EXECUTIVE SUMMARY

AND POLICY RECOMMENDATIONS

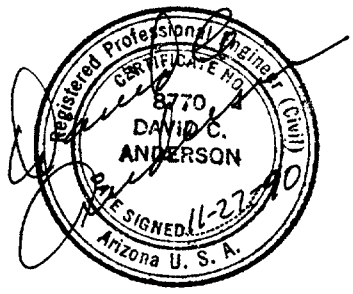
FOR THE

SOUTHWEST BASIN MANAGEMENT STUDY

BASIN INVENTORY/DRAINAGE REPORT

PREPARED FOR PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

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July 1990

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INTRODUCTION

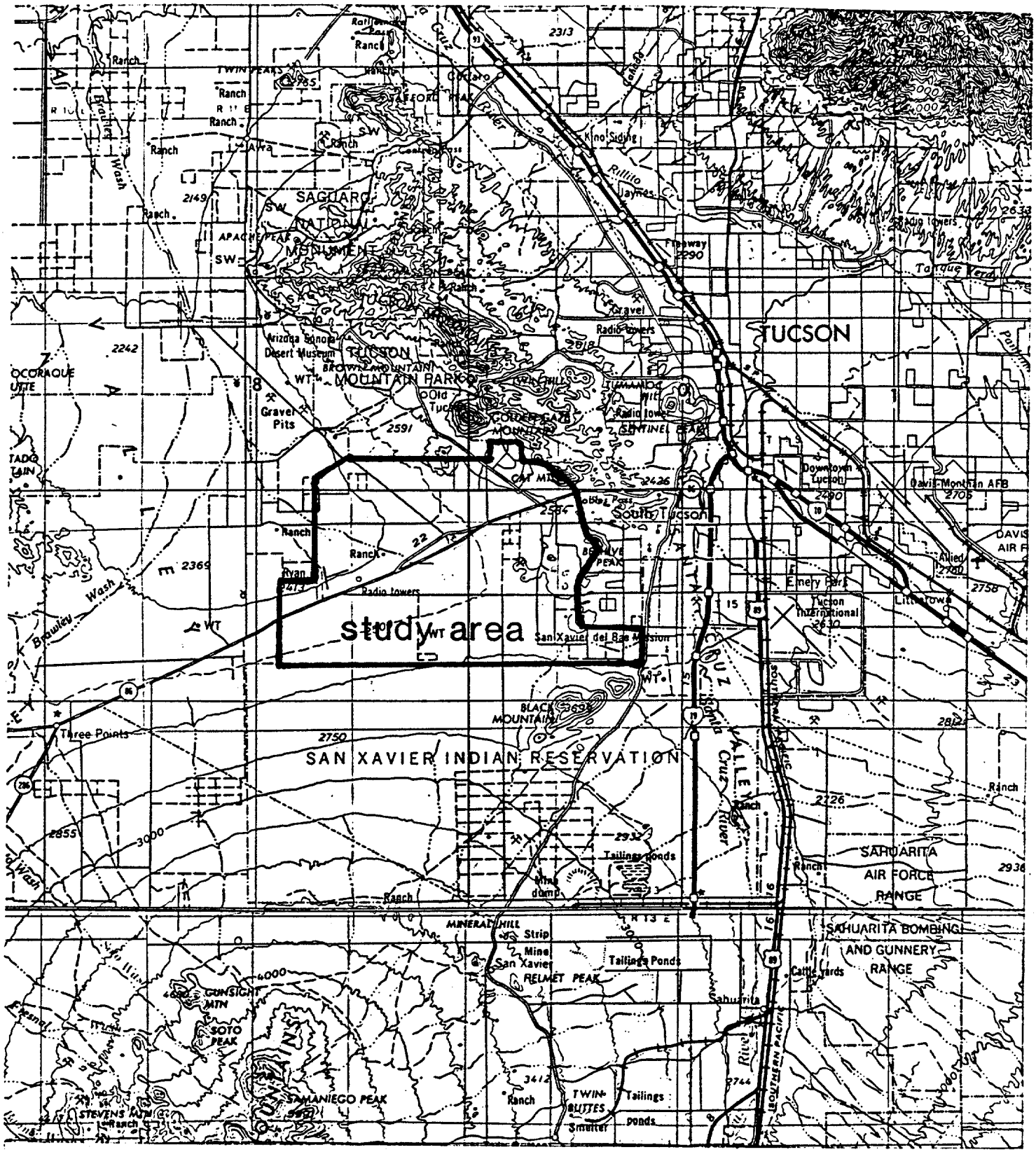
The purpose of this document is to provide an executive summary of the Southwest Basin Management Study as prepared by Anderson, Passarelli & Associates (APA) for the Pima County Flood Control District (PCFCD).

The purpose of the Southwest Basin Management Study (SWBMS) is to determine long range planning and land use policies for flood control and floodplain management in the southwest area. The scope of this project is to catalog existing basin conditions to determine feasible flood control projects for future allocation of funds and procurement of right-of-way, and to identify reasonable floodplain management policies for immediate use.

As per Task 3A of the scope of work for Phase I of the SWBMS, a basin inventory/drainage catalog of existing basin conditions determined from data collection and assimilation, field reconnaissance and qualitative and quantitative hydrologic and hydraulic analyses was performed. The Task 3A report also provides a detailed discussion (Section 6) of the relative advantages and disadvantages of different flood control approaches used within the study area and describes areas warranting further study.

The Southwest Basin Management Study Area (SWBMSA) is bounded on the north by Tucson Mountain Park, on the south by the San Xavier Indian Reservation, on the west by Postvale Road and on the east by the drainage divide between the Santa Cruz River and Black Wash. The location of the study area is shown on Figure 1. Black Wash is the major natural hydrologic feature in this area and traverses the

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study area
TUCSON
SAN XAVIER INDIAN RESERVATION
SAHUARITA AIR FORCE RANGE
SAHUARITA BOMBING AND GUNNERY RANGE
SAGUARO NATIONAL MONUMENT
TUCSON MOUNTAIN PARK
Three Points
South Tucson
Davis-Monthan AFB
Tucson International
Sahuarita
Tailings Ponds
Mine dump
Mine San Xavier
Smelter
Gravel Pits
Radio towers
Ranch
Wash
River
Freeway 290
Arizona Sonora Desert Museum
Old Tucson
Downtown Tucson
Cattle yards
Strip
BLACK MOUNTAIN
MINERAL HILL
TWIN BUTTES
SAMANIEGO PEAK
GUNSIGHT MTN
SOTO PEAK
HELMET PEAK
SILVER PEAK
SENTINEL PEAK
GOLDEN GATE MOUNTAIN
OAT MTN
TWIN PEAKS
BRADFORD PEAK
APACHE PEAK
Kino Siding
Jaynes
Rillito
Tortolita
Gravel
Ryan
Brawley
Santa Cruz
Southern Pacific
Anderson Bassetti Architects
SOUTHWEST BASIN MANAGEMENT STUDY
FIGURE 1
STUDY AREA LOCATION MAP
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basin from the southeast to the northwest.

LAND USE AND FACILITIES

The study area contains a variety of existing and proposed land uses. Most of the SWBMSA remains rural, however recent trends indicate large areas being rezoned to higher densities, including manufactured home communities. All new development within the SWBMSA is subject to the limitations of the adopted Southwest Area Plan (SWAP). The intent of the SWAP is to promote the concentration of new development in the eastern portion of the plan area and mitigate existing flood hazards. The SWAP encourages maintenance of existing zoning. The SWAP does, however, provide mechanisms for rezoning as well.

Approximately 56 percent of the land within the study area is held in private ownership. Of the privately owned land, approximately half is currently zoned for rural home sites while the remainder is zoned for residential uses of varying densities, with a small percent zoned for general business. Approximately 5 percent of the study area has been rezoned as the Star Valley Specific Plan, which calls for residential development densities to 20 units per acre.

Publicly owned land within this study area is held by Pima County, the City of Tucson, the State of Arizona, the Federal Government (including the Central Arizona Project), the University of Arizona, and the Pascua Yaqui Indian tribe. The Central Arizona Project is a significant landmark within the study area. It runs from northwest to southeast as an open channel to approximately Snyder Hill, then continues underground as a buried pipe line to the San Xavier Indian Reservation.

PREVIOUS STUDIES AND DOCUMENTED PROBLEMS

As part of this study a number of reports and plans prepared as parts of previous studies were reviewed. Key studies reviewed include the Star Valley Master Drainage Plan, the Black Wash Drainage Analysis and Policy Assessment Report, the Southwest Area Plan, the Transportation and Flood Control Facility Implementation Plan for the Southwest Area and the Pima County Flood Insurance Study Hydrologic Investigation. Also reviewed were documented drainage complaints located within the study area, and on file at the Pima County Department of Transportation and Flood Control District Planning Division. The majority of the complaints regard adjacent property owners constructing unauthorized flood control measures such as berms, fences and driveways, which act to divert and redirect flow in areas of shallow sheet flooding which predominate within the study area. Additionally, roadway access through the study area was a well documented problem.

Review of the reported drainage complaints led to the preliminary identification of a number of specific problem areas, including the Branding Iron Park subdivision which is impacted by the Black Wash, Tierra Bonita Subdivision, Diablo Village Subdivision and the Millstone Manor No. 6 subdivision which is transected by the Ironwood Wash. No complaints regarding actual flooding of homes were found in the records, however this should not be taken to mean that such flooding has not occurred.

ENVIRONMENTAL CONDITIONS

The SWBMSA contains many areas with little or no development. The

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western and southwestern portions of the study area are very rural. Major extensions of riparian habitat from protected areas exist within the study area and are utilized by wildlife for a wide variety of activities including movement corridors into and out of the Tucson Mountain Park. The Tumamoca globeberry vine, which may be present in the SWBMSA, is on the Federal Endangered Species list.

FIELD RECONNAISSANCE

An extensive amount of time was spent gathering data and investigating drainage features. This time was used to determine hydrologic base data, inventory existing hydraulic structures, survey roadway dip sections, gather sediment samples, research construction projects, examine flood control improvements and evaluate problematic areas.

The primary source for severe flooding within the SWBMSA is the Black Wash. However, less severe flooding potential exists to some degree throughout the entire area. In general the drainage systems within SWBMSA consist of distributary flow patterns characterized by channels with limited relief and areas where flow splits are indicated. The severity of the flooding hazards is directly related to existing development located within these areas, where human encroachments and activity results in diversion of natural flow patterns and illegal filling, dumping and grading in floodprone areas.

A few of the more serious problem areas based on field reconnaissance include: Branding Iron Subdivision Section 10, T15S, R12E, within the 100-year Black Wash floodplain, Millstone Manor #6 Section 30, T14S, R12E (Ironwood

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Wash), Tucson Estates Mobile Home Park Section 26, T14S, R12E and Diablo Village Section 16, T15S, R12S. A more detailed and quantitative discussion of floodprone areas is provided in Section III of the Task 3A report.

The primary maintenance problems associated with the SWBMSA are due to sediment deposition at culvert and roadway dip crossings. Field investigation indicates that the vast majority of culvert crossings within the study area experience significant sediment deposition. A sediment yield analysis discussed in Section 3.2.3 of the Task 3A report provides a quantitative assessment of annual sediment yields for some of the larger watersheds within the study area.

HYDROLOGIC ANALYSIS

The Southwest Basin is a hydrologically complex area. The drainage can be generally described as consisting of three components; 1) Black Wash, 2) areas of distributary flow and broad shallow sheet flooding to the south originating in the Sierrita Mountains, and 3) areas of distributary flow and broad shallow sheet flooding to the north originating in the Tucson Mountains. The western portion of the SWBMSA, where the three components converge, is typified by an extremely braided system and is subject to extensive sheet flooding during both frequent and infrequent storm events.

Most of the runoff generated in the SWBMSA eventually collects within the Black Wash. The administrative floodway associated with the Black Wash varies in width from approximately 0.2 miles to 0.6 miles. The 1989 FEMA maps for this area indicate areas of 100-year flood hazard for almost all of the SWBSA south of Ajo Road and the CAP alignment. A comprehensive hydrologic routing for Black

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Wash was performed as part of the Task 3A report (Section 3.1.3.) using the U.S. Army Corp of Engineers HEC-1 computer model. The recommended regulatory and design discharges determined from the analysis are shown in Table 1. Concentration point locations are shown on Figure 10 of the Task 3A report.

Predictions of peak discharges for tributary watersheds were determined using the method as prescribed in the "Hydrology Manual for Engineering Design and Flood Plain Management within Pima County, Arizona," September, 1979. Strategic points of concentration were determined to be major stream confluences, drainage crossings at major transportation routes, and any point where runoff quantities were needed to map floodplains or to examine other flood hazards.

HYDRAULIC ANALYSIS

Individual culvert capacity analyses were performed for all major culvert crossings found with the study area. Individual culvert exceedance recurrence intervals for specific culvert crossings are summarized in Section 2.2.2-1 of the Task 3A report. The most severe problems are associated with the culvert crossings along Ajo Road. While exceedance recurrence intervals range from the 5-year event up to the 100-year, the culvert system along Ajo Highway is generally inadequate to pass the 100-year runoff. As a result, ponding along the south side of the Ajo Highway occurs as depicted on the FEMA maps for Black Wash.

Critical roadway dip sections in the SWBMSA were analyzed for their capacity at a depth of flow equal to one (1) foot. Critical sections were determined to be those which might limit access to existing developed property during the 100-year runoff event.

TABLE 1

SUMMARY OF RECOMMENDED
REGULATORY AND DESIGN PEAK DISCHARGES

BLACK WASH	REGULATORY	DESIGN[1]
@ Continental Road Alignment	17872	21446
@ Ajo Road	9503	11404
@ Valencia Road	3504	4205

[1] Design discharges are 20 percent greater than regulatory discharges.

The results of the analysis indicate that many of the existing dip crossings within the study area do not provide all weather access.

Improved channels within the study area were analyzed for hydraulic capacity. Channel capacity varied from 2-year to 100-year with approximately half of the 37 channel reaches analyzed having 100-year capacity.

The results of the hydraulic analysis combined with review of previous studies and information and the field reconnaissance work provided a gauge for identifying specific problem areas. Specific problem areas include:

- Branding Iron Park (Section 10, T15S, R12E)
- Millstone Manor #6 (Section 30, T14S, R12E)
- Tierra Bonita Subdivision (Section 34, T14S, R11E)
- Diablo Village (Section 16, T15S, R12E)
- Tucson Estates Mobile Home Park (Section 26, T14S, R12E)

A more detailed discussion of the problems within the above areas in contained in Section 3.2.4 of the Task 3a report.

GEOMORPHIC ANALYSIS

As a part of the geomorphic analysis, a qualitative assessment was made of historic channel behavior in the study area. Aerial photographs from 1936 and 1988 were compared to make the qualitative assessment. The evaluation focused on the extent of lateral movement resulting from natural changes occurring in

watersheds during the 52 year time frame reviewed. However, the impact of suburban development was investigated where applicable. In general, the analysis indicated no significant changes in lateral channel alignment within the past 52 years, even for those areas in which suburban development had occurred.

As a result of the qualitative evaluation of long-term lateral channel behavior discussed above, it appears that the channels within the study area have relatively stable horizontal alignments. The more critical flood hazard concerns for these channels are associated with the lack of relief of these distributary channels and the potential for flow breakout during infrequent, high magnitude events.

A sediment yield analysis was performed to predict average annual sediment yield for the larger watersheds within the SWBMSA (i.e., Q100 > 1000 cfs). Average annual sediment loads were calculated at specific points using the Universal Soil Loss Equation (USLE). In general, the results of the sediment yield analysis are consistent with the percent average rate of erosion losses indicated for the study area in Table 3.4 of the Santa Cruz-San Pedro River Basin Main Report, prepared by the U.S. Department Of Agriculture Soil Conservation Service (1977). The above report indicates an average rate of erosion in the study area of .35 to .75 acre-feet per square mile per year.

FLOODPLAIN DELINEATIONS

One of the objectives of this study was the delineation of 100-year floodplains for urbanized areas not studied by FEMA where predicted 100-year peak discharges equaled or exceeded 500 cfs. The FEMA study in the SWBMSA includes all of the area south of Ajo Road and west of San Joaquin Road (Black

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Wash floodplain). The remaining area north of Ajo Road and east of San Joaquin Road was analyzed for flooding potential based upon the aforementioned criteria.

The results of the floodplain delineations indicate that the vast majority of the channels within the SWBMSA do not have sufficient capacity to contain the 100-year peak discharge. In many cases it was not possible to determine the depth and extent of flooding with a great deal of accuracy due to undefined upstream drainage patterns. The above conditions create an extensive flood hazard area, mapped as a part of this study, which is subject to sheet flow and/or potential upstream flow breakout. The flood limits determined are delineated on Figure 17 of the Task 3A report.

QUALITATIVE ASSESSMENT OF FLOOD CONTROL ALTERNATIVES

The SWBMSA has experienced human encroachment in the form of private development and various public works improvements, such as the Snyder Hill Wastewater Treatment Facility, Ryan Air Field, the Central Arizona Project and numerous principal and secondary arterial roadways. The approach to accommodating the drainage which impacts these developments has varied from construction of concrete lined channels and large scale detention/retention basins to providing virtually nothing in the way of flood hazard protection.

Review of the drainage design approaches taken in previous development within the study area suggests that neither the "do-nothing" nor the 100-year channelization approaches have been completely successful. As the case studies reviewed during the preparation of this report represent typical conditions within the study area, consideration of alternative solutions to drainage design is

warranted.

One of the main concerns within the SWBMSA is the flood hazard potential associated with flooding along the Black Wash. As discussed in Section III of the Task 3A report, the Black Wash is a very braided drainage conveyance system. In some locations the word "wash" does not adequately describe the collection of ill-defined flow paths which form the key drainage feature in the basin. Partially within the above-described floodplain lies the Branding Iron Park mobile home subdivision, while the Snyder Hill Wastewater Treatment Facility, further downstream, is located entirely within the floodplain. Flooding and damage potential within other areas of the SWBMSA are a result of similar conditions on the smaller tributaries that emanate from the mountain fronts which form the basin.

One regional plan proposed for mitigating flood hazards within the SWBMSA is proposed in the Transportation and Flood Control Facility Implementation Plan for the Southwest Area Plan, prepared by the Pima County Department of Transportation and Flood Control District (1980). The flood control element of this plan calls for construction of a series of detention/retention facilities referred to as "stormwater detention et park" (SWETPA) facilities. The plan as described in the County report is very ambitious and grand in scale. The cost/benefit analysis as described in the report, however, is very conceptual and makes a number of assumptions regarding the level of flood control protection provided, without discussing the design level of the facilities or providing an analysis of downstream flooding for the design condition. Economic considerations aside, the above plan is somewhat dated with regard to the changing philosophy

of the county which emphasizes moving away from structural flood control improvements.

One approach to flood control which lies between the extremes of the "do-nothing" and the 100-year channelization approaches is the use of composite channel sections. These allow for limited encroachment into the floodplain and/or minor channel improvements which are limited to the low-flow portion of the channel or watercourse. Such improvements result in accommodation of flooding while maintaining the aesthetic and hydrologic/geomorphic integrity of the natural drainage system.

Another approach to flood control which may be of use in the SWBMSA is quasi-passive, high-flow detention (QPHFD). The proposed concept basically involves above-grade storage of floodwaters generated by the less frequent events (i.e., 100-year) while allowing the peaks associated with the more frequent events to pass through the storage facility such that natural downstream channel capacity is not exceeded. As envisioned under this study, detention storage would ideally be accommodated by impounding runoff behind roadway embankments which are otherwise required for transportation purposes.

Because existing development is unlikely to participate substantially toward capital improvements, and because no major new developments which could share costs with Pima County are planned within the areas of defined flooding, the opportunities for funding of projects intended primarily for flood control appear limited. Alternative approaches to flood control within the SWBMSA can therefore be seen as falling into two categories:

- individual improvement projects designed to mitigate existing and defined

hazards in specific areas, with an emphasis on meeting multi-use objectives in order to more easily justify the cost of improvements, and

- specific floodplain management policies devised to control the approach to drainage design used in future development.

Specific floodplain management policies for the SWBMSA are addressed within the sub-section of this document titled "Policy Recommendations".

RECOMMENDATIONS FOR FUTURE STUDIES

The results of the data collection, field reconnaissance, and hydrologic and hydraulic analyses performed as a part of this study revealed a number of specific areas where development has occurred in potentially floodprone areas. The paragraphs below describe the specific areas for which additional study is recommended. The reader is referred to the main report for outlines of the study needs for the individual areas as envisioned based on the results of the SWBMS.

The **Branding Iron Park** subdivision is located entirely within the 1989 FEMA 100-year floodplain and almost entirely within the administrative floodplain of the Black Wash as defined by the Black Wash Administrative Floodway and Floodplain Map. The subdivision is also affected by tributary drainage emanating from the Saginaw Hill area to the east. Review of the documented drainage complaints within Section 10, T15S, R12E where the subdivision is located revealed a high number of complaints for this area.

The Branding Iron Park is affected by flood hazards to not only residences

but to transportation facilities as well. Both of the primary arterial roadways which provide access to the subdivision, namely Valencia Road and Camino Verde, are impacted by the Black Wash. These roadways are subject to flows in excess of one foot in depth during even the more frequent events.

Future recommendations for improvements to mitigate flooding in the Branding Iron Park area should be coordinated with plans for area transportation improvements. It is specifically recommended that the Major Streets and Routes Plan be revised to show Camino Verde Blvd. as the major north-south route through this area, rather than Wade Road as currently indicated, because of the potential for integrating construction of this roadway with flood control improvements for this area.

The **Millstone Manor #6** subdivision is located in the southwest quarter of Section 30, T14 S, R12E and is located directly within the path of floodwaters emanating from the western braid of the Ironwood Wash. A number of residences are located within the 100-year floodplain of Ironwood Wash. It should be noted that a bifurcation occurs on the Ironwood Wash immediately upstream of the subdivision and it is possible that future changes in channel definition may concentrate more flow along the western braid, making conditions potentially worse.

A number of documented flooding complaints from this area have been filed regarding inadequate channel capacity, diversion of flows resulting from encroachment into the drainageway and erosion of roadways which function as drainageways.

The **Tucson Estates Mobile Home Park** is located within Section 26, T14S, R12E. The park is traversed by washes which emanate from the Tucson Mountains. The quantitative analysis performed as a part of the Task 3A report identified improved channels which convey these washes through the subdivision as having less than 100-year capacity. The floodplain analysis performed as a part of this study indicated floodplains which encompass a number of mobile homes which front along the channels. Culvert crossings as well as a number of dip crossings of local streets within the subdivision do not provide for all weather access.

The **Mission West/West Branch Santa Cruz Area** is located within Sections 19, 20 and 21 of T15S, R13E. The area is roughly bounded by Los Reales Road on the north, Settler Avenue to the west and the San Xavier Indian Reservation on the east and south. This area is impacted by flows which concentrate at the topographical saddle located between Black Mountain and the hill located to the north of Black Mountain in Section 18. Settler Avenue roughly represents the ridge line of the saddle. The flow patterns in this area are very unclear and indicate that runoff from the upstream drainage area which concentrates flow at this location could drain either to the west and into the Black Wash or to the east through the Mission West area and into the West Branch of the Santa Cruz River. Review of the channel improvements for the San Xavier Estates development indicate that the main channels conveying flow around the south and west of the subdivision have capacity to convey the 10-year discharge or less, assuming all flow concentrating at the Settler Avenue saddle is conveyed to the east toward the Mission West area. Review of aerial photography indicates that scattered development throughout this area may be subject to extensive flooding.

The **Tierra Bonita/Camino Verde** area includes the Tierra Bonita and Golden Gate subdivisions located in Section 34, T14S, R12E and Camino Verde Road from Kay Lynn Drive to Ajo Road. Review of the drainage complaint history revealed the potential for sheet flow through this area. The dip crossing analysis performed as a part of this study indicates that the crossing of Bopp Road for the main wash through the Tierra Bonita subdivision has inadequate capacity to contain the 100-year flow and that consequently flow occurs as sheet flow along Bopp Road. The Golden Gate subdivision was built prior to implementation of floodplain regulation and consequently drainage improvements through the subdivision do not meet current standards. Camino Verde Road acts as a flow conveyor downstream of the Tierra Bonita Subdivision along the reach defined above. Since this roadway is proposed for future development as a major arterial the use of the roadway as a flow conveyor may not be appropriate.

It is recommended that additional studies be performed for each of the above described areas, as outlined in detail in the Task 3a report. The listing below provides a prioritization of additional study needs within the study area based on a qualitative assessment of existing problems as described in the preceding sub-sections:

Highest Priority --	1) Branding Iron Park
	2) Millstone Manor #6
	3) Tucson Estates Subdivision
	4) Mission West/West Branch Santa Cruz Area
Lowest Priority --	5) Tierra Bonita/Camino Verde Area

Generally speaking, the prioritization shown above was based on a qualitative assessment of flood hazard potential with respect to:

- Public Safety
- Public and Private Improvements
- Transportation impacts, including all-weather access
- Future improvements and development

POLICY RECOMMENDATIONS

The policy recommendations as developed by this study are listed below. For purposes of providing functional clarity the policies have been divided into two major categories entitled General Management Policies and Specific Development/Improvement Policies. It is intended that none of the proposed policies counteract, or cause to be less restrictive, any existing regulations as promulgated in the Pima County Floodplain and Erosion Hazard Management Ordinance No. 1988-FC2 (hereafter referred to as the FMO).

General Management Policies

1) Major and Secondary Watercourse Identification: It is recommended that watercourses throughout the study area which meet the definition of Major Watercourse as defined in the FMO, Article XII (i.e., those which convey a 100-year peak flow of 2000 cfs or more) be delineated as soon as possible.

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In cases where unclear flow patterns predominate and the potential exists for receiving flows in excess of 2000 cfs by one or more watercourses during any given event, the most probable of the watercourses to receive flow should be identified as the major watercourse. Examples of Major Watercourses include the Black Wash, Ironwood Wash and San Joaquin Wash. It is also recommended that those watercourses intercepting between 1000 cfs and 2000 cfs be determined and delineated as Secondary Watercourses.

2) Major Watercourse Maintenance: It is recommended that the floodway associated with each Major Watercourse (as defined in (1) above) be maintained in its natural state. This recommendation is made because of: 1) the width of the floodway, 2) the need to maintain the hydrologic and geomorphic integrity of the natural drainage system, 3) to minimize upstream and downstream flooding and erosion hazards and, 4) to maintain sediment balance. This recommendation is also made because of the environmental, recreational and groundwater recharge value of these watercourses as documented in the Basin Inventory/Drainage Report and associated references. Exception to maintaining the floodways of Major Watercourses in their natural state would be permitted in situations where structural flood control improvements are the only viable option in remedying an existing flood hazard. An example of this would be the structural flood control improvements, as discussed in the Black Wash Drainage Analysis and Policy Assessment Report, for the Branding Iron Park

Area and the Snyder Hill Wastewater Treatment Facility. However, any impact to the natural floodway, as a consequence of structural improvement must be kept to a minimum and mitigation should be required.

3) Secondary Watercourse Maintenance: It is recommended that the floodway associated with each secondary watercourses be maintained in its natural state especially where defined stream channel geometry exists. Alterations to the natural floodway for secondary watercourses should however be kept to a minimum and offsetting compensations would be required where floodway alterations occur.

4) Critical Basin Designation: It is recommended that the entire Southwest Basin area be designated as a critical basin. The basis for this recommendation is documented in Section 6.2 of the Basin Inventory/Drainage Report. An in-lieu fee or offsite drainage improvements financed by the developer should be considered, in certain instances, as a substitute to retention/detention. This critical basin classification should be re-evaluated periodically as regional flood control facilities are constructed and/or District property acquisitions remove downstream flood hazards.

5) Sub-basin Management Plans: It is recommended that a Sub-Basin Management Plan be required for any private development or public works improvement which directly impacts an area of 40 acres or more.

6) Southwest Area Plan: The Southwest Area Plan (SWAP) provides a basic set of policies which address rezoning requirements and associated issues such as site disturbance, landscaping, and transportation, recreational and flood control needs. These policies provide a basic framework for regulating development-related impacts to drainage conditions within the southwest area and, in general, it is recommended that they be maintained as a minimum standard for development within the study area. However, the following recommendations are made with respect to the SWAP flood control policies:

- It is recommended that the requirement which reads "All development will covenant to contribute funds which will be utilized to improve drainage and all-weather access into the area" be extended to apply to SWAP planning sub-areas 3 and 6.

- It is recommended that the Administrative Floodway as established by the Black Wash Drainage Analysis and Policy Assessment Report be incorporated onto the SWAP map during the next update of the SWAP.

- It is recommended that a note be included on the SWAP indicating that " in some instances the land use and /or density specified by the SWAP may not be consistent with the hydrologic, hydraulic and geomorphic constraints impacting a specific property".

- It is recommended that the SWAP policies reflecting discharges of less than 100 cfs be changed to 100 cfs. This is necessary because the FMO does not provide regulatory authority for discharges less than 100 cfs.

- The policies within the SWAP should be consistent with the current grading ordinance.

- Channelization studies should consider both upstream and downstream impacts (not just downstream).

- Implications of planning and regulatory documents such as the Wildlife Habitats in Tucson (Shaw), The Trails Master Plan, and 404 permits should be incorporated into the SWAP during its next update.

- SWAP policies should apply to governmental projects (roads, airports, etc.) as well as private improvements. As currently written, the emphasis is directed towards the private sector, yet civil works and infrastructure can have major impacts on drainage.

Specific Development/Improvement Policies

1) Channel Improvements: It is recommended that, where feasible, all channel improvements use environmentally sensitive stabilization methods which encourage infiltration and the re-establishment of vegetation. Examples of such methods include: a) permeable erosion control blankets, b) vegetative linings, c) articulated revetment and d) rock rip-rap.

2) Onsite Detention/Retention: It is recommended that requirements for onsite detention/retention as outlined in the Stormwater Detention/Retention Manual be adhered to with the following qualifying recommendations:

- discourage onsite detention in favor of other mitigation methods such as: a) density transfer credits, b) public dedication of riparian areas, and c) contribution to downstream or upstream riparian areas.

- where implemented, require all detention/retention facilities to restrict peak outflows for the 2-, 10-and 100-year events to 90% of existing peak inflows.

- Online detention/retention of Major or Secondary Watercourses shall only be implemented as regional facilities. The design of such facilities shall require the preparation of a Sub-basin Management Study.

- Where detention and retention are both required, incorporate retention volume into detention basin capacity.

3) Roadway Design: It is recommended that all private and public roadway improvements be designed so as to be either parallel or perpendicular to natural drainage flow patterns. Design of roadways on a skew to (i.e., neither parallel nor perpendicular) natural drainage patterns shall incorporate into their design means to mitigate the potential for alteration of natural drainage patterns (e.g., diversion of flows to adjacent basins, concentration of flow in roadways, etc.) which typically result from such improvements in areas of unclear or undefined drainage patterns such as those which exist within the Southwest Basin area.

4) Design for Sedimentation: All private and public drainage improvements including channel improvements, detention/retention facilities, roadway crossings, storm drains, catch basins, etc. shall be designed to accommodate sedimentation as predicted by an analysis to be performed as a part of the improvement design. Examples of implementation of this recommendation are: a) oversizing of roadway culverts and channels, b) sedimentation storage for detention/retention facilities, and c) sedimentation basins upstream of storm drain systems. The analysis shall be done using the procedure outlined in the Stormwater Detention/Retention Manual or other method acceptable to the regulatory agency of jurisdiction.

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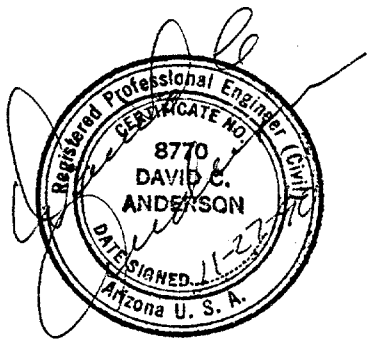
SOUTHWEST BASIN MANAGEMENT STUDY

BASIN INVENTORY/DRAINAGE REPORT

PREPARED FOR PIMA COUNTY DEPARTMENT OF TRANSPORTATION
AND FLOOD CONTROL DISTRICT

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July 1990



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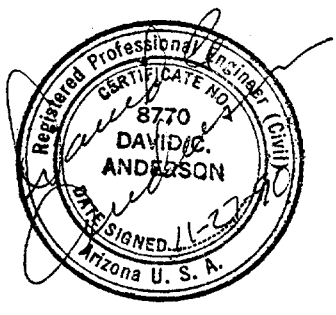
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* Appendices A through C and Appendices D through G are contained in two separate documents.

I. INTRODUCTION

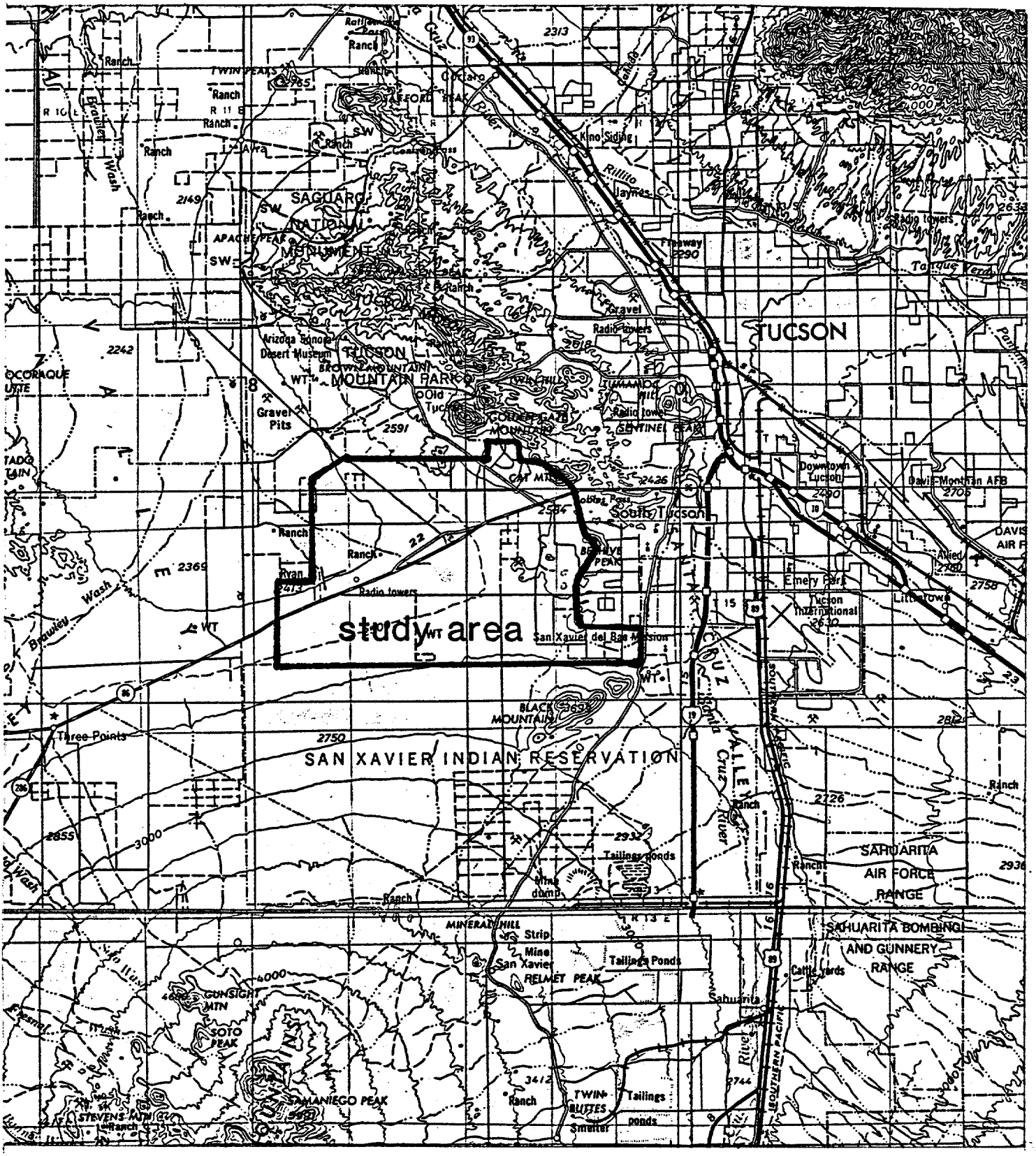
1.1 Statement of Purpose

This document represents the basin inventory/drainage report prepared as per Task 3A of the scope of work for Phase I of the Southwest Basin Management Study. This report was prepared by Anderson, Passarelli & Associates (APA) for the Pima County Flood Control District (PCFCD). The purpose of the Southwest Basin Management Study is to determine long range planning and land use policies for flood control and floodplain management in the southwest area. The scope of this project is to catalog existing basin conditions to determine feasible flood control projects for future allocation of funds and procurement of right-of-way, and to identify reasonable floodplain management policies for immediate use

The purpose of the basin inventory/drainage report is to catalog existing basin conditions determined from data collection and assimilation, field reconnaissance and qualitative and quantitative hydrologic and hydraulic analyses. The purpose of this report is also to discuss the relative advantages and disadvantages of different flood control approaches used within the study area and where applicable, to determine and describe areas requiring more detailed study.

1.2 Location and Description of Study Area

For the purpose of this study, the Southwest Basin Management Study Area (SWBMSA) is bounded on the north by Tucson Mountain Park, on the south by the San Xavier Indian Reservation, on the west by Postvale Road and on the east by the drainage divide between the Santa Cruz River and Black Wash. The location of the study area is shown on Figure 1. Black Wash is the major natural hydrologic feature in this area and traverses the Southwest Basin from the southeast to the northwest. In the southeast corner of the project area the drainage divide between the Black Wash and the West Fork of the Santa Cruz River is ill-defined. Due to this lack of definition, a small portion of the West Fork of the Santa Cruz watershed is included as part of the Southwest Basin Study Area.


study area
TUCSON
SAN XAVIER INDIAN RESERVATION
SAHUARITA AIR FORCE RANGE
SAHUARITA BOMBING AND GUNNERY RANGE
SAGUARO NATIONAL MONUMENT
TUCSON MOUNTAIN PARK
Arizona Sonora Desert Museum
Three Points
South Tucson
Downtown Tucson
Davis-Monthan AFB
Tucson International
Sahuarita
Tailings ponds
Mine dump
Gravel Pits
Radio towers
Ranch
Brawley Wash
Rillito
Julian Wash
Santa Cruz River
Interstate 10
Interstate 19
Interstate 86
Interstate 19
Freeway 2290
Kino Siding
Twin Peaks
Apache Peak
Gunsight Mtn
Soto Peak
Samaniego Peak
Stevens Mtn
Twin Buttes
Mineral Hill
San Xavier
Relmet Peak
Black Mountain
Sentinel Peak
Cat Mtn
Ryan Field
Old Tucson
Tucson Mountains
Tumamoc Hill
Golden Gate Mountain
Tanque Verde
Rillito
Gravel
Radio towers
Tailings Ponds
Cattle yards
Smelter
Strip Mine
Southern Pacific
Ocoraque Butte
Table Mtn
Ranch
Wash
Mine
Peak
Mtn
Hill
Pass
Gap
Canyon
Wash
River
Creek
Mountain
Mountains
Park
Monument
Reservation
Base
Range
Bombing
Gunnery
Pits
Ponds
Yards
Towers
Siding
Junction
Crossing
Bridge
Tunnel
Dam
Lake
Reservoir
Airport
Field
Station
Post Office
School
Church
Cemetery
Golf Course
Park
Trail
Road
Highway
Railroad
Power Line
Pipeline
Boundary
Township
Range
Section
Quadrangle
Contour
Elevation
Scale
Legend
North
South
East
West
Northeast
Northwest
Southeast
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Miles
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Feet
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Study Area Location Map
Anderson Rassieur
Southwest Basin Management Study
Figure 1
Study Area Location Map
1:50000
12-89
84145
1/1

II. DATA COLLECTION AND ASSIMILATION

2.1 Review of Available Information

2.1.1 Land Use and Facilities

The study area contains a variety of existing and proposed land uses (see Figure 2). While most of the SWBMSA remains rural, recent trends indicate large areas being rezoned to higher densities including manufactured home communities. All new development within the SWBMSA is subject to the limitations of the adopted Southwest Area Plan (SWAP). The intent of the SWAP is to promote the concentration of new development in the eastern portion of the plan and mitigate existing flood hazards. The SWAP encourages maintenance of existing zoning but does provide mechanisms for rezonings as well. Specific requirements are made for certain parcels which are particularly floodprone, such as the area along the Black Wash near Camino Verde Road (i.e., Parcel J of Planning Area 4) which limit the type and extent of future development. Table 1 shows the flood control requirements of the SWAP for each planning area. The SWAP planning areas are delineated on Figure 2.

Public use and facilities include; the Tucson Airport Authority operated Ryan Field, The Central Arizona Project (the CAP Synder Hill and Black Mountain pumping station includes regional flood control improvements) and the Pima County Waste Water

TABLE 1

SOUTHWEST AREA PLAN
FLOOD CONTROL REQUIREMENTS

PLANNING AREA	REQUIREMENTS *
# 3	(a), (d)
# 4 & 5	(a), (b), (c)
# 6	(e), (f), (g), (h)
# 7	Completion of flood control study pending.
# 8	The Southwest Area Plan designates Planning Area # 8 as a reserve area. Properties may only be developed in conformance with existing and approved zoning.

(a) Any channelization or channel improvement of a wash with a 100-year flow rate in excess of 50 cfs will require a master drainage report which examines the impact of the channelization on the downstream drainage system.

(b) Development in the West Branch of the Santa Cruz River Basin will be required to limit grading to establishment of roadways, drainageways, building pads and driveways. Grading plans will be required for any access road or driveway exceeding 100 linear feet.

(c) All development will covenant to contribute funds which will be utilized to improve drainage and all-weather access into area.

(d) The developer must submit to the Flood Control District road improvement plans for review and approval for any access road or driveway exceeding 100 linear feet.

(e) Grading will be restricted to roadways, driveways, and pad construction. Grading plans will be required for any access road or driveway exceeding 100 linear feet.

(f) Flows in excess of 20 cfs and any sheet flooding will cross all roadways, driveways and lots in a manner consistent with the predeveloped nature. Any onsite diversion of flow will be contained within a lot and will be required to exit the lot at the natural point of concentration.

(g) All drainage structures will be designed in such a manner as to reduce sedimentation in the structure, thus the design must maintain non-restricted conditions in the channels, or utilize a sediment reduction system.

(h) No channelization will be allowed within any wash with 100-year flow rate in excess of 50 cfs.

* see Southwest Area Plan for additional requirements.

Management sewage disposal ponds. A large portion (40 - 50 percent) of the area remains undeveloped exhibiting open range characteristics.

The existing zoning is approximately 46 percent RH (Rural Homesite), 26 percent GR-1 (Rural Residential), 22 percent SR (Suburban Ranch Zone), with the remainder being CR-1 (Single Residence Zone), SH (Suburban Homestead Zone), TH (Trailer Homesite Zone), TR (Transitional Zone), and CB-2 (General Business Zone). Also, as shown on Figure 2, approximately 5 percent of the study area (2.5 square miles) has been rezoned as the Star Valley Specific Plan. The Star Valley rezoning plan proposes zoning including 5 RAC (residence/acre), 8 RAC, 20 RAC and commercial uses.

2.1.1-1 Private Lands

The study area is comprised of approximately fifty square miles. About fifty-six percent of the land is held by private ownership. Most of the existing private development is low density and rural in nature. The western limit of development in the study area is marked by San Joaquin and Camino Verde Roads, except for some isolated areas (Figure 2). The area west of San Joaquin and Camino Verde Roads is largely undeveloped.

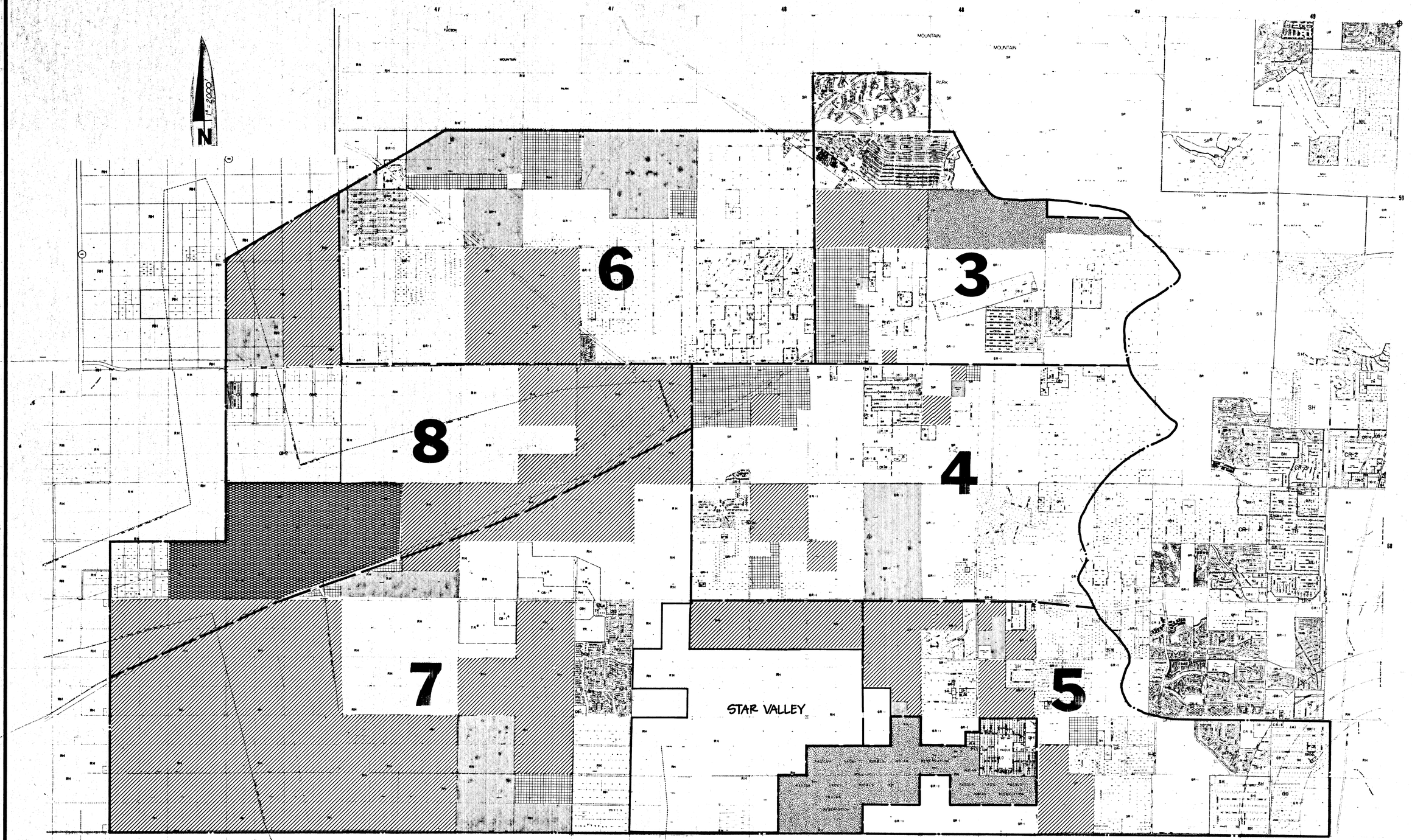
2.1.1-2 Public Lands

About forty-four percent of the southwest area is under non-private ownership. The various non-private owners include; Pima County, the City of Tucson, the State of Arizona (approximately 7000 ac), the Federal Government, the University of Arizona, the Boy Scouts of America and the Pascua Yaqui Indian tribe (see Figure 2).

Because such a large portion (approximately 22%) of the study area is owned by the State of Arizona, the Arizona State Land Department was contacted to discuss future state land use trends. It was stated by a representative of the department that the primary state land use at this time is livestock grazing and that no change in land use is projected for the foreseeable future.

2.1.1-3 Transportation and Utilities

Based upon the adopted Southwest Area Plan's projected land use and densities, substantial improvements are proposed to meet the transportation and utilities needs through the year 2000. Some proposed upgrades to the area's transportation network include; completion of unconstructed arterial highways (Irvington, Bopp, Mark/Joseph and San Joaquin Roads), reconstruction or widening for capacity improvements (Valencia, Kinney, Tucson-Ajo Highway, Camino Verde Blvd.), and paving of unpaved



LEGEND

TH-TRAILER HOMESITE ZONE
RH-RURAL HOMESITE
RH-RURAL HOMESITE ZONE
GR-1-RURAL RESIDENTIAL
SR-SURBAN RANCH ZONE
SH-SURBAN HOMESITE ZONE
CR-1-SINGLE RESIDENCE ZONE
TR-TRANSITIONAL ZONE
CB-2-GENERAL BUSINESS ZONE

LEGEND

3 SOUTHWEST AREA PLAN PLANNING AREA NUMBER

STATE LAND/U of A — FEDERAL LAND — OTHERS
PIMA COUNTY — CITY OF TUCSON — SOUTHWEST AREA PLAN PLANNING AREA

ANDERSON PASSARELLI & ASSOCIATES
ENGINEERS SURVEYORS PLANNERS

SOUTHWEST BASIN MANAGEMENT STUDY
EXISTING & PROPOSED LAND USE
FIGURE 2

DESIGN	DRAFT	CHECK	SHEET
TJP	BC	JMW	1 OF 1
SCALE 1" = 2000'	JUNE 1990	JOB NO 84145	

arterial highways (Los Reales Road). Existing and proposed major arterial roadways within the study area and associated scheduling information are shown on Figure 3.

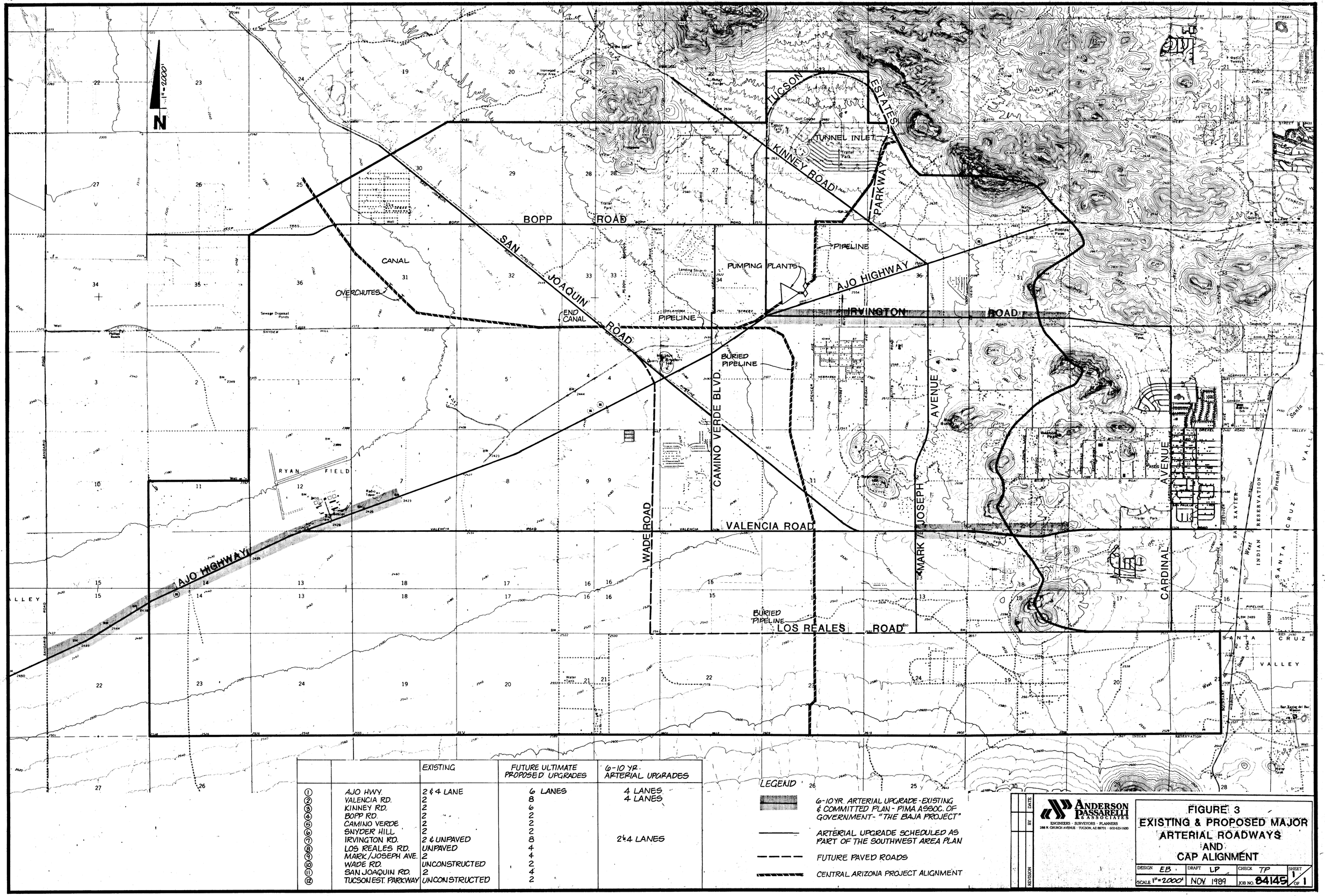
Upgrades to the area's utilities include; a new trunk/interceptor sewer system including solid waste transfer station, expansion of the water utility, new school sites and additional fire districts. Detailed locations of proposed improvements can be found in the Southwest Area Plan.

2.1.1-4 Archeological Sites

The southwest area contains numerous archaeological sites. Archaeological surveys have been conducted for approximately 16 percent of the study area (8 sq. mi.). Figure 4 was prepared based upon information obtained from the Arizona State Museum at the University of Arizona and demonstrates approximate locations of surveyed areas and known sample sites (areas where artifacts have been discovered).

2.1.1-5 Central Arizona Project

The Central Arizona Project (CAP) Reach 5 enters the SWBMSA in T14S, R12E, Section 25, approximately one-half mile west of Millstone Manor, (see Figure 3). The CAP alignment runs southeasterly to Snyder Hill Road where it turns east at the San Xavier pumping plant. The CAP is an open channel through Sections 25, 31, 32 and 36 to the San Xavier facility. The project continues east from the San Xavier plant as



		EXISTING	FUTURE ULTIMATE PROPOSED UPGRADES	6-10 YR. ARTERIAL UPGRADES
①	AJO HWY.	2 & 4 LANE	6 LANES	4 LANES
②	VALENCIA RD.	2	8	4 LANES
③	KINNEY RD.	2	6	
④	BOPP RD.	2	2	
⑤	CAMINO VERDE	2	2	
⑥	SNYDER HILL	2	2	
⑦	IRVINGTON RD.	2 & UNPAVED	8	2&4 LANES
⑧	LOS REALES RD.	UNPAVED	4	
⑨	MARK/JOSEPH AVE.	2	4	
⑩	WADE RD.	UNCONSTRUCTED	2	
⑪	SAN JOAQUIN RD.	2	4	
⑫	TUCSON EST. PARKWAY	UNCONSTRUCTED	2	

LEGEND

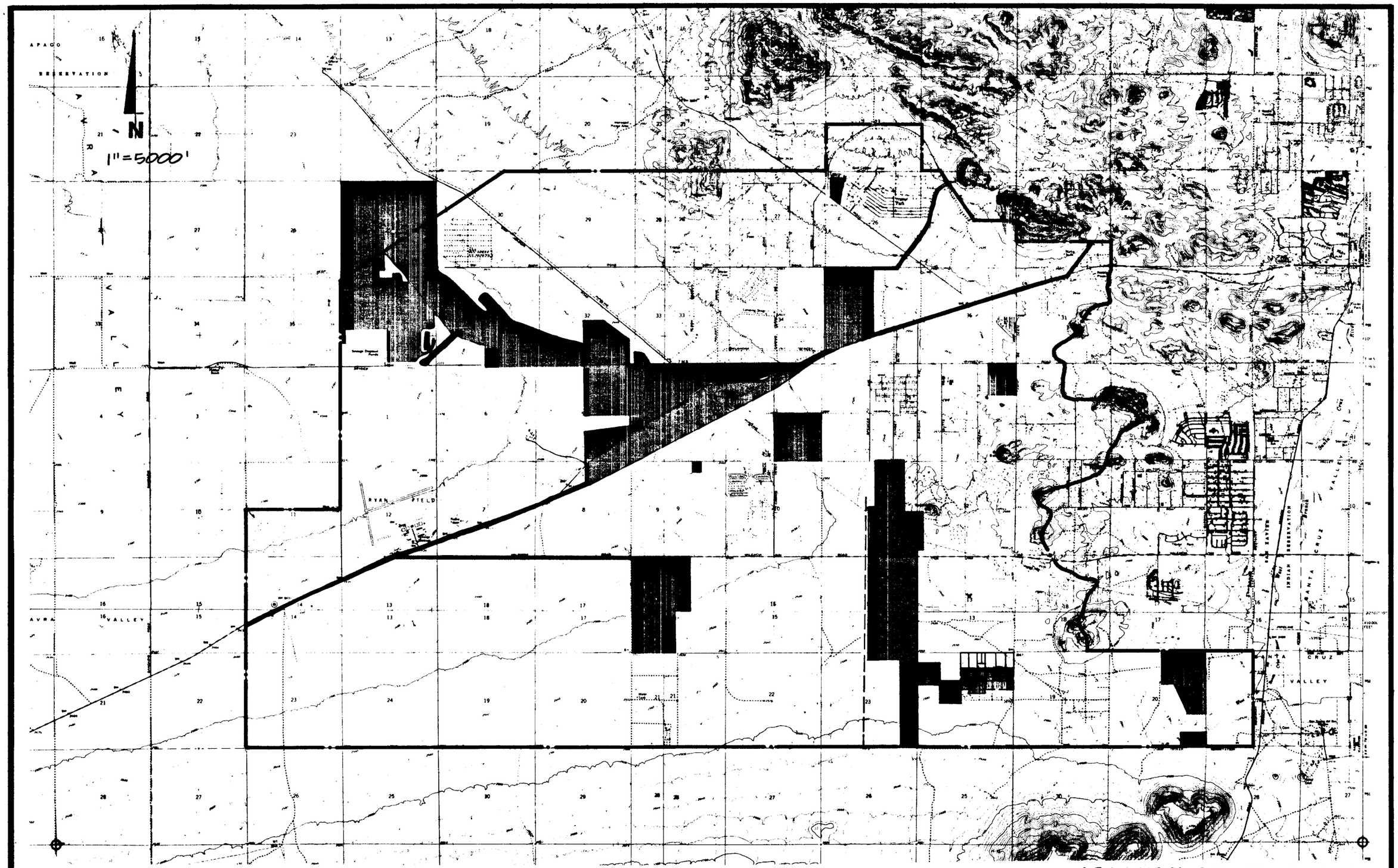
- 6-10 YR. ARTERIAL UPGRADE - EXISTING & COMMITTED PLAN - PIMA ASSOC. OF GOVERNMENT - "THE BAJA PROJECT"
- ARTERIAL UPGRADE SCHEDULED AS PART OF THE SOUTHWEST AREA PLAN
- FUTURE PAVED ROADS
- CENTRAL ARIZONA PROJECT ALIGNMENT

NO.	REVISION	BY	DATE

ANDERSON PASSARELLI ASSOCIATES
ENGINEERS · SURVEYORS · PLANNERS
288 N. CHURCH AVENUE · TUCSON, AZ 85701 · 602-623-1600

FIGURE 3
EXISTING & PROPOSED MAJOR ARTERIAL ROADWAYS AND CAP ALIGNMENT

DESIGN	DRAFT	CHECK	SHEET
EB	LP	TP	1 OF 1
SCALE 1"=2000'	NOV. 1989	JOB NO. 84145	



LEGEND

SURVEYED AREA

KNOWN SAMPLE SITE

· ARCHAEOLOGICAL SURVEY ·

FIGURE 4

FROM ARIZONA STATE MUSEUM, 1989

ANDERSON PASSARELLI & ASSOCIATES
ENGINEERS SURVEYORS PLANNERS
288 North Church Avenue Tucson Arizona 85701 602 623 1606

84145

043

a buried pipeline parallel to Snyder Hill Road until it reaches the Snyder Hill and Black Mountain Pumping Station. From here, Reach 5 continues northeast as a buried pipeline and exits the SWBMSA near the northeast corner along the Sarasota Road alignment. Reach 6 runs south from the Snyder Hill and Black Mountain Pumping Station as a buried pipeline to the Pascua Yaqui Indian Reservation.

Surface drainage will be affected where the project is above ground as open canal flow along Reach 5. Two concrete box flume overchutes have been constructed across the Reach 5 canal in T14S R12E, Section 31. Additionally, a 6'-8' earthen dike was constructed along the open channel segment to inhibit surface runoff from entering the canal. Ponding will occur on the upstream side of the dike and runoff will flow across the CAP through the two box flume overchutes into the Black Wash Floodplain.

The confinement of runoff to the two overchute crossing locations described above results in diversion of upstream runoff away from areas which previously experienced significant flows. However, the design also concentrates considerably more flow along the area immediately downstream of the overchute crossing points than existed before. Field inspection of the more southerly of the two overchutes indicates a well-defined channel downstream of the crossing in an area where aerial photography indicates no well-defined channel existed before.

B. *Structural Components*

Typical structural measures are described in the following text with associated Unit Cost:

Description	Unit Cost
Structure Relocation	$30K-$60K/structure
Structure relocation consists of physical relocation of existing structures within a flood- or erosion-hazard area as a means of reducing or eliminating personal flood risks and potential damages to existing properties and structures.	
Improved Drainage Channels/Corridors	
Bank Protection	
Riprap	$40-$75/CY
Rock and Rail	$170/LF
Soil Cement	$90-$200/LF
Concrete	$25/SY
Geotextiles	$15-$20/SY
Modular Lining	$45/SY
Concrete (fully lined)	$180/CY
Channelization	
Encroachment	
Channel Parkways	$0.50/SF (Landscaping)
Vegetated/Unlined Channels	$4/CY (Excavation)

In addition to the option of preserving channels in their current state, several choices of channel stabilization designs are available to the community. These include vegetation, rock, synthetic fabrics, soil cement, gunite, and

2.1.2 Previous Drainage Reports

The results of numerous projects and studies were evaluated during the preparation of this report. Hydrologic/hydraulic and other information was verified and incorporated into this document where and when relevant. Detailed references for these studies are included in Section VIII. The list of information reviewed includes reports and/or plans for;

1) Tucson Estates Parkway
2) Tucson CAP Water Treatment Plant
3) Star Valley Master Drainage Plan
3) Star Valley Sub-Basin Management Study
4) ADOT Tucson-Ajo Highway Improvement Plans
5) Kinney Road Improvement Plans
6) Diablo Village Drainage Report
7) Milestone Manor #6 Hydrologic and Hydraulic Analysis
8) Black Wash Drainage Analysis and Poilicy Assessment Report
9) Southwest Area Plan
10) Biological Resources Inventory Movement Study
11) Transportation and Flood Control Facility Implementation Plan for the Southwest Area Plan
12) Tucson Aqueduct (CAP) Reaches 5 and 6

13) Hydrologic/Hydraulic Report for Mission West I, II, & III

14) Tohono O'Odham Irrigation District Plan

15) Los Reales Improvement District Plan

16) Critical and Sensitive Biological Communities Maps

17) Mark/Valencia Intersection Improvement Plans

18) Final Drainage Report for Why-Tucson Highway (State Route 86)

19) Pima County Flood Insurance Study Hydrologic Investigation (1984)

20) Eastern Pima County Trails System Master Plan

2.1.3 Previous Drainage Complaints

A comprehensive list of drainage complaints has been prepared from information on file at the Pima County Flood Control District. The list is compiled based on section, township and range and includes a brief description. The complaint locations (1) - (80) are shown on Figure 5.

The majority of the complaints regard adjacent property owners with respect to unauthorized flood control measures. Typically the complaints highlight problems associated with berms, fences, driveways, etc. which act to divert and redirect flow in areas of shallow sheet flooding. No complaints regarding actual flooding of homes were found in the records, however this should not be taken to mean that such flooding has not occurred.

N
(1" = 2000')

RYAN FIELD

SAN XAVIER INDIAN RESERVATION

SANTA CRUZ VALLEY

REVISION	BY	DATE

ANDERSON PASSARELLI & ASSOCIATES
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388 N. CHURCH AVENUE · TUCSON, AZ 85701 · 602-623-1400

DRAINAGE COMPLAINT LOCATION MAP

FIGURE 5

(USE IN CONJUNCTION W/ TABLE II IN TEXT)

DESIGN EB	DRAFT LP	CHECK JW	SHEET 1
SCALE 1" = 2000'	MAR. '90	JOB NO. 84145	OF 1

Table 2 and Figure 5 provide an aid for identifying potential problem areas within the SWBMSA. Review of the table and exhibit indicate four relatively definable drainage complaint "hot spots" which are discussed below:

Area 1: This problem area is located mainly within the southwest 1/4 of Section 30, T14S, R12E. This area is the location of the Millstone Manor #6 subdivision. Recorded within this area are nine separate complaints (9-17) regarding encroachment into washes, roadway and driveway erosion and requests for County improvements.

Area 2: This area is located within Sections 28, 33, and 34 of T14S, R12E. Ten separate complaints (6, 7 and 20-28) cover a large area centered around the Northwest 1/4 of Section 33. The complaints mainly concern encroachment into area washes by private improvements, illegal improvements to washes and drainageways, dumping of debris into channels and requests to the County for improvements.

TABLE 2

Summary of Drainage Complaint History

Township 14 South Range 11 East

Sections 25 & 36

No complaints on file

Township 14 South Range 12 East

Sections 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36

Sect. 23	- No complaints on file	
Sect. 25	- (1)	Block wall encroachment in drainageway
Sect. 26	- (2)	Block wall encroachments in drainageways
	- (3)	Minor grading problems, yard flooded
	- (4)	Debris dumping in wash
Sect. 27	- (5)	Erosion at outlet of "holding" basin
Sect. 28	- (6)	Flood prone status inquiry
	- (7)	Minor wash encroachment
Sect. 29	- (8)	Erosion at culvert outlet
Sect. 30	- (9)	Encroachment in wash causing flooding at Albert Road

040

- (10) Request to construct private drainageway

- (11) Neal Road (dirt) eroding, functions as channel

- (12) Private block wall fence creates flooding/erosion

- (13) Service request to County Operations for construction of platted drainageway

- (14), (15), (16) Residents filling in washes, drainage diversion

Sect. 31 - (17) Wash graded by resident

- (18) Sheet flooding

- (19) Unspecified hazards from CAP overchute at Snyder Hill Road

Sect. 32 - No complaints on file

Sect. 33 - (20) Construction of ditch without permit

- (21) Debris dumped in San Joaquin Wash upstream of Bopp Road

- (22) Minor berms constructed by residents

- (23) Private driveway diverts wash

- (24) Wash filled in

Sect. 34 (25) County Operations to cut berm on Deaver to allow wash flows across road

- (26) County Operations requested to clean out drainage easement

- (27) Minor grading problems

- (28) Tierra Bonita II subject to sheet flow

(Hydrology Report in error) Private fence, fill and constructed ditch violations

Sect. 35 - (29) Minor wash encroachment

- (30) Driveway grading problem .

Sect. 36 - (31) Ponding due to wash constriction

Township 14 South Range 13 East

Sections 30, 31

Sect. 30 - No complaints on file

Sect. 31 - (32) Ajo median discharges onto private property. Referred to A.D.O.T.

Township 15 South Range 11 East

Sections 1, 11, 12, 13, 14, 23, 24

Sect. 1 - (33) Minor access problem on Continental Road

Sect. 11 - (34) Resident constructing structures in flooplain: complex legal issue

- (35) Drainageway diverting runoff and causing

flooding

Sect. 12 - No complaints on file

Sect. 13 - No complaints on file

Sect. 14 - (36) Dike on U of A property concentrating sheet flow to arroyo

Sect. 23 - No complaints on file

Sect. 24 - No complaints on file

Township 15 South Range 12 East

Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

Sect. 1 - (37) Minor grading problems

- (38) Fence across wash

- (39) FUP needed for fill

Sect. 2 - (40) Minor grading problems

- (41) Wyoming Street was a natural flow path, now floods property

Sect. 3 - (42) Flow diversion

Sect. 4 - No complaints on file

Sect. 5 - No complaints on file

Sect. 6 - No complaints on file

Sect. 7 - No complaints on file

Sect. 8 - No complaints on file

Sect. 9 - No complaints on file

Sect. 10 - (43) Complaints of residents diverting flow

- (44) East Arrow Road (private) not maintained, causing ponding

- (45) Lengthy neighbor v. neighbor, fill and diversion of flow, legal action taken

- (46) Erosion of drainageways

Sect. 11 - No complaints on file

Sect. 12 - (47) Ditch at Mark Road flooding

- (48) Driveway erosion

Sect. 13 - (49) Minor grading problem

- (50) Illegal berm

- (51) Mark/Valencia improved with culverts, scour downstream

Sect. 14 - (52) Minor grading problem at Elvado Road

Sect. 15 - (53) No complaints on file

Sect. 16 - (54) Erosion and headcutting of collector channels at Diablo Village. Pima County has accepted drainageway for maintenance.

- (55) Local flooding of mobile homes by new subdivision

Sect. 17 - No complaints on file

Sect. 18 - (56) Fill in wash

Sect. 19 - No complaints on file

Sect. 20 - No complaints on file

Sect. 21 - (57) Excavation of fill from wash changes wash course

Sect. 22 - No complaints on file

Sect. 23 - No complaints on file

Sect. 24 - No complaints on file

Township 15 South Range 13 East

Sections 5, 6, 7, 18, 19, 20, 21

Sect. 5 - (58) (59) Fill in wash violations

Sect. 6 - (60) Sheet flooding

- (61) Small (private) drainageway diversion

- (62) Failure to stabilize graded slope in hillside area

Sect. 7 - (63) Pima County installation of trench drain across Bilby Road in response to complaints of ponding

- (64) (65) (66) (67) Severe grading problem, numerous complaints

- (68) Fill in wash violation

Sect. 18 - (69) Sheet flooding

- (70) Wash eroding corner of private property

- (71) Debris in wash, source unidentified

Sect. 19 - (72) Flooding in Calle Torim Street (Private Street)

- (73) Wash dammed

- (74) Ponding problem on Settlers Avenue

Sect. 20 - (75) Ponding at Cardinal and Hermans Road

- (76) Illegal berm

- (77) Deterioration of Cardinal Street

- (78) Fence across wash

- (79) County operations to clean drainageway

Sect. 21 - (80) Sheet flooding of trailers below Mission West Detention basin outlet (Cardinal Mobile Home)

Area 3: This area is located mainly within Section 10, T15S, R12E. This area is the location of the Branding Iron Park subdivision. Various braids of the Black Wash traverse this area as well as tributary drainage from Saginaw Hill to the east. Five complaints (42-46) were found in the County files for this area. The complaints were primarily concerned with flow diversions, roadway and drainageway erosion and ponding of runoff along roadways.

Area 4: This area is located within Sections 19, 20 and 21 of T15S, R13E. This area is the location of a poorly defined watershed divide between the Black Wash and West Branch Santa Cruz River drainages. Flows from a large (approximately 6 square miles) upstream area have the potential for flowing into either watershed. This area is also the location of the Mission West subdivision (Section 20). Nine recorded complaints (66-74) are spread over the three section area and are primarily concerned with erosion, ponding, sheet flooding and illegal filling of washes.

2.1.4 Flood Insurance Studies

The Federal Emergency Management Agency (FEMA) published revised Flood Insurance Rate Maps (FIRM panels) for Pima County including the southwest area in

1989. In addition to the FEMA study, a report entitled "The Black Wash Drainage Analysis and Policy Assessment Report" was prepared by the Pima County Department of Transportation and Flood Control District, published December 14, 1989. Both studies illustrate the severity of the flooding potential in the southwest area due to the Black Wash and are discussed further in Section IV.

2.1.5 Photographic and Topographic Data Base

This report was prepared using the most current photographic and topographic data base available. Specifically, aerial photos at 1" = 400' and 1" = 1000', topographic mapping at 1" = 100' with a contour interval of 2 feet and U.S.G.S. 7.5 min. and 15 min. series topographic quadrangles were used. Figure 6 provides an aerial view of the study area on the 1" = 1000' scale mapping used as a part of this study. This figure also shows the locations of key features and problem areas which are discussed further in later sections of this report.

2.1.6 Environmental Conditions

The SWBMSA contains many areas with little or no development. As indicated in Section 2.1.1, some areas to the east and north have experienced development. However, the western and southwestern portions of the study area are very rural.

Non-structural Components

Implementation of non-structural measures can reduce or offset the need for some structural improvements. The components that received very advantageous rankings were Education, Ordinances/Policies, and Organization/Management. Components that received a ranking of more than somewhat advantageous were Floodplain Acquisition, Design Criteria, Plan Review, Maintenance Operation, Development Inspection, Flood Monitoring and Pollution Monitoring. These ten components ranked high because: 1) they are directly or indirectly supportive to each other, i.e. highly compatible, and 2) they ensure that existing policies and regulations established by Pima County to mitigate flooding/ drainage concerns are recognized, initiated, and maintained.

Flood Proofing, Floodplain Permitting, Enforcement, Data Base Management and Complaint/Emergency response ranked somewhat advantageous. These components also are effective in ensuring that established regulations are enlisted and maintained, yet their impact on the study area may involve rigorous manhours. In particular, Flood Proofing and Floodplain Permitting are components that primarily reduce or eliminate flood damage at specific locales; however, the implementation costs are estimated to be higher than previously discussed components. Floodproofing existing structures within the 100-year floodplain is usually the owners decision and responsibility. The majority of homes in the floodplain within Section 34 is approximately 70%, and the cost then is multiplied accordingly. Other higher ranked components have less direct cost associated with them, while continuing to benefit the study area as a whole.

The only non-structural alternative ranked disadvantageous is the Do Nothing component, which provides no benefit to the study area, and may possibly be detrimental to the overall watershed.

Structural Components

Structural components offer a variety of physical approaches at the level of effectiveness in flooding/erosion protection. No structural components ranked



NOTE:

BY	DATE	

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SOUTHWEST BASIN MANAGEMENT STUDY

AERIAL PHOTO

As demonstrated on Figure 7, several "major extensions of riparian habitat from Protected areas" exist within the study area. Figure 7 was prepared based on APA's review of the 1" = 400' scale mapping of "Critical and Sensitive Biological Communities Maps" prepared by Dr. William Shaw available at Pima County Mapping and Records. Also reviewed during the preparation of this report was a study prepared by the Arizona Game and Fish Department (AGFD) for the Bureau of Reclamation pertaining to the CAP entitled Biological Resources Inventory Phase B -- Central Arizona Project Aqueduct. The AGFD study states: "Those segments (CAP construction sub-reaches) that are found southwest of the Saguaro National Monument and Tucson Mountain Park are utilized by wildlife for a wide variety of activities... these segments (are) used extensively as a movement corridor by several species. It is the last suitable area for ungulate (i.e. "having hooves") movement into and out of the Tucson Mountain Park." Review of the eastern Pima County Trail System Master Plan indicated a number of proposed trails routes through the study area. The route locations are shown on Figure 7 as first priority candidate trails. The trail routes shown on Figure 7 make excellent use of floodprone area along the Black Wash. However, it appears that the CAP alignment may conflict with a proposed trail route in the northwestern portion of the SWBMSA.

Also according to the Arizona Game and Fish Department, the Tumamoca globeberry vine may be present in the SWBMSA. The Tumamoca globeberry vine is on the Federal Endangered Species list.

N

1" = 5000'

FROM CRITICAL AND SENSITIVE BIOLOGICAL COMMUNITIES MAPS PREPARED BY: DR. WILLIAM SHAW FOR P.C.D.O.T. & F.C.D., 8186

APACHE RESERVATION

AVRA VALLEY

SANTA CRUZ VALLEY

RYAN FIELD

LEGEND

- FIRST PRIORTY CANDIDATE TRAIL*
- WETLANDS W/ NO ADJACENT PLANT COVER
- IRONWOOD PLANT COMMUNITY
- IMPORTANT WILDLIFE MOVEMENT CORRIDOR
- MESQUITE BOSQUE
- MAJOR EXTENSIONS OF RIPARIAN HABITAT FROM PROTECTED AREAS
- MAJOR SEGMENTS OF RIPARIAN HABITAT NOT LINKED WITH PROTECTED AREAS

* FROM EASTERN PIMA COUNTY TRAIL SYSTEM MASTER PLAN

FIGURE 7 · WILDLIFE HABITATS ·

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84145 3/90

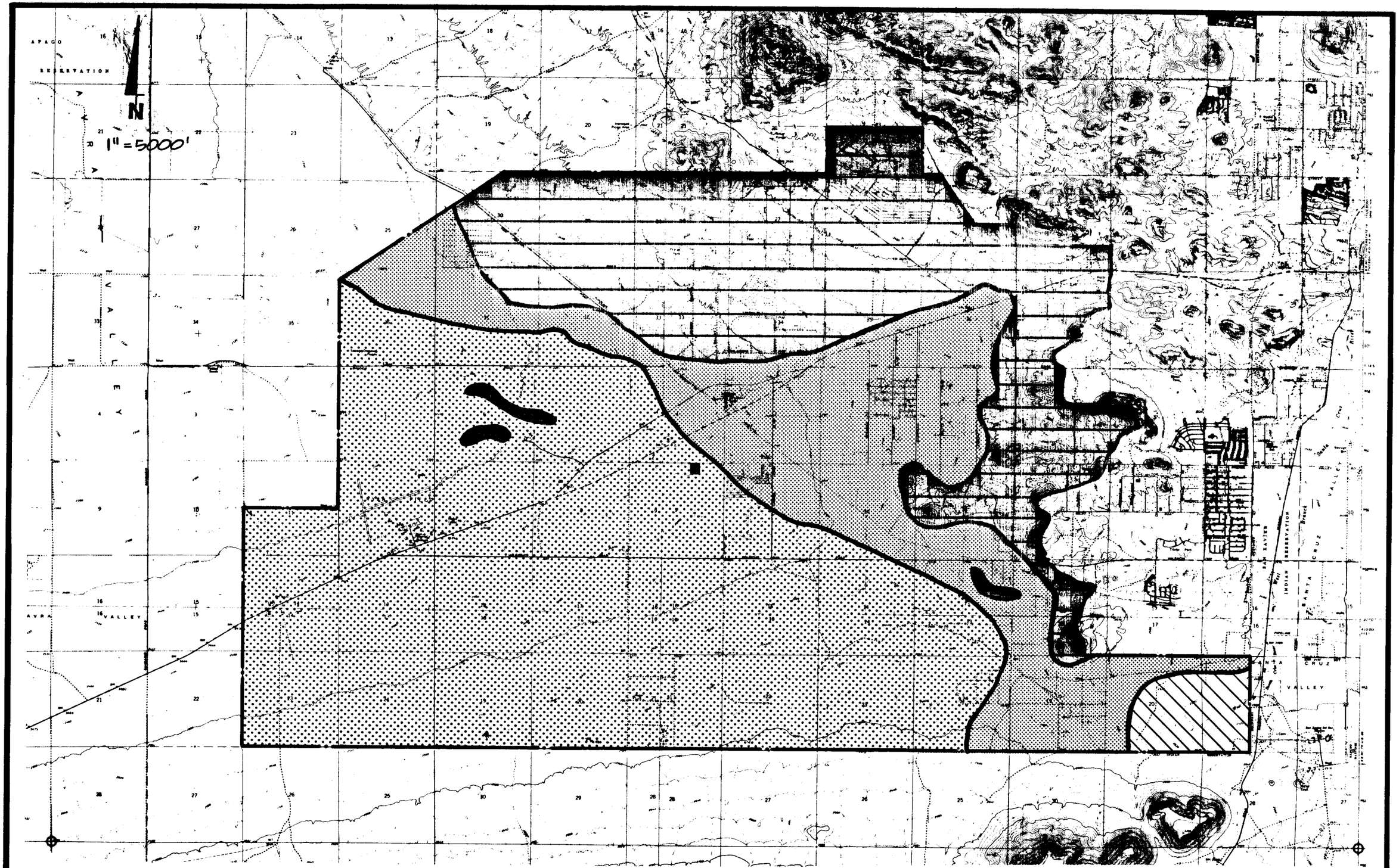
2.2 Field Reconnaissance

An extensive amount of time was spent gathering data and investigating drainage features. This time was used to determine hydrologic base data, inventory existing hydraulic structures, survey roadway dip sections, gather sediment samples, research construction projects, examine flood control improvements and evaluate problematic areas.

2.2.1 General Watershed Conditions

The SWBMSA demonstrates climatic features typical of the upper Sonoran Desert Regions specifically; moderately arid climate, short violent summer thunderstorms accounting for about half the annual rainfall. The majority of the remaining annual precipitation accrues during the more mild rainy season of mid-winter.

Figure 8 shows the vegetative cover groups within the study area. Vegetation within the study area is representative of the Sonoran Desert Shrub Community. The five vegetative associations within the SWBMSA are: Palo Verde-Saguaro Community, Creosote-Bursage Community, Woody Phase Desert Grassland, Deciduous Riparian Forest, and Desert Saltbrush.



LEGEND

- PALO VERDE - SAGUARO
- CREOSOTE BURSAGE
- DESERT SALTBRUSH
- GRASSLAND (WOODY PHASE)
- RIPARIAN

FIGURE 8 · VEGETATIVE COVER ·

FROM S.W. AREA PLAN, 1985

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Geologically, the SWBMSA is dominated by Quaternary alluvium with an estimated age of 10,000 years. The majority of the study area is comprised of Holocene and Middle to Late Pleistocene deposits. However, a significant amount of the northeast portion of the SWBMSA is composed of Mesozoic and Paleozoic sedimentary units and Tertiary intrusive volcanics. Numerous high angle faults are present within the SWBMSA, however, these faults are considered dormant with no signs of recent displacement.

Soils for the study area are shown on Figure 9 and are summarized in Table 3. Figure 9 was prepared from data obtained through the United States Department of Agriculture Soil Conservation Service, soil map numbers 36, 37, 46, and 47. The most extensively occurring soil groups are; the Tubac Complex, the Bucklebar-Sonoita complex and the Anklam-Pantano Soils.

2.2.2 Preliminary Assessment of Drainage Problems

The following paragraphs provide a qualitative assessment of problem areas based on field reconnaisance. Quantitative analyses of the areas discussed below are provided in Section III of this report.

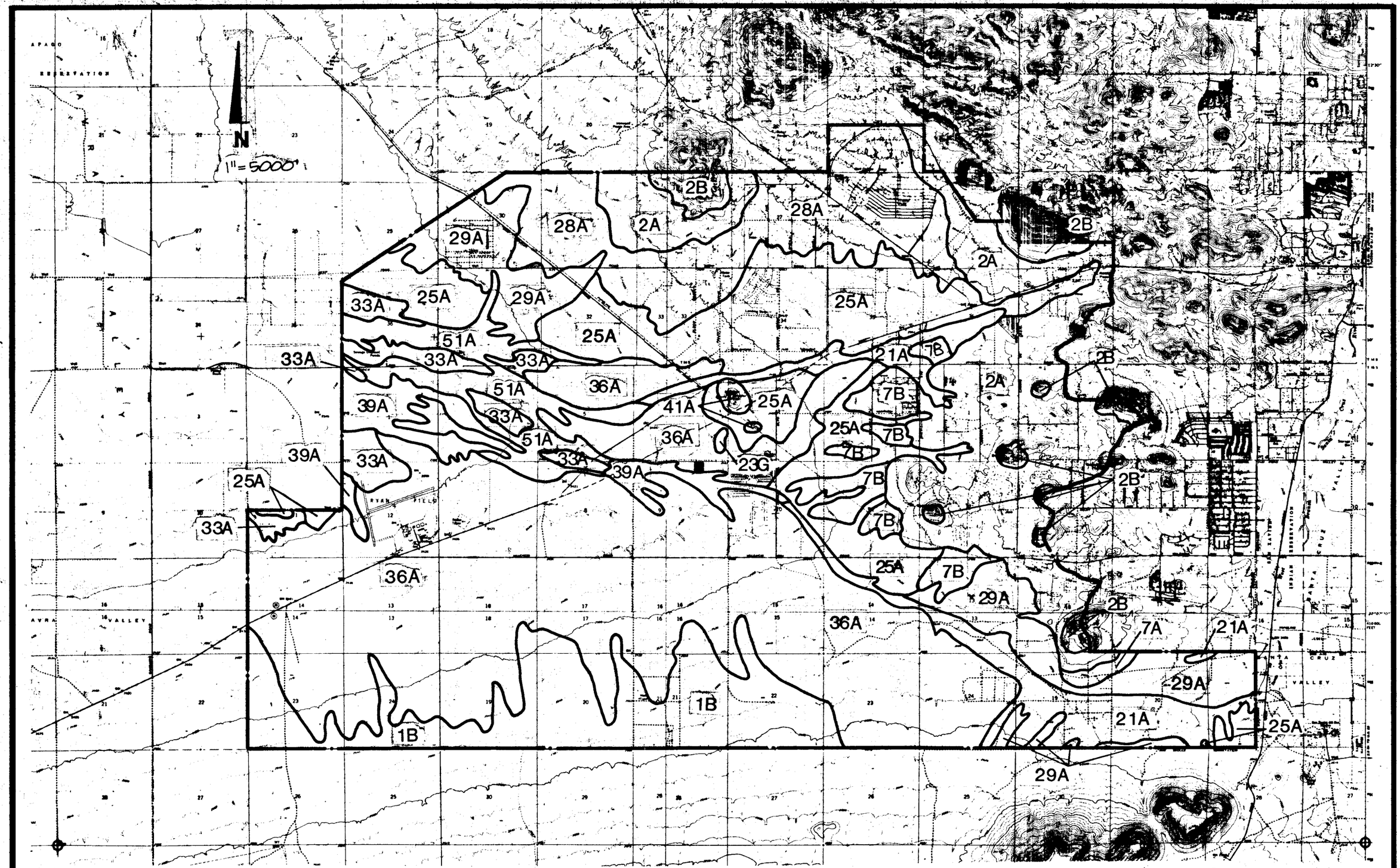


FIGURE 9 · SOILS ·

FROM U.S. SOIL CONSERVATION SERVICE

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TABLE 3

SOIL GROUP SUMMARY

SCS	Name	Hydrologic Soil Group
1B	Hayhook-Sonoita complex	100% B
2A	Anklam-Pantano complex	100% D
2B	Anklam-Rock outcrop complex	100% D
7A	Cave gravelly fine sandy loam	100% D
7B	Greyeagle extremely cobbly fine sandy loam	100% C
21A	Yacqui fine sandy loam	100% B
23G	Pits-Dumps	(no assignment)
25A	Mohave loam	100% B
28A	Pinaleno very cobbly sandy loam	100% B
29A	Sahuarita-Mohave complex	100% B
33A	Bucklebar-Sonoita complex	100% B
36A	Tubac sandy loam	100% C
39A	Riggs clay loam	100% C
41A	St. Thomas-Rock outcrop comples	100% B
51A	Anthony fine sandy loam	100% B

2.2.2-1 Inadequate Drainage Structures

Numerous culvert structures exist along the major arterial roadways within the SWBMSA, particularly along Ajo Road and Kinney Road. Field investigation indicates that, in most areas along these roadways limited relief and channel definition has created conditions where culvert size and available headwater appear to be inadequate. In some instances along Ajo Road training dikes have been constructed to more positively direct flows to the crossing structures because existing channel definition and relief are inadequate.

2.2.2-2 Flood Hazards

The primary source for severe flooding within the southwest study area is the Black Wash. However, less severe flooding potential exists to some degree throughout the entire area. In general the drainage systems within SWBMSA consist of distributary flow patterns characterized by channels with limited relief and areas where flow splits are indicated. The severity of the flooding hazards is directly related to existing development located within these areas, where human encroachments and activity results in diversion of natural flow patterns and illegal filling, dumping and grading in floodprone areas.

A few of the more serious areas problem areas based on field reconnaissance include; Branding Iron sub-division Section 10, T15S, R12E, within the 100-yr Black Wash floodplain, Millstone Manor #6 Section 30, T14S, R12E (Ironwood Wash) and Tucson Estates Mobile Home Park Section 26, T14S, R12E, Golden Gate Subdivision Section 34, T14S, R12E and Diablo Village Section T15S, R12S. A more detailed and quantitative discussion of floodprone areas is provided in Section III of this report.

2.2.2-3 Maintenance Problems

The primary maintenance problems within the SWBMSA are due to sediment deposition at culvert and roadway dip crossings. Field investigation indicates that the vast majority of culvert crossings within the study area experience significant sediment deposition. The presence of large quantities of sediment along the roadway shoulders and at dip crossing locations indicates that sedimentation is a problem and that frequent maintenance is required to alleviate the problem. A sediment yield analysis discussed in Section 3.2.3 provides a quantitative assessment of annual sediment yields for some of the larger watersheds within the study area.

III. EXISTING CONDITIONS ANALYSIS

3.1 Hydrologic Analysis

The Southwest Basin is a hydrologically complex area. The drainage can be generally described as consisting of three components; 1) Black Wash, 2) areas of distributary flow and broad shallow sheet flooding to the south originating in the Sierrita Mountains, and 3) areas of distributary flow and broad shallow sheet flooding to the north originating in the Tucson Mountains. The western portion of the SWBMSA, where the three components converge, is typified by an extremely braided system and is subject to extensive sheet flooding during the 100 yr event.

Black Wash can be described as an ephemeral braided stream system formed between coalescing watersheds. Most of the runoff generated in the SWBMSA eventually collects within this watercourse. The floodway at the western project boundary (2 miles west of Sandario Road) based on the Black Wash Administrative Floodway map is approximately 0.6 miles wide. At the Valencia Road crossing the floodway narrows to approximately 0.35 miles in width. Upstream of the Valencia Road crossing the floodway associated with Black Wash is approximately 0.2 miles wide. The 1989 FEMA maps for this area indicate areas of 100-yr flood hazard for almost all of the SWBMSA south of Ajo Road and the CAP alignment. The above referenced maps are discussed further in Section IV.

The watershed to the south of the project area is composed of sub-basins originating on the north slopes of the Sierrita Mountains. Inspection of aerial photographs of the upper bajada area indicate channel incisement, with some channel braiding. Extensive channel braiding and distributary flow patterns predominate along the lower portions of the Sierrita Mountain Bajada located within the SWBSA.

The watersheds originating at the southwest flank of the Tucson Mountains dominate the northern portion of the SWBMSA. These basins produce southwesterly drainage patterns to San Joaquin Road. Downstream of the CAP canal the runoff is conveyed into the Black Wash floodplain. Here again, incised channels predominate within the mountain and foothill areas while ill-defined distributary flow patterns predominate along the lower portions of the watersheds.

The following sub-sections provide a discussion of the information base and methodology used in determining peak discharges for the watersheds tributary to the study area.

3.1.1 Evaluation of Data From Previous Studies

The specific results of several drainage studies were incorporated into this document. The first, "Design Report for Off-Site Drainage Protection Facilities for

Tucson CAP Water Treatment Plant, March, 1988, Johnson Brittain & Associates (JBA) provides a regional detention facility at the northeast corner of the Ajo Road and Tucson Estates Parkway. The drainage features for this project were complete at the time this study was prepared. The improved features include a 25 ac-ft detention facility. The outflow hydrograph for this facility quantifies a developed Q100 peak of 4080 cfs leaving the project at the southwest corner (Tucson Estates Pkwy). Review of recent and historic aerial photography revealed that an inaccurate watershed delineation was made in the JBA report upstream of the Tucson Estates mobile home park in Section 23 T14S, R12E. The above-referenced inaccuracy is reflected on the U.S.G.S. 7.5 minute quadrangle for this area as well. Correction of this inaccuracy effectively removes approximately 266 acres of the northernmost watershed upstream of the CAP treatment facility. Analyses performed as a part of this study reflect the delineation based on the aerial photography.

The Master Drainage Study for Star Valley, December, 1987, McGovern, MacVittie, Lodge & Associates, details the drainage improvements proposed for an approximately 2.5 square mile development (see Figure 2). The watershed delineations for the Star Valley study were reviewed and incorporated into this report.

The drainage report for Why-Tucson (State Route 86) prepared by Simons, Li & Associates was reviewed to determine watershed delineations for the western most basins south of Ajo Road. These watersheds along Ajo Highway west of Star Valley

were difficult to delineate due to the braided nature of the system, particularly the five western most basins. Where watercourse divisions were encountered, the upstream drainage areas were proportionally divided between the potential flow paths based upon the assessments of respective channel conveyance determined from review of aerial photographs.

The hydrology for the Black Wash flood insurance study prepared by Cella Barr and Associates (CBA) was also reviewed. During the course of this review a discrepancy was found between the drainage area shown on the watershed map (Figure 3 from the CBA study) and the areas used in the peak discharge calculations for CBA concentration points 8 and 13. Further review of the hydrologic data sheets indicated that an upstream area was accounted for twice; once for CBA Concentration Points 8 and 13, and again for CBA Concentration Point 14. Since the peak discharges for concentration points 13 and 14 were convoluted (along with 12) to determine the 8872 cfs 100-year peak discharge at Ajo Road, the upstream area appears to have been accounted for twice in this calculation. The area in question is located in the headwaters of the Black Wash in the Sierrita Mountains. The total area estimated to have been accounted for twice is approximately 2500 acres. This area also added an additional 3 miles of watershed length to the hydrologic parameters for CBA Concentration Points 8 and 13. Review of the U.S.G.S. quad sheets upon which CBA Figure 3 is based suggests that a flow split occurs near the northwest corner of Section 4, Township 17S, Range 12E. Review of a 1"=400' scale December 1986 aerial photo

of the same area reveals that channel definition is well defined at this location with flow directed to the west to CBA Concentration Point 14 and not toward CBA Concentration Points 8 and 13. The peak discharge determinations made as a part of this study and discussed in the section which follows reflect the more accurate information provided by the 1986 aerial photo.

3.1.2 Peak Discharge Determinations

Predictions of peak discharges were determined using the method as prescribed in the "Hydrology Manual for Engineering Design and Flood Plain Management within Pima County, Arizona," September, 1979 (hereafter referred to as the Pima County Method). Runoff values for the full range of recurrence intervals (2, 5, 10, 25, 100-year) were determined at all strategic concentration points. Strategic points of concentration were determined to be major stream confluences, drainage crossings at major transportation routes, and any point where runoff quantities were needed to prepare floodplain mapping or to examine other flood hazards. Because the SWBMSA is almost entirely a balanced or critical basin, the future peak discharges were considered equal to existing runoff values. Discharge summary tables were prepared and are included here and as part of the narrative for each sub-section in the appendices where such information was used.

Watersheds were delineated, or previous delineations verified, using 1" = 100' photographic topography at contour intervals of two feet. For areas outside this coverage (southern off-site watersheds on the San Xavier Indian Reservation) watershed divides were determined using 1" = 400' and 1" = 1000' aerial photography and USGS 7.5 min. quad sheets.

Vegetative cover type fell within the Desert Brush category for all portions of the study area. Vegetative cover density was determined through field reconnaissance and inspection of aerial photography. Cover densities averaged about 20 percent. This value is representative of typical basin conditions. Soils data was taken from the information shown on Figure 9 and Table 2. At a vegetative cover density of twenty percent, curve numbers for hydrologic soil groups B, C and D were determined to be 83, 88 and 91 respectively.

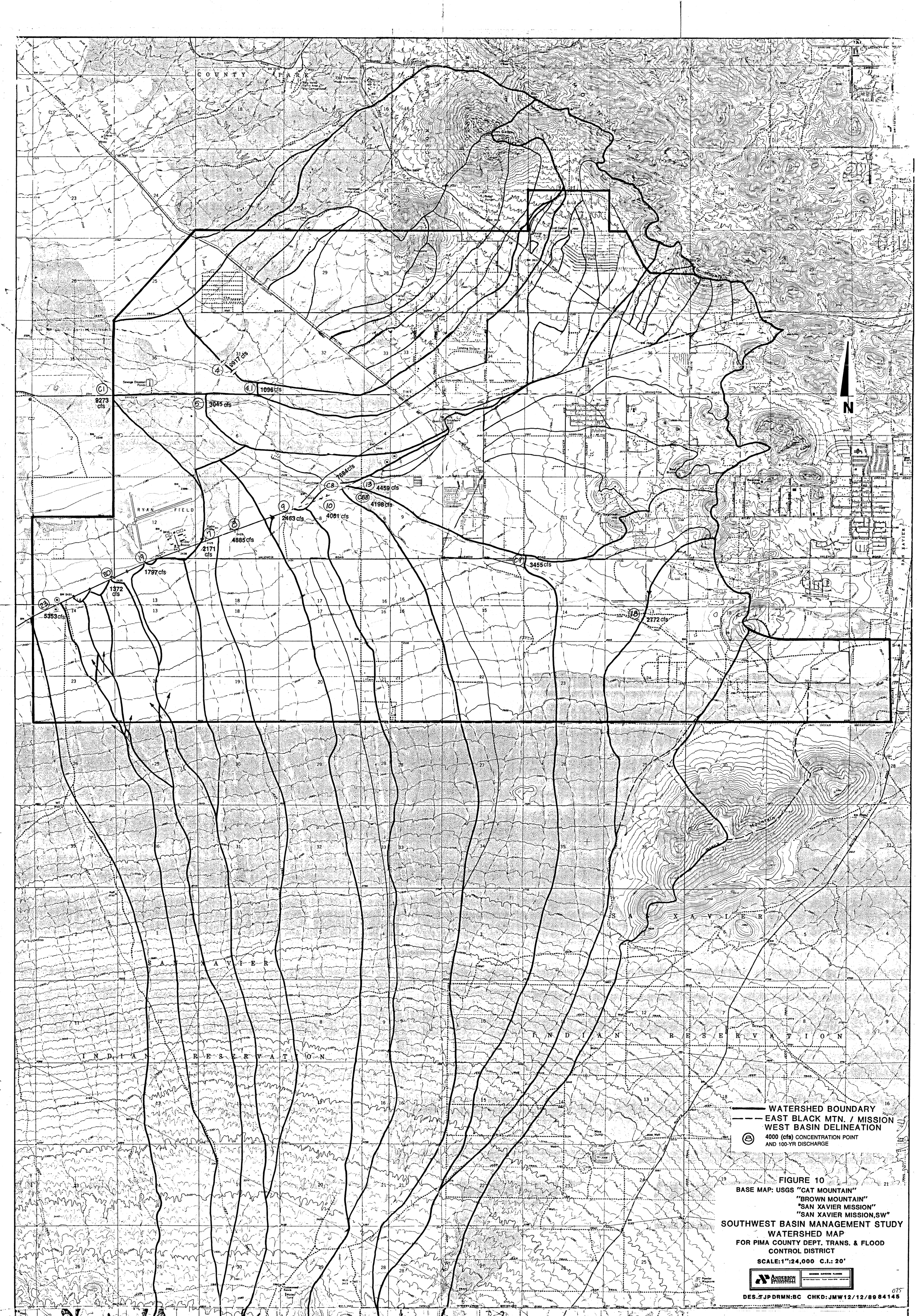
The percent of impervious cover varies with each watershed proportional to the type and degree of development within each respective area. In general the percent impervious value used averaged about 10 percent varying from 2 to 65 percent.

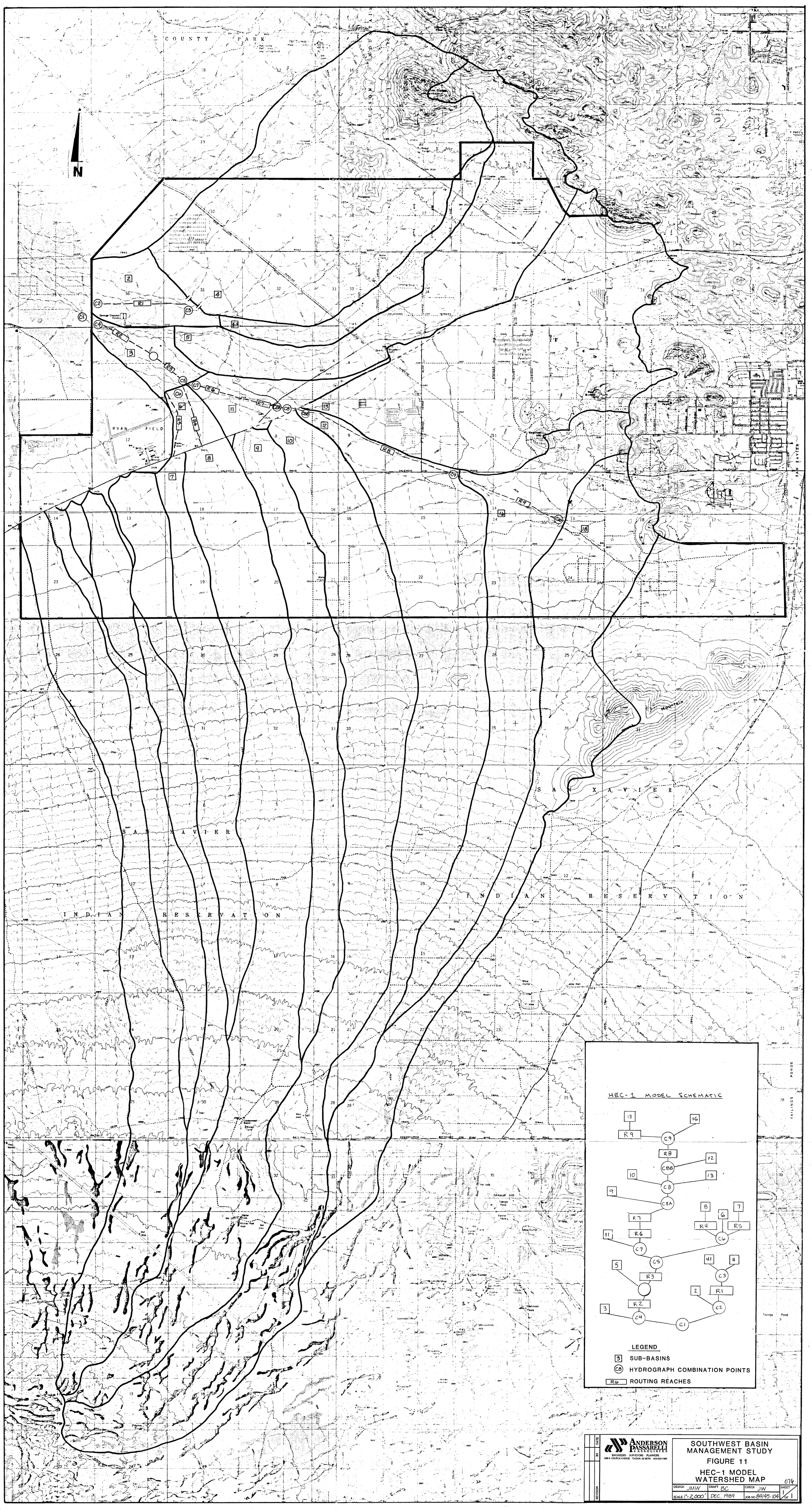
Precipitation data was determined using the Pima County Hydrology Manual and the specific values used are shown on the calculation sheets contained in Appendix A.

Figure 10 shows all of the basin boundaries determined as a part of this study. Table 3 provides a summary of the peak discharge determinations made for the major concentration points shown on Figure 10 using the Pima County Method. The individual hydrologic data sheets for the Figure 10 concentration points are contained in Appendix A. Peak discharges for those concentration points with a "C" prefix were also evaluated by detailed hydrologic routing which is discussed in Section 3.1.3. Concentrations points for the remainder of the basin delineations shown on Figure 10 are discussed in Section 3.2.

3.1.3 Detailed Flood Routing Analysis

A detailed flood routing analysis was performed for a number of strategic concentration points along the Black Wash within the study area. This additional hydrologic analysis was performed to determine the 100-year peak discharges for those watersheds which do not fall within the range of applicability of the Pima County Method. Generally the Pima County method is only applicable to watersheds of ten square miles or less. The contributing watershed to the Black Wash at the downstream limit of the study area is approximately 87 square miles.


COUNTY PARK
RYAN FIELD
SAN XAVIER INDIAN RESERVATION
SAN XAVIER INDIAN RESERVATION
MISSION
DUMP
Tailings Pond 9
Tailings Pond 10
Tailings Pond 11
Tailings Pond 12
Tailings Pond 13
Tailings Pond 14
Tailings Pond 15
Tailings Pond 16
Tailings Pond 17
Tailings Pond 18
Tailings Pond 19
Tailings Pond 20
Tailings Pond 21
Tailings Pond



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SOUTHWEST BASIN MANAGEMENT STUDY

FIGURE 11

HEC-1 MODEL WATERSHED MAP

074

DESIGN	JMW	DRAFT	RC	CHECK	JW	SHEET
SCALE 1"= 2,000'	DEC. 1989	JOB NO. 84/85.104				OF 1

TABLE 4

Summary of Results of Peak Discharge Determinations for Major Basins Using Pima County Method

Concentration Point *	Drainage Area (mi^2)	Peak Discharge (cfs) 2-yr	5-yr	10-yr	25-yr	100-yr
4	10.96	776	1972	3276	5304	9917
4.1	1.46	92	244	385	603	1096
5	5.54	235	659	1050	1666	3045
7	4.05	100	377	655	1121	2171
8	12.10	254	789	1442	2471	4885
9	4.41	171	517	838	1341	2463
10	12.78	295	798	1337	2210	4061
13	9.29	415	1094	1666	2539	4459
18	8.32	174	538	905	1504	2772
19	3.49	94	333	564	941	1797
20	2.57	69	249	425	718	1372
23	9.66	337	1071	1765	2885	5353
C9	14.46	190	533	962	1691	3455
C8B	22.78	**	595	1113	2008	4198
C8	44.85	**	1192	1824	3498	7694
C1	87.13	**	**	**	3848	9273

* Concentration point numbers with a "C" prefix are discussed in greater detail in Section 3.1.3

** Time of concentration exceeds 24 hours by Pima County method

NOTE: HYDROLOGIC/HYDRAULIC DATA FOR MOST LOCATIONS SHOWN ON THIS EXHIBIT ARE PROVIDED IN TABLE 7 OF THE BASIN INVENTORY/DRAINAGE REPORT. SOME LOCATIONS WERE CONSIDERED MINOR OR INSIGNIFICANT FROM A HYDROLOGIC OR TRANSPORTATION STANDPOINT AND WERE NOT ANALYZED, HOWEVER, DESCRIPTIONS OF THESE LOCATIONS ARE PROVIDED IN APPENDIX C OF THE REPORT.

