Format for Channel Survey Data (EACSD format)
Version 3.2 - 7th May 2013

1 Introduction

The EACSD data format is intended to be a universal transfer format which stores all the information required to supply input data to the common flood modelling packages including ISIS, HECRAS and MIKE11. It supersedes the EEBY format.

It is also anticipated that data stored in the format can be used to read into programs that run CFD analysis.

This version of EACSD is to be used with V3.2 of the National Specifications, hence it has also been numbered V3.2. It should be read in conjunction with example data: EACSD_Example_V3_2.txt

Following comments from surveyors and modellers, this revised version incorporates changes to the way structures are defined and a number of incremental improvements to cross-section and long section data.

2 EACSD Format

File Header

Group=File_header
EACSD_V=3.2
Survey_Title=[alphanumeric]
Revision_Number=[integer]
Revision_Comment=[alphanumeric]
Date_of_File_Preparation=[ddmmmyyyy] (month as first three alpha char)
Time_of_File_Preparation=[hh:mm:ss] (hh as 24hr clock)
File_Produced_by=[alphanumeric]
Surveyor_Ref=[alphanumeric]
Client_Ref=[alphanumeric]
NFCDD_Watercourse_Ref= [VARCHAR2(4)]
NFCDD_Reach_Ref=[NUMBER(2)]
NFCDD_Sub-reach_Ref=[NUMBER(2)]
Watercourse_Name=[alphanumeric]
SoS_Reach_Reference=[aphanumeric][1]

Watercourse centre-line string co-ordinates (digitised from vector maps)

* (line space for clarity)
Group=Centre-line_String
Centre-line_Derivation=[options: 1:10000_map, 1:2500_map, 1:1250_map, Survey][2]
E, N, C[3]
E, N, C
E, N, C
…
E, N, C

Cross-section header

* (line space for clarity)
Group=Cross-section_Header
Section_Name=[alphanumeric max 12 char]
Section_Description=[text]
Section_Notes=[text][4]
Complex_Group=[option: Y, N][5]
Chainage=[numeric mask: #####.###][6]
Water_Level=[numeric]
Section_Type=[option: Open or Structure]
Survey_Date=[ddmmmyyyy]
Survey_Time=[hh:mm:ss] 24 hour clock GMT
Survey_Method=[option: GNSSRTK, Level+tape, Total_station, Echo_sounder]

Start/End points of cross-section and turning points along section line

* (line space for clarity)
Group=Cross-section_alignment
E, N[7]
E, N
…
E, N

Cross-section data points

* (line space for clarity)
Group=Cross-section_Data_Points
S, E, N, H, B, CES1, CES2, CES3, C[8]

Cross-section structure data (Bridge)

* (line space for clarity)
Group=Bridge-structure_Data_Points
Structure_Exception=[option: Y, N][15]
Structure_Skew_Angle=[numeric 2 digits between 0 and 90 degrees]
Structure_Length=[numeric]
Structure_Notes=[text]
S, E, N, H, CES2[9], C[10]

Cross-section structure data (Weir component)[11]

* (line space for clarity)
Group=Weir-structure_Data_Points
Structure_Type=[option: BROAD, SHARP, CRUMP, VNOTCH, LAB]
Structure_Exception=[option: Y, N][15]
Structure_Length=[numeric] [11]
Structure_Notes=[text]
S, E, N, H, CES2[9], C[11]

Cross-section structure data (Culvert)

* (line space for clarity)
Group=Culvert-structure_Data_Points
Structure_Exception=[option: Y, N][15]
Trash_Screen_Size=[Numeric]
Trash_Screen_Bar_Spacing=[numeric]
Trash_Screen_Bar_Diameter=[numeric]
Structure_Length=[numeric]
Structure_Notes=[text]
S, SH, E, N, H, X, IN, CES2[12] (circular)
S, SH, E, N, H, X, Y, IN, CES2 (ellipse)
S, SH, E, N, H, X, Y, IN, CES2 (box)

S, SH, E, N, H, X, Y, IN, CES2 (arch)
S, SH, E, N, H, X, Y1, Y2, IN, CES2 (sprung arch)
S, E, N, H, CES2[9], C[10] (use for high chords(s), as necessary)

