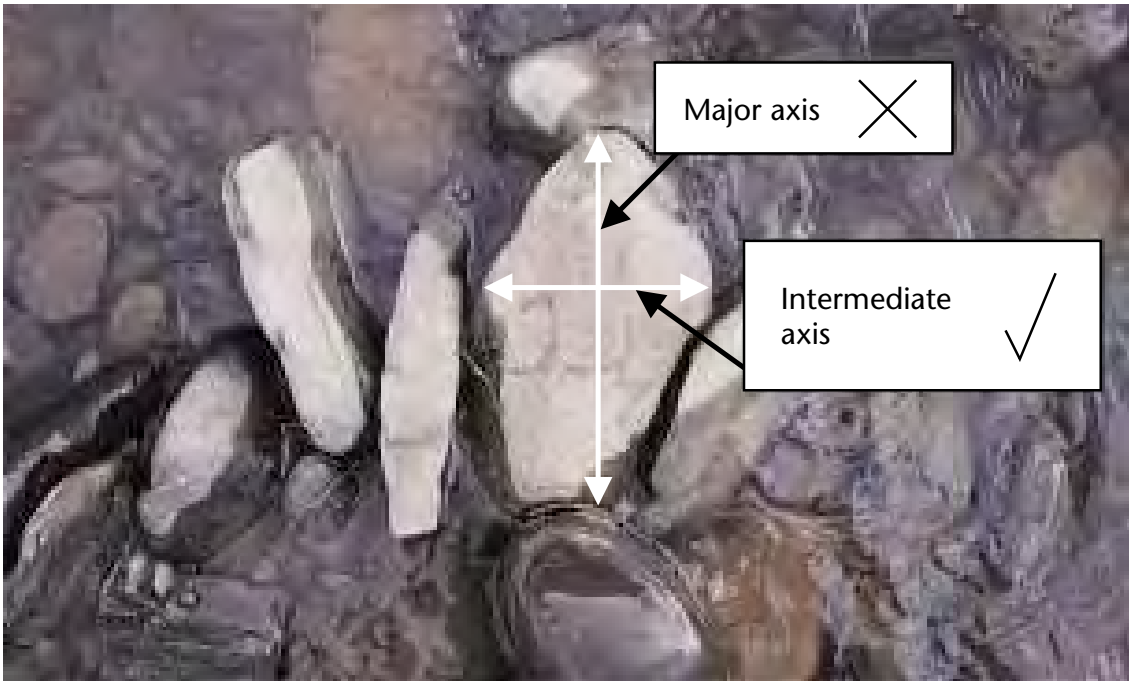
Categories of substrate size are determined by the Wentworth scale[8] (Wentworth; 1922). The scale is shown on the spot-check key. When assessing substrate size, do it using the intermediate axis and not the long axis (see spot-check key and Figure E5). For more details of similar categories used also for bank material, see Section E, Bank Materials.

**Boxes are emboldened, so only a single entry per box (the predominant substrate type) is permissible.**

### Not visible (NV)

Use this only if the channel is too deep, or water too turbid, to determine the predominant substrates of the channel. Health and safety considerations are paramount – follow the guidance in Appendix 1.

### Figure E5 Illustration of correct use of the 'intermediate axis' for channel substrate assessments in RHS



**Bedrock (BE)**

Underlying solid rock. C2b, E4Aa,b, E5Bb, E7Bb, M3a,b, M5b.

**Boulder (BO)**

Large rocks ≥256mm in diameter (larger than head size). E4Ba,b, E7Aa,b, M5a, M6a,b.

**Cobble (CO)**

Loose material 64-256mm in diameter (half-fist to large head size). B1a, D3a, E4Ca,b, M1a,b, M2a,c.

**Gravel/pebble (GP)**

A combined category: Coarse gravel is 16-64mm in diameter (includes pebbles that are conker to half-fist size); fine gravel is 2-16mm in diameter. Where it is obvious that either pebble or gravel dominate, put a circle round either G(P) or (G)P depending on which one is predominant. If, as is usually the case, the proportions are roughly equal, or it is not possible to determine which is predominant, simply enter GP. E4Da,b, E4Fb.

**Sand (SA)**

Particle sizes <2mm but ≥0.06mm in diameter. E4Ea.

**Silt (SI)**

Very fine material as a deposit exceeding a depth of 10mm. Exclude thin layers of silt covering coarser substrates. E4Fa,b.

**Sticky Clay (CL)**

Record 'CL' if the predominant river bed material comprises sticky cohesive clay material. E4Ga,b.

**Peat (PE)**

Peat, as a predominant channel substrate, is rare. Record 'PE' only if the river bed is formed of organic matter derived from decayed vegetation under water-logged conditions. Peat is normally dark brown or black. E4Ha.

**Earth (EA)**

**Reserved solely for recording when earth forms the substrate in streams with seasonal flow** (e.g. winterbournes). Such streams often flow through open fields, and have substrates similar to 'soil'. E4Ia.

**Artificial (AR)**

Obviously non-natural bed material predominant (e.g. concrete, bricks, tipped waste). D5a,b, E1La, E4Ja,b.

**Any channel substrates that cover ≥1% of the whole river bed within the whole RHS site, but are not recorded (i.e. were not predominant) in any of the ten spot-checks, should be entered in the shaded box in the end column.**

## FLOW TYPE

### Recognising flow-types in the field

The nine flow-types used for RHS are largely based on patterns of the surface, velocity, flow direction and the influence of river bed substrate. Flow-type at a particular location will vary with different volumetric discharges and river levels, but the definitions used correspond to those occurring during dry-weather conditions.

💡 Relying on photographs (Part Four) for recognition of flow-types is inadequate. Many of the diagnostic elements for flow-types come from other clues such as movement, sound and position in relation to channel features. 📻 **An RHS geomorphology training video** has been produced which describes characteristics of all the flow-types. All RHS surveyors will be shown this video as part of their overall training.

💡 In all instances, the **predominant** flow-type (i.e. that normally occupying at least 50% of the wetted channel) must be recorded and only **one entry per spot-check** is allowed. Where there are two flow-types both occupying about 50% of the wetted channel, the **faster** flow-type should be recorded.

💡 Beware: strong or gusty winds give a false impression of flow (e.g. wind-dragged ripples may suggest 'rippled' flow when flow-type is actually either 'smooth' or 'no perceptible'). Windy conditions should be recorded in Section A as a factor affecting survey conditions.

💡 **Boxes are emboldened, so only a single entry per box (the predominant flow-type) is permissible.**

### Not visible (NV)

This should only be used when the watercourse is in a long culvert and the flow-type cannot be seen.

### Free fall (FF)

Where vertically-falling water clearly separates from the 'back-wall' of a distinct vertical rock face. Generally associated with **waterfalls**. 📻 📷 E5Aa,b, M3a, M4a,b.

### Chute (CH)

Low, curving flow with substantial water contact 'hugging' the substrate. Where multiple chutes occur over individual boulders or bedrock outcrops, a 'stepped' profile is created. Mostly associated with **cascades**. 📻 📷 D1d, E5Ba,b.

### Broken standing waves (BW)

These are the 'stoppers' favoured by canoeists and rafters but they may occur on a more localised scale where water appears to be trying to flow upstream. A **white water tumbling wave** must be present for the wave to be described as broken. Mostly associated with **rapids**, but may occasionally occur within riffles. 📻 📷 B3a, D3e, E1Ba, E5Ca,b.

### Unbroken standing waves (UW)

'Babbling' water with a disturbed 'dragon-back' surface, which has **upstream facing wavelets** that have not broken. White water may occur as crest waves, not as breaking waves. Mostly associated with **riffles**, but may also occur within a **rapid**. 📻 📷 C1a,b, E5Da,b,c.

**Chaotic flow (CF)**

A chaotic mixture of several faster flow-types (e.g. FF, CH, BW and UW) in no organised pattern. This category should be used only where there are three of these fast flow-types at a spot-check, and where no one of them is clearly predominant. **Not to be used as a 'catch-all category'**. E5Ea.

**Rippled (RP)**

Water surface with distinct, symmetrical, small ripples that are generally **only a centimetre or so high** and moving downstream. Beware: in windy conditions smooth flow can have wind-induced ripples on the surface. E5Fa,b.

**Upwelling (UP)**

Upwellings are found where strong upward flow movements disturb the surface, creating an appearance of bubbling or boiling water (see Figure C1). Upwellings are sometimes also called 'boils'. They are typically found on the outside of tight meander bends, behind in-channel structures (e.g. bridge abutments) or below waterfalls, cascade weirs and sluices. Upwellings also help maintain the depth of pools by their scouring action, but also produce lateral bank erosion on meander bends. E5Ga.

**Smooth (SM)**

Laminar flow where water movement does not produce a disturbed surface. If in doubt, put a ranging rod into the water (or observe shadows on the bed in clear water) and you will artificially produce disturbed surface movement either side of the rod or shadow. Mostly associated with **glides**. E5Ha, E7De.

**No perceptible flow (NP)**

In ponded reaches (such as upstream from natural bedrock controls and weirs), it may be difficult to perceive any surface water movement. When using the ranging rod test (as in '**SM**'), no surface movement of water will be seen. If associated with **impounded reaches above dams, note in Section D**. **Marginal deadwater (Section K)** has no perceptible flow, as will stagnant pools in prolonged dry conditions. Also used to record flow in pools where there is obvious rotational surface flow, but no obvious net downstream movement of water at the surface. A1a, E1Da, E51a,b.

**No flow (DR)**

When a channel is dry, either naturally or due to excessive water abstraction in a dry year, record flow as 'DR'. In limestone or chalk areas, dry reaches will occur downstream from sinkholes or in headwater winterbournes that naturally dry annually. Record channel, bank and bed materials as if flow was present, EXCEPT for dry channels with soil/earth beds – record as 'EA'. Record channel vegetation according to 'type', and provide notes in Section P. Do not include terrestrial vegetation. E5Ja,b.

In rivers with pools present between long stretches of dry channel, record 'DR' in spot-checks where the channel is dry, and 'NP' if spot-checks are located at pools.

## CHANNEL MODIFICATION(S)

**All recording of modifications should be confined to alterations made to the river BED, not the banks. If you are sure, beyond reasonable doubt, that there are no obvious signs of channel modification, record 'NO' (none); if in doubt, record 'NK' (not known).**

**Boxes are NOT emboldened, so more than one entry per box is permissible.**

**Not known (NK)**

When unsure, record 'NK'. Seek further information from maps and flood defence records if unsure. For guidance on identifying individual types of modification, see below.

**None (NO)**

No **obvious** modification to the channel bed.

**Culverted (CV)**

As for 'Culvert' described earlier in Section E – 'Bank Modifications'.

**Resectioned (RS)**

**Obvious** over-deepening of the channel bed resulting from lowering of the river bed, affecting both long- and cross- section profiles, as well as artificially increasing the channel depth relative to its width. See 'Bank Resectioned' described earlier in Section E – 'Bank Modifications'. 💡 In Britain and Ireland channel deepening on its own is rare, so look for other signs as listed in Section E. 📷 A1a,b,c,d, E6a,b,c,d,e,f.

**Reinforced (RI)**

Artificial reinforcement of the channel bed with material such as concrete, brick or gabion baskets. Bank materials (artificial). 📷 E1H-M, E1Nd, E1O-P.

**Dam/weir/sluice (DA)**

Permanent in-channel structures installed to control river flows/levels. The presence of such structures at spotchecks may be rare, but their presence within an RHS site, and their 'impounding impacts', will be noted in Section D, and described in Section P. 📷 D1a,b,c,d,e,f.

**Ford (FO)**

Permanent, shallow, artificial fording place: can be made from concrete, metalled road surface, rubble infill or natural consolidated river bed material. (In Section D the 'category' of fords occurring within the site will be noted). 📷 D5a,b,c,d.

## CHANNEL FEATURE(S)

**Most channel features recorded by RHS will not be obvious unless the river is flowing at dry-weather level, or below.**

💡 **Boxes are NOT emboldened, so more than one entry is permissible (e.g. if unvegetated mid-channel bar and exposed bedrock present, record 'MB'/'EB').**

**Not visible (NV)**

Self-explanatory. Record 'NV' if flows are too high for accurate recording, or if mid-channel obstructions, including vegetation, obscure parts of the channel from view. Also use for culverts.

**None (NO)**

No channel features present. 💡 **'NO' must be entered if no other categories are recorded**.

**Exposed bedrock (EB)**

Bedrock exposure protruding above the water at low flow. 📷 E4Aa,b.

### Exposed boulders (RO)

Naturally occurring large, (at least 'head size') boulders protruding above the water. May be covered with mosses/liverworts in upland streams. 💡 Exposed boulders should only be recorded in spot-checks and in Section K if they are prominently protruding from the water, and where the predominant channel substrate is cobble, boulder or bedrock. In cases where boulder-sized material has been placed in the river for fishery enhancements, or has collapsed into the channel from boundary walls or rip-rap, this should be recorded as artificial ('AR') when predominant in the spot-check (i.e. material is out of context with the overall river bed character). Note the presence of failed reinforcement, or imported boulders for other purposes, in Section P. 📷 E7Aa,b, K4a.

### Vegetated rock (VR)

Bedrock or groups of boulders protruding from the water that have accumulated fine sediments in crevices which has allowed higher plant vegetation to become established (e.g. tall herbs, reeds, grasses, shrubs). 💡 **Does not include rocks with only mosses or liverworts**. 📷 E7Ba,b.

### Unvegetated mid-channel bar(s) (MB)

A distinctive, in-channel, depositional feature composed of unconsolidated river bed material. Exposed at low flow, usually with shallow sloping sides into the water. Classified as 'unvegetated' if <50% of the total surface area has plant cover. See Figure E3 for characteristics. 📷 E7Ca,b,c.

### Vegetated mid-channel bar(s) (VB)

A distinctive in-channel depositional feature composed of consolidating river bed material. Exposed at low flow, usually with shallow sloping sides into the water. Classified as 'vegetated' if ≥50% of the total surface area has plant cover. Vegetation may include perennials such as reed canary-grass, shrubs and trees. 💡 Moss-covered substrates are also included as these indicate stability. Surface of bar is lower than the bank height, so the whole feature is submerged during large floods. 📷 E7Da,b,c,d,e.

### Mature island(s) (MI)

Mature islands are an erosional feature. Permanent in-channel feature, formed by erosion, with the surface at the same height, or above, the bankfull height. Usually well vegetated, often with mature scrub and trees. 💡 **If significant deposits of fresh material surround a mature island, then both mature island (MI) and unvegetated mid-channel bar (MB) can be present – if so, record both at the spot-check** because this indicates both the presence of a mature feature and active deposition. See Figure E3. 📷 E7Ea,b,c.

### Trash [urban debris] (TR)

Rubbish such as bricks, shopping trolleys, piles of flotsam and jetsam etc. 📷 E7Fa, E7Cc.

### Braided channels

Braided rivers are dynamic and mobile, where the channel is divided into several sub-channels separated by active mid-channel bars along most (>50%) of the 500m site. 💡 In braided rivers, most bars are unvegetated and the wetted area, at low flows, represents substantially less than 50% of the river bed. Bar surfaces are typically at lower elevations than the vegetated floodplain margins. Braided rivers must feature at least two sub-channels and two mid-channel bars along most of the site. Some of the sub-channels may be dry at the time of the survey. **Recording features of braided channels is very difficult to do accurately, and surveys will take much longer to complete than on a more typical RHS site**.

For more details, see Section M, Special Features. M1a,b,c.

**When recording spot-checks on braided channels, record the number of sub-channels (wet and dry) at each spot-check in the grey row dedicated for such records, and then record all channel features of a spot-check on the channel carrying the major flow at the time of survey.**

Marginal and bank features, bank modifications and bankface vegetation structure records are all made from the outer edges of the two channels abutting the floodplain.

## SECTION F: BANKTOP LAND-USE AND VEGETATION STRUCTURE

**To be assessed over a 10m length of bank at each spot-check (See Figure 1). Refer to spot-check key prompts on the form.**

The contribution of adjacent land-use and vegetation structure alongside watercourses can contribute significantly to riparian habitat diversity.

At each spot-check, using the 10m wide transect guidance (Figure 1), surveyors are required, for both banks, to record:

(i) **land-use within 5m of the banktop**, using abbreviations in the spot-check key;

(ii) vegetation structure within 1m of the banktop;

(iii) **vegetation structure on the bankface**, using 'B' (bare), 'U' (uniform), 'S' (simple) or 'C' (complex) categories. **See below for guidance and Figure F1**.

Since floodplain land-use up to 50m from each bank is also recorded in Section H, the combination of vegetation structure within 1m, land-use within 5m and a general overview of land-use will provide a collective picture of riparian habitat character.

### Banktop

This is defined as the first major break in slope where cultivation or development would be possible. Where no distinct breaks in slope occur (e.g. streams in vee-shaped valleys), the bankfull height may be estimated by the winter flood level, often marked by a trashline or 'notches' at similar heights above the bed level. Notches may be seen along lines of exposed bank material that represent where vegetation has been ripped out by the roots at the level water reaches during times of peak floods.

Illustrated examples of banktop and bankface, as defined for recording vegetation structure and land-use during RHS are shown in Figures E1 and F1.

💡 A banktop hedgeline (as shown in photo D7a) should be recorded as complex structure (**C**) in spot-checks and not included as tree distribution (Section **J**). A hedgeline with scattered "standard trees" would be similarly recorded as complex structure in the spot-checks, but with "isolated" or "regularly spaced" trees (as appropriate) recorded in Section J.

## LAND-USE WITHIN 5M OF BANKTOP

**Boxes are emboldened, so only a single entry per box (the predominant land-use) is permissible.**

### Broadleaf/mixed woodland (BL)

Woodland containing predominantly deciduous broadleaved trees. 💡 **Does not include broadleaf/mixed plantations**. Vegetation below trees (understorey) is usually mixed young trees/shrubs and/or mixed grasses/herbs. 📷 C3b, E7Dd, F1a,b, J6a,b, M2b.

### Broadleaf/mixed plantation (BP)

Plantation woodland containing deciduous broadleaved trees such as poplars planted in rows, or in similar regimented fashion. Include young plantations with just saplings. 📷 F2a.

### Coniferous woodland (CW)

Native conifers, typically Caledonian forest in Scotland. 💡 **Excludes all coniferous plantations**. 📷 F3a.

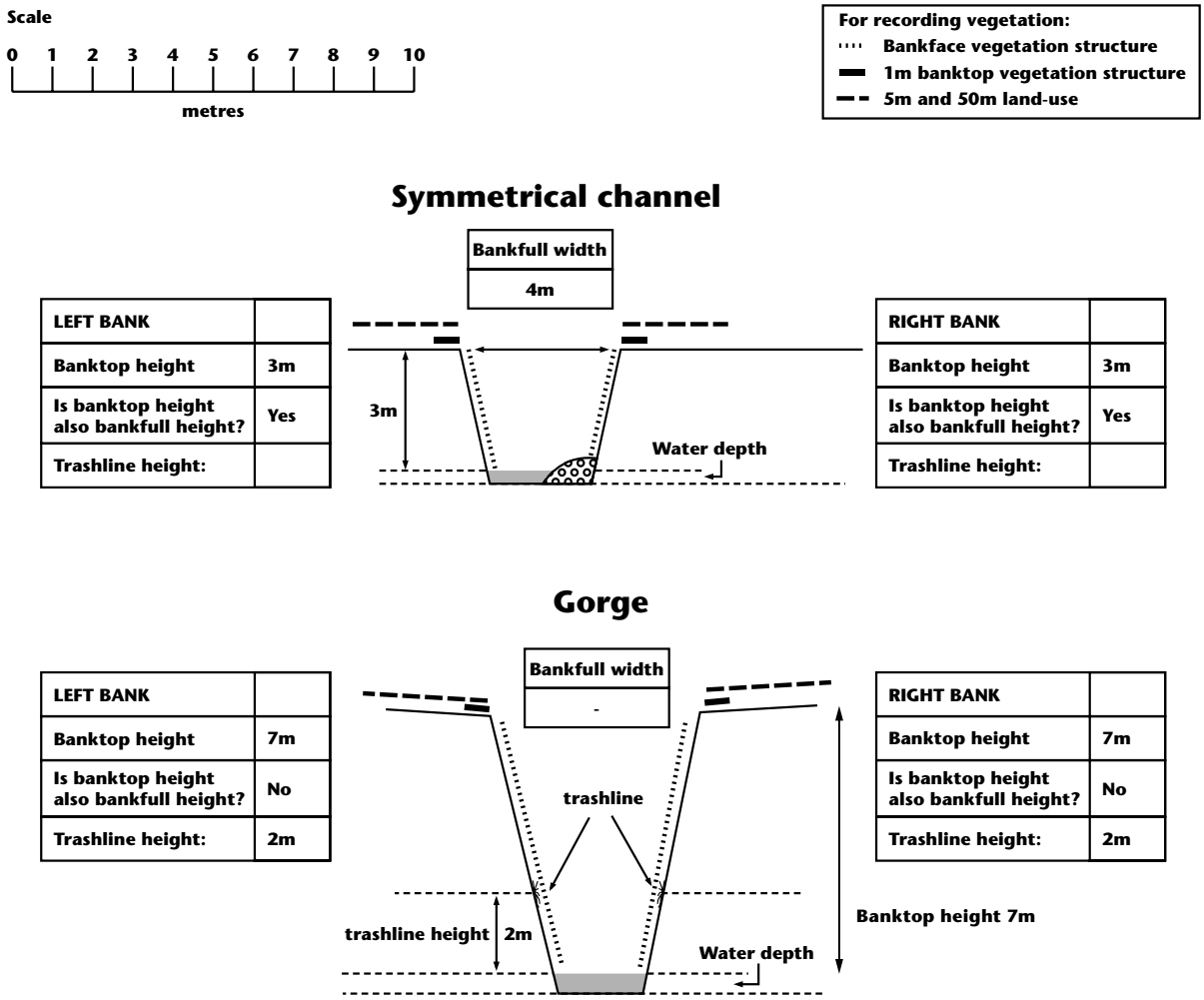
### Coniferous plantation (CP)

Coniferous trees (e.g. sitka spruce, lodgepole pine) planted for commercial forestry. F4a.

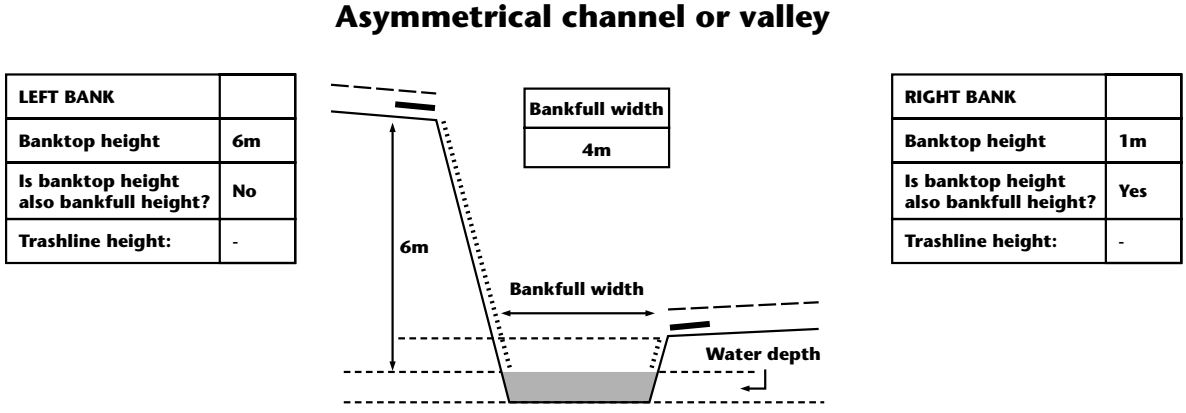
### Scrub & shrubs (SH)

Scrub (e.g. brambles, gorse, rhododendron) and woody shrubs (e.g. blackthorn and hawthorn). F5a.

