VOLUME I OF II - EXISTING CONDITIONS

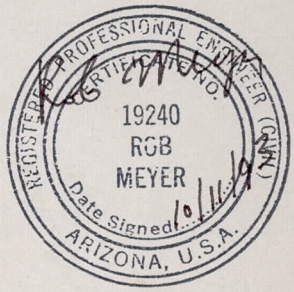
HYDROLOGY REPORT
84TH STREET AND CHOLLA ROAD ROADWAY IMPROVEMENTS AND 83RD PLACE & SHEA BOULEVARD NEIGHBORHOOD DRAINAGE IMPROVEMENTS

Prepared For:

CITY OF SCOTTSDALE
TRANSPORTATION DEPARTMENT

PROJECT NUMBERS
S-2709 & F-2708

October 8, 1993



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SECTION I INTRODUCTION

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SECTION I - INTRODUCTION

1.1 PROJECT AUTHORIZATION

The City of Scottsdale (COS) authorized this work by executing contract number 920106 on August 31, 1992. SMF Engineering Corporation (SMF) was directed to perform a drainage study for the conceptual design of the 84th Street and Cholla Road Roadway Improvement (S-2709) and 83rd Place and Shea Boulevard Neighborhood Drainage Improvement (F-2708) projects. The notice to proceed was executed on September 11, 1992.

1.2 SUBJECT OF STUDY

The first phase of this drainage study consists of determining runoff discharges at critical concentration points for existing conditions. Runoff discharges were determined for the 2, 5, 10, 25, 50 and 100 year return frequency storms.

The study area is generally bounded by Pima Road on the east; Shea Boulevard on the South; 82nd Place and 84th Street on the West; and the existing (Thunderbird wash) drainage channel from the Cactus Road / 84th Street Intersection to the Thunderbird Road / Pima Road Intersection on the northwest. From Sutton Drive to Thunderbird road, the Thunderbird wash is unimproved and onsite observation suggests that its capacity is limited to small flows. Erosion patterns indicate that during previous storm discharge events, overspillage has occurred from the Thunderbird wash channel which flows generally south into the study area (basin) of this project. Overspillage has occurred along the channel between Sutton Drive and Thunderbird Road. To set the northwest boundary of this project study area along that segment of the channel is only valid if future improvements eliminate overspillage.

The COS has received numerous citizen complaints concerning flooding and excessive flows in streets, causing street closures, traffic delays, damage to property and soil erosion.

The primary existing drainage facilities and streets carrying surface flows which this study addresses are:

1) The existing Cholla Channel or wash which flows to the southwest from the Cholla Road / 84th Street intersection to the two barrel 12' x 3' box culvert at Shea Boulevard, just west of 82nd Place.

2) Eighty-Fourth (84th) Street which carries flows to the south from Cactus Road to Cholla Road.

3) Cactus Road which carries flows to the west from Pima Road to 84th Street.

4) The existing waterway (Cholla wash) which crosses over Cholla Road at the location just west of 84th Street.

5) The existing 6' x 3' box culvert under the Clinton Street / 82nd Place intersection.

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6) The existing concrete lined channel (part of Cholla Channel) from the Clinton Street / 82nd Place intersection to Shea Boulevard.

7) The existing two barrel 12' x 3' box culvert under Shea Boulevard at the location just west of 82nd Place.

8) The existing storm sewer system in Shea Boulevard which flows west from 85th Place through 82nd Place to the two barrel 12' x 3' box culvert under Shea Boulevard.

9) Eighty-Third (83rd) Place including the existing Cholla wash from Gail Road to Desert Cove.

10) Surface flows (north to south) at the Cholla Road / 85th Street intersection.

11) Existing detention basins and drainage swales of the Scottsdale Country Club East Nine.

For additional detail, see Existing Drainage System Map, page 3.

The Scottsdale Country Club borders the project area on the west and is outside of this project's study area (see existing Drainage Area Map).

1.3 PURPOSE AND SCOPE

This Hydrology Report, Volume I, documents the calculated peak runoff discharges at various concentration points within the project study area for existing conditions. Those locations which require drainage improvements are identified; drainage improvements consist of increasing capacity of existing drainage facilities, redirecting flows to more suitable existing facilities, or construction of new facilities.

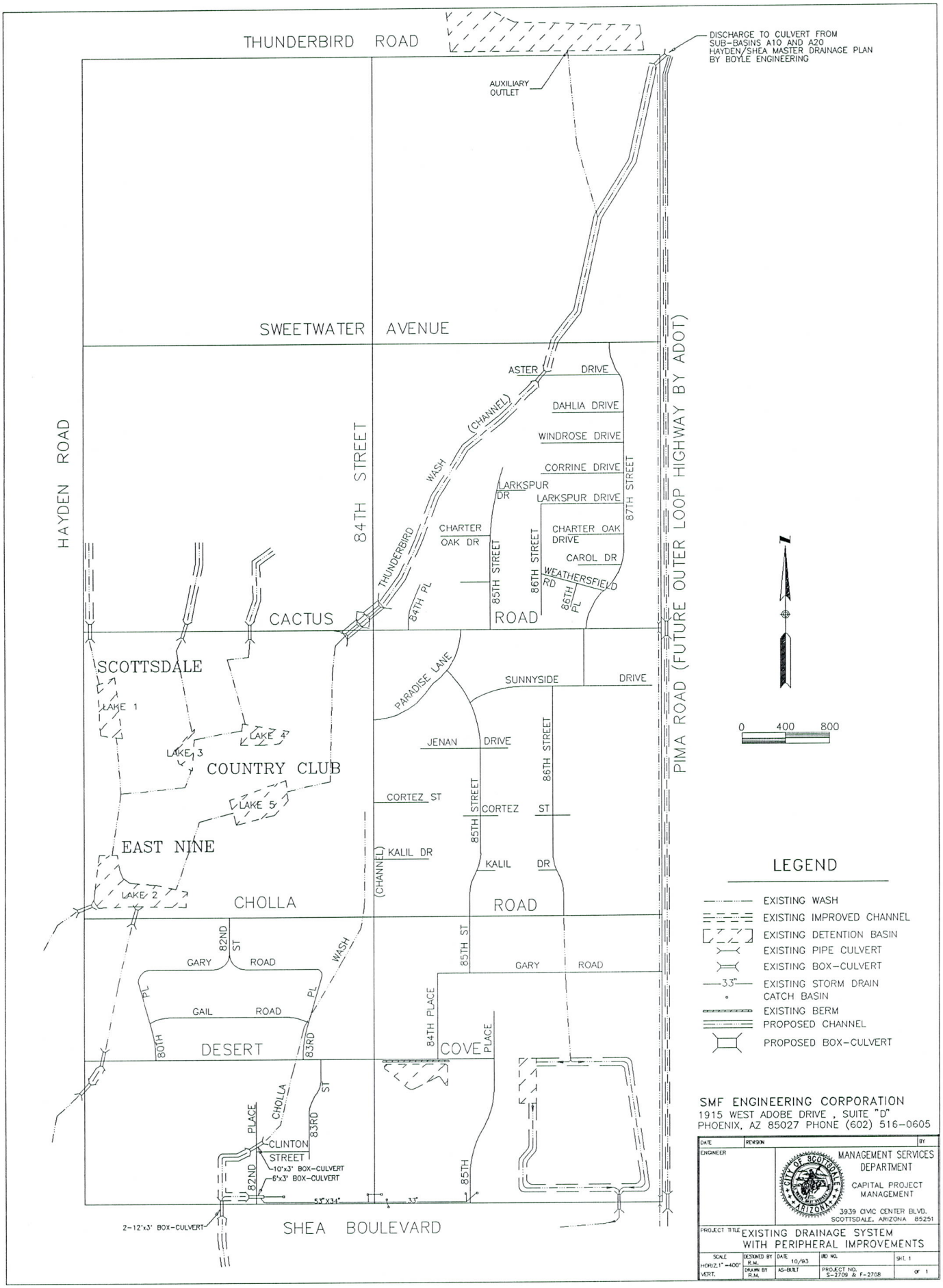
The study of various improvement plans, benefits derived, and cost comparisons is presented in Volume II.

Runoff discharges are calculated for 2, 5, 10, 25, 50 and 100 year return frequency storms utilizing the HEC-1 computer program, following the procedures outlined in the City's Section 2.2, Hydrology, Design Standards and Procedures, Draft, revised October 21, 1992. Print-outs of these computer runs are included in Appendix "C".

Cactus Road is a diversion component in the HEC-1 model; it carries surface flows to the west between Pima Road and 84th Street. Most of the surface flow in Cactus Road turns south at 84th Street and continues to Cortez Street where it enters the Cholla Wash.

The HEC-2 program, Backwater Curve Analysis, was modeled to estimate the split flows in Cactus Road at the 84th Street, Paradise Lane and 86th Street intersections.

Paradise Lane & 86th Street do not intersect 84th Street or 85th Street?



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MANAGEMENT SERVICES DEPARTMENT
CAPITAL PROJECT MANAGEMENT
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SCOTTSDALE, ARIZONA 85251

PROJECT TITLE: EXISTING DRAINAGE SYSTEM WITH PERIPHERAL IMPROVEMENTS

SCALE	DESIGNED BY	DATE	JOB NO.	SHT. 1
HORIZ. 1" =400'	R.M.	10/93		
VERT.	DRAWN BY R.M.	AS-BUILT	PROJECT NO. S-2709 & F-2708	OF 1

1.4 MASTER PLANS (REFERENCES)

The study area of several existing Master Plans and drainage studies include or overlap with the study area of this project. Of special interest are the following:

1. Hayden / Shea Area Master Drainage Plan Addendum No. 2, January 25, 1991, Boyle Engineering for The City of Scottsdale

2. Drainage Design Report and Addendum, Shea Boulevard, Scottsdale Road to Pima Road, March and January 1988, A-N West for the City of Scottsdale

3. Scottsdale Country Club, Second Nine and Addendum, November 1984 and June 1985, Collar, Williams and White Engineering for the Scottsdale Country Club

4. ADOT's General Plan for the future Outer Loop Highway

The Hayden / Shea Area Master Drainage Plan by Boyle Engineering presents studies and makes recommendations for future projects in the area bordered by the CAP Canal on the north, Shea Boulevard on the south, Pima Road on the east and Hayden Road on the west. The study area of this report (by SMF) is identified in the Hayden / Shea Master Drainage Plan as Basin R. The Hayden / Shea Master Plan made the following recommendations for proposed improvements in Basin R:

* Construct a storm drain in Cholla Road from 85th Street to 84th Street (R10-R20). This drain is to alleviate nuisance flows that can cross Cholla and flow south during large flow events.

* Construct a culvert at 84th Street and Cholla Road to convey flows under Cholla (R20).

* Upgrade the existing channel from 84th Street and Cholla Road to 82nd Place and Clinton Street (R25-R50).

* Construct a channel from 85th Place and Shea Boulevard to 82nd Place and Shea Boulevard (R30-R50) and construct a culvert at 84th Street and Shea Boulevard (R40) to convey flows under 84th Street.

* Upgrade both sets of culverts at 84th Street and Cactus Road (A200-A210). Detention of drainage areas A10 and A30 reduces required upgrades.

* Upgrade culverts out of Lake 2 at Scottsdale Country Club Second Nine (A272 and A275). Increase storage capacity of Lake 2 by regrading to allow the water surface elevation to reach 1375.0 without spillage.

R10, R20, etc. refer to node points of Exhibits in the Hayden / Shea Area Master Drainage Plan[1].

ADOT's General Plan for the Outer Loop Highway includes a channel along the east side of the Highway which will intercept all runoff discharges from the area east at Pima Road.

[1] Boyle Engineering Corporation, HAYDEN / SHEA AREA MASTER DRAINAGE PLAN, ADDENDUM NO. 2 (January 25, 1991).

SECTION II BASIS OF STUDY

SECTION II - BASIS OF STUDY

2.1 BASE DATA

The base data for this study was generated from the following sources:

* Topographic surveys including street cross-sections were completed for Cholla Road from Hayden Road to 86th Street; and 84th Street from Shea Boulevard to Cortez Street.

* Planimetric and topographic mapping with a one foot contour interval covers the existing Cholla Wash area from 84th Street at Cortez, extending south and southwest to a point about 500 feet south of Shea Boulevard. The mapping includes the channel overbank areas and the 12-acre parcel at the northwest corner of 84th Street and Cholla Road. Also, photogrammetric cross-sections were collected along this channel at 50-foot maximum spacing.

* Field surveyed cross-sections were collected along Cactus Road from Pima Road to a point 400 feet west of 84th Street.

* The COS provided the HEC-1 model (floppy disk) for the Scottsdale Country Club Second Nine's basins and drainage facilities. This model originated with the Boyle Report. The Boyle Report says... "The proposed improvements for the Scottsdale Country Club Second Nine are based on data taken from the "Grading and Drainage Plan for the Scottsdale Country Club Second Nine". Further design of the proposed improvements would require more accurate data of the site"[2]. Recent field surveys indicate that in some areas elevations differ as much as two (2) feet from the Grading and Drainage Plan.

* As-built drawings, aerial photography, grading and drainage plans, drainage reports, right-of-way maps and numerous other drawings and documents were collected from the COS records.

* On-site conditions of the basin area were studied during site visits; and numerous individuals and local residents were interviewed. One resident in particular provided valuable information and photographs of flooding conditions which occurred on September 3, 1990. Her house floor, at the southeast corner of Cactus Road and 84th Street was only 2 or 3 inches above the floodwater surface.

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[2] Boyle Engineering Corporation, HAYDEN / SHEA AREA MASTER DRAINAGE PLAN, ADDENDUM NO. 2 (January 25, 1991).

2.2 HEC-1

2.2.1 General

The HEC-1 computer program was used to analyze the hydrologic processes of flood events expected within the study area. It is the tool used to determine runoff for defined synthetic events. The latest version available was used, dated September 1990, version 4.0.

The hydrologic evaluation of the project area was performed using the SCS method of generalizing loss-rate functions through the SCS curve number technique within the HEC-1 program. Flood hydrographs were calculated for the 2, 5, 10, 25, 50 and 100 year storms at desired locations.

2.2.2 Precipitation

Precipitation values were taken from the Isopluvial Maps (Fig. 2.2-1 through 2.2-12) in Appendix "A" of the City's Section 2.2 Hydrology Design Standards and Procedures Manual (Draft), September 21, 1992.

Using the procedure outlined in Appendix "A", the precipitation values were calculated for the 5, 15 and 60 minutes and 2, 3 and 6 hour duration, 100-year storms; this data was entered on the PH card in the HEC-1 program.

Also the 6 hour precipitation values for the 2, 5, 10, 25, 50 and 100 year storms were obtained from the graph on Sheet 2 of Appendix "A" and a ratio was calculated and entered on the JR card.

The calculations are in Appendix "A" of this report.

2.2.3 Sub-Basin Areas

Sub-basin areas are shown on the "Drainage Area Map". Each sub-basin is designated by number; basin numbers 10 through 100 are located north of Cactus Road; basin numbers 110 through 270 are Street R/W areas along Cactus Road; basin numbers 310 through 390 are located between Cactus Road and Cholla Road; basin numbers 410 through 470 are located along and east of 84th Street between Cholla Road and Shea Boulevard; and basin numbers 510 through 610 are located west of 84th Street between Cholla Road and Shea Boulevard.

Also, concentration points are shown on the "Drainage Area Map". Each concentration point has been assigned a number (e.g. C340), and positioned at a location where it is desired to determine the runoff discharge flow.

Sub-Basin area boundaries and type of land use were determined using 1" = 400' aerial photographs, contour maps, as built grading and drainage maps, on-site observation and field surveys. Also, concentration points define the starting point for delineation of sub-basins.

2.2.4 Rainfall Losses

Rainfall losses were determined using the SCS Runoff Curve Number Option. The soil group

throughout the entire basin is Type "B" in accordance with the General Soil Map of Maricopa County by the US Soil Conservation Service[3].

Runoff Curve Numbers were taken from the table of Figure 2.2-19, Appendix "A" of reference 2. The residential sub-basins fall in the category of Western Desert Urban Area. After a site visit, in which several home owners were interviewed, it was concluded that all sub-basins are of the Natural Desert Landscape type. Some lots have impervious weed barrier (plastic sheets), but, they are either in very poor condition or of insignificant coverage. The actual impervious area (roofs, driveways, sidewalks and pavement) was calculated for each residential sub-basin. The sub-basins north of Cactus Road (10 through 100) have a higher impervious percentage because the lots have larger houses on smaller lots.

2.2.5 Time of Concentration (Lag)

As prescribed in the City's Hydrology Manual[4], Section 2.2, the time of concentration was calculated using the TR-55 program, following the procedure as shown in Appendix "B". The total time of concentration for each sub-basin was multiplied by 0.6 to arrive at TLAG (TLAG = 0.6 * Tc)[5]. The minimum time of concentration was taken to be 6 minutes, therefore, the minimum TLAG is 3.6 minutes or 0.06 hours. TLAG is entered on the UD card, which creates a SCS Dimensionless Unit Hydrograph. For TR-55 Printout, see Appendix "B" of this report.

2.2.6 Channel Routing

The Normal Depth (Modified Puls) routing method was used to route a hydrograph from one concentration point to the next one downstream. This routing method uses the RC card and requires 8 X-Y coordinates, slope, length and Manning's n-values for channel and over-bank areas.

2.2.7 Diversions

The drainage patterns of the project area change with an increased amount of runoff flowing in the streets and channels because water surfaces rise and overspillage occurs. Large runoff discharges overtop banks of under-designed channels and culverts or cause runoff discharges to split at street intersections, creating a more complicated hydrologic HEC-1 model. Therefore, to arrive at as accurate design data as possible, the Diversion Component in the HEC-1 was used. Diversions occur at several locations in the project area, most notably is the Cactus Road intersections with 84th Street, Paradise Lane and 86th Street. Refer to Section III, 3.3, for additional Cactus Road discussion. All diversions were evaluated separately; onsite reviews and field surveys were performed at numerous locations.

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[3] United States Department of Agriculture, Soil Conservation Service, GENERAL SOIL MAP, MARICOPA COUNTY ARIZONA (1973).

[4] City of Scottsdale Design Standards and Procedures, Chapter 2 Drainage, SECTION 2.2, HYDROLOGY, Draft (September 21, 1992).

[5] US Army Corps of Engineers, Hydrologic Engineering Center. HEC-1 FLOOD HYDROGRAPH PACKAGE, USER'S MANUAL (September, 1990), p. 24.

2.3 HEC-2

2.3.1 Cross-Sections

In order to determine the extent of split flows in Cactus Road, a hydraulic analysis was performed using the HEC-2 computer program. Cross-sections were surveyed at approximately 50' intervals. Also, sections were taken between the residences on the south side of Cactus Road to determine whether any overspillage would flow south between the houses. Split flows were calculated using the weir option and were checked against the Manning's equation for normal depth on the side streets.

2.3.2 Roughness Coefficient

A Manning's Coefficient of 0.016 was used for pavement and 0.030 for over-bank (front yard) areas.

SECTION III EXISTING CONDITIONS

MAPS

SECTION III - EXISTING CONDITIONS

3.1 EXISTING DRAINAGE PATTERNS

The study area as described in the Introduction, Section 1.2, is essentially fully developed with some minor exceptions. The area north of Cactus Road consists of residential subdivisions of low to medium density with desert landscaping. The area south of Cactus Road consists of residential subdivisions of one-acre lots with natural desert landscaping. Prior to development, this basin was characteristic of the old alluvium with desert cover. Numerous washes existed, some with weaving patterns. Most of the washes would only carry relatively small flows within their banks; and rainfall excess or runoff for larger storms would more or less sheetflow through the basin area. The direction of flow was generally to the southwest; larger storms overtop the banks and floodwaters spread and continue in a southwest direction. As subdivision development occurred, the impervious areas increased, thus, the excess rainfall increased, and no provision was made to detain or retain this increase. Streets were constructed in north-south / east-west directions, and drainage patterns were altered. The existing drainage conveyance system in this study area provides for surface flows only and consists primarily of streets and the Cholla channel. The hydraulic capacity of this existing system is not sufficient to adequately convey the flood waters through the basin to the outfall at Shea Boulevard; also, the outfall at Shea Boulevard was designed for a discharge flow less than the 100-year peak flow determined in this study. Additional discussion is presented in SECTION IV - HYDROLOGY. During public meetings held for this project, several homeowners expressed concerns that runoff discharges have increased over time as development upstream occurred.

Most north-south streets have an approximate slope of 0.0070 ft/ft and east-west streets a flatter slope of 0.0030 ft/ft.

The existing Thunderbird wash channel, which borders the north and northwest side of the study area, between the Cactus Road / 84th Street and Pima Road / Thunderbird Road intersections, intercepts flows from east of Pima Road, areas A10 and A20 of the Hayden / Shea Master Drainage Plan (see existing Drainage System Map). That Master Drainage Plan identifies the channel as deficient, therefore, the COS intends to improve the channel through other projects. The channel is currently improved between Cactus Road and Sweetwater Avenue; but it is unimproved from Sweetwater Avenue to Thunderbird Road. Overspillage has occurred in the past within the unimproved segment. The drainage improvements recommended in this report are assumed to begin concurrent with or subsequent to improvements which preclude the potential for overspillage into the study area. The drainage area model has no runoff flow entering the study area from outside its boundary. For this to be valid, the planned channel improvements must be constructed.

The COS plans to construct a new channel on the east side of Pima Road and remove or modify the box culvert under the Thunderbird Road / Pima Road Intersection. Therefore, only a controlled discharge will flow across Pima Road at Thunderbird Road, and sub-areas A10 & A20 are excluded from the study area.

The Hayden / Shea Master Drainage Plan says... " The channel on the east side of Pima Road (which was analyzed in the Pima / Doubletree Study) has culvert capacities slightly larger than

the 10-year flows at Cholla Road and at Cactus Road. The flooding that occurs at these locations may result in stormwater flowing west across Pima Road and exacerbating flooding in the Hayden / Shea Study Area."[6]

3.2 OUTER LOOP HIGHWAY

ADOT's future depressed Outer Loop Highway will follow the Pima Road alignment. Construction is planned for the year 2001. ADOT's General Plan includes a channel to be constructed on the east side of the Outer Loop Highway. This ADOT channel will then obviate the interim channel currently planned by the COS.

3.3 CACTUS ROAD

Cactus Road carries surface flows to the west between Pima Road and 84th Street; it is a diversion component in the HEC-1 model which has altered the historic southwest direction of flow. Some flow splits and flows south at 85th Place and at Paradise Lane; however, most of the flow continues to 84th Street where it turns south. Two box culverts are located near the 84th Street/Cactus Road intersection, one under 84th Street just north of Cactus and one under Cactus Road just west of 84th Street. Overspillage has occurred at these culverts in the past, and the Hayden / Shea Master Plan recommends improvements to increase their capacity. Subsequent to those improvements, no overspillage is expected from these culverts to flow south in 84th Street.

Cactus Road intercepts flows from sub-basins 10, 15, 20, 30, 40, 70, 80, 90 and 100 and carries most of it to 84th Street and there it turns south (see Drainage Area Map on page 3).

3.4 EIGHTY-FOURTH (84TH) STREET

Eighty-Fourth Street carries flow south from Cactus Road to Cholla Road where it enters Cholla Wash. There are three scuppers along the west side of 84th Street which potentially could discharge some flow into the Scottsdale Country Club Second Nine drainage swale. However, because of their small size and relative elevation to the adjacent berms, little or no flow is expected to enter the swale.

3.5 CHOLLA WASH

Recall that Cactus Road collects all runoff discharge from the north and then 84th Street intercepts and directs that flow to Cholla Road where it enters Cholla Wash; this creates a critical concentration point at the intersection of Cholla Road and 84th Street in Cholla wash. Runoff discharge in Cholla Wash, then, is exacerbated by flows which historically were spread over the sub-basins between 84th Street and Pima Road. Cholla Channel carries this flow and collects additional flows downstream; it outfalls at the existing two barrel 12' x 3' box culvert under Shea Boulevard (see existing Drainage System Map).

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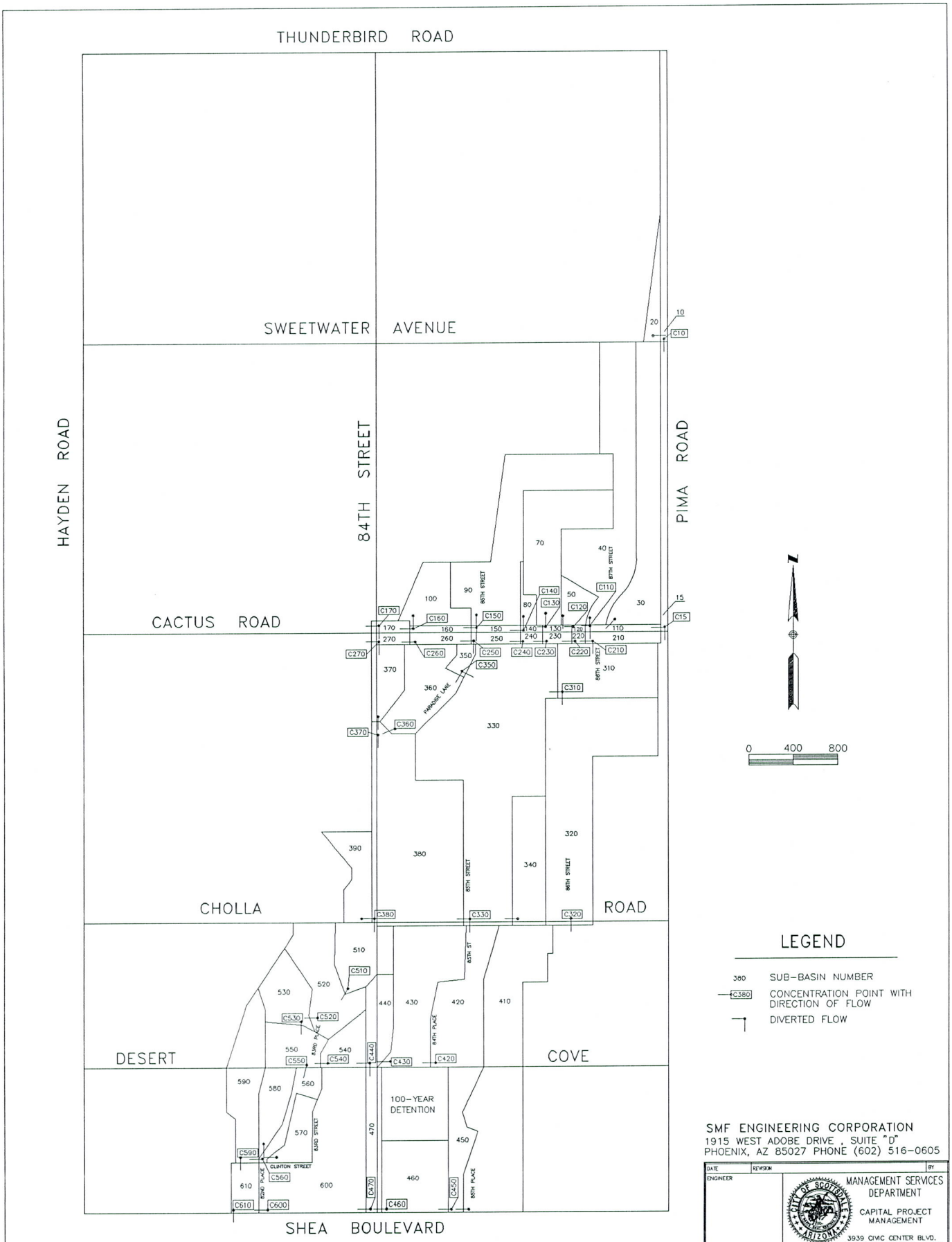
[6] Boyle Engineering Corporation, HAYDEN / SHEA AREA MASTER DRAINAGE PLAN, ADDENDUM NO. 2 (January 25, 1991).



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DATE | REVISION | BY

ENGINEER

CITY OF SCOTTSDALE ARIZONA

MANAGEMENT SERVICES DEPARTMENT
CAPITAL PROJECT MANAGEMENT
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE
DRAINAGE AREA MAP

SCALE	DESIGNED BY	DATE	BID NO.	SHT. 1
HORIZ. 1"=400'	R.M.	10/93		
VERT.	DRAWN BY R.M.	AS-BUILT	PROJECT NO. 5-2709 & F-2708	OF 1

Cholla Wash is unimproved from the intersection of 84th Street and Cholla Road to the 8' x 3' box culvert at 82nd Place and Clinton Street; from that intersection to Shea Boulevard the channel is improved with concrete paving.

3.6 SCOTTSDALE COUNTRY CLUB EAST NINE

The Scottsdale Country Club drainage facilities consist of a system of drainage swales, lakes and detention areas. The system intercepts flows from four major channels along Cactus Road between Hayden Road and 84th Street, including the Thunderbird wash channel which borders this study area on the northwest side between the 84th Street / Cactus Road and the Pima Road / Thunderbird Road intersections.

The Hayden / Shea Area Master Drainage Plan says... "Presently, there is a major flooding problem that occurs at the southwestern corner of the Scottsdale Country Club Second Nine. The lake at this location, Lake Number 2, has two culvert outlets, one under Cholla Road and one under Hayden Road. When a 10-year storm occurs on the watershed, water begins to spill out of Lake 2 onto Cholla and Hayden. Most of the water drains south on Hayden and some is captured by catch basins along Hayden. In a 100-year storm, over 2,000 cfs spills over onto Hayden and Cholla."[7]

Recall that the proposed Pima Road channel by the COS and the Outer Loop Highway channel by ADOT will intercept areas A10 and A20 thus reducing the tributary basin area which contributes to the Scottsdale Country Club drainage system.

3.7 CHOLLA AND 85TH STREET

The sub-basins which are tributary to this intersection are 340, 330 and 310 (see Drainage Area Map on page 3). Some overspillage (splits) occur at Paradise Lane and Cactus Road but it is very little. Therefore, most of the runoff is generated from the sub-basins south of Cactus Road (i.e. sub-basins 340, 330 and 310).

The flow splits south and west at the Cholla / 85th Street intersection. That flow which continues south concentrates at the intersection of 84th Street and Shea Boulevard where it is intercepted by the Shea storm sewer system. Several citizen complaints have been received by the COS regarding this flow and its resultant damage. The flow which continues west in Cholla Road is intercepted by the Cholla Channel at 84th Street. Cholla Road is a diversion component, thus altering the historic pattern to the southwest.

3.8 OUTFALL AT SHEA BOULEVARD

Approximately 200 feet west of 82nd Place, a two barrel 12' x 3' box culvert crosses under Shea Boulevard. This box is the outfall for virtually 100 percent of the runoff from the sub-basins of this project. This is a second critical concentration point of the project. The Shea Boulevard

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[7] Boyle Engineering Corporation, HAYDEN / SHEA AREA MASTER DRAINAGE PLAN, ADDENDUM NO. 2 (January 25, 1991).

Report by A-N West stated its capacity at 358 cfs.[8] Flows from this box culvert enter the McCormick Ranch channel on the south side of Shea Boulevard and the channel eventually reaches and discharges into Indian Bend Wash.

Tributary to this box culvert is Cholla Channel from the north and Shea Boulevard drainage system from the east.

The Shea Boulevard drainage system consists of a storm sewer pipe (34" x 58") from 85th Place to 82nd Place, including catch basins at 85th Place and 84th Street. The storm sewer pipe discharges into a concrete lined channel just east of 82nd Place. This channel crosses under 82nd Place in an 8' x 3' box culvert and continues west to the two barrel 12' x 3' box culvert which crosses under Shea Boulevard.

Recall that the Introduction states one of the recommendations of the Hayden / Shea Master Drainage Plan is... "Construct a channel from 85th Place and Shea Boulevard to 82nd Place and Shea Boulevard (R30 - R50) and construct a culvert at 84th Street and Shea Boulevard (R40) to convey flows under 84th Street"[9].

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[8] A-N West Inc., DRAINAGE DESIGN REPORT - SHEA BOULEVARD, SCOTTSDALE ROAD TO PIMA ROAD (March 1988 and Addendum January 1988).

[9] Boyle Engineering Corporation, HAYDEN / SHEA AREA MASTER DRAINAGE PLAN, ADDENDUM NO. 2 (January 25, 1991).

SECTION IV HYDROLOGY (RUNOFF DISCHARGES)

TABLES

SECTION IV - HYDROLOGY

4.1 HEC-1 PRINTOUT

For HEC-1 printout, see Appendix "C" of this report.

4.2 CACTUS ROAD

Cactus Road drains from east to west at a rather flat slope of 0.0030 ft/ft. Flow enters Cactus Road from the north at 87th Street, 86th Street and from between the houses along the north side on Cactus Road. Also, during large storms, some runoff enters Cactus Road from the Pima Road pipe culvert on the west side of Pima Road, due to the fact that this culvert is designed for smaller storms. As mentioned before, a hydraulic analysis was performed on Cactus Road using the HEC-2 program to arrive at an inflow and outflow curve at each intersection. The procedure was as follows:

- Develop rating curves for X-sections (HEC-12)
- Run HEC-1 without diversions, from Cactus Road.
- Use these flows to set up the HEC-2 for Cactus Road.
- Run HEC-2 for the 100 year storm.
- Calculate for which depth weir flow to side streets starts.
- Prepare rating curve for HEC-1 diversions.
- Run HEC-1 with diversions.

For the 100-year storm, only about 16 cfs enters 86th Street, from Cactus Road and at Paradise Lane approximately 32 cfs turns south. The peak flow at the 84th Street and Cactus Road Intersection is 125 cfs and turns south on 84th Street. Only 6 cfs continues west on Cactus Road. This flow corresponds to a depth of approximately 1 foot above the gutter, well above the maximum depth of 8" allowed by the City Ordinance Number 1993, Section 37-42, (4), "Streets as Water Carriers".

4.3 EXISTING CHOLLA WASH(CHOLLA ROAD TO SHEA BLVD.)

The upper end of the existing Cholla wash begins on the west side of 84th Street at Cortez Street (830 feet north of Cholla Road); it continues south to Cholla Road where it crosses in a surface waterway (dip section). Between Cholla Road and the existing 10' x 3' box culvert at the intersection of 82nd Place and Clinton Street, Cholla Wash meanders through the residential area passing through both front yards and back yards.

At Cholla Road, the peak discharge for the 100-year return frequency, 6-hour duration storm is 270 cfs; at the Desert Cove crossing the runoff discharge has increased to 360 cfs; at the 82nd

Place / Clinton Street existing 10' x 3' box culvert the runoff discharge has increased to 372 cfs; and at the outfall, in the improved channel approaching Shea Boulevard the runoff discharge increases to 401 cfs.

At the existing two barrel 12' x 3' box culvert under Shea Boulevard the Cholla Channel runoff discharge combines with that of the Shea Boulevard drainage system resulting in a total discharge of 655 cfs. The Hayden / Shea Master Drainage Plan (Table 2.2) lists the capacity of the box culvert at 576 cfs[10].

4.4 CHOLLA ROAD AND 85TH STREET INTERSECTION

At this intersection, the runoff discharge from sub-basins 310, 330, 340 and 350 concentrates. Since the north-south slope here is approximately 0.0070 ft/ft and east-west is 0.0030 ft/ft it is estimated that 80% of the runoff at this concentration point continues south in 85th Street and eventually concentrates at the 84th Street and Desert Cove Intersection. The 100-year runoff at 85th Street and Cholla Road is 127 cfs; and at 84th Street and Desert Cove it is 155 cfs.

4.5 SHEA BOULEVARD

The Shea Boulevard storm drain system has a flat 0.0025 ft/ft slope, is very shallow and was designed to carry a 100-year storm, per the Shea Boulevard as-built plans as follows:

Location	Type	Size	Slope	Capacity
85th St.-84th St.	Pipe	33"	0.0025	26.0 cfs
84th St.-82nd Pl.	Pipe	34" x 53"	0.0025	58.8 cfs
82nd Place	Box Culvert	8' x 3'	0.0030	114 cfs
82nd Pl.-Shea Blvd.	Open Channel	8' Bottom	0.0019	114 cfs

The HEC-1 program has calculated the following runoff discharges along Shea Boulevard:

85th Street	65 cfs
84th Street	206 cfs
82nd Place	248 cfs

Since the runoff flows are greater than the storm drain capacity, the balance will be carried in the street. The capacity of the north half of Shea Boulevard is approximately 30 cfs. The depth of flow would then be about 8 inches.

4.6 HEC-1 RUNOFF DISCHARGE SUMMARY

Table 4.6 shows discharges in cfs for the 2, 5, 10, 25, 50 and 100 year return frequency at concentration points shown on the Drainage Area Map.

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[10] Boyle Engineering Corporation, HAYDEN / SHEA AREA MASTER DRAINAGE PLAN, ADDENDUM NO. 2 (January 25, 1991).

Table 4.6	HEC-1 RUNOFF DISCHARGE SUMMARY					
LOCATION CONCENTRATION POINT NUMBER	RETURN FREQUENCY - 6-HOUR DURATION					
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR
C-110	14	26	34	48	66	85
C-150	27	51	64	84	102	124
C-160	27	41	44	56	66	80
C-170	28	42	45	56	67	82
C-210	4	10	16	23	31	39
C-250	9	27	41	55	70	85
C-260	8	21	31	41	51	56
C-270	28	53	66	86	104	122
C-310	5	11	15	23	29	37
C-320	12	25	35	50	63	80
C-330	18	39	52	77	98	127
C-350	3	8	13	18	23	34
C-370	32	62	81	110	136	160
C-380	44	91	120	173	222	270
410	11	22	29	41	53	65
C-420	17	37	50	73	96	121
C-430	21	44	60	88	117	148
C-440	23	47	63	92	122	155
C-450	13	26	34	49	63	78
C-460	14	29	39	57	74	92
C-470	32	66	89	130	167	206
C-510	46	94	124	178	226	277
C-520	47	98	128	185	238	295
C-530	49	100	133	191	246	306
C-540	8	16	21	31	40	51
C-550	57	117	157	224	288	360
C-560	58	122	165	237	301	372
C-590	61	129	176	254	323	401
C-600	38	79	106	155	201	248
C-610	96	209	283	408	526	655

For concentration point numbers and location, see Drainage Area Map.

APPENDIX A

PRECIPITATION CALCULATIONS

SMF ENGINEERING CORPORATION

PROJECT DESCRIPTION: 84TH STREET & CHOLLA ROAD DRAINAGE IMPROVEMENTS

LOCATION:

PROJECT NO.: F2708

Depth Duration Frequency Table

	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5-Min	0.30	0.45	0.54	0.66	0.78	0.88
10-Min	0.45	0.67	0.82	0.99	1.16	1.33
15-Min	0.55	0.81	0.99	1.21	1.41	1.61
30-Min	0.73	1.07	1.31	1.60	1.87	2.13
1-Hour	0.89	1.31	1.60	1.95	2.28	2.60
2-Hour	1.00	1.45	1.76	2.14	2.50	2.84
3-Hour	1.07	1.54	1.85	2.25	2.63	3.00
6-Hour	1.20	1.72	2.08	2.52	2.92	3.30
12-Hour	1.35	1.90	2.28	2.75	3.18	3.59
24-Hour	1.5	2.08	2.48	2.98	3.43	3.90

COMPUTED BY: RMM DATE: 6/18/93 CHECKED BY: _____ DATE: _____

11/4/92

APPENDIX A

Steps for Determination of Precipitation Values for Various Durations and Return Periods.

Sheet 1 of 3

(Source: Addendum to "Hydrologic Design for Highway Drainage in Arizona," April 1975)

Step 1: From the precipitation maps, Figures 2.2-1 through 2.2-12, determine the precipitation values for the six and twenty four hour durations storms for return periods of 2, 5, 10, 25, 50, and 100 years. Tabulate these values in Table 1 in the column headed "Map Values."

Table 1

Return Period (Years)	Precipitaton Values (Inches)			
	6 hour duration		24 hour duration	
	Map Value	Corrected Value	Map Value	Corrected Value
2	1.20	1.20	1.50	1.50
5	1.70	1.72	2.04	2.08
10	2.05	2.08	2.46	2.48
25	2.55	2.52	3.02	2.98
50	2.90	2.92	3.46	3.43
100	3.22	3.30	3.90	3.90

NOTE: There is a possibility of making an error while reading the maps because: (1) a site is not easy to locate precisely on a series of 12 maps, (2) there may be some slight registration differences in printing, and (3) precise interpolation between isolines is difficult. In order to minimize any errors in reading the maps, these values should be plotted on the diagram "Precipitation Depth versus Return Period," Appendix A, Figure 1.

Step 2: Plot these values on the diagram "Precipitation Depth versus Return Period," Appendix A, Figure 1.

Step 3: Draw a line of best fit through the 6 hour precipitation values and another line through the 24 hour precipitation values.

Step 4: Tabulate the values represented by the lines of best fit, obtained in Step 3, in the column of Table 1 entitled "Corrected Value."

NOTE: The 1 hour precipitation value is needed to determine the 2 and 3 hour values as well as the 5, 10, 15, and 30 minute values.

SMF ENGINEERING CORPORATION

PROJECT DESCRIPTION: MILLER ROAD SANITARY SEWER STUDY
LOCATION:
PROJECT NO.: 83860

CALCULATION SHEET

Precipitation Values:

Step 5: 1-hour values

$Y_2 = -0.011 + 0.942 (X_1^2/X_2)$

$Y_{100} = 0.494 + 0.755 (X_3^2/X_4)$

$Y_2 = -0.011 + 0.942 (1.2^2/1.5) = 0.89$ 2yr, 1hr.

$Y_{100} = 0.494 + 0.755 (3.3^2/3.9) = 2.60$ 100yr, 1hr

Step 7: 2 & 3 hour values

2yr, 2 hour = 0.341 (6 hr) + 0.659 (1 hr.)
= 0.341 · 1.20 + 0.659 · 0.89 = 1.00

100yr, 2hr = 0.341 · 3.30 + 0.659 · 2.60 = 2.84

2yr, 3 hour = 0.569 · 1.20 + 0.431 · 0.89 = 1.07

100yr, 3 hour = 0.569 · 3.30 + 0.431 · 2.60 = 3.00

Step 8: 12 hour values

$P_{12hr} = P_{24hr} - (0.51 (P_{24hr} - P_{6hr}))$

$P_{2yr,12hr} = 1.50 - (0.51 (1.50 - 1.20)) = 1.35$

$P_{100yr,12hr} = 3.90 - (0.51 (3.90 - 3.30)) = 3.59$

Step 9: Less than 1-hr. (See table)

100yr, 5 min = 0.34 · 2.60 = 0.88

100yr, 15 min = 0.62 · 2.60 = 1.61

COMPUTED BY: RM DATE: 11/5/92 CHECKED BY: _____ DATE: _____

FORM 035

SMF ENGINEERING CORPORATION

PROJECT DESCRIPTION: 84TH STREET & CHOLLA ROAD DRAINAGE IMPROVEMENTS

LOCATION:

PROJECT NO.: F2708

CALCULATION SHEET

Use PH record (6 hr duration).

5 min	15	60 min	2 hr	3 hr	6 hr
0.88	1.61	2.60	2.84	3.00	3.30

COMPUTED BY: RM DATE: 11/5/92 CHECKED BY: _____ DATE: _____

FORM 035

SMF ENGINEERING CORPORATION

PROJECT DESCRIPTION: 84TH STREET & CHOLLA ROAD DRAINAGE IMPROVEMENTS

LOCATION:

PROJECT NO.: F2708

CALCULATION SHEET

Calculate ratios for 2, 5, 10, 25, 50 Storm.
Use 1.0 for 100 yr Storm
Use JR card

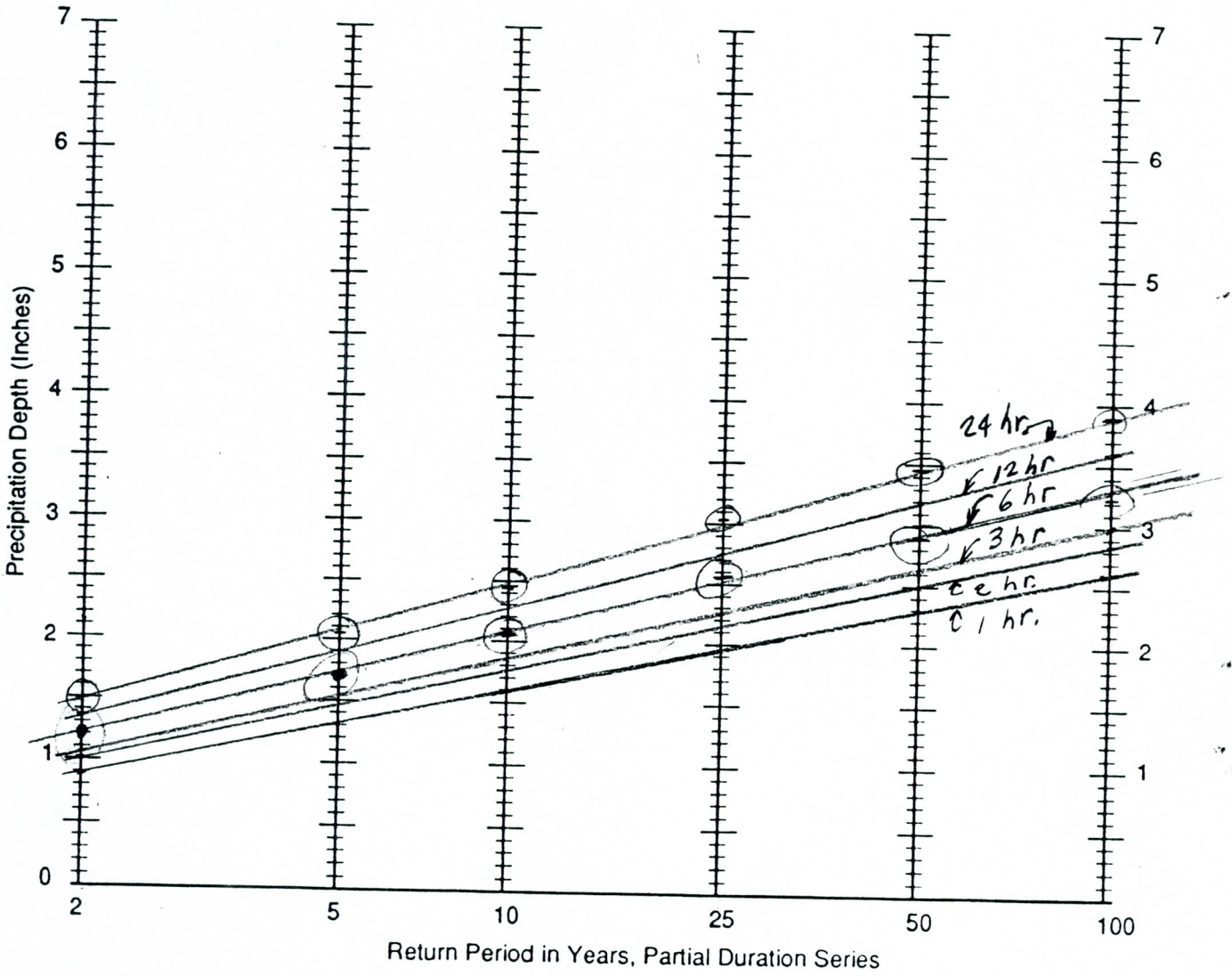
	Precipitation	Ratio
100 yr-Storm	3.30	1.0
50 " "	2.92	0.88
25 " "	2.52	0.76
10 " "	2.08	0.62
5 " "	1.72	0.53
2 " "	1.20	0.36

COMPUTED BY: RM DATE: 3/20/93 CHECKED BY: _____ DATE: _____

FORM 035

APPENDIX A

Figure 1
Precipitation Depth Versus Return Period for Partial - Duration Series
Sheet 2 of 3
(Source: Addendum to "Hydrologic Design for Highway Drainage in Arizona," April 1975)



Project: 84th St & Cholla Rd

Station: 84th St + Cholla

TR-55 Worksheet Input Data

Project: Cholla Road and 84th Street - City of Scottsdale
North of Cactus Road

D.A. nr.	Area		Overland Flow		Shallow Concentr.		Channel	
	Acres	Sq. Miles	Length	Slope	Length	Slope	Length	Slope
10	3.43	.00536	40'	.0200			2495'	.0070
15	3.58	.00559	40'	.0200	--		2605'	.0070
20	1.75	.00273	300'	.0057	900'	.0057		
30	15.77	.02464	300'	.0067	2400'	.0067		
40	19.98	.03122	240'	.0060	1420' 1030'	.0040 .0060		
50	4.22	.00659	95'	.0100	630'	.0060		
70	7.08	.01106	130'	.0100	1290' 450'	.0045 .0080		
80	1.21	.00189	300'	.0080	300'	.0080		
90	18.70	.02922	130'	.0100	680' 150'	.0040 .0025	240' 1250'	.0040 .0070
100	4.26	.00666	300'	.0070	440'	.0050		
Total	79.98	.12497						

TR-55 Worksheet Input Data

Project: Cholla Road and 84th Street - City of Scottsdale
Cactus Road North of Centerline

D.A. nr.	Area		Overland Flow		Shallow Concentr.		Channel	
	Acres	Sq. Miles	Length	Slope	Length	Slope	Length	Slope
110	0.57	.00089	33'	.0200	680'	.0030		
120	0.11	.00018	33'	.0200	125'	.0030		
130	0.24	.00038	33'	.0200	265'	.0030		
140	0.20	.00031	33'	.0200	215'	.0033		
150	0.41	.00064	33'	.0200	445'	.0030		
160	0.50	.00079	33'	.0200	550'	.0020		
170	0.76	.00120	90'	.0100	290'	.0020		
	---	---						
Total	2.79	.00436						

TR-55 Worksheet Input Data

Project: Cholla Road and 84th Street - City of Scottsdale
Cactus Road South of Centerline

D.A. nr.	Area		Overland Flow		Shallow Concentr.		Channel	
	Acres	Sq. Miles	Length	Slope	Length	Slope	Length	Slope
210	1.74	.00272	75'	0.010	640	.0034		
220	0.32	.00050	75'	0.010			125'	.0030
230	0.67	.00105	75'	0.010			265'	.0030
240	0.54	.00084	75'	0.010			215'	.0030
250	1.11	.00173	75'	0.010			440'	.0030
260	1.39	.00217	75'	0.010			550'	.0030
270	0.73	.00114	75'	0.010			290'	.0030
Total	6.50	.01016						

TR-55 Worksheet Input Data

Project: Cholla Road and 84th Street - City of Scottsdale
Between Cholla Road and Cactus Road

D.A. nr.	Area		Overland Flow		Shallow Concentr.		Channel	
	Acres	Sq. Miles	Length	Slope	Length	Slope	Length	Slope
310	10.54	.01647	300'	0.010	160'	0.007	720'	.0030
320	27.48	.04294	300'	0.010	160'	0.007	750'	.0030
							1600'	.0060
330	40.46	.06322	300'	0.010	110'	0.007	800'	.0030
							2040'	.0060
340	6.60	.01031	300'	0.010	400'	0.006	500'	.0060
350	1.44	.00225	70'	0.010			260'	.0060
360	8.45	.01320	300'	0.010	200'	0.070	650'	.0040
370	3.79	.00592	170'	0.010	170'	0.002	550'	.0077
380	29.44	.04600	120'	.0070	210'	0.003	520'	.0030
			180'	.0050			1030'	.0077
390	6.00	.00938	300'	.0045	50'	.0045	650'	.0060
							220'	.0050
Total	134.20	.20969						

TR-55 Worksheet Input Data

Project: Cholla Road and 84th Street - City of Scottsdale
East of 84th Street, South of Cholla

D.A. nr.	Area		Overland Flow		Shallow Concentr.		Channel	
	Acres	Sq. Miles	Length	Slope	Length	Slope	Length	Slope
410	28.20	0.04406	270	.0070	210	.0030	180	.0030
					730	.0070	1550	.0070
420	11.0	0.01719	280	.0070	110	.0030	1180	.0070
					230	.0070		
430	14.09	0.02202	300	.0070	200	.0070	1050	.0070
440	4.68	0.00731	100	.0070			780	.0070
			120	.0030				
450	5.14	0.00803	300	.0070	500	.0070	600	.0030
460	8.95	0.01398	300	.0070	340	.0070	400	.0020
470	4.59	0.00717	150	.0050			1100	.0070
	---	---						
Total	76.65	0.11977						

TR-55 Worksheet Input Data

Project: Cholla Road and 84th Street - City of Scottsdale
West of 84th Street, South of Cholla

D.A. nr.	Area		Overland Flow		Shallow Concentr.		Channel	
	Acres	Sq. Miles	Length	Slope	Length	Slope	Length	Slope
510	6.68	0.01044	80	.0060	300	.0100	150	.0056
520	8.97	0.01402	70	.0060	250 550	.0070 .0090		
530	5.16	0.00806	260	.0070	470	.0060	350	.0090
540	3.31	0.00517	260	.0070	250	.0070	300	.0030
550	4.50	0.00703	120	.0070	300	.0070	230	.0120
560	2.47	0.00386	280	.0089	160	.0023	250 500	.0040 .0060
570	3.15	0.00492	230	.0060	400	.0070	450	.0030
580	3.68	0.00575	300	.0070	100 150	.0070 .0060	380	.0050
590	12.36	0.01931	300	.0070	400	.0070	400 570	.0073 .0050
600	19.43	0.03036	300	.0060	400	.0100	450 700	.0061 .0060
610	2.24	0.00350	130	.0070	100	.0010		
Total	71.95	0.11242						

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 02-09-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: North of Cactus Road

Subarea #1 - 10

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	40	.02	A					0.014
Open Channel		2495	.007		.02510		11		0.148
						Time of Concentration =			0.16*
									=====

Subarea #2 - 20

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.0057	A					0.120
Shallow Concent'd		900	.0057	U					0.205
						Time of Concentration =			0.33*
									=====

Subarea #3 - 30

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.0067	A					0.112
Shallow Concent'd		1000	.0067	U					0.210
Open Channel		1400						1.5	0.259
						Time of Concentration =			0.58*
									=====

Subarea #4 - 40

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	240	.0060	A					0.098
Shallow Concent'd		1000	.0040						0.216
Open Channel		4					18		0.065
Open Channel		1					18		0.131
						ncentration =			0.51*
									=====

According to the City of Scottsdale's design standards the equation for calculating travel time uses the 10-year 6 hour rainfall. The rainfall used in these calculations is not the 10-year 6 hr. rainfall. Using the actual 10-year 6hr rainfall will reduce the Travel time ∴ reducing Tc ∴ higher Q

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 02-09-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: North of Cactus Road

Subarea #5 - 50

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	95	.01	A					0.038
Shallow Concent'd		630	.006	P					0.111
								Time of Concentration =	0.15*
									=====

Subarea #7 - 70

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	130	.01	A					0.049
Shallow Concent'd		1000	.0045	P					0.204
Open Channel		290	.0045		.0162	.64	16		0.043
Open Channel		450	.008		.0162	.64	16		0.050
								Time of Concentration =	0.35*
									=====

Subarea #8 - 80

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.008	A					0.105
Shallow Concent'd		300	.008	U					0.058
								Time of Concentration =	0.16*
									=====

Subarea #9 - 90

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	130	.010	A					0.049
Shallow Concent'd		680	.004	P					0.147
Shallow Concent'd		150	.0025	P					0.041
Open Channel		240	.004		.0162	.64	16		0.038
Open Channel		1250	.007		.0162	.64	16		0.148
								Time of Concentration =	0.42*
									=====

Subarea #10 - 100

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.007	A					0.110
Shallow Concent'd		440	.005	P					0.085
								Time of Concentration =	0.20*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short		

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84TH STREET AND CHOLLA ROAD User: Rob Date: 02-09-93
County : MARICOPA State: AZ Checked: ____ Date: _____
Subtitle: CACTUS ROAD AREAS

Subarea #1 - 110

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	33	.02	A					0.012
Open Channel		680	.003		.0167	.5	30		0.093
					Time of Concentration =				0.11*
									=====

Subarea #2 - 120

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	33	.02	A					0.012
Open Channel		125	.003		.0167	.5	30		0.017
					Time of Concentration =				0.03*
									=====

Subarea #3 - 130

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	33	.02	A					0.012
Open Channel		265	.003		.0167	.5	30		0.036
					Time of Concentration =				0.05*
									=====

Subarea #4 - 140

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	40	.02	A					0.014
Open Channel		215	.0033		.0167	.5	30		0.028
					Time of Concentration =				0.04*
									=====

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84TH STREET AND CHOLLA ROAD User: Rob Date: 02-09-93
County : MARICOPA State: AZ Checked: ____ Date: _____
Subtitle: CACTUS ROAD AREAS

Subarea #5 - 150

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	33	.02	A					0.012
Open Channel		445	.0033		.0167	5.0	30		0.058
						Time of Concentration =			0.07*
									=====

Subarea #6 - 160

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	33	.02	A					0.012
Open Channel		550	.002		.0167	5.0	30		0.092
						Time of Concentration =			0.10*
									=====

Subarea #7 - 170

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	90	.01	A					0.037
Open Channel		290	.002		.0167	5.0	30		0.049
						Time of Concentration =			0.09*
									=====

Subarea #8 - 15

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	40	.02	A					0.014
Open Channel		2605	.007		.025	30	24		0.125
						Time of Concentration =			0.14*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84TH STREET AND CHOLLA ROAD User: ROB Date: 02-17-93
County : MARICOPA State: AZ Checked: ____ Date: _____
Subtitle: CACTUS ROAD SOUTH OF CENTER LINE

Subarea #1 - 210

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.01	A					0.032
Shallow Concent'd		640	.0034	P					0.150
								Time of Concentration =	0.18*
									=====

Subarea #2 - 220

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.01	A					0.032
Open Channel		125	.003		.0167	5	30		0.017
								Time of Concentration =	0.05*
									=====

Subarea #3 - 230

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.010	A					0.032
Open Channel		265	.003		.0167	5	30		0.036
								Time of Concentration =	0.07*
									=====

Subarea #4 - 240

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.01	A					0.032
Open Channel		215	.003		.0167	5	30		0.030
								Time of Concentration =	0.06*
									=====

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84TH STREET AND CHOLLA ROAD User: ROB Date: 02-17-93
County : MARICOPA State: AZ Checked: ____ Date: _____
Subtitle: CACTUS ROAD SOUTH OF CENTER LINE

Subarea #5 - 250

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.01	A					0.032
Open Channel		440	.003		.0167	5	30		0.060
						Time of Concentration =			0.09*
									=====

Subarea #6 - 260

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.01	A					0.032
Open Channel		550	.003		.0167	5	30		0.075
						Time of Concentration =			0.11*
									=====

Subarea #7 - 270

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	75	.01	A					0.032
Open Channel		290	.002		.0167	5	30		0.049
						Time of Concentration =			0.08*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street User: Rob Date: 02-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: North of Cholla Road

Subarea #1 - 310

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.01	A					0.096
Shallow Concent'd		160	.007	U					0.033
Open Channel		720	.003		.0162	67	16		0.129
						Time of Concentration =			0.26*
									=====

Subarea #2 - 320

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.01	A					0.096
Shallow Concent'd		160	.007	U					0.033
Open Channel		750	.003		.0162	64	16		0.136
Open Channel		1600	.003		.0162	64	16		0.290
						Time of Concentration =			0.55*
									=====

Subarea #3 - 330

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.01	A					0.096
Shallow Concent'd		110	.007	U					0.023
Open Channel		800	.003		.0162	64	16		0.145
Open Channel		2040	.003		.0162	64	16		0.369
						Time of Concentration =			0.63*
									=====

Subarea #4 - 340

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.01	A					0.096
Shallow Concent'd		400	.006	U					0.089
Open Channel		500	.006		.0162	64	16		0.064
						Time of Concentration =			0.25*
									=====

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street User: Rob Date: 02-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: North of Cholla Road

---------- Subarea #5 - 350 ----------

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	70	.01	A					0.030
Open Channel		260	.006		.016	2.64	16		0.033
						Time of Concentration =			0.06*
									=====

---------- Subarea #6 - 360 ----------

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.01	A					0.096
Shallow Concent'd		200	.007	U					0.041
Open Channel		650	.004		.016	2.64	16		0.102
						Time of Concentration =			0.24*
									=====

---------- Subarea #7 - 370 ----------

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	170	.01	A					0.061
Shallow Concent'd		170	.002	U					0.065
Open Channel		550	.0077		.016	5	20		0.047
						Time of Concentration =			0.17*
									=====

---------- Subarea #8 - 380 ----------

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	120	.007	A					0.053
Sheet		180	.005	A					0.084
Shallow Concent'd		210	.003	U					0.066
Open Channel		520	.003		.016	2.64	16		0.094
						Time of Concentration =			0.30*
									=====

---------- Subarea #9 - 390 ----------

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.0045	A					0.132
Shallow Concent'd		50	.0045	U					0.013
Open Channel		650	.006		.025	1.5	6		0.099
Open Channel		220	.005		.025	1.5	6		0.037
						Time of Concentration =			0.28*

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 05-12-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: Split area 380 into 380N and 380S

Subarea #1 - 380S

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	120	.007	A					0.053
Sheet		180	.005	A					0.084
Shallow Concent'd		210	.003	U					0.066
Open Channel		520	.003		.016	2.64	16		0.094
						Time of Concentration =			0.30*
									=====

Subarea #2 - 380N

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	120	.007	A					0.053
Sheet		180	.007	A					0.073
Shallow Concent'd		150	.007	U					0.031
Shallow Concent'd		220	.003	U					0.069
Open Channel		180	.005		.016	5	2		0.019
						Time of Concentration =			0.25*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 03-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: East of 84th Street and South of Cholla AND Area 610

Subarea #1 - 410

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	270	.007	A					0.101
Shallow Concent'd		210	.003	U					0.066
Shallow Concent'd		730	.007	U					0.150
Open Channel		180	.003		.025	0.5	2		0.039
Open Channel		1550	.007		.016	0.5	2		0.139
						Time of Concentration =			0.50*
									=====

Subarea #2 - 420

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	280	.007	A					0.104
Shallow Concent'd		110	.003	U					0.035
Shallow Concent'd		230	.007	U					0.047
Open Channel		1180	.007		.025	0.5	2		0.166
						Time of Concentration =			0.35*
									=====

Subarea #3 - 430

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.007	A					0.110
Shallow Concent'd		200	.007	U					0.041
Open Channel		1050	.007		.030	0.5	2		0.177
						Time of Concentration =			0.33*
									=====

Subarea #4 - 440

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	100	.007	A					0.046
Sheet		120	.003	A					0.074
Open Channel		780	.007		.025	0.5	2		0.109
						Time of Concentration =			0.23*
									=====

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 03-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: East of 84th Street and South of Cholla AND Area 610

Subarea #5 - 450

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.007	A					0.110
Shallow Concent'd		500	.007	U					0.103
Open Channel		600	.003		.030.5		2		0.154
						Time of Concentration =			0.37*
									=====

Subarea #6 - 460

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.007	A					0.110
Shallow Concent'd		340	.007	U					0.070
Open Channel		400	.002		.0167.5		30		0.067
						Time of Concentration =			0.25*
									=====

Subarea #7 - 470

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	150	.005	A					0.072
Open Channel		1100	.007		.025.5		2		0.154
						Time of Concentration =			0.23*
									=====

Subarea #8 - 610

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	130	.007	A					0.057
Shallow Concent'd		100	.010	U					0.017
						Time of Concentration =			0.07*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 03-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: West of 84th Street and South of Cholla

Subarea #1 - 510

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	80	.006	A					0.041
Shallow Concent'd		300	.01	U					0.052
Open Channel		150	.0056		.04016		8		0.009
						Time of Concentration =			0.10*
									=====

Subarea #2 - 520

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	70	.006	A					0.037
Shallow Concent'd		250	.007	U					0.051
Open Channel		550	.009		.0250.5		2		0.068
						Time of Concentration =			0.16*
									=====

Subarea #3 - 530

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	260	.007	A					0.098
Shallow Concent'd		470	.006	U					0.104
Open Channel		350	.009		.025.5		2		0.043
						Time of Concentration =			0.25*
									=====

Subarea #4 - 540

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	260	.007	A					0.098
Shallow Concent'd		250	.007	U					0.051
Open Channel		300	.003		.025.5		2		0.064
						Time of Concentration =			0.21*
									=====

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 03-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: West of 84th Street and South of Cholla

Subarea #5 - 550

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	120	.007	A					0.053
Shallow Concent'd		300	.007	U					0.062
Open Channel		230	.012		.025.5		2		0.025
						Time of Concentration =			0.14*
									=====

Subarea #6 - 560

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	280	.0089	A					0.095
Shallow Concent'd		160	.0023	U					0.057
Open Channel		250	.0040		.04016		8		0.019
Open Channel		500	.0060		.04016		8		0.030
						Time of Concentration =			0.20*
									=====

Subarea #7 - 570

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	230	.006	A					0.095
Shallow Concent'd		400	.007	U					0.082
Open Channel		450	.003		.025.5		2		0.096
						Time of Concentration =			0.27*
									=====

Subarea #8 - 580

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.007	A					0.110
Shallow Concent'd		100	.007	U					0.021
Shallow Concent'd		150	.006	U					0.033
Open Channel		380	.005		.025.5		2		0.063
						Time of Concentration =			0.23*
									=====

Subarea #9 - 590

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.007	A					0.110
Shallow Concent'd		400	.007	U					0.082
Open Channel		400	.0073		.03 .5		2		0.066

Open Channel	570	.005	.025.5	2	0.095

Time of Concentration = 0.35*
=====

TR-55 Tc and Tt THRU SUBAREA COMPUTATION VERSION 1.11

Project : 84th Street and Cholla User: Rob Date: 03-18-93
County : Maricopa State: AZ Checked: ____ Date: _____
Subtitle: West of 84th Street and South of Cholla

Subarea #10 - 600

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	1.44	300	.006	A					0.117
Shallow Concent'd		400	.010	U					0.069
Open Channel		450	.0061		.030.5		2		0.081
Open Channel		700	.0060		.030.5		2		0.127
						Time of Concentration =			0.39*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

APPENDIX C

HEC-1 PRINTOUT

```
**********************************************
*                                            *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)        *
*             SEPTEMBER 1990                 *
*              VERSION 4.0                   *
*                                            *
*   RUN DATE  10/05/1993  TIME  11:02:51     *
*                                            *
**********************************************
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**********************************************
*                                            *
*     U.S. ARMY CORPS OF ENGINEERS           *
*     HYDROLOGIC ENGINEERING CENTER          *
*           609 SECOND STREET                *
*        DAVIS, CALIFORNIA 95616             *
*           (916) 756-1104                   *
*                                            *
**********************************************
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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        84TH STREET AND CHOLLA ROAD
  2       ID        2-5-10-25-50-100 yr STORM
  3       ID        EXISTING CONDITION --- NO IMPROVEMENTS
  4       ID        FILE CHEX.DAT
          *DIAGRAM
  5       IT      2                   300
  6       IO      5
  7       JR    PREC    0.36    0.53    0.62    0.76    0.88     1.0

  8       KK      10      SUBBASIN 10 RUNOFF
  9       BA  .00536
 10       PH                  0.88    1.61     2.6    2.84     3.0     3.3
 11       LS              89
 12       UD     .10

 13       KK      20      SUBBASIN 20 RUNOFF
 14       BA  .00273
 15       LS              77
 16       UD     .20

 17       KK     C10      COMBINE 10 AND 20
 18       HC       2

 19       KK     C15      ROUTE C10 TO C15
 20       RS     100    STOR      -1       0
 21       RC   0.016   0.025   0.040    2605  0.0070
 22       RX       0      20      40      49      51      60      80     100
 23       RY     100    99.6    99.2      97      97    99.2    99.6     100

 24       KK      15      SUBBASIN 15 RUNOFF
 25       BA  .00559
 26       LS              89
 27       UD     .08

 28       KK     C15      COMBINE C10 AND 15
 29       HC       2

 30       KK     C15      DIVERT C15 TO SOUTH PIMA ROAD
 31       DT     D15
 32       DI       0      19      30      40
 33       DQ       0      19      19      29

 34       KK    C110      ROUTE C15 TO 110
 35       RS     100    STOR      -1       0
 36       RC    .040   0.016    .016     680   .0030
 37       RX      20      40      65      70      70      72     100     100
 38       RY   103.1   102.9  101.75  101.74  101.27  101.35  101.63  103.63

 39       KK     110      SUBBASIN 110 RUNOFF
 40       BA  .00089
 41       LS              98
 42       UD     .07
```

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

  43      KK      30      SUBBASIN 30 RUNOFF
  44      BA  .02464
  45      LS              77
  46      UD     .35

  47      KK      40      SUBBASIN 40 RUNOFF
  48      BA  .03122
  49      LS              77      45
  50      UD     .42

  51      KK    C110      COMBINE C15 AND 110 AND 40 AND 30
  52      HC       4

  53      KK    C110      DIVERT C110 TO 210
  54      DT    D110                          .
  55      DI       0       19      30      50      70
  56      DQ       0        1      12      22      30

  57      KK    C120      ROUTE C110 TO 120
  58      RS     100    STOR      -1       0
  59      RC    .040    .016    .016     130   .0030
  60      RX      55      55    64.7    69.7    69.7    71.7     100     100
  61      RY   102.3   100.3   99.56   99.44   98.96   99.04   99.56  101.56

  62      KK      50      SUBBASIN 50 RUNOFF
  63      BA  .00659
  64      LS              77      35
  65      UD     .14

  66      KK     120      SUBBASIN 120 RUNOFF
  67      BA  .00018
  68      LS              98
  69      UD     .06

  70      KK    C120      COMBINE C110 AND 50 AND 120
  71      HC       3

  72      KK    C130      ROUTE C120 TO 130
  73      RS     100    STOR      -1       0
  74      RC    .040    .016    .016     125   .0030
  75      RX      55      55    64.7    69.7    69.7    71.7     100     100
  76      RY   101.5    99.5   99.06   98.94   98.48   98.56   99.13  101.13

  77      KK      70      SUBBASIN 70 RUNOFF
  78      BA  .01106
  79      LS              77      35
  80      UD     .19

  81      KK     130      SUBBASIN 130 RUNOFF
  82      BA  .00038
  83      LS              98
  84      UD     .06
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"What's the point of subbasin 120, 130? Very small ~ 7A 9S

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

  85      KK    C130      COMBINE C120 AND 70 AND 130
  86      HC       3
  87      KK    C140      ROUTE C130 TO 140
  88      RS     100    STOR      -1        0
  89      RC    .040    .016    .016      265    .0030
  90      RX      55      55      61       66       66       68      100      100
  91      RY   101.2    99.2   98.48    98.36    97.89    97.97    98.41   100.41
  92      KK      80      SUBBASIN 80 RUNOFF
  93      BA  .00189
  94      LS              77       30
  95      UD     .10
  96      KK     140      SUBBASIN 140 RUNOFF
  97      BA  .00031
  98      LS              98
  99      UD     .06
 100      KK    C140      COMBINE C130 AND 80 AND 140
 101      HC       3
 102      KK    C150      ROUTE C140 TO 150
 103      RS     100    STOR      -1        0
 104      RC    .040   0.016   0.016      440    .0030
 105      RX      55      55    60.7     65.7     65.7     67.7      100      100
 106      RY   100.5    98.5   97.69    97.57    97.11    97.19    97.81    99.81
 107      KK      90      SUBBASIN 90 RUNOFF
 108      BA  .02922
 109      LS              77       24
 110      UD     .23
 111      KK     150      SUBBASIN 150 RUNOFF
 112      BA  .00064
 113      LS              98
 114      UD     .06
 115      KK    C150      COMBINE C140 AND 90 AND 150
 116      HC       3
 117      KK    C150      DIVERT C150 TO 250
 118      DT    D150
 119      DI       0      20       40       60       80      100      130
 120      DQ       0       0        5       25       35       45       57
 121      KK    C160      ROUTE C150 TO 160
 122      RS     100    STOR      -1        0
 123      RC    .040    .016    .016      550    .0030
 124      RX      20      45      61       66       66       68      100      100
 125      RY    97.3    96.9   96.31    96.19    95.70    95.78    96.29    98.29
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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  126         KK     100      SUBBASIN 100 RUNOFF
  127         BA  .00666
  128         LS              77      24
  129         UD     .12

  130         KK     160      SUBBASIN 160 RUNOFF
  131         BA  .00079
  132         LS              98
  133         UD     .06

  134         KK    C160      COMBINE C150 AND 100 AND 160
  135         HC       3

  136         KK    C170      ROUTE C160 TO 170
  137         RS     100    STOR      -1       0
  138         RC    .040    .016    .016     290   .0020
  139         RX      35      35      65      70      70      72      95      95
  140         RY    98.3    96.3   95.38   95.16   94.68   94.76   95.11   97.11

  141         KK     170      SUBBASIN 170 RUNOFF
  142         BA  .00120
  143         LS              77      35
  144         UD     .06

  145         KK    C170      COMBINE C160 AND 170
  146         HC       2

  147         KK    C170      DIVERT C170 TO 270
  148         DT    D170
  149         DI       0      10      15      20      40      60      80     100     130
  150         DQ       0       2       7      12      32      47      63      75      94

  151         KK    D110      RETRIEVE D110
  152         DR    D110

  153         KK     210      SUBBASIN 210 RUNOFF
  154         BA  .00272
  155         LS              98
  156         UD     .11

  157         KK    C210      COMBINE D210 AND 210
  158         HC       2

  159         KK    C210      DIVERT C210 TO 310
  160         DT    D210
  161         DI    5.25      19    26.1      33      39
  162         DQ       0     1.5     3.4       6      16

  163         KK    C220      ROUTE 210 TO 220
  164         RS     100    STOR      -1       0
  165         RC    .016    .016    .040     125   .0030
  166         RX       0       0    31.5    33.5    33.5    38.5      55      80
  167         RY  101.56   99.56   99.15   99.03   99.49   99.61   100.1   100.2
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  168     KK     220      SUBBASIN 220 RUNOFF
  169     BA  .00050
  170     LS             98
  171     UD     .06

  172     KK    C220      COMBINE 210 AND 220
  173     HC       2

  174     KK    C230      ROUTE C220 TO 230
  175     RS     100    STOR      -1       0
  176     RC    .016    .016    .040      265   .0030
  177     RX       0       0    31.5     33.5    33.5    38.5      55      80
  178     RY  101.13   99.13   98.65    98.57   99.04   99.16    99.8  100.10

  179     KK     230      SUBBASIN 230 RUNOFF
  180     BA  .00105
  181     LS             98
  182     UD     .06

  183     KK    C230      COMBINE C220 AND 230
  184     HC       2

  185     KK    C240      ROUTE C230 TO 240
  186     RS     100    STOR      -1       0
  187     RC    .016    .016    .040      440   .0030
  188     RX       0       0    31.8     33.8    33.8    38.8      55      80
  189     RY  100.41   98.41   97.95    97.87   98.37   98.49    99.0    99.9

  190     KK     240      SUBBASIN 240 RUNOFF
  191     BA  .00084
  192     LS             98
  193     UD     .06

  194     KK    C240      COMBINE C230 AND 240
  195     HC       2

  196     KK    C250      ROUTE C240 TO 250
  197     RS     100    STOR      -1       0
  198     RC    .016    .016    .040      550   .0030
  199     RX       0       0    32.3     34.3    34.3    39.3      55      80
  200     RY   99.81   97.81   97.28     97.2   97.68    97.8    98.5    99.0

  201     KK     250      SUBBASIN 250 RUNOFF
  202     BA  .00173
  203     LS             98
  204     UD     .06

  205     KK    D150      RETRIEVE D150
  206     DR    D150
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  207     KK    C250      COMBINE C240 AND 250 AND D150
  208     HC       3
  209     KK    C250      DIVERT C250 TO 350
  210     DT    D250
  211     DI       1    44.5    58.2      72      85
  212     DQ       0    12.5    17.1    22.4      32
  213     KK    C260      ROUTE C250 TO 260
  214     RS     100    STOR      -1       0
  215     RC    .016    .016    .040     290   .0030
  216     RX       0       0    32.4    34.4    34.4    39.4      55      80
  217     RY   98.29   96.29   95.79   95.71   96.18   96.30    96.6    97.1
  218     KK     260      SUBBASIN 260 RUNOFF
  219     BA  .00217
  220     LS              98
  221     UD     .07
  222     KK    C260      COMBINE C250 AND 260
  223     HC       2
  224     KK    C270      ROUTE C260 TO 270
  225     RS     100    STOR      -1       0
  226     RC    .016    .016    .040     290   .0030
  227     RX       0       5    36.8    38.8    38.8    43.8      60      90
  228     RY   95.11   95.04   94.19   94.11   94.59   94.71    95.2    95.3
  229     KK    D170      RETRIEVE D170
  230     DR    D170
  231     KK     270      SUBBASIN 270 RUNOFF
  232     BA  .00114
  233     LS              98
  234     UD     .06
  235     KK    C270      COMBINE C260 AND 270 AND D170
  236     HC       3
  237     KK    C270      DIVERT C270 TO 370
  238     DT    D270
  239     DI       0    68.7    90.1   111.6     124
  240     DQ       0    67.7    89.0     110     118
  241     KK     340      SUBBASIN 340 RUNOFF
  242     BA  .01031
  243     LS              77      20
  244     UD     .15
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  245     KK    C330      ROUTE 340 TO 330
  246     RS     100    STOR      -1        0
  247     RC    .040    .016    .040      440    .0022
  248     RX       0   19.8    19.8       40     40.1       42       50       60
  249     RY    82.9   82.41   81.91    82.31    82.31    82.22     82.1     82.4

  250     KK    D210      RETRIEVE D210
  251     DR    D210

  252     KK    C310      ROUTE D210 TO C310
  253     RS     100    STOR      -1        0
  254     RC    .040    .016    .040      400    .0080
  255     RX       0      24    24.1       40     40.1       56     56.1       80
  256     RY     101   98.93   98.61    98.97    98.97    98.62    98.92      101
  257     RS     100    STOR      -1        0
  258     RC    .040    .016    .040      260    .0030
  259     RX       0      24    24.1       40     40.1       56     56.1       80
  260     RY  101.21  100.01   99.68      100      100    99.68   100.01   101.21

  261     KK     310      SUBBASIN 310 RUNOFF
  262     BA  .01647
  263     LS              77      20
  264     UD     .16

  265     KK    C310      COMBINE D210 AND 310
  266     HC       2

  267     KK    C320      DIVERT C310 TO 320
  268     DT    D310
  269     DI       0     100
  270     DQ       0      50

  271     KK    C330      ROUTE C310 TO 330
  272     RS     100    STOR      -1        0
  273     RC    .040    .016    .040      750    .0030
  274     RX       0      24    24.1       40     40.1       56     56.1       80
  275     RY     101   98.93   98.61    98.97    98.97    98.62    98.92      101
  276     RS     100    STOR      -1        0
  277     RC    .040    .016    .040     2000    .0060
  278     RX       0      24    24.1       40     40.1       56     56.1       80
  279     RY  101.21  100.01   99.68      100      100    99.68   100.01   101.21

  280     KK    D250      RETRIEVE D250
  281     DR    D250

  282     KK    C350      ROUTE D250 TO C350
  283     RS     100    STOR      -1        0
  284     RC    .040    .016    .040      350    .0040
  285     RX       0      24    24.1       40     40.1       56     56.1       80
  286     RY     101   98.93   98.61    98.97    98.97    98.62    98.92      101
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  287     KK     350      SUBBASIN 350 RUNOFF
  288     BA  .00225
  289     LS              77      20
  290     UD     .06

  291     KK    C350      COMBINE 350 AND D250
  292     HC       2

  293     KK    C350      DIVERT C350 TO 360
  294     DT    D350
  295     DI       0     100
  296     DQ       0      50

  297     KK    C330      ROUTE 350 TO 330
  298     RS     100    STOR      -1       0       .
  299     RC    .040    .016    .040    2200   .0060
  300     RX       0      24    24.1      40    40.1      56    56.1      80
  301     RY  101.21  100.01   99.68     100     100   99.68  100.01  101.21

  302     KK     330      SUBBASIN 330 RUNOFF
  303     BA  .06322
  304     LS              77      20
  305     UD     .38

  306     KK    C330      COMBINE C340 AND C310 AND 330 AND C350
  307     HC       4

  308     KK    C330      DIVERT 330 TO 380
  309     DT    D330
  310     DI       0     100     200
  311     DQ       0      20      40

  312     KK    C420      ROUTE 330 TO 420
  313     RS     100    STOR      -1       0
  314     RC    .040    .016    .040    1300   .0070
  315     RX       0      20      23      30    30.1      37      40      60
  316     RY     102    99.7   99.93     100     100   99.93    99.7     102
  317     RS     100    STOR      -1       0
  318     RC    .040    .016    .040     300   .0020
  319     RX       0      20      23      30    30.1      37      40      60
  320     RY     102    99.7   99.93     100     100   99.93    99.7     102

  321     KK     420      SUBBASIN 420 RUNOFF
  322     BA  .01719
  323     LS              77      20
  324     UD     .21

  325     KK    C420      COMBINE C330 AND 420
  326     HC       2
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  327     KK    C430      ROUTE C420 TO 430
  328     RS     100    STOR      -1        0
  329     RC    .040    .016    .040      480    .0020
  330     RX       0      20      23       30     30.1       37       40       60
  331     RY     102    99.7   99.93      100      100    99.93     99.7      102

  332     KK     430      SUBBASIN 430 RUNOFF
  333     BA  .02202
  334     LS              77      20
  335     UD     .20

  336     KK    C430      COMBINE C420 AND 430
  337     HC       2

  338     KK     440      SUBBASIN 440 RUNOFF
  339     BA  .00731
  340     LS              77      20
  341     UD     .14

  342     KK    C440      COMBINE C430 AND 440
  343     HC       2

  344     KK    C440      DIVERT C440 TO 540
  345     DT    D440
  346     DI       0     100     200     300
  347     DQ       0      30      60      90

  348     KK    C470      ROUTE C440 TO 470
  349     RS     100    STOR      -1        0
  350     RC    .040    .016    .040    1200    .0070
  351     RX       0      24    24.1      40     40.1       56     56.1       80
  352     RY  101.21  100.01   99.68     100      100    99.68   100.01   101.21

  353     KK     410      SUBBASIN 410 RUNOFF
  354     BA  .04406
  355     LS              77      20
  356     UD    0.30

  357     KK    C450      ROUTE 410 TO C450
  358     RS     100    STOR      -1        0
  359     RC    .040   0.016    .016     130    .0020
  360     RX      20      40      65      70       70       72      100      100
  361     RY   103.1   102.9  101.75  101.74   101.27   101.35   101.63   103.63

  362     KK     450      SUBBASIN 450 RUNOFF
  363     BA  .00803
  364     LS              77      20
  365     UD    0.22
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  366     KK    C450      COMBINE C420 AND 450
  367     HC       2

  368     KK    C460      ROUTE C450 TO 460
  369     RS     100    STOR      -1        0
  370     RC    .040   0.016    .016      600    .0020
  371     RX      20      40      65       70       70       72      100      100
  372     RY   103.1   102.9  101.75   101.74   101.27   101.35   101.63   103.63

  373     KK     460      SUBBASIN 460 RUNOFF
  374     BA  .01398
  375     LS              77
  376     UD    0.15

  377     KK    C460      COMBINE C450 AND 460
  378     HC       2

  379     KK     470      SUBBASIN 470 RUNOFF
  380     BA  .00717
  381     LS              98
  382     UD    0.14

  383     KK    C470      COMBINE C460 AND C440 AND 470
  384     HC       3

  385     KK    C600      ROUTE C470 TO 600
  386     RS     100    STOR      -1        0
  387     RC    .040   0.016    .016      980    .0020
  388     RX      20      40      65       70       70       72      100      100
  389     RY   103.1   102.9  101.75   101.74   101.27   101.35   101.63   103.63

  390     KK     600      SUBBASIN 600 RUNOFF
  391     BA  .03036
  392     LS              77      20
  393     UD     .23

  394     KK    C600      COMBINE C470 AND 600
  395     HC       2

  396     KK    C610      ROUTE C600 TO 610
  397     RS     100    STOR      -1        0
  398     RC    .040   0.016   0.016      250    .0020
  399     RX       0      20      40       46       54       60       80      100
  400     RY     101     100      99       96       96       99      100      101

  401     KK    D350      RETRIEVE D350
  402     DR    D350

  403     KK    C360      ROUTE D350 TO 360
  404     RS     100    STOR      -1        0
  405     RC    .040    .016    .040      850    .0040
  406     RX       0      24    24.1       40     40.1       56     56.1       80
  407     RY     101   98.93   98.61    98.97    98.97    98.62    98.92      101
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  408     KK     360      SUBBASIN 360 RUNOFF
  409     BA  .01320
  410     LS              77      20
  411     UD     .14

  412     KK    D270      RETRIEVE D270
  413     DR    D270

  414     KK    C370      ROUTE D270 TO 370
  415     RS     100    STOR      -1       0
  416     RC    .040    .016    .040     770   .0077
  417     RX       0      24    24.1      40    40.1      56    56.1      80
  418     RY     101   98.93   98.61   98.97   98.97   98.62   98.92     101

  419     KK     370      SUBBASIN 370 RUNOFF
  420     BA  .00592
  421     LS              77      20
  422     UD     .11

  423     KK    C370      COMBINE D350 AND 360 AND 370 AND D270
  424     HC       4

  425     KK    C380      ROUTE C370 TO 380
  426     RS     100    STOR      -1       0
  427     RC    .040    .016    .040     600   .0054
  428     RX       0      20    20.1      40    40.1      60    60.1      80
  429     RY     101   98.93   98.61   98.97   98.97   98.62   98.92     101
  430     RS     100    STOR      -1       0
  431     RC    .040    .016    .040    1200   .0077
  432     RX       0      20    20.1      40    40.1      60    60.1      80
  433     RY     101   98.93   98.61   98.97   98.97   98.62   98.92     101

  434     KK     390      SUBBASIN 390 RUNOFF
  435     BA  .00938
  436     LS              77
  437     UD     .17

  438     KK    D330      RETRIEVE D330
  439     DR    D330

  440     KK    C380      ROUTE D330 TO 380
  441     RS     100    STOR      -1       0
  442     RC    .040    .016    .040     200   .0075
  443     RX       0    19.8    19.8      40    40.1      42      50      60
  444     RY    82.9   82.41   81.91   82.31   82.31   82.22    82.1    82.4
  445     RS     100    STOR      -1       0
  446     RC    .040    .016    .040     700   .0036
  447     RX       0    19.8    19.8      40    40.1      42      50      60
  448     RY    82.9   82.41   81.91   82.31   82.31   82.22    82.1    82.4
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  449     KK     380      SUBBASIN 380 RUNOFF
  450     BA  .04600
  451     LS              77      20
  452     UD     .18

  453     KK    C380      COMBINE D330 AND C370 AND 380 AND 390
  454     HC       4

  455     KK    C510      ROUTE C390 TO 510
  456     RS     100    STOR      -1       0
  457     RC    .050    .035    .050     700   .0070
  458     RX       0      .1      17      22      28      33      50    50.1
  459     RY     102     100      99    96.5    96.5      99     100     102

  460     KK     510      SUBBASIN 510 RUNOFF
  461     BA  .01044
  462     LS              77      20
  463     UD     .06

  464     KK    C510      COMBINE C390 AND 510
  465     HC       2

  466     KK    C520      ROUTE C510 TO 520
  467     RS     100    STOR      -1       0
  468     RC    .050    .035    .050     440   .0030
  469     RX       0      .1      17      22      28      33      50    50.1
  470     RY     102     100      99    96.5    96.5      99     100     102

  471     KK     520      SUBBASIN 520 RUNOFF
  472     BA  .01402
  473     LS              77      20
  474     UD     .10

  475     KK    C520      COMBINE C510 AND 520
  476     HC       2

  477     KK     530      SUBBASIN 530 RUNOFF
  478     BA  .00806
  479     LS              77      20
  480     UD     .15

  481     KK    C530      COMBINE C520 AND 530
  482     HC       2

  483     KK    C550      ROUTE C530 TO 550
  484     RS     100    STOR      -1       0
  485     RC    .050    .035    .050     350   .0050
  486     RX       0      .1      17      22      28      33      50    50.1
  487     RY     102     100      99    96.5    96.5      99     100     102
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 488      KK    D440      RETRIEVE D440
 489      DR    D440

 490      KK    C540      ROUTE D440 TO C540
 491      RS     100    STOR      -1       0
 492      RC    .040    .016    .040     540   .0080
 493      RX       0      20      23      30    30.1      37      40      60
 494      RY     102    99.7   99.93     100     100   99.93    99.7     102

 495      KK     540      SUBBASIN 540 RUNOFF
 496      BA  .00517
 497      LS              77      20
 498      UD     .13

 499      KK    C540      COMBINE D440 AND 540
 500      HC       2

 501      KK    C550      ROUTE 540 TO C550
 502      RS     100    STOR      -1       0
 503      RC    .040    .016    .040     200   .0080
 504      RX       0      20      23      30    30.1      37      40      60
 505      RY     101    99.7   99.93     100     100   99.93    99.7     101

 506      KK     550      SUBBASIN 550
 507      BA  .00703
 508      LS              77      20
 509      UD     .08

 510      KK    C550      COMBINE 550 AND C530 AND 540
 511      HC       3

 512      KK    C560      ROUTE C550 TO 560
 513      RS     100    STOR      -1       0
 514      RC    .050    .035    .050     900   .0060
 515      RX       0      .1      20      22      28      30      50    50.1
 516      RY     102     100      99      97      97      99     100     102

 517      KK     570      SUBBASIN 570 RUNOFF
 518      BA  .00492
 519      LS              77      20
 520      UD     .16

 521      KK     580      SUBBASIN 580 RUNOFF
 522      BA  .00575
 523      LS              77      20
 524      UD     .14

 525      KK     560      SUBBASIN 560 RUNOFF
 526      BA  .00386
 527      LS              77      20
 528      UD     .12
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  529     KK    C560      COMBINE C550 AND 560 AND 570 AND 580
  530     HC       4

  531     KK    C590      ROUTE C560 TO 590
  532     RS     100    STOR      -1       0
  533     RC    .050    .035    .050      55   .0030
  534     RX       0      .1      20    20.1      32    32.1      50    50.1
  535     RY     102     100      99      96      96      99     100     102

  536     KK     590      SUBBASIN 590 RUNOFF
  537     BA  .01931
  538     LS              77      20
  539     UD    0.21

  540     KK    C590      COMBINE C560 AND 590
  541     HC       2

  542     KK    C610      ROUTE C590 TO 610
  543     RS     100    STOR      -1       0
  544     RC    .050    .035    .050     600   .0030
  545     RX       0      .1      20      24      32      36      50    50.1
  546     RY     102     100      99      96      96      99     100     102

  547     KK     610      SUBBASIN 610 RUNOFF
  548     BA   .0035
  549     LS              77      20
  550     UD    0.06

  551     KK    C610      COMBINE 610 AND C590 AND C600
  552     HC       3

  553     KK    D310      RETRIEVE C310
  554     DR    D310

  555     KK    C320      ROUTE D310 TO 320
  556     RS     100    STOR      -1       0
  557     RC    .040    .016    .040    2100   .0060
  558     RX       0      24    24.1      40    40.1      56    56.1      80
  559     RY     101   98.93   98.61   98.97   98.97   98.62   98.92     101

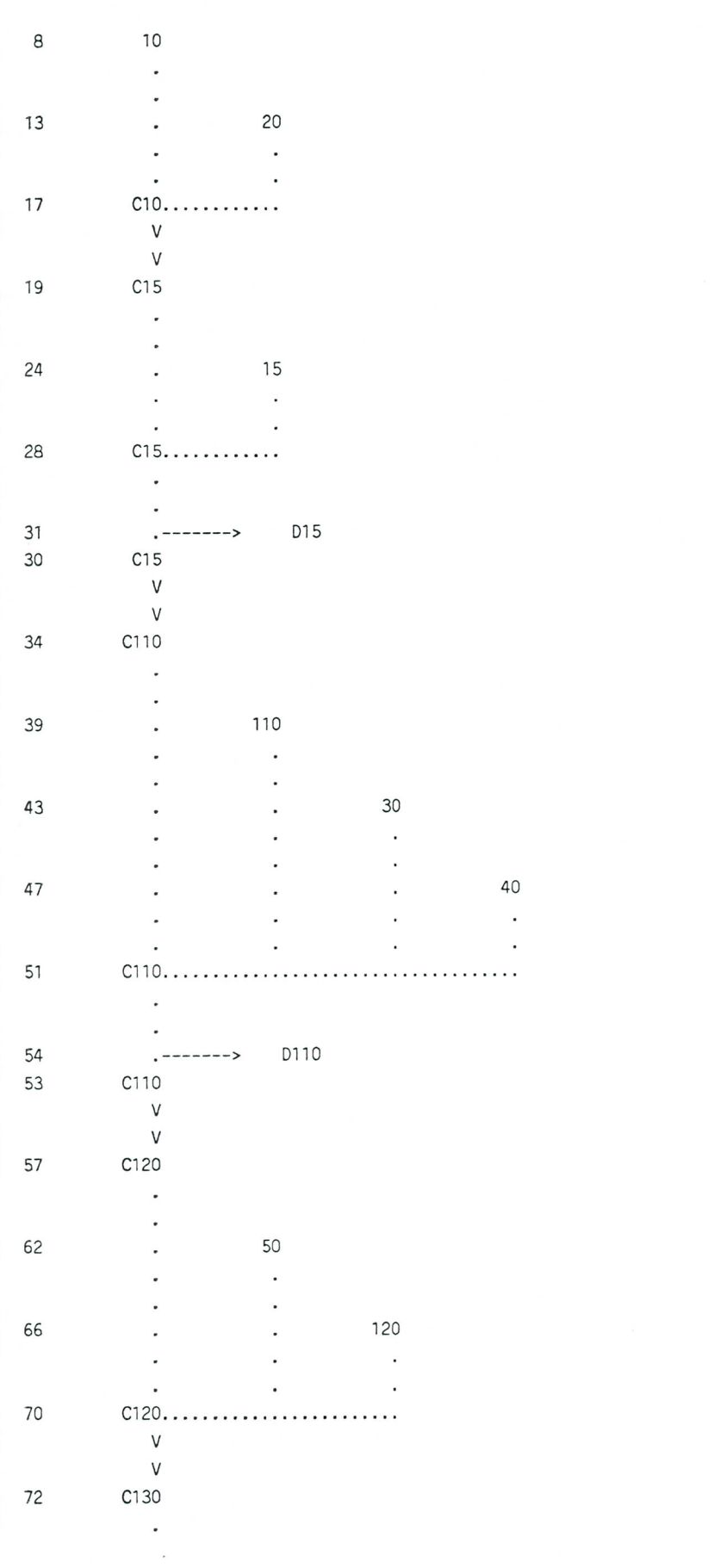
  560     KK     320      SUBBASIN 320 RUNOFF
  561     BA  .04294
  562     LS              77      20
  563     UD     .33

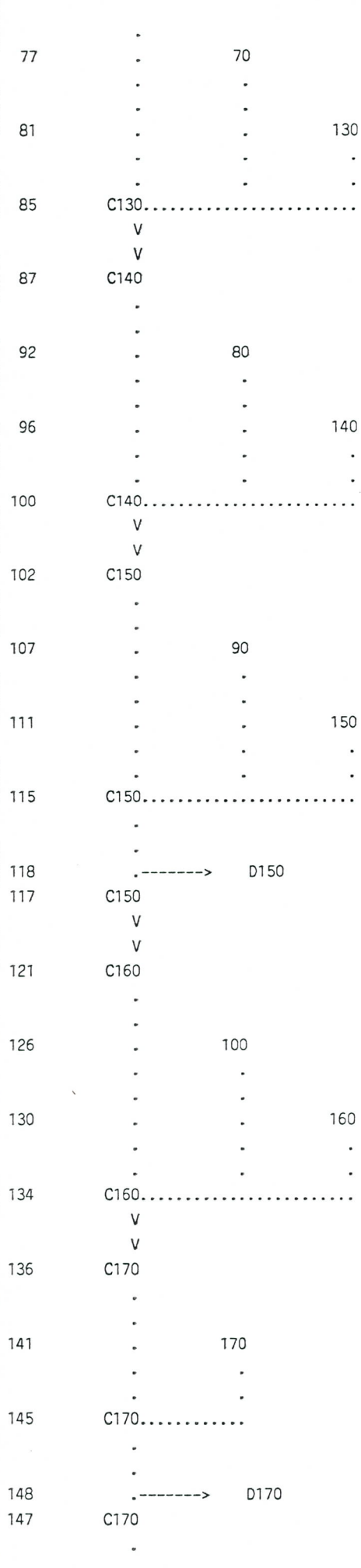
  564     KK    C320      COMBINE D310 AND 320
  565     HC       2
  566     ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING
(.) CONNECTOR
(---->) DIVERSION OR PUMP FLOW
(<----) RETURN OF DIVERTED OR PUMPED FLOW

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C130
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C140
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C140
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C150
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90
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115
C150
118
D150
117
C150
121
C160
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130
160
134
C160
136
C170
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145
C170
148
D170
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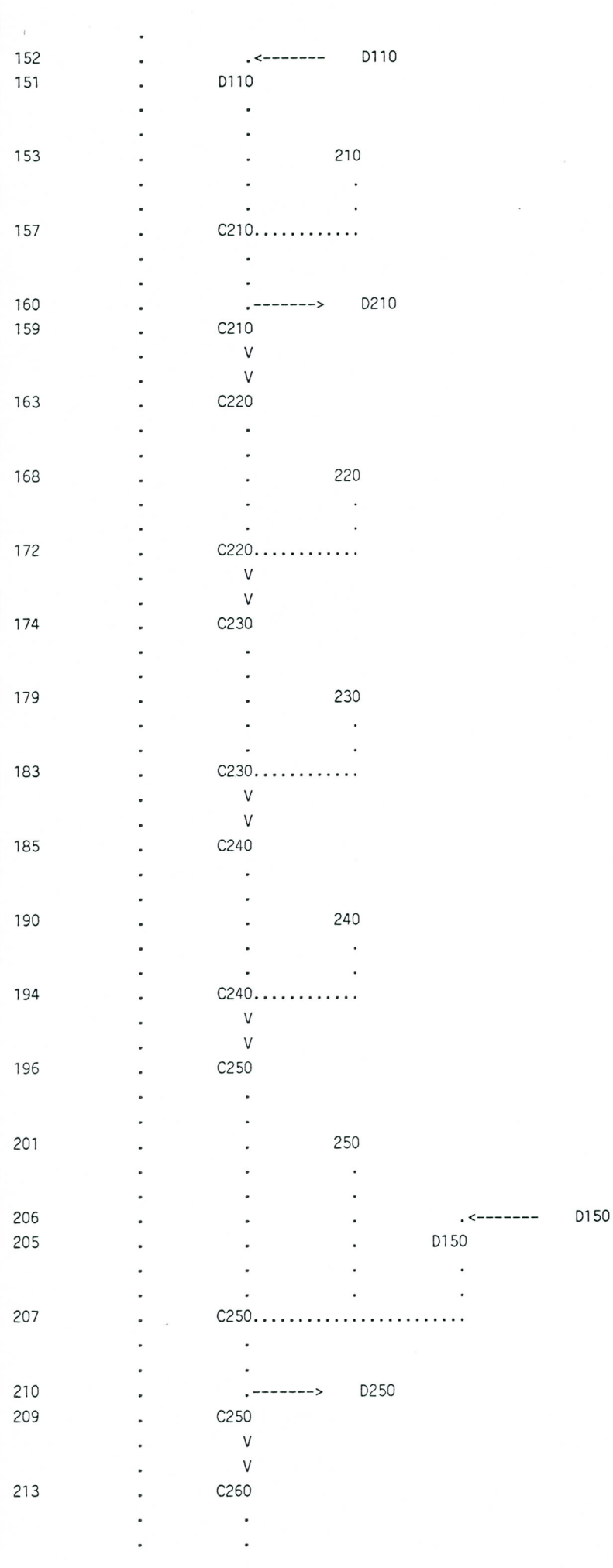
C170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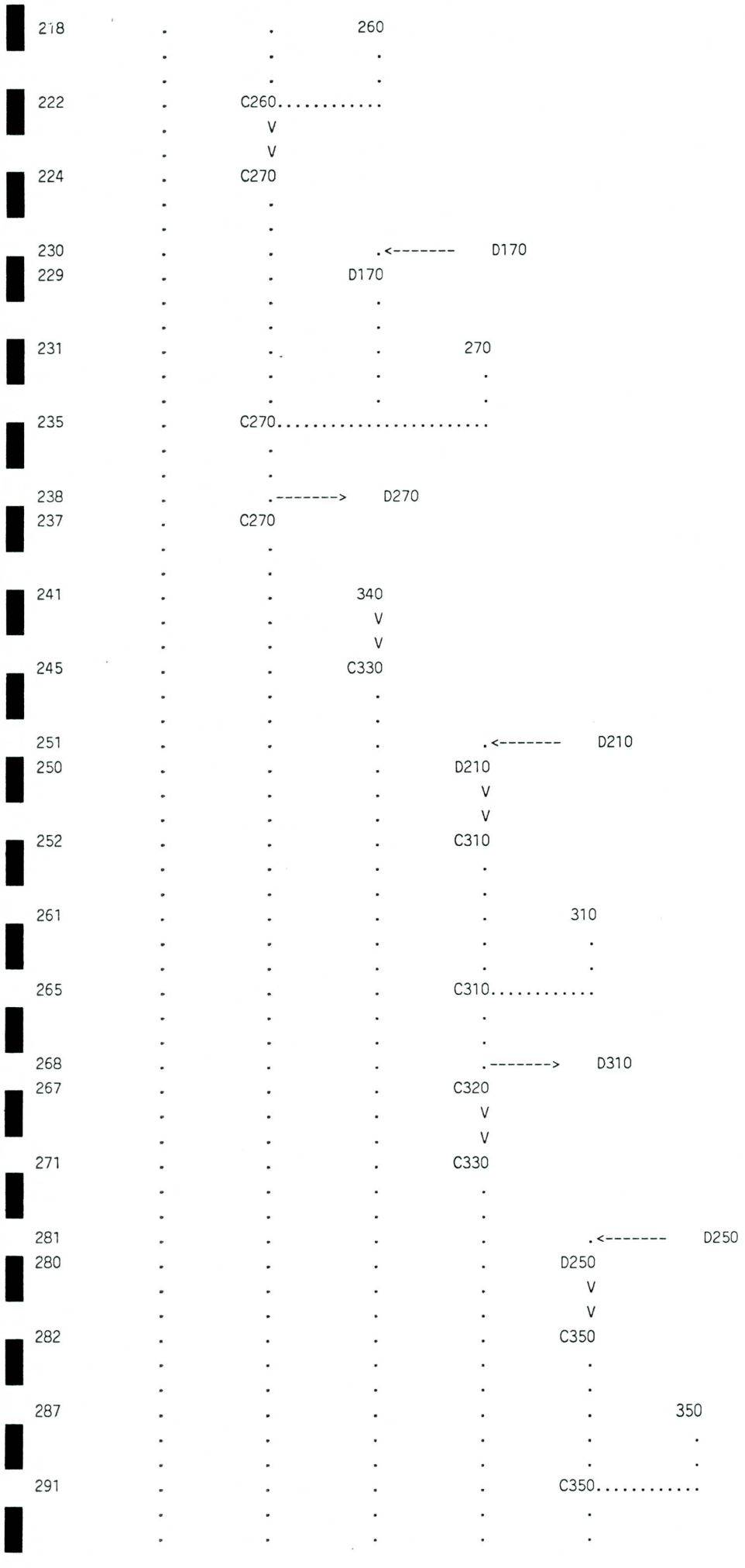
151 D110
153 210
157 C210.....
160 .--------> D210
159 C210
163 C220
168 220
172 C220.....
174 C230
179 230
183 C230.....
185 C240
190 240
194 C240.....
196 C250
201 250
206 .<-------- D150
205 D150
207 C250.....
210 .--------> D250
209 C250
213 C260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340
245
C330
251
D210
250
D210
252
C310
261
310
265
C310
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D310
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C320
271
C330
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D250
280
D250
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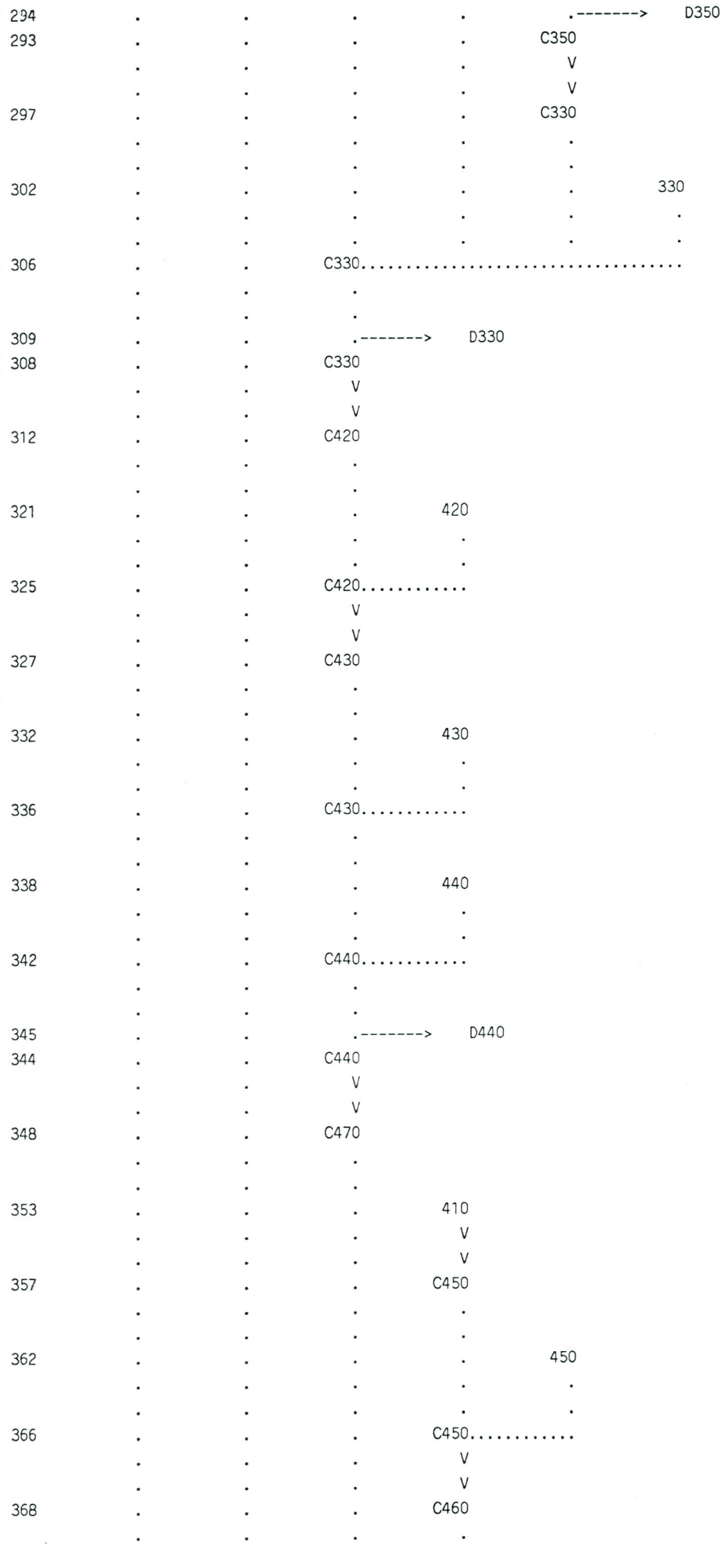
291
C350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366
368
C350
C330
330
C330
D330
C330
C420
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C420
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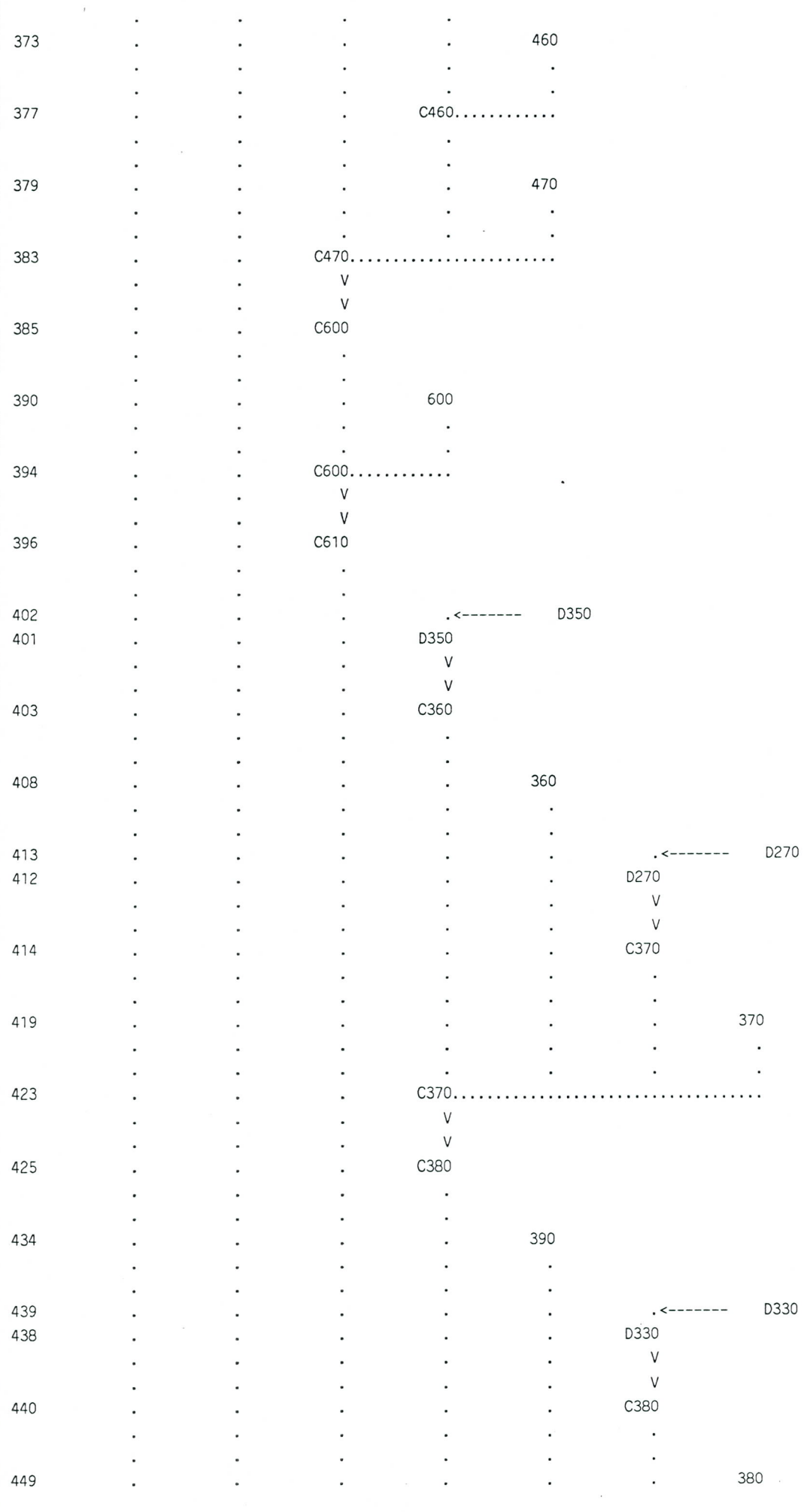
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C600
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C610
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D350
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D350
403
C360
408
360
413
D270
412
D270
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C370
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C380
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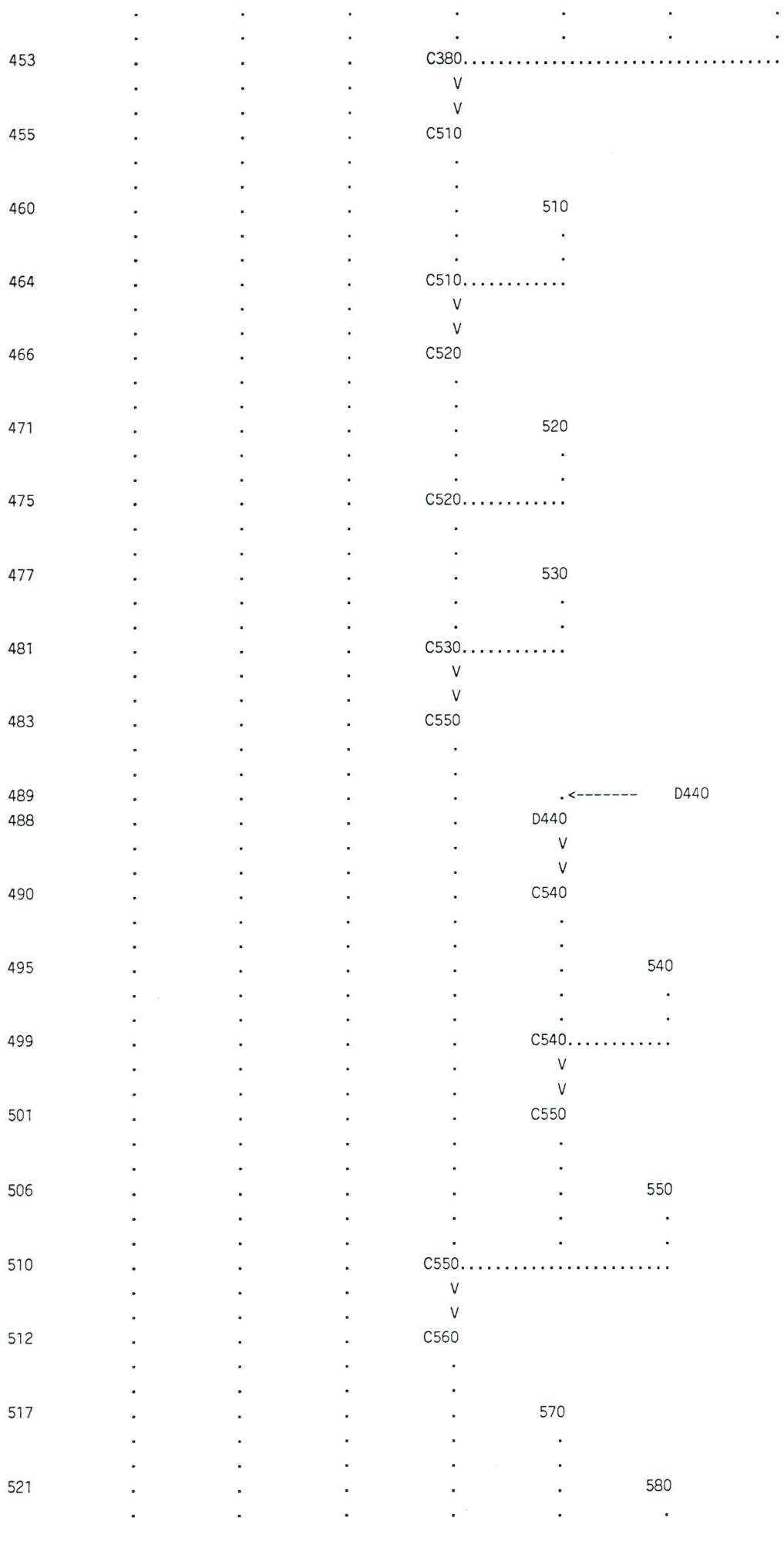
380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C550
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D440
488
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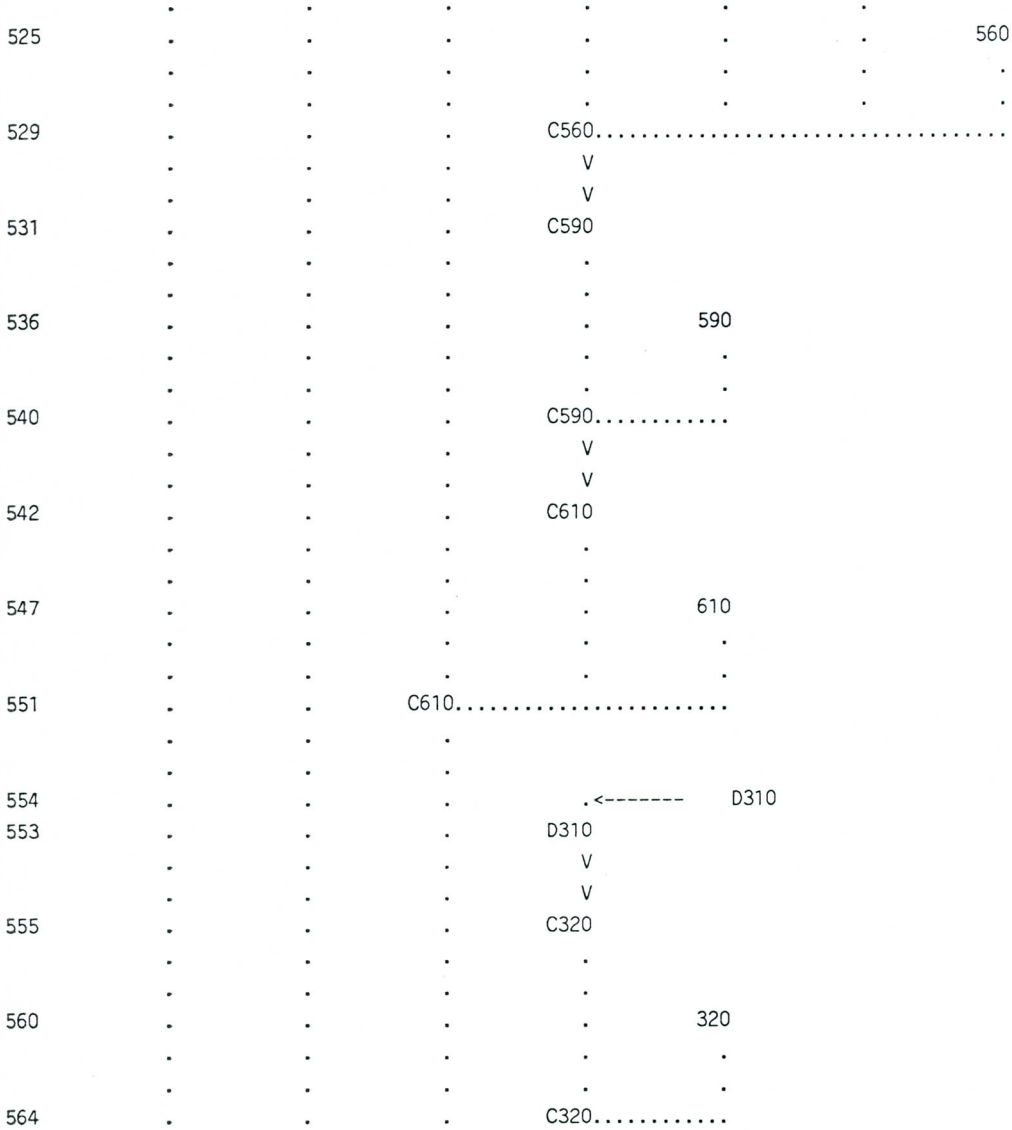

***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           SEPTEMBER 1990              *
*            VERSION 4.0                *
*                                       *
*  RUN DATE  10/05/1993  TIME  11:02:51 *
*                                       *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104              *
*                                       *
*****************************************
```

84TH STREET AND CHOLLA ROAD
2-5-10-25-50-100 yr STORM
EXISTING CONDITION --- NO IMPROVEMENTS
FILE CHEX.DAT

6 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		2	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	1	0	ENDING DATE
NDTIME		0958	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .03 HOURS
TOTAL TIME BASE 9.97 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

JP MULTI-PLAN OPTION

NPLAN	1	NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.36 .53 .62 .76 .88 1.00

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
					.36	.53	.62	.76	.88	1.00
YDROGRAPH AT	10	.01	1	FLOW	3.	7.	10.	13.	16.	19.
				TIME	3.13	3.13	3.13	3.13	3.13	3.13
YDROGRAPH AT	20	.00	1	FLOW	0.	1.	1.	2.	3.	4.
				TIME	3.37	3.30	3.30	3.27	3.27	3.27
2 COMBINED AT	C10	.01	1	FLOW	4.	8.	10.	14.	18.	22.
				TIME	3.13	3.13	3.13	3.13	3.13	3.13
OUTED TO	C15	.01	1	FLOW	5.	9.	11.	15.	19.	23.
				TIME	3.43	3.37	3.33	3.33	3.30	3.30
			** PEAK STAGES IN FEET **							
			1	STAGE	97.49	97.67	97.75	97.85	97.95	98.03
				TIME	3.43	3.37	3.33	3.33	3.30	3.30
YDROGRAPH AT	15	.01	1	FLOW	4.	8.	11.	15.	18.	22.
				TIME	3.13	3.10	3.10	3.10	3.10	3.10
2 COMBINED AT	C15	.01	1	FLOW	6.	11.	15.	20.	25.	30.
				TIME	3.43	3.37	3.33	3.30	3.30	3.30
DIVERSION TO	D15	.01	1	FLOW	6.	11.	15.	19.	19.	19.
				TIME	3.43	3.37	3.33	3.30	3.27	3.30
HYDROGRAPH AT	C15	.01	1	FLOW	0.	0.	0.	1.	6.	11.
				TIME	.03	.03	.03	3.30	3.30	3.30
ROUTED TO	C110	.01	1	FLOW	0.	0.	0.	0.	6.	13.
				TIME	.03	.03	.03	3.57	3.43	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	101.27	101.27	101.27	101.40	101.60	101.70
				TIME	.00	.00	.00	3.57	3.43	3.40
HYDROGRAPH AT	110	.00	1	FLOW	2.	2.	3.	3.	4.	5.
				TIME	3.10	3.10	3.10	3.10	3.10	3.10
HYDROGRAPH AT	30	.02	1	FLOW	2.	6.	9.	15.	20.	26.
				TIME	3.57	3.50	3.47	3.47	3.43	3.43
HYDROGRAPH AT	40	.03	1	FLOW	12.	20.	25.	33.	40.	47.
				TIME	3.47	3.47	3.47	3.47	3.47	3.47
4 COMBINED AT	C110	.07	1	FLOW	14.	26.	34.	48.	66.	85.
				TIME	3.47	3.47	3.47	3.47	3.43	3.40
IVERSION TO	D110	.07	1	FLOW	1.	8.	14.	21.	29.	36.
				TIME	3.47	3.47	3.47	3.47	3.43	3.40
YDROGRAPH AT	C110	.07	1	FLOW	13.	18.	20.	27.	38.	49.

				TIME	3.47	3.30	3.47	3.47	3.43	3.40
ROUTED TO	C120	.07	1	FLOW	13.	18.	20.	27.	38.	49.
				TIME	3.50	3.30	3.50	3.47	3.47	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	99.50	99.54	99.56	99.62	99.70	99.77
				TIME	3.50	3.30	3.50	3.47	3.47	3.40
HYDROGRAPH AT	50	.01	1	FLOW	4.	7.	8.	11.	14.	17.
				TIME	3.17	3.17	3.17	3.17	3.17	3.17
HYDROGRAPH AT	120	.00	1	FLOW	0.	0.	1.	1.	1.	1.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
3 COMBINED AT	C120	.08	1	FLOW	14.	23.	26.	31.	42.	56.
				TIME	3.43	3.30	3.23	3.40	3.47	3.40
ROUTED TO	C130	.08	1	FLOW	14.	22.	25.	31.	43.	55.
				TIME	3.47	3.30	3.23	3.43	3.47	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	99.04	99.13	99.15	99.19	99.27	99.34
				TIME	3.47	3.30	3.23	3.43	3.47	3.40
HYDROGRAPH AT	70	.01	1	FLOW	5.	9.	12.	16.	20.	25.
				TIME	3.23	3.23	3.23	3.23	3.23	3.23
HYDROGRAPH AT	130	.00	1	FLOW	1.	1.	1.	2.	2.	2.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
3 COMBINED AT	C130	.09	1	FLOW	17.	31.	38.	47.	55.	71.
				TIME	3.37	3.27	3.23	3.20	3.27	3.40
ROUTED TO	C140	.09	1	FLOW	17.	32.	38.	46.	55.	71.
				TIME	3.40	3.30	3.27	3.23	3.30	3.43
			** PEAK STAGES IN FEET **							
			1	STAGE	98.43	98.53	98.57	98.62	98.67	98.74
				TIME	3.40	3.30	3.27	3.23	3.30	3.43
HYDROGRAPH AT	80	.00	1	FLOW	1.	2.	3.	4.	4.	5.
				TIME	3.13	3.13	3.13	3.13	3.13	3.13
HYDROGRAPH AT	140	.00	1	FLOW	1.	1.	1.	1.	1.	2.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
3 COMBINED AT	C140	.09	1	FLOW	18.	33.	40.	50.	58.	72.
				TIME	3.30	3.30	3.27	3.20	3.23	3.43
ROUTED TO	C150	.09	1	FLOW	18.	33.	40.	50.	58.	72.
				TIME	3.40	3.33	3.30	3.23	3.23	3.37
			** PEAK STAGES IN FEET **							
			1	STAGE	97.70	97.83	97.87	97.93	97.97	98.04
				TIME	3.40	3.33	3.30	3.23	3.23	3.37
HYDROGRAPH AT	90	.03	1	FLOW	9.	18.	24.	34.	43.	53.
				TIME	3.27	3.30	3.30	3.27	3.27	3.27
HYDROGRAPH AT	150	.00	1	FLOW	1.	2.	2.	3.	3.	3.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07

3 COMBINED AT	C150	.12	1	FLOW	27.	51.	64.	84.	102.	124.
				TIME	3.30	3.30	3.30	3.27	3.30	3.30
DIVERSION TO	D150	.12	1	FLOW	2.	16.	27.	37.	46.	55.
				TIME	3.30	3.30	3.30	3.27	3.30	3.30
HYDROGRAPH AT	C150	.12	1	FLOW	25.	35.	37.	47.	56.	69.
				TIME	3.30	3.20	3.30	3.27	3.30	3.30
ROUTED TO	C160	.12	1	FLOW	26.	36.	37.	48.	56.	69.
				TIME	3.33	3.27	3.33	3.27	3.33	3.33
			** PEAK STAGES IN FEET **							
			1	STAGE	96.33	96.40	96.41	96.47	96.52	96.58
				TIME	3.33	3.27	3.33	3.27	3.33	3.33
HYDROGRAPH AT	100	.01	1	FLOW	3.	6.	8.	11.	14.	17.
				TIME	3.17	3.17	3.17	3.17	3.17	3.17
HYDROGRAPH AT	160	.00	1	FLOW	1.	2.	3.	3.	4.	4.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
3 COMBINED AT	C160	.13	1	FLOW	27.	41.	44.	56.	66.	80.
				TIME	3.33	3.23	3.20	3.27	3.27	3.30
ROUTED TO	C170	.13	1	FLOW	27.	41.	44.	56.	66.	81.
				TIME	3.37	3.27	3.23	3.30	3.27	3.27
			** PEAK STAGES IN FEET **							
			1	STAGE	95.37	95.49	95.51	95.59	95.66	95.74
				TIME	3.37	3.27	3.23	3.30	3.27	3.27
HYDROGRAPH AT	170	.00	1	FLOW	1.	2.	2.	3.	3.	4.
				TIME	3.10	3.10	3.10	3.10	3.10	3.10
2 COMBINED AT	C170	.13	1	FLOW	28.	42.	45.	56.	67.	82.
				TIME	3.37	3.27	3.23	3.30	3.27	3.27
DIVERSION TO	D170	.13	1	FLOW	20.	33.	35.	44.	53.	64.
				TIME	3.37	3.27	3.23	3.30	3.27	3.27
HYDROGRAPH AT	C170	.13	1	FLOW	8.	8.	9.	12.	14.	18.
				TIME	3.10	3.27	3.23	3.30	3.27	3.27
HYDROGRAPH AT	D110	.00	1	FLOW	1.	8.	14.	21.	29.	36.
				TIME	3.47	3.47	3.47	3.47	3.43	3.40
HYDROGRAPH AT	210	.00	1	FLOW	4.	6.	7.	9.	11.	12.
				TIME	3.13	3.13	3.13	3.13	3.13	3.13
2 COMBINED AT	C210	.00	1	FLOW	4.	10.	16.	23.	31.	39.
				TIME	3.13	3.47	3.43	3.43	3.43	3.40
DIVERSION TO	D210	.00	1	FLOW	0.	0.	1.	3.	5.	16.
				TIME	.03	3.47	3.43	3.43	3.43	3.40
HYDROGRAPH AT	C210	.00	1	FLOW	4.	9.	14.	20.	26.	27.
				TIME	3.13	3.47	3.43	3.43	3.43	3.30
ROUTED TO	C220	.00	1	FLOW	4.	9.	15.	20.	26.	27.
				TIME	3.17	3.47	3.47	3.47	3.47	3.30

			** PEAK STAGES IN FEET **							
			1	STAGE	99.39	99.49	99.57	99.62	99.66	99.67
				TIME	3.17	3.47	3.47	3.47	3.47	3.30
HYDROGRAPH AT	220	.00	1	FLOW	1.	1.	2.	2.	2.	3.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
2 COMBINED AT	C220	.00	1	FLOW	5.	9.	15.	21.	26.	28.
				TIME	3.13	3.47	3.47	3.47	3.47	3.30
ROUTED TO	C230	.00	1	FLOW	5.	9.	15.	21.	26.	27.
				TIME	3.20	3.53	3.47	3.47	3.47	3.33
			** PEAK STAGES IN FEET **							
			1	STAGE	98.92	99.01	99.10	99.15	99.19	99.20
				TIME	3.20	3.53	3.47	3.47	3.47	3.33
HYDROGRAPH AT	230	.00	1	FLOW	2.	3.	3.	4.	5.	6.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
2 COMBINED AT	C230	.00	1	FLOW	6.	10.	15.	21.	26.	28.
				TIME	3.17	3.53	3.47	3.47	3.47	3.33
ROUTED TO	C240	.00	1	FLOW	6.	10.	15.	21.	26.	29.
				TIME	3.23	3.60	3.53	3.47	3.50	3.37
			** PEAK STAGES IN FEET **							
			1	STAGE	98.25	98.31	98.40	98.45	98.49	98.51
				TIME	3.23	3.60	3.53	3.47	3.50	3.37
HYDROGRAPH AT	240	.00	1	FLOW	2.	2.	3.	3.	4.	5.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
2 COMBINED AT	C240	.01	1	FLOW	7.	10.	15.	22.	27.	29.
				TIME	3.20	3.20	3.53	3.47	3.50	3.37
ROUTED TO	C250	.01	1	FLOW	7.	11.	16.	22.	27.	29.
				TIME	3.30	3.27	3.57	3.53	3.57	3.43
			** PEAK STAGES IN FEET **							
			1	STAGE	97.61	97.67	97.75	97.81	97.85	97.87
				TIME	3.30	3.27	3.57	3.53	3.57	3.43
HYDROGRAPH AT	250	.00	1	FLOW	3.	5.	6.	7.	8.	9.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
HYDROGRAPH AT	D150	.00	1	FLOW	2.	16.	27.	37.	46.	55.
				TIME	3.30	3.30	3.30	3.27	3.30	3.30
3 COMBINED AT	C250	.01	1	FLOW	9.	27.	41.	55.	70.	85.
				TIME	3.27	3.30	3.27	3.27	3.30	3.30
DIVERSION TO	D250	.01	1	FLOW	2.	8.	11.	16.	22.	32.
				TIME	3.27	3.30	3.27	3.27	3.30	3.30
HYDROGRAPH AT	C250	.01	1	FLOW	7.	20.	29.	39.	48.	53.
				TIME	3.27	3.30	3.27	3.27	3.30	3.30
ROUTED TO	C260	.01	1	FLOW	7.	19.	29.	39.	49.	53.
				TIME	3.33	3.30	3.30	3.30	3.37	3.33

			** PEAK STAGES IN FEET **							
			1	STAGE	96.12	96.28	96.36	96.42	96.47	96.50
				TIME	3.33	3.30	3.30	3.30	3.37	3.33
HYDROGRAPH AT	260	.00	1	FLOW	4.	6.	7.	9.	10.	11.
				TIME	3.10	3.10	3.10	3.10	3.10	3.10
2 COMBINED AT	C260	.01	1	FLOW	8.	21.	31.	41.	51.	56.
				TIME	3.30	3.30	3.27	3.30	3.27	3.23
ROUTED TO	C270	.01	1	FLOW	8.	21.	32.	42.	50.	56.
				TIME	3.37	3.33	3.30	3.27	3.33	3.30
			** PEAK STAGES IN FEET **							
			1	STAGE	94.61	94.80	94.91	94.97	95.03	95.07
				TIME	3.37	3.33	3.30	3.27	3.33	3.30
HYDROGRAPH AT	D170	.00	1	FLOW	20.	33.	35.	44.	53.	64.
				TIME	3.37	3.27	3.23	3.30	3.27	3.27
HYDROGRAPH AT	270	.00	1	FLOW	2.	3.	4.	5.	5.	6.
				TIME	3.07	3.07	3.07	3.07	3.07	3.07
3 COMBINED AT	C270	.01	1	FLOW	28.	53.	66.	86.	104.	122.
				TIME	3.37	3.30	3.30	3.30	3.30	3.27
DIVERSION TO	D270	.01	1	FLOW	28.	52.	65.	85.	103.	116.
				TIME	3.37	3.30	3.30	3.30	3.30	3.27
HYDROGRAPH AT	C270	.01	1	FLOW	0.	1.	1.	1.	1.	5.
				TIME	3.37	3.30	3.30	3.30	3.30	3.27
HYDROGRAPH AT	340	.01	1	FLOW	3.	7.	10.	14.	18.	22.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
ROUTED TO	C330	.01	1	FLOW	3.	7.	10.	14.	18.	23.
				TIME	3.30	3.27	3.23	3.23	3.27	3.23
			** PEAK STAGES IN FEET **							
			1	STAGE	82.23	82.32	82.36	82.41	82.46	82.50
				TIME	3.30	3.27	3.23	3.23	3.27	3.23
HYDROGRAPH AT	D210	.00	1	FLOW	0.	0.	1.	3.	5.	16.
				TIME	.03	3.47	3.43	3.43	3.43	3.40
ROUTED TO	C310	.00	1	FLOW	0.	1.	1.	3.	5.	16.
				TIME	.03	3.50	3.50	3.50	3.50	3.43
			** PEAK STAGES IN FEET **							
			1	STAGE	99.68	99.79	99.83	99.89	99.95	100.09
				TIME	.00	3.50	3.50	3.50	3.50	3.43
HYDROGRAPH AT	310	.02	1	FLOW	5.	11.	15.	22.	28.	35.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
2 COMBINED AT	C310	.02	1	FLOW	5.	11.	15.	23.	29.	37.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
DIVERSION TO	D310	.02	1	FLOW	3.	6.	8.	11.	15.	19.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
HYDROGRAPH AT	C320	.02	1	FLOW	3.	6.	8.	11.	15.	19.

				TIME	3.20	3.20	3.20	3.20	3.20	3.20
ROUTED TO	C330	.02	1	FLOW	3.	6.	8.	11.	17.	21.
				TIME	3.47	3.47	3.43	3.40	3.37	3.33
			**	PEAK STAGES IN FEET **						
			1	STAGE	99.87	99.93	99.96	100.00	100.05	100.08
				TIME	3.47	3.47	3.43	3.40	3.37	3.33
HYDROGRAPH AT	D250	.00	1	FLOW	2.	8.	11.	16.	22.	32.
				TIME	3.27	3.30	3.27	3.27	3.30	3.30
ROUTED TO	C350	.00	1	FLOW	2.	7.	12.	16.	22.	32.
				TIME	3.33	3.33	3.30	3.23	3.37	3.33
			**	PEAK STAGES IN FEET **						
			1	STAGE	98.80	98.91	98.98	99.02	99.06	99.14
				TIME	3.33	3.33	3.30	3.23	3.37	3.33
HYDROGRAPH AT	350	.00	1	FLOW	1.	2.	3.	4.	6.	7.
				TIME	3.10	3.10	3.10	3.10	3.10	3.10
2 COMBINED AT	C350	.00	1	FLOW	3.	8.	13.	18.	23.	34.
				TIME	3.33	3.33	3.30	3.23	3.37	3.33
DIVERSION TO	D350	.00	1	FLOW	1.	4.	6.	9.	12.	17.
				TIME	3.33	3.33	3.30	3.23	3.37	3.33
HYDROGRAPH AT	C350	.00	1	FLOW	1.	4.	6.	9.	12.	17.
				TIME	3.33	3.33	3.30	3.23	3.37	3.33
ROUTED TO	C330	.00	1	FLOW	1.	4.	7.	9.	12.	17.
				TIME	3.77	3.63	3.57	3.53	3.50	3.43
			**	PEAK STAGES IN FEET **						
			1	STAGE	99.82	99.90	99.94	99.97	100.01	100.05
				TIME	3.77	3.63	3.57	3.53	3.50	3.43
HYDROGRAPH AT	330	.06	1	FLOW	13.	27.	36.	51.	65.	81.
				TIME	3.43	3.47	3.47	3.47	3.47	3.43
4 COMBINED AT	C330	.09	1	FLOW	18.	39.	52.	77.	98.	127.
				TIME	3.47	3.50	3.47	3.47	3.43	3.43
DIVERSION TO	D330	.09	1	FLOW	4.	8.	10.	15.	20.	25.
				TIME	3.47	3.50	3.47	3.47	3.43	3.43
HYDROGRAPH AT	C330	.09	1	FLOW	15.	31.	42.	62.	79.	102.
				TIME	3.47	3.50	3.47	3.47	3.43	3.43
ROUTED TO	C420	.09	1	FLOW	15.	31.	42.	61.	79.	102.
				TIME	3.50	3.53	3.50	3.47	3.50	3.47
			**	PEAK STAGES IN FEET **						
			1	STAGE	100.30	100.50	100.61	100.78	100.91	101.06
				TIME	3.50	3.53	3.50	3.47	3.50	3.47
HYDROGRAPH AT	420	.02	1	FLOW	5.	10.	14.	20.	25.	31.
				TIME	3.27	3.27	3.27	3.27	3.27	3.27
2 COMBINED AT	C420	.11	1	FLOW	17.	37.	50.	73.	96.	121.
				TIME	3.50	3.47	3.47	3.47	3.40	3.40

ROUTED TO	C430	.11	1	FLOW	17.	37.	50.	74.	96.	122.
				TIME	3.57	3.50	3.50	3.50	3.47	3.43
			** PEAK STAGES IN FEET **							
			1	STAGE	100.34	100.56	100.69	100.87	101.03	101.18
				TIME	3.57	3.50	3.50	3.50	3.47	3.43
HYDROGRAPH AT	430	.02	1	FLOW	6.	13.	18.	26.	33.	41.
				TIME	3.23	3.27	3.27	3.27	3.23	3.23
2 COMBINED AT	C430	.13	1	FLOW	21.	44.	60.	88.	117.	148.
				TIME	3.40	3.47	3.47	3.43	3.43	3.40
HYDROGRAPH AT	440	.01	1	FLOW	3.	5.	7.	10.	13.	16.
				TIME	3.17	3.20	3.20	3.20	3.17	3.17
2 COMBINED AT	C440	.14	1	FLOW	23.	47.	63.	92.	122.	155.
				TIME	3.40	3.37	3.47	3.43	3.43	3.40
DIVERSION TO	D440	.14	1	FLOW	7.	14.	19.	28.	37.	47.
				TIME	3.40	3.37	3.47	3.43	3.43	3.40
HYDROGRAPH AT	C440	.14	1	FLOW	16.	33.	44.	64.	85.	109.
				TIME	3.40	3.37	3.47	3.43	3.43	3.40
ROUTED TO	C470	.14	1	FLOW	16.	33.	44.	64.	85.	109.
				TIME	3.50	3.47	3.43	3.50	3.50	3.47
			** PEAK STAGES IN FEET **							
			1	STAGE	100.03	100.13	100.19	100.28	100.36	100.43
				TIME	3.50	3.47	3.43	3.50	3.50	3.47
HYDROGRAPH AT	410	.04	1	FLOW	11.	22.	29.	41.	53.	65.
				TIME	3.37	3.37	3.37	3.37	3.37	3.37
ROUTED TO	C450	.04	1	FLOW	11.	21.	29.	41.	53.	65.
				TIME	3.37	3.37	3.37	3.37	3.37	3.37
			** PEAK STAGES IN FEET **							
			1	STAGE	101.71	101.83	101.89	101.98	102.06	102.13
				TIME	3.37	3.37	3.37	3.37	3.37	3.37
HYDROGRAPH AT	450	.01	1	FLOW	2.	5.	6.	9.	12.	14.
				TIME	3.27	3.27	3.27	3.27	3.27	3.27
2 COMBINED AT	C450	.05	1	FLOW	13.	26.	34.	49.	63.	78.
				TIME	3.37	3.37	3.37	3.37	3.37	3.33
ROUTED TO	C460	.05	1	FLOW	13.	26.	34.	49.	63.	78.
				TIME	3.40	3.40	3.43	3.40	3.40	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	101.73	101.87	101.93	102.04	102.12	102.20
				TIME	3.40	3.40	3.43	3.40	3.40	3.40
HYDROGRAPH AT	460	.01	1	FLOW	1.	5.	8.	14.	19.	24.
				TIME	3.30	3.23	3.23	3.20	3.20	3.20
2 COMBINED AT	C460	.07	1	FLOW	14.	29.	39.	57.	74.	92.
				TIME	3.40	3.40	3.37	3.37	3.37	3.37

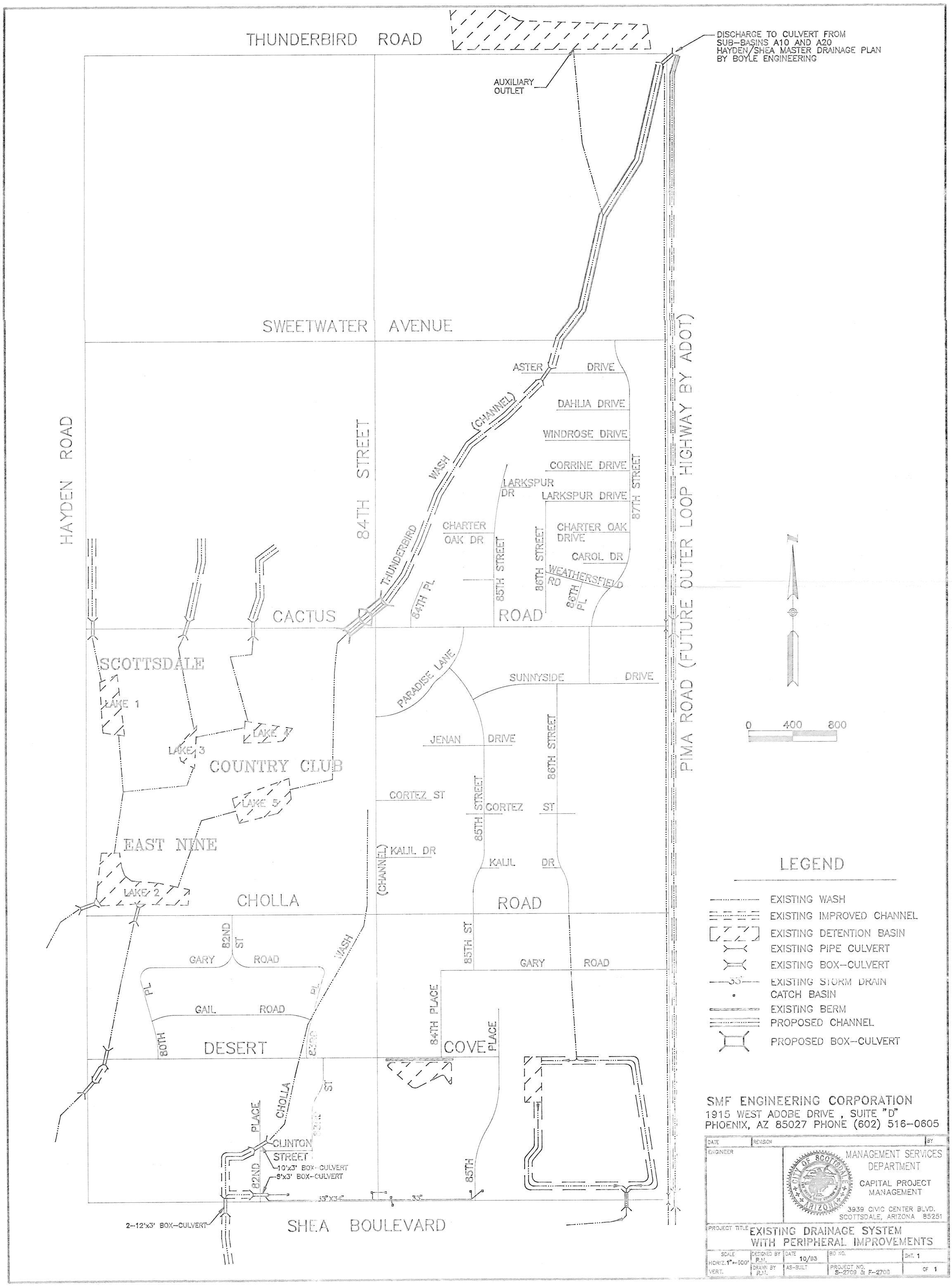
HYDROGRAPH AT	470	.01	1	FLOW	10.	15.	18.	22.	26.	29.
				TIME	3.17	3.17	3.17	3.17	3.17	3.17
3 COMBINED AT	C470	.21	1	FLOW	32.	66.	89.	130.	167.	206.
				TIME	3.40	3.40	3.40	3.37	3.37	3.37
ROUTED TO	C600	.21	1	FLOW	33.	67.	90.	129.	166.	207.
				TIME	3.50	3.47	3.47	3.43	3.43	3.43
			** PEAK STAGES IN FEET **							
			1	STAGE	101.92	102.14	102.26	102.44	102.58	102.73
				TIME	3.50	3.47	3.47	3.43	3.43	3.43
HYDROGRAPH AT	600	.03	1	FLOW	8.	17.	23.	33.	43.	53.
				TIME	3.27	3.30	3.30	3.30	3.27	3.27
2 COMBINED AT	C600	.24	1	FLOW	38.	79.	106.	155.	201.	248.
				TIME	3.50	3.47	3.43	3.40	3.40	3.40
ROUTED TO	C610	.24	1	FLOW	38.	79.	106.	155.	201.	249.
				TIME	3.50	3.47	3.47	3.43	3.40	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	97.03	97.55	97.82	98.23	98.56	98.86
				TIME	3.50	3.47	3.47	3.43	3.40	3.40
HYDROGRAPH AT	D350	.00	1	FLOW	1.	4.	6.	9.	12.	17.
				TIME	3.33	3.33	3.30	3.23	3.37	3.33
ROUTED TO	C360	.00	1	FLOW	1.	4.	7.	9.	12.	17.
				TIME	3.47	3.47	3.40	3.37	3.37	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	98.76	98.86	98.90	98.94	98.98	99.03
				TIME	3.47	3.47	3.40	3.37	3.37	3.40
HYDROGRAPH AT	360	.01	1	FLOW	5.	10.	13.	19.	24.	30.
				TIME	3.17	3.20	3.20	3.20	3.17	3.17
HYDROGRAPH AT	D270	.00	1	FLOW	28.	52.	65.	85.	103.	116.
				TIME	3.37	3.30	3.30	3.30	3.30	3.27
ROUTED TO	C370	.00	1	FLOW	27.	52.	66.	85.	102.	116.
				TIME	3.40	3.37	3.33	3.30	3.33	3.33
			** PEAK STAGES IN FEET **							
			1	STAGE	99.04	99.17	99.23	99.29	99.35	99.40
				TIME	3.40	3.37	3.33	3.30	3.33	3.33
HYDROGRAPH AT	370	.01	1	FLOW	2.	5.	6.	9.	12.	15.
				TIME	3.13	3.17	3.17	3.13	3.13	3.13
4 COMBINED AT	C370	.02	1	FLOW	32.	62.	81.	110.	136.	160.
				TIME	3.37	3.33	3.33	3.30	3.27	3.23
ROUTED TO	C380	.02	1	FLOW	32.	62.	80.	111.	137.	161.
				TIME	3.43	3.40	3.37	3.33	3.33	3.30
			** PEAK STAGES IN FEET **							
			1	STAGE	99.03	99.16	99.22	99.31	99.38	99.44
				TIME	3.43	3.40	3.37	3.33	3.33	3.30

HYDROGRAPH AT	390	.01	1	FLOW	1.	3.	5.	9.	12.	15.
				TIME	3.33	3.27	3.23	3.23	3.23	3.23
HYDROGRAPH AT	D330	.00	1	FLOW	4.	8.	10.	15.	20.	25.
				TIME	3.47	3.50	3.47	3.47	3.43	3.43
ROUTED TO	C380	.00	1	FLOW	4.	8.	11.	16.	20.	25.
				TIME	3.63	3.57	3.53	3.53	3.50	3.50
			** PEAK STAGES IN FEET **							
			1	STAGE	82.21	82.29	82.34	82.39	82.42	82.47
				TIME	3.63	3.57	3.53	3.53	3.50	3.50
HYDROGRAPH AT	380	.05	1	FLOW	14.	30.	40.	57.	74.	91.
				TIME	3.23	3.23	3.23	3.23	3.23	3.23
4 COMBINED AT	C380	.07	1	FLOW	44.	91.	120.	173.	222.	270.
				TIME	3.40	3.33	3.37	3.33	3.30	3.30
ROUTED TO	C510	.07	1	FLOW	45.	92.	120.	173.	220.	269.
				TIME	3.43	3.40	3.37	3.33	3.33	3.33
			** PEAK STAGES IN FEET **							
			1	STAGE	97.91	98.56	98.86	99.27	99.55	99.80
				TIME	3.43	3.40	3.37	3.33	3.33	3.33
HYDROGRAPH AT	510	.01	1	FLOW	5.	10.	14.	20.	26.	32.
				TIME	3.10	3.10	3.10	3.10	3.10	3.10
2 COMBINED AT	C510	.08	1	FLOW	46.	94.	124.	178.	226.	277.
				TIME	3.43	3.40	3.37	3.33	3.33	3.33
ROUTED TO	C520	.08	1	FLOW	46.	94.	123.	178.	228.	281.
				TIME	3.47	3.43	3.43	3.40	3.37	3.33
			** PEAK STAGES IN FEET **							
			1	STAGE	98.29	99.07	99.37	99.81	100.12	100.39
				TIME	3.47	3.43	3.43	3.40	3.37	3.33
HYDROGRAPH AT	520	.01	1	FLOW	6.	12.	16.	23.	30.	37.
				TIME	3.13	3.13	3.13	3.13	3.13	3.13
2 COMBINED AT	C520	.10	1	FLOW	47.	98.	128.	185.	238.	295.
				TIME	3.47	3.43	3.33	3.40	3.37	3.33
HYDROGRAPH AT	530	.01	1	FLOW	3.	6.	8.	11.	14.	18.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
2 COMBINED AT	C530	.11	1	FLOW	49.	100.	133.	191.	246.	306.
				TIME	3.47	3.43	3.33	3.40	3.37	3.33
ROUTED TO	C550	.11	1	FLOW	49.	100.	133.	190.	244.	305.
				TIME	3.50	3.37	3.37	3.33	3.40	3.37
			** PEAK STAGES IN FEET **							
			1	STAGE	98.11	98.85	99.17	99.58	99.89	100.16
				TIME	3.50	3.37	3.37	3.33	3.40	3.37
HYDROGRAPH AT	D440	.00	1	FLOW	7.	14.	19.	28.	37.	47.
				TIME	3.40	3.37	3.47	3.43	3.43	3.40
ROUTED TO	C540	.00	1	FLOW	7.	14.	19.	28.	37.	47.

				TIME	3.47	3.43	3.40	3.50	3.47	3.43
			** PEAK STAGES IN FEET **							
			1	STAGE	100.08	100.17	100.21	100.29	100.35	100.42
				TIME	3.47	3.43	3.40	3.50	3.47	3.43
HYDROGRAPH AT	540	.01	1	FLOW	2.	4.	5.	8.	10.	12.
				TIME	3.17	3.17	3.17	3.17	3.17	3.17
2 COMBINED AT	C540	.01	1	FLOW	8.	16.	21.	31.	40.	51.
				TIME	3.47	3.43	3.37	3.37	3.33	3.43
ROUTED TO	C550	.01	1	FLOW	8.	16.	21.	31.	40.	50.
				TIME	3.50	3.47	3.40	3.37	3.33	3.47
			** PEAK STAGES IN FEET **							
			1	STAGE	100.08	100.17	100.21	100.29	100.35	100.41
				TIME	3.50	3.47	3.40	3.37	3.33	3.47
HYDROGRAPH AT	550	.01	1	FLOW	3.	6.	8.	12.	16.	20.
				TIME	3.10	3.13	3.13	3.10	3.10	3.10
3 COMBINED AT	C550	.12	1	FLOW	57.	117.	157.	224.	288.	360.
				TIME	3.50	3.37	3.37	3.33	3.37	3.37
ROUTED TO	C560	.12	1	FLOW	56.	118.	159.	227.	289.	358.
				TIME	3.57	3.47	3.43	3.40	3.40	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	98.84	99.59	99.90	100.25	100.51	100.76
				TIME	3.57	3.47	3.43	3.40	3.40	3.40
HYDROGRAPH AT	570	.00	1	FLOW	2.	3.	5.	7.	8.	10.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
HYDROGRAPH AT	580	.01	1	FLOW	2.	4.	6.	8.	10.	13.
				TIME	3.17	3.20	3.20	3.20	3.17	3.17
HYDROGRAPH AT	560	.00	1	FLOW	1.	3.	4.	6.	8.	9.
				TIME	3.17	3.17	3.17	3.17	3.17	3.17
4 COMBINED AT	C560	.13	1	FLOW	58.	122.	165.	237.	301.	372.
				TIME	3.53	3.47	3.43	3.40	3.40	3.40
ROUTED TO	C590	.13	1	FLOW	58.	122.	165.	237.	302.	372.
				TIME	3.57	3.47	3.43	3.40	3.40	3.37
			** PEAK STAGES IN FEET **							
			1	STAGE	97.71	98.82	99.38	99.99	100.38	100.73
				TIME	3.57	3.47	3.43	3.40	3.40	3.37
HYDROGRAPH AT	590	.02	1	FLOW	6.	11.	15.	22.	29.	35.
				TIME	3.27	3.27	3.27	3.27	3.27	3.27
2 COMBINED AT	C590	.15	1	FLOW	61.	129.	176.	254.	323.	401.
				TIME	3.57	3.47	3.43	3.40	3.40	3.37
ROUTED TO	C610	.15	1	FLOW	61.	129.	176.	253.	326.	404.
				TIME	3.60	3.47	3.47	3.47	3.43	3.40
			** PEAK STAGES IN FEET **							
			1	STAGE	97.94	98.94	99.39	99.93	100.31	100.66

				TIME	3.60	3.47	3.47	3.47	3.43	3.40
HYDROGRAPH AT	610	.00	1	FLOW	2.	3.	5.	7.	9.	11.
				TIME	3.10	3.10	3.10	3.10	3.10	3.10
3 COMBINED AT	C610	.40	1	FLOW	96.	209.	283.	408.	526.	655.
				TIME	3.60	3.47	3.47	3.43	3.43	3.40
HYDROGRAPH AT	D310	.00	1	FLOW	3.	6.	8.	11.	15.	19.
				TIME	3.20	3.20	3.20	3.20	3.20	3.20
ROUTED TO	C320	.00	1	FLOW	3.	6.	9.	12.	14.	20.
				TIME	3.53	3.47	3.43	3.40	3.37	3.37
			** PEAK STAGES IN FEET **							
			1	STAGE	98.79	98.88	98.91	98.95	98.98	99.02
				TIME	3.53	3.47	3.43	3.40	3.37	3.37
HYDROGRAPH AT	320	.04	1	FLOW	10.	20.	26.	38.	49.	60.
				TIME	3.40	3.40	3.40	3.40	3.40	3.40
2 COMBINED AT	C320	.04	1	FLOW	12.	25.	35.	50.	63.	80.
				TIME	3.43	3.47	3.43	3.40	3.40	3.37

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



SMF ENGINEERING CORPORATION
1915 WEST ADOBE DRIVE , SUITE "D"
PHOENIX, AZ 85027 PHONE (602) 516-0605

DATE	REVISION	BY

ENGINEER

MANAGEMENT SERVICES DEPARTMENT
CAPITAL PROJECT MANAGEMENT
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE: EXISTING DRAINAGE SYSTEM WITH PERIPHERAL IMPROVEMENTS

SCALE	DESIGNED BY	DATE	BID NO.	SHT.
HORIZ. 1"=400'	R.M.	10/93		1
VERT.	DRAWN BY R.M.	AS-BUILT	PROJECT NO. S-2709 & F-2708	OF 1