16 HEC-RAS DATA EXCHANGE

At Version 2.0, HEC-RAS introduced a geospatial component to the geometry for the description of river networks and cross sections. This capability makes it possible to import channel geometry from CADD or GIS programs though automated data extraction procedures. Similarly, water surface elevations and other HEC-RAS results can be exported to CADD and GIS where they can be used to created model water surfaces for inundation mapping.
The spatial data the HEC-RAS can import and export are evolving - each new version of the software results in additional capabilities. HEC-RAS Version 3.1.3 will import and export data using in a spatial data format in an ASCII text file.
Data import options include:

- The structure of the river network, as represented by a series of interconnected reaches.
- The location and geometric description of cross sections for elevation data, bank positions, downstream reach lengths, Manning's *n* values data, levee positions and elevations (limited to one per bank), ineffective flow area positions and elevations.
- Bridge deck information for top-of-weir profile, deck width, and distance to the upstream cross section.
- Lateral and inline structure information top-of-weir profile, deck width, and distance to the upstream cross section for inline structures.
- Storage area elevation-volume information.

Data export options include:

- Cross section locations and elevation data.
- Water surface elevations at each cross section.
- Bounding polygon information for each water surface profile.
- Cross-sectional properties.

Spatial Data Format

HEC-RAS Version 3.1.3 will import and export data using a formatted ASCII text file. In general, the spatial data format consists of records, keywords and values. This section provides the general rules for constructing the and HEC-RAS import and export file.

This file format is evolving in that additional data types will be added and existing one may be modified for future versions. If you are writing software to read and write to the HEC-RAS spatial data format, keep in mind that you may need to modify your software to remain compatible with future versions of HEC-RAS.

Records

The spatial data format is composed of records, which are composed of keywords and values. All records must begin with a keyword. A record can also contain a value or a set of values following the keyword. Spaces, tabs, or line ends can be used as delimiters within a record.

A record that contains a keyword and no value marks the beginning or end of a group of related records. For example, the record "BEGIN HEADER:" MARKS the beginning of the header section of the file. A record that contains a keyword and a value assigns that value to the part of the model being named by the keyword.

Keywords

Keywords are used to identify that values unique to the part of the model being named by the keyword will follow. Keywords must end with a colon separating the keyword and the values. All keywords will have the spaces removed up to the colon and the letters capitalized. The keywords "Begin Header:", "Begin header:", and "Be GiNH eadEr:" are all equivalent. For readability, keywords named in this document will contain internal spaces.

Values

A record can assign a single value to a single variable or multiple values in an array. Values can be integers, floating point numbers, text strings, or locations (X, Y, Z, label). A single value in an array of values is called an "element" of that array.

A **numerical value** cannot contain internal blanks. A floating point number can contain a decimal point; an integer cannot. Elements in an array can be separated by commas, blanks, tabs, or line ends.

A **text string** can contain internal blanks, tabs, and commas, but cannot contain internal line ends.

A **location** consists of three coordinate values and a label (X, Y, Z, label). The first two coordinates are planar and the third is elevation. The coordinate values are floating point numbers and the label can by any type of value. In certain contexts, the elevation value or the label may not be required. If a label is used, all three coordinate values must be given; the value of "NULL" is valid for the elevation coordinate only. The coordinate values and the label can be separated by commas, blanks, or tabs, but a location cannot contain internal line ends.

Data Groups

Records in the data file can be collected in two types of groups: objects and file sections. An object is a group of records that combine to describe an entity within the model – a cross section, for example. A file section is a logical or functional grouping of data. The file header, for example, is a section that contains a description of the entire file.

Objects and file sections begin and end with records that contain keywords but no values. A file section starts with a record containing the a keyword composed of the word "BEGIN" followed by the section name and a colon and ends with a keyword composed of the word "END" followed by the section name and a colon. For example, records containing only the keywords "BEGIN HEADER:" and "END HEADER:" are used to start and end the header section of a file. An object starts with a record containing a keyword naming an object type and "END:" only. For example, a cross-section object begins and ends with records containing the keywords "CROSS-SECTION:" and "END:" only.

Comments

Hash characters (#) are used to identify comments. When a hash character is encountered in the file all data from the hash to the next line end is ignored. A line that begins with a hash is equivalent to a blank line.

Spatial Data Format

HEC-RAS Version 3.1.3 will import and export data using a formatted ASCII text file. In general, the spatial data format consists of records, keywords and values. This section provides the general rules for constructing the and HEC-RAS import and export file.
This file format is evolving in that additional data types will be added and existing one may be modified for future versions. If you are writing software to read and write to the HEC-RAS spatial data format, keep in mind that you may need to modify your software to remain compatible with future versions of HEC-RAS.

RAS GIS Import File (RASImport.sdf)

HEC-RAS reads channel geometry from a text file composed of several sections. A discussion of the sections in the import file is provided. And example RAS GIS import File is provided at the end of this appendix.

Header

The header is bounded by the records "BEGIN HEADER:" and "END HEADER:" and should contain a record to identify the units system used in the imported data set. The units system can be "US CUSTOMARY" or "METRIC". A summary of record that may be used in the Header section are provided in Table B-1.

Table B-1. Header options for the spatial data file.