## Figure F1 Examples of different channel shapes affecting definitions of bankface, banktop and bankfull width.

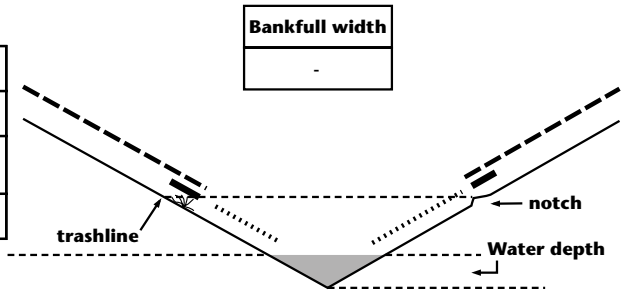



*Note: in over-deepened artificial channels there will be a trashline – see text.*



## Deep vee/shallow vee valley (and rivers with no obvious banktop)

| LEFT BANK | |
|---|---|
| Banktop height | - |
| Is banktop height also bankfull height? | - |
| Trashline height: | 1.5m |

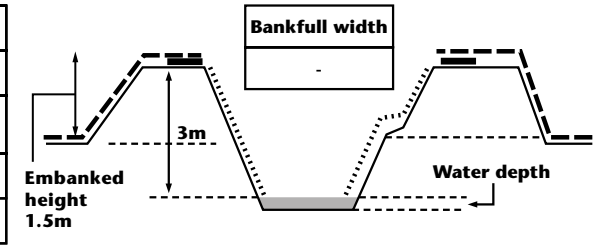



| RIGHT BANK | |
|---|---|
| Banktop height | - |
| Is banktop height also bankfull height? | - |
| Trashline height: | 1.5m |

*To be used **only** when no obvious banktop evident for both banks. Look for presence of small 'notches' at consistent height to indicate level of water during large floods. Use this, or trashlines, to determine bankfull height, and areas for recording banktop vegetation structure and land-use.*

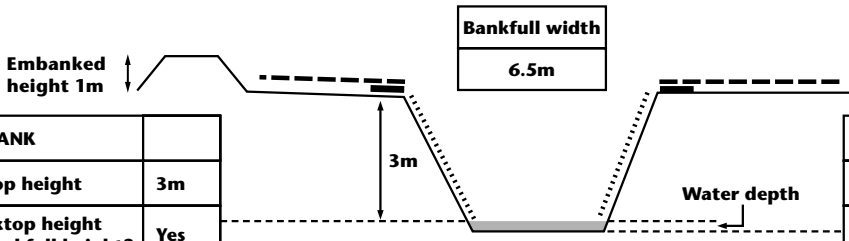
## Embanked channel

| LEFT BANK | |
|---|---|
| Banktop height | 3m |
| Is banktop height also bankfull height? | No |
| Trashline height: | - |
| Embanked height | 1.5m |




| RIGHT BANK | |
|---|---|
| Banktop height | 3m |
| Is banktop height also bankfull height? | No |
| Trashline height: | - |
| Embanked height: | 1.5m |

## Channel with set-back embankments

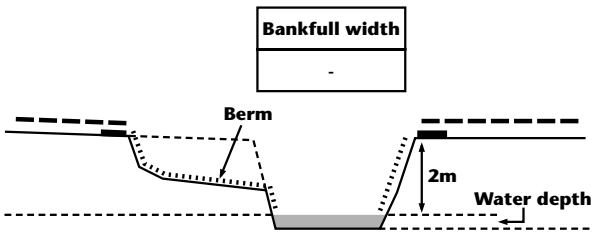



| LEFT BANK | |
|---|---|
| Banktop height | 3m |
| Is banktop height also bankfull height? | Yes |
| Trashline height: | - |
| Embanked height | 1m |

| RIGHT BANK | |
|---|---|
| Banktop height | 3m |
| Is banktop height also bankfull height? | Yes |
| Trashline height: | - |
| Embanked height | 1m |

## Two-stage channel formed through excavation

| LEFT BANK | |
|---|---|
| Banktop height | 2m |
| Is banktop height also bankfull height? | Yes |
| Trashline height: | - |




| RIGHT BANK | |
|---|---|
| Banktop height | 2m |
| Is banktop height also bankfull height? | Yes |
| Trashline height: | - |

### Orchard (OR)

Horticultural crop of fruit trees planted in lines and carefully managed to produce fruit crops. Includes hop fields and vineyards.

### Wetland (WL)

Includes bog, marsh, and fen. **Fens** typically have groundwater sustaining them as wetlands, with vegetation, often (but not exclusively) growing over peat, where the water-table is at, or just below, the surface. Water is derived from both rainfall and drainage of surrounding land. Some fens may have *Sphagnum* moss, but typically the vegetation is dominated by tall reeds, wetland herbs, sedges, and rushes. **Bogs** have vegetation growing on wet peat; the water source is direct rainfall, or in some cases, over-land flow during heavy rain events. *Sphagnum* moss is always present, often with bog cotton (*Eriophorum*). In locally drier areas heather (*Calluna*, *Erica*) may also be present, but never dominant. 📷 F7a,b,c, M15a, M18a,b, M20a.

### Moorland/heath (MH)

Typical moorlands and heaths have heather (*Calluna*, *Erica*) present, even if not the dominant vegetation type. In some upland areas (e.g. Bodmin Moor), or lowland heath areas (e.g. the machair of the Outer Hebrides), the plant communities may be dominated by acid-tolerant grasses such as purple moor-grass (*Molinia caerulea*). Cotton-grass (*Eriophorum* spp.) may occur in wetter areas, and in more free-draining areas may merge with heathy scrub with dwarf willow and birch (*Salix*, *Betula*) present. 📷 B2a,b, F8a,b, J1b, M16b.

💡 When the bog component within heathland is small, and heather is dominant, record wetland as 'present', and moorland/heath as 'extensive' in Section H.

### Artificial open water (AW)

Off-line artificial lakes, reservoirs, water-filled gravel pits, canals and the full range of amenity, farm and 'conservation' ponds. Natural lakes which have been modified by control structures are regarded as artificial. Includes mill streams, and artificial secondary channels which branch from, or join, the main watercourse. 📷 F9a,b,c.

💡 RHS should not be undertaken on on-line lakes.

### Natural open water (OW)

Natural lakes, ponds and pools, including bog pools and old river cut-offs.

💡 Some natural lakes have impounding structures; if these are not clearly visible, record 'OW'. 📷 F10a,b, M20b,c.

### Rough/unimproved grassland/pasture (RP)

Unimproved (i.e. not reseeded or fertilized) upland or lowland grassland. Usually herb-rich, and includes hay meadows. If ground is seasonally wet, tussocks of 'coarse' grass or rushes (e.g. *Deschampsia cespitosa*, *Juncus effusus*), can occur. 📷 F11a,b.

### Improved/semi-improved grassland (IG)

All **agricultural** grassland other than 'RP'. Includes pasture/meadow grassland which has been re-seeded (typically with *Lolium perenne* – rye-grass) or artificially fertilised. 📷 B7b, F12a.

### Tall herb/rank vegetation (TH)

Vegetation at least waist-high, dominated by herbs (not grasses or reeds, but **includes bracken** – *Pteridium*). 'Wildlife areas' where farmers have left the land on the inside of meanders uncultivated to grow 'wild' for conservation reasons are included. 📷 F13a,b,c.

**Rock, scree or sand dunes (RD)**

Collective category that includes extensive rock outcrops, mountain scree or sand dunes. F14a,b.

**Suburban/urban development (SU)**

Buildings, metalled roads, tracks, railways. Also includes land-fill sites.

Where un-metalled tracks follow the banktop, the land-use in which they are located should be recorded, and not 'SU'. A1c, F15a,b.

**Tilled land (TL)**

Agricultural land where crops grown on regularly ploughed soil. Includes root and horticultural crops and allotments. E1Jb, F16a.

**Irrigated land (IL)**

Agricultural land dependent on irrigation for crop yield. In Britain this includes cress beds. F17a.

**Parkland or gardens (PG)**

Includes parks, golf courses, public amenity spaces, sports fields and gardens. This includes a wide variety of land-uses, where grass is mown for recreational purposes. Do not confuse with agricultural land-use of improved grassland. E1La,b, F18a,b.

**Not visible (NV)**

Self-explanatory. Only to be used if land-use is genuinely obscured (e.g. top of a gorge, behind a mature island, or beyond dense stands of tall trees on the far bank).

## BANK AND BANKFACE VEGETATION STRUCTURE

**To be assessed over a 10m length of each bank (see Figure 1). Separate records are made for the structure of the vegetation on the face of the bank, and the vegetation structure in the 1m zone beyond the banktop (see definition above; Figures E1 and F1). Even in intensively farmed arable land, the 1m banktop vegetation structure may contrast with the land-use within the full width of the 5m banktop zone (recorded separately, and described above).**

**When recording bankface vegetation structure, ignore vegetation on bars or berms at the base of banks.**

The category recorded is determined by the complexity of structure produced by different vegetation types. If the vegetation structure cannot be assessed (i.e. when surveying from the bottom of a gorge), record 'NV' for not visible. On wide rivers, binoculars can assist with defining vegetation structure on the far bank.

Since this exercise is a rapid overview, only **the predominant structure** is to be assessed. Use your initial assessment – time must not be wasted searching for relatively inconspicuous types of vegetation.

Vegetation structure is based on four categories. Component elements represent vegetation types that contribute to vertical layering on the bank. **Refer to the spot-check key for diagrammatic representation, and the categories of vegetation types listed below**.

| | |
|---|---|
| **Bryophytes** | Mosses and liverworts. FV1a. |
| **Short/creeping herbs or grasses** | Below knee height (includes ivy). A1a, B7a,b, E2Ca, FV2a,b. |
| **Tall herbs or grasses** | Knee height, and taller; includes bracken and other ferns. C3a, D1c, D8a, E1Oa, F18a, FV3a,b. |
| **Scrub or shrubs** | Brambles, woody (and multi-stemmed) shrubs, thickets. D1c, F18a, FV4a,b. |
| **Saplings and trees** | Mature trees and single-stemmed young trees (*cf.* bushy nature of shrubs). FV5a,b, G2b. |

**Boxes are emboldened, so only a single entry per box (the predominant vegetation structure) is permissible.**

**Bare (B)**

Predominantly bare earth or unvegetated artificial bank material (e.g. concrete, sheet piling, gabion). Vegetation cover <50% over the 10m bank-length. A1c, E1La,b, E1Ma,b,c, E1Pa, E7Cc, FV6a,b.

**Uniform (U)**

Predominantly one vegetation type (e.g. grass, nettles, heather), but lacking scrub or trees. B7a,b, C4c, D6c, E2Ca, F8a, FV1a,b, FV2a,b, FV5b, FV7a,b.

**Simple (S)**

Predominantly 2-3 vegetation types, often with scrub, and may include trees. Trees with sparse herb understorey (e.g. coniferous forest extending to the riverbank) to be included in this category. E1Pd, E7Dd, F18a, FV8a,b, G2b.

**Complex (C)**

Four or more vegetation types, and scrub and/or trees must be present. FV4b, FV5b, FV9a,b, G2b.

**Not visible (NV)**

To be used only where the bank is genuinely obscured.

## SECTION G: CHANNEL VEGETATION TYPES

**To be assessed within a 10m wide transect across the channel at each spot-check (see Figure 1).**

Channel vegetation types are recorded in categories that assess the habitat structure they provide at the time of survey, not their morphological character described in textbooks. The purpose is to provide information on the range of functional habitats that channel vegetation may be providing for invertebrates and other animals. This is especially important in rivers with otherwise limited structural diversity.

💡 **To be recorded as present (✓), a channel vegetation type must occupy at least 1% of the channel area within the 10m wide transect (e.g. 1m² on a 10m wide river). To be recorded as extensive (E), the channel vegetation type must occupy at least 33% of the channel area within the 10m wide transect. Thus, vegetation growth should be obvious, and time should not be wasted looking for isolated plants.**

💡 **It is essential that at each spot-check at least one box has an entry. Several 'vegetation type' entries will be made for the same spot-check when there is more than a single type present. When the water is very turbid, enter 'NV', and record cover of emergent, floating or amphibious vegetation as appropriate.**

**It is important to complete the end-column to assess overall presence of vegetation types occurring along the 500m as a whole, including those types not recorded at the spot-checks. Use 'E' for vegetation forms covering ≥33% of the 500m site, or ✓ for those vegetation types occupying at least 1% of the 500m site, but <33% of it.**

💡 **This end-column is not a summation of the vegetation types recorded in spot-checks – it is possible that rare forms may be recorded in one or more spot-checks, but not cover ≥1% of the whole RHS site; as such they would not be recorded in the end-column.**

Important – See Technical Update 2006 – Channel Vegetation.

### None/Not visible

If <1% vegetation cover, or none is visible, even though water clarity is good, enter ✓ in this box. When the bed of the channel is not visible (e.g. when enclosed in a culvert) also enter 'NV'. Also enter 'NV' if the water is too turbid to determine submerged plant cover, even though entries for emergent, amphibious and floating forms can be made if present.

### Liverworts/mosses/lichens

Aquatic liverworts (e.g. *Scapania*), mosses (e.g. *Fontinalis*) and lichens (e.g. *Collema*). Includes vegetation that is submerged, or in the splash zone. 📷 G1a,b,c, M6a,b.

### Emergent broad-leaved herbs

Broad-leaved plants rooted on the river bed or along the water's edge. Leaves and flowers grow above water level e.g. fool's water-cress (*Apium nodiflorum*) and water-speedwell (*Veronica* spp.). 📷 G2a,b.

### Emergent reeds/sedges/rushes/grasses/horsetails

Narrow-leaved monocotyledons (e.g. reeds, sedges, rushes, grasses and horsetails) rooted below water-level or along the water's edge. Examples include branched bur-reed (*Sparganium erectum*), reedmace (*Typha*), common/Norfolk reed (*Phragmites australis*), sedges (*Carex* spp.), rushes (*Juncus* spp.) bulrush (*Schoenoplectus* spp.), reed sweet-grass (*Glyceria maxima*) and water horsetail (*Equisetum fluviatile*). 📷 G3a,b,c.

### Floating-leaved (rooted)

Plants rooted on the river bed but with either **broad floating leaves** such as yellow water-lily (*Nuphar lutea*) and broad-leaved pondweed (*Potamogeton natans*); or **linear floating leaves** such as those produced by unbranched bur-reed (*Sparganium emersum*). 📷 G4a.

### Free-floating

Plants floating on, or just under, the water surface, and not rooted to the river bed. Examples include duckweeds (*Lemna* spp.), frogbit (*Hydrocharis morsus-ranae*), hornwort (*Ceratophyllum* spp.) and water soldier (*Stratiotes aloides*). 📷 G5a,b,c.

### Amphibious

Plants rooted at the edge of the river, or on the bank, but shoots or leaves trail across the water. Examples include amphibious bistort (*Persicaria amphibia*), creeping bent-grass (*Agrostis stolonifera*), floating sweet- grass (*Glyceria fluitans*), marsh foxtail (*Alopecurus geniculatus*), and water forget-me-not (*Myosotis scorpioides*). 📷 G6a,b.

### Submerged broad-leaved

Rooted submerged plants with underwater leaves no more than four times longer than broad. Some part of the plant, or some leaves, may reach the surface but the majority are submerged. Includes submerged 'cabbage-like' leaves of yellow water-lily (*Nuphar lutea*), perfoliate and several other broad-leaved pondweeds (*Potamogeton perfoliatus*, *P. lucens*, *P. alpinus*), Canadian pondweed (*Elodea canadensis*), and starworts (*Callitriche* spp.). 📷 G7a,b,c.

### Submerged linear-leaved

Rooted submerged plants with narrow, unbranched, laminar leaves (blade/strap/belt-shaped) that are either totally submerged or just have their tips or upper parts floating on the surface. Shape is similar to tagliatelle! The most typical examples are unbranched bur-reed (*Sparganium emersum*) and the underwater leaves of arrowhead (*Sagittaria sagittifolia*), bulrush (*Schoenoplectus* spp.) and flowering rush (*Butomus umbellatus*). 📷 G8a,b.

### Submerged fine-leaved

Rooted submerged plants with fine, branched, leaves. Shape is similar to spaghetti strands. Examples include the feathery leaves of water milfoil (*Myriophyllum* spp.) and the longer 'shoe-lace' appearance of some water-crowfoot species (*Ranunculus* spp.) and fennel pondweed (*Potamogeton pectinatus*). 📷 G9a,b,c.

### Filamentous algae

Blanketweed (*Cladophora*), mole pelt (*Vaucheria*) and other obvious **filamentous** algal growths (e.g. *Enteromorpha*). Do not record diatom films that occur alone, or coating aquatic plants or stones. 📷 G10a,b.

## RHS form page 3: Sweep-up

**All sweep-up information is based on the occurrence of features and river characteristics over the whole 500m site.**

**💡 It is important to continue another 50m beyond the last spot-check to ensure the whole RHS site is 500m long.**

**For the majority of features, record their presence only if they occur along at least 1% of the channel or bank. Exceptions to this general rule include the presence of specific features such as waterfalls or overhanging boughs that typically may not extend more than 5m along the channel. 💡 All features that can be recorded as present even if they occur along <1% of the RHS sites are marked with an asterisk (*) on the form.**

**💡 It is possible that some features recorded as dominant in a spot-check in Section E (e.g. poached bank 'PC') may not even be recorded as a ✓ in the sweep-up if they do not extend at least 5m along the bank.**

## SECTION H: LAND-USE WITHIN 50M OF BANKTOP

**Record 'E' if a land-use type occurs along ≥ 33% of bank-length, or ✓ when it extends for 1-33% of the bank-length. Only record land-use occurring within 50m of the banktop. Record left and right sides of the watercourse separately. Where two parallel land-uses border the river (e.g. along 50% of one bank there is a 20m grassland strip giving way to arable) – both are recorded as 'E'. Moreover, if the other 50% is a parallel pattern of urban and artificial open water, these too are both recorded as 'E'. Therefore, in exceptional circumstances, more than three 'E' categories can be recorded for one bank.**

Use the prompts on the form. For descriptions of land-use categories, see Section F. The following categories are used:

**Broadleaf/mixed woodland (BL)**
**Broadleaf/mixed plantation (BP)**
**Coniferous woodland (CW)**
**Coniferous plantation (CP)**
**Scrub & shrubs (SH)**
**Orchard (OR) Wetland (WL)**
**Moorland/heath (MH)**
**Artificial open water (AW)**
**Natural open water (OW)**
**Rough/unimproved grassland/pasture (RP)**
**Improved/semi-improved grassland (IG)**
**Tall herb/rank vegetation (TH)**
**Rock, scree or sand dunes (RD)**
**Suburban/urban development (SU)**
**Tilled land (TL)**
**Irrigated land (IL)**
**Parkland or gardens (PG)**
**Not visible (NV)**

## SECTION I: BANK PROFILES

**Use 'E' (≥ 33% of bank-length within the site) or '✓' (present – ≥1% but <33%) for profiles visible on both left and right banks.**

## NATURAL/UNMODIFIED PROFILES

Record in the 'left' and 'right' bank columns the profiles (slopes) of unmodified banks. The first two categories cover vertical banks, including 'cliffs' recorded in Section E, and other vertical banks not forming cliff features such as banks on chalks streams that are vertical, but may be only a few centimetres high. Other steep banks should be recorded in the third category, and gently sloping banks in the fourth.

💡 **All natural bank profiles are recorded here. In cases where there is uncertainty over bank profile, record them as best as possible in the natural/unmodified categories.**

### Vertical/undercut

Predominantly vertical banks, which may include eroding and stable cliffs. 📷 B1b, C4a, E3Ab, I1a,b.

### Vertical with toe

Vertical bank with slumped material at base. 📷 I2a,b.

### Steep

Bank slope ≥45˚ angle, but not predominantly vertical. 📷 B3a, I3a, I4a.

### Gentle

Bank slope <45˚. 📷 B1b, B7a, C4a, E3Ec, I4a.

### Composite

Banks with complex profile which may be caused by previous slumping or sequences of channel erosion. 📷 I5a,b.

### Natural berm

See detailed definition in Section E and Figure E4. A transitional feature that requires a well-trained eye to confirm its presence. 💡 Beware: if artificial two-stage channels have been excavated just above the original river bed level, these may, over time, appear 'like a new floodplain'; **if so, do not record here**. 📷 E3Ea,b,c,d,e – for artificial berm, see E2Ca,b,c,d.

## ARTIFICAL/MODIFIED PROFILES

The same modifications to banks noted in Section E are also included here, and as for 'unmodified banks', all the different resectioned and reinforced profiles on the left and right banks should be recorded in the appropriate columns. This is the only place where the occurrences of embankments set back from the bank are recorded.

💡 **All modifications to banks are summarized here.**

### Resectioned (reprofiled)

Bank profile modified, often to accommodate flood flow, flood defence or other maintenance machinery. Recent re-profiling will produce a relatively smooth, uniformly angled, bank slope. See Section E; Bank Modifications. **Only record in the sweep-up if not accompanied by whole bank reinforcement**. 📷 A1a, D8a,b,c, E2Aa,b, E3Da, I6b.

### Reinforced bank

Whole or part of bank artificially strengthened for bank protection purposes. Examples include concrete, sheet piling, corrugated iron, wood piling, gabion, brick/laid stone, rip-rap and builders' waste (see descriptions of above in E: Bank Materials). For sweep-up purposes, bank reinforcements are differentiated into three categories to indicate their vertical extent: (i) whole bank; (ii) top only; (iii) toe only. **When the whole bank is reinforced, there is no need to record resectioning.** A1c, E1Ja,b, E1Ka, E1La,b, E1Oa, I6a,b,c.

