

streamflow, flow histories, etc; however, a thorough search for soils investigation records and existing utility/drainage systems should be made from as-builts of other projects in the vicinity. Old newspaper records may also be a source of timing and pictures of past flooding events.

C. Drainage Areas: If there is sufficient topographic information for a project site from readily available sources (aerial mapping), a field determination of drainage area may not be necessary, but spot-checking selected control elevations is always advised. For those project sites for which detailed information is not available, field survey work or aerial photo mapping should be performed. In all cases, a site visit by the designer is mandatory to confirm drainage area conditions.

Drainage areas shall be outlined on the drainage map (preferably on a contoured photo base map). Drainage area boundaries should connect with the job centerline, typically at high points in grade or at other locations where there is a definite division in the direction of storm runoff flow. After the overall areas are plotted, the drainage area should be sub-divided to show how the various sections contribute to the structures in the proposed drainage or storm drain system.

All drainage area boundaries should be followed from project centerline around the area being covered and closed again to the roadway centerline. Ridges that do not establish an area draining to the project should not be shown unless pertinent to determination of runoff concentration points or flow path segments. Exceptions to the rule for closing all drainage area boundaries to centerline are to be indicated clearly on the map by notation. These notations should show location and elevation of breakover or diversion to or from the drainage area.

Typically, a drainage area should close to each existing culvert along the project, for each probable cross drain location to each inlet for piped system, and protected overland flow entrances to channels. As an exception, where two or more structures operate conjunctively to drain a single area, flow distribution information should be noted.

For urban type construction surveys, appropriate city maps or specially prepared maps should be marked to show the boundaries of total areas contributing to the project. Streets or other drainage facilities in these areas should be marked with flow arrows. In many instances, elevations may have to be determined to accurately delineate direction of flow in gutters or side of road channels.

All areas contributing to existing storm drains which drain to or across the project should be shown. In very flat terrain, it is often necessary to develop profiles for cross streets and parallel streets to make a definite determination of drainage areas.

Specially flown aerial photography should be obtained for most construction projects. Elevation contours and ridge lines usually can be indicated on the photographs utilizing digitized cartography combined with ground based control surveys. When photographs are used, the field survey party should verify questionable points and supplement the information with structure sizes, elevations, and elevations as required. Drainage areas can also be determined by stereo interpretation of stereo paired photographs with spot field survey work as appropriate (usually sufficient for smaller areas).

D. Drainage Maps: For roadway projects, the drainage maps should be prepared on pre-formatted sheets that use a cross section grid printed across the lower portion for plotting the project profile. The profile is plotted to some convenient scale according to need. For projects involving interchanges, rest areas, urban streets and the like, a supplemental drainage map that shows only the plan portion on a sheet without a profile grid is required. The supplemental map is provided to show the small areas needed to calculate pipe sizes for the tabulation of drainage structures within these special areas.

The following data should be provided on the plan portion of the map:

1. Physical land features affecting drainage, such as elevation contours, land use, vegetation cover, streams, wadis, reservoirs and tidal areas, together with past high water