● CULVERT LOCATION

BY	DATE	REVISION

ANDERSON PASSARELLI & ASSOCIATES
ENGINEERS · SURVEYORS · PLANNERS
200 N. CHURCH AVENUE · TUCSON, AZ 85701 · 602-623-1600

SOUTHWEST BASIN MANAGEMENT STUDY

FIGURE 12

CULVERT STRUCTURE LOCATION MAP

DESIGN	DRAFT	CHECK	SHEET
TP	BC		OF
SCALE 1"=2000'	AUG. 1989	JOB NO. 84145	

B	B
1	
2	2
3	

The detailed hydrologic analysis was performed using the U.S. Army Corps of Engineers HEC-1 Flood Hydrograph Package. Figure 11 shows the subbasin boundaries used in developing the HEC-1 model. Figure 11 also provides a schematic of the HEC-1 model which shows the manner in which the subbasins are routed and combined.

Subbasin hydrograph generation was accomplished using the SCS Unit Hydrograph capabilities of the HEC-1 package. Both the SCS unit hydrograph method and the Pima County Method utilize the SCS curve number method for estimating runoff potential. Input data for development of the unit hydrograph input data including SCS curve number, watershed area, watercourse length and slope and percent impervious cover were taken from the Pima County Method data sheets. The SCS hydrograph parameter "lag" was determined using equation 9 from "A Guide to Hydrologic Analysis Using SCS Methods," McCuen, 1982.

The SCS type II rainfall distribution was used as the precipitation pattern for the HEC-1 model. This pattern is the distribution generally used in conjunction with the SCS hydrograph methods for the Arizona region. The type II distribution was applied to the 1-, 6-, and 24-hr rainfall depths for the various points of interest.

NOTE: HYDROLOGIC/HYDRAULIC DATA FOR MOST LOCATIONS SHOWN ON THIS EXHIBIT ARE PROVIDED IN TABLE 8 OF THE BASIN INVENTORY/DRAINAGE REPORT. SOME LOCATIONS WERE CONSIDERED MINOR OR INSIGNIFICANT FROM A HYDROLOGIC OR TRANSPORTATION STANDPOINT AND WERE NOT ANALYZED. HOWEVER, DESCRIPTIONS OF THESE LOCATIONS ARE PROVIDED IN APPENDIX D OF THE REPORT.

▲ DIP LOCATION

DATE	BY	REVISION

ANDERSON PASSARELLI ASSOCIATES
ENGINEERS · SURVEYORS · PLANNERS
288 N. CHURCH AVENUE · TUCSON, AZ 85701 · 602-623-1600

SOUTHWEST BASIN MANAGEMENT STUDY

FIGURE 13
ROADWAY DIP SECTION LOCATION MAP

DESIGN	DRAFT	CHECK	SHEET
TP	BC		OF
SCALE 1"=2000'	AUG. 1989	JOB NO. 84145	

B	B
1	1
2	
3	

Kinney Road

Bopp Road

Denver Road

Camino Verde

Tucson Estates Parkway

Oklahoma Street

Irvington Road

No. Highway

Cooper Aerial Survey Co.
TUCSON, ARIZONA

1" = 400'

90 TUCSON

MARCH 19

4-13

KEY:

- BANK PROTECTION
- BERM
- R.C.P.
- BOX CULVERT
- ROAD IMPROVEMENTS
- SEDIMENT BASIN
- DETENTION BASIN
- DRAINAGE CHANNEL

FIGURE 6

CONCEPT PLAN

PROPOSED STRUCTURAL IMPROVEMENTS SOUTHWEST BASIN MANAGEMENT STUDY, PHASE II , PART A , IN CONJUNCTION WITH TABLE 6

CBA
CHELA BARE ASSOCIATES
4811 EAST BROADWAY
TUCSON, ARIZONA 85711
(602) 750-7474

CBA JOB NO.
106579-01-0280



Cooper Aerial Survey Co.
TUCSON, ARIZONA

1″ = 400′

90 TUCSON

MARCH 19

5-13

KEY:

- BERM
- R.C.P.
- BOX CULVERT
- ROAD IMPROVEMENTS
- SEDIMENT BASIN
- DETENTION BASIN
- DRAINAGE CHANNEL

CONCEPT PLAN

PROPOSED STRUCTURAL IMPROVEMENTS SOUTHWEST BASIN MANAGEMENT STUDY, PHASE II , PART A

CBA CELLA BARR ASSOCIATES
4911 EAST BROADWAY
TUCSON, ARIZONA 85711
(602) 750-7474
FAX (602) 750-7470

CBA JOB NO.
106579-01-0280

A comparison of the SCS unit hydrograph method and Pima County methods was made by modifying the SCS unit hydrograph input parameters to reflect lag times and rainfall durations based on the time of concentration from the Pima County method data sheets. Equation 10 from the McCuen text was used to relate time of concentration to lag time. Table 5 shows the results of the above comparison. Review of Table 5 indicates that the peak discharges from the modified SCS unit hydrographs were all within -16% and +11% of the Pima County method peak discharges for the smaller and larger subbasins, respectively. The largest negative differences are most likely a result of not incorporating the "caliche effect" into the SCS unit hydrograph curve numbers for the smaller watersheds. This adjustment was not considered appropriate for the longer duration, less intense, rainfall distributions used in the larger Black Wash routing model. The results of the above analysis were felt to indicate a relatively good correlation between the two methods in terms of individual subbasin peak discharge determination.

Routing of subbasin hydrographs to downstream locations was accomplished using the Normal-Depth Storage option of the HEC-1 package. This routing option is a type of modified puls routing which utilizes an eight point cross-section which is "typical" of the routing reach. Cross-sections for the routing reaches were developed based on review of 1"=400' aerial photos and 1"=100' photo topo. The cross-sections basically provide the general definition of the channel and overbanks in terms of width

TABLE 5

COMPARISON OF PEAK DISCHARGES
FOR INDIVIDUAL SUB-BASINS
USING PIMA COUNTY METHOD AND
SCS UNIT HYDROGRAPH METHOD

SUBBASIN #	DRAINAGE AREA (Mi^2)	100-YEAR DISCHARGE PCM	PEAK (CFS) BY SCS-UH	% DIFFERENCE
2	1.27	1524	1277	-16
3	0.84	735	670	-9
4	10.96	9917	9484	-4
4.1	1.46	1096	1070	-2
5	5.54	3045	3001	-1
6	0.48	885	741	-16
7	4.05	2171	2138	-1
8	12.10	4885	5176	6
9	4.41	2463	2524	2
10	12.78	4061	4421	9
11	1.06	1034	959	-7
12	8.32	2408	2662	11
13	9.29	4459	4678	5
16	6.14	2504	2615	4
18	8.32	2772	2944	6

PCM = PIMA COUNTY METHOD

SCS-UH - SCS UNIT HYDROGRAPH

$$\% \text{ DIFFERENCE} = \frac{(\text{SCS-UH}) - \text{PCM}}{\text{PCM}} \times 100\%$$

and depth along the entire reach. For this reason the cross-sections used in the routings do not represent an actual cross-section at a specific location.

Table 6A provides a summary of the peak discharge determinations from the HEC-1 model compared with the results of the Pima County Method analysis for the analysed points. In each instance the 24-hr duration storm produced the most conservative (highest) peak discharge. However, as review of Table 5 indicates these peak discharges are fairly consistent with the Pima County method peak discharges for the smaller watersheds for which the Pima County method is most applicable. The results of the HEC-1 modeling suggest that the Pima County method produces peaks which are progressively lower than the routed peaks as the watershed size increases beyond the ten square mile limit. The HEC-1, 24-hour rainfall duration peak discharges were used, where applicable in the hydraulic analyses which are described in Sections 3.2. Input/output for the HEC-1 models are contained in Appendix B of this report.

Comparison of the results of the HEC-1 modeling indicate some differences with the results of the CBA FEMA study of the Black Wash. The FEMA study predicted a 100-year peak discharge of 8872 cfs at Ajo Road based on the convolution of three individual hydrographs (Concentration points 12, 13 and 14 from the CBA study, Figure 3). The HEC-1 model developed as a part of this study predicted a peak discharge of 9204 cfs for the same location at Ajo Road for the 24-hour rainfall event (Concentration

TABLE 6A

SUMMARY OF RESULTS OF HEC-1 MODEL ANALYSIS

CONCENTRATION POINT	DRAINAGE AREA (Mi^2)	100-YEAR PEAK DISCHARGE (CFS) HEC - 1 MODEL FOR RAINFALL DURATION OF: 1-HR		6-HR		24-HR		PIMA[1] COUNTY METHOD	
		Q_{100}	T_p	Q_{100}	T_p	Q_{100}	T_p	Q_{100}	T_p
C9	14.46	1972	5.5	3263	8.00	3504	16.83	3455	6.31
C8B	22.78	2658	6.5	4602	9.33	5010	18.17	4198	7.85
C8	44.85	4868	4.83	8586	8.17	9503	17.17	7694	8.13
C1	87.02	7768	5.17	16017	8.00	17872	17.00	9273	11.46

[1] Data sheets provided in Appendix A

TABLE 6B

SUMMARY OF RECOMMENDED REGULATORY AND DESIGN PEAK DISCHARGES

BLACK WASH	REGULATORY	DESIGN[1]
@ Continental Road Alignment	17872	21446
@ Ajo Road	9503	11404
@ Valencia Road	3504	4205

[1] Design discharges are 20 percent greater than regulatory discharges.

Point C8 in Table 3). The FEMA study also indicated a 100-year peak discharge of 5035 cfs on the Black Wash approximately one quarter mile upstream of Valencia Road. The HEC-1 model predicted a peak discharge of 3452 cfs on the Black Wash at Valencia Road (Concentration Point C9 in Table 3) for the 24-hour rainfall event. The HEC-1 C9 watershed represents a more downstream and consequently somewhat larger area than the above referenced FEMA point. More important however are the discrepancies found in the CBA FEMA study data which were discussed in detail in Section 3.1.1. It does not appear that the above discrepancy should materially affect the accuracy of the FEMA mapping for the Black Wash area due to the approximate methods used in developing the FEMA mapping.

Because of the above referenced discrepancies it is recommended that the peak discharges determined as a part of this study be utilized for regulatory purposes. Recommended regulatory and design discharges for the Black Wash are shown in Table 6B. The regulatory discharges shown in Table 6B are based on the peak discharges determined from the HEC-1 analysis. The design discharges are 20 percent greater than the regulatory discharges.

3.2 Hydraulic Analysis

Figures 12, 13 and 14, detail the locations of major drainage structures within the SWBMSA including culverts, road dips and improved channels respectively. Capacity

IMPROVED CHANNEL

B RET/DET BASIN

B	B	
1		
2		
3		

REVISION	BY	DATE

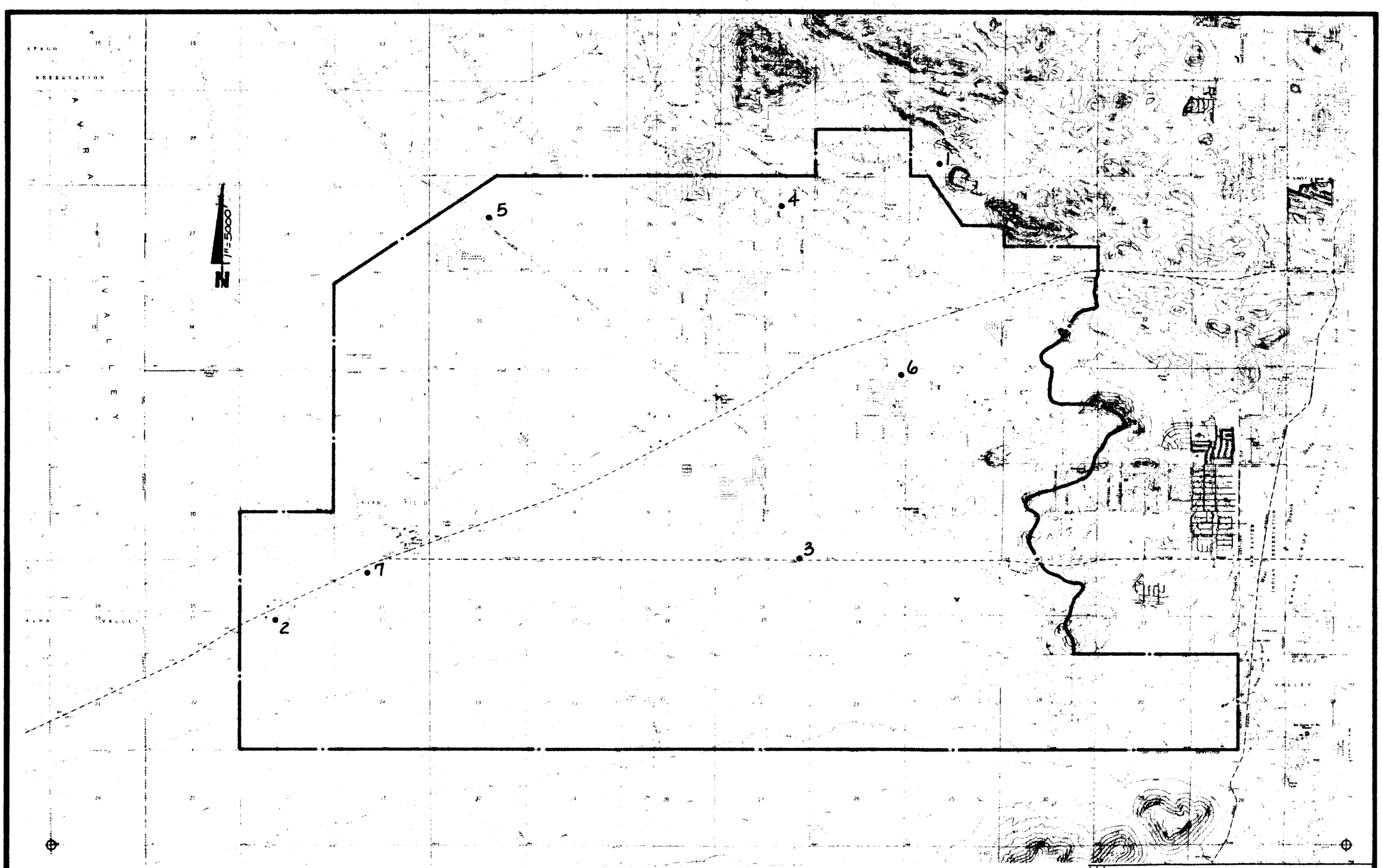
ANDERSON PASSARELLI ASSOCIATES
ENGINEERS · SURVEYORS · PLANNERS
288 N. CHURCH AVENUE · TUCSON, AZ 85701 · 602-623-1600

SOUTHWEST BASIN MANAGEMENT STUDY

FIGURE 14

IMPROVED CHANNEL LOCATION MAP

DESIGN	DRAFT	CHECK	SHEET
TP	BC		OF
SCALE 1" = 2000'	AUG. 1989	JOB NO. 84145	



SAMPLE #8 TAKEN T·16·S R·12·E SEC. 33
NEAR PIMA MINE ROAD
SAMPLE #9 TAKEN T·16·S R·12·E SEC. 3
ON SAN XAVIER INDIAN RESERVATION

ANDERSON PASSARELLI ASSOCIATES

SOUTHWEST BASIN MANAGEMENT STUDY
FIGURE 1
SEDIMENT SAMPLE LOCATION MAP

DESIGN TJP	DRAFT BC	CHECK TJP	SHEET 1/1
SCALE 1"=5000'	DATE 12-89	JOB NO 84145	

analyses were performed for major culverts and channels and roadway dip sections within the SWBMSA. The resulting capacities were then related to an event of specific return interval by comparison with the peak discharge determinations made for the point of interest.

3.2.1 Culvert Crossing Capacity Analysis

Culvert analyses were performed for capacity at available headwater using the Federal Highway Administration Hydraulics Microcomputer Program HY8, Culvert Analysis, 1987. Culvert details were taken from appropriate roadway improvement plans and field measurement performed by APA. Documentation of culvert analyses are included in Appendix C. Table 7 summarizes the results of the culvert capacity analysis. The culvert locations are shown on Figure 12. Individual culvert exceedance recurrence return intervals along Ajo Road range from 5-year event up to 100-year. However the culverts along Ajo Highway are generally inadequate to pass the 100-year runoff. As a result, ponding along the south side of the Ajo Highway occurs as depicted on the FEMA maps for Black Wash which are discussed in Section IV.

3.2.2 Roadway Dip Crossing Capacity Analysis

Critical roadway dip sections in the SWBMSA were analyzed for their capacity at a depth of flow equal to one (1) foot. Critical sections were determined to be those

TABLE 7
Culvert Capacity
Summary Table

#	Type	Road	Capacity (cfs)	Non-Exceedence Recurrence Interval (yr)	Q100yr (cfs)
C1	8-10'X4' RCB	AJO	2311	10	5353
C2	2-8'X3' RCB	AJO	305	25	501
C3	2-8'X3' RCB	AJO	265	25	389
C4	10-10'X4' RCB	AJO	2744	>100	1372
C5	1-6'X3' RCB	AJO	92	10	217
C6	4-10'X5' RCB	AJO	1777	50	1797
C8}*	7-10'X5' RCB	AJO	2590}	>100	2171
C9}	2-24" CMP	AJO	14}		
C10	5-10'X6' RCB	AJO	2075	25	4885
C11	3-10'X5' RCB	AJO	1035	10	2207
C12}*	1-10'X6' RCB	AJO	517}	10	3908
C13}	2-10'X6' RCB	AJO	870}		
C14	2-6'X7' RCB	AJO	630	>100	255
C15	4-24'X6' RCB	AJO	4971	50	4752[1]
C16	2-24'X6' RCB	AJO	2486		4459
C17	1-10'X4' RCB	AJO	306	>100	116
C18	1-10'X4' RCB	AJO	224	>100	124
C19	3-10'X4' RCB	AJO	630	>100	286
C20	4-10'X4' RCB	AJO	1019	10	1739
C21	4-10'X3' RCB	AJO	855	>100	806
C22	3-10'X3' RCB	AJO	643	>100	604
C22A	2-42" CMP	AJO	127	10	216
C22B	1-8'X4' RCB	AJO	267	5	571
C23	2-8'X5' RCB	OLD AJO	717	5	3908
C24	10-60" CMP	VALENCIA	1644	>100	885
C25	10-10'X5' RCB	CAMINO VERDE	4279	>100	3884
C26	4-54" CMP	MARK	430	2	1637
C27	3-10'X5' RCB	SUNSET	1231	10	2496
C28}*	1-49"X32" RCP	KINNEY	60}	2	343
C29}	1-30"X19" RCP	KINNEY	18}		
C30	1-45"X29" RCP	KINNEY	48	5	175
C31	1-49"X32" RCP	KINNEY	60	<2	597
C32	1-49"X32" RCP	KINNEY	60	25	100
C33	3-12'X6' RCB	KINNEY	1660	25	2255
C34}*	1-45"X29" RCP	KINNEY	48}	2	552
C35}	2-45"X29" RCP	KINNEY	110}		

Table 7 (continued)

C36}*	1-45"X29" RCP	KINNEY	48}	<2	839
C37}	1-45"X29" RCP	KINNEY	48}		
C38}	1-45"X29" RCP	KINNEY	48}		
C39	1-38"X24" RCP	KINNEY	27	<2	299
C40	4-10'X4' RCB	KINNEY	1370	25	1904
C41	1-10'X3' RCB	KINNEY	215	10	404
C42	1-45"X29" RCP	KINNEY	48	50	56
C43	2-6'X5' RCB	KINNEY	490	>100	99
C44}*	2-6'X3' RCB	KINNEY	260	>100	135
C44A}	1-38"X 24" RCP	KINNEY	35		
C45}*	2-12'X6' RCB	KINNEY	1250	>100	640
C45A}	1-30" CMP	KINNEY	33		
C46	8-48" CMP	LONE STAR DR.	953	5	2293

1 From HEC-1 Routing * Capacities summed

090

which might limit access to existing developed property during the 100-year runoff event. The resulting discharges were then related to an event of specific return interval. Road section geometries were taken from field surveys conducted by APA and 1" - 100' aerial photo-topo. Manning's equation was used to calculate hydraulic variables. Table 8 summarizes the roadway dip section analysis. Dip section locations are shown on Figure 13. Individual calculations are contained in Appendix D.

3.2.3 Improved Channel Capacity Analysis

Improved channels within the SWBMSA were cataloged as summarized in Table 9. Capacity ratings were performed using Manning's equation. These ratings were compared to the predicted 100 yr peak discharges for the appropriate watersheds, however, some of the improved channels are located within 100 yr sheetflow areas (Black Wash Floodplain). In these sheetflow areas specific 100-year discharges at the improved channel locations were not determined. The individual calculation sheets are contained in Appendix E.

3.2.4 Summary of Problem Areas

Table 10 provides a summary of the inadequate culvert crossings, roadway dip crossings and channel sections based on the results of analyses described above and shown in Tables 7, 8, and 9. Table 10 was developed to provide a more concise overview of the most severe problem areas. The

TABLE 8

Roadway Dip Section
Summary Table

#	Road	Q @ 1' Depth (cfs)	Non Exceedance Recurrence Interval** (yr)	Q100 (cfs)
D12	Valencia	263	2 yr	3525
D20	Valencia	257	10 yr	664
D22	Valencia	361	2 yr	2168
D26	Valencia	298	2 yr	4324
D28	Valencia	570	2 yr	2086
D29	Camino Verde	140	<2 yr	4324
D39	Camino Verde	544	10 yr	1034
D43	Joseph	depth =.48'*	10 yr	429
D58	Camino de Oeste	depth =.90'*	2 yr	2165
D62}[1]	Sunset	220	2 yr	3617
D63}	Sunset	270		
D64}[2]	Sheridan	476	2 yr	3617
D65}	Sheridan			
D75	Naomi	247	<2 yr	2456
D87	Bopp	sheetflow	SF	2092
D90	Bopp	203	5 yr	969
D92	Bopp	depth =.76'*	5 yr	702
D97	Bopp	depth =.32'*	SF	1758
D106	Bopp	depth =.62'*	10 yr	318
D111	San Joaquin	118	2 yr	674
D114}[3]	San Joaquin	288	2 yr	4069
D115}	San Joaquin	175		
D117	San Joaquin	287	25 yr	516
D125	San Joaquin	267	<2 yr	2588
D126	San Joaquin	depth =.77'*	50 yr	784
D128	San Joaquin	depth =.38'*	SF	1848
D130	San Joaquin	248	5 yr	1212
D133	San Joaquin	433	10 yr	933
D135	San Joaquin	625	25 yr	963
D136}[4]	San Joaquin	558	5 yr	4304
D137}	San Joaquin	321	5 yr	4304
D144	Camino de Oeste	493	2 yr	3125
D145	Tucson Estates Pkwy	310	5 yr	3186
D146	Camino Verde	83	<2 yr	2658

[1] D62 & D63 capacities summed
[2] D64 & D65 considered as single section
[3] D114 & D115 capacities summed
[4] D136 & D137 capacities summed

* maximum depth before breakover

** SF = No defined discharge concentrating at channel location, upstream flow occurs as sheet flow over a wide area.

TABLE 9
IMPROVED CHANNEL SUMMARY TABLE

Structure	Capacity (cfs)		Q100 (cfs)	Non-Exceedance Recurrence Interval
I1	447		1123	10 yr
I2	654		2863	5 yr
I3	4063		4063*	100 yr
I4a[1]	1017		1017*	100 yr
I4b	767		767*	100 yr
I5	49		49*	100 yr
I6	265		265*	100 yr
I7	234		-	
I8	172	806	- } 3455**[2]	
I9	400		-	
I10	1068		933	100 yr
I11	269	390	4459**[3]	
I12	121		- } 4061***[4]	
I13	108		-	
I14	818		818*	100 yr
I15	281		281*	100 yr
I16	281		281*	100 yr
I17	899		899*	100 yr
I18	707		- } 663	
I19	426		-	
I20	522		829	25 yr
I21	452		1758**	
I22	341		777	10 yr
(NO 23)				
I24	632		632*	100 yr
I26	300		300*	100 yr
I27	3300		3300*	100 yr
I29	558		3884	<5 yr
I30	265		1513	<2 yr
(NO 31)				
I32	378		404	50 yr
I33	1136		2293	10 yr
I34	231		431	10 yr
I35	608		552**	
I36	356		1386	2 yr
I37	356		657	10 yr

[1] Channel design approved and not constructed.
* Channel analyzed discharges taken from approved H&H reports.
** No defined discharge concentrating at channel location, upstream flow occurs as sheetflow over a wide area.
[2] From HEC-1 routing CP9.
[3] From HEC-1 routing CP13.
[4] From HEC-1 routing CP10.

TABLE 10

Summary of
Inadequate Structures

Roadway Dip Sections

	Capacity @ 1' depth** (cfs)	Non-Exceedence Recurrence Interval	Q100 cfs
D12	263	2yr	3525
D20	257	10yr	664
D22	361	2yr	2168
D26	298	2yr	4324
D28	570	2yr	2086
D29	140	<2yr	4324
D39	544	10yr	1034
D43	0.48' available	10yr	429
D58	0.90' available	2yr	2165
D62-D63*	490	2yr	3617
D64-D65*	476	2yr	3617
D75	247	<2yr	2456
D87	0.00' available	-	092
D90	203	5yr	969
D92	0.76' available	5yr	702
D97	0.32' available	-	1758
D111	118	2yr	674
D114-D115*	463	2yr	4069
D117	287	25yr	516
D125	267	<2yr	2588
D128	0.38' available	-	1848
D130	248	5yr	1212
D133	433	10yr	933
D135	625	25yr	963
D136-D137*	879	5yr	4304
D144	493	2yr	3125
D145	310	5yr	3186
D146	83	<2yr	2658

* Capacities summed

TABLE 10(cont.)

CULVERTS

	Capacity @ 1' depth** (cfs)	Non-Exceedence Recurrence Interval	Q100 cfs
C1	2311	10yr	5353
C2	305	25yr	501
C3	265	25yr	389
C5	92	10yr	217
C10	2075	10yr	4885
C11	1035	10yr	2207
C12-C13*	1387	10yr	3908
C15	4971	100yr	4752[1]
C16	2486	50yr	4459
C20	1019	25yr	1739
C22A	127	10yr	216
C22B	267	5yr	571
C23	717	5yr	3908
C26	430	2yr	1637
C27	1231	10yr	2496
C28-C29*	78	2yr	343
C30	48	5yr	175
C31	60	<2yr	597
C32	60	25yr	100
C33	1660	25yr	2255
C34-C35*	158	2yr	552
C36-C38*	144	<2yr	839
C39	27	<2yr	299
C40	1370	25yr	1904
C41	215	10yr	404
C42	48	50yr	56
C46	953	5yr	2293
		Improved Channels	
I1	447	10yr	1123
I2	654	5yr	2863
I20	522	25yr	829
I21	452	2yr	1758
I22	341	10yr	777
I29	558	<5yr	3884
I30	265	<2yr	1513
I32	378	50yr	404
I33	1136	10yr	2293
I34	231	10yr	431
I36	356	2yr	1386
I37	356	10yr	657

* Capacities summed
[1] From HEC-1 routing

following paragraphs provide additional discussion of specific problem areas. The location of the areas discussed below are shown on Figure 6.

1) Branding Iron Park, Section 10, T15S, R12E, is located almost entirely within the 100-year Black Wash Floodplain as determined by the F.I.S. and the Black Wash Drainage Analysis and Policy Assessment Report. The Black Wash at Branding Iron is ill-defined with distributary channel braids traversing the development. During the 100-year runoff event, this developed area could potentially experience severe flooding with depths of inundation exceeding 2 feet.

2) Millstone Manor #6, Section 30, T14S, R12E is located at San Joaquin Road and Ironwood Wash. A detailed hydraulic analysis using the U.S. Army Corp of Engineers HEC-2 backwater model was performed for Millstone Manor by the Pima County Flood Control District in June 1988. The results of the SWBMA study concur with those of the Pima County report. Specifically, a major portion of Millstone Manor is affected by Ironwood Wash. The potential for upstream channel breakout, inadequate channel capacity through the development and the relatively flat relief and associated 100-year sheet flooding may adversely effect a large portion of the development lots within this area, many of which have structures situated immediately adjacent to the main braid of the wash

3) The Tierra Bonita Subdivision is located in Section 34, T14S, R12E. The drainage

problems within this development are associated with upstream 100-year sheet flooding over Bopp Road. The capacity of the on-site improved channel (121) does not provide sufficient 100-year conveyance (Q_{cap} = 452 cfs) with respect to the upstream drainage area (Q_{100} = 1758 cfs). The lack of upstream natural channel definition at the improved channel inlet produces the potential for 100-year sheet flooding through portions of the development. Sheet flow and/or ill-defined channel flow conditions also predominate within the areas to the west and north of this subdivision. These areas were discussed in Section 2.1.3 of this report which addressed documented flooding complaints (Area 2 identified in Section 2.1.3). Occurrence of significant runoff quantities along the Golden Gate subdivision streets which parallel channels 118 and 119 was readily evident during field investigation.

4) Diablo Village is located in Section 16, T15S, T12E. This development is constructed within a 100-year sheet flooding area. A series of earthen collector channels (I114, I15, I16 and I17) were constructed as a part of the development to convey runoff through the subdivision. The flooding complaint record for the SWBMSA (see Table 1) indicates that these channels experience erosion and head cutting from runoff associated with recurrence intervals less than the 100-year. Also, field investigation indicated that sediment deposition was a problem at the inlets of the two culvert crossings along the collector channels. Pima County has accepted the maintenance of these earthen channels.

5) Tucson Estates mobile home park is located in Section 26, T14S, R12E. The capacities of improved channel I33 and culvert C46 appear to be based on the inaccurate watershed delineation discussed in Section 3.1.1. Use of the correct upstream watershed delineation indicated that runoff through the park (improved channel I33 & culvert C46) produces the potential for severe flooding during the 100-year event. Specifically, C46 has a capacity associated with available headwater of 953 cfs. Improved channel I33 has a capacity of approximately 1136 cfs. The predicted 100-year peak discharge based on the correct watershed delineation is 2293 cfs. During the floodplain mapping prepared for this study it was determined that the limited capacity of I33 with respect to the 100-year discharge would result in a floodplain width of 130 to 150 feet just upstream of Kinney Road. the channel top width at this location is approximately 40 feet. Also, although they intercept considerably less runoff, the smaller channels within the more easterly portions of Tucson Estates (I34, I36, I37) have considerably less than 100-year capacity. It appears from the floodplain mapping prepared as a part of this study that some mobile home structures may be inundated along improved channel I36 during the 100-year event.

3.3 Geomorphic Analyses

3.3.1 Qualitative Assessment of Historic Channel Behavior

As part of the geomorphic analysis a qualitative assessment was made of historic channel behavior in the study area. The evaluation was performed by

visual comparisons between historic 1936 aerial photography (1" = 2640') and more recent aerial photography dated March, 1988 (1" = 1000'). The comparison focused on two general areas, one including watersheds which drain the area north of the Black Wash (i.e. those watersheds emanating from the Tucson Mountain foothills) and the other including those watersheds which drain the area south of the Black Wash (those watersheds emanating from the Sierrita Mountain foothills). The evaluation performed focused on the extent of lateral movement resulting from natural changes occuring in watersheds during the 52 year time frame reviewed. However, the impact of suburban development was investigated where applicable.

In the northern area, the 1936 photo shows fairly well-defined and undisturbed natural watercourses. By 1988 a portion of this area had experienced suburban development with roadways cutting across natural channels. In general, comparisons between the two photograhic bases indicated no significant changes in lateral channel alignment within the past 52 years, even for those areas in which suburban development had occured.

Within the southern area the 1936 photo indicates a predominance of very poorly defined channels. The photo also shows several places where berms or dikes were constructed, presumably to divert runoff to stock ponds, to irrigate, or to control flooding. Examination of the 1988 photo shows that Valencia Road, which traverses the site perpendicular to the major watercourses, has altered channels in such a way

that upstream of the roadway they are poorly defined as in the historic photo, but downstream of roadway culverts they exhibit increased definition and incisement. Heavy vegetation indicates ponding upstream of the roadway. This suggests that streams entering the ponding area experience reduced velocities resulting in sediment deposition, thus decreasing the sediment supply of the stream as it continues downstream of the roadway. The consequent erosion of bank and channel bottom sediment results in more defined channels observable downstream from Valencia Road. Channels in this portion of the study area not affected by roadway crossings showed no significant changes within the past 52 years.

As a result of the qualitative evaluation of long-term lateral channel behavior discussed above, it appears that the channels within the study area have relatively stable horizontal alignments. The more critical flood hazard concerns for these channels are associated with the lack of relief of these distributary channels and the potential for flow breakout during infrequent, high magnitude events.

3.3.2 Sediment Yield Analysis

As a part of this study a sediment yield analysis was performed to predict average annual sediment yield for the larger watersheds within the SWBMSA (i.e., Q100 > 1000 cfs). Average annual sediment loads were calculated at specific points using the Universal Soil Loss Equation (USLE).

The USLE is described in the United States Department Of Agriculture Handbook Number 537 as an empirically derived erosion model designed to predict long-term average annual soil losses. The USLE is shown below:

$$A = R \times K \times LS \times C \times P$$

where A = soil loss, in tons/(acre)(year)

R = the rainfall erosion index,

in 100 ft - tons/acre x in/hr

K = soil erodibility factor, tons/acre per unit R

LS = slope length and steepness factor , dimensionless

C = vegetative cover factor, dimensionless

P = erosion control practice factor, dimensionless

The rainfall erosion index R is a measure of the erosive force and intensity of rain in a normal year. The rainfall erosion index contains both an energy component and an intensity component. Values of R have been computed for the continental United States from rainfall records and probability statistics. As discribed in the Erosion & Sediment Control Handbook (Goldman 1986), $R = 27p^{2.2}$ for storms of an SCS type II classification , where p is the 2-year, 6-hr rainfall in inches. Based on the above definition the value of R was determined to be 87 for the SWBMSA.

The P, C, and K factors were determined using SCS handbook # 537 and are constant throughout the SWBMSA.

P = 1.0 (no supporting practices)

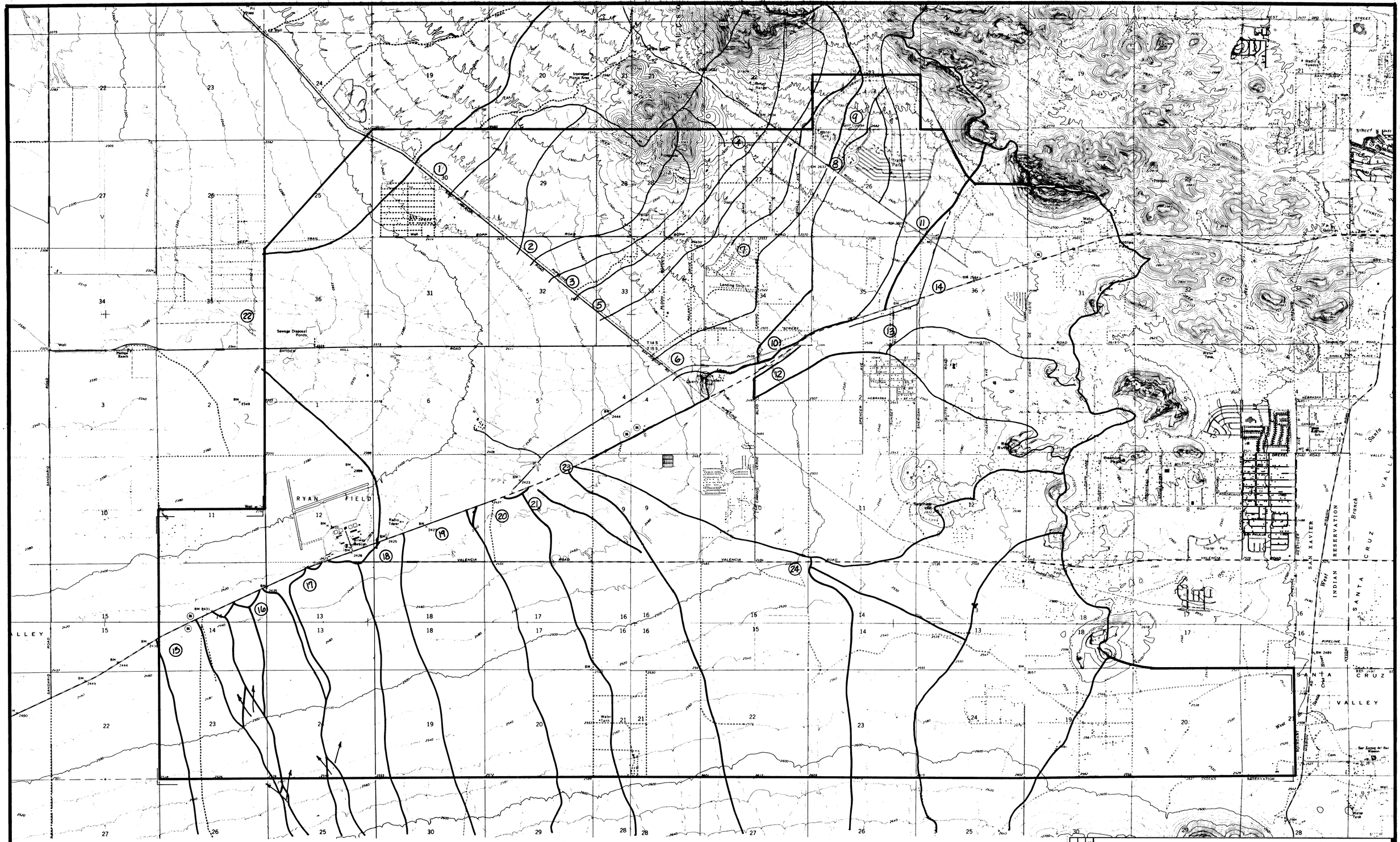
C = 0.36 (taken from SCS Handbook #537 Table 10)

K = 0.11 (using SCS Handbook #537 Fig. 3 and sediment gradation curves prepared by APA)

The specific LS factors were determined for each individual watershed. The locations of the sediment samples used to developed the gradation curves discussed above are shown on Figure 15. The gradation curves and SCS Handbook #537 worksheets are contained in Appendix F of this report.

The results of the sediment yield analysis are summarized in Table 9 which shows the sediment yield for the Black Wash and other selected watersheds at designated locations. Values ranged between 0.26 and 1.08 ac-ft per square mile per year, with most values falling between 0.3 and 0.7. Figure 16 shows the locations indicated in Table 11.

In general, the results of the sediment yield analysis are consistent with the percent average rate of erosion losses indicated for the study area in Table 3.4 of the Santa Cruz - San Pedro River Basin Main Report, prepared by the U.S. Department Of Agriculture Soil Conservation service. The above report indicates an average rate of erosion in the study area of .35 to .75 acre-ft per square mile per year. Typically sediment yields per unit area were higher for the steeper watersheds within



B	B		
1			
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REVISION	BY	DATE

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SOUTHWEST BASIN MANAGEMENT STUDY

FIGURE 16
SEDIMENT YIELD LOCATION MAP

DESIGN	DRAFT	CHECK	SHEET
TP	BC		OF
SCALE 1"=2000'	AUG. 1989	JOB NO. 84145	

TABLE 11

Summary of Results of Sediment Yield Analysis

Location	Drainage Area (mi^2)	Annual Sediment Yield		
		Tons	Acre-Ft[1]	Acre-Ft Per (mi^2)
1 (D114-D115)	3.45	5732	2.63	0.76
2 (D125)	1.19	1720	0.79	0.66
3 (D128)	1.30	1279	0.57	0.44
4 (D75)	0.75	1754	0.81	1.08
5 (D130)	1.00	1721	0.79	0.79
6 (D136-D137)	3.06	2150	0.99	0.32
7 (D97)	1.01	927	0.43	0.43
8 (C40)	0.89	1136	0.52	0.58
9 (C46)	0.77	1132	0.52	0.67
10 (D146)	1.39	2013	0.92	0.66
11 (C33)	1.06	1621	0.74	0.70
12 (C25)	3.23	4489	2.06	0.64
13 (C27)	1.18	1309	0.60	0.51
14 (C20)	0.79	1020	0.47	0.59
15 (C1)	9.66	11296	5.19	0.54
16 (C4)	2.57	1486	0.68	0.26
17 (C6)	3.49	2145	0.98	0.28
18 (C8-C9)	4.05	3003	6.38	0.34
19 (C10)	12.10	11603	5.33	0.44
20 (C11)	4.41	2991	1.37	0.31
21 (C12-C13)	12.63	11568	5.31	0.42
22 (HEC-1 C1)	87.13	80034	37.11	0.43
23 (HEC-1 C8)	44.85	43874	20.14	0.45
24 (HEC-1 C9)	14.46	12543	5.76	0.40

[1] Assumes 100 lbs/cubic foot

the foothills and mountain areas. Lower yields per unit area occurred along the lower reaches of the study area where milder slopes predominated. The individual sediment yield calculation sheets for the values shown in Table 9 are contained in Appendix F.

It should be noted that the USLE predicts soil loss rather than actual sediment yield. As such, it does not include a channel bed-load sediment yield component. However, bed-load is probably a small fraction of the total yield in the SWBMSA due to the limited channel definition along most reaches. Comparison of the results of this analysis with sediment yield values for the Santa Cruz and San Pedro River Basins indicate a good correlation. Table 3.5 of the SCS report referenced above, indicates an average annual sediment yield range of 0.13 to 0.50 ac.ft/sq.mi. which is consistent with the results of the USLE analysis.

The Modified Universal Soil Loss Equation (MUSLE) is a modification of the USLE which was developed to more accurately model single-event sediment yield volumes. The modification makes the MUSLE ostensibly more appropriate for arid regions where runoff is typically a result of isolated events. However, to use the "single-event yield" nature of the MUSLE to determine average annual yield, the Design Manual for Engineering Analysis of Fluvial Systems (ADWR, March 1985) recommends a probability weighing methodology which involves weighing the individual yields for the 2, 5, 10, 25, 50 and 100-year events by their probabilities of occurrence. In an effort to compare the USLE results with the MUSLE method, the above procedure

was performed for five of the watersheds shown in Table 11. The results of the comparison are shown in Table 12, As indicated in Table 12 the MUSLE results indicate considerably lower yields than the USLE results and the data from the SCS data report. Use of the USLE results is recommended because they represent a conservative estimate and are consistent with the SCS report results, .

TABLE 12

Comparison of Sediment Yield Analysis

Using USLE and MUSLE

Average Annual Sediment Yield (Ac-Ft/mi²)

Location	Area (mi²)	USLE	MUSLE
14	0.79	0.59	0.20
15	9.66	0.54	0.10
16	2.57	0.26	0.04
19	12.10	0.44	0.06
20	4.41	0.31	0.05

IV. FLOODPLAIN DELINEATIONS

One of the objectives of this study was to delineate 100 year floodplains for urbanized areas not studied by FEMA where predicted 100 year peak discharges equaled or exceeded 500 cfs. The FEMA study in the SWBMSA includes all of the area south of Ajo Road and west of San Joaquin Road (Black Wash floodplain). The remaining area north of Ajo Road and east of San Joaquin Road was analyzed for flooding potential based upon the aforementioned criteria.

Using the Pima County Method, predicted 100 year peak discharges were determined at specific concentration points. Manning's equation was used to rate cross-sections developed from 1" = 100', 2' contour interval mapping and roadway dip sections surveyed by APA. Where the channel capacity was exceeded by the predicted 100-year discharge, flow breakout was assumed to produce overland sheet flow. The flood limits determined from the above ratings were delineated on recent (March 1988) 1' = 1000' aerial photography and are shown on Figure 17. The floodplains as determined by this study were categorized using four designations 1) defined 100-yr floodplains, 2) Areas of defined 100-yr channel flow of undetermined depth and extent, 3) Areas subject to flood hazards due to sheetflow and/or potential upstream flow breakout, 4) Non-urbanized area or areas determined not to be subject to flood hazards for Q100 greater than or equal to 500 cfs. Also, the results of the Black Wash analysis prepared by the Pima County Flood Control District and the 1989 FEMA Black Wash 100-year floodplain

LEGEND:

100 YR. FLOODPLAIN AREA PER SWBMS	DEFINED 100 YR. FLOOD PLAIN.	
	SHEET FLOW AND/OR POTENTIAL UPSTREAM FLOW BREAKOUT	
	AREA OF DEFINED CHANNEL FLOW OF UNDETERMINED DEPTH AND EXTENT	
	NON-URBANIZED AREA OR AREA DETERMINED NOT TO BE SUBJECT TO FLOOD HAZARD FOR $Q_{100} \geq 500$ cfs	
FLOODPLAIN AREA DETERMINED FROM OTHER STUDIES	BLACK WASH MAIN STEM ADMINISTRATIVE FLOOD PLAIN	
	BLACK WASH ADMINISTRATIVE FLOODWAY	
	FEMA 100 YR. FLOODPLAIN (INCLUDES ENTIRE BLACK WASH FLOOD PLAIN)	

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SOUTHWEST BASIN MANAGEMENT STUDY
FIGURE 17
FLOOD PLAIN MAP
($Q_{100} \geq 500$ cfs)

DESIGN	DRAFT	CHECK	SHEET
TJP	BC	JMW	1 OF 1
SCALE 1"=1000'	DATE DEC. 1989	JOB NO. 84145.10A	

DATE | BY | DESCRIPTION

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are delineated on Figure 17. The floodplain for Millstone Manor (Sec. 30, T14S, R12E) is that as delineated by Pima County Flood Control District Hydrologic and Hydraulic Analysis and Recommended Guildines for Millstone Manor #6, June, 1984. Individual calculations for the floodplain analysis are contained in Appendix G. A summary of the cross-section ratings performed as a part of the floodplain delineations is provided in Table 13.

TABLE 13

FLOODPLAIN ANALYSIS
Summary Table

Cross[1] Section	Depth of flow before breakover	Discharge at contained depth	100yr breakover and/or sheetflow	Q100
1-1	1.92	674	-	674
2-1A}*	2.13	1500	yes	4069
2-1B}	2.13	403		
2-2	4.05	4069	-	4069
3-1	4.37	516	-	516
3-2	1.29	516	-	516
3-3	2.40	612	yes	3189
3-4	0.90	132	yes	3189
3-5	1.70	336	yes	3189
4-1	2.00	1426	yes	2588
4-2	2.40	877	yes	2588
4-3	4.21	2588	-	2588
5-1	0.77	784	-	784
5-2	1.45	784	-	784
5-3	3.02	697	yes	697
6-1	1.30	437	yes	1212
6-2	3.25	1212	-	1212
6-3	4.20	504	yes	969
6-4	1.91	969	-	969
7-1	0.40	64	yes	963
7-2	1.04	963	-	963
8-1A}*	.53	95		
8-1B}	1.13	377	yes	4304
8-2	4.95	4304	-	4304
8-3	1.40	348	yes	2658
8-4	2.81	3186	-	3186
9-1	0.39	99	yes	1848
9-2	Sheetflow	-	yes	2092
9-3	3.12	2092	-	2092
9-4	4.99	2456	-	2456
9-5	2.59	2456	-	2456
10-1	2.34	633	-	663
11-1	0.99	433	yes	933
11-2	1.70	753	yes	933
11-3	2.51	1010	-	702
11-4	0.76	213	yes	702
11-5	2.00	942	-	640
11-6	2.94	1010	-	640
12-1	2.20	1647	yes	1801
12-2	0.32	40	yes	1758

TABLE 13 (cont)

FLOODPLAIN ANALYSIS
Summary Table

Cross[1] Section	Depth of flow before breakover	Discharge at contained depth	100yr breakover and/or sheetflow	Q100
12-3	3.44	2293	-	2293
12-4	2.01	1904	-	1904
12-5	3.33	1904	-	1904
13-1	2.14	2255	-	2255
14-1	3.00	913	yes	2053
14-2	3.64	2053	-	2053
14-3	1.47	1114	-	1114
14-4	2.89	1114	-	1114
15-1	1.70	781	-	781
15-2	3.47	781	-	781
16-1	4.83	1637	-	1637
16-2	2.61	1637	-	1167

* channel capacities summed
[1] see Figure 17

V. QUALITATIVE ANALYSIS OF FLOOD CONTROL ALTERNATIVES

5.1 Comparison of Different Flood Control Approaches Previously Used Within the Study Area.

The SWBMSA has experienced human encroachment in the form of private development and various public works improvements such as the Snyder Hill Wastewater Treatment Facility, Ryan Air Field, the Central Arizona Project and numerous principal and secondary arterial roadways. The approaches to accommodating the drainage which impacted this development has varied from construction of concrete lined channels and large scale detention/retention basins to providing virtually nothing in the way of flood hazard protection. This sub-section discusses the merits and flaws of the different approaches to drainage design historically used within the study area.

Two of the older residential developments within the study area are the Millstone Manor #6 and Golden Gate subdivisions which are mobile home developments located within Sections 30 and 34, T14S, R12E, respectively. Descriptions of the drainage problems within these developments are provided in Section 3.2.4 of this report. The basic approach to accommodating drainage within both of these subdivisions was largely to "do-nothing". In the case of the Millstone Manor #6 subdivision a 60 foot drainageway was platted but no improvements were ever

constructed. The Golden Gate subdivision was designed with roadways laid out parallel to the washes which transect the development, however no improvements were made to the natural drainageways.

The result of the approaches taken in the two developments described above has been a history of flooding complaints as documented in Section 2.1.3 of this report, namely complaints of individual improvements by property owners causing redirection of flows or aggravation of pre-existing problems. By and large however the nature of the complaints appear to be limited in terms of documented losses. It would appear that the existing drainageways through these developments are capable of handling the typical "monsoon" storm runoff. Documentation of flooding problems resulting from occurrence of the more rare floods was not found during the course of this study. However, analysis of the 100-year event through the Millstone Manor #6 subdivision (as documented in the report entitled "Hydrologic and Hydraulic Analysis and Recommended Guidelines for Millstone Manor #6) indicates significant flooding potential.

In marked contrast to the drainage design philosophy employed in the above developments was the approach taken in dealing with drainage in the Diablo Village subdivision located in Section 16, T15S, R12E. Here, well-defined channels were excavated to accommodate the predicted 100-year discharges. The channels in this subdivision are relatively wide and shallow, with significant accumulation of sandy

sediment along many reaches. The design of the channels within this development appears to have been dictated solely by the need to adhere to the grid work pattern of the subdivision layout with 90 degree bends in channel alignment prevailing throughout.

One problem observed in the field at this location is the deposition of sediment at culvert entrances resulting from the inability of the crossings to match the sediment transport capacity of the improved channels. Another problem with the Diablo Village drainage design is that the channels, while sized for the 100-year flow, are not designed to effectively intercept and convey into the channels those flows which occur as sheet flow along the southern boundary of the subdivision. Flooding complaints for this area indicate problems with erosion and headcutting of the channels within the subdivision. A less easily quantified drawback to this flood control approach is the environmental loss resulting from the destruction of riparian habitat and the disruption of the hydraulic and geomorphic integrity of the natural drainage system in term of long range impacts to channel stability and natural groundwater recharge resulting from acceleration of flows through the system.

Review of the drainage design approaches take in previous development within the study area suggests that neither the "do-nothing" nor the 100-year channelization approaches have been completely successful, at least not as implemented in the three cases discussed above. In as much as the case studies described above seem to

represent fairly typical conditions within the study are it would appear that alternative solutions to drainage design warrant consideration.

5.2 Evaluation of Alternative Flood Control Techniques

The purpose of this sub-section of the report is to investigate, on a qualitative level, the merits of alternative flood control practices to be considered for use within the SWBMSA.

One of the main concerns within the SWBMSA is the flood hazard potential associated with flooding along the Black Wash. As discussed in Section III of this report the Black Wash is a very braided drainage conveyance system. In some locations the word "wash" can not even be used to appropriately describe the collection of ill-defined paths which form the key drainage feature in the basin. The administrative floodplain from the San Xavier Indian Reservation boundary to Snyder Hill Road as defined in the March 1989 Black Wash Drainage Analysis and Policy Assessment Report is nearly a mile in width in some locations. Partially within the above-described floodplain lies the Branding Iron Park mobile home subdivision while the Snyder Hill Wastewater Treatment Facility, further downstream, is located entirely within the floodplain. The Black Wash Drainage Analysis and Policy Assessment Report results indicate the approximately 112 mobile and 2 conventional homes are located within the administrative floodway. Flooding conditions and damage potential within

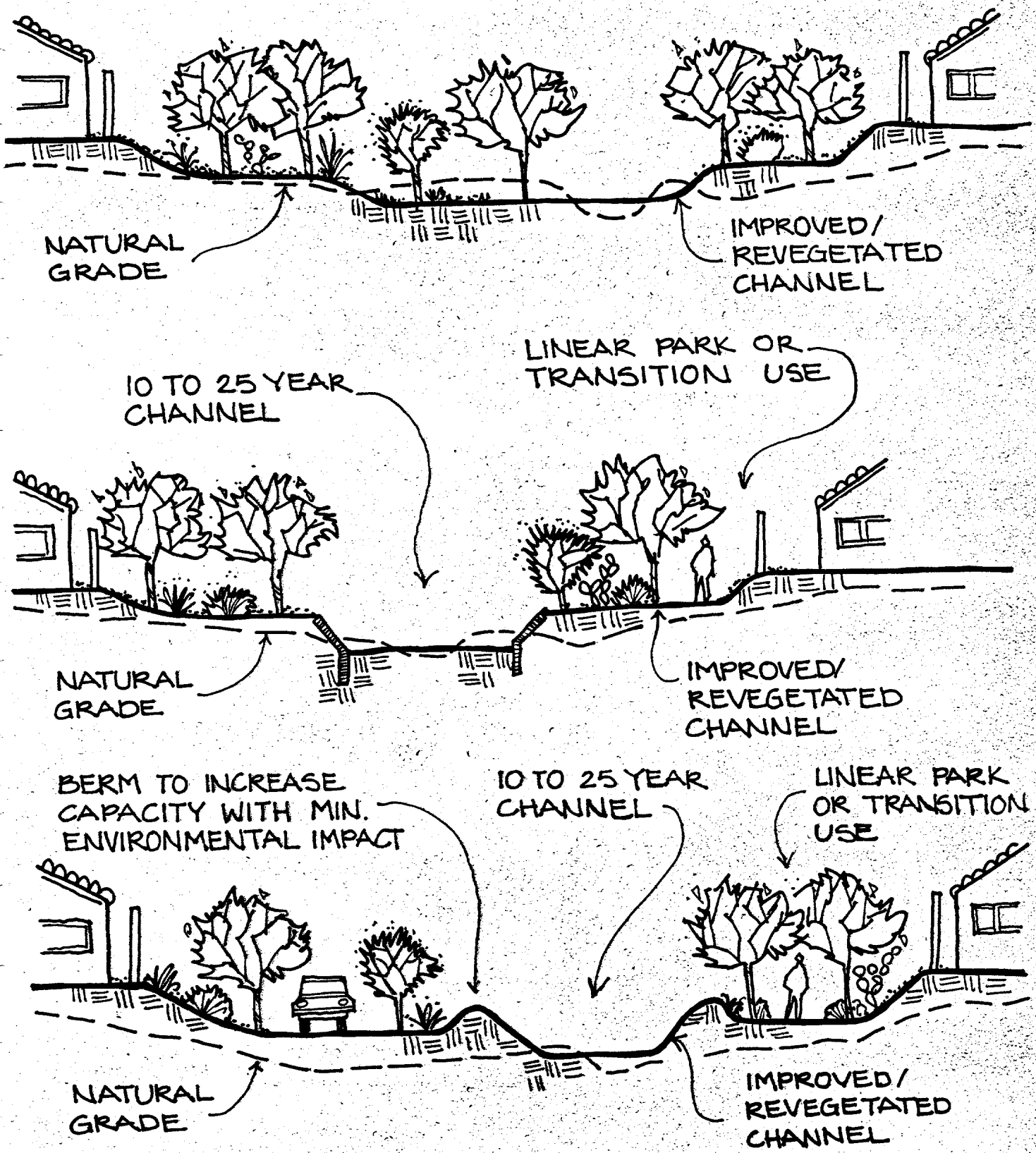
other floodprone areas of the SWBMSA are a result of flooding conditions similar to the sheet flow conditions of the Black Wash which occur on the smaller tributaries that emanate from the mountain fronts which form the basin.

One of the plans proposed for mitigating flood hazards within the SWBMSA on a regional basis is the one proposed in the Transportation and Flood Control Facility Implementation Plan for the Southwest Area plan prepared by the Pima County Department of Transportation and Flood Control District (1980). The flood control element of this plan calls for construction of a series of detention/retention facilities referred to as "stormwater detention et park" (SWETPA) facilities. The SWETPA as described in the proposed plan is a two-tiered excavated basin screened with vegetation and providing opportunities for recreation and groundwater recharge in addition to serving a flood control function. The plan, which calls for construction of ten such facilities at strategic locations throughout the SWBMSA, also suggests that the SWETPA's will result in savings on roadway maintenance and structural improvement costs downstream of each basin and that future sale of material excavated from the basis will provide an asset for the building industry in developing neighborhoods. The plan provides a conceptual cost benefit analysis which suggests a very favorable 2:1 benefit-to-cost ratio for the estimated $17 million dollar project.

The above plan as described in the County report is very ambitious and grand in scale. The cost benefit analysis as described in the report, however, is very

conceptual and makes a number of assumptions regarding the level of flood control protection provided without discussing the design level of the facilities or providing an analysis of downstream flooding for the design condition. Depending on the level of protection to be provided it appears that some of the estimates for land needs for the SWETPA's may be low. The basic premise of the plan is that the project will release 6000 acres or approximately nine square miles of land from flooding, representing a capital gain of roughly $20 million with an additional $15 million benefit in reduced downstream structural improvement needs. Whether the plan will actually release the estimated acreage from flooding danger and whether the value of the land released from flooding should be considered a direct and tangible benefit requires more detailed analysis. The economic considerations aside, the above plan is somewhat dated with regard to the changing philosophy of the county with regard to moving away from structural flood control improvements and the potential negative impacts of such large scale projects on the riparian environment.

One approach to flood control which lies between the extremes of the "do-nothing" and the 100-year channelization approaches is the use of composite channel sections which allow for limited encroachment into the floodplain and minor channel improvements which are limited to the low-flow portion of the channel or watercourse. Figure 18 shows three alternative conceptual cross-sections which could be used within the SWBMSA for incorporation into future development. The conceptual cross-sections shown draw and expand on concepts proposed for use in other areas where ill-defined



ALTERNATIVE CONCEPTUAL CHANNEL SECTIONS FOR THE SWBMSA

FIGURE 18

channels and sheet flow conditions predominate. These channel sections result in a much less radical impact on the stability of the upstream and downstream channel system. Semi-structural channel sections such as the one shown on Figure 18 can also provide a corridor for recreational facilities and improvements in addition to providing flood control.

Another approach to flood control which may be of use in the SWBMSA is quasi-passive, high-flow detention (QPHFD). Although somewhat ostentatious, the descriptive title for the flood control mechanism envisioned by this approach is fairly accurate and concise. The proposed concept basically involves above-grade storage of floodwaters generated by the less frequent events (i.e., 100-year) while allowing the peaks associated with the more frequent events to pass through the storage facility such that natural downstream channel capacity is not exceeded. As envisioned under this study, detention storage would ideally be accommodated by impounding runoff behind embankments for roadways which are otherwise required for transportation purposes. The QPHFD concept accomplishes a number of objectives including:

- providing flood control benefits,
- reducing the need for downstream structural improvements such as channel excavation and/or lining,
- providing through passage of low-flow runoff for support of downstream riparian environments,
- providing through passage of the dominant discharge for maintenance

of the natural sediment transport characteristics of the existing channel system,

- providing detention storage without the need for excavation of unsightly holes for ponding storage and the attendant maintenance problems associated with such excavation.

Implementation of the QPHFD approach should be evaluated on a case by case basis to determine the feasibility of it's use with regard to the location of future improvements such as roadway projects, the hydrologic properties of the tributary watersheds and the topographic and hydraulic characteristics of the site considered.

While regional planning for structural flood control facilities is generally desirable, regional planning for flood control structures in the SWBMSA does not appear feasible. Because existing developement is unlikely to participate substantially toward capital improvements and because no major new developments which could share costs with Pima County are planned within the areas of defined flooding, the opportunities for funding of projects intended primarily for flood control appear limited. Benefits provided would be largely to undeveloped lands which have typically been slow to develop and have traditionally been relatively low in value.

Seen in the above light the alternative approaches to flood control within the SWBMSA fall into two categories, namely:

- individual improvement projects designed to mitigate existing and defined hazards in specific areas with an emphasis on meeting multi-use objectives in order to more easily justify the cost of improvements, and
- specific floodplain management policies designed to control the approach to drainage design used in future developement.

Specific floodplain management policies for the SWBMSA will be addressed within the policies letter to be developed as a part of Task 3B of the Southwest Basin Management Study. The section which follows discusses recommendations for additonal study of specific problem areas within the study area.

VI. RECOMMENDATIONS

6.1 Southwest Area Plan Flood Control Policies

The Southwest Area Plan (SWAP) provides a basic set of policies which address rezoning requirements and associated issues such as site disturbance, landscaping, and transportation recreational and flood control needs. The flood control policies set forth in the SWAP were summarized in Table 1 (page 5) of this report. These policies provide a basic framework for regulating development related impacts to drainage conditions within the southwest area and, in general, it is recommended that they be maintained as a minimum standard for development wihtin the study area. However, the following recommendations are made with respect to the SWAP flood control policies:

- It is recommended that requirement (c) as describe in Table 1 of this report (i.e. "All development will covenant to contribute funds which will be utilized to improve drainage and all-weather access into the area") be extended to apply to SWAP planning sub-areas 3 and 6.

- It should be noted that regulation of 100-year peak discharges less than 100 cfs within a defined watercourse goes beyond floodplain management regulations as defined in the Floodplain and Erosion Hazard Management Ordinance No. 1988-FC2 (FMO). It is recommended that the SWAP

policies reflected by requirement (a) and (h) be revised to reflect the 100-cfs lower limit for regulatory purposes.

- The policies should be consistent with the grading ordinance and FMO. Grading plans and drainage studies should be prepared by a registered civil engineer.

- Channelization studies should consider both upstream and downstream impacts (not just downstream). Again, the reports should be prepared by a registrant.

- If access/driveway plans are to be reviewed by the FCD, then standards (at least design goals) should be specified prior to design initiation.

- Implications of planning and regulatory documents such as the Wildlife Habitats in Tucson (Shaw), The Trails Master Plan, and 404 permits should be discussed.

- General floodplain management goals and floodplain management tools mandated for the SWAP should be defined/discussed, and identified in an overlay with reference to the SWBMS.

- Policies for governmental projects (roads, airports, etc.) should also be defined. As currently written, the emphasis is directed towards the private sector, yet civil works and infrastructure can have major impacts on drainage.

- Monitoring of changes within/to the watershed is needed. Baseline conditions regarding floodplain channel slope/x-section, erosion/sedimentation should be defined and monitored. Land use should be inventoried and monitored in some kind of "living" document.

- The use of a flood control "zone" should be considered as provided by ARS 3604, to help fund improvements within the area.

6.2 Amendments to Balanced and Critical Basin Map

The results of the qualitative and quantitative analysis performed as a part of this study indicate that nearly all portions of the study area are subject to either defined or sheet type flooding during the 100-year event. Most areas appear to be subject to flood hazards for the more frequent events as well. Most of the existing DIP crossings along major roadways do not provide all-weather access and many of the culverted crossings provide less than 10-year capacity. The potential for collection and concentration of sheet flow by development presents the risk of increased peak

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HYDROLOGIC DATA SHEET

Project Name and Location: CBA - 3 2 of 5 Ctd (AZ)

Drainage Concentration Point: _____

Watershed Area (A): 581 acres/~~square miles~~.

Length of Watercourse (L_c): 14700 ft. Length to Center of Gravity (L_{ca}): 7350 ft

Incremental Change in Length (L_i) - ft.	Incremental Change in Elevation (H_i) - ft
14700	2510

Mean Slope (S_c): 0.17075 ft./ft. Watershed Type(s): _____ (future)

Basin Factor (n_b): .038 (future) Flood Frequency: 100 yrs

P24 (24 hour):	in.	Areal Value:	in.
P6 (6 hour):	in.	Areal Value:	in.
P1 (1 hour): 2.87	in.	Areal Value:	in.
P2 (2 hour):	in.	Areal Value:	in.
P3 (3 hour):	in.	Areal Value:	in.

Soil Group(s): 100% B Cover Type(s): _____

Cover Density (pervious areas): 20% Impervious Cover: 15% (future)

CN(s): 83 (curve number) (pervious & impervious areas) CN*(s): 87.5 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): _____ (pervious areas) _____ (impervious areas

Runoff Supply Rate (q): .635 i in./hr. (function of i)

Time of Concentration (T_c): 29 $i^{-.4}$ hrs./mins. (function of i)

Iterative Solution of T_c: 13 hrs./mins.

Rainfall Intensity (i) at T_c: 7.003 in./hr.

Runoff Supply Rate (q) at T_c: 4.45 in./hr.

Equation for T_c:

$$T_c = \frac{n_b}{50} \frac{(L_c L_{ca})^{.3}}{(S_c)^{.4}} q^{-.4} \text{ hours.}$$

Peak Discharge:

1.008 qA (acres): 2606 cfs.

645.33qA (square miles): _____ cfs.

Note: For impervious areas, CN* = 99 (constant).

Figure # E

Sheet 3 of 12

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discharges and additional flooding potential in already floodprone areas.

In light of the above determinations it is recommended that the entire SWBMSA be designated as a critical basin subject to the requirements as described in the Pima County Stormwater Detention/Retention Manual (February 1987). As a part of the development of floodplain management policies which will be developed under Task 3b of this study, additional recommendations will be developed for integration with the requirements of the Stormwater detention/Retention Manual to discourage inappropriate land uses and hence the need to require extensive on-site detention/retention works.

6.3 Future Studies Needs

The results of the data collection, field reconnaissance, and hydrologic and hydraulic analyses performed as a part of this study revealed a number of specific areas where development has occurred in potentially floodprone areas. The subsections below describe the specific areas for which additional study is recommended and provide an outline of the study needs for those areas as envisioned based on the results of this study.

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6.3.1 Branding Iron Park Subdivision

The Branding Iron Park subdivision is located entirely within the 100-year floodplain as determined by FEMA and almost entirely within the administrative floodplain of the Black Wash as defined by the Black Wash Administrative Floodway and Floodplain Map. The subdivision is also located partially within the floodway as defined on the same map. The subdivision is also affected by tributary drainage emanating from the Saginaw Hill area to the east. Review of the documented drainage complaints within Section 10, T15S, R12E where the subdivision is located revealed a high number of complaints for this area.

The Branding Iron Park is affected by flood hazards to not only residences but to transportation facilities as well. Both of the primary arterial roadways which provide access to the subdivision, namely Valencia Road and Camino Verde, are impacted by the Black Wash. These roadways are subject to flows in excess of one foot in depth during even the more frequent events. Future study of the Branding Iron Park area should include:

A) Detailed hydraulic analysis of the Black Wash in the vicinity of the Branding Iron Park including major tributaries affecting the Branding Iron Park (e.g. Saginaw Hill Tributary flow).

B) Evaluation of existing flood hazard potential in terms of threat to public safety, damage to public and private property and improvements and impact to transportation along major routes. The evaluation should include a risk analysis based on estimates of dollar damages for events of various return intervals.

C) Development and evaluation of alternatives for mitigation of flood hazards as determined under items (A) and (B) including, but not limited to: channelization, levee construction and construction of detention/retention facilities. Alternatives evaluated should include the concepts discussed in the Black Wash Drainage Analysis and Policy Assessment Report. The potential for implementing the QPHFD concept as described in Section 6 should also be considered in the alternatives development.

(D) Analysis of cost vs. benefits for the alternative developed in (C) to determine the cost effectiveness of implementation. The analysis should include identification of the parties by whom costs are borne and benefits accrued.

(E) Selection of a preferred plan for flood hazard mitigation and recommendations for implementation including phasing and financing.

Future recommendations for improvements to mitigate flooding in the Branding Iron Park area should be coordinated with plans for area transportation improvements. It is specifically recommended that the Major streets and Routes Plan be revised to show Camino Verde Blvd. as the major north-south route through this area, rather than Wade Road as currently indicated, because of the potential for integrating construction of this roadway with flood control improvements for this area.

6.3.2 Millstone Manor #6 Subdivision

The Millstone Manor #6 subdivision is located in the southwest quarter of Section 30, T14S, R12E and is located directly within the path of floodwaters emanating from the western braid of the Ironwood Wash. The existing flooding conditions within the subdivision are described in the report entitled "Hydrologic and Hydraulic Analysis and Recommended Guidelines for Millstone Manor #6". The above report defines the existing 100-year floodlimits along the western braid of the wash which transects the subdivision. A number of residences are located within the 100-year floodplain as shown in the county report.

It should be noted that a bifurcation occurs on the Ironwood Wash immediately upstream of the subdivision. The county report assigned only a portion of the 100-year discharge on the Ironwood Wash to the west braid while the remainder was assumed to flow down the east braid which parallels the subdivision to the east. This

assignment was based on an accurate evaluation of existing topography at the point of divergence of the two braids. However, it is possible that future changes in channel definition may concentrate more flow along the western braid making conditions potentially worse than predicted in the county report. It should also be noted that the hydrologic analysis performed as a part of this study determined a 100-year peak discharge for the Ironwood Wash which is approximately 33% higher than that determined by the county report. Conditions may be worse than previously predicted for this reason also.

As indicated in Table 2 of this report a number of documented flooding complaints from this area have been filed regarding inadequate channel capacity, diversion of flows resulting from encroachment into the drainageway and erosion of roadways which function as drainageways. The files for this area also indicate a service request from the floodplain section to the operations division for construction of the platted drainageway.

Because of the above documented conditions Millstone Manor #6 was determined to be one of the areas warranting recommendations for additional study. Future study of the Millstone Manor #6 subdivision should include, but not necessarily be limited to:

A) Detailed hydraulic and geomorphic analysis of the potential for future changes in the behavior of the bifurcation of the wash which may result in an increase

in flow concentration along one braid or the other.

B) Re-evaluation of existing flooding conditions using the HEC-2 model developed as a part of the county study to account for revisions to the design discharge determined in item (A). A hydraulic analysis should also be performed along the east braid of the wash to determine flooding potential to homes located along the eastern limit of the subdivision.

C) Development and evaluation of alternatives for mitigation of existing flood hazards as determined in (B). Alternatives to be considered should include at a minimum:

- improvements to the existing drainageway along the west braid
- realignment of the channel to divert flows into the east braid of the wash. This alternative should include necessary channel improvements to convey flows to a logical conclusion such as the CAP right-of-way.
- construction of a detention/retention facility on the property owned by Pima County upstream of the subdivision (i.e. on the north side of San Joaquin Road) to reduce downstream flood peaks. Evaluation of this alternative should include a qualitative/quantitative analysis of potential impacts to the sediment transport characteristics of the wash.
- construction of levees to contain flows through the subdivision.
- purchase of floodprone property

- do nothing
- other alternative as envisioned by the County or its consultant.

D) Selection of preferred alternative and recommendations for implementation.

6.3.3 Tucson Estates

The Tucson Estates Mobile Home Park is located within Section 26, T14S, R12E. The west end of the park is traversed by a wash which emanates from the Tucson Mountains. The quantitative analysis performed as a part of this study identified the improved channel which conveys this wash through the subdivision as having only 10-year capacity. Given the age of the subdivision it is possible that the channel was constructed to a lesser design standard than the 100-year discharge. That fact coupled with changes in recent years in the methodology used for computing peak discharges probably explains the limited capacity of the improved channel. The floodplain analysis performed as a part of this study indicated a floodplain width of approximately 100 to 140 feet through the subdivision. The above described floodplain encompasses a number of mobile homes which front along the channel.

The capacity of the culvert crossings of the above wash at Kinney Road and Lone Star Drive were also determined to be far below 100-year (25-year and 5-year capacity respectively). These two culvert crossings as well as a number of dip crossings

of local streets within the subdivision do not provide for all weather access.

Because of the above described conditions it is recommended that additional study be done utilizing the existing data base developed as a part of this study to evaluate the feasibility and cost-effectiveness of implementing drainage improvements. The additional study should include:

A) A detailed hydraulic analysis of flooding conditions along the study reach of the wash through the Tucson Estates subdivision. The analysis should reveal locations where flood elevations exceed finished floor elevations and where all-weather access is not provided.

B) Evaluation of the need for channel improvements based on the results of analysis performed in (A) in terms of potential flood damage to residences adjacent to the channel and other adjacent improvements.

C) An evaluation of various alternatives for improving the existing channel (if deemed necessary as per item (B)) and upgrading the existing culvert crossings at Kinney Road and Lone Star Drive. Evaluation of the potential for implementing detention upstream of Lone Star Drive should be included in the consideration of possible improvements.

D) Recommendations for improvements.

6.3.4 Mission West/West Branch Santa Cruz Area

The Mission West/West Branch Santa Cruz Area is located within Sections 19, 20 and 21 of T15S, R13E. The area is roughly bounded by Los Reales Road on the north, Settler Avenue to the west and the San Xavier Indian Reservation on the east and south. This area is impacted by flows which concentrate at the topographical saddle located between Black Mountain and the hill located to the north of Black Mountain in Section 18. Settler Avenue roughly represents the ridge line of the saddle. The flow patterns in this area are very unclear and indicate that the approximately 6 square mile upstream drainage area which concentrates flow at this location could drain either to the west and into the Black Wash or to the east through the Mission West area and into the West Branch of the Santa Cruz River.

Review of the channel improvements for the San Xavier Estates development located in Section 20 indicate that the main channels conveying flow around the south and west of the subdivision (improved channels I1 in I2 Table 9) have capacity to convey the 10-year discharge or less assuming all flow concentrating at the Settler Avenue saddle is conveyed to the east toward the Mission West area. Review of aerial photography indicates that scattered development throughout this area (i.e., Sections 19, 20, and 21) may be subject to extensive flooding as well.

Because of the uncertain drainage patterns within in this area and the limited amount of documentation regarding past flooding history or flooding potential it is recommended that a study be performed in this area to:

A) Evaluate flow patterns at the split area located on the saddle defined by Settler Avenue to develop a more accurate assessment of the quantity of runoff being conveyed toward the Mission West area during the 100-year event as defined by this study.

B) Determine exciting flooding conditions and damage potential between Settler Avenue to the west and the San Xavier Indian Reservation to the east including an evaluation of the existing drainage improvements within the Mission West developments.

C) Review results of items (A) and (B) and determine whether development of alternatives for flood hazard mitigation are warranted.

6.3.5 The Tierra Bonita/Golden Gate/Camino Verde

The Tierra Bonita/Golden Gate/Camino Verde area includes the Tierra Bonita and Golden Gate subdivisions located in Section 34, T14S, R12E and Camino Verde Road from Kay Lynn Drive to Ajo Road. This area is located downstream of the area

described in Section 6.2.3 and is impacted by the same wash in addition to a number of smaller tributaries.

Investigation by PCFCD staff of drainage complaints within the Tierra Bonita II Subdivision revealed that the hydrology report for the subdivision did not acknowledge the potential for sheet flow through the study area. The dip crossing analysis performed as a part of this analysis indicates that the crossing of Bopp Road for the main wash through the subdivision has inadequate capacity to contain the 100-year flow and that consequently flow occurs as sheet flow along Bopp Road. The Golden Gate subdivision was built prior to implementation of floodplain regulation.

Camino Verde Road acts as a flow conveyer downstream of the Tierra Bonita Subdivision along the reach defined above. Since this roadway is proposed for future development as a major arterial the use of the roadway as a flow conveyer may not be appropriate.

It is recommended that additional study be preformed in this area including:

A) An analysis of existing flooding conditions along the major wash through the Tierra Bonita Subdivision and evaluation of sheet flooding potential due to other tributaries through the Tierra Bonita and Golden Gate subdivisions.

B) An analysis of existing flooding conditions along Camino Verde Road and adjacent areas.

C) Identification and evaluation of potential flood hazard mitigation measures for severe conditions identified in items (A) and (B). Alternatives for mitigation should include evaluation of detention proposed as a part of the Tucson Estates Parkway extension and any possible detention sites upstream of the Tucson Estates subdivision.

6.4 Priority of Future Study Needs

The listing below provides a prioritization of additional study needs within the study area based on a qualitative assessment of existing problems as described in the preceding sub-sections:

Highest Priority - 1) Branding Iron Park
2) Millstone Manor #6
3) Tucson Estates Subdivision
4) Mission West/West Branch Santa Cruz Area

Lowest Priority - 5) Tierra Bonita/Golden Gate/Camino Verde Area

Generally speaking, the prioritization shown above was based on a qualitative assessment of flood hazard potential with respect to:

- Public Safety

- Public and Private Improvements

- Transportation impacts, including all-weather access

- Future improvements and development

VII. REFERENCES

A Guide To Hydrologic Analysis Using SCS Methods, Richard H. McCuen, 1982

American Society of Civil Engineers, Journal of the Hydraulics Division, December 1972, Sediment Yield Computed With Universal Equation. (Williams & Berndt)

Anderson, Passarelli and Associates, Stormwater Detention Along Tucson Estate Parkway Concept Design Report, February, 1986.

Arizona Department of Water Resources, by Simons, Li & Associates, Design Manual for Engineering Analysis of Fluvial Systems, March 1985.

Arizona Department of Transportation, State Highway, Gila Bend-Ajo-Tucson, Pima County, Project #EMP-S-222(26), 1969.

Arizona Department of Transportation, State Highway, Gila Bend-Ajo-Tucson, Pima County, Project #S-222-506, 1967.

Cella Barr & Assoc., Pima County Flood Insurance Study Hydrologic Investigation, 1984.

Erosion & Sediment Control Handbook, Goldman, Jackson & Brusztynsky, 1986.

Franzoy Corey, Tohono O'Odham Irrigation District Plan, November, 1987.

Federal Highway Administration, Hydraulics Microcomputer Program, HY8, Culvert Analysis, 1987.

Johnson Brittain & Assoc., Draft State Highway, Why-Tucson, Pima County, Project #F-056-1-503, 1988.

Johnson Brittain & Assoc., Design Report for Off-Site Drainage Protection Facilities for Tucson CAP Water Treatment Plant, March, 1988.

McGovern, MacVittie, Lodge & Assoc., Master Drainage Study for Star Valley, Associates, December 1987.

McGovern, MacVittie, Lodge & Assoc., Draft Report Star Valley Sub-Basin Management Study, December, 1987.

Osborn, Petterson, Walbert & Associates, Hydrologic and Hydraulic Reports for Mission West Phases I, II, III, and Retention Detention Analysis, Mission West II, 1986.

Pima County Department of Transportation and Flood Control District, Hydrology Manual for Engineering Design and Floodplain Management within Pima County, Arizona, 1979.

Pima County Department of Transportation and Flood Control District, Kinney Road, Ajo Highway to Tucson Mountain Park, Project #4BKRAH, 1986

Pima County Department of Transportation and Flood Control District, Camino Verde, Drexel to Ajo Highway, Project #4BACS4, 1984

Pima County Department of Transportation and Flood Control District, Black Wash Drainage Analysis and Policy Assessment Report, October 14, 1988.

Pima County Planning and Zoning Department, Southwest Area Plan, Information Packet, January, 1984

Pima County Department of Transportation and Flood Control District, by Dooley - Jones & Associates, Hydraulic Report for the Los Reales Drainage Improvement District, September, 1985

Pima County Department of Transportation and Flood Control District, Transportation and Flood Control Facility Implementation Plan for the Southwest Area Plan, April, 1980.

Pima County Department of Transportation and Flood Control District, Hydrologic and Hydraulic Analysis and Recommended Guidelines for Millstone Manor # 6, June, 1988.

Simons, Li and Associates, Final Drainage Report for Why-Tucson Highway (State Route 86), December 7, 1987.

Tucson Water, by Montgomery-Johnson-Collins, Tucson Water Treatment Plant Project Phase I, Preliminary Investigations Site Selection Draft Report, December 1983.

U.S. Army Corps of Engineers, Hydrologic Engineering Center HEC-1 Flood Hydrograph Package, September, 1981.

U.S. Department of Agriculture, Soil Conservation Service, soil maps, Pima County Arizona, # 36, # 37, # 46, # 47.

U.S. Department of Agriculture, Predicting Rainfall Erosion Losses, Agriculture Handbook #537, 1978

U.S. Department of Agriculture, Soil Conservation Service, Economic Research Service in Cooperation with the Arizona Water Commission, Santa Cruz - San Pedro River Basin Main Report, August 1977

U.S. Bureau of Reclamation Arizona Projects Office, by Arizona Game and Fish Department Special Service Division Phoenix, Arizona, Final Report for the Biological Resources Inventory Contract Extension, Tucson Division-Phase B--Central Arizona project Aqueduct, March 1985.

APPENDICES A THROUGH C OF

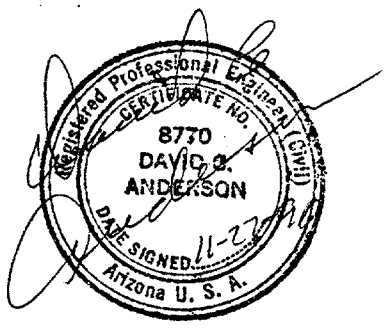
SOUTHWEST BASIN MANAGEMENT STUDY

BASIN INVENTORY/DRAINAGE REPORT

PREPARED FOR PIMA COUNTY DEPARTMENT OF TRANSPORTATION
AND FLOOD CONTROL DISTRICT

PREPARED BY ANDERSON, PASSARELLI & ASSOCIATES
270 North Church Avenue
Tucson, Arizona 85701

July 1990



APPENDIX A MAJOR WATERSHED HYDROLOGIC DATA SHEETS

APPENDIX B HEC-1 INPUT/OUTPUT

APPENDIX C CULVERT ANALYSIS CALCULATIONS

APPENDIX A MAJOR WATERSHED HYDROLOGIC DATA SHEETS

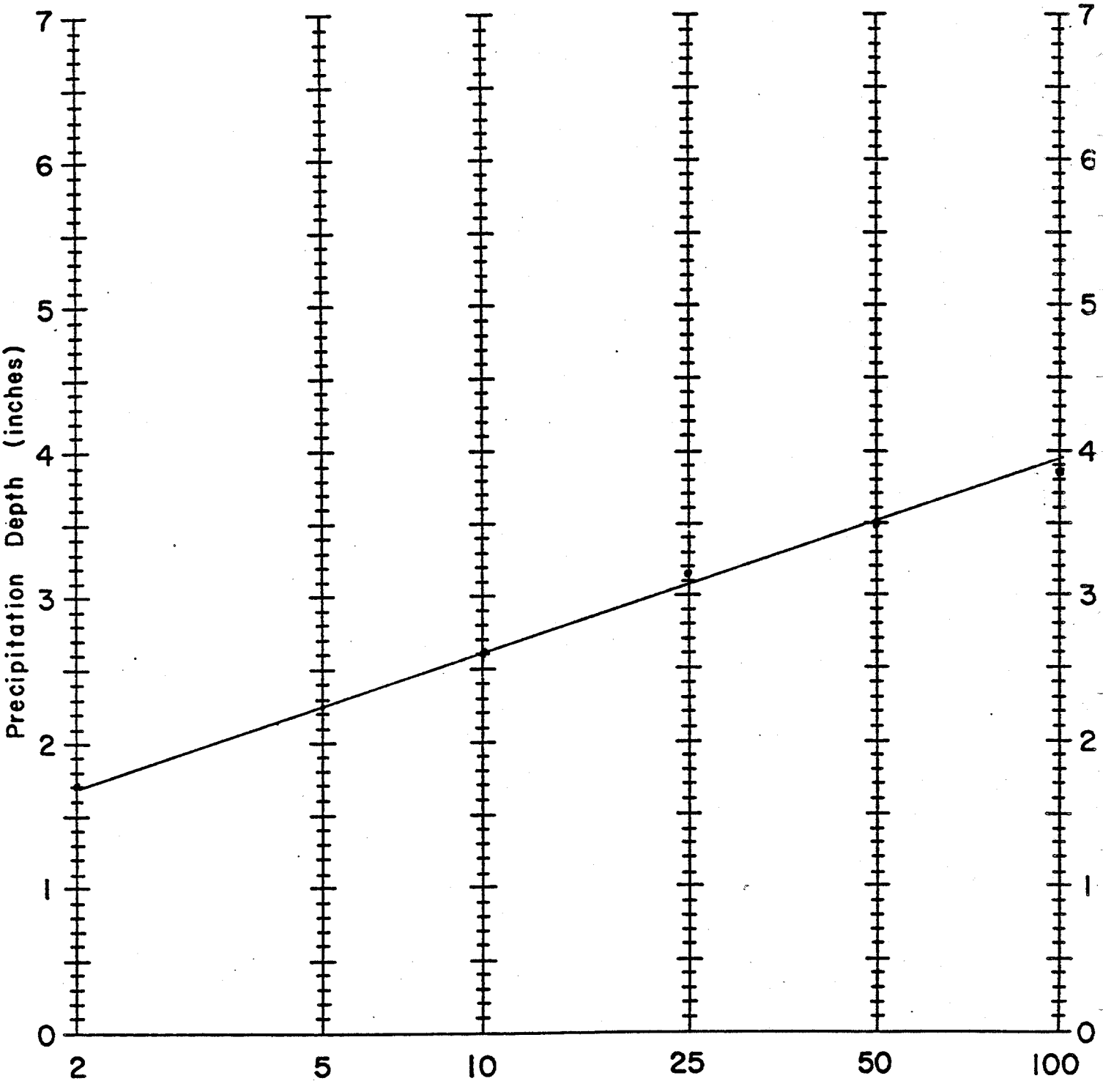
RAINFALL DATA SHEET

Return Period (Years)	Precipitation Values (inches)			
	6 Hour Duration		24 Hour Duration	
	Map Value	Corrected Value	Map Value	Corrected Value
2	1.70	1.70	2.10	2.15
5	2.25	2.25	2.70	2.70
10	2.60	2.60	3.25	3.25
25	3.15	3.08	3.90	3.85
50	3.50	3.50	4.30	4.35
100	3.85	3.93	4.85	4.90

$$Y_2 = -0.011 + 0.942\left(\frac{1.70^2}{2.15}\right) = 1.26$$

$$Y_{100} = 0.494 + 0.755\left(\frac{3.93^2}{4.90}\right) = 2.87$$

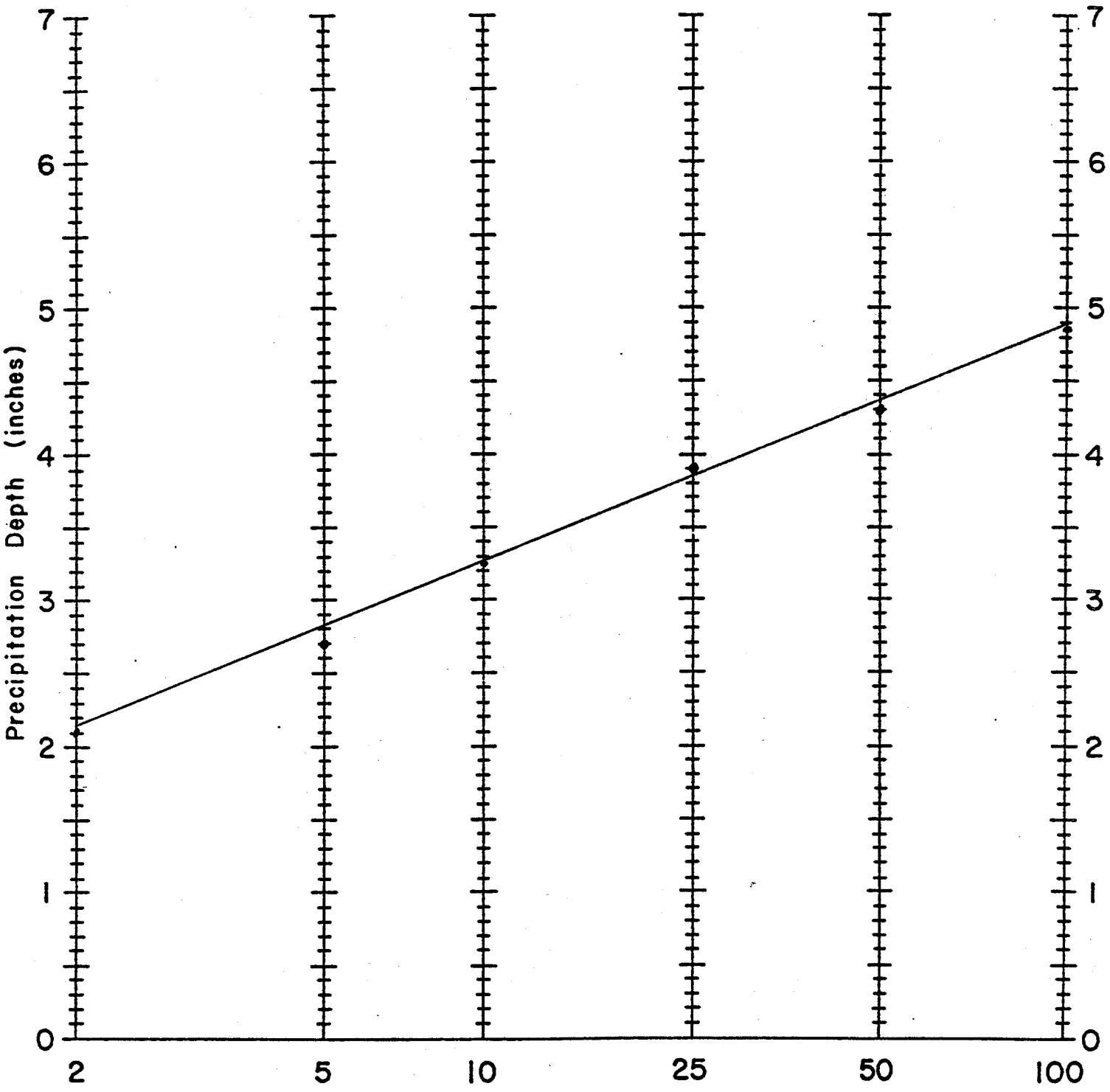
Latitude _____ Longitude _____



6 hr.

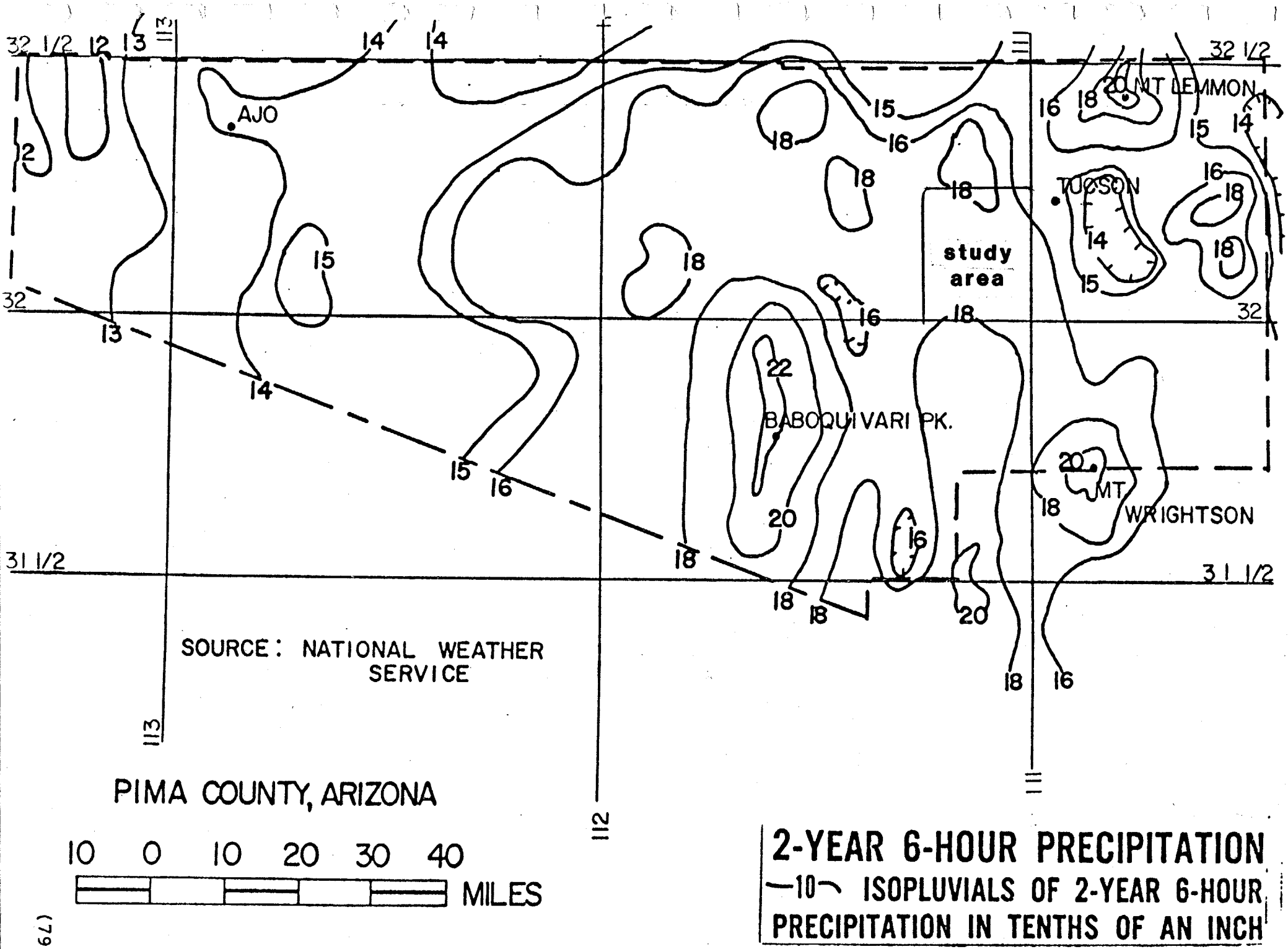
Precipitation Depth Versus Return Period For Partial - Duration Series

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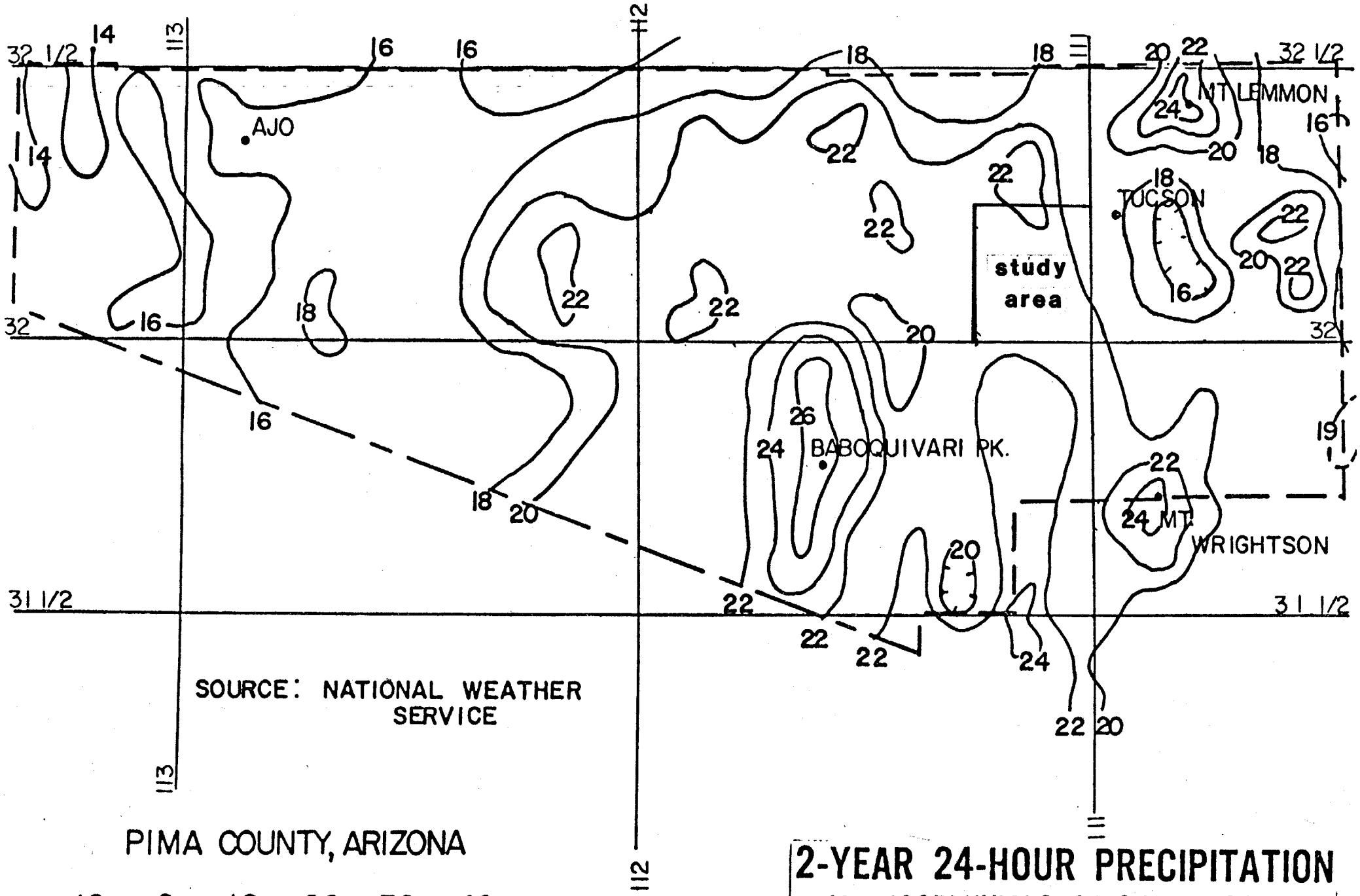
24 hr.