Cross-section structure data (Other Structures)

* (line space for clarity)
Group=Other_Structure[17]
Structure_Exception=Y
Structure_Notes=[text]

Cross-section photos

* (line space for clarity)
Group=Cross-section_photos
E, N, B, F, D[13]

Long-section data points

* (line space for clarity)
Group=Long-section_Left-bank_Data_Points
L, E, N, H, A, BT, C[14]

* (line space for clarity)
Group=Long-section_Right-bank_Data_Points
L, E, N, H, A, BT, C[14]

* (line space for clarity)
Group=Long-section_Deepest-bed_Data_Points
L, E, N, H, A, C[14]

* (line space for clarity)
Group=Long-section_Defence-left_Data_Points
L, E, N, H, A, C[14]

* (line space for clarity)
Group=Long-section_Defence-right_Data_Points
L, E, N, H, A, C[14]

* (line space for clarity)
Group=Long-section_Other-feature_Data_Points
L, E, N, H, A, C[14]

General photographs

* (line space for clarity)
Group=General_Photographs
E, N, B, F, D[15]

3 User notes

General Notes

A **Except for weir structures**, all points must be moved in plan from observed position to point on cross-section line.
B CES = Conveyance Estimation System: option for computing channel and floodplain hydraulic roughness
C All sections to be 'viewed' as if looking downstream
D All units are in metres
E Where a field is not used, two commas must be used next to each other i.e. ,, to show that the field is blank
F Unfilled fields are to be left blank – Do not use 'Null'

Specific Notes

1 One EACSD file shall be produced for each link of a river network between junctions. The numbering system shall be based on NFCDD. Where NFCDD is not being used to reference the survey NFCDD codes shall be left blank and the extent of each reach of watercourse agreed with the EA project manager.

2 The largest scale of mapping available shall be used for digitising centre-lines. Centre-line is defined as the mid-point of the river between water lines. Points shall be determined at cross-section / structure locations and at a maximum interval of 50m. The digitised river centre-line shall not deviate by more than 2m or $1/10^{th}$ of the width of the river from the location interpolated from the centre-line points. This guide is intended to ensure that surveyors digitise sufficient points around curves in the river. The digitised river centre-line will be the definitive centre-line of the river and will supersede previous roughly digitised centre-lines.

3 Comma-delimited, Easting, Northing, Code. Chainage runs up river from downstream end of survey. Code is 'Zero_Chainage' to indicate zero chainage zero point. The code field is blank for all other points. The sequence of points listed runs with the direction of flow so 'zero chainage' will be the last point in the list unless the centre-line is extended back to include negative chainages as may be necessary.

4 Available for revision comments or notes.

5 In some situations, the EACSD data format will not be able to fully represent the detail of the structure(s) being surveyed. The section group flag can be used when this situation is true. When the modeller, sees this flag in the EACSD data, they will know that a more in-depth review of the data is required, in order to represent the structure appropriately in the model.

6 Chainage to be reset to zero for each EACSD file. Negative chainages are permitted where sections are observed before the start of the survey.

7 Comma-delimited data from left bank to right bank. Most sections will only have start and end points which will be duplicates of the first and last points in the cross-

section detail group. Where more than two points are shown, the section is a dogleg section normally of the flood plain as well as channel.

8 Comma-delimited data:

- S = String attribute, options:
  - SB = soft bed (top of silt)
  - HB = hard bed (bottom of silt)
  - HC = high cord
  - DL = Left Bank defence string
  - DR = Right Bank defence string
- E = Easting of point
- N = Northing of point
- H = Altitude of point
- B = Bank top (optional), options:
  - LB = left bank top
  - RB = right bank top
- Channel roughness, based on simplified Conveyance Estimation System data (optional) (see section 5 for codes to use):
  - CES1 = Vegetation at survey point
  - CES2 = Ground/bed type at survey point
  - CES3 = Irregularity (only required for floodplain survey)
- C = Point comment field (optional)

There may be more than one string SB, HB and D which may be followed by a digit eg HB1, HB2, D1, D2, D3 to indicate string number.