Keyword	Value Type	Value
UNITS:	String	US CUSTOMARY or METRIC
DTM TYPE:	String	Type of terrain model (TIN or GRID)
DTM:	String	Name of terrain model
STREAM LAYER:	String	Name of Stream Centerline layer used in the CADD or GIS.
NUMBER OF REACHES:	Integer	Number of hydraulic reaches in the SDF file.
CROSS-SECTION LAYER:	String	Name of the Cross-Sectional Cut Lines layer used in the CADD or GIS.
NUMBER OF CROSS-SECTIONS:	Integer	Number of cross sections in the SDF file.
MAP PROJECTION:	String	Projection (coordinate) system used (e.g. Stateplane)
PROJECTION ZONE:	String	Projection zone (if applicable, e.g. 5101)
DATUM:	String	Reference datum for planar coordinates.
VERTICAL DATUM:	String	Reference datum for vertical coordinates.

BEGIN SPATIAL EXTENT:	None	None. Begin of Spatial Extents object.
Xmin:	Float	Minimum easting of geospatial data.
Ymin:	Float	Minimum northing of geospatial data.
Xmax:	Float	Maximum easting of geospatial data.
Ymax:	Float	Maximum northing of geospatial data.
END SPATIAL EXTENT:	None	None. End of Spatial Extents object.
NUMBER OF PROFILES:	Integer	Number of profile exported from HEC-RAS. RAS GIS Export File only.
PROFILE NAMES:	String array	Water surface profile names exported from HEC-RAS. RAS GIS Export File only.

River Network

The river network section is bounded by the records "BEGIN STREAM NETWORK:" and "END STREAM NETWORK:" and contains records describing reaches and reach endpoints. At a minimum, the stream network section must contain at least two endpoints and one reach.
A reach endpoint is represented by a record containing the keyword "ENDPOINT:" followed by four comma-delimited values containing the endpoint's X, Y, Z coordinates and an integer ID.
A reach consists of a multi-record object that begins with a record containing only the keyword "REACH:" and ends with a record only containing the keyword "END:". At a minimum, a reach object must contain records setting values for a Stream ID, a Reach ID, a FROM point, and a TO point. A reach's FROM and TO point IDs must match IDs for endpoints listed before the reach object in the file. The reach object must also contain an array of locations defining the stream centerline. This array begins with a record containing only the keyword "CENTERLINE:" and ends when any keyword is encountered. A location element in the array contains the X, Y, and Z coordinates of a point on the stream centerline, and the point's river station. In HEC-RAS, elevation and stationing are optional in the stream network definition. If a location element includes a station value, it must occupy the fourth field in the element. If the elevation is not known, the word "NULL" must take its place. Stationing is used for indexing locations along reaches, and is not used to precisely locate objects in the model. A summary of record that may be used in the River Network section are provided in Table B-2.

Table B-2. River network options for the spatial data file.

Keyword	Value Type	Value
ENDPOINT:	Location	X, Y, Z coordinates and integer ID.
REACH:	None	Marks beginning of Reach object.
END:	None	Marks end of Reach object.

The following records are required for a Reach object.

Keyword	Value Type	Value
STREAM ID:	String	River identifier to include reach.
REACH ID:	String	Unique ID for reach within river.
FROM POINT:	String	Integer reference to upstream endpoint.
TO POINT:	String	Integer reference to downstream endpoint.
CENTERLINE:	Location array	Array elements contain coordinates and station values.

Cross Sections0

The cross-sectional data section begins with a record containing the only the keyword "BEGIN CROSS-SECTIONS:" and ends with a record containing the only the keyword "END CROSS-SECTIONS:". A cross section is represented by multi-record object beginning with a record containing only the keyword "CROSS-SECTION:" and ending with a record containing only the keyword "END:."
A cross-sectional object must include records identifying the Stream ID, Reach ID, and Station value of the cross-section, a 2D cut line, and a series of 3D locations on the cross section. Stationing is given in miles for data sets with plane units of feet and in kilometers for data sets with plane units of meters. A cut line is composed of the label "CUT LINE:" followed by an array of 2D locations. A cross-sectional polyline consists of the label "SURFACE LINE:" plus 3D coordinates written as comma-delimited X, Y, Z real-number triples, one triple to a line. A summary of record that may be used in the River Network section are provided in Table B-3.
Table B-3. Cross-sectional data section options for the spatial data format.

Keyword	Value Type	Value
CROSS-SECTION:	None	Marks beginning of Cross Section object.
END:	None	Marks end of a Cross Section object.
The following records are required for a Cross Section object.		
STREAM ID:	String	Identifier for the River on which the cross section resides.
REACH ID:	String	Identifier for the Reach on which the cross section resides.
STATION:	Float	Relative position of the cross section on the river reach.
CUT LINE:	Location array	Array elements contain planar coordinates of cross section strike line.

