return to the main channel. Meandering channels close to and approximately parallel to the project centerline should be located carefully and cross-sectioned.

Across flood plains where the proposed project follows an existing fill, cross-sections should extend far enough to provide a record of natural ground profiles right and left of the project. Any washouts or significant swales, side wadiis, sloughs or ditch outlets should be noted clearly in the topography.

Recommendations for significant realignment or improvement of an existing channel often will come as part of the structure design, making it necessary to survey a designated location. For this reason, specific channel location surveys should not be made during the initial location survey unless the need for and logical location of such changes are apparent.

Required data on existing roadway and railroad structures upstream and downstream should be identified by the drainage engineer so it can be included in the survey. For fills and structures in reasonable proximity to the project, a profile of the existing roadway showing structure openings should be established relative to the project data. For structures farther removed, it is often adequate to include only a profile and high water information. The information should include observations on scour, washouts, or other pertinent hydraulic factors. Where scour is significant, cross-sections should be taken to determine the depth and extent.

Appropriate flood elevation data should be obtained for bridges. If reliable data is not available, that fact should be noted by the field party. The extreme high water, its location, and the approximate date of its occurrence should be recorded, if available. Other elevation high water that can be dated should also be recorded when practical. If possible, a "normal" high water elevation, or one which can be expected to recur about every 2 to 3 years, should be determined. A normal elevation that would be expected to prevail through seasons of average rainfall should be recorded.

Field surveys at existing bridges should include three profiles: the first on the survey centerline, the second approximately 10 meters right of the survey centerline, and the third approximately 10 meters left of the survey centerline. The purpose of the second and third profiles is to provide data at the edge of the bridge. The centerline profile should show the roadway grades and the ground line under the bridge. Cross-sections should be taken across the bridge area to furnish elevations for plotting the face of the slopes and for accurate plotting of low water channels. All profiles should include points indicating the top of the low water banks (the edges of the low water channel), water level at the date of the survey, and the profile of the stream bed along the survey lines. Where new lanes for the roadway are to be located at bridges from a survey along the old roadway using cross-sections for approximate elevations, it is necessary that the three profiles be run along each side of the new roadway, furnishing complete channel limits and elevations on each profile. These surveys should include corrected stationing referenced to the road survey, showing station and elevation equalities if necessary. At expressways, where a single profile is run along the centerline of the median for the roadway survey, the three profiles and cross-sections should be performed for each lane at all bridges.

5. Documentation: Documentation involves the compilation and presentation of all pertinent watershed data collected for the project. It should include (but is not limited to) basic items such as drainage area and other maps, field survey information, published data references, photographs, and narratives from witnesses of historic floods. This data should be maintained in the permanent records. The orderly compilation and presentation of watershed data will expedite the design, review, and evaluation phases of a drainage project

311.03 STORM WATER HYDROLOGY

To convert precipitation to stormwater runoff, hydrologic calculations are generally used to quantify the abstractions (precipitation losses) which occur as part of the hydrologic cycle. Virtually all drainage and flood plain calculations only consider infiltration, interception, and