Channel roughness classification is not required for the last point in each string, as the previous point contains the classification for that segment.

Modelling is by default run on the state of the river bed at the time of survey (ie the soft bed cross-section). In order to have the default cross-section data with the same code for the whole cross-section, SB is also used for ground points on the cross-section line. See Open Cross-Section Coding diagram below. All strings to be observed left to right. HB levels do not have to be observed at the same point as SB profile points and can be placed in sequence following SB data. It is intended that software developers will translate EACSD to produce soft bed or hard bed cross-section data as modelling input data. CAD software can be used to interpolate HB levels at SB section points for profile drawing.

9 Structure roughness based on simplified Conveyance Estimation System CES channel roughness for consistency with channel roughness. See section 5 for codes to use in the EACSD specification.

10 Comma-delimited data for bridge structures:

- S = String attribute, options:
  - SL = Spring point left (bridges)
  - SR = Spring point right (bridges)
  - SO = Soffit (bridges)

    - LC = Low chord (xyz point) – used for defining irregular structure shapes
    - HC = High chord (xyz point) – used for defining the shape of the top of the structure
- E = Easting of point
- N = Northing of point
- H = Altitude of point
- CES2 = Structure materials (see note 9)
- C = Comment field for point

There may be more than one string SL, SR etc. which may be followed by a digit eg SL1, SO1, SR1 and SL2, SO2, SL2 to indicate string number.

Cross-section points at bridge and culvert structures shall be observed along the face of the structure. This is to avoid the misalignment that results when offset open section points are snapped onto the line of a skewed section. Open channel sections are required up and downstream bridge structures where they are representative of the reach. There will be occasions (eg track bridges or elevated footbridges) where it is acceptable to reuse the cross-section data points used with the bridge structure section as open channel sections by copying them a few metres up and downstream of the structure.

Note that the points where the bridge verticals intersect the ground/bed profile should be included as SB-coded points in the cross-section data points section.

High chords should be recorded as components (see fig 1) so as to (for example) separate a high chord that represents the top of a solid parapet from a high chord that represents a road surface. The modeller will decide how to model railings based upon the section photographs.

In some cases (eg viaducts) it is not necessary to observe high chords strings because they are high above the worst flood water level. Conversely, there may be other instances (particularly for culverts) when there is more than one high chord feature – for example a wall crossing the flood plain.

