Section A3

Hydrologic Data

A3.1 $HYD Record - Hydrologic Data (required)

The $HYD record marks the beginning of the hydrologic data. This record is required and precedes discharge data described on the following pages.

Field	Variable	Value	Description
0	ID	$HYD	Record identification.

A3.2 Q Record - Comment and Output Control (required)

One comment record is required for each Q record in the hydrologic data. This record provides title information for each time step. It also allows the user to select various output options.

Field	Variable	Value	Description
0	ID	Q	Record identification (Column 1).

Output Control for Hydraulic Information

Column 5	OPTION		Optional output from the hydraulic computations (water surface profiles) is obtained by specifying one of the following codes in Column 5 on the Q record.
		blank	Discharge, starting water surface elevation, water temperature and flow duration in days is output. For this option, leave Column 5 blank, not zero. This is the standard hydraulic output option.
		A	Water surface and energy line elevations, velocity head, alpha, top width, average bed elevation, and velocity in each subsection are output for each discharge at each cross section.
		B	Cross section coordinates at the current time and distribution of hydrologic data across the section for the final calculated water surface are output.
		D	Trace information. (Not recommended for most users.)
		E	Detailed Trace Information. All of the above information plus coordinates, area and wetted perimeter for each trapezoidal area in each cross section and for each trial elevation at each cross section. (Not recommended for most users.)

Note: Output levels D and E produce very large quantities of output from the hydraulic computations. This output was designed for software error checking. Execution time will increase and output files will become very large if either of these options are used.

Field	Variable	Value	Description
Output Control for Sediment Transport Information			
Column 6	OPTION		Optional output from sediment transport computations.
		blank	No output except summary at end of job. For this option leave Column 6 blank, not zero.
		A	A table showing the volume of sediment entering and leaving each segment and the computed trap efficiency for each segment.
		B	In addition to A, the cumulative bed change, the water surface and thalweg elevations, and the sediment load passing in tons/day for clay, silt and sand for each cross section. This and all higher output levels cause a supplemental output file to be written at this time step for post-processing purposes.
		C	In addition to the above, values of the detailed distribution by grain size fraction for the bed surface material at each cross section before the values are corrected by percentage present in the bed. (Not recommended for most users.)
		D, E	Detailed Trace Information. (Not recommended for most users.)

Note: Output levels C, D and E produce very large quantities of output from the sedimentation computations. This trace output was designed primarily for software error checking. Execution time will increase and output files will become very large if any of these options are used.

Time Step Title Information			
2-10	Comment		Comment data for discharge-elevation-duration data that follows. Use the remainder of this record to provide title/comment information for this time step. This data will appear in the output file.

A3.3 Q Record - Water Discharges in cfs (required)

A Q record is required for each time step defined in the hydrologic data. The Q record provides HEC-6 with the outflow at the downstream boundary as well as flow conditions at each of the control points in a stream network. See Sections 3.4.1, 3.6, and Sections 6.1 through 6.3 for a complete description of how to enter data on the Q record for a stream network.

Field	Variable	Value	Description
0	ID	Q	Record identification (Column 1).
1	Q(1)	+	Outflow from downstream boundary of geometric model for this time step.
			If Tributaries, Local Inflows or Diversions are Present in the Geometric Data
2	Q(2)	0, +	Tributary discharge of first local inflow (diversion) point on main stem. If no local flows, enter discharge from stream segment at control point 2.
		-	Diversion flows are identified by a negative discharge. Otherwise, diversions and tributaries are subject to the same coding rules. They may be mixed but they both may not occur at the same time at the same cross section.
3-10	Q(3)-Q(10)	0, +, -	The discharge, inflow or outflow, of the next control/junction point defined in the network (see Section 3.6 and Sections 6.1 through 6.4 for details).
			If Tributaries, Local Inflows, and Divisions are not Present in the Geometric Data
2-10	Q(2)-Q(10)	+	Up to MNQ (I1.4) parallel discharges may be entered across the Q record.

A3.4 R Record - Downstream Water Surface Elevation Boundary Condition (required[9])

A water surface elevation must be specified at the downstream boundary of the model for every time step to begin the backwater computations. HEC-6 provides three methods for prescribing this downstream boundary condition: (1) a rating curve, (2) stage vs. time (R records), or (3) a combination of a rating curve and R records.

Method 1 involves the use of a rating curve which is specified using a $RATING record followed by a set of RC records containing the water surface elevation data as a function of discharge. The rating curve need only be specified once at the start of the hydrologic data (immediately following the $HYD record) and a water surface elevation will be determined by interpolation using the discharge given on the Q record for each time step. The rating curve may be temporarily modified using the S record or replaced by entering a new set of $RATING and RC records before any Q record in the hydrologic data.

In Method 2, R records are used instead of a rating curve to define the water surface elevation. To use this method, an R record is required for the first time step. The elevation entered in Field 1 of this record will be used for each succeeding time step until another R record is found with a non-zero value in Field 1. In this way, you need only insert R records to change the downstream water surface elevation to a new value.

