

Addendum to the Specification for watercourse and flood plain surveys

The information in this addendum is extracted from Environment Agency National Standard Contract and Specification for Surveying Services. This is to ensure the survey data is more suited for the assessment of flood risk and can be readily input into flood risk assessment software packages.

Presentation and Format of Data

For watercourse and flood plain surveys, the data is to be delivered in EACSD format (<http://www.eacsd.co.uk/documentation>). The EACSD format is an ASCII format that is open and independent of survey and modelling software. The Surveyor is to also to verify the survey data as compatible with HEC-RAS and Flood modeller geometry files.

In addition, surveyor shall provide a comma-delimited text file of point number, Easting, Northing, Height for all as-surveyed points before any adjustments are made to, for example, snap on to cross-section lines.

Data is to be presented graphically on key plan / section location maps, cross-sections, structure sections and long sections all presented in Autocad .dwg format all in accordance with Section I. Example drawings are included in NatSpecTemplatesV3.1.zip and prefixed Section IV.

Left Bank and Right Bank are defined as viewed downstream.

When congested data would cause over-writing of the coordinates under plotted sections, the descenders should be cranked to allow the values to be plotted without over printing.

All cross-sections, whether open channel or structure, shall be viewed looking downstream. A note: "All cross-sections are viewed looking downstream" is to be included on each sheet of cross-sections.

Culvert Surveys

Features to be surveyed

1. Culvert Entrance and Exit

- Cross sections of both the entrance and exit elevation, to include soffit and invert levels, shall be surveyed.
- Topographic plans of the entrance and exit, to include the wingwalls, shall be surveyed. Any services visible in or near the entrance/exit shall be shown on the plan.
- Photographs of the entrance and exit shall be taken from close up and further back (15 metres).

2. Inspection Covers/Chambers

The following inspection cover and chamber details shall be surveyed

- Culvert reference
- Manhole reference
- Location and access details
- National Grid Reference

- Cover details: Type (e.g. Heavy Iron), Lid Size, Frame Size
Shaft details: Construction (e.g. concrete), Shaft depth, Size of opening, Culvert Invert, Access details (e.g. 3 step irons)
- An OS large scale plan showing the approximate location of Inspection/Manhole covers
- A photograph of the cover to aid identification

3. Longitudinal Section

A longitudinal section shall be produced to include the following:

- Soffit, invert and ground levels at the culvert entrances and exits
- Cover, soffit and invert levels at all manhole/inspection cover locations
- Location of changes in direction and gradient

4. Other Features to be noted

- Details of any siltation or other blockage (e.g. tree roots, rubble) shall be included in the Survey.
- Details of any leakage in to the culvert shall be noted in the Report of Survey.
- Cross sections shall be surveyed at locations where the profile of the culvert changes.
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The above data is in addition to the provided culvert data collection Proforma requirements.

Open Channel Cross-section

Cross-sections are to be surveyed normal to the centre line of the channel at the interval specified. On tightly meandering channels, cross-sections shall be located where the channel is running parallel with the valley. This removes the need for “dog-leg” cross sections across a flood plain.

Structures not falling at the specified interval are to be surveyed. Cross-sections will be surveyed where the channel significantly changes width. Where it is not practical to survey a section at the prescribed position or interval the position of the section may be moved. However, the interval between two adjacent sections shall not exceed the prescribed interval.

Cross-sections are to be surveyed viewed downstream and the origin or zero Chainage of the cross-section must be established on the left bank (LB) of the channel viewed downstream. However, where a section is only required through the Right Bank, the origin or zero Chainage shall be located on the waterside of the bank, i.e. in the channel.