Keyword	Value Type	Value
SURFACE LINE:	Location array	Array elements contain 3D coordinates of cross section.
The following records are optional for a Cross Section object.		
NODE NAME:	String	Description of cross section.
BANK POSITIONS:	Float	Fraction of length along cut line where main channel bank stations are located.(*Left, Right*)
REACH LENGTHS:	Float	Distance along left overbank, main channel and right overbank flow paths to next cross section downstream.(*Left, Channel, Right*)
N VALUES:	Float	Manning's n values expressed as a fraction along cut line to start of *n* value.(*fraction, n value*)
LEVEE POSITIONS:	String, Float	Levee positions expressed as a fraction along cut line to position with elevation.(ID, *fraction, elevation*)
INEFFECTIVE POSITIONS:	String, Float	Ineffective flow areas expressed as a fraction along cut line to beginning and end positions with trigger elevation.(ID, *begin fraction, end fraction, elevation*)
BLOCKED POSTITIONS:	Float	Blocked flow areas expressed as a fraction along cut line to beginning and end positions with trigger elevation.(ID, *begin fraction, end fraction, elevation*)
WATER ELEVATION:	String array	Water surface profile names exported from HEC-RAS. RAS GIS Export File only.

Additional Cross Section Properties

Geospatial data used for display purposes in HEC-RAS for levees, ineffective flow areas, are blocked obstructions are stored outside of the Cross Section block of information. A summary of additional cross section properties is summarized in Table B-4.

Table B-4. Addition cross section properties options for the spatial data file.

Keyword	Value Type	Value
Levee records		
BEGIN LEVEES:	None	Marks beginning of Levees object.

Keyword	Value Type	Value
LEVEE ID:	String	Levee identifier. Corresponds to ID in LEVEE POSITIONS object on cross section.
SURFACE LINE:	Location array	Array elements contain 3D coordinates of levee profile points. Array concludes with END:
END LEVEES:	None	Marks end of Levees object.
Ineffective flow area records		
BEGIN INEFFECTIVE AREAS:	None	Marks beginning of Ineffective Areas object.
INEFFECTIVE ID:	String	Ineffective area identifier. Corresponds to ID in INEFFECTIVE POSITIONS object on cross section. Concludes with an "END:".
POLYGON:	Location array	Array elements contain 2D coordinates of ineffective area polygon points.
END INEFFECTIVE AREAS:	None	Marks end of Ineffective Areas object.
Blocked obstruction records		
BEGIN BLOCKED AREAS:	None	Marks beginning Blocked Obstructions object.
BLOCKED ID:	String	Blocked obstructions identifier. Corresponds to ID in BLOCKED POSITIONS object on cross section.
POLYGON:	Location array	Array elements contain 2D coordinates of ineffective area polygon points.
END BLOCKED AREAS:	None	Marks end of Blocked Obstructions object.

Bridge_Culverts

The bridge/culvert data section begins with a record containing the only the keyword "BEGIN BRIDGE/CULVERTS:" and ends with a record containing the only the keyword "END BRIDGE/CULVERTS:". A bridge is represented by multi-record object beginning with a record containing only the keyword "BRIDGE/CULVERT:" and ending with a record containing only the keyword "END:." Bridges/Culverts have the same required records as the Cross Sections object, but have other optional records. A summary of Bridge/Culvert records is provided in Table B-5.

Table B-5. Bridge/Culvert options in the spatial data format file.

Keyword	Value Type	Value
BRIDGE/CULVERT:	None	Marks beginning of Bridge/Culvert object.
END:	None	Marks end of a Bridge/Culvert object.

Keyword	Value Type	Value
The following records are required for a Briodge/Culvert object.		
STREAM ID:	String	Identifier for the River on which the bridge/culvert resides.
REACH ID:	String	Identifier for the Reach on which the bridge/culvert resides.
STATION:	Float	Relative position of the bridge on the river reach.
CUT LINE:	Location array	Array elements contain planar coordinates of bridge location.
SURFACE LINE:	Location array	Array elements contain 3D coordinates of bridge deck.
The following records are optional (but recommend) for a Bridge/Culvert object.		
NODE NAME:	String	Description of cross section.
US DISTANCE:	Float	Distance to upstream cross section.
TOP WIDTH:	Float	Top width of bridge deck.

Inline Structures

The inline structures data section begins with a record containing the only the keyword "BEGIN INLINE STRUCTURES:" and ends with a record containing the only the keyword "END INLINE STRUCTURES:". An inline structure is represented by multi-record object beginning with a record containing only the keyword "INLINE STRUCTURES:" and ending with a record containing only the keyword "END:."
Inline structures have the same required records as the Bridge/Culvert object. A summary of Inline Structures records is provided in Table B-6.
Table B-6. Inline structure options in the spatial data format file.

Keyword	Value Type	Value
INLINE STRUCTURES:	None	Marks beginning of Inline Structure object.
END:	None	Marks end of a Inline Structure object.
The following records are required for a Inline Structure object.		
STREAM ID:	String	Identifier for the River on which the inline structure resides.

Keyword	Value Type	Value
REACH ID:	String	Identifier for the Reach on which the inline structure resides.
STATION:	Float	Relative position of the inline structure on the river reach.
CUT LINE:	Location array	Array elements contain planar coordinates of inline structure location.
SURFACE LINE:	Location array	Array elements contain 3D coordinates of inline weir profile.
The following records are optional (but recommend) for an Inline Structure object.		
NODE NAME:	String	Description of inline structure.
US DISTANCE:	Float	Distance to upstream cross section.
TOP WIDTH:	Float	Top width of inline weir.