### Artificial two-stage channel

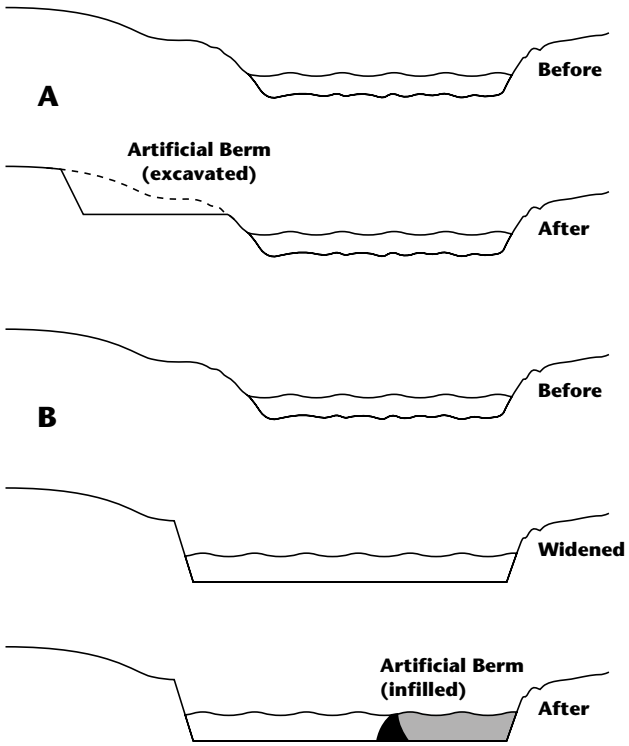
Typically this is where one or both banks have been excavated laterally into the floodplain to create a shelf above dry-weather flow (see Figure I1). Also included are shelves constructed in previously widened channels to create narrower low-flow channels. Water spills over the second (normally dry) stage shelves during high flows. These are constructed features. E2Ca,b,c,d.

Do not confuse with natural berms (see Natural berm E3Ea,b,c,d,e).

**Figure I1 Artificial two-stage channel – berm formation through:**

**A – bank excavation**

**B – channel infill**




### Poached bank

Bank significantly trampled or puddled by livestock. Include banks trampled as a result of human activity such as picnic spots, canoe access points, and fishing spots dug into the bank. E2Ba,b,c,d, I5b, P1a.

### Embanked

Artificial embankment created to increase the banktop height. Only recorded here when it forms an integral part of the bank. **Do not** include embankments set back from the immediate banktop; these are recorded as set-back embankments (below). E2Da,b.

### Set-back embankment

Artificial embankment or earth bund designed to increase flood capacity but set back from the river channel and forming a distinct floodplain landscape feature. I7a.

## SECTION J: EXTENT OF TREES AND ASSOCIATED FEATURES

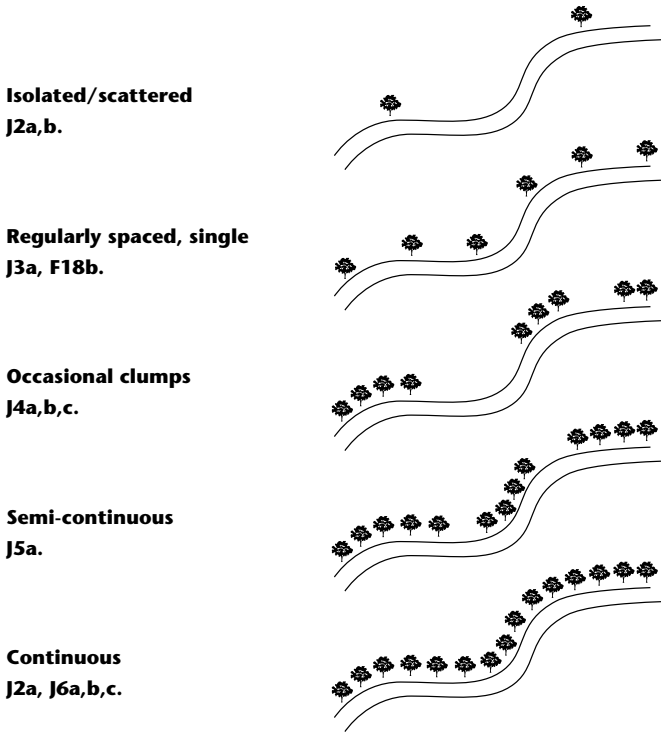
Due to the importance of trees and associated features, these warrant individual attention and are recorded in more detail in this section.

### TREES

Distribution along each bank for the entire 500m length is recorded using five descriptive categories. These are not meant to represent an accurate distribution pattern for individual sites, but to provide an overview. Recent aerial photographs can provide an extra check.

**For each bank tick one box only for the nearest distribution 'match' based on the categories in Figure J1. 💡 ONE BOX FOR EACH BANK MUST BE TICKED.**

**Figure J1 Illustration of RHS recording of bankside trees**




### ASSOCIATED FEATURES

**These are habitats, or features, associated with trees.**

**💡 IN EACH CASE, ONE BOX PER FEATURE MUST BE TICKED.**

**Records are made on their occurrence within, or along, the total 500m length of the site. Record 'None' when <1% occurrence (absent, or not present in >5m of channel length); 'Present' if 1-33% occurrence (present in 5-165m of channel length); and 'E' when ≥ 33% occurrence (present in >165m of channel length).**

**For the three features marked with an asterisk (*), presence can be ticked even if they do not occur in >1% of the site.**

#### Shading of channel

Extent of **direct**, overhead, **tree** canopy shade. 💡 Do not include shade from culverts and bridges. 📷 J7a,b, M4a, M6a, M7a.

#### *Overhanging boughs

Large (forearm-size or larger) tree boughs which arc horizontally over, or dip close to, the water surface. 📷 C2a, E4Bb, I1a, J6b, J7a, J8a,b, J9b.

#### *Exposed bankside roots

Large (forearm-sized or larger) exposed roots and associated cavities. These can provide a good location for otter holts. 📷 J9a,b.

#### *Underwater tree roots

Exposed underwater tree or shrub roots. Alder and willow roots are distinctive examples. 📷 J10a.

### Fallen trees

Uprooted or collapsed tree(s) that are **still attached to the bank**, either alive or dead. J11a,b,c.

### Large woody debris

Whole trees or large trunks and branches **swept downstream** and lodged in the channel or on the banks. May develop into debris dams – see section M. J12a,b.

## SECTION K: EXTENT OF CHANNEL AND BANK FEATURES

**This section includes a wide variety of features ranging from flow types to exposed bedrock.**

**💡 IN EACH CASE, ONE BOX PER FEATURE MUST BE TICKED.**

**Records are made on their occurrence within, or along, the total 500m length of the site. Record 'None' when <1% occurrence; 'Present' if 1-33% occurrence; and 'E' when ≥ 33% occurrence .**

**💡 For the five features marked with an asterisk (*), presence can be ticked even if they do not occur in >1% of the site.**

RHS uses flow-types as a diagnostic guide to channel habitats. Predominant flow-type is determined at the 10 spot-checks (Section E). However, it is also necessary to assess flow-types in the site as a whole. For this purpose only, you need to record flow-types when they are dominant across most of the channel width **and** when they form a distinct feature that is at least 5m long (i.e. >1% of channel length). 'Free fall' and 'upwelling' flow-types can be recorded as present even if they do not represent a predominant flow type along at least 5m of the channel length. 💡 **Do not record these flow-types in Section K if they result from artificial features such as weirs**.

For the definitions of flow-types and channel features, see Section E. The following are recorded (spot-check abbreviations are included for easy cross-reference).

***Free fall flow (FF) – but only if associated with natural features**

**Chute flow (CH)**

**Broken standing waves (BW)**

**Unbroken standing waves (UW)**

**Rippled flow (RP)**

***Upwelling (UP) – but only if associated with natural features**

**Smooth flow (SM)**

**No perceptible flow (NP) No flow [dry] (DR)**

The following other (non-flow-type related) features are recorded.

### Marginal deadwater

Margins of the main channel which have **no perceptible flow**. These are good refuge areas for various aquatic invertebrates and fish fry. Examples include where the bank has eroded into an embayment, or remnants of old abandoned channels are still connected to the main channel (also recorded as backwaters in Section M). Marginal deadwater may also occur downstream of large 'side' or 'point bars'. 📷 K1a,b,c, M12a,b.

### Eroding cliff(s) (EC)

See Section E, marginal and bank features. Extent is for both banks.

### Stable cliff(s) (SC)

See Section E, marginal and bank features. Extent is for both banks.

### Exposed bedrock (EB)

See Section E, channel features.

**Exposed boulders (RO)**

See Section E, channel features.

**Vegetated rock (VR)**

See Section E, channel features.

**Unvegetated mid-channel bar(s) (MB)**

See Section E, channel features.

**Vegetated mid-channel bar(s) (VB)**

See Section E, channel features.

**Mature island(s) (MI)**

See Section E, channel features.

**Unvegetated side bar(s) (SB)**

See Section E, marginal and bank features. Extent is for both banks.

**Vegetated side bar(s) (VS)**

See Section E, marginal and bank features. Extent is for both banks.

**Unvegetated point bar(s) (PB)**

See Section C. Extent is for both banks.

**Vegetated point bar(s) (VP)**

See Section C. Extent is for both banks.

***Unvegetated silt deposit(s)**

DO NOT RECORD when silt covers the bed from bank to bank and does not contrast with the predominant substrate present in the whole site (recorded as 'SI' in spot-checks in Section E) – the deposits must contrast with the predominant river bed substrate(s). Unvegetated silt deposits may be either underwater or exposed, in the channel or on the margins with a minimum size of $5m^2$. Silt deposits are often formed in response to obstructions (e.g. fallen tree, naturally protruding boulders, or artificial deflector structures); such deposits would be recorded as 'present'. Extensive deposits are often associated with rivers recovering from artificial channel over-widening. If they form discrete ledges, and occur in more than 33% of the site, record as 'E'. K2a,b,c.

***Discrete unvegetated sand deposit(s)**

A discrete unvegetated sand deposit is either underwater or exposed, in the channel or on the margins with a minimum size of $5m^2$. **DO NOT RECORD** when sand covers the bed from bank to bank (recorded as 'SA' in Section E) – the deposits must contrast with the predominant river bed substrate(s). Discrete sand deposits are often formed in response to obstructions (e.g. fallen tree, naturally protruding boulders or artificial deflector structures), or in recesses in banks. Discrete sand deposits are recorded because they are valuable habitats for several invertebrate species. As sand deposits are not considered to be 'discrete' if they are present along more than 33% of a site (sand would be a predominant substrate in Section E), it is not possible to record extensive discrete sand deposits ('extensive' box not on the form). K3a,b.

### *Discrete unvegetated gravel deposit(s)

A discrete unvegetated gravel deposit is either underwater or exposed, in the channel or on the margins with a minimum size of 5m$^2$. 💡 DO NOT RECORD when gravel covers the bed from bank to bank (recorded as 'GP' in Section E) – the deposits must contrast with the predominant river bed substrate(s). Found only in channels with a predominant substrate of cobbles/boulders/bedrock, and located in the lee of large boulders, structures, fallen trees or other obstacles. 💡 Do not record in any other circumstances, and not to be confused with bars (recorded in Section E). As gravel deposits are not considered to be 'discrete' if they are present along more than 33% of a site (gravel would be a predominant substrate in Section E), it is not possible to record extensive discrete gravel deposits ('extensive' box not on the form). 📷 K4a,b.

**RHS form page 4: Dimensions and Influences**

## SECTION L: CHANNEL DIMENSIONS

**☠ Make sure that Health & Safety guidance (Appendix 1) is strictly followed when entering the channel to take measurements. For large rivers where mid-channel water depth cannot be safely measured, enter "unknown" in the appropriate box.**

### Measurement of channel width, water depth and banktop height

Choose a straight part of the site if possible, preferably with well-defined banks and a riffle. This is the optimum location for measuring channel and bank dimensions. In many instances channel dimensions will need to be measured at a location other than at one of the spot-checks.

**For guidance on banktop, water width etc., see Figure F1. To ensure consistent recording it is imperative that surveyors fully comprehend this information before undertaking field measurements.**

**Both steep and very low gradient sites will not have riffles. In such cases choose a relatively uniform (and if possible, shallow) cross-section and state on the form the predominant flow-type at the location where channel dimensions are taken. In some instances, the river bed will be inaccessible and consequently water depth and river bed consolidation will not be determined. If so, indicate accordingly on the form.**

Rangefinders and ranging poles will improve the accuracy of measurements taken. When a rangefinder is used to measure width, indicate by adding 'R'.

💡 **Measuring channel dimensions on braided channels can be very complicated due to the presence of several sub-channels. Water depth should be the average depth of water in the largest channel (i.e. the one from which flow-type and substrate are recorded in spot-checks), but water width cannot be measured. Banktop height and bankfull width should be measured using the banks abutting the floodplain.**

### Banktop height (m)

Banktop height is the vertical distance from water level, to the first major break in slope above which cultivation or development is possible. Use the ranging pole to estimate height (m).

### Bankfull width (m)

Bankfull width is the horizontal distance across the channel to be measured at the level where the river first spills out of the channel on to the floodplain.

💡 Where no distinct breaks in slope occur (e.g. streams in vee-shaped valleys or gorges, the bankfull height should be **estimated** using clues such as the winter flood level, often marked by a trashline, or 'notches' along the bank at similar heights to the trashline. Estimate bankfull width and height at this point: ENTER MEASUREMENT IN LINE FOUR – and do not enter bankfull width measurements in line one.

### Is banktop height also bankfull height?

Bankfull height is the vertical distance from water level on the day, to the point where the river first spills out of its channel on to the floodplain (if it can). Indicate, using 'yes' or 'no', whether the bankfull height is equivalent to the banktop height.

### Water width (m)

Water width is the distance across the wetted perimeter of the channel. Use the ranging rod to make crossing the watercourse in shallow locations safer, and use the rod to help measure the width. When a range-finder is used to measure channel width, indicate by adding (R) with the width measurement entry. Note on the form the max-min range of the range-finder used.

💡 Beware: in misty conditions, or where the bank has a non-reflective substrate, accurate range-finder readings are difficult to get.

If it is impossible to wade safely across the river, and you do not have a range-finder, a reasonably accurate estimate can be made by sticking a ranging pole on the bank, and walking along the bank until the pole appears to be the same distance away as the far bank; pace the distance to the pole to estimate the channel width. Wherever possible, however, use a range-finder for measurements.

### Water depth (m)

Water depth is the estimated average depth of the channel (to the nearest 10cm). Where possible, always try to estimate the actual depth, using the ranging pole; otherwise use "not known". Common sense should prevail, but recording the average of three measurements taken across the depth range is good practice. ☠ If access to the channel is considered too risky, estimate the depth if feasible; if in doubt, record 'NK' in the box.

### Embanked height (m)

Where embankments are present, record the extra height created by the embanked material. Include set- back embankments where practicable.

### Trashline height (m)

The **height** of the trashline above water level is to be recorded only if lower than the banktop. This may give an indication of an over-deepened channel with the 'natural' bankfull height, indicated by trashline marks. The **width** of the channel at the trashline height can be estimated and recorded. As the height of the trashline is dependent on the previous flood, measurement of this level provides less reliable information than bankfull and banktop heights and widths.

NOTE: Do not choose a location for channel measurements based on the presence or absence of a trashline.

### River bed consolidation

Consolidated river bed material will be normally characterised by luxuriant bryophyte or rooted higher plant macrophyte growth. Where gravel and cobbles are present, these will be firmly inter-locked with other substrates, be hard to dislodge, and give a stable 'feel' when kicked.

💡 **Unconsolidated river bed material** will comprise gravel, pebbles, cobbles or boulders which are not inter-locked and so are easily dislodged or moved when kicked.

In deep rivers where the channel cannot be safely accessed, record as '**unknown**'.

### Location of measurements

Tick one of two boxes; if 'other' box ticked, enter the predominant flow type present across the channel where the measurements were taken.

## SECTION M: FEATURES OF SPECIAL INTEREST

This is an opportunity to record features of special ecological interest, either in the river channel or adjacent corridor.

**The extent of all these features should be recorded as present (✓) if present along ≥1-33% of the site, or 'E' if present along ≥33% of the site. Five of the 21 listed features are marked by an asterisk (*) – these can be ticked even if they do not occur within at least 1% of the site.**

**Special features should be recorded as '✓' or 'E' if they are within a 50m corridor either side of the channel. Where features of special interest are observed beyond this 50m limit, their presence should be noted in Section P.**

### None

💡 An entry is required in this box when no entries are made in any other boxes **to confirm that no features of interest were observed**.

### Braided channels

Braided rivers are dynamic, mobile, rivers where the channel is divided into several sub-channels separated by active mid-channel bars along most (≥50%) of the 500m site. In braided rivers, most bars are unvegetated and the wetted area, at low flows, represents substantially less than 50% of the river bed. Bar surfaces are typically at lower elevations than the vegetated floodplain margins. Braided rivers must feature at least two sub-channels and two mid-channel bars along most of the site. Some of the sub-channels may be dry at the time of the survey.

💡 Excludes all river reaches with more than a single channel that are **not actively changing the location of the sub-channels** – these include:

(i) where two or more channels have developed naturally and are separated by vegetated mid- channel bars or mature islands;
(ii) man-made by-pass channels, including mill leats;
(iii) secondary feeder channels;
(iv) parallel floodplain drainage systems;
(v) chalk streams with multiple, man-made, channels.

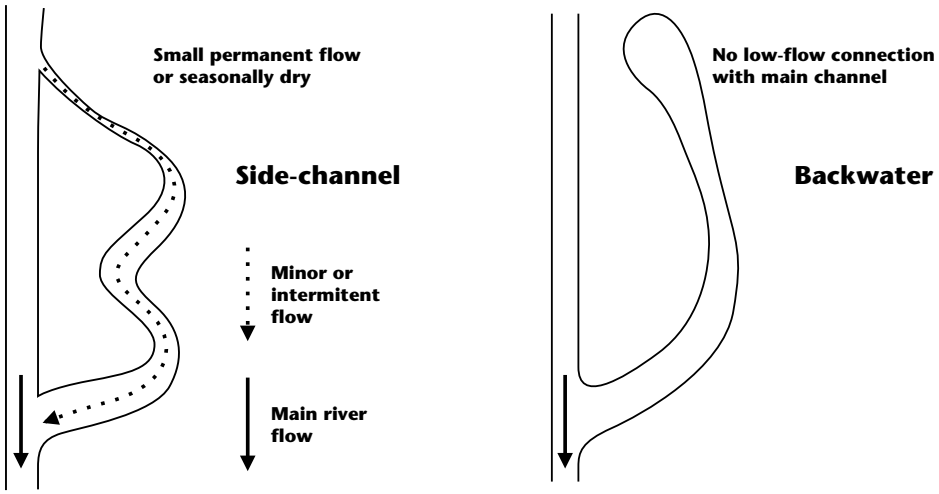
It is recommended that aerial photographs are included to confirm braided rivers. 📷 M1a,b,c.

### Side channel(s)

To be considered as features of special interest, side channels must be natural, and convey only a minor flow compared with the main channel. They may be dry in periods of low-flow, and will always have bed levels higher than in the main channel (*cf.* multiple channels associated with islands). Side channels generally indicate channel migration across the floodplain, and are most often associated with down-cutting of the main channel. They are always connected to the main channel at their upstream and downstream limits (which may be outside/beyond the site), and convey flow during moderate to high flows (see Figure M1). 📷 M2a,b,c.

💡 Do not record as special interest features any artificial channels (e.g. mill races, water meadow feeder channels and multi-channels of chalk rivers) which can be recorded in Section P as appropriate.

## Figure M1 Side channels and backwaters




***Natural waterfall(s) >5m high**

Uninterrupted natural free-fall flow more than 5m high. M3a,b.

***Natural waterfall(s) <5m high**

Uninterrupted natural free-fall flow < 5m high. M4a,b.

**Natural cascade(s)**

Distinct series of 'stepped' flow features occurring over boulder substrate or bedrock outcrops. E5Ca, M5a,b.

**Very large boulders (>1m)**

Very large, (at least 1m diameter), boulders protruding well above water level. Very large boulders will be recorded as extensive only if they occur along more than 33% of the channel length. Only naturally occurring boulders are noted; those introduced for fisheries enhancement purposes, or derived from collapsed rip-rap, are excluded but can be recorded in Section P. E4Bb, M5a, M6a,b.

***Debris dam(s)**

Log jam of large woody debris creating an obstruction across the channel and significantly impeding water flow. M7a,b.

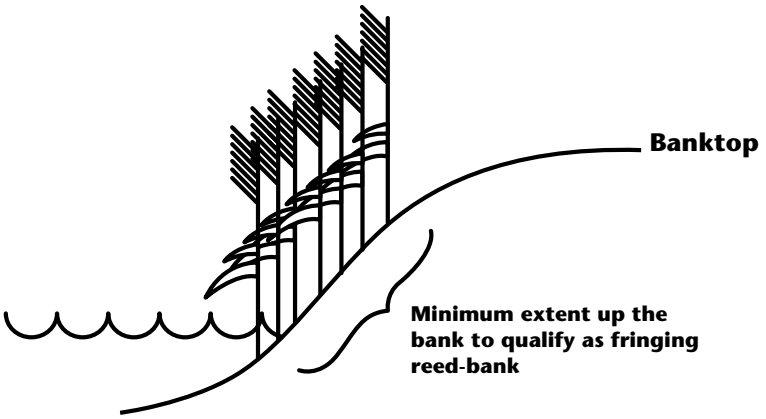
***Leafy debris**

Significant accumulations (at least $2m^2$) of twigs and leaf litter along channel edge. An important temporary habitat for some insects. M8a,b.

**Fringing reed-bank(s)**

Fringing reeds such as common/Norfolk reed (*Phragmites australis*) which extend **at least** half-way up the bank. To be recorded, a fringing reed-bank must extend at least 10m along the bank-length. See Figure M2. M9a,b,c.

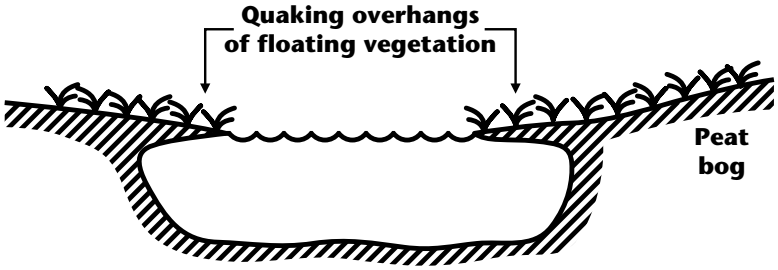
## Figure M2 Fringing reed bank




### Quaking bank(s)

A distinct floating 'ledge' or shelf of vegetation only, equivalent to a 'quaking', bog which extends into the channel. Usually an extension of adjacent wetland into the channel. Very rare in Britain and Ireland. See Figure M3. M10a.

## Figure M3 Quaking bank




### *Sink hole(s)

A feature of some channels in limestone areas. Except during spates, flow in the channel upstream disappears into the ground through the channel bed, re-appearing further downstream. M11a,b.

### Backwater(s)

Redundant river channels that are connected to the main channel only at one point, normally the downstream end. In contrast to side channels, they do not act as flood-conveyance channels (see Figure M1). B8a, K1a, M12a,b.

### Floodplain boulder deposits

Boulders deposited **on the floodplain** by the river, typically close to the banktop and downstream of a constricted section of channel (e.g. gorge or V-shaped valley). Boulders in the channel should be recorded as boulder substrates or exposed boulders, as appropriate, **and not floodplain boulder deposits**. M13a.