Each individual structure cross-section will be given a relevant title included in the section header. Open Channel Sections should not normally have a title. In addition to cross-sections through the channel, cross-sections will extend from the channel to the true land level on each side and at least 5m beyond the bank top unless mentioned otherwise in the Survey Brief. Where there is a defence, trees or bushes/shrubs line the channel the section shall extend to 5m beyond the vegetation, but no more than 50m from the channel. Beyond the extent of the cross-section, a general indication of the ground form will be given as a label e.g. “flat”, “rises steeply”. The point used for the longitudinal section bank top shall be indicated on the plotted cross-section.

Where a bank top is raised above the surrounding ground (flood plain), the crest is defined as the line along the bank top over which water will spill from the river onto the surrounding ground. Where there is no raised bank, the crest is the point marking the change of gradient from surrounding ground to eroded channel.

Note: Where a flood defence is present on the cross-section, this should be surveyed as a separate string. A flood defence is defined as an object (generally an embankment or wall) which provides a flood protection benefit.

Buildings are to have their floors or damp-proof course level indicated. Where they cannot be determined the threshold level shall be recorded. Buildings will be labelled with name and/or number, type and whether damp-proof course exists.

Fences will be labelled with their type and height.

Bed Levels

Bed levels will be measured directly whenever and wherever possible. Where direct measurement is impossible, where, for instance, the water depth is too great or other causes make it impractical, then it will be sufficient to read the depth of water against a staff or to use echo sounding and to relate these readings to a measured water level.

Modellers are generally required to base their models on the current state of the river bed. Therefore, by default, the bed level shall be taken on top of silt (soft bed), and a note added to the drawing to indicate that only soft bed has been shown. Hard bed levels, at base of silt, shall be surveyed if specified in the survey brief.

The nature of the bed material will be recorded and plotted on the section in simplified form, e.g. 'Gravel' based on the material and vegetation types detailed in EACSD_v3.2.doc. Surfaces outside the water area will also be labelled.

National Grid Reference and cross-section Orientation

Channel Surveys may be merged with photogrammetric or LiDAR surveys of the flood plains and therefore positional accuracy must be of the same order. Each Section Zero Point shall be monumented with a wooden peg and surveyed to E4 standard. Section orientation shall be determined by observations to another E4 station – not using a compass.

Flood Plain Sections

A Flood Plain Section will be taken normal to the centre line of the valley and not necessarily at right angles to the centre line of the channel. Because of this, flood plain sections may appear 'dog-legged' on the key plan. These sections may be defined on the contract mapping.

Structures

A section shall be surveyed on the upstream side of each structure which significantly affects the river flow at bank-full flow condition. Structures include bridges and culverts, weirs, mills, pipe crossings and impounding structures of any kind. Natural features, which act as structures, such as

rock outcrops, shall also be included. Structures which are not to be surveyed shall be photographed. The photographs and NG coordinates of the position of the structure shall be included as an appendix to the survey report. If there is any doubt, the Surveyor should consult the Employer to confirm whether a section is required.

Bridges and Culverts

A bridge is defined as a permanent structure spanning the channel. Cross sections of temporary and ad hoc crossings are not required unless specified. However, such crossings shall be shown on the longitudinal section.

A complete elevation of the upstream side is to be taken with particular attention paid to the measurement of the bridge openings and flood arches. Surveyor shall survey the bed level where the structure enters the bed. Details of any bridge piers will also be shown. Soffit, invert and springing levels will be added as labels. The structure section shall include banks behind the structure.

The downstream elevation will be presented as viewed looking downstream and is required to be surveyed when specifically requested or where it is different from the upstream side. Even when a Downstream elevation is not required, the downstream soffit, top of parapet, invert, bed level and bank crests are to be measured and added

The length of the bridge tunnel is to be measured parallel to the watercourse and this, together with hard inverts on aprons and their extent, added as labels on the cross-section plot.

Where a bridge changes section within its length and that change is significant, then an additional section shall be surveyed at the change.

At bridges, the channel section surveyed will be assumed by the modellers to be representative of the reach. Where the bridge structure constricts river flow, the open channel section details should be observed where they are representative of the reach – not necessarily up against the structure.