Precipitation Depth Versus Return Period For Partial - Duration Series


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TUCSON
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BABOQUIVARI PK.
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31 1/2
SOURCE: NATIONAL WEATHER SERVICE
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PIMA COUNTY, ARIZONA
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MILES
2-YEAR 6-HOUR PRECIPITATION
—10— ISOPLUVIALS OF 2-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH

(67)

6A1



SOURCE: NATIONAL WEATHER SERVICE

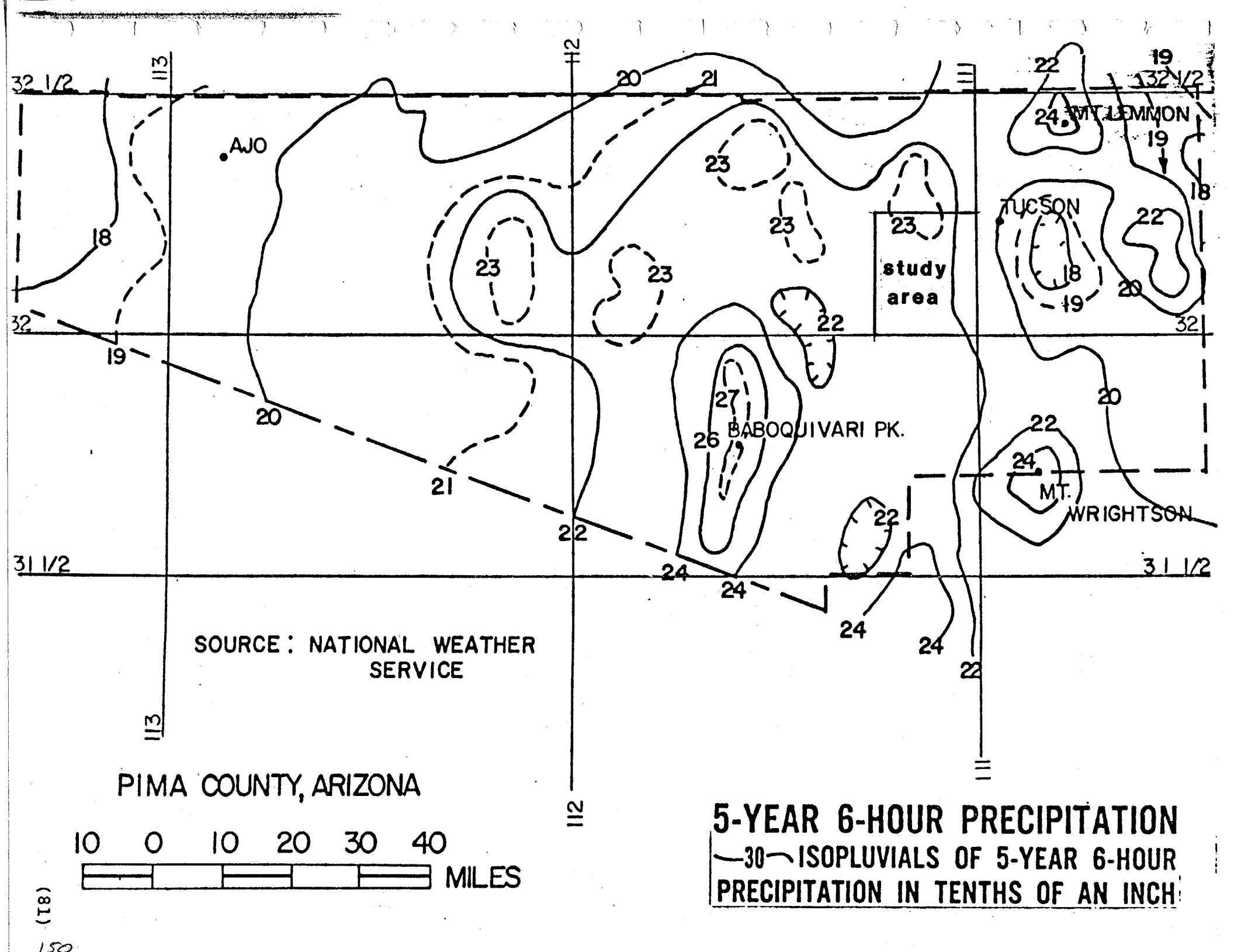
PIMA COUNTY, ARIZONA

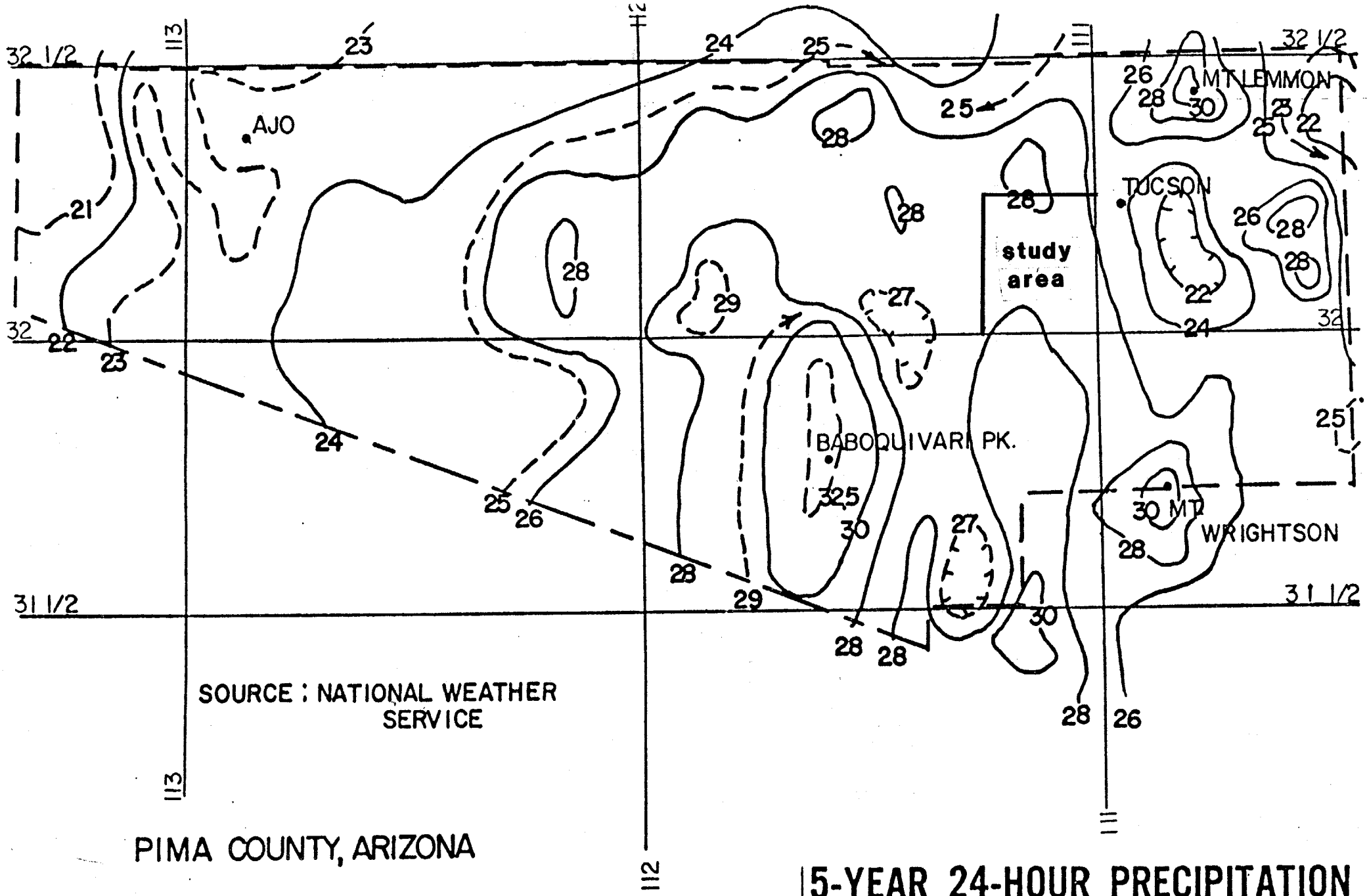
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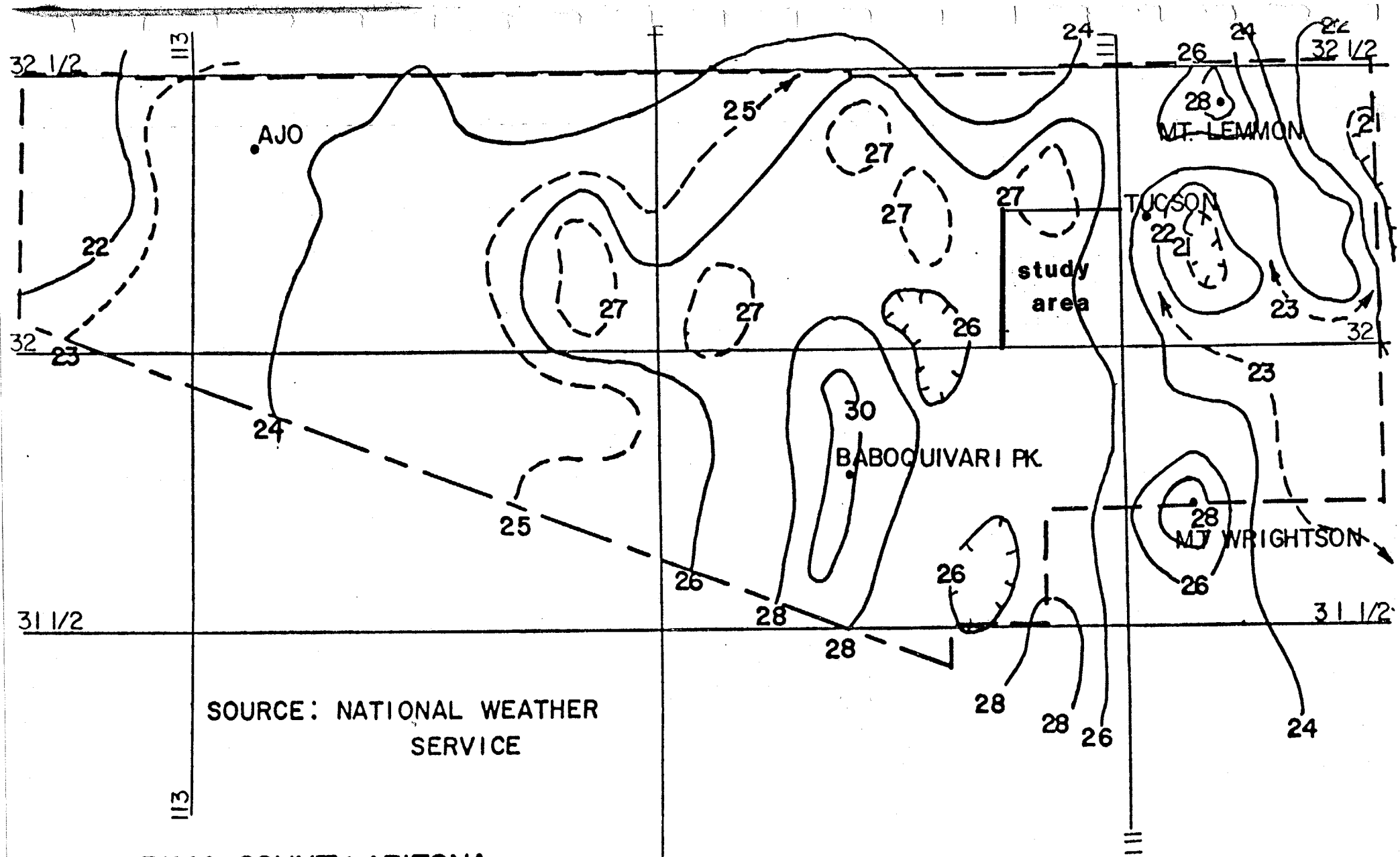
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2-YEAR 24-HOUR PRECIPITATION

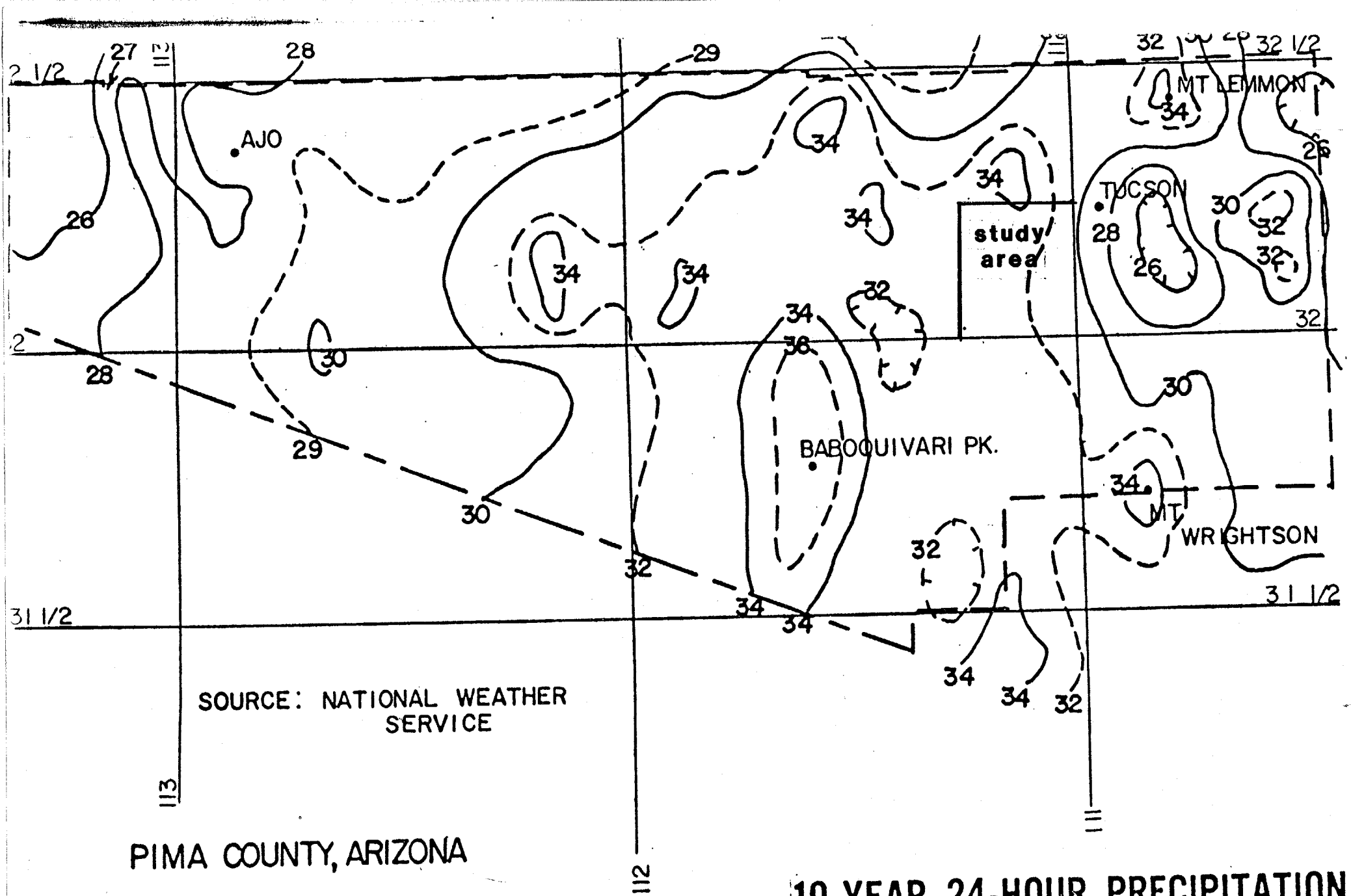
—30— ISOPLUVIALS OF 2-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH


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BABOQUIVARI PK.
MT. WRIGHTSON
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SOURCE: NATIONAL WEATHER SERVICE
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5-YEAR 6-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 5-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH


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study area
BABOQUIVARI PK.
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SOURCE : NATIONAL WEATHER SERVICE
PIMA COUNTY, ARIZONA
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5-YEAR 24-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 5-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH


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SOURCE: NATIONAL WEATHER SERVICE
PIMA COUNTY, ARIZONA
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10-YEAR 6-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 10-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH

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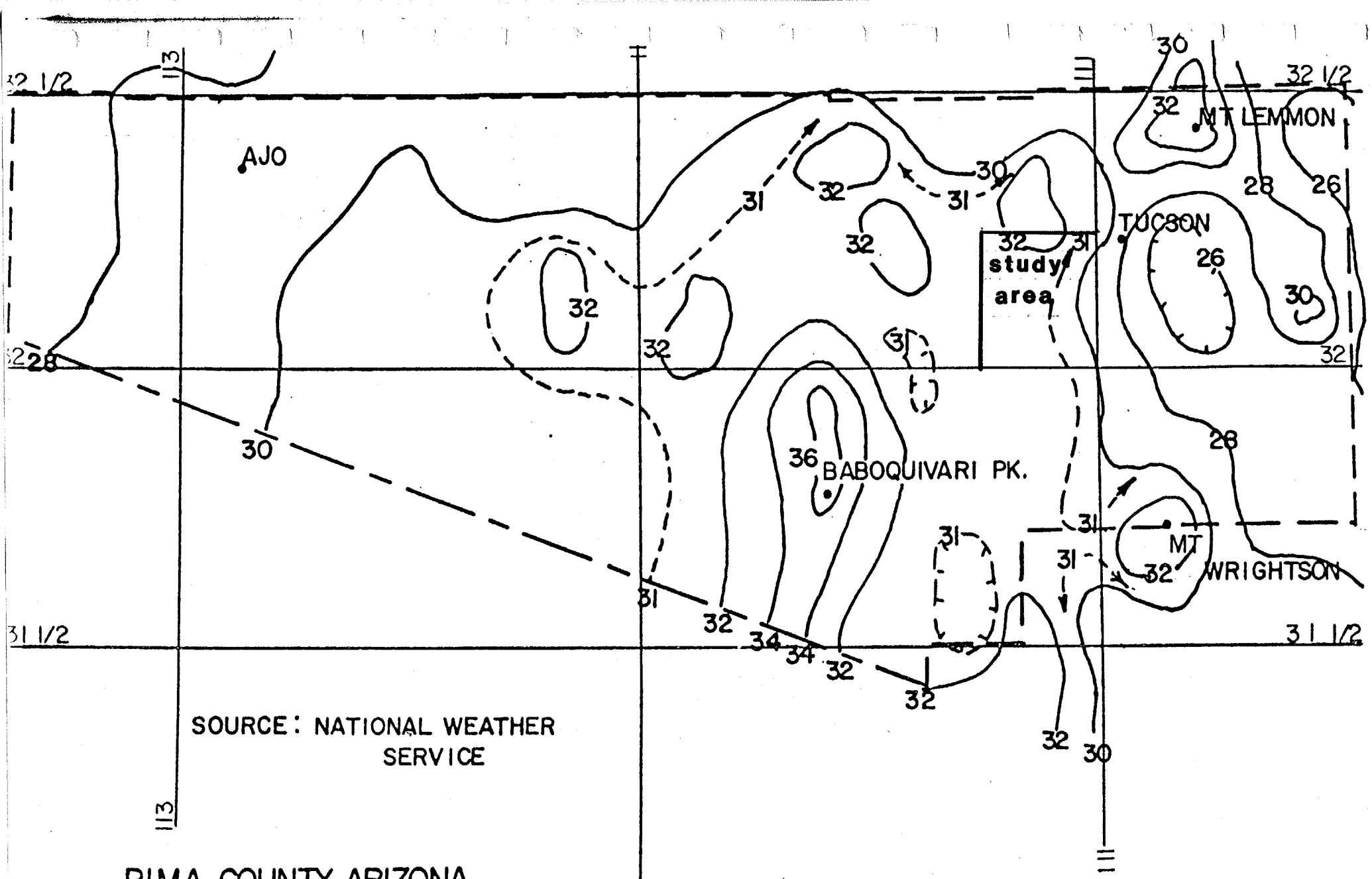
PIMA COUNTY, ARIZONA

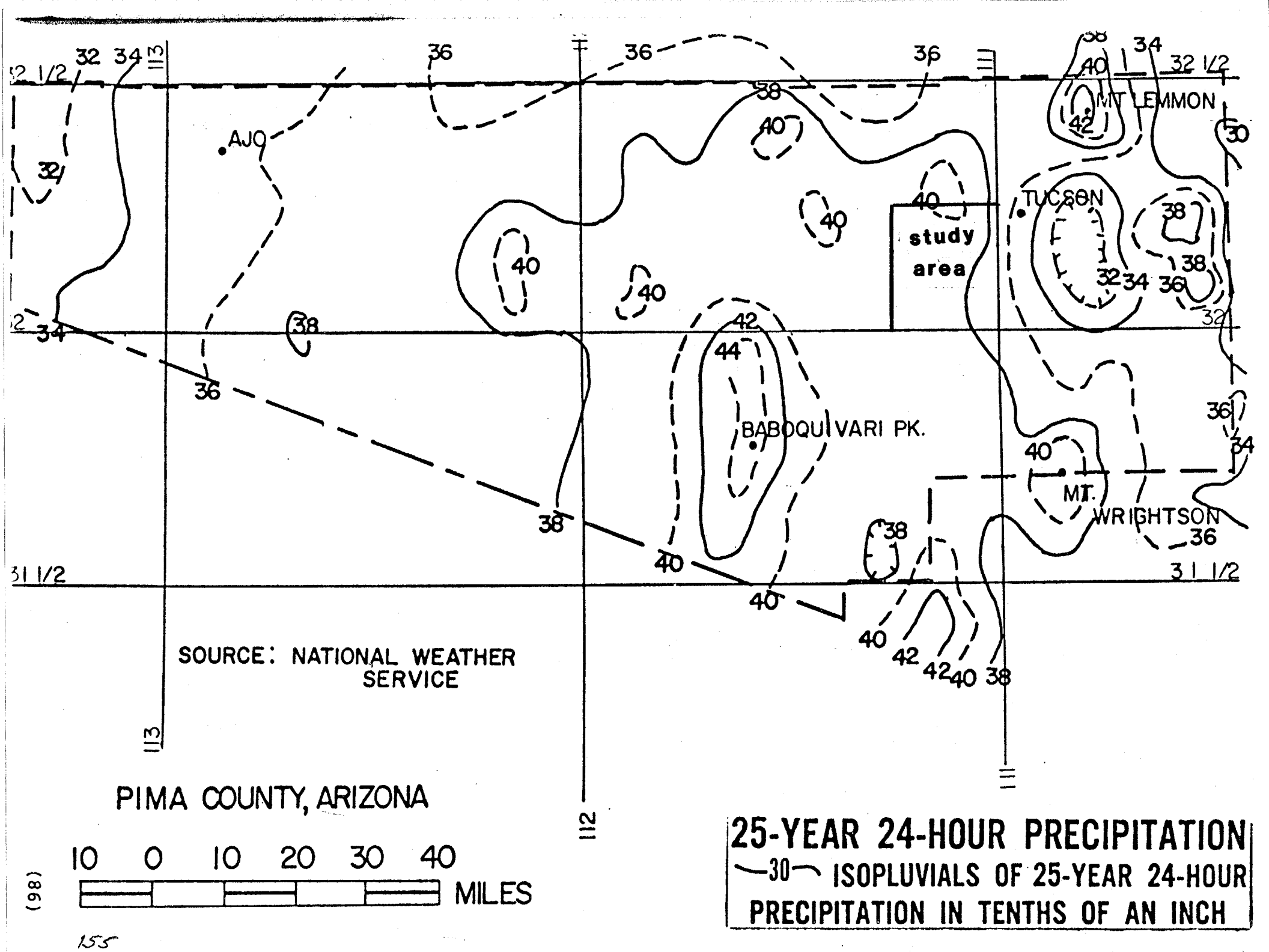
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10-YEAR 24-HOUR PRECIPITATION

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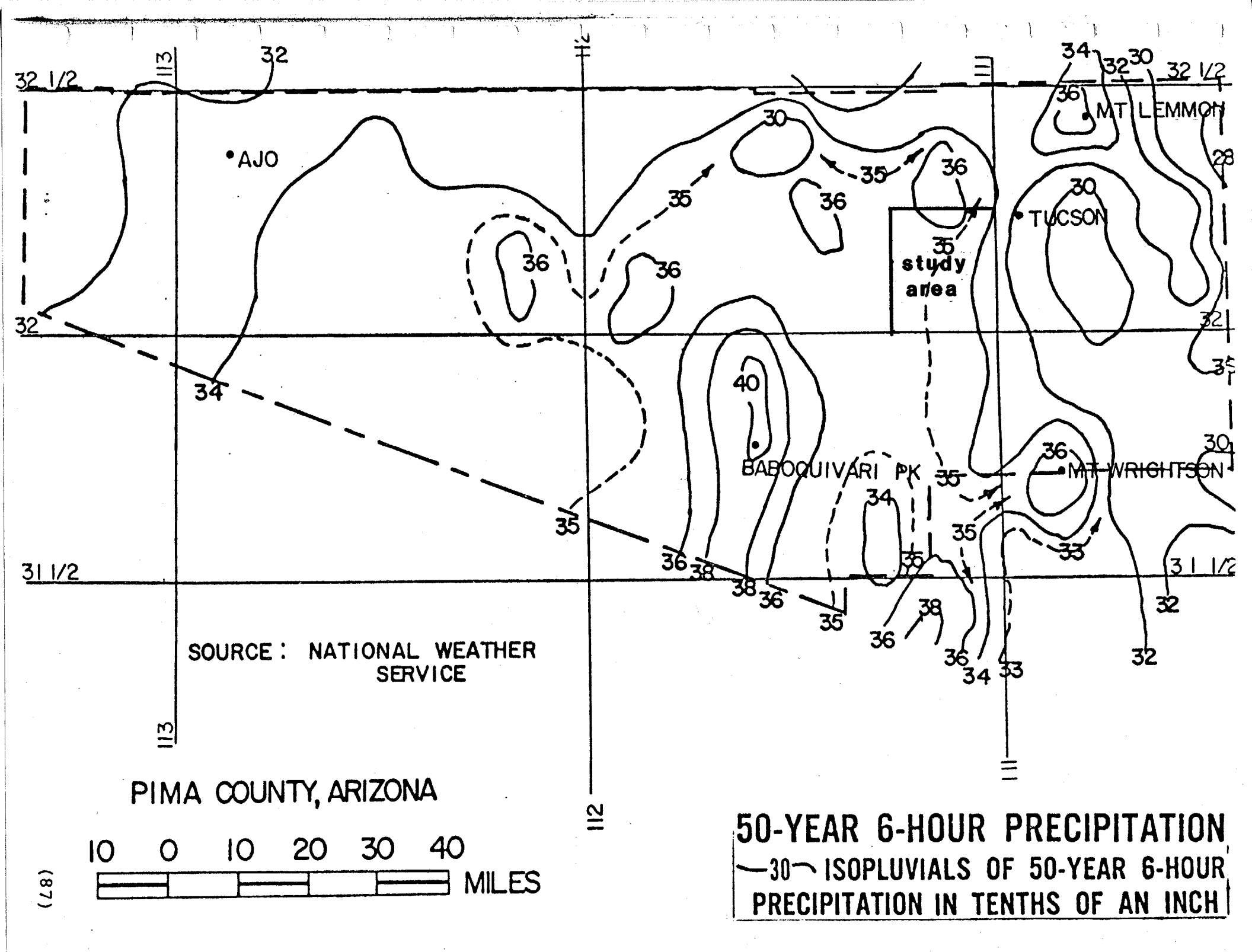
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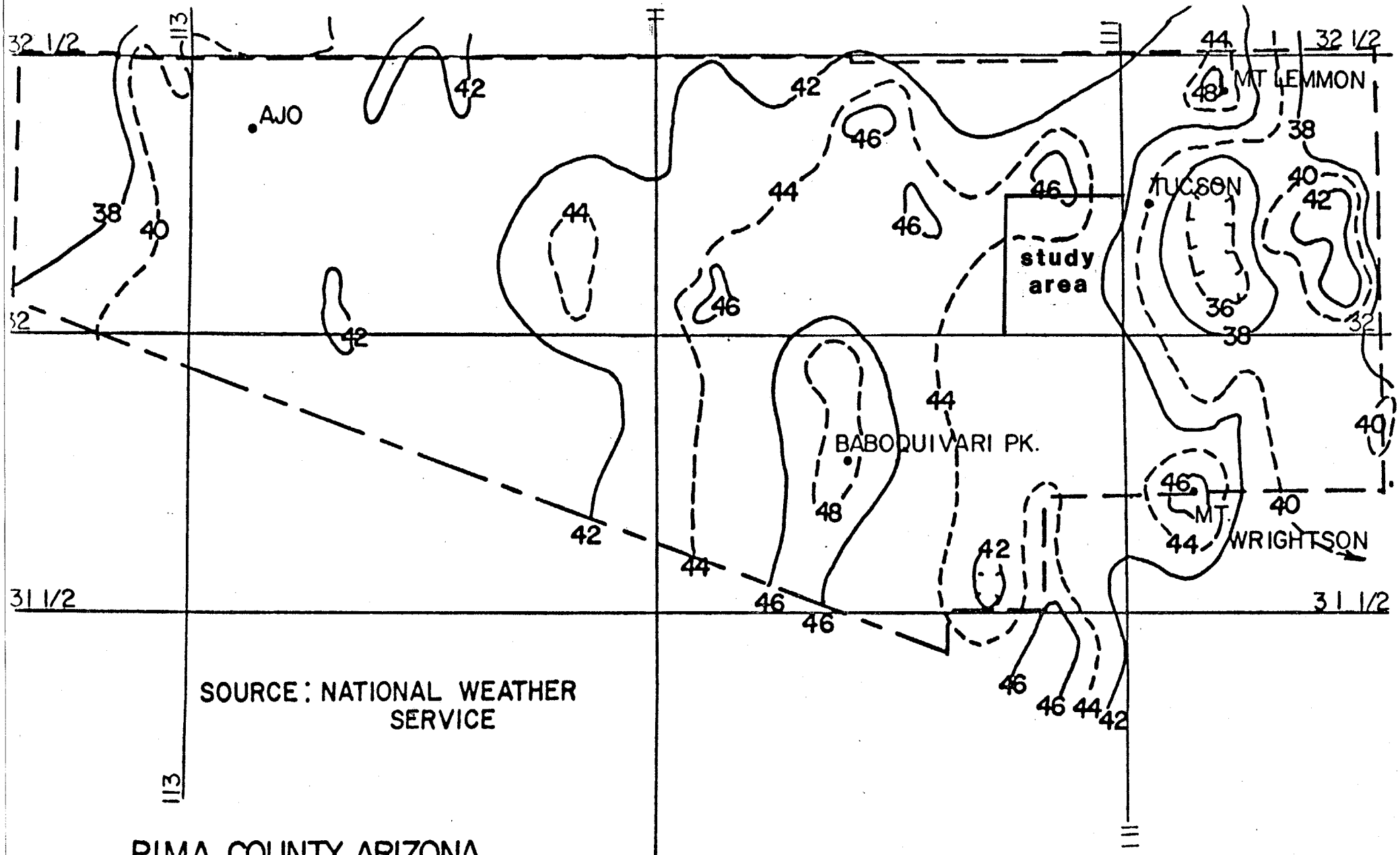

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SOURCE: NATIONAL WEATHER
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PIMA COUNTY, ARIZONA
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25-YEAR 6-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 25-YEAR 6-HOUR
PRECIPITATION IN TENTHS OF AN INCH


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SOURCE: NATIONAL WEATHER SERVICE
PIMA COUNTY, ARIZONA
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25-YEAR 24-HOUR PRECIPITATION
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SOURCE: NATIONAL WEATHER SERVICE
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PIMA COUNTY, ARIZONA
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50-YEAR 6-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 50-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH



SOURCE: NATIONAL WEATHER SERVICE

PIMA COUNTY, ARIZONA

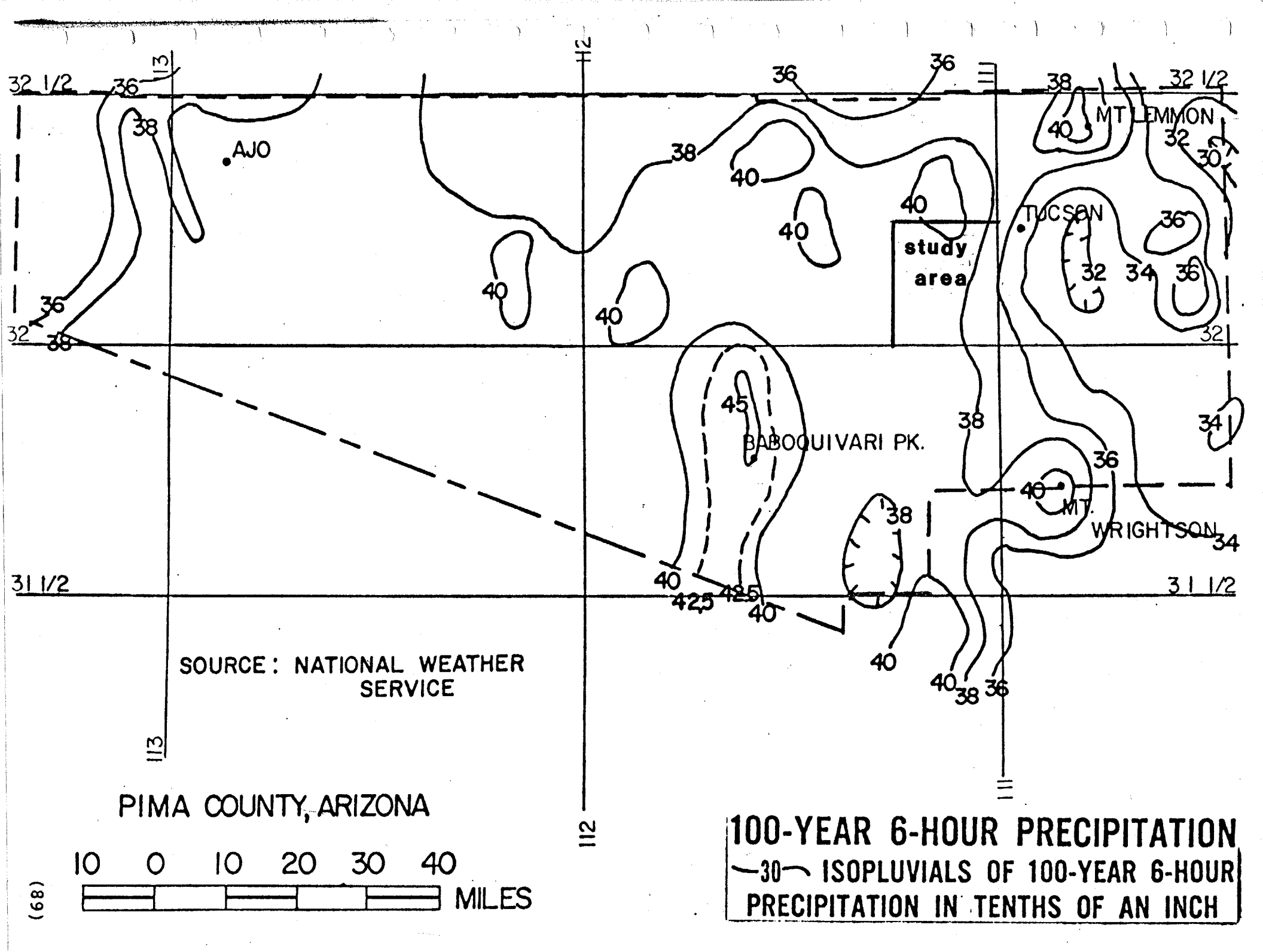
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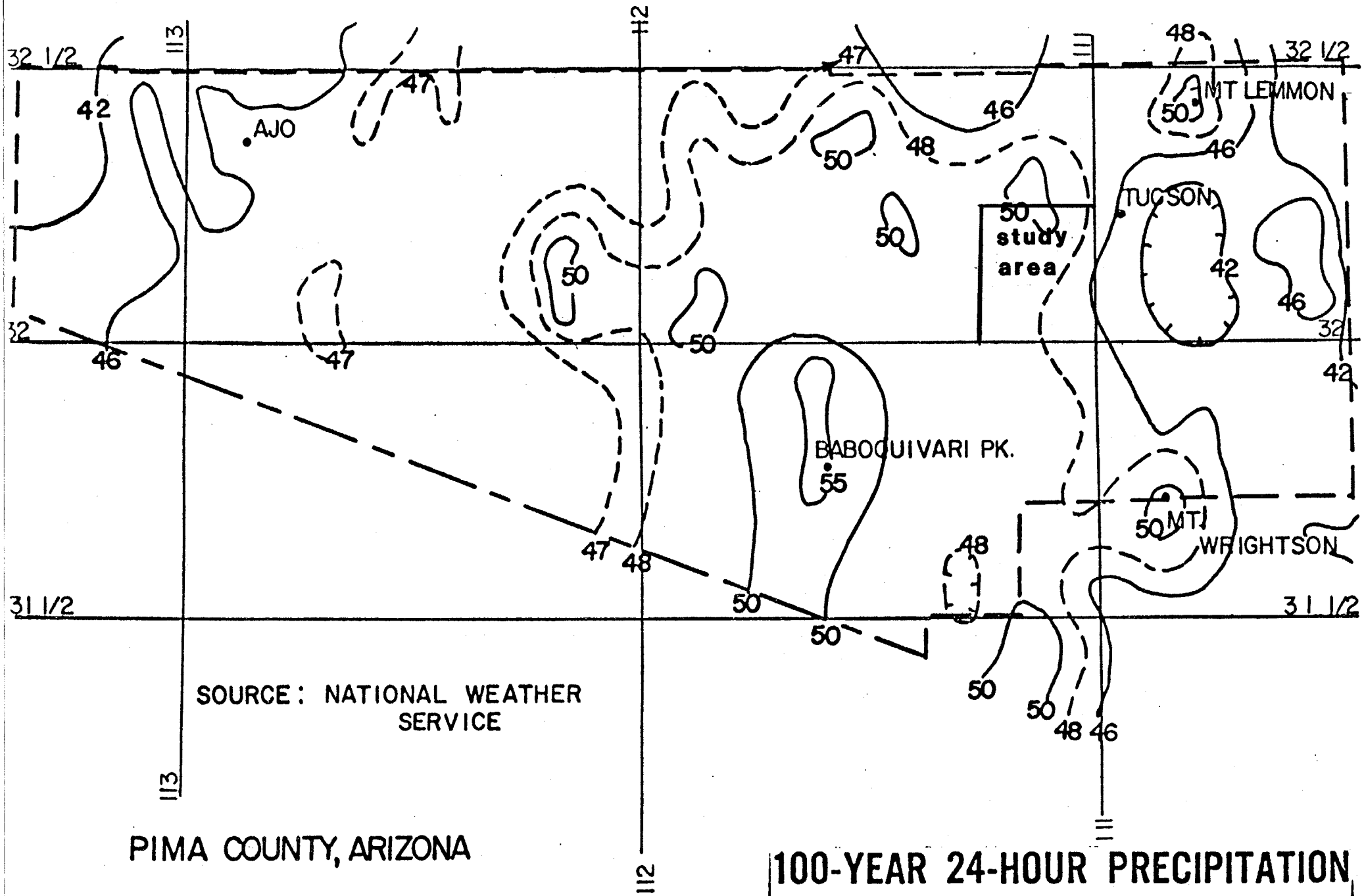
50-YEAR 24-HOUR PRECIPITATION

—30— ISOPLUVIALS OF 50-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH

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(68)
100-YEAR 6-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 100-YEAR 6-HOUR
PRECIPITATION IN TENTHS OF AN INCH



PIMA COUNTY, ARIZONA

10 0 10 20 30 40 MILES

(06)

159

100-YEAR 24-HOUR PRECIPITATION

—20— ISOPLUVIALS OF 100-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH

Summary of Results of Peak Discharge Determinations for Major Basins Using Pima County Method

Concentration Point *	Drainage Area (mi^2)	Peak Discharge (cfs) 2-yr	5-yr	10-yr	25-yr	100-yr
4	10.96	776	1972	3276	5304	9917
4.1	1.46	92	244	385	603	1096
5	5.54	235	659	1050	1666	3045
7	4.05	100	377	655	1121	2171
8	12.10	254	789	1442	2471	4885
9	4.41	171	517	838	1341	2463
10	12.78	295	798	1337	2210	4061
13	9.29	415	1094	1666	2539	4459
18	8.32	174	538	905	1504	2772
19	3.49	94	333	564	941	1797
20	2.57	69	249	425	718	1372
23	9.66	337	1071	1765	2885	5353
C9	14.46	190	533	962	1691	3455
C8B	22.78	**	595	1113	2008	4198
C8	44.85	**	1192	1824	3498	7694
C1	87.13	**	**	**	3848	9273

* Concentration point numbers with a "C" prefix are discussed in greater detail in Section 3.1.3

** Time of concentration exceeds 24 hours by Pima County method

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 4

WATERSHED AREA (A): 7016.00 acres

LENGTH OF WATERCOURSE (Lc): 26000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 13000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
5500.	1588.0
20500.	320.0

MEAN SLOPE (Sc): .0222 ft BASIN FACTOR (Nb): .0460

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.18	1.50	1.76	2.10	2.40	2.70
P 2	1.35	1.74	2.04	2.42	2.76	3.10
P 3	1.46	1.90	2.22	2.63	3.00	3.37
P 6	1.67	2.18	2.54	3.01	3.43	3.85
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

60. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
40. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.269	.389	.470	.553	.613	.659
Tc (FUNCTION OF i) :	154.87	133.54	123.80	116.00	111.38	108.16
SOLUTION OF Tc (MINUTES):	222	153	125	103	90	80
RAINFL INT. @ Tc (IN/HR):	.408	.716	.985	1.355	1.721	2.127
RUNOFF RATE @ Tc (IN/HR):	.110	.279	.463	.750	1.055	1.402
PEAK DISCHARGE (CFS) :	776.	1972.	3276.	5304.	7459.	9917.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 4.1

WATERSHED AREA (A): 935.00 acres

LENGTH OF WATERCOURSE (Lc): 26500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 13250. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
12000.	220.0
14500.	130.0

MEAN SLOPE (Sc): .0120 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

67. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
33. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 15. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.293	.425	.497	.571	.624	.667
Tc (FUNCTION OF i) :	189.46	163.23	153.38	145.08	139.98	136.33
SOLUTION OF Tc (MINUTES):	295	199	166	139	122	109
RAINFL INT. @ Tc (IN/HR):	.332	.608	.823	1.122	1.424	1.744
RUNOFF RATE @ Tc (IN/HR):	.097	.259	.409	.640	.889	1.163
PEAK DISCHARGE (CFS) :	92.	244.	385.	603.	838.	1096.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 5

WATERSHED AREA (A): 3548.00 acres

LENGTH OF WATERCOURSE (Lc): 42200. ft

LENGTH TO CENTER OF GRAVITY (Lca): 21100. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4500.	1340.0
6500.	200.0
31200.	280.0

MEAN SLOPE (Sc): .0127 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

61. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
18. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
21. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.281	.421	.495	.571	.626	.669
Tc (FUNCTION OF i) :	249.07	212.01	198.66	187.61	180.90	176.12
SOLUTION OF Tc (MINUTES):	446	295	245	204	178	160
RAINFL INT. @ Tc (IN/HR):	.234	.438	.593	.816	1.044	1.273
RUNOFF RATE @ Tc (IN/HR):	.066	.184	.293	.466	.653	.851
PEAK DISCHARGE (CFS) :	235.	659.	1050.	1666.	2335.	3045.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 7

WATERSHED AREA (A): 2589.00 acres

LENGTH OF WATERCOURSE (Lc): 44000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 22000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
44000.	995.0

MEAN SLOPE (Sc): .0226 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

82. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
18. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.182	.329	.410	.495	.557	.606
Tc (FUNCTION OF i) :	268.23	211.50	193.62	179.59	171.35	165.61
SOLUTION OF Tc (MINUTES):	500	294	236	190	164	146
RAINFL INT. @ Tc (IN/HR):	.211	.439	.612	.867	1.115	1.372
RUNOFF RATE @ Tc (IN/HR):	.038	.145	.251	.429	.621	.832
PEAK DISCHARGE (CFS) :	100.	377.	655.	1121.	1620.	2171.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 8

WATERSHED AREA (A): 7741.00 acres

LENGTH OF WATERCOURSE (Lc): 75000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 37500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
51000.	2020.0
24000.	375.0

MEAN SLOPE (Sc): .0280 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.17	1.47	1.74	2.07	2.37	2.67
P 2	1.34	1.71	2.01	2.39	2.73	3.07
P 3	1.46	1.90	2.22	2.63	3.00	3.37
P 6	1.65	2.14	2.51	2.97	3.39	3.81
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

56. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
10. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
34. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.205	.332	.421	.512	.577	.628
Tc (FUNCTION OF i) :	322.85	266.57	242.38	224.05	213.58	206.42
SOLUTION OF Tc (MINUTES):	675	429	337	272	234	207
RAINFL INT. @ Tc (IN/HR):	.158	.305	.439	.618	.800	.996
RUNOFF RATE @ Tc (IN/HR):	.033	.101	.185	.317	.462	.626
PEAK DISCHARGE (CFS) :	254.	789.	1442.	2471.	3603.	4885.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 9

WATERSHED AREA (A): 2820.00 acres

LENGTH OF WATERCOURSE (Lc): 48000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 24000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
48000.	973.0

MEAN SLOPE (Sc): .0203 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

26. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
74. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.265	.415	.494	.573	.629	.674
Tc (FUNCTION OF i) :	253.86	212.10	197.90	186.44	179.58	174.76
SOLUTION OF Tc (MINUTES):	459	295	244	202	176	158
RAINFL INT. @ Tc (IN/HR):	.228	.438	.595	.823	1.053	1.286
RUNOFF RATE @ Tc (IN/HR):	.060	.182	.294	.472	.663	.866
PEAK DISCHARGE (CFS) :	171.	517.	835.	1341.	1884.	2463.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 10

WATERSHED AREA (A): 8182.00 acres

LENGTH OF WATERCOURSE (Lc): 88000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 44000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
11000.	730.0
77000.	1770.0

MEAN SLOPE (Sc): .0255 ft BASIN FACTOR (Nb): .0590

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.21	1.55	1.81	2.15	2.46	2.76
P 2	1.34	1.71	2.01	2.39	2.73	3.07
P 3	1.46	1.88	2.20	2.61	2.99	3.35
P 6	1.66	2.16	2.52	2.99	3.41	3.83
P24	2.11	2.75	3.20	3.78	4.30	4.82

SOIL GROUPS

37. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
12. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
51. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.278	.415	.497	.580	.638	.683
Tc (FUNCTION OF i) :	385.14	328.25	305.35	287.19	276.49	269.03
SOLUTION OF Tc (MINUTES):	875	588	478	391	341	307
RAINFL INT. @ Tc (IN/HR):	.129	.233	.326	.462	.593	.721
RUNOFF RATE @ Tc (IN/HR):	.036	.097	.162	.268	.378	.492
PEAK DISCHARGE (CFS) :	295.	798.	1337.	2210.	3116.	4061.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 13

WATERSHED AREA (A): 5944.00 acres

LENGTH OF WATERCOURSE (Lc): 25200. ft

LENGTH TO CENTER OF GRAVITY (Lca): 19600. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1000.	660.0
4000.	40.0
20200.	220.0

MEAN SLOPE (Sc): .0115 ft BASIN FACTOR (Nb): .0630

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

26. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
27. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
47. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 11. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.347	.489	.561	.632	.683	.722
Tc (FUNCTION OF i) :	279.35	243.46	230.42	219.60	213.00	208.30
SOLUTION OF Tc (MINUTES):	532	361	305	258	228	206
RAINFL INT. @ Tc (IN/HR):	.200	.374	.496	.670	.845	1.031
RUNOFF RATE @ Tc (IN/HR):	.069	.183	.278	.424	.577	.744
PEAK DISCHARGE (CFS) :	415.	1094.	1666.	2539.	3457.	4459.

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PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 18

WATERSHED AREA (A): 5325.00 acres

LENGTH OF WATERCOURSE (Lc): 61000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 30500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
61000.	1240.0

MEAN SLOPE (Sc): .0203 ft BASIN FACTOR (Nb): .0620

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

74. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
5. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
21. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.239	.382	.460	.540	.597	.643
Tc (FUNCTION OF i) :	378.16	313.48	291.23	273.17	262.32	254.67
SOLUTION OF Tc (MINUTES):	841	536	435	355	311	278
RAINFL INT. @ Tc (IN/HR):	.136	.262	.367	.519	.656	.803
RUNOFF RATE @ Tc (IN/HR):	.032	.100	.169	.280	.391	.516
PEAK DISCHARGE (CFS) :	174.	538.	905.	1504.	2101.	2772.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 19

WATERSHED AREA (A): 2234.00 acres

LENGTH OF WATERCOURSE (Lc): 53000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 27500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
53000.	1356.0

MEAN SLOPE (Sc): .0256 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

67. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
26. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.205	.354	.435	.519	.579	.627
Tc (FUNCTION OF i) :	274.90	220.92	203.50	189.70	181.55	175.86
SOLUTION OF Tc (MINUTES):	519	314	254	207	179	160
RAINFL INT. @ Tc (IN/HR):	.204	.417	.576	.806	1.039	1.273
RUNOFF RATE @ Tc (IN/HR):	.042	.148	.250	.418	.602	.798
PEAK DISCHARGE (CFS) :	94.	333.	564.	941.	1355.	1797.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 20

WATERSHED AREA (A): 1647.00 acres

LENGTH OF WATERCOURSE (Lc): 48000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 24000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

48000. 1152.0

MEAN SLOPE (Sc): .0240 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

73. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
22. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
5. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.197	.345	.426	.510	.571	.619
Tc (FUNCTION OF i) :	267.38	213.49	196.23	182.60	174.56	168.95
SOLUTION OF Tc (MINUTES):	498	298	241	195	169	151
RAINFL INT. @ Tc (IN/HR):	.212	.435	.601	.848	1.088	1.334
RUNOFF RATE @ Tc (IN/HR):	.042	.150	.256	.433	.621	.826
PEAK DISCHARGE (CFS) :	69.	249.	425.	718.	1031.	1372.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 23

WATERSHED AREA (A): 6185.00 acres

LENGTH OF WATERCOURSE (Lc): 66000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 33000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
66000.	2330.0

MEAN SLOPE (Sc): .0353 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

60. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
5. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
35. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.240	.390	.469	.550	.608	.654
Tc (FUNCTION OF i) :	256.11	210.86	195.80	183.73	176.54	171.50
SOLUTION OF Tc (MINUTES):	465	293	240	197	172	154
RAINFL INT. @ Tc (IN/HR):	.225	.441	.603	.841	1.073	1.313
RUNOFF RATE @ Tc (IN/HR):	.054	.172	.283	.463	.652	.859
PEAK DISCHARGE (CFS) :	337.	1071.	1765.	2885.	4067.	5353.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C9

WATERSHED AREA (A): 9253.00 acres

LENGTH OF WATERCOURSE (Lc): 69500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 34750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
61000.	1240.0
8500.	35.0

MEAN SLOPE (Sc): .0154 ft BASIN FACTOR (Nb): .0620

WATERSHED TYPE(S): FOOTHILLS/VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.15	1.45	1.71	2.04	2.35	2.64
P 2	1.32	1.68	1.98	2.36	2.70	3.04
P 3	1.45	1.87	2.19	2.60	2.97	3.34
P 6	1.65	2.14	2.51	2.97	3.39	3.81
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

62. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
22. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
16. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.207	.323	.410	.501	.566	.618
Tc (FUNCTION OF i) :	484.83	405.50	368.46	340.13	323.85	312.71
SOLUTION OF Tc (MINUTES):	1224	811	640	511	436	384
RAINFL INT. @ Tc (IN/HR):	.099	.177	.251	.362	.476	.599
RUNOFF RATE @ Tc (IN/HR):	.020	.057	.103	.181	.270	.370
PEAK DISCHARGE (CFS) :	190.	533.	962.	1691.	2514.	3455.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C8B

WATERSHED AREA (A): 14577.00 acres

LENGTH OF WATERCOURSE (Lc): 82000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 41000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
61000.	1240.0
21000.	105.0

MEAN SLOPE (Sc): .0128 ft BASIN FACTOR (Nb): .0600

WATERSHED TYPE(S): FOOTHILLS/VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.12	1.38	1.63	1.96	2.26	2.56
P 2	1.28	1.60	1.89	2.27	2.61	2.94
P 3	1.42	1.81	2.12	2.53	2.90	3.27
P 6	1.63	2.11	2.47	2.93	3.36	3.77
P24	2.09	2.69	3.14	3.71	4.24	4.75

SOIL GROUPS

63. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
26. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
11. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.186	.290	.381	.476	.545	.600
Tc (FUNCTION OF i) :	582.03	487.01	436.80	399.43	378.38	364.16
SOLUTION OF Tc (MINUTES):	1440	1070	833	658	559	490
RAINFL INT. @ Tc (IN/HR):	.087	.140	.199	.287	.378	.476
RUNOFF RATE @ Tc (IN/HR):	.016	.041	.076	.137	.206	.286
PEAK DISCHARGE (CFS) :	237.	595.	1113.	2008.	3024.	4198.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED
NOTE: WHERE Tc = 1440 MIN (24 HRS) ACTUAL VALUE OF Tc MAY BE GREATER

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C8

WATERSHED AREA (A): 28703.00 acres

LENGTH OF WATERCOURSE (Lc): 82000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 41000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
61000.	1240.0
21000.	105.0

MEAN SLOPE (Sc): .0128 ft BASIN FACTOR (Nb): .0600

WATERSHED TYPE(S): FOOTHILLS/VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.02	1.19	1.44	1.76	2.04	2.33
P 2	1.21	1.47	1.75	2.12	2.45	2.78
P 3	1.37	1.72	2.03	2.43	2.80	3.16
P 6	1.58	2.01	2.36	2.82	3.24	3.65
P24	2.04	2.61	3.05	3.62	4.14	4.66

SOIL GROUPS

48. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
22. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
30. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.173	.249	.348	.454	.530	.590
Tc (FUNCTION OF i) :	598.69	517.43	452.60	407.15	382.68	366.61
SOLUTION OF Tc (MINUTES):	1440	1192	897	691	579	504
RAINFL INT. @ Tc (IN/HR):	.085	.124	.181	.266	.355	.451
RUNOFF RATE @ Tc (IN/HR):	.015	.031	.063	.121	.188	.266
PEAK DISCHARGE (CFS) :	426.	896.	1824.	3498.	5440.	7694.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED
NOTE: WHERE Tc = 1440 MIN (24 HRS) ACTUAL VALUE OF Tc MAY BE GREATER

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C1

WATERSHED AREA (A): 55761.00 acres

LENGTH OF WATERCOURSE (Lc): 102000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 51000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
61000.	1240.0
21000.	105.0
20000.	85.0

MEAN SLOPE (Sc): .0098 ft BASIN FACTOR (Nb): .0580

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.92	1.02	1.25	1.55	1.83	2.10
P 2	1.11	1.29	1.56	1.92	2.24	2.55
P 3	1.28	1.55	1.85	2.24	2.60	2.95
P 6	1.53	1.91	2.26	2.72	3.13	3.54
P24	2.00	2.52	2.96	3.53	4.05	4.56

SOIL GROUPS

57. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
18. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
25. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.121	.163	.261	.374	.459	.527
Tc (FUNCTION OF i) :	846.70	753.33	623.67	539.74	497.27	470.44
SOLUTION OF Tc (MINUTES):	1440	1440	1440	1065	873	749
RAINFL INT. @ Tc (IN/HR):	.083	.105	.123	.183	.245	.313
RUNOFF RATE @ Tc (IN/HR):	.010	.017	.032	.068	.113	.165
PEAK DISCHARGE (CFS) :	568.	960.	1809.	3848.	6325.	9273.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED
NOTE: WHERE Tc = 1440 MIN (24 HRS) ACTUAL VALUE OF Tc MAY BE GREATER

APPENDIX B HEC-1 INPUT/OUTPUT

A detailed hydrologic analysis was performed using the U.S. Army Corp of Engineers HEC-1 Flood Hydrograph Package. Figure 11 shows the subbasin boundaries used in developing the HEC-1 model. Figure 11 also provides a schematic of the HEC-1 model which shows the manner in which the subbasins are routed and combined.

Subbasin hydrograph generation was accommplished using the SCS Unit Hydrograph capabilities of the HEC-1 package. Input data for the unit hydrograph modules including SCS curve number, watershed area, watercourse length and slope and percent impervious cover were taken from the Pima County Method data sheets. The SCS hydrograph parameter "lag" was determined using equation 9 from "A Guide to Hydrologic Analysis Using SCS Methods," McCuen, 1982. The SCS type II rainfall distribution was used as the precipitation pattern for the HEC-1 model. The type II distribution was applied to the 1-, 3-, 6-, and 24-hr rainfall depths for the various points of interest.

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*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           FEBRUARY 1981               *
*         REVISED 01 APR 88             *
*                                       *
*  RUN DATE  03/30/1990  TIME  09:47:29 *
*                                       *
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C9 -----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   1-HR RAINFALL, SCS TYPE II DISTRIBUTION
  7       IT     10                    300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN      5
 12       PB   2.64
 13       PC   .000    .022    .048    .080    .120    .181    .663    .820    .880    .921
 14       PC   .952    .978   1.000
 15       LS              85      6
 16       UD   5.07

 17       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 18       RS      2   STOR       0
 19       RC   .060    .035    .060    8500    .004
 20       RX      0       0     100     100     275     277     375     375
 21       RY     50      24      24      20      20      24      24      50

 22       KK  S16    RUNOFF FROM SUBBASIN 16
 23       BA   6.14
 24       LS              86      6
 25       UD   4.09

 26       KK  C9     HYDROGRAPH COMBINATION @ C9
 27       HC      2
 28       ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1067.	5.50	871.	307.	148.	8.32		
ROUTED TO	R9	1064.	6.00	861.	307.	148.	8.32	21.63	6.00
HYDROGRAPH AT	S16	1017.	4.67	753.	237.	114.	6.14		
2 COMBINED AT	C9	1972.	5.50	1565.	544.	262.	14.46		

*** NORMAL END OF HEC-1 ***

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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            FEBRUARY 1981              *
*          REVISED 01 APR 88            *
*                                       *
*  RUN DATE  03/30/1990  TIME  11:02:46 *
*                                       *
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*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C9 -----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   6-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                    300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA    8.32
 11       IN      15
 12       PB    3.81
 13       PC    .000    .011    .022    .035    .048    .063    .080    .098    .120    .147
 14       PC    .181    .235    .663    .772    .820    .854    .880    .902    .921    .937
 15       PC    .952    .965    .978    .989   1.000
 16       LS             85       6
 17       UD    5.07

 18       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 19       RS       2   STOR       0
 20       RC    .060    .035    .060    8500    .004
 21       RX       0       0     100     100     275     277     375     375
 22       RY      50      24      24      20      20      24      24      50

 23       KK  S16    RUNOFF FROM SUBBASIN 16
 24       BA    6.14
 25       LS             86       6
 26       UD    4.09

 27       KK  C9     HYDROGRAPH COMBINATION @ C9
 28       HC       2
 29       ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1768.	8.50	1463.	532.	256.	8.32		
ROUTED TO	R9	1760.	8.67	1450.	532.	256.	8.32	22.14	8.67
HYDROGRAPH AT	S16	1621.	7.50	1248.	406.	196.	6.14		
2 COMBINED AT	C9	3263.	8.00	2627.	938.	452.	14.46		

*** NORMAL END OF HEC-1 ***

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*******************************************
*                                         *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *
*           FEBRUARY 1981                 *
*         REVISED 01 APR 88               *
*                                         *
* RUN DATE  03/30/1990  TIME  11:45:49    *
*                                         *
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*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
* THE HYDROLOGIC ENGINEERING CENTER     *
*        609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 551-1748               *
*                                       *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C9 ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   24-HR RAINFALL, SCS TYPE II DISTRIBUTION
  7       IT     10                  300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN     30
 12       PB   4.80
 13       PC   .000   .005   .011   .016   .022   .028   .035   .041   .048   .056
 14       PC   .063   .071   .080   .089   .098   .109   .120   .133   .147   .163
 15       PC   .181   .204   .235   .283   .663   .735   .772   .799   .820   .838
 16       PC   .854   .868   .880   .891   .902   .912   .921   .929   .937   .945
 17       PC   .952   .959   .965   .972   .978   .984   .989   .995  1.000
 18       LS            85     6
 19       UD   5.07

 20       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 21       RS      2   STOR      0
 22       RC   .060   .035   .060   8500   .004
 23       RX      0      0    100    100    275    277    375    375
 24       RY     50     24     24     20     20     24     24     50

 25       KK  S16    RUNOFF FROM SUBBASIN 16
 26       BA   6.14
 27       LS            86     6
 28       UD   4.09

 29       KK  C9     HYDROGRAPH COMBINATION @ C9
 30       HC      2
 31       ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1914.	17.33	1645.	724.	353.	8.32		
ROUTED TO	R9	1908.	17.67	1640.	724.	353.	8.32	22.25	17.67
HYDROGRAPH AT	S16	1715.	16.17	1380.	552.	268.	6.14		
2 COMBINED AT	C9	3504.	16.83	2952.	1274.	622.	14.46		

*** NORMAL END OF HEC-1 ***

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*******************************************
*                                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
*             FEBRUARY 1981               *
*           REVISED 01 APR 88             *
*                                         *
*  RUN DATE  03/30/1990  TIME  08:49:33   *
*                                         *
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***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*  THE HYDROLOGIC ENGINEERING CENTER  *
*         609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 551-1748            *
*                                     *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC10B, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C8B ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   1-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                  300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN      5
 12       PB   2.56
 13       PC   .000    .022    .048    .080    .120    .181    .663    .820    .880    .921
 14       PC   .952    .978   1.000
 15       LS             85      6
 16       UD   5.07

 17       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 18       RS      2   STOR       0
 19       RC   .060    .035    .060    8500    .004
 20       RX      0       0     100     100     275     277     375     375
 21       RY     50      24      24      20      20      24      24      50

 22       KK  S16    RUNOFF FROM SUBBASIN 16
 23       BA   6.14
 24       LS             86      6
 25       UD   4.09

 26       KK  C9     HYDROGRAPH COMBINATION @ C9
 27       HC      2

 28       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 29       RS      3   STOR       0
 30       RC   .060    .035    .060   12500    .004
 31       RX      0       0     400     400     470     470     670     670
 32       RY    100      70      70      66      66      70      70     100

 33       KK  S12    RUNOFF FROM SUBBASIN 12
 34       BA   8.32
 35       LS             85      5
 36       UD   6.00

 37       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 38       HC      2
 39       ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1016.	5.50	829.	292.	141.	8.32		
ROUTED TO	R9	1007.	6.17	820.	292.	141.	8.32	21.58	6.17
HYDROGRAPH AT	S16	970.	4.67	718.	226.	109.	6.14		
2 COMBINED AT	C9	1859.	5.33	1491.	518.	250.	14.46		
ROUTED TO	R8	1806.	6.50	1485.	518.	250.	14.46	69.77	6.50
HYDROGRAPH AT	S12	852.	6.50	737.	288.	139.	8.32		
2 COMBINED AT	C8B	2658.	6.50	2215.	806.	389.	22.78		

*** NORMAL END OF HEC-1 ***

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           FEBRUARY 1981               *
*         REVISED 01 APR 88             *
*                                       *
* RUN DATE  03/30/1990  TIME  08:55:33  *
*                                       *
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
* THE HYDROLOGIC ENGINEERING CENTER     *
*        609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 551-1748               *
*                                       *
*****************************************
```

```
H     H  EEEEEEE   CCCCC          1
H     H  E        C     C       11
H     H  E       C             1 1
HHHHHHH  EEEE    C        ------  1
H     H  E       C             1 1
H     H  E        C     C       11
H     H  EEEEEEE   CCCCC          1
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   -------- @ C8B ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   6-HR RAINFALL, SCS TYPE II DISTRIBUTION
  7       IT     10                    300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN     15
 12       PB   3.77
 13       PC   .000    .011    .022    .035    .048    .063    .080    .098    .120    .147
 14       PC   .181    .235    .663    .772    .820    .854    .880    .902    .921    .937
 15       PC   .952    .965    .978    .989   1.000
 16       LS             85      6
 17       UD   5.07

 18       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 19       RS      2   STOR       0
 20       RC   .060    .035    .060    8500    .004
 21       RX      0       0     100     100     275     277     375     375
 22       RY     50      24      24      20      20      24      24      50

 23       KK  S16    RUNOFF FROM SUBBASIN 16
 24       BA   6.14
 25       LS             86      6
 26       UD   4.09

 27       KK  C9     HYDROGRAPH COMBINATION @ C9
 28       HC      2

 29       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 30       RS      3   STOR       0
 31       RC   .060    .035    .060   12500    .004
 32       RX      0       0     400     400     470     470     670     670
 33       RY    100      70      70      66      66      70      70     100

 34       KK  S12    RUNOFF FROM SUBBASIN 12
 35       BA   8.32
 36       LS             85      5
 37       UD   6.00

 38       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 39       HC      2
 40       ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1742.	8.50	1441.	524.	253.	8.32		
ROUTED TO	R9	1733.	8.67	1428.	524.	253.	8.32	22.12	8.67
HYDROGRAPH AT	S16	1597.	7.50	1229.	400.	193.	6.14		
2 COMBINED AT	C9	3215.	8.00	2587.	924.	445.	14.46		
ROUTED TO	R8	3119.	9.17	2554.	924.	445.	14.46	70.56	9.17
HYDROGRAPH AT	S12	1488.	9.50	1291.	518.	251.	8.32		
2 COMBINED AT	C8B	4602.	9.33	3844.	1442.	696.	22.78		

*** NORMAL END OF HEC-1 ***

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 01 APR 88           *
*                                       *
*  RUN DATE  03/30/1990  TIME  08:58:25 *
*                                       *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC10B, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C8B ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   24-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                    300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN     30
 12       PB   4.75
 13       PC   .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 14       PC   .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 15       PC   .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 16       PC   .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 17       PC   .952    .959    .965    .972    .978    .984    .989    .995   1.000
 18       LS             85      6
 19       UD   5.07

 20       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 21       RS      2   STOR      0
 22       RC   .060    .035    .060    8500    .004
 23       RX      0       0     100     100     275     277     375     375
 24       RY     50      24      24      20      20      24      24      50

 25       KK  S16    RUNOFF FROM SUBBASIN 16
 26       BA   6.14
 27       LS             86      6
 28       UD   4.09

 29       KK  C9     HYDROGRAPH COMBINATION @ C9
 30       HC      2

 31       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 32       RS      3   STOR      0
 33       RC   .060    .035    .060   12500    .004
 34       RX      0       0     400     400     470     470     670     670
 35       RY    100      70      70      66      66      70      70     100

 36       KK  S12    RUNOFF FROM SUBBASIN 12
 37       BA   8.32
 38       LS             85      5
 39       UD   6.00

 40       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 41       HC      2
 42       ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1887.	17.33	1622.	714.	348.	8.32		
ROUTED TO	R9	1881.	17.67	1616.	713.	348.	8.32	22.23	17.67
HYDROGRAPH AT	S16	1692.	16.17	1360.	544.	264.	6.14		
2 COMBINED AT	C9	3454.	16.83	2909.	1256.	613.	14.46		
ROUTED TO	R8	3368.	18.00	2868.	1256.	613.	14.46	70.71	18.00
HYDROGRAPH AT	S12	1647.	18.33	1474.	705.	347.	8.32		
2 COMBINED AT	C8B	5010.	18.17	4343.	1961.	960.	22.78		

*** NORMAL END OF HEC-1 ***

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*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE (HEC-1)     *
*           FEBRUARY 1981               *
*         REVISED 01 APR 88             *
*                                       *
*  RUN DATE  03/30/1990  TIME  09:07:27 *
*                                       *
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C8 ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   1-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                    300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN      5
 12       PB   2.33
 13       PC   .000    .022    .048    .080    .120    .181    .663    .820    .880    .921
 14       PC   .952    .978   1.000
 15       LS              85       6
 16       UD   5.07

 17       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 18       RS      2   STOR       0
 19       RC   .060    .035    .060    6500    .004
 20       RX      0       0     100     100     275     277     375     375
 21       RY     50      24      24      20      20      24      24      50

 22       KK  S16    RUNOFF FROM SUBBASIN 16
 23       BA   6.14
 24       LS              86       6
 25       UD   4.09

 26       KK  C9     HYDROGRAPH COMBINATION @ C9
 27       HC      2

 28       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 29       RS      3   STOR       0
 30       RC   .060    .035    .060   12500    .004
 31       RX      0       0     400     400     470     470     670     670
 32       RY    100      70      70      66      66      70      70     100

 33       KK  S12    RUNOFF FROM SUBBASIN 12
 34       BA   8.32
 35       LS              85       5
 36       UD   6.00

 37       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 38       HC      2

 39       KK  S10    RUNOFF FROM SUBBASIN 10
 40       BA  12.78
 41       LS              88       5
 42       UD   5.43
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  43      KK  S13     RUNOFF FROM SUBBASIN S13
  44      BA    9.29
  45      LS              88      11
  46      UD    2.98

  47      KK  C8      HYDROGRAPH COMBINATION @ C8
  48      HC       3
  49      ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	873.	5.50	712.	251.	121.	8.32		
ROUTED TO	R9	861.	6.33	704.	251.	121.	8.32	21.36	6.33
HYDROGRAPH AT	S16	836.	4.67	619.	195.	94.	6.14		
2 COMBINED AT	C9	1599.	5.33	1282.	445.	215.	14.46		
ROUTED TO	R8	1563.	6.33	1277.	445.	215.	14.46	69.63	6.33
HYDROGRAPH AT	S12	731.	6.50	632.	247.	119.	8.32		
2 COMBINED AT	C8B	2293.	6.50	1903.	692.	334.	22.78		
HYDROGRAPH AT	S10	1443.	6.00	1208.	443.	214.	12.78		
HYDROGRAPH AT	S13	1978.	3.50	1216.	339.	163.	9.29		
3 COMBINED AT	C8	4868.	4.83	4042.	1474.	711.	44.85		

*** NORMAL END OF HEC-1 ***

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*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           FEBRUARY 1981               *
*         REVISED 01 APR 88             *
*                                       *
*  RUN DATE  03/30/1990  TIME  09:30:11 *
*                                       *
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*        609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 551-1748               *
*                                       *
*****************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C8 ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   6-HR RAINFALL, SCS TYPE II DISTRIBUTION
  7       IT     10                  300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN     15
 12       PB   3.65
 13       PC   .000   .011   .022   .035   .048   .063   .080   .098   .120   .147
 14       PC   .181   .235   .663   .772   .820   .854   .880   .902   .921   .937
 15       PC   .952   .965   .978   .989  1.000
 16       LS            85     6
 17       UD   5.07

 18       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 19       RS      2   STOR      0
 20       RC   .060   .035   .060   8500   .004
 21       RX      0      0    100    100    275    277    375    375
 22       RY     50     24     24     20     20     24     24     50

 23       KK  S16    RUNOFF FROM SUBBASIN 16
 24       BA   6.14
 25       LS            86     6
 26       UD   4.09

 27       KK  C9     HYDROGRAPH COMBINATION @ C9
 28       HC      2

 29       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 30       RS      3   STOR      0
 31       RC   .060   .035   .060  12500   .004
 32       RX      0      0    400    400    470    470    670    670
 33       RY    100     70     70     66     66     70     70    100

 34       KK  S12    RUNOFF FROM SUBBASIN 12
 35       BA   8.32
 36       LS            85     5
 37       UD   6.00

 38       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 39       HC      2

 40       KK  S10    RUNOFF FROM SUBBASIN 10
 41       BA  12.78
 42       LS            88     5
 43       UD   5.43
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  44      KK  S13     RUNOFF FROM SUBBASIN S13
  45      BA    9.29
  46      LS               88      11
  47      UD    2.98

  48      KK  C8      HYDROGRAPH COMBINATION @ C8
  49      HC       3
  50      ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1662.	8.50	1376.	500.	241.	8.32		
ROUTED TO	R9	1654.	8.83	1363.	500.	241.	8.32	22.06	8.83
HYDROGRAPH AT	S16	1526.	7.50	1174.	382.	184.	6.14		
2 COMBINED AT	C9	3069.	8.00	2467.	882.	425.	14.46		
ROUTED TO	R8	2977.	9.17	2439.	882.	425.	14.46	70.47	9.17
HYDROGRAPH AT	S12	1420.	9.50	1232.	495.	239.	8.32		
2 COMBINED AT	C8B	4393.	9.33	3670.	1377.	665.	22.78		
HYDROGRAPH AT	S10	2651.	8.83	2240.	846.	408.	12.78		
HYDROGRAPH AT	S13	3276.	6.17	2201.	635.	306.	9.29		
3 COMBINED AT	C8	8586.	8.17	7541.	2856.	1379.	44.85		

*** NORMAL END OF HEC-1 ***

```
*******************************************
*                                         *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *
*           FEBRUARY 1981                 *
*         REVISED 01 APR 88               *
*                                         *
*  RUN DATE  03/30/1990  TIME  09:43:54   *
*                                         *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C8 ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   24-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                   300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN     30
 12       PB   4.66
 13       PC   .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 14       PC   .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 15       PC   .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 16       PC   .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 17       PC   .952    .959    .965    .972    .978    .984    .989    .995   1.000
 18       LS             85      6
 19       UD   5.07

 20       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 21       RS      2   STOR       0
 22       RC   .060    .035    .060    8500    .004
 23       RX      0       0     100     100     275     277     375     375
 24       RY     50      24      24      20      20      24      24      50

 25       KK  S16    RUNOFF FROM SUBBASIN 16
 26       BA   6.14
 27       LS             86      6
 28       UD   4.09

 29       KK  C9     HYDROGRAPH COMBINATION @ C9
 30       HC      2

 31       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 32       RS      3   STOR       0
 33       RC   .060    .035    .060   12500    .004
 34       RX      0       0     400     400     470     470     670     670
 35       RY    100      70      70      66      66      70      70     100

 36       KK  S12    RUNOFF FROM SUBBASIN 12
 37       BA   8.32
 38       LS             85      5
 39       UD   6.00

 40       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 41       HC      2

 42       KK  S10    RUNOFF FROM SUBBASIN 10
 43       BA  12.78
 44       LS             88      5
 45       UD   5.43
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  46      KK  S13     RUNOFF FROM SUBBASIN S13
  47      BA    9.29
  48      LS              88     11
  49      UD    2.98

  50      KK  C8     HYDROGRAPH COMBINATION @ C8
  51      HC       3
  52      ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1838.	17.33	1580.	695.	340.	8.32		
ROUTED TO	R9	1832.	17.67	1574.	695.	340.	8.32	22.19	17.67
HYDROGRAPH AT	S16	1648.	16.17	1326.	530.	258.	6.14		
2 COMBINED AT	C9	3365.	16.83	2833.	1224.	597.	14.46		
ROUTED TO	R8	3281.	18.00	2794.	1224.	597.	14.46	70.66	18.00
HYDROGRAPH AT	S12	1604.	18.33	1436.	687.	338.	8.32		
2 COMBINED AT	C88	4881.	18.17	4230.	1911.	935.	22.78		
HYDROGRAPH AT	S10	2907.	17.67	2543.	1153.	565.	12.78		
HYDROGRAPH AT	S13	3401.	15.00	2397.	865.	420.	9.29		
3 COMBINED AT	C8	9503.	17.17	8560.	3915.	1920.	44.85		

*** NORMAL END OF HEC-1 ***

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*          REVISED 01 APR 88            *
*                                       *
*  RUN DATE  03/29/1990  TIME  11:15:29 *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*          (916) 551-1748               *
*                                       *
*****************************************
```


```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC10B, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C1 -----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   1-HR RAINFALL, SCS TYPE II DISTRIBUTION
  7       IT     10                  300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA   8.32
 11       IN      5
 12       PB   2.10
 13       PC   .000   .022   .048   .080   .120   .181   .663   .820   .880   .921
 14       PC   .952   .978  1.000
 15       LS            85      6
 16       UD   5.07

 17       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 18       RS      2   STOR      0
 19       RC   .060   .035   .060   8500   .004
 20       RX      0      0    100    100    275    277    375    375
 21       RY     50     24     24     20     20     24     24     50

 22       KK  S16    RUNOFF FROM SUBBASIN 16
 23       BA   6.14
 24       LS            86      6
 25       UD   4.09

 26       KK  C9     HYDROGRAPH COMBINATION @ C9
 27       HC      2

 28       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 29       RS      3   STOR      0
 30       RC   .060   .035   .060  12500   .004
 31       RX      0      0    400    400    470    470    670    670
 32       RY    100     70     70     66     66     70     70    100

 33       KK  S12    RUNOFF FROM SUBBASIN 12
 34       BA   8.32
 35       LS            85      5
 36       UD   6.00

 37       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 38       HC      2

 39       KK  S10    RUNOFF FROM SUBBASIN 10
 40       BA  12.78
 41       LS            88      5
 42       UD   5.43
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  43      KK  S13     RUNOFF FROM SUBBASIN S13
  44      BA   9.29
  45      LS              88      11
  46      UD   2.98

  47      KK  C8      HYDROGRAPH COMBINATION @ C8
  48      HC       3

  49      KK  S9      RUNOFF FROM SUBBASIN 9
  50      BA   4.41
  51      LS              87       5
  52      UD   3.89

  53      KK  C8A     HYDROGRAPH COMBINATION @ C8A
  54      HC       2

  55      KK  R7      NORMAL DEPTH ROUTING THROUGH REACH R7
  56      RS       1    STOR       0
  57      RC    .060    .035    .060    6000    .005
  58      RX       0       0     350     350     850     850    1350    1350
  59      RY     500     419     419     415     415     419     419     500

  60      KK  R6      NORMAL DEPTH ROUTING THROUGH REACH R6
  61      RS       3    STOR       0
  62      RC    .060    .035    .060    6000    .005
  63      RX       0       0     150     150    1150    1150    1250    1250
  64      RY     500     397     397     396     396     397     397     500

  65      KK  S11     RUNOFF FROM SUBBASIN 11
  66      BA   1.06
  67      LS              86       5
  68      UD   2.87

  69      KK  C7      HYDROGRAPH COMBINATION @ C7
  70      HC       2

  71      KK  S7      RUNOFF FROM SUBBASIN 7
  72      BA   4.05
  73      LS              84       2
  74      UD   3.83

  75      KK  R5      NORMAL DEPTH ROUTING THROUGH REACH R5
  76      RS       1    STOR       0
  77      RC    .050    .035    .050    4200   .0067
  78      RX       0       0     300     300     500     500     800     800
  79      RY      50      16      16      14      14      16      16      50

  80      KK  S8      RUNOFF FROM SUBBASIN 8
  81      BA  12.10
  82      LS              86       2
  83      UD   4.91
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  84      KK  R4    NORMAL DEPTH ROUTING THROUGH REACH R4
  85      RS     1   STOR      0
  86      RC  .060   .035   .060   4400  .0057
  87      RX     0     0    600    600    900    900   1500   1500
  88      RY    50    10     10      8      8     10     10     50

  89      KK  S6    RUNOFF FROM SUBBASIN 6
  90      BA   .48
  91      LS            88      2
  92      UD  1.00

  93      KK  C6    HYDROGRAPH COMBINATION @ C6
  94      HC     3

  95      KK  C5    HYDROGRAPH COMBINATION @ C5
  96      HC     2

  97      KK  R3    NORMAL DEPTH ROUTING THROUGH REACH R3
  98      RS     1   STOR      0
  99      RC  .060   .035   .060   1500  .005
 100      RX     0     0   1000   1000  4200   4200   4800   4800
 101      RY   100    70     70     68    68     70     70    100

 102      KK  S5     RUNOFF FROM SUBBASIN 5
 103      BA  5.54
 104      LS            85     10
 105      UD  4.77

 106      KK        HYDROGRAPH COMBINATION
 107      HC     2

 108      KK  R2    NORMAL DEPTH ROUTING THROUGH REACH R2
 109      RS     2   STOR      0
 110      RC  .060   .035   .060   6500  .005
 111      RX     0     0   1000   1000  4200   4200   4800   4800
 112      RY   100    70     70     68    68     70     70    100

 113      KK  S3     RUNOFF FROM SUBBASIN 3
 114      BA   .84
 115      LS            84      2
 116      UD  2.44

 117      KK  C4    HYDROGRAPH COMBINATION @ C4
 118      HC     2

 119      KK  S4    RUNOFF FROM SUBBASIN 4
 120      BA 10.96
 121      LS            86     10
 122      UD  2.36
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  123     KK  S4.1   RUNOFF FROM SUBBASIN 4.1
  124     BA    1.46
  125     LS              85      15
  126     UD    3.38

  127     KK  C3     HYDROGRAPH COMBINATION @ C3
  128     HC       2

  129     KK  R1     NORMAL DEPTH ROUTING THROUGH REACH R1
  130     RS       2    STOR       0
  131     RC    .060    .035    .060    7300    .007
  132     RX       0       0     650     650    1150    1150    1950    1950
  133     RY     100      60      60      58      58      60      60     100

  134     KK  S2     RUNOFF FROM SUBBASIN 2
  135     BA    1.27
  136     LS              86       2
  137     UD    2.13

  138     KK  C2     HYDROGRAPH COMBINATION @ C2
  139     HC       2

  140     KK  C1     HYDROGRAPH COMBINATION @ C1
  141     HC       2
  142     ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	733.	5.67	599.	211.	102.	8.32		
ROUTED TO	R9	724.	6.33	592.	211.	102.	8.32	21.14	6.33
HYDROGRAPH AT	S16	706.	4.67	522.	164.	79.	6.14		
2 COMBINED AT	C9	1347.	5.33	1080.	375.	181.	14.46		
ROUTED TO	R8	1340.	5.83	1075.	375.	181.	14.46	69.33	5.83
HYDROGRAPH AT	S12	614.	6.50	531.	207.	100.	8.32		
2 COMBINED AT	C8B	1945.	6.00	1601.	582.	281.	22.78		
HYDROGRAPH AT	S10	1228.	6.00	1028.	377.	182.	12.78		
HYDROGRAPH AT	S13	1693.	3.50	1041.	290.	140.	9.29		
3 COMBINED AT	C8	4133.	4.83	3421.	1250.	603.	44.85		
HYDROGRAPH AT	S9	556.	4.50	401.	123.	59.	4.41		
2 COMBINED AT	C8A	4681.	4.83	3813.	1373.	662.	49.26		
ROUTED TO	R7	4652.	5.00	3802.	1373.	662.	49.26	416.12	5.00
ROUTED TO	R6	4644.	5.17	3799.	1373.	662.	49.26	396.45	5.17
HYDROGRAPH AT	S11	170.	3.50	102.	28.	14.	1.06		
2 COMBINED AT	C7	4742.	5.17	3877.	1401.	676.	50.32		
HYDROGRAPH AT	S7	419.	4.33	300.	92.	44.	4.05		
ROUTED TO	R5	417.	4.67	299.	92.	44.	4.05	14.40	4.67
HYDROGRAPH AT	S8	1108.	5.50	893.	309.	149.	12.10		
ROUTED TO	R4	1102.	5.83	888.	309.	149.	12.10	8.65	5.83
HYDROGRAPH AT	S6	219.	1.50	55.	14.	7.	.48		
3 COMBINED AT	C6	1482.	5.33	1179.	414.	199.	16.63		
2 COMBINED AT	C5	6220.	5.17	5056.	1815.	875.	66.95		
ROUTED TO	R3	6215.	5.33	5052.	1815.	875.	66.95	68.46	5.33
HYDROGRAPH AT	S5	546.	5.33	434.	148.	71.	5.54		
2 COMBINED AT		6761.	5.33	5484.	1962.	946.	72.49		
ROUTED TO	R2	6703.	5.83	5461.	1962.	946.	72.49	68.49	5.83

2 COMBINED AT	C4	6736.	5.67	5497.	1981.	955.	73.33		
HYDROGRAPH AT	S4	2241.	3.00	1165.	307.	148.	10.96		
HYDROGRAPH AT	S4.1	214.	4.00	142.	41.	20.	1.46		
2 COMBINED AT	C3	2424.	3.00	1304.	349.	168.	12.42		
ROUTED TO	R1	2357.	3.33	1298.	349.	168.	12.42	58.76	3.33
HYDROGRAPH AT	S2	261.	2.67	125.	32.	16.	1.27		
2 COMBINED AT	C2	2583.	3.33	1420.	381.	184.	13.69		
2 COMBINED AT	C1	7768.	5.17	6519.	2362.	1139.	87.02		

*** NORMAL END OF HEC-1 ***

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           FEBRUARY 1981               *
*         REVISED 01 APR 88             *
*                                       *
*  RUN DATE  03/30/1990  TIME  08:18:29 *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```


```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X                X
XXXXXXX  XXXX     X       XXXXX    X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   -------- @ C1 ----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   6-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                  300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA    8.32
 11       IN      15
 12       PB    3.54
 13       PC    .000    .011    .022    .035    .048    .063    .080    .098    .120    .147
 14       PC    .181    .235    .663    .772    .820    .854    .880    .902    .921    .937
 15       PC    .952    .965    .978    .989   1.000
 16       LS              85       6
 17       UD    5.07

 18       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 19       RS       2   STOR       0
 20       RC    .060    .035    .060    8500    .004
 21       RX       0       0     100     100     275     277     375     375
 22       RY      50      24      24      20      20      24      24      50

 23       KK  S16    RUNOFF FROM SUBBASIN 16
 24       BA    6.14
 25       LS              86       6
 26       UD    4.09

 27       KK  C9     HYDROGRAPH COMBINATION @ C9
 28       HC       2

 29       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 30       RS       3   STOR       0
 31       RC    .060    .035    .060   12500    .004
 32       RX       0       0     400     400     470     470     670     670
 33       RY     100      70      70      66      66      70      70     100

 34       KK  S12    RUNOFF FROM SUBBASIN 12
 35       BA    8.32
 36       LS              85       5
 37       UD    6.00

 38       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 39       HC       2

 40       KK  S10    RUNOFF FROM SUBBASIN 10
 41       BA   12.78
 42       LS              88       5
 43       UD    5.43
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  44      KK  S13     RUNOFF FROM SUBBASIN S13
  45      BA   9.29
  46      LS              88     11
  47      UD   2.98

  48      KK  C8      HYDROGRAPH COMBINATION @ C8
  49      HC       3

  50      KK  S9      RUNOFF FROM SUBBASIN 9
  51      BA   4.41
  52      LS              87      5
  53      UD   3.89

  54      KK  C8A     HYDROGRAPH COMBINATION @ C8A
  55      HC       2

  56      KK  R7      NORMAL DEPTH ROUTING THROUGH REACH R7
  57      RS       1    STOR      0
  58      RC    .060    .035    .060    6000    .005
  59      RX       0       0     350     350     850     850    1350    1350
  60      RY     500     419     419     415     415     419     419     500

  61      KK  R6      NORMAL DEPTH ROUTING THROUGH REACH R6
  62      RS       3    STOR      0
  63      RC    .060    .035    .060    6000    .005
  64      RX       0       0     150     150    1150    1150    1250    1250
  65      RY     500     397     397     396     396     397     397     500

  66      KK  S11     RUNOFF FROM SUBBASIN 11
  67      BA   1.06
  68      LS              86      5
  69      UD   2.87

  70      KK  C7      HYDROGRAPH COMBINATION @ C7
  71      HC       2

  72      KK  S7      RUNOFF FROM SUBBASIN 7
  73      BA   4.05
  74      LS              84      2
  75      UD   3.83

  76      KK  R5      NORMAL DEPTH ROUTING THROUGH REACH R5
  77      RS       1    STOR      0
  78      RC    .050    .035    .050    4200   .0067
  79      RX       0       0     300     300     500     500     800     800
  80      RY      50      16      16      14      14      16      16      50

  81      KK  S8      RUNOFF FROM SUBBASIN 8
  82      BA  12.10
  83      LS              86      2
  84      UD   4.91
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  85      KK  R4     NORMAL DEPTH ROUTING THROUGH REACH R4
  86      RS      1    STOR       0
  87      RC   .060    .035    .060    4400    .0057
  88      RX      0       0     600     600     900     900    1500    1500
  89      RY     50      10      10       8       8      10      10      50

  90      KK  S6     RUNOFF FROM SUBBASIN 6
  91      BA    .48
  92      LS              88       2
  93      UD   1.00

  94      KK  C6     HYDROGRAPH COMBINATION @ C6
  95      HC      3

  96      KK  C5     HYDROGRAPH COMBINATION @ C5
  97      HC      2

  98      KK  R3     NORMAL DEPTH ROUTING THROUGH REACH R3
  99      RS      1    STOR       0
 100      RC   .060    .035    .060    1500    .005
 101      RX      0       0    1000    1000    4200    4200    4800    4800
 102      RY    100      70      70      68      68      70      70     100

 103      KK  S5      RUNOFF FROM SUBBASIN 5
 104      BA   5.54
 105      LS              85      10
 106      UD   4.77

 107      KK         HYDROGRAPH COMBINATION
 108      HC      2

 109      KK  R2     NORMAL DEPTH ROUTING THROUGH REACH R2
 110      RS      2    STOR       0
 111      RC   .060    .035    .060    6500    .005
 112      RX      0       0    1000    1000    4200    4200    4800    4800
 113      RY    100      70      70      68      68      70      70     100

 114      KK  S3      RUNOFF FROM SUBBASIN 3
 115      BA    .84
 116      LS              84       2
 117      UD   2.44

 118      KK  C4     HYDROGRAPH COMBINATION @ C4
 119      HC      2

 120      KK  S4     RUNOFF FROM SUBBASIN 4
 121      BA  10.96
 122      LS              86      10
 123      UD   2.36
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  124     KK  S4.1   RUNOFF FROM SUBBASIN 4.1
  125     BA    1.46
  126     LS              85      15
  127     UD    3.38

  128     KK  C3     HYDROGRAPH COMBINATION @ C3
  129     HC       2

  130     KK  R1     NORMAL DEPTH ROUTING THROUGH REACH R1
  131     RS       2   STOR       0
  132     RC    .060    .035    .060    7300    .007
  133     RX       0       0     650    .650    1150    1150    1950    1950
  134     RY     100      60      60      58      58      60      60     100

  135     KK  S2     RUNOFF FROM SUBBASIN 2
  136     BA    1.27
  137     LS              86       2
  138     UD    2.13

  139     KK  C2     HYDROGRAPH COMBINATION @ C2
  140     HC       2

  141     KK  C1     HYDROGRAPH COMBINATION @ C1
  142     HC       2
  143     ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1590.	8.50	1316.	478.	231.	8.32		
ROUTED TO	R9	1582.	8.83	1303.	478.	231.	8.32	22.01	8.83
HYDROGRAPH AT	S16	1461.	7.50	1124.	366.	176.	6.14		
2 COMBINED AT	C9	2937.	8.00	2359.	844.	407.	14.46		
ROUTED TO	R8	2847.	9.17	2335.	844.	407.	14.46	70.40	9.17
HYDROGRAPH AT	S12	1358.	9.50	1178.	473.	229.	8.32		
2 COMBINED AT	C8B	4202.	9.33	3511.	1317.	636.	22.78		
HYDROGRAPH AT	S10	2542.	8.83	2148.	811.	392.	12.78		
HYDROGRAPH AT	S13	3144.	6.17	2112.	610.	294.	9.29		
3 COMBINED AT	C8	8220.	8.17	7229.	2737.	1321.	44.85		
HYDROGRAPH AT	S9	1129.	7.17	851.	271.	130.	4.41		
2 COMBINED AT	C8A	9270.	8.00	8053.	3007.	1452.	49.26		
ROUTED TO	R7	9249.	8.17	8033.	3007.	1452.	49.26	417.23	8.17
ROUTED TO	R6	9243.	8.33	8027.	3007.	1452.	49.26	396.90	8.33
HYDROGRAPH AT	S11	334.	6.17	221.	63.	30.	1.06		
2 COMBINED AT	C7	9421.	8.33	8192.	3070.	1482.	50.32		
HYDROGRAPH AT	S7	921.	7.17	690.	218.	105.	4.05		
ROUTED TO	R5	914.	7.33	688.	218.	105.	4.05	14.87	7.33
HYDROGRAPH AT	S8	2407.	8.33	1971.	703.	339.	12.10		
ROUTED TO	R4	2387.	8.50	1962.	703.	339.	12.10	9.41	8.50
HYDROGRAPH AT	S6	354.	4.00	120.	30.	14.	.48		
3 COMBINED AT	C6	3231.	8.17	2642.	951.	458.	16.63		
2 COMBINED AT	C5	12652.	8.33	10828.	4021.	1940.	66.95		
ROUTED TO	R3	12646.	8.33	10826.	4021.	1940.	66.95	68.93	8.33
HYDROGRAPH AT	S5	1146.	8.17	930.	328.	158.	5.54		
2 COMBINED AT		13786.	8.33	11752.	4348.	2098.	72.49		
ROUTED TO	R2	13718.	8.83	11697.	4348.	2098.	72.49	69.01	8.83
HYDROGRAPH AT	S3	272.	5.67	166.	45.	22.	.84		

2 COMBINED AT	C4	13796.	8.67	11787.	4393.	2120.	73.33		
HYDROGRAPH AT	S4	4134.	5.50	2466.	670.	323.	10.96		
HYDROGRAPH AT	S4.1	415.	6.67	296.	89.	43.	1.46		
2 COMBINED AT	C3	4473.	5.50	2752.	760.	366.	12.42		
ROUTED TO	R1	4387.	6.00	2737.	760.	366.	12.42	59.41	6.00
HYDROGRAPH AT	S2	495.	5.33	278.	74.	36.	1.27		
2 COMBINED AT	C2	4829.	6.00	3009.	833.	401.	13.69		
2 COMBINED AT	C1	16017.	8.00	13869.	5224.	2521.	87.02		

*** NORMAL END OF HEC-1 ***

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*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           FEBRUARY 1981               *
*          REVISED 01 APR 88            *
*                                       *
* RUN DATE  03/30/1990  TIME  08:37:12  *
*                                       *
*****************************************
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
* THE HYDROLOGIC ENGINEERING CENTER     *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1       ID   SOUTHWEST BASIN MANAGEMENT STUDY
  2       ID   HEC-1 ANALYSIS FOR BLACK WASH
  3       ID   --------- @ C1 -----------------
  4       ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
  5       ID   ROUTING OF SUBWATERSHED HYDROGRAPHS BY NORMAL-DEPTH STORAGE AND OUTFLOW
  6       ID   24-HR RAINFALL,  SCS TYPE II DISTRIBUTION
  7       IT     10                    300
  8       IO      5

  9       KK  S18    RUNOFF FROM SUBBASIN 18
 10       BA    8.32
 11       IN      30
 12       PB    4.56
 13       PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 14       PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 15       PC    .181    .204    .235    .263    .663    .735    .772    .799    .820    .838
 16       PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 17       PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 18       LS              85      6
 19       UD    5.07

 20       KK  R9     NORMAL DEPTH ROUTING THROUGH REACH R9
 21       RS      2   STOR       0
 22       RC   .060    .035    .060    8500    .004
 23       RX     0       0     100     100     275     277     375     375
 24       RY    50      24      24      20      20      24      24      50

 25       KK  S16    RUNOFF FROM SUBBASIN 16
 26       BA    6.14
 27       LS              86      6
 28       UD    4.09

 29       KK  C9     HYDROGRAPH COMBINATION @ C9
 30       HC      2

 31       KK  R8     NORMAL DEPTH ROUTING THROUGH REACH R8
 32       RS      3   STOR       0
 33       RC   .060    .035    .060   12500    .004
 34       RX     0       0     400     400     470     470     670     670
 35       RY   100      70      70      66      66      70      70     100

 36       KK  S12    RUNOFF FROM SUBBASIN 12
 37       BA    8.32
 38       LS              85      5
 39       UD    6.00

 40       KK  C8B    HYDROGRAPH COMBINATION @ C8B
 41       HC      2

 42       KK  S10    RUNOFF FROM SUBBASIN 10
 43       BA   12.78
 44       LS              88      5
 45       UD    5.43
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  46      KK  S13     RUNOFF FROM SUBBASIN S13
  47      BA   9.29
  48      LS              88      11
  49      UD   2.98

  50      KK  C8      HYDROGRAPH COMBINATION @ C8
  51      HC       3

  52      KK  S9      RUNOFF FROM SUBBASIN 9
  53      BA   4.41
  54      LS              87       5
  55      UD   3.89

  56      KK  C8A     HYDROGRAPH COMBINATION @ C8A
  57      HC       2

  58      KK  R7      NORMAL DEPTH ROUTING THROUGH REACH R7
  59      RS       1    STOR       0
  60      RC    .060    .035    .060    6000    .005
  61      RX       0       0     350     350     850     850    1350    1350
  62      RY     500     419     419     415     415     419     419     500

  63      KK  R6      NORMAL DEPTH ROUTING THROUGH REACH R6
  64      RS       3    STOR       0
  65      RC    .060    .035    .060    6000    .005
  66      RX       0       0     150     150    1150    1150    1250    1250
  67      RY     500     397     397     396     396     397     397     500

  68      KK  S11     RUNOFF FROM SUBBASIN 11
  69      BA   1.06
  70      LS              86       5
  71      UD   2.87

  72      KK  C7      HYDROGRAPH COMBINATION @ C7
  73      HC       2

  74      KK  S7      RUNOFF FROM SUBBASIN 7
  75      BA   4.05
  76      LS              84       2
  77      UD   3.83

  78      KK  R5      NORMAL DEPTH ROUTING THROUGH REACH R5
  79      RS       1    STOR       0
  80      RC    .050    .035    .050    4200   .0067
  81      RX       0       0     300     300     500     500     800     800
  82      RY      50      16      16      14      14      16      16      50

  83      KK  S8      RUNOFF FROM SUBBASIN 8
  84      BA  12.10
  85      LS              86       2
  86      UD   4.91
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  87      KK  R4    NORMAL DEPTH ROUTING THROUGH REACH R4
  88      RS     1   STOR      0
  89      RC  .060   .035   .060   4400   .0057
  90      RX     0     0    600    600    900    900   1500   1500
  91      RY    50    10     10      8      8     10     10     50

  92      KK  S6    RUNOFF FROM SUBBASIN 6
  93      BA   .48
  94      LS            88      2
  95      UD  1.00

  96      KK  C6    HYDROGRAPH COMBINATION @ C6
  97      HC     3

  98      KK  C5    HYDROGRAPH COMBINATION @ C5
  99      HC     2

 100      KK  R3    NORMAL DEPTH ROUTING THROUGH REACH R3
 101      RS     1   STOR      0
 102      RC  .060   .035   .060   1500   .005
 103      RX     0     0   1000   1000   4200   4200   4800   4800
 104      RY   100    70     70     68     68     70     70    100

 105      KK  S5    RUNOFF FROM SUBBASIN 5
 106      BA  5.54
 107      LS            85     10
 108      UD  4.77

 109      KK        HYDROGRAPH COMBINATION
 110      HC     2

 111      KK  R2    NORMAL DEPTH ROUTING THROUGH REACH R2
 112      RS     2   STOR      0
 113      RC  .060   .035   .060   6500   .005
 114      RX     0     0   1000   1000   4200   4200   4800   4800
 115      RY   100    70     70     68     68     70     70    100

 116      KK  S3    RUNOFF FROM SUBBASIN 3
 117      BA   .84
 118      LS            84      2
 119      UD  2.44

 120      KK  C4    HYDROGRAPH COMBINATION @ C4
 121      HC     2

 122      KK  S4    RUNOFF FROM SUBBASIN 4
 123      BA 10.96
 124      LS            86     10
 125      UD  2.36
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  126     KK  S4.1   RUNOFF FROM SUBBASIN 4.1
  127     BA    1.46
  128     LS              85      15
  129     UD    3.38

  130     KK  C3     HYDROGRAPH COMBINATION @ C3
  131     HC       2

  132     KK  R1     NORMAL DEPTH ROUTING THROUGH REACH R1
  133     RS       2   STOR       0
  134     RC    .060    .035    .060    7300    .007
  135     RX       0       0     650     650    1150    1150    1950    1950
  136     RY     100      60      60      58      58      60      60     100

  137     KK  S2     RUNOFF FROM SUBBASIN 2
  138     BA    1.27
  139     LS              86       2
  140     UD    2.13

  141     KK  C2     HYDROGRAPH COMBINATION @ C2
  142     HC       2

  143     KK  C1     HYDROGRAPH COMBINATION @ C1
  144     HC       2
  145     ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	1784.	17.33	1534.	675.	330.	8.32		
ROUTED TO	R9	1778.	17.67	1526.	675.	330.	8.32	22.15	17.67
HYDROGRAPH AT	S16	1601.	16.17	1288.	515.	250.	6.14		
2 COMBINED AT	C9	3266.	16.83	2749.	1189.	580.	14.46		
ROUTED TO	R8	3185.	18.00	2712.	1188.	580.	14.46	70.60	18.00
HYDROGRAPH AT	S12	1557.	18.33	1393.	667.	328.	8.32		
2 COMBINED AT	C8B	4737.	18.17	4105.	1855.	908.	22.78		
HYDROGRAPH AT	S10	2826.	17.67	2472.	1121.	549.	12.78		
HYDROGRAPH AT	S13	3309.	15.00	2333.	842.	409.	9.29		
3 COMBINED AT	C8	9230.	17.17	8320.	3805.	1866.	44.85		
HYDROGRAPH AT	S9	1227.	16.00	968.	380.	184.	4.41		
2 COMBINED AT	C8A	10351.	16.83	9257.	4183.	2050.	49.26		
ROUTED TO	R7	10332.	17.17	9238.	4183.	2050.	49.26	417.50	17.17
ROUTED TO	R6	10328.	17.33	9234.	4183.	2050.	49.26	397.00	17.33
HYDROGRAPH AT	S11	361.	14.83	250.	89.	43.	1.06		
2 COMBINED AT	C7	10520.	17.33	9425.	4271.	2093.	50.32		
HYDROGRAPH AT	S7	1027.	16.00	808.	315.	152.	4.05		
ROUTED TO	R5	1022.	16.17	805.	315.	152.	4.05	14.97	16.17
HYDROGRAPH AT	S8	2700.	17.17	2300.	995.	484.	12.10		
ROUTED TO	R4	2683.	17.50	2292.	995.	484.	12.10	9.58	17.50
HYDROGRAPH AT	S6	364.	12.83	133.	42.	20.	.48		
3 COMBINED AT	C6	3656.	17.00	3104.	1350.	657.	16.63		
2 COMBINED AT	C5	14173.	17.17	12527.	5621.	2750.	66.95		
ROUTED TO	R3	14166.	17.33	12524.	5621.	2750.	66.95	69.04	17.33
HYDROGRAPH AT	S5	1266.	17.00	1070.	458.	224.	5.54		
2 COMBINED AT		15422.	17.17	13588.	6079.	2974.	72.49		
ROUTED TO	R2	15361.	17.67	13540.	6079.	2974.	72.49	69.13	17.67
HYDROGRAPH AT	S3	299.	14.50	192.	65.	32.	.84		

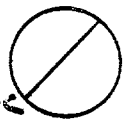
2 COMBINED AT	C4	15470.	17.67	13654.	6144.	3005.	73.33		
HYDROGRAPH AT	S4	4390.	14.33	2750.	940.	455.	10.96		
HYDROGRAPH AT	S4.1	443.	15.50	331.	124.	61.	1.46		
2 COMBINED AT	C3	4766.	14.33	3070.	1064.	516.	12.42		
ROUTED TO	R1	4672.	14.83	3056.	1064.	516.	12.42	59.50	14.83
HYDROGRAPH AT	S2	533.	14.00	316.	105.	51.	1.27		
2 COMBINED AT	C2	5143.	14.67	3364.	1169.	567.	13.69		
2 COMBINED AT	C1	17872.	17.00	16085.	7297.	3572.	87.02		

*** NORMAL END OF HEC-1 ***

Anderson, Passarelli & Associates

JOB NAME SWAMS
MADE BY SMW DATE 3/27/90
CHECKED BY _____ DATE _____

APA JOB NO. 84145
REFERENCE HEC-1 SCS vs PC



HEC-1 INPUT/OUTPUT
FOR COMPARISON OF
SCS-UNIT HYDROGRAPH
METHOD WITH PIMA
COUNTY METHOD

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

    1     ID   SOUTHWEST BASIN MANAGEMENT STUDY
    2     ID   HEC-1 ANALYSIS FOR BLACK WASH
    3     ID   SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
    4     ID   FOR COMPARISON WITH PC METHOD RESULTS
    5     ID   RAINFALL DURATION AND LAG BASED ON PC METHOD Tc
    6     ID   SCS TYPE II RAINFALL DISTRIBUTION
    7     IT     10                   300
    8     IO      5

    9     KK  S18    RUNOFF FROM SUBBASIN 18
   10     BA    8.32
   11     IN      25
   12     PB    3.78
   13     PC    .000    .022    .048    .080    .120    .181    .663    .820    .880    .921
   14     PC    .952    .978   1.000
   15     LS              85       6
   16     UD    2.78

   17     KK  S16    RUNOFF FROM SUBBASIN 16
   18     BA    6.14
   19     IN      10
   20     PB    3.62
   21     PC    .000    .011    .022    .035    .048    .063    .080    .098    .120    .147
   22     PC    .181    .235    .663    .772    .820    .854    .880    .902    .921    .937
   23     PC    .952    .965    .978    .989   1.000
   24     LS              86       6
   25     UD    2.26

   26     KK  S12    RUNOFF FROM SUBBASIN 12
   27     BA    8.32
   28     IN      15
   29     PB    3.93
   30     PC    .000    .011    .022    .035    .048    .063    .080    .098    .120    .147
   31     PC    .181    .235    .663    .772    .820    .854    .880    .902    .921    .937
   32     PC    .952    .965    .978    .989   1.000
   33     LS              85       5
   34     UD    3.26

   35     KK  S10    RUNOFF FROM SUBBASIN 10
   36     BA   12.78
   37     IN      25
   38     PB    3.67
   39     PC    .000    .022    .048    .080    .120    .181    .663    .820    .880    .921
   40     PC    .952    .978   1.000
   41     LS              88       5
   42     UD    3.07

   43     KK  S13     RUNOFF FROM SUBBASIN S13
   44     BA    9.29
   45     IN      10
   46     PB    3.62
   47     PC    .000    .011    .022    .035    .048    .063    .080    .098    .120    .147
   48     PC    .181    .235    .663    .772    .820    .854    .880    .902    .921    .937
   49     PC    .952    .965    .978    .989   1.000
   50     LS              88      11
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  51      UD   2.06

  52      KK  S9     RUNOFF FROM SUBBASIN 9
  53      BA   4.41
  54      IN     15
  55      PB   3.47
  56      PC   .000   .022   .048   .080   .120   .181   .663   .820   .880   .921
  57      PC   .952   .978  1.000
  58      LS            87     5
  59      UD   1.58

  60      KK  S11    RUNOFF FROM SUBBASIN 11
  61      BA   1.06
  62      IN      5
  63      PB   3.23
  64      PC   .000   .011   .022   .035   .048   .063   .080   .098   .120   .147
  65      PC   .181   .235   .663   .772   .820   .854   .880   .902   .921   .937
  66      PC   .952   .965   .978   .989  1.000
  67      LS            86     5
  68      UD   0.78

  69      KK  S7     RUNOFF FROM SUBBASIN 7
  70      BA   4.05
  71      IN     15
  72      PB   3.47
  73      PC   .000   .022   .048   .080   .120   .181   .663   .820   .880   .921
  74      PC   .952   .978  1.000
  75      LS            84     2
  76      UD   1.46

  77      KK  S8     RUNOFF FROM SUBBASIN 8
  78      BA  12.10
  79      IN     10
  80      PB   3.52
  81      PC   .000   .011   .022   .035   .048   .063   .080   .098   .120   .147
  82      PC   .181   .235   .663   .772   .820   .854   .880   .902   .921   .937
  83      PC   .952   .965   .978   .989  1.000
  84      LS            86     2
  85      UD   2.07

  86      KK  S6     RUNOFF FROM SUBBASIN 6
  87      BA    .48
  88      IN      5
  89      PB   2.87
  90      PC   .000   .022   .048   .080   .120   .181   .663   .820   .880   .921
  91      PC   .952   .978  1.000
  92      LS            88     2
  93      UD   0.35

  94      KK  S5     RUNOFF FROM SUBBASIN 5
  95      BA   5.54
  96      IN     15
  97      PB   3.47
  98      PC   .000   .022   .048   .080   .120   .181   .663   .820   .880   .921
  99      PC   .952   .978  1.000
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  100     LS            85     10
  101     UD   1.60

  102     KK  S3     RUNOFF FROM SUBBASIN 3
  103     BA    .84
  104     IN     5
  105     PB   3.23
  106     PC   .000   .011   .022   .035   .048   .063   .080   .098   .120   .147
  107     PC   .181   .235   .663   .772   .820   .854   .880   .902   .921   .937
  108     PC   .952   .965   .978   .989  1.000
  109     LS            84     2
  110     UD   0.80

  111     KK  S4     RUNOFF FROM SUBBASIN 4
  112     BA  10.96
  113     IN     5
  114     PB   3.10
  115     PC   .000   .011   .022   .035   .048   .063   .080   .098   .120   .147
  116     PC   .181   .235   .663   .772   .820   .854   .880   .902   .921   .937
  117     PC   .952   .965   .978   .989  1.000
  118     LS            86     10
  119     UD   0.80

  120     KK  S4.1   RUNOFF FROM SUBBASIN 4.1
  121     BA   1.46
  122     IN     5
  123     PB   3.23
  124     PC   .000   .011   .022   .035   .048   .063   .080   .098   .120   .147
  125     PC   .181   .235   .663   .772   .820   .854   .880   .902   .921   .937
  126     PC   .952   .965   .978   .989  1.000
  127     LS            85     15
  128     UD   1.09