### Water meadow(s)

Floodplain meadows, primarily associated with chalk streams, and traditionally flooded via constructed feeder channels. These drainage channels are straight, shallow and parallel. Features include remnant channels and floodplain grasslands. M14a,b.

### Fen(s)

Wetland vegetation, often (but not exclusively) growing over peat, where the water-table is at, or just below, the surface. Water is derived from both rainfall and drainage of surrounding land. Some fens may have *Sphagnum* moss, but typically the vegetation is dominated by tall reeds, wetland herbs, sedges, and rushes. 📷 M15a.

### Bog(s)

Vegetation growing on wet peat where the water table is at, or just below, the surface. The water source is direct rainfall and in some cases, over-land flow occurs during heavy rain events. *Sphagnum* moss is always present, often with bog cotton (*Eriophorum*). In locally drier areas heather (*Calluna*, *Erica*) may also be present, but never dominant. 💡 When the heathland component is uncommon, and bog predominates, record 'Moorland/heath' as 'present', and record 'Bog' as 'extensive'. 📷 M16a,b,c.

### Wet woodland(s) 🏳

Wet woodland comprises trees such as willow (*Salix* spp.) and alder (*Alnus* spp.), usually with an understorey of wetland herbs, reeds and mosses. Often at the edge of other wetlands, and often referred to as 'carr'. 📷 M17a,b.

### Marsh(es)

Wetland habitat that includes tall grasses and rushes on periodically wet ground (unlike fen or bog that are permanently wet), or where wetland herbs are an important component of the ground flora (e.g. meadowsweet – *Filipendula ulmaria*, marsh orchids – *Dactylorhiza* spp., kingcup – *Caltha palustris*, valerians – *Valeriana* spp.). 📷 F7a, M18a,b.

### Flush(es)

A collective term for wet areas near springs where water emerges from the ground or seeps from fissures in rock faces, or valley slopes. Flushes are fed by groundwater – when surface water predominates a stream is formed. 📷 M19a,b.

### Natural open water

Includes abandoned ox-bows, natural lakes, bog-pools and meres.

💡 Only include features that are **NOT** connected to the river channel except during periods of floods. 📷 M20a,b,c.

### Others

It is important to record any other features of ecological interest, such as reedbeds, herb-rich wet grassland etc. associated with the river and adjacent land.

## SECTION N: CHOKED CHANNEL

If 33% or more of the total channel area is choked with vegetation, causing **significant** impediment to flow, indicate by putting a ✓ in the 'Yes' box. If not, ✓ the 'No' box. 💡 **One of the two boxes must be ticked**. 📷 Na,b.

The extent of vegetation will depend to some degree on seasonal influences, but choked channels can present a barrier to fish migration, or increase flood risk.

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## SECTION O: NOTABLE NUISANCE PLANT SPECIES

Indicate the absence or presence (including extent) of those alien plant species listed on the form by ticking appropriate boxes.

Estimate abundance within the site as a whole by using a '✓' when present along <33% of the bank-length or 'E', when present along ≥33% of total bank-length. Separate records are made for the bankface, and the river corridor up to 50m from the banktop. **Include plants growing on mid-channel bars in the 'bankface' category.**

The main introduced nuisance species associated with rivers in Britain and Ireland are:

- giant hogweed (*Heracleum mantegazzianum*) 📷 O1a;
- Himalayan (Indian) balsam (*Impatiens glandulifera*) 📷 O2a;
- Japanese knotweed (*Fallopia japponica*) 📷 O3a.

If you know that other alien species are present, list these in the space provided. A common example in some upland locations is Rhododendron. 📷 O4a.

💡 Species are shown on the form prefixed by an *asterisk, so the presence of a single plant should be recorded. It is important to report even an isolated occurrence, since control measures may be able to be taken.

## SECTION P: OVERALL CHARACTERISTICS

This section has a prompt check-list to capture important additional information. Circle relevant prompt words on the form and add others as appropriate.

### Major impacts

Any major impacts on the site using the self-explanatory checklist on the form. 📷 P1a,b.

### Evidence of recent management

A brief descriptive checklist for obvious and recent activities is listed. Briefly describe other activities as appropriate.

'Recent' management is defined by the presence of **obvious signs** e.g. machinery present, excavated bare earth, weed/brash cuttings and bank mowing, unvegetated dredge spoil on the bank etc. 📷 E2Aa, P2a.

**Enhancement works**: examples include meander or riffle reinstatement, channel narrowing, bank re-profiling, reed-planting and tree-planting. Most will be obvious only when recently undertaken. 📷 E1Hb, E1Mb, E2Cc,d, P2b.

### Animals

Sightings of mammals, birds, insects and other taxa of interest. Use the checklist and add as appropriate. Indicate if the presence is indirectly inferred from footprints or faeces (e.g. otter spraints). Records of animals will not be systematic since they will depend greatly on the interests and expertise of individual surveyors.

### Other significant observations

💡 It is important to record your overview of the site to complement information recorded on the form and photographs. Use a separate sheet if necessary, and make sure it has the mid-site grid reference clearly marked on it and the sheet is attached to the form.

---

## SECTION Q: ALDERS

In this section record the presence or absence of alder trees (*Alnus glutinosa*). Record whether they are present or absent, and indicate whether they are healthy or affected by *Phytophthora* root disease. Information on *Phytophthora* is needed for a national assessment of the incidence of the disease. 📷 Qa,b.

💡 See Appendix 3 for illustrated guidance on how to recognise symptoms. This has been reproduced with the permission of the Forestry Commission from: *Information Note 'Phytophthora Disease of Alder'* (December 2004) © Crown Copyright 2004.

💡 One of the three boxes in both categories must by ticked. Record 'none' if no alders are present; 'present' if alders occur in <33% of bank-length (even if just one tree – hence the *asterisk reminder on the form); and 'E' if present along ≥33% of bank-length, **irrespective of whether they are affected by the disease or not**. If no trees are affected by *Phytophthora*, record 'None'; 'Present' if diseased alders occur in <33% of bank- length; and 'E' if disease affects alders along ≥33% of bank-length.

Observations of diseases affecting other trees (e.g. willows [*Salix*]) can be noted in Section P.

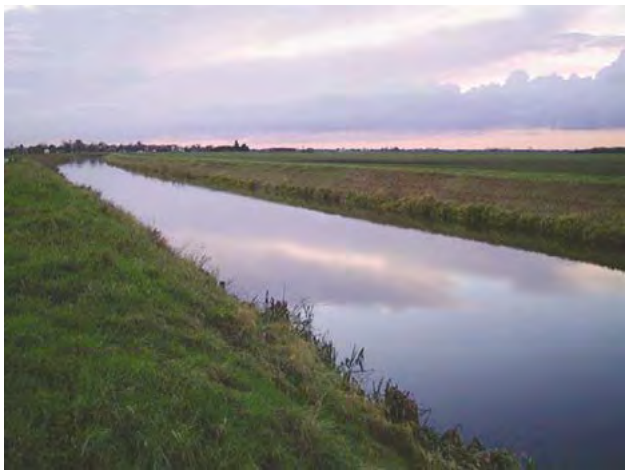
## SECTION R: FIELD SURVEY QUALITY CONTROL

**However experienced you are with filling in RHS forms, it is easy to make a mistake or send in an incomplete site record. To avoid this, you should check the form and tick the seven boxes as each one is checked in the field. This will save you having to rectify omissions later, and possibly save the need for a re-survey. The prompts ask the surveyor if they have:**

- taken at least two photos that illustrate the general character of the site and additional photos of all weirs and any major/intermediate structures across the channel?
- completed all ten spot-checks and made entries in all boxes in E and F on page 2?
- completed column 11 of section G, and E if appropriate on page 2?
- recorded in section C the number of riffles, pools and point bars (even if 0) on page 1?
- given an accurate (alphanumeric) grid reference for spot-checks 1 and 6, and the end of the site (page 1)?
- stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)?
- cross-checked spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key?

# PART FOUR – PHOTO GALLERY

## SECTION A: FIELD SURVEY DETAILS



A1a Artificial channel cut through flat fens; site is not part of a river. Note no obvious valley sides.


A1d Deepened and resectioned channel; site is hugely modified, but is still obviously part of a river. See also D7a.

A1b Artificial channel – straight cut through flat landscape; site is not part of a river. Channel vegetation = choked. See also Nb.

A3a Turbid and high water levels – bed of river is not visible.

A1c Concrete channel replacing part of natural watercourse; site is obviously hugely modified but is still part of a river. Note road on right hand side (suburban land-use).

A3b Dense free-floating macrophytes – bed of river is not visible.

## SECTION B: PREDOMINANT VALLEY FORM

B1a Shallow vee valley; flat valley bottom absent. Cobble bed. See also K4b.

B1b Shallow vee valley; narrow flat valley bottom present. Note bank profiles; vertical undercut on right, gentle on left; unvegetated point bar and eroding cliff present.

B2a Deep vee valley; flat valley bottom absent. Note also moorland/heath land-use.

B2b Deep vee valley with flat valley bottom.

B3a Gorge.


B4a Concave/bowl with a flat valley bottom evident.

B7a No valley sides obvious and therefore no flat valley bottom. See also A1a.

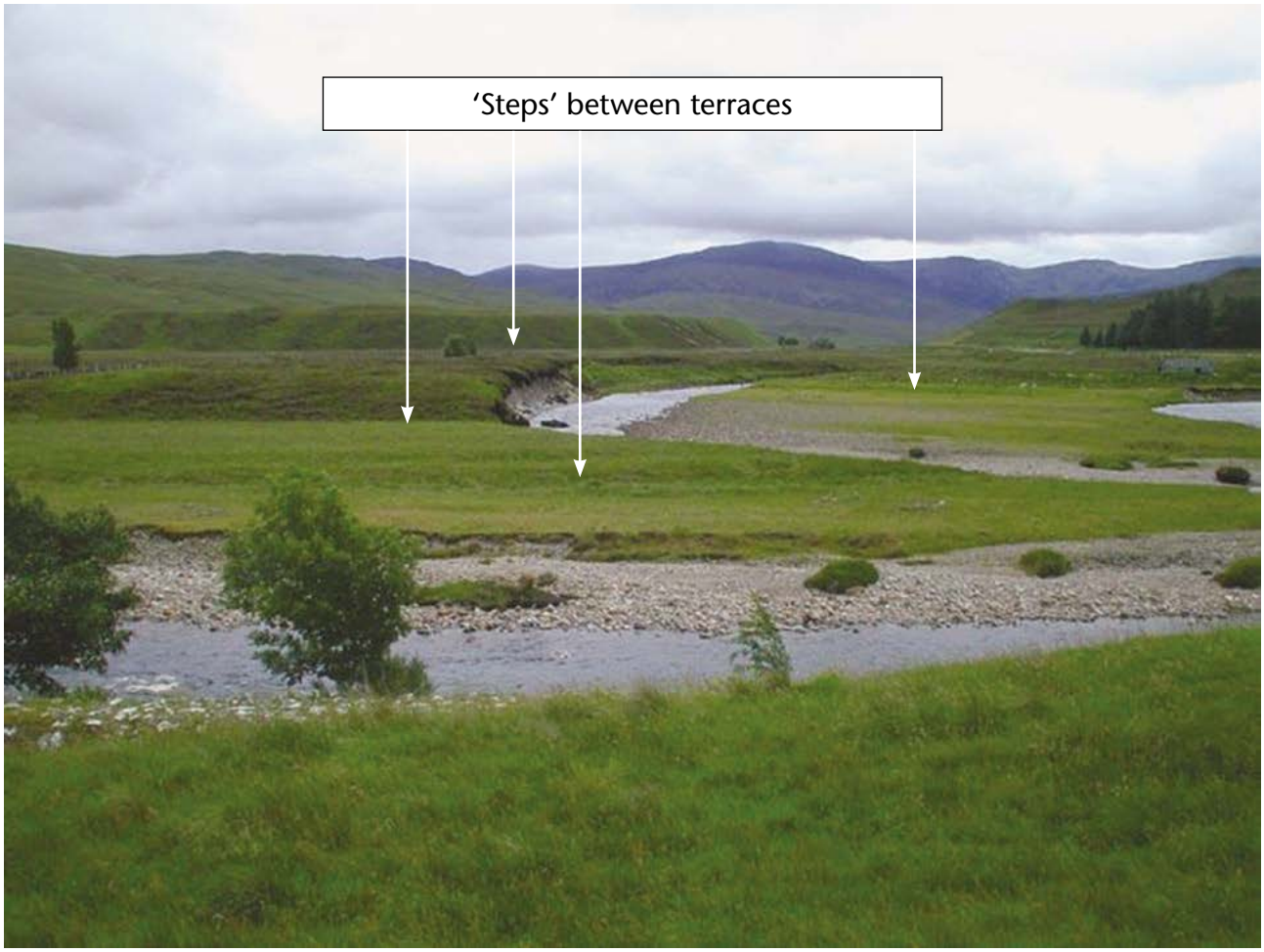
B5a Asymmetrical valley. Note river abuts steep side of valley; flat valley bottom present.

B7b No valley sides obvious and therefore no flat valley bottom. Note improved agricultural grassland land-use and slightly embanked left bank.

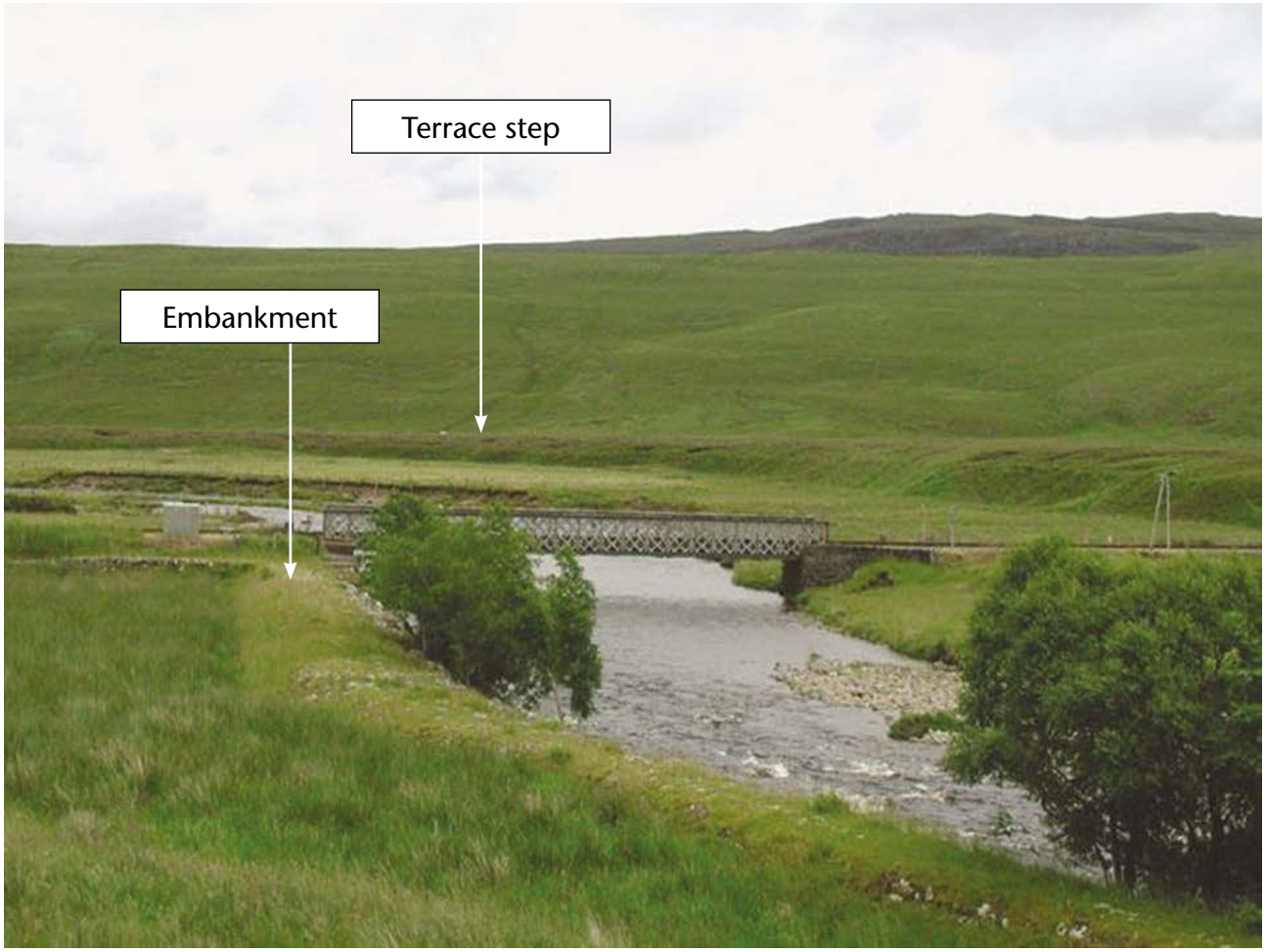
B6a U-shape glaciated valley (always with distinct flat valley bottom). See also C1a.

B8a Obvious flat valley bottom with floodplain wetlands (including backwater). See also B1b, B5a, B6a.

B8b Obvious flat valley bottom. See also B1a, B2a, B7a,b, M1c for flat valley bottom absent.




B9a Natural river terraces.




B9b Natural river terraces. Note embanked floodbank in foreground.

## SECTION C: RIFFLES, POOLS AND POINT BARS

C1a Riffle with 'unbroken standing wave' flow-type. Note U-shape valley form. See also E5Db.

C2a Pool on tight meander bend. Note over-hanging bough on left. See also C1b, I1a.

C1b Riffle at exit of meander pool with 'unvegetated point bar' on inside of bend.

C2b Pools in bedrock; the lower one is a plunge pool. See also E5Bb, M3a, M4a,b.

C1c Riffle in lowland, low gradient, woodland stream.

C2c Pool feature below a weir.

C3a Unvegetated point bar formed from sand.

C4a Vegetated point bar formed from sand and silt. Vertical bank on right, gentle on left.

C3b Unvegetated point bar formed from coarse sand.

C4b Vegetated point bar formed from pebbles and cobbles. Continuous trees on right, absent on left.

C3c Unvegetated point bar formed from gravel/ pebble. See also B1b, C1b I1a,b.

C4c Vegetated point bar formed from mixed pebbles, gravel and silt. Uniform vegetation structure on both banks.

## SECTION D: ARTIFICIAL FEATURES

D1a Major weir/sluice – weir; has a fixed level. This is an example of a composite weir. Note also to record a minor bridge. Flow-type is 'chute'. It is essential to photograph all major structures to aid interpretation of probable impact.


D1d Major weir/sluice – example of a complex weir structure used for measuring flow. Note also an intermediate bridge.

D1b Major weir/sluice – sluice; settings can be changed to influence water levels upstream. Water is impounded upstream.

D1e Intermediate weir – boulders are not cemented, and water can leak through the fissures.

D1c Major weir/sluice – despite small size, the weir structure is 'fixed,' and does not leak water. Note scrub and short grass on right, and short grass and tussocky tall grass on left – both with simple bank vegetation structure. Water upstream is impounded.

D1f Intermediate weir – wooden log construction, and water can leak through gaps.

D1g Minor weir – a temporary structure; often built by children from boulders and cobbles.

D3b Major bridge – all bridges with bankside abutments >25m long.

D2a Culvert – all are recorded as 'major' structures. When channel modification records 'CV', and it is impossible to see the bed and banks clearly, all other channel characteristics should be recorded as 'NK' or 'NV'.

D3c Intermediate bridge – no central piers, and with bank-side abutments 10-25m long. Note broken standing waves.

D3a Major bridge – all bridges with central piers are classed as 'major'. Note importance of photographs to show size of piers, and degree of associated bed armouring. Classic cobble channel substrate exposed in foreground. See also D5b.

D3d Minor bridge – farm track bridges <10m wide are recorded as 'minor'.

D3e Minor bridge – pipelines crossing rivers, if lacking central piers, are recorded as minor bridges. See also Na. Note exposed boulders and broken standing waves.

D4b An intermediate outfall, 10-25m long.

D3f Minor bridge – bridge lacks in-channel supports and has bank abutments <10m wide.

D4c Minor outfall – example of a flap-valve on a drainage channel – all such structures occupying <10m bank-length are recorded as 'minor'.

D4a Outfalls and intakes – this is a major water abstraction point (intake) occupying >25m bank-length.


D5a Major ford – both the bed and banks are made of artificial material, and there is obvious ponding of water upstream.

D5b Major ford – note the bed is composed of artificial material, but the banks are 'natural' gravel. Note major bridge downstream with in-channel supports.

D5e Cattle crossing point – NOT recorded as 'Ford', but as poached bank.

D5c Minor ford – farm track where bed and banks are of both composed of natural material, and there is no significant ponding impact from the ford.

D6a Major deflector/groyne/croy – extends across >20% of the channel width. This example is composed of mixed materials, including compacted earth.

D5d Minor ford – farm track where bed and banks are of natural material, and there is no ponding from the ford.

D6b This collapsed weir is recorded as a major deflector as it extends >20% across the channel.

D6c Intermediate deflector/groyne/croy – an example of a boulder deflector extending across 10-20% of the channel.

D6f Other artificial features – boat moorings. These extend 10-25m along the bank, so are classed as 'intermediate'.

D6d Intermediate deflector/groyne/croy – example of bank, and in-channel, deflectors extending across 10-20% of the channel.

D6g Other artificial features – stepping stones. This would be recorded as 'major' because it occupies more than 20% of the channel width.

D6e Minor deflector/groyne/croy – extends across <10% of the channel width. Example of boulder deflector installed to improve fish habitat.

D7a An obviously realigned and over-deepened channel. Note hedge at the top of the bank that should be recorded as complex banktop vegetation structure.

D7b An obviously realigned channel.

D8b Over-deepened channel – obvious signs include the slumping of the artificially steep banks and the channel width/bank depth ratio is <4:1.

D7c A channel showing NO obvious signs of having been re-aligned. See also B1b, B5a, B6a, B7a.

D8c Over-deepened channel – less obviously over-deepened, but with artificially steep, under-cutting, banks and the channel width/bank depth ratio is <4:1.

D8a Over-deepened channel – very obvious tell-tale signs are the uniformly sloping, artificially steep, banks and a channel width/bank depth ratio <4:1 See also E2Aa.

D9a Is water impounded by weir/dam? Photo shows water artificially impounded behind a shallow weir structure. See also D1b,c, D5a.

## SECTION E: PHYSICAL ATTRIBUTES

### BANK MATERIAL

E1Aa Bedrock bank material. See also C2b, E5Ab, M3a,b.

E1Bb Boulder bank material.

E1Ab Bedrock bank material. This is an example of a vertical rock bankface, but this is NOT recorded as a stable cliff.

E1Ca Cobble bank material.

E1Ba Boulder bank material. Note broken standing waves.

E1Cb Cobble bank material.

E1Da Gravel/sand bank material – example with fine sand predominant. See also E3Aa.

E1Ea Earth bank material. Also an eroding cliff. See also I1b, I2b.

