

Chapter 5

Drainage Map and Bridge Hydraulic Recommendation Sheet

5.1	Drainage Map.....	5-1
5.1.1	Plan Portion	5-2
5.1.2	Profile Portion	5-3
5.1.3	Flood Data Summary Box	5-4
5.1.4	Interchange Drainage Map	5-4
5.2	Bridge Hydraulic Recommendation Sheet	5-5
5.2.1	Required Information on BHRS.....	5-5
5.2.1.1	Plan View	5-6
5.2.1.2	Profile View	5-6
5.2.1.3	Location Map and Drainage Area	5-7
5.2.1.4	Existing Structures Data, Hydraulic Design Data and Hydraulic Recommendations	5-7
Exhibits		
Exhibit 5-1	Drainage Map Notes	5-9

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Chapter 5

Drainage Map and Bridge Hydraulic Recommendation Sheet

5.1 Drainage Map

When a drainage map is required (see FDOT *Drainage Manual, Topic No. 625-040-002*) it shall be prepared and included in the project file. Inclusion of a drainage map in the contract plans set is optional at the district's discretion.

Preformatted drainage map sheet cells are located in the FDOT Engineering/CADD Systems Software. The upper (grid) portion of each sheet is used for plotting the project profile, which is optional at the discretion of the district. The standard grid pattern for the profile portion of the sheet is five lines per inch, both in the horizontal and vertical. This will accommodate most scales. An optional grid with four lines per inch is available. This sheet may be used if approved by the district.

Topography of the project area shall be located in the remaining portion of the sheet. Aerial photography may be used to develop a drainage map but must not be used in the contract plans set.

The horizontal and vertical scales of the profile should be such that the stations and elevations can be read directly from the grid without the use of a scale. The horizontal scale must be the same for both the plan and profile views. Recommended scales for facility types are as follows:

<u>Type of Facility</u>	<u>Horizontal Scale</u>	<u>Vertical Scale</u>
Interstate Urban	1" = 500'	1" = 5'/1"=10'
Interstate & Other Rural	1"=1000'/2000'	1" = 10'/1"=20'
Municipal & Other	1"=200'/500'	1"= 5'/1" =10'

5.1.1 Plan Portion

The plan portion shall comply with the following requirements:

1. Stationing shall be shown every 500 feet for scales of 1" = 100'/200', every 1000 feet for a scale of 1" = 500' and every 5000 feet for scales of 1" = 1000'/2000'. For additional information see **Figure 10.1** in **Chapter 10** of this volume.

Station equations and exceptions shall be shown. Begin and end stations of project, construction, bridge and bridge culverts shall also be shown.

2. Existing physical land features affecting drainage, such as lakes, streams and swamps, shall be clearly labeled by name and direction of flow. Past high water elevations and date of occurrence, if available, and present water elevations along with the dates the readings were taken shall be shown.

Drainage divides and other information (such as pop-off elevations and spot elevations) shall be shown, where applicable, to indicate the overland flow of water. Drainage areas on maps shall be shown in acres.

Inserts shall be used to show areas that are of such magnitude that the boundaries cannot be plotted at the selected scale.

3. Existing road numbers and street names, drainage structures with type, size, flow line elevations, flow arrows and any other pertinent data shall be shown. Refer to the FDOT Engineering/CADD Systems Software and the **Design Standards, Index No. 002** for correct symbols for existing drainage facilities. In a situation of limited space, all data relating to existing drainage structures and pipes may be compiled in a table format and shown in either the plan or profile portion of the sheet. Should the space limitations be such that a table will not fit within the plan or profile view, a supplemental drainage data sheet is acceptable.
4. Proposed drainage structures, pipes, outfall structures and retention/detention pond locations, shall be shown. Structures and pipes shall be noted by structure number, and ponds by pond number. Arrows shall be shown to indicate direction of flow along proposed ditches.
5. Section, Township, Range and county lines shall be indicated for rural and urban projects when occurring within the project limits.
6. A north arrow and scale shall be shown, preferably in the upper right corner of the plan view.
7. If the drainage map is to be included in the contract plans set, include Note No. 1 (see **Exhibit 5-1**).

5.1.2 Profile Portion

The profile portion, if shown, shall comply with the following requirements:

1. The recommended vertical scale for rural and urban projects is 1" = 5' in level terrain and 1" = 10' in rolling terrain. A scale of 1" = 20' may sometimes be used for rural projects through rough terrain to avoid numerous profile breaks. The profile can be broken for rolling terrain in urban areas. However, a scale of 1" = 20' should never be used at locations of proposed storm sewer systems.
2. Elevation datum shall be shown at each side of the sheet. In cases where the profile block is insufficient and excess space is available on the plan portion of the sheet, the profile block may be expanded.
3. The profile of the existing natural ground shall be plotted and labeled and the existing elevation noted at each end.
4. The proposed profile grade line shall be plotted. Percent of grade need not be shown. The PC, PI, and PT of vertical curves shall be plotted using their respective standard symbols; however, no data (station, elevation, length of curve) needs be noted. Begin and end project, bridge and bridge culvert stations, station equations and exceptions shall be flagged. Profile grade line elevations shall be shown at begin and end project stations and at the beginning and end of each additional drainage sheet.
5. Proposed cross drains shall be plotted and identified by structure number. Do not show skew or pipe slope in plotting, but plot to elevation and location at point of crossing the construction centerline.
6. For projects with storm sewer systems, only the mainline structure and pipes shall be shown. Laterals need not be shown. Each structure shall be flagged with its appropriate structure number, and flow line elevations noted for the incoming and outgoing pipes.
7. All high water elevations affecting base clearance or roadway grades shall be shown.