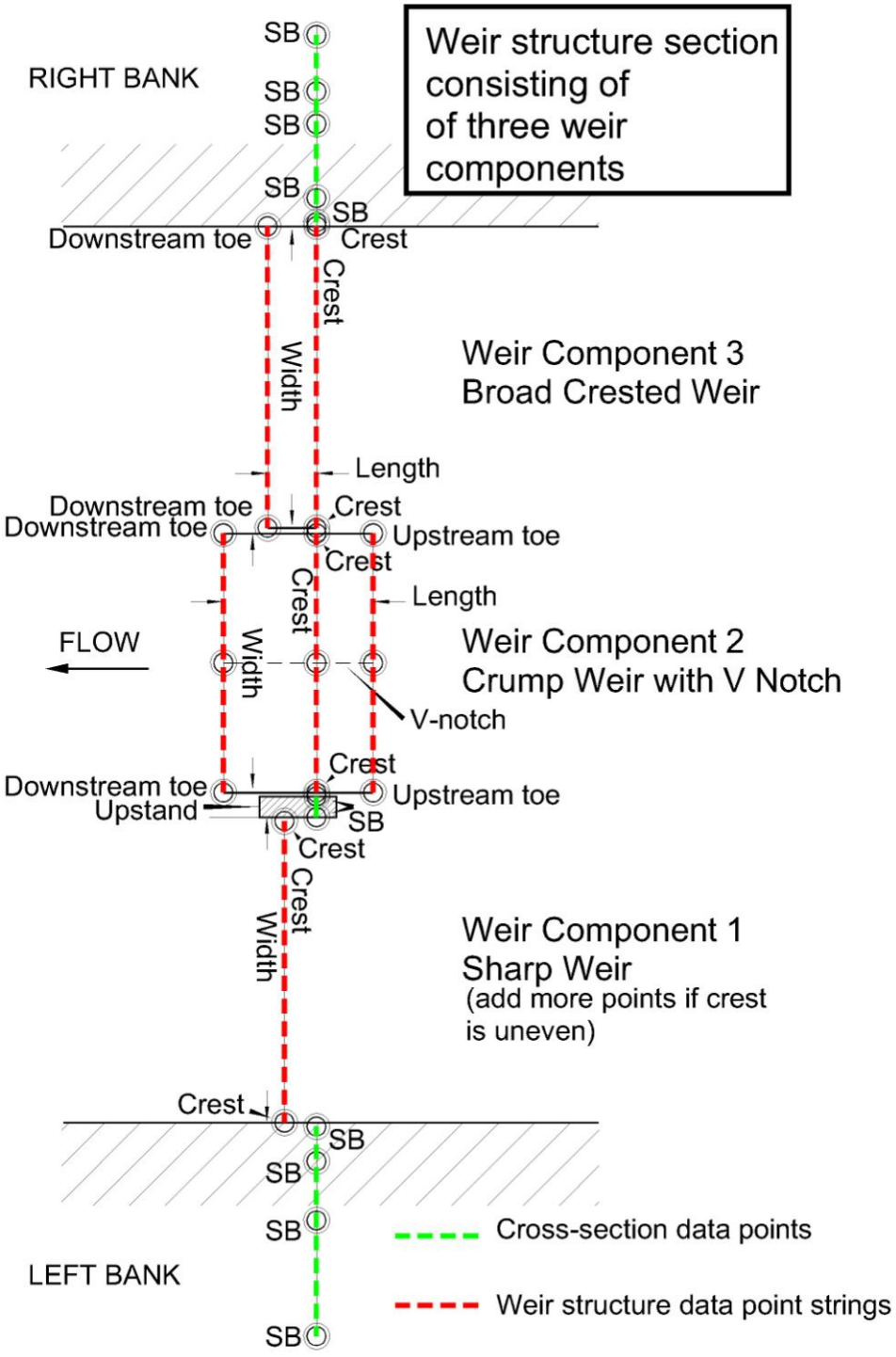
11 Comma-delimited data for weirs:

- E = Easting of point
- N = Northing of point
- H = Altitude of point
- CES2 = Structure materials (see note 9)
- S = “UT”, (upstream toe), “Crest” or “DT”, (downstream toe)
- C = Comment field for point

E, N coordinates presented in the weir structure data must not be snapped onto the overall section line.

This section covers cross-section data at weir structures. Open channel sections will generally also be required up and downstream of each weir where they should be representative of the channel cross-section.

The weir structure section will run along the crest of the weir, extending into the floodplain on the left and right banks. Ground points on the left and right banks are to be entered as "Cross-section data points" and observed from left to right as normal. Weir crest points should not be included as cross-section data points, however, if there are upstands between weir components, the upstand components may be included as cross-section data points for the tops of the upstands.



Each weir component shall be entered using the Weir Structure Data Points template:

Group=Weir-structure_Data_Points
Structure_Type=[option: BROAD, SHARP, CRUMP, VNOTCH, LAB]
Structure_Exception=[option: Y, N][15]
Structure_Length=[numeric] [11]
Structure_Notes=[text]
S, E, N, H, CES2[9], C[11]

For a compound weir, the "Weir structure data points" group shall be used to describe each component of the weir in order from left to right bank. The data file will therefore have a "Cross-section data Points" group followed by one "Weir structure data points" group for each component of the compound weir.

If the overall cross-section includes an "Other Structure" (see note 17), this shall be included as a component of the weir.

The Weir structure data points group(s) shall be surveyed as strings running from left to right across the weir component.

The structure exception label should be used to indicate when a weir is too complicated to interpret using this data structure.

Structure length is the longitudinal length of the weir structure in metres.

Structure width is the channel width at the top of weir crest. For a standard perpendicular flat weir, the structure width will be the difference between the left and right most, easting and northing points. For irregular shaped weirs these data will not be the same and will be used by modellers in different ways.