E1Db Gravel/sand bank material – example with mixed materials, but gravel/sand predominates.


E1Eb Earth bank material; a 'jab' with the ranging pole will not leave a smooth, well-defined, hole.

E1Dc Gravel/sand bank material – example with mixed materials, but gravel/sand predominates. Note in Section P use of bank by sand martins.

E1Fa Peat bank material.

E1Ga Clay bank material: a 'jab' with the ranging pole will leave a smooth, well-defined, hole. This bank illustrates that a stable clay bank is not always well vegetated. See also FV1a, I1a, I2a.

E1Ia Sheet piling bank material.

E1Ha Concrete bank material. See also A1c, E2Cb, E7Cc.

E1Ja Wood piling bank material – horizontal poles. See also I6b.

E1Hb Concrete bank material. This example illustrates an artificial berm as habitat creation as part of a flood defence scheme, and this should be noted in Section P.

E1Jb Wood piling bank material – vertical poles below resectioned bank and arable (tilled) land-use in background.

E1Ka Gabion bank material – boulders/cobbles in wire baskets. Typical example of use in protection of the bottom half of a bank.

E1Lc Brick/laid stone bank material – example of stone wall bank material used in rural areas such as the Lake District.

E1La Brick/laid stone bank material – cemented. Note parkland land-use on right and left banks

E1Ma Rip-rap bank material; placed (but not cemented), non-regular, blocks. Bank vegetation structure is recorded as bare.

E1Lb Brick/laid stone bank material – cemented bricks. Note parkland land-use on right.

E1Mb Rip-rap bank material; placed (but not cemented), square, blocks. Note under-water 'pipes' for fish shelter (note in Section P).

E1Mc Rip-rap bank material; tipped boulders.

E1Nb Tipped debris – gravel.

E1Md Rip-rap bank material; laid boulders with earth between. See also I6a.

E1Nc Tipped debris – pebbles.

E1Na Tipped debris – soil.

E1Nd Tipped debris – this category includes tyres, old cars, builders waste, and other materials considered as 'waste'. Record also as reinforced (RI).

E1Oa Fabric bank material – non-degradable sheet ('nicospan'). Note tall herb bank vegetation above, so record structure as 'simple'.

E1Pc Bio-engineering bank materials – woven dead stakes and twigs.

E1Pa Bio-engineering bank materials – bio-degradable matting with vegetation planting. Record bank vegetation structure as 'bare'.

E1Pd Bio-engineering bank materials – live willow stakes. Bank vegetation structure is 'simple'.

E1Pb Bio-engineering bank materials – brushwood. Note shallow vee valley.

E1Pe Bio-engineering bank materials – here bio-degradable hessian has been used in combination with reed planting and other vegetation.

## BANK MODIFICATION(S)

E2Aa Resectioned (reprofiled) bank – tell-tale smooth (trapezoidal) slope even though undertaken many years ago; river also over-deepened, with tell-tale 'step' in the profile where bed material at the base of the bank removed. See also A1a, D8a,b,c, E3Da, I6b.

E2Bb Poached bank – light cattle trampling (not bare as >50% vegetation cover). Note discrete silt deposit (bank material is earth, bed is gravel).

E2Ab Resectioned (reprofiled) bank – tell-tale even (trapezoidal) slope of newly resectioned bank.

E2Bc Poached bank – heavy due to cattle trampling (recorded as 'bare' due to <50% vegetation cover). See also I5b, P1a.

E2Ba Poached bank – due to human trampling.

E2Bd Poached bank – heavy due to human trampling (recorded as 'bare' due to <50% vegetation cover).

E2Ca Artificial Berm – formed by excavating bank material (here on both sides) to form a two-stage channel. Both the flat base of the berm, and the face of the top of the bank, constitute 'bankface'. See also E1Hb, F18b.

E2Cd Artificial Berm – formed during rehabilitation project by installing shallow shelves (here on both sides) to create a narrower low-flow channel with indistinct berms; note in Section P.

E2Cb Artificial Berm – formed by infilling wide, totally artificial, channel (here on both sides) to form a two-stage channel.

E2Da Embanked – note the earth embankment is placed on top of the natural bank (cf. set-back embankment, Section I).

E2Cc Artificial Berm – formed by infilling an over-widened channel (here on both sides) to form a distinct two-stage (slightly meandering) channel. Note in Section P, as part of river rehabilitation works.

E2Db Embanked – note the rock embankment is placed on top of the natural bank. Top of embankment represents 'banktop'.

## MARGINAL AND BANK FEATURE(S)

E3Aa Eroding cliff of sand (EC on form is circled). See also E1Da.

E3Bb Stable cliff – example of clay bank that is stable, but has little or no vegetation.

E3Ab Eroding cliff of earth (EC on form NOT circled). See also B1b, E1Dc,b, E1Ea,b.

E3Ca Unvegetated side bar – unconsolidated sediment bar along one side of a relatively straight section of river with <50% vegetation cover. Continuous trees on left.

E3Ba Stable cliff – no signs of recent erosion, and ferns and other vegetation well established. See also E5Fa, FV1a.

E3Da Vegetated side bar – consolidating sediment bar along one side of a relatively straight section of river with > 50% vegetation cover, and progressing towards natural berm. Note resectioning on left.

E3Ea Natural berm – depositional feature with a marked step from the river bed, and to the bank.

E3Ec Natural berm – young example where an over-wide channel has restored its previous low-flow width through formation of the natural berm. Note very gentle bank slopes.

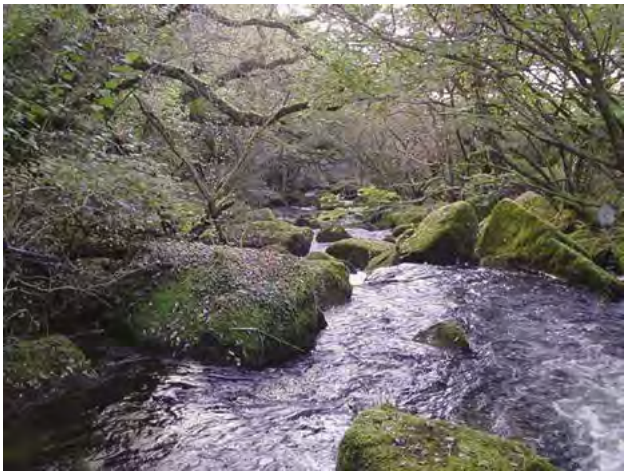

E3Eb Natural berm – depositional feature with a marked step from the river bed, and to the bank. In the foreground is an extensive silt deposit. The 'natural berm' is in the background; note the vertical face into the gravel-bedded river.

E3Ed Natural berm – this example shows the clear steep step between the river bed, and the bankface.

E3Ee Natural berm that has evolved to become the new 'bankface' – this example is 100m downstream of the berm shown in E3Ed, and shows the clear steep step to the river bed, but a gentle slope to the bankface.

## CHANNEL SUBSTRATE

E4Aa Bedrock channel substrate. Exposed bedrock also. See also C2b, D3e, E5Bb, E7Bb, M3a,b, M5b.



E4Bb Boulder channel substrate. Note overhanging bough.

E4Ab Bedrock channel substrate. Exposed bedrock also.

E4Ca Cobble channel substrate. See also B1a, D3a, M1a,b, M2a,c.

E4Ba Boulder channel substrate. See also E7Aa,b, M5a, M6a,b.

E4Cb Cobble channel substrate.

E4Da Gravel/pebble channel substrate (mixed, neither dominant).

E4Fa Silt/mud channel substrate

E4Db Gravel/pebble channel substrate (pebble dominant – P ringed on form).

E4Fb BEWARE thin silt over 'natural' channel substrate – this should be recorded as 'gravel'.

E4Ea Sand channel substrate.

E4Ga Clay channel substrate.

E4Gb Clay channel substrate – close-up.

E4Ha Peat channel substrate – photograph on fen drain following lowering of water level.

E4Ia Earth channel substrate – to be used ONLY when intermittent streams are dry, and soil forms the bed.

E4Ja Artificial channel substrate – both bed and banks artificial. See also D5a,b, E1La.

E4Jb Artificial channel substrate – concrete bed.

## FLOW-TYPE

E5Aa Free fall flow-type – vertically falling water. See also M3 & M4.

E5Ab Free fall flow-type – vertically falling water on high waterfall.

E5Ba Chute flow-type – steeply falling water, but water 'hugs' the substrate. See also D1d.

E5Bb Chute flow-type – steeply falling water, but water 'hugs' the substrate. Note plunge pool below.

E5Ca Broken standing waves flow-type – typical turbulent white water waves. See also B3c, D3e, E1Ba, E4Ba.

E5Cb Broken standing waves flow-type – typical turbulent white water waves.

E5Da Unbroken standing waves – surface like 'dragon-back', but waves not broken. See also C1a,b.

E5Ea Chaotic flow-type – Rare mix of three of the four most turbulent flow-types (free fall, chute, broken standing waves and upwelling) In centre of photo.

E5Db Unbroken standing waves – surface like 'dragon-back', but waves not broken.

E5Fa Rippled flow-type – surface with small, symmetrical, ripples. Note uniform bank vegetation structure.

E5Dc Unbroken standing waves – surface like 'dragon-back', but most waves not broken.

E5Fb BEWARE – appearance of 'Rippled flow-type' – surface with small ripples, but these are generated by wind action creating small waves.

E5Ga Upwelling flow-type – surface with appearance of 'boiling' water.

E5Ib No perceptible flow. See also A1a, E1Da.

E5Ha Smooth flow-type – water movement only obvious when stick or finger put in water; slight surface movement evident.

E5Ja No flow – dry channel; a typical chalk winterbourne – dry in summer and autumn.

E5Ia No perceptible flow – no water movement obvious; when stick or finger put in water there is no rippling effect either side. Boulder substrate.

E5Jb No flow – dry channel associated with upland limestone.

## CHANNEL MODIFICATIONS

E6a Resectioned channel – typical signs seen here include deep channel *cf.* width, steep smooth-sloped banks, and even-aged trees only on top of bank. See also A1a-c, D8a.

E6b Resectioned channel – typical signs include trapezoidal 45 degree banks and no trees.

E6c Resectioned channel – even after many decades, past resectioning obvious due to even gradient of bank. Note also Himalayan balsam on near bank.

E6d Resectioned bank – this example shows straight river with no trees, with channel width <4 times bank height; combination indicates deepening, resectioning and straightening.


E6e Resectioned bank – this example shows river with few trees, very even gradients to the banks, and with the banktop width <4 times the banktop height indicating both deepening and resectioning.


E6f Resectioned channel – this shows a mobile, gravel-bed, river that has been resectioned, with tell-tale spoil on the right.

## CHANNEL FEATURES

E7Aa Exposed boulders – these are relatively small boulders, but many are exposed. See also K4a.

E7Bb Vegetated rock – example where bedrock is the dominate substrate.

E7Ab Exposed boulders – example with very large boulders, the majority being exposed.

E7Ca Unvegetated mid-channel bar – example in upland stream.

E7Ba Vegetated rock – example where boulders are the dominate substrate.


E7Cb Unvegetated mid-channel bar – very large example from northern Europe.

E7Cc Unvegetated mid-channel bar – example in urban stream. Note concrete bank material and presence of shopping trolleys (urban debris; but not predominant).

E7Dc Vegetated mid-channel bar – intermediate sized example composed of gravel/pebble with vegetation cover >50%. Note upwelling in foreground.

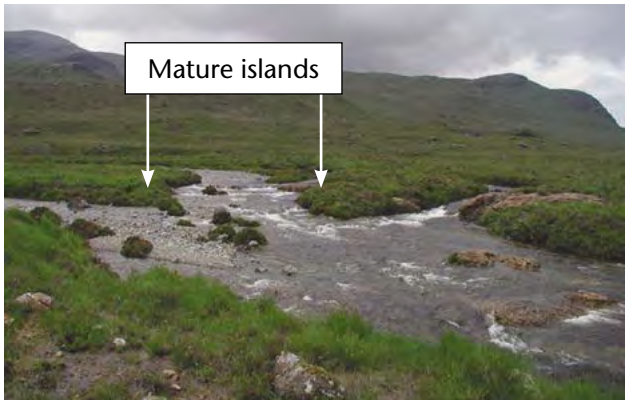
E7Da Vegetated mid-channel bar – small example composed of gravel and sand, with vegetation cover >50%.

E7Dd Vegetated mid-channel bar – example with saplings; note discrete sand deposit adjacent. Note mixed woodland (semi-natural) land-use on right.

E7Db Vegetated mid-channel bar.

E7De Vegetated mid-channel bar – example with trees; note height of bar is lower than bank height, therefore NOT a mature island.

E7Ea Mature island – height of island probably the same as that of the surrounding land; trees mature, so if in doubt, record as mature island.




E7Eb Mature islands – note height of islands is the same as that of the surrounding land; trees not present due to grazing.

E7Ec Mature island – height of island probably the same as that of the surrounding land; trees mature, so if in doubt, record as mature island. If spot-check at the extreme upstream point of island, vegetated mid-channel bar should be recorded, not mature island.

E7Fa Urban debris. See also E7Cc.

## SECTIONS F AND H: LAND-USE WITHIN 5M AND 50M OF BANKTOP

F1a Broadleaf/mixed woodland (semi-natural) land-use. See also C3b, E7Dd, J6a,b, M2b.

F1b Broadleaf/mixed woodland (semi-natural) land-use – an un-metalled path follows the bank; this is recorded as the same as the adjacent land-use.

F2a Broadleaf/mixed woodland (planted). Even though trees may be native willows, this is a plantation.

F3a Coniferous woodland land-use – very rare in the UK, and primarily in Scotland.

F4a Coniferous plantation – typically even-aged structure, and little or no vegetation below the trees (understorey).

F5a Scrub & shrubs land-use on horizon – multi-branched, short, woody vegetation.

F7a Wetland land-use – wet marshland. See also M15a, M18a,b.

F8a Moorland/heath land-use – this shows dry heath dominated by heather and uniform bank vegetation structure. See also E7Dc, E7Ea, J1b.

F7b Wetland land-use – reedbeds.


F8b Moorland/heath land-use – dominated by grass, with little heather. See B2a, M16b.

F7c Wetland land-use – wet blanket bog.

F9a Artificial open water land-use – wide range of types; includes shallow scrapes re-creating lost open water habitats.

F9b Artificial open water land-use – wide range of types; includes all man-made ponds, gravel pits and amenity lakes (as shown).

F10b Natural open water land-use – old ox-bows, backwaters, secondary channels and pools in floodplains. See M2a,b,c, M20b,c.

F9c Artificial open water land-use – wide range of types; includes canals.

F11a Rough/unimproved grassland/pasture land-use – includes rough, usually herb-rich, tussocky/rushy floodplain grassland.

F10a Natural open water land-use – wide range of types, including natural lakes and ponds surrounded by dry land.

F11b Rough/unimproved grassland/pasture land-use – includes herb-rich meadows.

F12a Improved/semi-improved grassland. See also B7b.

F13a Tall herb/rank vegetation land-use – typically at least waist high vegetation dominated by tall herbs.

F13b Tall herb/rank vegetation land-use – typically tall herb vegetation reverting to scrub due to lack of grazing/mowing.

F13c Tall herb/rank vegetation land-use – tall herb vegetation includes bracken.

F14a Rock, scree or sand dune land-use – fine scree on steep slope.

F14b Rock, scree or sand dune land-use – coarse scree on steep slope. Note multi-channels; these are not braiding – record as mature islands and vegetated mid-channel bars, and note as special feature in Section M.

F15a Suburban/urban development land-use – rivers surrounded by houses or industrial buildings. Note minor outfall and resectioned bed and banks.

F15b Suburban/urban development land-use – includes rail tracks and roads. See also A1c.


F16a Tilled land-use – includes arable crops or allotments. See also E1Jb.

F17a Irrigated land-use – rare within UK; cress-beds.

F18a Parkland & gardens land-use – includes public open space and sports fields. See also E1Lb. Note uniform bank vegetation structure on left with tall herbs and grasses; simple bank vegetation on right.

F18b Parkland & gardens land-use – includes sports fields. Note river has artificial berm and floodbank on left. Regularly spaced trees on right.

## BANK AND BANKFACE VEGETATION STRUCTURE

FV1a Bryophytes – liverworts on clay bank.

FV2b Short/creeping herbs or grasses.

FV1b Bryophytes – mosses.

FV3a Tall herbs or grasses. See also C3a, D1c, E1Oa, F18a, G2b.

FV2a Short/creeping herbs or grasses – short grazed grass. See also A1a, B7a,b, E2Ca.

FV3b Tall herbs or grasses.


FV4a Scrub or shrubs bank vegetation structure – bramble on right is included in this category. See also D1c, F18a.

FV5b Saplings and trees on left; on right tall herbs and grass.


FV4b Scrub or shrubs.

FV6a Bare bank on left, uniform on right. See also A1c, E1La,b, E1Ma,b,c, E1Pa, E7Cc.

FV5a Saplings and trees on bank. See also G2b.

FV6b Bare bank.

FV7a Uniform banktop (bare bankface) – predominantly one vegetation type only. See also B7a,b, C4c, D1c, D6c, E2Ca, FV1a,b, FV2a,b, FV5b,

FV8b Simple – mixed layer of two or three types; note if trees present, structure is not necessarily 'complex'.

FV7b Uniform – predominantly one vegetation type only along both bankface (reeds) and banktop (grass).

FV9a Complex – shrubs, tall herbs & grasses and short/creeping herbs & grasses. See also FV4b, FV5b, F18a, G2b.

FV8a Simple – mixed layer of two or three types. See also E1Pd, F18a, G2b.

FV9b Complex – mixed saplings, scrub and tall herbs & grasses.

## SECTION G: CHANNEL VEGETATION TYPES

G1a Liverworts/mosses/lichens – submerged bryophyte.

G2a Emergent broad-leaved herbs (brooklime – *Veronica beccabunga*).

G1b Liverworts/mosses/lichens – splash-zone bryophytes (close-up).

G2b Emergent broad-leaved herbs (water-cress – *Nasturtium officinalis* agg.). Note also complex bank vegetation structure (saplings and trees dominant) on the left, and simple structure (dominated by tall herbs and shrubs) on the right.

G1c Liverworts/mosses/lichens – splash-zone bryophytes; include such exposed cover as part of the channel vegetation. See also M6a,b.

G3a Emergent reeds/sedges/rushes/grasses/ horsetails (bulrush – *Schoenoplectus lacustris*). See also M9c.

G3b Emergent reeds/sedges/rushes/grasses/ horsetails (branched bur-reed – *Sparganium erectum*).

G5a Free-floating (frogbit – *Hydrocharis morsus-ranae*). See also A3b.

G3c Emergent reeds/sedges/rushes/grasses/ horsetails (water horsetail – *Equisetum fluviatile*).

G5b Free-floating (common hornwort – *Ceratophyllum demersum*).

G4a Floating-leaved (rooted) (yellow water-lily – *Nuphar lutea* & unbranched bur-reed – *Sparganium emersum*). Note majority of the leaves of the latter are floating, not submerged, therefore not recorded as submerged linear-leaved – see G8a.

G5c Free-floating (ivy-leaved duckweed – *Lemna trisulca*).

G6a Amphibious (*Glyceria* spp).

G7b Submerged broad-leaved (submerged 'cabbage-like' leaves of yellow water-lily – *Nuphar lutea*).

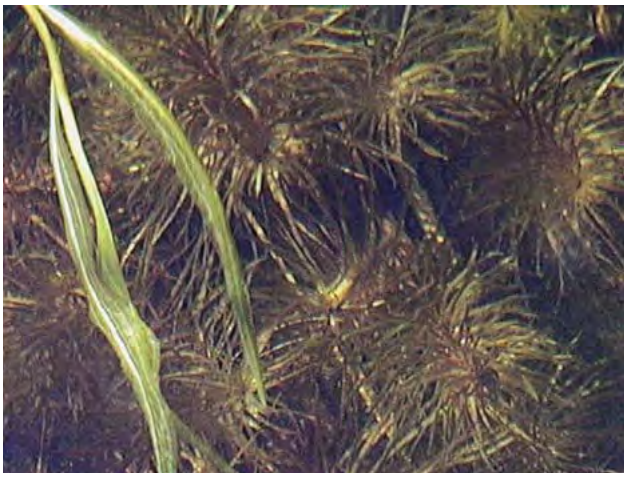
G6b Amphibious (amphibious bistort – *Persicaria amphibia*).

G7c Submerged broad-leaved (bog pondweed – *Potamogeton polygonifolius*).

G7a Submerged broad-leaved (opposite-leaved pondweed – *Groenlandia densa*).

G8a Submerged linear-leaved (unbranched bur-reed – *Sparganium emersum*) Note majority of leaves submerged, therefore not recorded as floating-leaved – see G4a.

G8b Submerged linear-leaved – rosettes (common plantain– *Alisma plantago-aquatica*).



G9c Submerged fine-leaved (mare's-tail – *Hippurus vulgaris*).

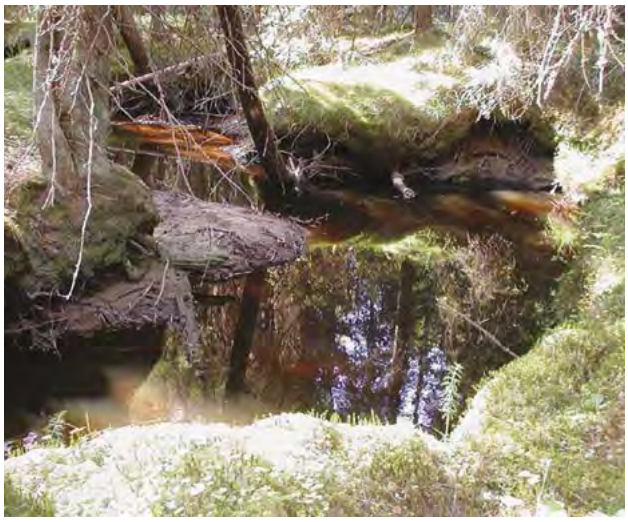
G9a Submerged fine-leaved (water-crowfoot – *Ranunculus* sp(p.)).

G10a Filamentous algae – algae smothering the bed of the river (*Cladophora*).

G9b Submerged fine-leaved (floating club-rush – *Eleogiton fluitans*).

G10b Filamentous algae – algae free-floating (*Enteromorpha*).

## SECTION I: BANK PROFILES



I1a Vertical/undercut bank profile – undercut. Note classic point bar, overhanging bough and pool present. See also B1b, C4a, E3Ab.

I2b Vertical plus toe bank profile. Note bank is eroding cliff with sandy/gravel soil (EC).

I1b Vertical/undercut bank profile – vertical. Note also classic point bar and eroding earth cliff opposite.

I3a Steep bank profile. See also B1b (right), B3a (gorge) I4a (left).

I2a Vertical plus toe bank profile.

I4a Gentle bank profile – on right, steep on left. See also B1b, B7a, C4a, E3Ec.

I5a Composite bank profile – slumping earth bank. Note complex vegetation structure on opposite bank (See also FV9b).