Where a structure is not normal to the channel but is skewed, the skew span will be measured and presented on the drawings, together with the approximate angle of skew, this being the angle between the bridge face and a line normal to the channel. The length of the bridge tunnel will then be the channel length through the bridge parallel to the watercourse, not the distance at right angles to the roadway.

Where a structure extends 10m beyond the top of the bank, then the complete elevation will be surveyed with its cross-section. Where a bridge spans the flood plain, then all relevant flood arches (and other openings that could take flood water, such as pedestrian subways) must be included in the cross-section. If the cross-section is excessive then a plot of the immediate channel will be drawn to the specified scale. The complete cross-section will be plotted at a reduced scale and provided on a separate sheet, cross-referenced to the channel plot.

Weirs and Drop Structures

A weir is defined as a permanent or temporary structure that impounds a head of water at normal summer levels greater than the height defined in the Survey Brief.

A cross-section will be taken across the crest of the weir, viewed downstream with structure details incorporated as shown in the Survey Brief. Other weirs that do not cross the river in a straight line perpendicular to the river, the actual length of the weir shall be stated clearly on the cross-section drawing. Additional cross-sections will be taken immediately upstream and downstream of the weir crest, viewed downstream and normal to the centreline of the channel as shown in the Survey Brief.

In the case of moveable gates or boards, the gate sill will be considered as the crest of the weir. Levels are to be taken on the tops of all gates and moveable boards. Where gates are open, levels are to be taken on the bottom of the gate. Where possible the maximum opening height of the gate is to be measured and noted on the drawing.

Moveable control structures, such as weir gates, should be distinguished from fixed structures such as sills and weir crests, by marking them with a diagonal cross.

Longitudinal sections through weirs are to be numbered with the same section number as the downstream elevation, suffixed with an alpha character (e.g. N.NNNA).

The longitudinal section will show the following information:

1. Upstream water level
2. Upstream bed level
3. Weir crests, gates and any bridge structures
4. Upstream and downstream extent of any apron
5. Downstream water level
6. Downstream bed level, including maximum depth of scour hole where it is safe to obtain levels
7. Water and bed levels at the tail of any weir pool

An additional cross-section will be taken both upstream and downstream of the weir where the channel returns to its normal cross-section and is free from the influence of deposition and scour.