Lateral Structures

The inline structures data section begins with a record containing the only the keyword "BEGIN LATERAL STRUCTURES:" and ends with a record containing the only the keyword "END INLINE STRUCTURES:". A lateral structure is represented by multi-record object beginning with a record containing only the keyword "LATERAL STRUCTURES:" and ending with a record containing only the keyword "END:."
Lateral structures have the same required records as the inline structures object. A summary of Lateral Structures records is provided in Table B-7.
Table B-7. Lateral structure options in the spatial data format file.

Keyword	Value Type	Value
LATERAL STRUCTURES:	None	Marks beginning of Lateral Structures object.
END:	None	Marks end of Lateral Structures object.
The following records are required for a Lateral Structure object.		
STREAM ID:	String	Identifier for the River on which the lateral structure resides.
REACH ID:	String	Identifier for the Reach on which the lateral structure resides.

Keyword	Value Type	Value
STATION:	Float	Relative position of the lateral structure on the river reach.
CUT LINE:	Location array	Array elements contain planar coordinates of lateral structure location.
SURFACE LINE:	Location array	Array elements contain 3D coordinates of weir profile.
The following records are optional (but recommend) for a Lateral Structure object.		
NODE NAME:	String	Description of lateral structure.
US DISTANCE:	Float	Distance to upstream cross section.
TOP WIDTH:	Float	Top width of weir.

Storage Areas0

The storage areas data section begins with a record containing the only the keyword "BEGIN STORAGE AREAS:" and ends with a record containing the only the keyword "END STORAGE STRUCTURES:". The keyword "SA ID:" identifies a storage area object. A summary of Lateral Structures records is provided in Table B-8.

Table B-8. Storage area options in the spatial data format file.

Keyword	Value Type	Value
SA ID:	String	Storage area identifier.
POLYGON:	Location array	Array elements contain 2D coordinates of storage area boundary. Concludes with an "END:"
ELEVATION-VOLUME:	Float array	Elevation volume information for storage area. (*Elevation, Volume*)Concludes with an "END:"
The following records are optional for a Storage Area object.		
TERRAIN:	Float array	X,Y,Z coordinates for terrain data within storage area. Concludes with an "END:".

Storage Area Connections

The storage areas data section begins with a record containing the only the keyword "BEGIN SA CONNECTIONS:" and ends with a record containing the only the keyword "END SA CONNECTIONS:". An inline structure is represented by multi-record object beginning with a record containing only the keyword "SA CONNECTION:" and ending with a record containing only the keyword "END:." A summary of Storage Area Connection records is provided in Table B-9.

Table B-9. Storage area connection options in the spatial data format file.

Keyword	Value Type	Value
SACONNID:	String	Storage area connection identifier.
USSA:	String	Identifier of upstream storage area (SA ID).
DSSA:	String	Identifier of downstream storage area (SA ID).
CUT LINE:	Location array	Array elements contain planar coordinates of storage area connection location.
SURFACE LINE:	Location array	Array elements contain 3D coordinates of weir profile.
The following records are optional for a Storage Area Connection object.		
NODE NAME:	String	Description of storage area connection.
TOP WIDTH:	Float	Top width of weir.

RAS GIS Export File (RASExport.sdf)

HEC-RAS exports model results to a text file using the same spatial data format as the data import file. The contents of the file, however, are not identical. An example HEC-RAS model export file is shown at the end of this appendix. A summary of model elements for data export from HEC-RAS that differs from the import file is provided in Table B-10.

Table B-10. HEC-RAS export options in the spatial data format file

Keyword	Value Type	Value
The following records are required for Header section of the RAS GIS Export File		
NUMBER OF PROFILES:	Integer	Number of profile exported from HEC-RAS. Required if greater than 1.
PROFILE NAMES:	String array	Water surface profile names exported from HEC-RAS. Required if number of profiles is greater than 1.

Keyword	Value Type	Value
The following records area required in the Cross Section portion of the Export File		
WATER ELEVATION:	Float array	Elevation of water surface at the cross section. The array must contain a value for each profile.
PROFILE ID:	String array	Water surface profile name(s). This must match the name(s) in the Profile Names record.
The following records area optional in the Cross Section portion of the Export File		
VELOCITIES:	Float, paired array	Fraction along cut line and value of velocity (*fraction, value*). Velocity records must follow Profile ID record.
WATER SURFACE EXTENTS:	Location array	A series of 2D locations marking the limits of a water surface on the cross section.
The following records make up a section defining Storage Areas in the Export File		
BEGIN STORAGE AREAS:	None	Marks beginning of Storage Area object.
END STORAGE AREAS:	None	Marks end Storage Area object.
SA ID:	String	Storage area identifier.
WATER ELEVATION:	Float array	Elevation of water surface at the storage area. The array must contain a value for each profile.
POLYGON:	Location array	Array elements contain 2D coordinates of storage area limits.
POLYGON:	Location array	Array elements contain 2D coordinates of water surface limits. A single profile limit can be merged from multiple polygons.
The following records make up a section defining Bounding Polygons for the water surface limits in the Export File		
BEGIN BOUNDARIES:	None	Marks start of boundaries section.