I6b Reinforced bank – toe only; reinforcement is metal sheet piling and rip rap above. Note also bank is resectioned.

I5b Composite bank profile – combination of rock and earth. Note bank is also poached.

I6c Reinforced bank – record as 'top only' on right, and 'whole' on left. See also A1c, E1La,b, E1Mb,c (all whole banks).

I6a Reinforced bank – toe only; reinforcement is with large boulders (rip-rap). See also E1Ja,b, E1Ka, E1Oa.

I7a Set back embankment made of earth (on right).

## SECTION J: EXTENT OF TREES AND ASSOCIATED FEATURES

J1a No trees on bank – a single small tree is not counted; requires 1% of bank to be covered by canopy (5m on each bank). See also C4b, FV2a, FV6a.


J2b Isolated/scattered trees on right.


J1b No trees on bank. Note moorland/heath land-use. Note deep vee valley.

J3a Regular spaced trees. See also F18b.

J2a Isolated/scattered trees on bank on right; continuous on left. See also E2Db, FV3a.


J4a Occasional clumps of trees on bank (right).

J4b Occasional clumps of trees on bank (right).

J6a Continuous trees (on right). Broadleaf/mixed woodland (semi-natural) is land-use in 5m banktop and 50m corridor zones on right. See also C4b, E3Ca, E4Cb, FV9a, J2a.

J5a Semi-continuous trees on bank (left).

J6b Continuous trees on both banks.

J5c Occasional clumps of trees on bank (left).

J6c Continuous trees on right.

J7a Shading of channel present. Note also overhanging boughs. See also M4a, M6a, M7a

J8b Overhanging boughs.

J7b Extensive shading of channel.

J9a Exposed bankside roots – forearm-sized roots and branches with associated cavities.

J8a Overhanging boughs. See also C2a, I1a, J7a.

J9b Exposed bankside tree roots.

J10a Underwater tree roots– fine roots of willow (*Salix*).

J11c Fallen trees – note still attached to earth bank.

J11a Fallen trees – note tree still attached to steep earth bank by roots.


J12a Large woody debris – whole branches and trunks washed down and lodged in the channel.

J11b Fallen trees – note tree still attached to unstable bank.

J12b Large woody debris – whole branches and trunks washed down and wedged across the channel.

## SECTION K: EXTENT OF CHANNEL AND BANK FEATURES

K1a Marginal deadwater. Note also a backwater (as feature located where old cut-off channel enters the river) and discrete silt deposit as predominant channel substrate is cobble/pebble. See also M12a,b.

K2a Unvegetated silt deposit – surface has >50% vegetated cover, but the underwater part of the deposit has no vegetation. See also E2Bb, K1a.

K1b Marginal deadwater – area of no flow in between extensive shelves with reeds.


K2b Unvegetated silt deposit – surface has >50% vegetated cover, but the underwater part of the deposit has no vegetation.

K1c Marginal deadwater – area of no perceptible flow.


K2c Unvegetated silt deposit – surface has >50% vegetated cover, but the underwater part of the deposit has no vegetation.

K3a Discrete unvegetated sand deposit – deposit is unvegetated and in mid-channel, with sand NOT the predominant substrate.


K4a Discrete unvegetated gravel deposit – deposit is unvegetated (<50% cover) and in mid-channel in lee of a large boulder; gravel is NOT the predominant channel substrate.

K3b Discrete unvegetated sand deposit – deposit is unvegetated (<50% cover) and on the channel margin; sand is NOT the predominant channel or bank substrate.

K4b Discrete unvegetated gravel deposit – deposit is unvegetated (<50% cover) and on the channel margin; gravel is NOT the predominant channel or bank substrate. See also M7b.

K3c Discrete unvegetated sand deposit – deposit is unvegetated (<50% cover) and on the channel margin; sand is NOT the predominant channel or bank substrate.

## SECTION M: FEATURES OF SPECIAL INTEREST

M1a Braided channel – view across a typical example with several channels and coarse, mobile, sediment.

M2a Side-channel – example of a seasonally dry side channel (upstream).

M1b Braided channel – aerial view of a typical example with several channels clearly evident.

M2b Side-channel – same channel as M2a in mid-reach.

M1c Braided channel – aerial view of a highly mobile channel with floodplain absent.

M2c Side channel – same channel as M2a,b close to the downstream confluence with main channel. Note another, older, side channel on right.

M3a Natural waterfall >5m high – example of falls with plunge pools. See also E5Ab.

M4b Natural waterfall <5m high – example of several falls into a plunge pool.

M3b Natural waterfall >5m high – example with vertical 'free-flow' flow-type plunging more than 50m.

M5a Natural cascade – boulder substrate.

M4a Natural waterfall <5m high – example of single fall into a wide pool. Shade extensive upstream of fall.

M5b Natural cascade – bedrock substrate. See also E5Ca.

M6a Very large boulders. See also E4Bb, M5a.

M7b Debris dam – woody debris is creating an obstacle to flow, downstream of which is a large discrete gravel deposit formed from scouring a hole below the debris dam.

M6b Very large boulders.

M8a Leafy debris – discrete accumulations of twigs and/or leaf litter.

M7a Debris dam – woody debris is creating an obstacle to flow. Channel also shaded.

M8b Leafy debris – deposit on top of a point bar – record both.

M9a Fringing reed-bank – extends >50% up the bank, and is >10m long. See also E3Ed.

M10a Quaking bank – overhanging reeds forming a mat over the water; very rare feature, and impossible to illustrate properly in a photo.

M9b Fringing reed-bank – extends >50% up the bank, and is >10m long.

M11a Sink hole – extremely rare feature in the UK.

M9c Fringing reed-bank – shows primarily in-channel reed growth, but as extends >50% up the bank, and is >10m long, recorded as fringing reed-bank and extensive emergent vegetation.

M11b Dry channel associated with the sink hole shown in M11a.

M12a Backwater formed from old redundant channel arm. Also marginal deadwater. See also B8a, K1c.

M14a Water meadow – historic floodplain management involving flooding in spring.

M12b Backwater formed from old redundant channel arm.

M14b Water meadow – flooded example.

M13a Boulder floodplain deposits – feature rarely associated with UK rivers.

M15a Fen – rich higher plant community dominated by great tussock-sedge (*Carex paniculata*) growing in areas with very high water-table.

M16a Bog – bog moss (*Sphagnum*), over peat, is a characteristic component of bog vegetation.

M17a Wet woodland: Calcium Carbonate rich wet woodland formed at the bottom of a slope; species present include Elder (*Sambucus nigra*), Alder (*Alnus glutinosa*), Willow (*Salix* sp), Butterbur (*Petasites hybridus*) and Nettles (*Urtica* sp).

M16b Bog – cotton-grass (*Eriophorum*) is often associated with wet blanket bogs, with surrounding slopes grassy moorland/heath.

M17b Wet woodland – typically alder (*Alnus glutinosa*) and willow/sallow (*Salix* sp(p.)) are the dominant trees/shrubs.

M16c Bog – Some bogs may have invasion of heather as they dry; when bog pools, cotton grass or *Sphagnum* present, record as bog.

M18a Marsh – example of rushy wet field. See also F7a.

M18b Marsh – example of an ungrazed rushy wet field.

M20a Natural open water – example of old channel now forming a sinuous shallow open water habitat – where no open water present, record as wetland. See also B8a.

M19a Flush – example is springs rising in open land to form a small flush.

M20b Natural open water.

M19b Flush – example is springs rising in woodland to form a flush that has an intermittent flow.

M20c Natural open water – a small pond left in an old meander pool of a redundant channel.

## SECTIONS N AND O: CHOKED CHANNEL AND NOTABLE NUISANCE PLANT SPECIES

Na Realigned channel choked with submerged aquatic vegetation. Note minor bridge. See also A1b. Do not record 'channel choked' when just free-floating vegetation (see A3b).

O2a Himalayan (Indian) balsam (*Impatiens glandulifera*).

Nb Channel choked with emergent reeds. Also realigned.

O3a Japanese knotweed (*Fallopia japonica*).

O1a Giant hogweed (*Heracleum mantegazzianum*)

O4a other nuisance species – a common example is rhododendron.

## SECTIONS P AND Q: OVERALL CHARACTERISTICS AND ALDERS

P1a Major impact – extreme effect of trampling.

P2b – Evidence of recent management – river rehabilitation works. See also E1Hb, E1Mb, E2Cc,d.

P2a Evidence of recent management – silt dredging. See E2Aa for bank mowing.

Qa Alders (*Alnus glutinosa*) along river bank.


P1b Major impact – silt run-off to river.

Qb Diseased alder (*Alnus glutinosa*).

# PART FIVE – TECHNICAL APPENDICES

## APPENDIX 1: HEALTH & SAFETY GUIDANCE

### General guidelines

Being near rivers, streams or any other body of water, either for work or recreation, is potentially hazardous.

☠ **When doing an RHS survey, health and safety must always be taken into account.**

💡 Safety is an integral, and important, part of the RHS training course with the main hazards/ risks being highlighted. However it is not fully comprehensive and line managers of surveyors are responsible for making all field staff aware of potential dangers, and the procedures to follow, in case of accidents.

RHS surveyors need to be physically fit and must have adequate personal protective equipment (PPE) i.e. appropriate footwear and waterproof jacket and trousers. Footwear should have cleated, felt or studded soles. Waders or wellington boots must be worn when surveying from the channel.

Every effort should be made to minimise risks in the field and the following guidelines should be followed:

- Life jackets should be worn at all times when working **in** rivers, and in any other situations wherever there is a risk of drowning. ☠ Do not enter a river in spate flow.
- ☠ Do not enter the water if the river bed is not visible.
- When entering the channel, take into account the depth, flow and temperature of water, conditions under foot (e.g. substrate, algae) and entry/exit points. Check for any potential obstructions.
- It is sensible to walk **against** the flow of the river.
- When in the channel, use a ranging pole or wading stick to check depth and substrate.
- Avoid steep, unstable and overhanging banks, and always have an identified exit route close to where you are surveying.
- Work in pairs if river channels need to be crossed.
- ☠ Never enter a culvert.
- Look out for hazards, especially in urban rivers, e.g. broken glass, sharp metal, decomposing waste or pollutants.
- Take care to avoid contact with the water, soil or vegetation before eating or drinking during survey work.
- Wear the right clothes for both the job and the weather conditions.
- When driving, shoes or walking boots should be worn and not waders.
- Carry a basic first-aid kit and hand-wipes.
- Wear a whistle, especially in remote, urban or wooded areas. Do not put it in a rucksack or pocket.
- When there is good reception, carry a mobile telephone.
- Always double-man or use a 'lone worker' system i.e. reporting-in and signing-off procedures, linked to a home base. (**NB lone working also includes where two people are working in a remote location.**) Line managers should have systems in place that ensure that the location of surveyors is known, and should establish an agreed system of emergency action in case a surveyor does not report back at the end of the day. For more details on lone-working, see Appendix 2.

A risk assessment should be carried out before doing survey work and an RHS health and safety assessment needs to be completed on-site. If there are problems on site, the surveyor needs to report these to their line manager, or survey coordinator, at their office. If it is considered unsafe, or there is any doubt, the survey should not be carried out.

**Risk assessment for a River Habitat Survey (see Appendix 1.1)**

Surveyors need to decide if there are any risks and to what level they are. Measures are suggested to reduce the risks and they should be applied. However it is down to the surveyor's, and their line manager/survey supervisor's, personal judgement(s) whether to proceed with the survey. The information in the Appendix 1.1 table should be used as a guide in undertaking risk assessment.

## Appendix 1.1: River Habitat Survey 2003 version: risk assessment

Site Number/Reference: Date:

| Task Element | Risk | Risk Level (low, moderate, high) | Potential Risk Control Measures | Proceed With Survey (Yes or No) |
|---|---|---|---|---|
| Arriving at site and the duration of survey | Aggressive animals/ people, hostile situation. | | Cautionary approach, avoid animals where possible, conflict resolution/breakaway training, double-man or lone worker system, mobile phone, personal alarm, whistle | |
| | Bank stability, high/ steep banks. | | Cautionary approach, test with ranging pole/wading stick, double-man, wear a lifejacket. | |
| | Falling in, swept-off feet, losing footing. | | Cautionary approach, double-man, wear a lifejacket, walk in upstream direction. | |
| | Fences (barbed wire, electric). | | Try to find a safe crossing point. Do not climb over, or crawl under, unless assessed to be safe to do so. If not safe to cross and no alternative crossing points, abandon the survey. | |
| | Livestock. | | Cautionary approach, avoid animals where possible, walk around the edges of fields. | |
| | Lone or remote working, lack of visibility, lack of local knowledge, vulnerable position. | | Double-man or lone worker system, estimated finish time known to others, assess communications before starting survey, mobile phone, personal alarm, whistle. | |
| | No communication (out of mobile range/no telephone). | | Double-man or lone worker system, estimated finish time known to others, assess communications before starting survey, personal alarm, whistle. | |
| | Railway, road. | | Find a safe crossing point. | |
| | Rough terrain, marsh/ bogs. | | Appropriate footwear and clothing, watch footing, walk around outer edges of bogs etc. | |
| | Ticks (Lyme disease). | | Wear long sleeves & trousers, regularly check for ticks, inspect body at end of survey. | |
| | Valuable equipment, high crime rate location. | | Double-man in such locations, estimated finish time known to others, assess communications before starting survey, mobile phone, personal alarm, whistle. If confronted for equipment, always give it over. | |
| | Weather: dehydration, heatstroke, hypothermia or unpredictable. | | Heat: wear suncream, sunglasses, keep head and back of neck covered, have bottled water, go into shade regularly. Cold: have insulating layers, wear hat/hood and gloves. Wet: do not survey in heavy rain, be extra vigilant to conditions underfoot. Be prepared for all likely conditions. | |
| When surveying from channel | Swept-off feet, losing footing. | | Double-man, use ranging pole to test depth and ground before entering channel, wear lifejacket, If water above knee-<br>height or you do not feel comfortable, do not survey from channel. | |
| | Entry & exit points. | | Check bank stability with ranging pole, wear lifejacket, double-man. | |
| | Hidden hazards under the water. | | Use ranging pole to check in the channel before entering, and whilst in, the channel. If hazards found, do not enter channel or make a safe exit from it. | |
| | Infection (in particular *Leptospirosis*). | | Keep open skin covered, wear gloves, have hand wipes and first- aid kit, wash hands thoroughly, avoid touching face, carry *Leptospirosis* Card. | |
| | Pools. | | Use ranging pole to test depth and ground, move around outer edges, watch footing. | |
| | Poor visibility/water clarity. | | Use ranging pole to check in channel, watch footing. If not comfortable do not survey from channel. | |
| | Poor water quality, pollution, sewage outfall/treatment works. | | Wear gloves, keep open skin covered, have hand wipes and first-aid kit, wash hands thoroughly before eating/drinking. | |
| | Substrate soft or uneven. | | Use ranging pole to test depth and conditions underfoot before entering the channel and whilst in it. If not comfortable, do not survey from channel. | |
| | Algae, thick weed growth, woody debris dams. | | Use ranging pole to check in channel, watch footing. If not comfortable, do not survey from channel. | |

### Site health and safety form (see Appendix 1.2)

This is now a required component of an RHS Survey and should be submitted along with the other four pages of the survey form. Surveyors need to assess, and comment on, the general characteristics of the site, and specifically on such aspects as weather and flow conditions. On the form it is necessary to record if the risks are low, medium or high. 💡 If a single category is recorded as a 'high' risk, surveys should not be carried out; similarly if more than three 'moderate' risks are recorded, RHS should not be carried out.

### Personal safety

Equipment used in an RHS survey can be highly expensive and the surveyor should also have a mobile phone. This may attract unwanted attention, particularly in urban areas, and might lead to a hostile situation.

Surveyors need to be able to recognise these types of situations and know how to deal with them appropriately, minimising risk of personal injury. Some sort of 'conflict resolution' training may be required so that the surveyor is able to evaluate the situation, avoid aggravating it, and know how to breakaway and escape attack if necessary.

☠ If confronted for survey equipment, always give it over. Equipment, or data, are not as valuable as the surveyor!

### Life jackets

☠ Where there is a risk of drowning a life jacket must be worn.

Surveyors must be trained in how to use, maintain and inspect their life jacket. They also need to know about the dangers of immersion and hypothermia.

### Weil's disease (*Leptospirosis*)

This can be a life threatening disease and surveyors need to **carry a medical/warning card at all times** to alert people to the nature of any potential illness. The symptoms start as a fever and headache. 💡 Treatment with antibiotics is needed straightaway.

Rivers being surveyed for RHS may contain rat urine, which can cause this illness. Therefore **waterproof clothing** must be worn when in the channel. Dead rodents at the site should not be touched, with or without, hand protection. Infection enters through breaks in the skin (i.e. abrasions, cuts, eyes, nose and mouth). Cuts and/or broken skin must be covered with **waterproof plasters** and surveyors should not rub their eyes, nose and mouth.

Surveyors **must always wash their hands before drinking, eating or smoking**. Clothing and equipment should be cleaned after use.

### Lyme disease

Lyme Disease can lead to serious illness if not treated quickly and properly. It is caught through being bitten by infected ticks, particularly in areas with sheep and deer. The first symptom is a ring-shaped rash around the bite followed by the development of flu-like symptoms within 24-48 hours. 💡 Treatment with antibiotics is required and is normally successful. If the disease is not treated, serious complications will develop over 1-12 weeks.

Whilst doing survey work in areas where tall grasses, reeds, heather (*Erica*, *Calluna*), bracken (*Pteridium*) and cranberry/blueberry/bilberry (*Vaccinium*) are abundant, surveyors must **keep their skin covered** (i.e. trousers and long sleeves). They also need to **regularly inspect** their clothing and skin for ticks and thoroughly check their body at the end of the day.

If ticks are found on the body, use tweezers to remove them. This needs to be done slowly and carefully to ensure no mouth-parts are left behind below the skin. Following removal, put a dressing over the bite, and seek medical attention.

## Appendix 1.2: River Habitat Survey 2003 version: site health and safety assessment form

| RIVER HABITAT SURVEY 2003 VERSION: SITE HEALTH AND SAFETY ASSESSMENT | | | |
|---|---|---|---|
| Site Number[1]: | Site Ref: | River Name: | Date: |
| Grid References/Co-ordinates: | Spot 1[2]: | Mid-site: | End of site[2]: |
| Surveyor Name: | | Accredited Surveyor Code: | |
| 1 Leave blank if new site. | | 2 Optional | |

| Weather Conditions: |
|---|
| Flow Conditions: |

| **Site details:** (enter comments or circle if applicable and give details) | **Risk Level (Low/Mod/High)** |
|---|---|
| Access and Parking:<br>(entry & exit) | |
| Conditions: comment on ground stability, footing, exposure/remoteness | |
| Obstacles/Hazards: fencing, stiles, dense vegetation, steep bank | |
| Occupied/Unoccupied: people, livestock, animals | |
| Activities/Land-use: agriculture, woodland, residential, industrial, construction, recreational | |
| Risk if lone-working | |

**IF THERE ARE ANY HIGH RISKS OR MORE THAN THREE MODERATE RISKS DO NOT CONTINUE WITH THE SURVEY.**

**Weil's Disease (*Leptospirosis*)**

Instructions to card holders

1. As infection may enter through breaks in the skin, ensure that any cut, scratch or abrasion is thoroughly cleansed and covered with a waterproof plaster.
2. Avoid rubbing your eyes, nose and mouth during work.
3. Clean protective clothing, footwear and equipment etc. after use
4. After work, and particularly before taking food or drink, wash hands thoroughly.
5. Report all accidents and/or injuries, however slight.
6. Keep your card with you at all times.

**Lyme Disease**

1. Dress appropriately with skin covered up.
2. Regularly inspect for ticks when in the field.
3. Check for, and remove, any ticks as soon as possible after leaving the site.
4. Seek medical attention if bitten by a tick.

## APPENDIX 2: LONE WORKING GUIDANCE

This Appendix contains excerpts from the Environment Agency's Lone Working guidance.

'**Lone working**' is where there is either no visual or audible communication with someone who can effectively get assistance in the event of an incident.

'**Remote working**' is when there are two people working in an area which is regarded as being isolated from potential rescuers, either because of the distance from inhabited locations, or because of features which make the site inaccessible.

**Lone** or **remote working** surveyors need to have the same level of safety as those working with others, or in populated locations, i.e. be in a minimal risk situation.

☠ If it is deemed **high risk** for a lone surveyor to do a survey, those responsible for the safety of surveyors need to make an additional person available. Surveyors should not perform RHS alone when there is a foreseeable chance that doing so might result in an accident, which would require a second person to be available to summon help.

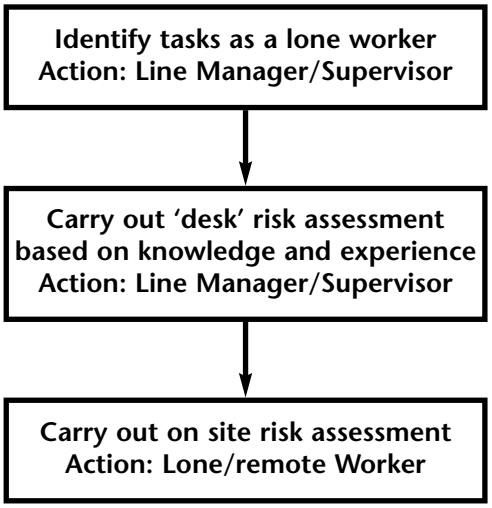
💡 Those who do work alone, or remotely, should have health and safety training which includes first-aid, map reading, using safety equipment and conflict resolution/breakaway skills.

### Risk assessment

Personnel responsible for the safety of surveyors must carry out a **risk assessment** for lone and remote surveyors and reduce risks to an acceptable level. However, surveyors must complete a risk assessment on site and use their own judgement. If they feel they are vulnerable, they should have assistance.

☠ **Surveyors should not put themselves or others at risk.**

The risk assessment may be carried out in three phases:




Lone or remote surveyors need to evaluate the following key risk criteria:

- the kind of accidents that may occur;
- the type of injuries that might result;
- the need for those injuries to receive immediate treatment;
- the chances of the injured person being able to summon help using telephone/radio equipment.

💡 **These should be looked at in addition to the RHS Risk Assessment (Appendix 1.1).**

☠ **Lone, or remote, surveyors should not do RHS in:**

- reduced visibility when there is a risk of falling into deep or fast flowing water or if there are steep banks;
- sites where banks are unstable or slippery;
- urban areas with high crime rates or known problems of physical attacks and muggings;
- sites where a hostile situation might be anticipated.

☠ Lone surveyors should not undertake survey from within the channel if the water is above knee height, fast flowing, or turbid.

### Safe system for lone working

Once risks have been assessed, and hazards identified, then risk control measures can be put in place to minimise the risks.

When designing a safe system of work, the following areas must be examined:

- work location;
- hazards;
- safety equipment;
- personnel;
- communication.