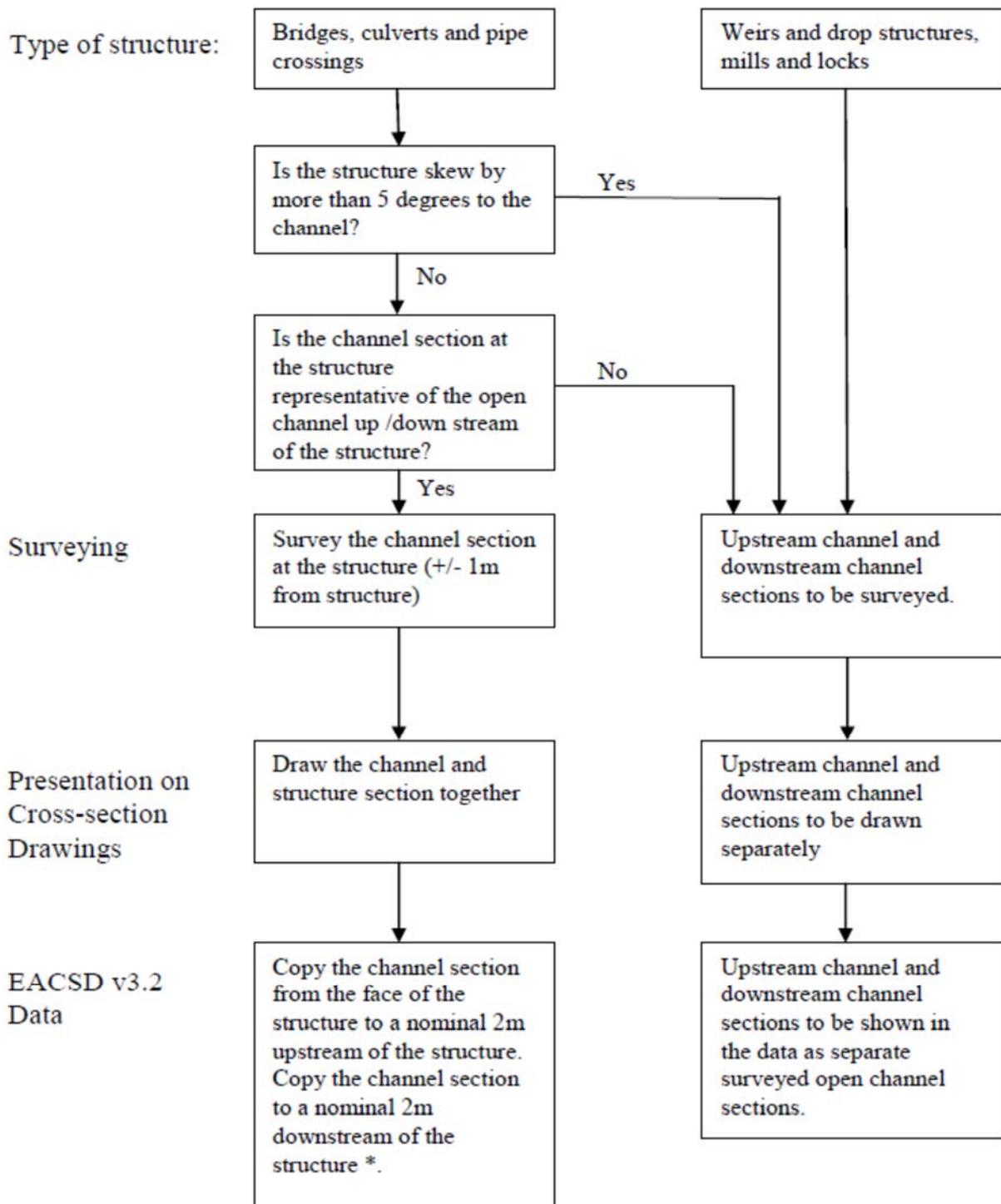
The downstream and upstream elevations are to be measured as for bridges with additional sections taken at significant changes in the section of the mill thorough.

Natural Constraining Features

Features such as rock formations, which cause gradient changes or affect water levels, are to be treated as weirs. Changes in water level gradient over shoals and aprons, and sudden changes in bed level are to be measured and added to the longitudinal section.

Surveying open channel sections up and downstream of structures

The following decision tree shall be used to decide what needs to be surveyed and how it is presented:



So if the structure length is 11m, the Chainage of the downstream channel section will be 12m (nominal) downstream of the structure section.

Chainage

Each cross-section shall be provided with a Chainage. This is the distance along the centre line of the channel from the downstream extent of the survey. Zero Chainage will be at the downstream extent of the watercourse.

Running chainages along the watercourse shall be noted on the levelling sheets, with the start point and direction of work clearly defined. Chainages shall be noted at boundaries, ditches, drainage pipes and other identifiable features, indicating on which bank these features appear. Cross-section chainages will also be noted and clearly referenced.

Flood bank levels

The crest level of these flood defences shall be surveyed at 25m intervals and at any low points. Surveyed points shall be accurate to within 1m in plan and 0.02m r.m.s.e in height above ODN. The crest level string data shall be supplied as separate comma separated ASCII data in the long section data points of the EACSD format. Raised river bank data shall be incorporated within the long section. The „crest“ is defined as the level at which water will flow over the defence to lower ground beyond. The crest level of wall defences shall be taken on the top of coping stones, the lower side of coping or at both locations, as specified in the survey brief.