For labyrinth weirs, surveyor will enter all the turning points on the weir crest. The weir width will be the distance along the crest, not the distance along the overall cross-section line. The same rule can be applied to horseshoe weirs, or Sharp weirs with other shapes.

12 Comma-delimited data for culverts:

- S = Inlet / Outlet, options:
  - Inlet
  - Outlet
  - HC = High chord (xyz point) – used for defining the shape of the top of the structure
- SH = Shape, options:
  - Circular
  - Ellipse
  - Box
  - Arch
  - Sprung Arch
- E = Easting of point (soffit)
- N = Northing of point (soffit)

- H = Altitude of point (soffit)
- X = Width (culverts)
- Y = Height (culverts)
- Y1 = Height to springing (sprung arch culverts)
- Y2 = Height to crown (sprung arch culverts)
- IN = Culvert inlet type (section 6 / figure 5) (used only for S = inlet)
- CES2 = Structure materials (see note 9)

For any culvert longer than a road crossing (over about 15m), structure sections will be required at the inlet and the outlet structures.
There may be more than one string HC, which may be followed by a digit eg HC1, HC2 to indicate string number.

13 Comma-delimited data for section photos:

- B = Bearing of photo (for standard photos)
- F = Filename of photo, 360 degree photo or video (local path)
- D = Photo Description

More than one photo may appear but note that some modelling packages accept only one photo, so the main photo should appear first in the data.

The photo file resolution should be limited 1600x1200 to reduce file sizes. 360 degree photos or video files can also be referenced in this section, if specified.

14 Comma-delimited data for long sections:

- L = Location attribute, options:
  - LB = Left Bank crest string
  - RB = Right Bank crest string
  - DB = Deepest Bed string
  - DL = Left Bank defence string
  - DR = Right Bank defence string
  - OF = Other notable features string
- E = Easting,
- N= Northing,
- H= Altitude of point
- A= Surface attribute, options:
  - GD=ground
  - SB=soft bed
  - HB=hard bed
  - PI=pipe invert and is followed by pipe diameter in mm (4 digits)
  - ST= structure point (eg side weir), In-flowing water courses will be represented by points in the LB or RB strings
- BT = Bank top, reference to Section_Name
- C = Comment field

Long section strings are used to define the boundary between in-bank and out-of-bank models to identify where water will spill out of the channel. They are also used to

modify interpolated sections which modellers insert between surveyed sections. Long section strings should include the points attributed as crest points in the cross-section data.

15 General photos – use the same format as for section photos.

16 Structure exception is where the structure cannot be fully represented by the data format as it is a complicated shape.

17 Other structure is a means of recording the presence of structures not covered elsewhere in this format. “Other Structures” will include fish pass orifices, sluices, and locks. The nature of the structure is to be recorded in the “Structure Notes” field, dimensional details are to be shown on the drawings and section photographs used to assist the description.

Figure 1 – Definition of structure openings and high chord for an arch bridge

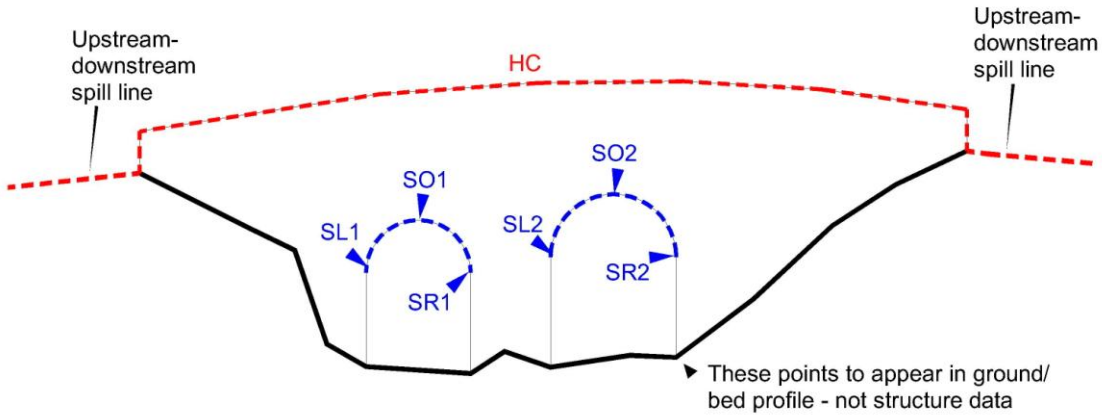


Figure 2 – Definition of structure openings and high chord for an flat-deck bridge

Note that SL1 and SR1 to be observed above or intersecting with the ground profile.

