VI. PRELIMINARY ENGINEERING INVESTIGATIONS

This section represents the results of an initial site visit, site hydrology and pavement design recommendations.

Introduction

Preliminary engineering investigations were undertaken as part of the scope of this master plan in an effort to gain a clearer insight into the potential design problems which may be encountered in the final engineering phases of the proposed development, and as a means to provide a close estimate of projected costs to be reflected in the Capital Improvements Plan.

Presented in the following paragraphs are the results of these investigations, which will provide the preliminary design criteria for future engineering work on the proposed airport improvements.

It should be stressed that the scope of the investigation for this master plan is not intended as adequate for final design of the proposed facilities. More detailed studies should be undertaken as part of the final design effort for each phase of construction.

Construction Materials Availability

The construction materials required for satisfactory construction of airside and landside pavement improvements are scarce in the local area. Small deposits of limestone, sand and gravel aggregates and basalt deposits are evident in the vicinity of the airport. Fine sand which may be satisfactory for production of soil cement exists within the local area.

Recent construction of similar improvements at the Window Rock Airport have utilized base course and asphalt pavement mineral aggregates from stockpiles at Yah-Tah-Hey, New Mexico; filler sand and aggregates from Albuquerque, New Mexico; lime from Tucson, Arizona; Portland cement concrete from Gallup, New Mexico; and bituminous materials for pavement production from Albuquerque, New Mexico and Phoenix, Arizona refineries.

Haul distances for suitable materials, especially for relatively small construction projects, can increase the cost of materials dramatically. For this reason, alternate pavement designs should be carefully considered and evaluated for their relative economic feasibility during the design of any planned improvements.

Pavement Design Recommendations

Soil in this area has not been evaluated, but there appear to be silty sands and gravels which would produce a conservative California Bearing Ratio (CBR) value of 5. Using Figure 5.2 "Design Curves for Flexible Pavements - Light Aircraft" in FAA (1978) AC 150/5320-6C, "Airport Pavement Design and Evaluation," the pavement thickness for 12,500 pound aircraft is 13 inches and for 30,000 pound aircraft is 17 inches. The figure also notes that the minimum surface course thickness is 2 inches. Using the Equivalency Factor shown in Table 3-2 of AC 150/5320-6C, a 1-inch base course equals 1.4 inches of subbase and 1-inch of asphalt equals 2-inches of subbase.

Chinle Clay will Swell! This Pavement Design INAPPROPRIATE

Site Hydrology

The purpose of airport drainage is to identify and conceptually dispose of storm water which may hinder activities necessary for the safe and efficient operation of the airport facilities. The drainage system should be designed to collect and dispose of surface storm runoff from the airport property, remove excess underground moisture accumulations and protect all airport improvements from the selected design storm.

An inadequately designed airport drainage system can cause or contribute to serious hazards to aircraft operations. The most dangerous consequences of an inadequate drainage system are saturation of subgrades and base courses, slope and pavement damage caused by erosion, and excessive ponding of storm water. Any and all of these consequences result in the loss of major capital improvements investment and maintenance dollars. Thus, careful consideration must be given to construction of adequate drainage facilities, consistent with the planned airport improvements.

Site Description. The proposed airport is located on the Navajo Indian Reservation as previously mentioned. The preliminary layout is located on a ridge line. The airport does not intersect any main water courses of watershed A, B or C (Figure 6.0). The Nazlini Wash flows downstream to the north and runs adjacent to the east side of the runway. There is a no-name wash that flows north which also runs adjacent to the runway on the west side.

Methodology. For the purposes of this Master Plan, a preliminary study of the watershed areas was undertaken to estimate the potential levels of storm runoff under existing conditions which will be considered in design of the planned improvements. This was accomplished by characterizing the existing drainage area, drainage patterns and key runoff concentration points (cp) in the vicinity of the site.