Keyword	Value Type	Value
END BOUNDARIES:	None	Marks end of boundaries section.
PROFILE LIMITS:	None	Marks start of an object defining the limits of a single water surface profile. Concludes with and "END:"
PROFILE ID:	String	Name of the profile. This must match a name in the Profile Names record in the header.
POLYGON:	Location array	Array elements contain 2D coordinates of water surface limits. A single profile limit can be merged from multiple polygons.

Water Surface Bounding Polygon

In addition to a water surface elevation at each cross section (one for each profile), the HEC-RAS program sends a bounding polygon for each hydraulic reach in the model (the program outputs a new set of bounding polygons for each profile computed). The bounding polygon is used as an additional tool to assist the GIS (or CADD) software to figure out the boundary of the water surface on top of the terrain.

In most cases, the bounding polygon will represent the outer limits of the cross section data, and the actual intersection of the water surface with the terrain will be inside of the polygon. In this case, the GIS software will use the water surface elevations at each cross section and create a surface that extends out to the edges of the bounding polygon. That surface is then intersected with the terrain data, and the actual water limits are found as the location where the water depth is zero.

However, is some cases, the bounding polygon may not represent the extents of the cross-section data. For example, if there are levees represented in the HEC-RAS model, which limit the flow of water, then the bounding polygon will only extend out to the levees at each cross section. By doing this, when the information is sent to the GIS, the bounding polygon will prevent the GIS system from allowing water to show up on both sides of the levees.

In addition to levees, the bounding polygon is also used at hydraulic structures such as bridges, culverts, weirs, and spillways. For example, if all of the flow is going under a bridge, the bounding polygon is brought into the edges of the bridge opening along the road embankment on the upstream side, and then back out to the extent of the cross-section data on the downstream side. By doing this, the GIS will be able to show the contraction and expansion of the flow through the hydraulic structures, even if the hydraulic structures are not geometrically represented in the GIS.

Another application of the bounding polygon is in FEMA floodway studies. When a floodway study is done, the first profile represents the existing conditions of the floodplain. The second and subsequent profiles are run by encroaching on the floodplain until some target increase in water surface elevation is met. When the encroached profile is sent to the GIS, the bounding polygon is set to the limits of the encroachment for each cross section. This will allow the GIS to display the encroached water surface (floodway) over the terrain, even though the water surface does not intersect the ground.

Import/Export Guidelines

The following rules apply to channel and cross-section import/export data.

Defining the River Network

- The stream network is represented by a set of interconnected reaches. A stream is a set of one or more connected reaches that share a common Stream ID.
- A stream is composed of one or more reaches with the same Stream ID, and each reach in a stream must have a unique Reach ID. Every reach must be identified by a unique combination of stream and reach IDs.
- Stream IDs and Reach IDs are alphanumeric strings. Reach endpoint IDs are integers.
- Streams cannot contain parallel flow paths. (If three reaches connect at a node, only two can have the same Stream ID.) This prevents ambiguity in stationing along a stream.
- A reach is represented by an ordered series of 3D coordinates, and identified by a Stream ID, a Reach ID, and IDs for its endpoints.
- A reach endpoint is represented by its 3D coordinates and identified by an integer ID.
- Reaches are not allowed to cross, but can be connected at their endpoints (junctions) to form a network.
- The normal direction of flow on a reach is indicated by the order of its endpoints. One point marks the upstream or "from" end of the reach, the other marks the downstream or "to" end of the reach.

Defining Cross Sections

- Each cross section is defined by a series of 3D coordinates, and identified by a stream name and reach name (which must refer to an existing stream and reach) and a station, indicating the distance from the cross-section to the downstream end of the stream.
- A cross-section line can cross a reach line exactly once, and cannot cross another cross-section line.

Results of a water surface calculation are exported in a file that contains cross-section locations in plane (2D) coordinates, water-surface elevations for the cross-sections, and boundary polygons for the reaches.

Water Surface Export Data Rules

- A cross-section is represented by a water surface elevation and a series of 2D coordinates on the cross-section cut line. The full width of the cross-section is included.
- One bounding polygon is created for each reach in the stream network, and for each profile.
- A reach's bounding polygon is made up of the most upstream cross-section on the reach, the endpoints of all cross-sections on the reach, and the most upstream cross-sections of reaches downstream of the reach.
- For purposes of defining bounding polygons *only*, the endpoints of a cross-section are adjusted to the edge of the water surface at the cross-section if the cross-section is part of a floodway, a leveed section of the reach, or the water extent is controlled by a hydraulic structure. This allows calculated water surfaces that are higher than the land surface to be reported back to the CADD or GIS program.