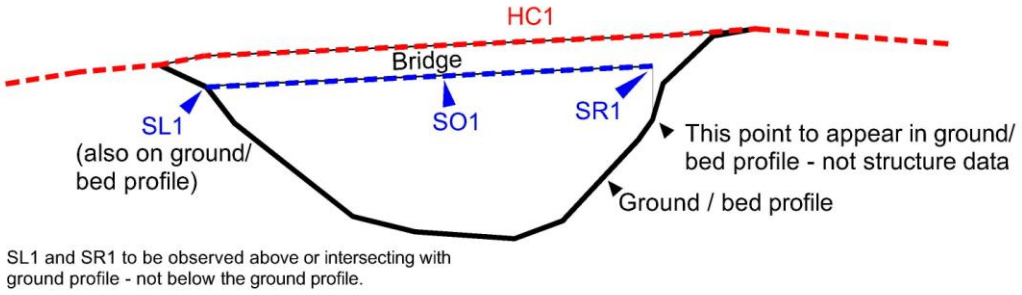
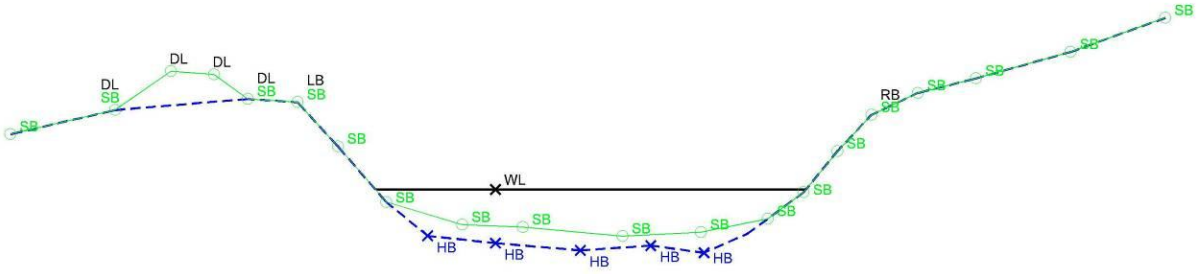