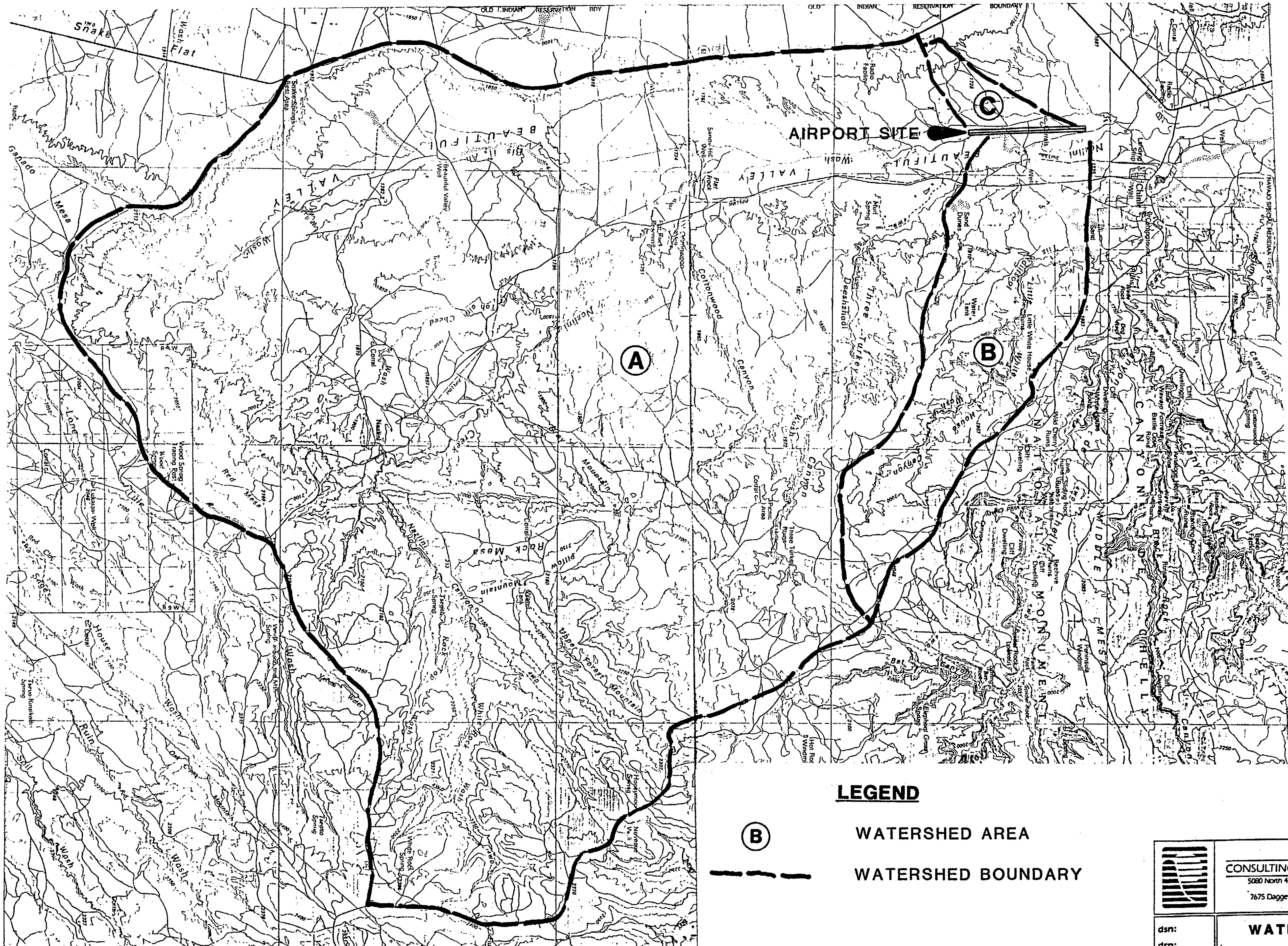

Figure 6.0

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The peak flows were estimated at specific cp's around the site with the United States Corps Of Engineers (COE), HEC-1, Flood Hydrograph package using the Soil Conservation Service (SCS) unit hydrograph option. The following data for estimating peak flows was used: (1) SCS Hydrologic Soil Group and curve number; (2) estimated 1990-year return period rainfall; (3) watershed areas estimated from USGS maps; and (4) watershed lag time.