Personnel responsible for the safety of surveyors need to ensure there is a system in place to enable effective communication with, and monitoring of, surveyors working alone or remotely. 💡 They should know the **surveyor's location, route, estimated start and finish times and be able to contact them**. Similarly, surveyors should be able to make contact with personnel operating their safety procedures.

**Good practice procedures for lone, or remote, surveyors include reporting to their office:**

- at the start of a survey;
- periodically during a survey;
- if there are problems or changes to the planned routine;
- at the end of the survey.

There also needs to be a pre-determined course of action in case a surveyor **fails to report in at the end of survey work, or at the agreed times**. 💡 In such circumstance, good practice requires attempts to be made to contact the surveyor at 5-10 minute intervals, and record the attempts made. If after an hour there is still no contact, search and emergency procedures should be initiated.

## APPENDIX 3: DISEASED ALDER LEAFLET

Forestry Commission
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EH12 7AT
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# Phytophthora Disease of Alder

**INFORMATION NOTE**

BY J. WEBBER, J. GIBBS* AND S. HENDRY OF FOREST RESEARCH DECEMBER 2004

## SUMMARY

**Phytophthora disease of alder can be found in young woodland plantations and orchard shelterbelts but its greatest impact is on the riparian alders of southern Britain. An annual survey of alders in fixed plots alongside rivers over 8 m wide has been carried out since 1994. This has shown that the incidence of the disease has increased steadily over the years; by 2003 more than 15% of the surveyed trees had been affected or killed by the disease. This Note presents information on the pathogen, on the nature of the disease and on approaches to management and control.**

## INTRODUCTION

There are four alder species native to Europe: the common alder (*Alnus glutinosa*), the grey alder (*A. incana*), the Italian alder (*A. cordata*) and the green alder (*A. viridis*). In general, members of the genus *Alnus* are pioneer species, able to colonise bare, open ground rapidly and with a great ability to tolerate wet sites. The roots have specialised nodules which fix atmospheric nitrogen as a result of a symbiotic association with the actinomycete *Frankia*. This nitrogen, fixed at rates of 60–400 kg $h^{-1}$ $yr^{-1}$, is available to both the host tree and to the environment. Common alder in particular has considerable landscape value along waterways; it plays a vital role in riparian ecosystems and the root system helps to stabilise riverbanks.

In 1993 a previously unknown and lethal disease of alder was described in southern Britain (Gibbs, 1995). Initially it was thought to be caused by *Phytophthora cambivora* – a fungus well-known as a pathogen of broadleaved trees but not previously reported from alder. However, it quickly became clear that the pathogen was an entirely new species. Further investigation revealed that the disease was widespread in southern England. Following this discovery, considerable efforts were directed towards characterising the new pathogen, determining the distribution and severity of the disease within the UK, and exploring methods for managing the disease. This Note provides a current assessment of the situation, updating the information presented by Gibbs and Lonsdale (2000). A more detailed record can be found in Forestry Commission Bulletin 126 (Gibbs *et al.*, 2003).

## CHARACTERISTICS OF THE DISEASE

From a distance, diseased alders attract attention in mid to late summer because the leaves are frequently abnormally small, yellow and sparse (Figure 1). They often fall prematurely, leaving the branches bare. In a tree with severe crown symptoms, the lower part of the stem is often marked with a black or rusty coloured exudate known as 'tarry spots' which can sometimes occur up to 2–3 m from ground level (Figure 2). These spots indicate that the underlying bark is necrotic or dead. Over the next

**Figure 1**

Affected alder stem showing foliage symptoms typical of Phytophthora disease.

*Previously Head of Pathology at Forest Research, now retired.

**Figure 2**

Base of alder stem showing the tarry spots commonly found with Phytophthora disease.

**Figure 3**

Italian alder in the remnant of a woodland planting subject to occasional flooding. One tree has recently died from Phytophthora disease.

few years the fine twig structure, the bark and eventually the trunk will break up. However, it is quite common for narrow strips of bark to remain alive and to support a limited growth of new shoots from the trunk and major branches.

The microscopic spores of the alder *Phytophthora* (known as zoospores) are free-swimming in water and therefore probably disperse via river systems as well as in soil. Despite this, it is rare to isolate the pathogen from river water or even from soils around infected alder trees (Brasier, 2003). Experiments have shown that the zoospores are attracted to the fine roots of young alders but these are probably not the main infection sites in nature. Studies of diseased trees have shown that bark killing often begins at the collar (the base of the stem) rather than in the root system (Lonsdale, 2003). Foliar and crown symptoms do not occur until the root collar has been largely girdled. Thus, many years may elapse between infection and the appearance of visible disease in the crowns of affected trees.

Occasionally, trees with severe crown symptoms may recover in subsequent years. This is due to the arrested development of the lesions at the stem base, followed by the development of sufficient live tissues to provide an effective link between root system and crown. Such trees may show basal cankers in the absence of any tarry spots.

Most records of the alder *Phytophthora* have come from the common alder (*A. glutinosa*), but the fungus has also been detected in grey alder (*A. incana*), and Italian alder, (*A. cordata;* Figure 3). Recent work which has compared the relative susceptibility of the three species indicates that *A. glutinosa* is most susceptible to the disease, while *A. incana* is the most resistant. The disease has not been recorded on any other tree genera and experiments on a number of species of common riparian trees have not shown any of them to be susceptible (Brasier and Kirk, 2001).

## DISEASE DISTRIBUTION IN THE UK AND EUROPE

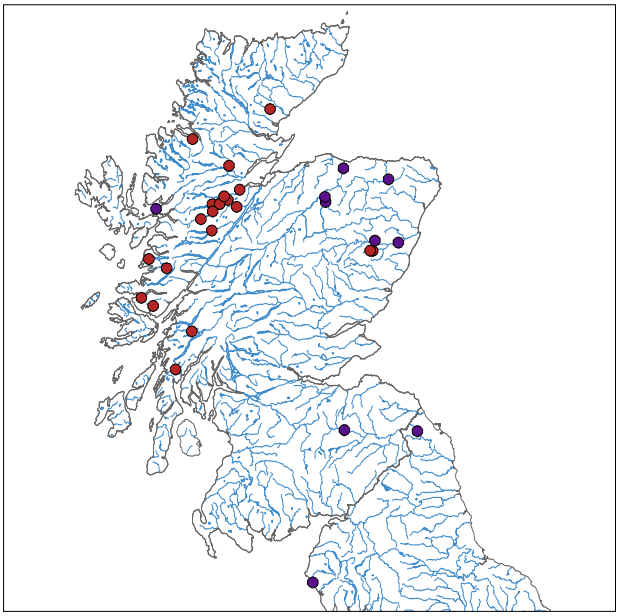
Phytophthora disease is now widespread in Europe and in addition to the UK has been reported from 10 countries: Austria, Belgium, France, Germany, Hungary, Ireland, Italy, Lithuania, The Netherlands and Sweden. Very high losses have occurred in some localities (such as parts of France and Germany) while in others the disease impact has been relatively small.

In the UK it has been known for some years that the disease is present through much of southern England and in parts of Wales (Gibbs *et al.,* 1999). However, until recently it was considered to be present at much lower levels in northern England but reports of the disease from this region are now increasing. For example, it has been recorded on the River Till, a tributary of the River Tweed in the extreme northeast of England (Figure 4).

The disease has also been found at several locations in Scotland, particularly in river catchments in the east of Scotland (Hendry, 2002) on the Rivers Avon, Dee, Deveron, Duirinish and Spey (Figure 4). Phytophthora

**Figure 4**

Locations in mainland Scotland where Phytophthora disease of alder (blue dots) and alder dieback (red dots) have been found.



disease should not be confused with another disease of native alders that is frequently seen in some parts of Scotland. Alder dieback, which was first observed as long ago as the beginning of the past century, is characterised by the death of aerial parts of the tree alone and not by the root collar and root mortality which occurs in trees affected by the Phytophthora disease. Instead bark lesions occur on branches and commonly coalesce in the parent stem, resulting in girdling and branch and stem death (Gregory *et al.*, 1996). Underlying these lesions the wood is typically stained a dark brown and, on isolation, often yields the Ascomycete fungus *Valsa oxystroma*. This fungus is not a strong pathogen and may only be capable of causing damage to trees subjected to environmental stress. In this respect, the incidence of alder dieback tends to be confined to catchments in the north and west of Scotland, the majority of which can be described as 'spate' systems in which water flow and water levels are inherently volatile. The riparian alders in these areas are likely to encounter greater fluctuations in their environment, and thus be subject to greater environmental stresses than alders growing elsewhere. Such stresses, in addition to local site factors, may contribute to the occurrence of dieback.

## The scale of the disease in the UK

The principal information on the scale of the disease comes from a series of riparian plots established in 1994 in the southern half of England and east Wales on rivers over 8 m wide. These plots have now been assessed for 10 successive years and data from them are contained in Table 1. Further analysis of the survey data from 1994 to 1996 can be found in Gibbs *et al.* (1999). The survey is based on alders (maidens or coppice stools) that have at least one stem of 7 cm diameter at breast height. Annual fluctuations in the total number of trees assessed are due to the net effect of recruitment, through growth into the 7 cm size class, and loss, due to activities such as felling or events such as flood. The data show that in 1994 4.3% of the stems that were assessed were diseased or dead, with a small proportion of the dead trees killed by causes other than *Phytophthora*. The percentage of trees affected by *Phytophthora* has increased each year so that by 2003 15.3% of the total was diseased or dead. By extrapolation from the plot data, it is possible to estimate the total number of trees in the survey area. This procedure gives a population of 580 000 trees, of which 63 000 are diseased and 26 000 have died. On average, the disease incidence is highest is southeast England. However, heavy losses are occurring in some of the large alder populations that occur along western rivers – for example, in the Marches.

Scrutiny of the individual plot data reveals considerable variation. For example, in some plots the increase in infected trees has been rapid and all are now diseased, while in others there has been little or no increase in disease levels from 1994 to 2003. The disease tends to be less frequent in trees that are 1–10 m away from the water's edge, indicating a strong negative effect of distance from water. However, in some instances where young seedling alders establish on the exposed soil of the

**Table 1** Summary of data from riparian alder plots surveyed each year from 1994–2003.

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of trees assessed | 1681 | 1718 | 1719 | 1721 | 1716 | 1734 | 1763 | 1773 | 1792 | 1752 |
| Number of diseased trees | 51 | 62 | 86 | 101 | 112 | 138 | 164 | 179 | 193 | 189 |
| Number of dead trees | 22 | 28 | 40 | 44 | 54 | 59 | 61 | 66 | 74 | 78 |
| % of diseased or dead trees | 4.3 | 5.2 | 7.3 | 8.4 | 9.7 | 11.4 | 12.8 | 13.8 | 14.9 | 15.3 |

river flood plain some distance from the river, many eventually succumb to the disease apparently becoming infected after episodes of flooding.

A few trees have definitely recovered from the disease, i.e. there has been no recent death of bark and the leaves are of a normal size and colour, although they may remain sparse. Such trees show the development of new tissues at the edge of basal stem lesions, as described above. It remains to be seen whether this remission from disease is permanent.

## THE PATHOGEN

Soon after the pathogen was first isolated in 1993, it was recognised that it had several unusual properties. This suggested that it was a new species hybrid which had probably originated relatively recently.

Building on a study of the morphological and cultural characteristics of the fungus (see Brasier *et al.,* 1995), molecular analysis has shown that the alder fungus is a hybrid between *P. cambivora* and a fungus close to *P. fragariae* – a pathogen of strawberry (Brasier *et al.,* 1999). It is now spreading across Europe as a hybrid swarm. Some of the hybrid types are locally very damaging, and pose a serious threat to alder and the stability of riparian ecosystems. The standard type of the pathogen has recently been named as *Phytophthora alni* subspecies *alni*, and the different hybrid types or variants are collectively known as *P. alni* subspecies *uniformis* and *P. alni* subspecies *multiformis* (Brasier *et al.*, 2004).

Environmental factors may also play a part in the occurrence of the disease and it seems probable that distinct waves of infection can occur, which may be associated with flooding episodes or other disturbance. In 1994 survey data showed a correlation between the level of total oxidised nitrates in a stretch of river and the incidence of *Phytophthora* infection in the adjacent riparian alder (Gibbs *et al.,* 1999), although this has not been repeated since. The reasons for the causal relationship between these two variables is unclear, but sections of river with highest nitrate counts will also be those most exposed to other types of human activity and disturbance. A newly evolved pathogen which is being gradually disseminated around the country, would be likely to appear in much-disturbed rivers before more remote watercourses.

## DISEASE MANAGEMENT

It is not recommended that time and resources should be spent in attempts to eliminate the fungus from a site through the felling or winching out of affected trees. These operations cannot be conducted in a sufficiently comprehensive way to be effective. On riparian sites, the disturbance created by this activity, including bringing machinery on site, may even spread the disease by allowing infective spores and fragments of the fungus from diseased trees or soil to come into contact with healthy trees further downstream.

### Coppicing

Coppicing encourages the regeneration of new growth, especially if the tree has a diseased root system that can no longer support the entire crown. It also prevents diseased trees from becoming unstable and causing damage to the anchoring riverbank. Ideally, trees should be cut for coppicing 20–30 cm above ground level, leaving a tall stump to develop new shoots under favourable space and light conditions.

Studies on the potential for Phytophthora disease management through the coppicing of affected trees were initiated in summer 1996 when 50 alders, in various stages of disease, were felled along Hadley Brook in Worcestershire. Some stools were either already dead or soon died. However, vigorous coppice growth occurred from the stumps of a number of severely affected trees. The health and vigour of the regrowth has now been assessed over eight years (see Figure 5). Much of it remains healthy, although it is clear that far fewer shoots regenerate from the stumps of diseased trees compared with healthy trees. In some cases apparently healthy trees were probably diseased but not yet showing symptoms prior to coppicing, as the new growth quickly showed signs of disease. However, even stumps cut from trees with entirely dead crowns sometimes resprouted, although the number and vigour of the sprouts were always less than with healthy stumps (Table 2).

### Resistance to disease

Experiments involving 15 European provenances of *A. glutinosa* saplings were established in 1996 on sites subject to flooding alongside rivers where many diseased trees could be found (the Rother in West Sussex and the Clun in Shropshire). After four years the disease was apparent in all of the provenances at one or other of the sites and no consistent evidence of variation in resistance was apparent.

**Figure 5**

Health of regrowth from coppiced trees at Hadley Brooke in Worcestershire: (a) trees coppiced after the entire crown had died; (b) diseased trees after coppicing; (c) healthy trees after coppicing. Dark purple bars indicate stools with only healthy regrowth; grey bars, stools with disease in some or all of the regrowth; light purple bars, dead stools.

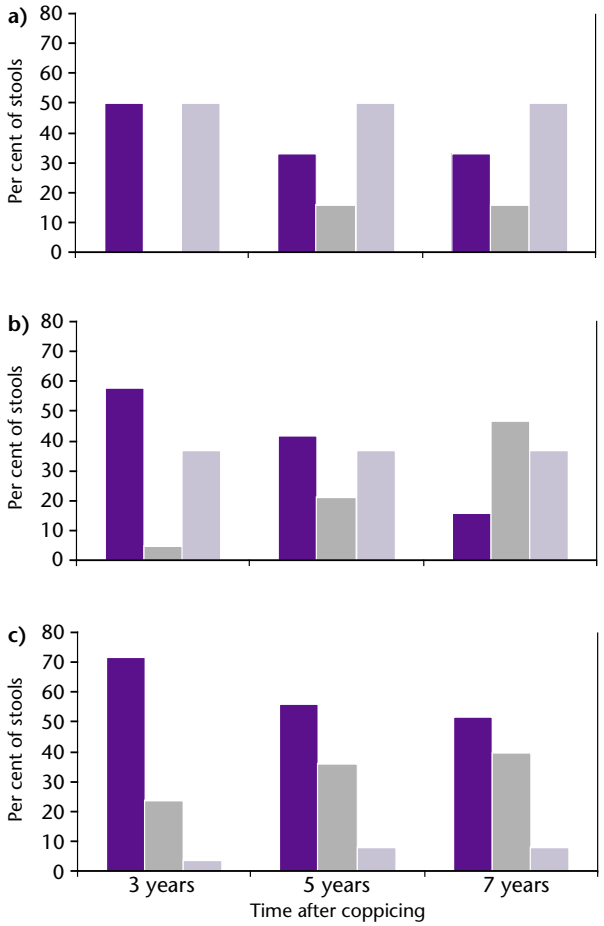



**Table 2**

Amount of resprouting after coppicing stems of *Alnus glutinosa.*

| Condition prior to coppice | Time after coppicing | | |
|---|---|---|---|
| | 3 years | 5 years | 7 years |
| **Dead trees (*n*=6)** | | | |
| Mean number of shoots | 3 (1–3)* | 1.7 (1–3) | 1.7 (1–3) |
| Mean height of shoots | 3.5 m | 3.5 m | 4.3 m |
| **Diseased trees (*n*=19)** | | | |
| Mean number of shoots | 6.3 (1–9) | 6.1 (1–26) | 11.5 (1–54) |
| Mean height of shoots | 2.5 m | 3.5 m | 4.0 m |
| **Healthy trees (*n*=25)** | | | |
| Mean number of shoots | 14.7 (3–40) | 14.9 (3–40) | 24.6 (3–63) |
| Mean height of shoots | 3.6 m | 4.3 m | 6.0 m |

* Range in the number of shoots on the coppiced stems.

At the Rother site the incidence of disease in each of the 15 provenances ranged from 29% in the Welsh provenance to 59% in an English provenance; at the Clun the disease incidence ranged from 0% (Austrian and Hungarian provenances) to 31% (English). However, the Hungarian and Austrian provenances were only moderately resistant when directly inoculated with *P. alni* (Gibbs, 2003).

## PLANTING POLICIES

There is evidence that the pathogen can be disseminated on alder plants which have become infected in the nursery, a common occurrence with other species of *Phytophthora* that affect ornamental nursery stock. Alders could become infected in the nursery either by watering with contaminated river water or through contact with already infected material. In Germany, the alder pathogen has been found in rootstocks of alders from three out of four commercial nurseries that were screened (Jung *et al.*, 2003). In the UK the evidence of nursery involvement is indirect. In one instance, disease in two young woodland plantations had the common feature that both had been planted up with alders supplied by the same nursery: the plants had been imported from Belgium. In addition, the disease has also been found in sites remote from watercourses: in young woodland plantations for example and in orchard shelterbelts. The most likely origin of the disease in those instances is that the trees were already infected in the nursery prior to planting out.

Those who are concerned about the risk of buying infected plants, should evaluate potential suppliers carefully and, if possible, see the growing stock in the nursery prior to purchase to determine that there are no apparent health problems. Partners in a European Union Concerted Action project (FAIR5 CT97 3615) working on disease of alder have suggested that good practice in nurseries should include:

- No irrigation with river water in the nursery.
- At least one growing season inspection of plants to look for symptoms of *Phytophthora* infection.
- Routine disinfection of the nursery before new alder plants are introduced into an area where alder plants have been previously.
- Replanting of alders in ground where diseased alder plants have been growing should not be attempted for three years.

In addition, it is important to know if Phytophthora-controlling fungicides have been applied to plants prior to

sale, as these may suppress symptom development in infected plants.

The planting of alder on sites liable to flooding by rivers, on the banks of rivers where diseased alders are known to occur, presents a high risk. While alder is often the most suitable genus for a variety of reasons, owners should take account of the threat of disease and consider other flood-tolerant species, such as willow, as replacements or in mixture.

Special care should be taken not to introduce the fungus to remote riparian sites. Instead, natural regeneration of alder from seed should be encouraged as it occurs readily although the young plants may need to be protected with a stock-proof enclosure.

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# APPENDIX 4: BIOSECURITY

## Invasive Non-Native Species

Plants and animals that have been introduced to a place where they do not naturally occur, are known as non-native species. Many of these live in the UK without causing a problem, but those that result in damage to our environment, leisure and economy are known as invasive non-native species (INNS).

## Managing Invasive Non-Native Species (INNS)

Taking a preventative approach to invasive non-native species means planning how we will respond to current and future threats. These plans could mean changes to the way we carry out our day-to-day activities through biosecurity. Biosecurity includes the measures that we take to reduce the risk of spreading diseases, parasites and invasive non-native species.

Whilst carrying out any type of fieldwork, you must follow the five steps to biosecurity:

### Plan

- Plan to visit sensitive sites early in the day, and sites with known invasive species problems last in the day.
- Plan where and how to clean equipment, taking necessary tools to clean (including disinfection) with you.
- Use kit that has less refuges for invasive species.
- Take duplicate equipment and kit if visiting multiple sites.
- Consider whether additional measures will be needed for exposure to diseases and pathogens.

### Avoid

- Keep access to a minimum, avoid taking vehicles into a site or keep to established tracks and park vehicles on hard standing.
- If possible, avoid areas that are likely to harbour invasive species when you visit the site.
- If possible, avoid work when propagules are most abundant.
- If possible, avoid spread by using stop-nets and other containment measures.

### Check

- Before going on site and before leaving a site, all clothing and equipment should be thoroughly inspected. Any visible debris (mud, plant or animal matter) should be removed and left at the water body where it was found, or disposed of safely.
- Be particularly vigilant with footwear tread and outer clothing. Ensure that vehicles are kept clean and that any accumulated mud is removed before leaving the site.

### Clean

- All clothing, equipment, PPE and vehicles or boats should be clean before leaving the site. Ideally these should be hosed down or pressure washed on site. At a minimum, all visible debris, plant fragments, seeds and mud should be removed or brushed off.
- Disinfectants such as Virkon S and FAM 30 have a limited effect on invasive species, and are not licensed for this use but they are useful in the control of micro-organisms and diseases. In situations where disinfection is appropriate, checking and cleaning before disinfection is still essential. Disinfectants will be less effective if equipment is still visibly dirty.

- Invasive species should be picked off or washed off with clean water. Recent studies have shown that cleaning equipment in hot water, particularly submersion for 15 minutes in 45°C water (or as hot as you can comfortably put your hand in) kills most high impact invasive non-native species. This should be used wherever possible.

**Dry**

- Thorough drying is an important method for disinfecting clothing and equipment. Equipment should be thoroughly dry for at least 48 hours (not including drying time) before it is used elsewhere, unless it has been cleaned in hot water.

## APPENDIX 5: TECHNICAL UPDATE – APRIL 2006

This appendix is a compilation of technical updates released after the manual was initially published to give extra clarification and guidance for recording features that are difficult to identify.

**IMPORTANT KEY NOTES FOR RECORDING RHS DATA.**

### Embankments

When you have an embankment along a river at a spot-check, record EM in your spot-check bank modifications. If the bank profile has also been resectioned, record RS too (EM/RS). In addition, record any other bank modifications present, such as reinforced (EM/RS/RI).

### Example

In this photograph, you can see that the left bank is embanked (look at the level of the car). This bank has also been resectioned. So you record both EM and RS in your spot-check bank modifications. (N.B. You would also record RI for bank modification in this example – EM/RS/RI.)