Method 3 is a combination of the first two methods. This method makes it possible to use the rating curve most of the time to determine the downstream water surface elevation while still allowing the user to specify the elevation exactly at given time steps. In this method, the R record's non-zero Field 1 value for the downstream water surface elevation will override the rating curve for that time step. On the next time step, HEC-6 will obtain the downstream water surface from to the rating curve unless another R record is found with a non-zero value in Field 1.

Water Surface Elevation at Internal Boundaries

R records have a secondary purpose. They may also be used to define the water surface elevation at certain internal boundaries in the geometry. The location of an internal boundary is defined by an X5 record. R records are then necessary to define the water surface at those internal boundaries where an R record field has been specified in field 4 of the X5 record. The water surface elevation (UPE) for that time step will be read from the R record at the field prescribed on the X5 record (X5.4). See the X5 record description (Section A1.7) for further details.

[9] An **R** record is required only if a rating table is not used, and then it is only required for the first time step.

If Internal Boundaries are not Present in the Geometry

Field	Variable	Value	Description
0	ID	R	Record identification (Column 1).
1	WS(1)	+	Enter the value for the prescribed water surface elevation that corresponds to the outflow entered on the Q record in Field 1.
		0	When no internal boundaries are present, then a zero in Field 1 should not be used. To define a water surface elevation at zero, input a small positive value (e.g., 0.001)
2-10			Leave blank.

If Internal Boundaries are Present in the Geometry

Field	Variable	Value	Description
0	ID	R	Record identification (Column 1).
1	WS(1)	+	Enter the value for the prescribed water surface elevation that corresponds to the outflow entered on the Q record in Field 1.
		0	When internal boundaries are present (defined on X5 records) and a rating curve exists, the water surface will be determined from the rating curve ($RATING and RC records). If a rating curve does not exist, the water surface from the previous time step will be reused.
2-10	WS(n)	+	Enter the water surface elevation for the internal boundary for which ICSH (X5.4)=n, where n equals the current field.
		0	Use the water surface value from the previous time step. To define a water surface elevation of zero, enter a small positive value (e.g., 0.001).

A3.5 S Record - Rating Shift (optional)

This record allows the user to alter the starting water surface elevation at the downstream boundary by a constant value. This alteration will remain in effect for succeeding time steps until another S record is read with a new shift value. The shift value is not cumulative.

Field	Variable	Value	Description
0	ID	S	Record identification (Column 1).
1	SHIFT	+, -	Enter the shift for starting water surface elevations in Field 1. All starting elevations will be shifted by this amount for this and subsequent Q's until a new shift value is read from an S record. To return to zero shift, enter an S record with Field 1 blank or zero.
		b, 0	Use original water surface elevation. No alteration.
2-10			Leave blank.

A3.6 T Record - Water Temperature (optional)

The T record provides water temperature data (refer to Section 3.4.2.1). This record is required only in the first time step. Include subsequent T records only if the water temperature changes. The water temperature(s) entered on this record will remain in effect until another T record is entered to change it. Water temperature is important for computing sediment settling velocity (especially for fine materials).

Field	Variable	Value	Description
0	ID	T	Record identification (Column 1).
1-10	WT(1)..WT(10)	+	Water temperature, in degrees Fahrenheit, corresponding to each Q that exists on the Q record. T.1 corresponds to Q.1, etc. Enter new values only if the water temperature changes from the values entered on the previous T record.

A3.7 W Record - Duration (required)

The W record defines the duration of the flow for the present time step. A W record is required for each time step in the hydrologic data set (refer to Section 3.4 and Figure 3.7).

Field	Variable	Value	Description
0	ID	W	Record identification (Column 1).
1	DD	+	The flow duration of this time step in days or fractions of days.
2			Leave Blank.

A3.8 X Record - Alternate Format for Duration Data (optional)

The X record may be used in place of the W record to define the time steps. The purpose, however, is to subdivide the time step prescribed by the W record into shorter time steps. This need arises when unstable computation steps are not detected until after the hydrologic data has been assembled using the traditional W record approach. The X record allows the computation time interval to be shortened without requiring additional time step data sets (Q, Q, W record sets) to be inserted into the hydrologic data. To use this capability, replace the W record of the unstable time step with an X record coded in one of the following two ways.

Coding Option #1

Field	Variable	Value	Description
0	ID	X	Record identification (Column 1).
1			Leave blank.
2	DT	+	Time Increment in days. Must be less than the total duration of the original time step (from W record).
3	DD	+	The Total Duration of the original time step. This is the value previously coded in the W record: NINC = DD ÷ DT Where NINC is the number of computational time steps that will be executed using the flow, temperature and starting water surface data of this timestep.
4-10			Leave blank.

Coding Option #2

Field	Variable	Value	Description
0	ID	X	Record identification (Column 1).
1	TCH	+	The Total Accumulated Time in days to be reached at the completion of this composite time step. This value must be accurate and can be obtained from the output of the original data set using the W records. The total duration of this flow equals TCH minus the accumulated time at the end of the previous time step.
2	DT	+	Time Increment in days. Must be less than the total duration of the original time step. Total duration divided by DT equals the number of computational time steps that will be used.
3-10			Leave blank.

A3.9 $$END Record - Required

Last record in the data file.

Field	Variable	Value	Description
0	ID	$$END	Record identification (Columns 1 through 5).