A 100-year, 24-hour rainfall was estimated as input to the HEC-1 computer program. This rainfall of 2.8 inches was utilized in determining the 100-year flood levels. Rainfall data was obtained from the highway drainage manual in Arizona (ADOT 1969) (Appendix B). The SCS Type II rainfall distribution was utilized in the HEC-1 computer model.

Runoff characteristics for the drainage areas were based on Hydrologic Soil Group C and a vegetative cover of desert brush with an assumed density of 15 percent. Soil data was obtained from the SCS (ADOT 1969) (Appendix B). A curve number of 89 for type C soil was obtained from Figure 2-3 of the above reference.

The time of concentration (Tc) for each watershed was estimated using the following formula.

$$Tc = \frac{L \quad 1.15}{7700\ H.38}$$

where:

L = length of drainage area-feet
H = elevation-feet
Tc = time of concentration-hours

The watershed lag time was estimated as 60 percent of the time of concentrations. Computations are given in Appendix B.

The offsite drainage areas were based on the Canyon de Chelly, Arizona and Ganado, Arizona 30 x 60 minute quadrangle showings.

Peak Discharge Estimates. Potential peak discharge was estimated for watersheds, A, B, and C, in the vicinity of the proposed Chinle Airport (see Figure 6.0). Peak discharge estimates represent flow at the identified concentration points.

Watershed A is approximately 248 square miles (sq. mi.). Concentration point (CP-1) is on the southeast sided of the proposed runway located in the Nazlini Wash.

The 100-year discharge at CP-1 was estimated to equal 31,994 cubic feet per second (cfs). Watershed B is approximately 27.41 sq.mi. and drains into the Nazlini wash at CP-2 (see Figure 6.0). The combined 100-year peak discharge of watershed A & B at CP-2 is

34,280 cfs. Watershed C is 2.91 sq. mi. The potential 100-year peak discharge was estimated to equal 1,391 cfs. at CP-3.

The 1 to 100,000 topographic maps indicate existing washes in the vicinity of the proposed airport are shallow with poorly defined flow patterns. This means that the flow depths and limits of inundation in washes on the east and west sides of the proposed airport can be estimated with only limited confidence. Detailed topography will have to be obtained if estimates of limit of inundation with acceptable levels of confidences are to be made. It is recommended that the proposed runway be set above the estimated 100-year flow elevation.

Preliminary 100-Year Flow Depths. Nazlini Wash was cross-sectioned at Section A-A and B-B downstream CP-1 for estimating the conveyance of the 100-year storm. Also cross-sections C-C and D-D are located downstream CP-2 through the Nazlini Wash. On the west side of the airport runway the closest adjacent wash cross-sections are shown on Figure 6.1. The cross-sections were analyzed by utilizing Mannings equation:

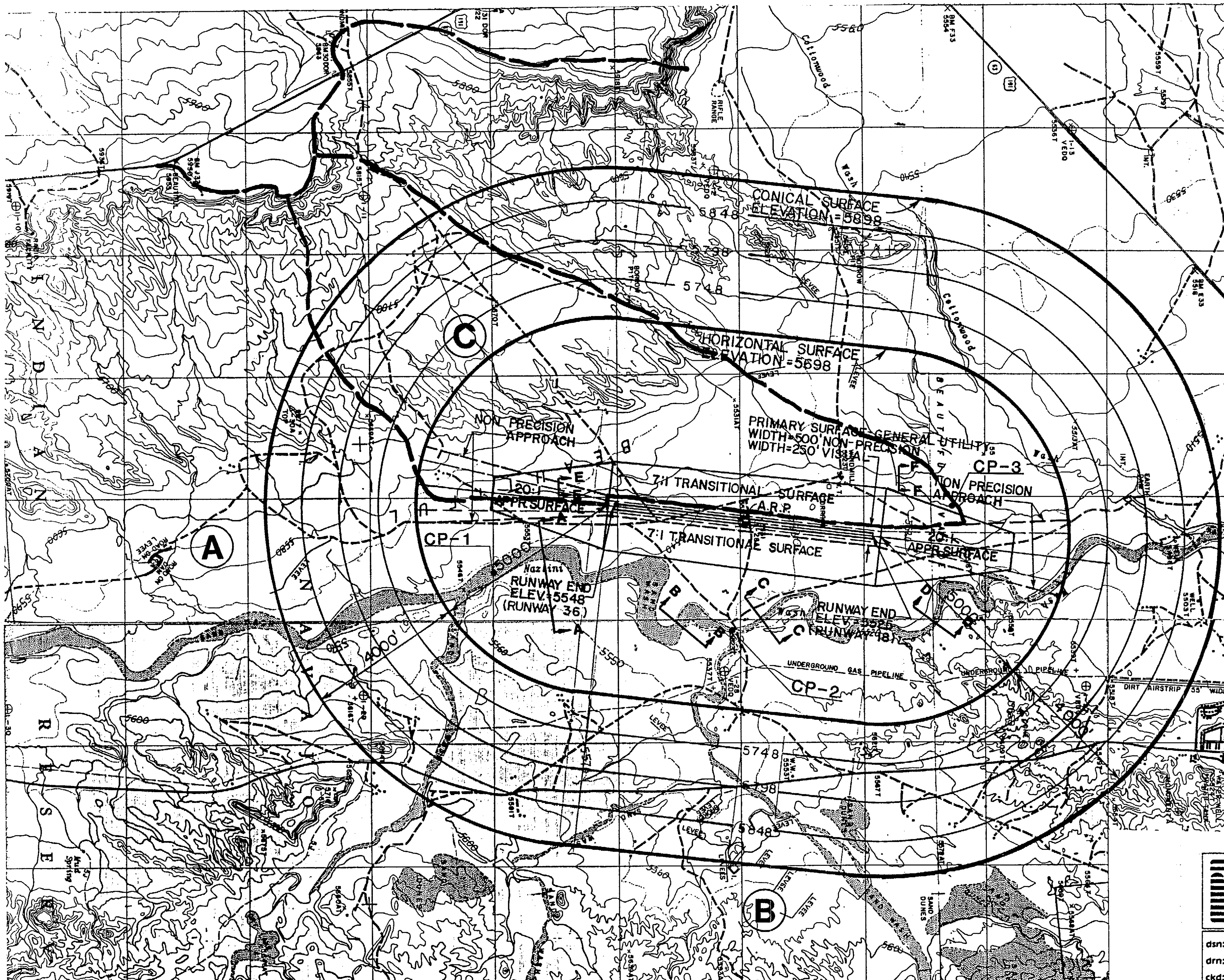
$$Q = \frac{1.486}{H} \quad A \quad R^{2/3} \quad S^{1/2}$$

where:

n = roughness coefficient = .030
A = cross-sectional area-feet squared
R = hydraulic radius = area/wetted perimeter
S = existing channel slope feet/feet

The supporting hydraulic calculations are listed in Appendix B.

Future flows and hydraulic character for the Chinle Airport surrounding area are not expected to change rapidly due to slow growth. The proposed airport location is estimated to be above the 100-year flood depths, based on bottom elevation of the referenced cross-sections. The on-site flows will drain to the existing washes. In the final analysis and/ or design A detailed cross-section should be utilized.



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N.T.S.

Figure 6.1

LEGEND

(C)	WATERSHED AREA
CP	CONCENTRATION POINT
— — —	WATERSHED BOUNDARY

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