You will find that not all embankments have resectioned banks. Some will have natural-looking bank profiles and earth has been dumped on top of the bank to create an embankment. In these situations you do not record RS. You record EM for bank modification, along with any other modifications present at a spot-check (e.g. RI, PC, BM). If you are uncertain about recording bank and/or channel modifications at a given site, record NK and check with local experts, e.g. EA flood risk management teams, to find out if the river is modified.

**DO NOT INCLUDE SET-BACK EMBANKMENTS IN YOUR SPOT-CHECKS. YOU RECORD SET-BACK EMBANKMENTS IN THE SWEEP-UP BANK PROFILES SECTION OF THE SURVEY FORM.**

## Channel Vegetation

Many surveyors are having difficulty in understanding how to complete section G of the form – channel vegetation.

Please re-read this section in your manual.

We have provided an example of how to complete this section below.

If there is no channel vegetation, or less than 1% channel vegetation, at your spot-check, enter a tick in the 'None/Not visible' row. Please leave the rest of the column blank.

| G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect: use E ( ≥ 33% area), ✓(present) or NV (not visible) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | ✓ | | | | | | | | | | |
| Liverworts/mosses/lichens | | | | | | | | | | | |
| Emergent broad-leaved herbs | | | | | | | | | | | |
| Emergent reeds/sedges/rushes/grasses/horsetails | | | | | | | | | | | |
| Floating-leaved (rooted) | | | | | | | | | | | |
| Free-floating | | | | | | | | | | | |
| Amphibious | | | | | | | | | | | |
| Submerged broad-leaved | | | | | | | | | | | |
| Submerged linear-leaved | | | | | | | | | | | |
| Submerged fine-leaved | | | | | | | | | | | |
| Filamentous algae | | | | | | | | | | | |

If you cannot see the bed of the channel (for example, if the water is turbid or murky), enter 'NV' in the 'None/Not visible' row. Then you enter 'NV' against all of the submerged vegetation types in section G.

In this situation, if there are some emergent plants present, place a tick, or an 'E' if extensive, against those vegetation types.

| G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect: use E ( ≥ 33% area), ✓(present) or NV (not visible) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | NV | | | | | | | | | | |
| Liverworts/mosses/lichens | | | | | | | | | | | |
| Emergent broad-leaved herbs | ✓ | | | | | | | | | | |
| Emergent reeds/sedges/rushes/grasses/horsetails | | | | | | | | | | | |
| Floating-leaved (rooted) | E | | | | | | | | | | |
| Free-floating | | | | | | | | | | | |
| Amphibious | | | | | | | | | | | |
| Submerged broad-leaved | NV | | | | | | | | | | |
| Submerged linear-leaved | NV | | | | | | | | | | |
| Submerged fine-leaved | NV | | | | | | | | | | |
| Filamentous algae | | | | | | | | | | | |

If you cannot see the channel at all (for example, if it is in a culvert or due to dense vegetation or access), then you enter 'NV' in the 'None/Not visible' row and 'NV' for the whole column.

| G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect: use E ( ⩾ 33% area), ✓(present) or NV (not visible) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | NV | | | | | | | | | | |
| Liverworts/mosses/lichens | | | | | | | | | | | |
| Emergent broad-leaved herbs | | | | | | | | | | | |
| Emergent reeds/sedges/rushes/grasses/horsetails | | | | | | | | | | | |
| Floating-leaved (rooted) | | | | | | | | | | | |
| Free-floating | | | | | | | | | | | |
| Amphibious | | | | | | | | | | | |
| Submerged broad-leaved | | | | | | | | | | | |
| Submerged linear-leaved | | | | | | | | | | | |
| Submerged fine-leaved | | | | | | | | | | | |
| Filamentous algae | | | | | | | | | | | |

If you can see the channel and the bed and vegetation is present, then place a tick for present and 'E' for extensive for the vegetation types occurring. Leave the rest of the column in section G blank.

| G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect: use E ( ⩾ 33% area), ✓(present) or NV (not visible) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | | | | | | | | | | | |
| Liverworts/mosses/lichens | | | | | | | | | | | |
| Emergent broad-leaved herbs | | | | | | | | | | | |
| Emergent reeds/sedges/rushes/grasses/horsetails | ✓ | | | | | | | | | | |
| Floating-leaved (rooted) | | | | | | | | | | | |
| Free-floating | | | | | | | | | | | |
| Amphibious | ✓ | | | | | | | | | | |
| Submerged broad-leaved | | | | | | | | | | | |
| Submerged linear-leaved | E | | | | | | | | | | |
| Submerged fine-leaved | | | | | | | | | | | |
| Filamentous algae | | | | | | | | | | | |

Remember to complete column 11. This column is a summary of the vegetation types present over 500m. So you record those vegetation types that you have seen at your spot-checks that cover more than 1% of the 500m. In addition, you record any vegetation types that have not been seen in your spot-checks, but have occurred between spot-checks, and cover more than 1% of the 500m.

Your completed section G may look something like this:

| **G CHANNEL VEGETATION TYPES** (to be assessed over a 10m wide transect: use E ( ⩾ 33% area), ✓(present) or NV (not visible) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None (✓) or Not Visible (NV) | ✓ | ✓ | NV | | | | | ✓ | | | |
| Liverworts/mosses/lichens | | | | ✓ | | | | | | | |
| Emergent broad-leaved herbs | | | | | | | | | | | |
| Emergent reeds/sedges/rushes/grasses/horsetails | | | ✓ | | ✓ | ✓ | E | | ✓ | ✓ | ✓ |
| Floating-leaved (rooted) | | | | | | | | | | | |
| Free-floating | | | | | | | | | | | ✓ |
| Amphibious | | | | | | ✓ | | | | | |
| Submerged broad-leaved | | | NV | | | | | | | | |
| Submerged linear-leaved | | | NV | | | | | | | | ✓ |
| Submerged fine-leaved | | | NV | | | | | | | | |
| Filamentous algae | | | | | | | | | | | |

In this example, we recorded liverworts/mosses/lichens as present in spot- check 4, but we did not tick them as present in column 11. This is because whilst they are present at >1% at the spot-check, overall they cover less than 1% of the 500m. The same is true for amphibious vegetation.

We recorded emergent reeds/sedges/rushes/grasses/horsetails in column 11 because they are present at more than 1% of the 500m reach.

We have recorded free-floating in column 11 even though it was not seen at any of the spot-checks. The free-floating vegetation was seen between spot- checks and it covers more than 1% of the 500m reach. The same is true for submerged linear-leaved.

# APPENDIX 6: TECHNICAL UPDATE – AUGUST 2009

This appendix is a compilation of technical updates released after the manual was initially published to give extra clarification and guidance for recording features that are difficult to identify.

## IMPORTANT KEY NOTES FOR RECORDING RHS DATA

### Bank and Channel Resectioning

Correct identification of resectioned banks and channel is important in allowing us to accurately judge how natural or how modified a reach is. However, resectioning is difficult to establish in many cases, so this technical update offers further guidance on when surveyors should record resectioning, and what clues to look for.

### Indicators

The RHS manual gives six indicators of resectioning, but does not make explicit which are describing **bank** resectioning and which are describing **channel** resectioning.

Although bank and channel resectioning often occur in tandem, each should be considered separately using the available evidence.

### Bank Resectioning

- Uniform angled bank profile – this is the key indicator for bank resectioning

The following indicators give clues as to whether bank resectioning is likely, but their presence or absence does not necessarily mean that banks are modified:

- No trees/uniform aged trees/young saplings along banktop
- High value/intensive land-use
- Channel resectioning (bank resectioning will usually be carried out in tandem with channel resectioning)

### Old Bank Resectioning

Some reaches have had their banks resectioned a long time ago but are now beginning to naturalise and display a heterogeneous (diverse) bank profile. Where this is the case, and uniform banks no longer remain, do not record RS in bank modifications. If you suspect the banks have been resectioned in the past, or have local knowledge and know that they have, note your observations in the comments box but record NO for bank modifications – we only want RS to be recorded based on the evidence available in the field. Record NK for bank modifications if you feel there is conflicting evidence and you are unsure of what to record – but note that recording NK should be a last resort, as it means that your survey will be left with incomplete information. Take photographs of the banks in all cases to illustrate any observations.

Each spot-check should be considered independently on its own merits, so a naturalising reach may have a mixture of RS and NO for its spot-checks.

### Channel Resectioning

There are a number of ways in which channels (i.e. the bed of the river) may beresectioned (see photographs below):

1. Over-deepened channel (width:height ratio <4:1)
2. Straightened planform
3. Over-widened channel

The presence of one (or more) of these three indicators provides direct evidence for channel resectioning. However, note that some reaches may be naturally straight or wider and deeper than the norm (for example, reaches are likely to widen naturally ifbankside trees are removed) – so you will also need to use your judgement as to whether your reach has been artificially resectioned or has a natural profile.

The following give additional clues as to whether channel resectioning may haveoccurred:

- Uniform/low energy flow
- No trees/uniform aged trees/young saplings along banktop
- High value/intensive land-use
- Bank resectioning

In addition, in some cases there may be spoil on the banktops where material from the channel has been dumped.

### How to record Channel Resectioning

If you have identified channel resectioning along your reach, you will need to recordRS in all of the affected spot-checks. **In addition**, you need to identify the type of channel resectioning as follows:

- Over-deepened – tick box in section D
- Realigned (refers to straightened planform) – tick box in section D
- Over-widened – currently nowhere to formally record on the form, so make a note in the comments box in section P.

Note that channels may have been over-deepened, over-widened and realigned, so it is possible that you will need to note all three. For more details, see the examplesbelow.

### Old Channel Resectioning

Where river processes have re-instated more natural channel dimensions (or in the case of realigned reaches, meanders), do not record RS for channel modifications or realignment/over-deepening in section D. If you suspect or know about past channelresectioning, make a note of your observations in the comments box (section P) but do not record resectioning (only record resectioning which is obvious at the time of the survey).

If you feel that you are unable to assess whether the channel has been resectioned,then record NK for channel modification in the spotchecks – but again, only use thisas a last resort.

Some examples of the different types of channel resectioning are given below, with guidance on how to record each type. For these examples, we are assuming that thephotograph is representative of the whole reach.

## Resectioned channel – Over-deepened, with resectioned banks


Example:

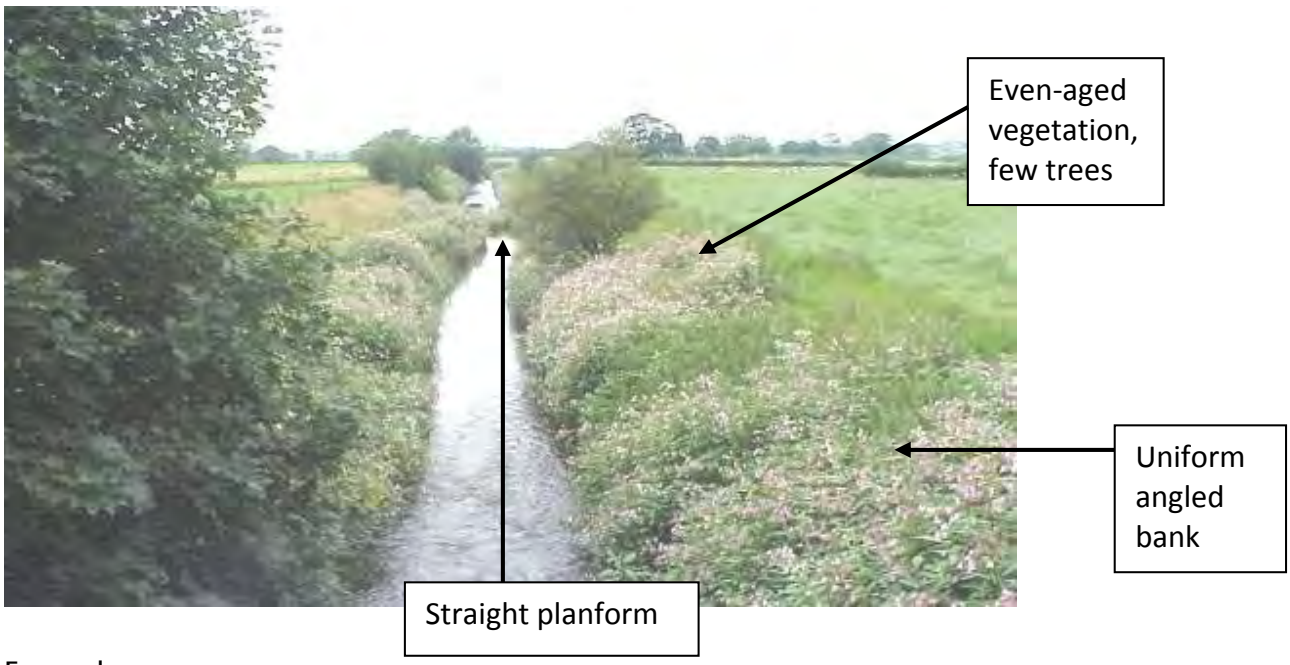
As the channel is obviously over-deepened, tick the relevant box in section D.

| | | | |
|---|---|---|---|
| Is channel obviously realigned? | No ☐ | Yes, <33% of site ☐ | ≥33% of site ☐ |
| Is channel obviously over-deepened? | No ☐ | Yes, <33% of site ☐ | ≥33% of site ☑ |
| Is water impounded by weir/dam? | No ☐ | Yes, <33% of site ☐ | ≥33% of site ☐ |

You have recorded channel resectioning (in the form of over-deepening) so record RS in the spotchecks for channel modification. You also have resectioned banks, so record these in bank modification spotchecks:

| LEFT BANK | Ring FC or SC if composed of sandy substrate | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | |
| Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | |
| **CHANNEL** | GP- ring either G or P if predominant | | | | | | | | | |
| Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR | | | | | | | | | | |
| Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR | | | | | | | | | | |
| Channel modification(s) NK, NO, CV, RS, RI, DA, FO | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR | | | | | | | | | | |
| For braided rivers only: number of sub-channels | | | | | | | | | | |
| **RIGHT BANK** | Ring EC or SC if composed of sandy substrate | | | | | | | | | |
| Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | |
| Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | |

## Resectioned channel – Realigned and over-deepened (also resectioned banks)




Example:

As the channel is obviously realigned and over-deepened, tick the relevant boxes in section D.

| | | | |
|---|---|---|---|
| Is channel obviously realigned? | No ❑ | Yes, <33% of site ❑ | ≥33% of site ☒ |
| Is channel obviously over-deepened? | No ❑ | Yes, <33% of site ❑ | ≥33% of site ☒ |
| Is water impounded by weir/dam? | No ❑ | Yes, <33% of site ❑ | ≥33% of site ❑ |

We have recorded channel resectioning along the whole reach (in the form of over-deepening) so we also need to record RS in the spotchecks for channel modification. We also have resectioned banks, so record these in bank modification spotchecks:

| LEFT BANK | Ring FC or SC if composed of sandy substrate | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | |
| Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | |
| CHANNEL | GP- ring either G or P if predominant | | | | | | | | | |
| Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR | | | | | | | | | | |
| Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR | | | | | | | | | | |
| Channel modification(s) NK, NO, CV, RS, RI, DA, FO | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR | | | | | | | | | | |
| For braided rivers only: number of sub-channels | | | | | | | | | | |
| RIGHT BANK | Ring EC or SC if composed of sandy substrate | | | | | | | | | |
| Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | |
| Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | |

## Resectioned channel – over-widened


There is nowhere in section D to record over-widening , instead, make a note in section P:

| P OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary) |
|---|
| **Major impacts:** landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing mining - quarrying - overdeepening - afforestation - fisheries management - silting - waterlogging - hydroelectric power |
| **Evidence of recent management:** dredging - bank mowing - weed cutting - enhancement - river rehabilitation - gravel extraction - other (please specify) |
| **Animals:** otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies |
| **Other significant observations:** if necessary use separate sheet to describe overall characteristics and relevant observations |
| **Channel over-widened for >33% of reach** |

We have noted channel resectioning along the whole reach (in the form of over-widening), so now record RS under channel modifications in the spotchecks:

| CHANNEL | GP- ring either G or P if predominant | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR | | | | | | | | | | | |
| Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR | | | | | | | | | | | |
| Channel modification(s) NK, NO, CV, RS, RI, DA, FO | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS | Enter chan spot-chec |
| Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR | | | | | | | | | | | |
| For braided rivers only: number of sub-channels | | | | | | | | | | | |

Note that bank modifications would be recorded as RI for whole bank modification (**not** RS/RI which should only be used for part-bank reinforcement with resectioning).

## Naturalising banks with over-deepened channel

In this example, the river has had both banks and channel resectioned in the past. The channel is still clearly over-deepened and realigned, but the banks are beginning to naturalise in places (note lots of erosion, slumping and diversity in the bank profile on the left).

In this example, realignment and over-deepening are still apparent so should be recorded in section D:

| | | | |
|---|---|---|---|
| Is channel obviously realigned? | No ☐ | Yes, <33% of site ☐ | ≥33% of site ☐ |
| Is channel obviously over-deepened? | No ☐ | Yes, <33% of site ☐ | ≥33% of site ☐ |
| Is water impounded by weir/dam? | No ☐ | Yes, <33% of site ☐ | ≥33% of site ☐ |

We have identified the types of channel resectioning (both over-deepening and realignment in this case) in section D, and also need to record resectioning in the channel modification spotchecks (along the entire reach in this case, so all 10 spotchecks). The banks have a mixture of places where the profile is very uniform and clearly resectioned, and other places where a more natural profile has been restored by river processes. This can represented by recording a mixture of RS and NO in the bank modification spotchecks as appropriate:

| LEFT BANK | Ring FC or SC if composed of sandy substrate | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | |
| Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM | RS | NO | RS | RS | NO | NO | RS | RS | RS | NO |
| Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | |
| CHANNEL | GP- ring either G or P if predominant | | | | | | | | | |
| Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR | | | | | | | | | | |
| Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR | | | | | | | | | | |
| Channel modification(s) NK, NO, CV, RS, RI, DA, FO | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR | | | | | | | | | | |
| For braided rivers only: number of sub-channels | | | | | | | | | | |
| RIGHT BANK | Ring EC or SC if composed of sandy substrate | | | | | | | | | |
| Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI | | | | | | | | | | |
| Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM | RS | RS | NO | RS | NO | NO | RS | RS | NO | RS |
| Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB | | | | | | | | | | |

## Silt deposits

### *Problems with current recording*

Currently the manual states:

"Point or side bars composed of silt are extremely unlikely to occur in UK rivers. '***Silt is not considered to be a substrate of distinct 'bars'; if silt is the predominant substrate in spot-checks, record SI; if discrete silt deposits are present record these as 'present' in Section K, and if large expanses of silt occur record as 'extensive' in Section K***'. If the silt forms distinct deposits resembling bars, note this in Section P, as these deposits are often signs of channels recovering from over-widening as a result of engineering works"

So unless it is the predominant substrate, silt can only be recorded if it fits the description of a 'unvegetated silt deposit' (Section K) or in Section P.

- This has led to inconsistency in data capture. Some surveyors record silt deposits resembling bars as PB/SB/MB etc. others do not.
- Vegetated deposits of silt are not recorded anywhere other than section P. Section P is in a free-text format and would not allow easy querying to identify where silt bars/deposits are occurring
- The use of the 'silting' option in Section P Major Impacts is not consistent – it is hard to identify RHS surveys where silting is a problem. The input of fine sediments from poaching and agricultural run-off is a very significant impact on river habitats with the clogging of gravels and smothering of vegetation. It would be highly beneficial to be able to use the RHS data to identify where siltation is occurring.

### *How silt should be recorded*

- Silt should not be treated in any different way to SA/GP/CO/BO. Silt bars should be allowed if they fit the description of a depositional bar.
- Silt deposits are to be recorded in section K if they fit the description – (contrasting with predominant bed substrate(s), >5m²). Unlike sand and gravel, silt deposits can be recorded as extensive in section K to pick up on channels recovering from over-widening as a result of engineering works.
- Silting should be recorded as a 'major impact' where appropriate.
- Unvegetated silt deposits to become 'discrete unvegetated silt deposits'
- 'Unvegetated' will be removed from all discrete deposits definitions from Section K in future versions of the RHS form to allow a place to record vegetated silt/sand/gravel deposits that are atypical within a reach. Meanwhile, record vegetated deposits in these boxes and make a note in section P that they were vegetated rather than unvegetated.

# APPENDIX 7: MAIN DIFFERENCES BETWEEN THE 1997 AND 2003 RHS SURVEY FORMS

| 2003 Form | 1997 Form | NOTES |
|---|---|---|
| - | Section A | Background map-based information – no longer part of field-survey, so not on 2003 form. |
| A | A | Field survey details – minor changes of detail only. It is now important to record grid-references at spot-checks 1, 6 and the end of site for map-based data gathering and GIS applications. |
| B | B | Predominant valley form – minor changes: e.g. addition of U-shape valley; presence/absence of floodplain recorded. |
| C | C | Number of riffles, pools and point bars – no change. |
| D | D | Artificial features – moved to front page from back, and types refined. |
| E | E | Physical attributes – 3 additional bank materials: tipped debris (TD) [includes old category of 'builders waste, as well as other discarded materials], fabric (FA), bio-engineering (BI); one additional marginal and bank feature: natural berm (NB); Flow-type: No water abbreviation changed from NO to DR to give unique 2-letter abbreviation; Earth (EA) added as bed material for seasonally dry channels; two additional channel features: Exposed bedrock (EB) and Vegetated rock (VR); capability to record numbers of channels at braided sites. |
| F | F | Banktop land-use and vegetation structure – Same method of recording, but seven new categories of land-use to enable, for example, separation of 'natural' woodlands from plantations, and 'natural' open water from artificial open water. |
| G | G | Channel vegetation types – no change, but clearer guidance on data entry in column 11. |
| H | H | Land-use within 50m of banktop – same additions of categories as F. |
| I | I | Bank profiles – natural berm added. |
| J | J | Extent of trees and associated features – no change except clearer guidance, by way of *asterisks, for recording discrete features that may not extend along 1% of the site, but require recording if present. |
| K | K | Extent of channel and bank features – significant changes. All descriptive flow types (e.g. rapids, runs) replaced by flow types (e.g. broken standing waves, rippled); eroding/stable cliffs, vegetated bedrock/boulders, unvegetated/vegetated point bars and discrete gravel deposits additions to 2003 form. Use of *asterisks for some features, as in J. |
| L | L | Channel dimensions – no significant change, but now requires flow-type to be noted if measurements not taken at a riffle. |
| M | O | Features of special interest – more categories. Includes: splitting of braided and side channels; slight changes in terminology (e.g. wet woodland(s) for carr); new categories <5m high waterfalls, natural cascades, very large boulders, floodplain boulder deposits, backwaters. |
| P | N | Choked channel – no change in recording. |
| O | Q | Notable nuisance plant species – ability to record on the bankface and in the 50m corridor separately. Use of *asterisks to remind surveyors that just a single occurrence of an alien species should be recorded. |
| P | R | Overall characteristics – only minor additions in guidance notes. |
| Q | S | Alders – no change, but use of *asterisks to remind surveyors that just a single alder, or a single diseased one, should be recorded. |
| R | - | Field survey quality control – new guidance for checking entries are completed before leaving the site. |