Sample RAS GIS Import File

#This file is generated by HEC-GeoRAS for ArcGIS
BEGIN HEADER:
DTM TYPE: TIN
DTM: C:\Examples\Baxter\baxter_tin
STREAM LAYER: C:\Examples\Baxter\baxter.mdb\River
NUMBER OF REACHES: 3

CROSS-SECTION LAYER: C:\Examples\Baxter\baxter.mdb\XSCutLines
NUMBER OF CROSS-SECTIONS: 173
MAP PROJECTION: STATEPLANE
PROJECTION ZONE:
DATUM: NAD83
VERTICAL DATUM:
BEGIN SPATIAL EXTENT:
XMIN: 6366478.85990533
YMIN: 2010839.52690533
XMAX: 6468128.45990533
YMAX: 2112489.12690533
END SPATIAL EXTENT:
UNITS: FEET
END HEADER:
BEGIN STREAM NETWORK:
ENDPOINT: 6453740, 2051685, 60, 1
ENDPOINT: 6421541, 2051194, 34, 2
ENDPOINT: 6387438, 2035323, 32.95776, 3
ENDPOINT: 6426447, 2059280, 52.14808, 4
REACH:
STREAM ID: Baxter River
REACH ID: Upper Reach
FROM POINT: 1
TO POINT: 2
CENTERLINE:
6453739.98997957, 2051684.77998051, 59.99999997, 89378.4140625
--- *many lines omitted* ---
6421540.44998505, 2051194.18999834, 34.00000001, 48157.06640625
END:
REACH:
STREAM ID: Baxter River
REACH ID: Lower Reach
FROM POINT: 2
TO POINT: 3
CENTERLINE:
6421540.44998505, 2051194.18999834, 34.00000001, 48157.06640625
--- *many lines omitted* ---
6387438.24001357, 2035323.14001705, 32.95775604, 0
END:
REACH:
STREAM ID: Tule Creek
REACH ID: Tributary
FROM POINT: 4
TO POINT: 2
CENTERLINE:
6426446.76000561, 2059279.84000069, 52.14807890, 12551.4970703125
--- *many lines omitted* ---
6421540.44998505, 2051194.18999834, 34.00000001, 0

END:
END STREAM NETWORK:

BEGIN CROSS-SECTIONS:
CROSS-SECTION:
STREAM ID: Baxter River
REACH ID: Upper Reach
STATION: 84815.69
NODE NAME:
BANK POSITIONS: 0.5417204, 0.6313727
REACH LENGTHS: 343.447, 815.2449, 627.6476
NVALUES:
0, 0.06
0.2595427, 0.035
0.6867172, 0.06
LEVEE POSITIONS:
INEFFECTIVE POSITIONS:
BLOCKED POSITIONS:
CUT LINE:
6451252.61043617, 2049658.48075948
6450473.97548097, 2050754.33739816
6449753.01716107, 2051480.10208855
SURFACE LINE:
6451252.61043617, 2049658.48075948, 125.00000002
--- many lines omitted ---
6449753.01716107, 2051480.10208855, 110.31235503
END:
CROSS-SECTION:
STREAM ID: Baxter River
REACH ID: Upper Reach
STATION: 77909.16
NODE NAME:
BANK POSITIONS: 0.4635276, 0.572924
REACH LENGTHS: 223.1558, 229.2013, 233.3537
NVALUES:
0, 0.06
0.4353712, 0.035
0.6486487, 0.06
LEVEE POSITIONS:
INEFFECTIVE POSITIONS:
354, 0, 0.3630761, 93.26781
355, 0.6235623, 1, 105.4026
BLOCKED POSITIONS:
379, 0.37786, 0.9548786, 79.19141
CUT LINE:
6446531.40685930, 2048445.67038340
6446341.91498890, 2048655.03933954
6446207.54346581, 2049102.94440073

6446140.35770426, 2049409.01289628
6446028.38145080, 2049909.17358660
6445838.02350501, 2050713.98307530
SURFACE LINE:
6446531.40685930, 2048445.67038340, 93.26781466
--- many lines omitted ---
6445838.02350501, 2050713.98307530, 105.40263370
END:
--- many Cross Sections omitted ---
CROSS-SECTION:
STREAM ID: Baxter River
REACH ID: Lower Reach
STATION: 34251.78
NODE NAME:
BANK POSITIONS: 0.2088515, 0.2746628
REACH LENGTHS: 678.4368, 652.6373, 592.5861
NVALUES:
0, 0.06
0.2023585, 0.035
0.5760272, 0.05
LEVEE POSITIONS:
380, 0.5949767, 72.00802
INEFFECTIVE POSITIONS:
BLOCKED POSITIONS:
CUT LINE:
6412787.19596798, 2042663.48848210
6412627.43755387, 2043633.45026854
6412056.87180271, 2047399.18430193
SURFACE LINE:
6412787.19596798, 2042663.48848210, 80.15862274
--- many lines omitted ---
6412056.87180271, 2047399.18430193, 77.57256318
END:
END CROSS-SECTIONS:

BEGIN BRIDGES/CULVERTS:
BRIDGE/CULVERT:
STREAM ID: Tule Creek
REACH ID: Tributary
STATION: 4514.028
NODE NAME: Yosemite Street
US DISTANCE: 100
TOP WIDTH: 96
CUT LINE:
6422221.24109452, 2055203.79594125
6421766.89378999, 2055127.22052519
6421302.33643314, 2054958.75468559
6421128.76554372, 2054912.80947382

6420924.56454467, 2054892.38936919
SURFACE LINE:
6422221.24109452, 2055203.79594125, 88.73309329
--- many lines omitted ---
6420924.56454467, 2054892.38936919, 83.88871764
END:
--- many Bridges/Culverts omitted ---
END BRIDGES/CULVERTS:

BEGIN LEVEES:
LEVEE ID: 380
SURFACE LINE:
6416224.46794023, 2048201.03890064, 80.30300144
--- many lines omitted ---
6408127.91921907, 2047348.05802148, 73.83999635
END:
END LEVEES:
BEGIN INEFFECTIVE AREAS:
INEFFECTIVE ID: 354
POLYGON:
6446126.65267778, 2049275.06766575
6446347.63945516, 2049062.58037434
6446466.63230616, 2048960.58649530
--- many lines omitted ---
6446126.65267778, 2049275.06766575
END:
INEFFECTIVE ID: 355
POLYGON:
6446009.40721919, 2049877.88188569
6445816.78229256, 2050758.82118551
--- many lines omitted ---
6446009.40721919, 2049877.88188569
END:
--- many Ineffective Areas omitted ---
END INEFFECTIVE AREAS:

BEGIN BLOCKED OBSTRUCTIONS:
BLOCKED ID: 379
POLYGON:
6422107.09773554, 2052558.24567028
6423542.24950153, 2052503.04750541
6422076.43212521, 2052184.12491178
6422107.09773554, 2052558.24567028
END:
END BLOCKED OBSTRUCTIONS:

BEGIN LATERAL STRUCTURES:
LATERAL STRUCTURE:

STREAM ID: Baxter River
REACH ID: Lower Reach
STATION: 27469.68
NODE NAME: North LS
US DISTANCE: 0
TOP WIDTH: 20
CUT LINE:
6407389.53497197, 2047168.40301990
6406371.11447597, 2046886.24321303
--- many lines omitted ---
6402363.56369299, 2045153.60574580
SURFACE LINE:
6407389.53497197, 2047168.40301990, 69.83999637
--- many lines omitted ---
6402363.56369299, 2045153.60574580, 65.27986148
END:
END LATERAL STRUCTURES:

BEGIN STORAGE AREAS:
SA ID: 369
POLYGON:
6402631.96981374, 2045430.51958869
--- many lines omitted ---
6402631.96981374, 2045430.51958869
END:
ELEVATION-VOLUME:
63.34, 0
64.59, 272682.8
65.84, 2102153
67.09, 1.130536E+07
68.34, 2.241535E+07
69.59, 3.505853E+07
70.84, 4.921408E+07
72.09, 6.477892E+07
73.34, 8.095226E+07
74.59, 9.734569E+07
75.84, 1.142249E+08
END:
TERRAIN:
END:
END STORAGE AREAS:
BEGIN SA CONNECTIONS:
  SA CONNECTION:
    SACONN ID: 444

NODE NAME:
US SA: 369
DS SA: 371
TOP WIDTH: 20
CUT LINE:
6407389.53497197, 2047168.40301990
6406371.11447597, 2046886.24321303
--- *many lines omitted* ---
6402363.56369299, 2045153.60574580
SURFACE LINE:
6407389.53497197, 2047168.40301990, 69.83999637
--- *many lines omitted* ---
6402363.56369299, 2045153.60574580, 65.27986148
END:
END SA CONNECTIONS:

Sample RAS GIS Export File

1. RAS export file created on DAY DAYMONTHYEAR TIME
2. by HEC-RAS Version 3.1.3
   BEGIN HEADER:
   UNITS:
   DTM TYPE: TIN
   DTM: C:\Examples\Baxter\baxter_tin
   STREAM LAYER: C:\Examples\Baxter\baxter.mdb\River
   CROSS-SECTION LAYER: C:\Examples\Baxter\baxter.mdb\XSCutLines
   MAP PROJECTION: STATEPLANE
   PROJECTION ZONE:
   DATUM: NAD83
   VERTICAL DATUM:
   BEGIN SPATIALEXTENT:
   Xmin: 6386768.00418383
   Ymin: 2029042.52107352
   Xmax: 6454403.07894787
   Ymax: 2059837.49270508
   END SPATIALEXTENT:
   NUMBER OF PROFILES: 3
   PROFILE NAMES:
   50yr
   100yr
   500yr
   NUMBER OF REACHES: 3
   NUMBER OF CROSS-SECTIONS: 179
   END HEADER:
   BEGINSTREAMNETWORK:
   ENDPOINT:6421540.50,2051194.25, , 1
   ENDPOINT:6453739.99,2051684.78, , 2
   ENDPOINT:6387438.24,2035323.14, , 3
   ENDPOINT:6426446.76,2059279.84, , 4
   REACH:

STREAM ID: Baxter River
REACH ID: Upper Reach
FROM POINT: 2
TO POINT: 1
CENTERLINE:
6453739.99, 2051684.78, ,
6421540.45, 2051194.19, ,
END:
REACH:
STREAM ID: Baxter River
REACH ID: Lower Reach
FROM POINT: 1
TO POINT: 3
CENTERLINE:
6421540.45, 2051194.19, ,
6387438.24, 2035323.14, ,
END:
REACH:
STREAM ID: Tule Creek
REACH ID: Tributary
FROM POINT: 4
TO POINT: 1
CENTERLINE:
6426446.76, 2059279.84, ,
6421540.45, 2051194.19, ,
END:
ENDSTREAMNETWORK:

BEGIN CROSS-SECTIONS:
CROSS-SECTION:
STREAM ID:Baxter River
REACH ID:Upper Reach
STATION:84815.69
NODE NAME:
CUT LINE:
6451252.6104362 , 2049658.4807595
6450473.975481 , 2050754.3373982
6449753.0171611 , 2051480.1020886
REACH LENGTHS:826.24,806.49,525.17
BANK POSITIONS:0.45159,0.51309
LEVEE POSITIONS:
380,0.93260,79.95625
WATER ELEVATION:70.39427,76.72782,86.74971
WATER SURFACE EXTENTS:
6450877.21, 2050186.83, 6450289.15, 2050940.40
6450896.85, 2050159.18, 6450262.99, 2050966.73
6450912.28, 2050137.47, 6450189.98, 2051040.23
PROFILE ID:50yr
VELOCITIES:
0.32733, 1.558
0.46174, 2.381
0.55094, 3.764
0.56925, 4.280

0.58721, 6.164
0.60317, 5.713
0.62166, 3.942
0.64436, 1.926
PROFILE ID:100yr
VELOCITIES:
0.31866, 2.972
0.45698, 3.829
0.55086, 5.019
0.56908, 5.459
0.58709, 7.245
0.60341, 6.737
0.62189, 5.168
0.65404, 3.202
PROFILE ID:500yr
VELOCITIES:
0.31332, 4.739
0.45464, 5.533
0.55081, 6.526
0.56894, 6.860
0.58698, 8.456
0.60365, 7.890
0.62206, 6.635
0.66467, 4.272
SURFACE LINE:
6451252.61, 2049658.48, 125.00
--- *many lines omitted* ---
449753.02, 2051480.10, 110.31
END:
CROSS-SECTION:
STREAM ID:Tule Creek
REACH ID:Tributary
STATION:1595.102
NODE NAME:
CUT LINE:
6422369.1971783 , 2052943.6596315
6421588.0439919 , 2052573.50648
--- *many lines omitted* ---
6420275.0509832 , 2052670.3666247
WATER ELEVATION:62.67044,69.44948,78.49661
WATER SURFACE EXTENTS:
6421432.49, 2052554.70, 6420609.83, 2052432.00
6421570.89, 2052571.43, 6420459.69, 2052510.35
6422048.65, 2052791.77, 6420316.40, 2052634.53
PROFILE ID:50yr
VELOCITIES:
0.47364, 0.016
0.65126, 0.056
0.74604, 0.171
0.75411, 0.221
0.76221, 0.247
0.77030, 0.207
0.77842, 0.151

0.79265, 0.059
PROFILE ID:100yr
VELOCITIES:
0.44844, 0.116
0.62783, 0.185
0.74591, 0.383
0.75406, 0.466
0.76221, 0.514
0.77035, 0.444
0.77857, 0.350
0.81222, 0.177
0.86985, 0.096
PROFILE ID:500yr
VELOCITIES:
0.21051, 0.019
0.42227, 0.092
0.62301, 0.192
0.74582, 0.350
0.75403, 0.407
0.76221, 0.444
0.77039, 0.393
0.77866, 0.327
0.81602, 0.232
0.88706, 0.146
0.94874, 0.075
SURFACE LINE:
6422369.20, 2052943.66, 80.22
--- *many lines omitted* ---
6420275.05, 2052670.37, 85.26
END:
END CROSS-SECTIONS:

BEGIN STORAGE AREAS:
SA ID: 369
WATER ELEVATION:65,65,65
POLYGON:
6402631.9698137 , 2045430.5195887 ,
6402648.7543614 , 2046009.5857725 ,
--- *many lines omitted* ---
6402631.9698137 , 2045430.5195887 ,
END:
SA ID: 370
WATER ELEVATION:65,65,65
POLYGON:
6411089.902679 , 2043584.9518455 ,
6411100.24735 , 2041762.9675571 ,
--- *many lines omitted* ---
6411089.902679 , 2043584.9518455 ,
END:
END STORAGE AREAS:

BEGIN BOUNDS:
PROFILE LIMITS:
PROFILE ID:50yr
POLYGON:
6449753.02,2051480.10,70.39
--- *many lines omitted* ---
6449462.09,2051308.23,70.35
POLYGON:
6424775.60,2059535.58,62.69
--- *many lines omitted* ---
6424246.32,2059434.43,62.69
POLYGON:
6420221.24,2052718.80,62.36
--- *many lines omitted* ---
6420143.38,2052744.69,62.32
END:
PROFILE LIMITS:
PROFILE ID:100yr
POLYGON:
6449753.02,2051480.10,76.73
--- *many lines omitted* ---
6449462.09,2051308.23,76.73
POLYGON:
6424775.60,2059535.58,69.51
--- *many lines omitted* ---
6424246.32,2059434.43,69.52
POLYGON:
6420221.24,2052718.80,69.19
--- *many lines omitted* ---
6420143.38,2052744.69,69.17
END:
PROFILE LIMITS:
PROFILE ID:500yr
POLYGON:
6449753.02,2051480.10,86.75
--- *many lines omitted* ---
6449462.09,2051308.23,86.83
POLYGON:
6424775.60,2059535.58,78.54
--- *many lines omitted* ---
6424246.32,2059434.43,78.54
POLYGON:
6420221.24,2052718.80,78.18
--- *many lines omitted* ---
6420143.38,2052744.69,78.16
END:
END BOUNDS: