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MASTER DRAINAGE REPORT

FOR

DEL WEBB'S GRAND AVENUE PROPERTY

Prepared For

DEL E. WEBB DEVELOPMENT CO. L.P.,
a Delaware Limited Partnership,
Developer

DEL WEBB HOME CONSTRUCTION, INC.
an Arizona Corporation,
Owner

Prepared By

STANLEY CONSULTANTS, INC.
2929 E. Camelback Road, Suite 130
Phoenix, Arizona 85016
(602) 912-6500

December, 1994

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
26837
G. SCOTT
BUCHANAN
Date Signed 12-22-94
ARIZONA, U.S.A.

December, 1994

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EXHIBITS

Exhibit A, Existing Condition HEC-1 Watershed Map ..... Appendix A
Exhibit B, Developed Condition Soil Hydraulic Conductivity ..... Appendix A
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- Exhibit A Existing Condition HEC-1 Watershed Map
- Exhibit B Developed Condition Soil Hydraulic Conductivity
- Exhibit C Developed Condition HEC-1 Watershed Map
- Exhibit D Phase I Developed Condition HEC-1 Watershed Map
- Computer Model Input Files

Appendix B Existing Condition HEC-1 Printout and Supporting Calculations
Appendix C Proposed Completely Developed Drainage System HEC-1 Printout and Supporting Calculations
Appendix D Proposed Phase I Drainage HEC-1 Printout and Supporting Calculations
Appendix E Design Criteria and Development Agreement with City of Surprise
Appendix F Summary of Findings Regarding McMicken Dam

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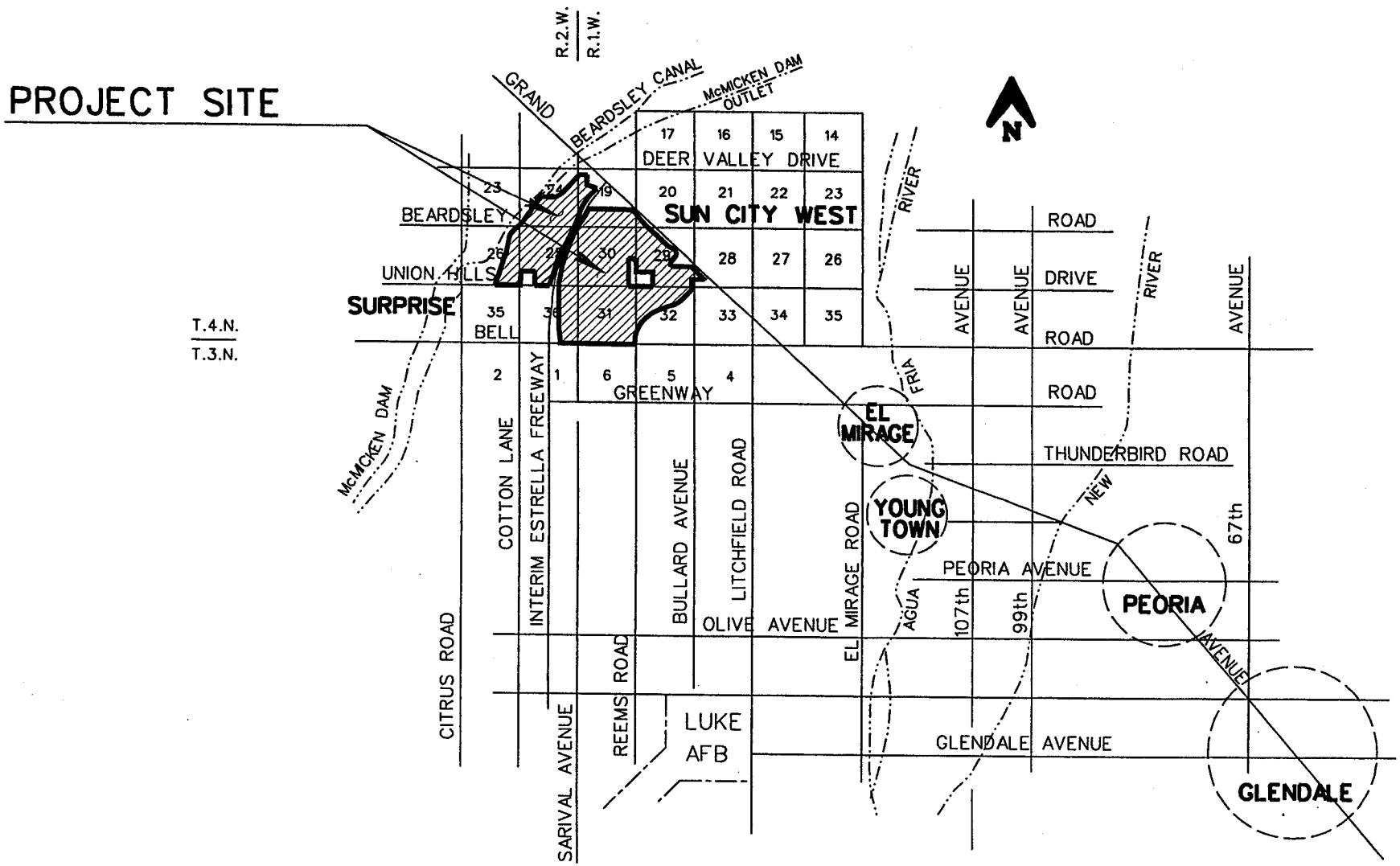
INTRODUCTION

Del Webb's Grand Avenue Property is a proposed master planned (primarily) residential development project. It consists of approximately 3700 acres located in Township 4 North, Range 1 West within the incorporated limits of the City of Surprise, Arizona. The proposed development is roughly bounded by the Beardsley Canal on the northwest, Grand Avenue (hereafter referred to as HWY 60-89) on the northeast, Bullard Avenue (alignment) on the east, Bell Road on the south and the Interim Estrella Freeway (hereafter referred to as SR 303L) and Union Hills Drive to the southwest. There are exception parcels within this project boundary which are not part of the Del Webb Grand Avenue Property development. Refer to Figures 1 and 2 for project location, vicinity and boundary.

Del Webb's Grand Avenue Property, when complete, will consist of medium and low density single family homes, multi-family residential housing, golf course and open space, recreation centers, commercial/retail areas and churches. Present land use within the project area consists primarily of vacant desert and either active or former agricultural land. Existing roadways pass through the project area generally in a north-south or east-west direction. Bell Road, HWY 60-89, Reems Road and SR 303L are the major paved roadways within or adjacent to the project. Union Hills Drive and Beardsley Road are dirt roads within the project area. There are numerous other private farm roads, unimproved dirt roads and agricultural irrigation wells and irrigation distribution facilities within the project area. Bell Road, HWY 60-89 and SR 303L all contain relatively recent roadway and drainage improvements.

Just to the west of Del Webb's Grand Avenue Property is the existing McMicken Dam Flood Control Project. This dam was designed and built by the Corps of Engineers in 1955 to protect the downstream farm land, irrigation and transportation improvements and Luke Air Force Base from the 100-year flood. The dam was extensively reconditioned in the mid-1980's. McMicken Dam and its outlet channel provide significant flood protection to Del Webb's Grand Avenue Property. The Beardsley Canal, an existing major irrigation facility, generally parallels the east side of McMicken Dam and its outlet channel. This canal primarily carries surface water from New Waddell Dam.



LOCATION MAP

N.T.S.

DEL WEBB'S

GRAND AVENUE PROPERTY
in SURPRISE, ARIZONA

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2929 EAST CAMELBACK ROAD, SUITE 130
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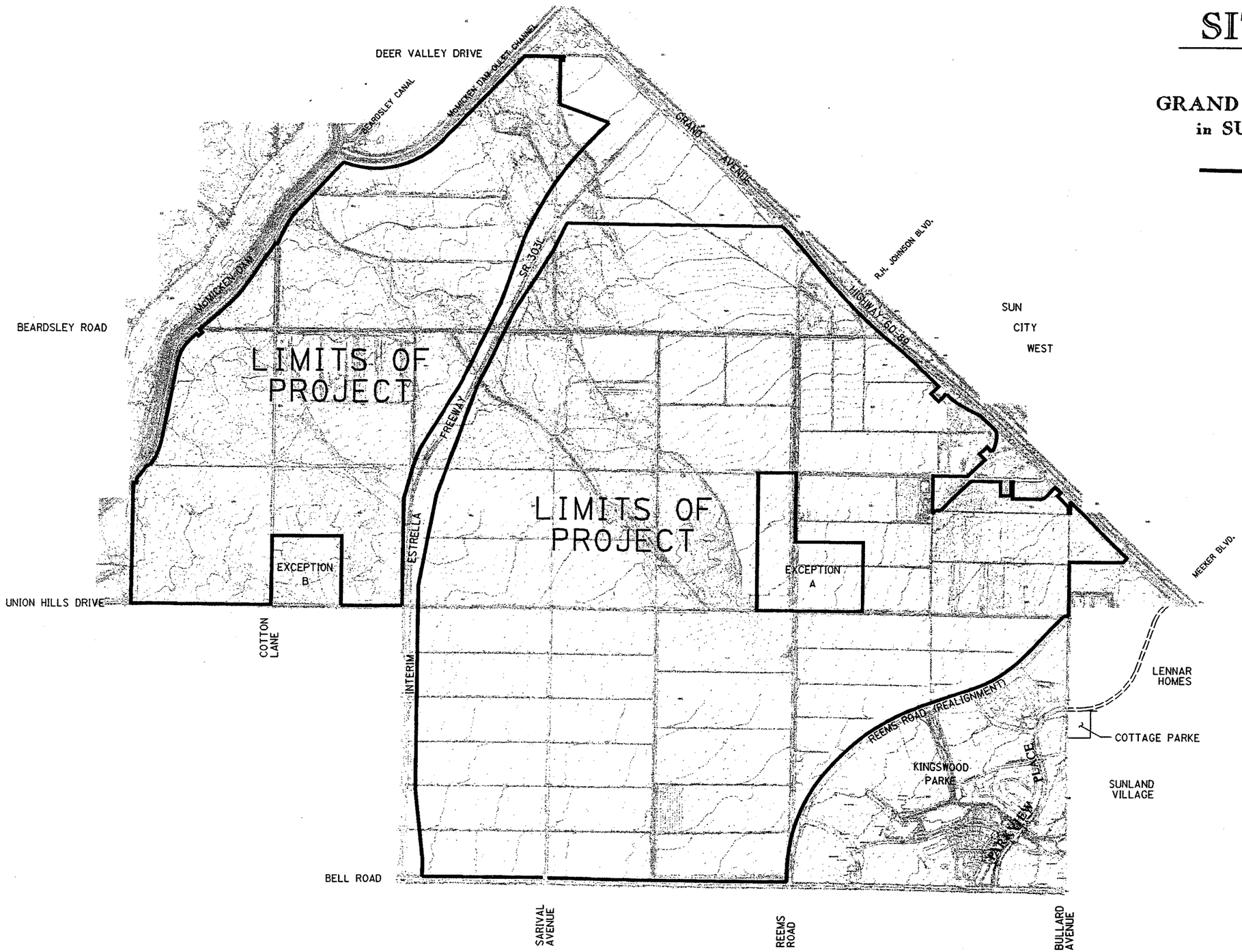
FIGURE 1

SITE MAP

DEL WEBB'S
GRAND AVENUE PROPERTY
in SURPRISE, ARIZONA

PROPERTY BOUNDARY



N

SCALE: 1"=2000'

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FIGURE 2

Across HWY 60-89 to the northeast is the existing Del Webb Sun City West and Sun City West Expansion Area master planned residential communities. To the east of Del Webb's Grand Avenue Property are four existing relatively recent residential developments: Kingswood Parke, Sunland Village, Cottage Parke and Lennar Homes. Kingswood Parke and Sunland Village are master planned residential developments. Only a small portion of the original Kingswood Parke development was constructed. Improvements included roadways, single family homes, open space, drainage and stormwater detention facilities and a public grade school. Construction of the remaining Kingswood Parke development was halted a few years ago and ownership of the project has since changed.

Sunland Village is nearing completion of development. It contains drainage and stormwater detention improvements which receive runoff from Kingswood Parke. Cottage Parke is a recently completed apartment complex located just north of Sunland Village. The Lennar Homes development is a single-family residential subdivision currently under construction adjacent to Cottage Parke. Locations of these developments in relationship to the proposed Del Webb Grand Avenue Property are illustrated on Figure 2. The existing land use across Bell Road to the south of the Del Webb Grand Avenue Property is primarily agricultural fields and orchards.

Del Webb's Grand Avenue Property will be constructed in phases beginning in 1995 and continuing for several years. Presently, four phases are anticipated. Phase I will begin in the north central portion of the project bounded roughly by HWY 60-89 on the northeast, Reems Road on the east, Union Hills Drive on the south and the Interim Estrella Freeway on the west. The Del Webb Grand Avenue Property incudes approximately 170 acres of primarily commercial and retail development along HWY 60-89 from R.H. Johnson Boulevard to Reems Road (realigned). This commercial/retail portion of the Grand Avenue Property will be designed and constructed by a different engineer/developer than Stanley Consultants/Del Webb. However, construction will be consistent with the Del Webb Grand Avenue Property master drainage plan.

The remaining undeveloped portion of Kingswood Parke is currently being planned for development by Coventry Homes, which is a subsidiary company of the Del Webb Corporation. Engineering design for Kingswood Parke will be separate from Del Webb's Grand Avenue Property. Construction of the remaining undeveloped portions of Kingswood Parke is expected to begin immediately and run concurrent with the Grand Avenue Property development.

The purpose of this report is to establish the drainage criteria and standards for development, evaluate existing drainage conditions present in the project area, proposed drainage conditions that will result from development and the impacts (if any) on existing drainage. This report will provide support for the construction of interim drainage improvements necessary for Phase I and set the foundation for future drainage design and construction of subdivision roadway and golf course/open space drainage improvements.

EXISTING DRAINAGE CONDITIONS

The general existing land slope in the project area is from northwest to southeast at an overall grade of approximately 0.5%. The upper drainage boundary of the project area is the Beardsley Canal which is just downslope from McMicken Dam and the McMicken Dam Outlet Channel. HWY 60-89 forms another upper drainage boundary for a portion of Del Webb's Grand Avenue Property. Historical drainage patterns and characteristics have been significantly altered by construction of McMicken Dam and the various agricultural, irrigation and roadway improvements within the property. Prior to McMicken Dam, the project area was subject to occasional flooding from wide shallow washes having relatively large off-site contributing drainage areas. McMicken Dam has essentially eliminated this off-site contributing area.

The runoff generated by the small strip of land between McMicken Dam and the Beardsley Canal along the western boundary of the property does not contribute to the project site. Runoff generated by this land directly enters the Beardsley Canal and is conveyed south, away from the project site.

Runoff originates as shallow sheetflow and shallow concentrated flow in the upper reaches of the contributing area near the Beardsley Canal. In areas with no agricultural improvements, runoff concentrates along shallow washes and swales. This condition applies to the entire project area but occurs primarily in the area northwest of the Interim Estrella Freeway where there are still relatively large tracts of vacant desert.

Existing roadway and irrigation improvements in the study area generally impact runoff by locally diverting the overall southeasterly drainage pattern to the east or to the south. Some of the existing roadway and irrigation facilities are elevated above existing adjacent grades which results in potential ponding of runoff in addition to diversion. Other roadway and irrigation improvements are situated at or below grade and act as channels. Many of the smaller irrigation delivery ditches and culvert pipes have only minor potential to locally divert flow because their hydraulic capacities are insignificant in relation to the contributing drainage. On the other hand, Reems Road within the study area has significant conveyance capacity and diverts a large amount of flow to the south, out of the project area.

Although the overall drainage pattern is toward the southeast, the roadway and irrigation features described above have altered the distribution of runoff and the concentration points at which runoff collects. Peak discharges within the existing project area for the 100-year storm have been estimated at various locations and range from less than 50 cubic feet per second (cfs) to more than 1500 cfs. The total existing condition 100-year, 2-hour runoff volume generated by the Del Webb Grand Avenue Property is approximately 480 acre feet.

Runoff from existing contributing areas that are considered offsite to the Del Webb Grand Avenue Property enters the project at several locations. The following is a brief list and description of the existing condition runoff inflow points with regard to the project:

- North Project Limit Near Grand Avenue - The contributing area is approximately 190 acres located along the south side of HWY 60-89 near SR 303L. Runoff from this contributing area enters the project and eventually discharges to an existing Arizona Department of Transportation (ADOT) 5 ft. by 3 ft. oval concrete pipe culvert under HWY 60-89 near the existing Reems Road intersection.

- Beardsley Canal Right-of-Way - This is a narrow strip of contributing area along the southeast side of the canal. This area lies between the canal itself which is considered the upstream limit of the offsite contributing area and the lower canal right-of-way or property line which is the proposed Del Webb Grand Avenue Property upstream limit. This runoff is minor in magnitude and enters the Grand Avenue Property at numerous locations as sheetflow and shallow concentrated flow.

- Exception Parcel "A" at Reems Road and Union Hills Drive - There is an "L" shaped exception parcel of approximately 83 acres which straddles Reems Road north of Union Hills Drive. Del Webb's Grand Avenue Property surrounds this parcel on all sides. Runoff from this parcel collects along Union Hills Drive and enters the Grand Avenue Property at Reems Road and at the exception parcel's southeast corner.

- Exception Parcel "B" on the North Side of Union Hills Drive - There is an exception parcel approximately 40 acres in size located on the north side of Union Hills Drive approximately 1/4 mile west of the Interim Estrella Freeway. This property is surrounded on its east, north and west sides by the Del Webb Grand Avenue Property. Runoff from this parcel collects along the north side of Union Hills Drive and flows east into the Grand Avenue Property.

- SR 303L between Bell Road and Union Hills Drive - The existing half section of agricultural land just west of the Interim Estrella Freeway generates runoff which enters the existing irrigation system. This system includes six 24-inch diameter reinforced concrete pipes under the interim roadway located at uniform intervals between Bell Road and Union Hills Drive. Offsite runoff enters the Del Webb Grand Avenue Property via these irrigation pipes. Runoff which exceeds the conveyance capacity of these irrigation pipes and runoff conveyed along Bell Road from the west and runoff from SR 303L right-of-way will concentrate at the intersection of the Interim Estrella Freeway and Bell Road.

Runoff from the existing Del Webb Grand Avenue Property concentrates at numerous locations along the lower or downstream limit of the project. In addition to concentrated discharge locations, there are other locations where flow discharges from the existing property as sheetflow. The following is a brief list and description of existing condition runoff discharge points with regard to the Grand Avenue Property:

- Grand Avenue at Reems Road - The existing ADOT 5 ft. by 3 ft. oval concrete pipe culvert under Grand Avenue near Reems Road discharges to a drainage channel within HWY 60-89 right-of-way. This channel flows along HWY 60-89 toward the southeast and eventually discharges to the Agua Fria River.

- Parkview Place near Union Hills Drive - Shallow concentrated flow crosses Parkview Place between Union Hills and Grand Avenue. Potential sheetflow also enters Parkview Place south of Union Hills Drive.

- Reems Road at Kingswood Parke - A flow split occurs at the existing Reems Road/Union Hills Drive intersection sending flow east in Union Hills Drive. Subsequent flow splits occur in Union Hills Drive east of Reems Road. These splits send flow southeast toward Kingswood Parke and the realigned Reems Road which was pregraded with the initial development of Kingswood Parke. This flow may have been anticipated in the initial design of Kingswood Parke as evidenced by an existing major drainage channel which has been constructed as part of that development. The actual existing condition discharge is in the form of sheetflow and shallow concentrated flow which would enter the realigned Reems Road between the above drainage channel and Bullard Avenue alignment. In its existing condition, however, the Kingswood Parke drainage channel would intercept little or none of this runoff.

- Reems Road at Bell Road - This is a major concentration point under existing conditions. Runoff concentrates in Reems Road and passes south across Bell Road out of the project area. The 100-year, 2-hour peak discharge estimated for Reems Road at this location is estimated to be 1585 cfs under existing watershed conditions.

- Bell Road between the Interim Estrella Freeway and Reems Road Intersections - Flow splits occur at the Bell/Estrella intersection sending sheetflow and shallow concentrated flow to the south and southeast. Runoff from the Grand Avenue Property and offsite runoff conveyed along Bell Road has the potential to overflow south at each of the numerous gaps in the Bell Road raised median between the Interim Estrella Freeway and Reems Road.

- Union Hills Drive 1/2 Mile West of the Interim Estrella Freeway - Approximately 115 acres of Del Webb's existing Grand Avenue Property north of Union Hills Drive west of the Interim Estrella Freeway discharges runoff to Exception Parcel "B" described earlier. Most of this runoff concentrates along the north side of Union Hills Drive and discharges from the Grand Avenue Property at that location. However, runoff can also potentially discharge from the Grand Avenue Property all along the west side of Exception Parcel "B".

These existing condition outfall points will be discussed in greater detail in later sections of this report. The ultimate outfall for runoff from the Del Webb Grand Avenue Property is the Agua Fria River which is approximately 3.5 miles to the southeast. Aside from the existing drainage channel described previously in ADOT HWY 60-89 right-of-way, there are no significant continuous existing channels or washes that would convey runoff from the project area to the Agua Fria River.

SUMMARY OF PREVIOUS STUDIES

A number of studies have been done in the past which provide various levels of runoff analysis for parts or all of the Del Webb Grand Avenue Property. These reports have been done for various developments and roadway improvement projects and for existing and proposed flood control projects. They utilize a variety of different methodologies. The following is a brief list and description of past drainage reports relative to the proposed Del Webb Grand Avenue Property.

- White Tanks/Agua Fria Area Drainage Master Study (ADMS) - This report was prepared by the WLB Group for the Flood Control District of Maricopa County (FCDMC) in 1992. The study limits extend from HWY 60-89 on the north to the Gila River on the south, and from the White Tank Mountains and McMicken Dam on the west to the Agua Fria River on the east. The total study area is approximately 220 square miles. The study is based on 2-foot contour mapping which was flown in 1989 and utilizes hydrologic methodologies from the Drainage Design Manual for Maricopa County, Volume I, Hydrology. Specifically, the study uses the 24-hour SCS Type II rainfall distribution, Green and Ampt loss rate functions and Phoenix Valley "S" graph unit hydrograph. This methodology is combined in a HEC-1 computer model to analyze existing watershed conditions.

  This study identifies major concentration points and flow splits which occur within its limits which include the Del Webb Grand Avenue Property. Discharges along Reems Road from Beardsley Road south have been analyzed in the study. Because of the magnitude of flow, an approximate floodplain limit for Reems Road based on approximate hydraulic analysis has been designated. The White Tanks/Agua Fria ADMS has been reviewed and approved by the Federal Emergency Management Agency (FEMA). Although the Reems Road approximate floodplain between Bell Road and Beardsley Road has not been reflected on the County's revised Flood Insurance Rate Map (FIRM), it is recognized by FCDMC as an existing flood zone for floodplain management purposes. FCDMC has been given responsibility for floodplain management by the City of Surprise within its incorporated limits. No other floodplains have been delineated within the limits of the Del Webb Grand Avenue Property. Development of the Del Webb Grand Avenue Property will result in the

realignment of Reems Road and elimination of its delineated floodplain through re-grading and use of onsite runoff retention/detention in the developed contributing area.

Figure 3 on the following page is a composite of FIRM panels 1145 and 1165. As indicated, the Del Webb Grand Avenue Property has been designated as Flood Insurance Zone X. A Zone X is defined as:

> "Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood."

In addition to the hydrologic and hydraulic analysis of the White Tanks/Agua Fria ADMS, a separate study phase is nearing completion to identify potential solutions to the various flooding problems within the study limits. There are no projects proposed by the ADMS within the expected time frame of the Del Webb Grand Avenue Property which would provide a formal outfall for drainage from the project to the Agua Fria River.

- Kingswood Parke - This study was performed by Coe and Van Loo Engineers for the developers of Kingswood Parke. This study pre-dates the White Tanks/Agua Fria ADMS. It utilizes the Soil Conversation Service (SCS) TR-20 computer model which is based on SCS curve number loss functions and the SCS dimensionless unit hydrograph. The 100-year, 6 and 24-hour rainfall distribution were used. Off-site contributing areas were estimated based on United States Geological Survey (USGS) topographic mapping with 10 foot contour intervals. This study includes most of the Del Webb Grand Avenue property as contributing area to Kingswood Parke. The Kingswood Parke study also includes that portion of the Sunland Village development which receives offsite runoff from Kingswood Parke. The large volume of offsite flow passing through Kingswood Parke and Sunland Village was intended to overflow onto Bell Road.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

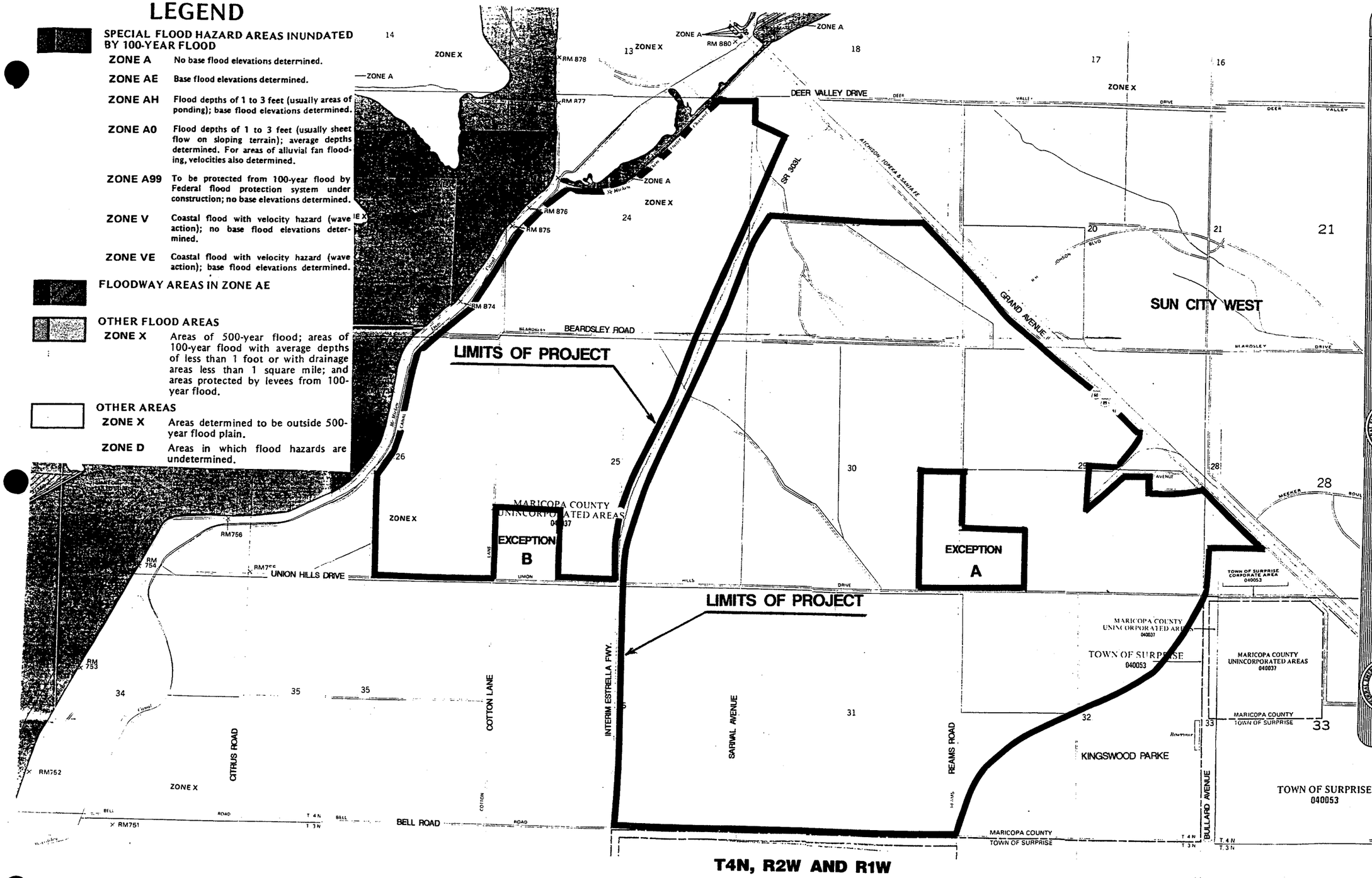
FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1145 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY UNINCORPORATED AREAS	040037	1145	E
SURPRISE, TOWN OF	040053	1145	E

MAP NUMBER 04013C1145 E

MAP REVISED: SEPTEMBER 4, 1991

PANEL 1165 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL MIRAGE, TOWN OF	040041	1165	F
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1165	F
SURPRISE, TOWN OF	040053	1165	F

MAP NUMBER 04013C1165 F

MAP REVISED: SEPTEMBER 4, 1991

Federal Emergency Management Agency

FIGURE 3

DEL WEBB'S

GRAND AVENUE PROPERTY in SURPRISE, ARIZONA

The proposed drainage concept for Kingswood Parke involved receiving offsite flow and passing it through the development via linear park/detention basin conveyance to Sunland Village. Individual subdivision parcels within Kingswood Parke were intended to have their own onsite retention. Disposal of retained onsite runoff was to be accomplished through the use of drywells or anticipated construction of a proposed storm drain trunkline outfall. Temporary retention upstream from the realigned Reems Road was going to be used to provide interim protection for the downstream phases of Kingswood Parke. However, this temporary retention was never constructed.

- ADOT Grand Avenue (HWY 60-89) - Drainage design for the recent roadway improvements to HWY 60-89 was done by Kimley-Horn and Associates, Inc. Runoff generated by the right-of-way and by adjacent offsite contributing areas is conveyed by storm drain, culvert and open channel within the ADOT Grand Avenue right-of-way. HEC-1 methodology was used to estimate peak discharges. Design frequency for culverts receiving offsite flow was 25 year. Design frequency for onsite roadway drainage and catch basins was 10-year. HWY 60-89 runs in a northwest to southeast direction which generally parallels local runoff patterns. Within the Del Webb Grand Avenue Property, there is only one location where offsite runoff has been recognized and received into the HWY 60-89 drainage system. This is the existing 5 ft. by 3 ft. concrete pipe culvert near the existing Reems Road intersection mentioned previously.

- Interim Estrella Freeway (SR 303L) - There were two studies performed for ADOT regarding this roadway. The first study was done in 1987 by Cella Barr and Associates and was actually an alignment study and cost estimate for the proposed ultimate freeway improvements. Drainage was analyzed for offsite contributing areas based on regionalized general area - discharge curves developed for the study. These curves were based on a 50-year return frequency and the SCS TR-55 methodology. Preliminary drainage structure locations and configurations were developed as part of this study. The primary purpose of this study was to establish and preserve the right-of-way required for future freeway construction. Retention

or detention of onsite roadway drainage was not incorporated in the proposed drainage design concept.

The other study for the Interim Estrella Freeway was also done by Cella-Barr and Associates. This study was done in support of the drainage design for the recent interim roadway improvements. Area-discharge curves based on SCS TR55 methodology were used to estimate peak discharges. Design frequency for interim cross culverts was generally either 2-year or 50-year depending on the location, type and magnitude of flow. In some cases, no drainage cross-culverts were provided at certain concentration points. At these locations, runoff would potentially pond in the right-of-way adjacent to the interim roadway and/or potentially overtop the roadway. Culvert locations, size and configuration were developed based on inlet control.

- McMicken Dam - Documentation for the original design of McMicken Dam and for the repairs that were made to it is on file at FCDMC. This documentation was reviewed by Stanley Consultants and a summary of the findings is contained in Appendix F of this report. This documentation supports the basic drainage design assumption for the Grand Avenue Property that McMicken Dam and its outlet channel will prevent the 100-year discharge from contributing to the project.

- Other Reports - It is assumed that some form of drainage report or design calculations were prepared in support of the Lennar Homes Subdivision, the Cottage Parke apartments and the recent roadway and drainage improvements along Bell Road. This information has not been researched and no reports have been obtained for review.

HYDROLOGIC METHODOLOGY

Rainfall-runoff modeling was used to quantify the impact of the design rainfall event on the project site and contributing watershed. Computer modeling of the watershed was accomplished through the use of the HEC-1 Flood Hydrograph Package (U.S. Army Corps of Engineers, 1990). The HEC-1 computer program provides the modeling capabilities of the hydrologic procedures that are specified in the Drainage Design Manual of Maricopa County, Volume 1, Hydrology dated June 1, 1992.

The rainfall depth-duration-frequency (D-D-F) for the project site is identical to the D-D-F used for the adjacent Sun City West Expansion Area which is currently being constructed. The D-D-F rainfall for the project is presented in Table 1.

TABLE 1

RAINFALL DEPTH-DURATION-FREQUENCY

Duration	Rainfall Depth (inches) Return Frequency (years)						
	2	5	10	25	50	100	500
5-min	0.30	0.41	0.49	0.59	0.67	0.75	0.93
10-min	0.46	0.63	0.74	0.90	1.03	1.15	1.43
15-min	0.55	0.78	0.94	1.15	1.31	1.47	1.85
30-min	0.73	1.05	1.26	1.55	1.78	2.00	2.51
1-hour	0.89	1.30	1.57	1.93	2.22	2.50	3.15
2-hour	1.00	1.44	1.74	2.15	2.46	2.77	3.49
3-hour	1.07	1.54	1.86	2.29	2.62	2.95	3.72
6-hour	1.20	1.73	2.08	2.56	2.93	3.30	4.15
12-hour	1.35	1.94	2.33	2.87	3.29	3.70	4.65
24-hour	1.50	2.15	2.59	3.18	3.64	4.10	5.16

The D-D-F statistics were developed using the computer program PREFRE written by the Office of Hydrology, National Oceanic and Atmospheric Administration, as modified by the U.S. Bureau of Reclamation (1988). A primary zone number of 7 and short-duration zone number of 8 was used to develop the D-D-F statistics. Drainage design for the entire project will utilize the rainfall depths and corresponding frequencies presented above.

Maricopa County's Hydrology Manual recommends use of the 6-hour local storm as the design storm for watersheds in Maricopa County of 100 square miles or less. However, because of the higher peak intensity of rainfall in the Hydrology Manual's 2-hour distribution, it generally results in greater peak discharges and runoff volumes in relation to the Hydrology Manual's 6-hour storm distribution and 6-hour point depth.

Both the Hydrology Manual and the drainage design standards presented in Appendix E of this report require the 100-year, 2-hour storm to be utilized as the basis for retention/detention design. The 2-hour storm distribution was used for design of all major drainage facilities in the Sun City West Expansion Area which is currently under construction.

The 100-year, 2-hour storm was chosen to model both the existing condition hydrology and the proposed developed condition hydrology for this report in order to achieve a consistent comparison between existing and proposed discharges and for the other reasons stated above. The 100-year, 2-hour storm point rainfall depth of 2.77 inches was not reduced for aerial extent. The 2-hour storm distribution is from Table 2.3 of the County's Hydrology Manual.

Rainfall losses are generally considered to be the result of evaporation of water from the land surface, interception of rainfall by vegetative cover, depression storage on the land surface, and infiltration of water into the soil matrix. These rainfall loss mechanisms were grouped into two major components to simplify the rainfall loss estimates for the project site. Surface retention loss, is considered the summation of all rainfall losses other than infiltration. Estimates of surface retention loss were developed from Table 4.1 of the Hydrology Manual. Table 2 presents the surface retention

losses used within the study. The surface retention losses presented below are identical to the values used for the Sun City West Expansion Area Master Drainage Study.

TABLE 2

SURFACE RETENTION LOSSES

Land Use	Surface Retention Loss (IA), inches
Desert	0.35
Open	0.35
Golf Course	0.35
Low Density Residential	0.15
Medium Density Residential	0.15
Multi-Family Residential	0.15
Commercial	0.10
Agriculture	0.50
Fallow	0.50

The second phase of the rainfall loss process is the infiltration of rainfall into the soil matrix. Green and Ampt methodology was used to estimate rainfall soil infiltration losses. This methodology utilizes three infiltration parameters: hydraulic conductivity at natural saturation (XKSAT); wetting front capillary suction (PSIF); and, volumetric soil deficit at the start of rainfall (DTHETA).

The sub-basin soil distributions used for existing conditions is identical to the distributions used in the White Tanks/Agua Fria ADMS. Drainage sub-basins from the ADMS which were subdivided in this study maintain the same soil distribution as the larger ADMS sub-basin. The composite XKSAT value for a sub-basin was determined using area-weighted logarithms of the individual soil XKSAT values. The individual soil XKSAT values are presented in Appendix B of the Hydrology Manual.

The sub-basin soil distributions used for proposed developed conditions were re-evaluated based on the developed condition drainage sub-basins. Exhibit B in Appendix A illustrates the grouping of the various soil types found in the project area according to values of XKSAT. This exhibit was used to generate composite XKSAT values for the developed condition. Basic Green and Ampt soil parameters for the developed condition were estimated using existing condition soil parameters assuming that there is no significant change in characteristics due to grading and earthwork.

The composite bare ground XKSAT values were corrected for vegetative cover utilizing area-weighted land use vegetative cover estimates. Table 3 presents the percentage of vegetative cover for the various land uses used in this study and are consistent with those values used in the Sun City West Expansion Area Master Drainage Report. Figure 4.4 of the Hydrology Manual was used to correct the bare ground composite XKSAT value with the land use area-averaged percent vegetative cover.

TABLE 3

PERCENT VEGETATIVE COVER

Land Use	Vegetative Cover (%)
Fallow	20
Desert	25
Open	25
Low Density Residential	25
Medium Density Residential	35
Multi-Family Residential	25
Commercial	25
Golf Course	80
Agriculture	90

DTHETA is a function of the effective porosity of the soil, land use, and the antecedent soil moisture condition that could be expected at the start of a design rainfall. If a soil is effectively saturated at the start of the design rainfall then DTHETA was assumed to be 0.0. Soils within actively irrigated agricultural land uses were assumed "saturated." Soils within fallow agricultural fields and natural occurring desert areas were assumed "dry." The remaining land uses were assumed to have "normal" antecedent soil moisture conditions. Corresponding PSIF and DTHETA values were then determined from Figure 4.3 in the Hydrology Manual utilizing the previously determined bare ground composite XKSAT values.

The effective impervious area is the portion of land area, expressed in percent of total land area, that will drain directly to the outlet of a drainage area without flowing over pervious area. Effective impervious area consists of such areas as roofs, driveways, streets and parking lots which are directly connected to a means of runoff conveyance such as a street or drainage channel. The effective percent impervious area used for the various land uses within this study are presented in Table 4 and are identical to the estimates used in the Sun City West Expansion Area Master Drainage Study.

TABLE 4

CONNECTED IMPERVIOUS AREA

Land Use	Effective Impervious Area (%, RTIMP)
Fallow	0
Desert	0
Open	1
Low Density Residential	25
Medium Density Residential	35
Multi-Family Residential	55
Commercial	80
Golf Course	1
Agriculture	0

The Clark Unit Hydrograph methodology was used for routing rainfall excess. The Hydrology Manual recommends the use of the Clark Unit Hydrograph procedure for watersheds or sub-basins less than about 5 square miles in size with an upper limit of application of 10 square miles. The Clark unitgraph method uses two numeric parameters, Tc and R, and a graphical parameter, the time-area relation. The time of concentration (Tc) is defined as the travel time, during the corresponding period of most intense rainfall excess, for a floodwave to travel from the hydraulically most distant point in the watershed to the point of interest. The equation used to estimate the time of concentration is:

$$T_c = 11.4 L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38}$$

Where:

T_c	=	Time of concentration in hours;
L	=	Length of the flow path for T_c in miles;
K_b	=	representative watershed resistance coefficient;
S	=	watercourse slope in ft/mile; and
i	=	the average rainfall excess intensity, during the time T_c, in inches/hour

Lengths and slopes for the proposed developed condition were estimated from preliminary sub-division layouts and mass grading plans. Lengths and slopes for the existing condition within Del Webb's Grand Avenue Property were estimated based on recent 1-foot contour mapping.

The watershed resistance coefficient was determined using the following equation from the Hydrology Manual:

$$K_b = m \log A + b$$

Where A is the contributing area in acres and m and b are equation parameters from Table 5.1 of the Hydrology Manual. The m and b parameters were area-weighted for sub-basins with more than one land use. Table 5 presents the m and b parameters estimated for each land use within the contributing watershed.

TABLE 5

ROUGHNESS COEFFICIENT m AND b PARAMETERS

Land Use	Roughness Coefficient (K_b) Equation Parameters	
	m	b
Fallow	-0.01375	0.08
Desert	-0.01375	0.08
Open	-0.01375	0.08
Low Density Residential	-0.00625	0.04
Medium Density Residential	-0.00625	0.04
Multi-Family Residential	-0.00625	0.04
Commercial	-0.00625	0.04
Golf Course	-0.00625	0.04
Agriculture	-0.01375	0.08

The storage coefficient (R) is a Clark Unit Hydrograph parameter that is used to account for the effect that temporary storage in the watershed has on the hydrograph. The equation used to estimate the storage coefficient (R) is:

$$R=0.37T_c^{1.11}A^{-0.57}L^{0.80}$$

Where:

R	=	Storage coefficient in hours;
T_c	=	Time of concentration in hours;
A	=	Drainage area in square miles; and
L	=	Length of the flow path in miles

The time-area relationships used for the study area are from Table 5.2 of the Hydrology Manual. The time area relation selected for a particular sub-basin was dependent upon the major land use within the basin. However, if a watershed was evenly split between urban and natural conditions, the default HEC-1 time-area relation was utilized. Generally, all existing condition sub-basins and developed condition sub-basins that are primarily golf course and open space use the "natural" time-area relationship. All other developed condition sub-basins use the "urban" time-area relationship.

This study utilized Maricopa County's new Drainage Design Menu System (DDMS) to organize the hydrologic data and calculate the various rainfall-runoff parameters for use in the HEC-1 model. The DDMS provides the ability to efficiently change the design storm frequency and durations. The Tc and R parameters were calculated using the MCUHP1 computer program (December 16, 1991) which is incorporated in the DDMS. The DDMS is in the final stages of completion by FCDMC and is not officially available to the general engineering community. The DDMS data files used for this study are available from Stanley Consultants upon request. The DDMS software is currently only available through FCDMC.

Existing conditions hydrograph routing was performed using Modified Puls normal-depth storage routing. The method used for computing the number of calculation steps (NSTPS) within the Grand Avenue Property was a function of the difference between the "Time of Peak" at the upstream and downstream routing limits. The basis of this methodology is to estimate the travel time through the routing reach approximating the fully developed flood wave travel time (wave celerity). Although this method is subject to compromise because of HEC-1's rounding protocol when printing "Time of Peak," the methodology was determined to be sufficiently accurate for the study objective.

Hydrograph routing for the proposed developed condition utilized Modified Puls normal depth storage routing for golf course and open space channels, Modified Puls level pool storage routing for golf course and open space retention/detention basins and kinematic wave routing for proposed open channels. Infiltration/percolation losses are assumed to be zero for all Modified Puls routing. The number of routing steps (NSTPS) is one (1) for all level pool routing.

Existing condition flow splits occur at various locations throughout the project area. All flow splits were estimated on the basis of hydraulic analysis. This analysis generally utilized either step-backwater, normal depth, weir flow methods or combinations thereof.

Clark unitgraph/Green and Ampt HEC-1 hydrology modeling will be used for the analysis of existing condition and proposed developed condition drainage and for the design of major drainage features such as channels, retention/detention basins and major storm drain trunklines. Future drainage design of individual subdivision parcels will generally be accomplished using the Rational Method. This applies to minor local channels, storm drains, catch basins and street conveyance of runoff. Generally, most design applications which only require a peak discharge and not a hydrograph will be supported by Rational Method hydrology. Past experience has indicated that Rational Method peak discharges agree closely with Clark unitgraph/Green and Ampt peak discharges. Hydraulic design within the Del Webb Grand Avenue Property will generally utilize either standard step-backwater, normal depth or weir flow analysis depending on the particular application.

EXISTING CONDITION HYDROLOGIC ANALYSIS

The most current and comprehensive study of existing condition hydrology available for the Grand Avenue Property is the White Tanks/Agua Fria ADMS. The ADMS was reviewed by Stanley Consultants to determine if it would be appropriate for use in the design of the Grand Avenue property. The ADMS HEC-1 model was modified extensively for the Grand Avenue Property Master Drainage Study. An accurate existing condition hydrologic analysis was considered essential to this project for the following reasons:

1. It is anticipated that development of the Grand Avenue Property will have a significant impact on drainage in the project area. This impact will be beneficial to adjoining and downstream properties in that the Grand Avenue Property will control, through the use of retention/detention facilities, runoff which historically and potentially causes significant damage. However, the Grand Avenue Project will provide storage volume for the 100-year, 2-hour onsite runoff only.

   Although the Grand Avenue Property accounts for nearly all of the potential contributing area to adjacent and downstream properties, there are still some areas that will contribute offsite runoff to the Grand Avenue Property. This runoff will be designed to pass through the Grand Avenue Property and seek its historical outfalls until such time as these offsite areas are developed and onsite retention/detention is provided for them.

2. Runoff events in excess of the 100-year, 2-hour storm are rare but possible. This runoff may exceed the capacity of onsite retention/detention facilities and pass through the Grand Avenue Property to seek its historical outfall.

3. It is anticipated that runoff from within the Grand Avenue Property under developed conditions may be locally diverted from its historical path. The proposed onsite retention/detention facilities will compensate for this potential diversion by storing the design runoff volume. However, offsite flows and flows in excess of the design storm as mentioned in 1 and 2 above will be designed to discharge from the project at historical outfalls.

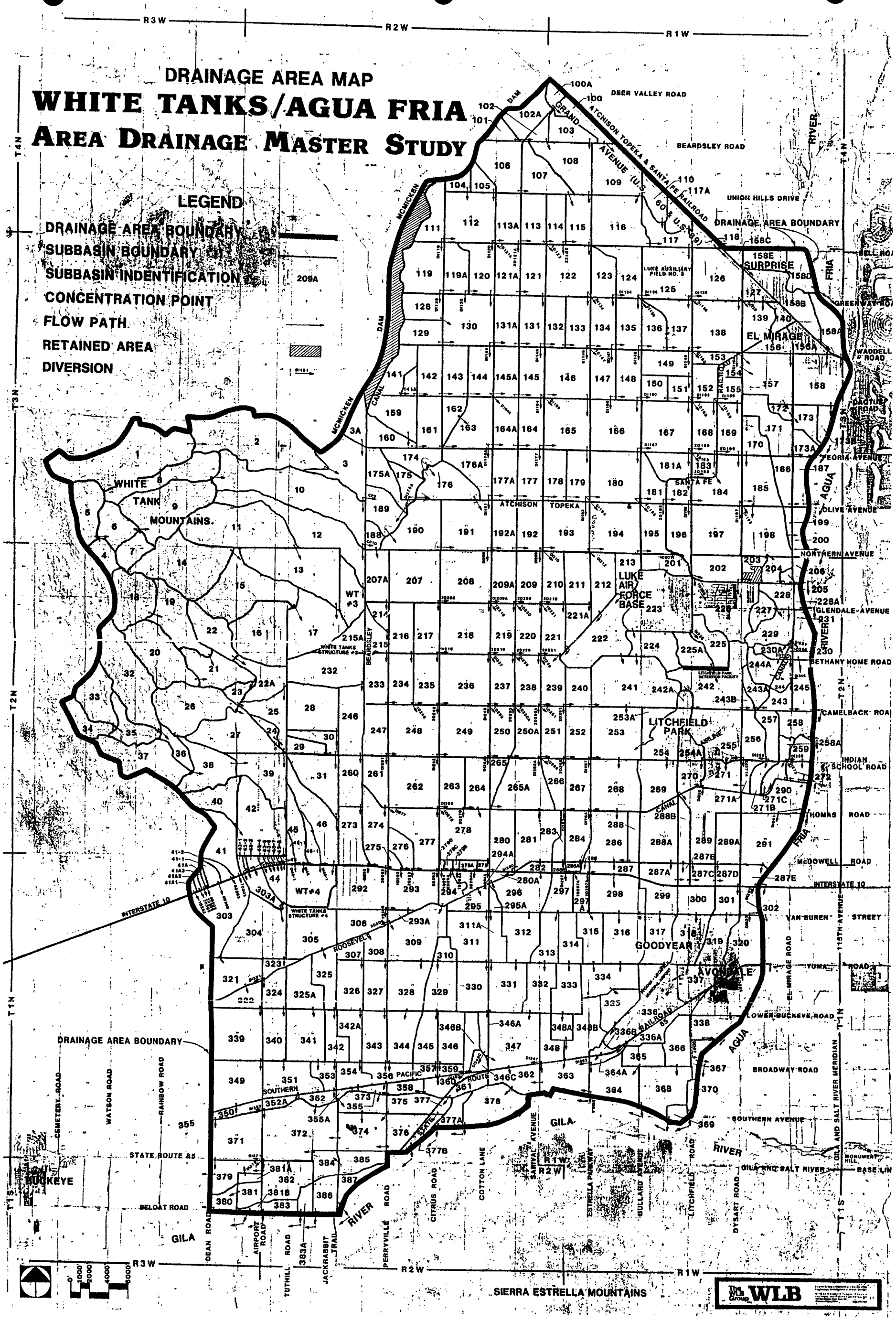
4. Since development is anticipated to occur in phases over several years, it is particularly important to know the location and magnitude of existing condition runoff. This information is necessary to design temporary facilities to control runoff from areas upstream of each phase and to evaluate potential impacts of temporary drainage facilities on existing historical drainage outfalls downstream from each phase.

In evaluating the White Tanks/Agua Fria ADMS, it was found that, while adequate for its original scope and intent, it was not adequate to fulfill the needs of the Del Webb Grand Avenue Property. Generally, the ADMS lacks the required detail and contains methodology which is not consistent with the proposed design methodology. When evaluating flow splits and drainage sub-basin boundaries with the more current and accurate 1 ft. contour topography that was acquired for the Grand Avenue Property, several discrepancies were found along with the need for additional concentration points.

The existing conditions HEC-1 model which was prepared in this study utilized as many aspects of the White Tanks/Agua Fria ADMS as possible. All of the contributing sub-basins in the revised existing condition HEC-1 model that are west of the Interim Estrella Freeway between Bell Road and Union Hills essentially retain the basic watersheds, hydrograph routing and flow split parameters from the ADMS. Most of the drainage sub-basin boundaries within the Grand Avenue Property have not significantly changed. As mentioned previously, the basic composite bare ground soil parameters from the ADMS have not been changed.

The primary differences between the ADMS HEC-1 model and the Grand Avenue Property revised HEC-1 model for existing conditions are in unitgraph method, rainfall depth/duration/distribution, analysis of flow splits and location of concentration points. Peak discharges were compared at several concentration points having common locations between the White Tanks/Agua Fria ADMS and the Del Webb Grand Avenue Property HEC-1 models. The Grand Avenue Property HEC-1 model generally produced higher peak discharges than the White Tanks/Agua Fria ADMS for essentially the same contributing area.

A reduced copy of the original watershed sub-basin boundary map from the White Tanks/Agua Fria ADMS is found in Figure 4 at the end of this section. The output printout of the original ADMS HEC-1 model has not been reproduced in this report because of its length but is available upon request. The existing condition HEC-1 model prepared for the Grand Avenue Property is found on diskette in Appendix A of this report and is printed out in Appendix B. The existing condition watershed sub-basin map, Exhibit A, prepared for the Grand Avenue Property, is found in Appendix A. All other supporting data and calculations regarding input parameters, hydrograph routing and flow splits is found in Appendix B.



DEL WEBB'S
GRAND AVENUE PROPERTY
in SURPRISE, ARIZONA

FIGURE 4

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK RD. Suite 130
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PROPOSED COMPLETELY DEVELOPED DRAINAGE SYSTEM

The drainage design concept for Del Webb's Grand Avenue Property is relatively simple. The project site is divided into four construction phases which generally retain the 100-year, 2-hour fully developed storm runoff. Each construction phase, as well as the fully developed condition, is designed to preserve the overall existing drainage pattern and historical outfalls. Stormwater runoff is conveyed from the residential lots through streets, storm drains, and drainage channels to permanent golf course lakes or open space retention/detention facilities. Retention/detention will be provided within the topographic features of the golf courses and open space associated with the development. In general, the golf course lakes act as aesthetic stormwater retention/detention facilities. Runoff volume in excess of the golf course lake retention/detention basins and runoff from those areas down-slope of the golf courses will drain into retention/detention basins located at the downstream limits of the project area along Bell Road and the Reems Road re-alignment. Exhibit C in Appendix A presents the completely developed condition HEC-1 watershed map for the Grand Avenue Property.

Stormwater which is collected in the retention/detention facilities from the onsite development will meet the drainage standards set forth in the development agreement between Del Webb and the City of Surprise, Arizona. The drainage design concepts and standards for the Grand Avenue Property originally presented to the City of Surprise in February of this year are provided in Appendix E. The current drainage design concept has changed since then from a detention concept to more of a retention concept. The development drainage regulations presented in Appendix E will continue to be followed during the subdivision design process. A copy of the Drainage Standards is provided in Appendix E. The key retention/detention development regulations are summarized below:

- All stormwater from a 100-year, 2-hour storm which falls within the development is to be detained/retained within the boundaries of the development.

- All retention/detention basins shall have a design capacity to preclude a water depth in excess of eight (8) feet (exclusive of lakes). In no event shall stormwater stand in the retention basins longer than ninety six (96) hours. Retention/detention basins will be operated in conformance with Maricopa County Vector Control Regulations.

- Retention/detention may be provided upon asphalt, concrete, or other hard surfaces for non-residential areas. Residential parking areas may not hold retention/detention volume.

Golf course lakes which do not have the capacity to retain the local contributing runoff, due to space or volume limitations, will be designed to weir flow through the golf course to the next downstream lake. The golf course lakes include a positive overflow outlet design to contain the flow in the golf course or open space and preclude any adjacent lot flooding. The lakes generally are designed with steeper banks adjacent to subdivision lots and flatter slopes within the golf course. This design enables the collected stormwater runoff to expand over larger areas within the golf course while minimizing the lake depth. The 100-year, 2-hour storm water-surface elevation within the golf course lakes are designed to maintain one foot of freeboard from the lowest adjacent lot elevation.

The total onsite runoff volume generated by the proposed fully developed condition is approximately 570 ac-ft (not including exception parcels A and B). The total onsite runoff volume generated by the proposed development corresponds to an overall rational equation runoff coefficient of approximately 0.68.

The golf course lake retention/detention basins in Phase I utilize preliminary golf course mass grading contours. Phase I mass grading plans were also used to determine HEC-1 watershed data. All other developed onsite data was estimated from preliminary grading and lotting layout concepts. HEC-1 information presented for future construction phases are conceptual and may be revised when better information becomes available.

The proposed retention/detention facilities for Del Webb's Grand Avenue Property are designed for onsite stormwater runoff only. The term onsite stormwater runoff applies to all runoff including the runoff from the adjacent half width of abutting streets. However, this term is not considered to apply to the existing or future improved SR 303L right-of-way which is considered as offsite contributing area. Since the drainage design concept is to retain runoff generated by onsite development, it can be difficult to separate onsite from offsite contributing flows. As a result, offsite contributing flows are designed to pass through the development to historical outfall points. All offsite areas are

considered hydrologically to be in their existing undeveloped condition. It is assumed that offsite areas will be constructed with drainage systems which will reduce or eliminate offsite contributing runoff to the Del Webb Grand Avenue Property.

As discussed earlier, the proposed development has several existing contributing areas that are considered offsite to the Del Webb Grand Avenue Property. A brief list and description is provided below which addresses the existing condition runoff inflow points and methodology for managing the offsite contributing runoff for the fully developed project:

- North Project Limit Near Grand Avenue - Runoff from this contributing area enters the golf course at the northeastern corner of the project and is conveyed to the existing ADOT 5 ft. by 3 ft. oval concrete pipe culvert under HWY 80-69. The existing culvert conveyance capacity is maintained while an overflow section in the golf course near the culvert inlet provides a high-level spillway, thus preserving the existing drainage pattern. No stormwater storage volume is provided within the proposed Grand Avenue Property for this contributing area. The developer(s) within this contributing area will have to provide retention for the developed condition 100-year, 2-hour storm.

  The contributing drainage area to the ADOT culvert increases by approximately 22 acres from sub-basin E103B. However, a portion of the Phase I construction will remove approximately 27 acres of contributing drainage area (portions of sub-basins S101 and S108) to the ADOT culvert. This results in a net 5 acre decrease in contributing drainage area to the ADOT culvert.

  Del Webb has reached an agreement with the land owner north of the North Grand Avenue Property boundary which will permit the construction of temporary stormwater conveyance facilities on the adjacent property instead of on the Grand Avenue Property in exchange for a stormwater outfall through the Grand Avenue Property.

- Beardsley Canal Right-of-Way - The narrow strip of contributing area along the southeast side of the canal is proposed to enter the project at concentrated locations. The runoff generated by this area is minor and will be addressed in greater detail during the development of drainage plans for the future development phase adjacent to the canal.

- Exception Parcel "A" - The runoff from this contributing area is proposed to be intercepted by a gunite lined channel paralleling the south boundary of the exception parcel. However, no stormwater storage volume is provided within the proposed development for this contributing area. The developer of this parcel will have to provide retention for the developed condition 100-year, 2-hour storm.

- Exception Parcel "B" - The runoff from this contributing area is proposed to be intercepted at existing concentration points and conveyed through the project. No stormwater storage volume is provided within the proposed development for this contributing area. The developer of this parcel will have to provide retention for the developed condition 100-year, 2-hour storm.

  A portion of the proposed Grand Avenue Project (approximately 70 acres) will contribute stormwater runoff to the southwestern corner Exception Parcel B (sub-basin S220). However, the developed condition actually reduces the contributing drainage area to the exception parcel. It is proposed that the concentrated runoff generated by the Grand Avenue Property be conveyed along the southern boundary of the parcel in the Union Hills Drive right-of-way or a drainage easement. This runoff is then proposed to be routed to a proposed retention/ detention facility at the northwest corner of SR 303L and Union Hills Drive.

- ADOT SR 303L Right-of-Way North of Union Hills Drive - Runoff generated by ADOT's right-of-way will continue to enter the project in the same manner as existing conditions. However, no stormwater storage volume is provided within the proposed Grand Avenue Property for this contributing area. ADOT will have to develop a drainage system for the ultimate freeway facility which will not impact the Grand Avenue Property. Ultimately, the

future construction phase west of SR 303L will eliminate virtually all of the 100-year, 2-hour existing offsite runoff contributing to the adjacent segment of SR 303L.

- SR 303L between Bell Road and Union Hills Drive - Runoff generated by the existing offsite area will continue to enter the proposed Grand Avenue Property via the existing 24-inch pipes in the same manner as existing conditions. However, no runoff storage volume is provided within the Grand Avenue Property for this offsite contributing area. The existing conditions runoff along this boundary amounts to about 2 acre feet and will be routed to a proposed retention/detention basin (S310C) along Bell Road. The runoff from the existing contributing offsite areas will ultimately pass through the Grand Avenue Property to the existing historical outfall in the vicinity of Bell Road at Sarival Avenue. The design of this retention/detention system will be addressed as part of the future construction phase. The development or improvement of this offsite contributing area including SR 303L right-of-way will need to incorporate retention or other drainage facilities which will result in no adverse impact to the Grand Avenue Property.

- Bell Road at SR 303L - The White Tanks/Agua Fria ADMS indicates a significant discharge and runoff volume concentrates at the intersection of Bell Road and SR 303L. The proposed drainage concept along Bell Road is to provide conveyance capacity equal to existing conditions for offsite flows along the southern property boundary and maintain the existing outfalls for storms in excess of the 100-year, 2-hour event. In general, the drainage design concept along Bell Road is to separate contributing offsite flows from the onsite drainage system. The design of this drainage conveyance system will be provided as part of the future construction phase.

- Reems Road at Kingswood Parke - Runoff from the proposed development for the 100-year, 2-hour storm will not outfall into Kingswood Parke. However, contributing offsite existing condition runoff and runoff from storms in excess of the design storm event will potentially pass through the proposed Grand Avenue Property retention/detention drainage system and into Kingswood Parke at the existing/historical outflow points.

- Reems Road at Bell Road - The existing conditions hydrology estimates that 1585 cfs outfalls from the project at Bell Road and Reems Road. Under the completely developed condition, no runoff from the 100-year, 2-hour storm which falls within the project boundary outfalls south into Reems Road. The completely developed hydrologic model estimates that approximately 260 cfs will concentrate at the Bell Road and Reems Road intersection from offsite contributing areas west of the Grand Avenue Property boundary. In addition, this intersection will continue to be used as a historical outfall for the Grand Avenue Project for storm events in excess of the 100-year, 2-hour design storm.

Runoff from the proposed commercial/retail and multi-family development along HWY 60-89 between R. H. Johnson Boulevard and Reems Road (realigned) was excluded from the Grand Avenue Project's ultimate drainage system. The developer(s) of these properties will have to provide retention and a means of disposal of the stormwater runoff for the onsite developed conditions and also consider the impact of offsite contributing areas from the 100-year, 2-hour storm event.

Two major design concepts have been developed to dispose of stormwater runoff collected at the retention/detention facilities. One of the stormwater disposal systems under consideration is a conventional storm drain trunkline outfall pipe which ultimately outfalls to the Agua Fria River through an existing Sun City West drainage channel. A preliminary study of this outfall pipe alternative indicates that it is feasible from a hydrologic, hydraulic and engineering design standpoint. However, this alternative for stormwater disposal is costly and will likely require a permit and right-of-way lease from ADOT.

The alternative concept for the disposal of stormwater at the retention/detention basins is through the development of a groundwater recharge system. The groundwater recharge system may employ the use of simple drywells or it may involve the use of an active groundwater recharge pump system. The details of the groundwater recharge alternative is currently under study to address cost-effectiveness, maintenance considerations, and constructibility. In accordance with an agreement between Del Webb and the Arizona Department of Water Resources, a total of 40 ac-ft of surface water per year from the Beardsley Canal will be received into the Grand Avenue Property and

recharged into the groundwater aquifer. This requirement is separate from any potential stormwater recharge but may utilize the same system.

Stormwater collected in the retention/detention facilities may also be disposed of by other methods. Some of the stormwater will be partially disposed of by direct infiltration/percolation and evaporation. These mechanisms of stormwater disposal area not hydrologically considered in the HEC-1 model. In addition, a portion of the stormwater runoff may be disposed of by pumping to irrigate the golf course turf areas. Ultimately, the drainage system will dispose of the 100-year, 2-hour stormwater runoff volume within the 96 hour standard, and comply with Maricopa County Vector Control Regulations.

PROPOSED DRAINAGE PHASING

PHASE I

Phase I is generally located in the north central portion of the property and is bounded on the west by SR 303L, on the north by the property boundary, on the east by approximately Reems Road, and on the south by approximately Union Hills Drive. Exhibit D in Appendix A presents the HEC-1 watershed map for the Phase I developed condition.

Stormwater runoff is conveyed from the residential lots through streets, storm drains, and drainage channels to the permanent golf course lakes or open space retention/detention facilities. Retention/detention is provided within the topographic features of the golf courses for the subdivisions which contribute to the golf course/open space. The depth of the 100-year, 2-hour runoff volume within the Phase I golf course/open space retention/detention basins varies from 2 to 4.5 feet above the permanent lake water surface. Temporary retention facilities will be provided along the eastern limit of the Phase I development to retain the developed condition 100-year, 2-hour runoff which does not contribute to the Phase I golf course.

The temporary retention/detention facilities consist of two basins located on Del Webb property along the east side of the Phase I development. Exhibit D schematically illustrates the location of these temporary retention/detention basins. The temporary basins will retain the contributing runoff volume from the 100-year, 2-hour design storm at a depth of less than three feet. In the event that a storm in excess of the 100-year, 2-hour event occurs, the temporary basins would spill excess water in a manner consistent with existing conditions. The temporary retention/detention basins will ultimately be replaced by permanent basins located along the re-aligned Reems Road at the downstream limits of the overall project.

The total runoff volume generated by the Phase I developed condition is approximately 150 ac-ft (not including ADOT SR 303L right-of-way). Approximately 130 ac-ft of runoff contributes to the Phase I golf course and is retained within the topographic features of the course. An additional 21 ac-ft of temporary retention volume will be provided within the temporary basins discussed above.

Runoff from the 10-year storm generated by Phase I sub-basin S103 will be diverted by a storm drain through sub-basin S105B. The storm drain will outfall into the golf course driving range retention basin in sub-basin S107B. The remaining runoff will flow east into sub-basin S102. No other diversions are currently anticipated for the developed condition. The design of this storm drain and roadway drainage will be accomplished as part of the subdivision improvement plans.

Retention/detention basins within Phase I retain the developed condition runoff generated by the 100-year, 2-hour design storm event. The 100-year water-surface elevations for all the retention/detention basins are a maximum of one foot below the lowest adjacent lot elevation. Final 100-year water-surface elevations for the retention/detention facilities will be made available once the golf course grading is finalized.

A large percentage of the Phase I developed runoff concentrates in sub-basin S110. An emergency outfall to convey runoff from storms in excess of the 100-year, 2-hour design storm from the contributing area is provided by means of a channel along the major north-south arterial adjacent to the proposed community center. The emergency outfall channel is designed to operate at an elevation one foot below the lowest adjacent lot elevation and convey flow to sub-basin S115. A golf cart underpass in the southeast corner of sub-basin S115 is intended to convey flows greater than the design storm event south and east in a similar manner and location as the historical outfall location. The golf cart underpass is not designed to convey a specific storm frequency or discharge capacity. The golf cart underpass provides a factor of safety for the Phase I drainage system and is intended to convey runoff in excess of the 100-year, 2-hour storm through the project.

Two temporary offsite retention facilities are proposed to protect the Phase I development from contributing offsite flows. The northern retention facility is proposed to be a combination berm and channel system which concentrates contributing offsite runoff near the intersection of Beardsley Road and SR 303L. The north offsite temporary retention facility would provide approximately 38 ac-ft of storage for runoff from the 100-year, 2-hour design storm event. The north offsite temporary retention facility is located just west of the SR 303L right-of-way and is schematically illustrated on Exhibit D in Appendix A.

The southern offsite temporary retention facility is proposed to be a combination berm and channel system which concentrates contributing runoff near SR 303L, approximately 1800 feet north of Union Hills Drive. The south temporary retention facility would provide approximately 41 ac-ft of storage for runoff from the 100-year, 2-hour design storm event. The south offsite temporary retention facility is located just west of the SR 303L right-of-way and is schematically illustrated on Exhibit D in Appendix A.

The temporary retention/detention facilities are expected to remain on line over a period of approximately five years before they are replaced with permanent facilities. Consequently, the probability of retaining large volumes of runoff in these facilities is relatively small. Therefore, runoff concentrated in the temporary retention/detention facilities will generally be disposed of through infiltration/percolation and evaporation. In the event that a large volume of runoff is collected in the temporary retention/detention facilities, the basins can be drained into adjacent irrigation canals and turned out on fallow fields owned by Del Webb.

The two retention facilities west of SR 303L are intended to temporarily protect Phase I from offsite runoff until the phase west of SR 303L is constructed. Development of the phase west of SR 303L will permanently protect Phase I from the design storm by retaining the contributing offsite runoff. The two proposed temporary retention facilities west of SR 303L reduce the 100-year, 2-hour storm runoff crossing SR 303L and Union Hills Drive from approximately 705 cfs to approximately 680 cfs. The existing watershed contributing to the intersection of Union Hills Drive and SR 303L south of the temporary retention/detention facilities will continue to discharge runoff to SR 303L like it does currently.

Runoff which originates from the ADOT right-of-way adjacent to Phase I will enter the property in a similar manner and location as existing conditions. The runoff from the ADOT right-of-way is considered offsite runoff and retention volume for it is not provided in the Phase I development. Therefore, the completed Phase I development will convey the existing conditions runoff from the ADOT right-of-way through the project and outlet the stormwater at a historical outfall point.

Construction of Phase I will significantly reduce the offsite runoff contributing to Exception Parcel A. The contributing area north of Beardsley Road will no longer pass through the exception parcel.

The existing conditions hydrologic analysis indicates that approximately 480 cfs would split east from the intersection of Union Hills Drive and Reems Road. Approximately 430 cfs would continue south along the Reems Road alignment. This diversion is based on a hydraulic split-flow analysis along Reems Road. The Phase I developed condition hydrologic analysis indicates that the split east along Union Hills Drive should be reduced to approximately 105 cfs while approximately 125 cfs continues south along Reems Road. The construction of Phase I should significantly reduce the peak discharges along Reems Road between Union Hills Drive and Bell Road.

Phase I reduces the runoff exiting the project at the intersection of Bell Road and Reems Road. The construction of Phase I reduces the 100-year, 2-hour storm peak discharge at this outfall point to approximately 1050 cfs. Most of this peak discharge is from the local contributing areas north of Bell Road and west of Reems Road. Approximately 1585 cfs is estimated to exit the project at this outfall point under existing conditions. The construction of Phase I does not impact the concentration of stormwater runoff along Bell Road.

The construction of Phase I does not adversely impact the peak discharge exiting the project site into Kingswood Parke. The peak discharge to Kingswood Parke is approximately 310 cfs for both existing and Phase I developed conditions. The construction of Phase I reduces the volume of runoff leaving the project site to approximately 22 ac-ft from the existing condition 24 ac-ft. Phase I does reduce the peak discharge exiting the project at the intersection of Union Hills Drive and the Bullard Avenue alignment. The peak discharge is reduced from approximately 50 cfs to approximately 40 cfs at this point. The construction of Phase I also reduces the runoff outfalling from the project limits east of the Bullard Avenue alignment from approximately 610 cfs to approximately 590 cfs.

DESCRIPTION OF COMPUTER FILES

File Name	Description
E12291.SBR	Existing conditions sub-basin soils, land use, and supporting hydrologic variable documentation.
E12291.M1R	Existing conditions sub-basin summary of MCUHP1 input parameters and output data for the 100-year, 2-hr storm.
E12291.DAT	Existing conditions HEC-1 input data file for the 100-year, 2-hr storm.
D12291.SBR	Proposed completely developed condition sub-basin soils, land use, and supporting hydrologic variable documentation.
D12291.M1R	Proposed completely developed condition sub-basin summary of MCUHP1 input parameters and output data for the 100-year, 2-hr storm.
D12291.DAT	Proposed completely developed condition HEC-1 input data file for the 100-year, 2-hr storm.
P12291.SBR	Phase I developed combined with existing conditions sub-basin soils, land use, and supporting hydrologic variable documentation.
P12291.M1R	Phase I developed combined with existing conditions sub-basin summary of MCUHP1 input parameters and output data for the 100-year, 2-hr storm.
P12291.DAT	Phase I developed combined with existing conditions HEC-1 input data file for the 100-year, 2-hr storm.

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EXHIBIT A
MASTER DRAINAGE PLAN
EXISTING CONDITION
HEC-1 WATERSHED MAP

For

Del Webb's

Grand Avenue Property

Surprise, Arizona

North

0 400 800 1600

Scale: 1" = 800'

10 ac. 2.5 1 ACRES

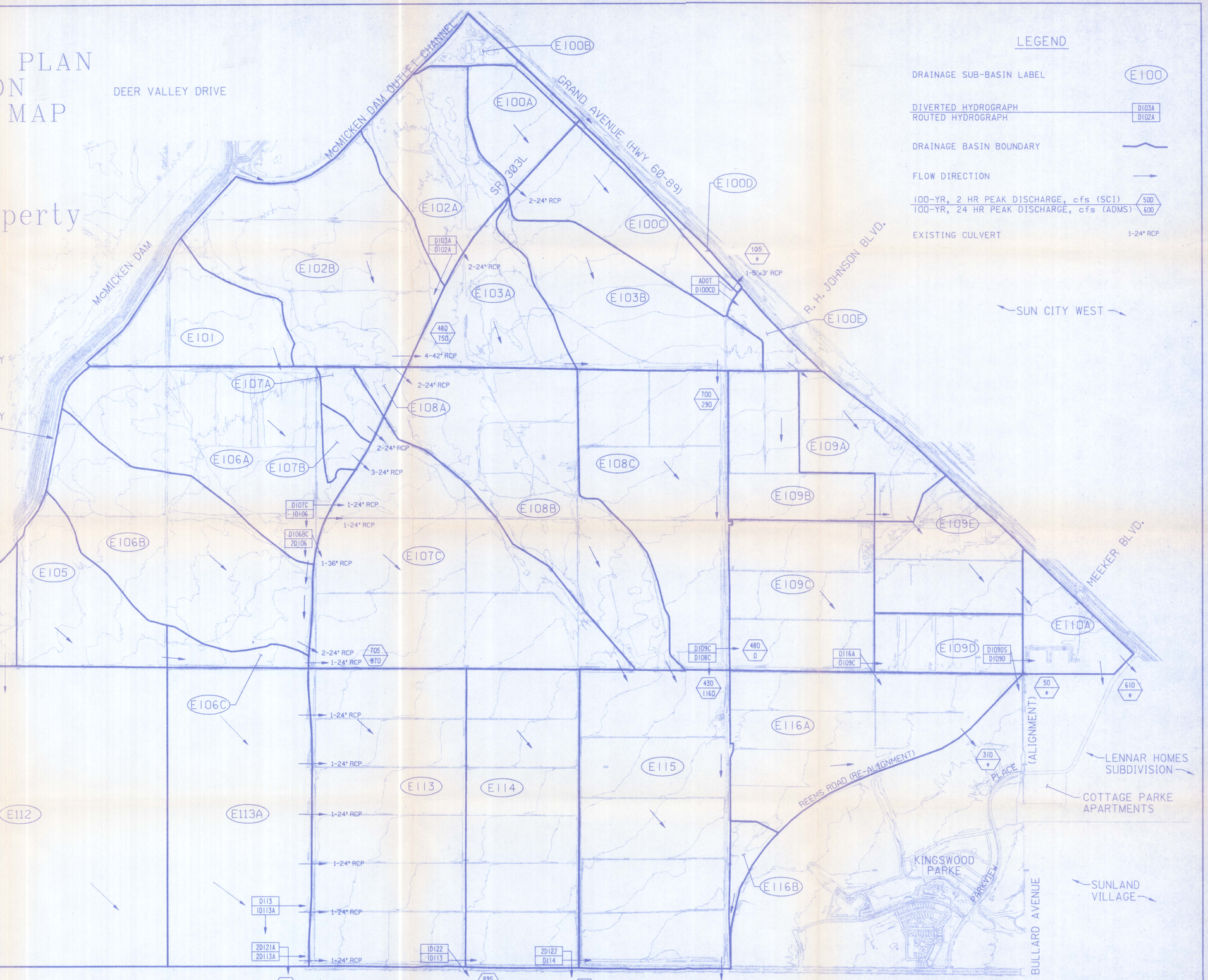
December 1994

NOTES:

CONTOUR INTERVAL SHOWN IS 5 FT AND IS TAKEN FROM AERIAL MAPPING FLOWN IN 1993 BY COOPER AERIAL PREPARED TO 1 FT CONTOUR AND 1"=40 FT HORIZONTAL MAPPING STANDARDS. (1 FT CONTOURS NOT SHOWN)

OFF-SITE CONTRIBUTING SUB-BASINS ARE FROM THE WHITE TANKS ADMS DEVELOPED BY THE WLB GROUP.

• INDICATES CONCENTRATION POINT NOT COMMON WITH THE WHITE TANKS ADMS.



STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-6500

DES. JRM	CKD. GSB
DRN. TPO	APP. GSB
DATE. DECEMBER 1994	
SHEET 1 OF 1	
DWG EXHIBIT A	
PROJ. NO. 12291	

REVISIONS: DATE:

File : GRAND/GAH/DRO.DGN

EXHIBIT B
MASTER DRAINAGE PLAN
DEVELOPED CONDITION
SOIL HYDRAULIC CONDUCTIVITY (XKSAT)

For

Del Webb's

Grand Avenue Property

Surprise, Arizona

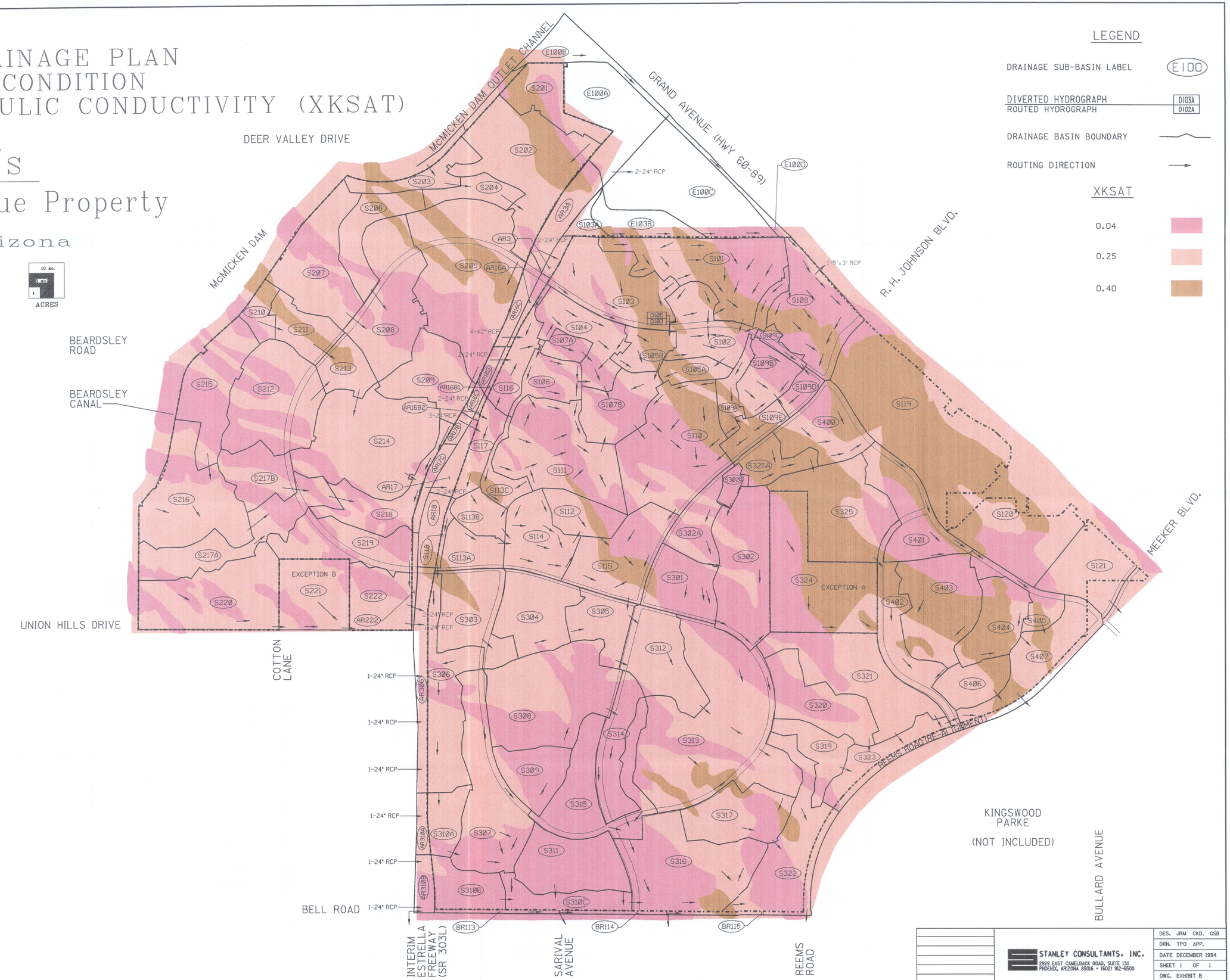
North

Scale: 1" = 800'

0 400 800 1600

10 ac. 5 ac. 1 ACRES

December 1994



REVISIONS:	DATE:

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-6500

DES. JRM	CKD. GSB		
DRN. TPO	APP.		
DATE DECEMBER 1994			
SHEET 1	OF	1	
DWG. EXHIBIT B			
PROJ. NO. 12291			

File : GRAND/SOILSPRP.DGN

EXHIBIT C
MASTER DRAINAGE PLAN
DEVELOPED CONDITION
HEC-1 WATERSHED MAP

For

Del Webb's

Grand Avenue Property

Surprise, Arizona

North

Scale: 1" = 800'

0 400 800 1600

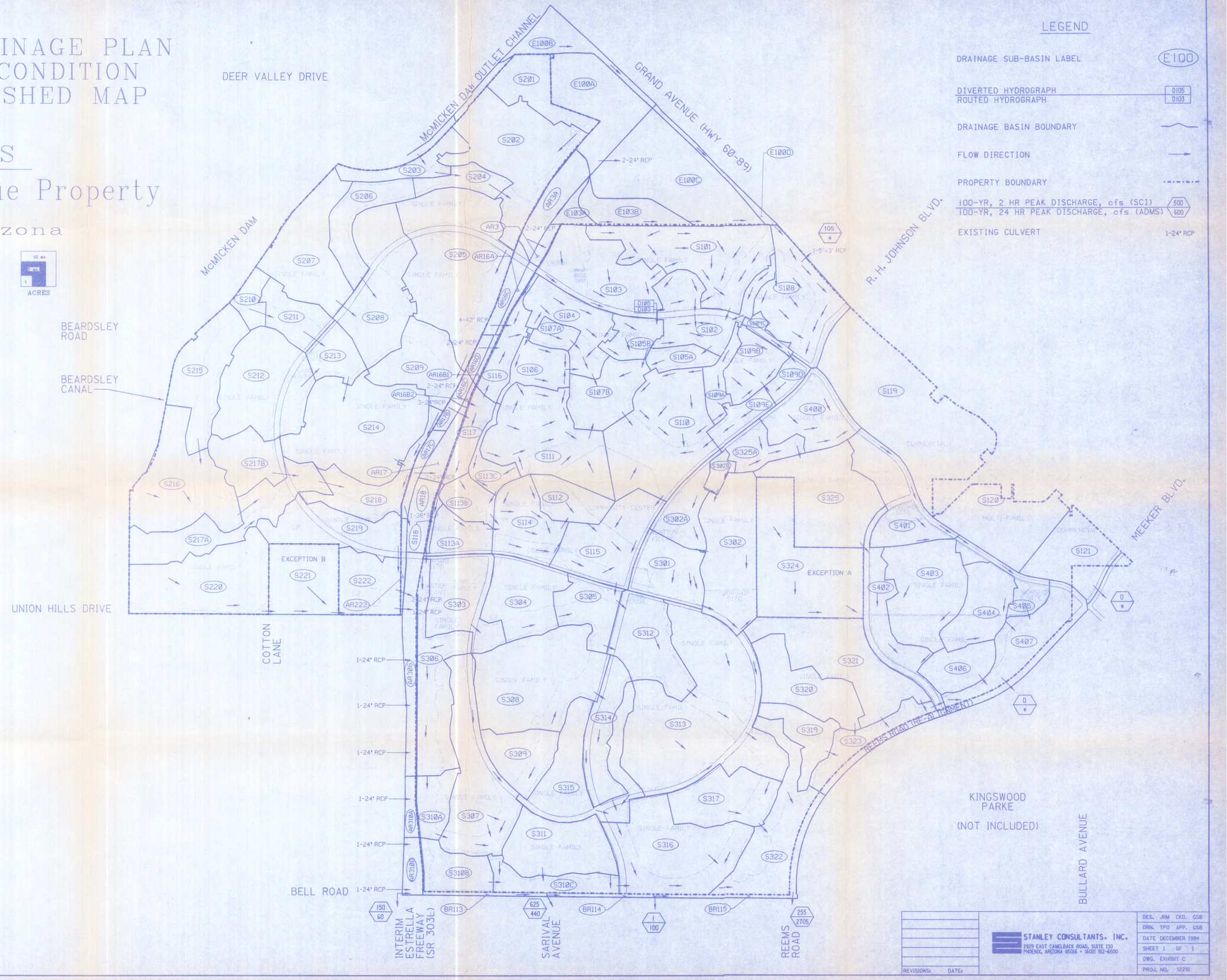
10 ac. 8 6 4 2 1 ACRES

December 1994

NOTES:

OFF-SITE CONTRIBUTING SUB-BASINS ARE FROM THE WHITE TANKS ADMS DEVELOPED BY THE WLB GROUP.

• INDICATES CONCENTRATION POINT NOT COMMON WITH THE WHITE TANKS ADMS.



REVISIONS: DATE:	STANLEY CONSULTANTS, INC. 2929 EAST CAMELBACK ROAD, SUITE 130 PHOENIX, ARIZONA 85016 • (602) 912-6500

DES. JRM	CKD. GSB
DRN. TPO	APP. GSB
DATE DECEMBER 1994	
SHEET 1 OF 1	
DWG. EXHIBIT C	
PROJ. NO. 12291	

File : GRAND/ZONEPRP.DGN

EXHIBIT D
MASTER DRAINAGE PLAN
PHASE I DEVELOPED CONDITION
HEC-1 WATERSHED MAP

For

Del Webb's

Grand Avenue Property

Surprise, Arizona

North

Scale: 1" = 800'

0 400 800 1600

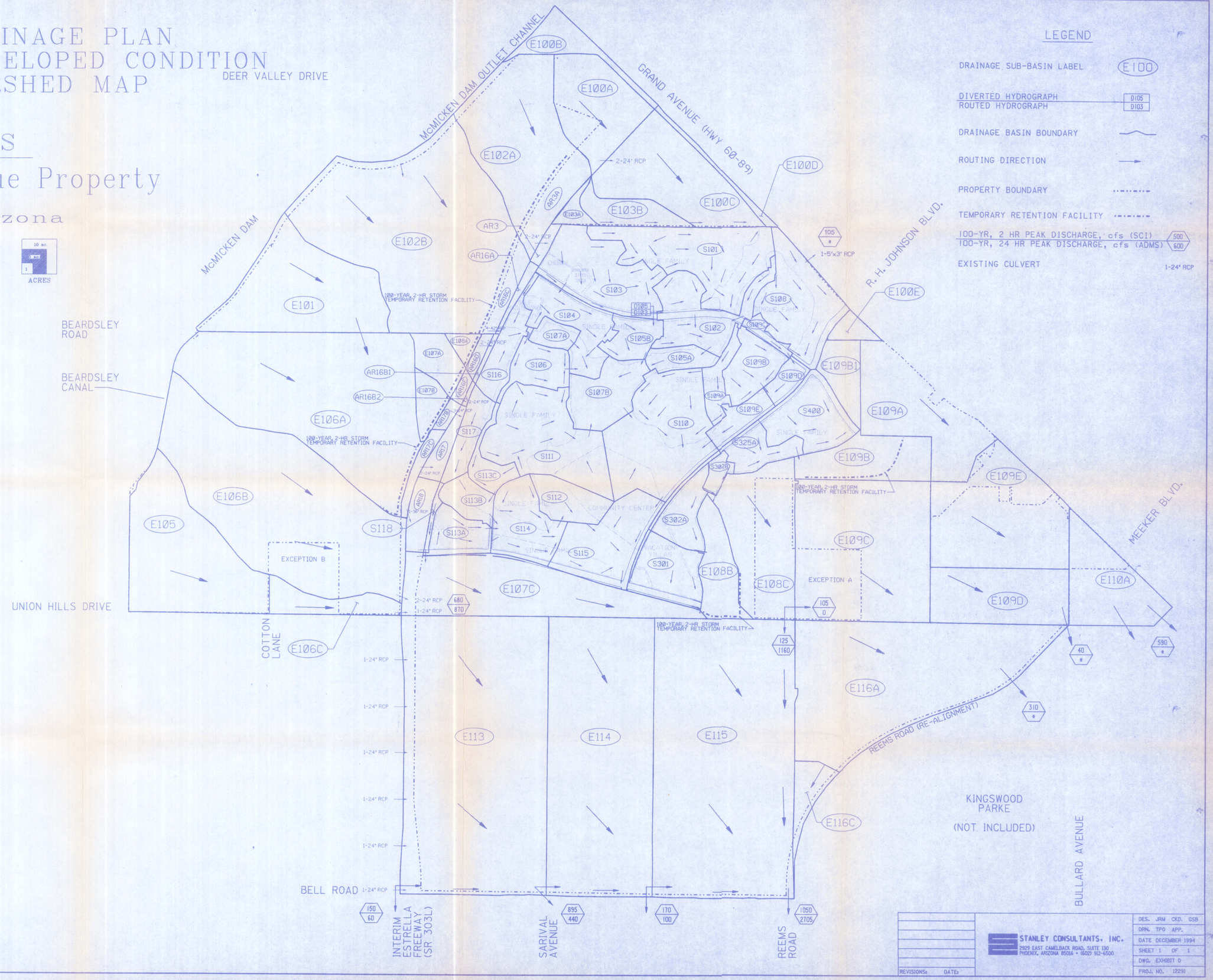
10 ac. 2 ac 1 ACRES

December 1994

NOTES:

OFF-SITE CONTRIBUTING SUB-BASINS ARE FROM THE WHITE TANKS ADMS DEVELOPED BY THE WLB GROUP.

* INDICATES CONCENTRATION POINT NOT COMMON WITH THE WHITE TANKS ADMS.



REVISIONS:	DATE:

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-6500

DES. JRM	CKD. GSB
DRN. TPO	APP.
DATE DECEMBER 1994	
SHEET 1 OF 1	
DWG. EXHIBIT D	
PROJ. NO. 12291	

File : GRAND/PH1EXIST.DGN

APPENDIX B
EXISTING CONDITION HEC-1
OUTPUT AND SUPPORTING CALCULATIONS

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  12/22/1994  TIME  10:35:27 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
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
  2           ID       DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE, ARIZONA
  3           ID       STANLEY CONSULTANTS, INC. JOB # 12291
  4           ID       HEC-1 MODEL INPUT FILENAME: E12291.DAT
  5           ID
  6           ID       ********************************
  7           ID       *                              *
  8           ID       *     EXISTING CONDITIONS      *
  9           ID       *   100-YEAR, 2-HOUR STORM     *
 10           ID       *                              *
 11           ID       ********************************
 12           ID
 13           ID       CLARK UNIT HYDROGRAPH
 14           ID
 15           ID       100-YEAR, 2-HR STORM DISTRIBUTION
 16           ID       (FCDMC HYDROLOGIC DESIGN MANUAL; TABLE 2.2)
 17           ID       P100 = 2.77"  (NO AERIAL REDUCTION)
 18           ID
 19           ID       COMPUTATION TIME INTERVAL 3 MINUTES
 20           ID
 21           ID       GREEN-AMPT LOSS RATES AND PARAMETERS FOR EXISTING CONDITIONS:
 22           ID
 23           ID              DTHETA   VEGETATIVE              ROUGHNESS  Kb EQN. PARAMETERS
 24           ID     LAND USE CONDITION  COVER (%) RTIMP  IA  DESCRIPTION    "m"      "b"
 25           ID      ------- --------- ---------- ----- ---- ----------- --------  ------
 26           ID      Desert     DRY         25       0  0.35      Low    -0.01375   0.08
 27           ID      OPEN     NORMAL        25       1  0.35      Low    -0.01375   0.08
 28           ID      L.D.R.   NORMAL        25      25  0.15      Min    -0.00625   0.04
 29           ID      M.F.R.   NORMAL        25      55  0.15      Min    -0.00625   0.04
 30           ID      Comm     NORMAL        25      80  0.10      Min    -0.00625   0.04
 31           ID      Ag         WET         90       0  0.50      Low    -0.01375   0.08
 32           ID      Fallow     DRY         20       0  0.50      Low    -0.01375   0.08
 33           ID
 34           ID       SURFACE RETENTION LOSS IS BASED ON FCDMC HYDROLOGY MANUAL TABLE 4.1.
 35           ID
 36           ID       SUB-BASIN XKSAT VALUES ARE AREA-WEIGHTED LOGARITHMS OF THE INDIVIDUAL
 37           ID       XKSAT VALUES OCCURRING WITHIN THE SUB-BASIN.  THE BARE GROUND XKSAT
 38           ID       VALUE IS ADJUSTED FOR VEGETATIVE COVER.  THE ADJUSTMENT IS AREA-WEIGHTED
 39           ID       BY LAND USE AND THE CORRECTION PRESENTED IN FIGURE 4.4 OF THE FCDMC
 40           ID       HYDROLOGY MANUAL IS APPLIED.  THE WHITE TANKS/AGUA FRIA ADMS SOIL
 41           ID       DISTRIBUTION IS ASSUMED FOR THE EXISTING CONDITIONS.
 42           ID
 43           ID       THE WETTING FRONT CAPILLARY SUCTION (PSIF) AND VOLUMETRIC SOIL MOISTURE
 44           ID       DEFICIT AT THE START OF RAINFALL (DTHETA) ARE A FUNCTION OF THE SUB-
 45           ID       BASIN SOIL, GROUND SURFACE, AND LAND USE CHARACTERISTICS.  THESE
 46           ID       VARIABLES ARE AREA-WEIGHTED BY SUB-BASIN.  DTHETA IS A FUNCTION OF THE
 47           ID       ASSUMED SOIL MOISTURE CONDITION AT THE START OF RAINFALL FOR THE LAND
 48           ID       USES PRESENTED IN THE ABOVE TABLE.
 49           ID
 50           ID       TIME OF CONCENTRATION (TC), AND STORAGE COEFFICIENT (R), IS BASED ON
 51           ID       MCUHP1 (REVISED 12-16-91). LENGTHS AND SLOPES FOR ALL ON-SITE AREAS
 52           ID       ARE BASED ON EXISTING 1' CONTOUR TOPOGRAPHIC MAPPING.  CONTRIBUTING
 53           ID       OFF-SITE AREAS WEST OF SR 303L BETWEEN BELL ROAD AND UNION HILLS DRIVE
 54           ID       ARE IDENTICAL TO THE WHITE TANKS/AGUA FRIA ADMS.
 55           ID
```

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

  56          ID        Kb VALUES ARE BASED ON m AND b PARAMETERS FROM TABLE 5.1 OF HYDROLOGY
  57          ID        MANUAL.  Kb VALUES ARE AREA-WEIGHTED BY COMPOSITE LAND USE.
  58          ID
  59          ID        THE TIME-AREA RELATION FOR EACH SUB-BASIN IS BASED ON THE FCDMC
  60          ID        HYDROLOGY MANUAL TABLE 5.2:
  61          ID          1. ALL NON-DEVELOPED AREAS USE THE NATURAL TIME-AREA UA RECORD.
  62          ID          2. DEVELOPED AREAS ASSUME A TIME-AREA UA BASED ON THE DOMINANT
  63          ID             LAND USE WITHIN THE SUB-BASIN.
  64          ID
  65          ID        HYDROGRAPH ROUTING THRU THE EXISTING WATERSHED USES NORMAL DEPTH
  66          ID        MODIFIED PULS ASSUMING:
  67          ID
  68          ID        1. 8-POINT CROSS-SECTION REPRESENTATIVE OF THE CHANNEL REACH.
  69          ID        2. WHITE TANKS/AGUA FRIA ADMS ROUTING BLOCKS WHERE APPLICABLE.
  70          ID        3. "n" VALUES BASED ON FIELD RECON GENERALLY DECREASING IN THE
  71          ID           DOWNSTREAM DIRECTION AS A RESULT OF THE INCREASED DEPTH.
  72          ID        4. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH
  73          ID           APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
  74          ID        5. INFILTRATION/PERCOLATION IS ZERO.
  75          ID        6. INITIAL DISCHARGE IS ZERO.
  76          ID
  77          ID        HYDROGRAPH ROUTING THRU RETENTION BASINS USES LEVEL POOL MODIFIED PULS
  78          ID        ASSUMING:
  79          ID
  80          ID        1. INFILTRATION/PERCOLATION IS ZERO.
  81          ID        2. DETENTION BASINS ARE EMPTY AT START OF MODEL.
  82          ID        3. EXISTING TOPOGRAPHY USED TO DEVELOP SA/SE RELATIONS.
  83          ID
  84          ID        ALL FLOW SPLITS WERE ESTIMATED ON THE BASIS OF HYDRAULIC ANALYSES.  THE
  85          ID        ANALYSES GERERALLY UTILIZED EITHER STEP-BACKWATER, NORMAL DEPTH, WEIR
  86          ID        FLOW METHODS OR COMBINATIONS THEREOF.
  87          ID
  88          IT      3                    300
  89          IO      5
            *DIAGRAM

  90          KK    E101
  91          KM   SUB-BASIN E101
  92          BA    .163
  93          IN      5
  94          KM   RAINFALL DEPTH OF 2.77 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  95          PB   2.770
  96          KM   THE FOLLOWING PC RECORD USED A 2-HOUR RAINFALL DISTRIBUTION
  97          PC    .000    .011    .018    .023    .028    .032    .046    .071    .100    .137
  98          PC    .176    .232    .327    .601    .743    .863    .901    .930    .954    .962
  99          PC    .970    .979    .982    .992   1.000
 100          LG    .350    .370   5.200    .250    .000
 101          UC    .675    .429
 102          UA       0       3       5       8      12      20      43      75      90      96
 103          UA     100
```

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

 104          KK   R106A
 105          KM        ROUTE FLOW FROM E101 TO C106A
 106          RS      18    FLOW      -1       0
 107          RC    .075    .075    .075    3889   .0046
 108          RX       0       5      10      30     245     290     420     550
 109          RY       3       2       1       0       0       1       2       3

 110          KK   E106A
 111          KM   SUB-BASIN E106A
 112          BA    .361
 113          LG    .389    .346   5.400    .260    .000
 114          UC    .788    .523
 115          UA       0       3       5       8      12      20      43      75      90      96
 116          UA     100

 117          KK   C106A
 118          KM        ADD HYDROGRAPHS AT C106A - R106A, E106A
 119          HC       2

 120          KK  LP106A
 121          KM       RESERVOIR ROUTE OF C106A
 122          RS       1    STOR      -1       0
 123          SA       0    .027    .030    0.69    2.78    7.37    9.45    11.6
 124          SE    1302    1304  1305.8    1306    1307    1308  1308.5    1309
 125          SQ       0      16      67      73      99     212     336     517
 126          SE    1302    1304  1305.8    1306    1307    1308  1308.5    1309
 127          SS    1309       1     .62     1.5
 128          ST  1308.4      64     2.9     1.5
 129          SW       0      64
 130          SE  1308.4  1309.4

 131          KK   1D106
 132          KM        DIVERT C106A (2-24" CULVERTS EAST - D106'A'  A - TWO CULVERTS)
 133          DT   D107C
 134          DI       0      16      73      99     212     336
 135          DQ       0       3      29      43      53      57

 136          KK   2D106
 137          KM        DIVERT C106A (36" CULVERT UNDER 303 - SOUTH TO C106BC)
 138          DT  D106BC
 139          DI       0      13      44      56     159     279
 140          DQ       0      13      44      50      57      61

 141          KK   R106B
 142          KM        ROUTE REMAINING FLOW FROM C106A TO C106B
 143          RS       9    FLOW      -1       0
 144          RC    .035    .035    .035    1440   .0042
 145          RX       0       6      14      31      58      63      67      83
 146          RY     2.3       2       1       0       0       1       2     2.5
```

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

 147          KK   E106B
 148          KM   SUB-BASIN E106B
 149          BA    .373
 150          LG    .350    .380   5.600    .210    .000
 151          UC    .708    .522
 152          UA       0       3       5       8      12      20      43      75      90      96
 153          UA     100

 154          KK   C106B
 155          KM        ADD HYDROGRAPHS AT C106B - R106B, E106B
 156          HC       2

 157          KK    E105
 158          KM   SUB-BASIN E105
 159          BA    .178
 160          LG    .350    .380   5.400    .220    .000
 161          UC    .504    .356
 162          UA       0       3       5       8      12      20      43      75      90      96
 163          UA     100

 164          KK   R106C
 165          KM        ROUTE FLOW FROM E105 TO C106C
 166          RS       3    FLOW      -1       0
 167          RC    .035    .035    .035    2498   .0044
 168          RX       0      26      39      54      65      70      83      88
 169          RY     2.5       2       1       0       0       1       2     2.5

 170          KK   E106C
 171          KM   SUB-BASIN E106C
 172          BA    .036
 173          LG    .350    .380   5.600    .210    .000
 174          UC    .446    .549
 175          UA       0       3       5       8      12      20      43      75      90      96
 176          UA     100

 177          KK   C106C
 178          KM        ADD HYDROGRAPHS AT C106C - R106C, E106C
 179          HC       2

 180          KK  2DR106
 181          KM       RECALL 2D106 (36" CULVERT UNDER SR 303)
 182          DR  D106BC

 183          KK  1R107C
 184          KM       ROUTE D106BC TO C106BC (2DR106 - RECALLED HYDROGRAPH)
 185          RS       9    FLOW      -1       0
 186          RC    .016    .016    .016    1680   .0042
 187          RX       0       1       1     3.5     4.5       7       7       8
 188          RY       4       4       3       0       0       3       4       4
```

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

 189          KK  C106BC
 190          KM        ADD HYDROGRAPHS AT C106BC - C106B, C106C, 1R107C
 191          HC       3

 192          KK  2R107C
 193          KM        ROUTE FLOW FROM C106BC TO C107C
 194          RS      19    FLOW      -1       0
 195          RC    .075     .03     .03    5600   .0034
 196          RX    1000    1430    1860    1890    1940    1960    1969    1970
 197          RY    1292    1291    1290  1289.5  1289.5    1290  1290.5  1290.5

 198          KK   E107A
 199          KM   SUB-BASIN E107A
 200          BA    .031
 201          LG    .350    .350   4.900    .280    .000
 202          UC    .329    .290
 203          UA       0       3       5       8      12      20      43      75      90      96
 204          UA     100

 205          KK   E107B
 206          KM   SUB-BASIN E107B
 207          BA    .024
 208          LG    .350    .350   4.900    .280    .000
 209          UC    .258    .213
 210          UA       0       3       5       8      12      20      43      75      90      96
 211          UA     100

 212          KK  C107AB
 213          KM        ADD HYDROGRAPHS AT C107AB - E107A, E107B
 214          HC       2

 215          KK  3R107C
 216          KM        ROUTE FLOW FROM C107AB TO C107C
 217          RS      31    FLOW      -1       0
 218          RC    .075    .075    .075    5760   .0052
 219          RX       0      30      55     100     140     170     200     215
 220          RY       2       1      .5       0       0      .5       1       2

 221          KK  1DR106
 222          KM        RECALL 1D106 (2-24" CULVERTS DIVERTED EAST)
 223          DR   D107C

 224          KK  4R107C
 225          KM        ROUTE D107C TO C107C (1DR106 - RECALLED HYDROGRAPH)
 226          RS      48    FLOW      -1       0
 227          RC    .075    .075    .075    6480   .0048
 228          RX       0      60      90     140     200     275     350     360
 229          RY       2       1      .5       0       0      .5       1       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 230          KK   E107C
 231          KM   SUB-BASIN E107C
 232          BA    .526
 233          LG    .473    .350   4.900    .270    .000
 234          UC    .758    .460
 235          UA       0       3       5       8      12      20      43      75      90      96
 236          UA     100

 237          KK   C107C
 238          KM        ADD HYDROGRAPHS AT C107C - 2R107C, 3R107C, 4R107C, E107C
 239          HC       4

 240          KK   1R115
 241          KM        ROUTE FLOW FROM C107C TO C115
 242          RS      12    FLOW      -1       0
 243          RC    .035    .035    .075    6880   .0042
 244          RX    1000    1001    1002    1030    1100    1370    1900    2290
 245          RY    1259    1259    1259    1258    1258    1260    1262    1264

 246          KK   E108A
 247          KM   SUB-BASIN E108A
 248          BA    .015
 249          LG    .350    .390   6.200    .160    .000
 250          UC    .267    .288
 251          UA       0       3       5       8      12      20      43      75      90      96
 252          UA     100

 253          KK   R108B
 254          KM        ROUTE FLOW FROM E108A TO C108B
 255          RS      85    FLOW      -1       0
 256          RC    .075    .075    .075    8072   .0044
 257          RX    1000    1001    1120    1700    2030    2630    3070    3270
 258          RY    1289    1289    1288    1286    1286    1288    1290    1292

 259          KK   E108B
 260          KM   SUB-BASIN E108B
 261          BA    .394
 262          LG    .393    .339   6.200    .170    .000
 263          UC    .867    .797
 264          UA       0       3       5       8      12      20      43      75      90      96
 265          UA     100

 266          KK   C108B
 267          KM        ADD HYDROGRAPHS AT C108B - R108B, E108B
 268          HC       2

 269          KK   2R115
 270          KM        ROUTE FLOW FROM C108B TO C115
 271          RS      12    FLOW      -1       0
 272          RC    .035    .035    .075    5249   .0055
 273          RX    1000    1001    1002    1030    1100    1370    1900    2290
 274          RY    1259    1259    1259    1258    1258    1260    1262    1264
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 275          KK   E102A
 276          KM   SUB-BASIN E102A
 277          BA    .188
 278          LG    .350    .360   5.000    .270    .000
 279          UC    .463    .299
 280          UA       0       3       5       8      12      20      43      75      90      96
 281          UA     100

 282          KK   D102A
 283          KM       DIVERT E102A ( 2-24" RCP TO E103A )
 284          DT   D103A
 285          DI       0      10      50      54     100     150     200     250
 286          DQ       0      10      50      54      67      67      67      67

 287          KK   R102B
 288          KM        ROUTE REMAINING FLOW FROM E102A TO C102B
 289          RS       3    FLOW      -1       0
 290          RC    .035    .035    .035    1680   .0024
 291          RX       0      10      12      14      25      27      35      47
 292          RY     3.0     1.5      .5       0       0      .5     1.5     3.0

 293          KK   E102B
 294          KM   SUB-BASIN E102B
 295          BA    .401
 296          LG    .485    .360   5.000    .260    .000
 297          UC    .879    .616
 298          UA       0       3       5       8      12      20      43      75      90      96
 299          UA     100

 300          KK   C102B
 301          KM       ADD HYDROGRAPHS AT C102B - R102B, E102B
 302          HC       2

 303          KK  1R103A
 304          KM        ROUTE FLOW FROM C102B TO C103A
 305          RS       2    FLOW      -1       0
 306          RC    .035    .035    .035    2942   .0056
 307          RX    1000    1001    1030    1085    1120    1138    1139    1140
 308          RY    1319    1319    1318    1316    1316    1317    1317    1317

 309          KK   E103A
 310          KM   SUB-BASIN E103A
 311          BA    .160
 312          LG    .380    .350   4.800    .290    .000
 313          UC    .525    .387
 314          UA       0       3       5       8      12      20      43      75      90      96
 315          UA     100

 316          KK  DR102A
 317          KM       RECALL D102A ( FROM E102A )
 318          DR   D103A
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 319          KK  2R103A
 320          KM       ROUTE D102A TO C103A (RECALLED HYDROGRAPH)
 321          RS       8    FLOW      -1       0
 322          RC    .035    .035    .035    3682    .005
 323          RX       0      10      20      30      40      50      60      70
 324          RY       3       2       1       0       0       1       2       3

 325          KK   C103A
 326          KM        ADD HYDROGRAPHS AT C103A - 1R103A, E103A, 2R103A
 327          HC       3

 328          KK   R103B
 329          KM        ROUTE FLOW FROM C103A TO C103B
 330          RS       4    FLOW      -1       0
 331          RC    .035    .035    .035    2649   .0019
 332          RX    1000    1001    1030    1085    1120    1138    1139    1140
 333          RY    1319    1319    1318    1316    1316    1317    1317    1317

 334          KK   E103B
 335          KM   SUB-BASIN E103B
 336          BA    .247
 337          LG    .500    .350   4.800    .280    .000
 338          UC    .642    .510
 339          UA       0       3       5       8      12      20      43      75      90      96
 340          UA     100

 341          KK   C103B
 342          KM        ADD HYDROGRAPHS AT C103B - R103B, E103B
 343          HC       2

 344          KK   R108C
 345          KM        ROUTE FLOW FROM C103B TO CP108C
 346          RS       4    FLOW      -1       0
 347          RC     .08    .022    .035    5217   .0044
 348          RX    1000    1050    1080    1095    1130    1150    1300    1830
 349          RY    1285    1284    1282    1280    1280    1282    1284    1286

 350          KK   E108C
 351          KM   SUB-BASIN E108C
 352          BA    .380
 353          LG    .500    .035   6.200    .250    .000
 354          UC   1.308   1.279
 355          UA       0       3       5       8      12      20      43      75      90      96
 356          UA     100

 357          KK   C108C
 358          KM        ADD HYDROGRAPHS AT C108C - R108C, E108C
 359          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 360          KK   D108C
 361          KM        DIVERT C108C TO C109C (SEE HEC-2 ANALYSIS:REEMS.OUT)
 362          DT  1D109C
 363          DI       0     500    1000    1500    2000
 364          DQ       0     227     533     864    1207

 365          KK   3R115
 366          KM        ROUTE REMAINING FLOW FROM C108C TO C115
 367          RS      13    FLOW      -1       0
 368          RC    .035    .035    .075    5844   .0031
 369          RX    1000    1001    1002    1030    1100    1370    1900    2290
 370          RY    1259    1259    1259    1258    1258    1260    1262    1264

 371          KK    E111
 372          KM   SUB-BASIN E111
 373          BA    .500
 374          LG    .395    .252   5.100    .300    .000
 375          UC    .842    .528
 376          UA       0       3       5       8      12      20      43      75      90      96
 377          UA     100

 378          KK    D111
 379          KM        DIVERT TO  C119 FROM  C111
 380          DT    D119
 381          DI       0      32     109     228     389     599     858    1170    1539    1967
 382          DQ       0      11      39      83     145     228     333     462     617     799

 383          KK   1R112
 384          KM        ROUTE REMAINDER FROM  C111 TO  C112
 385          RS      14    FLOW      -1       0
 386          RC    .075    .035    .035    5280   .0040
 387          RX    1000    1570    2040    2370    2440    2468    2469    2470
 388          RY    1312    1310    1308    1306    1306    1307    1307    1307

 389          KK    E104
 390          KM   SUB-BASIN E104
 391          BA    .150
 392          LG    .350    .380   5.600    .210    .000
 393          UC    .546    .350
 394          UA       0       3       5       8      12      20      43      75      90      96
 395          UA     100

 396          KK   2R112
 397          KM        ROUTE FLOW FROM  E104 TO  C112
 398          RS      51    FLOW      -1       0
 399          RC    .075    .075    .075    6552   .0056
 400          RX    1000    1001    1230    1270    1750    2000    2380    2650
 401          RY    1321    1321    1320    1318    1318    1319    1318    1320
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 402          KK    E112
 403          KM   SUB-BASIN E112
 404          BA    .970
 405          LG    .325    .125   5.600    .280  28.000
 406          UC    .529    .246

 407          KK    C112
 408          KM        ADD HYDROGRAPHS FROM E112, 1R112 & 2R112
 409          HC       3

 410          KK   D112A
 411          KM        DIVERT TO  C120 FROM  C112
 412          DT    D120
 413          DI       0      48     165     355     625     981    1434    1990
 414          DQ       0      16      55     118     208     327     478     663

 415          KK   D112B
 416          KM        DIVERT TO  C121A FROM  C112
 417          DT  1D121A
 418          DI       0      32     110     237     417     654     956    1327
 419          DQ       0      16      55     118     208     327     478     663

 420          KK   R113A
 421          KM        ROUTE REMAINDER FROM  C112 TO  C113A
 422          RS       8    FLOW      -1       0
 423          RC    .075    .035    .035    2640   .0023
 424          RX    1000    1490    1830    2600    2770    2788    2789    2790
 425          RY    1290    1288    1286    1284    1284    1285    1285    1285

 426          KK   E113A
 427          KM   SUB-BASIN E113A
 428          BA    .500
 429          LG    .500    .000   5.800    .300    .000
 430          UC    .567    .320
 431          UA       0       3       5       8      12      20      43      75      90      96
 432          UA     100

 433          KK  1D113A
 434          KM        DIVERT TO C113 FROM C113A (6 CROSS-CULVERTS UNDER SR 303)
 435          DT    D113
 436          DI       0      89     100     200     400     800
 437          DQ       0      89      89      89      89      89

 438          KK   C113A
 439          KM        ADD HYDROGRAPHS R113A & 1D113A
 440          HC       2

 441          KK  2D113A
 442          KM        DIVERT TO  C121A FROM  C113A
 443          DT  2D121A
 444          DI       0     185     545     642     893    1913
 445          DQ       0       0       0      12      74     467
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 446          KK   1R113
 447          KM        ROUTE REMAINDER FROM  C113A TO  C113
 448          RS      12    FLOW      -1       0
 449          RC    .075    .035    .035    2740   .0058
 450          RX    1000    1080    2620    2725    2735    2798    2799    2800
 451          RY    1278    1277    1277    1276    1276    1277    1277    1277

 452          KK  DR113A
 453          KM        RECALL 1D113A (EAST)
 454          DR    D113

 455          KK   2R113
 456          KM        ROUTE CROSS-CULVERT FLOW FROM C113A TO C113, (RECALLED HYDROGRAPH D113)
 457          RS      10    FLOW      -1       0
 458          RC    .075    .035    .035    2740   .0058
 459          RX    1000    1080    2620    2725    2735    2798    2799    2800
 460          RY    1278    1277    1277    1276    1276    1277    1277    1277

 461          KK    E113
 462          KM   SUB-BASIN E113
 463          BA    .517
 464          LG    .500    .312   6.400    .160    .000
 465          UC    .804    .538
 466          UA       0       3       5       8      12      20      43      75      90      96
 467          UA     100

 468          KK    C113
 469          KM        ADD HYDROGRAPHS FROM 1R113, 2R113, E113
 470          HC       3

 471          KK   1D113
 472          KM        DIVERT TO  C122 FROM  C113
 473          DT   1D122
 474          DI       0     105     354     622    1153    1882
 475          DQ       0       0     195     395     845    1480

 476          KK    R114
 477          KM        ROUTE REMAINDER FROM  C113 TO  C114
 478          RS       5    FLOW      -1       0
 479          RC    .075     .04     .04    1997   .0040
 480          RX    1000    1020    1100    1850    2030    2048    2049    2050
 481          RY    1266    1264    1262    1260    1260    1261    1261    1261

 482          KK    E114
 483          KM   SUB-BASIN E114
 484          BA    .377
 485          LG    .500    .000   7.600    .150    .000
 486          UC    .621    .449
 487          UA       0       3       5       8      12      20      43      75      90      96
 488          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 489          KK    C114
 490          KM        ADD HYDROGRAPHS FROM R114 & E114
 491          HC       2

 492          KK    D114
 493          KM        DIVERT TO  C122 FROM  C114
 494          DT   2D122
 495          DI       0     235     313     480     717    1056
 496          DQ       0       0       2      81     225     462

 497          KK   4R115
 498          KM        ROUTE REMAINDER FROM C114 TO C115
 499          RS       3    FLOW      -1       0
 500          RC     .06    .022    .035    2578   .0035
 501          RX    1000    1380    1790    1800    1840    1850    1899    1900
 502          RY    1258    1256    1254    1250    1250    1252    1253    1253

 503          KK    E115
 504          KM   SUB-BASIN E115
 505          BA    .504
 506          LG    .500    .109   5.800    .270    .000
 507          UC    .762    .499
 508          UA       0       3       5       8      12      20      43      75      90      96
 509          UA     100

 510          KK   E116B
 511          KM   SUB-BASIN E116B
 512          BA    .024
 513          LG    .500    .350   4.800    .280    .000
 514          UC    .742   1.069
 515          UA       0       3       5       8      12      20      43      75      90      96
 516          UA     100

 517          KK    C115
 518          KM        ADD HYDROGRAPHS FROM 1R115, 2R115, 3R115, 4R115, E115, AND E116B
 519          HC       6

 520          KK  DR108C
 521          KM        RECALL 1D109C
 522          DR  1D109C

 523          KK   R109C
 524          KM        ROUTE 1D109C TO C109C  (RECALLED HYDROGRAPH)
 525          RS       8    FLOW      -1       0
 526          RC    .075    .035    .035    2536   .0036
 527          RX    1000    1430    1860    1890    1940    1960    1969    1970
 528          RY    1292    1291    1290  1289.5  1289.5    1290  1290.5  1290.5

 529          KK   E109C
 530          KM   SUB-BASIN E109C
 531          BA    .245
 532          LG    .500    .360   5.000    .260    .000
 533          UC    .708    .503
 534          UA       0       3       5       8      12      20      43      75      90      96
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 535          UA     100

 536          KK   C109C
 537          KM        ADD HYDROGRAPHS AT C109C - R109C, E109C
 538          HC       2

 539          KK   D109C
 540          KM        DIVERT C109C TO C116A
 541          DT   D116A
 542          DI       0       9      59     173     390     450     500     550     622     650
 543          DQ       0       0       0       0       0      60     110     160     232     260

 544          KK   R109D
 545          KM        ROUTE REMAINDER FROM C109C TO C109D
 546          RS       4    FLOW      -1       0
 547          RC    .025    .025    .025    2600   .0054
 548          RX       0       0      32      55      65      66      72      79
 549          RY  1256.4  1255.9  1254.4  1255.5  1255.8    1256    1256  1256.4

 550          KK   E109D
 551          KM   SUB-BASIN E109D
 552          BA    .095
 553          LG    .500    .115   5.000    .380    .000
 554          UC    .442    .339
 555          UA       0       3       5       8      12      20      43      75      90      96
 556          UA     100

 557          KK   C109D
 558          KM        ADD HYDROGRAPHS AT C109D - R109D, E109D
 559          HC       2

 560          KK   D109D
 561          KM        DIVERT C109D SOUTH TO KINGSWOOD PARK
 562          DT  D109DS
 563          DI       0      26     197     250     301     360     423     488     568
 564          DQ       0       0       0      15      26      40      58      78     105

 565          KK  1R110A
 566          KM       ROUTE REMAINDER FROM C109D TO C110A
 567          RS       2    FLOW      -1       0
 568          RC    .022    .022    .022    1620   .0081
 569          RX       0       1       3      14      15      34      63      69
 570          RY    4.45    4.45    2.45       0       0    1.41    1.66    3.66

 571          KK   E100B
 572          KM   SUB-BASIN E100B
 573          BA    .035
 574          LG    .280    .250   4.900    .280  23.000
 575          UC    .346    .456
 576          UA       0       3       5       8      12      20      43      75      90      96
 577          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 578          KK   R100D
 579          KM        ROUTE E100B TO C100D
 580          RS     11    FLOW      -1       0
 581          RC   .035    .035    .035    4066   .0054
 582          RX      0      50      75      90     100     130     150     160
 583          RY      1       1       0       0       0       0       1       1

 584          KK   E100D
 585          KM   SUB-BASIN E100D
 586          BA    .015
 587          LG    .350    .250   4.900    .280   1.000
 588          UC    .617   1.923
 589          UA      0       3       5       8      12      20      43      75      90      96
 590          UA    100

 591          KK   C100D
 592          KM        ADD HYDROGRAPHS AT C100D - R100D, E100D
 593          HC      2

 594          KK   E100A
 595          KM   SUB-BASIN E100A
 596          BA    .092
 597          LG    .500    .350   4.900    .270    .000
 598          UC    .750    .668
 599          UA      0       3       5       8      12      20      43      75      90      96
 600          UA    100

 601          KK   R100C
 602          KM        ROUTE E100A TO C100C
 603          RS     59    FLOW      -1       0
 604          RC     .1      .1      .1    4560   .0056
 605          RX      0      20     445     915     940     970     990    1000
 606          RY      1      .5     .25       0       0      .5       1       2

 607          KK   E100C
 608          KM   SUB-BASIN E100C
 609          BA    .163
 610          LG    .500    .350   4.900    .270    .000
 611          UC    .596    .519
 612          UA      0       3       5       8      12      20      43      75      90      96
 613          UA    100

 614          KK   C100C
 615          KM        ADD HYDROGRAPHS AT C100C - R100C, E100C
 616          HC      2

 617          KK  C100CD
 618          KM        ADD HYDROGRAPHS AT C100CD - C100D, C100C
 619          HC      2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 620          KK  D100CD
 621          KM        DIVERT C100CD TO ADOT CULVERT
 622          DT    ADOT
 623          DI      0      60     100     120     140     150     200
 624          DQ      0      60     100     106     104     103      96

 625          KK   R100E
 626          KM        ROUTE REMAINDER FROM C100CD TO C100E
 627          RS     14    FLOW      -1       0
 628          RC     .1      .1      .1    1969   .0064
 629          RX      0      10      20     120     140     180     210     240
 630          RY    1.5       1      .5       0       0       1       2       3

 631          KK   E100E
 632          KM   SUB-BASIN E100E
 633          BA    .030
 634          LG    .350    .350   4.900    .280    .000
 635          UC    .321    .349
 636          UA      0       3       5       8      12      20      43      75      90      96
 637          UA     100

 638          KK   C100E
 639          KM        ADD HYDROGRAPHS AT C100E ( R100E & E100E)
 640          HC       2

 641          KK   R109A
 642          KM        ROUTE C100E TO C109A
 643          RS     38    FLOW      -1       0
 644          RC   .075    .075    .075    3190   .0065
 645          RX      0      65     200     275     285     320     440     620
 646          RY    1.5       1      .5       0       0      .5       1     1.5

 647          KK   E109A
 648          KM   SUB-BASIN E109A
 649          BA    .122
 650          LG    .500    .360   5.000    .260    .000
 651          UC    .438    .330
 652          UA      0       3       5       8      12      20      43      75      90      96
 653          UA     100

 654          KK   E109B
 655          KM   SUB-BASIN E109B
 656          BA    .164
 657          LG    .500    .360   5.000    .260    .000
 658          UC    .579    .473
 659          UA      0       3       5       8      12      20      43      75      90      96
 660          UA     100

 661          KK   C109A
 662          KM        ADD HYDROGRAPHS AT C109A (R109A, E109A, AND E109B)
 663          HC       3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 664          KK   R109E
 665          KM        ROUTE C109A TO C109E
 666          RS      10    FLOW      -1       0
 667          RC    .075    .075    .075    2640   .0067
 668          RX       0      10      30      80     265     330     380     430
 669          RY       2       1      .5       0       0     .25      .5       1

 670          KK   E109E
 671          KM   SUB-BASIN E109E
 672          BA    .173
 673          LG    .500    .223   5.000    .320    .000
 674          UC    .463    .314
 675          UA       0       3       5       8      12      20      43      75      90      96
 676          UA     100

 677          KK   C109E
 678          KM        ADD HYDROGRAPHS AT C109E - R109E, E109E
 679          HC       2

 680          KK  2R110A
 681          KM        ROUTE C109E TO C110A
 682          RS       8    FLOW      -1       0
 683          RC    .075    .075    .075    2000   .0045
 684          RX       0      10      30      80     265     330     380     430
 685          RY       2       1      .5       0       0     .25      .5       1

 686          KK   E110A
 687          KM   SUB-BASIN E110A
 688          BA    .088
 689          LG    .455    .370   6.600    .140    .000
 690          UC    .504    .466
 691          UA       0       3       5       8      12      20      43      75      90      96
 692          UA     100

 693          KK   C110A
 694          KM        ADD HYDROGRAPHS AT C110A (1R110A, 2R110A, AND E110A)
 695          HC       3

 696          KK  DR109C
 697          KM        RECALL D109C
 698          DR   D116A

 699          KK   R116A
 700          KM        ROUTE D109C TO C116A (RECALLED HYDROGRAPH)
 701          RS      12    FLOW      -1       0
 702          RC    .075    .075    .075    2000   .0025
 703          RX       0      50      65      80     170     195     220     245
 704          RY     2.5       1      .5       0       0      .5       1     2.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 705          KK   E116A
 706          KM   SUB-BASIN E116A
 707          BA    .321
 708          LG    .500    .350   4.800    .280    .000
 709          UC    .792    .501
 710          UA      0       3       5       8      12      20      43      75      90      96
 711          UA    100

 712          KK   C116A
 713          KM       ADD HYDROGRAPHS AT C116A - R116A, E116A
 714          HC      2
 715          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  90       E101
              V
              V
 104      R106A
              .
              .
 110          .       E106A
              .           .
              .           .
 117      C106A............
              V
              V
 120     LP106A
              .
              .
 133          .------->   D107C
 131      1D106
              .
              .
 138          .------->  D106BC
 136      2D106
              V
              V
 141      R106B
              .
              .
 147          .       E106B
              .           .
              .           .
 154      C106B............
              .
              .
 157          .        E105
              .           V
              .           V
 164          .       R106C
              .           .
              .           .
 170          .           .      E106C
              .           .          .
              .           .          .
 177          .       C106C............
              .           .
              .           .
 182          .           .          .<-------  D106BC
 180          .           .     2DR106
              .           .          V
              .           .          V
 183          .           .     1R107C
              .           .          .
              .           .          .
 189     C106BC........................
              V
              V
 192     2R107C
              .
              .
 198          .       E107A
              .           .
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                .          .
205             .          .      E107B
                .          .          .
                .          .          .
212             .     C107AB............
                .          V
                .          V
215             .     3R107C
                .          .
                .          .
223             .          .          .<-------   D107C
221             .          .     1DR106
                .          .          V
                .          .          V
224             .          .     4R107C
                .          .          .
                .          .          .
230             .          .          .      E107C
                .          .          .          .
                .          .          .          .
237        C107C.................................
               V
               V
240        1R115
               .
               .
246             .     E108A
                .          V
                .          V
253             .     R108B
                .          .
                .          .
259             .          .     E108B
                .          .          .
                .          .          .
266             .     C108B............
                .          V
                .          V
269             .     2R115
                .          .
                .          .
275             .          .     E102A
                .          .          .
                .          .          .
284             .          .          .-------->  D103A
282             .          .     D102A
                .          .          V
                .          .          V
287             .          .     R102B
                .          .          .
                .          .          .
293             .          .          .      E102B
                .          .          .          .
                .          .          .          .
300             .          .     C102B............
                .          .          V
                .          .          V
303             .          .    1R103A
                .          .          .
                .          .          .
309             .          .          .      E103A
                .          .          .          .
                .          .          .          .
318             .          .          .          .          .<-------   D103A
316             .          .          .          .     DR102A
                .          .          .          .          V
```

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                                                V
319                                         2R103A
                                                .
                                                .
325                   C103A......................
                        V
                        V
328                   R103B
                        .
                        .
334                     .       E103B
                        .           .
                        .           .
341                   C103B............
                        V
                        V
344                   R108C
                        .
                        .
350                     .       E108C
                        .           .
                        .           .
357                   C108C............
                        .
                        .
362                     .-------> 1D109C
360                   D108C
                        V
                        V
365                   3R115
                        .
                        .
371                     .       E111
                        .           .
                        .           .
380                     .           .-------> D119
378                     .       D111
                        .           V
                        .           V
383                     .       1R112
                        .           .
                        .           .
389                     .           .       E104
                        .           .          V
                        .           .          V
396                     .           .       2R112
                        .           .          .
                        .           .          .
402                     .           .          .       E112
                        .           .          .          .
                        .           .          .          .
407                     .       C112.......................
                        .           .
                        .           .
412                     .           .-------> D120
410                     .       D112A
                        .           .
                        .           .
417                     .           .-------> 1D121A
415                     .       D112B
                        .           V
                        .           V
420                     .       R113A
                        .           .
                        .           .
426                     .           .       E113A
```

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          .         .         .         .         .
          .         .         .         .         .
435       .         .         .         .         .-------->   D113
433       .         .         .         .     1D113A
          .         .         .         .         .
          .         .         .         .         .
438       .         .         .     C113A............
          .         .         .         .
          .         .         .         .
443       .         .         .         .-------->  2D121A
441       .         .         .    2D113A
          .         .         .        V
          .         .         .        V
446       .         .         .     1R113
          .         .         .         .
          .         .         .         .
454       .         .         .         .         .<--------   D113
452       .         .         .         .    DR113A
          .         .         .         .        V
          .         .         .         .        V
455       .         .         .         .     2R113
          .         .         .         .         .
          .         .         .         .         .
461       .         .         .         .         .       E113
          .         .         .         .         .          .
          .         .         .         .         .          .
468       .         .         .     C113........................
          .         .         .         .
          .         .         .         .
473       .         .         .         .-------->   1D122
471       .         .         .    1D113
          .         .         .        V
          .         .         .        V
476       .         .         .     R114
          .         .         .         .
          .         .         .         .
482       .         .         .         .       E114
          .         .         .         .         .
          .         .         .         .         .
489       .         .         .     C114............
          .         .         .         .
          .         .         .         .
494       .         .         .         .-------->   2D122
492       .         .         .     D114
          .         .         .        V
          .         .         .        V
497       .         .         .    4R115
          .         .         .         .
          .         .         .         .
503       .         .         .         .       E115
          .         .         .         .         .
          .         .         .         .         .
510       .         .         .         .         .      E116B
          .         .         .         .         .          .
          .         .         .         .         .          .
517    C115.......................................................
          .
          .
522       .         .<-------  1D109C
520       .    DR108C
          .         V
          .         V
523       .     R109C
          .         .
          .         .
529       .         .      E109C
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                .          .          .
                .          .          .
536             .      C109C...........
                .          .
                .          .
541             .          .-------> D116A
539             .      D109C
                .          V
                .          V
544             .      R109D
                .          .
                .          .
550             .          .      E109D
                .          .          .
                .          .          .
557             .      C109D...........
                .          .
                .          .
562             .          .-------> D109DS
560             .      D109D
                .          V
                .          V
565             .     1R110A
                .          .
                .          .
571             .          .      E100B
                .          .          V
                .          .          V
578             .          .      R100D
                .          .          .
                .          .          .
584             .          .          .      E100D
                .          .          .          .
                .          .          .          .
591             .          .      C100D...........
                .          .          .
                .          .          .
594             .          .          .      E100A
                .          .          .          V
                .          .          .          V
601             .          .          .      R100C
                .          .          .          .
                .          .          .          .
607             .          .          .          .      E100C
                .          .          .          .          .
                .          .          .          .          .
614             .          .          .      C100C...........
                .          .          .          .
                .          .          .          .
617             .          .     C100CD...........
                .          .          .
                .          .          .
622             .          .          .------->    ADOT
620             .          .     D100CD
                .          .          V
                .          .          V
625             .          .      R100E
                .          .          .
                .          .          .
631             .          .          .      E100E
                .          .          .          .
                .          .          .          .
638             .          .      C100E...........
                .          .          V
                .          .          V
641             .          .      R109A
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                .          .          .
                .          .          .
647             .          .          .       E109A
                .          .          .          .
                .          .          .          .
654             .          .          .          .       E109B
                .          .          .          .          .
                .          .          .          .          .
661             .          .       C109A.......................
                .          .          V
                .          .          V
664             .          .       R109E
                .          .          .
                .          .          .
670             .          .          .       E109E
                .          .          .          .
                .          .          .          .
677             .          .       C109E............
                .          .          V
                .          .          V
680             .          .      2R110A
                .          .          .
                .          .          .
686             .          .          .       E110A
                .          .          .          .
                .          .          .          .
693             .       C110A.......................
                .          .
                .          .
698             .          .          .<-------   D116A
696             .          .      DR109C
                .          .          V
                .          .          V
699             .          .       R116A
                .          .          .
                .          .          .
705             .          .          .       E116A
                .          .          .          .
                .          .          .          .
712             .          .       C116A............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  12/22/1994  TIME  10:35:27 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE, ARIZONA
STANLEY CONSULTANTS, INC. JOB # 12291
HEC-1 MODEL INPUT FILENAME: E12291.DAT

```
********************************
*                              *
*     EXISTING CONDITIONS      *
*   100-YEAR, 2-HOUR STORM     *
*                              *
********************************
```

CLARK UNIT HYDROGRAPH

100-YEAR, 2-HR STORM DISTRIBUTION
(FCDMC HYDROLOGIC DESIGN MANUAL; TABLE 2.2)
P100 = 2.77" (NO AERIAL REDUCTION)

COMPUTATION TIME INTERVAL 3 MINUTES

GREEN-AMPT LOSS RATES AND PARAMETERS FOR EXISTING CONDITIONS:

LAND USE	DTHETA CONDITION	VEGETATIVE COVER (%)	RTIMP	IA	ROUGHNESS DESCRIPTION	Kb EQN. PARAMETERS "m"	"b"
Desert	DRY	25	0	0.35	Low	-0.01375	0.08
OPEN	NORMAL	25	1	0.35	Low	-0.01375	0.08
L.D.R.	NORMAL	25	25	0.15	Min	-0.00625	0.04
M.F.R.	NORMAL	25	55	0.15	Min	-0.00625	0.04
Comm	NORMAL	25	80	0.10	Min	-0.00625	0.04
Ag	WET	90	0	0.50	Low	-0.01375	0.08
Fallow	DRY	20	0	0.50	Low	-0.01375	0.08

SURFACE RETENTION LOSS IS BASED ON FCDMC HYDROLOGY MANUAL TABLE 4.1.

SUB-BASIN XKSAT VALUES ARE AREA-WEIGHTED LOGARITHMS OF THE INDIVIDUAL XKSAT VALUES OCCURRING WITHIN THE SUB-BASIN. THE BARE GROUND XKSAT VALUE IS ADJUSTED FOR VEGETATIVE COVER. THE ADJUSTMENT IS AREA-WEIGHTED BY LAND USE AND THE CORRECTION PRESENTED IN FIGURE 4.4 OF THE FCDMC HYDROLOGY MANUAL IS APPLIED. THE WHITE TANKS/AGUA FRIA ADMS SOIL DISTRIBUTION IS ASSUMED FOR THE EXISTING CONDITIONS.

THE WETTING FRONT CAPILLARY SUCTION (PSIF) AND VOLUMETRIC SOIL MOISTURE DEFICIT AT THE START OF RAINFALL (DTHETA) ARE A FUNCTION OF THE SUB-BASIN SOIL, GROUND SURFACE, AND LAND USE CHARACTERISTICS. THESE VARIABLES ARE AREA-WEIGHTED BY SUB-BASIN. DTHETA IS A FUNCTION OF THE ASSUMED SOIL MOISTURE CONDITION AT THE START OF RAINFALL FOR THE LAND USES PRESENTED IN THE ABOVE TABLE.

TIME OF CONCENTRATION (TC), AND STORAGE COEFFICIENT (R), IS BASED ON MCUHP1 (REVISED 12-16-91). LENGTHS AND SLOPES FOR ALL ON-SITE AREAS ARE BASED ON EXISTING 1' CONTOUR TOPOGRAPHIC MAPPING. CONTRIBUTING

OFF-SITE AREAS WEST OF SR 303L BETWEEN BELL ROAD AND UNION HILLS DRIVE ARE IDENTICAL TO THE WHITE TANKS/AGUA FRIA ADMS.

Kb VALUES ARE BASED ON m AND b PARAMETERS FROM TABLE 5.1 OF HYDROLOGY MANUAL. Kb VALUES ARE AREA-WEIGHTED BY COMPOSITE LAND USE.

THE TIME-AREA RELATION FOR EACH SUB-BASIN IS BASED ON THE FCDMC HYDROLOGY MANUAL TABLE 5.2:

1. ALL NON-DEVELOPED AREAS USE THE NATURAL TIME-AREA UA RECORD.
2. DEVELOPED AREAS ASSUME A TIME-AREA UA BASED ON THE DOMINANT LAND USE WITHIN THE SUB-BASIN.

HYDROGRAPH ROUTING THRU THE EXISTING WATERSHED USES NORMAL DEPTH MODIFIED PULS ASSUMING:

1. 8-POINT CROSS-SECTION REPRESENTATIVE OF THE CHANNEL REACH.
2. WHITE TANKS/AGUA FRIA ADMS ROUTING BLOCKS WHERE APPLICABLE.
3. "n" VALUES BASED ON FIELD RECON GENERALLY DECREASING IN THE DOWNSTREAM DIRECTION AS A RESULT OF THE INCREASED DEPTH.
4. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
5. INFILTRATION/PERCOLATION IS ZERO.
6. INITIAL DISCHARGE IS ZERO.

HYDROGRAPH ROUTING THRU RETENTION BASINS USES LEVEL POOL MODIFIED PULS ASSUMING:

1. INFILTRATION/PERCOLATION IS ZERO.
2. DETENTION BASINS ARE EMPTY AT START OF MODEL.
3. EXISTING TOPOGRAPHY USED TO DEVELOP SA/SE RELATIONS.

ALL FLOW SPLITS WERE ESTIMATED ON THE BASIS OF HYDRAULIC ANALYSES. THE ANALYSES GERERALLY UTILIZED EITHER STEP-BACKWATER, NORMAL DEPTH, WEIR FLOW METHODS OR COMBINATIONS THEREOF.

```
89 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                    NMIN          3  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       1457  ENDING TIME
                   ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .05 HOURS
                  TOTAL TIME BASE   14.95 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	E101	191.	1.70	24.	10.	10.	.16		
ROUTED TO	R106A	131.	2.60	24.	10.	10.	.16	.61	2.60
HYDROGRAPH AT	E106A	355.	1.75	52.	21.	21.	.36		
2 COMBINED AT	C106A	355.	1.75	76.	31.	31.	.52		
ROUTED TO	LP106A	217.	2.10	76.	31.	31.	.52	1308.02	2.10
DIVERSION TO	D107C	53.	2.10	22.	9.	9.	.52		
HYDROGRAPH AT	1D106	164.	2.10	54.	22.	22.	.52		
DIVERSION TO	D106BC	57.	2.10	29.	12.	12.	.52		
HYDROGRAPH AT	2D106	107.	2.10	25.	10.	10.	.52		
ROUTED TO	R106B	107.	2.20	25.	10.	10.	.52	1.09	2.20
HYDROGRAPH AT	E106B	394.	1.70	57.	23.	23.	.37		
2 COMBINED AT	C106B	394.	1.70	82.	33.	33.	.90		
HYDROGRAPH AT	E105	252.	1.55	27.	11.	11.	.18		
ROUTED TO	R106C	229.	1.70	27.	11.	11.	.18	2.00	1.70
HYDROGRAPH AT	E106C	39.	1.55	5.	2.	2.	.04		
2 COMBINED AT	C106C	262.	1.70	32.	13.	13.	.21		
HYDROGRAPH AT	2DR106	57.	2.10	29.	12.	12.	.00		
ROUTED TO	1R107C	57.	2.20	29.	12.	12.	.00	2.72	2.20
3 COMBINED AT	C106BC	706.	1.70	143.	57.	57.	1.11		
ROUTED TO	2R107C	602.	2.65	142.	57.	57.	1.11	1290.94	2.65
HYDROGRAPH AT	E107A	50.	1.40	5.	2.	2.	.03		
HYDROGRAPH AT	E107B	47.	1.35	4.	1.	1.	.02		
2 COMBINED AT	C107AB	95.	1.40	8.	3.	3.	.05		
ROUTED TO	3R107C	40.	2.95	8.	3.	3.	.05	.59	2.95
HYDROGRAPH AT	1DR106	53.	2.10	22.	9.	9.	.00		
ROUTED TO	4R107C	52.	4.15	21.	9.	9.	.00	.55	4.15
HYDROGRAPH AT	E107C	549.	1.75	73.	29.	29.	.53		
4 COMBINED AT	C107C	706.	2.55	241.	99.	99.	1.69		
ROUTED TO	1R115	672.	3.15	238.	99.	99.	1.69	1259.41	3.15

HYDROGRAPH AT	E108A	26.	1.40	2.	1.	1.	.01		
ROUTED TO	R108B	11.	5.65	2.	1.	1.	.01	1286.05	5.65
HYDROGRAPH AT	E108B	312.	1.85	63.	25.	25.	.39		
2 COMBINED AT	C108B	312.	1.85	65.	26.	26.	.41		
ROUTED TO	2R115	282.	2.45	65.	26.	26.	.41	1258.88	2.45
HYDROGRAPH AT	E102A	289.	1.50	27.	11.	11.	.19		
DIVERSION TO	D103A	67.	1.50	13.	5.	5.	.19		
HYDROGRAPH AT	D102A	222.	1.50	15.	6.	6.	.19		
ROUTED TO	R102B	202.	1.65	15.	6.	6.	.19	2.63	1.65
HYDROGRAPH AT	E102B	334.	1.85	55.	22.	22.	.40		
2 COMBINED AT	C102B	479.	1.75	70.	28.	28.	.59		
ROUTED TO	1R103A	429.	1.95	70.	28.	28.	.59	1317.68	1.95
HYDROGRAPH AT	E103A	204.	1.55	23.	9.	9.	.16		
HYDROGRAPH AT	DR102A	67.	1.30	13.	5.	5.	.00		
ROUTED TO	2R103A	67.	1.90	13.	5.	5.	.00	1.17	1.90
3 COMBINED AT	C103A	595.	1.90	106.	42.	42.	.75		
ROUTED TO	R103B	571.	2.10	106.	42.	42.	.75	1318.45	2.10
HYDROGRAPH AT	E103B	246.	1.65	34.	13.	13.	.25		
2 COMBINED AT	C103B	702.	2.05	139.	56.	56.	1.00		
ROUTED TO	R108C	678.	2.25	139.	56.	56.	1.00	1282.08	2.25
HYDROGRAPH AT	E108C	232.	2.25	71.	29.	29.	.38		
2 COMBINED AT	C108C	910.	2.25	209.	85.	85.	1.38		
DIVERSION TO	1D109C	478.	2.25	101.	41.	41.	1.38		
HYDROGRAPH AT	D108C	432.	2.25	108.	44.	44.	1.38		
ROUTED TO	3R115	397.	2.90	108.	44.	44.	1.38	1259.18	2.90
HYDROGRAPH AT	E111	499.	1.80	75.	30.	30.	.50		
DIVERSION TO	D119	188.	1.80	28.	11.	11.	.50		
HYDROGRAPH AT	D111	310.	1.80	47.	19.	19.	.50		
ROUTED TO	1R112	262.	2.50	47.	19.	19.	.50	1306.89	2.50
HYDROGRAPH AT	E104	210.	1.60	23.	9.	9.	.15		
ROUTED TO	2R112	84.	4.15	23.	9.	9.	.15	1318.25	4.15
HYDROGRAPH AT	E112	1793.	1.50	203.	81.	81.	.97		
3 COMBINED AT	C112	1793.	1.50	269.	110.	110.	1.62		

DIVERSION TO	D120	597.	1.50	90.	37.	37.	1.62		
HYDROGRAPH AT	D112A	1196.	1.50	179.	73.	73.	1.62		
DIVERSION TO	1D121A	597.	1.50	90.	37.	37.	1.62		
HYDROGRAPH AT	D112B	598.	1.50	90.	37.	37.	1.62		
ROUTED TO	R113A	514.	1.90	89.	37.	37.	1.62	1284.95	1.90
HYDROGRAPH AT	E113A	930.	1.60	104.	42.	42.	.50		
DIVERSION TO	D113	89.	1.60	25.	10.	10.	.50		
HYDROGRAPH AT	1D113A	841.	1.60	79.	32.	32.	.50		
2 COMBINED AT	C113A	1083.	1.70	169.	68.	68.	2.12		
DIVERSION TO	2D121A	147.	1.70	10.	4.	4.	2.12		
HYDROGRAPH AT	2D113A	936.	1.70	159.	65.	65.	2.12		
ROUTED TO	1R113	847.	2.30	158.	65.	65.	2.12	1277.34	2.30
HYDROGRAPH AT	DR113A	89.	1.20	25.	10.	10.	.00		
ROUTED TO	2R113	89.	2.05	25.	10.	10.	.00	1276.72	1.95
HYDROGRAPH AT	E113	526.	1.80	80.	32.	32.	.52		
3 COMBINED AT	C113	1209.	2.25	262.	107.	107.	2.64		
DIVERSION TO	1D122	893.	2.25	158.	63.	63.	2.64		
HYDROGRAPH AT	1D113	315.	2.25	104.	43.	43.	2.64		
ROUTED TO	R114	305.	2.50	103.	43.	43.	2.64	1260.67	2.50
HYDROGRAPH AT	E114	598.	1.65	85.	34.	34.	.38		
2 COMBINED AT	C114	626.	1.70	187.	77.	77.	3.01		
DIVERSION TO	2D122	170.	1.70	24.	9.	9.	3.01		
HYDROGRAPH AT	D114	456.	1.70	163.	68.	68.	3.01		
ROUTED TO	4R115	454.	1.80	163.	68.	68.	3.01	1251.79	1.80
HYDROGRAPH AT	E115	580.	1.75	84.	34.	34.	.50		
HYDROGRAPH AT	E116B	14.	1.80	3.	1.	1.	.02		
6 COMBINED AT	C115	1585.	2.95	652.	271.	271.	7.02		
HYDROGRAPH AT	DR108C	478.	2.25	101.	41.	41.	.00		
ROUTED TO	R109C	440.	2.65	101.	41.	41.	.00	1290.81	2.65
HYDROGRAPH AT	E109C	243.	1.70	34.	13.	13.	.25		
2 COMBINED AT	C109C	484.	2.65	134.	54.	54.	.25		
DIVERSION TO	D116A	94.	2.40	5.	2.	2.	.25		
HYDROGRAPH AT	D109C	390.	2.40	128.	52.	52.	.25		

ROUTED TO	R109D	390.	2.65	128.	52.	52.	.25	1256.36	2.60
HYDROGRAPH AT	E109D	143.	1.50	15.	6.	6.	.09		
2 COMBINED AT	C109D	397.	2.60	142.	58.	58.	.34		
DIVERSION TO	D109DS	51.	2.60	10.	4.	4.	.34		
HYDROGRAPH AT	D109D	347.	2.60	133.	54.	54.	.34		
ROUTED TO	1R110A	346.	2.65	133.	54.	54.	.34	2.10	2.65
HYDROGRAPH AT	E100B	51.	1.45	7.	3.	3.	.04		
ROUTED TO	R100D	41.	2.00	7.	3.	3.	.04	.40	2.00
HYDROGRAPH AT	E100D	6.	1.75	2.	1.	1.	.01		
2 COMBINED AT	C100D	47.	2.00	9.	4.	4.	.05		
HYDROGRAPH AT	E100A	75.	1.75	13.	5.	5.	.09		
ROUTED TO	R100C	38.	4.70	12.	5.	5.	.09	.31	4.70
HYDROGRAPH AT	E100C	164.	1.65	22.	9.	9.	.16		
2 COMBINED AT	C100C	164.	1.65	32.	14.	14.	.25		
2 COMBINED AT	C100CD	170.	1.65	41.	18.	18.	.31		
DIVERSION TO	ADOT	106.	1.65	36.	16.	16.	.31		
HYDROGRAPH AT	D100CD	70.	1.65	5.	2.	2.	.31		
ROUTED TO	R100E	47.	2.35	5.	2.	2.	.31	.68	2.35
HYDROGRAPH AT	E100E	44.	1.40	4.	2.	2.	.03		
2 COMBINED AT	C100E	52.	2.30	10.	4.	4.	.34		
ROUTED TO	R109A	42.	3.25	10.	4.	4.	.34	.62	3.25
HYDROGRAPH AT	E109A	170.	1.50	17.	7.	7.	.12		
HYDROGRAPH AT	E109B	175.	1.60	22.	9.	9.	.16		
3 COMBINED AT	C109A	330.	1.55	49.	20.	20.	.62		
ROUTED TO	R109E	268.	2.05	48.	20.	20.	.62	.74	2.05
HYDROGRAPH AT	E109E	254.	1.50	25.	10.	10.	.17		
2 COMBINED AT	C109E	330.	2.00	73.	30.	30.	.79		
ROUTED TO	2R110A	289.	2.40	71.	30.	30.	.79	.85	2.40
HYDROGRAPH AT	E110A	108.	1.55	14.	6.	6.	.09		
3 COMBINED AT	C110A	612.	2.55	217.	89.	89.	1.22		
HYDROGRAPH AT	DR109C	94.	2.65	5.	2.	2.	.00		
ROUTED TO	R116A	54.	3.25	5.	2.	2.	.00	.67	3.25
HYDROGRAPH AT	E116A	308.	1.75	44.	18.	18.	.32		

2 COMBINED AT	C116A	308.	1.75	49.	20.	20.	.32

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION LP106A
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1302.00	1309.00	1308.40
STORAGE	0.	16.	10.
OUTFLOW	0.	537.	311.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1308.02	.00	7.	217.	.00	2.10	.00

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

DESIGNED BY KJV DATE 10/5/94 SHEET NO. PAGE NO.
CHECKED BY JRB DATE 12/13/94 OF JOB NO.
REVIEWED BY DATE SUBJECT: DIVERSION @ E102A
APPROVED BY DATE

AREA E102A

- HYDRAULIC ANALYSIS #51

DATA:

- 2 - 24" x 84' RCP
- INV @ 1306.4 OUT 1306.0
- POSSIBLE HEAD BEFORE FLOW INTO S102B
  1310.7 - 1306.4 = 4.3' 1312.2 - 1306.4 = 5.8
- DISCHARGE FROM S102A Q = 242 cfs
- TAILWATER
  - DEFINED CHANNEL
    - ASSUME TRAP BOTTOM = 5' SIDE SLOPES = 4.5 : 1 SLOPE = .0044
      n = 0.03

CURRENT DATE: 10-05-1994
CURRENT TIME: 15:12:50

FILE DATE: 10-05-1994
FILE NAME: CULVT51

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1306.40	1306.00	84.00	2 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULVT51 DATE: 10-05-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1306.40	0	0	0	0	0	0	0	0	1
1307.26	7	7	0	0	0	0	0	0	1
1307.74	14	14	0	0	0	0	0	0	1
1308.12	20	20	0	0	0	0	0	0	1
1308.61	27	27	0	0	0	0	0	0	1
1308.92	34	34	0	0	0	0	0	0	1
1309.40	41	41	0	0	0	0	0	0	1
1310.00	48	48	0	0	0	0	0	0	1
1310.70	54	54	0	0	0	0	0	0	1
1311.50	61	61	0	0	0	0	0	0	1
1312.25	67	67	0	0	0	0	0	0	1
1313.50	76	76	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULVT51 DATE: 10-05-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1306.40	0.00	0	0	0.00
1307.26	0.00	7	0	0.00
1307.74	0.00	14	0	0.00
1308.12	0.00	20	0	0.00
1308.61	0.00	27	0	0.00
1308.92	0.00	34	0	0.00
1309.40	0.00	41	0	0.00
1310.00	0.00	48	0	0.00
1310.70	0.00	54	0	0.00
1311.50	0.00	61	0	0.00
1312.25	0.00	67	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

2/4

CURRENT DATE: 10-05-1994 FILE DATE: 10-05-1994
CURRENT TIME: 15:12:50 FILE NAME: CULVT51

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (2 BY 2) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1306.40	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-0.00
7	1307.26	0.86	0.86	1-S2n	0.61	0.64	4.23	0.61	1.73	0.52
14	1307.74	1.34	1.34	1-S2n	0.88	0.92	5.11	0.88	2.11	0.74
20	1308.12	1.72	1.72	1-S2n	1.12	1.14	5.65	1.12	2.36	0.91
27	1308.61	2.09	2.21	2-M2c	1.36	1.32	6.17	1.32	2.55	1.04
34	1308.92	2.51	2.52	2-M2c	1.66	1.48	6.83	1.48	2.70	1.16
41	1309.40	3.00	2.97	6-FFn	2.00	1.62	6.49	2.00	2.84	1.27
48	1310.00	3.60	3.58	6-FFn	2.00	1.72	7.58	2.00	2.95	1.36
54	1310.70	4.30	4.28	6-FFn	2.00	1.82	8.66	2.00	3.06	1.45
61	1311.50	5.10	5.07	6-FFn	2.00	1.92	9.74	2.00	3.15	1.53
67	1312.25	5.85	5.81	6-FFn	2.00	2.00	10.66	2.00	3.23	1.60

El. inlet face invert 1306.40 ft El. outlet invert 1306.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** EMBANKMENT TOE **********

UPSTREAM STATION (FT)	-6.00
UPSTREAM ELEVATION (FT)	1306.43
UPSTREAM EMBANKMENT SLOPE (X:1)	3.00
DOWMSTREAM STATION (FT)	90.00
DOWNSTREAM ELEVATION (FT)	1305.97
DOWNSTREAM EMBANKMENT SLOPE (X:1)	3.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 10-05-1994 FILE DATE: 10-05-1994
CURRENT TIME: 15:12:50 FILE NAME: CULVT51

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	5.00
SIDE SLOPE H/V (X:1)	5.0
CHANNEL SLOPE V/H (FT/FT)	0.004
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1306.00
CULVERT NO.1 OUTLET INVERT ELEVATION	1306.00 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1306.00	0.000	0.00	0.00	0.00
6.80	1306.52	0.424	0.52	1.73	0.14
13.60	1306.74	0.431	0.74	2.11	0.20
20.40	1306.91	0.436	0.91	2.36	0.25
27.20	1307.04	0.439	1.04	2.55	0.29
34.00	1307.16	0.442	1.16	2.70	0.32
40.80	1307.27	0.444	1.27	2.84	0.35
47.60	1307.36	0.446	1.36	2.95	0.37
54.40	1307.45	0.447	1.45	3.06	0.40
61.20	1307.53	0.449	1.53	3.15	0.42
67.00	1307.60	0.450	1.60	3.23	0.44

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	40.00
CREST LENGTH (FT)	200.00
OVERTOPPING CREST ELEVATION (FT)	1313.50

DESIGNED BY KJU DATE 10/6/94 SHEET NO. PAGE NO.
CHECKED BY JRB DATE 12/13/94 OF JOB NO.
REVIEWED BY DATE SUBJECT: DIVERSION @ E102B
APPROVED BY DATE

AREA E102B #50

- HYDRAULIC ANALYSIS

DATA

- 4 - 42" x 84' RCP w/ 8 - 42" FES
- INV @: 1304.0 cfs OUT 1303.4 cfs
- POSSIBLE HEAD BEFORE WEIR OVER 1000 BCS → INTO S103H
  - 1309.5 - 1304.0 = 5.5'
- POSSIBLE HEAD BEFORE WEIR OVER BEHRDSLEY ROAD → INTO S108H
  - 1311.5 - 1304.0 = 7.5'
- DISCHARGE @ C102B Q = 518 cfs
- TAILWATER
  - DEFINED CHANNEL
  - CHANNEL COORD.

X	0	2	9	33	37	42	45	63
Y	1308	1307	1306	1306	1308	1309	1310	1311

n = .025

SLOPE: .0051

CURRENT DATE: 10-06-1994
CURRENT TIME: 12:19:45

FILE DATE: 10-06-1994
FILE NAME: CLVT50

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1304.00	1303.40	84.00	4 RCP	3.50	3.50	.012	IMPR SDT CIR
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CLVT50 DATE: 10-06-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1306.00	0	0	0	0	0	0	0	0	1
1306.81	52	52	0	0	0	0	0	0	1
1307.16	104	104	0	0	0	0	0	0	1
1307.63	156	156	0	0	0	0	0	0	1
1308.17	208	208	0	0	0	0	0	0	1
1308.95	260	260	0	0	0	0	0	0	1
1309.58	312	295	0	0	0	0	0	15	10
1309.70	364	302	0	0	0	0	0	60	5
1309.79	416	306	0	0	0	0	0	107	4
1309.87	468	310	0	0	0	0	0	156	4
1309.94	520	314	0	0	0	0	0	202	3
1309.50	291	291	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CLVT50 DATE: 10-06-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1306.00	0.00	0	0	0.00
1306.81	0.00	52	0	0.00
1307.16	0.00	104	0	0.00
1307.63	0.00	156	0	0.00
1308.17	0.00	208	0	0.00
1308.95	0.00	260	0	0.00
1309.58	-0.01	312	1	0.43
1309.70	-0.01	364	2	0.60
1309.79	-0.01	416	3	0.69
1309.87	-0.01	468	2	0.39
1309.94	-0.00	520	5	0.88

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

2/4

CURRENT DATE: 10-06-1994 FILE DATE: 10-06-1994
CURRENT TIME: 12:19:45 FILE NAME: CLVT50

PERFORMANCE CURVE FOR CULVERT # 1 - 4 (3.5 BY 3.5) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1306.00	0.00	2.00	0-NF	0.00	0.00	0.00	0.00	0.00	2.60
52	1306.81	1.53	2.81	3-M1t	0.87	1.09	1.40	3.26	2.99	3.26
104	1307.16	2.30	3.16	1-S1f	1.26	1.56	2.70	3.50	3.78	3.58
156	1307.63	3.07	3.63	4-FFt	1.58	1.93	4.05	3.50	4.38	3.82
208	1308.17	4.16	4.17	4-FFt	1.88	2.25	5.40	3.50	4.86	4.03
260	1308.95	4.95	4.77	4-FFt	2.17	2.52	6.76	3.50	5.26	4.22
295	1309.58	5.58	5.27	4-FFt	2.37	2.68	7.67	3.50	5.61	4.39
302	1309.70	5.70	5.50	4-FFt	2.41	2.71	7.84	3.50	5.91	4.55
306	1309.78	5.78	5.59	4-FFt	2.43	2.73	7.95	3.50	6.00	4.60
310	1309.87	5.87	5.63	4-FFt	2.46	2.75	8.06	3.50	6.00	4.60
314	1309.94	5.94	5.67	4-FFt	2.48	2.76	8.15	3.50	6.00	4.60

El. inlet face invert 1304.00 ft El. outlet invert 1303.40 ft
El. inlet throat invert 1304.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1304.00
OUTLET STATION (FT)	84.00
OUTLET ELEVATION (FT)	1303.40
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0071
CULVERT LENGTH ALONG SLOPE (FT)	84.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	IMPR SDT CIRC
INLET EDGE AND WALL	SQUARE EDGE TOP (26-90 DEG WINGWALL)
INLET DEPRESSION	NONE

***** SIDE-TAPERED CIRCULAR IMPROVED INLET *******

FACE WIDTH	3.50 FT
SIDE TAPER (4:1 TO 6:1) (X:1)	4.00
FACE HEIGHT	3.50 FT

3/4

CURRENT DATE: 10-06-1994 FILE DATE: 10-06-1994
CURRENT TIME: 12:19:45 FILE NAME: CLVT50

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: TW50
MAIN CHANNEL ONLY FILE DATE: 10-06-1994

LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING N LEFT OVER BANK	0.000
MANNING N MAIN CHANNEL	0.025
MANNING N RIGHT OVER BAN	0.000
SLOPE OF CHANNEL (FT/FT)	0.0051

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1308.00
2	2.00	1307.00
3	9.00	1306.00
4	33.00	1306.00
5	37.00	1308.00
6	42.00	1309.00
7	45.00	1310.00
8	63.00	1311.00

***** UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1306.00	0.000	2.60	0.00	0.00
52.00	1306.66	0.683	3.26	2.99	0.19
104.00	1306.98	0.723	3.58	3.78	0.27
156.00	1307.22	0.749	3.82	4.38	0.33
208.00	1307.43	0.768	4.03	4.86	0.39
260.00	1307.62	0.783	4.22	5.26	0.44
312.00	1307.79	0.794	4.39	5.61	0.48
364.00	1307.95	0.804	4.55	5.91	0.52
416.00	1308.00	0.807	4.60	6.00	0.53
468.00	1308.00	0.807	4.60	6.00	0.53
520.00	1308.00	0.807	4.60	6.00	0.53

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	40.00
CREST LENGTH (FT)	228.00
OVERTOPPING CREST ELEVATION (FT)	1309.50

STANLEY CONSULTANTS

Computed by JRM Date 12/14/94
Checked by JRB Date 12/21/94
Reviewed by _____ Date _____
Approved by _____ Date _____

Job No. 12291 Page No. _____
Subject ADOT CROSS-CULVERT
GRAND AVE. @ REEMS RD.
Sheet No. _____ of _____

METHODOLOGY: H48 COMPUTER PROGRAM

DT	ADOT						
DI	0	60	100	120	140	150	200
DQ	0	60	100	106	104	103	96

— DIVERSION TO ADOT DRAINAGE CHANNEL

SC 3004 R1 691

CURRENT DATE: 12-14-1994 FILE DATE: 12-14-1994
CURRENT TIME: 16:06:02 FILE NAME: ADOT

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1295.31	1294.99	154.00	1 RCPE	5.00	3.17	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: ADOT DATE: 12-14-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1295.31	0	0	0	0	0	0	0	0	1
1297.69	20	20	0	0	0	0	0	0	1
1298.19	40	40	0	0	0	0	0	0	1
1298.61	60	60	0	0	0	0	0	0	1
1298.98	80	80	0	0	0	0	0	0	1
1299.84	100	100	0	0	0	0	0	0	1
1300.28	120	106	0	0	0	0	0	13	12
1300.41	140	104	0	0	0	0	0	35	10
1300.46	150	103	0	0	0	0	0	46	7
1300.57	180	99	0	0	0	0	0	80	8
1300.63	200	96	0	0	0	0	0	102	6
1300.00	103	103	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: ADOT DATE: 12-14-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1295.31	0.00	0	0	0.00
1297.69	0.00	20	0	0.00
1298.19	0.00	40	0	0.00
1298.61	0.00	60	0	0.00
1298.98	0.00	80	0	0.00
1299.84	0.00	100	0	0.00
1300.28	-0.00	120	1	0.62
1300.41	-0.00	140	1	0.73
1300.46	-0.00	150	1	0.98
1300.57	-0.00	180	1	0.72
1300.63	-0.00	200	2	0.97

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-14-1994 FILE DATE: 12-14-1994
CURRENT TIME: 16:06:02 FILE NAME: ADOT

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (5 BY 3.166667) RCPE

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1296.84	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
20	1297.69	2.38	1.66	3-M1t	1.14	1.06	2.87	1.69	3.49	1.69
40	1298.19	2.88	2.41	3-M1t	1.69	1.55	4.27	2.19	4.15	2.19
60	1298.61	3.30	3.05	3-M1t	2.21	1.94	5.47	2.56	4.59	2.56
80	1298.98	3.67	3.65	6-FFn	3.17	2.26	6.26	3.17	4.94	2.85
100	1299.84	4.09	4.53	6-FFn	3.17	2.54	7.83	3.17	5.22	3.09
106	1300.28	4.31	4.97	4-FFt	3.17	2.60	8.25	3.17	5.46	3.31
104	1300.41	4.24	5.10	4-FFt	3.17	2.58	8.11	3.17	5.68	3.51
103	1300.45	4.19	5.14	4-FFt	3.17	2.57	8.00	3.17	5.78	3.60
99	1300.57	4.05	5.26	4-FFt	3.17	2.53	7.69	3.17	6.05	3.86
96	1300.63	3.95	5.32	4-FFt	3.17	2.49	7.48	3.17	6.21	4.01

El. inlet face invert 1295.31 ft El. outlet invert 1294.99 ft
El. inlet throat invert 0.00 ft El. inlet crest 1296.84 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1296.81
OUTLET STATION (FT)	154.00
OUTLET ELEVATION (FT)	1294.99
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0021
CULVERT LENGTH ALONG SLOPE (FT)	154.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	ELLIPTICAL
BARREL SPAN	5.00 FT
BARREL RISE	3.17 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END WITH HEADWALL
INLET DEPRESSION	YES

CURRENT DATE: 12-14-1994 FILE DATE: 12-14-1994
CURRENT TIME: 16:06:02 FILE NAME: ADOT

IMPROVED INLET FOR CULVERT # 1 - 1 (5 BY 3.166667) RCPE

DIS-CHARGE Flow (cfs)	HEAD-WATER Elev. (ft)	INLET CONTROL Depth (ft)	OUTLET CONTROL Depth (ft)	FLOW TYPE <F4>	CREST CONTROL Elev. (ft)	FACE CONTROL Elev. (ft)	THROAT CONTROL Elev. (ft)	TAILWATER Elev. (ft)
0	1296.84	0.00	0.00	0-NF	1296.84	1295.31	0.00	1294.99
20	1297.69	2.38	1.66	3-M1t	1297.69	1296.75	0.00	1296.68
40	1298.19	2.88	2.41	3-M1t	1298.19	1297.48	0.00	1297.18
60	1298.61	3.30	3.05	3-M1t	1298.61	1298.11	0.00	1297.55
80	1298.98	3.67	3.65	6-FFn	1298.98	1298.73	0.00	1297.84
100	1299.84	4.09	4.53	6-FFn	1299.33	1299.40	0.00	1298.08
106	1300.28	4.31	4.97	4-FFt	1299.43	1299.62	0.00	1298.30
104	1300.41	4.24	5.10	4-FFt	1299.40	1299.55	0.00	1298.50
103	1300.45	4.19	5.14	4-FFt	1299.37	1299.50	0.00	1298.59
99	1300.57	4.05	5.26	4-FFt	1299.31	1299.36	0.00	1298.85
96	1300.63	3.95	5.32	4-FFt	1299.26	1299.26	0.00	1299.00

***** FALL SUMMARY **********

MAXIMUM ALLOWABLE FALL		1.82 FT
INLET DEPRESSION		1.50 FT
FALL SLOPE	(X:1)	2.00
CREST WIDTH		9.00 FT

CURRENT DATE: 12-14-1994 FILE DATE: 12-14-1994
CURRENT TIME: 16:06:02 FILE NAME: ADOT

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.005
MANNING'S N (.01-0.1)	0.025
CHANNEL INVERT ELEVATION (FT)	1294.99
CULVERT NO.1 OUTLET INVERT ELEVATION	1294.99 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

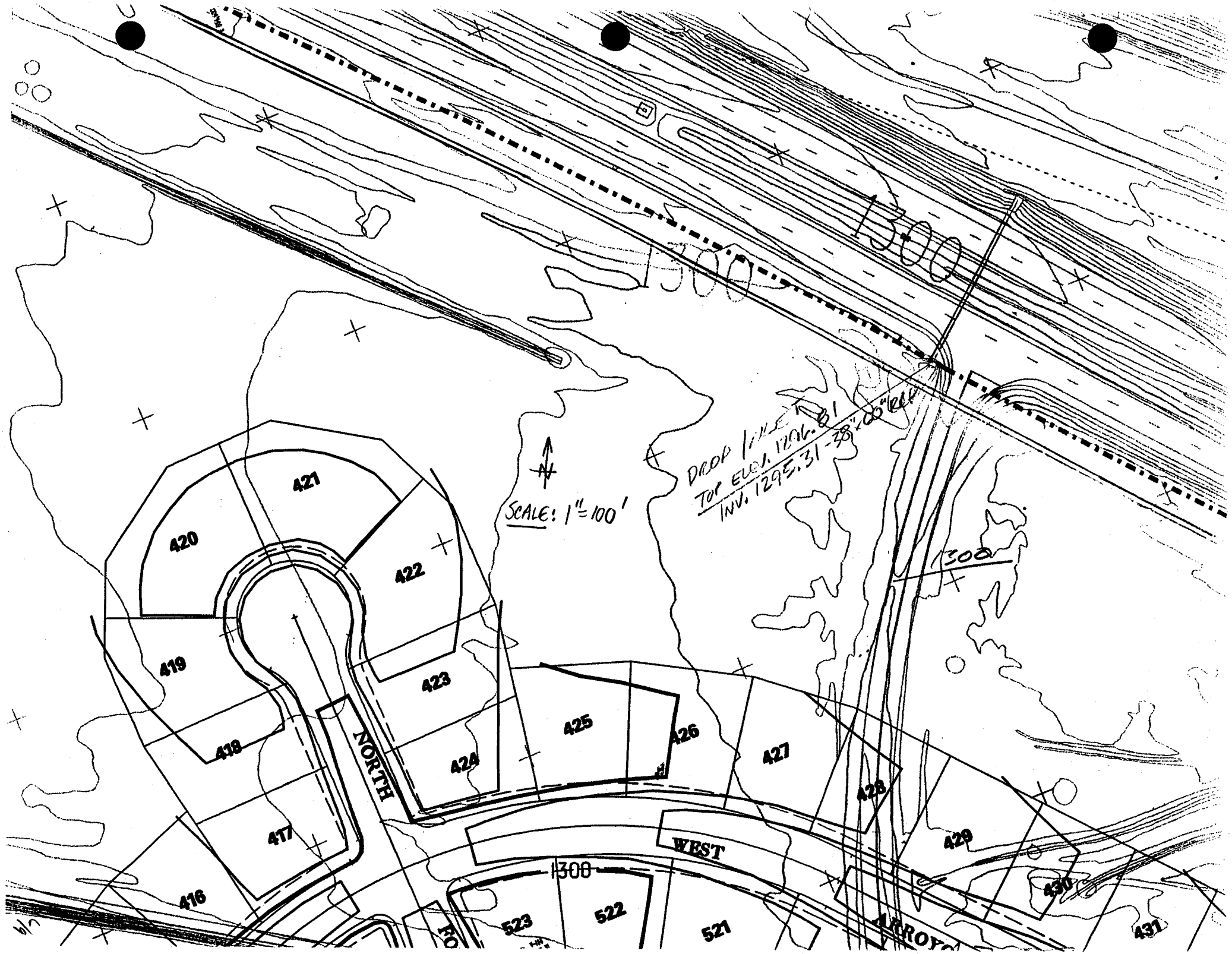
FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1294.99	0.000	0.00	0.00	0.00
20.00	1296.68	0.473	1.69	3.49	0.53
40.00	1297.18	0.494	2.19	4.15	0.68
60.00	1297.55	0.506	2.56	4.59	0.80
80.00	1297.84	0.515	2.85	4.94	0.89
100.00	1298.08	0.523	3.09	5.22	0.97
120.00	1298.30	0.529	3.31	5.46	1.03
140.00	1298.50	0.534	3.51	5.68	1.10
150.00	1298.59	0.536	3.60	5.78	1.12
180.00	1298.85	0.543	3.86	6.05	1.20
200.00	1299.00	0.546	4.01	6.21	1.25

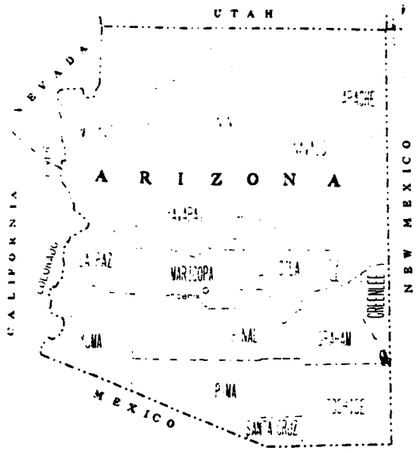
ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	25.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	100.00	1301.00
2	250.00	1300.00
3	405.00	1301.00


1300
1300
1300
1300
1300
SCALE: 1" = 100'
DROP INLET #61
TOP ELEV. 1306.61
INV. 1295.31-28"x20" RCP
NORTH
WEST
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
521
522
523



ENGINEERING RECORDS SERVICES
FILE COPY
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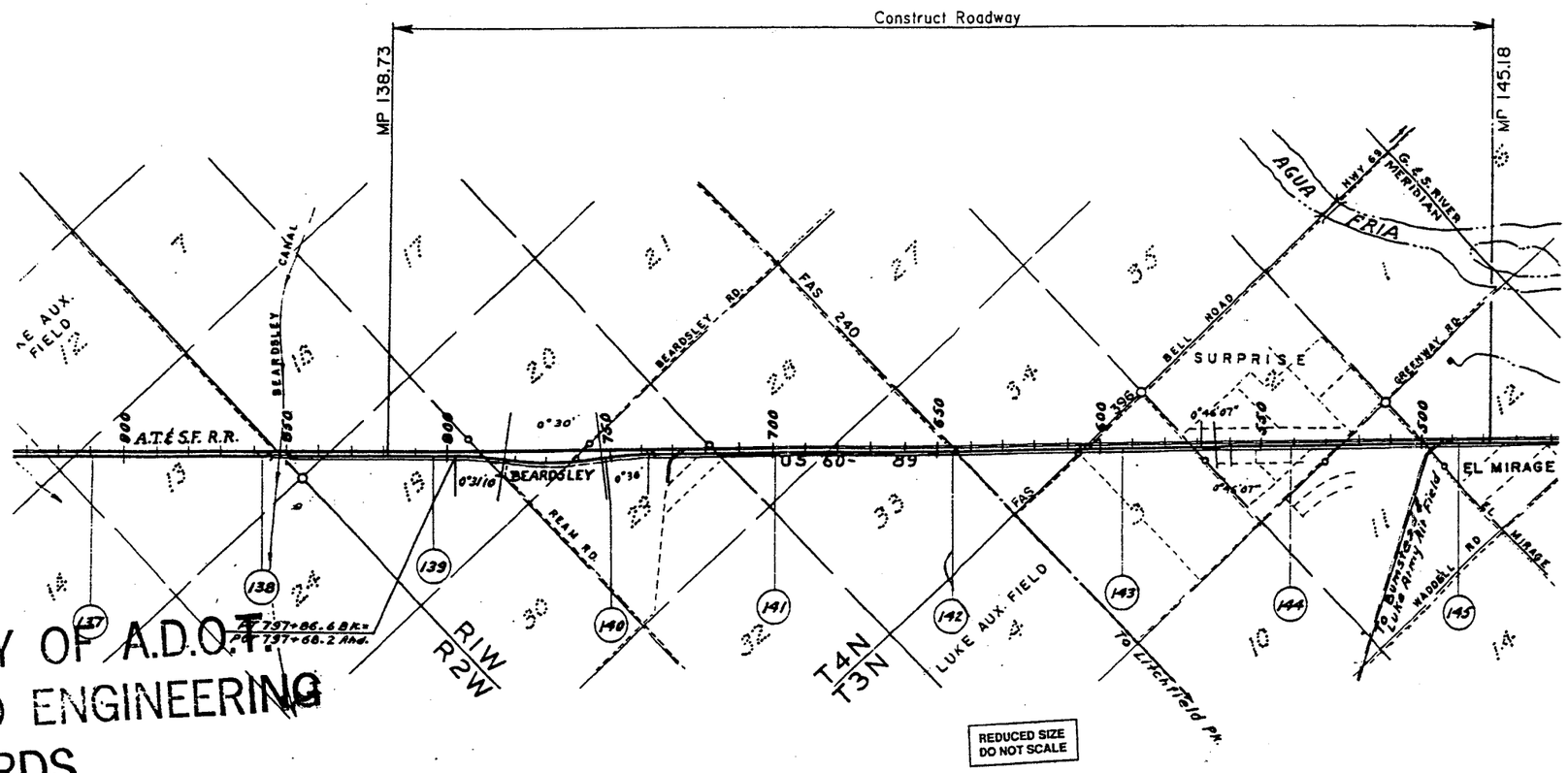
ENGINEERING RECORDS SERVICES

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ENGINEERING RECORDS SERVICES
AUG. 1 1 1992
FILE COPY.

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY
WICKENBURG-PHOENIX HWY (US 60)
STP-022-2(36)
060 MA 138



PROPERTY OF A.D.O.T.
RETURN TO ENGINEERING
RECORDS

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
APPROVED: GARY K. ROBINSON
STATE ENGINEER

APPROVED DATE 7-31-92
for ASSISTANT STATE ENGINEER-DESIGN
Larry H. Etherton

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

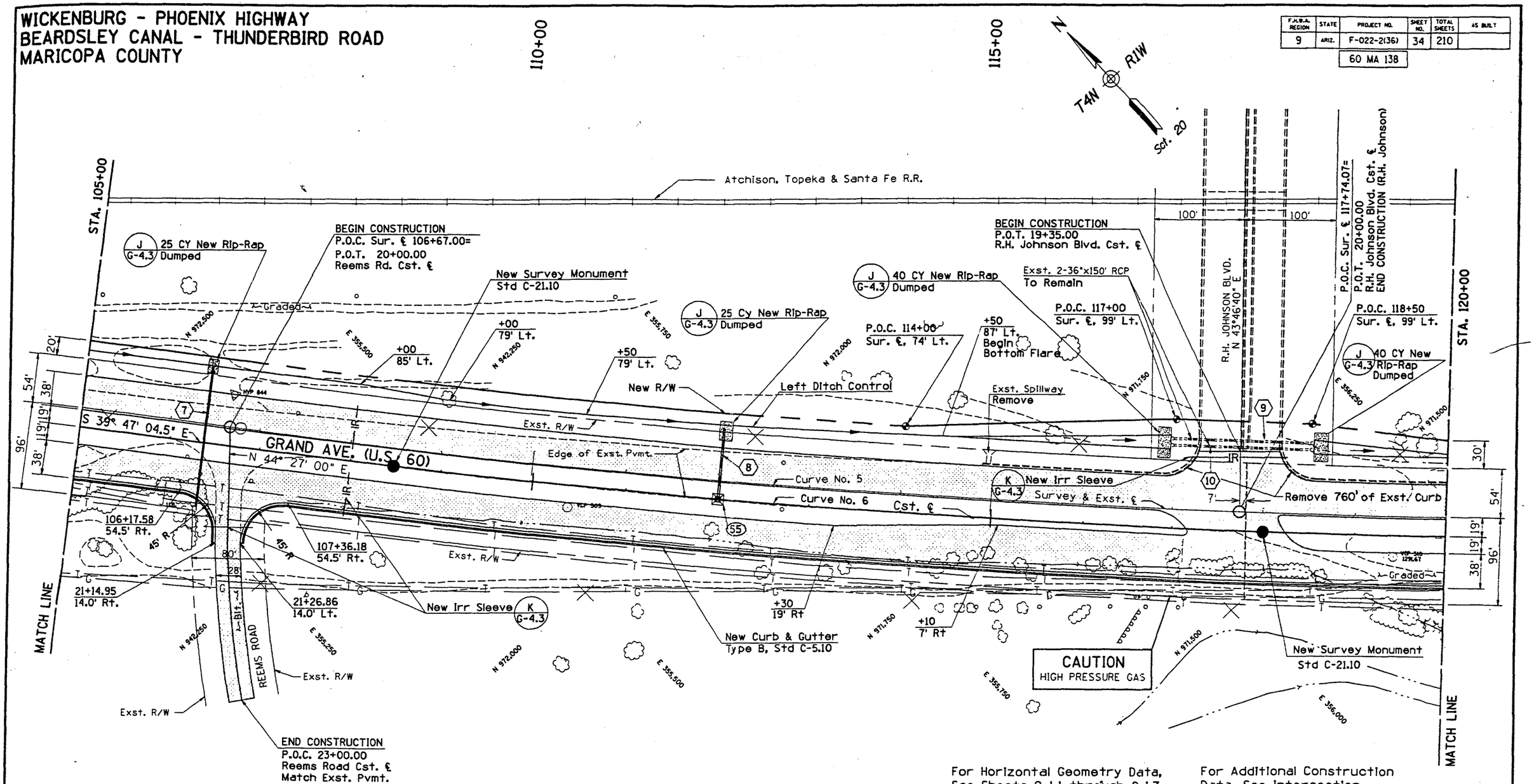
APPROVED DATE
DIVISION ADMINISTRATOR

GRAND AVE, BEARDSLEY CNL-THUNDERBIRD

TRACS NO. H0358 04 C

WICKENBURG - PHOENIX HIGHWAY
BEARDSLEY CANAL - THUNDERBIRD ROAD
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	F-022-2(36)	34	210	
		60 MA 138			



For Horizontal Geometry Data, See Sheets C-1.1 through C-1.7

For Additional Construction Data, See Intersection Staking Plan, Sheet C-4.9.

New R/W Marker, Std. C-21.10

New Construction

Resurfacing

Remove Pvmt.

For Additional Construction Data, See Minor Crossroads Profile Sheet C-4.4

Use Exst. Reems Road ℄ For Horizontal Alignment

BM No. 78.2, 158.5' Lt., Sta. 107+87.80, 1/2" Re-Bar
2' South Of Power Pole - Elev. 1294.99

	NAME	DATE
DESIGN	E.W.L.	3-92
DRAWN	M.J.S.	3-92
CHECKED	G.E.E.	3-92

Kimley-Horn

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLAN SHEET
STA. 105+00 TO STA. 120+00

ROUTE: U.S. 60
LOCATION: BEARDSLEY CANAL - THUNDERBIRD ROAD

SHEET C-2.5 OF ___ OF ___

REDUCED SIZE DO NOT SCALE

263·1100

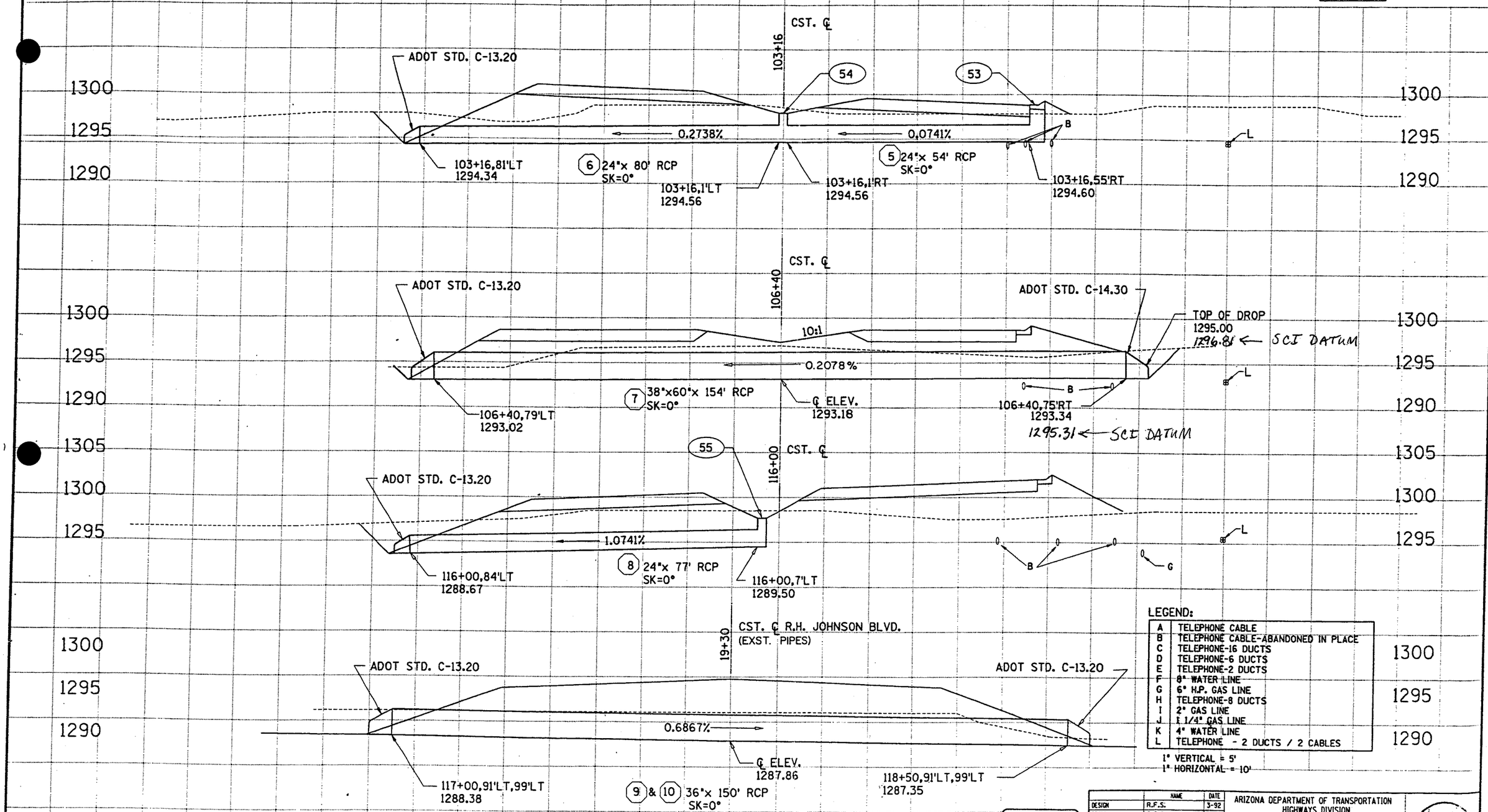
TRACS NO. H0358 04 C

8/9

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••
VIEW NAME:

WICKENBURG - PHOENIX HIGHWAY
BEARDSLEY CANAL - THUNDERBIRD ROAD
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	F-022-2(36)	119	210	
		60 MA 138			



LEGEND:

A	TELEPHONE CABLE
B	TELEPHONE CABLE-ABANDONED IN PLACE
C	TELEPHONE-16 DUCTS
D	TELEPHONE-6 DUCTS
E	TELEPHONE-2 DUCTS
F	8" WATER LINE
G	6" H.P. GAS LINE
H	TELEPHONE-8 DUCTS
I	2" GAS LINE
J	1 1/4" GAS LINE
K	4" WATER LINE
L	TELEPHONE - 2 DUCTS / 2 CABLES

1" VERTICAL = 5'
1" HORIZONTAL = 10'

REDUCED SIZE DO NOT SCALE

263-1000

	NAME	DATE
DESIGN	R.F.S.	3-92
DRAWN	D.C.O.	3-92
CHECKED	E.W.L.	3-92

Kimley-Horn

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PIPE PROFILES

ROUTE U.S. 60 | LOCATION BEARDSLEY CANAL - THUNDERBIRD ROAD

SHEET D-1.2 OF

TRACS NO. H0358 04 C

OF

*****DGN*SPECIFICATION*****
*****SYSTIME*****
VIEW NAME:

9/9

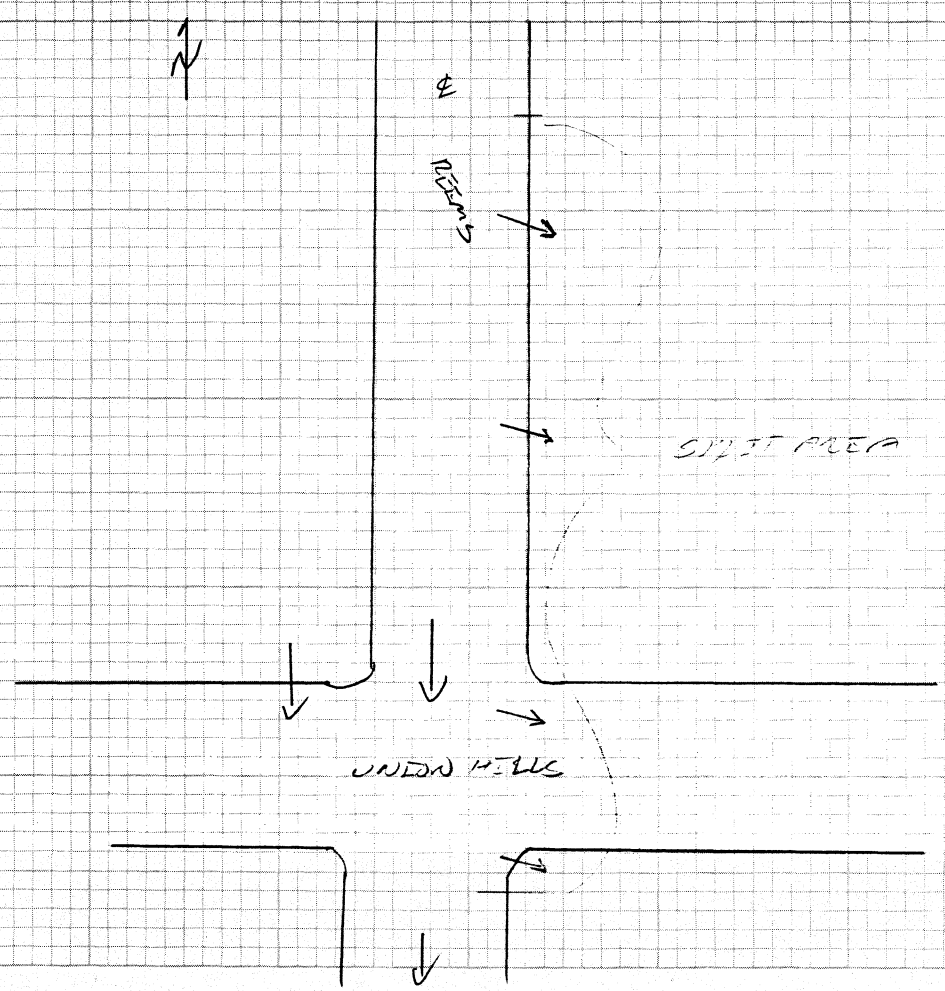
DESIGNED BY KJV DATE 9/16/94 SHEET NO. PAGE NO.
CHECKED BY JRB DATE 12/14/94 OF JOB NO.
REVIEWED BY DATE SUBJECT: DIVERSION @ REEMS AND UNION HILLS
APPROVED BY DATE

D108C

GAP - REEMS + UNIONHILLS FLOW SPLIT

THE FLOW SPLIT AT REEMS AND UNIONHILLS WAS MODELED USING HEC-2 WITH A SIDE WEIR OPTION. CROSS SECTION DATA WAS COLLECTED AND IT WAS DETERMINED THAT A LARGE VOLUME OF WATER WOULD OVER FLOW REEMS ROAD JUST NORTH OF UNION HILLS. A HEC-2 REACH WAS ESTABLISHED FOR REEMS RD WITH THE SIDE WEIR ALONG THE EASTERN SIDE.

* SEE FOLLOWING HEC-2 MODEL



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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    16SEP94    TIME   15:08:13   *
*********************************************
```

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D/OB
****************************************
*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET, SUITE D
*  DAVIS, CALIFORNIA 95616-4687
*          (916) 756-1104
****************************************
```

```
X     X  XXXXXXX  XXXXX            XXXXX
X     X  X       X     X          X     X
X     X  X       X                      X
XXXXXXX  XXXX    X         XXXXX   XXXXX
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX  XXXXX            XXXXXXX
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THIS RUN EXECUTED 16SEP94 15:08:13

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************


SPLIT FLOW BEING PERFORMED

SF      SPLIT FLOW @ INTERSECTION OF REEMS AND UNIONHILLS - EAST


TN      NORMAL DEPTH SPLIT FLOW ANALYSIS
NS     9       2       3      -1    .022   .0039
NG     0    1269       7    1269       9    1268      11    1267      30    1266
NG    35    1266      38    1267      43    1268      45  1268.1

TN      NORMAL DEPTH SPLIT FLOW ANALYSIS
NS     7       3       4      -1    .022   .0039
NG     0  1268.1      14  1268.3      23    1268      91  1267.8     100    1268
NG   119  1268.3     120    1269
```

```
T1      REEMS AND UNIONHILLS
T2      HEC-2 ANALYSIS OF REEMS ROAD AT INTERSECTION W/ UNIONHILLS
T3      REEMS RD
T4
T4      MODEL USED FOR SPLIT FLOW ANALYSIS AT THE INTERSECTION OF
T4      REEMS AND UNIONHILLS.

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                           .0031                                   1267

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1                  -1                                                                      15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        43        1         8         25        26        9         14        26        17
     16        17

J5  LPRNT     NUMSEC                    ********REQUESTED SECTION NUMBERS********

    -10       -10

NC      .08       .035      .022      .1        .3
QT        4       500       1000      1500      2000
X1        1        21       1009      1082
GR     1266      1000       1267      1009      1267.1    1011      1267      1013      1266      1019
GR   1266.4      1026       1266      1031      1266.4    1050      1266      1065      1266      1075
GR     1267      1082     1267.2      1086       1267     1088      1266      1095      1266      1111
GR     1266      1132     1266.8      1405       1267     1527      1268      1665      1269      1750
GR     1270      1790

X1        2         9       1004      1073       125      126       125
GR     1269      1000       1268      1004       1267     1009    1266.4      1041      1267      1065
GR     1268      1073       1269      1173     1269.5     1395      1270      1653

X1        3        14       1003      1088        47       47        47
GR     1269      1000       1268      1003     1268.3     1008      1268      1015      1267      1019
GR     1266      1022       1266      1026     1266.4     1050      1267      1084      1268      1088
GR     1268      1120       1268      1185       1269     1375      1270      1653

X1        4        25       1010      1120       119      120       117
GR     1268      1000       1268      1003     1268.3     1010      1268      1017      1267      1023
GR   1266.5      1035       1267      1050     1266.5     1062      1266      1070      1266      1082
GR     1267      1087       1268      1099       1268     1104    1268.1      1112      1268      1120
GR     1268      1140       1268      1147       1268     1160    1267.6      1180      1268      1200
GR   1268.8      1284       1269      1332       1269     1767      1269      1865      1270      1885
```

X1	5	23	1009	1122	125	130	125			
GR	1268	1000	1268.6	1009	1268	1019	1267	1025	1267	1030
GR	1267.4	1050	1267	1065	1266	1073	1265.3	1084	1266	1092
GR	1266	1095	1268	1105	1268.4	1122	1269	1138	1269	1148
GR	1267	1151	1268	1156	1269	1255	1269	1786	1268.8	1804
GR	1269	1825	1269	1870	1270	1895				

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 1.00 CWSEL= 1266.76

STA=	1000.	1007.	1082.	1095.	1111.	1132.	1391.
PER Q=	.5	34.4	.9	8.7	11.4	44.2	
AREA=	2.6	37.0	2.0	12.1	15.9	98.1	
VEL=	.5	2.5	1.2	1.9	1.9	1.2	
DEPTH=	.4	.6	.2	.8	.8	.4	

FLOW DISTRIBUTION FOR SECNO= 2.00 CWSEL= 1267.60

STA=	1006.	1073.
PER Q=	100.0	
AREA=	52.5	
VEL=	5.2	
DEPTH=	.8	

FLOW DISTRIBUTION FOR SECNO= 3.00 CWSEL= 1267.87

STA=	1016.	1088.
PER Q=	100.0	
AREA=	94.1	
VEL=	4.9	
DEPTH=	1.3	

FLOW DISTRIBUTION FOR SECNO= 4.00 CWSEL= 1268.39

STA=	1000.	1003.	1010.	1120.	1140.	1147.	1160.	1180.	1200.	1240.
PER Q=	.1	.1	90.9	1.3	.5	.9	2.7	2.7	.8	
AREA=	1.1	1.6	143.3	7.6	2.7	4.9	11.6	11.6	7.6	
VEL=	.4	.3	3.2	.9	.9	.9	1.2	1.2	.6	
DEPTH=	.4	.2	1.3	.4	.4	.4	.6	.6	.2	

FLOW DISTRIBUTION FOR SECNO= 5.00 CWSEL= 1268.57

STA=	1000.	1009.	1122.	1126.	1151.	1156.	1212.
PER Q=	.1	96.0	.0	.4	1.5	1.9	
AREA=	2.4	166.4	.4	1.8	5.3	15.9	
VEL=	.3	2.9	.3	1.1	1.4	.6	
DEPTH=	.3	1.5	.1	.1	1.1	.3	

T1 REEMS AND UNIONHILLS
T3 REEMS RD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		3			.0031				1267	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2		-1							

```
T1     REEMS AND UNIONHILLS
T3      REEMS RD
J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                4                           .0031                                   1267
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     3                  -1
```

```
T1     REEMS AND UNIONHILLS
T3      REEMS RD
J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                5                           .0031                                   1267
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     4                   -1
```

THIS RUN EXECUTED 16SEP94 15:09:03

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

REEMS RD

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	DEPTH	AREA	VCH	WSELK	QCH	VCH	K*XNCH	K*XNL	K*XNCH
	1.000	272.77	1266.76	.76	167.77	2.54	1267.00	93.83	2.54	22.00	80.00	22.00
	1.000	467.26	1266.94	.94	244.63	3.01	1267.00	148.34	3.01	22.00	80.00	22.00
	1.000	636.39	1267.07	1.07	308.50	3.25	1267.00	188.39	3.25	22.00	80.00	22.00
	1.000	793.34	1267.17	1.17	362.90	3.46	1267.00	225.39	3.46	22.00	80.00	22.00
*	2.000	272.77	1267.60	1.20	52.47	5.20	.00	272.77	5.20	22.00	.00	22.00
*	2.000	467.26	1267.97	1.57	77.09	6.06	.00	467.26	6.06	22.00	.00	22.00
*	2.000	636.39	1268.26	1.86	101.05	6.50	.00	633.43	6.50	22.00	80.00	22.00
*	2.000	793.34	1268.52	2.12	129.59	6.73	.00	776.25	6.73	22.00	80.00	22.00
*	3.000	463.84	1267.87	1.87	94.14	4.93	.00	463.84	4.93	22.00	.00	22.00
*	3.000	772.64	1268.30	2.30	166.39	5.70	.00	729.22	5.70	22.00	80.00	22.00
*	3.000	1067.47	1268.71	2.71	279.84	5.48	.00	890.34	5.48	22.00	80.00	22.00
*	3.000	1336.66	1269.04	3.04	393.67	5.29	.00	1005.07	5.29	22.00	80.00	22.00
*	4.000	500.00	1268.39	2.39	192.08	3.17	.00	454.48	3.17	22.00	80.00	22.00
*	4.000	1000.00	1268.87	2.87	321.13	4.16	.00	818.35	4.16	22.00	80.00	22.00
*	4.000	1500.00	1269.07	3.07	416.59	5.35	.00	1166.44	5.35	22.00	80.00	22.00
*	4.000	2000.00	1269.30	3.30	624.63	5.63	.00	1376.74	5.63	22.00	80.00	22.00
	5.000	500.00	1268.57	3.27	192.27	2.89	.00	480.01	2.89	22.00	80.00	22.00
	5.000	1000.00	1269.07	3.77	349.03	4.01	.00	894.21	4.01	22.00	80.00	22.00
*	5.000	1500.00	1269.46	4.16	689.29	4.02	.00	1071.47	4.02	22.00	80.00	22.00
*	5.000	2000.00	1269.68	4.38	884.54	4.33	.00	1262.06	4.33	22.00	80.00	22.00

% DIVERTED EAST

Q CFS	DIVERTED (SPLIT) CFS	% SPLIT
500	227.23	45.5
1000	532.74	53.3
1500	863.61	57.6
2000	1206.70	60.3

DESIGNED BY ..... DATE ..... SHEET NO. ..... PAGE NO. .....
CHECKED BY ..... DATE ..... OF ..... JOB NO. .....
REVIEWED BY ..... DATE ..... SUBJECT: .....
APPROVED BY ..... DATE .....

SPLITFLOW: NORMAL DEPTH METHOD

- SPLIT OCCURS @ INTERSECTION OF REEMS AND UNION HILLS:
  - SPLIT PROCEEDS FAST ON UNION HILLS

GROUND COORDINATE DATA:

2-3

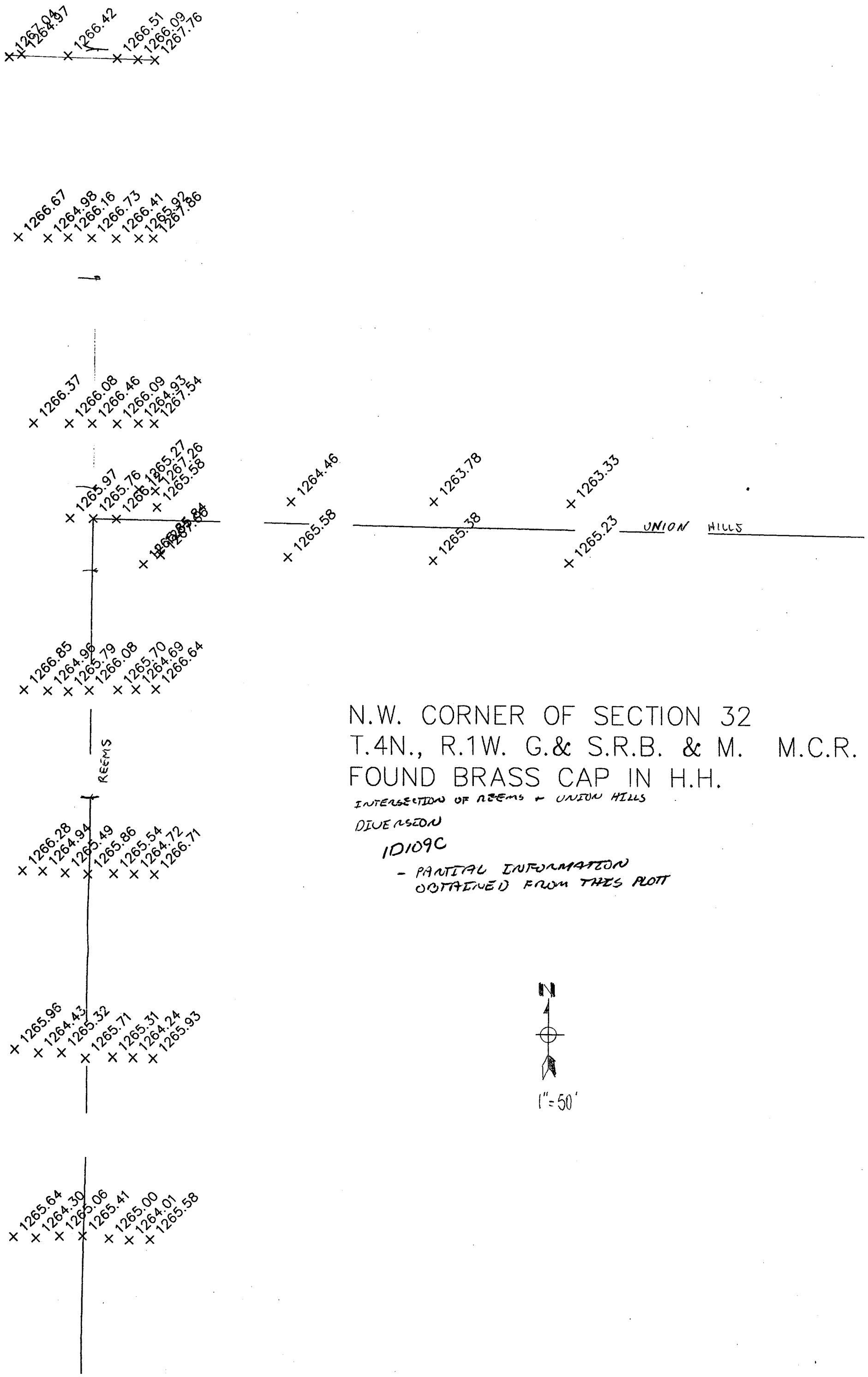
1	2	3	4	5	6	7	8	9
0	7	9	11	30	35	38	43	45
1269	1269	1268	1267	1266	1266	1267	1268	1268.1

SLOPE: .0039 ft/ft ASSUME ≈ ENERGY SLOPE

n : .022

3-4

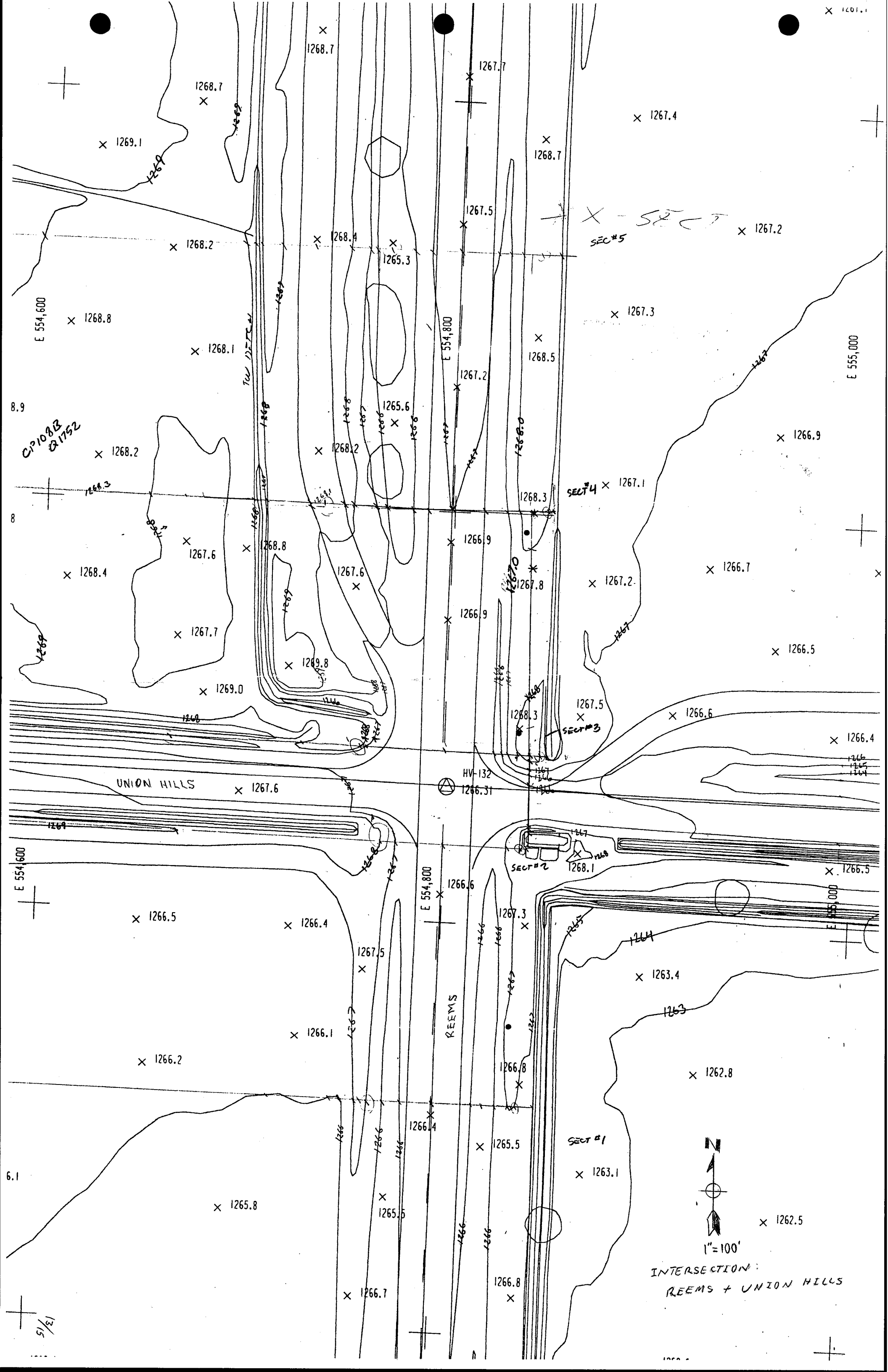
1	2	3	4	5	6	7
0	14	23	91	100	119	120
1268.1	68.3	68	67.8	68	68.3	69

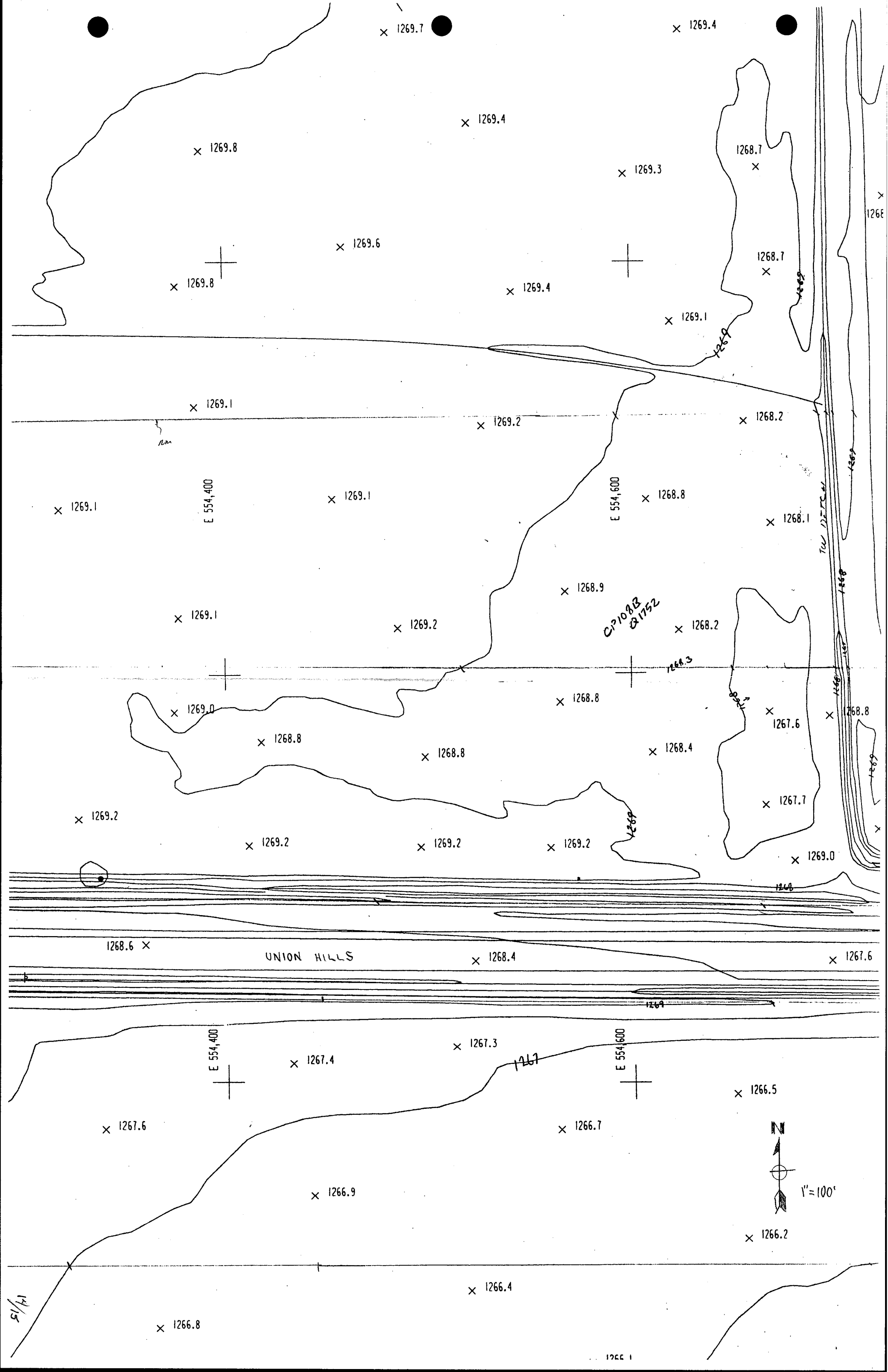


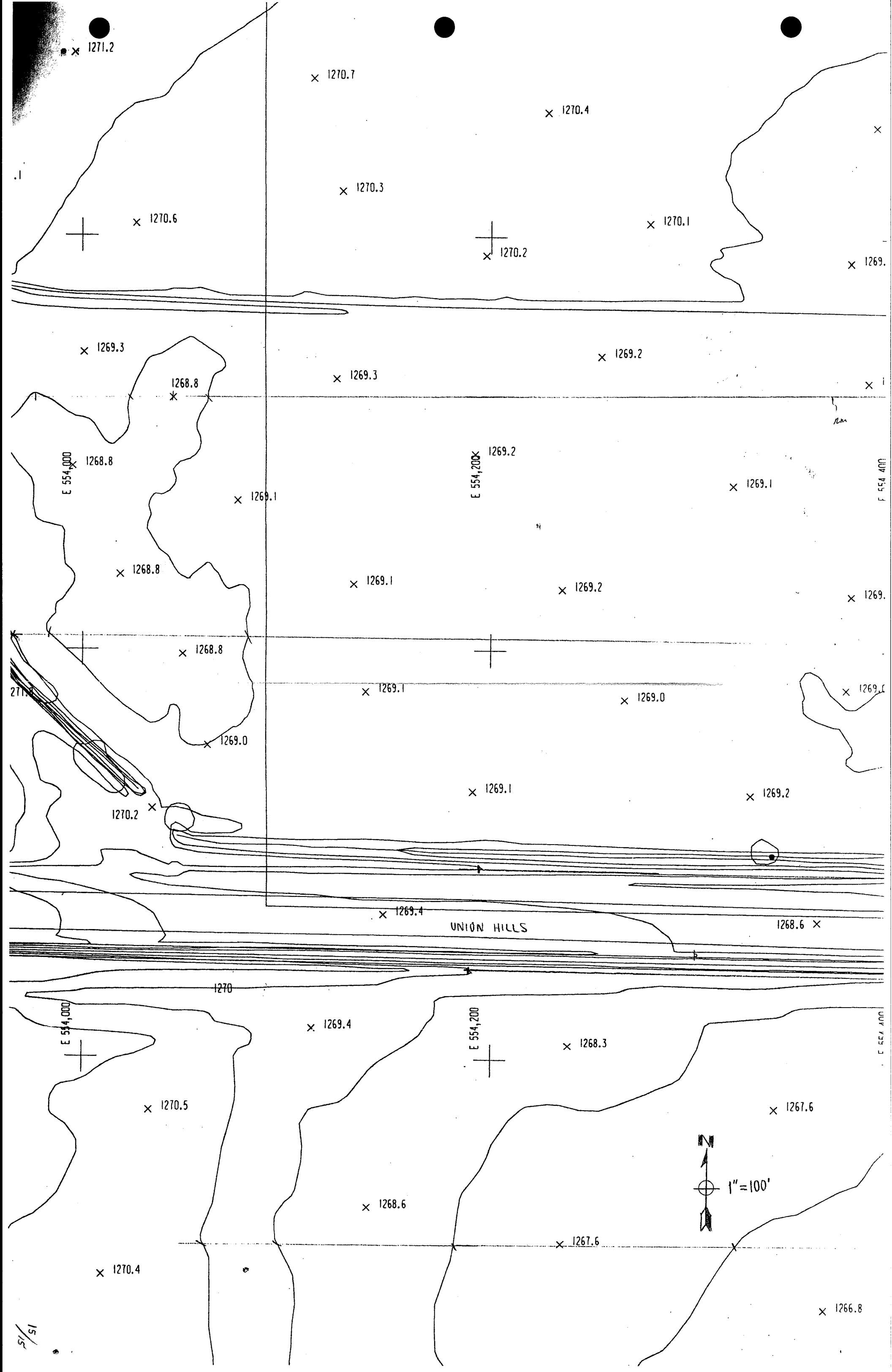
N.W. CORNER OF SECTION 32
T.4N., R.1W. G.& S.R.B. & M. M.C.R.
FOUND BRASS CAP IN H.H.

INTERSECTION OF REEMS + UNION HILLS
DIVERSION
1D109C
- PARTIAL INFORMATION
OBTAINED FROM THIS PLOTT

14/15


UNION HILLS
REEMS
HV-132
1266.31
E 554,600
E 554,800
E 555,000
SECT#1
SECT#2
SECT#3
SECT#4
SEC#5
CP1083
Q1752
1"=100'
INTERSECTION:
REEMS + UNION HILLS


1269.7
1269.4
1269.4
1269.8
1268.7
1269.3
1269.6
1268.7
1269.8
1269.4
1269.1
1269.1
1269.2
1268.2
1269.1
E 554,400
1269.1
E 554,600
1268.8
1268.1
1269.1
1269.2
1268.9
1268.2
1269.0
1268.8
1268.8
1268.8
1267.6
1268.4
1267.7
1269.2
1269.2
1269.2
1269.2
1269.0
1268.6
UNION HILLS
1268.4
1267.6
E 554,400
1267.4
1267.3
E 554,600
1266.5
1267.6
1266.7
N
1"=100'
1266.9
1266.2
1266.4
1266.8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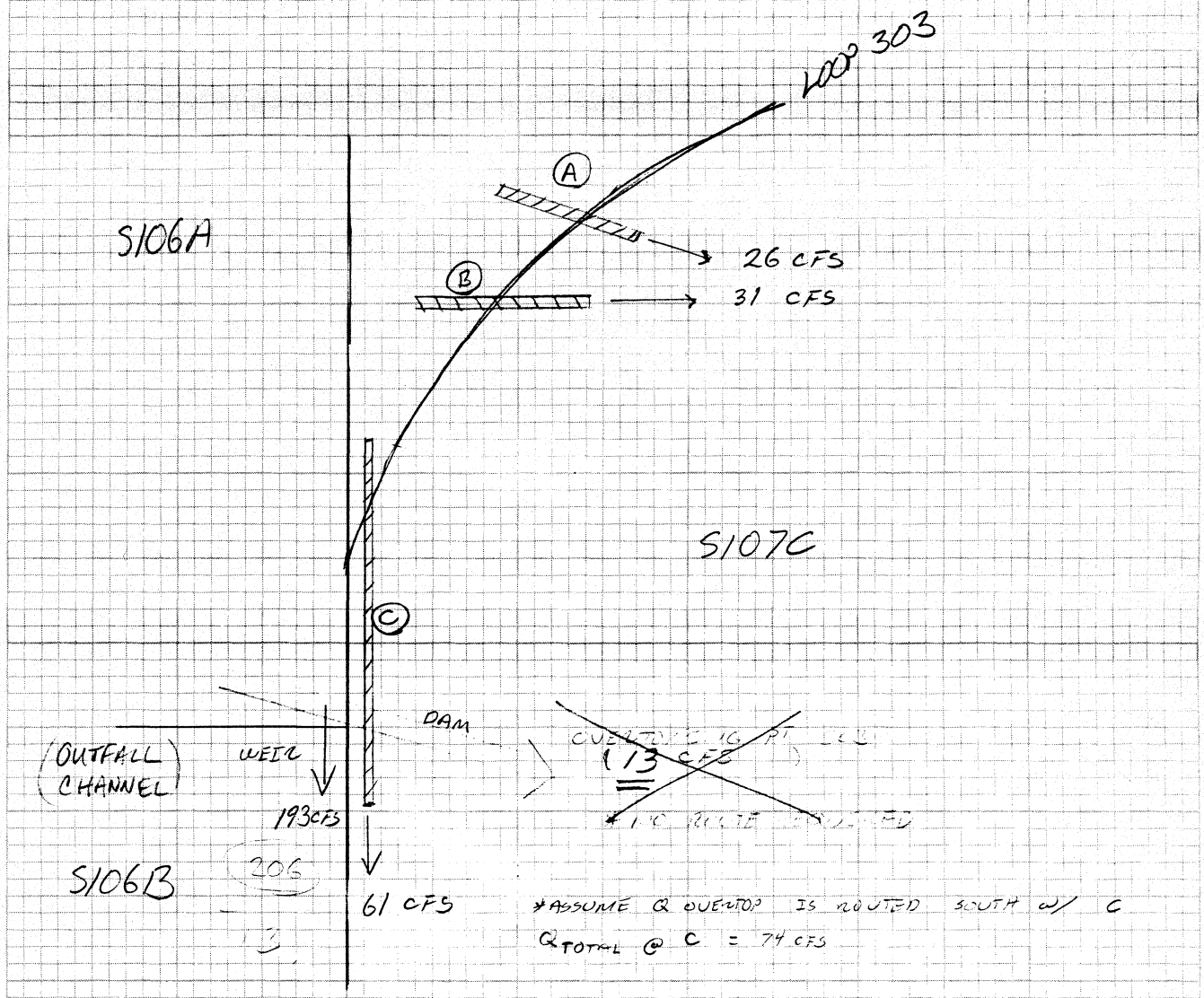
1270.3
1270.6
1270.1
1270.2
1269.3
1269.2
1268.8
1269.3
1268.8
1269.2
1269.1
1269.1
1269.2
1268.8
1269.1
1268.8
1269.1
1269.0
1269.0
1269.1
1269.2
1270.2
1269.4
UNION HILLS
1268.6
1270
1269.4
1268.3
1270.5
1267.6
1268.6
1267.6
1270.4
1266.8
E 554,000
E 554,200
E 554,400
N
1"=100'

15/15

DESIGNED BY KJV DATE SHEET NO. PAGE NO.
CHECKED BY JRM DATE 10-22-94 OF JOB NO.
REVIEWED BY DATE SUBJECT: EXISTING CONDITIONS
APPROVED BY DATE STORAGE @ SR 303



CULVERT	INLET INV. (ELEV.)	OUTLET INV. (ELEV.)	LENGTH (FT)	DIA (FT)	MATERIAL	DISCHARGE (CFS) APPROX
A #45	1302.6	1302.2	84'	2	RCP	≈ 26
B #44	1303.2	1302.8	96'	2	RCP	≈ 31
C #59	1302.3	1300.7	556'	3	RCP	≈ 61
WEIR	1306.5					≈ 193
DAM	1308.4					≈ 13
						324

SC 3020

DESIGNED BY ..... DATE 9/30/94 SHEET NO. ..... PAGE NO. .....
CHECKED BY ..... DATE ..... OF ..... JOB NO. .....
REVIEWED BY ..... DATE ..... SUBJECT: .....
APPROVED BY ..... DATE ....

STORAGE ROUTING:

CONTOUR:	AREA (AC):
1302	0
1304	.027
1305.8	.030
1306	.69
1307	2.78
1308	7.73
1308.5	9.45
1309	11.60

HYDRAULIC INFORMATION:

24" DIA CONCRETE CULVERTS:
- TWO CULVERTS DIVERT FLOW TO EAST
- INVERTS @ A - 1302.6' B - 1303.2'

36" DIA CONCRETE CULVERTS:
- CULVERT ROUTES FLOW TO SOUTH - IRRIGATION CHANNEL
- INVERT @ C - 1302.3'
- CHANNEL CAPACITY IS SUFFIENT

- HIGH POINT BETWEEN SUBBASINS S106A AND S106B WILL BE MODELED AS A WEIR.
- A SECTION OF LOOP 303 THAT IS ADJACENT TO THE WEIR MODEL WILL BE MODELED AS A NON LEVEL TOP OF DAM

DESIGNED BY ..... DATE ..... SHEET NO. ..... PAGE NO. .....
CHECKED BY ..... DATE ..... OF ..... JOB NO. .....
REVIEWED BY ..... DATE ..... SUBJECT: .....
APPROVED BY ..... DATE .....

COMPOSITE RATING CURVE

ELEVATION (FT)	Q "C" (CFS)	Q "B" (CFS)	Q "A" (CFS)	Q "CULVERTS" (CFS)	Q WEIR (CFS)	Q TOTAL (CFS)
1302.3	0	0	0	0	0	0
1303.2	5	0	0	5	0	5
1303.4	7	1	0	8	0	8
1304.0	13	3	0	16	0	16
1304.4	20	6	0	26	0	26
1304.8	26	9	0	35	0	35
1305.1	33	10	1	44	0	44
1305.5	39	15	4	58	0	58
1305.8	42	18	7	67	0	67
1306.3	46	22	13	81	0	81
1306.9	50	24	17	91	3.3	94
1307.2	52	25	19	96	13.9	110
1307.6	54	27	22	103	45.3	148
1308.3	59	30	25	114	165.1	279
1308.9	62	32	28	122	352.9	475

FOR HEC-1 INPUT
- DISCHARGES PER AREA - ELEVATIONS ARE REQUIRED
- SE, SQ CARDS

ELEVATION (FT)	Q "C" (CFS)	Q "B" (CFS)	Q "A" (CFS)	Q WEIR (CFS)	Q TOTAL (CFS)
1302	0	0	0	0	0
1304	13	3	0	0	16
1305.8	42	18	7	0	67
1306	44	19	10	0	73
1307	50	25	18	5.8	98.9
1308	57	29	24	102.2	212
1308.5	61	31	26	218.0	336 ✓
1309	62	32	30	393.2	517
1308.9	62	32	28	352.9	475

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
* RUN DATE  10/22/1994  TIME  15:45:53 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
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
  2           ID
  3           ID        DEL WEBBS GRAND AVENUE PROJECT - SCI PROJECT NO. 12291-3-700
  4           ID        100-YEAR, 2-HR GENERAL STORM                      EXISTR.DAT
  5           ID        CLARK UNIT GRAPH PROCEDURES
  6           ID        DDMS AUTOMATIC AERIAL REDUCTION FOR EACH BASIN
  7           ID
  8           ID        * NOTE:  IRRIGATION CHANNELS ASSUMED FULL.  DIVERSIONS DO NOT
  9           ID                 REFLECT CHANNEL CAPACITY.
 10           ID
 11           ID        * RESERVOIR ANALYSIS AT LOOP 303 AND ADJACENT AREA S106A
 12           ID
 13           ID
 14           ID   DDM MCUHP1 Del Webb's Grand Avenue Project - Existing Conditions
 15           IT       5                    300
 16           IO       5
              *DIAGRAM
              * DDM   ***** Updated *****

 17           KK    S101
 18           KM   SUB-BASIN S101
 19           KM   2-HOUR RAINFALL DISTRIBUTION WAS USED TO FIND TC & R FOR THIS BASIN
 20           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 21           BA    .163
 22           IN       5
 23           KM   RAINFALL DEPTH OF 2.77 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 24           PB   2.770
 25           KM   THE FOLLOWING PC RECORD USED A 2-HOUR RAINFALL DISTRIBUTION
 26           PC    .000    .011    .018    .023    .028    .032    .046    .071    .100    .137
 27           PC    .176    .232    .327    .601    .743    .863    .901    .930    .954    .962
 28           PC    .970    .979    .982    .992   1.000
 29           LG    .350    .370   5.200    .230    .000
 30           UC    .663    .420
 31           UA       0       3       5       8      12      20      43      75      90      96
 32           UA     100
              * DDM   ***** Preserved *****

 33           KK   1R101
 34           KM        ROUTE FLOW FROM S101 TO C106A
 35           RS       8    FLOW      -1       0
 36           RC    .075    .045    .075    3889   .0046
 37           RX       0       5      10      30     245     290     420     550
 38           RY       3       2       1       0       0       1       2       3
              * DDM   ***** Updated *****

 39           KK   S106A
 40           KM   SUB-BASIN S106A
 41           KM   2-HOUR RAINFALL DISTRIBUTION WAS USED TO FIND TC & R FOR THIS BASIN
 42           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 43           BA    .361
 44           LG    .389    .281   5.400    .250    .000
 45           UC    .646    .420
 46           UA       0       3       5       8      12      20      43      75      90      96
 47           UA     100
              * DDM   ***** Preserved *****
```

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

 48           KK   C106A
 49           KM        ADD HYDROGRAPHS AT C106A
 50           HC       2
              * DDM   ***** Preserved *****

 51           KK  LP106A
 52           KM       RESERVOIR ROUTE OF C106A
 53           RS       1    STOR      -1       0
 54           SA       0    .027    .030    0.69    2.78    7.37    9.45    11.6
 55           SE    1302    1304  1305.8    1306    1307    1308  1308.5    1309
 56           SQ       0      16      67      73      99     212     336     517
 57           SE    1302    1304  1305.8    1306    1307    1308  1308.5    1309
 58           SS    1309       1     .62     1.5
 59           ST  1308.4      64     2.9     1.5
 60           SW       0      64
 61           SE  1308.4  1309.4
              * DDM   ***** Preserved *****

 62           KK   1D106
 63           KM        DIVERT C106A (2-24" CULVERTS EAST - D106'A'  A - TWO CULVERTS)
 64           DT   D107C
 65           DI       0      16      73      99     212     336
 66           DQ       0       3      29      43      53      57
              * DDM   ***** Preserved *****

 67           KK   2D106
 68           KM        DIVERT C106A (36" CULVERT UNDER 303 - SOUTH TO C106BC)
 69           DT  D106BC
 70           DI       0      13      44      56     159     279
 71           DQ       0      13      44      50      57      61
 72           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   17        S101
                V
                V
   33       1R101
                .
                .
   39           .       S106A
                .           .
                .           .
   48       C106A............
                V
                V
   51      LP106A
                .
                .
   64           .------->   D107C
   62       1D106
                .
                .
   69           .------->  D106BC
   67       2D106
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  10/22/1994  TIME  15:45:53 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
DEL WEBBS GRAND AVENUE PROJECT - SCI PROJECT NO. 12291-3-700
100-YEAR, 2-HR GENERAL STORM                      EXISTR.DAT
CLARK UNIT GRAPH PROCEDURES
DDMS AUTOMATIC AERIAL REDUCTION FOR EACH BASIN

* NOTE:  IRRIGATION CHANNELS ASSUMED FULL.  DIVERSIONS DO NOT
         REFLECT CHANNEL CAPACITY.

* RESERVOIR ANALYSIS AT LOOP 303 AND ADJACENT AREA S106A


          DDM MCUHP1 Del Webb's Grand Avenue Project - Existing Conditions

16 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                   NMIN          5  MINUTES IN COMPUTATION INTERVAL
                  IDATE      1   0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      2   0  ENDING DATE
                 NDTIME       0055  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .08 HOURS
                 TOTAL TIME BASE   24.92 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S101	198.	1.67	25.	6.	6.	.16		
ROUTED TO	1R101	139.	2.33	25.	6.	6.	.16	.47	2.33
HYDROGRAPH AT	S106A	444.	1.67	55.	14.	13.	.36		
2 COMBINED AT	C106A	444.	1.67	80.	20.	19.	.52		
ROUTED TO	LP106A	269.	2.00	80.	20.	19.	.52	1308.23	2.00
DIVERSION TO	D107C	55.	2.00	21.	5.	5.	.52		
HYDROGRAPH AT	1D106	214.	2.00	59.	15.	14.	.52		
DIVERSION TO	D106BC	59.	2.00	26.	7.	6.	.52		
HYDROGRAPH AT	2D106	155.	2.00	33.	8.	8.	.52		

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION LP106A
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1302.00	1309.00	1308.40
STORAGE	0.	16.	10.
OUTFLOW	0.	537.	311.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1308.23	.00	8.	269.	.00	2.00	.00

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

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: RESERVOIR OUTFALL

Description: Sub-basin S106A

Solve For Discharge

Given Constant Data;

Bottom Width.....	0.50
Z-Left.....	12.00
Z-Right.....	12.00
Mannings 'n'.....	0.022
Channel Slope.....	0.0043

Variable Input Data	Minimum	Maximum	Increment By
Channel Depth	0.40	2.40	0.10

11/21

Bottom Width ft	Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	VARIABLE Channel Depth ft	COMPUTED Channel Discharge cfs	COMPUTED Velocity fps
0.50	12.00	12.00	0.022	0.0043	0.40	3.31	1.56
0.50	12.00	12.00	0.022	0.0043	0.50	5.85	1.80
0.50	12.00	12.00	0.022	0.0043	0.60	9.35	2.02
0.50	12.00	12.00	0.022	0.0043	0.70	13.94	2.24
0.50	12.00	12.00	0.022	0.0043	0.80	19.71	2.44
0.50	12.00	12.00	0.022	0.0043	0.90	26.79	2.63
0.50	12.00	12.00	0.022	0.0043	1.00	35.27	2.82
0.50	12.00	12.00	0.022	0.0043	1.10	45.26	3.00
0.50	12.00	12.00	0.022	0.0043	1.20	56.85	3.18
0.50	12.00	12.00	0.022	0.0043	1.30	70.13	3.35
0.50	12.00	12.00	0.022	0.0043	1.40	85.20	3.52
0.50	12.00	12.00	0.022	0.0043	1.50	102.15	3.68
0.50	12.00	12.00	0.022	0.0043	1.60	121.07	3.84
0.50	12.00	12.00	0.022	0.0043	1.70	142.03	4.00
0.50	12.00	12.00	0.022	0.0043	1.80	165.12	4.15
0.50	12.00	12.00	0.022	0.0043	1.90	190.42	4.30
0.50	12.00	12.00	0.022	0.0043	2.00	218.02	4.45
0.50	12.00	12.00	0.022	0.0043	2.10	248.00	4.60
0.50	12.00	12.00	0.022	0.0043	2.20	280.42	4.74
0.50	12.00	12.00	0.022	0.0043	2.30	315.37	4.88
0.50	12.00	12.00	0.022	0.0043	2.40	352.93	5.02

12/21

CURRENT DATE: 10-03-1994
CURRENT TIME: 13:19:58

FILE DATE: 10-03-1994
FILE NAME: 303C

CULVERT NO. 59

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1302.30	1300.70	556.00	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: 303C DATE: 10-03-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1302.30	0	0	0	0	0	0	0	0	1
1303.44	7	7	0	0	0	0	0	0	1
1303.95	13	13	0	0	0	0	0	0	1
1304.37	20	20	0	0	0	0	0	0	1
1304.75	26	26	0	0	0	0	0	0	1
1305.11	33	33	0	0	0	0	0	0	1
1305.50	39	39	0	0	0	0	0	0	1
1306.26	46	46	0	0	0	0	0	0	1
1307.24	52	52	0	0	0	0	0	0	1
1308.33	59	59	0	0	0	0	0	0	1
1308.96	65	62	0	0	0	0	0	3	14
1308.90	62	62	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 303C DATE: 10-03-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1302.30	0.00	0	0	0.00
1303.44	0.00	7	0	0.00
1303.95	0.00	13	0	0.00
1304.37	0.00	20	0	0.00
1304.75	0.00	26	0	0.00
1305.11	0.00	33	0	0.00
1305.50	0.00	39	0	0.00
1306.26	0.00	46	0	0.00
1307.24	0.00	52	0	0.00
1308.33	0.00	59	0	0.00
1308.96	-0.01	65	0	0.76

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

C

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CURRENT DATE: 10-03-1994 FILE DATE: 10-03-1994
CURRENT TIME: 13:19:58 FILE NAME: 303C

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3 BY 3) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1302.30	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
7	1303.44	1.05	1.14	3-M1t	0.82	0.79	3.45	0.94	3.28	0.94
13	1303.95	1.58	1.65	3-M1t	1.20	1.14	4.29	1.33	3.91	1.33
20	1304.37	2.00	2.07	3-M1t	1.50	1.41	5.02	1.62	4.33	1.62
26	1304.75	2.36	2.45	3-M1t	1.80	1.64	5.68	1.85	4.65	1.85
33	1305.11	2.68	2.81	3-M2t	2.10	1.85	6.31	2.05	4.91	2.05
39	1305.50	3.01	3.20	3-M2t	2.49	2.03	6.93	2.23	5.14	2.23
46	1306.26	3.36	3.96	6-FFn	3.00	2.19	6.44	3.00	5.34	2.39
52	1307.24	3.75	4.94	6-FFn	3.00	2.34	7.36	3.00	5.51	2.54
59	1308.33	4.18	6.03	6-FFn	3.00	2.46	8.28	3.00	5.68	2.68
62	1308.96	4.41	6.66	6-FFn	3.00	2.51	8.73	3.00	5.82	2.81

El. inlet face invert 1302.30 ft El. outlet invert 1300.70 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1302.30
OUTLET STATION (FT)	556.00
OUTLET ELEVATION (FT)	1300.70
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0029
CULVERT LENGTH ALONG SLOPE (FT)	556.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END IN HEADWALL
INLET DEPRESSION	NONE

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CURRENT DATE: 10-03-1994 FILE DATE: 10-03-1994
CURRENT TIME: 13:19:58 FILE NAME: 303C

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	1.17
SIDE SLOPE H/V (X:1)	1.0
CHANNEL SLOPE V/H (FT/FT)	0.003
MANNING'S N (.01-0.1)	0.016
CHANNEL INVERT ELEVATION (FT)	1300.70
CULVERT NO.1 OUTLET INVERT ELEVATION	1300.70 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1300.70	0.000	0.00	0.00	0.00
6.50	1301.64	0.596	0.94	3.28	0.18
13.00	1302.03	0.597	1.33	3.91	0.25
19.50	1302.32	0.600	1.62	4.33	0.30
26.00	1302.55	0.602	1.85	4.65	0.35
32.50	1302.75	0.604	2.05	4.91	0.38
39.00	1302.93	0.606	2.23	5.14	0.42
45.50	1303.09	0.608	2.39	5.34	0.45
52.00	1303.24	0.610	2.54	5.51	0.48
58.50	1303.38	0.611	2.68	5.68	0.50
65.00	1303.51	0.613	2.81	5.82	0.53

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	25.00
CREST LENGTH (FT)	64.00
OVERTOPPING CREST ELEVATION (FT)	1308.90

CURRENT DATE: 10-03-1994
CURRENT TIME: 13:20:53

FILE DATE: 10-03-1994
FILE NAME: 303B

CULVERT NO. 44

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1303.20	1302.80	96.00	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: 303B DATE: 10-03-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1303.20	0	0	0	0	0	0	0	0	1
1304.00	3	3	0	0	0	0	0	0	1
1304.44	6	6	0	0	0	0	0	0	1
1304.92	9	9	0	0	0	0	0	0	1
1305.22	12	12	0	0	0	0	0	0	1
1305.52	15	15	0	0	0	0	0	0	1
1305.84	18	18	0	0	0	0	0	0	1
1306.36	21	21	0	0	0	0	0	0	1
1306.94	24	24	0	0	0	0	0	0	1
1307.58	27	27	0	0	0	0	0	0	1
1308.30	30	30	0	0	0	0	0	0	1
1308.90	32	32	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 303B DATE: 10-03-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1303.20	0.00	0	0	0.00
1304.00	0.00	3	0	0.00
1304.44	0.00	6	0	0.00
1304.92	0.00	9	0	0.00
1305.22	0.00	12	0	0.00
1305.52	0.00	15	0	0.00
1305.84	0.00	18	0	0.00
1306.36	0.00	21	0	0.00
1306.94	0.00	24	0	0.00
1307.58	0.00	27	0	0.00
1308.30	0.00	30	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

B

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CURRENT DATE: 10-03-1994 FILE DATE: 10-03-1994
CURRENT TIME: 13:20:53 FILE NAME: 303B

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1303.20	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
3	1304.00	0.80	0.80	1-S2n	0.59	0.60	3.89	0.59	3.22	0.54
6	1304.44	1.24	1.24	1-S2n	0.85	0.86	4.71	0.85	3.88	0.79
9	1304.92	1.59	1.72	2-M2c	1.08	1.07	5.28	1.07	4.31	0.97
12	1305.22	1.92	2.02	2-M2c	1.30	1.24	5.85	1.24	4.64	1.13
15	1305.52	2.25	2.32	2-M2c	1.56	1.40	6.41	1.40	4.91	1.26
18	1305.84	2.64	2.64	6-FFn	2.00	1.52	5.73	2.00	5.14	1.38
21	1306.36	3.10	3.16	6-FFn	2.00	1.63	6.68	2.00	5.34	1.48
24	1306.94	3.64	3.74	6-FFn	2.00	1.72	7.64	2.00	5.52	1.58
27	1307.58	4.25	4.38	6-FFn	2.00	1.81	8.59	2.00	5.68	1.67
30	1308.30	4.95	5.10	6-FFn	2.00	1.90	9.55	2.00	5.84	1.76

El. inlet face invert 1303.20 ft El. outlet invert 1302.80 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1303.20
OUTLET STATION (FT)	96.00
OUTLET ELEVATION (FT)	1302.80
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0042
CULVERT LENGTH ALONG SLOPE (FT)	96.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 10-03-1994 FILE DATE: 10-03-1994
CURRENT TIME: 13:20:53 FILE NAME: 303B

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	1.17
SIDE SLOPE H/V (X:1)	1.0
CHANNEL SLOPE V/H (FT/FT)	0.005
MANNING'S N (.01-0.1)	0.016
CHANNEL INVERT ELEVATION (FT)	1302.80
CULVERT NO.1 OUTLET INVERT ELEVATION	1302.80 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1302.80	0.000	0.00	0.00	0.00
3.00	1303.34	0.770	0.54	3.22	0.17
6.00	1303.59	0.770	0.79	3.88	0.25
9.00	1303.77	0.770	0.97	4.31	0.30
12.00	1303.93	0.770	1.13	4.64	0.35
15.00	1304.06	0.771	1.26	4.91	0.39
18.00	1304.18	0.771	1.38	5.14	0.43
21.00	1304.28	0.772	1.48	5.34	0.46
24.00	1304.38	0.774	1.58	5.52	0.49
27.00	1304.47	0.775	1.67	5.68	0.52
30.00	1304.56	0.776	1.76	5.84	0.55

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	25.00
CREST LENGTH (FT)	64.00
OVERTOPPING CREST ELEVATION (FT)	1308.90

CURRENT DATE: 10-03-1994
CURRENT TIME: 13:21:51

FILE DATE: 10-03-1994
FILE NAME: 303A

CULVERT NO. 45

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1302.60	1302.20	84.00	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: 303A DATE: 10-03-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1305.00	0	0	0	0	0	0	0	0	1
1305.39	3	3	0	0	0	0	0	0	1
1305.62	6	6	0	0	0	0	0	0	1
1305.89	9	9	0	0	0	0	0	0	1
1306.21	12	12	0	0	0	0	0	0	1
1306.58	15	15	0	0	0	0	0	0	1
1307.02	18	18	0	0	0	0	0	0	1
1307.52	21	21	0	0	0	0	0	0	1
1308.08	24	24	0	0	0	0	0	0	1
1308.71	27	27	0	0	0	0	0	0	1
1308.95	30	28	0	0	0	0	0	2	18
1308.90	28	28	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 303A DATE: 10-03-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1305.00	0.00	0	0	0.00
1305.39	0.00	3	0	0.00
1305.62	0.00	6	0	0.00
1305.89	0.00	9	0	0.00
1306.21	0.00	12	0	0.00
1306.58	0.00	15	0	0.00
1307.02	0.00	18	0	0.00
1307.52	0.00	21	0	0.00
1308.08	0.00	24	0	0.00
1308.71	0.00	27	0	0.00
1308.95	-0.00	30	0	0.98

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

A

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CURRENT DATE: 10-03-1994 FILE DATE: 10-03-1994
CURRENT TIME: 13:21:51 FILE NAME: 303A

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1305.00	0.00	2.40	0-NF	0.00	0.00	0.00	0.00	0.00	2.80
3	1305.39	0.80	2.79	4-FFt	0.57	0.60	0.95	2.00	0.80	3.16
6	1305.62	1.24	3.02	4-FFt	0.82	0.86	1.91	2.00	0.95	3.28
9	1305.89	1.59	3.29	4-FFt	1.04	1.07	2.86	2.00	1.05	3.38
12	1306.21	1.92	3.61	4-FFt	1.24	1.24	3.82	2.00	1.13	3.47
15	1306.58	2.25	3.98	4-FFt	1.47	1.40	4.77	2.00	1.20	3.54
18	1307.02	2.64	4.42	4-FFt	1.79	1.52	5.73	2.00	1.25	3.60
21	1307.52	3.10	4.92	4-FFt	2.00	1.63	6.68	2.00	1.31	3.66
24	1308.08	3.64	5.48	4-FFt	2.00	1.72	7.64	2.00	1.35	3.72
27	1308.71	4.25	6.11	4-FFt	2.00	1.81	8.59	2.00	1.39	3.77
28	1308.94	4.45	6.34	4-FFt	2.00	1.84	8.87	2.00	1.42	3.83

El. inlet face invert 1302.60 ft El. outlet invert 1302.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1302.60
OUTLET STATION (FT)	84.00
OUTLET ELEVATION (FT)	1302.20
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0048
CULVERT LENGTH ALONG SLOPE (FT)	84.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 10-03-1994 FILE DATE: 10-03-1994
CURRENT TIME: 13:21:51 FILE NAME: 303A

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: 303AT
MAIN CHANNEL ONLY FILE DATE: 10-03-1994

LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING N LEFT OVER BANK	0.000
MANNING N MAIN CHANNEL	0.025
MANNING N RIGHT OVER BAN	0.000
SLOPE OF CHANNEL (FT/FT)	0.0010

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1307.00
2	9.00	1306.00
3	15.00	1305.00
4	25.00	1305.00
5	41.00	1306.00
6	56.00	1306.50

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1305.00	0.000	2.80	0.00	0.00
3.00	1305.36	0.267	3.16	0.80	0.02
6.00	1305.48	0.279	3.28	0.95	0.02
9.00	1305.58	0.286	3.38	1.05	0.03
12.00	1305.67	0.291	3.47	1.13	0.03
15.00	1305.74	0.295	3.54	1.20	0.03
18.00	1305.80	0.299	3.60	1.25	0.03
21.00	1305.86	0.302	3.66	1.31	0.04
24.00	1305.92	0.305	3.72	1.35	0.04
27.00	1305.97	0.307	3.77	1.39	0.04
30.00	1306.03	0.308	3.83	1.42	0.04

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	25.00
CREST LENGTH (FT)	64.00
OVERTOPPING CREST ELEVATION (FT)	1308.90

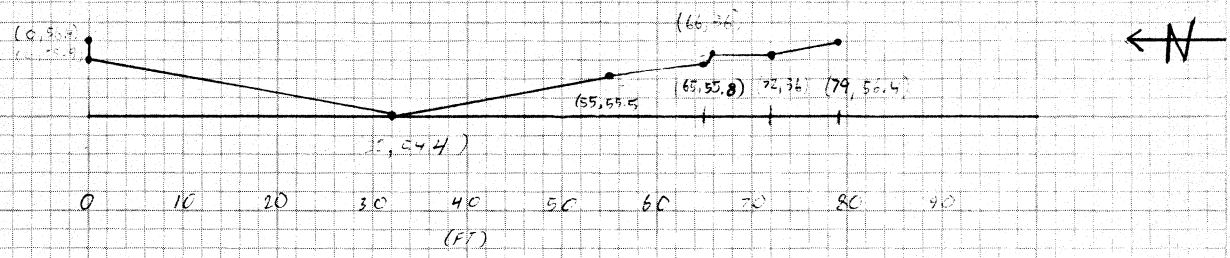
DESIGNED BY KJV DATE 11/2/94 SHEET NO. 1 PAGE NO. 1
CHECKED BY JRM DATE 12/14/94 OF JOB NO.
REVIEWED BY DATE SUBJECT: DIVERSION @ D109C
APPROVED BY DATE

D116A

- AREA OF UNION HILLS AND OUTFALL OF C109C

* IT IS ASSUMED THAT THE GIVEN CROSS SECTION IS A CONTROL POINT FOR CONVEYANCE TO THE EAST. EXCESS DISCHARGE CONTRIBUTES TO AREA E116A.

* NORTHERN CROSS-SECTION BOUNDARY:
  - NORTHERN BOUNDARY LOCATION AND ELEVATION IS BASED ON AN EXISTING STAND (IE - ROW) OF TREES. A SMALL BERM ADJACENT TO THE ROWS AND THICK VEGETATION ACT AS AN EFFECTIVE FLOW BOUNDARY.



GR	1256.4	0	1255.9	0	1254.4	32	1255.5	55	1255.8	65
GR	1256	66	1256	72	1256.4	79				

D_{MAX} - 2.0'

DEPTH (FT)	ELEVATION (FT)	DISCHARGE (CFS)
0	1254.4	0.0
.5	1254.9	9.0
1.0	1255.4	59.0
1.5	1255.9	173.0
2.0	1256.4	390.0

D109C → DIVERTED TO C116A

DI	0	9	59	173	390	450	500	550	622	650
DQ	0	0	0	0	0	60	110	160	232	260

UNBOLL2.DAT

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    02NOV94    TIME   10:44:12   *
*********************************************
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***************************************
*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET, SUITE D
*  DAVIS, CALIFORNIA 95616-4687
*          (916) 756-1104
***************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

THIS RUN EXECUTED 02NOV94 10:44:13

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************


T1      AREA OF UNIONHILLS AND OUTFALL OF C109C
T2      HEC-2 ANALYSIS OF CROSS SECTION AT ROUTE START
T3      DIVERSION AT D109C.  FLOW IS DIVERTED TO C109D
T4
T4      MODEL USED FOR CROSS SECTION ANALYSIS TO DETERMINE CAPACITY.
T4

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                           .0054                                   1.5

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1                  -1                                                                      15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        43         1         8        25        26         9        14        26        17
     16        17

J5  LPRNT     NUMSEC                     ********REQUESTED SECTION NUMBERS********

    -10       -10

NC     .025      .025      .025        .1        .3
QT        4         9        59       173       390
X1        1         8         0        79         0         0         0
GR   1256.4         0    1255.9         0    1254.4        32    1255.5        55    1255.8        65
GR     1256        66      1256        72    1256.4        79
```

3/11

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 1.00 CWSEL= 1254.90

STA= 21. 79.
PER Q= 100.0
AREA= 5.2
VEL= 1.7
DEPTH= .2

```
T1     UNION HILLS @ AREA OF C109D
T3      D109D
J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                3                           .0054                                   1.5
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     2                  -1
```

```
T1     UNION HILLS @ AREA OF C109D
T3      D109D
J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
                4                         .0054                                1.5
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     3                 -1
```

6/11

```
T1     UNION HILLS @ AREA OF C109D
T3      BULLARD
J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
               5                         .0054                              1.5
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     4                 -1
```

THIS RUN EXECUTED 02NOV94 10:44:14

```
************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************
```

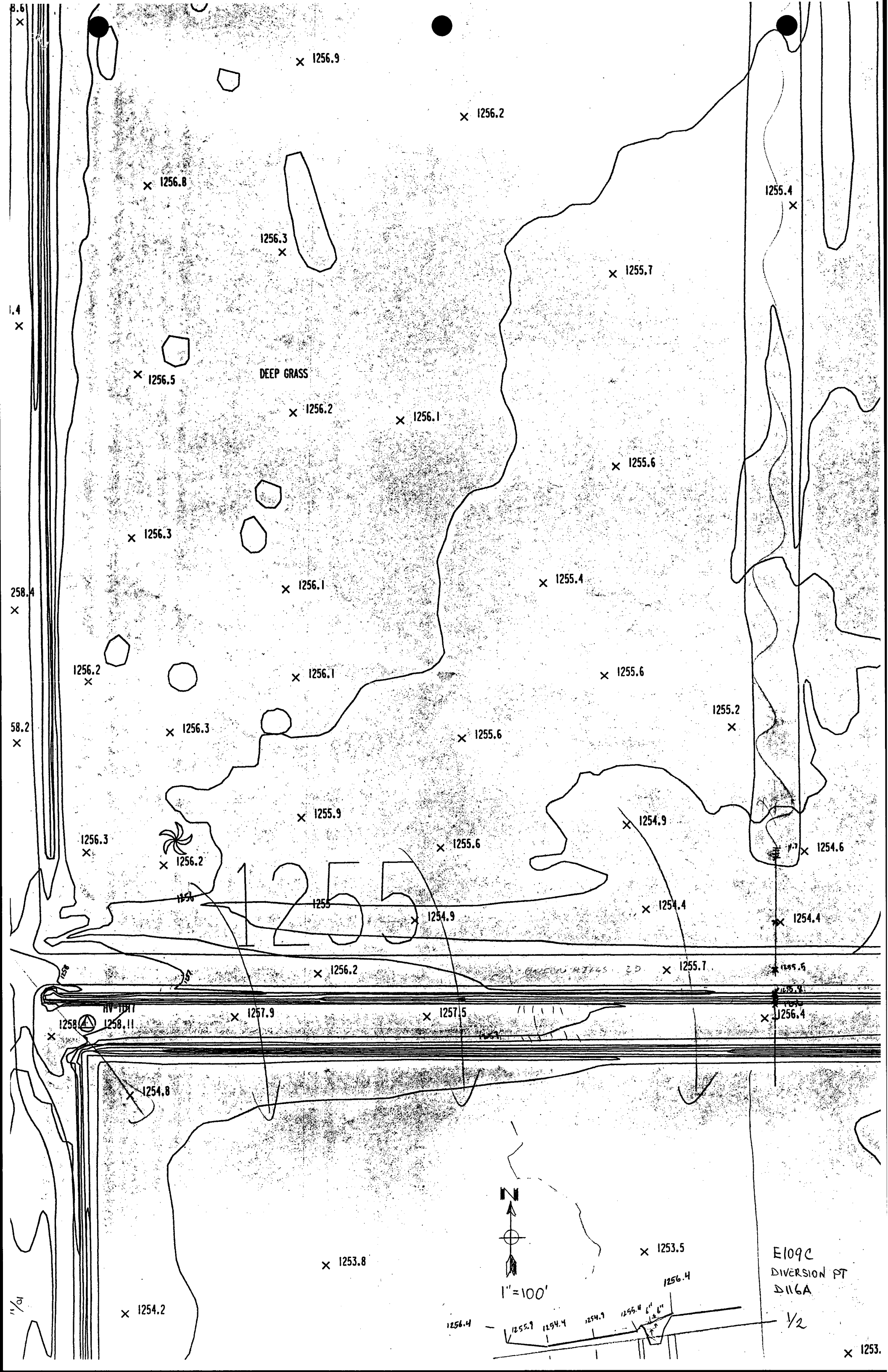
NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

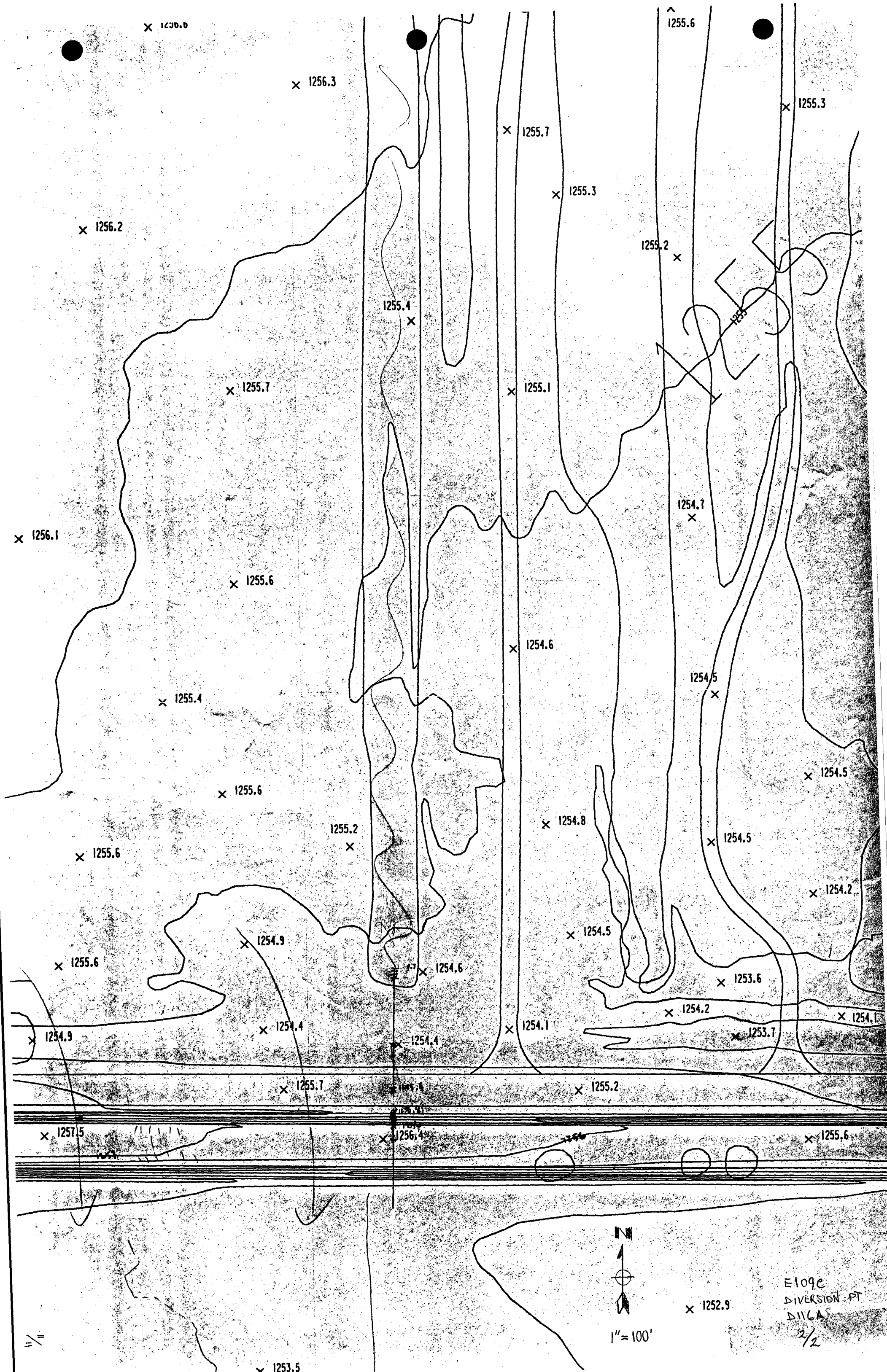
DIVERSION AT D109C. FLO

SUMMARY PRINTOUT

SECNO	Q	CWSEL	DEPTH	AREA	VCH	WSELK	QCH	VCH	K*XNCH	K*XNL	K*XNCH
1.000	9.00	1254.90	.50	5.22	1.72	1.50	9.00	1.72	25.00	.00	25.00
1.000	59.00	1255.40	1.00	21.25	2.78	1.50	59.00	2.78	25.00	.00	25.00
1.000	173.00	1255.90	1.50	48.40	3.57	1.50	173.00	3.57	25.00	.00	25.00
1.000	390.00	1256.40	2.00	85.11	4.58	1.50	390.00	4.58	25.00	.00	25.00

SUMMARY OF ERRORS AND SPECIAL NOTES


1256.9
1256.2
1256.8
1255.4
1256.3
1255.7
1256.5
DEEP GRASS
1256.2
1256.1
1255.6
1256.3
1256.1
1255.4
258.4
1256.2
1256.1
1255.6
1255.2
58.2
1256.3
1255.6
1255.9
1254.9
1256.3
1255.6
1254.6
1256.2
1255
1254.9
1254.4
1254.4
1256.2
1255.7
1257.9
1257.5
1256.4
1258.11
1254.8
1253.8
1253.5
1254.2
1253.
N
1"=100'
1256.4
1255.9
1254.4
1254.9
1255.4
6"
6"
E109C
DIVERSION PT
D116A
1/2


1256.3
1255.7
1255.3
1255.3
1256.2
1255.2
1255.4
1255.7
1255.1
1256.1
1254.7
1255.6
1254.6
1254.5
1255.4
1254.5
1255.6
1254.8
1255.2
1254.5
1255.6
1254.2
1254.9
1254.5
1255.6
1254.6
1253.6
1254.2
1254.1
1254.9
1254.4
1254.1
1253.7
1254.4
1255.7
1255.2
1257.5
1256.4
1255.6
1252.9
1253.5
N
1"=100'
E109C
DIVERSION PT
D116A
2/2

DESIGNED BY KJV DATE 11/1/94 SHEET NO. PAGE NO.
CHECKED BY JRB DATE 12/13/94 OF JOB NO.
REVIEWED BY DATE SUBJECT: DIVERSION @ D109D
APPROVED BY DATE

FROM HEC-2 ANALYSIS AREA C109D (HEC-2 MODEL UNBULL1.DAT)

CAPACITY OF CROSS SECTION AT C109D - EASTERN FLOW

ELEVATION (FT)	DISCHARGE (CFS)
1244.09	0
1245.09	26.00
1246.09	197.00
1246.19	235.00
1246.29	275.00
1246.39	320.00
1246.49	365.00
1246.59	410.00
1246.69	463.00

CAPACITY OF CROSS SECTION AT C109D - SOUTHERN FLOW
D109DS - TO KINGSWOOD PARK (HEC-2 MODEL UNBULL2.DAT)

ELEVATION (FT)	DISCHARGE (CFS)
1244.09	0
1245.09	0
1246.09	0
1246.19	15.00
1246.29	26.00
1246.39	40.00
1246.49	58.00
1246.59	78.00
1246.69	105.00

DIVERSION INPUT FOR HEC-1 MODEL @ C109D

DT D109DS · TO KINGSWOOD PARK

DI	0	26	197	250	301	360	423	488	568
DQ	0	0	0	15	26	40	58	78	105

SC 3020

```
*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    01NOV94    TIME   12:10:22   *
*********************************************
```

```
*************************************
*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET, SUITE D
*  DAVIS, CALIFORNIA 95616-4687
*          (916) 756-1104
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                   X
X     X  X        X     X             X
X     X  XXXXXXX   XXXXX              XXXXXXX
```

THIS RUN EXECUTED 01NOV94 12:10:22

```
************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************

T1      UNION HILLS AND BULLARD AVE.
T2      HEC-2 ANALYSIS OF CROSS SECTION AT DIVERSION FILE: UNBULL1.DAT
T3      C109D TO C110 - FLOW THAT CONTINUES TO THE EAST ALONG UNION HILLS
T4
T4      MODEL USED FOR CROSS SECTION ANALYSIS TO DETERMINE CAPACITY.
T4

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
              2                         .0081                                  1

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     1                -1                                                              15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       43       1        8        25       26       9        14       26       17
     16       17

J5  LPRNT    NUMSEC                 ********REQUESTED SECTION NUMBERS********

    -10      -10

NC    .022     .022     .022      .1       .3
QT       8       26      197     235      275      320      365      410      463
X1       1        6        0      67
X3       0        0        0       0        0        0        0
GR  1248.5        0   1264.5       2   1244.1       13   1245.5       32   1245.8       61
GR  1247.8       67
```

3/24

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 1.00 CWSEL= 1245.10

```
STA=      12.      67.
  PER Q=    100.0
   AREA=      7.1
    VEL=      3.7
  DEPTH=       .5
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                3                           .0081                                     1
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     2                  -1
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW
J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
                4                         .0081                                1
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     3                 -1
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                5                           .0081                                     1
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     4                  -1
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW
J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
                6                        .0081                                  1
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     5                 -1
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
                 7                      .0081                                  1

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     6                 -1
```

9/24

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW
J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
               8                         .0081                                  1
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     7                 -1
```

10/24

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
                9                         .0081                                1
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     8                 -1
```

THIS RUN EXECUTED 01NOV94 12:10:25

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

C109D TO C110 - FLOW THA

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	DEPTH	AREA	VCH	WSELK	QCH	VCH	K*XNCH	K*XNL	K*XNCH
	1.000	26.00	1245.10	1.00	7.06	3.69	1.00	26.00	3.69	22.00	.00	22.00
	1.000	197.00	1246.09	1.99	38.71	5.09	1.00	197.00	5.09	22.00	.00	22.00
	1.000	235.00	1246.19	2.09	43.39	5.42	1.00	235.00	5.42	22.00	.00	22.00
*	1.000	275.00	1246.29	2.19	48.67	5.65	1.00	275.00	5.65	22.00	.00	22.00
*	1.000	320.00	1246.39	2.29	53.64	5.97	1.00	320.00	5.97	22.00	.00	22.00
*	1.000	365.00	1246.49	2.39	58.67	6.22	1.00	365.00	6.22	22.00	.00	22.00
*	1.000	410.00	1246.59	2.49	63.87	6.42	1.00	410.00	6.42	22.00	.00	22.00
*	1.000	463.00	1246.69	2.59	69.30	6.68	1.00	463.00	6.68	22.00	.00	22.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=      1.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      1.000  PROFILE=  5  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      1.000  PROFILE=  6  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      1.000  PROFILE=  7  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      1.000  PROFILE=  8  CRITICAL DEPTH ASSUMED
```

```
*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    01NOV94    TIME   11:31:08   *
*********************************************
```

```
***************************************
*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET, SUITE D
*  DAVIS, CALIFORNIA 95616-4687
*          (916) 756-1104
***************************************
```

```
X     X  XXXXXXX  XXXXX            XXXXX
X     X  X       X     X          X     X
X     X  X       X                      X
XXXXXXX  XXXX    X         XXXXX   XXXXX
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX  XXXXX            XXXXXXX
```

14/24

THIS RUN EXECUTED 01NOV94 11:31:08

```
************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************

T1      UNION HILLS AND BULLARD AVE.
T2      HEC-2 ANALYSIS OF CROSS SECTION AT DIVERSION
T3      C109D TO C116A - FLOW THAT CONTINUES TO THE SOUTH
T4
T4      MODEL USED FOR CROSS SECTION ANALYSIS TO DETERMINE CAPACITY.
T4

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

              2                         .0045                                  1

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

     1                -1                                                                15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       43       1        8        25       26       9        14       26       17
     16       17

J5  LPRNT    NUMSEC                 ********REQUESTED SECTION NUMBERS********

    -10      -10

NC    .040     .040     .040      .1       .3
QT       6       15       26      40       58       78      105
X1       1        8        0     181
X3       0        0        0       0        0        0        0
GR  1248.8        0   1248.8      16   1245.7       32   1246.1       57   1246.9      117
GR  1246.1      143   1245.8     175   1247.8      181
```

FILE: UNBULL2.DAT

15/24

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 1.00 CWSEL= 1246.19

STA= 29. 181.
PER Q= 100.0
AREA= 16.1
VEL= .9
DEPTH= .2

T1 UNION HILLS AND BULLARD AVE.
T3 ~~EAST~~ SOUTH FLOW

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		3			.0045				1	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2		-1							

T1 UNION HILLS AND BULLARD AVE.
T3 ~~EAST~~ SOUTH FLOW

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		4			.0045				1	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3		-1							

```
T1     UNION HILLS AND BULLARD AVE.
T3      ~~EAST~~ SOUTH FLOW
J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                5                           .0045                                     1
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     4                  -1
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      ~~EAST~~ SOUTH FLOW
J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
                6                         .0045                                1
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     5                 -1
```

```
T1     UNION HILLS AND BULLARD AVE.
T3      EAST FLOW
                SOUTH
J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                7                           .0045                                     1
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     6                   -1
```

THIS RUN EXECUTED 01NOV94 11:31:10

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

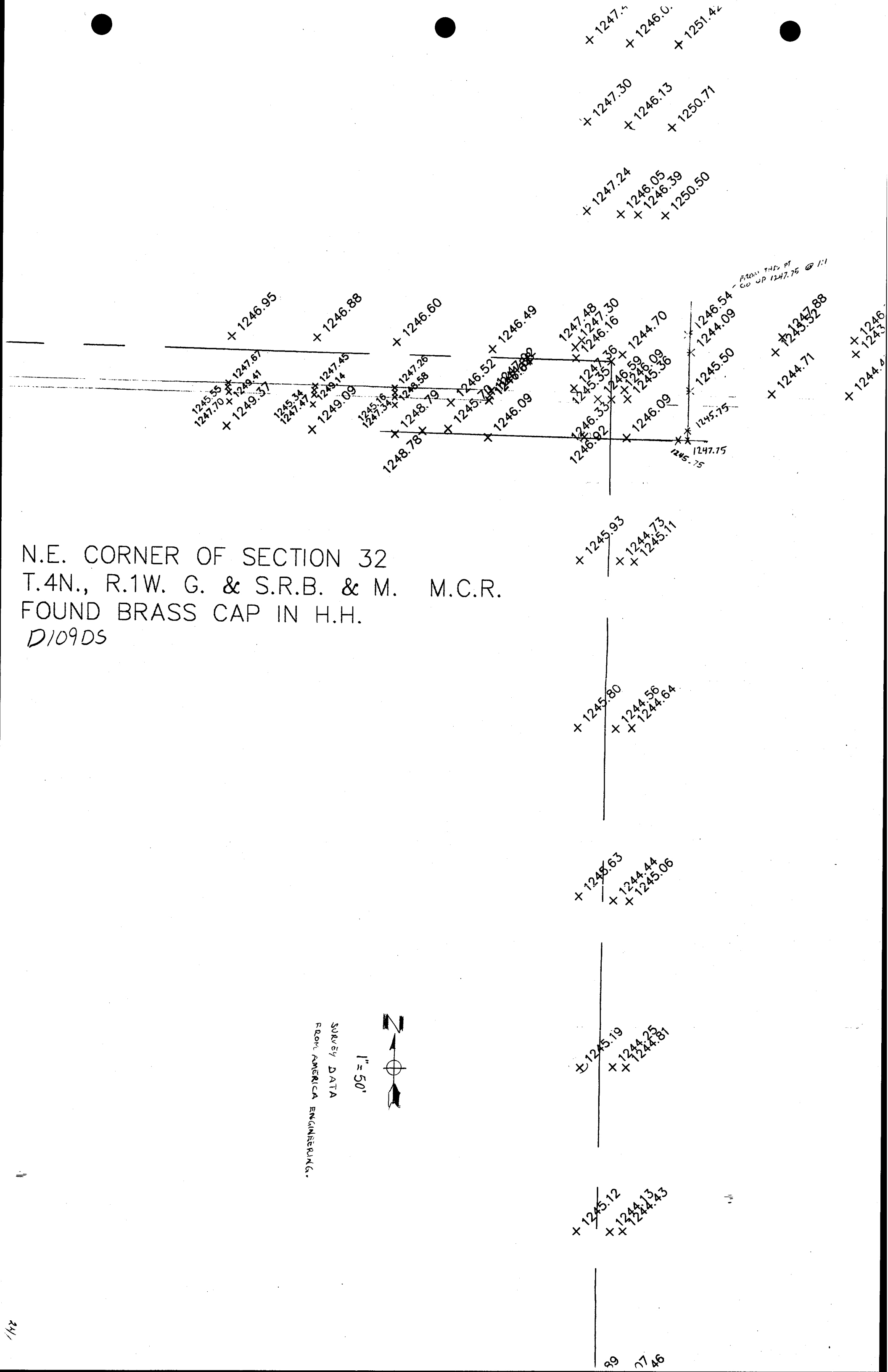
NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

C109D TO C116A - FLOW TH

SUMMARY PRINTOUT

SECNO	Q	CWSEL	DEPTH	AREA	VCH	WSELK	QCH	VCH	K*XNCH	K*XNL	K*XNCH
1.000	15.00	1246.19	.49	16.09	.93	1.00	15.00	.93	40.00	.00	40.00
1.000	26.00	1246.29	.59	23.84	1.09	1.00	26.00	1.09	40.00	.00	40.00
1.000	40.00	1246.39	.69	32.49	1.23	1.00	40.00	1.23	40.00	.00	40.00
1.000	58.00	1246.49	.79	42.62	1.36	1.00	58.00	1.36	40.00	.00	40.00
1.000	78.00	1246.59	.89	53.10	1.47	1.00	78.00	1.47	40.00	.00	40.00
1.000	105.00	1246.69	.99	66.15	1.59	1.00	105.00	1.59	40.00	.00	40.00

SUMMARY OF ERRORS AND SPECIAL NOTES

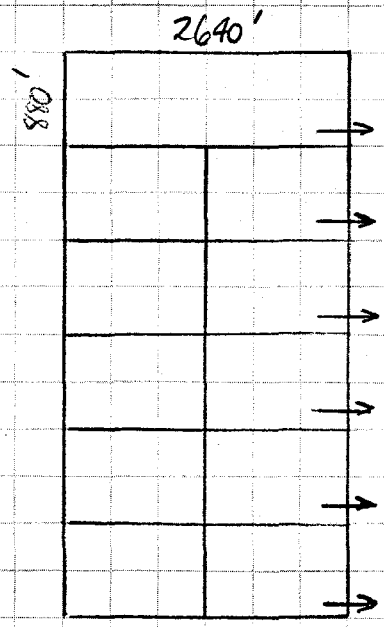

N.E. CORNER OF SECTION 32
T.4N., R.1W. G. & S.R.B. & M. M.C.R.
FOUND BRASS CAP IN H.H.
D109DS
1" = 50'
SURVEY DATA
FROM AMERICA ENGINEERING.
1247.30
1246.13
1250.71
1247.24
1246.05
1246.39
1250.50
1246.95
1246.88
1246.60
1246.49
1247.48
1247.30
1246.16
1244.70
1246.54
1244.09
1245.50
1245.75
1247.75
1245.75
1245.93
1244.73
1245.11
1245.80
1244.56
1244.64
1245.63
1244.44
1245.06
1245.19
1244.25
1244.81
1245.12
1244.13
1244.43

STANLEY CONSULTANTS

Computed by JRM Date 10/8/94
Checked by JRB Date 12/13/94
Reviewed by _____ Date _____
Approved by _____ Date _____

Job No. 12291-3-700 Page No. _____
Subject FLOW DIVERSION
S113A TO S113
Sheet No. _____ of _____

S113A:



CULVERT #	Q (cfs)	
39	16	
37	14	
35	16	
33	15	
31	16	$Q_T = 77$ cfs
969+00	12.4	(FULL FLOW)

TOTAL Q = 89.4 cfs

1D113A
Q = 46

2D113A
Q = 15

3D113A
Q = 28

NOTE: Q_{PEAK} AT CROSS CULVERTS GREATER THAN CAPACITY.

$$Q_{PEAK} = 0.25(2.8)(52) \approx 36 \text{ cfs}$$

IRRIGATION CHANNELS ASSUMED FULL!

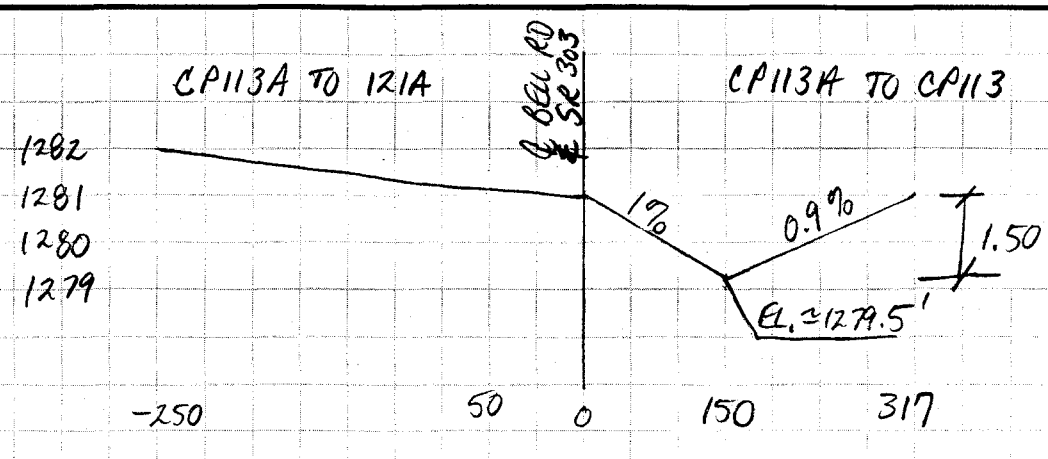
ASSUME:
1. OVERTOPPING CAPACITY OF CROSS-CULVERTS FLOW EAST. REMAINING RUNOFF FLOWS SOUTH.
2. OVERTOPPING ELEVATION DEFINED AS TOP OF IRRIGATION DITCH AND NOT ROADWAY PROFILE.

SC 3004 R1 691

STANLEY CONSULTANTS

Computed by JRM Date 10/21/94
Checked by _____ Date _____
Reviewed by _____ Date _____
Approved by _____ Date _____

Job No. 12291-3-700 Page No. _____
Subject FLOW DIVERSION
℄ BELL RD. & SR303
Sheet No. _____ of _____



S = 0.01 ft/ft
DIVERSION
(WEST)

S = 0.002 ft/ft
n = 0.025
REMAINDER
(NORTH)

DT 20113A

DI	0	185	545	642	893	1913
DQ	0	0	0	12	74	467

SC 3004 R1 691

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: DIVERSION CP113A
Description: CP113A TO CP113
Solve For Discharge
Given Constant Data;
Z-Left..... 111.00
Z-Right..... 110.00
Mannings 'n'..... 0.025
Channel Slope..... 0.0020

VARIABLE COMPUTED COMPUTED

Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	Channel Depth ft	Channel Discharge cfs	Velocity (fps)
111.00	110.00	0.025	0.0020	0.25	4.59	0.66
111.00	110.00	0.025	0.0020	0.50	29.14	1.05
111.00	110.00	0.025	0.0020	0.75	85.92	1.38
111.00	110.00	0.025	0.0020	1.00	185.04	1.67
111.00	110.00	0.025	0.0020	1.25	335.49	1.94
111.00	110.00	0.025	0.0020	1.50	545.55	2.19

Given Constant Data;
Bottom Width..... 317.00
Z-Left..... 111.00
Z-Right..... 0.00
Mannings 'n'..... 0.025
Channel Slope..... 0.0020

VARIABLE COMPUTED COMPUTED

Bottom Width ft	Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	Channel Depth ft	Channel Discharge cfs	Velocity fps
317.00	111.00	0.00	0.025	0.0020	0.25	84.86	1.03
317.00	111.00	0.00	0.025	0.0020	0.50	273.89	1.59
317.00	111.00	0.00	0.025	0.0020	0.75	547.85	2.04
317.00	111.00	0.00	0.025	0.0020	1.00	901.22	2.42

Description: CP113A TO S121A
Given Constant Data;
Z-Left..... 0.00
Z-Right..... 250.00
Mannings 'n'..... 0.025
Channel Slope..... 0.0100

VARIABLE COMPUTED COMPUTED

Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	Channel Depth ft	Channel Discharge cfs	Velocity (fps)
0.00	250.00	0.025	0.0100	0.25	11.58	1.48
0.00	250.00	0.025	0.0100	0.50	73.52	2.35
0.00	250.00	0.025	0.0100	0.75	216.76	3.08
0.00	250.00	0.025	0.0100	1.00	466.81	3.73

Open Channel Flow Module, Version 3.21 (c)

Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

VERTICAL CURVE CALCULATION	LENGTH OF CURVE = 200	VERT CORR AT PI = +0.472
	BACK GRADE IN % = -1.000	AHEAD GRADE IN % = +0.889
	STATION AT PI = 96975.00	PI TANGENT ELEV = 1278.98
	LOW STATION = 96980.85	LOW ELEVATION = 1279.45

STATION =	ELEV	STATION =	ELEV	STATION =	ELEV
96875.00	=1279.98	96950.00	=1279.50	97025.00	=1279.54
96880.00	=1279.93	96955.00	=1279.48	97030.00	=1279.56
96885.00	=1279.88	96960.00	=1279.47	97035.00	=1279.59
96890.00	=1279.84	96965.00	=1279.46	97040.00	=1279.62
96895.00	=1279.80	96970.00	=1279.46	97045.00	=1279.65
96900.00	=1279.76	96975.00	=1279.45	97050.00	=1279.68
96905.00	=1279.72	96980.00	=1279.45	97055.00	=1279.71
96910.00	=1279.69	96985.00	=1279.45	97060.00	=1279.75
96915.00	=1279.66	96990.00	=1279.45	97065.00	=1279.79
96920.00	=1279.63	96995.00	=1279.46	97070.00	=1279.83
96925.00	=1279.60	97000.00	=1279.47	97075.00	=1279.87
96930.00	=1279.57	97005.00	=1279.48		
96935.00	=1279.55	97010.00	=1279.49		
96940.00	=1279.53	97015.00	=1279.51		
96945.00	=1279.51	97020.00	=1279.52		

<Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

CURRENT DATE: 10-08-1994
CURRENT TIME: 18:46:31

FILE DATE: 10-08-1994
FILE NAME: 96900

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1275.50	1274.90	180.00	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: 96900 DATE: 10-08-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1279.00	0	0	0	0	0	0	0	0	1
1279.03	5	2	0	0	0	0	0	3	14
1279.05	10	3	0	0	0	0	0	7	11
1279.07	15	4	0	0	0	0	0	11	9
1279.09	20	4	0	0	0	0	0	16	7
1279.11	25	5	0	0	0	0	0	20	7
1279.12	30	5	0	0	0	0	0	25	6
1279.14	35	5	0	0	0	0	0	30	6
1279.15	40	5	0	0	0	0	0	34	5
1279.16	45	6	0	0	0	0	0	39	5
1279.18	50	6	0	0	0	0	0	44	5
1279.00	0	0	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 96900 DATE: 10-08-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1279.00	0.00	0	0	0.00
1279.03	-0.00	5	0	0.54
1279.05	-0.00	10	0	0.89
1279.07	-0.00	15	0	0.78
1279.09	-0.00	20	0	0.97
1279.11	-0.00	25	0	0.71
1279.12	-0.00	30	0	0.64
1279.14	-0.00	35	0	0.57
1279.15	-0.00	40	0	0.82
1279.16	-0.00	45	0	0.62
1279.18	-0.00	50	0	0.58

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 10-08-1994 FILE DATE: 10-08-1994
CURRENT TIME: 18:46:31 FILE NAME: 96900

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1279.00	0.00	3.50	0-NF	0.00	0.00	0.00	0.00	0.00	4.10
2	1279.02	0.64	3.52	4-FFt	0.53	0.51	0.71	2.00	0.00	4.10
3	1279.04	0.78	3.54	4-FFt	0.62	0.60	0.95	2.00	0.00	4.10
4	1279.07	0.90	3.57	4-FFt	0.69	0.67	1.18	2.00	0.00	4.10
4	1279.09	0.98	3.59	4-FFt	0.75	0.72	1.35	2.00	0.00	4.10
5	1279.11	1.05	3.61	4-FFt	0.79	0.75	1.48	2.00	0.00	4.10
5	1279.12	1.09	3.62	4-FFt	0.82	0.78	1.59	2.00	0.00	4.10
5	1279.13	1.12	3.63	4-FFt	0.84	0.80	1.65	2.00	0.00	4.10
5	1279.14	1.15	3.64	4-FFt	0.85	0.82	1.72	2.00	0.00	4.10
6	1279.16	1.19	3.66	4-FFt	0.88	0.84	1.82	2.00	0.00	4.10
6	1279.17	1.22	3.67	4-FFt	0.90	0.86	1.89	2.00	0.00	4.10

El. inlet face invert 1275.50 ft El. outlet invert 1274.90 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1275.50
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	1274.90
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0033
CULVERT LENGTH ALONG SLOPE (FT)	180.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	BEVELED EDGE (1:1)
INLET DEPRESSION	NONE

CURRENT DATE: 10-08-1994
CURRENT TIME: 18:46:31

FILE DATE: 10-08-1994
FILE NAME: 96900

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1279.00

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	180.00
CREST LENGTH (FT)	200.00
OVERTOPPING CREST ELEVATION (FT)	1279.00

DESIGNED BY JRM DATE 11-19-94 SHEET NO. PAGE NO.
CHECKED BY JRB DATE 12/13/94 OF JOB NO. 12291
REVIEWED BY DATE SUBJECT: DIVERSION TABLE
APPROVED BY DATE CP113

DT 1D122

DI	0	105	354	622	1153	1882
DQ	0	0	195	395	845	1480

DESIGNED BY JRM DATE 11-19-94 SHEET NO. PAGE NO.
CHECKED BY DATE OF JOB NO.
REVIEWED BY DATE SUBJECT: DIVERSION TABLE
APPROVED BY DATE CP 113

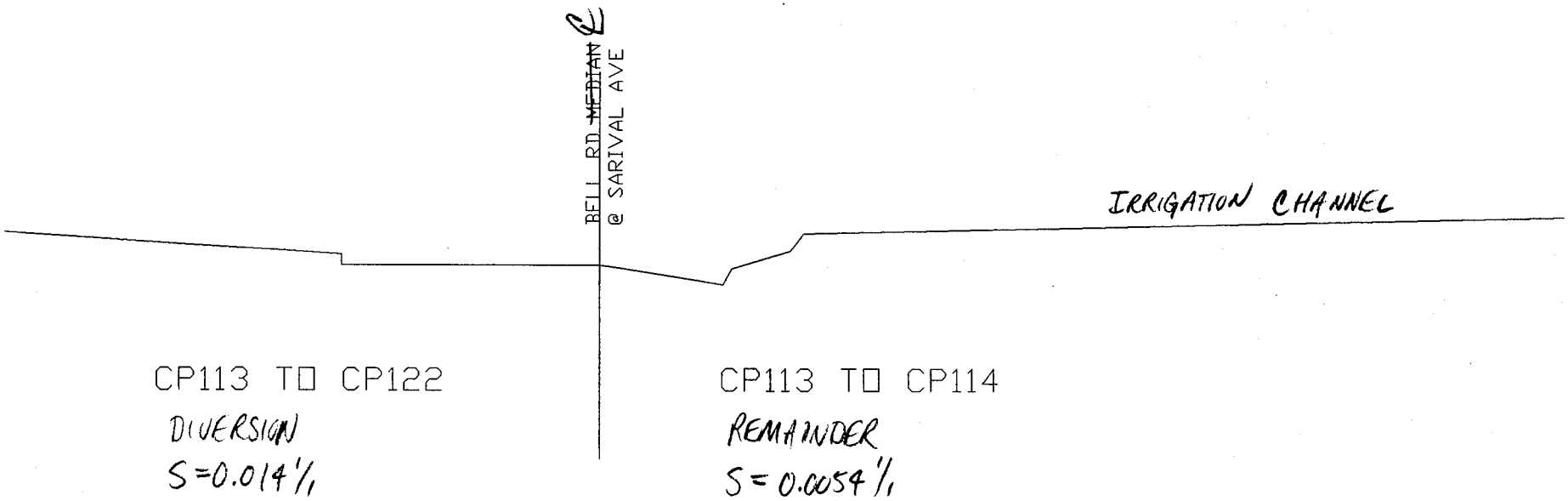
STATION	ELEV.	COMMENT
1010	1266	
1035	1265.5	
1059	1266	
1085	1267	
1091	1268	
1430	1269	

EL. 1266.2 @ ℄ (0.02'/, FOR 10')
EL. 1265.1 @ FACE OF CURB (0.02' FOR 55')

$S = 0.014 = \frac{1}{70}$ TO CP122

$S = \frac{2}{370} = 0.0054'/,$ (ALONG ROAD) TO CP114

Q = 106


BELL RD ~~MEDIAN~~ ℄
@ SARIVAL AVE
IRRIGATION CHANNEL
CP113 TO CP122
DIVERSION
S=0.014%
CP113 TO CP114
REMAINDER
S=0.0054%

01/2

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: CP113

Description: CP113 TO CP114

Solve For Discharge

Given Constant Data;

Bottom Width.....	13.00
Z-Left.....	12.00
Z-Right.....	0.00
Mannings 'n'.....	0.016
Channel Slope.....	0.0054

Variable Input Data	Minimum	Maximum	Increment By
Channel Depth	1.00	2.00	0.25

4/10

Bottom Width ft	Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	VARIABLE Channel Depth ft	COMPUTED Channel Discharge cfs	COMPUTED Velocity fps	ELEV.
13.00	12.00	0.00	0.016	0.0054	1.00	105.09	5.53	1266.20
13.00	12.00	0.00	0.016	0.0054	1.25	159.93	6.24	1266.45
13.00	12.00	0.00	0.016	0.0054	1.50	227.23	6.89	1266.70
13.00	12.00	0.00	0.016	0.0054	1.75	307.73	7.48	1266.95
13.00	12.00	0.00	0.016	0.0054	2.00	402.15	8.04	1267.20

Open Channel Flow Module, Version 3.21 (c)
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: CP113

Comment: CP113 TO CP114

Solve For Discharge

Given Input Data:

Bottom Width.....	0.00 ft
Left Side Slope..	0.00:1 (H:V)
Right Side Slope.	50.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0054 ft/ft
Depth.....	1.00 ft

Computed Results:

Discharge.....	106.06 cfs
Velocity.....	4.24 fps
Flow Area.....	25.00 sf
Flow Top Width...	50.00 ft
Wetted Perimeter.	51.01 ft
Critical Depth...	1.02 ft
Critical Slope...	0.0048 ft/ft
Froude Number....	1.06 (flow is Supercritical)

ROAD CAPACITY CALIBRATION

Open Channel Flow Module, Version 3.21 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: CP113

Description: CP113 TO CP122

Solve For Discharge

Given Constant Data;

(INTERSECTION OPENING)

Bottom Width..... 115.00
Z-Left..... 0.00
Z-Right..... 0.00
Mannings 'n'..... 0.016
Channel Slope..... 0.0140

Variable Input Data	Minimum	Maximum	Increment By
Channel Depth	0.25	0.50	0.25

DEPTH	Q	ELEV.
0.25	195	1266.45
0.50	395	1266.70
0.75	845	1266.95
1.00	1480	1267.20

Open Channel Flow Module, Version 3.21 (c)
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

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Bottom Width ft	Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	VARIABLE Channel Depth ft	COMPUTED Channel Discharge cfs	COMPUTED Velocity fps
115.00	0.00	0.00	0.016	0.0140	0.25	125.02	4.35
115.00	0.00	0.00	0.016	0.0140	0.50	395.76	6.88

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: CP113

Description: CP113 TO CP122

Solve For Discharge

Given Constant Data;

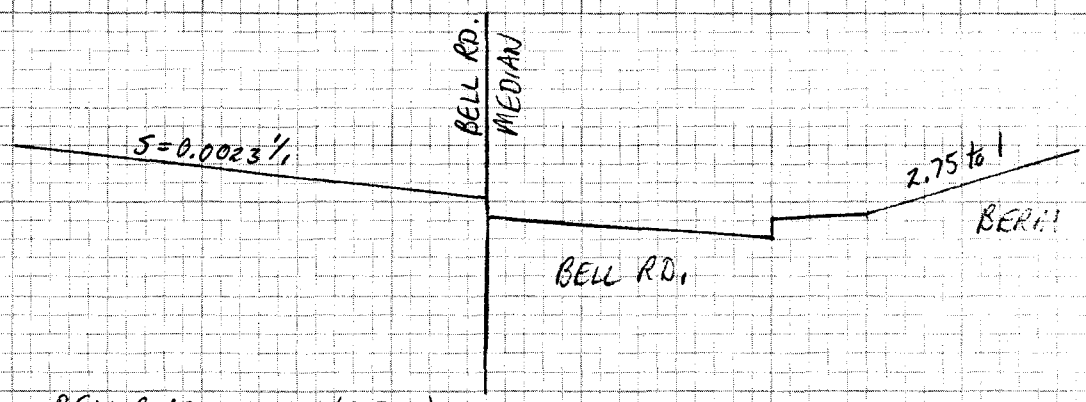
Bottom Width..... 97.00
Z-Left..... 0.00
Z-Right..... 150.00
Mannings 'n'..... 0.016
Channel Slope..... 0.0140

Variable Input Data	Minimum	Maximum	Increment By
Channel Depth	0.50	1.00	0.25

9/10

Bottom Width ft	Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	VARIABLE Channel Depth ft	COMPUTED Channel Discharge cfs	COMPUTED Velocity fps
97.00	0.00	150.00	0.016	0.0140	0.50	394.39	5.86
97.00	0.00	150.00	0.016	0.0140	0.75	844.45	7.35
97.00	0.00	150.00	0.016	0.0140	1.00	1480.94	8.61

DESIGNED BY VRM	DATE 11-19-94	SHEET NO. 1	PAGE NO.
CHECKED BY JRB	DATE 12-13-94	OF	JOB NO. 12291
REVIEWED BY	DATE	SUBJECT: DIVERSION TABLE	
APPROVED BY	DATE	BELL RD. 2000'E. SARIVAL AVE.	