Figure 3 – Open cross section coding

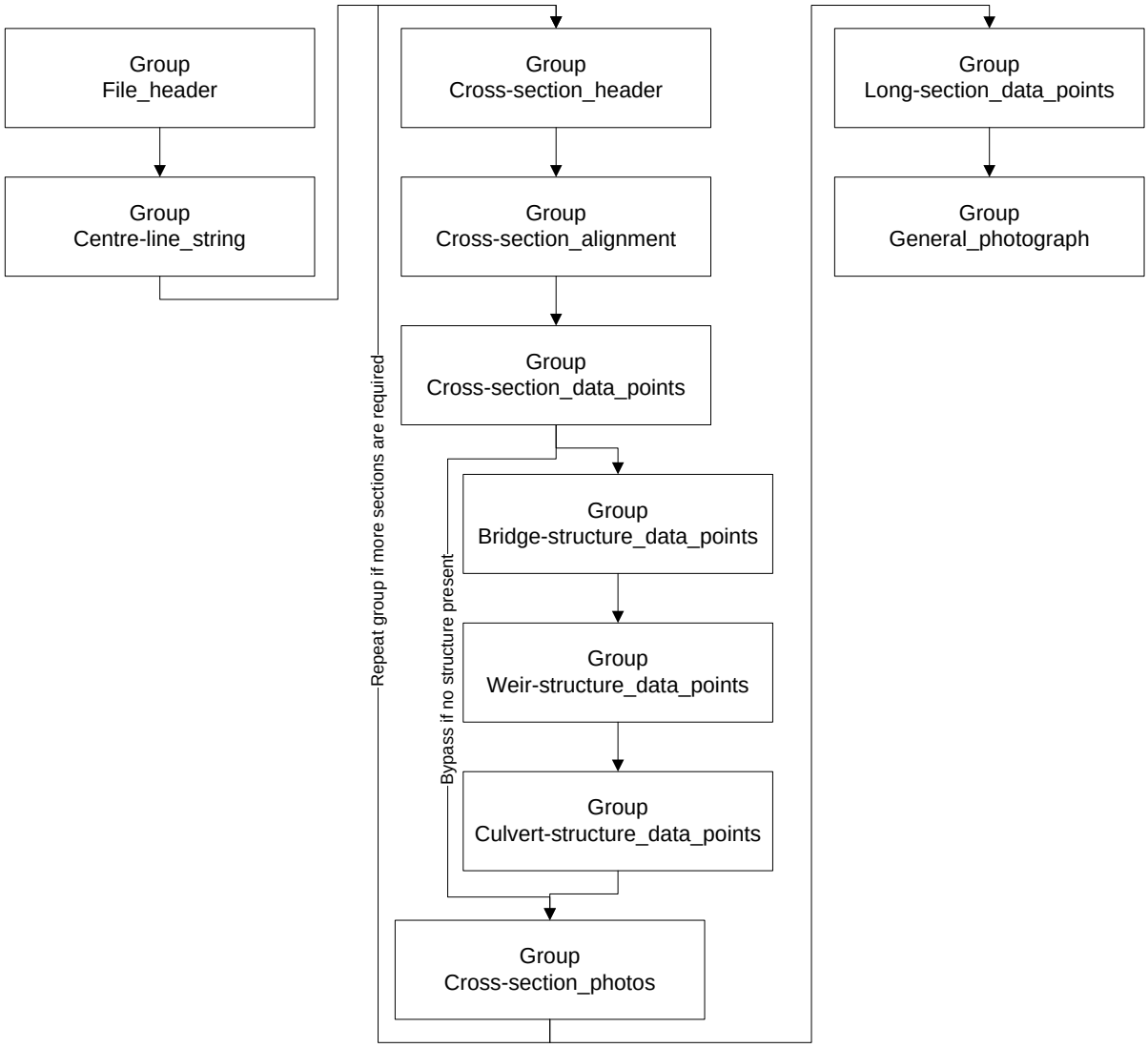
Note that the coding is not the same as used for EEBY data, but more logical



4 EACSD data file diagram

The structure of the EACSD data file is outlined in Figure 4 below.

Figure 4 – EACSD data file structure



5 Channel and floodplain roughness

CES1 and CES2 are to be recorded for channel survey. CES1, CES2 and CES3 are to be recorded for floodplain survey. The codes to use in the EACSD data file are shown in brackets [].

5.1 Channel Survey

CES1 – Vegetation at survey point

Vegetation types for river banks

			
None [NONE]	Trailing bank-side plants [TBSPLNT]	Emergent reeds [REED]	Grass [GRASS]

Vegetation types for channel beds

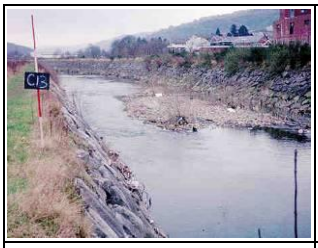
			
None [NONE]	Free floating plants [FFPLNT]	Moss [MOSS]	Trailing bank-side plants [TBSPLNT]
			
Reeds [REED]	Submerged plants [SUBPLNT]		

CES2 – Ground or material type at survey point

General types

			
Bedrock [BROCK]	Rubble (irregular sizes) [RUBBLE]	Cobbles (64-256mm) [COBBLE]	Gravel (2-64mm) [GRAVEL]
			
Soil (Sand, Silt, Clay, Peat) [SOIL]	Metal (iron, steel) [METAL]	Corrugated metal [CMETAL]	Wood [WOOD]
			
Concrete [CONC]	Brick [BRICK]	Asphalt [ASPH]	Plastic [PLASTIC]

Bank specific ground types

			
Rip-rap [RIPRAP]	Sheet pile [SPILE]	Gabion [GABION]	

5.2 Floodplain Survey

CES1 – Vegetation at survey point

Use CES1 vegetation types from section 5.2 and supplement with the additional vegetation types in this section.