5.1.3 Flood Data Summary Box

The flood data shall be shown on the drainage map, either in the plan or in the profile portion. If the drainage map is not included in the plans the flood data shall be shown on the summary of quantities sheet or on the first plan-profile sheet.

Design, base and overtopping or greatest flood discharge and stage values are required for all cross structures (culverts and bridges), regardless of size, under the following conditions:

1. All new cross structures
2. All cross structures that are being modified (extended, new end section, replaced, etc.)
3. All cross structures that have a history of flooding or other hydraulic problems, even if the structure is not to be modified; or
4. Cross structures that are not being modified but are being impacted by the modification of another cross structure within the same drainage basin.

A "disclaimer" and definitions are required to avoid misuse and possible responsibility for changes in the flood information values over which the FDOT has no control (see **Exhibit 5-1**). A preformatted summary box with disclaimer and definitions is located in the FDOT Engineering/CADD Systems Software.

The project drainage engineer shall provide the information required to complete the box.

5.1.4 Interchange Drainage Map

If projects include interchanges or rest areas, a drainage map on a 1" = 200' or 1" = 500' scale shall be included. The purpose of this detail is to show the small areas needed to calculate pipe sizes for the tabulation of drainage structures within these special areas. Should major drains pass through one of these areas, a cross reference note should indicate the proper sheet which reflects the drainage area for that through-structure.

5.2 Bridge Hydraulic Recommendation Sheet

When a Bridge Hydraulic Recommendation Sheet (BHRS) is required (see FDOT *Drainage Manual, Topic No. 625-040-002*), it shall be prepared on a preformatted sheet. The cell for this sheet is located in the FDOT Engineering/CADD Systems Software.

The inclusion of this sheet in the plans set is optional at the discretion of the district. When included in the plans, the BHRS shall be placed in the structures plans. If the BHRS is not included in the plans, sufficient details to show the location and extent of bottom and slope protection shall be contained in the plans.

Parallel (dual) bridges may be shown on one sheet, although a second sheet should be used, if necessary, to clearly convey the fit of the bridge to the stream bank. When two sheets are used, only the plan and profile information needs to be furnished on the second sheet.

A completed Bridge Hydraulic Recommendation Sheet is shown as *Exhibit BHD-1*.

5.2.1 Required Information on BHRS

The preformatted BHRS is divided into the four regions listed below. The required information for each region is described in the following sections.

1. Plan View
2. Profile View
3. Location Map and Drainage Area
4. Existing Structures, Hydraulic Design Data and Hydraulic Recommendations

5.2.1.1 Plan View

1. Stationing, scale, and north arrow.
2. Existing topography (i.e., Including existing bridge) and contours (i.e., show elevations). Sufficient detail shall be shown in the vicinity of the proposed bridge to depict how the structure will tie to natural ground.
3. Label the name of the water body (i.e., St. Johns River).
4. Arrows showing the direction of the flow.
5. Proposed bridge begin and end station.
6. Limits of riprap.

5.2.1.2 Profile View

1. Stationing and scale.
2. One cross section which most represents the section at the proposed crossing.
3. Road profile for the proposed structure (i.e., stationing and elevation).
4. Proposed bridge with low member, and pier locations (when practical).
5. Abutment locations (i.e., toe of slope).
6. Flood elevations. For non-tidal crossings, the Normal High Water (NHW) and Design Flood elevations shall be shown. For tidal crossings, the Mean High Water (MHW) and Design Flood Stage elevations shall be shown.
7. Present water elevation with month, day and year of survey.
8. Bridge Number. The bridge number should be for the new (proposed) structure.

5.2.1.3 Location Map and Drainage Area

1. A north arrow.
2. The range and township.
3. An arrow showing the project location.
4. A location map similar to that used on the key sheet for most projects. The map shall be of a scale so that the entire drainage area for the proposed structure is shown. (For projects with very large drainage areas, the map shall be of a scale that clearly shows the project location rather than a scale that shows the entire drainage area).

The drainage area boundaries shall be shown using a very heavy, broken line, with the area (in acres or square miles) shown within the boundary. The proposed structure location should be shown. Existing structures over the same water body and those structures that affect the hydraulics of the proposed structure should be located and numbered and corresponding existing structure information listed in the appropriate columns.

5.2.1.4 Existing Structures Data, Hydraulic Design Data and Hydraulic Recommendations

The *Cross Drain Handbook* provides guidance for filling out this section. Updated guidance will soon be found in the new *BHR Handbook* (which was not available at the time of this publication but should be online mid 2006).

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Exhibit 5-1 Drainage Map Notes

Below are standard notes which shall be placed on the drainage map as applicable.

1. (To be placed on the drainage map when it is to be included in the plans):
DO NOT USE THE INFORMATION ON THIS SHEET FOR CONSTRUCTION PURPOSES. This sheet is in the plans for documentation and to assist construction personnel with drainage concerns.
2. (To be placed under Flood Data Box):
Note: The hydraulic data is shown for informational purposes only, to indicate the flood discharges and water surface elevations which may be anticipated in any given year. This data was generated using highly variable factors determined by a study of the watershed. Many judgments and assumptions are required to establish these factors. The resultant hydraulic data is sensitive to changes, particularly of antecedent conditions, urbanization, channelization and land use. Users of this data are cautioned against the assumption of precision which can not be attained. Discharges are in cubic feet per second (cfs) and stages are in feet, NGVD, 1929 or NAVD 88, as appropriate.

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