BELL ROAD MEDIAN (WEST)
DIVERSION
WEIR FLOW

2000'E. OF SARIVAL (NORTH)
REMAINDER
S=0.0023'/, (1' C.I. TOPO)

DT	20122					
DI	0	235	313	480	717	1056
DQ	0	0	2	81	225	462

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name:

Description: CP114 TO CP115

Solve For Discharge

Given Constant Data;

Bottom Width.....	32.60
Z-Left.....	2.75
Z-Right.....	0.00
Mannings 'n'.....	0.016
Channel Slope.....	0.0023

Variable Input Data	Minimum	Maximum	Increment By
Channel Depth	1.34	2.34	0.25

Open Channel Flow Module, Version 3.21 (c)
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Bottom Width ft	Z-Left (H:V)	Z-Right (H:V)	Mannings 'n'	Channel Slope ft/ft	VARIABLE Channel Depth ft	COMPUTED Channel Discharge cfs	COMPUTED Velocity fps
32.60	2.75	0.00	0.016	0.0023	1.34	234.58	5.08
32.60	2.75	0.00	0.016	0.0023	1.59	311.82	5.64
32.60	2.75	0.00	0.016	0.0023	1.84	397.64	6.15
32.60	2.75	0.00	0.016	0.0023	2.09	491.70	6.63
32.60	2.75	0.00	0.016	0.0023	2.34	593.73	7.08

DESIGNED BY URM DATE 11-19-94 SHEET NO. 2 PAGE NO.
CHECKED BY DATE OF JOB NO. 12291
REVIEWED BY DATE SUBJECT: DIVERSION @ BELL ROAD
APPROVED BY DATE 2000' E. OF SARGENT AVE

STATION	ELEV.	COMMENT
1057	1258	
1061	1259	
1066	1260	
1079	1266	TOP OF BERM

$S = \frac{1}{440} = 0.0023\ ft/ft$

$S = \frac{1258-1259}{440}$ @ BERM

AVG. BANK SLOPE OF BERM $= \frac{8}{22} = 2.75$ to 1

MEDIAN SLOPE $\simeq 0.003\ ft/ft$ WEST

AREA BELOW MEDIAN CURB = 58.5 ☐ $W_p = 61.4'$

AREA WITHIN ROADWAY = 48 ☐ $W_p = 47.2'$

d = TOP OF MEDIAN

$Q_1 = \frac{1.49}{0.016}(48)\left(\frac{48}{47.2}\right)^{2/3}(0.0023)^{1/2} = 216.8$ cfs

$Q_2 = \frac{1.49}{0.035}(10.5)\left(\frac{10.5}{14.2}\right)^{2/3}(0.0023)^{1/2} = 17.5$ cfs

(USE TO CALIBRATE TRAP. CHANNEL) $Q_T = 234.3$ cfs

WEIR FLOW OVER MEDIAN: $Q = CLH^{3/2}$ $C = 3.0$

WEIR SLOPE $\simeq 0.0023$ (ASSUME $d/2$ = AVERAGE DEPTH)

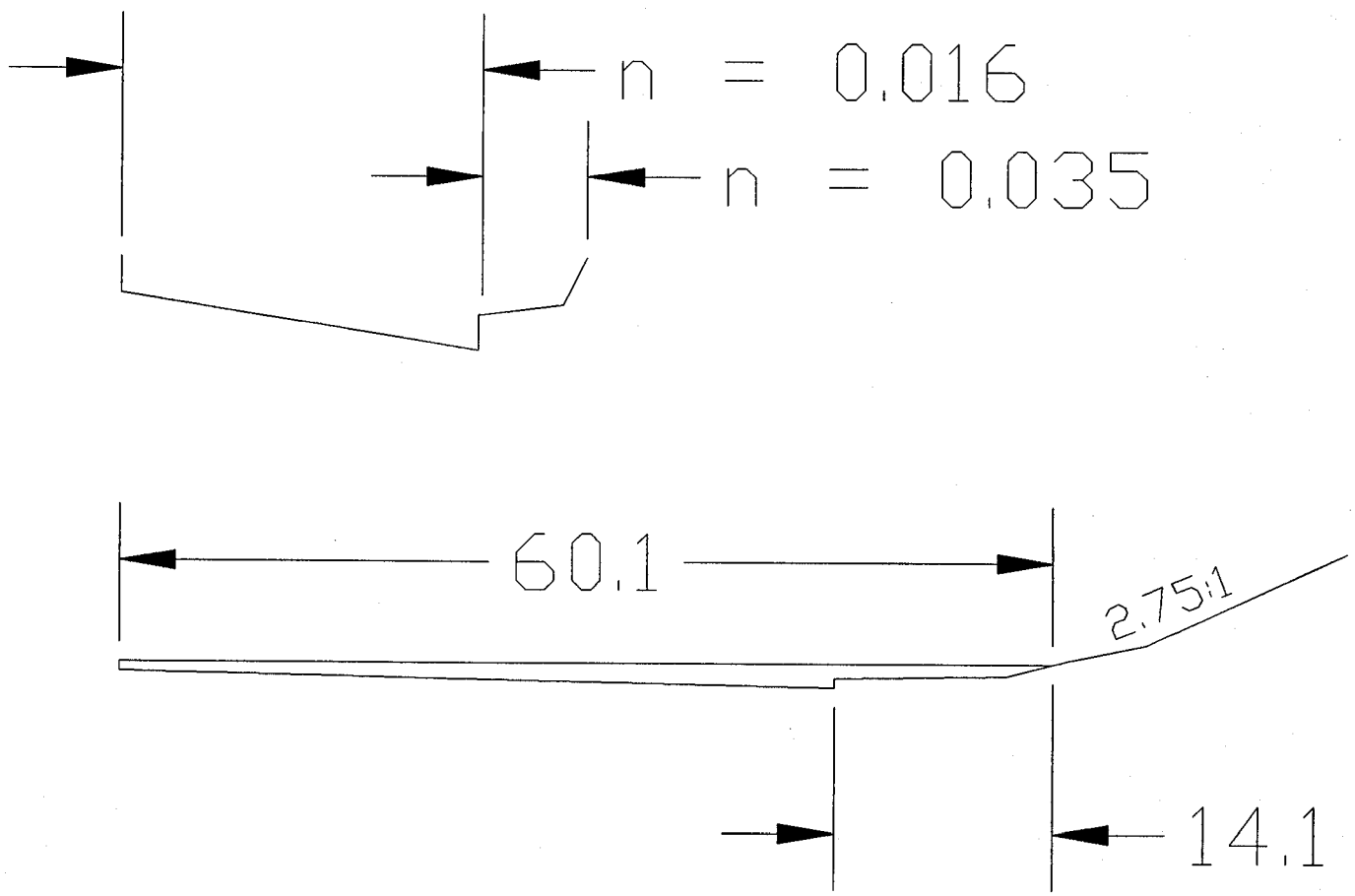
$d = 0.25'$ $Q = 3.0(11)(0.125)^{3/2} = 1.5$ cfs

$d = 0.5'$ $Q = 3.0(217)(0.25)^{3/2} = 81$ cfs

$d = 0.75'$ $Q = 3.0(326)(0.375)^{3/2} = 225$ cfs

$d = 1'$ $Q = 3.0(435)(0.5)^{3/2} = 462$ cfs

SC 3020



5/5

APPENDIX C
PROPOSED COMPLETELY DEVELOPED DRAINAGE SYSTEM HEC-1 OUTPUT AND SUPPORTING CALCULATIONS

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
* RUN DATE  12/22/1994  TIME  10:47:44 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
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
  2           ID       DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE, ARIZONA
  3           ID       STANLEY CONSULTANTS, INC. JOB # 12291
  4           ID       HEC-1 MODEL INPUT FILENAME: D12291.DAT
  5           ID
  6           ID       ********************************
  7           ID       *                              *
  8           ID       *     PROPOSED COMPLETELY      *
  9           ID       *       DEVELOPED SITE         *
 10           ID       *   100-YEAR, 2-HOUR STORM     *
 11           ID       *                              *
 12           ID       ********************************
 13           ID
 14           ID       CLARK UNIT HYDROGRAPH
 15           ID
 16           ID       100-YEAR, 2-HR STORM DISTRIBUTION
 17           ID       (FCDMC HYDROLOGIC DESIGN MANUAL; TABLE 2.2)
 18           ID       P100 = 2.77"  (NO AERIAL REDUCTION)
 19           ID
 20           ID       COMPUTATION TIME INTERVAL 3 MINUTES
 21           ID
 22           ID       GREEN-AMPT LOSS RATES AND PARAMETERS FOR THE FULLY DEVELOPED CONDITION:
 23           ID
 24           ID                DTHETA   VEGETATIVE              ROUGHNESS  Kb EQN. PARAMETERS
 25           ID     LAND USE CONDITION  COVER (%) RTIMP  IA  DESCRIPTION    "m"     "b"
 26           ID     -------- --------- ---------- ----- ---- ---------  --------  ------
 27           ID      Fallow     DRY         20       0  0.50     Low     -0.01375   0.08
 28           ID      Desert     DRY         25       0  0.35     Low     -0.01375   0.08
 29           ID      Open     NORMAL        25       1  0.35     Low     -0.01375   0.08
 30           ID      L.D.R.   NORMAL        25      25  0.15     Min     -0.00625   0.04
 31           ID      M.D.R.   NORMAL        25      35  0.15     Min     -0.00625   0.04
 32           ID      M.F.R.   NORMAL        25      55  0.15     Min     -0.00625   0.04
 33           ID      Comm     NORMAL        25      80  0.10     Min     -0.00625   0.04
 34           ID      Golf     NORMAL        80       1  0.35     Min     -0.00625   0.04
 35           ID      Ag         WET         90       0  0.50     Low     -0.01375   0.08
 36           ID
 37           ID       SURFACE RETENTION LOSS IS BASED ON FCDMC HYDROLOGY MANUAL TABLE 4.1.
 38           ID
 39           ID       SUB-BASIN XKSAT VALUES ARE AREA-WEIGHTED LOGARITHMS OF THE INDIVIDUAL
 40           ID       XKSAT VALUES OCCURRING WITHIN THE SUB-BASIN.  THE BARE GROUND XKSAT
 41           ID       VALUE IS ADJUSTED FOR VEGETATIVE COVER.  THE ADJUSTMENT IS AREA-WEIGHTED
 42           ID       BY LAND USE AND THE CORRECTION PRESENTED IN FIGURE 4.4 OF THE FCDMC
 43           ID       HYDROLOGY MANUAL IS APPLIED.  THE EXISTING XKSAT SOIL DISTRIBUTION IS
 44           ID       USED AND ASSUMED NOT TO BE AFFECTED BY GRADING AND EARTHWORK FOR THE
 45           ID       DEVELOPED CONDITIONS.
 46           ID
 47           ID       THE WETTING FRONT CAPILLARY SUCTION (PSIF) AND VOLUMETRIC SOIL MOISTURE
 48           ID       DEFICIT AT THE START OF RAINFALL (DTHETA) ARE A FUNCTION OF THE SUB-
 49           ID       BASIN SOIL, GROUND SURFACE, AND LAND USE CHARACTERISTICS.  THESE
 50           ID       VARIABLES ARE AREA-WEIGHTED BY SUB-BASIN.  DTHETA IS A FUNCTION OF THE
 51           ID       ASSUMED SOIL MOISTURE CONDITION AT THE START OF RAINFALL FOR THE LAND
 52           ID       USES PRESENTED IN THE ABOVE TABLE.
 53           ID
 54           ID       THE DIRECTLY CONNECTED PERCENT IMPERVIOUS (RTIMP) IS ASSUMED TO BE THE
 55           ID       SAME AS THAT USED IN THE SUN CITY WEST EXPANSION AREA MASTER DRAINAGE
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  56          ID        STUDY (JULY 1993), SINCE THE PROJECTS CONTAIN SIMILAR LAND USE.
  57          ID
  58          ID        TIME OF CONCENTRATION (TC), AND STORAGE COEFFICIENT (R), IS BASED ON
  59          ID        MCUHP1 (REVISED 12-16-91). LENGTHS AND SLOPES FOR ALL ON-SITE AREAS
  60          ID        ARE BASED ON PRELIMINARY LOTING LAYOUTS AND MASS GRADING PLANS.
  61          ID
  62          ID        Kb VALUES ARE BASED ON m AND b PARAMETERS FROM TABLE 5.1 OF HYDROLOGY
  63          ID        MANUAL.  Kb VALUES ARE AREA-WEIGHTED BY COMPOSITE LAND USE.
  64          ID
  65          ID        THE TIME-AREA RELATION FOR EACH SUB-BASIN IS BASED ON THE FCDMC
  66          ID        HYDROLOGY MANUAL TABLE 5.2:
  67          ID          1. OFFSITE AREAS AND EXCEPTION PARCELS USE NATURAL TIME-AREA UA
  68          ID             RECORD.
  69          ID          2. ON-SITE AREAS USE AN URBAN TIME-AREA UA RECORD EXCEPT WHERE THE
  70          ID             SUB-BASIN IS PRIMARILY GOLF COURSE, IN WHICH CASE, NATURAL
  71          ID             TIME-AREA IS USED.
  72          ID
  73          ID        HYDROGRAPH ROUTING THRU STREETS USE KINEMATIC WAVE.  STORM DRAIN
  74          ID        CONVEYANCE IS DISREGARDED UNLESS IT IS ANTICIPATED TO CROSS SUB-BASIN
  75          ID        BOUNDARIES.
  76          ID
  77          ID        HYDROGRAPH ROUTING THRU GUNITE CHANNEL USES KINEMATIC WAVE AND ASSUMES:
  78          ID        TRAPEZOID CHANNEL, B=10'; SIDE SLOPE 1V:0.5H; "n" = 0.016; SLOPES ARE
  79          ID        BASED ON A PRELIMINARY MASS GRADING PLAN.
  80          ID
  81          ID        HYDROGRAPH ROUTING THRU GOLF COURSE CHANNELS USE NORMAL DEPTH MODIFIED
  82          ID        PULS ASSUMING:
  83          ID
  84          ID        1. 8-POINT CROSS-SECTION WITH LOW FLOW AND OVERBANKS
  85          ID        2. LOW FLOW "n" = 0.025; OVERBANK "n" = 0.030
  86          ID        3. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH
  87          ID           APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
  88          ID        4. INFILTRATION/PERCOLATION IS ZERO.
  89          ID        5. INITIAL DISCHARGE IS ZERO.
  90          ID        6. GOLF CHANNELS ARE HYPOTHETICAL WITH ARBITRARY DATUM AND SLOPE
  91          ID           BASED ON PRELIMINARY MASS GRADING PLAN.
  92          ID
  93          ID        HYDROGRAPH ROUTING THRU RETENTION/DETENTION BASINS USES LEVEL POOL
  94          ID        MODIFIED PULS ASSUMING:
  95          ID
  96          ID        1. INFILTRATION/PERCOLATION IS ZERO.
  97          ID        2. DETENTION BASINS ARE EMPTY AT START OF MODEL.
  98          ID        3. DETENTION BASINS USE MASS GRADING ELEVATIONS WHERE AVAILABLE.
  99          ID        4. GOLF COURSE RETENTION BASINS UTILIZE EMERGENCY SPILLWAYS.  THE
 100          ID           CONCEPT IS TO RETAIN AND RECHARGE THE LOCAL STORMWATER RUNOFF.
 101          ID        5. DETENTION BASINS ASSUME A CONIC SHAPE TO MATCH THE AERIAL EXTENT
 102          ID           OF PRELIMINARY LAYOUTS. SIDE SLOPES ARE ASSUMED TO BE 10:1.
 103          ID
 104          ID        ALL FLOW SPLITS WERE ESTIMATED ON THE BASIS OF HYDRAULIC ANALYSES.  THE
 105          ID        ANALYSES GERERALLY UTILIZED EITHER STEP-BACKWATER, NORMAL DEPTH, WEIR
 106          ID        FLOW METHODS OR COMBINATIONS THEREOF.
 107          ID
              *DIAGRAM
 108          IT      3                    300
 109          IO      5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  110         KK   E111
  111         KM   SUB-BASIN E111
  112         BA   .500
  113         IN      5
  114         KM   RAINFALL DEPTH OF 2.77 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  115         PB   2.770
  116         KM   THE FOLLOWING PC RECORD USED A 2-HOUR RAINFALL DISTRIBUTION
  117         PC   .000    .011    .018    .023    .028    .032    .046    .071    .100    .137
  118         PC   .176    .232    .327    .601    .743    .863    .901    .930    .954    .962
  119         PC   .970    .979    .982    .992   1.000
  120         LG   .395    .252   5.100    .300    .000
  121         UC   .842    .528
  122         UA      0       3       5       8      12      20      43      75      90      96
  123         UA    100

  124         KK   D111
  125         KM       DIVERT TO  C119 FROM  C111
  126         DT   D119
  127         DI      0      32     109     228     389     599     858    1170    1539    1967
  128         DQ      0      11      39      83     145     228     333     462     617     799

  129         KK   1R112
  130         KM       ROUTE REMAINDER FROM  E111 TO  C112
  131         RS     14    FLOW      -1       0
  132         RC   .075    .035    .035    5280   .0040
  133         RX   1000    1570    2040    2370    2440    2468    2469    2470
  134         RY   1312    1310    1308    1306    1306    1307    1307    1307

  135         KK   E104
  136         KM   SUB-BASIN E104
  137         BA   .150
  138         LG   .350    .380   5.600    .210    .000
  139         UC   .546    .350
  140         UA      0       3       5       8      12      20      43      75      90      96
  141         UA    100

  142         KK   2R112
  143         KM       ROUTE FLOW FROM  3104 TO  C112
  144         RS     52    FLOW      -1       0
  145         RC   .075    .075    .075    6552   .0056
  146         RX   1000    1001    1230    1270    1750    2000    2380    2650
  147         RY   1321    1321    1320    1318    1318    1319    1318    1320

  148         KK   E112
  149         KM   SUB-BASIN E112
  150         BA   .970
  151         LG   .325    .125   5.600    .280  28.000
  152         UC   .529    .246
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 153          KK   C112
 154          KM       ADD HYDROGRAPHS FROM 1R112, 2R112, E112
 155          HC      3

 156          KK  D112A
 157          KM       DIVERT TO  C120 FROM  C112
 158          DT   D120
 159          DI      0      48     165     355     625     981    1434    1990
 160          DQ      0      16      55     118     208     327     478     663

 161          KK  D112B
 162          KM       DIVERT TO  C121A FROM  C112
 163          DT  1D121A
 164          DI      0      32     110     237     417     654     956    1327
 165          DQ      0      16      55     118     208     327     478     663

 166          KK  R113A
 167          KM       ROUTE REMAINDER FROM  C112 TO  C113A
 168          RS      8    FLOW      -1       0
 169          RC   .075    .035    .035    2640   .0023
 170          RX   1000    1490    1830    2600    2770    2788    2789    2790
 171          RY   1290    1288    1286    1284    1284    1285    1285    1285

 172          KK  E113A
 173          KM  SUB-BASIN E113A
 174          BA   .500
 175          LG   .500    .000   5.800    .300    .000
 176          UC   .567    .320
 177          UA      0       3       5       8      12      20      43      75      90      96
 178          UA    100

 179          KK 3D113A
 180          KM       DIVERT TO S306 FROM E113A (3 CROSS-CULVERTS UNDER SR 303)
 181          DT   D306
 182          DI      0      46     100     200     400     800
 183          DQ      0      46      46      46      46      46

 184          KK 4D113A
 185          KM       DIVERT TO S310A FROM E113A (1 CROSS-CULVERTS UNDER SR 303)
 186          DT  D310A
 187          DI      0      46     100     200     400     800
 188          DQ      0      15      15      15      15      15

 189          KK 5D113A
 190          KM       DIVERT TO S310B FROM E113A (2 CROSS-CULVERTS UNDER SR 303)
 191          DT  D310B
 192          DI      0      46     100     200     400     800
 193          DQ      0      28      28      28      28      28
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 194          KK   C113A
 195          KM        ADD HYDROGRAPHS FROM R113A AND REMAINDER FROM E113A
 196          HC       2

 197          KK  2D113A
 198          KM        DIVERT TO  C121A FROM C113A
 199          DT  2D121A
 200          DI       0     185     545     642     893    1913
 201          DQ       0       0       0      12      74     467

 202          KK  AR310B
 203          KM   SUB-BASIN AR310B
 204          BA    .012
 205          LG    .350    .320   7.600    .090    .000
 206          UC    .208    .148
 207          UA       0       3       5       8      12      20      43      75      90      96
 208          UA     100

 209          KK  R113A3     RECALL DIVERTED HYDROGRAPH FROM E113A
 210          KM             2 CROSS-CULVERTS UNDER SR 303
 211          DR   D310B

 212          KK   C1130     COMBINE OFFSITE HYDROGRAPHS - 2D113A, AR310B, D310B
 213          HC       3

 214          KK   1R113
 215          KM        ROUTE REMAINDER FROM  C1130 TO  C113
 216          RS       9    FLOW      -1       0
 217          RC    .075    .035    .035    2280   .0058
 218          RX    1000    1080    2620    2725    2735    2798    2799    2800
 219          RY    1278    1277    1277    1276    1276    1277    1277    1277

 220          KK   1D113     DIVERT TO C122 FROM C113
 221          DT   1D122
 222          DI       0     105     354     622    1153    1882
 223          DQ       0       0     195     395     845    1480

 224          KK    R114
 225          KM        ROUTE REMAINDER FROM C113 TO C114
 226          RS       8    FLOW      -1       0
 227          RC    .075     .04     .04    1997   .0040
 228          RX    1000    1020    1100    1850    2030    2048    2049    2050
 229          RY    1266    1264    1262    1260    1260    1261    1261    1261

 230          KK    D114
 231          KM        DIVERT TO  C122 FROM  C114
 232          DT   2D122
 233          DI       0     235     313     480     717    1056
 234          DQ       0       0       2      81     225     462
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 235          KK   4R115
 236          KM        ROUTE REMAINDER FROM  C114 TO  C115W
 237          RS       2    FLOW      -1       0
 238          RC     .06    .022    .035    2578   .0035
 239          RX    1000    1380    1790    1800    1840    1850    1899    1900
 240          RY    1258    1256    1254    1250    1250    1252    1253    1253

 241          KK    S201
 242          KM   SUB-BASIN S201
 243          BA    .044
 244          LG    .159    .250   5.600    .210  24.000
 245          UC    .321    .293
 246          UA       0       5      16      30      65      77      84      90      94      97
 247          UA     100

 248          KK   1R202    ROUTE HYDROGRAPH FROM S201 TO CP202
 249          RS       3    FLOW      -1       0
 250          RC     .03    .025     .03    2700    .003
 251          RX       0      12      33      45      55      67      88     100
 252          RY       5       3       3       0       0       3       3       5

 253          KK    S203
 254          KM   SUB-BASIN S203
 255          BA    .030
 256          LG    .173    .250   4.650    .320  22.000
 257          UC    .287    .342
 258          UA       0       5      16      30      65      77      84      90      94      97
 259          UA     100

 260          KK   DT203   ROUTE HYDROGRAPH SUM S203 THRU DET BASIN DT203
 261          KM           OUTFALL IS A FUNCTION OF WEIR ELEVATION
 262          RS       1    STOR       0       0
 263          SA       0    1.61    1.83    2.07    2.32    2.59    2.87
 264          SE  1325.9    1326    1327    1328    1329    1330    1331
 265          SS    1329     100     3.0     1.5

 266          KK    R204    ROUTE HYDROGRAPH FROM BASIN DT203 TO CP204
 267          RS       1    FLOW      -1       0
 268          RC     .03    .025     .03    1100    .013
 269          RX       0      12      33      45      55      67      88     100
 270          RY       5       3       3       0       0       3       3       5

 271          KK    S204
 272          KM   SUB-BASIN S204
 273          BA    .025
 274          LG    .295    .150   8.800    .070   8.000
 275          UC    .258    .264
 276          UA       0       3       5       8      12      20      43      75      90      96
 277          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 278          KK   CP204    COMBINE HYDROGRAPHS R204 AND S204
 279          HC       2

 280          KK   2R202     ROUTE HYDROGRAPH FROM CP204 TO CP202
 281          RS       2    FLOW      -1       0
 282          RC     .03    .025     .03    1300    .004
 283          RX       0      12      33      45      55      67      88     100
 284          RY       5       3       3       0       0       3       3       5

 285          KK    S202
 286          KM   SUB-BASIN S202
 287          BA    .128
 288          LG    .191    .250   4.800    .300  22.000
 289          UC    .354    .287
 290          UA       0       5      16      30      65      77      84      90      94      97
 291          UA     100

 292          KK   CP202     COMBINE HYDROGRAPHS 1R202, 2R202, AND S202
 293          HC       3

 294          KK   DT202   ROUTE HYDROGRAPH SUM CP202 THRU DET BASIN DT202
 295          KM           OUTFALL IS A FUNCTION OF WEIR ELEVATION
 296          RS       1    STOR       0       0
 297          SA       0     1.0    1.18    1.37    1.57    1.79    2.03    2.28    2.54    2.82
 298          SE  1314.9    1315    1316    1317    1318    1319    1320    1321    1322    1323
 299          SS    1322     100     3.0     1.5

 300          KK    R205     ROUTE HYDROGRAPH FROM DT202 TO CP205
 301          RS      12    FLOW      -1       0
 302          RC     .03    .025     .03    2450    .001
 303          RX       0      12      33      45      55      67      88     100
 304          RY       5       3       3       0       0       3       3       5

 305          KK    S205
 306          KM   SUB-BASIN S205
 307          BA    .176
 308          LG    .182    .250   5.700    .200  23.000
 309          UC    .488    .409
 310          UA       0       5      16      30      65      77      84      90      94      97
 311          UA     100

 312          KK   CP205     COMBINE HYDROGRAPHS R205 AND S205
 313          HC       2

 314          KK   1R209
 315          KM   ROUTE FROM CP205 TO CP209
 316          RS       1    FLOW      -1       0
 317          RC     .03    .025     .03     120    .017
 318          RX       0      12      33      45      55      67      88     100
 319          RY       5       3       3       0       0       3       3       5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 320          KK    S206
 321          KM   SUB-BASIN S206
 322          BA    .045
 323          LG    .292    .250   5.000    .310   8.000
 324          UC    .679    .836
 325          UA       0       3       5       8      12      20      43      75      90      96
 326          UA     100

 327          KK    S207
 328          KM   SUB-BASIN S207
 329          BA    .087
 330          LG    .153    .230   6.200    .160  27.000
 331          UC    .358    .300
 332          UA       0       5      16      30      65      77      84      90      94      97
 333          UA     100

 334          KK  CP2067     COMBINE HYDROGRAPHS S206 AND S207
 335          HC       2

 336          KK    R208    ROUTE HYDROGRAPH FROM CP206,207 (CP2067) TO CP208
 337          RS       1    FLOW      -1       0
 338          RC     .03    .025     .03     600    .005
 339          RX       0      12      33      45      55      67      88     100
 340          RY       5       3       3       0       0       3       3       5

 341          KK    S208
 342          KM   SUB-BASIN S208
 343          BA    .101
 344          LG    .241    .150   7.300    .120  14.000
 345          UC    .358    .275
 346          UA       0       5      16      30      65      77      84      90      94      97
 347          UA     100

 348          KK   CP208     COMBINE HYDROGRAPHS R208 AND S208
 349          HC       2

 350          KK   DT208    ROUTE HYDROGRAPH SUM CP208 THRU DET BASIN DT208
 351          KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
 352          RS       1    STOR       0       0
 353          SA       0    7.50    7.97    8.46    8.96    9.48   10.01
 354          SE  1324.9    1325    1326    1327    1328    1329    1330
 355          SS    1328     100     3.0     1.5

 356          KK   2R209    ROUTE HYDROGRAPH FROM DT208 AND CP209
 357          RS       1    FLOW      -1       0
 358          RC     .03    .025     .03    1200    .007
 359          RX       0      12      33      45      55      67      88     100
 360          RY       5       3       3       0       0       3       3       5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 361          KK   S209
 362          KM   SUB-BASIN S209
 363          BA   .068
 364          LG   .216    .250   5.200    .260  17.000
 365          UC   .283    .211
 366          UA      0       5      16      30      65      77      84      90      94      97
 367          UA    100

 368          KK   CP209     COMBINE HYDROGRAPHS 1R209, 2R209, S209
 369          HC      3

 370          KK   DT209    ROUTE HYDROGRAPH SUM CP209 THRU DET BASIN DT209
 371          KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
 372          RS      1    STOR       0       0
 373          SA      0    3.79    4.13    4.48    4.85    5.23    5.62    6.03    6.64    6.90
 374          SE 1310.9    1311    1312    1313    1314    1315    1316    1317    1318    1319
 375          SS   1318     100     3.0     1.5

 376          KK   1R218    ROUTE HYDROGRAPH FROM DT209 TO CP218
 377          RS      1    FLOW      -1       0
 378          RC    .03    .025     .03    1900    .002
 379          RX      0      12      33      45      55      67      88     100
 380          RY      5       3       3       0       0       3       3       5

 381          KK   S210
 382          KM   SUB-BASIN S210
 383          BA   .016
 384          LG   .219    .250   5.800    .200  17.000
 385          UC   .196    .176
 386          UA      0       5      16      30      65      77      84      90      94      97
 387          UA    100

 388          KK   DT210    ROUTE HYDROGRAPH SUM S210 THRU DET BASIN 210
 389          KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
 390          RS      1    STOR       0       0
 391          SA      0    1.18    1.37    1.58    1.80    2.03    2.28
 392          SE 1328.9    1329    1330    1331    1332    1333    1334
 393          SS   1332     100     3.0     1.5

 394          KK   R211   ROUTE HYDROGRAPH FROM DT210 TO CP211
 395          RS      1    FLOW      -1       0
 396          RC    .03    .025     .03     400    .013
 397          RX      0      12      33      45      55      67      88     100
 398          RY      5       3       3       0       0       3       3       5

 399          KK   S211
 400          KM   SUB-BASIN S211
 401          BA   .035
 402          LG   .240    .250   4.550    .370  14.000
 403          UC   .329    .322
 404          UA      0       5      16      30      65      77      84      90      94      97
 405          UA    100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 406          KK   CP211    COMBINE HYDROGRAPHS R211 AND S211
 407          HC       2

 408          KK   DT211    ROUTE HYDROGRAPH SUM CP211 THRU DET BASIN DT211
 409          KM            OUTFALL IS A FUNCTION OF WIER ELEVATION
 410          RS       1    STOR       0       0
 411          SA       0    2.28    2.54    2.82    3.11    3.42    3.74
 412          SE  1323.9    1324    1325    1326    1327    1328    1329
 413          SS    1327     100     3.0     1.5

 414          KK   1R213     ROUTE HYDROGRAPH FROM DT211 TO CP213
 415          RS       1    FLOW      -1       0
 416          RC     .03    .025     .03     650    .009
 417          RX       0      12      33      45      55      67      88     100
 418          RY       5       3       3       0       0       3       3       5

 419          KK    S212
 420          KM   SUB-BASIN S212
 421          BA    .106
 422          LG    .183    .150   7.000    .120  23.000
 423          UC    .350    .297
 424          UA       0       5      16      30      65      77      84      90      94      97
 425          UA     100

 426          KK   DT212    ROUTE HYDROGRAPH SUM S212 THRU DET BASIN DT212
 427          KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
 428          RS       1    STOR       0       0
 429          SA       0    2.49    2.77    3.05    3.36    3.68    4.01
 430          SE  1317.9    1318    1319    1320    1321    1322    1323
 431          SS    1321     100     3.0     1.5

 432          KK   2R213    ROUTE HYDROGRAPH FROM DT212 TO CP213
 433          RS      12    FLOW      -1       0
 434          RC     .03    .025     .03     550    .002
 435          RX       0      12      33      45      55      67      88     100
 436          RY       5       3       3       0       0       3       3       5

 437          KK    S213
 438          KM   SUB-BASIN S213
 439          BA    .030
 440          LG    .320    .250   4.650    .360   5.000
 441          UC    .225    .161
 442          UA       0       3       5       8      12      20      43      75      90      96
 443          UA     100

 444          KK   CP213     COMBINE HYDROGRAPHS 1R213, 2R213, S213
 445          HC       3

 446          KK   DT213    ROUTE HYDROGRAPH SUM CP213 THRU DET BASIN DT213
 447          KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
 448          RS       1    STOR       0       0
 449          SA       0    3.42    3.74    4.08    4.43    4.79    5.17
 450          SE  1317.9    1318    1319    1320    1321    1322    1323
 451          SS    1321     100     3.0     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

452           KK   1R214    ROUTE HYDROGRAPH FROM DT213 TO CP214
453           RS       1    FLOW      -1       0
454           RC     .03    .025     .03    1800    .005
455           RX       0      12      33      45      55      67      88     100
456           RY       5       3       3       0       0       3       3       5

457           KK    S214
458           KM   SUB-BASIN S214
459           BA    .142
460           LG    .181    .250   5.200    .250  22.000
461           UC    .287    .165
462           UA       0       5      16      30      65      77      84      90      94      97
463           UA     100

464           KK   CP214     COMBINE HYDROGRAPHS 1R214, AND S214
465           HC       2

466           KK   2R218    ROUTE HYDROGRAPH CP214 TO CP218
467           RS       2    FLOW      -1       0
468           RC     .03    .025     .03    1450    .002
469           RX       0      12      33      45      55      67      88     100
470           RY       5       3       3       0       0       3       3       5

471           KK    S215
472           KM   SUB-BASIN S215
473           BA    .074
474           LG    .241    .150   8.000    .090  15.000
475           UC    .521    .498
476           UA       0       5      16      30      65      77      84      90      94      97
477           UA     100

478           KK   DT215    ROUTE HYDROGRAPH SUM S215 THRU DET BASIN DT215
479           KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
480           RS       1    STOR       0       0
481           SA       0    3.56    3.89    4.23    4.59    4.96    5.34
482           SE  1327.9    1328    1329    1330    1331    1332    1333
483           SS    1331     100     3.0     1.5

484           KK    R216     ROUTE HYDROGRAPH FROM DT215 TO CP216
485           RS       1    FLOW      -1       0
486           RC     .03    .025     .03     950    .011
487           RX       0      12      33      45      55      67      88     100
488           RY       5       3       3       0       0       3       3       5

489           KK    S216
490           KM   SUB-BASIN S216
491           BA    .106
492           LG    .192    .250   5.400    .230  21.000
493           UC    .321    .254
494           UA       0       5      16      30      65      77      84      90      94      97
495           UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

496           KK   CP216     COMBINE HYDROGRAPHS R216 AND S216
497           HC       2

498           KK   DT216    ROUTE HYDROGRAPH SUM CP216 THRU DET BASIN DT216
499           KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
500           RS       1    STOR       0       0
501           SA       0    2.56    2.84    3.13    3.44    3.76    4.10
502           SE  1321.9    1322    1323    1324    1325    1326    1327
503           SS    1325     100     3.0     1.5

504           KK  1R217A     ROUTE HYDROGRAPH FROM DT216 TO CP217B
505           RS      16    FLOW      -1       0
506           RC     .03    .025     .03    1000    .005
507           RX       0      12      33      45      55      67      88     100
508           RY       5       3       3       0       0       3       3       5

509           KK   S217B
510           KM   SUB-BASIN S217B
511           BA    .042
512           LG    .162    .150   7.600    .090  24.000
513           UC    .233    .224
514           UA       0       5      16      30      65      77      84      90      94      97
515           UA     100

516           KK  CP217B     COMBINE HYDROGRAPHS S217B AND 1R217A
517           HC       2

518           KK  DT217B    ROUTE HYDROGRAPH SUM C217B THRU DET BASIN DT217B
519           KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
520           RS       1    STOR       0       0
521           SA       0    0.75    0.90    1.07    1.26    1.45    1.67
522           SE  1317.4  1317.5  1318.5  1319.5  1320.5  1321.5  1322.5
523           SS  1320.5     100     3.0     1.5

524           KK  2R217A    ROUTE HYDROGRAPH FROM DT217B TO CP217A
525           RS       5    FLOW      -1       0
526           RC     .03    .025     .03     500    .007
527           RX       0      12      33      45      55      67      88     100
528           RY       5       3       3       0       0       3       3       5

529           KK   S217A
530           KM   SUB-BASIN S217A
531           BA    .085
532           LG    .204    .250   6.000    .180  18.000
533           UC    .488    .652
534           UA       0       5      16      30      65      77      84      90      94      97
535           UA     100

536           KK  CP217A     COMBINE HYDROGRAPHS 2R217A, S217A
537           HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 538          KK  DT217A    ROUTE HYDROGRAPH SUM CP217A THRU DET BASIN DT217A
 539          KM            OUTFLOW IS A FUNCTION OF WEIR ELEVATION
 540          RS       1    STOR       0       0
 541          SA       0    1.46    1.67    1.90    2.14    2.40    2.67
 542          SE  1313.9    1314    1315    1316    1317    1318    1319
 543          SS    1317     100     3.0     1.5

 544          KK   3R218      ROUTE HYDROGRAPH FROM DT217A TO CP218
 545          RS      12    FLOW      -1       0
 546          RC     .03    .025     .03     800   0.009
 547          RX       0      12      33      45      55      67      88     100
 548          RY       5       3       3       0       0       3       3       5

 549          KK    S218
 550          KM   SUB-BASIN S218
 551          BA    .049
 552          LG    .264    .230   6.200    .180  11.000
 553          UC    .396    .355
 554          UA       0       5      16      30      65      77      84      90      94      97
 555          UA     100

 556          KK   CP218     COMBINE HYDROGRAPHS 1R218, 2R218, 3R218, AND S218
 557          HC       4

 558          KK   DT218    ROUTE HYDROGRAPH SUM CP218 THRU DET BASIN DT218
 559          KM            OUTFALL IS A FUNCTION OF WEIR ELEVATION
 560          RS       1    STOR       0       0
 561          SA       0    3.77    4.11    4.46    4.82    5.20    5.60
 562          SE  1306.9    1307    1308    1309    1310    1311    1312
 563          SS    1310     100     3.0     1.5

 564          KK    R219    ROUTE HYDROGRAPH FROM DT218 TO CP219
 565          RS      15    FLOW      -1       0
 566          RC     .03    .025     .03     900    .007
 567          RX       0      12      33      45      55      67      88     100
 568          RY       5       3       3       0       0       3       3       5

 569          KK    S219
 570          KM   SUB-BASIN S219
 571          BA    .068
 572          LG    .157    .210   6.400    .150  24.000
 573          UC    .175    .116
 574          UA       0       5      16      30      65      77      84      90      94      97
 575          UA     100

 576          KK   CP219     COMBINE HYDROGRAPHS R219 AND S219
 577          HC       2

 578          KK    S220
 579          KM   SUB-BASIN S220
 580          BA    .107
 581          LG    .150    .250   6.000    .180  27.000
 582          UC    .229    .160
 583          UA       0       5      16      30      65      77      84      90      94      97
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 584          UA     100

 585          KK    R221   ROUTE HYDROGRAPH FROM S220 TO CP221
 586          RS       2    FLOW      -1       0
 587          RC    .035    .035    .035    1300    .004
 588          RX       0      26      39      54      65      70      83      88
 589          RY     2.5       2       1       0       0       1       2     2.5

 590          KK    S221
 591          KM   SUB-BASIN S221
 592          BA    .063
 593          LG    .350    .390   5.700    .200    .000
 594          UC    .321    .224
 595          UA       0       3       5       8      12      20      43      75      90      96
 596          UA     100

 597          KK   CP221     COMBINE HYDROGRAPHS R221 AND S221
 598          HC       2

 599          KK    R222    ROUTE HYDROGRAPH FROM CP221 TO CP222
 600          RS       1    FLOW      -1       0
 601          RC     .03    .025     .03    1150    .004
 602          RX       0      12      33      45      55      67      88     100
 603          RY       5       3       3       0       0       3       3       5

 604          KK    S222
 605          KM   SUB-BASIN S222
 606          BA    .048
 607          LG    .215    .230   6.200    .160  17.000
 608          UC    .275    .220
 609          UA       0       5      16      30      65      77      84      90      94      97
 610          UA     100

 611          KK   AR222
 612          KM   SUB-BASIN AR222
 613          BA    .004
 614          LG    .350    .350   4.800    .290    .000
 615          UC    .412   1.359
 616          UA       0       3       5       8      12      20      43      75      90      96
 617          UA     100

 618          KK   CP222     COMBINE HYDROGRAPHS CP219, R222, S222, AR222
 619          HC       4

 620          KK   DT222    ROUTE HYDROGRAPH SUM CP222 THRU DET BASIN DT222
 621          RS       1    STOR       0       0
 622          SA       0    4.69    5.07    5.45    5.86    6.28    6.71    7.16    7.62    8.09
 623          SQ       0       0       0       0       0       0       0       0       0       0
 624          SE  1292.9    1293    1294    1295    1296    1297    1298    1299    1300    1301
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 625          KK   AR18
 626          KM   SUB-BASIN AR18
 627          BA    .020
 628          LG    .350    .350   4.650    .320    .000
 629          UC    .354    .359
 630          UA       0       3       5       8      12      20      43      75      90      96
 631          UA     100

 632          KK   S118
 633          KM   SUB-BASIN S118
 634          BA    .004
 635          LG    .350    .250   4.650    .320   1.000
 636          UC    .379    .968
 637          UA       0       3       5       8      12      20      43      75      90      96
 638          UA     100

 639          KK   CP118     COMBINE HYDROGRAPHS AR18 AND S118
 640          HC       2

 641          KK   1R306
 642          KM        ROUTE CP118 TO CP306A
 643          RK    1040    .003    .022            TRAP      10       6

 644          KK  CP306A     COMBINE HYDROGRAPHS DT222 AND 1R306
 645          HC       2

 646          KK   2R306
 647          KM        ROUTE CP306A TO 3R306
 648          RK     680    .003    .022            TRAP      10       6

 649          KK   3R306     ROUTE HYDROGRAPH 2R306 THRU REACH 306C, TO CP306B
 650          RS       4    FLOW      -1       0
 651          RC     .03    .025     .03    1920    .003
 652          RX     500     512     533     545     555     567     588     600
 653          RY       5       3       3       0       0       3       3       5

 654          KK   AR306
 655          KM   SUB-BASIN AR306
 656          BA    .036
 657          LG    .350    .350   4.900    .280    .000
 658          UC    .579    .795
 659          UA       0       3       5       8      12      20      43      75      90      96
 660          UA     100

 661          KK  CP306B     COMBINE HYDROGRAPHS 3R306 AND AR306
 662          HC       2

 663          KK  R113A1     RECALL DIVERTED HYDROGRAPH FROM E113A
 664          KM             3 CROSS-CULVERTS UNDER SR 303
 665          DR    D306
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 666          KK  CP3060     COMBINE HYDROGRAPHS CP3060 AND D306 (R113A1)
 667          HC       2

 668          KK    S306
 669          KM   SUB-BASIN S306
 670          BA    .080
 671          LG    .287    .250   5.300    .260   9.000
 672          UC    .338    .323
 673          UA       0       3       5       8      12      20      43      75      90      96
 674          UA     100

 675          KK   CP306     COMBINE CP3060 AND S306
 676          HC       2

 677          KK   DT306    GOLF COURSE LAKE
 678          RS       1    STOR       0       0
 679          SA       0     2.3    2.56    2.84    3.14    3.45    3.77    4.11    4.46    4.82
 680          SE  1279.9    1280    1281    1282    1283    1284    1285    1286    1287    1288
 681          SS    1284     100     3.0     1.5

 682          KK   R310A     ROUTE HYDROGRAPH DT306 THRU REACH 310A TO C310A
 683          RS      20    FLOW      -1       0
 684          RC     .03    .025     .03    1100    .003
 685          RX     500     512     533     545     555     567     588     600
 686          RY       5       3       3       0       0       3       3       5

 687          KK  AR310A
 688          KM   SUB-BASIN AR310A
 689          BA    .009
 690          LG    .350    .250   4.800    .290   1.000
 691          UC    .183    .131
 692          UA       0       3       5       8      12      20      43      75      90      96
 693          UA     100

 694          KK  R113A2     RECALL DIVERTED HYDROGRAPH FROM E113A
 695          KM             1 CROSS-CULVERT UNDER SR 303
 696          DR   D310A

 697          KK   C3100     COMBINE HYDROGRAPHS - AR310A, D310A (R113A2)
 698          HC       2

 699          KK   S310A
 700          KM   SUB-BASIN S310A
 701          BA    .028
 702          LG    .268    .250   5.300    .260  11.000
 703          UC    .563    .430
 704          UA       0       3       5       8      12      20      43      75      90      96
 705          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 706          KK   C310A     COMBINE HYDROGRAPHS - R310A, C310O, S310A
 707          HC       3

 708          KK   1R307     ROUTE HYDROGRAPH  C310A THRU REACH 307 TO CP307A
 709          RS       1    FLOW      -1       0
 710          RC     .03    .025     .03    1100    .005
 711          RX     500     512     533     545     555     567     588     600
 712          RY       5       3       3       0       0       3       3       5

 713          KK    S307
 714          KM   SUB-BASIN S307
 715          BA    .112
 716          LG    .191    .210   6.400    .160  22.000
 717          UC    .313    .275
 718          UA       0       5      16      30      65      77      84      90      94      97
 719          UA     100

 720          KK  CP307A     COMBINE HYDROGRAPHS S307 AND 1R307
 721          HC       2

 722          KK    S309
 723          KM   SUB-BASIN S309
 724          BA    .045
 725          LG    .220    .150   8.800    .060  17.000
 726          UC    .146    .079
 727          UA       0       5      16      30      65      77      84      90      94      97
 728          UA     100

 729          KK   DT309    GOLF COURSE LAKE
 730          RS       1    STOR       0       0
 731          SA       0     1.4    1.61    1.83    2.07    2.32    2.59
 732          SE  1273.9    1274    1275    1276    1277    1278    1279
 733          SS  1278.5     100     3.0     1.5

 734          KK   2R307     ROUTE HYDROGRAPH  DT309 THRU REACH 307 TO CP307
 735          RS       1    FLOW      -1       0
 736          RC     .03    .025     .03    1200    .002
 737          RX     500     512     533     545     555     567     588     600
 738          RY       5       3       3       0       0       3       3       5

 739          KK   CP307     COMBINE HYDROGRAPHS CP307A AND 2R307
 740          HC       2

 741          KK    S311
 742          KM   SUB-BASIN S311
 743          BA    .073
 744          LG    .150    .150   9.700    .050  27.000
 745          UC    .183    .103
 746          UA       0       5      16      30      65      77      84      90      94      97
 747          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 748          KK   S310C
 749          KM   SUB-BASIN S310C
 750          BA    .034
 751          LG    .315    .150   9.700    .050   5.000
 752          UC    .083    .012
 753          UA       0       3       5       8      12      20      43      75      90      96
 754          UA     100

 755          KK   S310B
 756          KM   SUB-BASIN S310B
 757          BA    .038
 758          LG    .173    .150   8.800    .060  22.000
 759          UC    .279    .209
 760          UA       0       3       5       8      12      20      43      75      90      96
 761          UA     100

 762          KK   BR113
 763          KM   SUB-BASIN BR113
 764          BA    .005
 765          LG    .100    .150   9.700    .050  80.000
 766          UC    .229    .752
 767          UA       0       5      16      30      65      77      84      90      94      97
 768          UA     100

 769          KK  CP310C     COMBINE HYDROGRAPHS  CP307, S311, S310C, S310B, BR113
 770          HC       5

 771          KK  DT310C    RETENTION LAKE
 772          RS       1    STOR       0       0
 773          SA       0    8.20    8.69    9.20    9.72   10.26   10.81   11.38   11.96   12.55
 774          SQ       0       0       0       0       0       0       0       0       0       0
 775          SE  1251.9    1252    1253    1254    1255    1256    1257    1258    1259    1260

 776          KK   1R316     ROUTE HYDROGRAPH DT310C THRU REACH 316B TO CP316B
 777          RS       1    FLOW      -1       0
 778          RC     .03    .025     .03    1720    .008
 779          RX     500     512     533     545     555     567     588     600
 780          RY       5       3       3       0       0       3       3       5

 781          KK    S308
 782          KM   SUB-BASIN S308
 783          BA    .137
 784          LG    .186    .150   7.300    .110  22.000
 785          UC    .213    .113
 786          UA       0       5      16      30      65      77      84      90      94      97
 787          UA     100

 788          KK   DT308    GOLF COURSE LAKE
 789          RS       1    STOR       0       0
 790          SA       0     2.3    2.56    2.84    3.14    3.45    3.77    4.11    4.46    4.82
 791          SE  1273.9    1274    1275    1276    1277    1278    1279    1280    1281    1282
 792          SS    1281     100     3.0     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 793          KK    R314     ROUTE HYDROGRAPH DT308 THRU REACH 314 TO CP314
 794          RS       1    FLOW      -1       0
 795          RC     .03    .025     .03    1400    .002
 796          RX     500     512     533     545     555     567     588     600
 797          RY       5       3       3       0       0       3       3       5

 798          KK    S314
 799          KM   SUB-BASIN S314
 800          BA    .048
 801          LG    .285    .150   9.700    .050   9.000
 802          UC    .304    .299
 803          UA       0       3       5       8      12      20      43      75      90      96
 804          UA     100

 805          KK   CP314     COMBINE HYDROGRAPHS R314 AND S314
 806          HC       2

 807          KK   DT314    GOLF COURSE LAKE
 808          RS       1    STOR       0       0
 809          SA       0     2.0    2.25    2.51    2.79    3.08    3.38
 810          SE  1267.9    1268    1269    1270    1271    1272    1273
 811          SS  1272.5     100     3.0     1.5

 812          KK    S315
 813          KM   SUB-BASIN S315
 814          BA    .090
 815          LG    .161    .150   9.700    .050  24.000
 816          UC    .250    .194
 817          UA       0       5      16      30      65      77      84      90      94      97
 818          UA     100

 819          KK   CP315     COMBINE HYDROGRAPHS DT314 AND S315
 820          HC       2

 821          KK   DT315    GOLF COURSE LAKE
 822          RS       1    STOR       0       0
 823          SA       0     1.9    2.14    2.40    2.67    2.95    3.25    3.56    3.89    4.23
 824          SE  1267.9    1268    1269    1270    1271    1272    1273    1274    1275    1276
 825          SS    1275     100     3.0     1.5

 826          KK   2R316     ROUTE HYDROGRAPH DT315 THRU REACH 316A TO CP316A
 827          RS       1    FLOW      -1       0
 828          RC     .03    .025     .03    2000    .008
 829          RX     500     512     533     545     555     567     588     600
 830          RY       5       3       3       0       0       3       3       5

 831          KK    S316
 832          KM   SUB-BASIN S316
 833          BA    .123
 834          LG    .224    .150   7.600    .100  18.000
 835          UC    .204    .107
 836          UA       0       5      16      30      65      77      84      90      94      97
 837          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 838          KK  CP316A     COMBINE HYDROGRAPHS 2R316 AND S316
 839          HC       2

 840          KK   DT316     GOLF COURSE LAKE
 841          RS       1    STOR       0       0
 842          SA       0     1.6    1.82    2.06    2.31    2.57    2.85    3.15    3.46    3.78
 843          SE  1252.9    1253    1254    1255    1256    1257    1258    1259    1260    1261
 844          SS    1260     100     3.0     1.5

 845          KK  CP316B     COMBINE HYDROGRAPHS 1R316 AND DT316
 846          HC       2

 847          KK    S101
 848          KM   SUB-BASIN S101
 849          BA    .116
 850          LG    .190    .250   6.000    .180  20.000
 851          UC    .246    .158
 852          UA       0       5      16      30      65      77      84      90      94      97
 853          UA     100

 854          KK   DT101
 855          KM        GOLF COURSE LAKE
 856          RS       1    STOR       0       0
 857          SA       0    1.39    1.72    2.31    2.85    3.24    3.69    4.27    4.73    4.73
 858          SE  1291.4  1291.5  1292.5  1293.5  1294.5    1295  1295.5    1296  1296.5    1297
 859          SS    1296      45     3.0     1.5

 860          KK    S103
 861          KM   SUB-BASIN S103
 862          BA    .090
 863          LG    .133    .250   4.650    .320  46.000
 864          UC    .275    .228
 865          UA       0       5      16      30      65      77      84      90      94      97
 866          UA     100

 867          KK    D103
 868          KM        DIVERT 10-YEAR STORM DRAIN THROUGH S105 (48" ??)
 869          DT    D105
 870          DI       0     100     200     500
 871          DQ       0     100     100     100

 872          KK   1R102     ROUTE REMAINDER FROM S103 TO 2R102
 873          RK    1200   .0042    .016            TRAP      60    0.05

 874          KK   2R102
 875          KM        ROUTE FLOW FROM 1R102 TO CP102
 876          RS       2    FLOW      -1       0
 877          RC    .035    .035    .035     500   .0024
 878          RX       0      10      12      14      25      27      35      47
 879          RY     2.5     1.5      .5       0       0      .5     1.5     2.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

880           KK    S102
881           KM   SUB-BASIN S102
882           BA    .067
883           LG    .181    .250   4.900    .280  21.000
884           UC    .225    .168
885           UA       0       5      16      30      65      77      84      90      94      97
886           UA     100

887           KK   CP102     COMBINE HYDROGRAPHS DT101, 2R102, S102
888           HC       3

889           KK   DT102
890           KM        GOLF COURSE LAKE
891           RS       1    STOR       0       0
892           SA       0    1.56    1.94    2.53    3.03    3.52    3.77    3.77
893           SE  1288.4  1288.5    1289    1290    1291    1292  1292.5    1293
894           SS    1292     115     3.0     1.5

895           KK   S105A
896           KM   SUB-BASIN S105A
897           BA    .019
898           LG    .297    .250   4.400    .410   7.000
899           UC    .133    .079
900           UA       0       3       5       8      12      20      43      75      90      96
901           UA     100

902           KK  CP105A     COMBINE HYDROGRAPHS DT102, AND S105A
903           KM        ROADWAY CROSSING OF GOLF COURSE (ELMIN = 1289.3')
904           HC       2

905           KK   DT105
906           KM        GOLF COURSE LAKE
907           RS       1    STOR       0       0
908           SA       0    0.75    0.96    1.36    1.82    3.58    3.58
909           SE  1287.5    1288    1289    1290    1291    1292  1292.5
910           SS    1292      35     3.0     1.5

911           KK   DR105
912           KM        RECALL 10-YEAR STORM DRAIN THROUGH S105
913           DR    D105

914           KK   R105B     ROUTE 10-YEAR STORM DRAIN THRU S105 TO CP105B
915           RK     900   .0033    .012            CIRC       4

916           KK   S105B
917           KM   SUB-BASIN S105B
918           BA    .026
919           LG    .150    .250   4.400    .370  28.000
920           UC    .158    .118
921           UA       0       5      16      30      65      77      84      90      94      97
922           UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 923          KK  CP105B     COMBINE HYDROGRAPHS R105B, AND S105B
 924          KM       CONCENTRATION PT. BEFORE ENTERING GOLF COURSE
 925          HC       2

 926          KK   CP105     COMBINE HYDROGRAPHS CP105B, AND DT105
 927          KM       ROADWAY CROSSING OF GOLF COURSE
 928          HC       2

 929          KK   R107B
 930          KM       ROUTE HYDROGRAPH  CP105 TO CP107B
 931          RS     1    FLOW      -1       0
 932          RC    .03    .025     .03     600   .0035
 933          RX    500     512     533     545     555     567     588     600
 934          RY   1292    1290    1290    1287    1287    1290    1290    1292

 935          KK    AR3A
 936          KM   SUB-BASIN AR3A
 937          BA    .032
 938          LG    .350    .350   4.800    .290    .000
 939          UC    .283    .254
 940          UA      0       3       5       8      12      20      43      75      90      96
 941          UA    100

 942          KK   DAR3A
 943          KM       DIVERT AR3A ( 2-24" RCP TO S103A )
 944          DT   D103A
 945          DI      0      10      50      54     100     150     200     250
 946          DQ      0      10      50      54      67      67      67      67

 947          KK   AR16C
 948          KM   SUB-BASIN AR16C
 949          BA    .017
 950          LG    .350    .350   4.800    .290    .000
 951          UC   1.158   1.696
 952          UA      0       3       5       8      12      20      43      75      90      96
 953          UA    100