			
Crops - Crops perpendicular to flow [PECROP]	Crops - Crops parallel to flow [PACROP]		
			
Grass - Turf [GRASS]	Grass - Medium (0.75-1m) [MGRASS]	Grass - Tall (1-1.8m) [TGRASS]	
			
Hedges - Clean (<250m spacing) [CHDGECL]	Hedges - Clean (>250m spacing) [CHDGEFA]	Hedges - Dirty (<250m spacing) [DHDGECL]	Hedges - Dirty (>250m spacing) [DHDGEFA]
			
Trees - Light brush [LBRUSH]	Trees - Medium brush [MBRUSH]	Trees - Dense brush [DBRUSH]	Trees - Cleared land (tree stumps) [CLEARED]

			
Trees - Heavy stand of trees [HSTREE]			

CES2 – Ground or material type at survey point

Use CES2 vegetation types from section 5.2.

CES3 – Irregularity

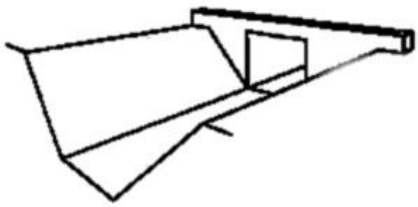
			
None [NONE]	Ridges or ploughed fields [RIDGE]	Minor irregularities [MIRREG]	Appreciable irregularities [AIRREG]
			
Minor obstructions [MOBST]	Appreciable obstructions [AOBST]		

6. Culvert Inlet types

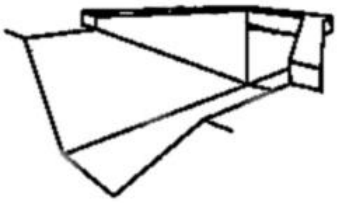
The culvert codes to use in EACSD data file are shown in brackets []. The file

- Headwall [HEADWAL]
- Headwall with wingwalls [HEADWWW]
- Projecting [PROJTNG]
- Mitre to slope [MITRESL]
- Other [OTHER]

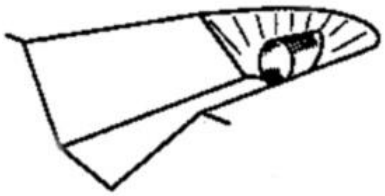
Figure 5 – Culvert inlet types



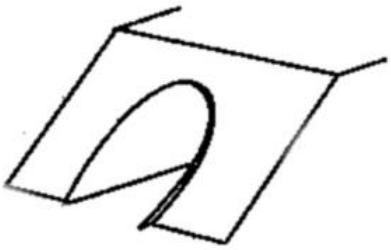
Headwall



Headwall with wingwalls



Projecting



Mitre to slope

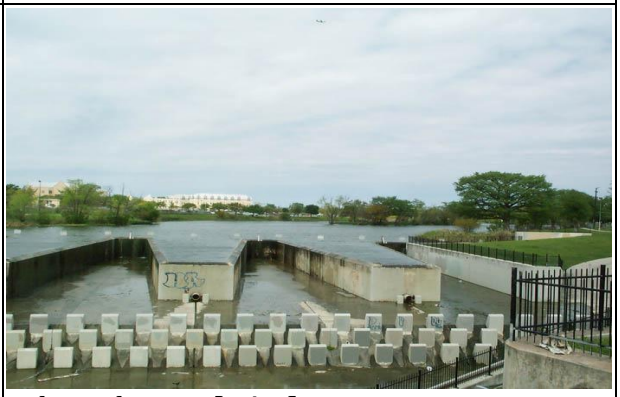
7. Weir types

The weir codes to use in the EACSD data file are shown in brackets [].

Sharp crested weir [SHARP]

Broad crested weir [BROAD]

Gated weir [GATED]



Labyrinth weir [LAB]

V-notch weir [VNOTCH]