  129     KK  S2     RUNOFF FROM SUBBASIN 2
  130     BA   1.27
  131     IN     5
  132     PB   2.87
  133     PC   .000   .022   .048   .080   .120   .181   .663   .820   .880   .921
  134     PC   .952   .978  1.000
  135     LS            86     2
  136     UD   0.60
  137     ZZ
```

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 01 APR 88           *
*                                       *
*  RUN DATE  03/29/1990  TIME  07:31:50 *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```


SOUTHWEST BASIN MANAGEMENT STUDY
HEC-1 ANALYSIS FOR BLACK WASH
SUBWATERSHED MODELING BY SCS UNIT HYDROGRAPH METHOD
FOR COMPARISON WITH PC METHOD RESULTS
RAINFALL DURATION AND LAG BASED ON PC METHOD Tc
SCS TYPE II RAINFALL DISTRIBUTION

8 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN	10	MINUTES IN COMPUTATION INTERVAL
IDATE	1 0	STARTING DATE
ITIME	0000	STARTING TIME
NQ	300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	3 0	ENDING DATE
NDTIME	0150	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL .17 HOURS
TOTAL TIME BASE 49.83 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S18	2944.	5.50	1880.	526.	254.	8.32		
HYDROGRAPH AT	S16	2615.	4.50	1428.	378.	182.	6.14		
HYDROGRAPH AT	S12	2662.	6.50	1864.	553.	266.	8.32		
HYDROGRAPH AT	S10	4421.	5.83	2964.	854.	412.	12.78		
HYDROGRAPH AT	S13	4678.	4.17	2405.	628.	303.	9.29		
HYDROGRAPH AT	S9	2524.	3.17	1040.	263.	127.	4.41		
HYDROGRAPH AT	S11	959.	1.83	220.	55.	26.	1.06		
HYDROGRAPH AT	S7	2138.	3.17	839.	211.	102.	4.05		
HYDROGRAPH AT	S8	5176.	4.33	2676.	698.	336.	12.10		
HYDROGRAPH AT	S6	741.	.83	89.	22.	11.	.48		
HYDROGRAPH AT	S5	3001.	3.17	1255.	319.	153.	5.54		
HYDROGRAPH AT	S3	670.	1.83	157.	39.	19.	.84		
HYDROGRAPH AT	S4	9484.	1.83	2220.	555.	267.	10.96		
HYDROGRAPH AT	S4.1	1070.	2.17	314.	79.	38.	1.46		
HYDROGRAPH AT	S2	1277.	1.17	216.	54.	26.	1.27		

*** NORMAL END OF HEC-1 ***

APPENDIX C CULVERT ANALYSIS CALCULATIONS

For culverts C1 through C46 capacitiy analyses were performed at available headwater using the Federal Highway Administration Hydraulics Microcomputer Program HY8, Culvert Analysis, 1987. These capacities were then compared to the full range of predicted peak discharges as determined by the Pima County Method. Culvert details were taken from appropriate roadway improvement plans and field measurement performed by APA. Table 6 summarizes the results of the culvert capacity analysis. Descriptions for culverts C47 through C60 are included as part of this summary. All culvert locations are shown on Figure 13.

DRAINAGE STRUCTURES INVENTORY

CULVERTS (see figure 12)	DESCRIPTION	
C1	8 - 10' X 4'	RCB
C2	2 - 8' X 3'	RCB
C3	2 - 8' X 3'	RCB
C4	10 - 10' X 4'	RCB
C5	1 - 6' X 3'	RCB
C6	4 - 10' X 5'	RCB
C7	2 - 36"	CMP
C8	7 - 10' X 5'	RCB
C9	2 - 24"	CMP
C10	5 - 10' X 6'	RCB
C11	3 - 10' X 5'	RCB
C12	1 - 10' X 6'	RCB
C13	2 - 10' X 6'	RCB
C14	2 - 6' X 7'	RBC
C15	4 - 24' X 6'	RCB
C16	2 - 24' X 6'	RCB
C17	1 - 10' X 4'	RCB
C18	1 - 10' X 4'	RCB
C19	3 - 10' X 4'	RCB
C20	4 - 10' X 4'	RCB
C21	4 - 10' X 4'	RCB
C22	3 - 10' X 3'	RCB
C22A	2 - 42"	CMP
C22B	1 - 8' X 4'	RCB
C23	2 - 8' X 5'	RCB
C24	10 - 60"	CMP
C25	10 - 10' X 5'	RCB
C26	4 - 54"	CMP
C27	3 - 10' X 5'	RCB
C28	1 - 49" X 32"	RCP
C29	1 - 30" X 19"	RCP
C30	1 - 45" X 29"	RCP
C31	1 - 49" X 32"	RCP
C32	1 - 49" X 32"	RCP
C33	3 - 12' X 6'	RCB
C34	1 - 45" X 29"	RCP
C35	2 - 45" X 29"	RCP
C36	1 - 45" X 29"	RCP
C37	1 - 45" X 29"	RCP
C38	1 - 45" X 29"	RCP

C39	1 - 38" X 24"	RCP
C40	4 - 10' X 4'	RCB
C41	1 - 10' X 3'	RCB
C42	1 - 45" X 29"	RCP
C43	2 - 6' X 5'	RCB
C44	2 - 6' X 3'	RCB
C44A	1 - 38" X 24"	RCP
C45	2 - 12' X 6'	RCB
C45A	1 - 30"	CMP
C46	8 - 48"	CMP
C46A	1 - 42" X 350'	RCP(STORMDRAIN)
C47	1 - 10' X 4'	RCB
C48	3 - 36"	RCP
C49	2 - 42" ARCH	CMP
C50	5 - 8' X 3'	RCB
C51	1 - 42"	CMP
C52	2 - 42"	RCP
C53	3 - 42"	RCP
C54	1 - 42"	RCP
C55	2 - 24"	CMP
C56	5 - 10' X 7'	RCB
C57	1 - 10' X 6'	RCB
C58	2 - 24"	CMP
C59	2 - 45" X 32"	RCP
C60	8 - 10 X 4'	RCB

Culvert Capacity Summary Table

#	Type	Road	Capacity (cfs)	Non-Exceedence Recurrence Interval (yr)	Q100yr (cfs)
C1	8-10'X4' RCB	AJO	2311	10	5353
C2	2-8'X3' RCB	AJO	305	25	501
C3	2-8'X3' RCB	AJO	265	25	389
C4	10-10'X4' RCB	AJO	2744	>100	1372
C5	1-6'X3' RCB	AJO	92	10	217
C6	4-10'X5' RCB	AJO	1777	50	1797
C8}*	7-10'X5' RCB	AJO	2590}	>100	2171
C9}	2-24" CMP	AJO	14}		
C10	5-10'X6' RCB	AJO			
C11	3-10'X5' RCB	AJO	1035	10	2207
C12}*	1-10'X6' RCB	AJO	517}	10	3908
C13}	2-10'X6' RCB	AJO	870}		
C14	2-6'X7' RCB	AJO	630	>100	255
C15	4-24'X6' RCB	AJO	4971	50	4752[1]
C16	2-24'X6' RCB	AJO	2486		4459
C17	1-10'X4' RCB	AJO	306	>100	116
C18	1-10'X4' RCB	AJO	224	>100	124
C19	3-10'X4' RCB	AJO	630	>100	286
C20	4-10'X4' RCB	AJO	1019	10	1739
C21	4-10'X3' RCB	AJO	855	>100	806
C22	3-10'X3' RCB	AJO	643	>100	604
C22A	2-42" CMP	AJO	127	10	216
C22B	1-8'X4' RCB	AJO	267	5	571
C23	2-8'X5' RCB	OLD AJO	717	5	3908
C24	10-60" CMP	VALENCIA	1644	>100	885
C25	10-10'X5' RCB	CAMINO VERDE	4279	>100	3884
C26	4-54" CMP	MARK	430	2	1637
C27	3-10'X5' RCB	SUNSET	1231	10	2496
C28}*	1-49"X32" RCP	KINNEY	60}	2	343
C29}	1-30"X19" RCP	KINNEY	18}		
C30	1-45"X29" RCP	KINNEY	48	5	175
C31	1-49"X32" RCP	KINNEY	60	<2	597
C32	1-49"X32" RCP	KINNEY	60	25	100
C33	3-12'X6' RCB	KINNEY	1660	25	2255
C34}*	1-45"X29" RCP	KINNEY	48}	2	552
C35}	2-45"X29" RCP	KINNEY	110}		

C36}*	1-45"X29" RCP	KINNEY	48}	<2	839
C37}	1-45"X29" RCP	KINNEY	48}		
C38}	1-45"X29" RCP	KINNEY	48}		
C39	1-38"X24" RCP	KINNEY	27	<2	299
C40	4-10'X4' RCB	KINNEY	1370	25	1904
C41	1-10'X3' RCB	KINNEY	215	10	404
C42	1-45"X29" RCP	KINNEY	48	50	56
C43	2-6'X5' RCB	KINNEY	490	>100	99
C44}*	2-6'X3' RCB	KINNEY	260	>100	135
C44A}	1-38"X 24" RCP	KINNEY	35		
C45}*	2-12'X6' RCB	KINNEY	1250	>100	640
C45A}	1-30" CMP	KINNEY	33		
C46	8-48" CMP	LONE STAR DR.	953	5	2293

1 From HEC-1 Routing * Capacities summed

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C1

WATERSHED AREA (A): 6185.00 acres

LENGTH OF WATERCOURSE (Lc): 66000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 33000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
66000.	2330.0

MEAN SLOPE (Sc): .0353 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

60. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
5. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
35. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.240	.390	.469	.550	.608	.654
Tc (FUNCTION OF i) :	256.11	210.86	195.80	183.73	176.54	171.50
SOLUTION OF Tc (MINUTES):	465	293	240	197	172	154
RAINFL INT. @ Tc (IN/HR):	.225	.441	.603	.841	1.073	1.313
RUNOFF RATE @ Tc (IN/HR):	.054	.172	.283	.463	.652	.859
PEAK DISCHARGE (CFS) :	337.	1071.	1765.	2885.	4067.	5353.

CULVERT ANALYSIS 1.1 DATE: 5/24/88
CULVERT FILE : c2 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	30.58	0.00	1.55
2	308.20	31.33	4.02	0.47
3	616.40	31.71	5.26	0.71
4	924.60	32.02	6.14	0.90
5	1232.80	32.29	6.85	1.07
6	1541.00	32.54	7.44	1.22
7	1849.20	32.76	7.97	1.36
8	2157.40	32.97	8.44	1.49
9	2465.60	33.16	8.86	1.61
10	2773.80	33.35	9.25	1.73
11	3082.00	33.53	9.61	1.84

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/24/88
CULVERT FILE NAME: c1 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	31.15	30.58	86	8 -RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

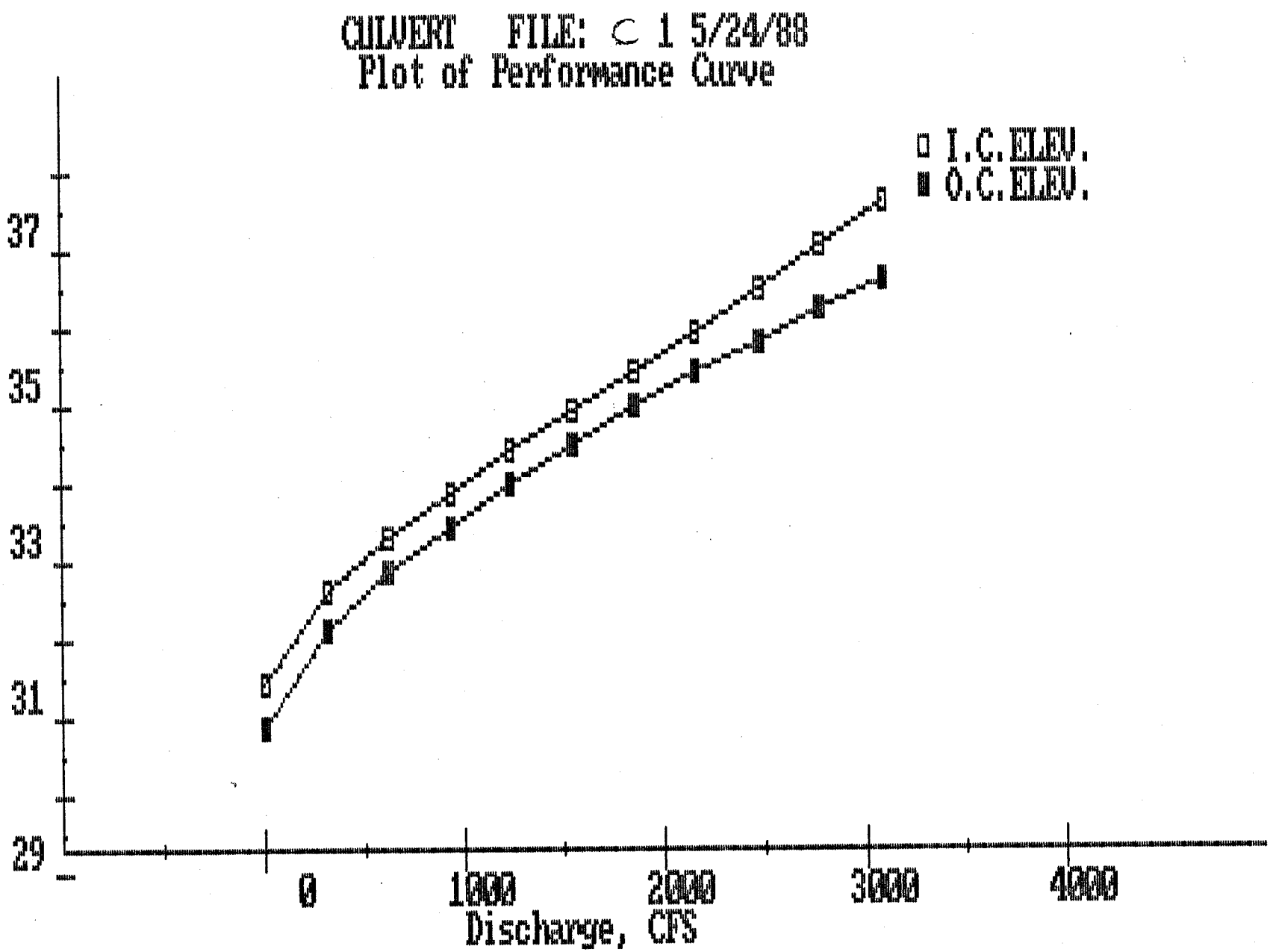
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 8 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	31.15	30.58	0.00	-0.57	0.00	0.00
308.20	32.30	31.33	1.15	0.67	0.75	5.14
616.40	32.97	31.71	1.82	1.39	1.13	6.79
924.60	33.56	32.02	2.41	2.00	1.44	8.01
1232.80	34.12	32.29	2.97	2.55	1.71	9.00
1541.00	34.64	32.54	3.49	3.05	1.95	9.85
1849.20	35.14	32.76	3.99	3.51	2.18	10.61
2157.40	35.66	32.97	4.51	3.95	2.39	11.30
2465.60	36.18	33.16	5.03	4.37	2.58	11.94
2773.80	36.74	33.35	5.59	4.78	2.77	12.53
3082.00	37.34	33.53	6.19	5.17	2.95	12.99

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 35.92
∴ Culvert Capacity ≡ 2311 cfs


CULVERT FILE: C 1 5/24/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
37
35
33
31
29
0
1000
2000
3000
4000
Discharge, CFS

345

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C2

WATERSHED AREA (A): 206.60 acres

LENGTH OF WATERCOURSE (Lc): 10000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10000.	129.0

MEAN SLOPE (Sc): .0129 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

11. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
89. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.261	.418	.498	.579	.636	.680
Tc (FUNCTION OF i) :	107.38	89.02	82.96	78.12	75.25	73.24
SOLUTION OF Tc (MINUTES):	126	81	66	55	49	44
RAINFL INT. @ Tc (IN/HR):	.675	1.276	1.765	2.394	2.954	3.535
RUNOFF RATE @ Tc (IN/HR):	.176	.533	.879	1.386	1.878	2.405
PEAK DISCHARGE (CFS) :	37.	111.	183.	289.	391.	501.

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C2 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	28.36	27.79	86	2 -RCB	96	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	28.36	27.79	0.00	-0.57	0.00	0.00
40.00	29.22	28.36	0.86	0.36	0.57	4.38
80.00	29.73	28.65	1.37	0.90	0.86	5.83
120.00	30.17	28.88	1.81	1.36	1.09	6.91
160.00	30.58	29.07	2.22	1.77	1.28	7.81
200.00	30.97	29.25	2.61	2.14	1.46	8.59
240.00	31.35	29.40	2.99	2.49	1.61	9.29
280.00	31.74	29.55	3.38	2.82	1.76	9.94
320.00	32.13	29.69	3.77	3.14	1.90	10.54
360.00	32.55	29.82	4.19	3.44	2.03	11.02
400.00	33.00	29.94	4.64	3.73	2.15	11.38

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 31.99
∴ Capacity = 305 cfs

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C2 CULVERT NO. 1

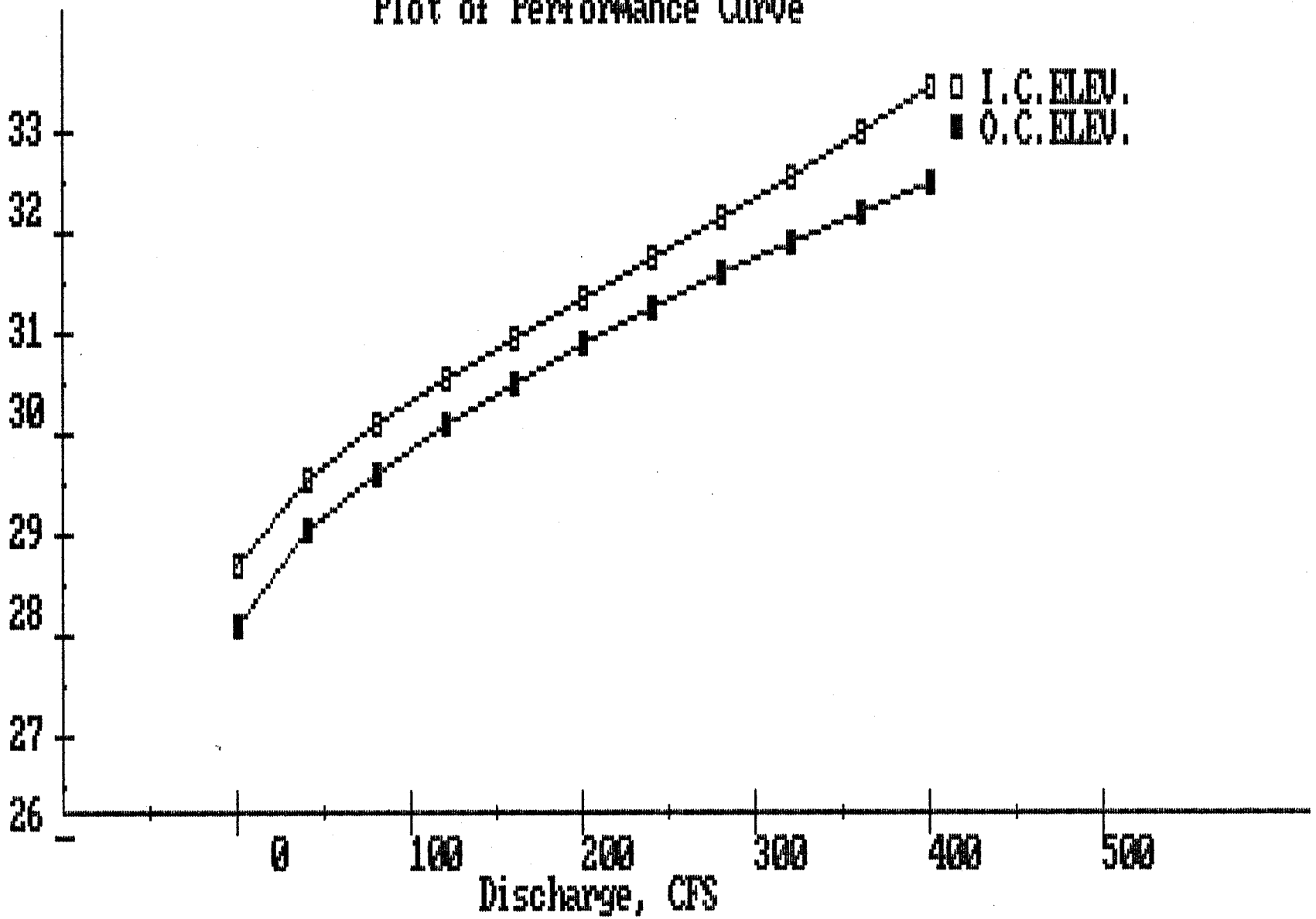
ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 8 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	27.79	0.00	0.59
2	40.00	28.36	3.22	0.36
3	80.00	28.65	4.13	0.54
4	120.00	28.88	4.75	0.68
5	160.00	29.07	5.24	0.80
6	200.00	29.25	5.64	0.91
7	240.00	29.40	5.98	1.01
8	280.00	29.55	6.29	1.10
9	320.00	29.69	6.56	1.18
10	360.00	29.82	6.81	1.27
11	400.00	29.94	7.04	1.34

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU


CULVERT FILE:C2 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
33
32
31
30
29
28
27
26
0
100
200
300
400
500
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C3

WATERSHED AREA (A): 160.70 acres

LENGTH OF WATERCOURSE (Lc): 10300. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5150. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10300.	132.0

MEAN SLOPE (Sc): .0128 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

6. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
94. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.267	.424	.504	.585	.641	.686
Tc (FUNCTION OF i) :	108.66	90.32	84.25	79.41	76.53	74.52
SOLUTION OF Tc (MINUTES):	128	83	68	56	50	45
RAINFL INT. @ Tc (IN/HR):	.666	1.251	1.720	2.371	2.902	3.506
RUNOFF RATE @ Tc (IN/HR):	.178	.530	.868	1.387	1.862	2.404
PEAK DISCHARGE (CFS) :	29.	86.	141.	225.	302.	389.

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C3 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 8 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	25.50	0.00	1.34
2	40.00	26.07	3.22	0.36
3	80.00	26.36	4.13	0.54
4	120.00	26.59	4.75	0.68
5	160.00	26.78	5.24	0.80
6	200.00	26.96	5.64	0.91
7	240.00	27.11	5.98	1.01
8	280.00	27.26	6.29	1.10
9	320.00	27.40	6.56	1.18
10	360.00	27.53	6.81	1.27
11	400.00	27.65	7.04	1.34

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C3 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	25.88	25.50	86	2 -RCB	96	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

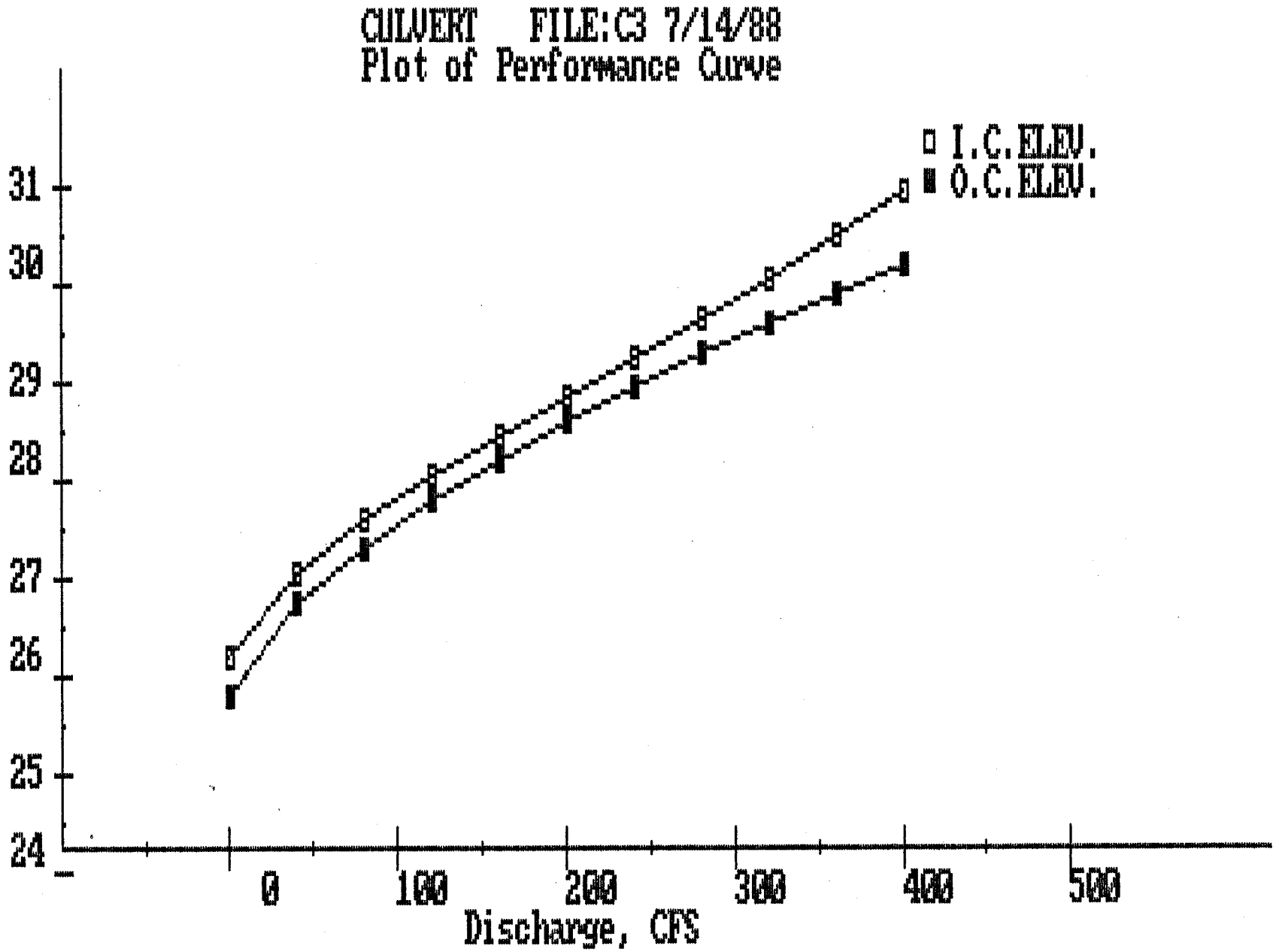
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	25.88	25.50	0.00	-0.38	0.00	0.00
40.00	26.74	26.07	0.86	0.55	0.57	4.38
80.00	27.25	26.36	1.37	1.09	0.86	5.83
120.00	27.69	26.59	1.81	1.55	1.09	6.91
160.00	28.11	26.78	2.23	1.96	1.28	7.81
200.00	28.50	26.96	2.62	2.33	1.46	8.59
240.00	28.88	27.11	3.00	2.68	1.64	8.82
280.00	29.26	27.26	3.38	3.01	1.83	9.27
320.00	29.66	27.40	3.78	3.33	2.00	9.69
360.00	30.07	27.53	4.19	3.63	2.17	10.06
400.00	30.52	27.65	4.64	3.92	2.34	10.41

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 29.12
∴ Capacity ≈ 265 cfs


CULVERT FILE:C3 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
31
30
29
28
27
26
25
24
0
100
200
300
400
500
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C4

WATERSHED AREA (A): 1647.00 acres

LENGTH OF WATERCOURSE (Lc): 48000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 24000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
48000.	1152.0

MEAN SLOPE (Sc): .0240 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

73. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
22. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
5. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.197	.345	.426	.510	.571	.619
Tc (FUNCTION OF i) :	267.38	213.49	196.23	182.60	174.56	168.95
SOLUTION OF Tc (MINUTES):	498	298	241	195	169	151
RAINFL INT. @ Tc (IN/HR):	.212	.435	.601	.848	1.088	1.334
RUNOFF RATE @ Tc (IN/HR):	.042	.150	.256	.433	.621	.826
PEAK DISCHARGE (CFS) :	69.	249.	425.	718.	1031.	1372.

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE : C4 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	21.78	0.00	0.59
2	300.00	22.44	3.72	0.41
3	600.00	22.78	4.87	0.62
4	900.00	23.06	5.70	0.80
5	1200.00	23.29	6.36	0.94
6	1500.00	23.51	6.93	1.08
7	1800.00	23.71	7.42	1.20
8	2100.00	23.89	7.87	1.32
9	2400.00	24.07	8.27	1.43
10	2700.00	24.23	8.64	1.53
11	3000.00	24.39	8.99	1.63

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE NAME: C4 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	22.78	21.78	86	10-RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

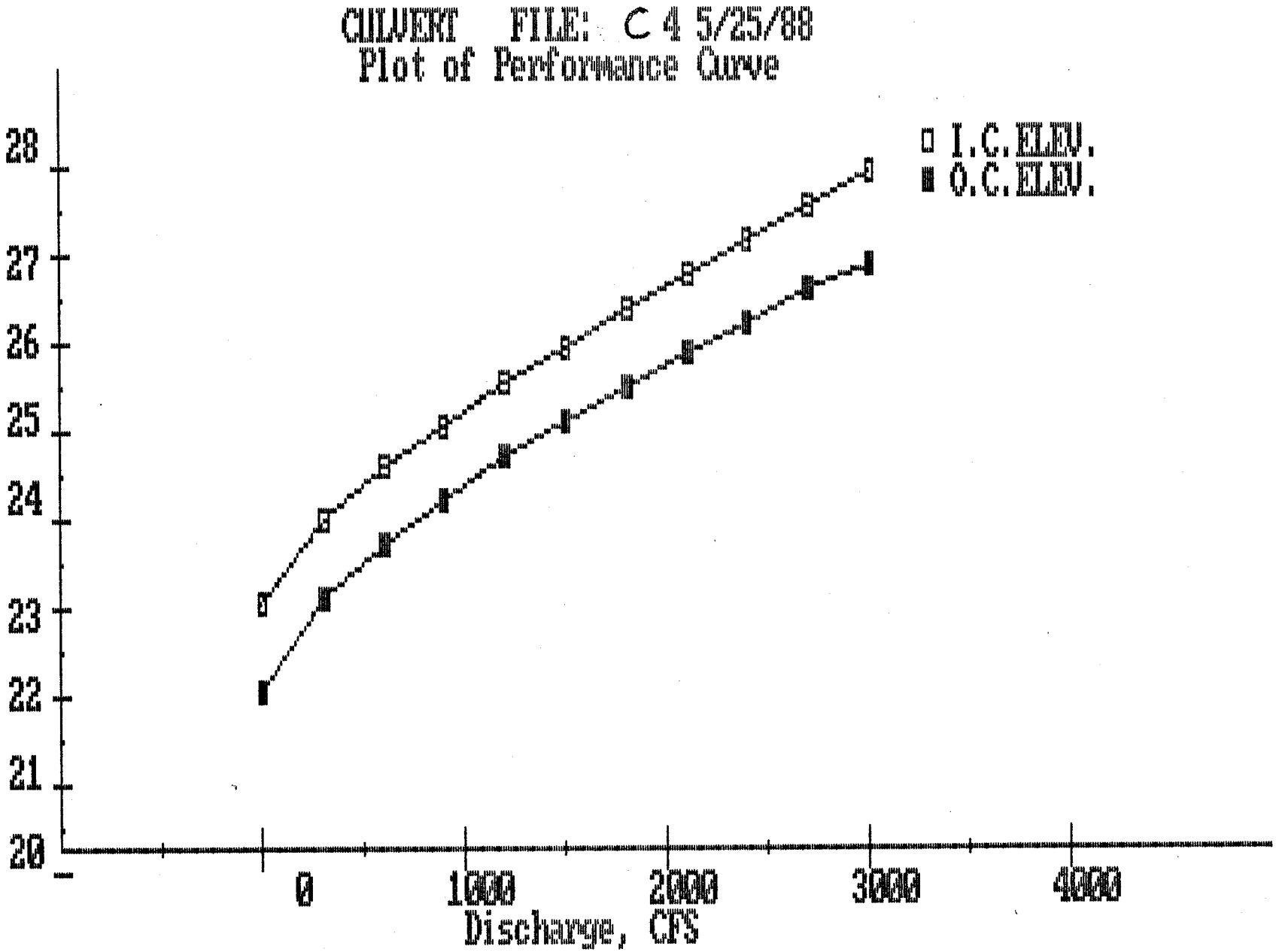
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 10 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	22.78	21.78	0.00	-1.00	0.00	0.00
300.00	23.75	22.44	0.97	0.05	0.66	4.53
600.00	24.31	22.78	1.53	0.66	1.00	5.99
900.00	24.79	23.06	2.01	1.18	1.28	7.05
1200.00	25.25	23.29	2.47	1.64	1.51	7.93
1500.00	25.68	23.51	2.90	2.06	1.73	8.67
1800.00	26.09	23.71	3.31	2.46	1.93	9.34
2100.00	26.48	23.89	3.70	2.83	2.11	9.94
2400.00	26.88	24.07	4.10	3.19	2.29	10.49
2700.00	27.28	24.23	4.50	3.53	2.45	11.01
3000.00	27.69	24.39	4.91	3.86	2.61	11.49

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 27.34
∴ Capacity ≈ 2744 cfs


CULVERT FILE: C 4 5/25/88
Plot of Performance Curve
I.C. ELEV.
O.C. ELEV.
28
27
26
25
24
23
22
21
20
0
1000
2000
3000
4000
Discharge, CFS

257

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C5

WATERSHED AREA (A): 73.00 acres

LENGTH OF WATERCOURSE (Lc): 6500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3250. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
6500.	75.0

MEAN SLOPE (Sc): .0115 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.274	.431	.512	.592	.648	.692
Tc (FUNCTION OF i) :	85.12	70.96	66.27	62.52	60.30	58.75
SOLUTION OF Tc (MINUTES):	89	58	48	41	36	33
RAINFL INT. @ Tc (IN/HR):	.896	1.685	2.244	2.913	3.621	4.253
RUNOFF RATE @ Tc (IN/HR):	.245	.727	1.148	1.725	2.347	2.942
PEAK DISCHARGE (CFS) :	18.	54.	85.	127.	173.	217.

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE : CS CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 6 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	21.29	0.00	0.00
2	20.00	21.70	2.33	0.20
3	40.00	21.90	3.00	0.30
4	60.00	22.06	3.47	0.39
5	80.00	22.21	3.84	0.46
6	100.00	22.33	4.15	0.52
7	120.00	22.45	4.41	0.58
8	140.00	22.56	4.65	0.63
9	160.00	22.66	4.86	0.68
10	180.00	22.75	5.05	0.73
11	200.00	22.84	5.23	0.77

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE NAME: C5 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	22.00	21.29	86	1 -RCB	72	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

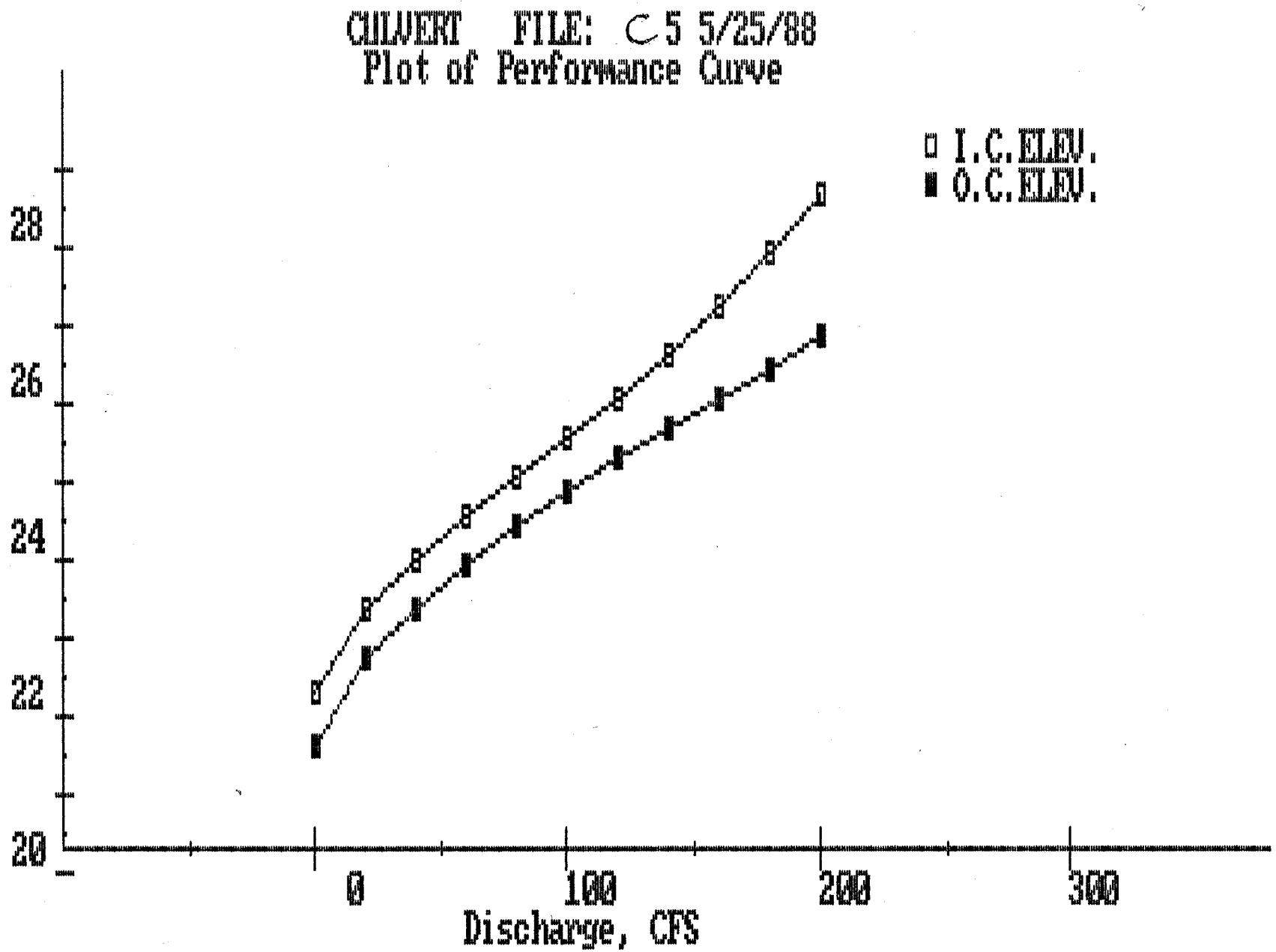
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	22.00	21.29	0.00	-0.71	0.00	0.00
20.00	23.04	21.69	1.04	0.41	0.50	6.66
40.00	23.66	21.90	1.66	1.07	0.79	8.39
60.00	24.22	22.06	2.22	1.62	1.04	9.02
80.00	24.74	22.21	2.74	2.11	1.27	9.81
100.00	25.24	22.33	3.24	2.57	1.48	10.45
120.00	25.77	22.45	3.77	2.99	1.68	11.02
140.00	26.33	22.56	4.33	3.39	1.87	11.44
160.00	26.95	22.66	4.95	3.77	2.06	11.86
180.00	27.63	22.75	5.63	4.15	2.24	12.22
200.00	28.38	22.84	6.38	4.59	2.42	12.58

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 25.92
∴ Capacity = 92 cfs


CULVERT FILE: C5 5/25/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
28
26
24
22
20
0
100
200
300
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C6

WATERSHED AREA (A): 2234.00 acres

LENGTH OF WATERCOURSE (Lc): 53000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 27500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
53000.	1356.0

MEAN SLOPE (Sc): .0256 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

67. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
26. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.205	.354	.435	.519	.579	.627
Tc (FUNCTION OF i) :	274.90	220.92	203.50	189.70	181.55	175.86
SOLUTION OF Tc (MINUTES):	519	314	254	207	179	160
RAINFL INT. @ Tc (IN/HR):	.204	.417	.576	.806	1.039	1.273
RUNOFF RATE @ Tc (IN/HR):	.042	.148	.250	.418	.602	.798
PEAK DISCHARGE (CFS) :	94.	333.	564.	941.	1355.	1797.

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE : C6 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	17.95	0.00	0.77
2	200.00	18.82	4.36	0.54
3	400.00	19.26	5.64	0.82
4	600.00	19.62	6.54	1.04
5	800.00	19.93	7.24	1.23
6	1000.00	20.20	7.83	1.40
7	1200.00	20.45	8.34	1.56
8	1400.00	20.69	8.79	1.71
9	1600.00	20.91	9.20	1.84
10	1800.00	21.11	9.57	1.97
11	2000.00	21.31	9.92	2.09

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE NAME: C6 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	18.51	17.95	86	4 -RCB	120	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

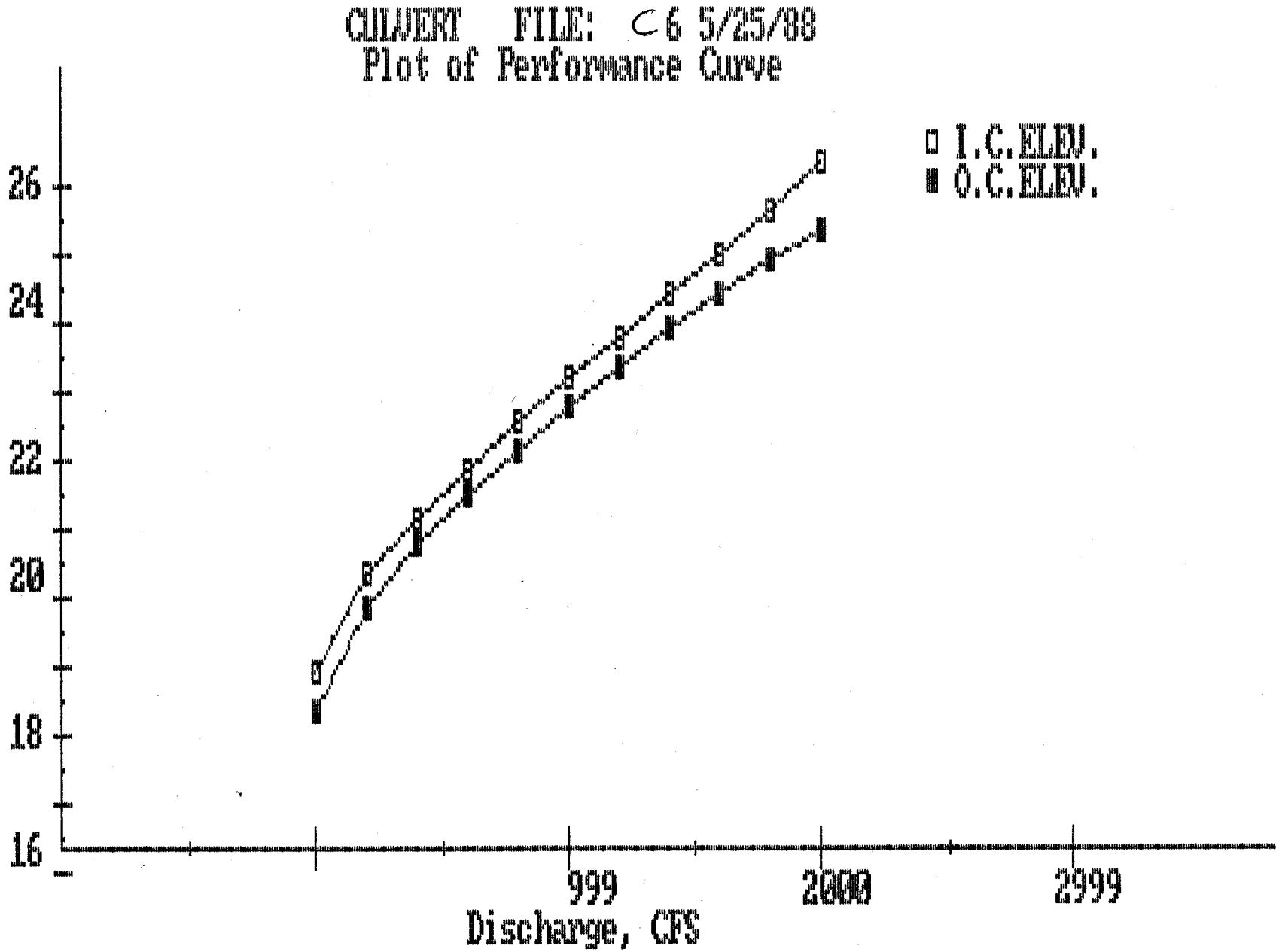
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 4 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	18.51	17.95	0.00	-0.56	0.00	0.00
200.00	19.88	18.82	1.37	0.91	0.87	5.73
400.00	20.68	19.26	2.17	1.77	1.31	7.61
600.00	21.37	19.62	2.86	2.50	1.67	8.99
800.00	22.03	19.92	3.52	3.15	1.97	10.13
1000.00	22.64	20.20	4.13	3.74	2.25	11.11
1200.00	23.23	20.45	4.72	4.30	2.50	11.99
1400.00	23.82	20.69	5.31	4.82	2.74	12.63
1600.00	24.42	20.91	5.91	5.32	2.95	13.08
1800.00	25.05	21.11	6.54	5.80	3.16	13.51
2000.00	25.71	21.31	7.20	6.26	3.36	13.92

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 24.94
∴ Capacity = 1777 cfs


CULVERT FILE: C6 5/25/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
26
24
22
20
18
16
999
2000
2999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C8-C9

WATERSHED AREA (A): 2589.00 acres

LENGTH OF WATERCOURSE (Lc): 44000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 22000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
44000.	995.0

MEAN SLOPE (Sc): .0226 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

82. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
18. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.182	.329	.410	.495	.557	.606
Tc (FUNCTION OF i) :	268.23	211.50	193.62	179.59	171.35	165.61
SOLUTION OF Tc (MINUTES):	500	294	236	190	164	146
RAINFL INT. @ Tc (IN/HR):	.211	.439	.612	.867	1.115	1.372
RUNOFF RATE @ Tc (IN/HR):	.038	.145	.251	.429	.621	.832
PEAK DISCHARGE (CFS) :	100.	377.	655.	1121.	1620.	2171.

CULVERT ANALYSIS 1.1 DATE: 5/26/88
CULVERT FILE : c8 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	19.31	0.00	0.00
2	260.00	19.99	3.76	0.42
3	520.00	20.33	4.93	0.64
4	780.00	20.61	5.76	0.81
5	1040.00	20.86	6.42	0.97
6	1300.00	21.08	6.99	1.10
7	1560.00	21.28	7.48	1.23
8	1820.00	21.47	7.92	1.35
9	2080.00	21.65	8.32	1.46
10	2340.00	21.81	8.69	1.56
11	2600.00	21.98	9.03	1.66

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/26/88
CULVERT FILE NAME: C8 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	19.71	19.31	100	7 -RCB	120	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

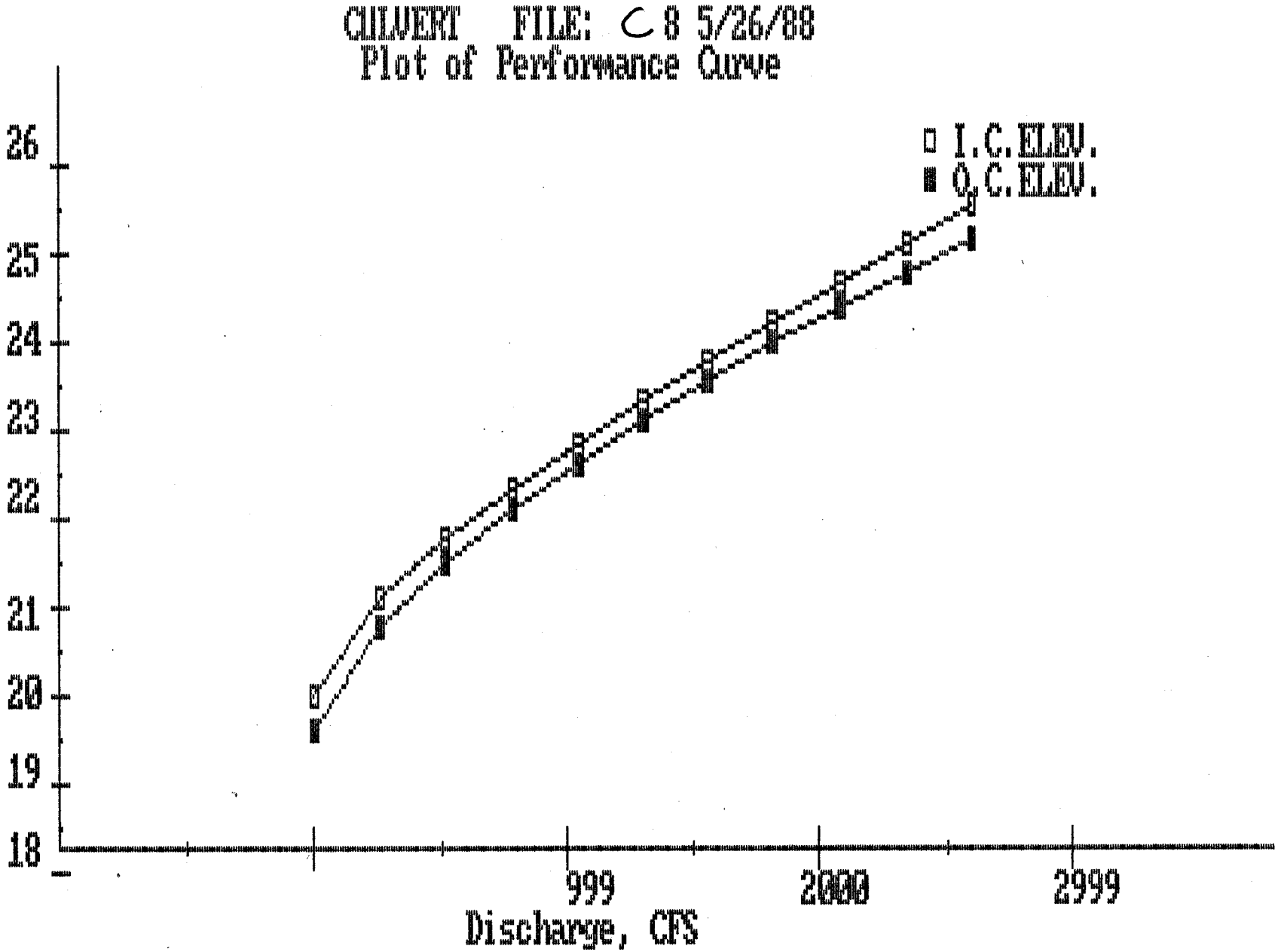
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 7 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	19.71	19.31	0.00	-0.40	0.00	0.00
260.00	20.83	19.99	1.12	0.81	0.68	5.49
520.00	21.49	20.33	1.78	1.51	1.04	6.85
780.00	22.05	20.61	2.34	2.11	1.35	8.26
1040.00	22.56	20.86	2.85	2.64	1.64	8.76
1300.00	23.05	21.08	3.34	3.13	1.90	9.46
1560.00	23.52	21.28	3.81	3.58	2.15	10.08
1820.00	23.96	21.47	4.25	4.01	2.40	10.56
2080.00	24.40	21.65	4.69	4.42	2.63	10.95
2340.00	24.84	21.81	5.13	4.82	2.85	11.33
2600.00	25.28	21.98	5.57	5.20	3.08	11.69

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 25.21
∴ Capacity = 2590


CULVERT FILE: C 8 5/26/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
26
25
24
23
22
21
20
19
18
999
2000
2999
Discharge, CFS

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C9 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 2 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) SQUARE EDGE WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	20.53	0.00	1.84
2	5.00	20.78	1.87	0.16
3	10.00	20.90	2.40	0.23
4	15.00	21.00	2.76	0.30
5	20.00	21.09	3.05	0.35
6	25.00	21.17	3.29	0.40
7	30.00	21.24	3.50	0.44
8	35.00	21.30	3.68	0.48
9	40.00	21.36	3.84	0.52
10	45.00	21.42	3.99	0.56
11	50.00	21.48	4.12	0.59

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C9 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	20.95	20.53	100	2 -CSP	24	24	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	20.95	20.53	0.00	-0.42	0.00	0.00
5.00	21.82	20.78	0.75	0.87	0.54	3.60
10.00	22.23	20.91	1.10	1.28	0.79	4.36
15.00	22.57	21.00	1.40	1.62	0.97	4.99
20.00	22.96	21.09	1.67	2.01	1.13	5.49
25.00	23.52	21.17	1.95	2.57	1.27	5.96
30.00	24.22	21.24	2.24	3.27	1.40	6.41
35.00	25.04	21.30	2.56	4.09	1.50	6.93
40.00	25.95	21.36	2.92	5.00	1.60	7.40
45.00	26.96	21.42	3.33	6.01	1.68	8.02
50.00	28.07	21.48	3.78	7.12	1.75	8.59

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 22.55
∴ Capacity ≅ 14 cfs

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C9 CULVERT NO. 1

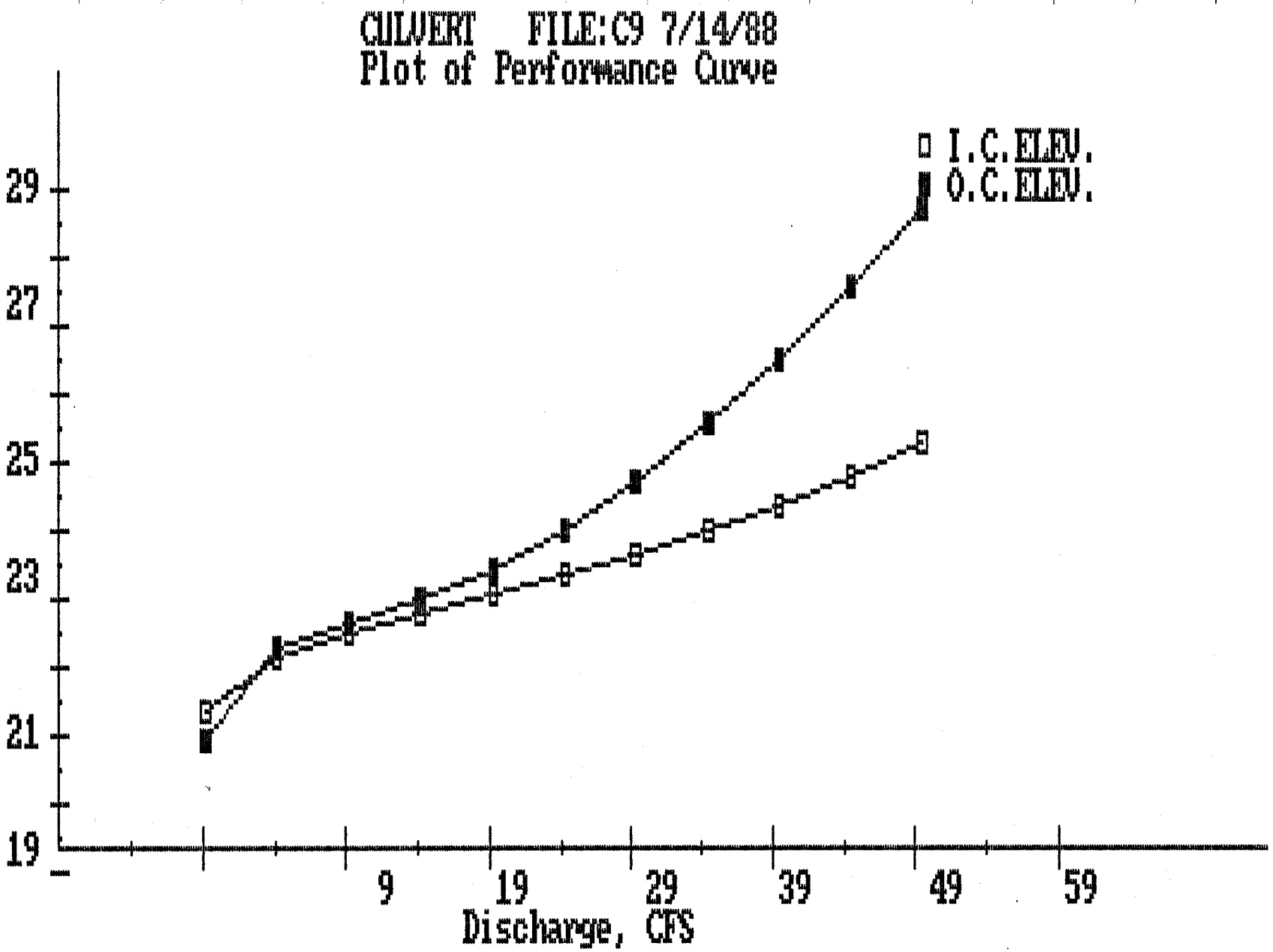
ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 2 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) SQUARE EDGE WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	20.53	0.00	1.84
2	5.00	20.78	1.87	0.16
3	10.00	20.90	2.40	0.23
4	15.00	21.00	2.76	0.30
5	20.00	21.09	3.05	0.35
6	25.00	21.17	3.29	0.40
7	30.00	21.24	3.50	0.44
8	35.00	21.30	3.68	0.48
9	40.00	21.36	3.84	0.52
10	45.00	21.42	3.99	0.56
11	50.00	21.48	4.12	0.59

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU


CULVERT FILE:C9 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
29
27
25
23
21
19
9
19
29
39
49
59
Discharge, CFS

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE : C10 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 6 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	19.99	0.00	0.00
2	250.00	20.88	4.46	0.56
3	500.00	21.34	5.78	0.84
4	750.00	21.71	6.71	1.07
5	1000.00	22.02	7.45	1.27
6	1250.00	22.31	8.06	1.45
7	1500.00	22.57	8.60	1.61
8	1750.00	22.81	9.07	1.76
9	2000.00	23.04	9.50	1.90
10	2250.00	23.25	9.89	2.03
11	2500.00	23.46	10.25	2.16

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE NAME: C10 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	18.50	18.09	51	5 -RCB	120	72	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

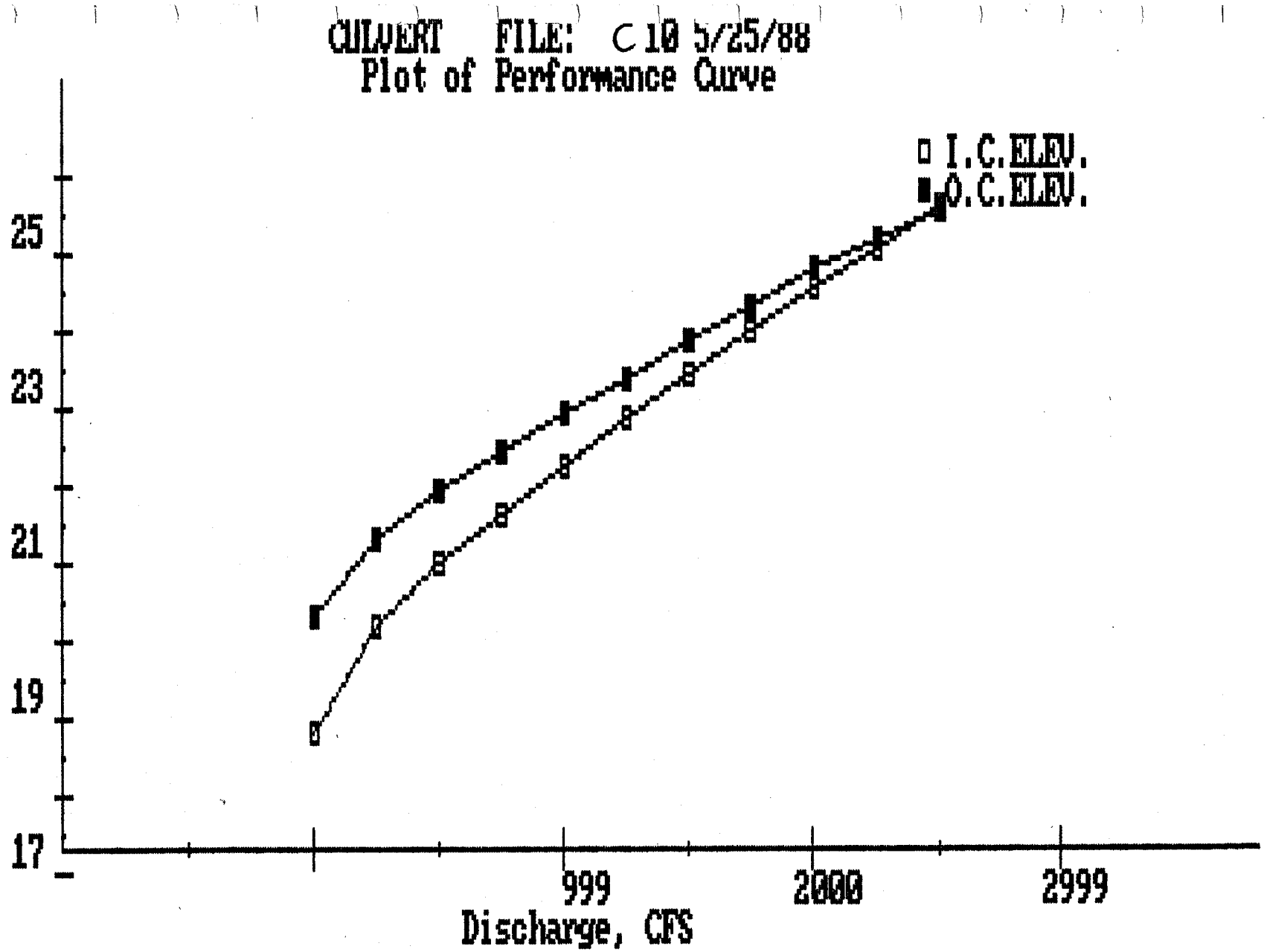
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 5 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	19.99	19.99	0.00	1.49	1.90	0.00
250.00	21.02	20.89	1.36	2.52	2.80	1.79
500.00	21.65	21.34	2.16	3.15	3.25	3.08
750.00	22.13	21.70	2.84	3.63	3.61	4.15
1000.00	22.61	22.02	3.47	4.11	3.93	5.09
1250.00	23.08	22.31	4.07	4.58	4.22	5.93
1500.00	23.55	22.57	4.63	5.05	4.48	6.70
1750.00	24.01	22.81	5.18	5.51	4.72	7.42
2000.00	24.48	23.03	5.72	5.98	4.94	8.09
2250.00	24.88	23.25	6.26	6.38	5.16	8.72
2500.00	25.30	23.45	6.80	6.76	5.36	9.32

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

H.W. = 24.6
∴ Capacity = 2075 cfs


CULVERT FILE: C10 5/25/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
25
23
21
19
17
999
2000
2999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C11

WATERSHED AREA (A): 2820.00 acres

LENGTH OF WATERCOURSE (Lc): 48000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 24000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
48000.	973.0

MEAN SLOPE (Sc): .0203 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93.
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

74. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
26. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.213	.357	.436	.518	.578	.625
Tc (FUNCTION OF i) :	277.20	225.29	207.98	194.11	185.86	180.07
SOLUTION OF Tc (MINUTES):	526	323	262	214	185	165
RAINFL INT. @ Tc (IN/HR):	.202	.408	.561	.783	1.010	1.242
RUNOFF RATE @ Tc (IN/HR):	.043	.146	.245	.406	.584	.776
PEAK DISCHARGE (CFS) :	122.	414.	695.	1154.	1659.	2207.

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE : C11 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	23.08	0.00	1.90
2	150.00	23.92	4.22	0.52
3	300.00	24.34	5.44	0.79
4	450.00	24.68	6.28	1.00
5	600.00	24.97	6.95	1.18
6	750.00	25.23	7.50	1.34
7	900.00	25.47	7.98	1.49
8	1050.00	25.69	8.41	1.63
9	1200.00	25.90	8.79	1.76
10	1350.00	26.09	9.13	1.88
11	1500.00	26.28	9.45	2.00

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/25/88
CULVERT FILE NAME: C11 SUMMARY TABLE

CU L V NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	23.50	23.08	52	3 -RCB	120	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

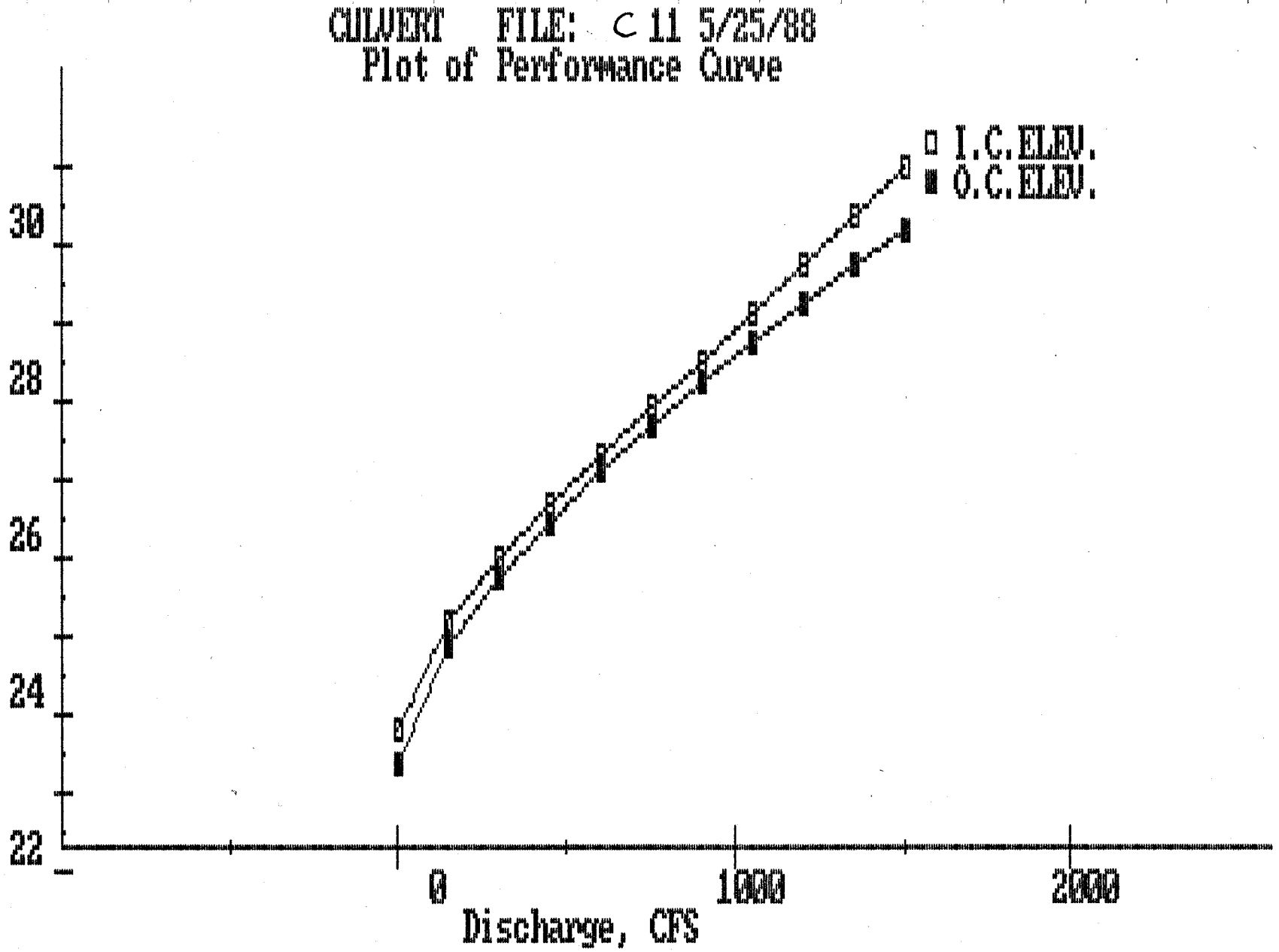
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 3 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	23.50	23.08	0.00	-0.42	0.00	0.00
150.00	24.86	23.92	1.36	1.05	0.84	5.97
300.00	25.66	24.34	2.16	1.91	1.26	7.94
450.00	26.36	24.68	2.86	2.64	1.60	9.38
600.00	27.01	24.97	3.51	3.28	1.89	10.58
750.00	27.62	25.23	4.12	3.88	2.15	11.52
900.00	28.22	25.47	4.72	4.43	2.39	12.11
1050.00	28.81	25.69	5.31	4.96	2.61	12.65
1200.00	29.41	25.90	5.91	5.46	2.82	13.11
1350.00	30.03	26.09	6.53	5.94	3.01	13.54
1500.00	30.69	26.28	7.19	6.40	3.20	13.95

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 29.2
Capacity = 1035 cfs


CULVERT FILE: C 11 5/25/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
30
28
26
24
22
0
1000
2000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C12-C13

WATERSHED AREA (A): 8085.00 acres

LENGTH OF WATERCOURSE (Lc): 88000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 44000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
11000.	730.0
77000.	1770.0

MEAN SLOPE (Sc): .0255 ft BASIN FACTOR (Nb): .0590

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.17	1.47	1.74	2.07	2.37	2.67
P 2	1.34	1.71	2.01	2.39	2.73	3.07
P 3	1.46	1.90	2.22	2.63	3.00	3.37
P 6	1.65	2.14	2.51	2.97	3.39	3.81
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

37. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
11. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
52. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.262	.389	.476	.563	.624	.671
Tc (FUNCTION OF i) :	394.33	336.81	310.79	290.59	278.87	270.81
SOLUTION OF Tc (MINUTES):	908	614	494	400	346	310
RAINFL INT. @ Tc (IN/HR):	.124	.223	.315	.450	.583	.714
RUNOFF RATE @ Tc (IN/HR):	.033	.087	.150	.253	.364	.479
PEAK DISCHARGE (CFS) :	266.	707.	1220.	2065.	2967.	3908.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C12 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 7 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	20.82	0.00	2.20
2	70.00	21.61	3.94	0.50
3	140.00	22.01	5.00	0.74
4	210.00	22.32	5.73	0.93
5	280.00	22.58	6.29	1.10
6	350.00	22.82	6.75	1.25
7	420.00	23.03	7.14	1.38
8	490.00	23.22	7.49	1.50
9	560.00	23.41	7.80	1.61
10	630.00	23.58	8.08	1.72
11	700.00	23.74	8.34	1.82

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C12 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	22.00	20.82	118	1 -RCB	120	84	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

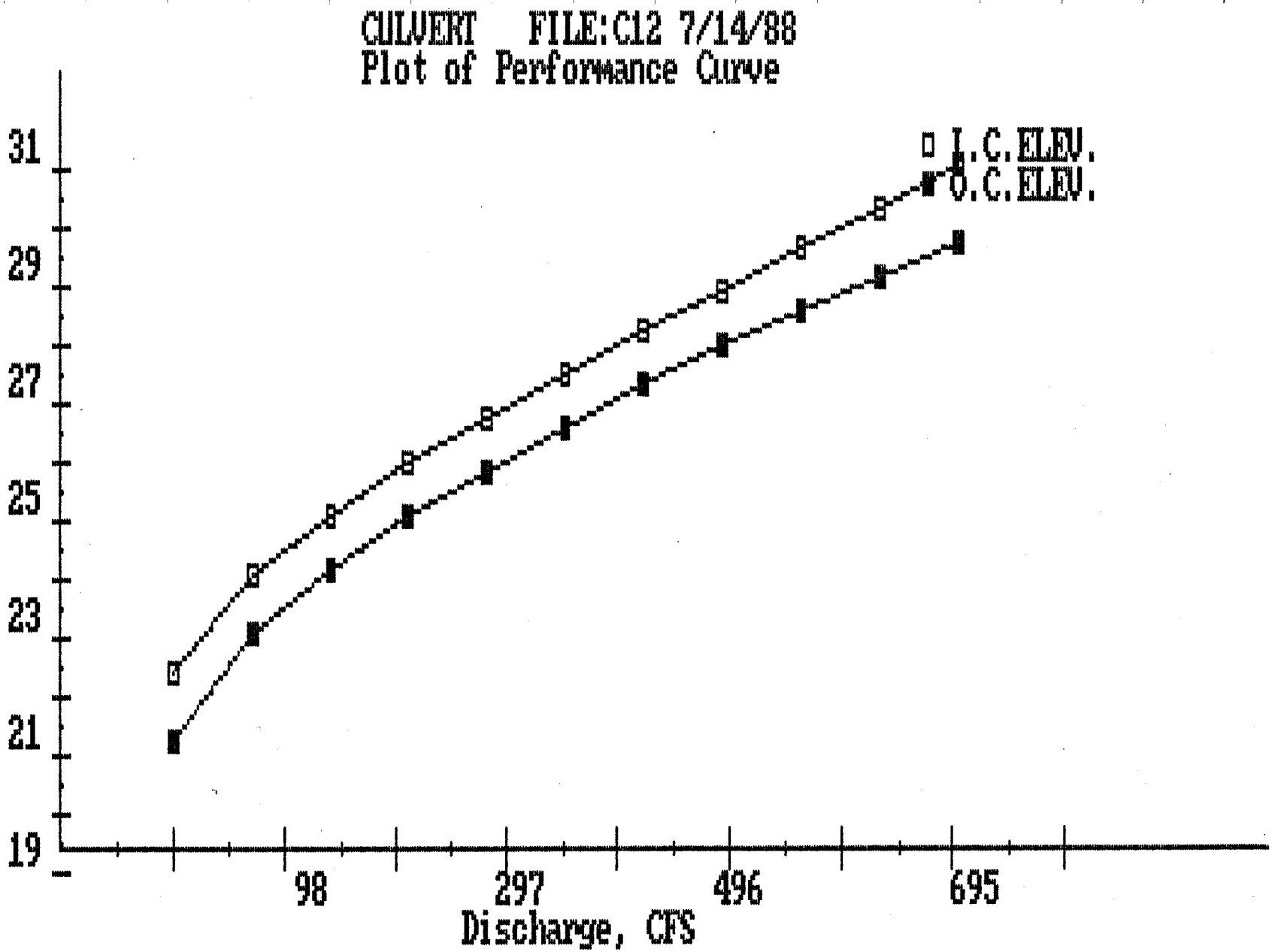
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	22.00	20.82	0.00	-1.18	0.00	0.00
70.00	23.70	21.61	1.70	0.66	0.79	8.82
140.00	24.70	22.01	2.70	1.74	1.19	11.09
210.00	25.55	22.32	3.55	2.65	1.52	12.43
280.00	26.35	22.58	4.35	3.46	1.83	13.39
350.00	27.11	22.82	5.11	4.20	2.15	14.19
420.00	27.83	23.03	5.83	4.90	2.43	14.86
490.00	28.53	23.22	6.53	5.55	2.71	15.44
560.00	29.22	23.41	7.22	6.18	2.97	15.98
630.00	29.93	23.58	7.93	6.78	3.23	16.45
700.00	30.66	23.74	8.66	7.36	3.49	16.90

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.L. = 28.8
∴ Capacity ≅ 517 cfs


CULVERT FILE:C12 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
31
29
27
25
23
21
19
98
297
496
695
Discharge, CFS

282

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C13 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 6 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	22.18	0.00	1.82
2	100.00	22.96	3.98	0.49
3	200.00	23.35	5.11	0.73
4	300.00	23.66	5.88	0.92
5	400.00	23.93	6.49	1.09
6	500.00	24.17	7.00	1.24
7	600.00	24.38	7.43	1.38
8	700.00	24.59	7.81	1.50
9	800.00	24.78	8.16	1.62
10	900.00	24.95	8.47	1.73
11	1000.00	25.12	8.76	1.84

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C13 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	23.00	22.18	102	2 -RCB	120	72	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

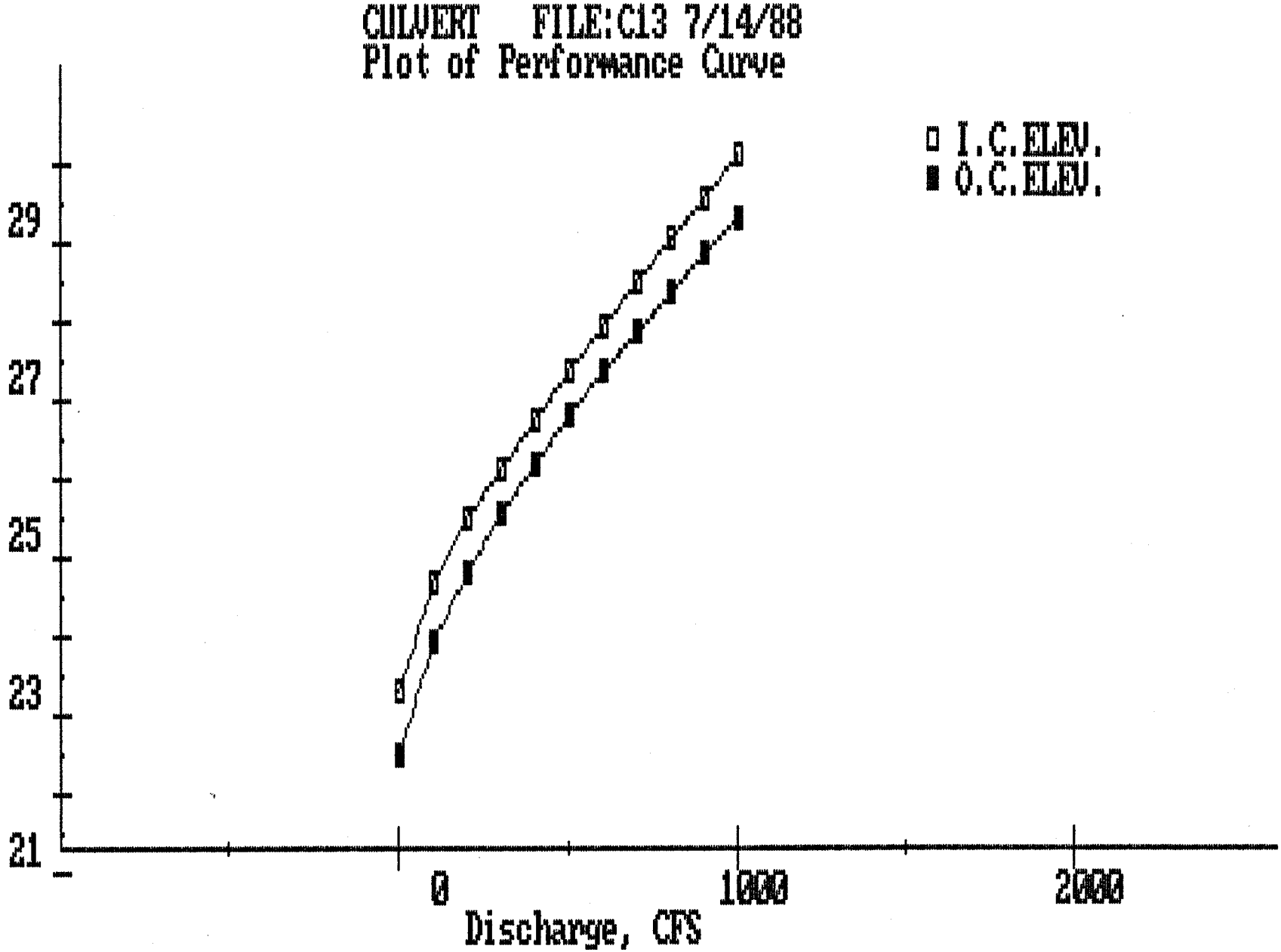
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	23.00	22.18	0.00	-0.82	0.00	0.00
100.00	24.36	22.96	1.36	0.65	0.78	6.44
200.00	25.16	23.35	2.16	1.52	1.17	8.55
300.00	25.84	23.66	2.84	2.24	1.48	10.14
400.00	26.47	23.93	3.47	2.89	1.75	11.44
500.00	27.07	24.17	4.07	3.48	1.99	12.15
600.00	27.63	24.39	4.63	4.04	2.20	12.81
700.00	28.18	24.59	5.18	4.56	2.41	13.31
800.00	28.72	24.77	5.72	5.06	2.59	13.81
900.00	29.26	24.95	6.26	5.55	2.77	14.24
1000.00	29.80	25.12	6.80	6.01	2.97	14.64

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 29.1
∴ Capacity ≈ 870 cfs


CULVERT FILE:C13 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
29
27
25
23
21
0
1000
2000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C14

WATERSHED AREA (A): 97.30 acres

LENGTH OF WATERCOURSE (Lc): 5800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1950. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
5800.	30.0

MEAN SLOPE (Sc): .0052 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.274	.431	.512	.592	.648	.692
Tc (FUNCTION OF i) :	97.28	81.09	75.73	71.45	68.91	67.14
SOLUTION OF Tc (MINUTES):	109	70	58	49	43	40
RAINFL INT. @ Tc (IN/HR):	.759	1.445	1.956	2.597	3.210	3.765
RUNOFF RATE @ Tc (IN/HR):	.208	.623	1.001	1.537	2.081	2.604
PEAK DISCHARGE (CFS) :	20.	61.	98.	151.	204.	255.

CULVERT ANALYSIS 1.1 DATE: 5/26/88
CULVERT FILE : C14 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 6 FT X 7 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	21.75	0.00	1.89
2	70.00	22.54	3.94	0.50
3	140.00	22.94	5.00	0.74
4	210.00	23.25	5.73	0.93
5	280.00	23.51	6.29	1.10
6	350.00	23.75	6.75	1.25
7	420.00	23.96	7.14	1.38
8	490.00	24.15	7.49	1.50
9	560.00	24.34	7.80	1.61
10	630.00	24.51	8.08	1.72
11	700.00	24.67	8.34	1.82

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/26/88
CULVERT FILE NAME: C14 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	22.70	21.75	118	2 -RCB	72	84	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

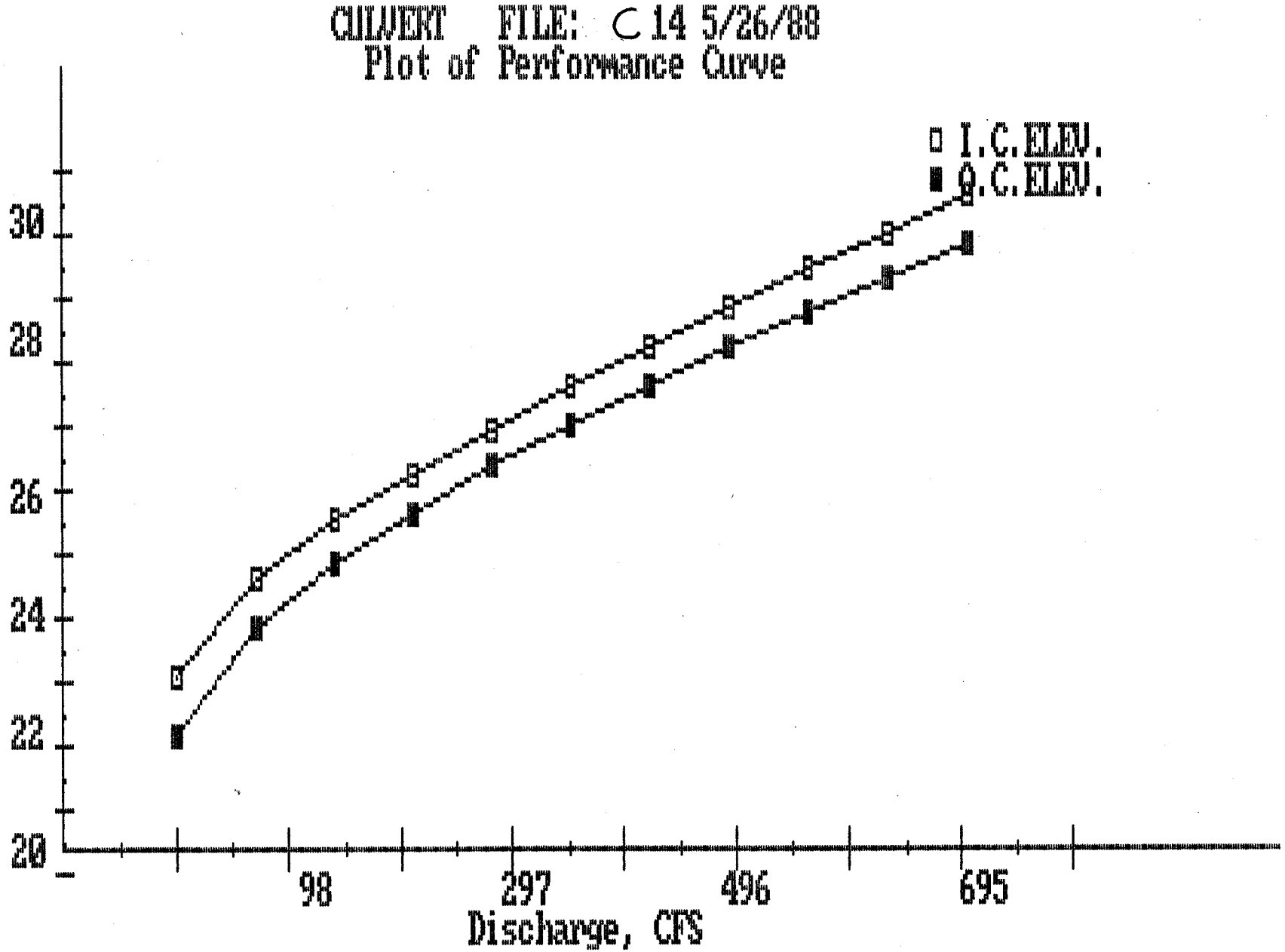
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	22.70	21.75	0.00	-0.95	0.00	0.00
70.00	24.21	22.54	1.51	0.75	0.79	7.35
140.00	25.10	22.94	2.40	1.71	1.19	9.83
210.00	25.84	23.25	3.14	2.51	1.54	10.79
280.00	26.53	23.51	3.83	3.23	1.88	11.62
350.00	27.19	23.75	4.49	3.89	2.22	12.32
420.00	27.81	23.96	5.11	4.50	2.53	12.91
490.00	28.41	24.15	5.71	5.09	2.84	13.46
560.00	29.00	24.34	6.30	5.64	3.14	13.89
630.00	29.58	24.51	6.88	6.17	3.43	14.30
700.00	30.16	24.67	7.46	6.69	3.72	14.68

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 29.6
∴ Capacity ≅ 630 cfs


CULVERT FILE: C 14 5/26/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
30
28
26
24
22
20
98
297
496
695
Discharge, CFS

C15 Q100 = 4752 cfs

Discharge taken from

HEC-1 routing

(see Section 3.1.3)

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C15 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 24 FT X 6 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	27.50	0.00	2.03
2	600.00	28.55	5.03	0.66
3	1200.00	29.09	6.56	0.99
4	1800.00	29.53	7.64	1.27
5	2400.00	29.91	8.51	1.50
6	3000.00	30.25	9.24	1.71
7	3600.00	30.56	9.88	1.91
8	4200.00	30.85	10.45	2.09
9	4800.00	31.12	10.97	2.26
10	5400.00	31.38	11.44	2.42
11	6000.00	31.63	11.88	2.58

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C15 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	29.00	27.50	141	4 -RCB	288	72	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

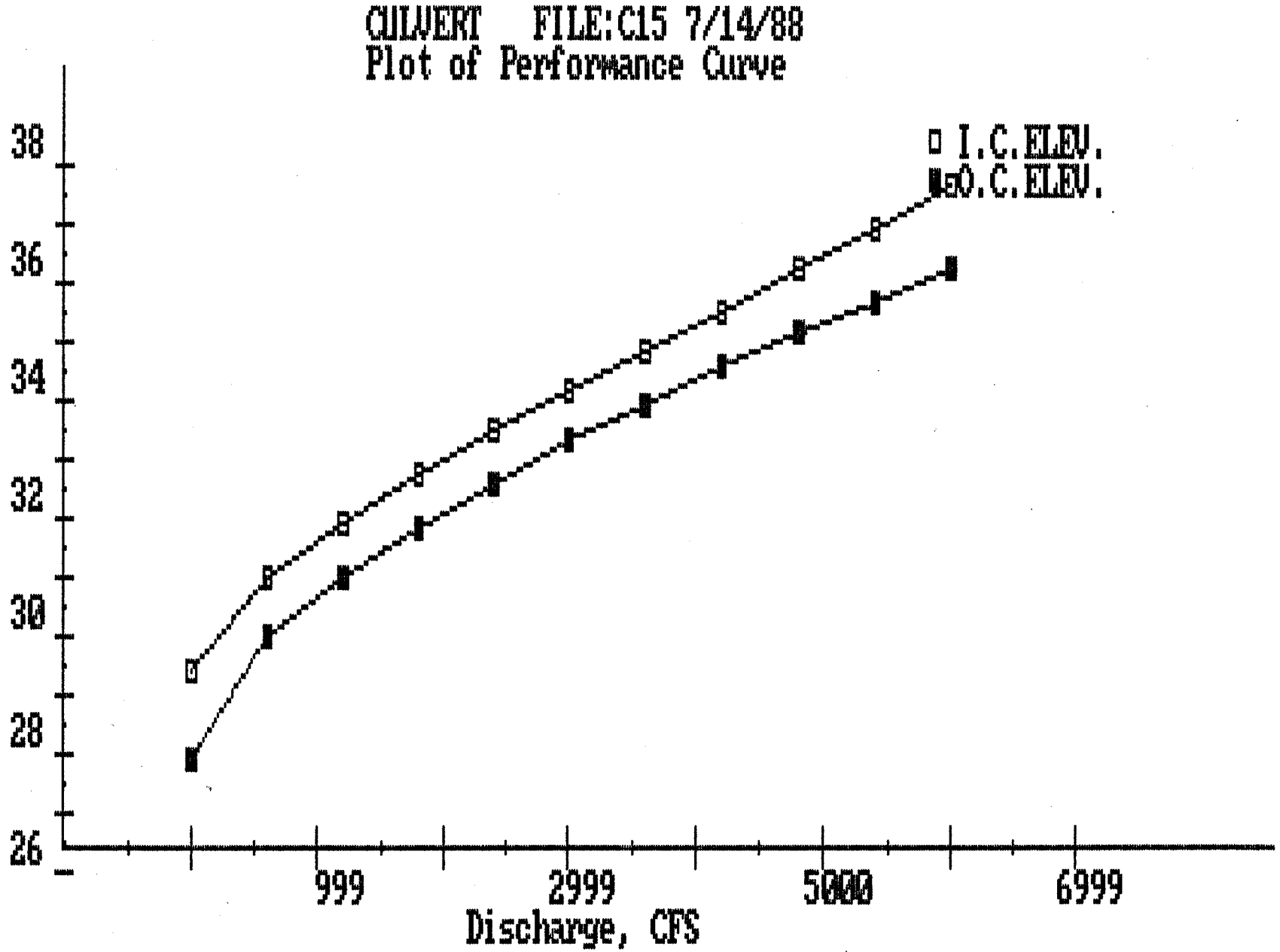
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 4 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	29.00	27.50	0.00	-1.50	0.00	0.00
600.00	30.58	28.55	1.58	0.60	1.05	5.93
1200.00	31.51	29.09	2.51	1.61	1.59	7.84
1800.00	32.30	29.53	3.30	2.45	2.03	9.25
2400.00	33.06	29.91	4.06	3.20	2.41	10.39
3000.00	33.76	30.25	4.76	3.89	2.75	11.38
3600.00	34.44	30.56	5.44	4.53	3.06	12.27
4200.00	35.12	30.85	6.12	5.14	3.35	13.07
4800.00	35.80	31.12	6.80	5.72	3.62	13.81
5400.00	36.50	31.38	7.50	6.28	3.88	14.49
6000.00	37.23	31.63	8.23	6.82	4.13	15.14

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 36.0
∴ Capacity ≈ 4971 cfs


CULVERT FILE:C15 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
38
36
34
32
30
28
26
999
2999
5000
6999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C16

WATERSHED AREA (A): 5944.00 acres

LENGTH OF WATERCOURSE (Lc): 25200. ft

LENGTH TO CENTER OF GRAVITY (Lca): 19600. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1000.	660.0
4000.	40.0
20200.	220.0

MEAN SLOPE (Sc): .0115 ft BASIN FACTOR (Nb): .0630

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

26. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
27. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
47. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 11. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.347	.489	.561	.632	.683	.722
Tc (FUNCTION OF i) :	279.35	243.46	230.42	219.60	213.00	208.30
SOLUTION OF Tc (MINUTES):	532	361	305	258	228	206
RAINFL INT. @ Tc (IN/HR):	.200	.374	.496	.670	.845	1.031
RUNOFF RATE @ Tc (IN/HR):	.069	.183	.278	.424	.577	.744
PEAK DISCHARGE (CFS) :	415.	1094.	1666.	2539.	3457.	4459.

CULVERT ANALYSIS 1.1 DATE: 6/14/88
CULVERT FILE :C16 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 24 FT X 6 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	32.09	0.00	1.38
2	300.00	33.09	4.78	0.62
3	600.00	33.59	6.19	0.94
4	900.00	34.00	7.17	1.19
5	1200.00	34.35	7.95	1.41
6	1500.00	34.67	8.60	1.61
7	1800.00	34.96	9.16	1.79
8	2100.00	35.22	9.66	1.96
9	2400.00	35.47	10.11	2.11
10	2700.00	35.71	10.52	2.26
11	3000.00	35.94	10.90	2.40

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 6/14/88
CULVERT FILE NAME: C16 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	33.50	32.09	141	2 -RCB	288	72	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

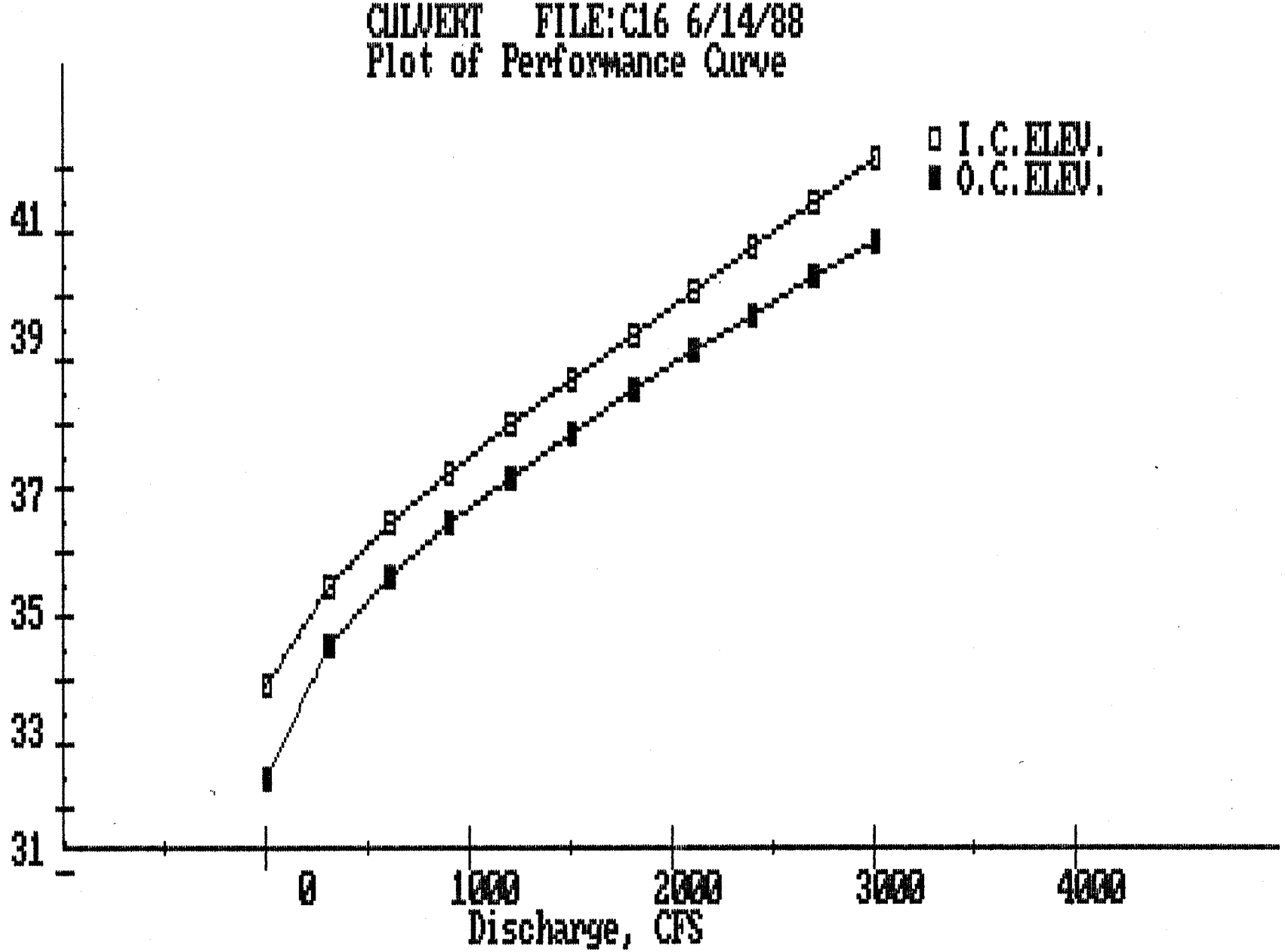
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	33.50	32.09	0.00	-1.41	0.00	0.00
300.00	35.08	33.09	1.58	0.67	1.00	6.27
600.00	36.01	33.59	2.51	1.67	1.50	8.31
900.00	36.81	34.00	3.31	2.51	1.91	9.82
1200.00	37.56	34.35	4.06	3.26	2.26	11.06
1500.00	38.27	34.67	4.77	3.95	2.58	12.13
1800.00	38.95	34.96	5.45	4.59	2.87	13.09
2100.00	39.62	35.22	6.12	5.20	3.13	13.96
2400.00	40.30	35.47	6.80	5.79	3.38	14.77
2700.00	41.00	35.71	7.50	6.34	3.62	15.53
3000.00	41.73	35.94	8.23	6.88	3.85	16.25

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 40.5
∴ Capacity ≈ 2486 cfs


CULVERT FILE:C16 6/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
41
39
37
35
33
31
0
1000
2000
3000
4000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C17

WATERSHED AREA (A): 39.50 acres

LENGTH OF WATERCOURSE (Lc): 5250. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2625. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
5250.	42.0

MEAN SLOPE (Sc): .0080 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.274	.431	.512	.592	.648	.692
Tc (FUNCTION OF i) :	86.69	72.27	67.50	63.68	61.42	59.83
SOLUTION OF Tc (MINUTES):	92	59	50	42	37	34
RAINFL INT. @ Tc (IN/HR):	.871	1.669	2.167	2.868	3.544	4.196
RUNOFF RATE @ Tc (IN/HR):	.239	.720	1.109	1.698	2.297	2.903
PEAK DISCHARGE (CFS) :	9.50	28.67	44.16	67.60	91.46	115.57

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C17 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	36.50	0.00	1.14
2	40.00	37.07	3.22	0.36
3	80.00	37.36	4.13	0.54
4	120.00	37.59	4.75	0.68
5	160.00	37.78	5.24	0.80
6	200.00	37.96	5.64	0.91
7	240.00	38.11	5.98	1.01
8	280.00	38.26	6.29	1.10
9	320.00	38.40	6.56	1.18
10	360.00	38.53	6.81	1.27
11	400.00	38.65	7.04	1.34

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C17 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	37.50	36.50	118	1 -RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

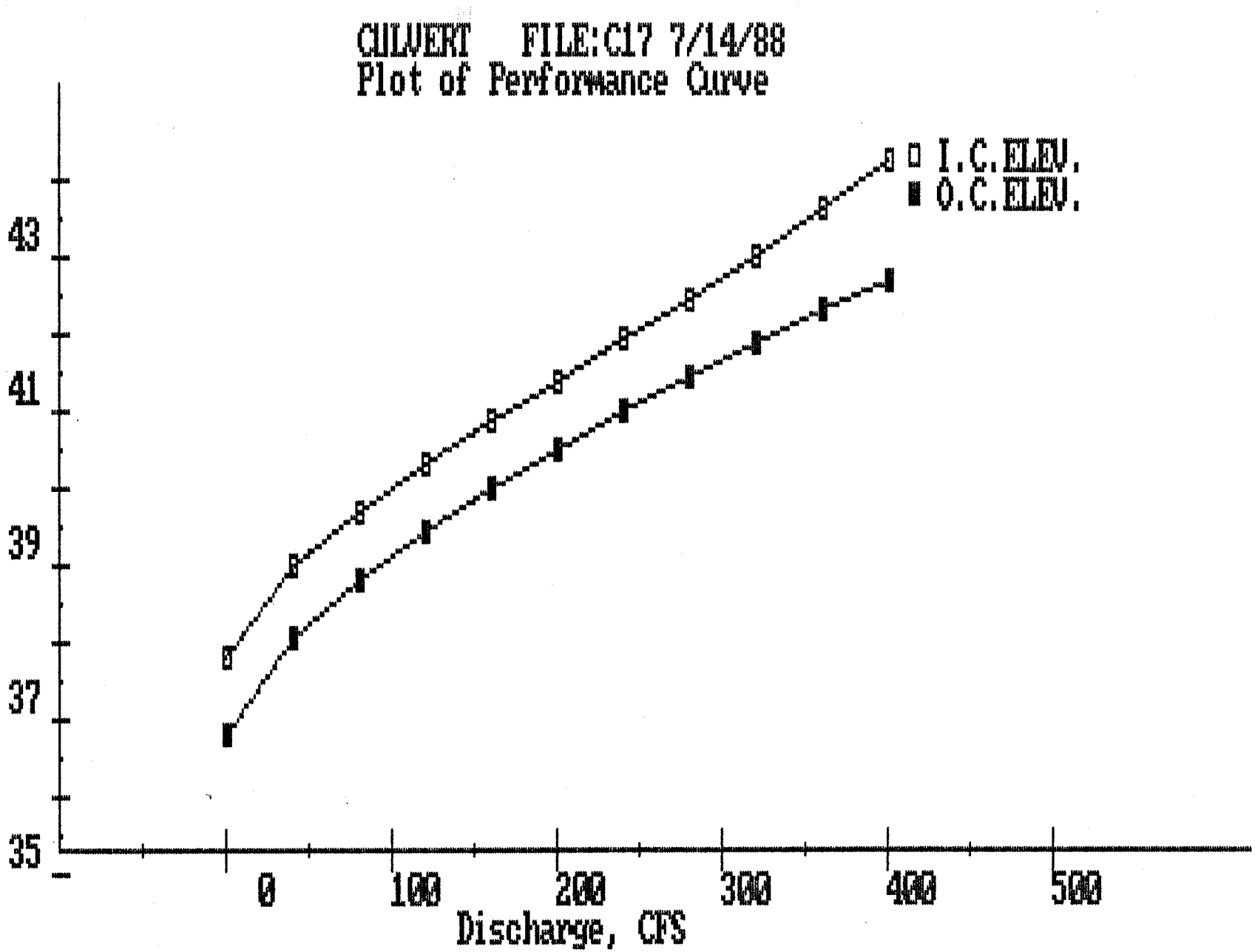
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	37.50	36.50	0.00	-1.00	0.00	0.00
40.00	38.67	37.07	1.17	0.26	0.57	7.01
80.00	39.36	37.36	1.86	1.01	0.86	8.97
120.00	39.98	37.59	2.48	1.63	1.11	10.15
160.00	40.54	37.78	3.04	2.19	1.34	11.01
200.00	41.08	37.96	3.58	2.70	1.56	11.75
240.00	41.61	38.11	4.11	3.18	1.75	12.37
280.00	42.14	38.26	4.64	3.63	1.95	12.87
320.00	42.70	38.40	5.20	4.06	2.13	13.35
360.00	43.29	38.53	5.79	4.48	2.31	13.77
400.00	43.92	38.65	6.42	4.88	2.49	14.15

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 42.5
∴ Capacity = 306 cfs


CULVERT FILE:C17 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
43
41
39
37
35
0
100
200
300
400
500
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C18

WATERSHED AREA (A): 43.20 acres

LENGTH OF WATERCOURSE (Lc): 4660. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2330. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4660.	30.0

MEAN SLOPE (Sc): .0064 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.274	.431	.512	.592	.648	.692
Tc (FUNCTION OF i) :	88.04	73.39	68.54	64.67	62.37	60.76
SOLUTION OF Tc (MINUTES):	94	60	50	43	38	35
RAINFL INT. @ Tc (IN/HR):	.856	1.652	2.167	2.823	3.493	4.109
RUNOFF RATE @ Tc (IN/HR):	.234	.713	1.109	1.671	2.264	2.843
PEAK DISCHARGE (CFS) :	10.	31.	48.	73.	99.	124.

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C18 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	40.50	0.00	1.34
2	40.00	41.07	3.22	0.36
3	80.00	41.36	4.13	0.54
4	120.00	41.59	4.75	0.68
5	160.00	41.78	5.24	0.80
6	200.00	41.96	5.64	0.91
7	240.00	42.11	5.98	1.01
8	280.00	42.26	6.29	1.10
9	320.00	42.40	6.56	1.18
10	360.00	42.53	6.81	1.27
11	400.00	42.65	7.04	1.34

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C18 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	41.70	40.50	144	1 -RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

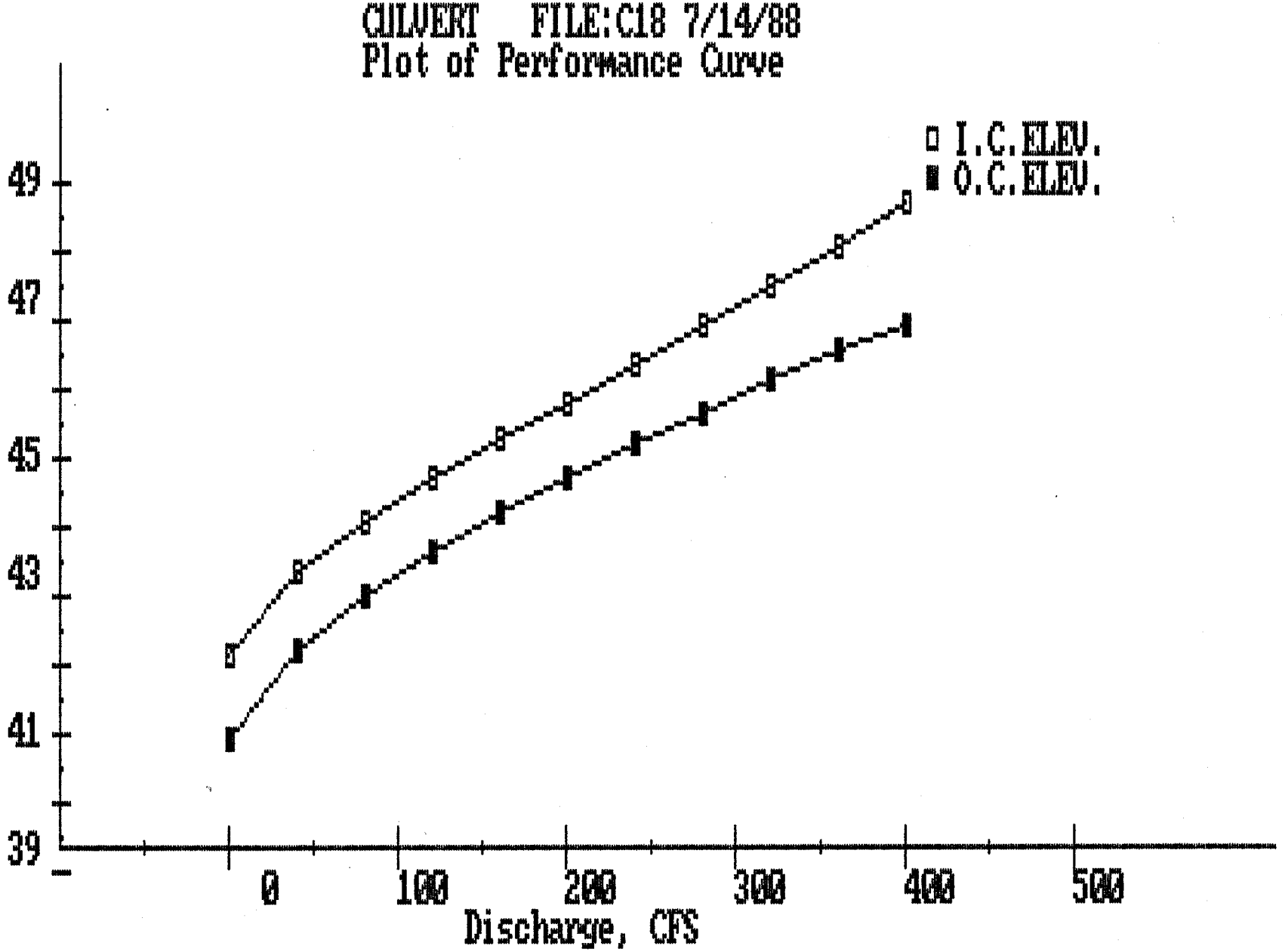
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	41.70	40.50	0.00	-1.20	0.00	0.00
40.00	42.87	41.07	1.17	0.07	0.57	7.01
80.00	43.56	41.36	1.86	0.82	0.86	9.05
120.00	44.18	41.59	2.48	1.44	1.12	10.28
160.00	44.74	41.78	3.04	2.00	1.35	11.12
200.00	45.28	41.96	3.58	2.51	1.57	11.84
240.00	45.81	42.11	4.11	2.99	1.77	12.52
280.00	46.34	42.26	4.64	3.44	1.97	13.02
320.00	46.90	42.40	5.20	3.87	2.15	13.52
360.00	47.49	42.53	5.79	4.29	2.33	13.92
400.00	48.12	42.65	6.42	4.69	2.51	14.34

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 45.6
∴ Capacity ≈ 224 cfs


CULVERT FILE:C18 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
49
47
45
43
41
39
0
100
200
300
400
500
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C19

WATERSHED AREA (A): 108.00 acres

LENGTH OF WATERCOURSE (Lc): 6300. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3150. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

6300. 77.0

MEAN SLOPE (Sc): .0122 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.222	.357	.433	.513	.571	.618
Tc (FUNCTION OF i) :	88.70	73.38	67.96	63.52	60.84	58.95
SOLUTION OF Tc (MINUTES):	95	60	50	42	37	33
RAINFL INT. @ Tc (IN/HR):	.849	1.652	2.167	2.868	3.544	4.253
RUNOFF RATE @ Tc (IN/HR):	.189	.590	.938	1.470	2.023	2.628
PEAK DISCHARGE (CFS) :	21.	64.	102.	160.	220.	286.

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE : c19 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	47.68	0.00	1.18
2	70.00	48.21	3.16	0.33
3	140.00	48.48	4.11	0.50
4	210.00	48.70	4.77	0.64
5	280.00	48.89	5.30	0.76
6	350.00	49.06	5.75	0.86
7	420.00	49.22	6.13	0.96
8	490.00	49.36	6.47	1.05
9	560.00	49.50	6.78	1.13
10	630.00	49.63	7.07	1.21
11	700.00	49.75	7.33	1.29

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE NAME: C19 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	48.70	47.68	102	3 -RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

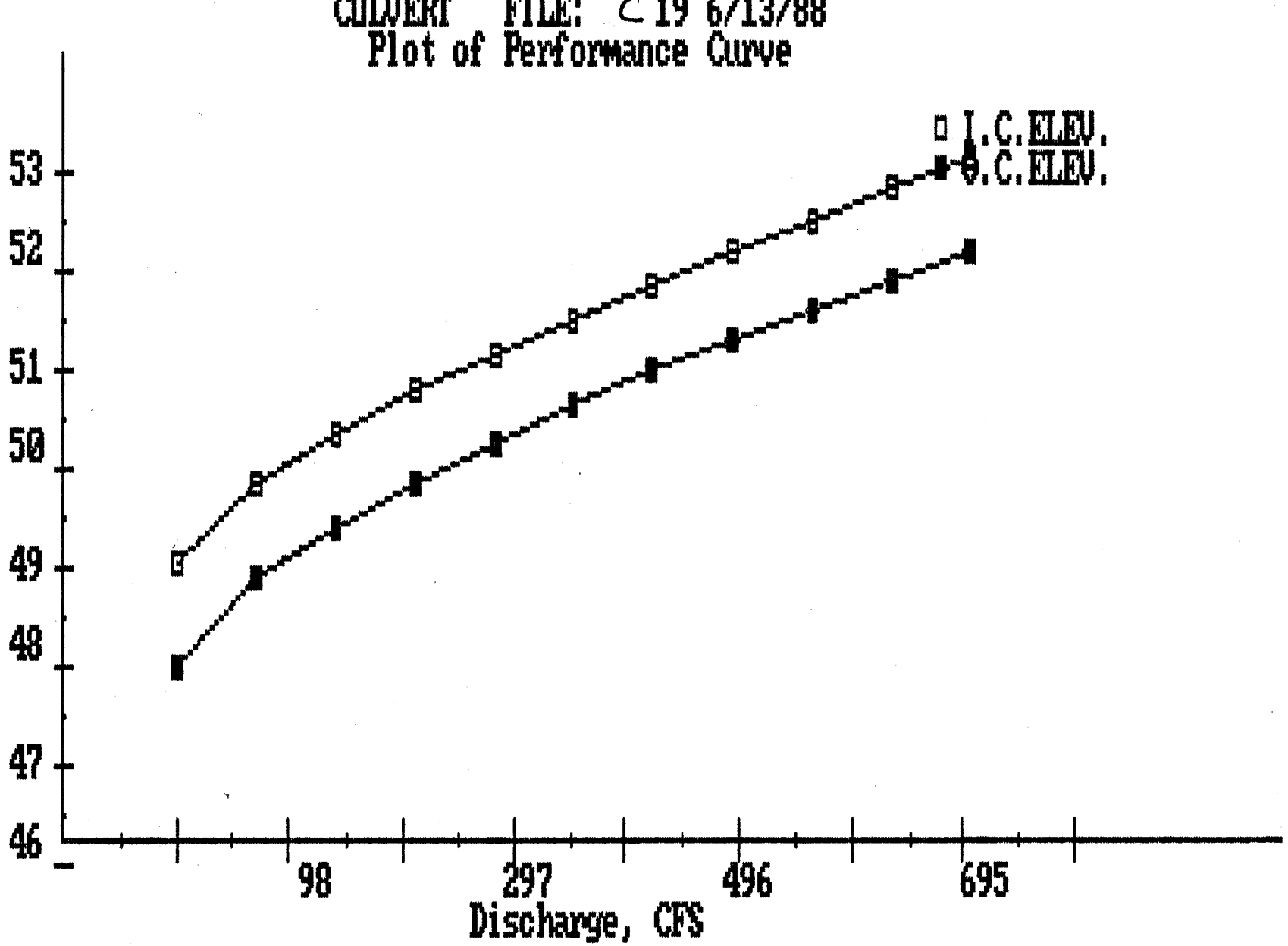
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 3 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	48.70	47.68	0.00	-1.02	0.00	0.00
70.00	49.52	48.21	0.82	-0.14	0.53	4.39
140.00	50.00	48.48	1.30	0.38	0.80	5.81
210.00	50.40	48.70	1.70	0.82	1.02	6.86
280.00	50.77	48.89	2.07	1.21	1.21	7.71
350.00	51.12	49.06	2.42	1.57	1.38	8.45
420.00	51.46	49.22	2.76	1.90	1.53	9.12
490.00	51.79	49.36	3.09	2.22	1.68	9.72
560.00	52.10	49.50	3.40	2.52	1.82	10.28
630.00	52.41	49.63	3.71	2.81	1.94	10.80
700.00	52.72	49.75	4.02	3.09	2.07	11.28

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

H.W. = 52.4
∴ Capacity = 630


CULVERT FILE: C19 6/13/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
53
52
51
50
49
48
47
46
98
297
496
695
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C20

WATERSHED AREA (A): 505.00 acres

LENGTH OF WATERCOURSE (Lc): 9100. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4550. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1800.	800.0
7300.	140.0

MEAN SLOPE (Sc): .0270 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

44. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
56. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.330	.471	.544	.616	.667	.708
Tc (FUNCTION OF i) :	68.86	59.70	56.37	53.61	51.93	50.73
SOLUTION OF Tc (MINUTES):	65	45	39	33	30	27
RAINFL INT. @ Tc (IN/HR):	1.170	2.016	2.570	3.342	4.058	4.828
RUNOFF RATE @ Tc (IN/HR):	.386	.949	1.397	2.060	2.709	3.416
PEAK DISCHARGE (CFS) :	196.	483.	711.	1049.	1379.	1739.

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE : C20 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	58.78	0.00	1.40
2	150.00	59.51	3.91	0.46
3	300.00	59.89	5.07	0.69
4	450.00	60.19	5.89	0.88
5	600.00	60.45	6.54	1.04
6	750.00	60.68	7.08	1.19
7	900.00	60.90	7.55	1.32
8	1050.00	61.10	7.96	1.44
9	1200.00	61.28	8.34	1.56
10	1350.00	61.46	8.68	1.67
11	1500.00	61.63	9.00	1.78

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE NAME: C20 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	59.30	58.78	53	4 -RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

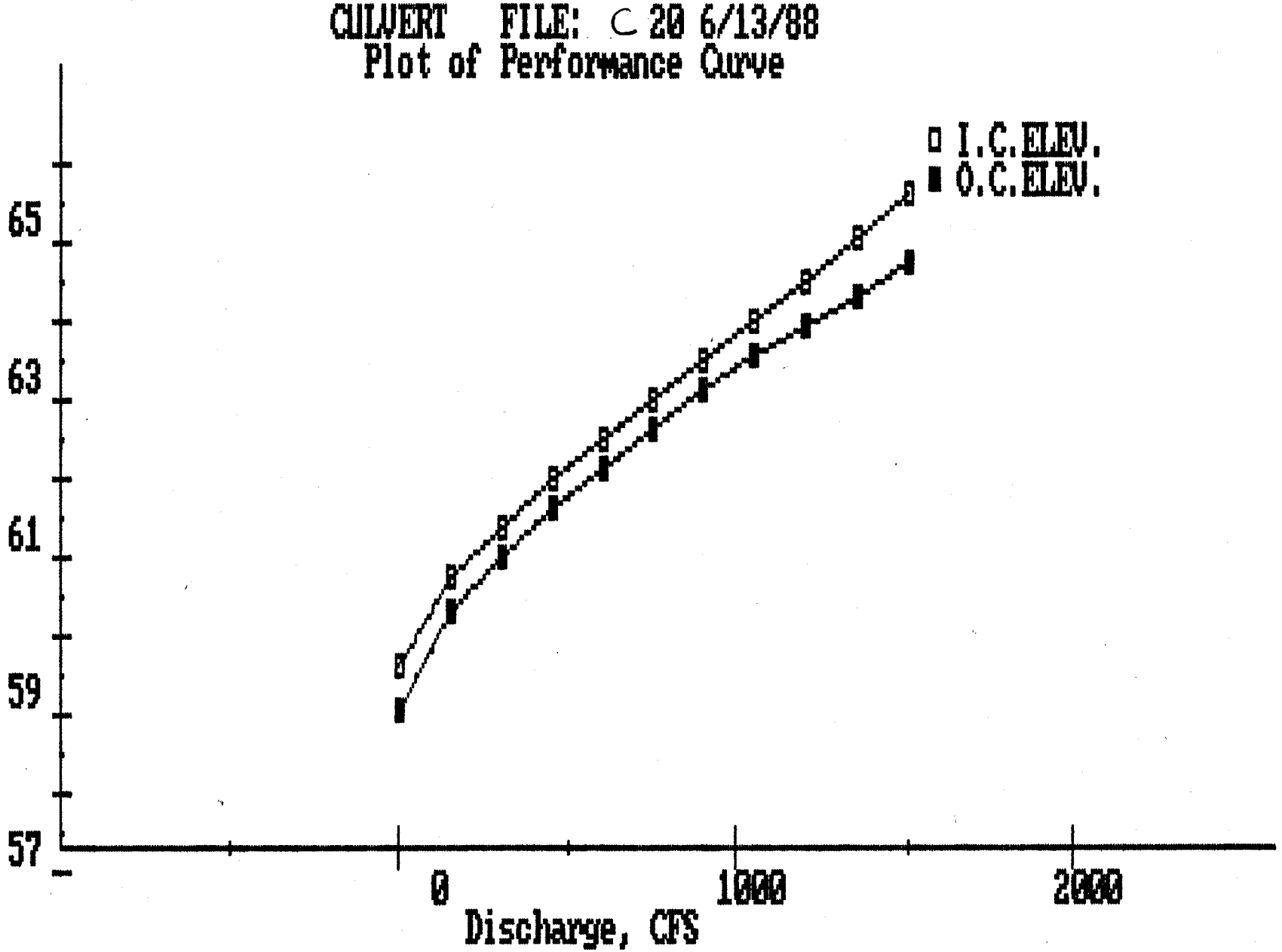
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 4 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	59.30	58.78	0.00	-0.52	0.00	0.00
150.00	60.42	59.51	1.12	0.69	0.74	5.10
300.00	61.08	59.89	1.78	1.41	1.11	6.76
450.00	61.66	60.19	2.36	2.00	1.41	7.98
600.00	62.20	60.45	2.90	2.54	1.67	8.99
750.00	62.71	60.68	3.41	3.03	1.90	9.86
900.00	63.21	60.90	3.91	3.49	2.12	10.63
1050.00	63.70	61.10	4.40	3.92	2.32	11.34
1200.00	64.21	61.28	4.91	4.33	2.50	11.99
1350.00	64.75	61.46	5.45	4.73	2.68	12.60
1500.00	65.32	61.63	6.02	5.11	2.85	13.17

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

H.W. = 63.6
∴ Capacity ≈ 1019 cfs


CULVERT FILE: C 20 6/13/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
65
63
61
59
57
0
1000
2000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C21

WATERSHED AREA (A): 137.00 acres

LENGTH OF WATERCOURSE (Lc): 5200. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2600. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1800.	1152.0
3400.	115.0

MEAN SLOPE (Sc): .0629 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.414	.560	.631	.698	.743	.778
Tc (FUNCTION OF i) :	32.03	28.37	27.06	25.99	25.34	24.88
SOLUTION OF Tc (MINUTES):	23	17	15	13	12	11
RAINFL INT. @ Tc (IN/HR):	2.310	3.569	4.372	5.510	6.472	7.501
RUNOFF RATE @ Tc (IN/HR):	.956	2.000	2.757	3.845	4.812	5.836
PEAK DISCHARGE (CFS) :	132.	276.	381.	531.	664.	806.

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE : C21 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	79.47	0.00	1.14
2	100.00	80.05	3.35	0.36
3	200.00	80.34	4.36	0.54
4	300.00	80.58	5.07	0.69
5	400.00	80.78	5.64	0.82
6	500.00	80.97	6.12	0.94
7	600.00	81.14	6.54	1.04
8	700.00	81.30	6.91	1.14
9	800.00	81.45	7.24	1.23
10	900.00	81.59	7.55	1.32
11	1000.00	81.72	7.83	1.40

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE NAME: C2\ SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	80.50	79.47	128	4 -RCB	120	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

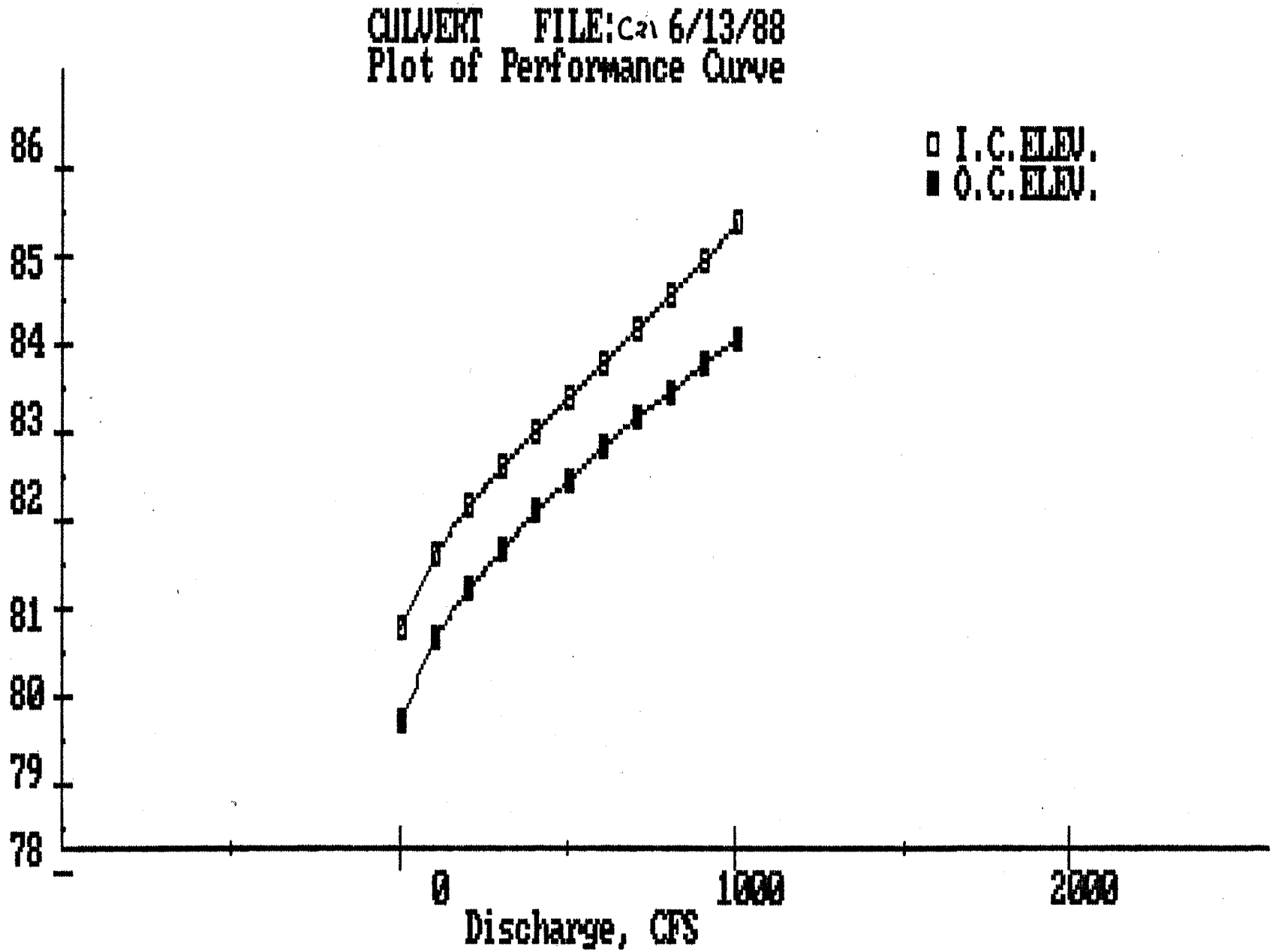
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 4 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	80.50	79.47	0.00	-1.03	0.00	0.00
100.00	81.36	80.05	0.86	-0.10	0.58	4.33
200.00	81.86	80.34	1.36	0.45	0.87	5.73
300.00	82.31	80.58	1.81	0.90	1.11	6.76
400.00	82.72	80.78	2.22	1.31	1.31	7.61
500.00	83.11	80.97	2.61	1.68	1.50	8.34
600.00	83.49	81.14	2.99	2.03	1.67	8.99
700.00	83.87	81.30	3.37	2.37	1.83	9.58
800.00	84.27	81.45	3.77	2.68	1.97	10.13
900.00	84.69	81.59	4.19	2.98	2.12	10.63
1000.00	85.13	81.72	4.63	3.27	2.25	11.11

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 84.5
∴ Capacity ≅ 855 cfs


CULVERT FILE: C2\ 6/13/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
86
85
84
83
82
81
80
79
78
0
1000
2000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C22

WATERSHED AREA (A): 85.90 acres

LENGTH OF WATERCOURSE (Lc): 3700. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1850. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1900.	1060.0
1800.	90.0

MEAN SLOPE (Sc): .1220 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.392	.544	.617	.687	.734	.770
Tc (FUNCTION OF i) :	22.75	19.95	18.98	18.18	17.70	17.36
SOLUTION OF Tc (MINUTES):	15	11	10	9	8	7
RAINFL INT. @ Tc (IN/HR):	2.862	4.312	5.178	6.414	7.679	9.052
RUNOFF RATE @ Tc (IN/HR):	1.121	2.345	3.194	4.404	5.637	6.971
PEAK DISCHARGE (CFS) :	97.	203.	277.	381.	488.	604.

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE : C22 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	10.21	0.00	1.40
2	100.00	10.78	4.19	0.57
3	200.00	11.07	5.44	0.86
4	300.00	11.31	6.32	1.10
5	400.00	11.51	7.01	1.30
6	500.00	11.69	7.59	1.48
7	600.00	11.86	8.10	1.65
8	700.00	12.01	8.55	1.80
9	800.00	12.16	8.95	1.95
10	900.00	12.30	9.32	2.08
11	1000.00	12.43	9.66	2.22

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE NAME: C22 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	12.50	10.21	143	3 -RCB	120	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

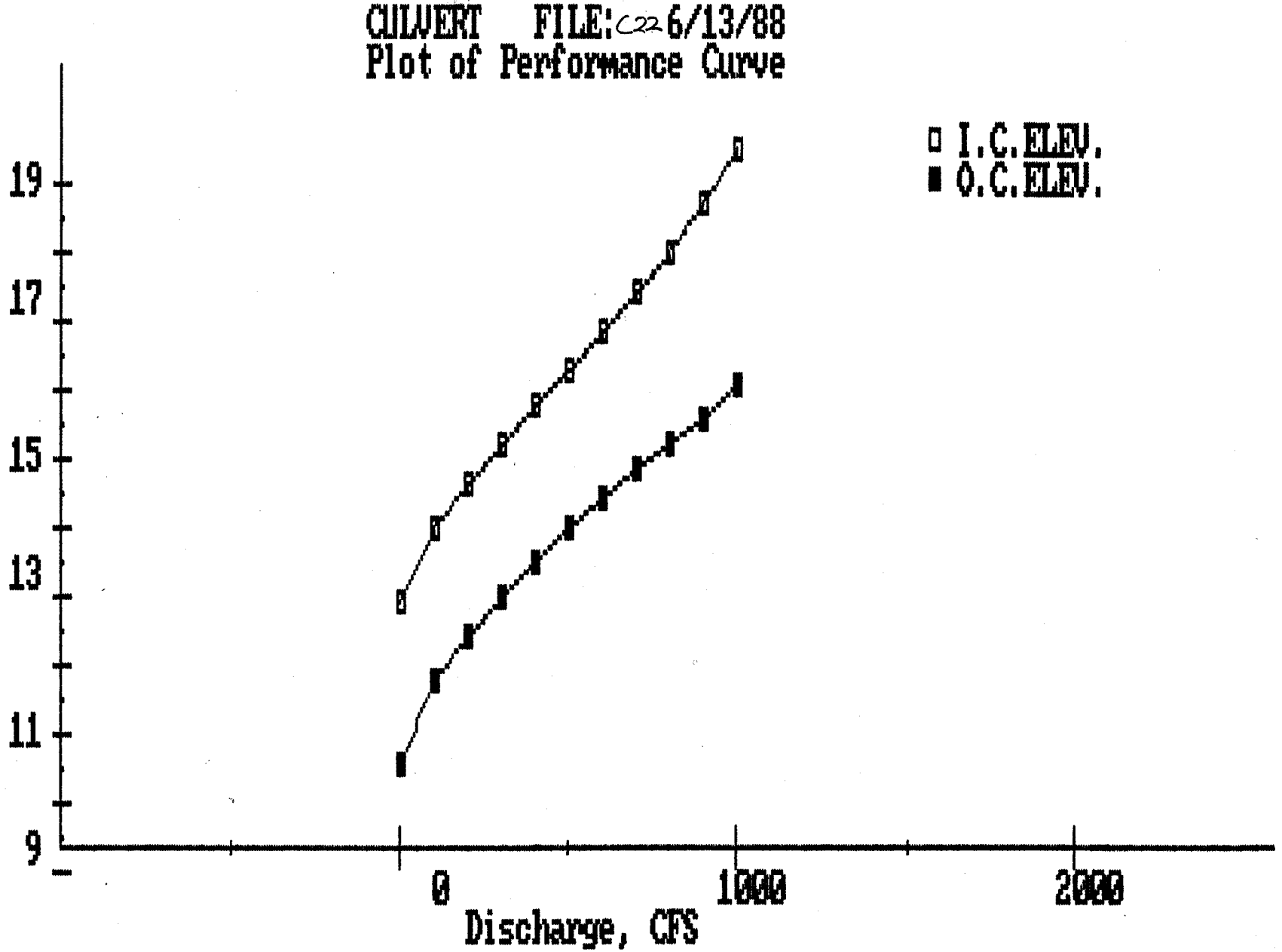
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 3 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	12.50	10.21	0.00	-2.29	0.00	0.00
100.00	13.53	10.78	1.03	-1.17	0.57	5.83
200.00	14.15	11.07	1.65	-0.51	0.86	7.72
300.00	14.71	11.31	2.21	0.05	1.10	9.12
400.00	15.23	11.51	2.73	0.54	1.30	10.26
500.00	15.73	11.69	3.23	0.99	1.48	11.25
600.00	16.26	11.86	3.76	1.42	1.65	12.13
700.00	16.82	12.01	4.32	1.82	1.80	12.93
800.00	17.44	12.16	4.94	2.20	1.95	13.68
900.00	18.12	12.30	5.62	2.58	2.09	14.37
1000.00	18.86	12.43	6.36	3.01	2.22	15.02

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 16.5
∴ Capacity = 643 cfs


CULVERT FILE: C22 6/13/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
19
17
15
13
11
9
0
1000
2000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C22A

WATERSHED AREA (A): 29.10 acres

LENGTH OF WATERCOURSE (Lc): 2700. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1350. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
800.	400.0
1900.	180.0

MEAN SLOPE (Sc): .1366 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.392	.544	.617	.687	.734	.770
Tc (FUNCTION OF i) :	18.00	15.78	15.01	14.38	14.00	13.73
SOLUTION OF Tc (MINUTES):	11	9	7	7	6	6
RAINFL INT. @ Tc (IN/HR):	3.276	4.692	6.041	7.114	8.527	9.541
RUNOFF RATE @ Tc (IN/HR):	1.283	2.552	3.726	4.885	6.259	7.347
PEAK DISCHARGE (CFS) :	38.	75.	109.	143.	184.	216.

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C22A CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 3.5 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(1) THIN EDGE PROJECTING
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	6.24
2	25.00	0.73	3.13	0.68
3	50.00	1.06	3.84	0.99
4	75.00	1.31	4.31	1.23
5	100.00	1.52	4.67	1.42
6	125.00	1.70	4.97	1.59
7	150.00	1.86	5.22	1.74
8	175.00	2.01	5.45	1.88
9	200.00	2.14	5.64	2.00
10	225.00	2.26	5.82	2.12
11	250.00	2.38	5.99	2.23

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C22A CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 3.5 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(1) THIN EDGE PROJECTING
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	6.24
2	25.00	0.73	3.13	0.68
3	50.00	1.06	3.84	0.99
4	75.00	1.31	4.31	1.23
5	100.00	1.52	4.67	1.42
6	125.00	1.70	4.97	1.59
7	150.00	1.86	5.22	1.74
8	175.00	2.01	5.45	1.88
9	200.00	2.14	5.64	2.00
10	225.00	2.26	5.82	2.12
11	250.00	2.38	5.99	2.23

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1
CULVERT FILE NAME: C22A

DATE: 11-2-89
SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	A - SITE DATA: OUTLET ELEV. (FT)	A - SITE DATA: CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	2.10	0.00	140	2 -CSP	42	42	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	2.10	0.00	0.00	-2.10	0.00	0.00
25.00	4.16	0.73	1.58	2.06	1.02	5.34
50.00	5.01	1.06	2.33	2.91	1.48	6.47
75.00	5.72	1.31	3.02	3.62	1.87	7.16
100.00	6.04	1.52	3.72	3.94	2.20	7.85
125.00	6.63	1.70	4.53	4.53	2.47	8.60
150.00	7.59	1.86	5.49	5.31	2.70	9.43
175.00	9.26	2.01	6.64	7.16	2.89	10.32
200.00	11.22	2.14	8.00	9.12	3.05	11.27
225.00	13.47	2.27	9.60	11.37	3.50	11.69
250.00	15.80	2.38	11.43	13.70	3.50	12.99

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

$Hw = 6.10$

$\therefore$ capacity = 127 cfs

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C22B

WATERSHED AREA (A): 73.50 acres

LENGTH OF WATERCOURSE (Lc): 2600. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1300. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
950.	500.0
1650.	155.0

MEAN SLOPE (Sc): .1509 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.392	.544	.617	.687	.734	.770
Tc (FUNCTION OF i) :	16.91	14.83	14.10	13.51	13.15	12.90
SOLUTION OF Tc (MINUTES):	11	8	7	6	6	5
RAINFL INT. @ Tc (IN/HR):	3.276	4.940	6.041	7.498	8.527	10.001
RUNOFF RATE @ Tc (IN/HR):	1.283	2.687	3.726	5.148	6.259	7.702
PEAK DISCHARGE (CFS) :	95.	199.	276.	381.	464.	571.

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C22B CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 8 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	2.23
2	50.00	0.99	3.89	0.93
3	100.00	1.45	4.81	1.36
4	150.00	1.80	5.41	1.69
5	200.00	2.09	5.87	1.96
6	250.00	2.35	6.25	2.20
7	300.00	2.58	6.57	2.41
8	350.00	2.78	6.85	2.60
9	400.00	2.97	7.11	2.78
10	450.00	3.15	7.34	2.95
11	500.00	3.32	7.55	3.11

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1
CULVERT FILE NAME: C22B

DATE: 11-2-89
SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	2.10	0.00	140	1 -RCB	96	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

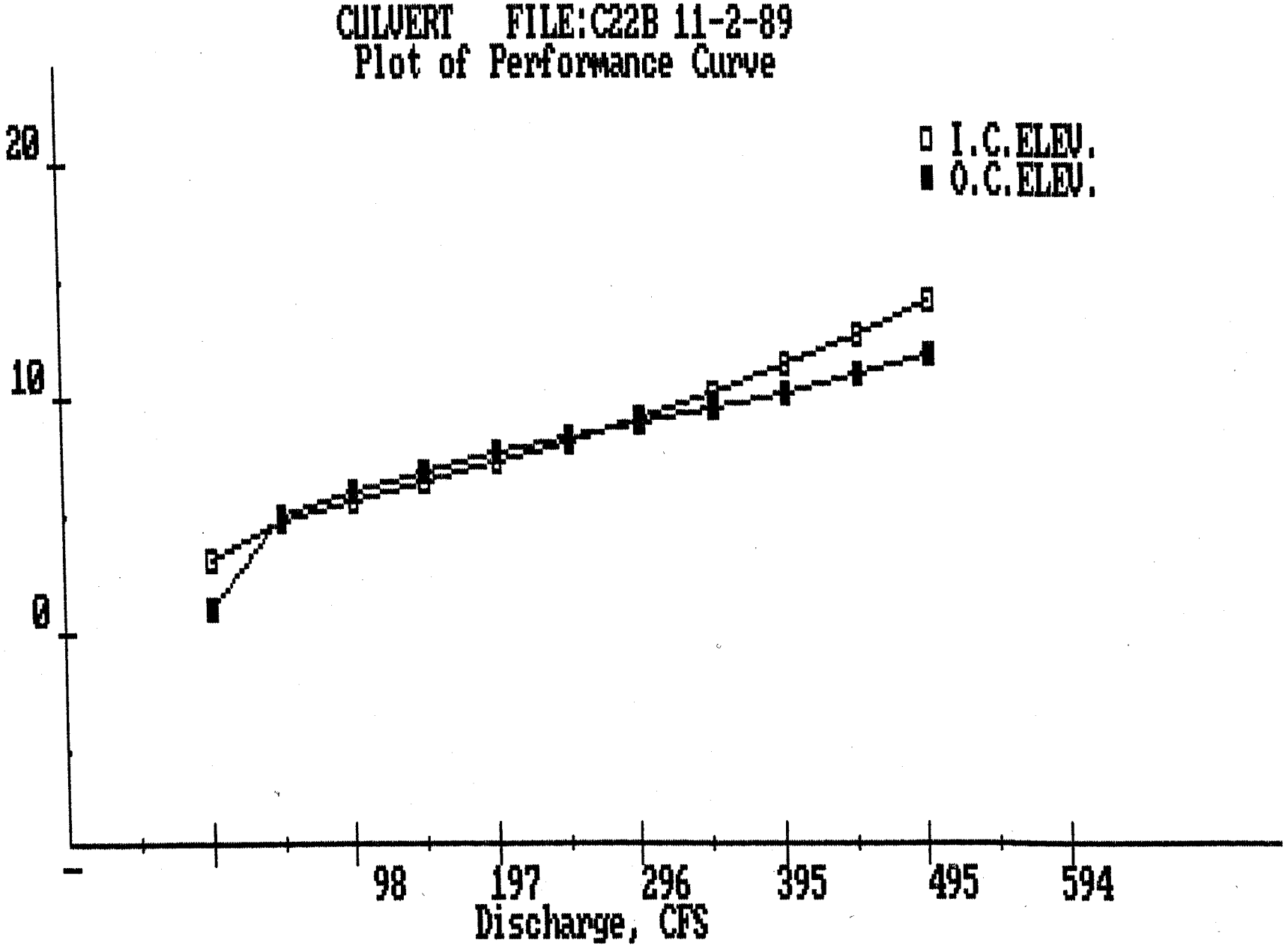
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	2.10	0.00	0.00	-2.10	0.00	0.00
50.00	4.06	0.99	1.57	1.96	0.99	6.31
100.00	5.06	1.45	2.54	2.96	1.45	8.62
150.00	5.90	1.80	3.40	3.80	1.80	10.42
200.00	6.65	2.09	4.23	4.55	2.09	11.94
250.00	7.34	2.35	5.08	5.24	2.35	13.31
300.00	8.11	2.58	6.01	5.89	2.58	14.56
350.00	9.15	2.78	7.05	6.50	2.78	15.72
400.00	10.32	2.97	8.22	7.17	2.97	16.81
450.00	11.64	3.15	9.54	7.94	3.15	17.85
500.00	13.11	3.32	11.01	8.80	3.32	18.84

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Hw = 7.6' ∴ capacity = 267 cfs


CULVERT FILE:C22B 11-2-89
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
98
197
296
395
495
594
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C23

WATERSHED AREA (A): 8085.00 acres

LENGTH OF WATERCOURSE (Lc): 88000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 44000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
11000.	730.0
77000.	1770.0

MEAN SLOPE (Sc): .0255 ft BASIN FACTOR (Nb): .0590

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.17	1.47	1.74	2.07	2.37	2.67
P 2	1.34	1.71	2.01	2.39	2.73	3.07
P 3	1.46	1.90	2.22	2.63	3.00	3.37
P 6	1.65	2.14	2.51	2.97	3.39	3.81
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

37. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
11. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
52. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.262	.389	.476	.563	.624	.671
Tc (FUNCTION OF i) :	394.33	336.81	310.79	290.59	278.87	270.81
SOLUTION OF Tc (MINUTES):	908	614	494	400	346	310
RAINFL INT. @ Tc (IN/HR):	.124	.223	.315	.450	.583	.714
RUNOFF RATE @ Tc (IN/HR):	.033	.087	.150	.253	.364	.479
PEAK DISCHARGE (CFS) :	266.	707.	1220.	2065.	2967.	3908.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C23 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 8 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(8) 1:1 BEVEL (45 DEG. FLARE)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	80.00	0.72	5.03	1.12
3	160.00	1.08	6.40	1.68
4	240.00	1.36	7.34	2.12
5	320.00	1.60	8.07	2.50
6	400.00	1.81	8.67	2.83
7	480.00	2.01	9.18	3.13
8	560.00	2.19	9.63	3.41
9	640.00	2.36	10.04	3.68
10	720.00	2.51	10.40	3.92
11	800.00	2.66	10.74	4.15

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE NAME: C23 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	A - SITE DATA: OUTLET ELEV. (FT)	A - SITE DATA: CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	2.10	0.00	140	2 -RCB	96	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

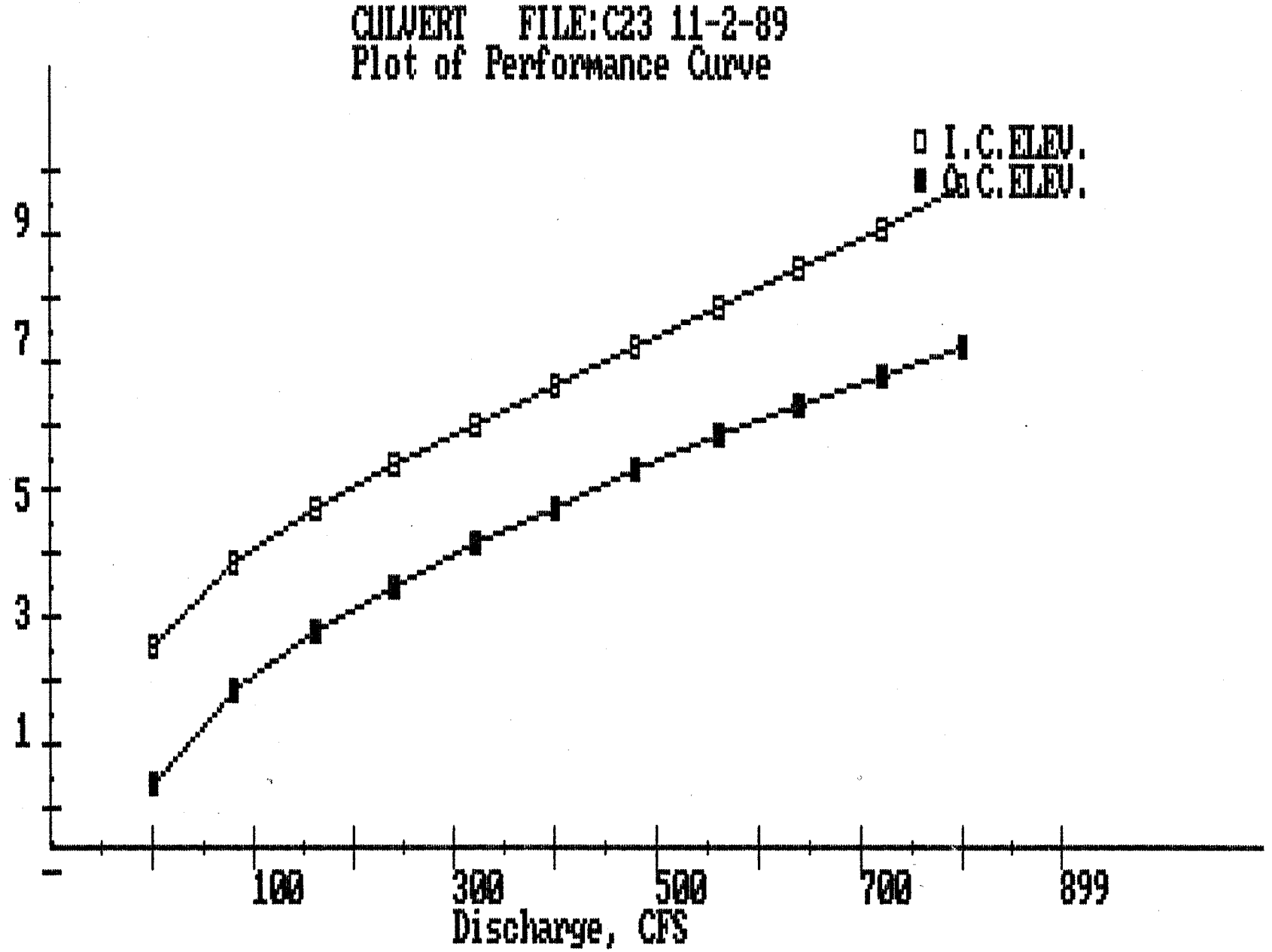
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	2.10	0.00	0.00	-2.10	0.00	0.00
80.00	3.45	0.72	1.35	-0.63	0.72	6.96
160.00	4.25	1.08	2.15	0.23	1.08	9.29
240.00	4.94	1.36	2.84	0.96	1.36	11.05
320.00	5.59	1.60	3.49	1.60	1.60	12.50
400.00	6.21	1.81	4.11	2.20	1.81	13.78
480.00	6.80	2.01	4.70	2.75	2.01	14.93
560.00	7.39	2.19	5.29	3.28	2.19	15.99
640.00	7.99	2.36	5.89	3.78	2.36	16.98
720.00	8.62	2.51	6.52	4.26	2.51	17.91
800.00	9.28	2.66	7.18	4.72	2.66	18.78

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Hw = 8.6' ∴ CAPACITY = 717 cfs


CULVERT FILE:C23 11-2-89
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
9
7
5
3
1
100
300
500
700
899
Discharge, CFS

C24 Q100 = 885 cfs

Discharge taken from

Star Valley Sub-Basin Study

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE : C24 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 5 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(1) THIN EDGE PROJECTING
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	1.61
2	200.00	0.78	4.10	0.49
3	400.00	1.18	5.32	0.74
4	600.00	1.50	6.19	0.94
5	800.00	1.78	6.87	1.11
6	1000.00	2.03	7.45	1.27
7	1200.00	2.26	7.95	1.41
8	1400.00	2.47	8.39	1.54
9	1600.00	2.67	8.79	1.67
10	1800.00	2.86	9.16	1.79
11	2000.00	3.05	9.50	1.90

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 6/13/88
CULVERT FILE NAME: c24 SUMMARY TABLE

CU LV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.51	0.00	51	10-CSP	60	60	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

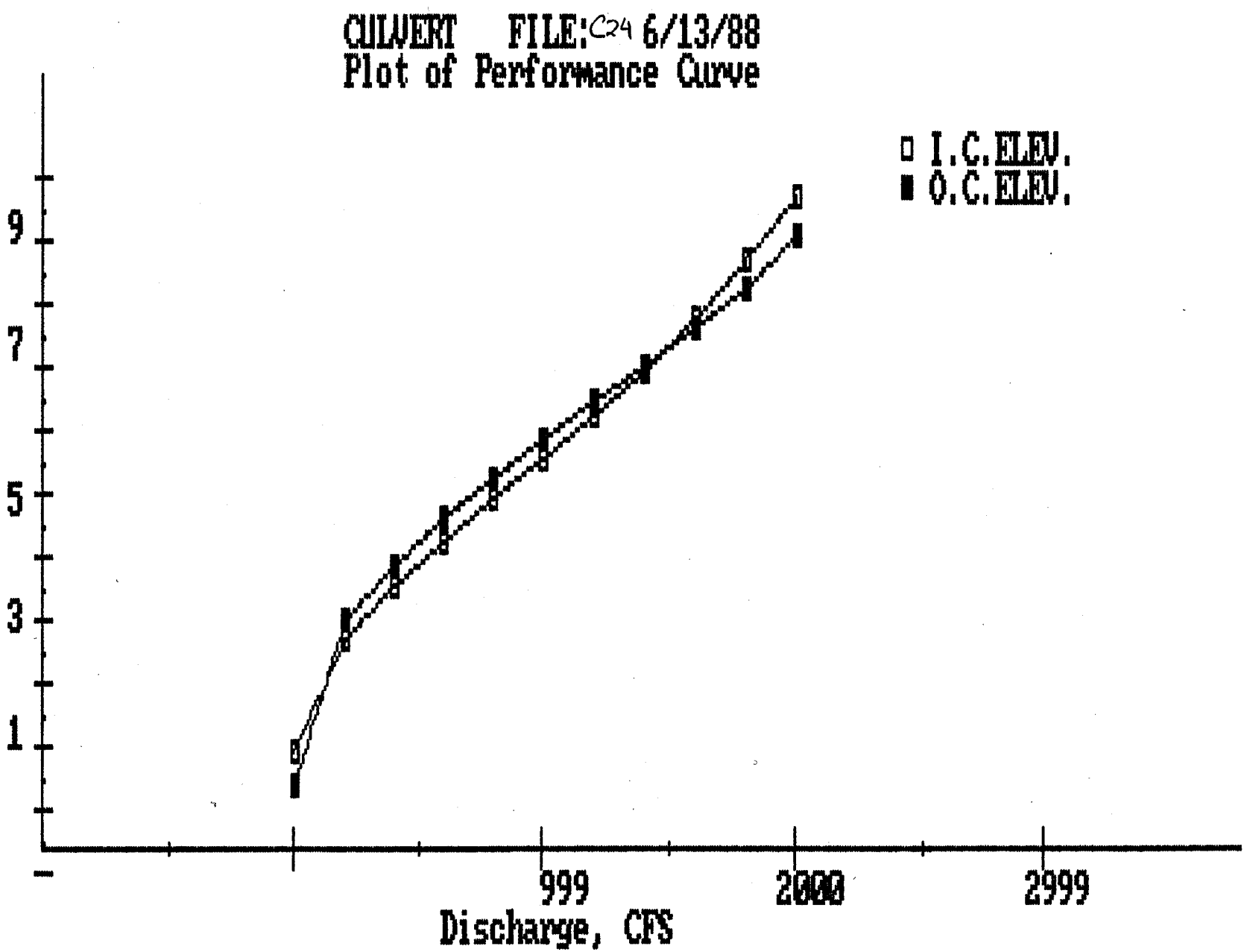
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 10 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.51	0.00	0.00	-0.51	0.00	0.00
200.00	2.58	0.78	1.81	2.07	1.21	5.40
400.00	3.44	1.18	2.62	2.93	1.75	6.52
600.00	4.20	1.50	3.31	3.69	2.16	7.37
800.00	4.82	1.78	3.96	4.31	2.52	8.08
1000.00	5.44	2.03	4.60	4.93	2.83	8.72
1200.00	6.01	2.26	5.26	5.50	3.12	9.32
1400.00	6.58	2.47	5.99	6.07	3.38	9.92
1600.00	7.31	2.68	6.80	6.65	3.62	10.54
1800.00	8.22	2.87	7.71	7.27	3.83	11.18
2000.00	9.24	3.05	8.73	8.10	4.03	11.80

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 7.5'
∴ Capacity ≈ 1644 cfs


CULVERT FILE: C24 6/13/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
9
7
5
3
1
999
2000
2999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C25

WATERSHED AREA (A): 2702.00 acres

LENGTH OF WATERCOURSE (Lc): 20700. ft

LENGTH TO CENTER OF GRAVITY (Lca): 10000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
2000.	1152.0
10000.	142.0
8700.	65.0

MEAN SLOPE (Sc): .0122 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

43. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
2. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
55. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.298	.446	.522	.598	.652	.694
Tc (FUNCTION OF i) :	166.63	141.74	133.08	126.01	121.75	118.74
SOLUTION OF Tc (MINUTES):	243	161	134	112	99	89
RAINFL INT. @ Tc (IN/HR):	.389	.726	.981	1.340	1.683	2.055
RUNOFF RATE @ Tc (IN/HR):	.116	.324	.512	.802	1.097	1.426
PEAK DISCHARGE (CFS) :	315.	881.	1395.	2184.	2988.	3884.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE :# C25 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	450.00	0.94	4.66	0.59
3	900.00	1.42	6.08	0.89
4	1350.00	1.81	7.08	1.13
5	1800.00	2.14	7.89	1.34
6	2250.00	2.45	8.57	1.53
7	2700.00	2.72	9.16	1.70
8	3150.00	2.98	9.69	1.86
9	3600.00	3.23	10.17	2.01
10	4050.00	3.46	10.61	2.16
11	4500.00	3.68	11.01	2.30

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: # C25 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.61	0.00	61	10-RCB	120	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

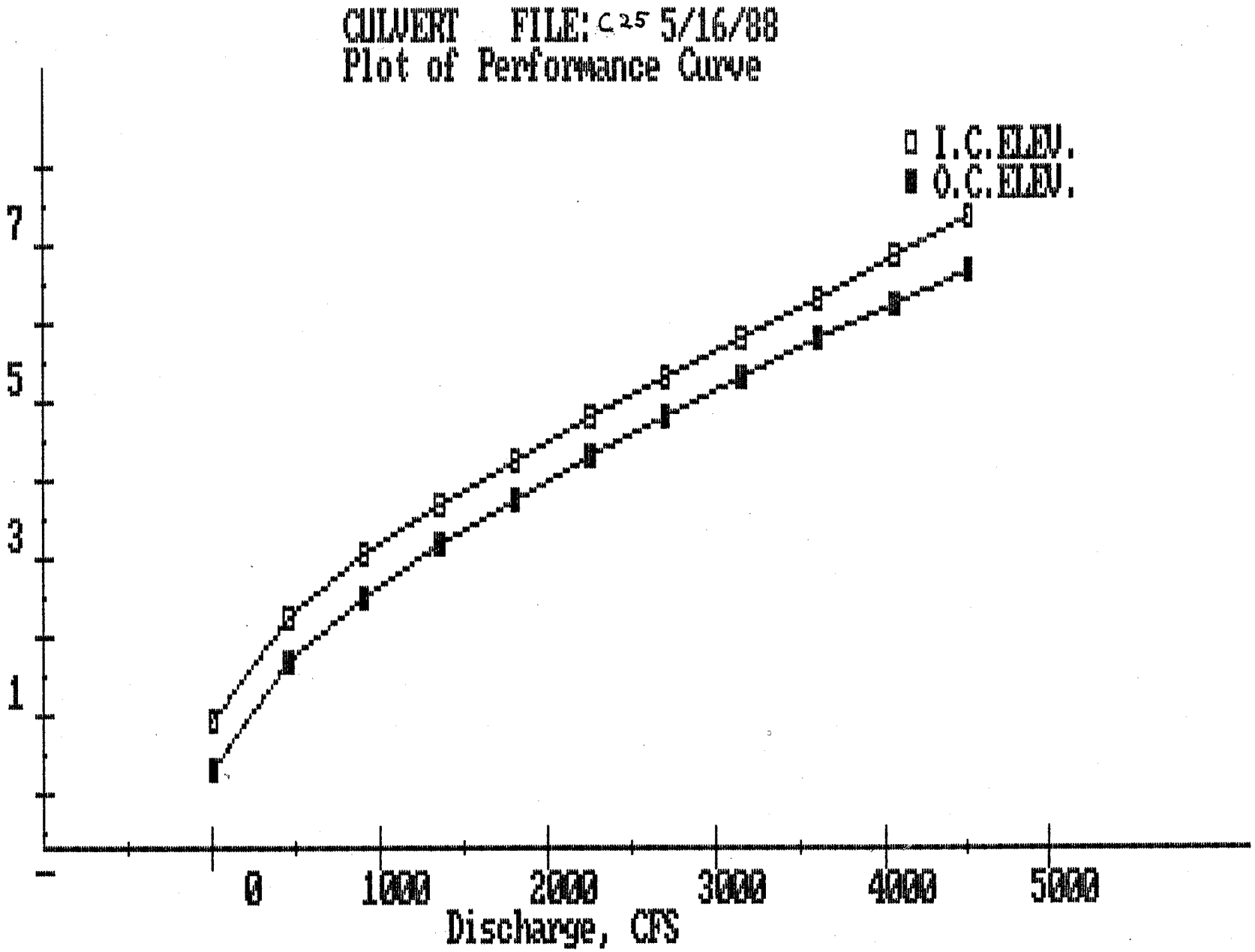
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 10 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.61	0.00	0.00	-0.61	0.00	0.00
450.00	1.96	0.94	1.35	0.76	0.94	4.79
900.00	2.76	1.42	2.15	1.56	1.42	6.34
1350.00	3.40	1.81	2.79	2.24	1.81	7.47
1800.00	3.96	2.14	3.35	2.84	2.14	8.40
2250.00	4.49	2.45	3.88	3.40	2.45	9.19
2700.00	5.00	2.72	4.39	3.92	2.72	9.91
3150.00	5.51	2.98	4.90	4.40	2.98	10.56
3600.00	6.02	3.23	5.41	4.87	3.23	11.15
4050.00	6.54	3.46	5.93	5.32	3.46	11.71
4500.00	7.09	3.68	6.48	5.75	3.68	12.23

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 6.82
∴ capacity = 4279 cfs


CULVERT FILE: C25 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
7
5
3
1
0
1000
2000
3000
4000
5000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C26

WATERSHED AREA (A): 332.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
8000.	205.0

MEAN SLOPE (Sc): .0256 ft BASIN FACTOR (Nb): .0340

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 15. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.441	.581	.648	.712	.755	.788
Tc (FUNCTION OF i) :	43.74	39.18	37.51	36.13	35.28	34.68
SOLUTION OF Tc (MINUTES):	35	26	23	20	18	17
RAINFL INT. @ Tc (IN/HR):	1.795	2.825	3.529	4.494	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.792	1.641	2.285	3.199	4.073	4.893
PEAK DISCHARGE (CFS) :	265.	549.	765.	1070.	1363.	1637.

CULVERT ANALYSIS 1.1 DATE: 5/17/88
CULVERT FILE : c26 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 4.5 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(1) THIN EDGE PROJECTING
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	2.16
2	100.00	1.08	3.97	0.47
3	200.00	1.61	5.00	0.70
4	300.00	2.02	5.69	0.88
5	400.00	2.37	6.22	1.04
6	500.00	2.68	6.65	1.17
7	600.00	2.96	7.03	1.29
8	700.00	3.21	7.35	1.40
9	800.00	3.45	7.64	1.51
10	900.00	3.67	7.91	1.60
11	1000.00	3.88	8.15	1.69

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/17/88
CULVERT FILE NAME: C26 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.50	0.00	50	4 -CSP	54	54	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

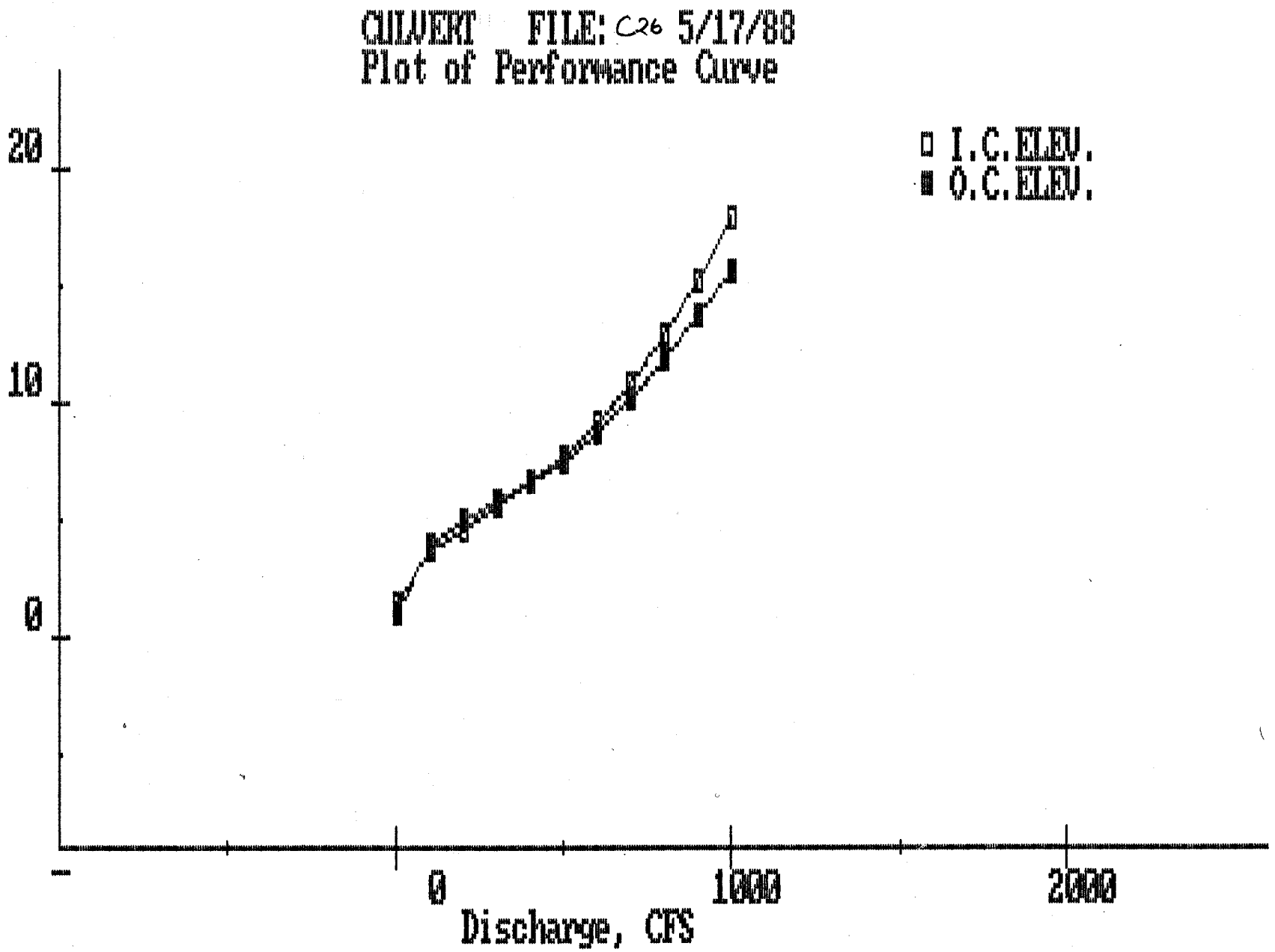
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 4 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.50	0.00	0.00	-0.50	0.00	0.00
100.00	2.84	1.08	2.11	2.34	1.42	5.81
200.00	3.97	1.61	3.13	3.47	2.03	7.18
300.00	4.87	2.02	4.07	4.37	2.52	8.21
400.00	5.69	2.37	5.06	5.19	2.93	9.14
500.00	6.72	2.68	6.22	6.06	3.28	10.08
600.00	8.13	2.96	7.63	7.15	3.59	11.02
700.00	9.83	3.21	9.33	8.64	3.81	12.22
800.00	11.86	3.45	11.36	10.24	4.03	13.32
900.00	14.24	3.67	13.74	12.12	4.50	14.15
1000.00	16.94	3.88	16.44	14.03	4.50	15.72

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 6.0'
∴ Capacity = 430 cfs


CULVERT FILE: C26 5/17/88
Plot of Performance Curve
I.C. ELEV.
O.C. ELEV.
20
10
0
0
1000
2000
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C27

WATERSHED AREA (A): 758.00 acres

LENGTH OF WATERCOURSE (Lc): 13000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 6500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
13000.	239.0

MEAN SLOPE (Sc): .0184 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

16. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
4. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
80. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.350	.502	.576	.649	.700	.738
Tc (FUNCTION OF i) :	75.48	65.36	61.83	58.96	57.23	56.01
SOLUTION OF Tc (MINUTES):	74	51	44	38	34	31
RAINFL INT. @ Tc (IN/HR):	1.046	1.850	2.359	3.071	3.750	4.426
RUNOFF RATE @ Tc (IN/HR):	.366	.929	1.360	1.994	2.623	3.267
PEAK DISCHARGE (CFS) :	280.	709.	1039.	1524.	2004.	2496.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C27 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM: 0
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	2.30
2	250.00	1.00	4.74	0.62
3	500.00	1.50	6.12	0.94
4	750.00	1.90	7.08	1.19
5	1000.00	2.25	7.83	1.40
6	1250.00	2.56	8.46	1.60
7	1500.00	2.85	9.00	1.78
8	1750.00	3.11	9.48	1.94
9	2000.00	3.36	9.92	2.09
10	2250.00	3.59	10.31	2.24
11	2500.00	3.81	10.67	2.38

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C27 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.61	0.00	61	3 -RCB	120	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

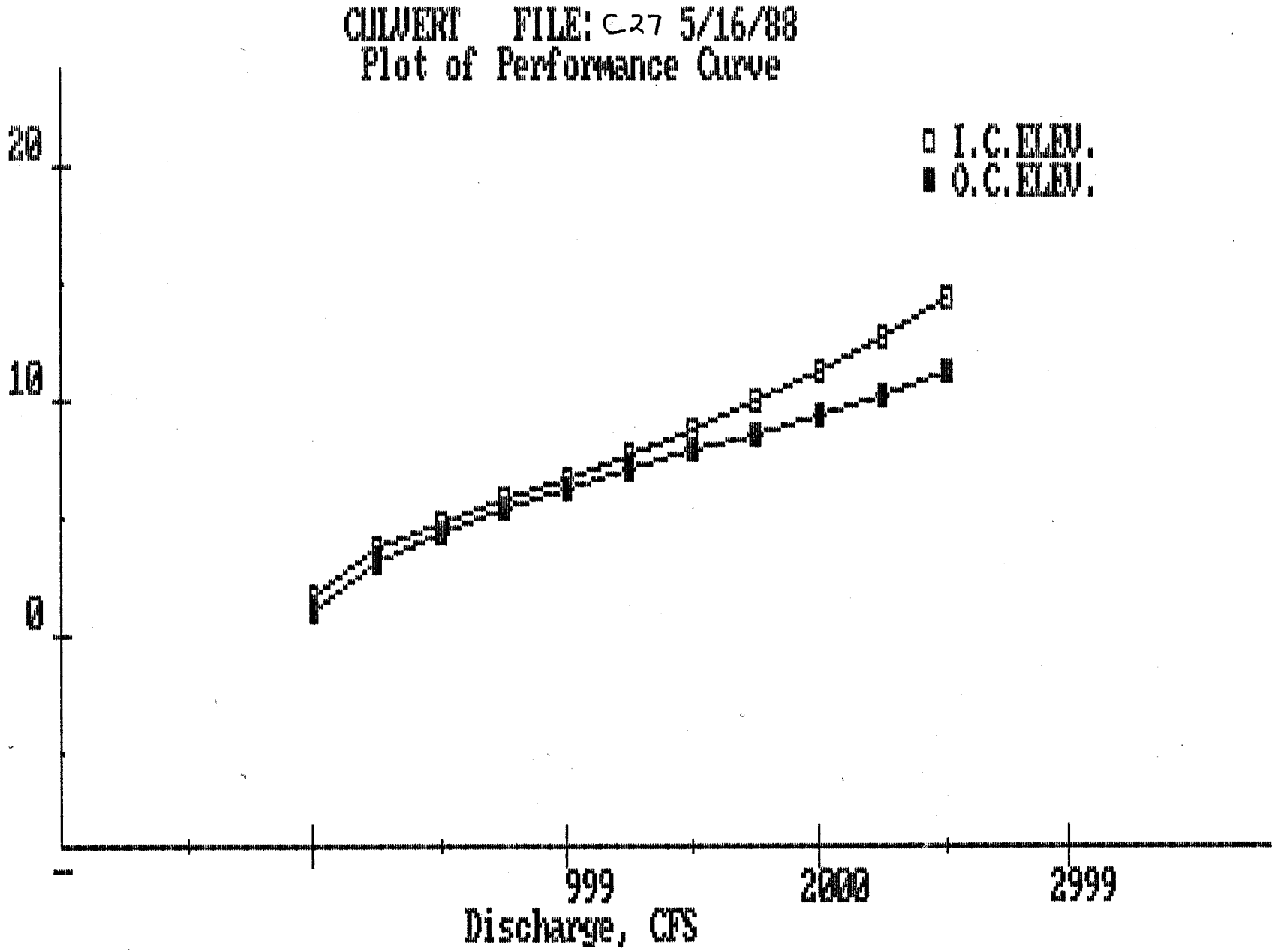
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 3 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.61	0.00	0.00	-0.61	0.00	0.00
250.00	2.65	1.00	2.04	1.46	1.00	8.38
500.00	3.80	1.50	3.19	2.67	1.50	10.90
750.00	4.78	1.90	4.17	3.69	1.90	12.14
1000.00	5.72	2.25	5.11	4.60	2.25	14.81
1250.00	6.68	2.56	6.07	5.43	2.56	16.26
1500.00	7.73	2.85	7.12	6.21	2.85	17.56
1750.00	8.91	3.11	8.30	6.95	3.11	18.74
2000.00	10.22	3.36	9.61	7.70	3.37	19.81
2250.00	11.71	3.59	11.10	8.58	3.66	20.47
2500.00	13.36	3.81	12.75	9.57	3.96	21.06

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 6.61
∴ Capacity = 1231 cfs


CULVERT FILE: C27 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
999
2000
2999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C28-29

WATERSHED AREA (A): 67.00 acres

LENGTH OF WATERCOURSE (Lc): 4900. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2450. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4900.	210.0

MEAN SLOPE (Sc): .0429 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

34. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
66. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.349	.491	.563	.635	.685	.724
Tc (FUNCTION OF i) :	38.59	33.64	31.85	30.36	29.46	28.81
SOLUTION OF Tc (MINUTES):	29	21	18	16	15	13
RAINFL INT. @ Tc (IN/HR):	2.021	3.189	4.027	5.013	5.856	7.012
RUNOFF RATE @ Tc (IN/HR):	.705	1.567	2.269	3.183	4.010	5.074
PEAK DISCHARGE (CFS) :	48.	106.	153.	215.	271.	343.

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE : C28 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 49 IN RISE = 32 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	YES

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	10.00	0.21	2.26	0.23
3	20.00	0.32	2.94	0.34
4	30.00	0.41	3.43	0.44
5	40.00	0.49	3.81	0.52
6	50.00	0.56	4.14	0.59
7	60.00	0.62	4.42	0.66
8	70.00	0.68	4.68	0.72
9	80.00	0.73	4.90	0.78
10	90.00	0.79	5.11	0.84
11	100.00	0.84	5.31	0.89

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE NAME: C26 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	49	32	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

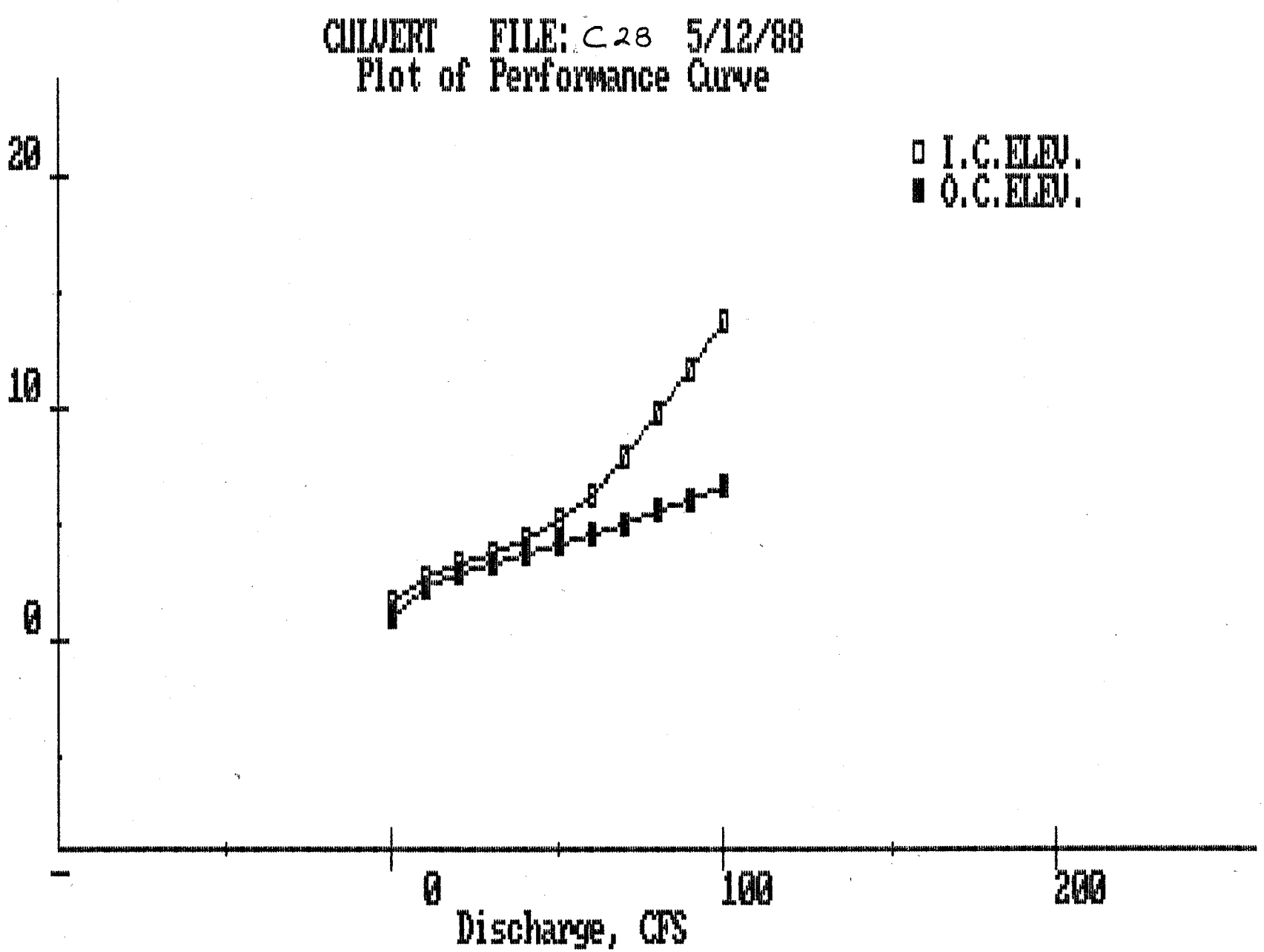
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.69	0.21	1.09	0.65	0.58	6.77
20.00	2.24	0.32	1.64	1.25	0.83	7.75
30.00	2.77	0.41	2.17	1.73	1.03	8.52
40.00	3.37	0.49	2.77	2.16	1.21	10.30
50.00	4.15	0.56	3.55	2.58	1.37	10.97
→ 60.00	5.24	0.62	4.64	3.01	1.52	11.57
70.00	6.77	0.68	6.17	3.46	1.66	12.04
80.00	8.80	0.74	8.20	3.92	1.82	12.43
90.00	10.62	0.79	10.02	4.42	1.99	12.72
100.00	12.66	0.84	12.06	4.98	2.18	12.86

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.26'
∴ Culvert capacity = 60 cfs


CULVERT FILE: C28 5/12/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
100
200
Discharge, CFS

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C29 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 30 IN RISE = 19 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	10.00	0.31	1.55	0.10
3	20.00	0.47	2.01	0.15
4	30.00	0.59	2.33	0.18
5	40.00	0.70	2.58	0.22
6	50.00	0.80	2.80	0.25
7	60.00	0.89	2.98	0.28
8	70.00	0.97	3.14	0.30
9	80.00	1.05	3.29	0.33
10	90.00	1.12	3.43	0.35
11	100.00	1.19	3.55	0.37

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C29 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.30	0.00	60	1 -RCPE	30	19	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

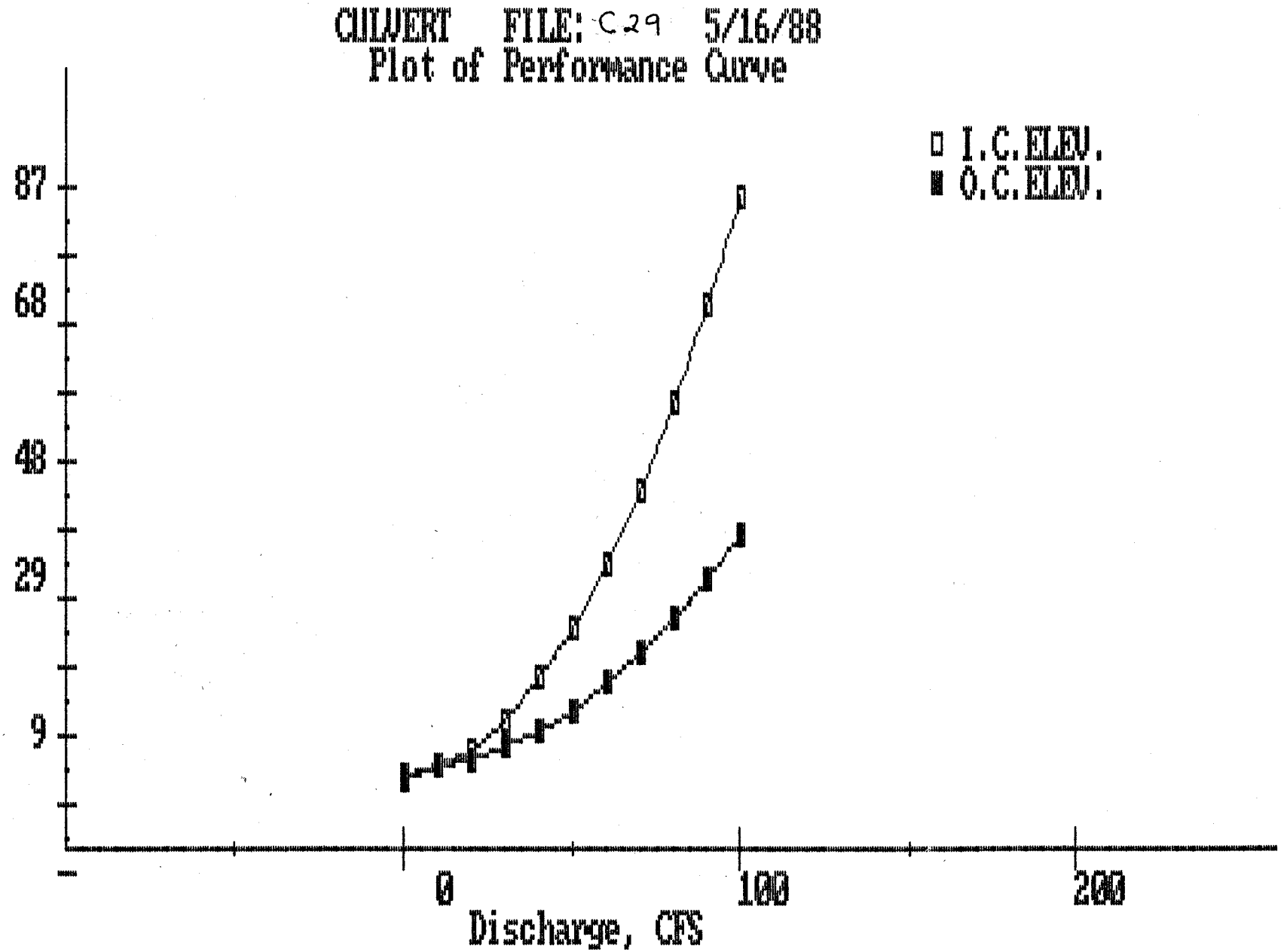
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.30	0.00	0.00	-0.30	0.00	0.00
10.00	1.78	0.31	1.48	1.24	0.86	5.65
→ 20.00	4.12	0.47	3.82	2.44	1.33	7.01
30.00	8.40	0.59	8.10	4.22	1.58	9.36
40.00	14.09	0.70	13.79	6.50	1.58	12.48
50.00	21.40	0.80	21.10	9.43	1.58	15.60
60.00	30.33	0.89	30.03	13.01	1.58	18.72
70.00	40.89	0.97	40.59	17.25	1.58	21.84
80.00	53.07	1.05	52.77	22.13	1.58	24.96
90.00	66.88	1.12	66.58	27.67	1.58	28.08
100.00	82.31	1.19	82.01	33.86	1.58	31.20

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W = 3.98
∴ capacity ≅ 18 cfs


CULVERT FILE: C29 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
87
68
48
29
9
0
100
200
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C30

WATERSHED AREA (A): 44.00 acres

LENGTH OF WATERCOURSE (Lc): 3600. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1800. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3600.	70.0

MEAN SLOPE (Sc): .0194 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

88. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
12. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.245	.382	.457	.535	.592	.637
Tc (FUNCTION OF i) :	50.63	42.43	39.49	37.07	35.61	34.57
SOLUTION OF Tc (MINUTES):	42	29	24	21	18	17
RAINFL INT. @ Tc (IN/HR):	1.594	2.660	3.452	4.359	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.391	1.015	1.576	2.331	3.191	3.955
PEAK DISCHARGE (CFS) :	17.	45.	70.	103.	142.	175.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C30 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.37
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C30 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

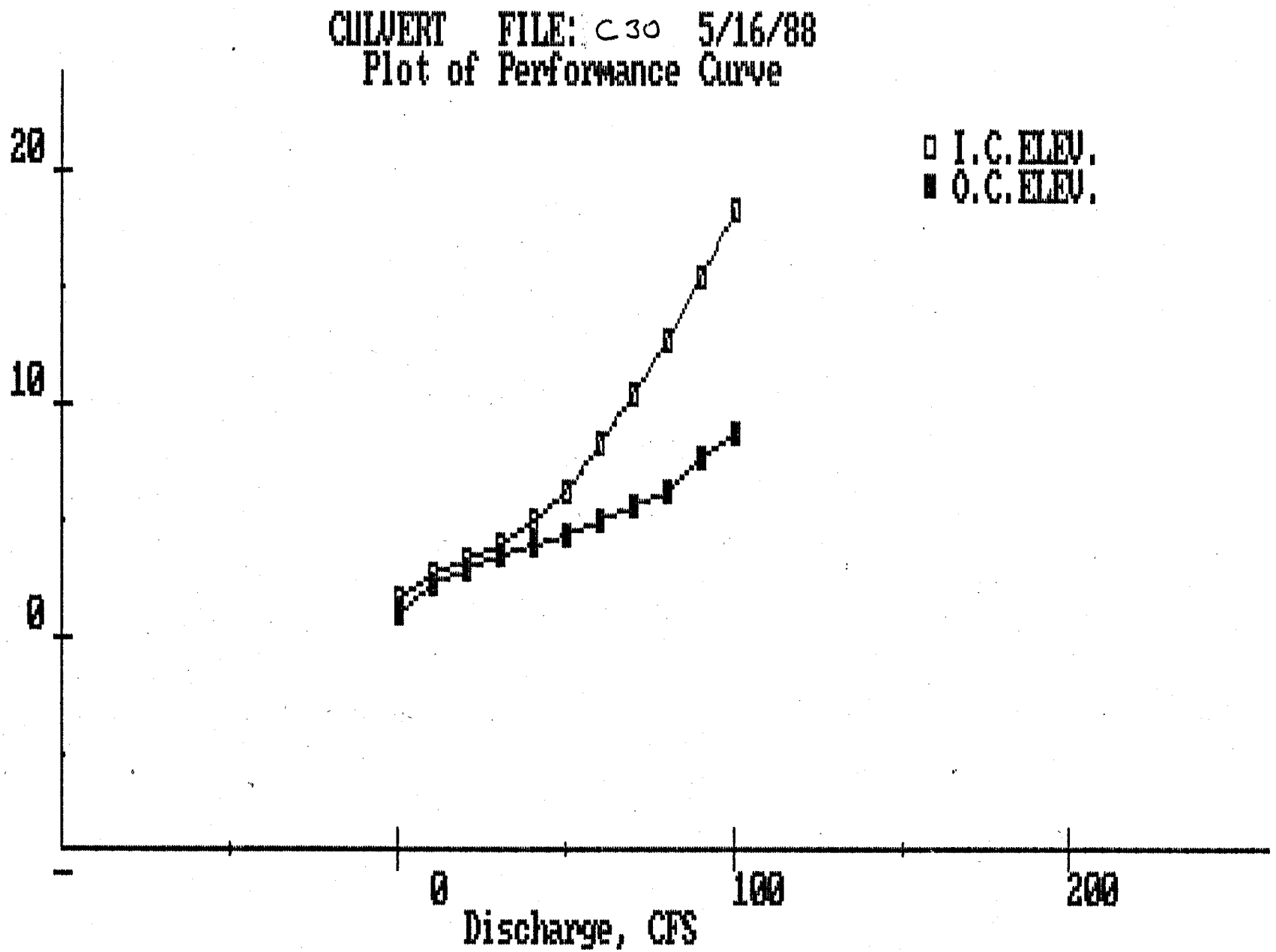
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.72	0.25	1.12	0.69	0.59	6.88
20.00	2.34	0.38	1.74	1.31	0.86	7.93
30.00	2.98	0.48	2.38	1.82	1.07	8.63
40.00	3.86	0.57	3.26	2.31	1.26	10.37
50.00	5.19	0.65	4.59	2.80	1.43	11.04
60.00	7.21	0.73	6.61	3.33	1.61	11.55
70.00	9.40	0.79	8.80	3.89	1.80	11.92
80.00	11.72	0.86	11.12	4.53	2.05	12.01
90.00	14.35	0.92	13.75	6.09	2.42	12.13
100.00	17.29	0.98	16.69	7.10	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.01
∴ Capacity = 48 cfs


CULVERT FILE: C30 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
100
200
Discharge, CFS

3/12

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C31

WATERSHED AREA (A): 140.00 acres

LENGTH OF WATERCOURSE (Lc): 6400. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1800.	800.0
4600.	107.0

MEAN SLOPE (Sc): .0379 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

35. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
65. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.347	.489	.561	.633	.683	.722
Tc (FUNCTION OF i) :	50.96	44.41	42.03	40.06	38.86	38.01
SOLUTION OF Tc (MINUTES):	43	31	26	23	20	19
RAINFL INT. @ Tc (IN/HR):	1.569	2.544	3.279	4.155	5.111	5.863
RUNOFF RATE @ Tc (IN/HR):	.544	1.245	1.841	2.630	3.491	4.233
PEAK DISCHARGE (CFS) :	77.	176.	260.	371.	493.	597.

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE : C3\ CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 49 IN RISE = 32 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	10.00	0.15	3.27	0.53
3	20.00	0.23	4.28	0.80
4	30.00	0.29	5.00	1.02
5	40.00	0.34	5.57	1.21
6	50.00	0.39	6.06	1.39
7	60.00	0.43	6.49	1.54
8	70.00	0.48	6.87	1.69
9	80.00	0.51	7.22	1.83
10	90.00	0.55	7.53	1.96
11	100.00	0.59	7.83	2.09

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE NAME: C3\ SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	49	32	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

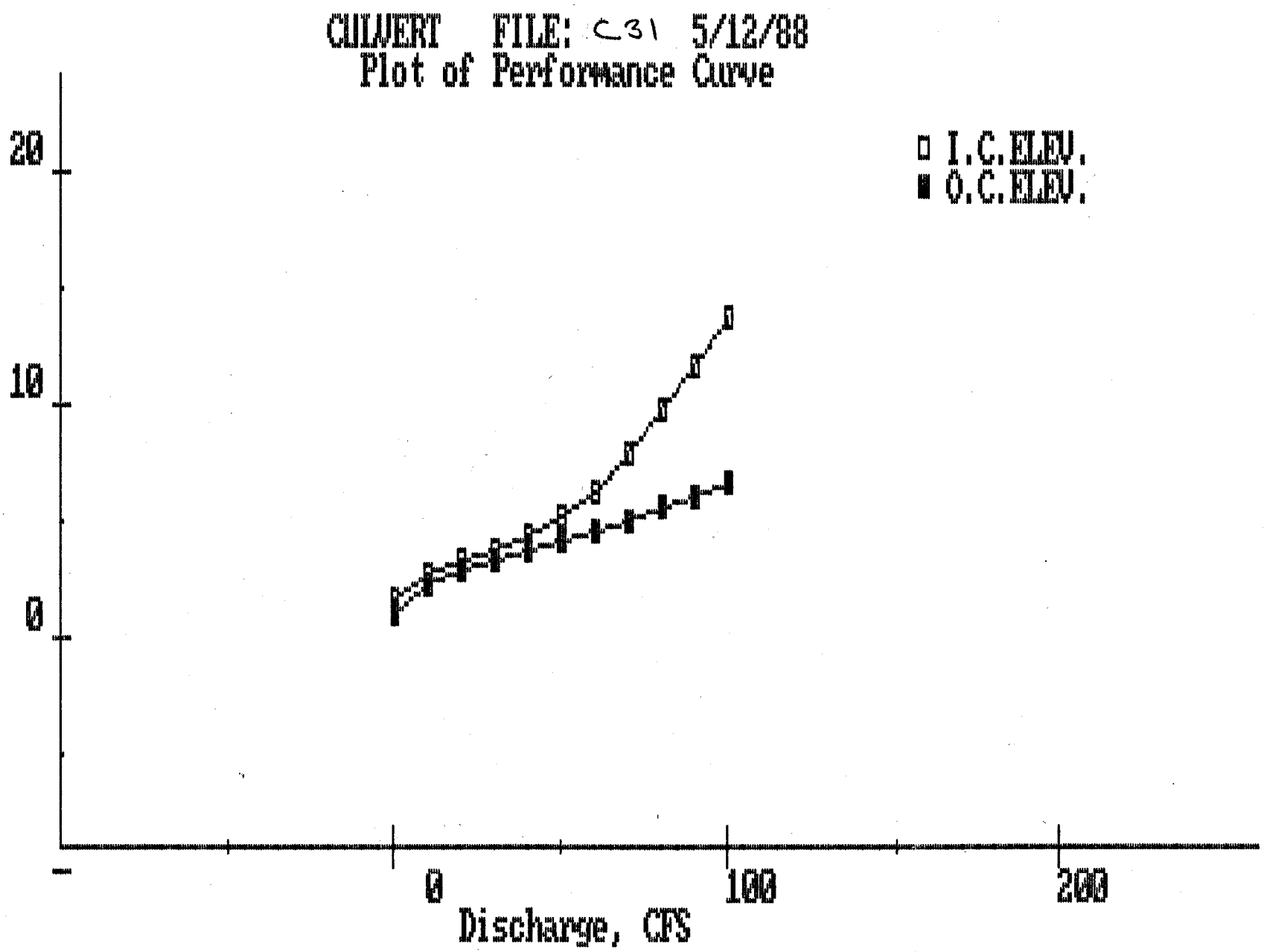
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.69	0.15	1.09	0.65	0.58	6.77
20.00	2.24	0.23	1.64	1.25	0.83	7.75
30.00	2.77	0.29	2.17	1.73	1.03	8.52
40.00	3.37	0.34	2.77	2.16	1.21	10.30
50.00	4.15	0.39	3.55	2.58	1.37	10.97
60.00	5.24	0.43	4.64	3.01	1.52	11.57
70.00	6.77	0.48	6.17	3.46	1.66	12.04
80.00	8.80	0.51	8.20	3.92	1.82	12.43
90.00	10.62	0.55	10.02	4.42	1.99	12.72
100.00	12.66	0.59	12.06	4.98	2.18	12.86

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W = 5.22
∴ Capacity = 60 cfs


CULVERT FILE: C31 5/12/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
100
200
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C32

WATERSHED AREA (A): 23.00 acres

LENGTH OF WATERCOURSE (Lc): 2200. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1100. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
2200.	35.0

MEAN SLOPE (Sc): .0159 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.222	.357	.433	.513	.571	.618
Tc (FUNCTION OF i) :	42.46	35.13	32.53	30.41	29.12	28.22
SOLUTION OF Tc (MINUTES):	33	23	19	16	14	13
RAINFL INT. @ Tc (IN/HR):	1.858	3.040	3.912	5.013	6.087	7.012
RUNOFF RATE @ Tc (IN/HR):	.413	1.086	1.694	2.570	3.475	4.332
PEAK DISCHARGE (CFS) :	9.58	25.19	39.27	59.58	80.56	100.44

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE : C32 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 49 IN RISE = 32 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	10.00	0.15	3.27	0.53
3	20.00	0.23	4.28	0.80
4	30.00	0.29	5.00	1.02
5	40.00	0.34	5.57	1.21
6	50.00	0.39	6.06	1.39
7	60.00	0.43	6.49	1.54
8	70.00	0.48	6.87	1.69
9	80.00	0.51	7.22	1.83
10	90.00	0.55	7.53	1.96
11	100.00	0.59	7.83	2.09

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE NAME: C32 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	49	32	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

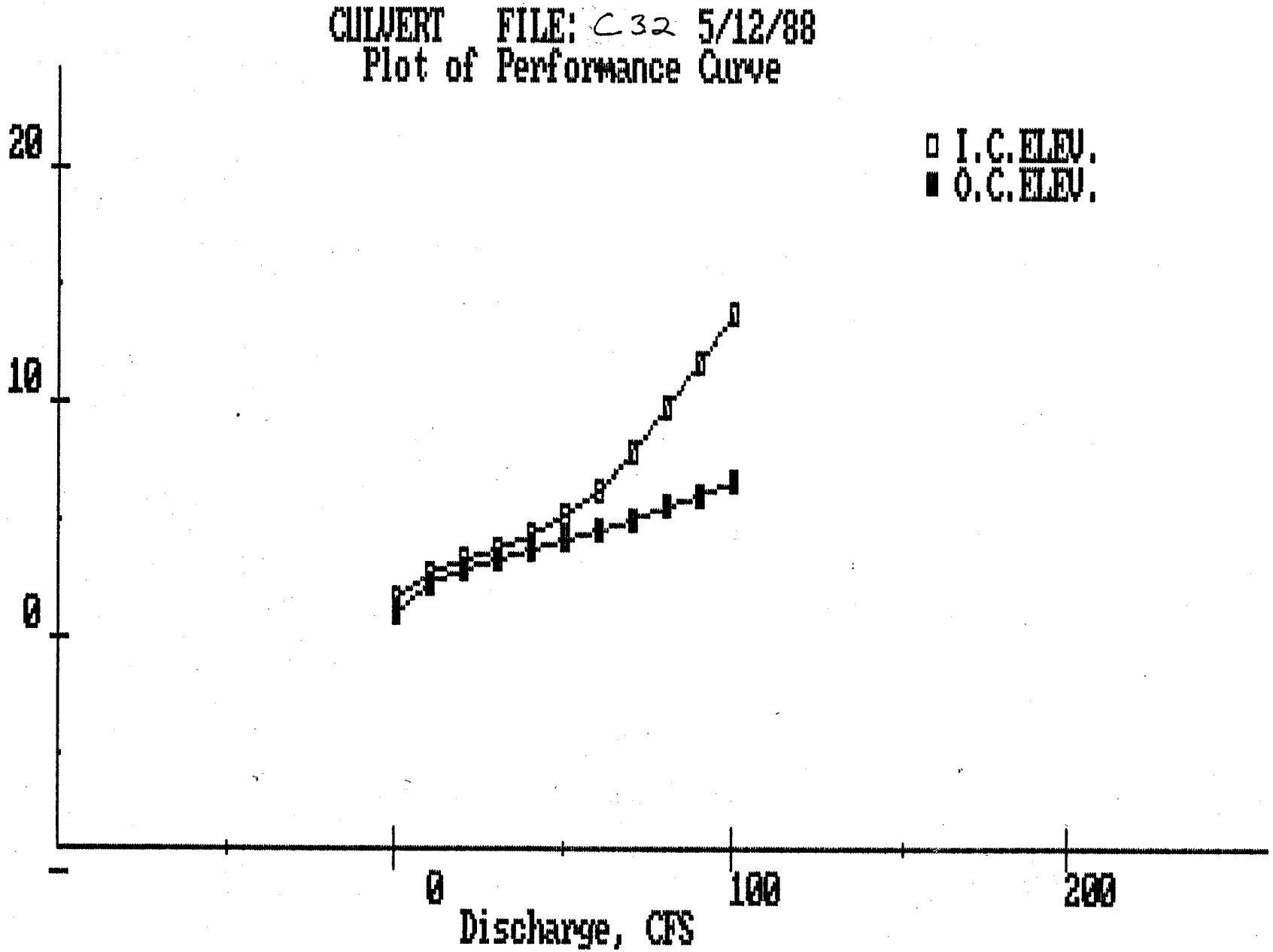
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.69	0.15	1.09	0.65	0.58	6.77
20.00	2.24	0.23	1.64	1.25	0.83	7.75
30.00	2.77	0.29	2.17	1.73	1.03	8.52
40.00	3.37	0.34	2.77	2.16	1.21	10.30
50.00	4.15	0.39	3.55	2.58	1.37	10.97
60.00	5.24	0.43	4.64	3.01	1.52	11.57
70.00	6.77	0.48	6.17	3.46	1.66	12.04
80.00	8.80	0.51	8.20	3.92	1.82	12.43
90.00	10.62	0.55	10.02	4.42	1.99	12.72
100.00	12.66	0.59	12.06	4.98	2.18	12.86

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W = 5.22
∴ Capacity = 60 cfs


CULVERT FILE: C32 5/12/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
100
200
Discharge, CFS

370

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C33

WATERSHED AREA (A): 680.00 acres

LENGTH OF WATERCOURSE (Lc): 10150. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5075. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
750.	240.0
9400.	204.0

MEAN SLOPE (Sc): .0243 ft BASIN FACTOR (Nb): .0420

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

55. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
45. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 17. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.355	.486	.554	.623	.672	.711
Tc (FUNCTION OF i) :	69.45	61.26	58.13	55.46	53.81	52.62
SOLUTION OF Tc (MINUTES):	66	47	40	35	31	29
RAINFL INT. @ Tc (IN/HR):	1.155	1.950	2.512	3.229	3.955	4.627
RUNOFF RATE @ Tc (IN/HR):	.410	.948	1.393	2.013	2.659	3.289
PEAK DISCHARGE (CFS) :	281.	650.	955.	1380.	1823.	2255.

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE : C33 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 12 FT X 6 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(1) SQUARE EDGE (90-45 DEG.)
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	200.00	1.55	5.23	0.77
3	400.00	2.29	6.51	1.14
4	600.00	2.85	7.36	1.42
5	800.00	3.33	8.01	1.66
6	1000.00	3.75	8.55	1.87
7	1200.00	4.12	9.00	2.06
8	1400.00	4.46	9.40	2.23
9	1600.00	4.78	9.75	2.38
10	1800.00	5.07	10.08	2.53
11	2000.00	5.35	10.37	2.67

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/12/88
CULVERT FILE NAME: C33 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.23	0.00	47	3 -RCB	144	72	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

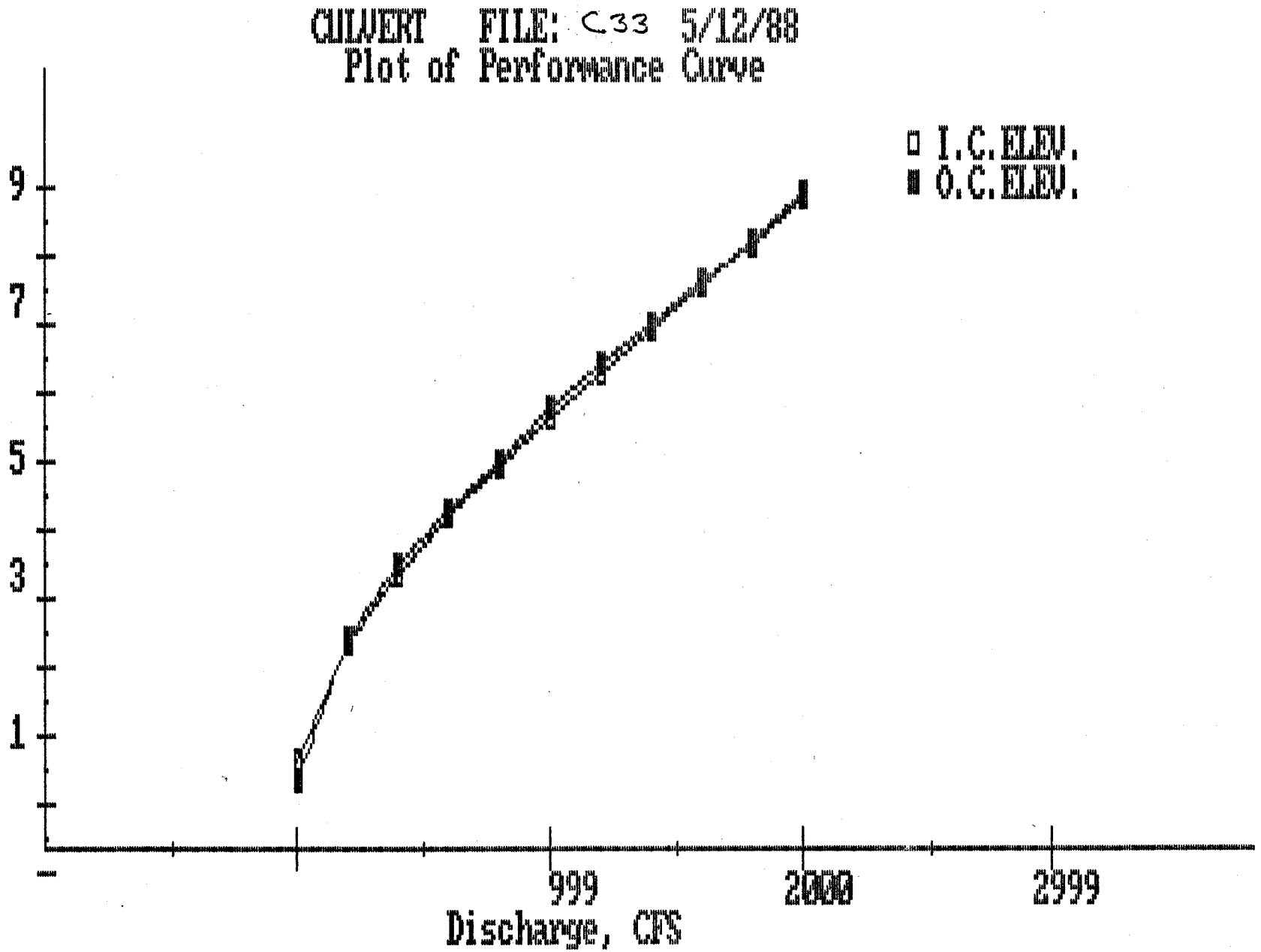
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 3 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.23	0.00	0.00	-0.23	0.00	0.00
200.00	1.96	1.55	1.69	1.73	1.55	3.58
400.00	2.99	2.29	2.68	2.76	2.29	4.86
600.00	3.82	2.85	3.49	3.59	2.85	5.84
800.00	4.51	3.33	4.20	4.28	3.33	6.68
1000.00	5.25	3.75	4.87	5.02	3.75	7.42
1200.00	5.87	4.12	5.50	5.64	4.12	8.09
1400.00	6.46	4.46	6.12	6.23	4.46	8.72
1600.00	7.04	4.78	6.75	6.81	4.78	9.30
1800.00	7.63	5.07	7.40	7.32	5.07	9.86
2000.00	8.32	5.35	8.09	8.02	5.35	10.39

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W = 7.23'
∴ capacity = 1660 cfs


CULVERT FILE: C33 5/12/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
9
7
5
3
1
999
2000
2999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C34-C35

WATERSHED AREA (A): 105.60 acres

LENGTH OF WATERCOURSE (Lc): 6300. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3150. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
6300.	120.0

MEAN SLOPE (Sc): .0190 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 48. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.513	.599	.647	.697	.733	.762
Tc (FUNCTION OF i) :	35.46	33.31	32.31	31.37	30.74	30.26
SOLUTION OF Tc (MINUTES):	26	21	19	17	15	14
RAINFL INT. @ Tc (IN/HR):	2.146	3.189	3.912	4.878	5.856	6.811
RUNOFF RATE @ Tc (IN/HR):	1.100	1.911	2.530	3.398	4.291	5.189
PEAK DISCHARGE (CFS) :	117.	203.	269.	362.	457.	552.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C-34 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.37
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C34 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

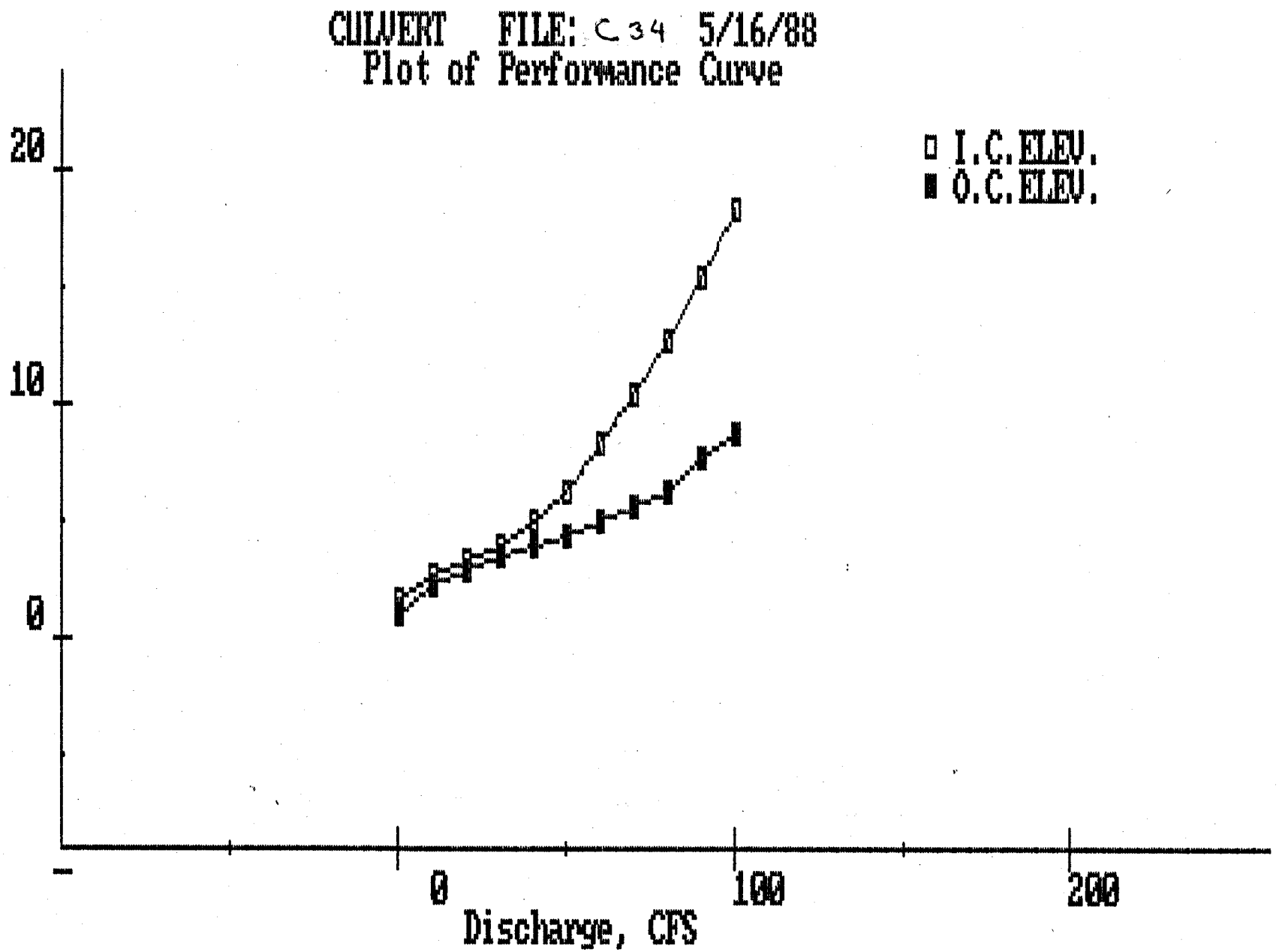
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.72	0.25	1.12	0.69	0.59	6.88
20.00	2.34	0.38	1.74	1.31	0.86	7.93
30.00	2.98	0.48	2.38	1.82	1.07	8.63
40.00	3.86	0.57	3.26	2.31	1.26	10.37
50.00	5.19	0.65	4.59	2.80	1.43	11.04
60.00	7.21	0.73	6.61	3.33	1.61	11.55
70.00	9.40	0.79	8.80	3.89	1.80	11.92
80.00	11.72	0.86	11.12	4.53	2.05	12.01
90.00	14.35	0.92	13.75	6.09	2.42	12.13
100.00	17.29	0.98	16.69	7.10	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.01
∴ Capacity = 48 cfs


CULVERT FILE: C34 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
100
200
Discharge, CFS

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE :C35 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.00
2	20.00	0.56	3.05	0.35
3	40.00	0.83	3.84	0.52
4	60.00	1.05	4.36	0.65
5	80.00	1.23	4.77	0.77
6	100.00	1.38	5.10	0.86
7	120.00	1.53	5.38	0.95
8	140.00	1.66	5.63	1.04
9	160.00	1.78	5.86	1.11
10	180.00	1.89	6.06	1.18
11	200.00	2.00	6.24	1.25

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 7/14/88
CULVERT FILE NAME: C35 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.92	0.00	92	2 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

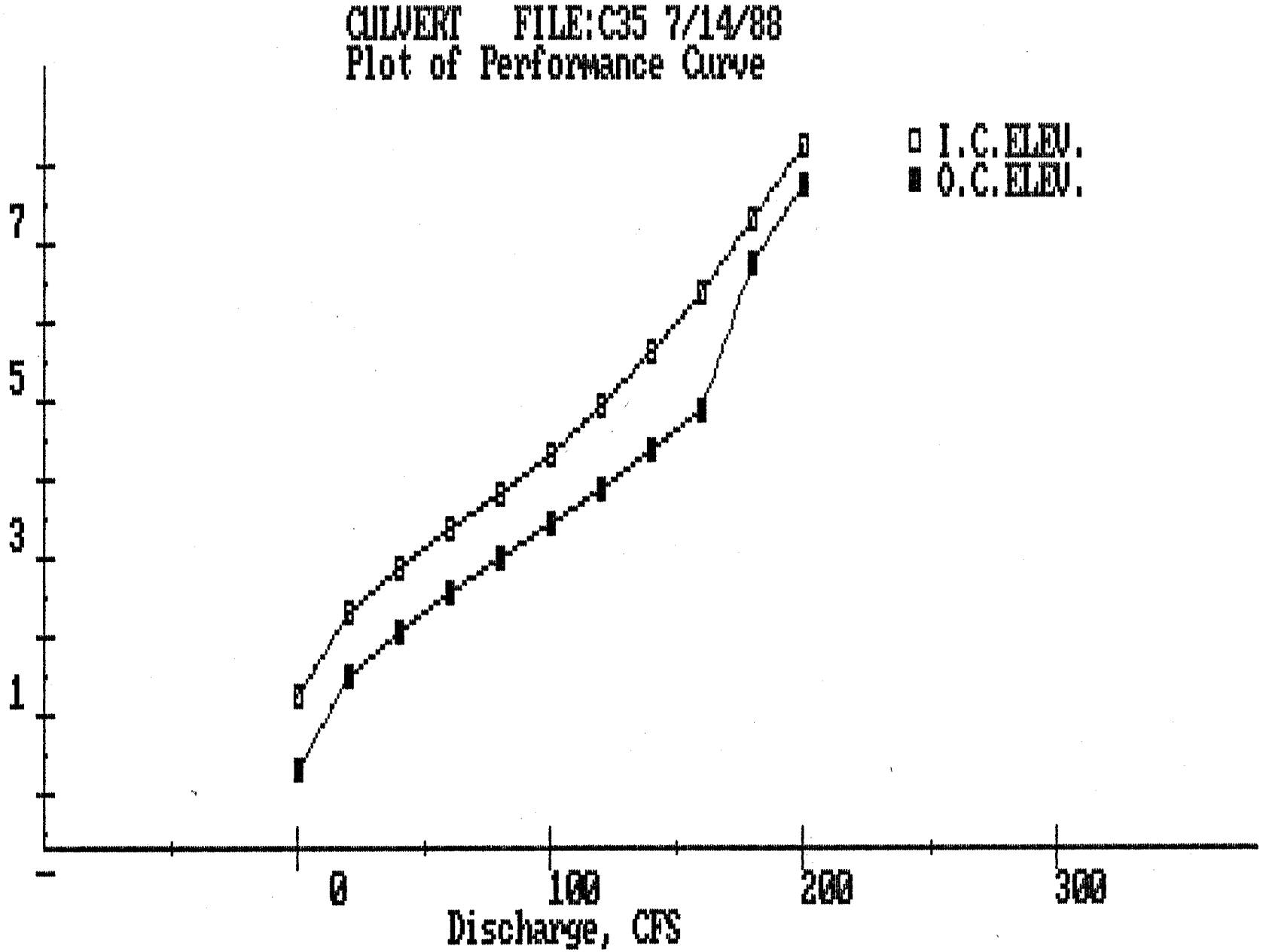
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.92	0.00	0.00	-0.92	0.00	0.00
20.00	2.02	0.56	1.10	0.28	0.59	6.88
40.00	2.57	0.83	1.65	0.85	0.86	8.47
60.00	3.05	1.05	2.13	1.31	1.07	8.89
80.00	3.52	1.23	2.60	1.75	1.26	10.37
100.00	4.03	1.38	3.11	2.18	1.43	11.04
120.00	4.62	1.53	3.70	2.64	1.61	11.55
140.00	5.30	1.66	4.38	3.16	1.80	11.92
160.00	6.09	1.78	5.17	3.66	2.05	12.01
180.00	6.98	1.89	6.06	5.54	2.42	12.13
200.00	7.97	2.00	7.05	6.49	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 4.33
∴ Capacity ≡ 110 cfs


CULVERT FILE:C35 7/14/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
7
5
3
1
0
100
200
300
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C36-38

WATERSHED AREA (A): 124.00 acres

LENGTH OF WATERCOURSE (Lc): 4750. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2375. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft | INCREMENTAL CHANGE IN ELEV (Hi) - ft

4750. | 180.0

MEAN SLOPE (Sc): .0379 ft BASIN FACTOR (Nb): .0280

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 53. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.551	.631	.675	.721	.754	.781
Tc (FUNCTION OF i) :	20.62	19.52	19.01	18.51	18.18	17.93
SOLUTION OF Tc (MINUTES):	13	11	10	9	8	8
RAINFL INT. @ Tc (IN/HR):	3.063	4.312	5.178	6.414	7.679	8.593
RUNOFF RATE @ Tc (IN/HR):	1.687	2.721	3.495	4.622	5.791	6.710
PEAK DISCHARGE (CFS) :	211.	340.	437.	578.	724.	839.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C36 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.37
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C36 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

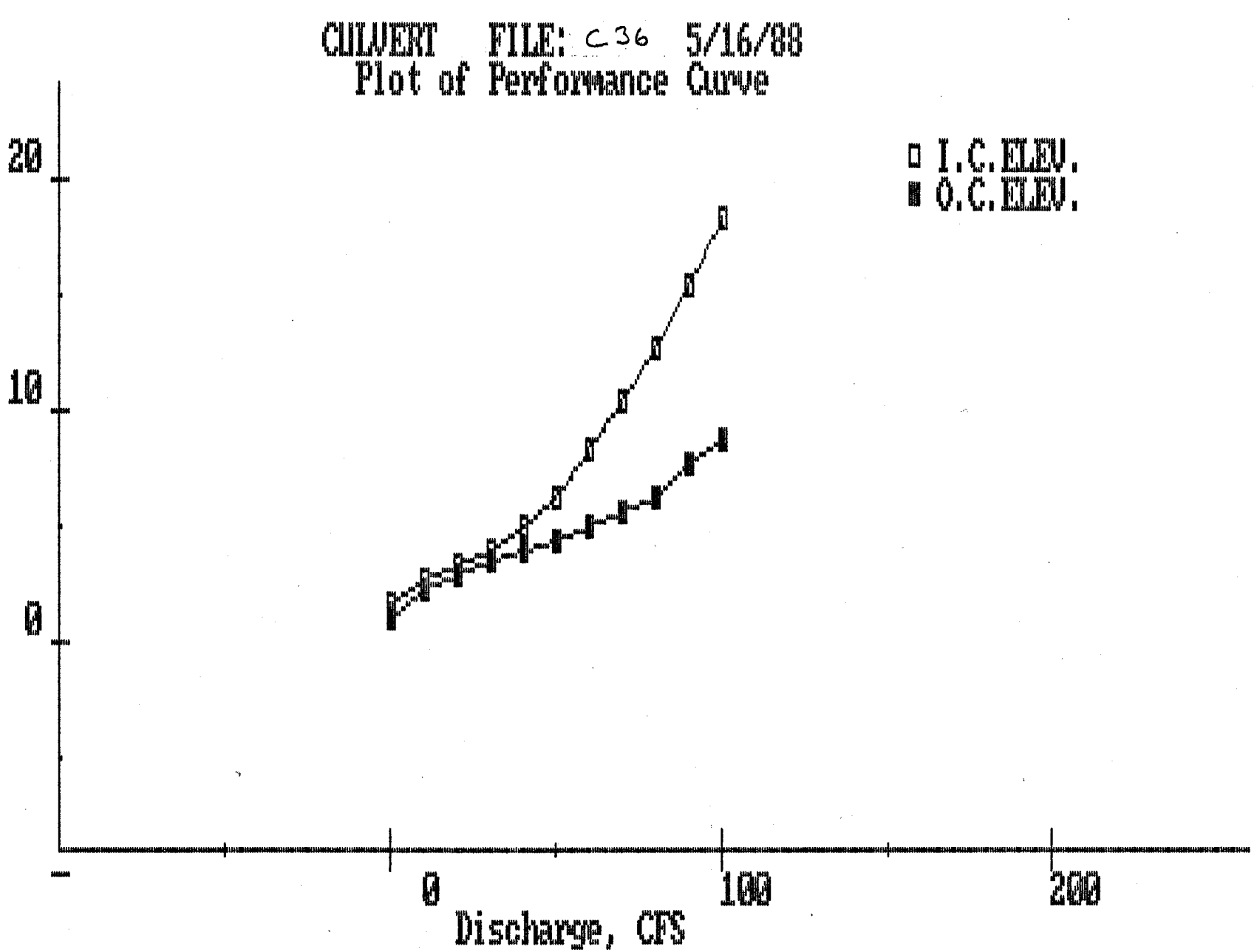
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.72	0.25	1.12	0.69	0.59	6.88
20.00	2.34	0.38	1.74	1.31	0.86	7.93
30.00	2.98	0.48	2.38	1.82	1.07	8.63
40.00	3.86	0.57	3.26	2.31	1.26	10.37
50.00	5.19	0.65	4.59	2.80	1.43	11.04
60.00	7.21	0.73	6.61	3.33	1.61	11.55
70.00	9.40	0.79	8.80	3.89	1.80	11.92
80.00	11.72	0.86	11.12	4.53	2.05	12.01
90.00	14.35	0.92	13.75	6.09	2.42	12.13
100.00	17.29	0.98	16.69	7.10	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.01
∴ Capacity = 48 cfs


CULVERT FILE: C36 5/16/88
Plot of Performance Curve
I.C. ELEV.
O.C. ELEV.
20
10
0
0
100
200
Discharge, CFS

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C37 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.37
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C37 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

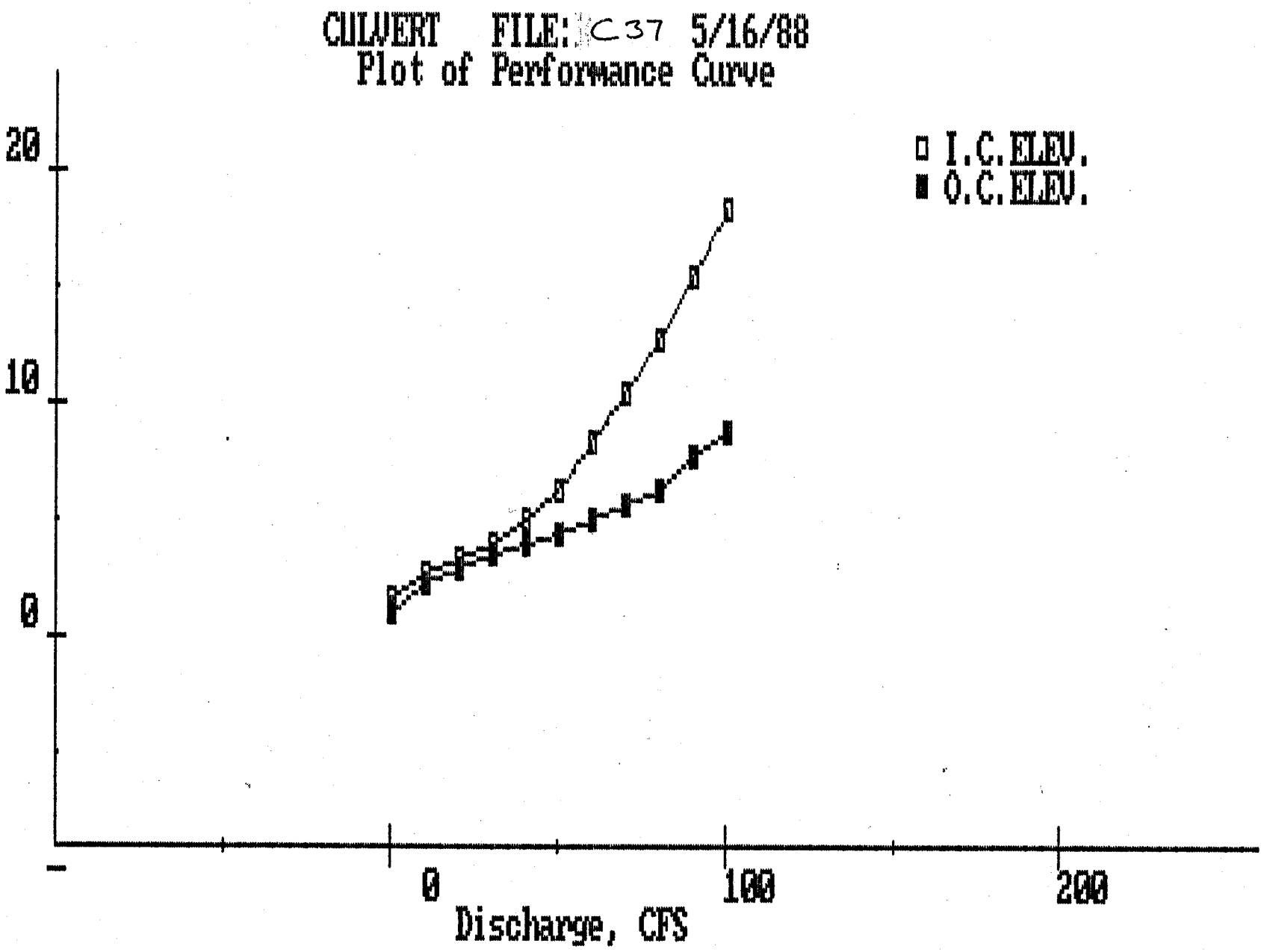
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.72	0.25	1.12	0.69	0.59	6.88
20.00	2.34	0.38	1.74	1.31	0.86	7.93
30.00	2.98	0.48	2.38	1.82	1.07	8.63
40.00	3.86	0.57	3.26	2.31	1.26	10.37
50.00	5.19	0.65	4.59	2.80	1.43	11.04
60.00	7.21	0.73	6.61	3.33	1.61	11.55
70.00	9.40	0.79	8.80	3.89	1.80	11.92
80.00	11.72	0.86	11.12	4.53	2.05	12.01
90.00	14.35	0.92	13.75	6.09	2.42	12.13
100.00	17.29	0.98	16.69	7.10	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.01
∴ Capacity = 48 cfs


CULVERT FILE: C37 5/16/88
Plot of Performance Curve
I.C. ELEV.
O.C. ELEV.
20
10
0
0
100
200
Discharge, CFS

388

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C38 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.37
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C38 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

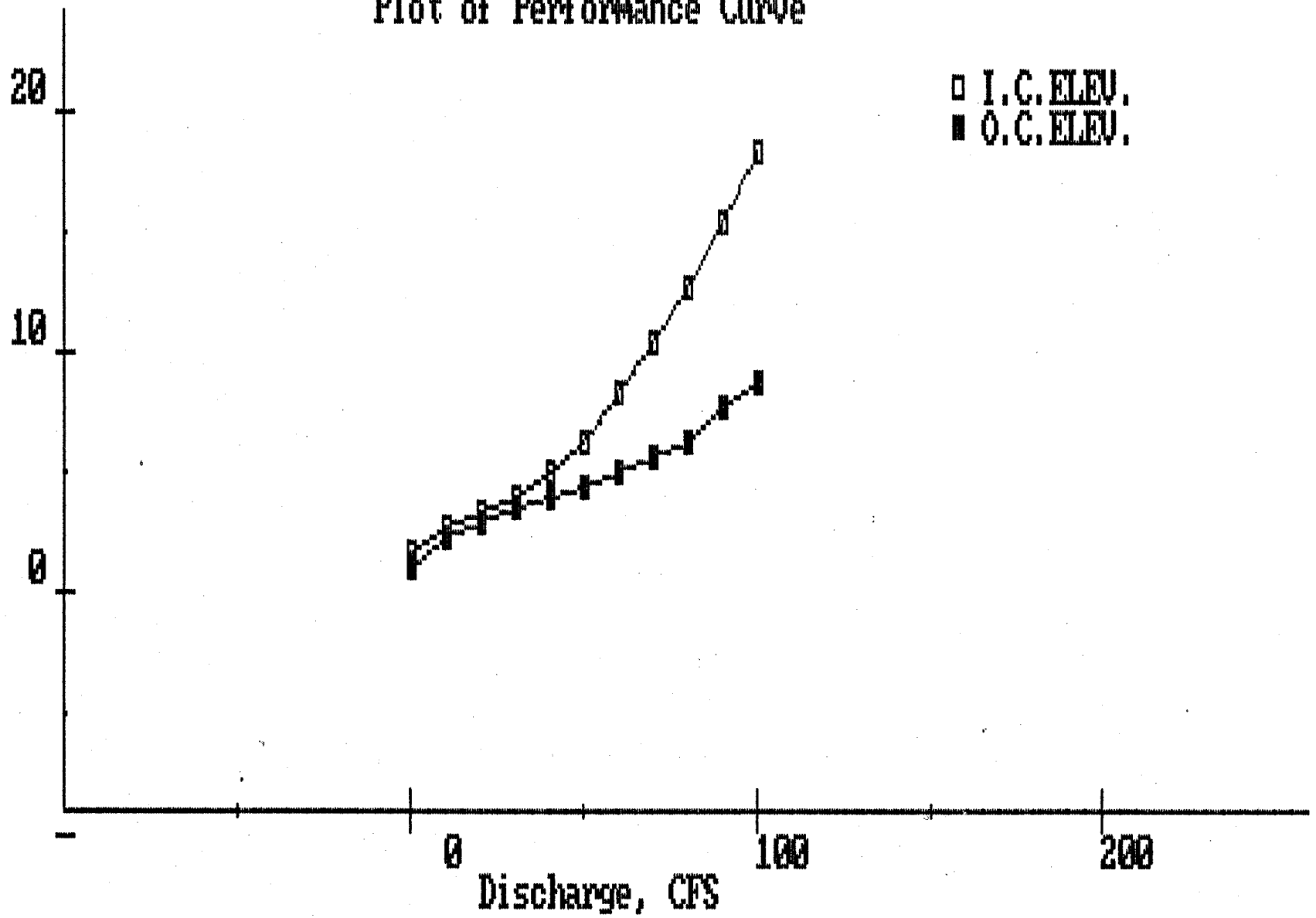
Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.72	0.25	1.12	0.69	0.59	6.88
20.00	2.34	0.38	1.74	1.31	0.86	7.93
30.00	2.98	0.48	2.38	1.82	1.07	8.63
40.00	3.86	0.57	3.26	2.31	1.26	10.37
50.00	5.19	0.65	4.59	2.80	1.43	11.04
60.00	7.21	0.73	6.61	3.33	1.61	11.55
70.00	9.40	0.79	8.80	3.89	1.80	11.92
80.00	11.72	0.86	11.12	4.53	2.05	12.01
90.00	14.35	0.92	13.75	6.09	2.42	12.13
100.00	17.29	0.98	16.69	7.10	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.01
∴ Capacity = 48 cfs

CULVERT FILE: C38 5/16/88

Plot of Performance Curve



PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C39

WATERSHED AREA (A): 36.00 acres

LENGTH OF WATERCOURSE (Lc): 2500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1250. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

2500. 48.0

MEAN SLOPE (Sc): .0192 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 64. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.635	.701	.737	.774	.801	.823
Tc (FUNCTION OF i) :	13.67	13.14	12.88	12.63	12.45	12.32
SOLUTION OF Tc (MINUTES):	8	7	6	6	5	5
RAINFL INT. @ Tc (IN/HR):	3.753	5.205	6.367	7.498	8.938	10.001
RUNOFF RATE @ Tc (IN/HR):	2.382	3.649	4.691	5.803	7.159	8.226
PEAK DISCHARGE (CFS) :	86.	132.	170.	211.	260.	299.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C39 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 38 IN RISE = 24 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.91
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C39 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.98	0.00	98	1 -RCPE	38	24	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

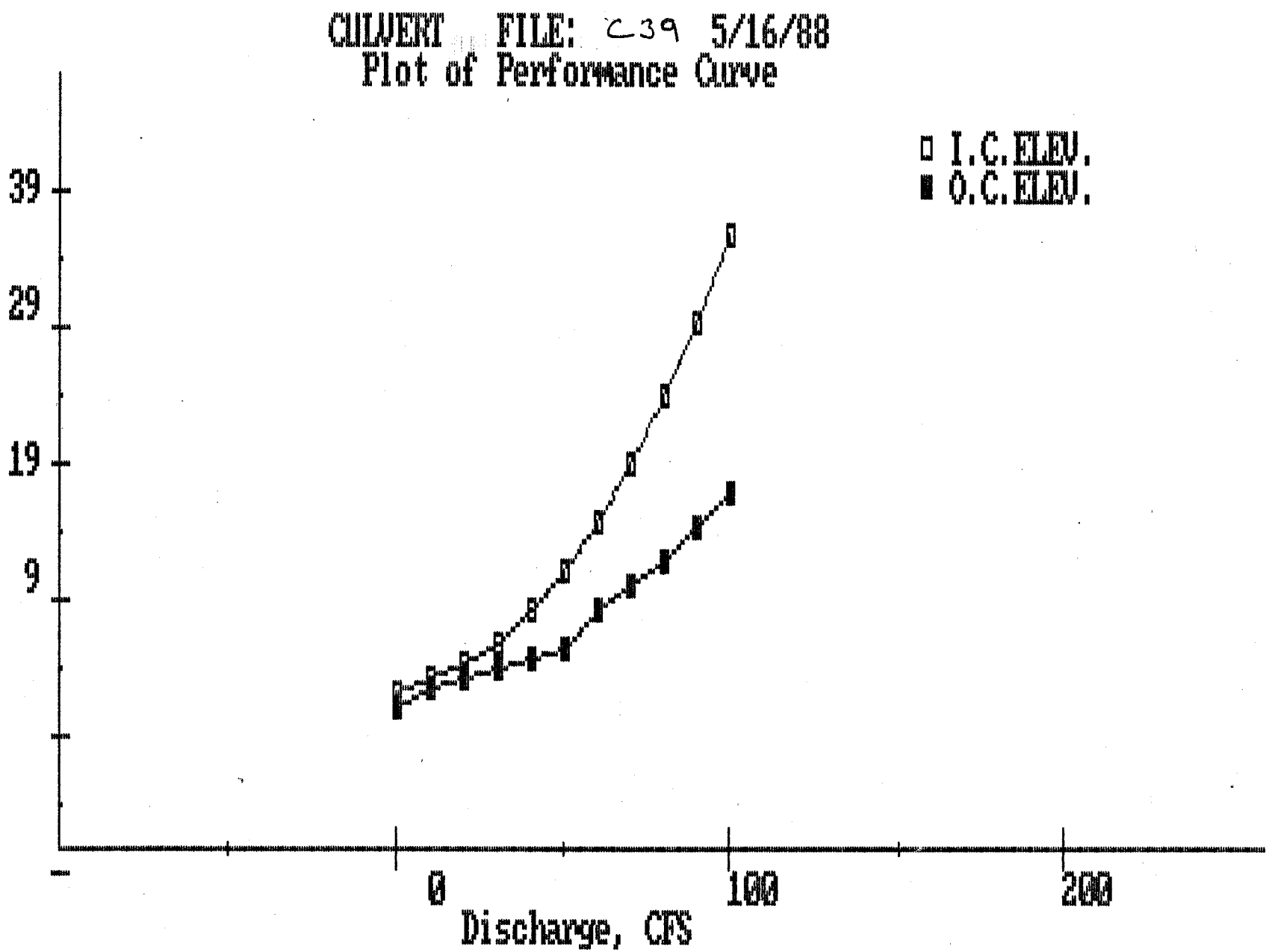
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.98	0.00	0.00	-0.98	0.00	0.00
10.00	2.20	0.25	1.22	0.39	0.63	6.99
20.00	3.04	0.38	2.06	1.10	0.92	8.63
30.00	4.42	0.48	3.44	1.74	1.17	9.66
40.00	7.05	0.57	6.07	2.43	1.42	10.36
50.00	9.91	0.65	8.93	3.24	1.76	10.51
60.00	13.39	0.73	12.41	5.88	2.00	11.70
70.00	17.51	0.79	16.53	7.63	2.00	13.66
80.00	22.27	0.86	21.29	9.66	2.00	15.61
90.00	27.66	0.92	26.68	11.95	2.00	17.56
100.00	33.68	0.98	32.70	14.51	2.00	19.51

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 3.98
∴ Capacity ≈ 27 cfs


CULVERT FILE: C39 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
39
29
19
9
0
100
200
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C40

WATERSHED AREA (A): 569.00 acres

LENGTH OF WATERCOURSE (Lc): 13300. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
9000.	275.0

MEAN SLOPE (Sc): .0503 ft BASIN FACTOR (Nb): .0480

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

31. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
69. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 11. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.361	.502	.573	.644	.693	.731
Tc (FUNCTION OF i) :	73.30	64.20	60.89	58.13	56.45	55.25
SOLUTION OF Tc (MINUTES):	71	50	43	37	33	30
RAINFL INT. @ Tc (IN/HR):	1.084	1.867	2.397	3.116	3.801	4.541
RUNOFF RATE @ Tc (IN/HR):	.391	.938	1.374	2.006	2.634	3.319
PEAK DISCHARGE (CFS) :	224.	538.	788.	1151.	1511.	1904.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C40 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 4 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.61
2	200.00	0.87	4.36	0.54
3	400.00	1.31	5.64	0.82
4	600.00	1.67	6.54	1.04
5	800.00	1.98	7.24	1.23
6	1000.00	2.25	7.83	1.40
7	1200.00	2.50	8.34	1.56
8	1400.00	2.74	8.79	1.71
9	1600.00	2.96	9.20	1.84
10	1800.00	3.16	9.57	1.97
11	2000.00	3.36	9.92	2.09

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C40 SUMMARY TABLE

CU LV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.44	0.00	88	4 -RCB	120	48	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

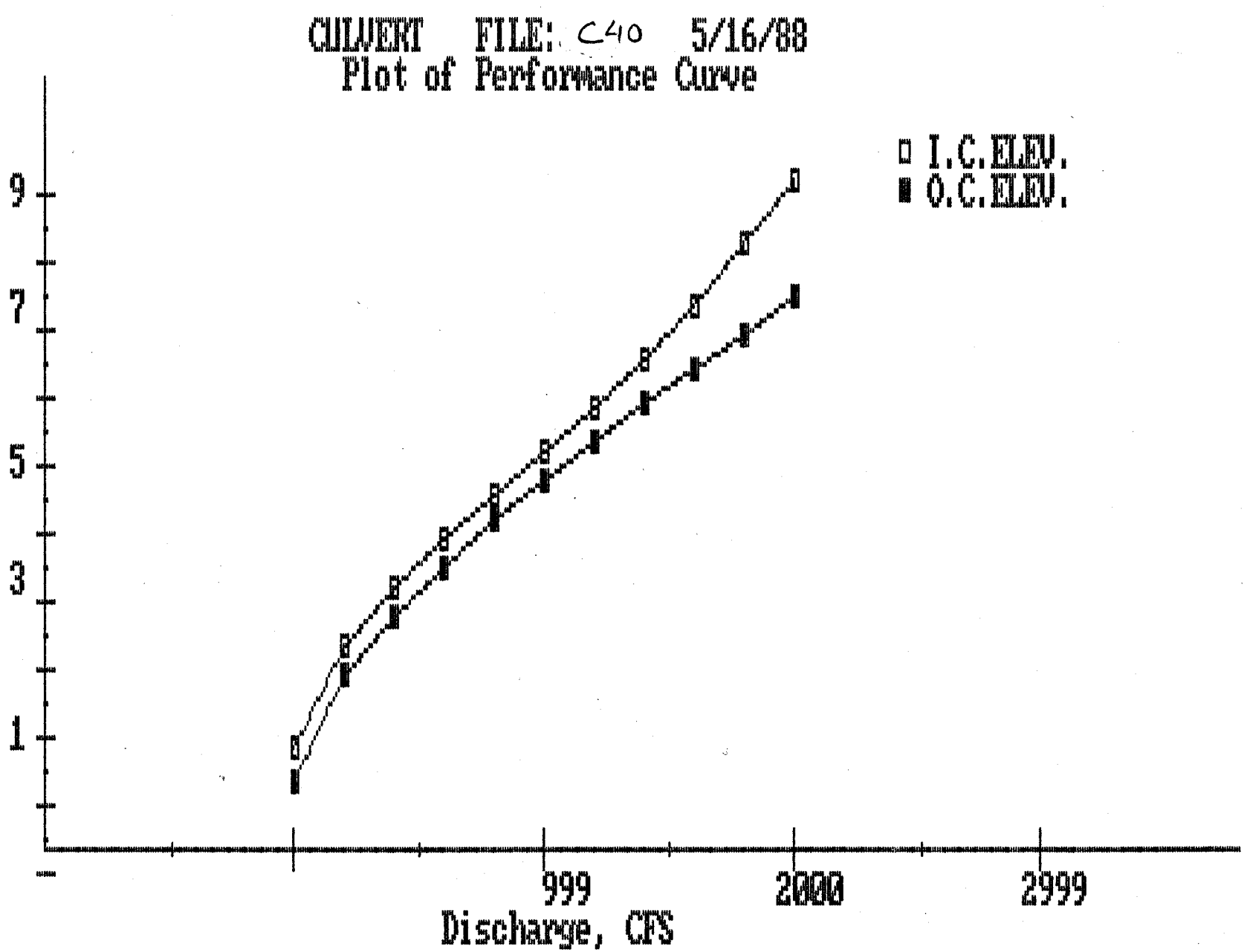
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 4 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.44	0.00	0.00	-0.44	0.00	0.00
200.00	1.90	0.87	1.46	1.03	0.87	5.73
400.00	2.73	1.31	2.29	1.89	1.31	7.61
600.00	3.41	1.67	2.97	2.62	1.67	8.99
800.00	4.05	1.98	3.61	3.26	1.98	10.13
1000.00	4.68	2.25	4.24	3.86	2.25	11.11
1200.00	5.33	2.50	4.89	4.41	2.50	11.99
1400.00	6.04	2.74	5.60	4.94	2.74	12.79
1600.00	6.80	2.95	6.36	5.44	3.00	13.35
1800.00	7.65	3.16	7.21	5.92	3.26	13.81
2000.00	8.58	3.36	8.14	6.47	3.51	14.24

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.94
∴ Capacity = 1370 cfs


CULVERT FILE: C40 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
9
7
5
3
1
999
2000
2999
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C41

WATERSHED AREA (A): 75.00 acres

LENGTH OF WATERCOURSE (Lc): 4900. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2450. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4900.	112.0

MEAN SLOPE (Sc): .0229 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 35. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.413	.516	.574	.634	.677	.713
Tc (FUNCTION OF i) :	30.90	28.27	27.10	26.05	25.36	24.85
SOLUTION OF Tc (MINUTES):	22	17	15	13	12	11
RAINFL INT. @ Tc (IN/HR):	2.372	3.569	4.372	5.510	6.472	7.501
RUNOFF RATE @ Tc (IN/HR):	.981	1.843	2.508	3.491	4.384	5.345
PEAK DISCHARGE (CFS) :	74.	139.	190.	264.	331.	404.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C41 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 10 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	2.09
2	50.00	0.65	3.50	0.41
3	100.00	0.98	4.46	0.61
4	150.00	1.24	5.12	0.77
5	200.00	1.46	5.64	0.91
6	250.00	1.65	6.06	1.03
7	300.00	1.83	6.43	1.14
8	350.00	2.00	6.75	1.25
9	400.00	2.15	7.04	1.34
10	450.00	2.29	7.30	1.43
11	500.00	2.43	7.54	1.52

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C41 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.84	0.00	84	1 -RCB	120	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

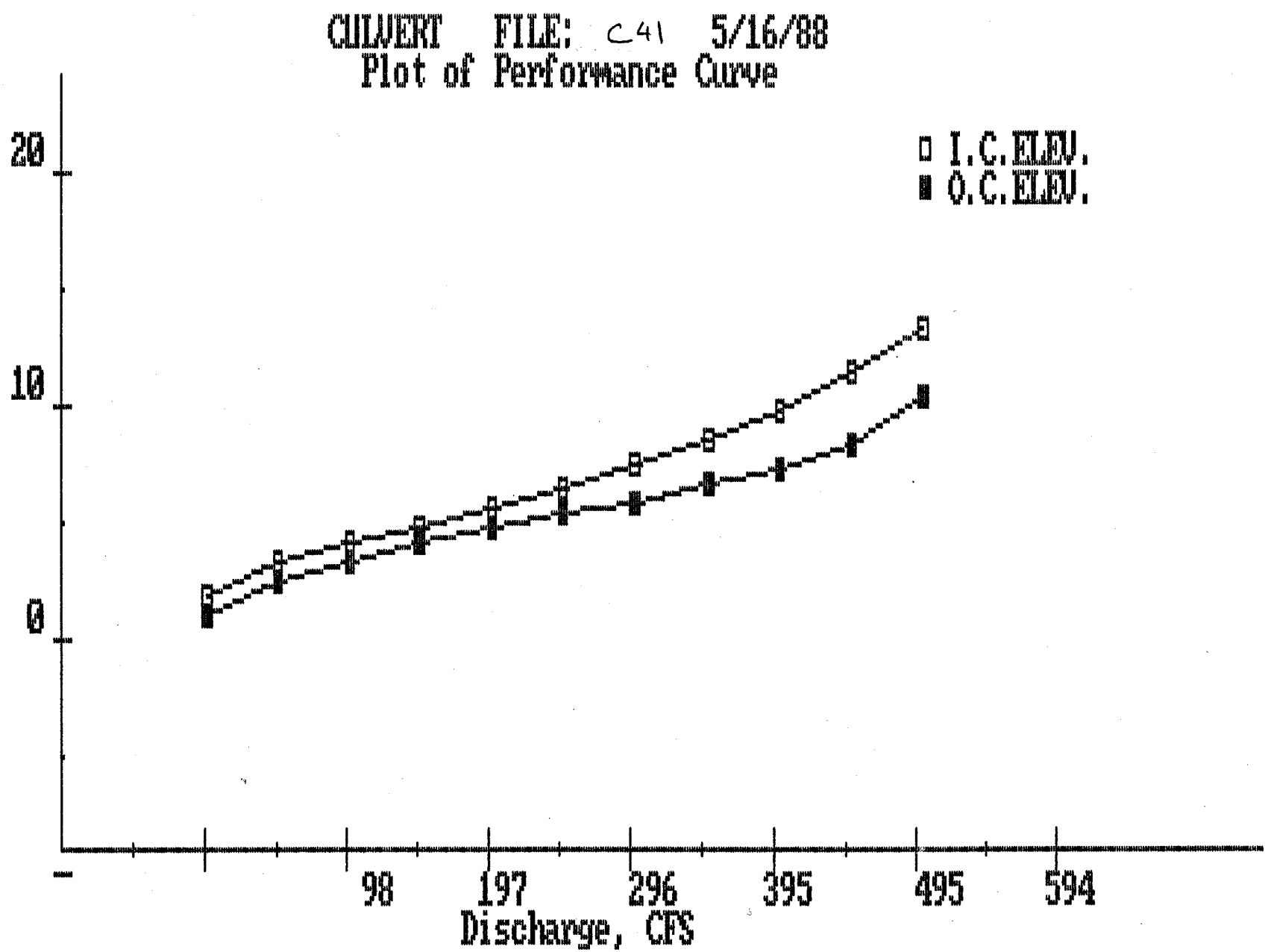
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.84	0.00	0.00	-0.84	0.00	0.00
50.00	2.29	0.65	1.45	0.63	0.65	7.67
100.00	3.10	0.98	2.26	1.49	0.98	9.71
150.00	3.83	1.24	2.99	2.22	1.24	10.92
200.00	4.58	1.46	3.74	2.86	1.48	13.56
250.00	5.42	1.65	4.58	3.46	1.71	14.62
300.00	6.40	1.83	5.56	4.02	1.93	15.52
350.00	7.53	2.00	6.69	4.70	2.15	16.30
400.00	8.84	2.15	8.00	5.47	2.35	17.00
450.00	10.40	2.29	9.56	6.35	2.55	17.63
500.00	12.29	2.43	11.45	8.59	3.00	16.67

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 4.84
∴ Capacity ≅ 215 cfs


CULVERT FILE: C41 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
98
197
296
395
495
594
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C42

WATERSHED AREA (A): 6.30 acres

LENGTH OF WATERCOURSE (Lc): 850. ft

LENGTH TO CENTER OF GRAVITY (Lca): 425. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

850. 6.0

MEAN SLOPE (Sc): .0071 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 80. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.757	.803	.827	.851	.869	.883
Tc (FUNCTION OF i) :	9.95	9.72	9.60	9.49	9.42	9.35
SOLUTION OF Tc (MINUTES):	6	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.167	5.750	6.674	7.859	8.938	10.001
RUNOFF RATE @ Tc (IN/HR):	3.154	4.616	5.518	6.691	7.768	8.833
PEAK DISCHARGE (CFS) :	20.	29.	35.	42.	49.	56.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: c42 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.60	0.00	60	1 -RCPE	45	29	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.60	0.00	0.00	-0.60	0.00	0.00
10.00	1.72	0.25	1.12	0.69	0.59	6.88
20.00	2.34	0.38	1.74	1.31	0.86	7.93
30.00	2.98	0.48	2.38	1.82	1.07	8.63
40.00	3.86	0.57	3.26	2.31	1.26	10.37
50.00	5.19	0.65	4.59	2.80	1.43	11.04
60.00	7.21	0.73	6.61	3.33	1.61	11.55
70.00	9.40	0.79	8.80	3.89	1.80	11.92
80.00	11.72	0.86	11.12	4.53	2.05	12.01
90.00	14.35	0.92	13.75	6.09	2.42	12.13
100.00	17.29	0.98	16.69	7.10	2.42	13.48

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 5.01
∴ Capacity = 48 cfs

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C42 CULVERT NO. 1

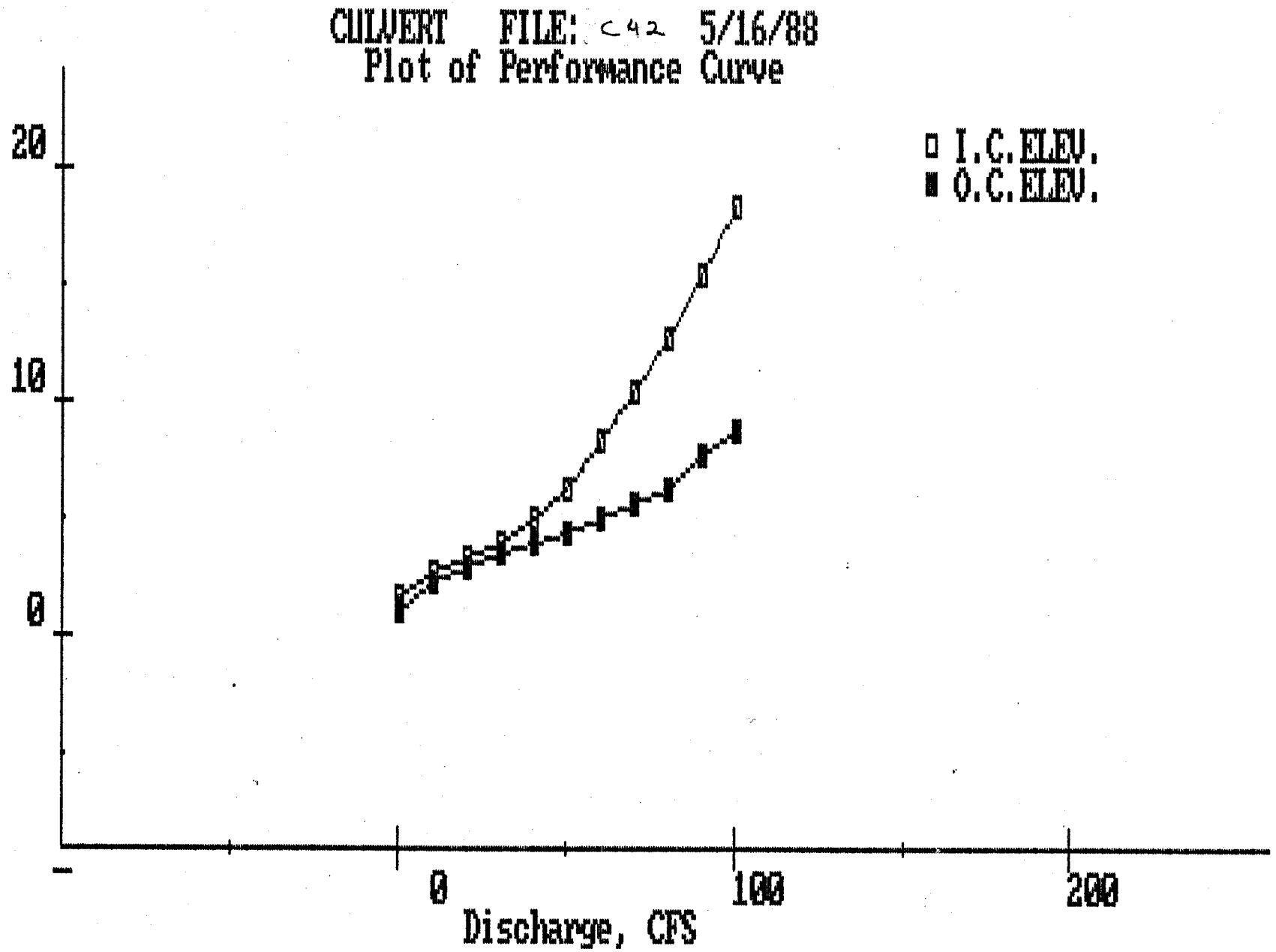
ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 45 IN RISE = 29 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	0.37
2	10.00	0.25	1.92	0.16
3	20.00	0.38	2.50	0.24
4	30.00	0.48	2.90	0.30
5	40.00	0.57	3.22	0.36
6	50.00	0.65	3.50	0.41
7	60.00	0.73	3.73	0.45
8	70.00	0.79	3.94	0.50
9	80.00	0.86	4.13	0.54
10	90.00	0.92	4.30	0.57
11	100.00	0.98	4.46	0.61

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU


CULVERT FILE: C42 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
100
200
Discharge, CFS

107

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C43

WATERSHED AREA (A): 25.70 acres

LENGTH OF WATERCOURSE (Lc): 3900. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1950. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3900.	85.0

MEAN SLOPE (Sc): .0218 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.222	.357	.433	.513	.571	.618
Tc (FUNCTION OF i) :	52.78	43.67	40.44	37.80	36.20	35.08
SOLUTION OF Tc (MINUTES):	45	30	25	21	19	17
RAINFL INT. @ Tc (IN/HR):	1.531	2.611	3.356	4.359	5.240	6.207
RUNOFF RATE @ Tc (IN/HR):	.341	.933	1.453	2.234	2.991	3.835
PEAK DISCHARGE (CFS) :	8.83	24.17	37.64	57.87	77.49	99.36

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C43 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 6 FT X 5 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	1.14
2	50.00	0.65	3.50	0.41
3	100.00	0.98	4.46	0.61
4	150.00	1.24	5.12	0.77
5	200.00	1.46	5.64	0.91
6	250.00	1.65	6.06	1.03
7	300.00	1.83	6.43	1.14
8	350.00	2.00	6.75	1.25
9	400.00	2.15	7.04	1.34
10	450.00	2.29	7.30	1.43
11	500.00	2.43	7.54	1.52

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: c43 SUMMARY TABLE

CU LV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.44	0.00	84	2 -RCB	72	60	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

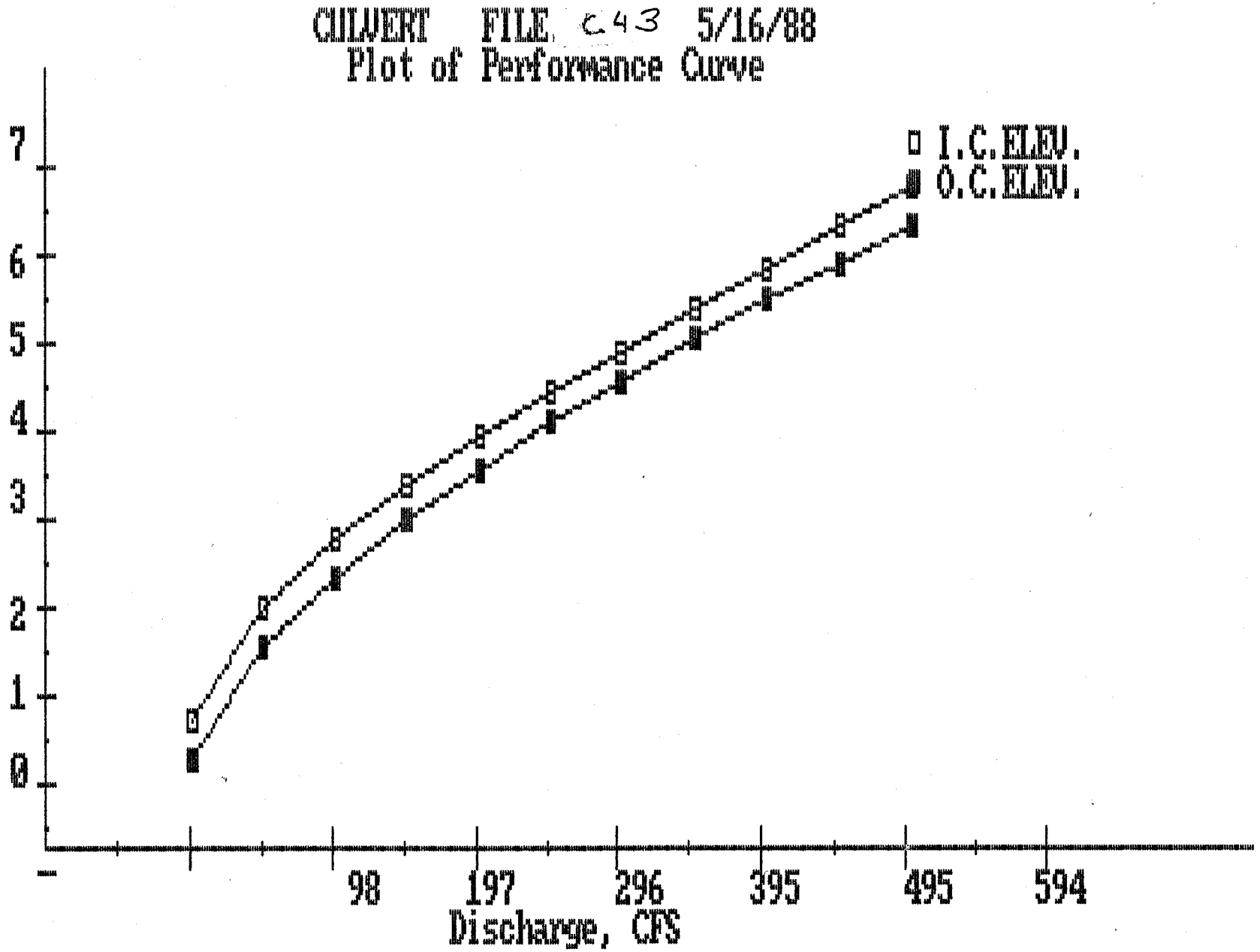
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.44	0.00	0.00	-0.44	0.00	0.00
50.00	1.73	0.65	1.29	0.87	0.67	6.24
100.00	2.49	0.98	2.05	1.63	1.08	7.73
150.00	3.11	1.24	2.67	2.27	1.42	8.44
200.00	3.64	1.46	3.20	2.84	1.74	9.28
250.00	4.14	1.65	3.70	3.37	2.04	9.96
300.00	4.62	1.83	4.18	3.86	2.33	10.45
350.00	5.09	2.00	4.65	4.33	2.61	10.88
400.00	5.56	2.15	5.12	4.77	2.88	11.58
450.00	6.03	2.29	5.59	5.20	3.14	11.92
500.00	6.53	2.43	6.09	5.61	3.41	12.23

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 6.44
∴ Capacity ≈ 490 cfs


CULVERT FILE c43 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
7
6
5
4
3
2
1
0
98
197
296
395
495
594
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C44 & C44A

WATERSHED AREA (A): 34.90 acres

LENGTH OF WATERCOURSE (Lc): 3700. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1850. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3700.	78.0

MEAN SLOPE (Sc): .0211 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.222	.357	.433	.513	.571	.618
Tc (FUNCTION OF i) :	51.83	42.88	39.71	37.11	35.55	34.44
SOLUTION OF Tc (MINUTES):	44	29	24	21	18	17
RAINFL INT. @ Tc (IN/HR):	1.544	2.660	3.452	4.359	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.343	.951	1.494	2.234	3.079	3.835
PEAK DISCHARGE (CFS) :	12.	33.	53.	79.	108.	135.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C44 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 6 FT X 3 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	1.52
2	40.00	0.57	3.22	0.36
3	80.00	0.86	4.13	0.54
4	120.00	1.09	4.75	0.68
5	160.00	1.28	5.24	0.80
6	200.00	1.46	5.64	0.91
7	240.00	1.61	5.98	1.01
8	280.00	1.76	6.29	1.10
9	320.00	1.90	6.56	1.18
10	360.00	2.03	6.81	1.27
11	400.00	2.15	7.04	1.34

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C44 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.84	0.00	84	2 -RCB	72	36	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

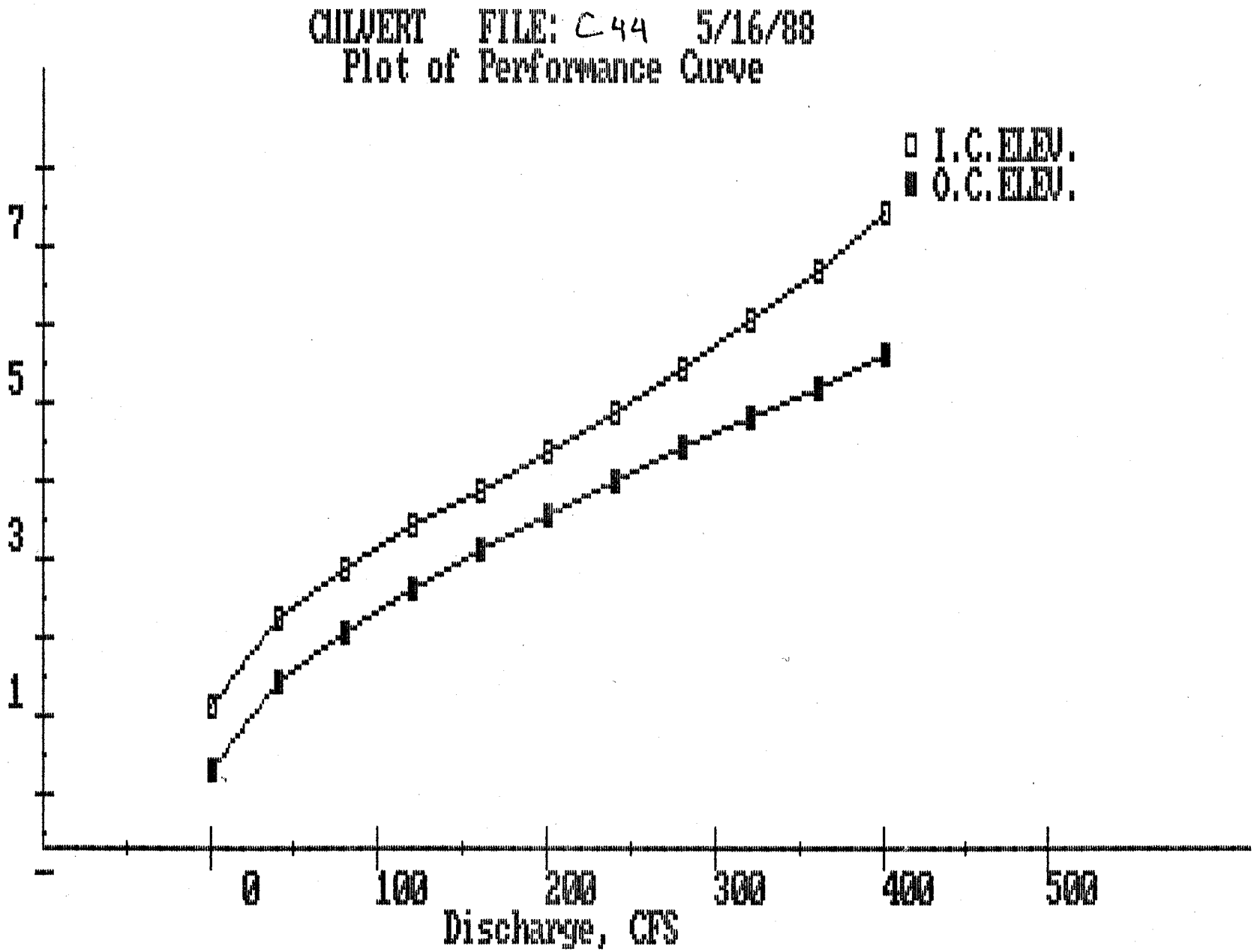
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.84	0.00	0.00	-0.84	0.00	0.00
40.00	1.95	0.57	1.11	0.28	0.57	5.84
80.00	2.58	0.86	1.74	0.94	0.86	7.77
120.00	3.10	1.09	2.26	1.49	1.09	9.21
160.00	3.59	1.28	2.75	1.99	1.28	10.32
200.00	4.08	1.46	3.24	2.44	1.46	11.45
240.00	4.58	1.61	3.74	2.86	1.61	12.39
280.00	5.13	1.76	4.29	3.27	1.76	13.25
320.00	5.73	1.90	4.89	3.65	1.93	13.83
360.00	6.40	2.03	5.56	4.02	2.10	14.29
400.00	7.14	2.15	6.30	4.46	2.26	14.73

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W. = 4.84
∴ Capacity ≈ 260 cfs


CULVERT FILE: C44 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
7
5
3
1
0
100
200
300
400
500
Discharge, CFS

5/16

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C44A CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	ELLIPTICAL SPAN = 38 IN RISE = 24 IN
(2) BARREL MATERIAL:	2 CONCRETE
(3) INLET TYPE:	CONVENTIONAL
(4) INLET EDGE AND WALL:	2 GROOVED END WITH HEADWALL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	3.25
2	16.00	0.40	3.05	0.50
3	32.00	0.60	3.89	0.74
4	48.00	0.75	4.46	0.94
5	64.00	0.89	4.91	1.11
6	80.00	1.01	5.28	1.26
7	96.00	1.12	5.60	1.39
8	112.00	1.22	5.87	1.52
9	128.00	1.31	6.12	1.64
10	144.00	1.40	6.35	1.75
11	160.00	1.48	6.56	1.85

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1
CULVERT FILE NAME: C44A

DATE: 11-2-89
SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	A - SITE DATA: OUTLET ELEV. (FT)	A - SITE DATA: CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.84	0.00	84	1 -RCPE	38	24	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

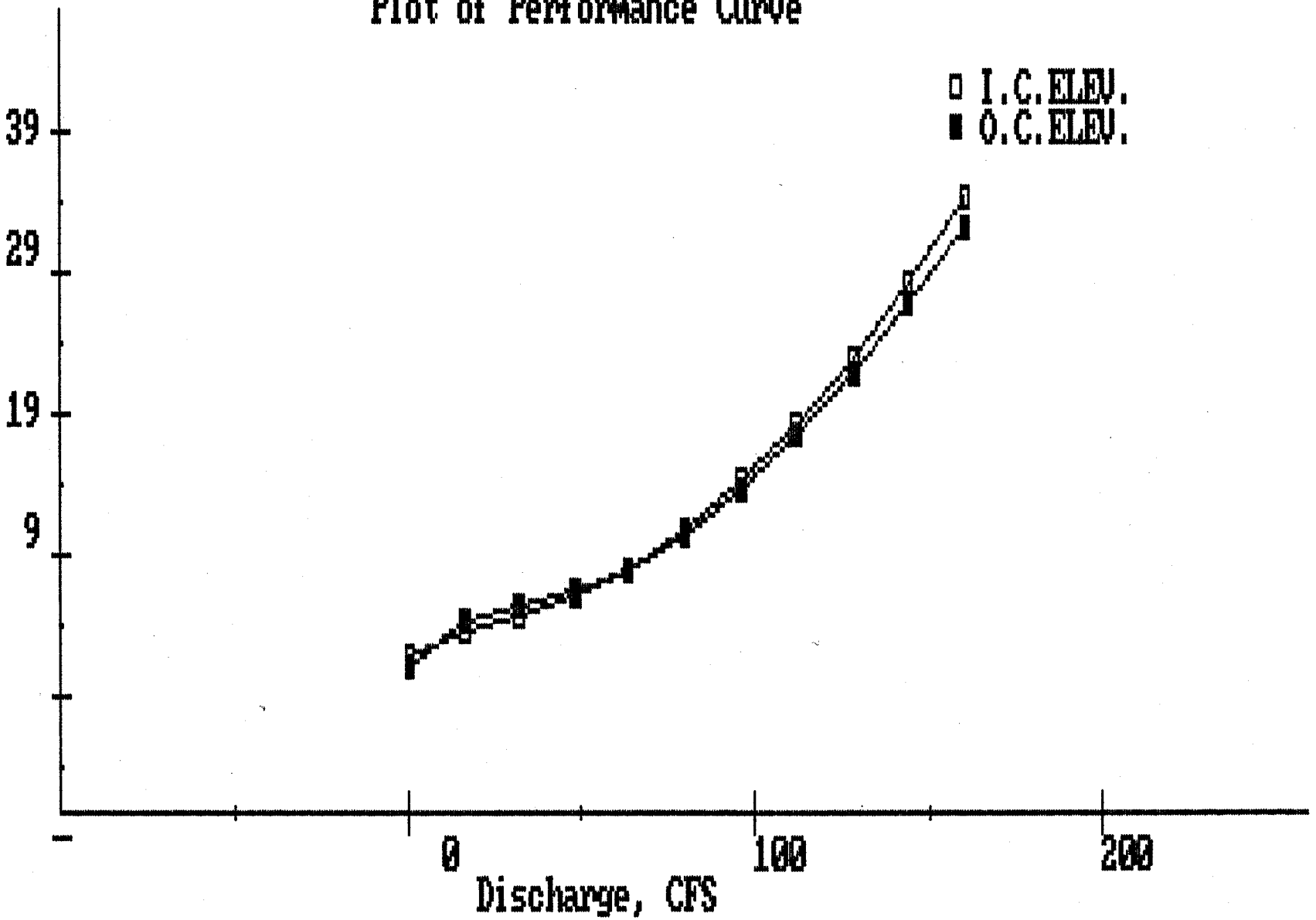
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.84	0.00	0.00	-0.84	0.00	0.00
16.00	3.24	0.40	1.57	2.40	0.82	8.06
32.00	4.17	0.60	2.59	3.33	1.22	9.82
48.00	5.20	0.75	3.97	4.36	1.67	10.58
64.00	6.73	0.89	5.89	5.69	2.00	12.49
80.00	9.46	1.01	8.62	8.24	2.00	15.61
96.00	12.82	1.12	11.98	11.35	2.00	18.73
112.00	16.78	1.22	15.94	15.03	2.00	21.85
128.00	21.35	1.31	20.51	19.28	2.00	24.97
144.00	26.54	1.40	25.70	24.09	2.00	28.09
160.00	32.33	1.48	31.49	29.47	2.00	31.21

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

HW = 4.34' ∴ CAPACITY = 35 CFS


CULVERT FILE:C44A 11-2-89
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
39
29
19
9
0
100
200
Discharge, CFS

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C45-C45A

WATERSHED AREA (A): 163.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
6800.	260.0

MEAN SLOPE (Sc): .0484 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

71. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
29. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.278	.416	.490	.566	.621	.664
Tc (FUNCTION OF i) :	53.98	45.93	43.02	40.61	39.14	38.10
SOLUTION OF Tc (MINUTES):	46	32	27	23	21	19
RAINFL INT. @ Tc (IN/HR):	1.506	2.495	3.222	4.155	4.957	5.863
RUNOFF RATE @ Tc (IN/HR):	.419	1.038	1.579	2.353	3.078	3.895
PEAK DISCHARGE (CFS) :	69.	171.	260.	387.	506.	640.

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE : C45 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	BOX 12 FT X 6 FT
(2) BARREL MATERIAL:	(1) CONCRETE N = .012
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(3) 1:1 BEVEL
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	1.39
2	150.00	0.84	4.22	0.52
3	300.00	1.26	5.44	0.79
4	450.00	1.60	6.28	1.00
5	600.00	1.89	6.95	1.18
6	750.00	2.15	7.50	1.34
7	900.00	2.39	7.98	1.49
8	1050.00	2.61	8.41	1.63
9	1200.00	2.82	8.79	1.76
10	1350.00	3.01	9.13	1.88
11	1500.00	3.20	9.45	2.00

TYPE : 0
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1 DATE: 5/16/88
CULVERT FILE NAME: C45 SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.84	0.00	84	2 -RCB	144	72	0.012	CONVENTIONAL
2								
3								
4								
5								
6								

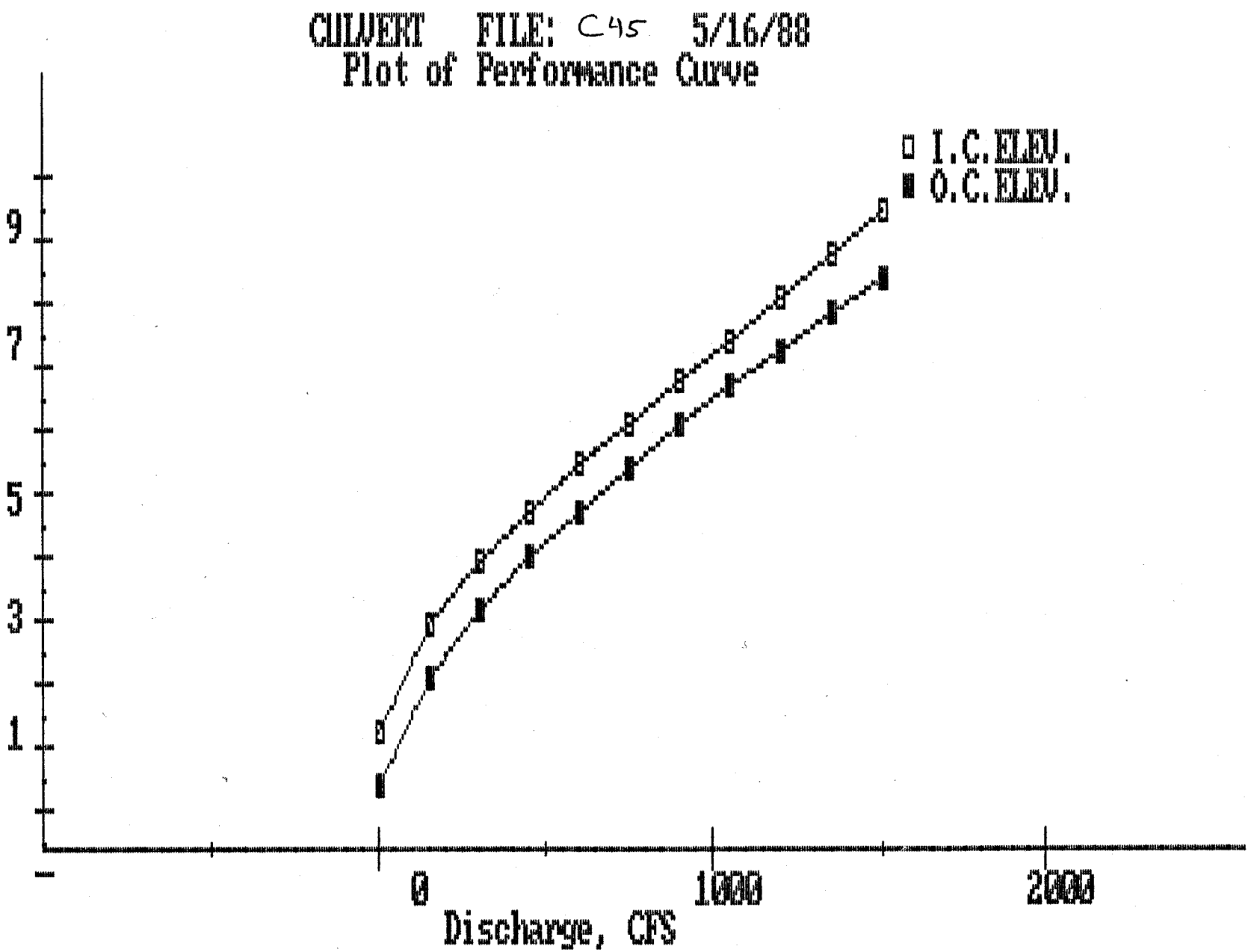
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 2 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.84	0.00	0.00	-0.84	0.00	0.00
150.00	2.52	0.84	1.68	0.87	0.84	7.47
300.00	3.51	1.26	2.67	1.87	1.26	9.92
450.00	4.31	1.60	3.47	2.71	1.60	11.71
600.00	5.01	1.89	4.17	3.46	1.89	12.65
750.00	5.67	2.15	4.83	4.15	2.15	13.42
900.00	6.32	2.39	5.48	4.79	2.39	14.05
1050.00	6.96	2.61	6.12	5.40	2.61	16.76
1200.00	7.61	2.82	6.77	5.98	2.82	17.74
1350.00	8.29	3.01	7.45	6.54	3.01	18.66
1500.00	9.00	3.20	8.16	7.08	3.20	19.53

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

Available H.W = 7.84
∴ capacity = 1250 cfs


CULVERT FILE: C45 5/16/88
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
9
7
5
3
1
0
1000
2000
Discharge, CFS

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C45A CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 2.5 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(1) THIN EDGE PROJECTING
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	1.85
2	9.00	0.46	3.09	0.57
3	18.00	0.67	3.83	0.84
4	27.00	0.83	4.31	1.04
5	36.00	0.97	4.69	1.21
6	45.00	1.09	4.99	1.36
7	54.00	1.20	5.25	1.49
8	63.00	1.29	5.48	1.62
9	72.00	1.38	5.68	1.73
10	81.00	1.47	5.87	1.83
11	90.00	1.55	6.03	1.93

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1
CULVERT FILE NAME: C45A

DATE: 11-2-89
SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.85	0.00	85	1 -CSP	30	30	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

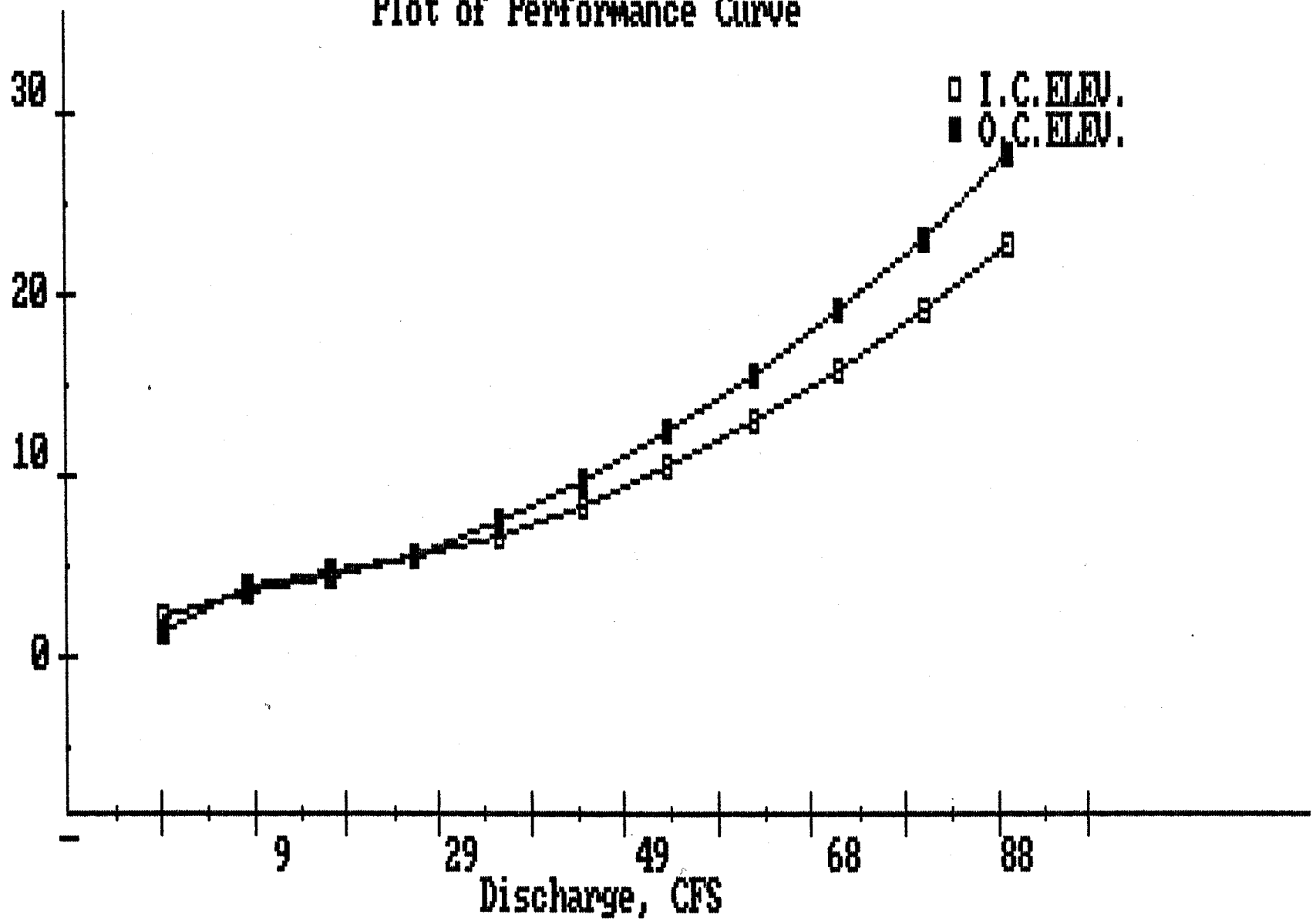
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 1 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.85	0.00	0.00	-0.85	0.00	0.00
9.00	2.50	0.46	1.50	1.65	1.00	4.91
18.00	3.31	0.67	2.33	2.46	1.43	6.20
27.00	4.16	0.83	3.25	3.31	1.77	7.27
36.00	6.10	0.97	4.47	5.25	2.03	8.45
45.00	8.36	1.09	6.10	7.51	2.22	9.79
54.00	11.06	1.20	8.20	10.21	2.50	11.00
63.00	14.16	1.29	10.71	13.31	2.50	12.83
72.00	17.72	1.38	13.60	16.87	2.50	14.67
81.00	21.77	1.47	16.88	20.92	2.50	16.50
90.00	26.29	1.55	20.55	25.44	2.50	18.33

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

$Hw = 5.35' \therefore$ capacity = 33 cfs


CULVERT FILE:C45A 11-2-89
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
30
20
10
0
9
29
49
68
88
Discharge, CFS

524

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: C46

WATERSHED AREA (A): 491.00 acres

LENGTH OF WATERCOURSE (Lc): 9000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3400.	1200.0
5600.	200.0

MEAN SLOPE (Sc): .0648 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

17. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
83. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.369	.517	.589	.660	.709	.746
Tc (FUNCTION OF i) :	46.02	40.24	38.18	36.49	35.47	34.74
SOLUTION OF Tc (MINUTES):	37	27	23	20	18	17
RAINFL INT. @ Tc (IN/HR):	1.732	2.776	3.529	4.494	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.640	1.435	2.079	2.966	3.823	4.632
PEAK DISCHARGE (CFS) :	317.	710.	1029.	1468.	1892.	2293.

CULVERT ANALYSIS 1.1 DATE: 11-2-89
CULVERT FILE :C46 CULVERT NO. 1

ITEM	SELECTED CULVERT
(1) BARREL SHAPE:	CIRCULAR 4 FT DIAMETER
(2) BARREL MATERIAL:	(2) CORRUGATED METAL N = .024
(3) INLET TYPE:	(1) CONVENTIONAL
(4) INLET EDGE AND WALL:	(2) MITERED TO CONFORM TO SLOPE
(5) INLET DEPRESSION:	NONE

TYPE ITEM NO. TO EDIT ITEM:
(RET) TO CONTINUE DATA LISTING

TAILWATER RATING CURVE

NO.	FLOW(CFS)	T.W.E.(FT)	VEL.(FPS)	SHEAR(PSF)
1	0.00	0.00	0.00	2.84
2	120.00	0.58	5.01	1.09
3	240.00	0.88	6.53	1.65
4	360.00	1.12	7.60	2.10
5	480.00	1.33	8.46	2.49
6	600.00	1.52	9.19	2.84
7	720.00	1.69	9.82	3.17
8	840.00	1.85	10.38	3.47
9	960.00	2.00	10.89	3.75
10	1080.00	2.15	11.35	4.02
11	1200.00	2.28	11.78	4.28

TYPE :
(P) TO PLOT RATING CURVE
(R) TO RELIST CROSS-SECTION DATA
(RET) TO CONTINUE
(ESC) FOR TAILWATER MENU

CULVERT ANALYSIS 1.1
CULVERT FILE NAME: C46

DATE: 11-2-89
SUMMARY TABLE

CULV NO.	A - SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	B - CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (IN)	RISE (IN)	MANN. N	INLET TYPE
1	0.45	0.00	45	8 -CSP	48	48	0.024	CONVENTIONAL
2								
3								
4								
5								
6								

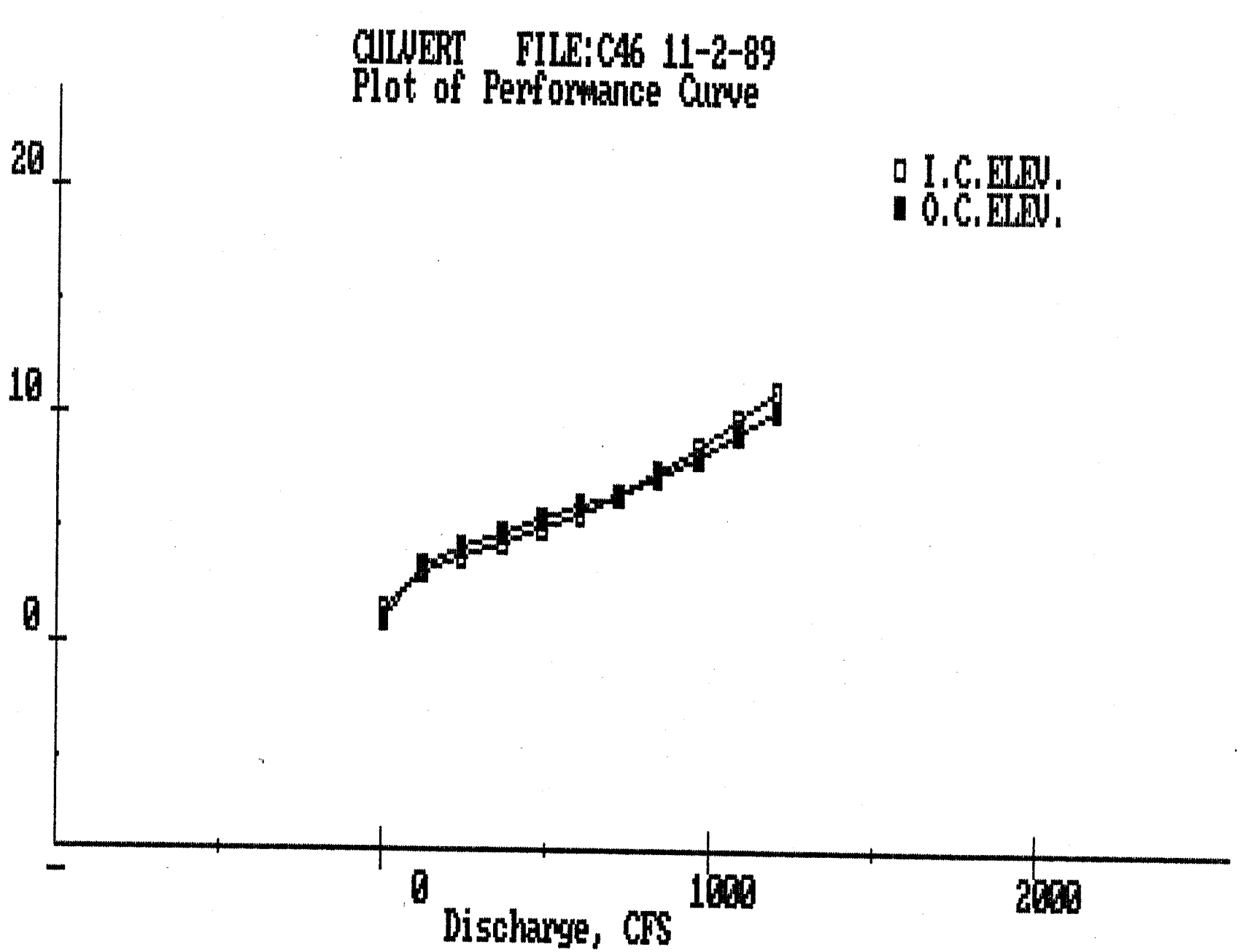
TO EDIT DATA PRESS (A) FOR SITE DATA
(B) FOR CULVERT SHAPE, MATERIAL, OR INLET DATA,
(C) FOR DISCHARGE RANGE,
(D) FOR TAILWATER DATA,
(E) FOR OVERTOPPING DATA,
(F) TO ADD OR DELETE CULVERTS,
(RET) TO CONTINUE ANALYSIS.

CULVERT # 1 PERFORMANCE CURVE
FOR 8 BARRELS

Q (cfs)	HW (ft)	TWE (ft)	ICH (ft)	OCH (ft)	TWH (ft)	VO (fps)
0.00	0.45	0.00	0.00	-0.45	0.00	0.00
120.00	2.23	0.58	1.61	1.78	1.12	5.16
240.00	3.06	0.88	2.36	2.61	1.62	6.28
360.00	3.72	1.12	2.97	3.27	2.00	7.18
480.00	4.34	1.33	3.56	3.89	2.33	7.91
600.00	4.91	1.52	4.22	4.46	2.61	8.64
720.00	5.51	1.69	5.02	5.06	2.87	9.34
840.00	6.41	1.85	5.96	5.74	3.09	10.09
960.00	7.51	2.00	7.06	6.70	3.28	10.90
1080.00	8.74	2.15	8.29	7.73	3.44	11.79
1200.00	10.08	2.29	9.63	8.82	3.59	12.61

PRESS <V> TO PLOT PRESS <ENTER> TO CONTINUE

$HW = 7.45'$ $\therefore$ CAPACITY = 953 cfs


CULVERT FILE:C46 11-2-89
Plot of Performance Curve
I.C.ELEV.
O.C.ELEV.
20
10
0
0
1000
2000
Discharge, CFS

429

APPENDICES D THROUGH G OF

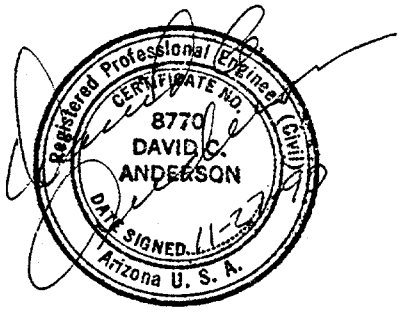
SOUTHWEST BASIN MANAGEMENT STUDY

BASIN INVENTORY/DRAINAGE REPORT

PREPARED FOR PIMA COUNTY DEPARTMENT OF TRANSPORTATION
AND FLOOD CONTROL DISTRICT

PREPARED BY ANDERSON, PASSARELLI & ASSOCIATES
270 North Church Avenue
Tucson, Arizona 85701

July 1990



APPENDIX D	ROADWAY DIP ANALYSIS CALCULATIONS
APPENDIX E	IMPROVED CHANNEL ANALYSIS CALCULATIONS
APPENDIX F	SEDIMENT ANALYSIS CALCULATIONS
APPENDIX G	FLOODPLAIN ANALYSIS CALCULATIONS

APPENDIX D ROADWAY DIP ANALYSIS CALCULATIONS

Critical roadway dip sections in the SWBMSA were analyzed for their capacity at a depth of flow equal to one (1) foot. Critical sections were determined to be those which might limit access to existing developed property druing the 100-year runoff event. The resulting discharges were then related to an event of specific return interval. Road section geometries were taken from field surveys conducted by APA and 1" = 100' aerial photo-topo. Manning's equation was used to calculate hydraulic vaiables. Table 8 summarizes the roadway dip section analysis. Dip section locations are shown on Figure 13. Individual calculations are contained in this appendix.

Roadway Dip Section
Summary Table

#	Road	Q @ 1' Depth (cfs)	Non Exceedance Recurrence Interval** (yr)	Q100 (cfs)
D12	Valencia	263	2 yr	3525
D20	Valencia	257	10 yr	664
D22	Valencia	361	2 yr	2168
D26	Valencia	298	2 yr	4324
D28	Valencia	570	2 yr	2086
D29	Camino Verde	140	<2 yr	4324
D39	Camino Verde	544	10 yr	1034
D43	Joseph	depth =.48'*	10 yr	429
D58	Camino de Oeste	depth =.90'*	2 yr	2165
D62}[1]	Sunset	220	2 yr	3617
D63}	Sunset	270		
D64}[2]	Sheridan	476	2 yr	3617
D65}	Sheridan			
D75	Naomi	247	<2 yr	2456
D87	Bopp	sheetflow	SF	2092
D90	Bopp	203	5 yr	969
D92	Bopp	depth =.76'*	5 yr	702
D97	Bopp	depth =.32'*	SF	1758
D106	Bopp	depth =.62'*	10 yr	318
D111	San Joaquin	118	2 yr	674
D114}[3]	San Joaquin	288	2 yr	4069
D115}	San Joaquin	175		
D117	San Joaquin	287	25 yr	516
D125	San Joaquin	267	<2 yr	2588
D126	San Joaquin	depth =.77'*	50 yr	784
D128	San Joaquin	depth =.38'*	SF	1848
D130	San Joaquin	248	5 yr	1212
D133	San Joaquin	433	10 yr	933
D135	San Joaquin	625	25 yr	963
D136}[4]	San Joaquin	558	5 yr	4304
D137}	San Joaquin	321	5 yr	4304
D144	Camino de Oeste	493	2 yr	3125
D145	Tucson Estates Pkwy	310	5 yr	3186
D146	Camino Verde	83	<2 yr	2658

[1] D62 & D63 capacities summed
[2] D64 & D65 considered as single section
[3] D114 & D115 capacities summed
[4] D136 & D137 capacities summed

* maximum depth before breakover

** SF = No defined discharge concentrating at channel location, upstream flow occurs as sheet flow over a wide area.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D12

WATERSHED AREA (A): 4803.00 acres

LENGTH OF WATERCOURSE (Lc): 78000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 39000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4000.	480.0
74000.	1940.0

MEAN SLOPE (Sc): .0277 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

43. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
10. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
47. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.290	.438	.515	.592	.646	.689
Tc (FUNCTION OF i) :	289.10	245.09	229.82	217.37	209.88	204.59
SOLUTION OF Tc (MINUTES):	561	365	304	254	223	200
RAINFL INT. @ Tc (IN/HR):	.191	.370	.497	.679	.861	1.058
RUNOFF RATE @ Tc (IN/HR):	.055	.162	.256	.402	.556	.728
PEAK DISCHARGE (CFS) :	268.	785.	1239.	1944.	2693.	3525.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D12

STA:	.00	25.00	50.00	75.00	100.00	125.00	137.40
ELEV:	100.00	99.95	99.70	99.15	98.52	97.97	97.92

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	98.14	98.88	99.61	99.95	100.13

DISCHARGE = 263. WSEL = 98.92 SLOPE = .0090

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	263.24	263.24
VELOCITY (FT/S) =	4.91	4.91
AREA (SQUARE FT) =	53.63	53.63
TOPWIDTH (FT) =	92.24	92.24
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.58	.58
WET. PERIM. (FT) =	92.27	92.27
HYD. RADIUS (FT) =	.58	.58
FROUDE NUMBER =	1.13	1.13
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D20

WATERSHED AREA (A): 781.00 acres

LENGTH OF WATERCOURSE (Lc): 24000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 12000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
24000.	335.0

MEAN SLOPE (Sc): .0140 ft BASIN FACTOR (Nb): .0600

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

81. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
19. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.205	.349	.428	.510	.570	.618
Tc (FUNCTION OF i) :	258.54	209.08	192.66	179.53	171.73	166.26
SOLUTION OF Tc (MINUTES):	472	289	234	190	165	147
RAINFL INT. @ Tc (IN/HR):	.222	.446	.616	.867	1.109	1.364
RUNOFF RATE @ Tc (IN/HR):	.046	.155	.263	.442	.632	.843
PEAK DISCHARGE (CFS) :	36.	122.	207.	348.	498.	664.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D20

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.10	100.10	100.10	99.90	99.68	99.22	98.83

STA:	162.70	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	98.70	98.78	99.34	100.14	100.65	100.72	100.76

DISCHARGE = 257. WSEL = 99.70 SLOPE = .0060

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	256.91	256.91
VELOCITY (FT/S) =	3.96	3.96
AREA (SQUARE FT) =	64.85	64.85
TOPWIDTH (FT) =	113.52	113.52
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.57	.57
WET. PERIM. (FT) =	113.54	113.54
HYD. RADIUS (FT) =	.57	.57
FROUDE NUMBER =	.92	.92
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D22

WATERSHED AREA (A): 4105.00 acres

LENGTH OF WATERCOURSE (Lc): 55600. ft

LENGTH TO CENTER OF GRAVITY (Lca): 27800. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
55600.	1035.0

MEAN SLOPE (Sc): .0186 ft BASIN FACTOR (Nb): .0620

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3,47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

66. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
31. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
3. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.231	.375	.453	.534	.592	.639
Tc (FUNCTION OF i) :	375.55	309.42	286.91	268.72	257.83	250.17
SOLUTION OF Tc (MINUTES):	833	525	425	347	303	271
RAINFL INT. @ Tc (IN/HR):	.137	.267	.374	.528	.669	.820
RUNOFF RATE @ Tc (IN/HR):	.032	.100	.170	.282	.397	.524
PEAK DISCHARGE (CFS) :	131.	415.	703.	1168.	1641.	2168.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D22

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.92	99.82	99.64	99.18	98.82	98.65

STA:	158.60	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	98.64	98.80	99.23	99.73	100.22	100.53	100.71

DISCHARGE = 361. WSEL = 99.64 SLOPE = .0060

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	361.08	361.08
VELOCITY (FT/S) =	4.11	4.11
AREA (SQUARE FT) =	87.85	87.85
TOPWIDTH (FT) =	145.50	145.50
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.60	.60
WET. PERIM. (FT) =	145.52	145.52
HYD. RADIUS (FT) =	.60	.60
FROUDE NUMBER =	.93	.93
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D26

WATERSHED AREA (A): 9253.00 acres

LENGTH OF WATERCOURSE (Lc): 63800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 31900. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
63800.	1280.0

MEAN SLOPE (Sc): .0201 ft BASIN FACTOR (Nb): .0620

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.15	1.45	1.71	2.04	2.35	2.64
P 2	1.32	1.68	1.98	2.36	2.70	3.04
P 3	1.45	1.87	2.19	2.60	2.97	3.34
P 6	1.65	2.14	2.51	2.97	3.39	3.81
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

54. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
19. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
27. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.224	.343	.430	.520	.584	.635
Tc (FUNCTION OF i) :	400.72	338.32	308.93	286.33	273.30	264.37
SOLUTION OF Tc (MINUTES):	930	618	489	391	336	300
RAINFL INT. @ Tc (IN/HR):	.122	.222	.317	.459	.596	.731
RUNOFF RATE @ Tc (IN/HR):	.027	.076	.136	.239	.348	.464
PEAK DISCHARGE (CFS) :	255.	708.	1272.	2227.	3246.	4324.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D26

STA:	.00	25.00	50.00	75.00	100.00	110.50	125.00
ELEV:	100.00	99.97	99.64	99.16	98.74	98.65	98.82

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	99.08	99.35	99.71	100.49	100.80

DISCHARGE = 298. WSEL = 99.65 SLOPE = .0060

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	298.15	298.15
VELOCITY (FT/S) =	3.80	3.80
AREA (SQUARE FT) =	78.55	78.55
TOPWIDTH (FT) =	146.59	146.59
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.54	.54
WET. PERIM. (FT) =	146.61	146.61
HYD. RADIUS (FT) =	.54	.54
FROUDE NUMBER =	.91	.91
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D28

WATERSHED AREA (A): 422.40 acres

LENGTH OF WATERCOURSE (Lc): 10400. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5200. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10400.	402.0

MEAN SLOPE (Sc): .0387 ft BASIN FACTOR (Nb): .0320

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

5. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
95. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 9. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.399	.546	.617	.686	.732	.768
Tc (FUNCTION OF i) :	42.58	37.54	35.75	34.27	33.38	32.75
SOLUTION OF Tc (MINUTES):	33	25	21	19	17	16
RAINFL INT. @ Tc (IN/HR):	1.858	2.891	3.701	4.607	5.548	6.380
RUNOFF RATE @ Tc (IN/HR):	.740	1.579	2.284	3.159	4.063	4.900
PEAK DISCHARGE (CFS) :	315.	672.	972.	1345.	1730.	2086.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D28

STA:	.00	25.00	50.00	52.30	75.00	100.00	125.00
ELEV:	100.30	100.14	100.01	99.97	100.17	100.36	100.63

DISCHARGE = 570. WSEL = 100.97 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	570.43	570.43
VELOCITY (FT/S) =	6.11	6.11
AREA (SQUARE FT) =	93.31	93.31
TOPWIDTH (FT) =	125.00	125.00
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.75	.75
WET. PERIM. (FT) =	125.00	125.00
HYD. RADIUS (FT) =	.75	.75
FROUDE NUMBER =	1.25	1.25
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 125.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D29

WATERSHED AREA (A): 9253.00 acres

LENGTH OF WATERCOURSE (Lc): 63800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 31900. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
63800.	1280.0

MEAN SLOPE (Sc): .0201 ft BASIN FACTOR (Nb): .0620

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.15	1.45	1.71	2.04	2.35	2.64
P 2	1.32	1.68	1.98	2.36	2.70	3.04
P 3	1.45	1.87	2.19	2.60	2.97	3.34
P 6	1.65	2.14	2.51	2.97	3.39	3.81
P24	2.11	2.74	3.19	3.76	4.29	4.80

SOIL GROUPS

54. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
19. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
27. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.224	.343	.430	.520	.584	.635
Tc (FUNCTION OF i) :	400.72	338.32	308.93	286.33	273.30	264.37
SOLUTION OF Tc (MINUTES):	930	618	489	391	336	300
RAINFL INT. @ Tc (IN/HR):	.122	.222	.317	.459	.596	.731
RUNOFF RATE @ Tc (IN/HR):	.027	.076	.136	.239	.348	.464
PEAK DISCHARGE (CFS) :	255.	708.	1272.	2227.	3246.	4324.

NOTE: AREA > 10 SQ. MI. RAINFALL VALUES SHOWN HAVE BEEN AREALY REDUCED

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D29

STA:	.00	25.00	50.00	75.00	100.00	125.00	133.70
ELEV:	100.00	99.42	98.77	97.83	96.13	94.78	94.52
STA:	150.00	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	94.74	95.86	97.54	98.97	99.97	100.13	100.11

DISCHARGE = 140. WSEL = 95.52 SLOPE = .0060

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	139.58	139.58
VELOCITY (FT/S) =	4.11	4.11
AREA (SQUARE FT) =	33.94	33.94
TOPWIDTH (FT) =	56.11	56.11
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.60	.60
WET. PERIM. (FT) =	56.16	56.16
HYD. RADIUS (FT) =	.60	.60
FROUDE NUMBER =	.93	.93
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D39

WATERSHED AREA (A): 879.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1000.	404.0
13000.	115.0

MEAN SLOPE (Sc): .0100 ft BASIN FACTOR (Nb): .0640

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

40. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
10. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
50. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.296	.445	.521	.598	.651	.694
Tc (FUNCTION OF i) :	196.62	167.09	156.84	148.47	143.44	139.88
SOLUTION OF Tc (MINUTES):	311	207	172	143	126	114
RAINFL INT. @ Tc (IN/HR):	.318	.588	.800	1.096	1.386	1.683
RUNOFF RATE @ Tc (IN/HR):	.094	.262	.417	.655	.903	1.167
PEAK DISCHARGE (CFS) :	83.	232.	369.	580.	800.	1034.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D39

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.62	98.99	98.55	98.41	98.47	98.57

STA:	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	98.87	99.18	99.47	99.66	99.81	99.95

DISCHARGE = 544. WSEL = 99.41 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	543.62	543.62
VELOCITY (FT/S) =	4.59	4.59
AREA (SQUARE FT) =	118.41	118.41
TOPWIDTH (FT) =	186.49	186.49
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.63	.63
WET. PERIM. (FT) =	186.51	186.51
HYD. RADIUS (FT) =	.63	.63
FROUDE NUMBER =	1.02	1.02
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D43

WATERSHED AREA (A): 72.00 acres

LENGTH OF WATERCOURSE (Lc): 3000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
600.	384.0
2400.	35.0

MEAN SLOPE (Sc): .0212 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.370	.527	.603	.676	.725	.762
Tc (FUNCTION OF i) :	28.97	25.13	23.82	22.76	22.13	21.69
SOLUTION OF Tc (MINUTES):	20	15	13	11	10	10
RAINFL INT. @ Tc (IN/HR):	2.498	3.767	4.679	5.894	6.935	7.759
RUNOFF RATE @ Tc (IN/HR):	.923	1.987	2.822	3.982	5.025	5.913
PEAK DISCHARGE (CFS) :	67.	144.	205.	289.	365.	429.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D43

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.72	99.46	99.14	99.12	99.10	99.12

STA:	158.00	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	99.09	99.10	99.13	99.36	99.51	99.57	99.17

DISCHARGE = 280. WSEL = 99.57 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	280.34	280.34
VELOCITY (FT/S) =	3.43	3.43
AREA (SQUARE FT) =	81.75	81.75
TOPWIDTH (FT) =	260.58	260.58
DEPTH (FT) =	.48	.48
HYD. DEPTH (FT) =	.31	.31
WET. PERIM. (FT) =	260.58	260.58
HYD. RADIUS (FT) =	.31	.31
FROUDE NUMBER =	1.08	1.08
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D58

WATERSHED AREA (A): 406.00 acres

LENGTH OF WATERCOURSE (Lc): 6800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3200. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1500.	800.0
5300.	103.0

MEAN SLOPE (Sc): .0288 ft BASIN FACTOR (Nb): .0320

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

19. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
82. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.381	.526	.598	.669	.717	.755
Tc (FUNCTION OF i) :	37.13	32.61	30.98	29.64	28.82	28.24
SOLUTION OF Tc (MINUTES):	28	21	18	16	14	13
RAINFL INT. @ Tc (IN/HR):	2.059	3.189	4.027	5.013	6.087	7.012
RUNOFF RATE @ Tc (IN/HR):	.783	1.679	2.410	3.352	4.365	5.291
PEAK DISCHARGE (CFS) :	321.	687.	986.	1372.	1786.	2165.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D58

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.72	99.24	98.75	98.27	97.93	97.68

STA:	157.00	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	97.66	97.81	97.95	98.18	98.36	98.43	98.56

DISCHARGE = 475. WSEL = 98.56 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	474.97	474.97
VELOCITY (FT/S) =	4.95	4.95
AREA (SQUARE FT) =	96.02	96.02
TOPWIDTH (FT) =	215.10	215.10
DEPTH (FT) =	.90	.90
HYD. DEPTH (FT) =	.45	.45
WET. PERIM. (FT) =	215.11	215.11
HYD. RADIUS (FT) =	.45	.45
FROUDE NUMBER =	1.30	1.30
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D62-D63

WATERSHED AREA (A): 1597.00 acres

LENGTH OF WATERCOURSE (Lc): 12000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 6000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
2000.	1152.0
10000.	142.0

MEAN SLOPE (Sc): .0192 ft BASIN FACTOR (Nb): .0520

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

45. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
55. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.295	.443	.520	.596	.650	.692
Tc (FUNCTION OF i) :	112.40	95.53	89.67	84.88	81.99	79.95
SOLUTION OF Tc (MINUTES):	135	90	75	62	55	50
RAINFL INT. @ Tc (IN/HR):	.637	1.169	1.582	2.195	2.722	3.247
RUNOFF RATE @ Tc (IN/HR):	.188	.518	.822	1.308	1.769	2.247
PEAK DISCHARGE (CFS) :	303.	834.	1323.	2105.	2848.	3617.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D62

STA:	.00	25.00	50.00	75.00	97.80	100.00	125.00
ELEV:	100.00	99.70	99.12	98.41	97.91	97.96	98.32

STA:	150.00	175.00	200.00
ELEV:	99.05	99.43	99.39

DISCHARGE = 220. WSEL = 98.91 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	219.56	219.56
VELOCITY (FT/S) =	4.49	4.49
AREA (SQUARE FT) =	48.86	48.86
TOPWIDTH (FT) =	87.81	87.81
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.56	.56
WET. PERIM. (FT) =	87.84	87.84
HYD. RADIUS (FT) =	.56	.56
FROUDE NUMBER =	1.06	1.06
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 200.00 (CHANNEL)

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D63

STA:	.00	25.00	50.00	75.00	100.00	104.60	125.00
ELEV:	100.00	99.74	99.44	98.99	98.57	98.52	98.72

STA:	150.00	175.00	200.00
ELEV:	99.41	100.00	100.11

DISCHARGE = 270. WSEL = 99.52 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	270.38	270.38
VELOCITY (FT/S) =	4.44	4.44
AREA (SQUARE FT) =	60.87	60.87
TOPWIDTH (FT) =	111.33	111.33
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.55	.55
WET. PERIM. (FT) =	111.35	111.35
HYD. RADIUS (FT) =	.55	.55
FROUDE NUMBER =	1.06	1.06
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 200.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D64-D65

WATERSHED AREA (A): 1597.00 acres

LENGTH OF WATERCOURSE (Lc): 12000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 6000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
2000.	1152.0
10000.	142.0

MEAN SLOPE (Sc): .0192 ft BASIN FACTOR (Nb): .0520

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

45. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
55. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.295	.443	.520	.596	.650	.692
Tc (FUNCTION OF i) :	112.40	95.53	89.67	84.88	81.99	79.95
SOLUTION OF Tc (MINUTES):	135	90	75	62	55	50
RAINFL INT. @ Tc (IN/HR):	.637	1.169	1.582	2.195	2.722	3.247
RUNOFF RATE @ Tc (IN/HR):	.188	.518	.822	1.308	1.769	2.247
PEAK DISCHARGE (CFS) :	303.	834.	1323.	2105.	2848.	3617.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D64-65

STA:	.00	25.00	50.00	75.00	99.00	100.00	125.00
ELEV:	100.00	99.70	99.00	97.90	97.50	97.60	97.70
STA:	150.00	175.00	200.00	225.00	250.00	272.00	275.00
ELEV:	97.60	97.50	97.30	97.20	97.10	96.70	96.80
STA:	300.00	325.00	350.00	375.00	400.00	425.00	450.00
ELEV:	97.20	97.20	97.00	97.10	97.70	98.20	98.60

DISCHARGE = 476. WSEL = 97.70 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	476.45	476.45
VELOCITY (FT/S) =	3.68	3.68
AREA (SQUARE FT) =	129.30	129.30
TOPWIDTH (FT) =	313.00	313.00
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.41	.41
WET. PERIM. (FT) =	313.02	313.02
HYD. RADIUS (FT) =	.41	.41
FROUDE NUMBER =	1.01	1.01
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 450.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D75

WATERSHED AREA (A): 482.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3000.	1488.0
5000.	205.0

MEAN SLOPE (Sc): .0763 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

14. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
86. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 4. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.352	.505	.580	.653	.704	.742
Tc (FUNCTION OF i) :	40.94	35.43	33.52	31.97	31.04	30.38
SOLUTION OF Tc (MINUTES):	32	23	20	17	15	14
RAINFL INT. @ Tc (IN/HR):	1.895	3.040	3.816	4.878	5.856	6.811
RUNOFF RATE @ Tc (IN/HR):	.667	1.536	2.215	3.188	4.120	5.055
PEAK DISCHARGE (CFS) :	324.	746.	1076.	1549.	2002.	2456.

SWRMS 11-2-89
CROSS-SECTION - D75

STA:	.00	150.00	290.00	305.00	330.00	425.00
ELEV:	500.00	494.00	492.00	491.80	492.00	500.00

DISCHARGE = 247. WSEL = 492.80 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	246.88	246.88
VELOCITY (FT/S) =	3.97	3.97
AREA (SQUARE FT) =	62.20	62.20
TOPWIDTH (FT) =	105.50	105.50
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.59	.59
WET. PERIM. (FT) =	105.54	105.54
HYD. RADIUS (FT) =	.59	.59
FROUDE NUMBER =	.91	.91
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 425.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D87

WATERSHED AREA (A): 700.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3000.	1488.0
11000.	293.0

MEAN SLOPE (Sc): .0382 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

23. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
77. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.346	.495	.569	.642	.693	.732
Tc (FUNCTION OF i) :	84.59	73.27	69.29	66.03	64.07	62.68
SOLUTION OF Tc (MINUTES):	88	60	51	44	39	36
RAINFL INT. @ Tc (IN/HR):	.904	1.652	2.148	2.778	3.442	4.052
RUNOFF RATE @ Tc (IN/HR):	.313	.818	1.223	1.784	2.384	2.964
PEAK DISCHARGE (CFS) :	221.	577.	863.	1259.	1682.	2092.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING 087

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.58	99.14	98.74	98.46	98.29	98.09

STA:	175.00	200.00
ELEV:	97.81	97.51

DISCHARGE = 232. WSEL = 98.51 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	231.54	231.54
VELOCITY (FT/S) =	4.95	4.95
AREA (SQUARE FT) =	46.74	46.74
TOPWIDTH (FT) =	104.46	104.46
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.45	.45
WET. PERIM. (FT) =	104.47	104.47
HYD. RADIUS (FT) =	.45	.45
FROUDE NUMBER =	1.31	1.31
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 200.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D90

WATERSHED AREA (A): 448.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3000.	1400.0
11000.	180.0

MEAN SLOPE (Sc): .0240 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

72. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
28. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.248	.391	.468	.547	.604	.650
Tc (FUNCTION OF i) :	116.36	96.94	90.22	84.76	81.47	79.15
SOLUTION OF Tc (MINUTES):	142	92	75	62	55	49
RAINFL INT. @ Tc (IN/HR):	.610	1.148	1.582	2.195	2.722	3.305
RUNOFF RATE @ Tc (IN/HR):	.151	.449	.741	1.201	1.645	2.147
PEAK DISCHARGE (CFS) :	68.	203.	334.	542.	743.	969.

SWRMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D90

STA:	.00	25.00	50.00	75.00	100.00	108.00	125.00
ELEV:	100.00	98.79	96.80	94.65	93.57	93.56	94.15
STA:	150.00	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	95.12	96.29	97.62	99.00	99.87	100.18	100.04

DISCHARGE = 203. WSEL = 94.56 SLOPE = .0140

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	202.54	202.54
VELOCITY (FT/S) =	6.05	6.05
AREA (SQUARE FT) =	33.45	33.45
TOPWIDTH (FT) =	58.48	58.48
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.57	.57
WET. PERIM. (FT) =	58.52	58.52
HYD. RADIUS (FT) =	.57	.57
FROUDE NUMBER =	1.41	1.41
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D92

WATERSHED AREA (A): 318.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
12800.	360.0

MEAN SLOPE (Sc): .0323 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

93. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.199	.340	.419	.501	.561	.610
Tc (FUNCTION OF i) :	112.69	91.01	83.76	77.95	74.50	72.07
SOLUTION OF Tc (MINUTES):	135	84	67	55	48	43
RAINFL INT. @ Tc (IN/HR):	.637	1.238	1.742	2.394	3.005	3.592
RUNOFF RATE @ Tc (IN/HR):	.127	.421	.730	1.200	1.687	2.190
PEAK DISCHARGE (CFS) :	41.	135.	234.	385.	541.	702.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D92

STA:	.00	25.00	50.00	75.00	100.00	125.00	130.30
ELEV:	100.00	99.60	99.05	98.29	97.51	97.19	97.18

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	97.48	97.94	97.83	97.62	97.48

DISCHARGE = 213. WSEL = 97.94 SLOPE = .0110

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	213.17	213.17
VELOCITY (FT/S) =	3.81	3.81
AREA (SQUARE FT) =	55.98	55.98
TOPWIDTH (FT) =	163.78	163.78
DEPTH (FT) =	.76	.76
HYD. DEPTH (FT) =	.34	.34
WET. PERIM. (FT) =	163.80	163.80
HYD. RADIUS (FT) =	.34	.34
FROUDE NUMBER =	1.15	1.15
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D97

WATERSHED AREA (A): 645.00 acres

LENGTH OF WATERCOURSE (Lc): 17500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
13200.	340.0

MEAN SLOPE (Sc): .0378 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

39. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
61. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 11. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.345	.486	.558	.629	.679	.718
Tc (FUNCTION OF i) :	91.34	79.67	75.41	71.86	69.70	68.15
SOLUTION OF Tc (MINUTES):	99	68	58	49	44	40
RAINFL INT. @ Tc (IN/HR):	.820	1.482	1.956	2.597	3.159	3.765
RUNOFF RATE @ Tc (IN/HR):	.283	.720	1.091	1.634	2.146	2.704
PEAK DISCHARGE (CFS) :	184.	468.	709.	1062.	1395.	1758.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D97

STA:	.00	25.00	50.00	75.00	100.00	118.60	125.00
ELEV:	100.00	99.71	99.42	99.06	98.81	98.68	98.70

STA:	150.00	175.00
ELEV:	98.87	99.00

DISCHARGE = 40. WSEL = 99.00 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	39.60	39.60
VELOCITY (FT/S) =	2.55	2.55
AREA (SQUARE FT) =	15.53	15.53
TOPWIDTH (FT) =	94.00	94.00
DEPTH (FT) =	.32	.32
HYD. DEPTH (FT) =	.17	.17
WET. PERIM. (FT) =	94.00	94.00
HYD. RADIUS (FT) =	.17	.17
FROUDE NUMBER =	1.11	1.11
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 175.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D106

WATERSHED AREA (A): 117.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
8000.	151.0

MEAN SLOPE (Sc): .0189 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 20. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.299	.421	.489	.561	.613	.656
Tc (FUNCTION OF i) :	84.95	74.07	69.75	66.03	63.71	62.04
SOLUTION OF Tc (MINUTES):	89	61	52	44	39	35
RAINFL INT. @ Tc (IN/HR):	.896	1.628	2.109	2.778	3.442	4.109
RUNOFF RATE @ Tc (IN/HR):	.268	.686	1.032	1.558	2.111	2.695
PEAK DISCHARGE (CFS) :	32.	81.	122.	184.	249.	318.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING 0106

STA:	.00	25.00	50.00	56.80	75.00	100.00	125.00
ELEV:	100.00	99.62	99.26	99.15	99.31	99.56	99.77

STA:	150.00
ELEV:	99.53

DISCHARGE = 135. WSEL = 99.77 SLOPE = .0140

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	135.17	135.17
VELOCITY (FT/S) =	3.69	3.69
AREA (SQUARE FT) =	36.66	36.66
TOPWIDTH (FT) =	134.87	134.87
DEPTH (FT) =	.62	.62
HYD. DEPTH (FT) =	.27	.27
WET. PERIM. (FT) =	134.88	134.88
HYD. RADIUS (FT) =	.27	.27
FROUDE NUMBER =	1.25	1.25
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 150.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D111

WATERSHED AREA (A): 329.00 acres

LENGTH OF WATERCOURSE (Lc): 10400. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5200. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10400.	145.0

MEAN SLOPE (Sc): .0139 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.184	.326	.405	.488	.550	.599
Tc (FUNCTION OF i) :	122.56	97.62	89.47	83.00	79.17	76.49
SOLUTION OF Tc (MINUTES):	153	93	74	60	52	47
RAINFL INT. @ Tc (IN/HR):	.574	1.138	1.600	2.258	2.825	3.391
RUNOFF RATE @ Tc (IN/HR):	.106	.370	.648	1.103	1.553	2.031
PEAK DISCHARGE (CFS) :	35.	123.	215.	366.	515.	674.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING 0111

STA:	.00	40.00	65.00	90.00	120.00	170.00	230.00
ELEV:	28.00	26.00	24.00	22.00	20.20	22.00	24.00

STA:	345.00
ELEV:	25.00

DISCHARGE = 118. WSEL = 21.20 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	118.48	118.48
VELOCITY (FT/S) =	5.33	5.33
AREA (SQUARE FT) =	22.22	22.22
TOPWIDTH (FT) =	44.44	44.44
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.50	.50
WET. PERIM. (FT) =	44.49	44.49
HYD. RADIUS (FT) =	.50	.50
FROUDE NUMBER =	1.33	1.33
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 345.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D114-115

WATERSHED AREA (A): 2205.00 acres

LENGTH OF WATERCOURSE (Lc): 24000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 12000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
6000.	1288.0
18000.	260.0

MEAN SLOPE (Sc): .0218 ft BASIN FACTOR (Nb): .0430

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

52. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
48. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.288	.434	.509	.586	.640	.683
Tc (FUNCTION OF i) :	135.46	114.97	107.79	101.92	98.38	95.87
SOLUTION OF Tc (MINUTES):	178	118	98	82	72	65
RAINFL INT. @ Tc (IN/HR):	.507	.940	1.266	1.728	2.194	2.680
RUNOFF RATE @ Tc (IN/HR):	.146	.408	.645	1.013	1.405	1.831
PEAK DISCHARGE (CFS) :	324.	906.	1434.	2251.	3122.	4069.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D114

STA:	.00	25.00	50.00	75.00	100.00	125.00	136.60
ELEV:	100.00	99.78	99.48	98.94	98.15	97.54	97.47

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	97.60	98.30	99.07	99.53	99.60

DISCHARGE = 288. WSEL = 98.47 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	287.80	287.80
VELOCITY (FT/S) =	5.29	5.29
AREA (SQUARE FT) =	54.44	54.44
TOPWIDTH (FT) =	90.65	90.65
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.60	.60
WET. PERIM. (FT) =	90.67	90.67
HYD. RADIUS (FT) =	.60	.60
FROUDE NUMBER =	1.20	1.20
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D115

STA:	.00	25.00	60.00	70.00	78.00	82.00	90.00
ELEV:	40.00	39.00	38.00	37.00	36.00	35.40	35.00

STA:	100.00	105.00	115.00	125.00	250.00
ELEV:	35.00	35.20	35.50	36.00	36.50

DISCHARGE = 175. WSEL = 36.00 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	175.25	175.25
VELOCITY (FT/S) =	5.64	5.64
AREA (SQUARE FT) =	31.10	31.10
TOPWIDTH (FT) =	47.00	47.00
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.66	.66
WET. PERIM. (FT) =	47.08	47.08
HYD. RADIUS (FT) =	.66	.66
FROUDE NUMBER =	1.22	1.22
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D117

WATERSHED AREA (A): 220.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft | INCREMENTAL CHANGE IN ELEV (Hi) - ft

8000. | 120.0

MEAN SLOPE (Sc): .0150 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

85. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
15. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.222	.364	.441	.522	.581	.628
Tc (FUNCTION OF i) :	104.91	86.09	79.68	74.49	71.39	69.20
SOLUTION OF Tc (MINUTES):	121	77	62	52	46	41
RAINFL INT. @ Tc (IN/HR):	.698	1.332	1.863	2.484	3.082	3.707
RUNOFF RATE @ Tc (IN/HR):	.155	.485	.823	1.297	1.790	2.327
PEAK DISCHARGE (CFS) :	34.	107.	182.	288.	397.	516.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D117

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.73	99.12	98.24	97.22	96.09	94.99
STA:	175.00	200.00	225.00	235.80	250.00	275.00	300.00
ELEV:	93.96	93.03	92.43	92.38	92.54	93.27	94.21
STA:	325.00	350.00	375.00	400.00	425.00	450.00	
ELEV:	95.14	96.04	96.95	97.59	97.90	98.00	

DISCHARGE = 287. WSEL = 93.38 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	286.85	286.85
VELOCITY (FT/S) =	5.36	5.36
AREA (SQUARE FT) =	53.53	53.53
TOPWIDTH (FT) =	87.33	87.33
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.61	.61
WET. PERIM. (FT) =	87.36	87.36
HYD. RADIUS (FT) =	.61	.61
FROUDE NUMBER =	1.21	1.21
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 450.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D125

WATERSHED AREA (A): 762.00 acres

LENGTH OF WATERCOURSE (Lc): 11000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3200.	484.0
7800.	170.0

MEAN SLOPE (Sc): .0325 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

33. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
67. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.326	.474	.549	.623	.675	.715
Tc (FUNCTION OF i) :	71.99	61.96	58.44	55.55	53.80	52.57
SOLUTION OF Tc (MINUTES):	69	48	41	35	31	28
RAINFL INT. @ Tc (IN/HR):	1.111	1.933	2.474	3.229	3.955	4.713
RUNOFF RATE @ Tc (IN/HR):	.362	.916	1.357	2.011	2.668	3.369
PEAK DISCHARGE (CFS) :	278.	704.	1043.	1545.	2049.	2588.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D125

STA:	.00	100.00	155.00	230.00	300.00
ELEV:	32.00	30.40	30.00	32.00	32.50

DISCHARGE = 267. WSEL = 31.00 SLOPE = .0050

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	266.96	266.96
VELOCITY (FT/S) =	3.61	3.61
AREA (SQUARE FT) =	74.00	74.00
TOPWIDTH (FT) =	130.00	130.00
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.57	.57
WET. PERIM. (FT) =	130.02	130.02
HYD. RADIUS (FT) =	.57	.57
FROUDE NUMBER =	.84	.84
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 0126

WATERSHED AREA (A): 275.00 acres

LENGTH OF WATERCOURSE (Lc): 10000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1500.	465.0
4500.	110.0
4000.	55.0

MEAN SLOPE (Sc): .0232 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

63. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
37. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.266	.410	.487	.565	.621	.665
Tc (FUNCTION OF i) :	84.28	70.84	66.16	62.34	60.04	58.41
SOLUTION OF Tc (MINUTES):	88	57	48	41	36	33
RAINFL INT. @ Tc (IN/HR):	.904	1.718	2.244	2.913	3.621	4.253
RUNOFF RATE @ Tc (IN/HR):	.240	.705	1.092	1.645	2.247	2.827
PEAK DISCHARGE (CFS) :	67.	195.	303.	456.	623.	784.

SWDMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D126

STA:	.00	110.00	260.00	380.00
ELEV:	32.00	31.00	31.00	32.00

DISCHARGE = 777. WSEL = 31.77 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	777.04	777.04
VELOCITY (FT/S) =	4.23	4.23
AREA (SQUARE FT) =	183.68	183.68
TOPWIDTH (FT) =	327.10	327.10
DEPTH (FT) =	.77	.77
HYD. DEPTH (FT) =	.56	.56
WET. PERIM. (FT) =	327.11	327.11
HYD. RADIUS (FT) =	.56	.56
FROUDE NUMBER =	.99	.99
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 380.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D128

WATERSHED AREA (A): 830.00 acres

LENGTH OF WATERCOURSE (Lc): 18000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 9000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4000.	1588.0
14000.	255.0

MEAN SLOPE (Sc): .0267 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

35. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
65. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.322	.470	.545	.619	.671	.712
Tc (FUNCTION OF i) :	116.72	100.33	94.57	89.85	86.99	84.98
SOLUTION OF Tc (MINUTES):	143	97	81	68	60	54
RAINFL INT. @ Tc (IN/HR):	.607	1.099	1.482	2.026	2.568	3.104
RUNOFF RATE @ Tc (IN/HR):	.195	.516	.807	1.254	1.723	2.208
PEAK DISCHARGE (CFS) :	163.	432.	675.	1049.	1442.	1848.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D128

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.79	99.36	98.83	98.49	98.31	98.20

STA:	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	98.12	98.22	98.43	98.50	98.40	98.26

DISCHARGE = 94. WSEL = 98.50 SLOPE = .0120

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	93.68	93.68
VELOCITY (FT/S) =	2.59	2.59
AREA (SQUARE FT) =	36.13	36.13
TOPWIDTH (FT) =	200.74	200.74
DEPTH (FT) =	.38	.38
HYD. DEPTH (FT) =	.18	.18
WET. PERIM. (FT) =	200.74	200.74
HYD. RADIUS (FT) =	.18	.18
FROUDE NUMBER =	1.08	1.08
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D130

WATERSHED AREA (A): 643.00 acres

LENGTH OF WATERCOURSE (Lc): 19000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 9500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1400.	1200.0
4800.	260.0
12800.	191.0

MEAN SLOPE (Sc): .0224 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

83. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
17. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.240	.380	.456	.535	.592	.638
Tc (FUNCTION OF i) :	130.85	108.97	101.29	95.02	91.23	88.55
SOLUTION OF Tc (MINUTES):	169	109	90	74	64	58
RAINFL INT. @ Tc (IN/HR):	.529	1.001	1.357	1.884	2.428	2.931
RUNOFF RATE @ Tc (IN/HR):	.127	.380	.619	1.008	1.438	1.871
PEAK DISCHARGE (CFS) :	82.	246.	401.	653.	932.	1212.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D130

STA:	.00	95.00	125.00	160.00
ELEV:	48.00	46.10	46.10	47.40

DISCHARGE = 248. WSEL = 47.10 SLOPE = .0043

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	247.71	247.71
VELOCITY (FT/S) =	3.62	3.62
AREA (SQUARE FT) =	68.46	68.46
TOPWIDTH (FT) =	106.92	106.92
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.64	.64
WET. PERIM. (FT) =	106.95	106.95
HYD. RADIUS (FT) =	.64	.64
FROUDE NUMBER =	.80	.80
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 160.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D133

WATERSHED AREA (A): 524.00 acres

LENGTH OF WATERCOURSE (Lc): 21000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 10500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
19800.	450.0

MEAN SLOPE (Sc): .0250 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

93. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.206	.347	.425	.507	.566	.614
Tc (FUNCTION OF i) :	141.58	114.94	105.97	98.76	94.45	91.43
SOLUTION OF Tc (MINUTES):	190	118	96	78	68	60
RAINFL INT. @ Tc (IN/HR):	.480	.940	1.287	1.802	2.304	2.874
RUNOFF RATE @ Tc (IN/HR):	.099	.326	.547	.913	1.305	1.766
PEAK DISCHARGE (CFS) :	52.	172.	289.	482.	689.	933.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D133

STA:	.00	25.00	50.00	75.00	100.00	107.00	125.00
ELEV:	100.00	99.76	99.36	99.04	98.77	98.75	98.87

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	99.12	99.45	99.62	99.74	99.68

DISCHARGE = 433. WSEL = 99.74 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	433.19	433.19
VELOCITY (FT/S) =	4.34	4.34
AREA (SQUARE FT) =	99.86	99.86
TOPWIDTH (FT) =	223.75	223.75
DEPTH (FT) =	.99	.99
HYD. DEPTH (FT) =	.45	.45
WET. PERIM. (FT) =	223.76	223.76
HYD. RADIUS (FT) =	.45	.45
FROUDE NUMBER =	1.14	1.14
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D135

WATERSHED AREA (A): 638.00 acres

LENGTH OF WATERCOURSE (Lc): 17800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8900. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
17800.	275.0

MEAN SLOPE (Sc): .0154 ft BASIN FACTOR (Nb): .0460

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.207	.345	.422	.503	.562	.610
Tc (FUNCTION OF i) :	158.40	129.23	119.21	111.10	106.25	102.83
SOLUTION OF Tc (MINUTES):	226	141	114	93	81	72
RAINFL INT. @ Tc (IN/HR):	.413	.810	1.122	1.557	1.986	2.455
RUNOFF RATE @ Tc (IN/HR):	.086	.279	.473	.783	1.117	1.498
PEAK DISCHARGE (CFS) :	55.	179.	304.	503.	718.	963.

SWBMS
CROSS-SECTION - DIP SECTION RATING D135

STA:	.00	30.00	50.00	115.00	190.00
ELEV:	60.00	59.60	59.60	60.00	60.30

DISCHARGE = 625. WSEL = 60.60 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	625.39	625.39
VELOCITY (FT/S) =	4.82	4.82
AREA (SQUARE FT) =	129.75	129.75
TOPWIDTH (FT) =	190.00	190.00
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.68	.68
WET. PERIM. (FT) =	190.00	190.00
HYD. RADIUS (FT) =	.68	.68
FROUDE NUMBER =	1.03	1.03
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 190.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D137-D136

WATERSHED AREA (A): 2717.00 acres

LENGTH OF WATERCOURSE (Lc): 26500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 13250. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
22200.	440.0

MEAN SLOPE (Sc): .0256 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): FOOTHILLS/MTN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

66. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
34. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 7. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.267	.410	.485	.563	.619	.663
Tc (FUNCTION OF i) :	151.68	127.78	119.37	112.50	108.34	105.40
SOLUTION OF Tc (MINUTES):	211	138	114	95	83	75
RAINFL INT. @ Tc (IN/HR):	.438	.824	1.122	1.530	1.946	2.371
RUNOFF RATE @ Tc (IN/HR):	.117	.338	.545	.861	1.204	1.572
PEAK DISCHARGE (CFS) :	320.	925.	1491.	2359.	3297.	4304.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D136

STA:	.00	25.00	50.00	75.00	100.00	125.00	133.60
ELEV:	100.00	99.73	99.38	99.10	98.76	98.48	98.38

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	98.45	98.53	98.81	98.86	98.91

DISCHARGE = 558. WSEL = 99.38 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	558.45	558.45
VELOCITY (FT/S) =	4.51	4.51
AREA (SQUARE FT) =	123.75	123.75
TOPWIDTH (FT) =	200.00	200.00
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.62	.62
WET. PERIM. (FT) =	200.01	200.01
HYD. RADIUS (FT) =	.62	.62
FROUDE NUMBER =	1.01	1.01
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D137

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	98.91	98.68	98.16	97.62	97.14	96.95	97.19

STA:	175.00	200.00	225.00	250.00
ELEV:	97.70	98.04	98.08	97.93

DISCHARGE = 321. WSEL = 97.95 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	321.35	321.35
VELOCITY (FT/S) =	4.21	4.21
AREA (SQUARE FT) =	76.35	76.35
TOPWIDTH (FT) =	136.99	136.99
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.56	.56
WET. PERIM. (FT) =	137.01	137.01
HYD. RADIUS (FT) =	.56	.56
FROUDE NUMBER =	.99	.99
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D144

WATERSHED AREA (A): 3570.00 acres

LENGTH OF WATERCOURSE (Lc): 56000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 28000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
56000.	1223.0

MEAN SLOPE (Sc): .0218 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

55. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
4. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
41. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.278	.424	.500	.577	.632	.675
Tc (FUNCTION OF i) :	249.16	210.57	197.09	186.08	179.43	174.74
SOLUTION OF Tc (MINUTES):	446	292	242	201	176	158
RAINFL INT. @ Tc (IN/HR):	.234	.442	.599	.826	1.053	1.286
RUNOFF RATE @ Tc (IN/HR):	.065	.187	.299	.477	.666	.868
PEAK DISCHARGE (CFS) :	234.	673.	1077.	1716.	2395.	3125.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D144

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.75	99.39	99.09	98.92	99.01	99.17

STA:	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	99.27	99.48	99.79	100.11	100.38	100.63

DISCHARGE = 493. WSEL = 99.92 SLOPE = .0050

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	492.65	492.65
VELOCITY (FT/S) =	3.69	3.69
AREA (SQUARE FT) =	133.60	133.60
TOPWIDTH (FT) =	227.16	227.16
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.59	.59
WET. PERIM. (FT) =	227.17	227.17
HYD. RADIUS (FT) =	.59	.59
FROUDE NUMBER =	.85	.85
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D145

WATERSHED AREA (A): 1604.00 acres

LENGTH OF WATERCOURSE (Lc): 14960. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7480. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1180.	240.0
6020.	160.0
7760.	75.0

MEAN SLOPE (Sc): .0159 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): FOOTHILLS/MTN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

68.% B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
32. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.249	.394	.472	.551	.608	.653
Tc (FUNCTION OF i) :	128.11	106.60	99.22	93.23	89.64	87.10
SOLUTION OF Tc (MINUTES):	164	106	87	72	63	56
RAINFL INT. @ Tc (IN/HR):	.542	1.023	1.396	1.929	2.461	3.017
RUNOFF RATE @ Tc (IN/HR):	.135	.403	.658	1.063	1.496	1.971
PEAK DISCHARGE (CFS) :	218.	652.	1064.	1718.	2419.	3186.

SWBMS 11-2-89
CROSS-SECTION - DIP SECTION RATING D145

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.69	99.00	98.28	97.20	96.07	95.35
STA:	172.30	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	95.09	95.10	95.30	95.82	96.53	97.28	97.97
STA:	325.00	350.00	375.00	400.00			
ELEV:	98.63	99.15	99.51	99.77			

DISCHARGE = 310. WSEL = 96.09 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	309.58	309.58
VELOCITY (FT/S) =	4.53	4.53
AREA (SQUARE FT) =	68.38	68.38
TOPWIDTH (FT) =	109.95	109.95
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.62	.62
WET. PERIM. (FT) =	109.97	109.97
HYD. RADIUS (FT) =	.62	.62
FROUDE NUMBER =	1.01	1.01
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 400.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: D146

WATERSHED AREA (A): 1652.00 acres

LENGTH OF WATERCOURSE (Lc): 17910. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8955. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1180.	240.0
6020.	160.0
10710.	100.0

MEAN SLOPE (Sc): .0142 ft BASIN FACTOR (Nb): .0460

WATERSHED TYPE(S): FOOTHILLS/MTN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

69. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
31. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 7. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.261	.403	.479	.557	.613	.658
Tc (FUNCTION OF i) :	150.05	126.04	117.62	110.74	106.58	103.64
SOLUTION OF Tc (MINUTES):	208	136	112	93	81	73
RAINFL INT. @ Tc (IN/HR):	.444	.834	1.137	1.557	1.986	2.426
RUNOFF RATE @ Tc (IN/HR):	.116	.336	.545	.868	1.218	1.596
PEAK DISCHARGE (CFS) :	193.	560.	908.	1445.	2028.	2658.

DSWBMS 12-18-89
CROSS-SECTION - SECTION RATING D146

STA:	.00	30.00	70.00	140.00	200.00	220.00	240.00
ELEV:	501.40	500.00	499.50	499.50	500.00	498.60	498.60

STA:	255.00	280.00	300.00	325.00
ELEV:	499.50	499.70	499.70	500.00

DISCHARGE = 83. WSEL = 499.60 SLOPE = .0075

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	82.67	82.67
VELOCITY (FT/S) =	1.88	1.88
AREA (SQUARE FT) =	44.02	44.02
TOPWIDTH (FT) =	151.79	151.79
DEPTH (FT) =	1.00	1.00
HYD. DEPTH (FT) =	.29	.29
WET. PERIM. (FT) =	151.85	151.85
HYD. RADIUS (FT) =	.29	.29
FROUDE NUMBER =	.61	.61
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 325.00

APPENDIX E IMPROVED CHANNEL ANALYSIS CALCULATIONS

Improved channels within the SWBMSA were cataloged as summarized in Table 9. Capacity ratings were performed using Manning's equation. These ratings were compared to the predicted 100-year peak discharges for the appropriate watersheds, however, some of the improved channels are located within 100-year sheetflow areas. In these sheetflow areas specific 100-year discharges at the improved channel locations were not determined. The improved channel locations are shown on Figure 14.

IMPROVED CHANNEL SUMMARY TABLE

Structure	Capacity (cfs)		Q100 (cfs)	Non-Exceedance Recurrence Interval
I1	447		1123	10 yr
I2	654		2863	5 yr
I3	4063		4063*	100 yr
I4a[1]	1017		1017*	100 yr
I4b	767		767*	100 yr
I5	49		49*	100 yr
I6	265		265*	100 yr
I7	234		-	
I8	172	806	- } 3455**[2]	
I9	400		-	
I10	1068		933	100 yr
I11	269	390	4459**[3]	
I12	121		- } 4061***[4]	
I13	108		-	
I14	818		818*	100 yr
I15	281		281*	100 yr
I16	281		281*	100 yr
I17	899		899*	100 yr
I18	707		- } 663	
I19	426		-	
I20	522		829	25 yr
I21	452		1758**	
I22	341		777	10 yr
(NO 23)				
I24	632		632*	100 yr
I26	300		300*	100 yr
I27	3300		3300*	100 yr
I29	558		3884	<5 yr
I30	265		1513	<2 yr
(NO 31)				
I32	378		404	50 yr
I33	1136		2293	10 yr
I34	231		431	10 yr
I35	608		552**	
I36	356		1386	2 yr
I37	356		657	10 yr

[1] Channel design approved and not constructed.

* Channel analyzed discharges taken from approved H&H reports.

** No defined discharge concentrating at channel location, upstream flow occurs as sheetflow over a wide area.

[2] From HEC-1 routing CP9.

[3] From HEC-1 routing CP13.

[4] From HEC-1 routing CP10.

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I1

WATERSHED AREA (A): 213.00 acres

LENGTH OF WATERCOURSE (Lc): 4800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2400. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 4800.

INCREMENTAL CHANGE IN ELEV (Hi) - 750.0

MEAN SLOPE (Sc): .1563 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

88. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
12. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.186	.333	.414	.498	.559	.608
Tc (FUNCTION OF i) :	29.18	23.14	21.21	19.70	18.80	18.18
SOLUTION OF Tc (MINUTES):	20	13	11	10	8	8
RAINFL INT. @ Tc (IN/HR):	2.498	4.031	5.005	6.097	7.679	8.593
RUNOFF RATE @ Tc (IN/HR):	.466	1.342	2.071	3.037	4.295	5.228
PEAK DISCHARGE (CFS) :	100.	288.	445.	652.	922.	1123.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I1

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0050 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	19.40	1.80	0.47	23.0
1.00	1.00	23.00	26.32	894.9	63.28	2.75	0.52	26.0
1.50	1.50	36.75	29.49	1811.9	128.12	3.49	0.55	29.0
2.00	2.00	52.00	32.65	3019.1	213.48	4.11	0.57	32.0
2.50	2.50	68.75	35.81	4520.9	319.68	4.65	0.58	35.0
3.00	3.00	87.00	38.97	6326.1	447.32	5.14	0.60	38.0
3.50	3.50	106.75	42.14	8445.6	597.19	5.59	0.61	41.0
4.00	4.00	128.00	45.30	10891.3	770.13	6.02	0.62	44.0
4.50	4.50	150.75	48.46	13675.9	967.03	6.41	0.63	47.0
5.00	5.00	175.00	51.62	16812.1	1188.79	6.79	0.64	50.0

CAPACITY @ AVAILABLE DEPTH

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I2

WATERSHED AREA (A): 1263.00 acres

LENGTH OF WATERCOURSE (Lc): 15500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
5500.	900.0
10000.	165.0

MEAN SLOPE (Sc): .0287 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

86. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
14. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.220	.362	.439	.520	.579	.626
Tc (FUNCTION OF i) :	108.66	89.06	82.38	76.99	73.77	71.50
SOLUTION OF Tc (MINUTES):	128	81	66	54	48	43
RAINFL INT. @ Tc (IN/HR):	.666	1.276	1.765	2.439	3.005	3.592
RUNOFF RATE @ Tc (IN/HR):	.146	.462	.775	1.269	1.740	2.249
PEAK DISCHARGE (CFS) :	186.	588.	987.	1616.	2215.	2863.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

nderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I2

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0060 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	21.25	1.98	0.51	23.0
1.00	1.00	23.00	26.32	894.9	69.32	3.01	0.56	26.0
1.50	1.50	36.75	29.49	1811.9	140.35	3.82	0.60	29.0
2.00	2.00	52.00	32.65	3019.1	233.86	4.50	0.62	32.0
2.50	2.50	68.75	35.81	4520.9	350.19	5.09	0.64	35.0
3.00	3.00	87.00	38.97	6326.1	490.02	5.63	0.66	38.0
3.50	3.50	106.75	42.14	8445.6	654.19	6.13	0.67	41.0
4.00	4.00	128.00	45.30	10891.3	843.64	6.59	0.68	44.0
4.50	4.50	150.75	48.46	13675.9	1059.33	7.03	0.69	47.0
5.00	5.00	175.00	51.62	16812.1	1302.26	7.44	0.70	50.0

AVAILABLE DEPTH

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I3

Preparer: TJP
Job#: 84145
Date: 03-28-1990

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	2526.00	.027
2	20.00	2520.00	.027
3	80.00	2520.00	.027
4	110.00	2526.00	-

Channel Slope = 0.0040 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft
2521.00	1.00	64.17	68.58	3387.5	214.24	3.34	0.61	68.3
2521.50	1.50	99.38	72.87	6744.1	426.54	4.29	0.65	72.5
2522.00	2.00	136.67	77.16	11041.0	698.29	5.11	0.67	76.
2522.50	2.50	176.04	81.45	16240.4	1027.13	5.83	0.70	80.
2523.00	3.00	217.50	85.74	22325.9	1412.01	6.49	0.72	85.0
2523.50	3.50	261.04	90.03	29292.6	1852.63	7.10	0.73	89.
2524.00	4.00	306.67	94.32	37142.9	2349.12	7.66	0.74	93.
2524.50	4.50	354.38	98.61	45883.8	2901.94	8.19	0.76	97.5
2525.00	5.00	404.17	102.90	55525.5	3511.74	8.69	0.77	101.
2525.50	5.50	456.04	107.19	66080.6	4179.30	9.16	0.78	105.
2526.00	6.00	510.00	111.47	77563.1	4905.52	9.62	0.79	110.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I4a (proposed) (Mission West II)

Preparer: TJP
Job#: 84145
Date: 03-28-1990

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	6.00	.027
2	12.00	0.00	.027
3	82.00	0.00	.027
4	94.00	6.00	-

Channel Slope = 0.0030 ft./ft.

Filename: I3

Press any key to continue...

W.S.E. = 5.29 ft.
Depth = 5.29 ft.
Channel Slope = 0.0030 ft./ft.

	NOTES	STA-ft	MAN.n	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
LEFT BANK		1.4								
			0.027	425.99	93.64	64540.0	3535.00	8.30	0.68	91.1
RIGHT BANK		92.6								
TOTALS:				425.99	93.64	64540.0	3535.00	8.30	0.68	91.1

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I4b

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	45.00	0.00	.035
4	60.00	5.00	-

Channel Slope = 0.0060 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	15.75	33.16	408.2	31.62	2.01	0.51	33.0
1.00	1.00	33.00	36.32	1317.8	102.08	3.09	0.57	36.0
1.50	1.50	51.75	39.49	2638.4	204.37	3.95	0.60	39.0
2.00	2.00	72.00	42.65	4345.8	336.62	4.68	0.63	42.0
2.50	2.50	93.75	45.81	6433.1	498.31	5.32	0.65	45.0
3.00	3.00	117.00	48.97	8901.3	689.49	5.89	0.67	48.0
3.50	3.50	141.75	52.14	11755.3	910.56	6.42	0.68	51.0
4.00	4.00	168.00	55.30	15002.4	1162.08	6.92	0.69	54.0
4.50	4.50	195.75	58.46	18651.5	1444.74	7.38	0.70	57.0
5.00	5.00	225.00	61.62	22712.3	1759.29	7.82	0.71	60.0

AVAILABLE DEPTH

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I5

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0040 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	17.35	1.61	0.42	23.0
1.00	1.00	23.00	26.32	894.9	56.60	2.46	0.46	26.0
1.50	1.50	36.75	29.49	1811.9	114.59	3.12	0.49	29.0
2.00	2.00	52.00	32.65	3019.1	190.94	3.67	0.51	32.0
2.50	2.50	68.75	35.81	4520.9	285.93	4.16	0.52	35.0
3.00	3.00	87.00	38.97	6326.1	400.10	4.60	0.54	38.0
3.50	3.50	106.75	42.14	8445.6	534.15	5.00	0.55	41.0
4.00	4.00	128.00	45.30	10891.3	688.83	5.38	0.56	44.0
4.50	4.50	150.75	48.46	13675.9	864.94	5.74	0.56	47.0
5.00	5.00	175.00	51.62	16812.1	1063.29	6.08	0.57	50.0

AVAILABLE DEPTH

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I6

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0050 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	19.40	1.80	0.47	23.0
1.00	1.00	23.00	26.32	894.9	63.28	2.75	0.52	26.0
1.50	1.50	36.75	29.49	1811.9	128.12	3.49	0.55	29.0
2.00	2.00	52.00	32.65	3019.1	213.48	4.11	0.57	32.0
2.50	2.50	68.75	35.81	4520.9	319.68	4.65	0.58	35.0
3.00	3.00	87.00	38.97	6326.1	447.32	5.14	0.60	38.0
3.50	3.50	106.75	42.14	8445.6	597.19	5.59	0.61	41.0
4.00	4.00	128.00	45.30	10891.3	770.13	6.02	0.62	44.0
4.50	4.50	150.75	48.46	13675.9	967.03	6.41	0.63	47.0
5.00	5.00	175.00	51.62	16812.1	1188.79	6.79	0.64	50.0

AVAILABLE DEPTH

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I7

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0060 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	21.25	1.98	0.51	23.0
1.00	1.00	23.00	26.32	894.9	69.32	3.01	0.56	26.0
1.50	1.50	36.75	29.49	1811.9	140.35	3.82	0.60	29.0
2.00	2.00	52.00	32.65	3019.1	233.86	4.50	0.62	32.0
2.50	2.50	68.75	35.81	4520.9	350.19	5.09	0.64	35.0
3.00	3.00	87.00	38.97	6326.1	490.02	5.63	0.66	38.0
3.50	3.50	106.75	42.14	8445.6	654.19	6.13	0.67	41.0
4.00	4.00	128.00	45.30	10891.3	843.64	6.59	0.68	44.0
4.50	4.50	150.75	48.46	13675.9	1059.33	7.03	0.69	47.0
5.00	5.00	175.00	51.62	16812.1	1302.26	7.44	0.70	50.0

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I8

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	25.00	0.00	.035
4	40.00	5.00	-

Channel Slope = 0.0100 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	140.9	14.09	2.45	0.65	13.0
1.00	1.00	13.00	16.32	475.5	47.55	3.66	0.72	16.0
1.50	1.50	21.75	19.49	996.3	99.63	4.58	0.75	19.0
2.00	2.00	32.00	22.65	1715.3	171.53	5.36	0.78	22.0
2.50	2.50	43.75	25.81	2647.7	264.77	6.05	0.81	25.0
3.00	3.00	57.00	28.97	3809.9	380.99	6.68	0.83	28.0
3.50	3.50	71.75	32.14	5217.9	521.79	7.27	0.84	31.0
4.00	4.00	88.00	35.30	6887.9	688.79	7.83	0.86	34.0
4.50	4.50	105.75	38.46	8835.7	883.57	8.36	0.87	37.0
5.00	5.00	125.00	41.62	11076.8	1107.68	8.86	0.88	40.0

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I9

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0040 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	17.35	1.61	0.42	23.0
1.00	1.00	23.00	26.32	894.9	56.60	2.46	0.46	26.0
1.50	1.50	36.75	29.49	1811.9	114.59	3.12	0.49	29.0
2.00	2.00	52.00	32.65	3019.1	190.94	3.67	0.51	32.0
2.50	2.50	68.75	35.81	4520.9	285.93	4.16	0.52	35.0
3.00	3.00	87.00	38.97	6326.1	400.10	4.60	0.54	38.0
3.50	3.50	106.75	42.14	8445.6	534.15	5.00	0.55	41.0
4.00	4.00	128.00	45.30	10891.3	688.83	5.38	0.56	44.0
4.50	4.50	150.75	48.46	13675.9	864.94	5.74	0.56	47.0
5.00	5.00	175.00	51.62	16812.1	1063.29	6.08	0.57	50.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I10

WATERSHED AREA (A): 524.00 acres

LENGTH OF WATERCOURSE (Lc): 21000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 10500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
19800.	450.0

MEAN SLOPE (Sc): .0250 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

93. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.206	.347	.425	.507	.566	.614
Tc (FUNCTION OF i) :	141.58	114.94	105.97	98.76	94.45	91.43
SOLUTION OF Tc (MINUTES):	190	118	96	78	68	60
RAINFL INT. @ Tc (IN/HR):	.480	.940	1.287	1.802	2.304	2.874
RUNOFF RATE @ Tc (IN/HR):	.099	.326	.547	.913	1.305	1.766
PEAK DISCHARGE (CFS) :	52.	172.	289.	482.	689.	933.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I10

Preparer: TJP
Job#: 85145
Date: 10-25-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	55.00	0.00	.035
4	70.00	5.00	

Channel Slope = 0.0050 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	20.75	43.16	542.1	38.33	1.85	0.47	43.0
1.00	1.00	43.00	46.32	1741.9	123.17	2.86	0.52	46.0
1.50	1.50	66.75	49.49	3469.1	245.30	3.67	0.55	49.0
2.00	2.00	92.00	52.65	5682.1	401.78	4.37	0.58	52.0
2.50	2.50	118.75	55.81	8363.0	591.35	4.98	0.60	55.0
3.00	3.00	147.00	58.97	11504.7	813.51	5.53	0.61	58.0
3.50	3.50	176.75	62.14	15106.2	1068.17	6.04	0.63	61.0
4.00	4.00	208.00	65.30	19170.1	1355.53	6.52	0.64	64.0
4.50	4.50	240.75	68.46	23701.1	1675.92	6.96	0.65	67.0
5.00	5.00	275.00	71.62	28706.0	2029.82	7.38	0.66	70.0

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I11

Preparer: TJP
Job#: 85145
Date: 10-25-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	
			.035
2	15.00	0.00	
			.035
3	55.00	0.00	
			.035
4	70.00	5.00	

Channel Slope = 0.0060 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	20.75	43.16	542.1	41.99	2.02	0.51	43.0
1.00	1.00	43.00	46.32	1741.9	134.93	3.14	0.57	46.0
1.50	1.50	66.75	49.49	3469.1	268.71	4.03	0.61	49.0
2.00	2.00	92.00	52.65	5682.1	440.13	4.78	0.63	52.0
2.50	2.50	118.75	55.81	8363.0	647.79	5.46	0.65	55.0
3.00	3.00	147.00	58.97	11504.7	891.15	6.06	0.67	58.0
3.50	3.50	176.75	62.14	15106.2	1170.12	6.62	0.69	61.0
4.00	4.00	208.00	65.30	19170.1	1484.91	7.14	0.70	64.0
4.50	4.50	240.75	68.46	23701.1	1835.88	7.63	0.71	67.0
5.00	5.00	275.00	71.62	28706.0	2223.56	8.09	0.72	70.0

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I12

Preparer: EAB
Job#: 84145
Date: 09-26-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	25.00	0.00	.035
4	40.00	5.00	

Channel Slope = 0.0050 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft
0.50	0.50	5.75	13.16	140.9	9.97	1.73	0.46	13.
1.00	1.00	13.00	16.32	475.5	33.62	2.59	0.51	16.
1.50	1.50	21.75	19.49	996.3	70.45	3.24	0.53	19.
2.00	2.00	32.00	22.65	1715.3	121.29	3.79	0.55	22.
2.50	2.50	43.75	25.81	2647.7	187.22	4.28	0.57	25.
3.00	3.00	57.00	28.97	3809.9	269.40	4.73	0.58	28.
3.50	3.50	71.75	32.14	5217.9	368.96	5.14	0.60	31.
4.00	4.00	88.00	35.30	6887.9	487.05	5.53	0.61	34.
4.50	4.50	105.75	38.46	8835.7	624.78	5.91	0.62	37.
5.00	5.00	125.00	41.62	11076.8	783.25	6.27	0.62	40.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I13

Preparer: EAB
Job#: 84145
Date: 09-26-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	
			.035
2	15.00	0.00	
			.035
3	25.00	0.00	
			.035
4	40.00	5.00	

Channel Slope = 0.0040 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft
0.50	0.50	5.75	13.16	140.9	8.91	1.55	0.41	1
1.00	1.00	13.00	16.32	475.5	30.07	2.31	0.45	16.
1.50	1.50	21.75	19.49	996.3	63.01	2.90	0.48	19.
2.00	2.00	32.00	22.65	1715.3	108.48	3.39	0.50	2
2.50	2.50	43.75	25.81	2647.7	167.46	3.83	0.51	2
3.00	3.00	57.00	28.97	3809.9	240.96	4.23	0.52	28.
3.50	3.50	71.75	32.14	5217.9	330.01	4.60	0.53	3
4.00	4.00	88.00	35.30	6887.9	435.63	4.95	0.54	3
4.50	4.50	105.75	38.46	8835.7	558.82	5.28	0.55	37.
5.00	5.00	125.00	41.62	11076.8	700.56	5.60	0.56	4

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I14 (McGovern, McVittie: Star Valley)

Preparer: EAB
Job#: 84145
Date: 12-15-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	3.33	.03
2	10.00	0.00	.03
3	40.00	0.00	.03
4	50.00	3.33	-

Channel Slope = 0.0108 ft./ft.

W.S.E. = 2.57 ft.
Depth = 2.57 ft.
Channel Slope = 0.0108 ft./ft.

NOTES	STA-ft	MAN.n	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
LEFT BANK	2.3								
		0.030	96.84	46.26	7871.2	818.00	8.45	1.02	45.4
RIGHT BANK	47.7								
TOTALS:			96.84	46.26	7871.2	818.00	8.45	1.02	45.4

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I15 (McGovern, McVilthe, Star Valley)

Preparer: EAB
Job#: 84145
Date: 12-15-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	4.00	.03
2	12.00	0.00	.03
3	29.00	0.00	.03
4	41.00	4.00	-

Channel Slope = 0.0023 ft./ft.

W.S.E. = 2.84 ft.
Depth = 2.84 ft.
Channel Slope = 0.0023 ft./ft.

	NOTES	STA-ft	MAN.n	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
LEFT BANK		3.5								
			0.030	72.54	34.97	5859.4	281.01	3.87	0.47	34.1
RIGHT BANK		37.5								
TOTALS:				72.54	34.97	5859.4	281.01	3.87	0.47	34.1

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I16

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.032
2	15.00	0.00	.032
3	25.00	0.00	.032
4	40.00	5.00	-

Channel Slope = 0.0080 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	154.1	13.79	2.40	0.64	13.0
1.00	1.00	13.00	16.32	520.1	46.52	3.58	0.70	16.0
1.50	1.50	21.75	19.49	1089.7	97.47	4.48	0.74	19.0
2.00	2.00	32.00	22.65	1876.1	167.80	5.24	0.77	22.0
2.50	2.50	43.75	25.81	2896.0	259.02	5.92	0.79	25.0
3.00	3.00	57.00	28.97	4167.0	372.71	6.54	0.81	28.0
3.50	3.50	71.75	32.14	5707.1	510.45	7.11	0.82	31.0
4.00	4.00	88.00	35.30	7533.7	673.83	7.66	0.84	34.0
4.50	4.50	105.75	38.46	9664.1	864.38	8.17	0.85	37.0
5.00	5.00	125.00	41.62	12115.3	1083.62	8.67	0.86	40.0

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I16

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.032
2	15.00	0.00	.032
3	25.00	0.00	.032
4	40.00	5.00	-

Channel Slope = 0.0080 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	154.1	13.79	2.40	0.64	13.0
1.00	1.00	13.00	16.32	520.1	46.52	3.58	0.70	16.0
1.50	1.50	21.75	19.49	1089.7	97.47	4.48	0.74	19.0
2.00	2.00	32.00	22.65	1876.1	167.80	5.24	0.77	22.0
2.50	2.50	43.75	25.81	2896.0	259.02	5.92	0.79	25.0
3.00	3.00	57.00	28.97	4167.0	372.71	6.54	0.81	28.0
3.50	3.50	71.75	32.14	5707.1	510.45	7.11	0.82	31.0
4.00	4.00	88.00	35.30	7533.7	673.83	7.66	0.84	34.0
4.50	4.50	105.75	38.46	9664.1	864.38	8.17	0.85	37.0
5.00	5.00	125.00	41.62	12115.3	1083.62	8.67	0.86	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I18

WATERSHED AREA (A): 266.00 acres

LENGTH OF WATERCOURSE (Lc): 10000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 10000.

INCREMENTAL CHANGE IN ELEV (Hi) - f 190.0

MEAN SLOPE (Sc): .0190 ft

BASIN FACTOR (Nb): .0430

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.207	.345	.422	.503	.562	.610
Tc (FUNCTION OF i) :	96.45	78.69	72.58	67.65	64.69	62.61
SOLUTION OF Tc (MINUTES):	107	67	55	45	40	36
RAINFL INT. @ Tc (IN/HR):	.770	1.501	2.033	2.755	3.365	4.052
RUNOFF RATE @ Tc (IN/HR):	.160	.517	.857	1.386	1.892	2.473
PEAK DISCHARGE (CFS) :	43.	139.	230.	372.	507.	663.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I18

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0125 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	30.67	2.85	0.74	23.0
1.00	1.00	23.00	26.32	894.9	100.05	4.35	0.82	26.0
1.50	1.50	36.75	29.49	1811.9	202.57	5.51	0.86	29.0
2.00	2.00	52.00	32.65	3019.1	337.55	6.49	0.90	32.0
2.50	2.50	68.75	35.81	4520.9	505.45	7.35	0.92	35.0
3.00	3.00	87.00	38.97	6326.1	707.28	8.13	0.95	38.0
3.50	3.50	106.75	42.14	8445.6	944.24	8.85	0.97	41.0
4.00	4.00	128.00	45.30	10891.3	1217.69	9.51	0.98	44.0
4.50	4.50	150.75	48.46	13675.9	1529.01	10.14	1.00	47.0
5.00	5.00	175.00	51.62	16812.1	1879.65	10.74	1.01	50.0

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I19

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	25.00	0.00	.035
4	40.00	5.00	-

Channel Slope = 0.0125 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	140.9	15.76	2.74	0.73	13.0
1.00	1.00	13.00	16.32	475.5	53.16	4.09	0.80	16.0
1.50	1.50	21.75	19.49	996.3	111.39	5.12	0.84	19.0
2.00	2.00	32.00	22.65	1715.3	191.77	5.99	0.88	22.0
2.50	2.50	43.75	25.81	2647.7	296.03	6.77	0.90	25.0
3.00	3.00	57.00	28.97	3809.9	425.95	7.47	0.92	28.0
3.50	3.50	71.75	32.14	5217.9	583.38	8.13	0.94	31.0
4.00	4.00	88.00	35.30	6887.9	770.09	8.75	0.96	34.0
4.50	4.50	105.75	38.46	8835.7	987.87	9.34	0.97	37.0
5.00	5.00	125.00	41.62	11076.8	1238.42	9.91	0.99	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I20

WATERSHED AREA (A): 274.00 acres

LENGTH OF WATERCOURSE (Lc): 9000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 9000.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 190.0

MEAN SLOPE (Sc): .0211 ft

BASIN FACTOR (Nb): .0400

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 15. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.261	.389	.461	.537	.592	.637
Tc (FUNCTION OF i) :	73.66	62.75	58.64	55.18	53.05	51.53
SOLUTION OF Tc (MINUTES):	72	49	41	35	31	28
RAINFL INT. @ Tc (IN/HR):	1.071	1.900	2.474	3.229	3.955	4.713
RUNOFF RATE @ Tc (IN/HR):	.279	.739	1.141	1.733	2.342	3.001
PEAK DISCHARGE (CFS) :	77.	204.	315.	479.	647.	829.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I20

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	25.00	0.00	.035
4	40.00	5.00	-

Channel Slope = 0.0100 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	140.9	14.09	2.45	0.65	13.0
1.00	1.00	13.00	16.32	475.5	47.55	3.66	0.72	16.0
1.50	1.50	21.75	19.49	996.3	99.63	4.58	0.75	19.0
2.00	2.00	32.00	22.65	1715.3	171.53	5.36	0.78	22.0
2.50	2.50	43.75	25.81	2647.7	264.77	6.05	0.81	25.0
3.00	3.00	57.00	28.97	3809.9	380.99	6.68	0.83	28.0
3.50	3.50	71.75	32.14	5217.9	521.79	7.27	0.84	31.0
4.00	4.00	88.00	35.30	6887.9	688.79	7.83	0.86	34.0
4.50	4.50	105.75	38.46	8835.7	883.57	8.36	0.87	37.0
5.00	5.00	125.00	41.62	11076.8	1107.68	8.86	0.88	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I21

WATERSHED AREA (A): 645.00 acres

LENGTH OF WATERCOURSE (Lc): 17500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
13200.	340.0

MEAN SLOPE (Sc): .0378 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

39. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
61. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 11. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.345	.486	.558	.629	.679	.718
Tc (FUNCTION OF i) :	91.34	79.67	75.41	71.86	69.70	68.15
SOLUTION OF Tc (MINUTES):	99	68	58	49	44	40
RAINFL INT. @ Tc (IN/HR):	.820	1.482	1.956	2.597	3.159	3.765
RUNOFF RATE @ Tc (IN/HR):	.283	.720	1.091	1.634	2.146	2.704
PEAK DISCHARGE (CFS) :	184.	468.	709.	1062.	1395.	1758.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I21

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	35.00	0.00	.035
4	50.00	5.00	-

Channel Slope = 0.0100 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	274.3	27.43	2.55	0.66	23.0
1.00	1.00	23.00	26.32	894.9	89.49	3.89	0.73	26.0
1.50	1.50	36.75	29.49	1811.9	181.19	4.93	0.77	29.0
2.00	2.00	52.00	32.65	3019.1	301.91	5.81	0.80	32.0
2.50	2.50	68.75	35.81	4520.9	452.09	6.58	0.83	35.0
3.00	3.00	87.00	38.97	6326.1	632.61	7.27	0.85	38.0
3.50	3.50	106.75	42.14	8445.6	844.56	7.91	0.86	41.0
4.00	4.00	128.00	45.30	10891.3	1089.13	8.51	0.88	44.0
4.50	4.50	150.75	48.46	13675.9	1367.59	9.07	0.89	47.0
5.00	5.00	175.00	51.62	16812.1	1681.21	9.61	0.90	50.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I22

WATERSHED AREA (A): 242.00 acres

LENGTH OF WATERCOURSE (Lc): 7000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 7000.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 145.0

MEAN SLOPE (Sc): .0207 ft

BASIN FACTOR (Nb): .0420

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 14. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.253	.383	.455	.532	.588	.633
Tc (FUNCTION OF i) :	67.83	57.47	53.62	50.39	48.41	47.00
SOLUTION OF Tc (MINUTES):	63	43	36	31	27	25
RAINFL INT. @ Tc (IN/HR):	1.203	2.065	2.704	3.478	4.315	5.029
RUNOFF RATE @ Tc (IN/HR):	.304	.791	1.232	1.850	2.537	3.184
PEAK DISCHARGE (CFS) :	74.	193.	300.	451.	619.	777.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I22

Preparer: EAB
Job#: 84145
Date: 09-26-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	
			.035
2	15.00	0.00	
			.035
3	25.00	0.00	
			.035
4	40.00	5.00	

Channel Slope = 0.0080 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft
0.50	0.50	5.75	13.16	140.9	12.61	2.19	0.58	13.
1.00	1.00	13.00	16.32	475.5	42.53	3.27	0.64	16.
1.50	1.50	21.75	19.49	996.3	89.11	4.10	0.67	19.
2.00	2.00	32.00	22.65	1715.3	153.42	4.79	0.70	22.
2.50	2.50	43.75	25.81	2647.7	236.82	5.41	0.72	25.
3.00	3.00	57.00	28.97	3809.9	340.76	5.98	0.74	28.
3.50	3.50	71.75	32.14	5217.9	466.70	6.50	0.75	31.
4.00	4.00	88.00	35.30	6887.9	616.07	7.00	0.77	34.
4.50	4.50	105.75	38.46	8835.7	790.29	7.47	0.78	37.
5.00	5.00	125.00	41.62	11076.8	990.74	7.93	0.79	40.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I24 (X-section from Johnson/Brittain Report)

Preparer: EAB
Job#: 84145
Date: 09-26-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	45.70	28.10	.04
2	83.20	28.10	.04
3	94.00	24.50	.04
4	106.00	24.50	.04
5	116.80	28.10	.04
6	154.30	28.10	

Channel Slope = 0.0020 ft./ft.

W.S.E. = 29.47 ft.
Depth = 4.97 ft.
above invert elevation of 24.50 ft.

NOTES	STA-ft	MAN.n	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(
LEFT BANK EXT.	45.7								
		0.040	231.01	109.77	14132.0	632.00	2.74	0.33	10
RIGHT BANK EXT	154.3								
TOTALS:			231.01	109.77	14132.0	632.00	2.74	0.33	10

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I26 (X-Section From Johnson/Brittain Report)

Preparer: EAB
Job#: 84145
Date: 09-26-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	91.00	44.00	.016
2	95.50	40.34	.016
3	104.50	40.34	.016
4	109.00	44.00	

Channel Slope = 0.0040 ft./ft.

W.S.E. = 43.04 ft.
Depth = 2.70 ft.
above invert elevation of 40.34 ft.

NOTES	STA-ft	MAN.n	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(f
LEFT BANK	92.2	0.016	33.27	17.56	4743.5	300.01	9.02	1.09	15.
RIGHT BANK	107.8								
TOTALS:			33.27	17.56	4743.5	300.01	9.02	1.09	15.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I27 (Johnson/Brittain Report)

Preparer: EAB
Job#: 84174
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	6.00	.025
2	8.00	0.00	.025
3	48.00	0.00	.025
4	56.00	6.00	-

Channel Slope = 0.0030 ft./ft.

W.S.E. = 6.69 ft.
Depth = 6.69 ft.
Channel Slope = 0.0030 ft./ft.

NOTES	STA-ft	MAN.n	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
LEFT BANK EXT.	0.0								
		0.025	326.65	60.00	60249.4	3300.00	10.10	0.74	56.0
RIGHT BANK EXT	56.0								
TOTALS:			326.65	60.00	60249.4	3300.00	10.10	0.74	56.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I29 (C25)

WATERSHED AREA (A): 2702.00 acres

LENGTH OF WATERCOURSE (Lc): 20700. ft

LENGTH TO CENTER OF GRAVITY (Lca): 10000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
2000.	1152.0
10000.	142.0
8700.	65.0

MEAN SLOPE (Sc): .0122 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

43. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
2. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
55. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.298	.446	.522	.598	.652	.694
Tc (FUNCTION OF i) :	166.63	141.74	133.08	126.01	121.75	118.74
SOLUTION OF Tc (MINUTES):	243	161	134	112	99	89
RAINFL INT. @ Tc (IN/HR):	.389	.726	.981	1.340	1.683	2.055
RUNOFF RATE @ Tc (IN/HR):	.116	.324	.512	.802	1.097	1.426
PEAK DISCHARGE (CFS) :	315.	881.	1395.	2184.	2988.	3884.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I29

Preparer: EAB
Job#: 84145
Date: 09-26-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	
			.035
2	15.00	0.00	
			.035
3	25.00	0.00	
			.035
4	40.00	5.00	

Channel Slope = 0.0040 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(f
0.50	0.50	5.75	13.16	140.9	8.91	1.55	0.41	3
1.00	1.00	13.00	16.32	475.5	30.07	2.31	0.45	16
1.50	1.50	21.75	19.49	996.3	63.01	2.90	0.48	19
2.00	2.00	32.00	22.65	1715.3	108.48	3.39	0.50	2
2.50	2.50	43.75	25.81	2647.7	167.46	3.83	0.51	5
3.00	3.00	57.00	28.97	3809.9	240.96	4.23	0.52	28
3.50	3.50	71.75	32.14	5217.9	330.01	4.60	0.53	1
4.00	4.00	88.00	35.30	6887.9	435.63	4.95	0.54	4
4.50	4.50	105.75	38.46	8835.7	558.82	5.28	0.55	37
5.00	5.00	125.00	41.62	11076.8	700.56	5.60	0.56	40

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I30

WATERSHED AREA (A): 197.00 acres

LENGTH OF WATERCOURSE (Lc): 3000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1000.	400.0
2000.	180.0

MEAN SLOPE (Sc): .1323 ft BASIN FACTOR (Nb): .0320

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

5. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
95. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.382	.533	.606	.677	.725	.762
Tc (FUNCTION OF i) :	12.56	10.99	10.44	9.99	9.72	9.53
SOLUTION OF Tc (MINUTES):	7	6	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	3.954	5.485	6.674	7.859	8.938	10.001
RUNOFF RATE @ Tc (IN/HR):	1.509	2.925	4.047	5.321	6.480	7.618
PEAK DISCHARGE (CFS) :	300.	581.	804.	1057.	1287.	1513.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I30

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.035
2	15.00	0.00	.035
3	25.00	0.00	.035
4	40.00	5.00	-

Channel Slope = 0.0100 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	140.9	14.09	2.45	0.65	13.0
1.00	1.00	13.00	16.32	475.5	47.55	3.66	0.72	16.0
1.50	1.50	21.75	19.49	996.3	99.63	4.58	0.75	19.0
2.00	2.00	32.00	22.65	1715.3	171.53	5.36	0.78	22.0
2.50	2.50	43.75	25.81	2647.7	264.77	6.05	0.81	25.0
3.00	3.00	57.00	28.97	3809.9	380.99	6.68	0.83	28.0
3.50	3.50	71.75	32.14	5217.9	521.79	7.27	0.84	31.0
4.00	4.00	88.00	35.30	6887.9	688.79	7.83	0.86	34.0
4.50	4.50	105.75	38.46	8835.7	883.57	8.36	0.87	37.0
5.00	5.00	125.00	41.62	11076.8	1107.68	8.86	0.88	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I32

WATERSHED AREA (A): 75.00 acres

LENGTH OF WATERCOURSE (Lc): 4900. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2450. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4900.	112.0

MEAN SLOPE (Sc): .0229 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 35. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.413	.516	.574	.634	.677	.713
Tc (FUNCTION OF i) :	30.90	28.27	27.10	26.05	25.36	24.85
SOLUTION OF Tc (MINUTES):	22	17	15	13	12	11
RAINFL INT. @ Tc (IN/HR):	2.372	3.569	4.372	5.510	6.472	7.501
RUNOFF RATE @ Tc (IN/HR):	.981	1.843	2.508	3.491	4.384	5.345
PEAK DISCHARGE (CFS) :	74.	139.	190.	264.	331.	404.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I32

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.03
2	15.00	0.00	.03
3	25.00	0.00	.03
4	40.00	5.00	-

Channel Slope = 0.0150 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	164.4	20.14	3.50	0.93	13.0
1.00	1.00	13.00	16.32	554.7	67.94	5.23	1.02	16.0
1.50	1.50	21.75	19.49	1162.4	142.36	6.55	1.08	19.0
2.00	2.00	32.00	22.65	2001.2	245.09	7.66	1.12	22.0
2.50	2.50	43.75	25.81	3089.0	378.33	8.65	1.15	25.0
3.00	3.00	57.00	28.97	4444.8	544.38	9.55	1.18	28.0
3.50	3.50	71.75	32.14	6087.5	745.57	10.39	1.20	31.0
4.00	4.00	88.00	35.30	8035.9	984.19	11.18	1.23	34.0
4.50	4.50	105.75	38.46	10308.4	1262.51	11.94	1.24	37.0
5.00	5.00	125.00	41.62	12922.9	1582.73	12.66	1.26	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I33

WATERSHED AREA (A): 491.00 acres

LENGTH OF WATERCOURSE (Lc): 9000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3400.	1200.0
5600.	200.0

MEAN SLOPE (Sc): .0648 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

17. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
83. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.369	.517	.589	.660	.709	.746
Tc (FUNCTION OF i) :	46.02	40.24	38.18	36.49	35.47	34.74
SOLUTION OF Tc (MINUTES):	37	27	23	20	18	17
RAINFL INT. @ Tc (IN/HR):	1.732	2.776	3.529	4.494	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.640	1.435	2.079	2.966	3.823	4.632
PEAK DISCHARGE (CFS) :	317.	710.	1029.	1468.	1892.	2293.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I33

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.03
2	15.00	0.00	.03
3	35.00	0.00	.03
4	50.00	5.00	-

Channel Slope = 0.0133 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	320.1	36.91	3.43	0.89	23.0
1.00	1.00	23.00	26.32	1044.0	120.40	5.23	0.98	26.0
1.50	1.50	36.75	29.49	2113.9	243.78	6.63	1.04	29.0
2.00	2.00	52.00	32.65	3522.3	406.21	7.81	1.08	32.0
2.50	2.50	68.75	35.81	5274.4	608.27	8.85	1.11	35.0
3.00	3.00	87.00	38.97	7380.5	851.16	9.78	1.14	38.0
3.50	3.50	106.75	42.14	9853.2	1136.32	10.64	1.16	41.0
4.00	4.00	128.00	45.30	12706.5	1465.39	11.45	1.18	44.0
4.50	4.50	150.75	48.46	15955.2	1840.04	12.21	1.20	47.0
5.00	5.00	175.00	51.62	19614.1	2262.01	12.93	1.22	50.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I34

WATERSHED AREA (A): 73.00 acres

LENGTH OF WATERCOURSE (Lc): 4000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 4000.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 90.0

MEAN SLOPE (Sc): .0225 ft

BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 46. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.497	.586	.636	.687	.724	.754
Tc (FUNCTION OF i) :	25.57	23.94	23.18	22.47	22.00	21.64
SOLUTION OF Tc (MINUTES):	17	14	13	11	10	10
RAINFL INT. @ Tc (IN/HR):	2.711	3.916	4.679	5.894	6.935	7.759
RUNOFF RATE @ Tc (IN/HR):	1.348	2.297	2.974	4.048	5.022	5.853
PEAK DISCHARGE (CFS) :	99.	169.	219.	298.	370.	431.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I34

Preparer: EAB
Job#: 841
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.03
2	15.00	0.00	.03
3	25.00	0.00	.03
4	40.00	5.00	-

Channel Slope = 0.0133 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	164.4	18.96	3.30	0.87	13.0
1.00	1.00	13.00	16.32	554.7	63.97	4.92	0.96	16.0
1.50	1.50	21.75	19.49	1162.4	134.05	6.16	1.02	19.0
2.00	2.00	32.00	22.65	2001.2	230.79	7.21	1.05	22.0
2.50	2.50	43.75	25.81	3089.0	356.24	8.14	1.08	25.0
3.00	3.00	57.00	28.97	4444.8	512.60	8.99	1.11	28.0
3.50	3.50	71.75	32.14	6087.5	702.05	9.78	1.13	31.0
4.00	4.00	88.00	35.30	8035.9	926.75	10.53	1.15	34.0
4.50	4.50	105.75	38.46	10308.4	1188.82	11.24	1.17	37.0
5.00	5.00	125.00	41.62	12922.9	1490.35	11.92	1.19	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I35

WATERSHED AREA (A): 105.60 acres

LENGTH OF WATERCOURSE (Lc): 6300. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3150. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
6300.	120.0

MEAN SLOPE (Sc): .0190 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 48. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.513	.599	.647	.697	.733	.762
Tc (FUNCTION OF i) :	35.46	33.31	32.31	31.37	30.74	30.26
SOLUTION OF Tc (MINUTES):	26	21	19	17	15	14
RAINFL INT. @ Tc (IN/HR):	2.146	3.189	3.912	4.878	5.856	6.811
RUNOFF RATE @ Tc (IN/HR):	1.100	1.911	2.530	3.398	4.291	5.189
PEAK DISCHARGE (CFS) :	117.	203.	269.	362.	457.	552.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I35

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.03
2	15.00	0.00	.03
3	35.00	0.00	.03
4	50.00	5.00	-

Channel Slope = 0.0133 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	10.75	23.16	320.1	36.91	3.43	0.89	23.0
1.00	1.00	23.00	26.32	1044.0	120.40	5.23	0.98	26.0
1.50	1.50	36.75	29.49	2113.9	243.78	6.63	1.04	29.0
2.00	2.00	52.00	32.65	3522.3	406.21	7.81	1.08	32.0
2.50	2.50	68.75	35.81	5274.4	608.27	8.85	1.11	35.0
3.00	3.00	87.00	38.97	7380.5	851.16	9.78	1.14	38.0
3.50	3.50	106.75	42.14	9853.2	1136.32	10.64	1.16	41.0
4.00	4.00	128.00	45.30	12706.5	1465.39	11.45	1.18	44.0
4.50	4.50	150.75	48.46	15955.2	1840.04	12.21	1.20	47.0
5.00	5.00	175.00	51.62	19614.1	2262.01	12.93	1.22	50.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I36

WATERSHED AREA (A): 269.00 acres

LENGTH OF WATERCOURSE (Lc): 7000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
130.	580.0
6870.	160.0

MEAN SLOPE (Sc): .0241 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 45. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.490	.580	.630	.682	.720	.751
Tc (FUNCTION OF i) :	35.01	32.71	31.65	30.66	30.01	29.51
SOLUTION OF Tc (MINUTES):	26	21	18	16	15	14
RAINFL INT. @ Tc (IN/HR):	2.146	3.189	4.027	5.013	5.856	6.811
RUNOFF RATE @ Tc (IN/HR):	1.051	1.850	2.537	3.419	4.216	5.112
PEAK DISCHARGE (CFS) :	285.	502.	688.	927.	1143.	1386.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I36

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.03
2	15.00	0.00	.03
3	25.00	0.00	.03
4	40.00	5.00	-

Channel Slope = 0.0133 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	164.4	18.96	3.30	0.87	13.0
1.00	1.00	13.00	16.32	554.7	63.97	4.92	0.96	16.0
1.50	1.50	21.75	19.49	1162.4	134.05	6.16	1.02	19.0
2.00	2.00	32.00	22.65	2001.2	230.79	7.21	1.05	22.0
2.50	2.50	43.75	25.81	3089.0	356.24	8.14	1.08	25.0
3.00	3.00	57.00	28.97	4444.8	512.60	8.99	1.11	28.0
3.50	3.50	71.75	32.14	6087.5	702.05	9.78	1.13	31.0
4.00	4.00	88.00	35.30	8035.9	926.75	10.53	1.15	34.0
4.50	4.50	105.75	38.46	10308.4	1188.82	11.24	1.17	37.0
5.00	5.00	125.00	41.62	12922.9	1490.35	11.92	1.19	40.0

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I37

WATERSHED AREA (A): 101.00 acres

LENGTH OF WATERCOURSE (Lc): 5500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	340.0
4300.	160.0

MEAN SLOPE (Sc): .0502 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 45. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.490	.580	.630	.682	.720	.751
Tc (FUNCTION OF i) :	22.59	21.11	20.43	19.79	19.36	19.04
SOLUTION OF Tc (MINUTES):	15	12	11	10	9	8
RAINFL INT. @ Tc (IN/HR):	2.862	4.164	5.005	6.097	7.294	8.593
RUNOFF RATE @ Tc (IN/HR):	1.401	2.415	3.153	4.158	5.252	6.449
PEAK DISCHARGE (CFS) :	143.	246.	321.	423.	535.	657.

CROSS-SECTIONAL ANALYSIS

X-SECT.BAS/v.1

Anderson, Passarelli & Associates
Project: SWBMS
Cross Section Description: I37

Preparer: EAB
Job#: 84145
Date: 12-14-1989

NO.	STA(ft)	ELEV(ft)	MANNINGS n (to Next #)
1	0.00	5.00	.03
2	15.00	0.00	.03
3	25.00	0.00	.03
4	40.00	5.00	-

Channel Slope = 0.0133 ft./ft.

RATING CURVE

WSE(ft)	D(ft)	AREA-sf	WT.P-ft	CONV(K)	Q-(cfs)	V-fps	Fr.#	TW(ft)
0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.0
0.50	0.50	5.75	13.16	164.4	18.96	3.30	0.87	13.0
1.00	1.00	13.00	16.32	554.7	63.97	4.92	0.96	16.0
1.50	1.50	21.75	19.49	1162.4	134.05	6.16	1.02	19.0
2.00	2.00	32.00	22.65	2001.2	230.79	7.21	1.05	22.0
2.50	2.50	43.75	25.81	3089.0	356.24	8.14	1.08	25.0
3.00	3.00	57.00	28.97	4444.8	512.60	8.99	1.11	28.0
3.50	3.50	71.75	32.14	6087.5	702.05	9.78	1.13	31.0
4.00	4.00	88.00	35.30	8035.9	926.75	10.53	1.15	34.0
4.50	4.50	105.75	38.46	10308.4	1188.82	11.24	1.17	37.0
5.00	5.00	125.00	41.62	12922.9	1490.35	11.92	1.19	40.0

APPENDIX F SEDIMENT ANALYSIS CALCULATIONS

A sedimentation analysis was performed to predict sediment movement within the watershed and aggregate sediment yield exiting the SWBMSA. Aggregate sediment loads were calculated at specific points using the Universal Soil Loss Equation (USLE).

The P, C, and K factors were determined using SCS handbook # 537 and are constant throughout the SWBMSA. The specific LS factors were determined for each individual watershed. The locations of the sediment samples used to developed the gradation curves are shown on Figure 15. The gradation curves, "Figure 3" worksheets and Figure 15 are contained in this section after the individual calculation sheets.

Summary of Results of Sediment Yield Analysis

Location	Drainage Area (mi^2)	Tons	Acre-Ft	Acre-Ft Per (mi^2)
1 (D114-D115)	3.45	5732	2.63	0.76
2 (D125)	1.19	1720	0.79	0.66
3 (D128)	1.30	1239	0.57	0.44
4 (D75)	0.75	1754	0.81	1.08
5 (D130)	1.00	1721	0.79	0.79
6 (D136-D137)	3.06	2150	0.99	0.32
7 (D97)	1.01	927	0.43	0.43
8 (C40)	0.89	1136	0.52	0.58
9 (C46)	0.77	1132	0.52	0.67
10 (D146)	1.39	2013	0.92	0.66
11 (C33)	1.06	1621	0.74	0.70
12 (C25)	3.23	4489	2.06	0.64
13 (C27)	1.18	1309	0.60	0.51
14 (C20)	0.79	1020	0.47	0.59
15 (C1)	9.66	11296	5.19	0.54
16 (C4)	2.57	1486	0.68	0.26
17 (C6)	3.49	2145	0.98	0.28
18 (C8-C9)	4.05	3003	6.38	0.34
19 (C10)	12.10	11603	5.33	0.44
20 (C11)	4.41	2991	1.37	0.31
21 (C12-C13)	12.63	11568	5.31	0.42
22 (HEC-1 C1)	87.13	80034	37.11	0.43
23 (HEC-1 C8)	44.85	43874	20.14	0.45
24 (HEC-1 C9)	14.46	12543	5.76	0.40

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SOUTHWEST BASIN MANAGEMENT STUDY
LOCATION : 1 (D114-D115)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.75
L	=	200.10 (ft)
S	=	5.00 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.60 (tons/acre/year)

BASIN AREA = 2205.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 5732.13 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 2.63 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 2 (0125)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.66
L	=	150.88 (ft)
S	=	5.00 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.26 (tons/acre/year)

BASIN AREA = 762.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1720.07 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .79 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 3 (D128)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.43
L	=	100.43 (ft)
S	=	4.30 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.49 (tons/acre/year)

BASIN AREA = 830.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1238.54 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .57 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 4 (D75)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p_{2,6}^{2.2}$

$p_{2,6}$ = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
$p_{2,6}$	=	1.70 (in)
K	=	.11
LS	=	1.06
L	=	131.22 (ft)
S	=	7.60 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 3.64 (tons/acre/year)

BASIN AREA = 482.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1753.62 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .81 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 5 (D130)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.78
L	=	73.71 (ft)
S	=	7.50 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.68 (tons/acre/year)

BASIN AREA = 643.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1721.23 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .79 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 6 (D136-D137)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.32
L	=	160.76 (ft)
S	=	2.90 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = 1.10 (tons/acre/year)

BASIN AREA = 1956.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 2149.77 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .99 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 7 (D97)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.42
L	=	80.27 (ft)
S	=	4.50 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.44 (tons/acre/year)

BASIN AREA = 645.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 927.46 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .43 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 8 (C40)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.58
L	=	93.18 (ft)
S	=	5.50 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.00 (tons/acre/year)

BASIN AREA = 569.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1135.57 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .52 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 9 (C46)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.67
L	=	118.82 (ft)
S	=	5.60 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.31 (tons/acre/year)

BASIN AREA = 491.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1131.99 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .52 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 10 (D146)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.66
L	=	114.15 (ft)
S	=	5.60 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.26 (tons/acre/year)

BASIN AREA = 891.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 2013.42 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .92 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 11 (C33)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.69
L	=	145.92 (ft)
S	=	5.30 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.38 (tons/acre/year)

BASIN AREA = 680.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1621.47 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .74 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 12 (C25)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p_{2,6}^{2.2}$

$p_{2,6}$ = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.63
L	=	225.10 (ft)
S	=	4.50 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 2.17 (tons/acre/year)

BASIN AREA = 2067.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 4489.43 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 2.06 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 13 (C27)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.50
L	=	126.99 (ft)
S	=	4.50 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.73 (tons/acre/year)

BASIN AREA = 758.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1309.44 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .60 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.59
L	=	120.87 (ft)
S	=	5.00 (percent)
n	=	.50
C	=	.36
P	=	1.00

Ys = 2.02 (tons/acre/year)

BASIN AREA = 505.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1020.29 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .47 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.53
L	=	204.10 (ft)
S	=	4.00 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.83 (tons/acre/year)

BASIN AREA = 6185.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 11296.21 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 5.19 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.26
L	=	74.73 (ft)
S	=	3.00 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = .90 (tons/acre/year)

BASIN AREA = 1647.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 1486.46 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .68 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 17 (C6)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p_{2,6}^{2.2}$

$p_{2,6}$ = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
$p_{2,6}$	=	1.70 (in)
K	=	.11
LS	=	.28
L	=	91.80 (ft)
S	=	3.00 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = .96 (tons/acre/year)

BASIN AREA = 2234.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 2144.61 (tons)

TOTAL ANNUAL SEDIMENT YIELD = .98 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 18 (C8-C9)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.34
L	=	128.16 (ft)
S	=	3.10 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.16 (tons/acre/year)

BASIN AREA = 2589.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 3002.85 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 1.38 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p_{2,6}^{2.2}$

$p_{2,6}$ = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
$p_{2,6}$	=	1.70 (in)
K	=	.11
LS	=	.44
L	=	224.80 (ft)
S	=	3.20 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.50 (tons/acre/year)

BASIN AREA = 7741.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 11603.35 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 5.33 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p_{2,6}^{2.2}$

$p_{2,6}$ = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
$p_{2,6}$	=	1.70 (in)
K	=	.11
LS	=	.31
L	=	127.96 (ft)
S	=	3.00 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = 1.06 (tons/acre/year)

BASIN AREA = 2820.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 2990.71 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 1.37 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 21 (C12-C13)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.42
L	=	200.10 (ft)
S	=	3.20 (percent)
n	=	.40
C	=	.36
P	=	1.00

Ys = 1.43 (tons/acre/year)

BASIN AREA = 8085.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 11567.80 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 5.31 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 22 (HEC1 C1)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.42
L	=	1190.66 (ft)
S	=	2.00 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = 1.45 (tons/acre/year)

BASIN AREA = 55761.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 80834.05 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 37.11 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 23 (HEC1 C8)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p_{2,6}^{2.2}$

$p_{2,6}$ = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
$p_{2,6}$	=	1.70 (in)
K	=	.11
LS	=	.44
L	=	762.38 (ft)
S	=	2.50 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = 1.53 (tons/acre/year)

BASIN AREA = 28703.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 43873.68 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 20.14 (acre-ft)
(assuming 100 lbs/cubic foot)

UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 24 (HEC1 C9)

$Ys = R \times K \times LS \times C \times P$

where: Ys = annual sediment yield (tons/acre/year)

R = rainfall erosion index

$= 27 \times p2,6^{2.2}$

p2,6 = 2-year, 6-hour rainfall (in)

K = soil erodibility factor

LS = slope length and steepness factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

C = vegetative cover factor

P = erosion control practice factor

R	=	87.00
p2,6	=	1.70 (in)
K	=	.11
LS	=	.39
L	=	289.97 (ft)
S	=	3.00 (percent)
n	=	.30
C	=	.36
P	=	1.00

Ys = 1.36 (tons/acre/year)

BASIN AREA = 9253.00 (acres)

TOTAL ANNUAL SEDIMENT YIELD (A x Ys) = 12542.81 (tons)

TOTAL ANNUAL SEDIMENT YIELD = 5.76 (acre-ft)
(assuming 100 lbs/cubic foot)

SEDIMENT GRADATION
Summary

Sample #	% very fine (< .16 mm)	% sand (0.10-2.0 mm)
1	5	53
2	5	81
3	11	81
4	4	56
5	4	42
6	8	57
7	4	50
8	4	44
9	7	86

			Soil Erodibility Factor (K)
Average	6	61	0.105
Minimum	4	42	0.100
Maximum	11	86	0.110

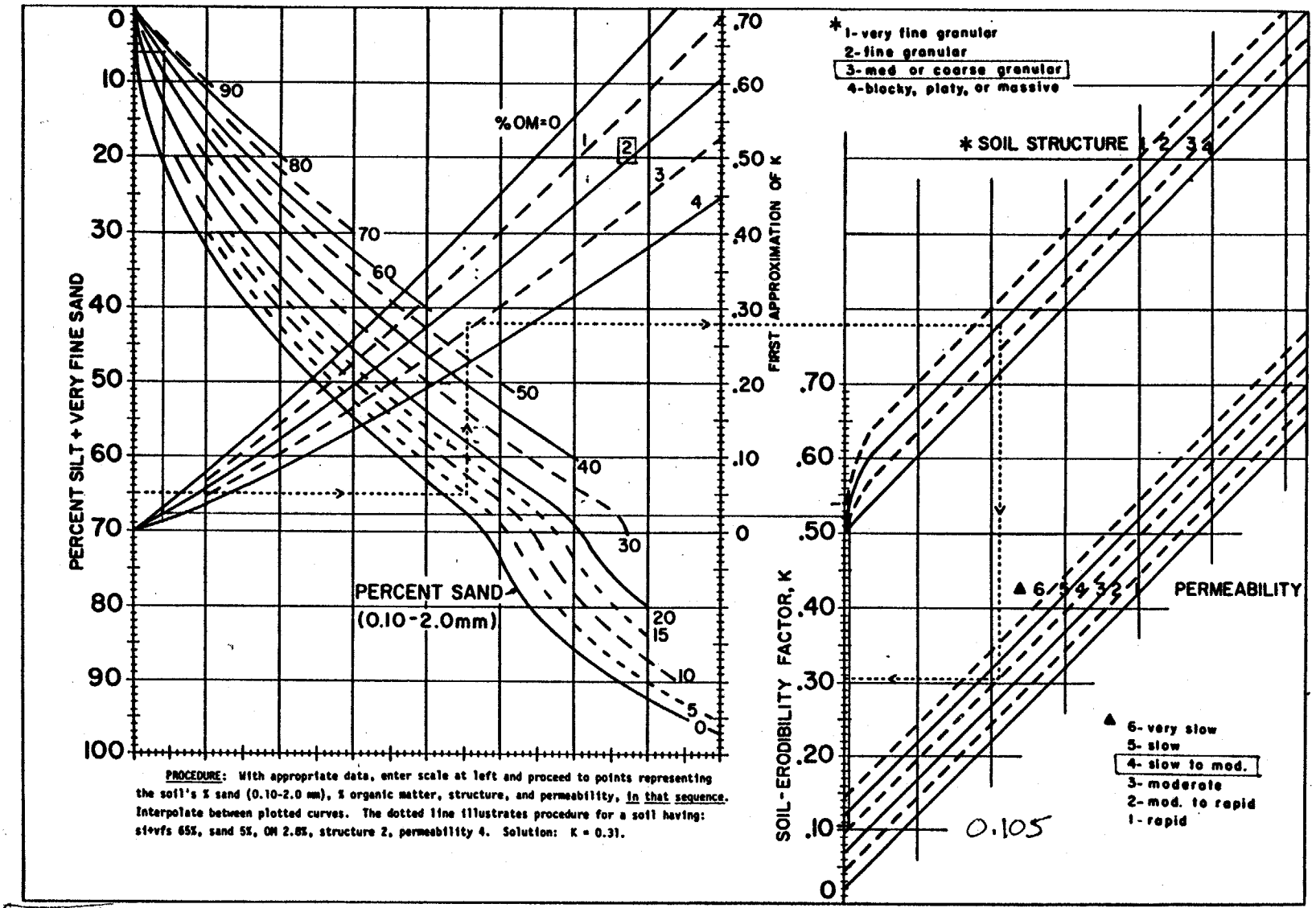


FIGURE 3.—The soil-erodibility nomograph. Where the silt fraction does not exceed 70 percent, the equation is $100\ K = 2.1\ M^{1.14}\ (10^{-4})\ (12 - a) + 3.25\ (b - 2) + 2.5\ (c - 3)$ where M = (percent si + vfs) (100 — percent c), a = percent organic matter, b = structure code, and c = profile permeability class.

865

"K" WORKSHEET

AVERAGE VALUES

6% VERY FINE SAND

61% SAND (0.10-2.0mm)

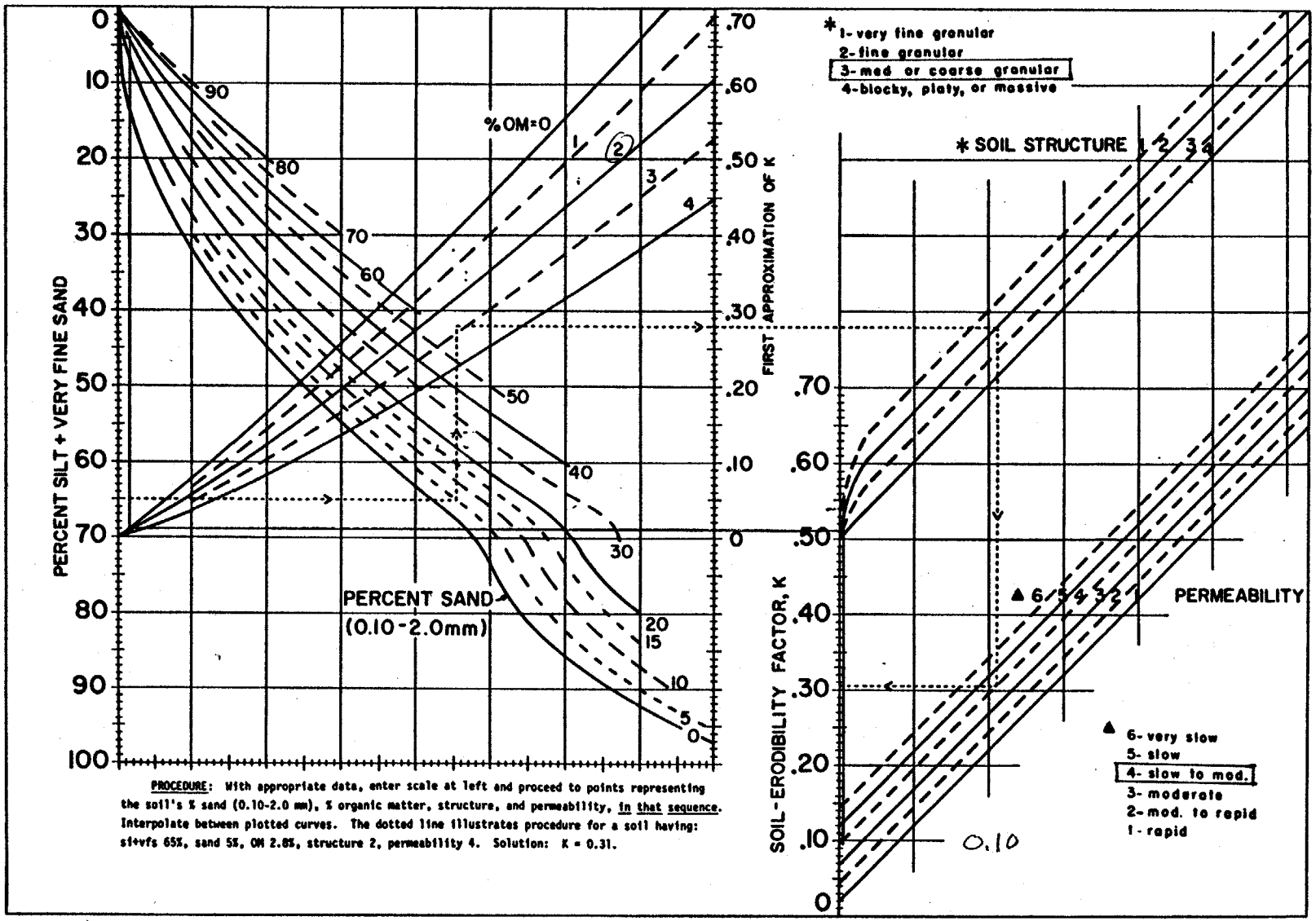


FIGURE 3.—The soil-erodibility nomograph. Where the silt fraction does not exceed 70 percent, the equation is $100\ K = 2.1\ M^{1.14}\ (10^{-4})\ (12 - a) + 3.25\ (b - 2) + 2.5\ (c - 3)$ where M = (percent si + vfs) (100 — percent c), a = percent organic matter, b = structure code, and c = profile permeability class.

"K" WORKSHEET

MINIMUM VALUES

4% VERY FINE SAND

42% SAND (0.10-2.0 mm)

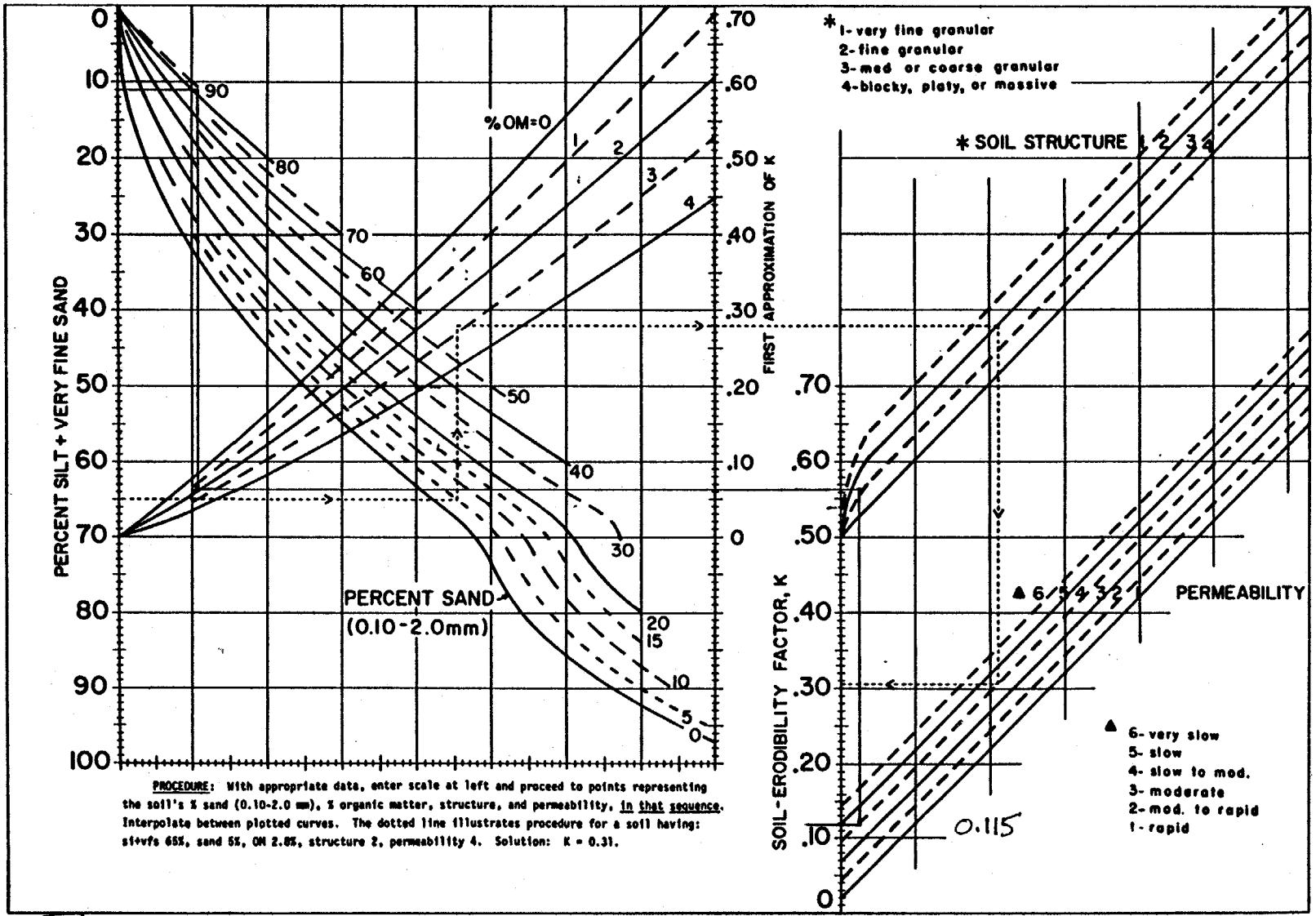


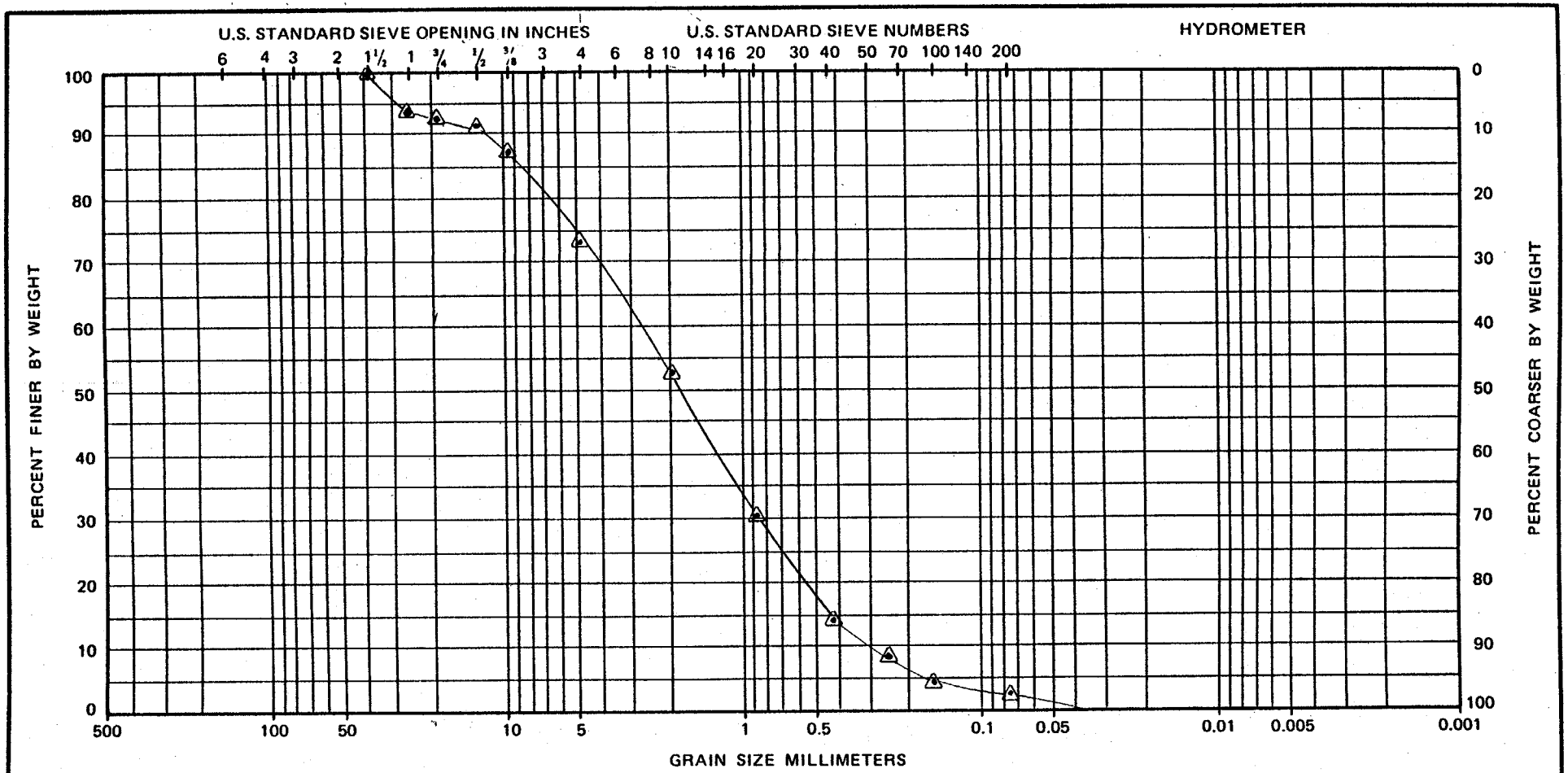
FIGURE 3.—The soil-erodibility nomograph. Where the silt fraction does not exceed 70 percent, the equation is $100\ K = 2.1\ M^{1.14}\ (10^{-4})\ (12 - a) + 3.25\ (b - 2) + 2.5\ (c - 3)$ where M = (percent si + vfs) (100 — percent c), a = percent organic matter, b = structure code, and c = profile permeability class.

"K" WORKSHEET

MAXIMUM VALUES

11% VERY FINE SAND
86% SAND (0.10-2.0 mm)

GRADATION CURVES



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
1						

PROJECT S.W. Basin Study

AREA Base of Tucson Mtns

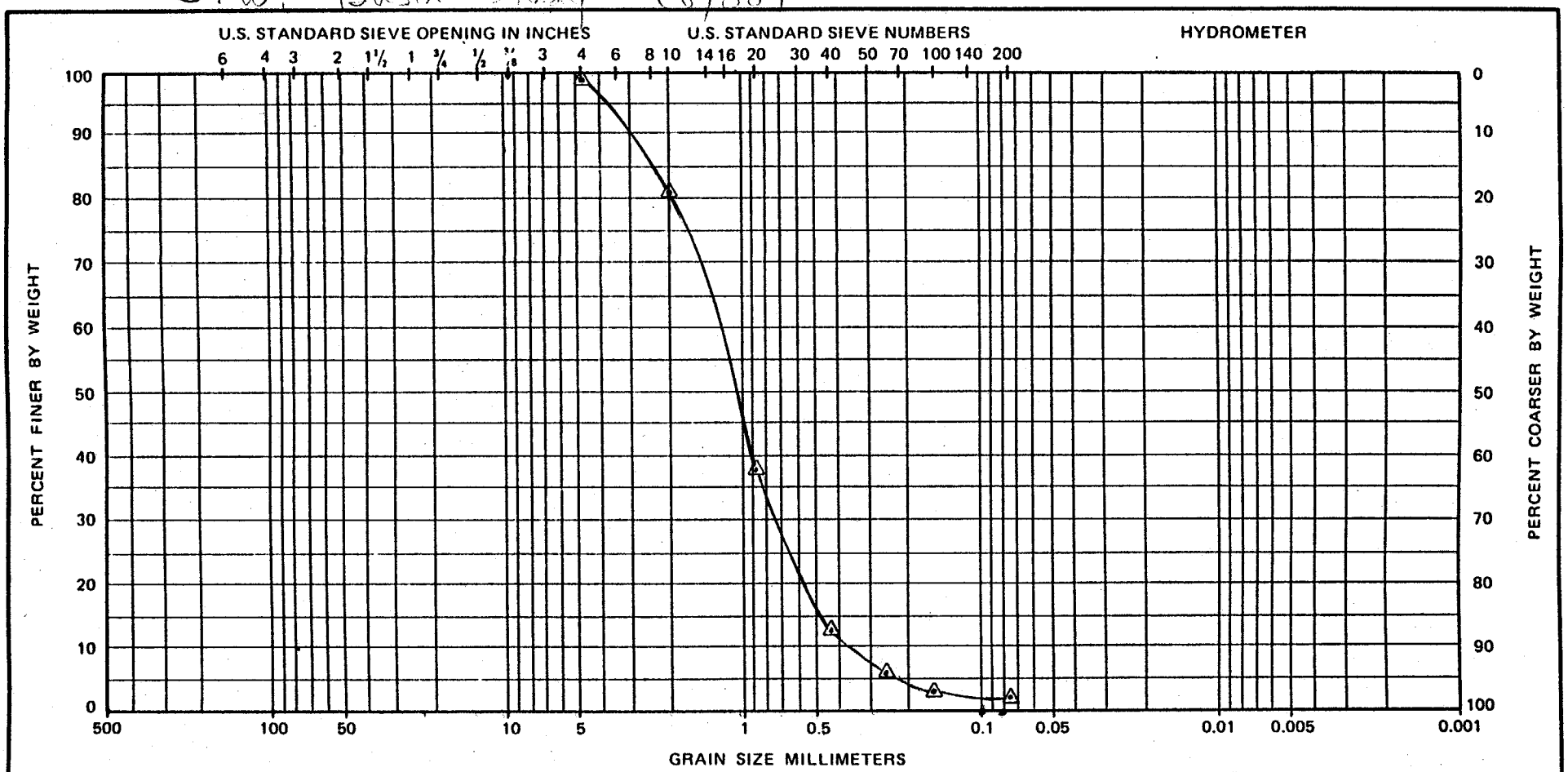
T.14S R12E Sec 24

185

Wiley-Fisk Form 16-7

GRADATION CURVES

S.W. Basin Study (6/88)



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
2						

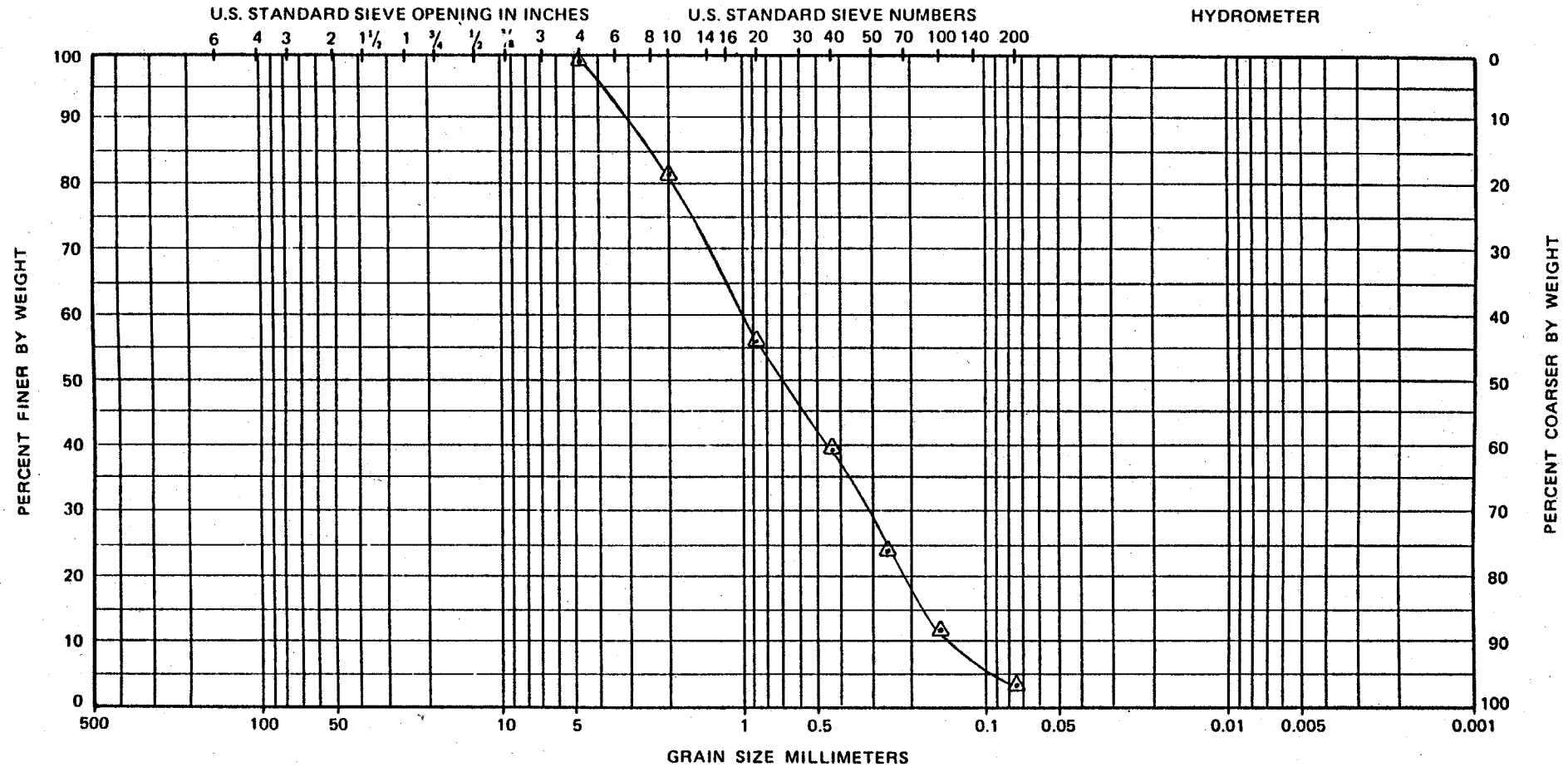
PROJECT S.W. Basin Study

AREA S of Ajo Highway
T15S R11E Sec. 14

582

Wiley-Fisk Form 16-7

GRADATION CURVES



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
3						

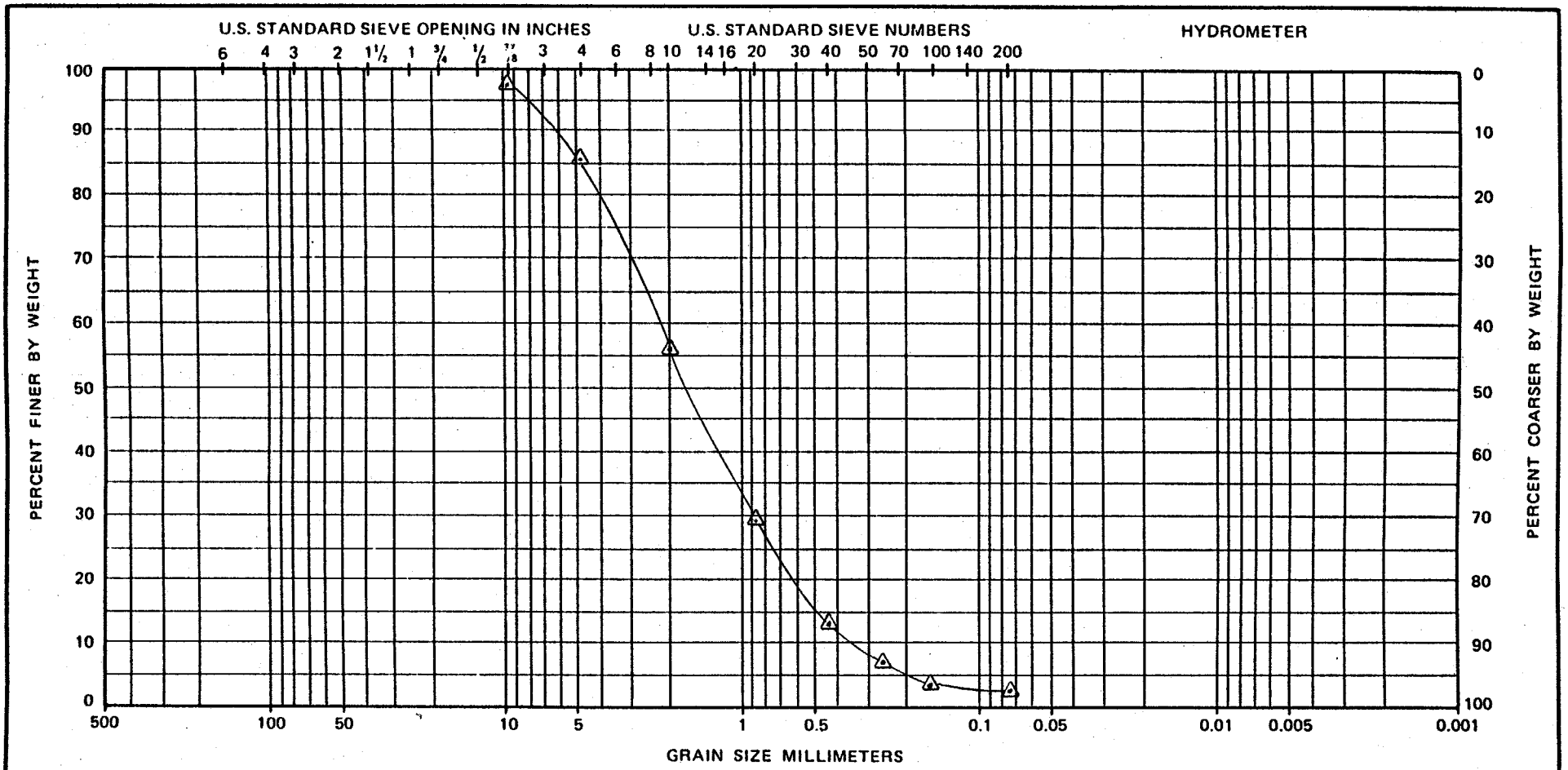
PROJECT SW Basin Study

AREA S. of Valencia Road

T15S R1DE Sec 15

Wiley-Fisk Form 16-7

GRADATION CURVES



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
4						

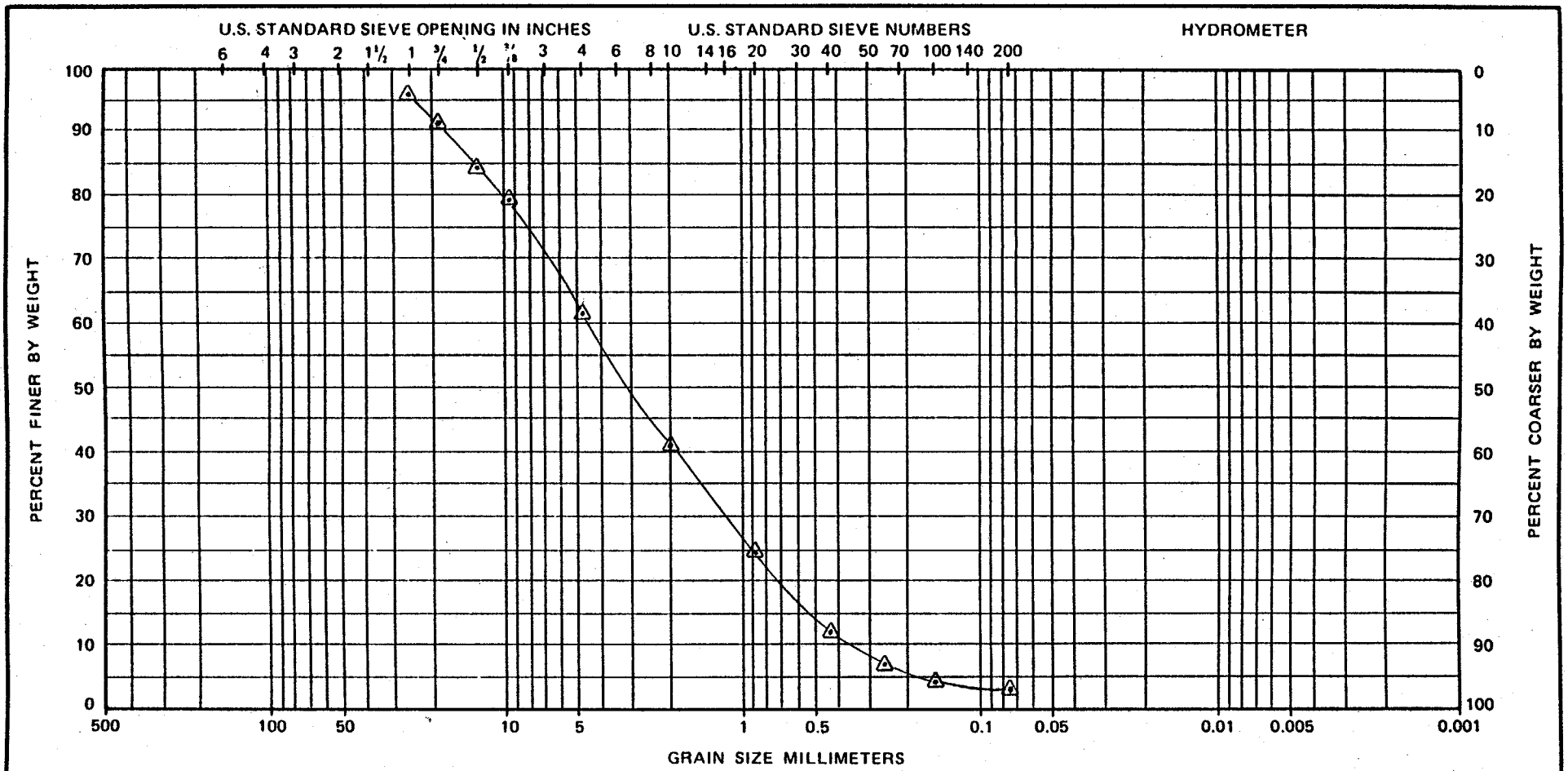
PROJECT SW Basin Study

AREA Near Sheila Ave.
T 14S R 1 E Sec 27

5894

Wiley-Fisk Form 16-7

GRADATION CURVES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
5						

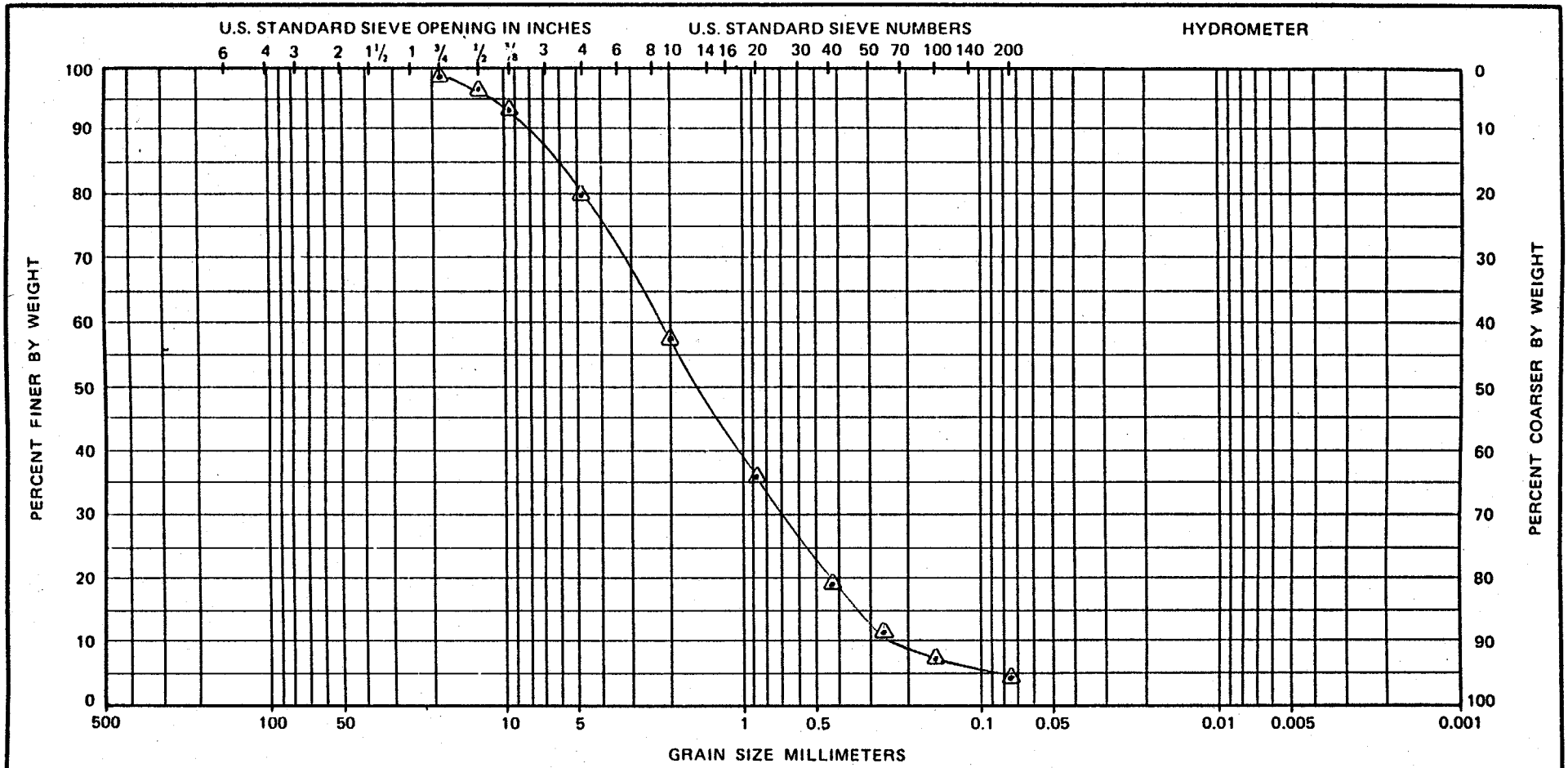
PROJECT SW Basin Study

AREA N. of San Joaquin
T14S R12E Sec 30

585

Wiley-Fisk Form 16-7

GRADATION CURVES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
6						

PROJECT SW Basin Study

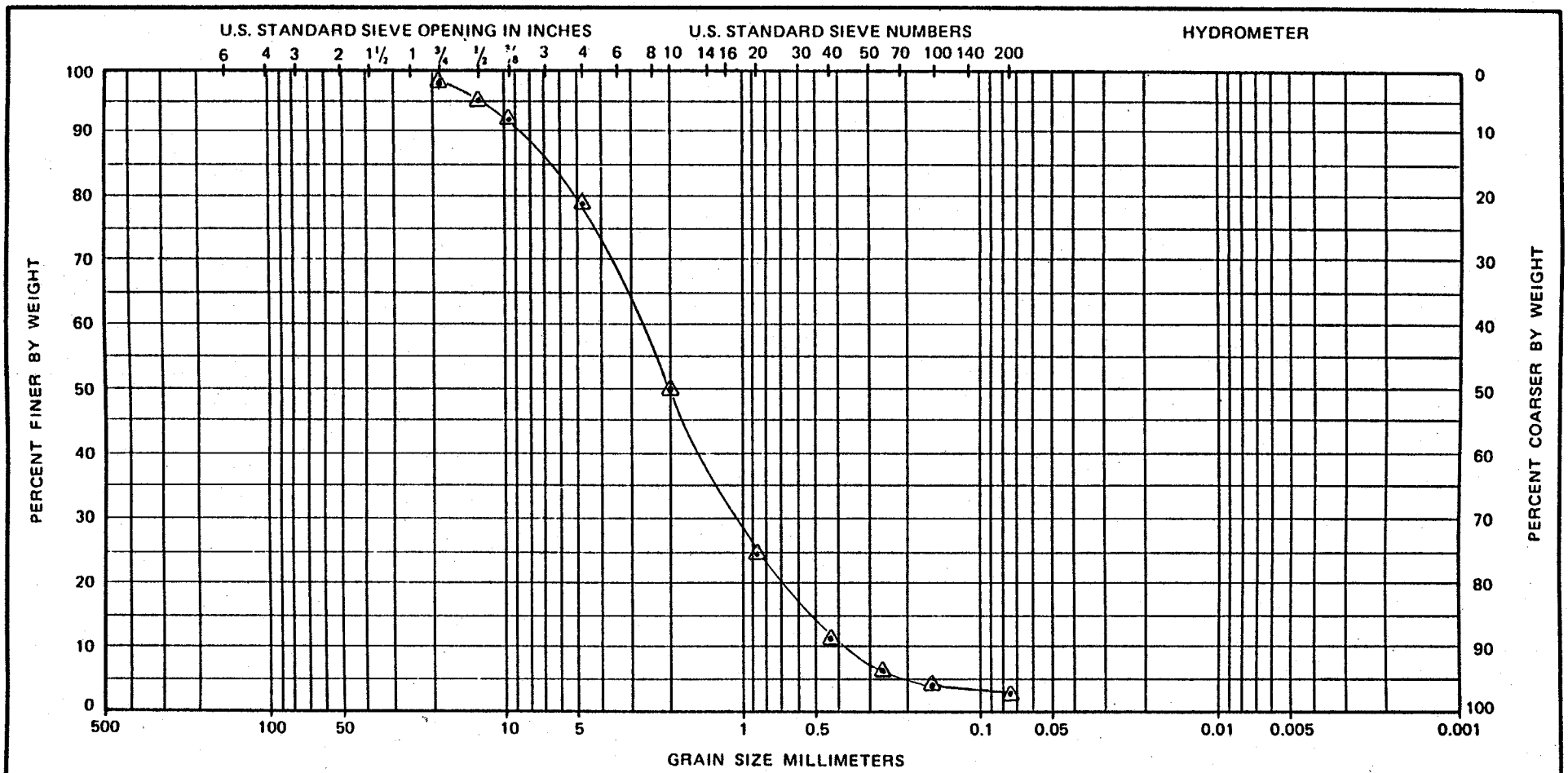
AREA W of Sheridan Ave.

T 15S R 12 E Sec 2

585

Wiley-Fisk Form 16-7

GRADATION CURVES



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
7						

PROJECT SW Basin Study

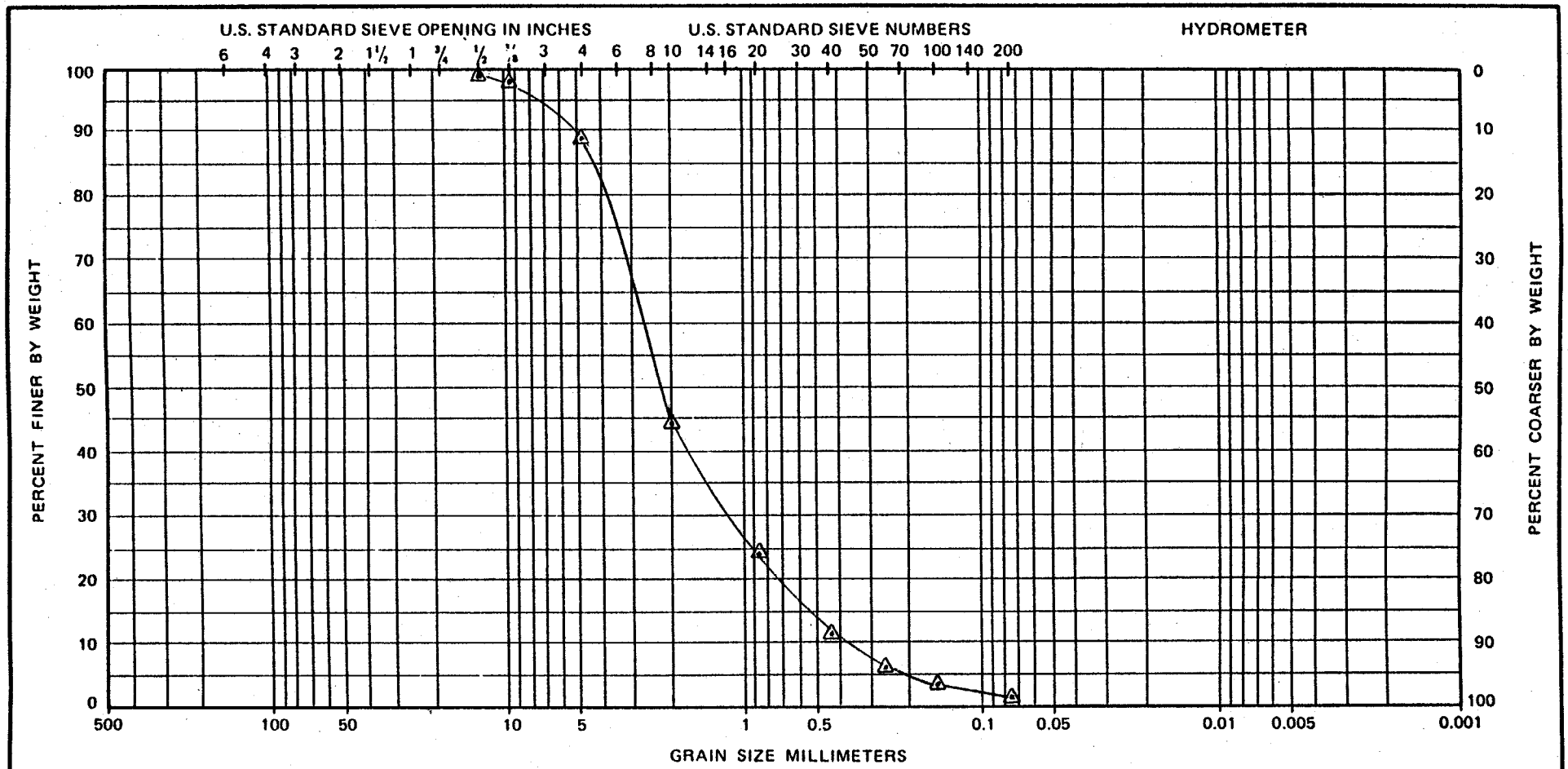
AREA S. of Ajo Highway

T14S R12E Sec. 13

L85

Wiley-Fisk Form 16-7

GRADATION CURVES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
8						

PROJECT SW Basin Study

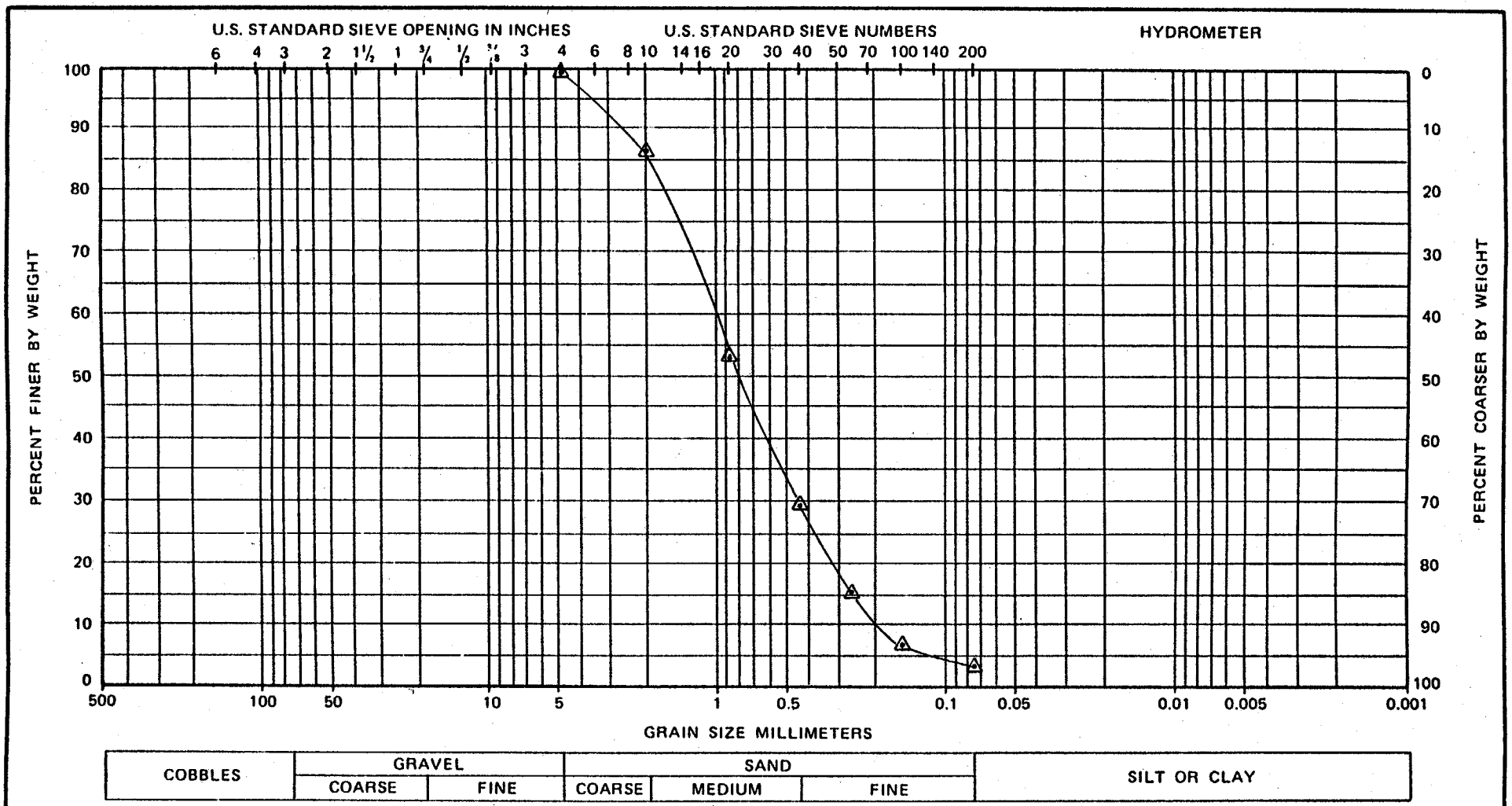
AREA North Pima Mine Road

T 16 S R 12 E Sec 33

885

Wiley-Fisk Form 16-7

GRADATION CURVES



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
9						

PROJECT SW Basin Study

AREA on Reservation

T10S R1DE Sec 3

Wiley-Fisk Form 16-7

Anderson, Passarelli & Associates

JOB NAME SWOMS
MADE BY SMW DATE 3/27/90
CHECKED BY _____ DATE _____

APA JOB NO. 84145
REFERENCE MUSLE

CALCULATION SHEETS
FOR COMPARISON
OF USLE WITH MUSLE

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20) , 100-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	74855.82	
Qp	=	1739.00	(cfs)
V	=	85.51	(acre-ft)
K	=	.11	
LS	=	.59	
L	=	120.87	(ft)
S	=	5.00	(percent)
n	=	.50	
CP	=	.36	
Ys	=	1738.36	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20) , 50-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	59766.01	
Qp	=	1379.00	(cfs)
V	=	72.14	(acre-ft)
K	=	.11	
LS	=	.59	
L	=	120.87	(ft)
S	=	5.00	(percent)
n	=	.50	
CP	=	.36	

Ys = 1387.93 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20) , 25-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	45637.88	
Qp	=	1049.00	(cfs)
V	=	58.59	(acre-ft)
K	=	.11	
LS	=	.59	
L	=	120.87	(ft)
S	=	5.00	(percent)
n	=	.50	
CP	=	.36	
Ys	=	1059.84	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20) , 10-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	31250.45	
Qp	=	711.00	(cfs)
V	=	43.96	(acre-ft)
K	=	.11	
LS	=	.59	
L	=	120.87	(ft)
S	=	5.00	(percent)
n	=	.50	
CP	=	.36	
Ys	=	725.72	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20) , 5-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	21326.44	
Qp	=	483.00	(cfs)
V	=	32.71	(acre-ft)
K	=	.11	
LS	=	.59	
L	=	120.87	(ft)
S	=	5.00	(percent)
n	=	.50	
CP	=	.36	
Ys	=	495.26	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 14 (C20) , 2-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	9656.49	
Qp	=	196.00	(cfs)
V	=	19.58	(acre-ft)
K	=	.11	
LS	=	.59	
L	=	120.87	(ft)
S	=	5.00	(percent)
n	=	.50	
CP	=	.36	
Ys	=	224.25	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1) , 100-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	601545.60	
Qp	=	5253.00	(cfs)
V	=	1169.68	(acre-ft)
K	=	.11	
LS	=	.53	
L	=	204.10	(ft)
S	=	4.00	(percent)
n	=	.40	
CP	=	.36	

Ys = 12628.23 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1) , 50-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	469758.30	
Qp	=	4067.00	(cfs)
V	=	971.46	(acre-ft)
K	=	.11	
LS	=	.53	
L	=	204.10	(ft)
S	=	4.00	(percent)
n	=	.40	
CP	=	.36	
Ys	=	9861.62	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1) , 25-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	365094.70	
Qp	=	2885.00	(cfs)
V	=	873.12	(acre-ft)
K	=	.11	
LS	=	.53	
L	=	204.10	(ft)
S	=	4.00	(percent)
n	=	.40	
CP	=	.36	

Ys = 7664.42 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1) , 10-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	231145.20	
Qp	=	1765.00	(cfs)
V	=	630.92	(acre-ft)
K	=	.11	
LS	=	.53	
L	=	204.10	(ft)
S	=	4.00	(percent)
n	=	.40	
CP	=	.36	

Ys = 4852.42 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1) , 5-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	145021.70	
Qp	=	1071.00	(cfs)
V	=	452.28	(acre-ft)
K	=	.11	
LS	=	.53	
L	=	204.10	(ft)
S	=	4.00	(percent)
n	=	.40	
CP	=	.36	

Ys = 3044.44 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 15 (C1) , 2-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	56375.31	
Qp	=	337.00	(cfs)
V	=	265.96	(acre-ft)
K	=	.11	
LS	=	.53	
L	=	204.10	(ft)
S	=	4.00	(percent)
n	=	.40	
CP	=	.36	

Ys = 1183.49 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4) , 100-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	131093.20	
Qp	=	1372.00	(cfs)
V	=	294.80	(acre-ft)
K	=	.11	
LS	=	.26	
L	=	74.73	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	1359.94	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4) , 50-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	100238.40	
Qp	=	1031.00	(cfs)
V	=	242.95	(acre-ft)
K	=	.11	
LS	=	.26	
L	=	74.73	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	

Ys = 1039.86 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4) , 25-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	76557.53	
Qp	=	718.00	(cfs)
V	=	215.59	(acre-ft)
K	=	.11	
LS	=	.26	
L	=	74.73	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	794.20	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4) , 10-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	47034.48	
Qp	=	425.00	(cfs)
V	=	152.60	(acre-ft)
K	=	.11	
LS	=	.26	
L	=	74.73	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	487.93	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4) , 5-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	28510.38	
Qp	=	249.00	(cfs)
V	=	106.54	(acre-ft)
K	=	.11	
LS	=	.26	
L	=	74.73	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	295.76	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 16 (C4) , 2-year

$$Ys = Rw \times K \times LS \times CP$$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$$= 95 \times (Qp \times V)^{.56}$$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	9898.12	
Qp	=	69.00	(cfs)
V	=	58.13	(acre-ft)
K	=	.11	
LS	=	.26	
L	=	74.73	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	102.68	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10) , 100-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	674602.60	
Qp	=	4885.00	(cfs)
V	=	1543.48	(acre-ft)
K	=	.11	
LS	=	.44	
L	=	224.80	(ft)
S	=	3.20	(percent)
n	=	.40	
CP	=	.36	

Ys = 11622.91 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10) , 50-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	508172.10	
Qp	=	3603.00	(cfs)
V	=	1261.80	(acre-ft)
K	=	.11	
LS	=	.44	
L	=	224.80	(ft)
S	=	3.20	(percent)
n	=	.40	
CP	=	.36	

Ys = 8755.43 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10) , 25-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	357315.70	
Qp	=	2471.00	(cfs)
V	=	980.94	(acre-ft)
K	=	.11	
LS	=	.44	
L	=	224.80	(ft)
S	=	3.20	(percent)
n	=	.40	
CP	=	.36	

Ys = 6156.29 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10) , 10-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	215548.10	
Qp	=	1442.00	(cfs)
V	=	681.67	(acre-ft)
K	=	.11	
LS	=	.44	
L	=	224.80	(ft)
S	=	3.20	(percent)
n	=	.40	
CP	=	.36	

Ys = 3713.74 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10) , 5-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	141399.90	
Qp	=	789.00	(cfs)
V	=	586.82	(acre-ft)
K	=	.11	
LS	=	.44	
L	=	224.80	(ft)
S	=	3.20	(percent)
n	=	.40	
CP	=	.36	

Ys = 2436.22 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 19 (C10) , 2-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	49430.58	
Qp	=	254.00	(cfs)
V	=	279.03	(acre-ft)
K	=	.11	
LS	=	.44	
L	=	224.80	(ft)
S	=	3.20	(percent)
n	=	.40	
CP	=	.36	
Ys	=	851.65	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11) , 100-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	232449.30	
Qp	=	2207.00	(cfs)
V	=	509.66	(acre-ft)
K	=	.11	
LS	=	.31	
L	=	127.96	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	

Ys = 2833.57 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11) , 50-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	190847.80	
Qp	=	1659.00	(cfs)
V	=	476.76	(acre-ft)
K	=	.11	
LS	=	.31	
L	=	127.96	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	

Ys = 2326.45 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11) , 25-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	136135.00	
Qp	=	1154.00	(cfs)
V	=	374.93	(acre-ft)
K	=	.11	
LS	=	.31	
L	=	127.96	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	

Ys = 1659.49 (tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11) , 10-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	84813.35	
Qp	=	695.00	(cfs)
V	=	267.42	(acre-ft)
K	=	.11	
LS	=	.31	
L	=	127.96	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	1033.88	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11) , 5-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	52210.55	
Qp	=	414.00	(cfs)
V	=	188.76	(acre-ft)
K	=	.11	
LS	=	.31	
L	=	127.96	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	636.45	(tons)

MODIFIED UNIVERSAL SOIL LOSS EQUATION CALCULATION SHEET

PROJECT NAME: SWBMS
LOCATION : 20 (C11) , 2-year

$Ys = Rw \times K \times LS \times CP$

where: Ys = sediment yield (tons)

Rw = storm runoff energy factor

$= 95 \times (Qp \times V)^{.56}$

Qp = peak discharge (cfs)
V = storm event runoff volume (acre-ft)

K = soil erodibility factor

LS = topographic factor

$= (L/72.6)^{n} \times (.065 + (.0454 \times S) + (.0065 \times S^{2}))$

L = slope length (ft)
S = slope gradient (percent)
n = .3 for slope < 3 percent
n = .4 for slope = 4 percent
n = .5 for slope > 5 percent

CP = erosion control practice factor

Rw	=	19228.32	
Qp	=	122.00	(cfs)
V	=	107.62	(acre-ft)
K	=	.11	
LS	=	.31	
L	=	127.96	(ft)
S	=	3.00	(percent)
n	=	.30	
CP	=	.36	
Ys	=	234.39	(tons)

Anderson, Passarelli & Associates

JOB NAME SWRMS APA JOB NO. 84145
MADE BY EAB DATE 3/26/90
CHECKED BY SMW DATE 3/27/90 REFERENCE MUSLE

(19)

C.P. C10

VOL_{100} = 11623 tons
VOL_{50} = 8755 tons
VOL_{25} = 6157 tons
VOL_{10} = 3714 tons
VOL_5 = 2436 tons
VOL_2 = 852 tons

$(VOL_5)_m$ = 1677 tons

DA = 7741 AC = 12.10 mi^2

$(VOL_6)_m$ = .06 AC.FT/mi^2

(20)

CP. C11

VOL_{100} = 2834 tons
VOL_{50} = 2326 tons
VOL_{25} = 1659 tons
VOL_{10} = 1034 tons
VOL_5 = 636 tons
VOL_2 = 234 tons

$(VOL_5)_m$ = 447 tons

DA = 2820 AC = 4.41 mi^2

$(VOL_6)_m$ = .05 AC.FT/mi^2

Anderson, Passarelli & Associates

JOB NAME SWBMS APA JOB NO. 84145
MADE BY EAB DATE 3/26/90
CHECKED BY JMW DATE 3/27/90 REFERENCE MUSLE

Equation:

$$(VOL_s)_m = 0.01\,(VOL_s)_{100} + 0.01\,\frac{(VOL_s)_{100} + (VOL_s)_{50}}{2} + 0.02\,\frac{(VOL_s)_{50} + (VOL_s)_{25}}{2} + 0.06\,\frac{(VOL_s)_{25} + (VOL_s)_{10}}{2} + 0.1\,\frac{(VOL_s)_{10} + (VOL_s)_5}{2} + 0.3\,\frac{(VOL_s)_5 + (VOL_s)_2}{2} + 0.5\,\frac{(VOL_s)_2 + 0}{2}$$

(14)

CP. C20

$(VOL)_{100}$ = 1738 tons
VOL_{50} = 1389 tons
VOL_{25} = 1060 tons
VOL_{10} = 726 tons
VOL_5 = 495 tons
VOL_2 = 224 tons

$(VOL_s)_m$ = 336 tons
DA = 505 AC = .79 mi²
$(VOL_s)_m$ = .20 AC-FT/mi²

(15)

CP. C1

VOL_{100} = 12628 tons
VOL_{50} = 9861 tons
VOL_{25} = 7664 tons
VOL_{10} = 4852 tons
VOL_5 = 3044 tons
VOL_2 = 1183 tons

$(VOL_s)_m$ = 2114 tons
DA = 6185 AC = 9.66 mi²
$(VOL_s)_m$ = .10 AC-FT/mi²

(16)

CP. C4

VOL_{100} = 1360 tons
VOL_{50} = 1040 tons
VOL_{25} = 794 tons
VOL_{10} = 488 tons
VOL_5 = 296 tons
VOL_2 = 103 tons

$(VOL_s)_m$ = 207 tons
DA = 1647 AC = 2.57 mi²
$(VOL_s)_m$ = .04 AC-FT/mi²

APPENDIX G FLOODPLAIN ANALYSIS CALCULATIONS

This section provides the individual calculation sheets used to delineate 100-year floodplains for urbanized areas not studied by FEMA where predicted 100-year peak discharges equaled or exceeded 500 cfs. The results are summarized in Table 13.

Using the Pima County Method, predicted 100-year peak discharges were determined at specific concnetration points. Mannings's equation was used to rate cross-secitons developed form 1" = 100', 2' contour interval mapping and roadway dip sections surveyed by APA. Where the channel capacity was exceeded by the predicted 100-year discharge, flow breakout was assumed to produce overland sheet flow. The flood limits determined from the above ratings were delineated on recent (March 1988) 1" = 1000' aerial photography and are shown on Figure 17.

FLOODPLAIN ANALYSIS
Summary Table

Cross[1] Section	Depth of flow before breakover	Discharge at contained depth	100yr breakover and/or sheetflow	Q100
1-1	1.92	674	-	674
2-1A}*	2.13	1500	yes	4069
2-1B}	2.13	403		
2-2	4.05	4069	-	4069
3-1	4.37	516	-	516
3-2	1.29	516	-	516
3-3	2.40	612	yes	3189
3-4	0.90	132	yes	3189
3-5	1.70	336	yes	3189
4-1	2.00	1426	yes	2588
4-2	2.40	877	yes	2588
4-3	4.21	2588	-	2588
5-1	0.77	784	-	784
5-2	1.45	784	-	784
5-3	3.02	697	yes	697
6-1	1.30	437	yes	1212
6-2	3.25	1212	-	1212
6-3	4.20	504	yes	969
6-4	1.91	969	-	969
7-1	0.40	64	yes	963
7-2	1.04	963	-	963
8-1A}*	.53	95		
8-1B}	1.13	377	yes	4304
8-2	4.95	4304	-	4304
8-3	1.40	348	yes	2658
8-4	2.81	3186	-	3186
9-1	0.39	99	yes	1848
9-2	Sheetflow	-	yes	2092
9-3	3.12	2092	-	2092
9-4	4.99	2456	-	2456
9-5	2.59	2456	-	2456
10-1	2.34	633	-	663
11-1	0.99	433	yes	933
11-2	1.70	753	yes	933
11-3	2.51	1010	-	702
11-4	0.76	213	yes	702
11-5	2.00	942	-	640
11-6	2.94	1010	-	640
12-1	2.20	1647	yes	1801
12-2	0.32	40	yes	1758

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 1-1 (0111)

WATERSHED AREA (A): 329.00 acres

LENGTH OF WATERCOURSE (Lc): 10400. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5200. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10400.	145.0

MEAN SLOPE (Sc): .0139 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.184	.326	.405	.488	.550	.599
Tc (FUNCTION OF i) :	122.56	97.62	89.47	83.00	79.17	76.49
SOLUTION OF Tc (MINUTES):	153	93	74	60	52	47
RAINFL INT. @ Tc (IN/HR):	.574	1.138	1.600	2.258	2.825	3.391
RUNOFF RATE @ Tc (IN/HR):	.106	.370	.648	1.103	1.553	2.031
PEAK DISCHARGE (CFS) :	35.	123.	215.	366.	515.	674.

SWDMS 12-18-89
CROSS-SECTION - SECTION RATING 1-1 (D111)

STA:	.00	40.00	65.00	90.00	120.00	170.00	230.00
ELEV:	28.00	26.00	24.00	22.00	20.20	22.00	24.00

STA: 345.00
ELEV: 2425.00

DISCHARGE = 674. WSEL = 22.12 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	674.12	674.12
VELOCITY (FT/S) =	8.25	8.25
AREA (SQUARE FT) =	81.75	81.75
TOPWIDTH (FT) =	85.02	85.02
DEPTH (FT) =	1.92	1.92
HYD. DEPTH (FT) =	.96	.96
WET. PERIM. (FT) =	85.11	85.11
HYD. RADIUS (FT) =	.96	.96
FROUDE NUMBER =	1.48	1.48
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 345.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 2-1 (D114-115)

WATERSHED AREA (A): 2205.00 acres

LENGTH OF WATERCOURSE (Lc): 24000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 12000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
6000.	1288.0
18000.	260.0

MEAN SLOPE (Sc): .0218 ft BASIN FACTOR (Nb): .0430

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

52. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
48. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.288	.434	.509	.586	.640	.683
Tc (FUNCTION OF i) :	135.46	114.97	107.79	101.92	98.38	95.87
SOLUTION OF Tc (MINUTES):	178	118	98	82	72	65
RAINFL INT. @ Tc (IN/HR):	.507	.940	1.266	1.728	2.194	2.680
RUNOFF RATE @ Tc (IN/HR):	.146	.408	.645	1.013	1.405	1.831
PEAK DISCHARGE (CFS) :	324.	906.	1434.	2251.	3122.	4069.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 2-1A (D114)

STA:	.00	25.00	50.00	75.00	100.00	125.00	136.60
ELEV:	100.00	99.78	99.48	98.94	98.15	97.54	97.47

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	97.60	98.30	99.07	99.53	99.60

DISCHARGE = 1499. WSEL = 99.60 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1499.50	1499.50
VELOCITY (FT/S) =	7.31	7.31
AREA (SQUARE FT) =	205.07	205.07
TOPWIDTH (FT) =	210.00	210.00
DEPTH (FT) =	2.13	2.13
HYD. DEPTH (FT) =	.98	.98
WET. PERIM. (FT) =	210.05	210.05
HYD. RADIUS (FT) =	.98	.98
FROUDE NUMBER =	1.30	1.30
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 2-1B (D115)

STA:	.00	25.00	60.00	70.00	78.00	82.00	90.00
ELEV:	40.00	39.00	38.00	37.00	36.00	35.40	35.00

STA:	100.00	105.00	115.00	125.00	250.00
ELEV:	35.00	35.20	35.50	36.00	36.50

DISCHARGE = 403. WSEL = 36.50 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	402.70	402.70
VELOCITY (FT/S) =	4.64	4.64
AREA (SQUARE FT) =	86.85	86.85
TOPWIDTH (FT) =	176.00	176.00
DEPTH (FT) =	1.50	1.50
HYD. DEPTH (FT) =	.49	.49
WET. PERIM. (FT) =	176.11	176.11
HYD. RADIUS (FT) =	.49	.49
FROUDE NUMBER =	1.16	1.16
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 2-2

STA:	.00	80.00	140.00	260.00	280.00	290.00	310.00
ELEV:	59.00	58.00	56.90	58.00	58.40	58.00	56.00
STA:	325.00	345.00	410.00	525.00	550.00	570.00	610.00
ELEV:	54.60	56.00	58.10	56.40	58.40	58.00	56.70
STA:	660.00	800.00					
ELEV:	58.00	59.00					

DISCHARGE = 4069. WSEL = 58.65 SLOPE = .0150

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	4068.99	4068.99
VELOCITY (FT/S) =	4.81	4.81
AREA (SQUARE FT) =	845.53	845.53
TOPWIDTH (FT) =	722.10	722.10
DEPTH (FT) =	4.05	4.05
HYD. DEPTH (FT) =	1.17	1.17
WET. PERIM. (FT) =	722.52	722.52
HYD. RADIUS (FT) =	1.17	1.17
FROUDE NUMBER =	.78	.78
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 800.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 3-2 (D117)

WATERSHED AREA (A): 220.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

8000. 120.0

MEAN SLOPE (Sc): .0150 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

85. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
15. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.222	.364	.441	.522	.581	.628
Tc (FUNCTION OF i) :	104.91	86.09	79.68	74.49	71.39	69.20
SOLUTION OF Tc (MINUTES):	121	77	62	52	46	41
RAINFL INT. @ Tc (IN/HR):	.698	1.332	1.863	2.484	3.082	3.707
RUNOFF RATE @ Tc (IN/HR):	.155	.485	.823	1.297	1.790	2.327
PEAK DISCHARGE (CFS) :	34.	107.	182.	288.	397.	516.

SWRMS 12-18-89
CROSS-SECTION - SECTION RATING 3-1

STA:	.00	40.00	45.00	50.00	56.00	100.00	111.00
ELEV:	60.00	52.00	51.00	52.00	54.00	56.00	58.00

DISCHARGE = 516. WSEL = 55.37 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	516.06	516.06
VELOCITY (FT/S) =	5.07	5.07
AREA (SQUARE FT) =	101.74	101.74
TOPWIDTH (FT) =	62.90	62.90
DEPTH (FT) =	4.37	4.37
HYD. DEPTH (FT) =	1.62	1.62
WET. PERIM. (FT) =	63.78	63.78
HYD. RADIUS (FT) =	1.60	1.60
FROUDE NUMBER =	.70	.70
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 111.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 3-2 (0117)

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.73	99.12	98.24	97.22	96.09	94.99
STA:	175.00	200.00	225.00	235.80	250.00	275.00	300.00
ELEV:	93.96	93.03	92.43	92.38	92.54	93.27	94.21
STA:	325.00	350.00	375.00	400.00	425.00	450.00	
ELEV:	95.14	96.04	96.95	97.59	97.90	98.00	

DISCHARGE = 516. WSEL = 93.67 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	516.01	516.01
VELOCITY (FT/S) =	6.35	6.35
AREA (SQUARE FT) =	81.31	81.31
TOPWIDTH (FT) =	102.95	102.95
DEPTH (FT) =	1.29	1.29
HYD. DEPTH (FT) =	.79	.79
WET. PERIM. (FT) =	102.99	102.99
HYD. RADIUS (FT) =	.79	.79
FROUDE NUMBER =	1.26	1.26
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 450.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 3-3

STA:	.00	50.00	70.00	85.00	100.00	115.00	130.00
ELEV:	17.00	16.00	15.30	15.90	14.00	13.60	14.00

STA:	150.00
ELEV:	16.00

DISCHARGE = 612. WSEL = 16.00 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	612.10	58.59	494.63	58.88
VELOCITY (FT/S) =	5.33	2.04	7.49	2.94
AREA (SQUARE FT) =	114.75	28.75	66.00	20.00
TOPWIDTH (FT) =	100.00	50.00	30.00	20.00
DEPTH (FT) =	2.40	2.00	2.40	2.00
HYD. DEPTH (FT) =	1.15	.58	2.20	1.00
WET. PERIM. (FT) =	100.25	50.14	30.01	20.10
HYD. RADIUS (FT) =	1.14	.57	2.20	1.00
FROUDE NUMBER =	.88	.47	.89	.52
MANNINGS N VALUE =	.0273	.0450	.0300	.0450

SUBSECTION 1 = STATION	.00	TO	STATION	100.00	
SUBSECTION 2 = STATION	100.00	TO	STATION	130.00	(CHANNEL)
SUBSECTION 3 = STATION	130.00	TO	STATION	150.00	

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 3-4 (D81)

STA:	.00	160.00	230.00	260.00	280.00
ELEV:	15.00	14.00	12.10	12.10	13.00

DISCHARGE = 132. WSEL = 13.00 SLOPE = .0053

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	132.36	132.36
VELOCITY (FT/S) =	2.60	2.60
AREA (SQUARE FT) =	50.92	50.92
TOPWIDTH (FT) =	83.16	83.16
DEPTH (FT) =	.90	.90
HYD. DEPTH (FT) =	.61	.61
WET. PERIM. (FT) =	83.19	83.19
HYD. RADIUS (FT) =	.61	.61
FROUDE NUMBER =	.59	.59
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 280.00

SWDMS 12-18-89
CROSS-SECTION - SECTION RATING 3-5

STA:	.00	150.00	160.00	175.00	210.00	250.00	260.00
ELEV:	4.00	2.00	1.00	2.00	2.50	2.00	1.00
STA:	270.00	285.00	300.00	310.00	325.00	370.00	375.00
ELEV:	2.00	2.30	2.00	1.00	2.00	2.00	.30
STA:	390.00	400.00					
ELEV:	.30	2.00					

DISCHARGE = 336. WSEL = 2.00 SLOPE = .0120

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3	4
DISCHARGE (CFS) =	335.53	.00	42.62	51.12	241.78
VELOCITY (FT/S) =	4.58	2.60	3.41	2.27	6.32
AREA (SQUARE FT) =	73.25	.00	12.50	22.50	38.25
TOPWIDTH (FT) =	100.00	.00	25.00	45.00	30.00
DEPTH (FT) =	1.70	.00	1.00	1.00	1.70
HYD. DEPTH (FT) =	.73	.61	.50	.50	1.27
WET. PERIM. (FT) =	100.69	.00	25.08	45.18	30.42
HYD. RADIUS (FT) =	.73	.61	.50	.50	1.26
FROUDE NUMBER =	.94	.59	.85	.57	.99
MANNINGS N VALUE =	.0287	.0450	.0300	.0450	.0300

SUBSECTION 1 = STATION	.00	TO	STATION	150.00	
SUBSECTION 2 = STATION	150.00	TO	STATION	175.00	(CHANNEL)
SUBSECTION 3 = STATION	175.00	TO	STATION	370.00	
SUBSECTION 4 = STATION	370.00	TO	STATION	400.00	(CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 4-1 (D125)

WATERSHED AREA (A): 762.00 acres

LENGTH OF WATERCOURSE (Lc): 11000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3200.	484.0
7800.	170.0

MEAN SLOPE (Sc): .0325 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

33. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
67. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.326	.474	.549	.623	.675	.715
Tc (FUNCTION OF i) :	71.99	61.96	58.44	55.55	53.80	52.57
SOLUTION OF Tc (MINUTES):	69	48	41	35	31	28
RAINFL INT. @ Tc (IN/HR):	1.111	1.933	2.474	3.229	3.955	4.713
RUNOFF RATE @ Tc (IN/HR):	.362	.916	1.357	2.011	2.668	3.369
PEAK DISCHARGE (CFS) :	278.	704.	1043.	1545.	2049.	2588.

SWRMS 12-18-89
CROSS-SECTION - SECTION RATING 4-1 (0125)

STA:	.00	100.00	155.00	230.00	300.00
ELEV:	32.00	30.40	30.00	32.00	32.50

DISCHARGE = 1426. WSEL = 32.00 SLOPE = .0050

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1425.63	1425.63
VELOCITY (FT/S) =	5.61	5.61
AREA (SQUARE FT) =	254.00	254.00
TOPWIDTH (FT) =	230.00	230.00
DEPTH (FT) =	2.00	2.00
HYD. DEPTH (FT) =	1.10	1.10
WET. PERIM. (FT) =	230.04	230.04
HYD. RADIUS (FT) =	1.10	1.10
FROUDE NUMBER =	.94	.94
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 4-2

STA:	.00	50.00	75.00	160.00	180.00	190.00	195.00
ELEV:	36.00	36.00	35.00	35.50	34.00	33.70	34.00
STA:	205.00	210.00	215.00	220.00	250.00	275.00	290.00
ELEV:	34.20	34.00	33.60	34.00	35.90	34.60	36.00
STA:	400.00						
ELEV:	38.00						

DISCHARGE = 877. WSEL = 36.00 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	876.64	876.64
VELOCITY (FT/S) =	3.58	3.58
AREA (SQUARE FT) =	244.75	244.75
TOPWIDTH (FT) =	240.00	240.00
DEPTH (FT) =	2.40	2.40
HYD. DEPTH (FT) =	1.02	1.02
WET. PERIM. (FT) =	240.29	240.29
HYD. RADIUS (FT) =	1.02	1.02
FROUDE NUMBER =	.63	.63
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 400.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 4-3

STA:	.00	230.00	295.00	305.00	320.00	460.00	590.00
ELEV:	50.00	48.00	46.00	44.80	46.00	48.00	50.00

DISCHARGE = 2588. WSEL = 49.01 SLOPE = .0090

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	2588.01	552.04	854.59	1181.38
VELOCITY (FT/S) =	4.34	2.91	9.46	3.75
AREA (SQUARE FT) =	595.68	190.00	90.35	315.34
TOPWIDTH (FT) =	412.48	181.59	25.00	205.90
DEPTH (FT) =	4.21	3.01	4.21	3.01
HYD. DEPTH (FT) =	1.44	1.05	3.61	1.53
WET. PERIM. (FT) =	412.66	181.62	25.12	205.92
HYD. RADIUS (FT) =	1.44	1.05	3.60	1.53
FROUDE NUMBER =	.64	.50	.88	.53
MANNINGS N VALUE =	.0414	.0500	.0350	.0500

SUBSECTION 1 = STATION	.00	TO	STATION	295.00	
SUBSECTION 2 = STATION	295.00	TO	STATION	320.00	(CHANNEL)
SUBSECTION 3 = STATION	320.00	TO	STATION	590.00	

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 5-1 (D126)

WATERSHED AREA (A): 275.00 acres

LENGTH OF WATERCOURSE (Lc): 10000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1500.	465.0
4500.	110.0
4000.	55.0

MEAN SLOPE (Sc): .0232 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

63. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
37. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.266	.410	.487	.565	.621	.665
Tc (FUNCTION OF i) :	84.28	70.84	66.16	62.34	60.04	58.41
SOLUTION OF Tc (MINUTES):	88	57	48	41	36	33
RAINFL INT. @ Tc (IN/HR):	.904	1.718	2.244	2.913	3.621	4.253
RUNOFF RATE @ Tc (IN/HR):	.240	.705	1.092	1.645	2.247	2.827
PEAK DISCHARGE (CFS) :	67.	195.	303.	456.	623.	784.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 5-1

STA:	.00	110.00	260.00	380.00
ELEV:	32.00	31.00	31.00	32.00

DISCHARGE = 784. WSEL = 31.77 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	784.00	784.00
VELOCITY (FT/S) =	4.24	4.24
AREA (SQUARE FT) =	184.85	184.85
TOPWIDTH (FT) =	327.92	327.92
DEPTH (FT) =	.77	.77
HYD. DEPTH (FT) =	.56	.56
WET. PERIM. (FT) =	327.93	327.93
HYD. RADIUS (FT) =	.56	.56
FROUDE NUMBER =	1.00	1.00
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 380.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 5-2

STA:	.00	100.00	130.00	150.00	160.00	170.00	210.00
ELEV:	36.00	34.20	34.20	35.50	34.00	34.00	35.30
STA:	260.00	340.00	500.00	515.00	530.00	600.00	650.00
ELEV:	34.70	35.30	34.00	33.60	34.00	35.00	34.20
STA:	920.00						
ELEV:	36.00						

DISCHARGE = 784. WSEL = 35.05 SLOPE = .0120

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	784.00	784.00
VELOCITY (FT/S) =	2.47	2.47
AREA (SQUARE FT) =	317.39	317.39
TOPWIDTH (FT) =	623.44	623.44
DEPTH (FT) =	1.45	1.45
HYD. DEPTH (FT) =	.51	.51
WET. PERIM. (FT) =	623.61	623.61
HYD. RADIUS (FT) =	.51	.51
FROUDE NUMBER =	.61	.61
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 920.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 5-3

WATERSHED AREA (A): 156.00 acres

LENGTH OF WATERCOURSE (Lc): 6000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1500.	465.0
4500.	110.0

MEAN SLOPE (Sc): .0363 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

35. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
65. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 7. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.328	.475	.549	.622	.674	.714
Tc (FUNCTION OF i) :	47.70	41.14	38.82	36.91	35.76	34.94
SOLUTION OF Tc (MINUTES):	39	28	24	20	18	17
RAINFL INT. @ Tc (IN/HR):	1.682	2.710	3.452	4.494	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.552	1.286	1.894	2.797	3.635	4.433
PEAK DISCHARGE (CFS) :	87.	202.	298.	440.	572.	697.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 5-3

STA:	.00	30.00	50.00	65.00	90.00	120.00	150.00
ELEV:	52.00	50.00	49.00	50.00	50.00	49.00	50.00
STA:	200.00	240.00	250.00	265.00	290.00	320.00	350.00
ELEV:	50.00	48.00	46.50	48.00	49.00	48.20	50.00
STA:	400.00	460.00					
ELEV:	50.00	52.00					

DISCHARGE = 697. WSEL = 49.52 SLOPE = .0110

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	696.80	66.52	435.74	194.55
VELOCITY (FT/S) =	4.33	1.83	7.66	2.86
AREA (SQUARE FT) =	161.06	36.27	56.85	67.93
TOPWIDTH (FT) =	182.34	80.27	25.00	77.07
DEPTH (FT) =	3.02	1.52	3.02	1.52
HYD. DEPTH (FT) =	.88	.45	2.27	.88
WET. PERIM. (FT) =	182.68	80.35	25.19	77.14
HYD. RADIUS (FT) =	.88	.45	2.26	.88
FROUDE NUMBER =	.81	.48	.90	.54
MANNINGS N VALUE =	.0331	.0500	.0350	.0500

SUBSECTION 1 = STATION .00 TO STATION 240.00
SUBSECTION 2 = STATION 240.00 TO STATION 265.00 (CHANNEL)
SUBSECTION 3 = STATION 265.00 TO STATION 460.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 6-1 (0130)

WATERSHED AREA (A): 643.00 acres

LENGTH OF WATERCOURSE (Lc): 19000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 9500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1400.	1200.0
4800.	260.0
12800.	191.0

MEAN SLOPE (Sc): .0224 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

83. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
17. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.240	.380	.456	.535	.592	.638
Tc (FUNCTION OF i) :	130.85	108.97	101.29	95.02	91.23	88.55
SOLUTION OF Tc (MINUTES):	169	109	90	74	64	58
RAINFL INT. @ Tc (IN/HR):	.529	1.001	1.357	1.884	2.428	2.931
RUNOFF RATE @ Tc (IN/HR):	.127	.380	.619	1.008	1.438	1.871
PEAK DISCHARGE (CFS) :	82.	246.	401.	653.	932.	1212.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 6-1 (D130)

STA:	.00	95.00	125.00	160.00
ELEV:	48.00	46.10	46.10	47.40

DISCHARGE = 437. WSEL = 47.40 SLOPE = .0043

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	436.55	436.55
VELOCITY (FT/S) =	4.20	4.20
AREA (SQUARE FT) =	104.00	104.00
TOPWIDTH (FT) =	130.00	130.00
DEPTH (FT) =	1.30	1.30
HYD. DEPTH (FT) =	.80	.80
WET. PERIM. (FT) =	130.04	130.04
HYD. RADIUS (FT) =	.80	.80
FROUDE NUMBER =	.83	.83
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 160.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 6-2

STA:	.00	30.00	70.00	90.00	100.00	130.00	150.00
ELEV:	55.80	55.00	55.60	54.00	52.00	50.20	50.20

STA:	155.00	160.00	180.00	210.00	260.00	300.00
ELEV:	52.00	54.00	55.20	54.00	54.00	56.00

DISCHARGE = 1212. WSEL = 53.45 SLOPE = .0110

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	1212.02	.00	1212.02	.00
VELOCITY (FT/S) =	7.82	.78	7.82	1.14
AREA (SQUARE FT) =	155.01	.00	155.01	.00
TOPWIDTH (FT) =	65.86	.00	65.86	.00
DEPTH (FT) =	3.25	.00	3.25	.00
HYD. DEPTH (FT) =	2.35	.13	2.35	.22
WET. PERIM. (FT) =	66.65	.00	66.65	.00
HYD. RADIUS (FT) =	2.33	.13	2.33	.22
FROUDE NUMBER =	.90	.39	.90	.43
MANNINGS N VALUE =	.0350	.0500	.0350	.0500

SUBSECTION 1 = STATION .00 TO STATION 90.00
SUBSECTION 2 = STATION 90.00 TO STATION 160.00 (CHANNEL)
SUBSECTION 3 = STATION 160.00 TO STATION 300.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 6-3 (D90)

WATERSHED AREA (A): 448.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3000.	1400.0
11000.	180.0

MEAN SLOPE (Sc): .0240 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

72. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
28. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.248	.391	.468	.547	.604	.650
Tc (FUNCTION OF i) :	116.36	96.94	90.22	84.76	81.47	79.15
SOLUTION OF Tc (MINUTES):	142	92	75	62	55	49
RAINFL INT. @ Tc (IN/HR):	.610	1.148	1.582	2.195	2.722	3.305
RUNOFF RATE @ Tc (IN/HR):	.151	.449	.741	1.201	1.645	2.147
PEAK DISCHARGE (CFS) :	68.	203.	334.	542.	743.	969.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 6-3

STA:	.00	10.00	25.00	30.00	40.00	45.00	70.00
ELEV:	68.20	68.00	66.00	64.00	64.00	66.00	68.00

STA:	100.00
ELEV:	68.40

DISCHARGE = 504. WSEL = 68.20 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	504.31	504.31
VELOCITY (FT/S) =	4.05	4.05
AREA (SQUARE FT) =	124.50	124.50
TOPWIDTH (FT) =	85.00	85.00
DEPTH (FT) =	4.20	4.20
HYD. DEPTH (FT) =	1.46	1.46
WET. PERIM. (FT) =	85.99	85.99
HYD. RADIUS (FT) =	1.45	1.45
FROUDE NUMBER =	.59	.59
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 100.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 6-4 (090)

STA:	.00	25.00	50.00	75.00	100.00	108.00	125.00
ELEV:	100.00	98.79	96.80	94.65	93.57	93.56	94.15
STA:	150.00	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	95.12	96.29	97.62	99.00	99.87	100.18	100.04

DISCHARGE = 969. WSEL = 95.47 SLOPE = .0140

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	969.10	969.10
VELOCITY (FT/S) =	9.45	9.45
AREA (SQUARE FT) =	102.55	102.55
TOPWIDTH (FT) =	91.93	91.93
DEPTH (FT) =	1.91	1.91
HYD. DEPTH (FT) =	1.12	1.12
WET. PERIM. (FT) =	92.02	92.02
HYD. RADIUS (FT) =	1.11	1.11
FROUDE NUMBER =	1.58	1.58
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 7-1 (D135)

WATERSHED AREA (A): 638.00 acres

LENGTH OF WATERCOURSE (Lc): 17800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8900. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
17800.	275.0

MEAN SLOPE (Sc): .0154 ft BASIN FACTOR (Nb): .0460

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.207	.345	.422	.503	.562	.610
Tc (FUNCTION OF i) :	158.40	129.23	119.21	111.10	106.25	102.83
SOLUTION OF Tc (MINUTES):	226	141	114	93	81	72
RAINFL INT. @ Tc (IN/HR):	.413	.810	1.122	1.557	1.986	2.455
RUNOFF RATE @ Tc (IN/HR):	.086	.279	.473	.783	1.117	1.498
PEAK DISCHARGE (CFS) :	55.	179.	304.	503.	718.	963.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 7-1 (0135)

STA:	.00	30.00	50.00	115.00	190.00
ELEV:	60.00	59.60	59.60	60.00	60.30

DISCHARGE = 64. WSEL = 60.00 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	63.85	63.85
VELOCITY (FT/S) =	2.36	2.36
AREA (SQUARE FT) =	27.00	27.00
TOPWIDTH (FT) =	115.00	115.00
DEPTH (FT) =	.40	.40
HYD. DEPTH (FT) =	.23	.23
WET. PERIM. (FT) =	115.00	115.00
HYD. RADIUS (FT) =	.23	.23
FROUDE NUMBER =	.86	.86
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 190.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 7-2

STA:	.00	320.00	440.00	470.00	500.00	510.00	540.00
ELEV:	70.00	68.00	68.30	68.70	68.00	68.00	68.50
STA:	570.00	580.00	630.00	690.00	700.00	750.00	890.00
ELEV:	68.00	68.00	69.00	68.00	68.00	69.00	68.70
STA:	910.00	920.00	935.00	950.00	970.00	1020.00	
ELEV:	69.30	68.70	69.60	68.30	68.30	70.00	

DISCHARGE = 963. WSEL = 69.04 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	963.13	963.13
VELOCITY (FT/S) =	2.14	2.14
AREA (SQUARE FT) =	450.03	450.03
TOPWIDTH (FT) =	808.82	808.82
DEPTH (FT) =	1.04	1.04
HYD. DEPTH (FT) =	.56	.56
WET. PERIM. (FT) =	808.94	808.94
HYD. RADIUS (FT) =	.56	.56
FROUDE NUMBER =	.51	.51
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 1020.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 8-1 (0137-0136)

WATERSHED AREA (A): 2717.00 acres

LENGTH OF WATERCOURSE (Lc): 26500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 13250. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
22200.	440.0

MEAN SLOPE (Sc): .0256 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): FOOTHILLS/MTN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

66. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
34. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 7. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.267	.410	.485	.563	.619	.663
Tc (FUNCTION OF i) :	151.68	127.78	119.37	112.50	108.34	105.40
SOLUTION OF Tc (MINUTES):	211	138	114	95	83	75
RAINFL INT. @ Tc (IN/HR):	.438	.824	1.122	1.530	1.946	2.371
RUNOFF RATE @ Tc (IN/HR):	.117	.338	.545	.861	1.204	1.572
PEAK DISCHARGE (CFS) :	320.	925.	1491.	2359.	3297.	4304.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 8-1A (0136)

STA:	.00	25.00	50.00	75.00	100.00	125.00	133.60
ELEV:	100.00	99.73	99.38	99.10	98.76	98.48	98.38

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	98.45	98.53	98.81	98.86	98.91

DISCHARGE = 95. WSEL = 98.91 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	95.46	95.46
VELOCITY (FT/S) =	2.43	2.43
AREA (SQUARE FT) =	39.32	39.32
TOPWIDTH (FT) =	161.03	161.03
DEPTH (FT) =	.53	.53
HYD. DEPTH (FT) =	.24	.24
WET. PERIM. (FT) =	161.03	161.03
HYD. RADIUS (FT) =	.24	.24
FROUDE NUMBER =	.87	.87
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 8-1B (0137)

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	98.91	98.68	98.16	97.62	97.14	96.95	97.19

STA:	175.00	200.00	225.00	250.00
ELEV:	97.70	98.04	98.08	97.93

DISCHARGE = 377. WSEL = 98.08 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	376.93	376.93
VELOCITY (FT/S) =	3.88	3.88
AREA (SQUARE FT) =	97.02	97.02
TOPWIDTH (FT) =	196.30	196.30
DEPTH (FT) =	1.13	1.13
HYD. DEPTH (FT) =	.49	.49
WET. PERIM. (FT) =	196.32	196.32
HYD. RADIUS (FT) =	.49	.49
FROUDE NUMBER =	.97	.97
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 8-2

STA:	.00	30.00	170.00	220.00	360.00	380.00	395.00
ELEV:	73.70	72.10	72.00	70.00	70.00	70.50	70.00
STA:	405.00	420.00	440.00	455.00	525.00	545.00	585.00
ELEV:	67.40	70.00	70.30	70.00	70.00	70.40	70.00
STA:	680.00	750.00	810.00	1080.00	1430.00		
ELEV:	72.00	72.80	72.00	72.20	73.40		

DISCHARGE = 4304. WSEL = 72.35 SLOPE = .0080

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	4304.01	4304.01
VELOCITY (FT/S) =	3.65	3.65
AREA (SQUARE FT) =	1179.04	1179.04
TOPWIDTH (FT) =	1023.34	1023.34
DEPTH (FT) =	4.95	4.95
HYD. DEPTH (FT) =	1.15	1.15
WET. PERIM. (FT) =	1023.99	1023.99
HYD. RADIUS (FT) =	1.15	1.15
FROUDE NUMBER =	.60	.60
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 1430.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 8-3 (0146)

WATERSHED AREA (A): 1652.00 acres

LENGTH OF WATERCOURSE (Lc): 17910. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8955. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1160.	240.0
5020.	160.0
10710.	100.0

MEAN SLOPE (Sc): .0142 ft BASIN FACTOR (Nb): .0460

WATERSHED TYPE(S): FOOTHILLS/MTN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

69. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
31. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 7. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.261	.403	.479	.557	.613	.658
Tc (FUNCTION OF i) :	150.05	126.04	117.62	110.74	106.58	103.64
SOLUTION OF Tc (MINUTES):	208	136	112	93	81	73
RAINFL INT. @ Tc (IN/HR):	.444	.834	1.137	1.557	1.986	2.426
RUNOFF RATE @ Tc (IN/HR):	.116	.336	.545	.868	1.218	1.596
PEAK DISCHARGE (CFS) :	193.	560.	908.	1445.	2028.	2658.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 8-3

STA:	.00	30.00	70.00	140.00	200.00	220.00	240.00
ELEV:	501.40	500.00	499.50	499.50	500.00	498.60	498.60

STA:	255.00	280.00	300.00	325.00
ELEV:	499.50	499.70	499.70	500.00

DISCHARGE = 348. WSEL = 500.00 SLOPE = .0075

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	348.00	348.00
VELOCITY (FT/S) =	2.56	2.56
AREA (SQUARE FT) =	136.00	136.00
TOPWIDTH (FT) =	295.00	295.00
DEPTH (FT) =	1.40	1.40
HYD. DEPTH (FT) =	.46	.46
WET. PERIM. (FT) =	295.08	295.08
HYD. RADIUS (FT) =	.46	.46
FROUDE NUMBER =	.66	.66
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 325.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 8-4 (0145)

WATERSHED AREA (A): 1604.00 acres

LENGTH OF WATERCOURSE (Lc): 14960. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7480. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1180.	240.0
6020.	160.0
7760.	75.0

MEAN SLOPE (Sc): .0159 ft/ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): FOOTHILLS/MTN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

68. % B, CN= 83. COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
32. % D, CN= 91. COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.249	.394	.472	.551	.608	.653
Tc (FUNCTION OF i) :	128.11	106.60	99.22	93.23	89.64	87.10
SOLUTION OF Tc (MINUTES):	164	106	87	72	63	56
RAINFL INT. @ Tc (IN/HR):	.542	1.023	1.396	1.929	2.461	3.017
RUNOFF RATE @ Tc (IN/HR):	.135	.403	.658	1.063	1.496	1.971
PEAK DISCHARGE (CFS) :	218.	652.	1064.	1718.	2419.	3186.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 8-4 (0145)

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.69	99.00	98.23	97.20	96.07	95.35
STA:	172.30	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	95.09	95.10	95.30	95.82	96.53	97.28	97.97
STA:	325.00	350.00	375.00	400.00			
ELEV:	98.63	99.15	99.51	99.77			

DISCHARGE = 3186. WSEL = 97.90 SLOPE = .0070

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	3185.99	3185.99
VELOCITY (FT/S) =	8.82	8.82
AREA (SQUARE FT) =	361.40	361.40
TOPWIDTH (FT) =	213.96	213.96
DEPTH (FT) =	2.81	2.81
HYD. DEPTH (FT) =	1.69	1.69
WET. PERIM. (FT) =	214.05	214.05
HYD. RADIUS (FT) =	1.69	1.69
FROUDE NUMBER =	1.20	1.20
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 400.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 9-1 (0128)

WATERSHED AREA (A): 830.00 acres

LENGTH OF WATERCOURSE (Lc): 18000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 9000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4000.	1588.0
14000.	255.0

MEAN SLOPE (Sc): .0267 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

35. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
65. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.322	.470	.545	.619	.671	.712
Tc (FUNCTION OF i) :	116.72	100.33	94.57	89.85	86.99	84.98
SOLUTION OF Tc (MINUTES):	143	97	81	68	60	54
RAINFL INT. @ Tc (IN/HR):	.607	1.099	1.482	2.026	2.568	3.104
RUNOFF RATE @ Tc (IN/HR):	.195	.516	.807	1.254	1.723	2.208
PEAK DISCHARGE (CFS) :	163.	432.	675.	1049.	1442.	1848.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 9-1 (0128)

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.79	99.36	98.83	98.49	98.31	98.20

STA:	175.00	200.00	225.00	250.00	275.00	300.00
ELEV:	98.12	98.22	98.43	98.50	98.40	98.26

DISCHARGE = 99. WSEL = 98.51 SLOPE = .0120

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	98.52	98.52
VELOCITY (FT/S) =	2.64	2.64
AREA (SQUARE FT) =	37.27	37.27
TOPWIDTH (FT) =	201.15	201.15
DEPTH (FT) =	.39	.39
HYD. DEPTH (FT) =	.19	.19
WET. PERIM. (FT) =	201.16	201.16
HYD. RADIUS (FT) =	.19	.19
FROUDE NUMBER =	1.08	1.08
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 300.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 9-2 (D87)

WATERSHED AREA (A): 700.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3000.	1488.0
11000.	293.0

MEAN SLOPE (Sc): .0382 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

23. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
77. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.346	.495	.569	.642	.693	.732
Tc (FUNCTION OF i) :	84.59	73.27	69.29	66.03	64.07	62.68
SOLUTION OF Tc (MINUTES):	88	60	51	44	39	36
RAINFL INT. @ Tc (IN/HR):	.904	1.652	2.148	2.778	3.442	4.052
RUNOFF RATE @ Tc (IN/HR):	.313	.818	1.223	1.784	2.384	2.964
PEAK DISCHARGE (CFS) :	221.	577.	863.	1259.	1682.	2092.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 9-2 (087)

STA:	.00	25.00	50.00	75.00	100.00	125.00	150.00
ELEV:	100.00	99.58	99.14	98.74	98.46	98.29	98.09

STA:	175.00	200.00
ELEV:	97.81	97.51

DISCHARGE = 2092. WSEL = 99.68 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	2091.99	2091.99
VELOCITY (FT/S) =	9.59	9.59
AREA (SQUARE FT) =	218.18	218.18
TOPWIDTH (FT) =	181.20	181.20
DEPTH (FT) =	2.17	2.17
HYD. DEPTH (FT) =	1.20	1.20
WET. PERIM. (FT) =	181.22	181.22
HYD. RADIUS (FT) =	1.20	1.20
FROUDE NUMBER =	1.54	1.54
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 200.00 (CHANNEL)

SWRMS 12-18-89
CROSS-SECTION - SECTION RATING 9-3

STA:	.00	40.00	90.00	110.00	210.00	220.00	230.00
ELEV:	38.50	38.00	37.20	38.00	36.00	35.50	36.00
STA:	260.00	295.00	310.00	330.00	360.00	380.00	420.00
ELEV:	36.80	36.00	34.80	36.00	37.00	38.00	39.00
STA:	455.00	485.00	510.00	520.00	530.00	550.00	575.00
ELEV:	38.00	38.50	38.00	37.20	38.00	38.00	37.20
STA:	590.00	600.00	620.00	640.00			
ELEV:	38.00	40.00	42.00	42.20			

DISCHARGE = 2092. WSEL = 37.92 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	2092.01	33.94	2014.39	43.68
VELOCITY (FT/S) =	5.04	1.50	5.52	1.57
AREA (SQUARE FT) =	415.28	22.60	364.86	27.82
TOPWIDTH (FT) =	381.12	62.89	245.94	72.28
DEPTH (FT) =	3.12	.72	3.12	.92
HYD. DEPTH (FT) =	1.09	.36	1.48	.38
WET. PERIM. (FT) =	381.41	62.91	246.10	72.40
HYD. RADIUS (FT) =	1.09	.36	1.48	.38
FROUDE NUMBER =	.85	.44	.80	.45
MANNINGS N VALUE =	.0312	.0500	.0350	.0500

SUBSECTION 1 = STATION .00 TO STATION 110.00
SUBSECTION 2 = STATION 110.00 TO STATION 360.00 (CHANNEL)
SUBSECTION 3 = STATION 360.00 TO STATION 640.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 9-4 (075)

WATERSHED AREA (A): 482.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3000.	1488.0
5000.	205.0

MEAN SLOPE (Sc): .0763 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

14. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
86. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 4. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.352	.505	.580	.653	.704	.742
Tc (FUNCTION OF i) :	40.94	35.43	33.52	31.97	31.04	30.38
SOLUTION OF Tc (MINUTES):	32	23	20	17	15	14
RAINFL INT. @ Tc (IN/HR):	1.895	3.040	3.816	4.878	5.856	6.811
RUNOFF RATE @ Tc (IN/HR):	.667	1.536	2.215	3.188	4.120	5.055
PEAK DISCHARGE (CFS) :	324.	746.	1076.	1549.	2002.	2456.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 9-4

STA:	.00	75.00	120.00	230.00	270.00	300.00	320.00
ELEV:	100.00	98.00	98.30	95.00	96.00	94.00	94.50
STA:	330.00	350.00	450.00	500.00	630.00	770.00	775.00
ELEV:	93.60	94.20	93.00	91.80	90.00	90.00	85.70
STA:	800.00	850.00	885.00	930.00	1000.00	1030.00	1080.00
ELEV:	85.70	93.00	92.00	94.20	92.00	94.20	89.00
STA:	1150.00						
ELEV:	100.00						

DISCHARGE = 2456. WSEL = 90.69 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	2456.06	242.70	2152.71	60.65
VELOCITY (FT/S) =	6.79	2.12	9.59	2.65
AREA (SQUARE FT) =	361.91	114.52	224.47	22.92
TOPWIDTH (FT) =	281.38	190.11	64.20	27.07
DEPTH (FT) =	4.99	.69	4.99	1.69
HYD. DEPTH (FT) =	1.29	.60	3.50	.85
WET. PERIM. (FT) =	283.56	190.11	66.16	27.29
HYD. RADIUS (FT) =	1.28	.60	3.39	.84
FROUDE NUMBER =	1.05	.48	.90	.51
MANNINGS N VALUE =	.0258	.0500	.0350	.0500

SUBSECTION 1 = STATION .00 TO STATION 770.00
SUBSECTION 2 = STATION 770.00 TO STATION 850.00 (CHANNEL)
SUBSECTION 3 = STATION 850.00 TO STATION 1150.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 9-5 (D75)

STA:	.00	150.00	290.00	305.00	330.00	425.00
ELEV:	500.00	494.00	492.00	491.80	492.00	500.00

DISCHARGE = 2456. WSEL = 494.39 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	2456.05	2456.05
VELOCITY (FT/S) =	7.44	7.44
AREA (SQUARE FT) =	330.05	330.05
TOPWIDTH (FT) =	218.14	218.14
DEPTH (FT) =	2.59	2.59
HYD. DEPTH (FT) =	1.51	1.51
WET. PERIM. (FT) =	218.26	218.26
HYD. RADIUS (FT) =	1.51	1.51
FROUDE NUMBER =	1.07	1.07
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 425.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 10-1

WATERSHED AREA (A): 266.00 acres

LENGTH OF WATERCOURSE (Lc): 10000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10000.	190.0

MEAN SLOPE (Sc): .0190 ft BASIN FACTOR (Nb): .0430

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.207	.345	.422	.503	.562	.610
Tc (FUNCTION OF i) :	96.45	78.69	72.58	67.65	64.69	62.61
SOLUTION OF Tc (MINUTES):	107	67	55	45	40	36
RAINFL INT. @ Tc (IN/HR):	.770	1.501	2.033	2.755	3.365	4.052
RUNOFF RATE @ Tc (IN/HR):	.160	.517	.857	1.386	1.892	2.473
PEAK DISCHARGE (CFS) :	43.	139.	230.	372.	507.	663.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 10-1

STA:	.00	60.00	90.00	130.00	170.00	180.00	190.00
ELEV:	62.00	60.00	60.00	61.50	60.00	59.50	60.00
STA:	225.00	250.00	270.00	300.00	330.00	360.00	370.00
ELEV:	61.00	60.00	58.30	60.00	61.00	60.00	60.00
STA:	410.00	500.00	560.00	650.00	730.00	785.00	795.00
ELEV:	61.00	60.30	61.00	60.70	61.50	60.00	59.40
STA:	805.00	860.00					
ELEV:	60.00	62.00					

DISCHARGE = 663. WSEL = 60.64 SLOPE = .0180

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	662.98	662.98
VELOCITY (FT/S) =	3.11	3.11
AREA (SQUARE FT) =	213.04	213.04
TOPWIDTH (FT) =	400.94	400.94
DEPTH (FT) =	2.34	2.34
HYD. DEPTH (FT) =	.53	.53
WET. PERIM. (FT) =	401.23	401.23
HYD. RADIUS (FT) =	.53	.53
FROUDE NUMBER =	.75	.75
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 860.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 11-1 (0133)

WATERSHED AREA (A): 524.00 acres

LENGTH OF WATERCOURSE (Lc): 21000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 10500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
19800.	450.0

MEAN SLOPE (Sc): .0250 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

93. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.206	.347	.425	.507	.566	.614
Tc (FUNCTION OF i) :	141.58	114.94	105.97	98.76	94.45	91.43
SOLUTION OF Tc (MINUTES):	190	118	96	78	68	60
RAINFL INT. @ Tc (IN/HR):	.480	.940	1.287	1.802	2.304	2.874
RUNOFF RATE @ Tc (IN/HR):	.099	.326	.547	.913	1.305	1.766
PEAK DISCHARGE (CFS) :	52.	172.	289.	482.	689.	933.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 11-1 (0133)

STA:	.00	25.00	50.00	75.00	100.00	107.00	125.00
ELEV:	100.00	99.76	99.36	99.04	98.77	98.75	98.87

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	99.12	99.45	99.62	99.74	99.68

DISCHARGE = 433. WSEL = 99.74 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	433.19	433.19
VELOCITY (FT/S) =	4.34	4.34
AREA (SQUARE FT) =	99.86	99.86
TOPWIDTH (FT) =	223.75	223.75
DEPTH (FT) =	.99	.99
HYD. DEPTH (FT) =	.45	.45
WET. PERIM. (FT) =	223.76	223.76
HYD. RADIUS (FT) =	.45	.45
FROUDE NUMBER =	1.14	1.14
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 11-2

STA:	.00	100.00	220.00	225.00	230.00	270.00	280.00
ELEV:	62.00	62.00	60.00	59.50	60.00	60.00	61.50

STA:	350.00	500.00	680.00	870.00
ELEV:	60.50	61.00	60.50	61.20

DISCHARGE = 753. WSEL = 61.20 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	753.42	753.42
VELOCITY (FT/S) =	2.20	2.20
AREA (SQUARE FT) =	342.65	342.65
TOPWIDTH (FT) =	699.00	699.00
DEPTH (FT) =	1.70	1.70
HYD. DEPTH (FT) =	.49	.49
WET. PERIM. (FT) =	699.16	699.16
HYD. RADIUS (FT) =	.49	.49
FROUDE NUMBER =	.55	.55
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 870.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 11- 3 (D92)

WATERSHED AREA (A): 318.00 acres

LENGTH OF WATERCOURSE (Lc): 14000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 7000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
12800.	360.0

MEAN SLOPE (Sc): .0323 ft BASIN FACTOR (Nb): .0500

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

93. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
7. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 6. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.199	.340	.419	.501	.561	.610
Tc (FUNCTION OF i) :	112.69	91.01	83.76	77.95	74.50	72.07
SOLUTION OF Tc (MINUTES):	135	84	67	55	48	43
RAINFL INT. @ Tc (IN/HR):	.637	1.238	1.742	2.394	3.005	3.592
RUNOFF RATE @ Tc (IN/HR):	.127	.421	.730	1.200	1.687	2.190
PEAK DISCHARGE (CFS) :	41.	135.	234.	385.	541.	702.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 11-3

STA:	.00	60.00	120.00	160.00	230.00	235.00	240.00
ELEV:	12.50	11.00	11.50	12.00	10.00	9.00	10.00

STA:	260.00	320.00	330.00	340.00	520.00
ELEV:	11.80	10.00	9.00	10.00	12.00

DISCHARGE = 702. WSEL = 11.29 SLOPE = .0160

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	702.10	702.10
VELOCITY (FT/S) =	3.47	3.47
AREA (SQUARE FT) =	202.38	202.38
TOPWIDTH (FT) =	296.06	296.06
DEPTH (FT) =	2.29	2.29
HYD. DEPTH (FT) =	.68	.68
WET. PERIM. (FT) =	296.46	296.46
HYD. RADIUS (FT) =	.68	.68
FROUDE NUMBER =	.74	.74
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 520.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 11-4

STA:	.00	25.00	50.00	75.00	100.00	125.00	130.30
ELEV:	100.00	99.60	99.05	98.29	97.51	97.19	97.18

STA:	150.00	175.00	200.00	225.00	250.00
ELEV:	97.48	97.94	97.83	97.62	97.48

DISCHARGE = 213. WSEL = 97.94 SLOPE = .0110

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	213.17	213.17
VELOCITY (FT/S) =	3.81	3.81
AREA (SQUARE FT) =	55.98	55.98
TOPWIDTH (FT) =	163.78	163.78
DEPTH (FT) =	.76	.76
HYD. DEPTH (FT) =	.34	.34
WET. PERIM. (FT) =	163.80	163.80
HYD. RADIUS (FT) =	.34	.34
FROUDE NUMBER =	1.15	1.15
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 250.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 11- 5 (C45-C45A)

WATERSHED AREA (A): 163.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	700.0
6800.	260.0

MEAN SLOPE (Sc): .0484 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

71. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
29. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.278	.416	.490	.566	.621	.664
Tc (FUNCTION OF i) :	53.98	45.93	43.02	40.61	39.14	38.10
SOLUTION OF Tc (MINUTES):	46	32	27	23	21	19
RAINFL INT. @ Tc (IN/HR):	1.506	2.495	3.222	4.155	4.957	5.863
RUNOFF RATE @ Tc (IN/HR):	.419	1.038	1.579	2.353	3.078	3.895
PEAK DISCHARGE (CFS) :	69.	171.	260.	387.	506.	640.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 11-5

STA:	.00	125.00	140.00	150.00	160.00	190.00	220.00
ELEV:	23.50	22.00	20.00	19.10	20.00	20.80	20.00
STA:	250.00	260.00	270.00	290.00	300.00	310.00	320.00
ELEV:	20.00	18.00	18.00	20.00	20.00	19.50	20.00
STA:	350.00	540.00	590.00	600.00	660.00		
ELEV:	20.50	20.00	18.00	18.00	20.00		

DISCHARGE = 640. WSEL = 19.71 SLOPE = .0170

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3	4	5
DISCHARGE (CFS) =	640.37	169.94	1.11	142.01	135.58	191.74
VELOCITY (FT/S) =	4.52	3.93	1.24	3.88	7.92	4.36
AREA (SQUARE FT) =	141.80	43.24	.89	36.61	17.11	43.94
TOPWIDTH (FT) =	161.85	49.26	8.46	42.79	10.00	51.34
DEPTH (FT) =	1.71	1.71	.21	1.71	1.71	1.71
HYD. DEPTH (FT) =	.88	.88	.11	.86	1.71	.86
WET. PERIM. (FT) =	162.23	49.57	8.47	42.82	10.00	51.37
HYD. RADIUS (FT) =	.87	.87	.11	.86	1.71	.86
FROUDE NUMBER =	.85	.74	.67	.74	1.07	.83
MANNINGS N VALUE =	.0392	.0450	.0350	.0450	.0350	.0400

SUBSECTION 1 = STATION .00 TO STATION 300.00
SUBSECTION 2 = STATION 300.00 TO STATION 320.00 (CHANNEL)
SUBSECTION 3 = STATION 320.00 TO STATION 590.00
SUBSECTION 4 = STATION 590.00 TO STATION 600.00 (CHANNEL)
SUBSECTION 5 = STATION 600.00 TO STATION 660.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 11-6

STA:	.00	70.00	110.00	120.00	135.00	140.00	150.00
ELEV:	50.00	48.00	46.00	45.00	45.00	46.00	48.00

STA:	190.00
ELEV:	49.00

DISCHARGE = 640. WSEL = 47.39 SLOPE = .0160

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	640.06	56.61	569.47	13.98
VELOCITY (FT/S) =	7.26	2.94	8.88	2.91
AREA (SQUARE FT) =	88.16	19.24	64.11	4.81
TOPWIDTH (FT) =	64.67	27.74	30.00	6.93
DEPTH (FT) =	2.39	1.39	2.39	1.39
HYD. DEPTH (FT) =	1.36	.69	2.14	.69
WET. PERIM. (FT) =	65.00	27.77	30.15	7.07
HYD. RADIUS (FT) =	1.36	.69	2.13	.68
FROUDE NUMBER =	1.10	.62	1.07	.62
MANNINGS N VALUE =	.0317	.0500	.0350	.0500

SUBSECTION 1 = STATION	.00	TO	STATION	110.00	
SUBSECTION 2 = STATION	110.00	TO	STATION	140.00	(CHANNEL)
SUBSECTION 3 = STATION	140.00	TO	STATION	190.00	

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 12-1

WATERSHED AREA (A): 797.00 acres

LENGTH OF WATERCOURSE (Lc): 20800. ft

LENGTH TO CENTER OF GRAVITY (Lca): 10400. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
16500.	385.0

MEAN SLOPE (Sc): .0322 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

51. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
49. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 10. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.316	.457	.530	.603	.655	.696
Tc (FUNCTION OF i) :	111.81	96.50	90.95	86.34	83.53	81.53
SOLUTION OF Tc (MINUTES):	134	91	76	64	56	51
RAINFL INT. @ Tc (IN/HR):	.641	1.158	1.564	2.135	2.697	3.219
RUNOFF RATE @ Tc (IN/HR):	.203	.529	.828	1.288	1.768	2.241
PEAK DISCHARGE (CFS) :	163.	425.	666.	1035.	1420.	1801.

SWDMS 12-18-89
CROSS-SECTION - SECTION RATING 12-1

STA:	.00	200.00	320.00	370.00	375.00	380.00	500.00
ELEV:	7.90	6.50	7.00	6.00	5.70	6.00	8.00

DISCHARGE = 1647. WSEL = 7.90 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1647.45	1647.45
VELOCITY (FT/S) =	3.46	3.46
AREA (SQUARE FT) =	476.80	476.80
TOPWIDTH (FT) =	494.00	494.00
DEPTH (FT) =	2.20	2.20
HYD. DEPTH (FT) =	.97	.97
WET. PERIM. (FT) =	494.05	494.05
HYD. RADIUS (FT) =	.97	.97
FROUDE NUMBER =	.62	.62
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 500.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 12-2 (097)

WATERSHED AREA (A): 645.00 acres

LENGTH OF WATERCOURSE (Lc): 17500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 8750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
4300.	1300.0
13200.	340.0

MEAN SLOPE (Sc): .0378 ft BASIN FACTOR (Nb): .0470

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

39. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
61. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 11. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.345	.486	.558	.629	.679	.718
Tc (FUNCTION OF i) :	91.34	79.67	75.41	71.86	69.70	68.15
SOLUTION OF Tc (MINUTES):	99	68	58	49	44	40
RAINFL INT. @ Tc (IN/HR):	.820	1.482	1.956	2.597	3.159	3.765
RUNOFF RATE @ Tc (IN/HR):	.283	.720	1.091	1.634	2.146	2.704
PEAK DISCHARGE (CFS) :	184.	468.	709.	1062.	1395.	1758.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 12-2 (097)

STA:	.00	25.00	50.00	75.00	100.00	118.60	125.00
ELEV:	100.00	99.71	99.42	99.06	98.81	98.68	98.70

STA:	150.00	175.00
ELEV:	98.87	99.00

DISCHARGE = 40. WSEL = 99.00 SLOPE = .0130

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	39.60	39.60
VELOCITY (FT/S) =	2.55	2.55
AREA (SQUARE FT) =	15.53	15.53
TOPWIDTH (FT) =	94.00	94.00
DEPTH (FT) =	.32	.32
HYD. DEPTH (FT) =	.17	.17
WET. PERIM. (FT) =	94.00	94.00
HYD. RADIUS (FT) =	.17	.17
FROUDE NUMBER =	1.11	1.11
MANNINGS N VALUE =	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 175.00 (CHANNEL)

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 12-3 (C46)

WATERSHED AREA (A): 491.00 acres

LENGTH OF WATERCOURSE (Lc): 9000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3400.	1200.0
5600.	200.0

MEAN SLOPE (Sc): .0648 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

17. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
83. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 8. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.369	.517	.589	.660	.709	.746
Tc (FUNCTION OF i) :	46.02	40.24	38.18	36.49	35.47	34.74
SOLUTION OF Tc (MINUTES):	37	27	23	20	18	17
RAINFL INT. @ Tc (IN/HR):	1.732	2.776	3.529	4.494	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.640	1.435	2.079	2.966	3.823	4.632
PEAK DISCHARGE (CFS) :	317.	710.	1029.	1468.	1892.	2293.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 12-3

STA:	.00	25.00	50.00	65.00	75.00	90.00	110.00
ELEV:	8.00	8.20	8.00	6.60	6.00	5.20	6.00
STA:	130.00	155.00	170.00	185.00	190.00	195.00	200.00
ELEV:	6.80	6.00	4.70	4.00	3.70	4.00	5.20
STA:	210.00	250.00	285.00	300.00	320.00	345.00	360.00
ELEV:	6.00	7.50	6.00	5.60	6.00	7.30	8.00
STA:	395.00	430.00					
ELEV:	8.20	8.00					

DISCHARGE = 2293. WSEL = 7.14 SLOPE = .0180

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3	4	5	6	7
DISCHARGE (CFS) =	2293.48	29.29	410.06	109.04	1306.87	89.40	348.82	.00
VELOCITY (FT/S) =	7.18	2.93	7.60	3.27	10.07	2.74	5.86	.86
AREA (SQUARE FT) =	319.26	9.99	53.97	33.39	129.81	32.60	59.51	.00
TOPWIDTH (FT) =	264.86	15.81	35.00	45.00	55.00	57.10	56.96	.00
DEPTH (FT) =	3.44	1.14	1.94	1.14	3.44	1.14	1.54	.00
HYD. DEPTH (FT) =	1.21	.63	1.54	.74	2.36	.57	1.04	.10
WET. PERIM. (FT) =	265.32	15.85	35.04	45.03	55.26	57.14	57.00	.00
HYD. RADIUS (FT) =	1.20	.63	1.54	.74	2.35	.57	1.04	.10
FROUDE NUMBER =	1.15	.65	1.08	.67	1.15	.64	1.01	.48
MANNINGS N VALUE =	.0314	.0500	.0350	.0500	.0350	.0500	.0350	.0500

SUBSECTION 1 = STATION	.00	TO	STATION	75.00	
SUBSECTION 2 = STATION	75.00	TO	STATION	110.00	(CHANNEL)
SUBSECTION 3 = STATION	110.00	TO	STATION	155.00	
SUBSECTION 4 = STATION	155.00	TO	STATION	210.00	(CHANNEL)
SUBSECTION 5 = STATION	210.00	TO	STATION	285.00	
SUBSECTION 6 = STATION	285.00	TO	STATION	345.00	(CHANNEL)
SUBSECTION 7 = STATION	345.00	TO	STATION	430.00	

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 12-4

STA:	.00	110.00	160.00	210.00	270.00	340.00	390.00
ELEV:	42.00	41.00	42.00	43.00	42.00	40.00	38.00

STA:	410.00	470.00	530.00	600.00	760.00
ELEV:	38.00	40.00	42.00	44.00	45.50

DISCHARGE = 1904. WSEL = 40.01 SLOPE = .0150

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1904.01	1904.01
VELOCITY (FT/S) =	12.55	12.55
AREA (SQUARE FT) =	151.72	151.72
TOPWIDTH (FT) =	130.86	130.86
DEPTH (FT) =	2.01	2.01
HYD. DEPTH (FT) =	1.16	1.16
WET. PERIM. (FT) =	130.93	130.93
HYD. RADIUS (FT) =	1.16	1.16
FROUDE NUMBER =	2.05	2.05
MANNINGS N VALUE =	.0160	.0160

SUBSECTION 1 = STATION .00 TO STATION 760.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 12-5

STA:	.00	175.00	200.00	235.00	250.00	440.00	530.00
ELEV:	48.00	46.00	44.50	44.50	46.00	48.00	48.00
STA:	540.00	541.00	550.00	564.00	565.00	610.00	780.00
ELEV:	46.00	44.00	42.50	44.00	46.00	49.00	49.00
STA:	890.00						
ELEV:	50.00						

DISCHARGE = 1904. WSEL = 45.83 SLOPE = .0150

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3	4	5
DISCHARGE (CFS) =	1903.97	81.06	637.55	1.21	1184.15	.00
VELOCITY (FT/S) =	14.56	5.53	13.73	.14	19.44	.02
AREA (SQUARE FT) =	130.81	14.66	46.42	8.80	60.93	.00
TOPWIDTH (FT) =	95.20	22.11	35.00	13.26	24.83	.00
DEPTH (FT) =	3.33	1.33	1.33	1.33	3.33	.00
HYD. DEPTH (FT) =	1.37	.66	1.33	.66	2.45	.05
WET. PERIM. (FT) =	97.76	22.15	35.00	13.33	27.29	.00
HYD. RADIUS (FT) =	1.34	.66	1.33	.66	2.23	.05
FROUDE NUMBER =	2.19	1.20	2.10	.03	2.19	.02
MANNINGS N VALUE =	.0152	.0250	.0160	1.0000	.0160	1.0000

SUBSECTION 1 = STATION	.00	TO	STATION	200.00	
SUBSECTION 2 = STATION	200.00	TO	STATION	235.00	(CHANNEL)
SUBSECTION 3 = STATION	235.00	TO	STATION	530.00	
SUBSECTION 4 = STATION	530.00	TO	STATION	565.00	(CHANNEL)
SUBSECTION 5 = STATION	565.00	TO	STATION	890.00	

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: 13-1 (C33)

WATERSHED AREA (A): 680.00 acres

LENGTH OF WATERCOURSE (Lc): 10150. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5075. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
750.	240.0
9400.	204.0

MEAN SLOPE (Sc): .0243 ft BASIN FACTOR (Nb): .0420

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

55. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
45. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 17. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.355	.486	.554	.623	.672	.711
Tc (FUNCTION OF i) :	69.45	61.26	58.13	55.46	53.81	52.62
SOLUTION OF Tc (MINUTES):	66	47	40	35	31	29
RAINFL INT. @ Tc (IN/HR):	1.155	1.950	2.512	3.229	3.955	4.627
RUNOFF RATE @ Tc (IN/HR):	.410	.948	1.393	2.013	2.659	3.289
PEAK DISCHARGE (CFS) :	281.	650.	955.	1380.	1823.	2255.

XSWBMS 12-18-89
CROSS-SECTION - SECTION RATING 13-1

STA:	.00	110.00	225.00	280.00	285.00	300.00	380.00
ELEV:	608.00	606.00	604.00	602.00	600.00	600.00	598.00
STA:	495.00	585.00	590.00	595.00	610.00	720.00	750.00
ELEV:	596.00	596.00	598.00	600.00	602.00	602.00	601.00
STA:	800.00	1090.00	1250.00	1375.00			
ELEV:	602.00	604.00	606.00	607.00			

DISCHARGE = 2255. WSEL = 598.14 SLOPE = .0170

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1	2	3
DISCHARGE (CFS) =	2254.99	.30	2254.69	.00
VELOCITY (FT/S) =	6.85	.81	6.86	1.07
AREA (SQUARE FT) =	329.12	.37	328.75	.00
TOPWIDTH (FT) =	215.81	5.47	210.34	.00
DEPTH (FT) =	2.14	.14	2.14	.00
HYD. DEPTH (FT) =	1.53	.07	1.56	.10
WET. PERIM. (FT) =	216.24	5.47	210.77	.00
HYD. RADIUS (FT) =	1.52	.07	1.56	.10
FROUDE NUMBER =	.98	.55	.97	.58
MANNINGS N VALUE =	.0374	.0400	.0380	.0400

SUBSECTION 1 = STATION .00 TO STATION 380.00
SUBSECTION 2 = STATION 380.00 TO STATION 595.00 (CHANNEL)
SUBSECTION 3 = STATION 595.00 TO STATION 1375.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I36 13a

WATERSHED AREA (A): 269.00 acres

LENGTH OF WATERCOURSE (Lc): 7000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 3500. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - f
130.	580.0
6870.	160.0

MEAN SLOPE (Sc): .0241 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 45. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.490	.580	.630	.682	.720	.751
Tc (FUNCTION OF i) :	35.01	32.71	31.65	30.66	30.01	29.51
SOLUTION OF Tc (MINUTES):	26	21	18	16	15	14
RAINFL INT. @ Tc (IN/HR):	2.146	3.189	4.027	5.013	5.856	6.811
RUNOFF RATE @ Tc (IN/HR):	1.051	1.850	2.537	3.419	4.216	5.112
PEAK DISCHARGE (CFS) :	285.	502.	688.	927.	1143.	1386.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 13a-1 (I36)

STA:	.00	95.00	105.00	120.00	128.00	215.00
ELEV:	2640.00	2638.00	2636.00	2636.00	2638.00	2640.00

DISCHARGE = 1386. WSEL = 2639.58 SLOPE = .0133

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1386.43	1386.43
VELOCITY (FT/S) =	6.47	6.47
AREA (SQUARE FT) =	214.13	214.13
TOPWIDTH (FT) =	176.99	176.99
DEPTH (FT) =	3.58	3.58
HYD. DEPTH (FT) =	1.21	1.21
WET. PERIM. (FT) =	177.47	177.47
HYD. RADIUS (FT) =	1.21	1.21
FROUDE NUMBER =	1.04	1.04
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 215.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 13a-2 (I36)

STA:	.00	50.00	60.00	80.00	83.00	125.00
ELEV:	2658.00	2656.00	2654.00	2654.00	2656.00	2658.00

DISCHARGE = 1386. WSEL = 2657.73 SLOPE = .0133

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1386.05	1386.05
VELOCITY (FT/S) =	7.74	7.74
AREA (SQUARE FT) =	179.03	179.03
TOPWIDTH (FT) =	112.62	112.62
DEPTH (FT) =	3.73	3.73
HYD. DEPTH (FT) =	1.59	1.59
WET. PERIM. (FT) =	113.50	113.50
HYD. RADIUS (FT) =	1.58	1.58
FROUDE NUMBER =	1.08	1.08
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 125.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: I37 136

WATERSHED AREA (A): 101.00 acres

LENGTH OF WATERCOURSE (Lc): 5500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1200.	340.0
4300.	160.0

MEAN SLOPE (Sc): .0502 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 45. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.490	.580	.630	.682	.720	.751
Tc (FUNCTION OF i) :	22.59	21.11	20.43	19.79	19.36	19.04
SOLUTION OF Tc (MINUTES):	15	12	11	10	9	8
RAINFL INT. @ Tc (IN/HR):	2.862	4.164	5.005	6.097	7.294	8.593
RUNOFF RATE @ Tc (IN/HR):	1.401	2.415	3.153	4.158	5.252	6.449
PEAK DISCHARGE (CFS) :	143.	246.	321.	423.	535.	657.

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 13b-1 (I37)

STA:	.00	128.00	130.00	135.00	145.00	152.00
ELEV:	2640.00	2638.00	2636.00	2636.00	2638.00	2640.00

DISCHARGE = 657. WSEL = 2639.43 SLOPE = .0133

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	657.47	657.47
VELOCITY (FT/S) =	5.72	5.72
AREA (SQUARE FT) =	114.85	114.85
TOPWIDTH (FT) =	113.24	113.24
DEPTH (FT) =	3.43	3.43
HYD. DEPTH (FT) =	1.01	1.01
WET. PERIM. (FT) =	114.48	114.48
HYD. RADIUS (FT) =	1.00	1.00
FROUDE NUMBER =	1.00	1.00
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 152.00

SWBMS 12-18-89
CROSS-SECTION - SECTION RATING 13b-2 (I37)

STA:	.00	10.00	18.00	25.00	31.00	33.00
ELEV:	2646.00	2644.00	2642.00	2642.00	2644.00	2646.00

DISCHARGE = 657. WSEL = 2645.59 SLOPE = .0133

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	657.02	657.02
VELOCITY (FT/S) =	9.54	9.54
AREA (SQUARE FT) =	68.85	68.85
TOPWIDTH (FT) =	30.52	30.52
DEPTH (FT) =	3.59	3.59
HYD. DEPTH (FT) =	2.26	2.26
WET. PERIM. (FT) =	31.90	31.90
HYD. RADIUS (FT) =	2.16	2.16
FROUDE NUMBER =	1.12	1.12
MANNINGS N VALUE =	.0300	.0300

SUBSECTION 1 = STATION .00 TO STATION 33.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 14-1

WATERSHED AREA (A): 457.00 acres

LENGTH OF WATERCOURSE (Lc): 10000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 5000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
10000.	610.0

MEAN SLOPE (Sc): .0610 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 1. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.364	.523	.600	.673	.722	.760
Tc (FUNCTION OF i) :	50.52	43.70	41.38	39.52	38.41	37.64
SOLUTION OF Tc (MINUTES):	42	30	26	22	20	19
RAINFL INT. @ Tc (IN/HR):	1.594	2.611	3.279	4.268	5.111	5.863
RUNOFF RATE @ Tc (IN/HR):	.580	1.366	1.966	2.871	3.692	4.456
PEAK DISCHARGE (CFS) :	267.	629.	906.	1323.	1701.	2053.

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 14-1

STA:	.00	25.00	45.00	65.00	80.00	100.00	150.00
ELEV:	2596.00	2594.00	2594.00	2592.00	2592.00	2594.00	2595.00

DISCHARGE = 913. WSEL = 2595.00 SLOPE = .0140

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	913.16	913.16
VELOCITY (FT/S) =	5.18	5.18
AREA (SQUARE FT) =	176.25	176.25
TOPWIDTH (FT) =	137.50	137.50
DEPTH (FT) =	3.00	3.00
HYD. DEPTH (FT) =	1.28	1.28
WET. PERIM. (FT) =	137.75	137.75
HYD. RADIUS (FT) =	1.28	1.28
FROUDE NUMBER =	.81	.81
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 150.00

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 14-2

STA:	.00	22.00	28.00	85.00	100.00	125.00	135.00
ELEV:	2616.00	2614.00	2612.00	2610.00	2610.00	2612.00	2614.00

STA:	170.00
ELEV:	2615.00

DISCHARGE = 2053. WSEL = 2613.64 SLOPE = .0110

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	2052.97	2052.97
VELOCITY (FT/S) =	7.27	7.27
AREA (SQUARE FT) =	282.23	282.23
TOPWIDTH (FT) =	110.15	110.15
DEPTH (FT) =	3.64	3.64
HYD. DEPTH (FT) =	2.56	2.56
WET. PERIM. (FT) =	110.69	110.69
HYD. RADIUS (FT) =	2.55	2.55
FROUDE NUMBER =	.80	.80
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 170.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 14-3

WATERSHED AREA (A): 152.00 acres

LENGTH OF WATERCOURSE (Lc): 3500. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1750. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 3500.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 550.0

MEAN SLOPE (Sc): .1571 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 2. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.370	.527	.603	.676	.725	.762
Tc (FUNCTION OF i) :	18.32	15.89	15.06	14.39	13.99	13.72
SOLUTION OF Tc (MINUTES):	12	9	7	7	6	6
RAINFL INT. @ Tc (IN/HR):	3.163	4.692	6.041	7.114	8.527	9.541
RUNOFF RATE @ Tc (IN/HR):	1.169	2.475	3.643	4.806	6.179	7.271
PEAK DISCHARGE (CFS) :	179.	379.	558.	736.	947.	1114.

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 14-3

STA:	.00	150.00	210.00	284.00	350.00	450.00	540.00
ELEV:	2650.00	2642.00	2640.00	2638.00	2638.00	2640.00	2642.00

STA:	630.00
ELEV:	2650.00

DISCHARGE = 1114. WSEL = 2639.47 SLOPE = .0250

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1114.15	1114.15
VELOCITY (FT/S) =	5.82	5.82
AREA (SQUARE FT) =	191.44	191.44
TOPWIDTH (FT) =	194.08	194.08
DEPTH (FT) =	1.47	1.47
HYD. DEPTH (FT) =	.99	.99
WET. PERIM. (FT) =	194.11	194.11
HYD. RADIUS (FT) =	.99	.99
FROUDE NUMBER =	1.03	1.03
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 630.00

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 14-4

STA:	.00	21.00	30.00	50.00	58.00	130.00
ELEV:	2664.00	2662.00	2660.00	2660.00	2662.00	2664.00

DISCHARGE = 1114. WSEL = 2662.89 SLOPE = .0500

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1114.12	1114.12
VELOCITY (FT/S) =	10.27	10.27
AREA (SQUARE FT) =	108.53	108.53
TOPWIDTH (FT) =	78.49	78.49
DEPTH (FT) =	2.89	2.89
HYD. DEPTH (FT) =	1.38	1.38
WET. PERIM. (FT) =	79.01	79.01
HYD. RADIUS (FT) =	1.37	1.37
FROUDE NUMBER =	1.54	1.54
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 130.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 15-1

WATERSHED AREA (A): 130.00 acres

LENGTH OF WATERCOURSE (Lc): 4000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 4000.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 180.0

MEAN SLOPE (Sc): .0450 ft

BASIN FACTOR (Nb): .0420

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 5. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.386	.540	.613	.684	.732	.768
Tc (FUNCTION OF i) :	30.02	26.25	24.95	23.88	23.25	22.80
SOLUTION OF Tc (MINUTES):	21	16	14	12	11	10
RAINFL INT. @ Tc (IN/HR):	2.423	3.668	4.545	5.691	6.703	7.759
RUNOFF RATE @ Tc (IN/HR):	.936	1.980	2.788	3.892	4.905	5.960
PEAK DISCHARGE (CFS) :	123.	259.	365.	510.	643.	781.

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 15-1

STA:	.00	50.00	160.00	200.00	230.00	235.00	300.00
ELEV:	2602.00	2600.00	2598.00	2599.00	2598.00	2600.00	2601.00

DISCHARGE = 781. WSEL = 2599.70 SLOPE = .0160

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	781.06	781.06
VELOCITY (FT/S) =	4.68	4.68
AREA (SQUARE FT) =	166.96	166.96
TOPWIDTH (FT) =	167.71	167.71
DEPTH (FT) =	1.70	1.70
HYD. DEPTH (FT) =	1.00	1.00
WET. PERIM. (FT) =	168.08	168.08
HYD. RADIUS (FT) =	.99	.99
FROUDE NUMBER =	.83	.83
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 300.00

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 15-2

STA:	.00	35.00	45.00	65.00	75.00	85.00	95.00
ELEV:	2628.00	2626.00	2624.00	2622.00	2622.00	2624.00	2626.00

STA:	105.00
ELEV:	2628.00

DISCHARGE = 781. WSEL = 2625.47 SLOPE = .0110

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	781.13	781.13
VELOCITY (FT/S) =	6.52	6.52
AREA (SQUARE FT) =	119.76	119.76
TOPWIDTH (FT) =	54.73	54.73
DEPTH (FT) =	3.47	3.47
HYD. DEPTH (FT) =	2.19	2.19
WET. PERIM. (FT) =	55.32	55.32
HYD. RADIUS (FT) =	2.16	2.16
FROUDE NUMBER =	.78	.78
MANNINGS N VALUE =	.0400	.0400

SUBSECTION 1 = STATION .00 TO STATION 105.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 16-1 (CP-26)

WATERSHED AREA (A): 332.00 acres

LENGTH OF WATERCOURSE (Lc): 8000. ft

LENGTH TO CENTER OF GRAVITY (Lca): 4000. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 8000.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 205.0

MEAN SLOPE (Sc): .0256 ft

BASIN FACTOR (Nb): .0340

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 15. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.441	.581	.648	.712	.755	.788
Tc (FUNCTION OF i) :	43.74	39.18	37.51	36.13	35.28	34.68
SOLUTION OF Tc (MINUTES):	35	26	23	20	18	17
RAINFL INT. @ Tc (IN/HR):	1.795	2.825	3.529	4.494	5.394	6.207
RUNOFF RATE @ Tc (IN/HR):	.792	1.641	2.285	3.199	4.073	4.893
PEAK DISCHARGE (CFS) :	265.	549.	765.	1070.	1363.	1637.

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 16-1

STA:	.00	40.00	45.00	55.00	75.00	215.00	280.00
ELEV:	2580.00	2578.00	2576.00	2574.00	2576.00	2578.00	2579.00

STA:	305.00	330.00	395.00	420.00
ELEV:	2578.00	2577.50	2578.00	2580.00

DISCHARGE = 1637. WSEL = 2578.83 SLOPE = .0050

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1637.10	1637.10
VELOCITY (FT/S) =	3.15	3.15
AREA (SQUARE FT) =	519.41	519.41
TOPWIDTH (FT) =	366.59	366.59
DEPTH (FT) =	4.83	4.83
HYD. DEPTH (FT) =	1.42	1.42
WET. PERIM. (FT) =	367.38	367.38
HYD. RADIUS (FT) =	1.41	1.41
FROUDE NUMBER =	.47	.47
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 420.00

PROJECT NAME AND LOCATION: SOUTHWEST BASIN MANAGEMENT STUDY

DRAINAGE CONCENTRATION POINT: RATING 16-2

WATERSHED AREA (A): 167.00 acres

LENGTH OF WATERCOURSE (Lc): 3700. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1850. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
3700.	355.0

MEAN SLOPE (Sc): .0959 ft BASIN FACTOR (Nb): .0450

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.26	1.65	1.92	2.26	2.57	2.87
P 2	1.41	1.86	2.15	2.54	2.89	3.23
P 3	1.51	1.99	2.31	2.73	3.10	3.47
P 6	1.70	2.25	2.61	3.08	3.51	3.93
P24	2.15	2.82	3.28	3.85	4.38	4.90

SOIL GROUPS

100. % D, CN= 91, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 4. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.381	.536	.610	.681	.729	.766
Tc (FUNCTION OF i) :	22.80	19.89	18.88	18.07	17.58	17.24
SOLUTION OF Tc (MINUTES):	15	11	10	9	8	7
RAINFL INT. @ Tc (IN/HR):	2.862	4.312	5.178	6.414	7.679	9.052
RUNOFF RATE @ Tc (IN/HR):	1.089	2.310	3.158	4.368	5.601	6.935
PEAK DISCHARGE (CFS) :	183.	389.	532.	735.	943.	1167.

SWBMS 3-22-90
CROSS-SECTION - SECTION RATING 16-2

STA:	.00	20.00	25.00	35.00	60.00	75.00	95.00
ELEV:	2592.00	2590.00	2588.00	2586.00	2586.00	2588.00	2590.00
STA:	125.00	155.00	250.00	315.00	320.00	335.00	360.00
ELEV:	2592.00	2592.00	2590.00	2588.00	2586.00	2586.00	2588.00
STA:	410.00	460.00	485.00	495.00	545.00		
ELEV:	2589.00	2588.00	2588.00	2590.00	2592.00		

DISCHARGE = 1167. WSEL = 2588.61 SLOPE = .0170

SECTION AND SUBSECTION HYDRAULIC DATA

	TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS) =	1167.34	1167.34
VELOCITY (FT/S) =	4.95	4.95
AREA (SQUARE FT) =	235.92	235.92
TOPWIDTH (FT) =	211.37	211.37
DEPTH (FT) =	2.61	2.61
HYD. DEPTH (FT) =	1.12	1.12
WET. PERIM. (FT) =	212.40	212.40
HYD. RADIUS (FT) =	1.11	1.11
FROUDE NUMBER =	.83	.83
MANNINGS N VALUE =	.0420	.0420

SUBSECTION 1 = STATION .00 TO STATION 545.00