 954          KK   AR16D
 955          KM   SUB-BASIN AR16D
 956          BA    .007
 957          LG    .350    .290   8.400    .070    .000
 958          UC    .138    .101
 959          UA      0       3       5       8      12      20      43      75      90      96
 960          UA    100

 961          KK  CAR16C
 962          KM       ADD HYDROGRAPHS AT CAR16C - DAR3A, AR16C, AR16D
 963          HC       3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 964          KK   E103A
 965          KM   SUB-BASIN E103A
 966          BA    .011
 967          LG    .350    .350   4.800    .290    .000
 968          UC    .204    .238
 969          UA       0       3       5       8      12      20      43      75      90      96
 970          UA     100

 971          KK   1RAR3
 972          KM        ROUTE S103A TO CAR3
 973          RK     840   .0030    .020            TRAP       5       1

 974          KK  DR102A
 975          KM       RECALL D102A ( FROM S102A )
 976          DR   D103A

 977          KK   2RAR3
 978          KM        ROUTE D103A TO CAR3  (DR102A)
 979          RK     460   .0030    .020            TRAP       5       1

 980          KK     AR3
 981          KM   SUB-BASIN AR3
 982          BA    .006
 983          LG    .350    .370   5.200    .250    .000
 984          UC    .296    .428
 985          UA       0       3       5       8      12      20      43      75      90      96
 986          UA     100

 987          KK    CAR3
 988          KM       ADD HYDROGRAPHS 1RAR3, 2RAR3, AR3
 989          HC       3

 990          KK  RAR16A
 991          KM        ROUTE HYDROGRAPH CAR3 TO C116, GOLF CHANNEL
 992          RS       2    FLOW      -1       0
 993          RC     .03    .025     .03    1480   .0030
 994          RX     500     512     533     545     555     567     588     600
 995          RY       3       2       1       0       0       1       2       3

 996          KK   AR16A
 997          KM   SUB-BASIN AR16A
 998          BA    .006
 999          LG    .350    .390   6.200    .160    .000
1000          UC    .400    .893
1001          UA       0       3       5       8      12      20      43      75      90      96
1002          UA     100

1003          KK  AR16B1
1004          KM   SUB-BASIN AR16B1
1005          BA    .003
1006          LG    .350    .250   9.700    .050    .000
1007          UC    .146    .174
1008          UA       0       3       5       8      12      20      43      75      90      96
1009          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1010          KK    S116
1011          KM   SUB-BASIN S116
1012          BA    .031
1013          LG    .329    .190   6.600    .150   4.000
1014          UC    .208    .135
1015          UA       0       3       5       8      12      20      43      75      90      96
1016          UA     100

1017          KK   CP116
1018          KM       ADD HYDROGRAPHS CAR16C, RAR16A, AR16A, AR16B1, S116
1019          HC       5

1020          KK   S107A
1021          KM   SUB-BASIN S107A
1022          BA    .014
1023          LG    .293    .150   8.400    .080   8.000
1024          UC    .133    .088
1025          UA       0       3       5       8      12      20      43      75      90      96
1026          UA     100

1027          KK  CP107A
1028          KM       ADD HYDROGRAPHS C116 AND S107A
1029          HC       2

1030          KK  DT107A
1031          KM        GOLF COURSE LAKE
1032          RS       1    STOR       0       0
1033          SA       0    1.08    1.25    1.44    1.74    1.74
1034          SE  1299.5    1300    1301    1302    1303    1304
1035          SS    1303     190     3.0     1.5

1036          KK  DT107B
1037          KM        GOLF COURSE LAKE
1038          RS       1    STOR       0       0
1039          SA       0    0.56    0.72    1.24    1.37    1.37
1040          SE  1297.9    1298    1299    1300  1300.5    1301
1041          SS  1300.4      40     3.0     1.5

1042          KK    S104
1043          KM   SUB-BASIN S104
1044          BA    .054
1045          LG    .201    .210   6.400    .150  26.000
1046          UC    .221    .172
1047          UA       0       5      16      30      65      77      84      90      94      97
1048          UA     100

1049          KK    S106
1050          KM   SUB-BASIN S106
1051          BA    .032
1052          LG    .150    .190   6.600    .140  25.000
1053          UC    .192    .173
1054          UA       0       5      16      30      65      77      84      90      94      97
1055          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1056          KK   CP104     COMBINE HYDROGRAPHS DT107B, S104 AND S106
1057          HC       3

1058          KK   DT104
1059          KM        GOLF COURSE LAKE
1060          RS       1    STOR       0       0
1061          SA       0    1.02    1.20    1.71    2.30    2.75    2.75
1062          SE  1291.9    1292    1293    1294    1295  1295.5    1296
1063          SS    1295      75     3.0     1.5

1064          KK    S111
1065          KM   SUB-BASIN S111
1066          BA    .113
1067          LG    .177    .190   6.600    .140  32.000
1068          UC    .204    .124
1069          UA       0       5      16      30      65      77      84      90      94      97
1070          UA     100

1071          KK   DT111
1072          KM        2 - GOLF COURSE LAKES
1073          RS       1    STOR       0       0
1074          SA       0    1.16    2.62    3.58    4.91    6.49    7.24    7.24
1075          SE  1285.9    1286    1287    1288    1289    1290  1290.5    1291
1076          SS    1290     140     3.0     1.5

1077          KK   S107B
1078          KM   SUB-BASIN S107B
1079          BA    .051
1080          LG    .328    .190   6.600    .160   4.000
1081          UC    .146    .068
1082          UA       0       3       5       8      12      20      43      75      90      96
1083          UA     100

1084          KK  CP107B     COMBINE HYDROGRAPHS R107B, DT104, DT111, S107B
1085          HC       4

1086          KK   DT107
1087          KM        GOLF COURSE DRIVING RANGE
1088          RS       1    STOR       0       0
1089          SA       0     .67    2.72    5.03    8.19   10.35   11.75   11.75
1090          SE  1281.5    1282    1283    1284    1285    1286  1286.5    1287
1091          SS    1286     110     3.0     1.5

1092          KK   E100B
1093          KM   SUB-BASIN E100B
1094          BA    .035
1095          LG    .280    .250   4.900    .280  23.000
1096          UC    .346    .456
1097          UA       0       3       5       8      12      20      43      75      90      96
1098          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1099          KK   R100D
1100          KM        ROUTE E100B TO CP100D
1101          RS       8    FLOW      -1       0
1102          RC    .035    .035    .035    3150   .0054
1103          RX       0      50      75      90     100     130     150     160
1104          RY       1       1       0       0       0       0       1       1

1105          KK   E100D
1106          KM   SUB-BASIN E100D
1107          BA    .010
1108          LG    .350    .250   4.900    .280   1.000
1109          UC    .533   1.689
1110          UA       0       3       5       8      12      20      43      75      90      96
1111          UA     100

1112          KK  CP100D
1113          KM        ADD HYDROGRAPHS R100D, E100D
1114          HC       2

1115          KK   E100A
1116          KM   SUB-BASIN E100A
1117          BA    .079
1118          LG    .500    .350   4.900    .270    .000
1119          UC   1.063   1.959
1120          UA       0       3       5       8      12      20      43      75      90      96
1121          UA     100

1122          KK  1R100C
1123          KM        ROUTE E100A TO 1C100C
1124          RS      57    FLOW      -1       0
1125          RC      .1      .1      .1    3650   .0056
1126          RX       0      20     445     915     940     970     990    1000
1127          RY       1      .5     .25       0       0      .5       1       2

1128          KK   E100C
1129          KM   SUB-BASIN E100C
1130          BA    .125
1131          LG    .500    .350   4.900    .270    .000
1132          UC    .529    .459
1133          UA       0       3       5       8      12      20      43      75      90      96
1134          UA     100

1135          KK  1C100C
1136          KM        ADD HYDROGRAPHS 1R100C, E100C
1137          HC       2

1138          KK   E103B
1139          KM   SUB-BASIN E103B
1140          BA    .034
1141          LG    .500    .350   4.800    .280    .000
1142          UC    .429    .589
1143          UA       0       3       5       8      12      20      43      75      90      96
1144          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1145          KK  2R100C
1146          KM        ROUTE E103B TO 2C100C
1147          RK    1500   .0024    .022            TRAP       5       4

1148          KK  2C100C
1149          KM        ADD HYDROGRAPHS 1C100C, 2R100C
1150          HC       2

1151          KK  C100CD
1152          KM        ADD HYDROGRAPHS CP100D, 2C100C
1153          HC       2

1154          KK    R101
1155          KM        ROUTE C100CD TO ADOT CULVERT
1156          RK     850   .0024    .022            TRAP       5       4

1157          KK   REEMS
1158          KM        DIVERT C100CD TO ADOT CULVERT
1159          DT    ADOT
1160          DI       0      60     100     120     140     150     200
1161          DQ       0      60     100     106     104     103      96

1162          KK    R108
1163          KM        ROUTE REEMS TO CP108
1164          RK     850    .005    .022            TRAP      10       6

1165          KK    S108
1166          KM   SUB-BASIN S108
1167          BA    .084
1168          LG    .229    .150   7.300    .110  15.000
1169          UC    .271    .205
1170          UA       0       5      16      30      65      77      84      90      94      97
1171          UA     100

1172          KK   CP108
1173          KM       ADD HYDROGRAPHS REEMS AND S108
1174          HC       2

1175          KK  DT108A
1176          KM        GOLF COURSE LAKE
1177          RS       1    STOR       0       0
1178          SA       0    1.74    2.15    2.61    3.06    3.06
1179          SE  1285.9    1286    1287    1288    1289    1290
1180          SS    1289      35     3.0     1.5

1181          KK  DT108B
1182          KM        GOLF COURSE LAKE
1183          RS       1    STOR       0       0
1184          SA       0    1.04    1.10    1.23    1.41    1.41
1185          SE  1283.9    1284    1285    1286    1287    1288
1186          SS    1287      20     3.0     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1187          KK   S109C
1188          KM   SUB-BASIN S109C
1189          BA    .008
1190          LG    .150    .150   9.700    .050  25.000
1191          UC    .275    .367
1192          UA       0       5      16      30      65      77      84      90      94      97
1193          UA     100

1194          KK   CP109     COMBINE HYDROGRAPHS DT108B, S109C
1195          HC       2

1196          KK   S109B
1197          KM   SUB-BASIN S109B
1198          BA    .036
1199          LG    .150    .170   6.800    .130  29.000
1200          UC    .179    .132
1201          UA       0       5      16      30      65      77      84      90      94      97
1202          UA     100

1203          KK   S109D
1204          KM   SUB-BASIN S109D
1205          BA    .015
1206          LG    .286    .150   9.700    .050   9.000
1207          UC    .142    .096
1208          UA       0       5      16      30      65      77      84      90      94      97
1209          UA     100

1210          KK  CP109D     COMBINE HYDROGRAPHS CP109, S109B AND S109D
1211          HC       3

1212          KK   S109A
1213          KM   SUB-BASIN S109A
1214          BA    .020
1215          LG    .150    .250   5.200    .250  27.000
1216          UC    .162    .161
1217          UA       0       5      16      30      65      77      84      90      94      97
1218          UA     100

1219          KK   S109E
1220          KM   SUB-BASIN S109E
1221          BA    .022
1222          LG    .304    .250   4.350    .420   7.000
1223          UC    .338    .322
1224          UA       0       5      16      30      65      77      84      90      94      97
1225          UA     100

1226          KK  CP109E     COMBINE HYDROGRAPHS CP109D, S109A AND S109E
1227          HC       3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1228          KK   DT109
1229          KM        GOLF COURSE LAKE
1230          RS       1    STOR       0       0
1231          SA       0    1.67    3.28    4.40    6.00    9.43   13.08   13.08
1232          SE  1279.4  1279.5    1280    1281    1282    1283    1284    1285
1233          SS    1284      70     3.0     1.5

1234          KK    S110
1235          KM   SUB-BASIN S110
1236          BA    .138
1237          LG    .204    .150   8.400    .070  29.000
1238          UC    .262    .132
1239          UA       0       5      16      30      65      77      84      90      94      97
1240          UA     100

1241          KK   CP110     COMBINE HYDROGRAPHS DT107, S110
1242          HC       3

1243          KK   DT110
1244          KM        GOLF COURSE LAKE
1245          RS       1    STOR       0       0
1246          SA       0    6.06    6.61    7.69    8.94   10.42   11.46
1247          SQ       0       0       0       0       0       0       0
1248          SE  1279.4  1279.5    1280    1281    1282  1282.5    1283

1249          KK   AR16E
1250          KM   SUB-BASIN AR16E
1251          BA    .005
1252          LG    .350    .350   4.800    .290    .000
1253          UC    .225    .211
1254          UA       0       3       5       8      12      20      43      75      90      96
1255          UA     100

1256          KK   AR17B
1257          KM   SUB-BASIN AR17B
1258          BA    .005
1259          LG    .350    .380   5.400    .220    .000
1260          UC    .192    .192
1261          UA       0       3       5       8      12      20      43      75      90      96
1262          UA     100

1263          KK  AR16B2
1264          KM   SUB-BASIN AR16B2
1265          BA    .002
1266          LG    .350    .350   4.800    .290    .000
1267          UC    .188    .238
1268          UA       0       3       5       8      12      20      43      75      90      96
1269          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1270          KK  CP117A     COMBINE HYDROGRAPHS AR16E, AR17B AND AR16B2
1271          HC       3

1272          KK   R117A
1273          KM        ROUTE HYDROGRAPH CP117A TO CP117B, GOLF CHANNEL
1274          RS       2    FLOW      -1       0
1275          RC     .03    .025     .03    1250   .0114
1276          RX     500     512     533     545     555     567     588     600
1277          RY       5       3       3       0       0       3       3       5

1278          KK   AR17C
1279          KM   SUB-BASIN AR17C
1280          BA    .012
1281          LG    .350    .350   4.800    .290    .000
1282          UC    .258    .213
1283          UA       0       3       5       8      12      20      43      75      90      96
1284          UA     100

1285          KK    AR17
1286          KM   SUB-BASIN AR17
1287          BA    .016
1288          LG    .350    .370   5.200    .250    .000
1289          UC    .396    .519
1290          UA       0       3       5       8      12      20      43      75      90      96
1291          UA     100

1292          KK    S117
1293          KM   SUB-BASIN S117
1294          BA    .028
1295          LG    .325    .250   6.000    .190   4.000
1296          UC    .283    .253
1297          UA       0       3       5       8      12      20      43      75      90      96
1298          UA     100

1299          KK  CP117B     COMBINE HYDROGRAPHS R117A, AR17C, AR17, S117
1300          HC       4

1301          KK   R113B
1302          KM        ROUTE HYDROGRAPH CP117B TO CP113B, GOLF CHANNEL
1303          RS       1    FLOW      -1       0
1304          RC     .03    .025     .03    1000   .0114
1305          RX     500     512     533     545     555     567     588     600
1306          RY       5       3       3       0       0       3       3       5

1307          KK   S113C
1308          KM   SUB-BASIN S113C
1309          BA    .019
1310          LG    .150    .250   4.600    .330  25.000
1311          UC    .229    .332
1312          UA       0       5      16      30      65      77      84      90      94      97
1313          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1314          KK   S113B
1315          KM   SUB-BASIN S113B
1316          BA    .026
1317          LG    .242    .250   4.800    .310  14.000
1318          UC    .183    .134
1319          UA       0       5      16      30      65      77      84      90      94      97
1320          UA     100

1321          KK  CP113B     COMBINE HYDROGRAPHS R113B, S113C, S113B
1322          HC       3

1323          KK   S113A
1324          KM   SUB-BASIN S113A
1325          BA    .029
1326          LG    .150    .250   4.700    .300  25.000
1327          UC    .204    .187
1328          UA       0       5      16      30      65      77      84      90      94      97
1329          UA     100

1330          KK   CP113     COMBINE HYDROGRAPHS CP113B AND S113A
1331          HC       2

1332          KK   1R114
1333          KM        ROUTE HYDROGRAPH CP113 TO CP114, GOLF CHANNEL
1334          RS       1    FLOW      -1       0
1335          RC     .03    .025     .03     700   .0114
1336          RX     500     512     533     545     555     567     588     600
1337          RY       5       3       3       0       0       3       3       5

1338          KK    S114
1339          KM   SUB-BASIN S114
1340          BA    .059
1341          LG    .210    .250   4.800    .300  19.000
1342          UC    .129    .059
1343          UA       0       5      16      30      65      77      84      90      94      97
1344          UA     100

1345          KK   CP114     COMBINE HYDROGRAPHS 1R114, S114
1346          HC       2

1347          KK   DT114
1348          KM        GOLF COURSE LAKE
1349          RS       1    STOR       0       0
1350          SA       0    2.04    2.04    2.49    3.21    3.89    3.89
1351          SE  1285.9    1286    1287    1288    1289    1290    1291
1352          SS    1289      60     3.0     1.5

1353          KK    S112
1354          KM   SUB-BASIN S112
1355          BA    .034
1356          LG    .260    .250   5.600    .230  27.000
1357          UC    .154    .109
1358          UA       0       5      16      30      65      77      84      90      94      97
1359          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1360          KK   CP112     COMBINE HYDROGRAPHS DT114, S112
1361          HC       2

1362          KK   DT112
1363          KM        GOLF COURSE LAKE
1364          RS       1    STOR       0       0
1365          SA       0    1.57    1.94    2.70    3.59    4.39    4.39    4.39
1366          SE  1284.9  1284.5    1285    1286    1287  1287.5    1288    1289
1367          SS    1288     140     3.0     1.5

1368          KK    S115
1369          KM   SUB-BASIN S115
1370          BA    .085
1371          LG    .205    .250   6.000    .180  40.000
1372          UC    .183    .080
1373          UA       0       5      16      30      65      77      84      90      94      97
1374          UA     100

1375          KK  CP115A     COMBINE HYDROGRAPHS DT112, S115
1376          HC       2

1377          KK  DT115A
1378          KM        GOLF COURSE LAKE AT DOWNSTREAM END OF PHASE I (OUTFALL)
1379          RS       1    STOR       0       0
1380          SA       0    2.32    3.06    3.28    3.49    4.03    4.46    4.46
1381          SE  1282.4  1282.5    1283  1283.5    1284    1285  1285.5    1286
1382          SS    1285      95     3.0     1.5

1383          KK  CP115B     COMBINE HYDROGRAPHS DT115A, DT110
1384          HC       2

1385          KK  DT115B
1386          KM        GOLF COURSE LAKE
1387          RS       1    STOR       0       0
1388          SA       0    0.11    0.84    1.25    1.45    1.64    1.83    2.09    2.67
1389          SQ       0       0       0       0       0       0       0       0       0
1390          SE  1279.5    1280    1281    1282  1282.5    1283  1283.5    1284    1285

1391          KK    S303
1392          KM   SUB-BASIN S303
1393          BA    .070
1394          LG    .168    .250   4.700    .310  28.000
1395          UC    .233    .171
1396          UA       0       5      16      30      65      77      84      90      94      97
1397          UA     100

1398          KK   DT303     GOLF COURSE LAKE
1399          RS       1    STOR       0       0
1400          SA       0     1.6    1.82    2.06    2.31    2.57    2.85    3.15    3.46    3.78
1401          SE  1286.9    1287    1288    1289    1290    1291    1292    1293    1294    1295
1402          SS    1294     100     3.0     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1403          KK    R304     ROUTE HYDROGRAPH DT303 THRU REACH 304 TO CP304
1404          RS       1    FLOW      -1       0
1405          RC     .03    .025     .03     450    .002
1406          RX     500     512     533     545     555     567     588     600
1407          RY       5       3       3       0       0       3       3       5

1408          KK    S304
1409          KM   SUB-BASIN S304
1410          BA    .066
1411          LG    .193    .250   4.900    .290  24.000
1412          UC    .208    .129
1413          UA       0       5      16      30      65      77      84      90      94      97
1414          UA     100

1415          KK   CP304     COMBINE HYDROGRAPHS R304, S304
1416          HC       2

1417          KK   DT304     GOLF COURSE LAKE
1418          RS       1    STOR       0       0
1419          SA       0     1.5    1.72    1.94    2.19    2.45    2.72    3.01    3.31    3.63
1420          SE  1282.9    1283    1284    1285    1286    1287    1288    1289    1290    1291
1421          SS    1290     100     3.0     1.5

1422          KK    R305     ROUTE HYDROGRAPH DT304 THRU REACH 305 TO CP305
1423          RS       1    FLOW      -1       0
1424          RC     .03    .025     .03     800    .005
1425          RX     500     512     533     545     555     567     588     600
1426          RY       5       3       3       0       0       3       3       5

1427          KK    S305
1428          KM   SUB-BASIN S305
1429          BA    .041
1430          LG    .255    .250   5.000    .300  12.000
1431          UC    .167    .106
1432          UA       0       5      16      30      65      77      84      90      94      97
1433          UA     100

1434          KK   CP305     COMBINE HYDROGRAPHS R305 AND S305
1435          HC       2

1436          KK   DT305    GOLF COURSE LAKE
1437          RS       1    STOR       0       0
1438          SA       0     2.2    2.46    2.73    3.02    3.32    3.64
1439          SE  1275.9    1276    1277    1278    1279    1280    1281
1440          SS  1280.5     100     3.0     1.5

1441          KK    R312     ROUTE DT305 TO CP312A
1442          RS       1    FLOW      -1       0
1443          RC     .03    .025     .03     400    .005
1444          RX     500     512     533     545     555     567     588     600
1445          RY       5       3       3       0       0       3       3       5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1446          KK    S312
1447          KM   SUB-BASIN S312
1448          BA    .069
1449          LG    .272    .250   4.900    .330  19.000
1450          UC    .221    .156
1451          UA       0       3       5       8      12      20      43      75      90      96
1452          UA     100

1453          KK  CP312A     COMBINE HYDROGRAPHS  R312 AND S312
1454          HC       2

1455          KK   CP312     COMBINE HYDROGRAPHS CP312A AND DT115B
1456          HC       2

1457          KK   DT312     GOLF COURSE DRIVING RANGE RETENTION
1458          RS       1    STOR       0       0
1459          SA       0     2.0    2.25    2.51    2.79    3.08    3.38
1460          SE  1267.9    1268    1269    1270    1271    1272    1273
1461          SS  1272.5     100     3.0     1.5

1462          KK    S313
1463          KM   SUB-BASIN S313
1464          BA    .238
1465          LG    .177    .250   5.800    .190  23.000
1466          UC    .313    .187
1467          UA       0       5      16      30      65      77      84      90      94      97
1468          UA     100

1469          KK   CP313     COMBINE HYDROGRAPHS DT312 AND S313
1470          HC       2

1471          KK   DT313     GOLF COURSE LAKE
1472          RS       1    STOR       0       0
1473          SA       0     1.2    1.39     1.6    1.82    2.06    2.31    2.58    2.86    3.15
1474          SE  1257.9    1258    1259    1260    1261    1262    1263    1264    1265    1266
1475          SS    1263     100     3.0     1.5

1476          KK    R317     ROUTE HYDROGRAPH DT313 THRU REACH 317 TO CP317
1477          RS       1    FLOW      -1       0
1478          RC     .03    .025     .03     650    .003
1479          RX     500     512     533     545     555     567     588     600
1480          RY       5       3       3       0       0       3       3       5

1481          KK    S317
1482          KM   SUB-BASIN S317
1483          BA    .064
1484          LG    .194    .250   5.700    .210  20.000
1485          UC    .167    .093
1486          UA       0       5      16      30      65      77      84      90      94      97
1487          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1488          KK   CP317     COMBINE HYDROGRAPHS R317 AND S317
1489          HC       2

1490          KK   DT317     GOLF COURSE LAKE
1491          RS       1    STOR       0       0
1492          SA       0     1.0    1.18    1.37    1.57    1.79    2.03    2.28    2.54    2.82
1493          SE  1255.9    1256    1257    1258    1259    1260    1261    1262    1263    1264
1494          SS  1262.5     100     3.0     1.5

1495          KK  CP322A     COMBINE HYDROGRAPHS DT110 AND DT317
1496          HC       2

1497          KK    S322
1498          KM   SUB-BASIN S322
1499          BA    .095
1500          LG    .241    .190   6.600    .140  14.000
1501          UC    .083    .011
1502          UA       0       3       5       8      12      20      43      75      90      96
1503          UA     100

1504          KK  CP322B     COMBINE HYDROGRAPHS CP322A AND S322
1505          HC       2

1506          KK   BR114
1507          KM   SUB-BASIN BR114
1508          BA    .005
1509          LG    .100    .150   9.700    .050  80.000
1510          UC    .250    .750
1511          UA       0       5      16      30      65      77      84      90      94      97
1512          UA     100

1513          KK   5R115
1514          KM        ROUTE BELL R.O.W. FROM C114 TO C115W
1515          RS       8    FLOW      -1       0
1516          RC     .06    .022    .035    2578   .0035
1517          RX    1000    1380    1790    1800    1840    1850    1899    1900
1518          RY    1258    1256    1254    1250    1250    1252    1253    1253

1519          KK   BR115
1520          KM   SUB-BASIN BR115
1521          BA    .006
1522          LG    .100    .250   6.000    .180  80.000
1523          UC    .329   1.162
1524          UA       0       5      16      30      65      77      84      90      94      97
1525          UA     100

1526          KK   C115W
1527          KM        ADD HYDROGRAPHS FROM 4R115 AND BR115
1528          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1529          KK  CP322C
1530          KM        ADD HYDROGRAPHS FROM CP322B AND C115W
1531          HC       2

1532          KK   DT322     RETENTION LAKE
1533          KM            OUTLET EMERGENCY SPILLWAY (WEIR)
1534          RS       1    STOR       0       0
1535          SA       0    14.4   15.05   15.72   16.40   17.09   17.80   18.53   19.27   20.02
1536          SE  1243.9    1244    1245    1246    1247    1248    1249    1250    1251    1252
1537          SS    1250     100     3.0     1.5

1538          KK    C115
1539          KM        ADD HYDROGRAPHS FROM C115W AND DT322
1540          HC       2

1541          KK    S319
1542          KM   SUB-BASIN S319
1543          BA    .036
1544          LG    .150    .250   5.100    .260  28.000
1545          UC    .208    .173
1546          UA       0       5      16      30      65      77      84      90      94      97
1547          UA     100

1548          KK    S320
1549          KM   SUB-BASIN S320
1550          BA    .065
1551          LG    .150    .170   6.800    .130  29.000
1552          UC    .258    .235
1553          UA       0       5      16      30      65      77      84      90      94      97
1554          UA     100

1555          KK  CP323A     COMBINE HYDROGRAPHS S319 AND S320
1556          HC       2

1557          KK    S321
1558          KM   SUB-BASIN S321
1559          BA    .103
1560          LG    .150    .250   5.700    .200  28.000
1561          UC    .421    .441
1562          UA       0       5      16      30      65      77      84      90      94      97
1563          UA     100

1564          KK  CP323B     COMBINE HYDROGRAPHS CP323A AND S321
1565          HC       2

1566          KK    S323
1567          KM   SUB-BASIN S323
1568          BA    .048
1569          LG    .268    .250   5.100    .260  11.000
1570          UC    .083    .008
1571          UA       0       3       5       8      12      20      43      75      90      96
1572          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1573          KK   CP323     COMBINE HYDROGRAPHS CP323B, S323
1574          HC       2

1575          KK   DT323     RETENTION LAKE
1576          RS       1    STOR       0       0
1577          SA       0    1.99    3.87    5.81    7.97   10.59
1578          SQ       0       0       0       0       0       0
1579          SE  1241.9    1242    1244    1246    1248    1250

1580          KK   S302A
1581          KM   SUB-BASIN S302A
1582          BA    .037
1583          LG    .150    .150   8.400    .070  25.000
1584          UC    .192    .156
1585          UA       0       5      16      30      65      77      84      90      94      97
1586          UA     100

1587          KK   1R302     ROUTE HYDROGRAPH S302A THRU REACH 302B, LOCAL STREET, 32FT SCTN
1588          KM             TO CP302A
1589          RK     800   .0030    .016            TRAP      32    0.01

1590          KK   S302B
1591          KM   SUB-BASIN S302B
1592          BA    .010
1593          LG    .150    .150   8.000    .080  25.000
1594          UC    .083    .039
1595          UA       0       5      16      30      65      77      84      90      94      97
1596          UA     100

1597          KK   2R302     ROUTE HYDROGRAPH S302B THRU REACH 302C, LOCAL STREET, 32FT SCTN
1598          KM             TO CP302A
1599          RK    2200   .0030    .016            TRAP      32    0.01

1600          KK  CP302A     COMBINE HYDROGRAPHS 1R302 AND 2R302
1601          HC       2

1602          KK   3R302     ROUTE HYDROGRAPH CP302A THRU REACH 302D, GUNITE CHANNEL, TO CP302B
1603          RK    1360   .0030    .016            TRAP      10     0.5

1604          KK    S302
1605          KM   SUB-BASIN S302
1606          BA    .093
1607          LG    .138    .150   8.800    .060  41.000
1608          UC    .267    .211
1609          UA       0       5      16      30      65      77      84      90      94      97
1610          UA     100

1611          KK  CP302B     COMBINE HYDROGRAPHS 3R302 AND S302
1612          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1613          KK    S301
1614          KM   SUB-BASIN S301
1615          BA    .054
1616          LG    .144    .150   8.000    .080  37.000
1617          UC    .488   1.025
1618          UA       0       3       5       8      12      20      43      75      90      96
1619          UA     100

1620          KK   4R302     ROUTE HYDROGRAPH S301 THRU REACH 302, GUNITE CHANNEL, TO CP302C
1621          RK     400   .0030    .016            TRAP      10     0.5

1622          KK  CP302C     COMBINE HYDROGRAPHS CP302B AND 4R302
1623          HC       2

1624          KK    R324     ROUTE HYDROGRAPH CP302C THRU REACH 324, GUNITE CHANNEL, TO CP324
1625          RK    2080   .0050    .016            TRAP      10     0.5

1626          KK    S324
1627          KM   SUB-BASIN S324
1628          BA    .130
1629          LG    .500    .000   5.000    .430    .000
1630          UC    .521    .451
1631          UA       0       3       5       8      12      20      43      75      90      96
1632          UA     100

1633          KK   CP324     COMBINE HYDROGRAPHS R324 AND S324
1634          HC       2

1635          KK   1R402     ROUTE HYDROGRAPH CP324 THRU REACH 402, GUNITE CHANNEL, TO CP402A
1636          RK    1400   .0043    .016            TRAP      10     0.5

1637          KK    S402
1638          KM   SUB-BASIN S402
1639          BA    .056
1640          LG    .150    .250   4.700    .300  25.000
1641          UC    .396    .555
1642          UA       0       5      16      30      65      77      84      90      94      97
1643          UA     100

1644          KK  CP402A     COMBINE HYDROGRAPHS 1R402 AND S402
1645          HC       2

1646          KK    S403
1647          KM   SUB-BASIN S403
1648          BA    .091
1649          LG    .150    .250   5.800    .190  25.000
1650          UC    .358    .309
1651          UA       0       5      16      30      65      77      84      90      94      97
1652          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1653          KK   2R402     ROUTE HYDROGRAPH S403 THRU REACH 402, LOCAL STREET, 32FT SCTN
1654          KM              TO CP204
1655          RK    520   .0040    .016            TRAP      32    0.01

1656          KK   CP402     COMBINE HYDROGRAPHS CP402A, AND 2R402
1657          HC      2

1658          KK   3R402     ROUTE HYDROGRAPH CP402 THRU REACH 402, GUNITE CHANNEL, TO CP407A
1659          RK    760   .0030    .016            TRAP      10     0.5

1660          KK   S325A
1661          KM   SUB-BASIN S325A
1662          BA    .029
1663          LG    .150    .250   4.100    .440  25.000
1664          UC    .162    .126
1665          UA       0       5      16      30      65      77      84      90      94      97
1666          UA     100

1667          KK    R325     ROUTE HYDROGRAPH S325A THRU REACH 325, LOCAL STREET, 32FT SCTN
1668          KM              TO CP325
1669          RK   2240   .0040    .016            TRAP      32    0.01

1670          KK    S325
1671          KM   SUB-BASIN S325
1672          BA    .112
1673          LG    .150    .250   4.650    .320  25.000
1674          UC    .208    .117
1675          UA       0       5      16      30      65      77      84      90      94      97
1676          UA     100

1677          KK   CP325     COMBINE HYDROGRAPHS R325, AND S325
1678          HC      2

1679          KK   1R401     ROUTE HYDROGRAPH CP325 THRU REACH 401A, GUNITE CHANNEL, TO CP401A
1680          RK   1680   .0030    .016            TRAP      10     0.5

1681          KK    S400
1682          KM   SUB-BASIN S400
1683          BA    .059
1684          LG    .150    .250   5.200    .250  30.000
1685          UC    .162    .097
1686          UA       0       5      16      30      65      77      84      90      94      97
1687          UA     100

1688          KK   2R401     ROUTE HYDROGRAPH S400 THRU REACH 401B, COLLECT STREET, 68FT SCTN
1689          KM              TO CP401A
1690          RK   2920   .0040    .016            TRAP      68    0.01

1691          KK  CP401A     COMBINE HYDROGRAPHS 1R401 AND 2R401
1692          HC      2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1693          KK    S401
1694          KM   SUB-BASIN S401
1695          BA    .061
1696          LG    .150    .230   6.200    .160  30.000
1697          UC    .317    .315
1698          UA       0       5      16      30      65      77      84      90      94      97
1699          UA     100

1700          KK   CP401     COMBINE HYDROGRAPHS CP401A AND S401
1701          HC       2

1702          KK    R405     ROUTE HYDROGRAPH  CP401 THRU REACH 405, GUNITE CHANNEL, TO CP407A
1703          RK    2200   .0032    .016            TRAP      10      0.5

1704          KK    S405
1705          KM   SUB-BASIN S405
1706          BA    .025
1707          LG    .137    .150   8.000    .080  39.000
1708          UC    .287    .358
1709          UA       0       5      16      30      65      77      84      90      94      97
1710          UA     100

1711          KK  CP407A     COMBINE HYDROGRAPHS 3R402, R405, AND S405
1712          HC       3

1713          KK    S404
1714          KM   SUB-BASIN S404
1715          BA    .052
1716          LG    .150    .250   5.400    .220  25.000
1717          UC    .179    .113
1718          UA       0       5      16      30      65      77      84      90      94      97
1719          UA     100

1720          KK  CP407B     COMBINE HYDROGRAPHS CP407B AND S404
1721          HC       2

1722          KK    S406
1723          KM   SUB-BASIN S406
1724          BA    .039
1725          LG    .150    .250   4.550    .340  25.000
1726          UC    .208    .127
1727          UA       0       5      16      30      65      77      84      90      94      97
1728          UA     100

1729          KK  CP407C     COMBINE HYDROGRAPHS CP407B AND S406
1730          HC       2

1731          KK    S407
1732          KM   SUB-BASIN S407
1733          BA    .056
1734          LG    .328    .250   4.650    .320   4.000
1735          UC    .162    .070
1736          UA       0       3       5       8      12      20      43      75      90      96
1737          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1738          KK   CP407     COMBINE HYDROGRAPHS DT323, CP407C, AND S407
1739          HC       3

1740          KK   DT407     RETENTION LAKE
1741          RS       1    STOR       0       0
1742          SA       0    7.17   10.13   13.10   16.17   19.13    22.2
1743          SQ       0       0       0       0       0       0       0
1744          SE  1237.9    1238    1240    1242    1244    1246    1248

1745          KK    S119
1746          KM   SUB-BASIN S119
1747          BA    .193
1748          LG    .100    .250   4.500    .350  80.000
1749          UC    .254    .173
1750          UA       0       5      16      30      65      77      84      90      94      97
1751          UA     100

1752          KK    S120
1753          KM   SUB-BASIN S120
1754          BA    .126
1755          LG    .119    .150   7.300    .100  70.000
1756          UC    .208    .119
1757          UA       0       5      16      30      65      77      84      90      94      97
1758          UA     100

1759          KK    S121
1760          KM   SUB-BASIN S121
1761          BA    .073
1762          LG    .100    .150   8.800    .060  80.000
1763          UC    .183    .080
1764          UA       0       5      16      30      65      77      84      90      94      97
1765          UA     100
1766          ZZ
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                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 110        E111
              .
              .
 126          .------->    D119
 124        D111
              V
              V
 129       1R112
              .
              .
 135          .        E104
              .           V
              .           V
 142          .       2R112
              .           .
              .           .
 148          .           .        E112
              .           .           .
              .           .           .
 153        C112.......................
              .
              .
 158          .------->    D120
 156       D112A
              .
              .
 163          .------->  1D121A
 161       D112B
              V
              V
 166       R113A
              .
              .
 172          .       E113A
              .           .
              .           .
 181          .           .------->    D306
 179          .      3D113A
              .           .
              .           .
 186          .           .------->   D310A
 184          .      4D113A
              .           .
              .           .
 191          .           .------->   D310B
 189          .      5D113A
              .           .
              .           .
 194       C113A............
              .
              .
 199          .------->  2D121A
 197      2D113A
              .
              .
 202          .      AR310B
              .           .
              .           .
 211          .           .           .<-------   D310B
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209          .           .      R113A3
             .           .           .
             .           .           .
212      C113O.......................
             V
             V
214      1R113
             .
             .
221          .-------->   1D122
220      1D113
             V
             V
224       R114
             .
             .
232          .-------->   2D122
230       D114
             V
             V
235      4R115
             .
             .
241          .       S201
             .          V
             .          V
248          .      1R202
             .          .
             .          .
253          .          .       S203
             .          .          V
             .          .          V
260          .          .      DT203
             .          .          V
             .          .          V
266          .          .       R204
             .          .          .
             .          .          .
271          .          .          .       S204
             .          .          .          .
             .          .          .          .
278          .          .      CP204............
             .          .          V
             .          .          V
280          .          .      2R202
             .          .          .
             .          .          .
285          .          .          .       S202
             .          .          .          .
             .          .          .          .
292          .      CP202.......................
             .          V
             .          V
294          .      DT202
             .          V
             .          V
300          .       R205
             .          .
             .          .
305          .          .       S205
             .          .          .
             .          .          .
312          .      CP205............
             .          V
             .          V
314          .      1R209
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                .         .
                .         .
320             .         .       S206
                .         .         .
                .         .         .
327             .         .         .        S207
                .         .         .          .
                .         .         .          .
334             .         .     CP2067............
                .         .         V
                .         .         V
336             .         .       R208
                .         .         .
                .         .         .
341             .         .         .        S208
                .         .         .          .
                .         .         .          .
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376             .     1R218
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381             .         .       S210
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399             .         .         .        S211
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406             .         .     CP211............
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408             .         .     DT211
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414             .         .     1R213
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419             .         .         .        S212
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432             .         .         .       2R213
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452             .         .     1R214
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457             .         .         .       S214
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464             .         .     CP214............
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564          .      R219
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576          .     CP219............
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646          .     2R306
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649          .     3R306
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663             .         .     R113A1
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666             .    CP306O............
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668             .         .       S306
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762                                                S310B
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771               DT310C
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776               1R316
781                          S308
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788                          DT308
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793                          R314
798                                          S314
805                          CP314............
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807                          DT314
812                                          S315
819                          CP315............
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845               CP316B............
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                             V
854                          DT101
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869             .-------> D105
867          D103
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872         1R102
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874         2R102
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880             .       S102
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887       CP102.......................
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889       DT102
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895          .      S105A
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902       CP105A............
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905       DT105
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913             .<------- D105
911          .     DR105
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                V
914          .     R105B
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916             .     S105B
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923          .   CP105B............
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926       CP105............
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             V
929       R107B
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935          .      AR3A
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944             .-------> D103A
942          .    DAR3A
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947             .     AR16C
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954             .       .       AR16D
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961          .   CAR16C........................
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964                                  E103A
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971                                  1RAR3
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976                                    .          .<-------   D103A
974                                    .       DR102A
                                       .          V
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977                                    .       2RAR3
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980                                    .          .        AR3
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987                                    .       CAR3.........................
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990                                    .      RAR16A
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996                                    .          .      AR16A
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1027                              CP107A............
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1030                              DT107A
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1056                              CP104.........................
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1058                              DT104
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1071                                   .      DT111
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1249  .    .    .  AR16E
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1713          .          .          .       S404
              .          .          .          .
              .          .          .          .
1720          .          .     CP407B............
              .          .          .
              .          .          .
1722          .          .          .       S406
              .          .          .          .
              .          .          .          .
1729          .          .     CP407C............
              .          .          .
              .          .          .
1731          .          .          .       S407
              .          .          .          .
              .          .          .          .
1738          .      CP407.......................
              .          V
              .          V
1740          .      DT407
              .          .
              .          .
1745          .          .       S119
              .          .          .
              .          .          .
1752          .          .          .       S120
              .          .          .          .
              .          .          .          .
1759          .          .          .          .       S121
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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  12/22/1994  TIME  10:47:44 *
*                                      *
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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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DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE, ARIZONA
STANLEY CONSULTANTS, INC. JOB # 12291
HEC-1 MODEL INPUT FILENAME: D12291.DAT

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*********************************
*                               *
*     PROPOSED COMPLETELY       *
*       DEVELOPED SITE          *
*   100-YEAR, 2-HOUR STORM      *
*                               *
*********************************
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CLARK UNIT HYDROGRAPH

100-YEAR, 2-HR STORM DISTRIBUTION
(FCDMC HYDROLOGIC DESIGN MANUAL; TABLE 2.2)
P100 = 2.77" (NO AERIAL REDUCTION)

COMPUTATION TIME INTERVAL 3 MINUTES

GREEN-AMPT LOSS RATES AND PARAMETERS FOR THE FULLY DEVELOPED CONDITION:

LAND USE	DTHETA CONDITION	VEGETATIVE COVER (%)	RTIMP	IA	ROUGHNESS DESCRIPTION	Kb EQN. PARAMETERS "m"	"b"
Fallow	DRY	20	0	0.50	Low	-0.01375	0.08
Desert	DRY	25	0	0.35	Low	-0.01375	0.08
Open	NORMAL	25	1	0.35	Low	-0.01375	0.08
L.D.R.	NORMAL	25	25	0.15	Min	-0.00625	0.04
M.D.R.	NORMAL	25	35	0.15	Min	-0.00625	0.04
M.F.R.	NORMAL	25	55	0.15	Min	-0.00625	0.04
Comm	NORMAL	25	80	0.10	Min	-0.00625	0.04
Golf	NORMAL	80	1	0.35	Min	-0.00625	0.04
Ag	WET	90	0	0.50	Low	-0.01375	0.08

SURFACE RETENTION LOSS IS BASED ON FCDMC HYDROLOGY MANUAL TABLE 4.1.

SUB-BASIN XKSAT VALUES ARE AREA-WEIGHTED LOGARITHMS OF THE INDIVIDUAL XKSAT VALUES OCCURRING WITHIN THE SUB-BASIN. THE BARE GROUND XKSAT VALUE IS ADJUSTED FOR VEGETATIVE COVER. THE ADJUSTMENT IS AREA-WEIGHTED BY LAND USE AND THE CORRECTION PRESENTED IN FIGURE 4.4 OF THE FCDMC HYDROLOGY MANUAL IS APPLIED. THE EXISTING XKSAT SOIL DISTRIBUTION IS USED AND ASSUMED NOT TO BE AFFECTED BY GRADING AND EARTHWORK FOR THE DEVELOPED CONDITIONS.

THE WETTING FRONT CAPILLARY SUCTION (PSIF) AND VOLUMETRIC SOIL MOISTURE DEFICIT AT THE START OF RAINFALL (DTHETA) ARE A FUNCTION OF THE SUB-BASIN SOIL, GROUND SURFACE, AND LAND USE CHARACTERISTICS. THESE VARIABLES ARE AREA-WEIGHTED BY SUB-BASIN. DTHETA IS A FUNCTION OF THE ASSUMED SOIL MOISTURE CONDITION AT THE START OF RAINFALL FOR THE LAND USES PRESENTED IN THE ABOVE TABLE.

THE DIRECTLY CONNECTED PERCENT IMPERVIOUS (RTIMP) IS ASSUMED TO BE THE SAME AS THAT USED IN THE SUN CITY WEST EXPANSION AREA MASTER DRAINAGE STUDY (JULY 1993), SINCE THE PROJECTS CONTAIN SIMILAR LAND USE.

TIME OF CONCENTRATION (TC), AND STORAGE COEFFICIENT (R), IS BASED ON MCUHP1 (REVISED 12-16-91). LENGTHS AND SLOPES FOR ALL ON-SITE AREAS ARE BASED ON PRELIMINARY LOTING LAYOUTS AND MASS GRADING PLANS.

Kb VALUES ARE BASED ON m AND b PARAMETERS FROM TABLE 5.1 OF HYDROLOGY MANUAL. Kb VALUES ARE AREA-WEIGHTED BY COMPOSITE LAND USE.

THE TIME-AREA RELATION FOR EACH SUB-BASIN IS BASED ON THE FCDMC HYDROLOGY MANUAL TABLE 5.2:

1. OFFSITE AREAS AND EXCEPTION PARCELS USE NATURAL TIME-AREA UA RECORD.
2. ON-SITE AREAS USE AN URBAN TIME-AREA UA RECORD EXCEPT WHERE THE SUB-BASIN IS PRIMARILY GOLF COURSE, IN WHICH CASE, NATURAL TIME-AREA IS USED.

HYDROGRAPH ROUTING THRU STREETS USE KINEMATIC WAVE. STORM DRAIN CONVEYANCE IS DISREGARDED UNLESS IT IS ANTICIPATED TO CROSS SUB-BASIN BOUNDARIES.

HYDROGRAPH ROUTING THRU GUNITE CHANNEL USES KINEMATIC WAVE AND ASSUMES: TRAPEZOID CHANNEL, B=10'; SIDE SLOPE 1V:0.5H; "n" = 0.016; SLOPES ARE BASED ON A PRELIMINARY MASS GRADING PLAN.

HYDROGRAPH ROUTING THRU GOLF COURSE CHANNELS USE NORMAL DEPTH MODIFIED PULS ASSUMING:

1. 8-POINT CROSS-SECTION WITH LOW FLOW AND OVERBANKS
2. LOW FLOW "n" = 0.025; OVERBANK "n" = 0.030
3. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
4. INFILTRATION/PERCOLATION IS ZERO.
5. INITIAL DISCHARGE IS ZERO.
6. GOLF CHANNELS ARE HYPOTHETICAL WITH ARBITRARY DATUM AND SLOPE BASED ON PRELIMINARY MASS GRADING PLAN.

HYDROGRAPH ROUTING THRU RETENTION/DETENTION BASINS USES LEVEL POOL MODIFIED PULS ASSUMING:

1. INFILTRATION/PERCOLATION IS ZERO.
2. DETENTION BASINS ARE EMPTY AT START OF MODEL.
3. DETENTION BASINS USE MASS GRADING ELEVATIONS WHERE AVAILABLE.
4. GOLF COURSE RETENTION BASINS UTILIZE EMERGENCY SPILLWAYS. THE CONCEPT IS TO RETAIN AND RECHARGE THE LOCAL STORMWATER RUNOFF.
5. DETENTION BASINS ASSUME A CONIC SHAPE TO MATCH THE AERIAL EXTENT OF PRELIMINARY LAYOUTS. SIDE SLOPES ARE ASSUMED TO BE 10:1.

ALL FLOW SPLITS WERE ESTIMATED ON THE BASIS OF HYDRAULIC ANALYSES. THE ANALYSES GERERALLY UTILIZED EITHER STEP-BACKWATER, NORMAL DEPTH, WEIR FLOW METHODS OR COMBINATIONS THEREOF.

```
109 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          3  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        1457  ENDING TIME
          ICENT           19  CENTURY MARK

       COMPUTATION INTERVAL     .05 HOURS
           TOTAL TIME BASE   14.95 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

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  2

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	E111	499.	1.80	75.	30.	30.	.50		
DIVERSION TO	D119	188.	1.80	28.	11.	11.	.50		
HYDROGRAPH AT	D111	310.	1.80	47.	19.	19.	.50		
ROUTED TO	1R112	262.	2.50	47.	19.	19.	.50	1306.89	2.50
HYDROGRAPH AT	E104	210.	1.60	23.	9.	9.	.15		
ROUTED TO	2R112	85.	4.15	23.	9.	9.	.15	1318.25	4.15
HYDROGRAPH AT	E112	1793.	1.50	203.	81.	81.	.97		
3 COMBINED AT	C112	1793.	1.50	269.	110.	110.	1.62		
DIVERSION TO	D120	597.	1.50	90.	37.	37.	1.62		
HYDROGRAPH AT	D112A	1196.	1.50	179.	73.	73.	1.62		
DIVERSION TO	1D121A	597.	1.50	90.	37.	37.	1.62		
HYDROGRAPH AT	D112B	598.	1.50	90.	37.	37.	1.62		
ROUTED TO	R113A	514.	1.90	89.	37.	37.	1.62	1284.95	1.90
HYDROGRAPH AT	E113A	930.	1.60	104.	42.	42.	.50		
DIVERSION TO	D306	46.	1.60	15.	6.	6.	.50		
HYDROGRAPH AT	3D113A	884.	1.60	90.	36.	36.	.50		
DIVERSION TO	D310A	15.	1.60	4.	1.	1.	.50		
HYDROGRAPH AT	4D113A	869.	1.60	86.	35.	35.	.50		
DIVERSION TO	D310B	28.	1.60	6.	3.	3.	.50		
HYDROGRAPH AT	5D113A	841.	1.60	80.	32.	32.	.50		
2 COMBINED AT	C113A	1083.	1.70	169.	69.	69.	2.12		
DIVERSION TO	2D121A	147.	1.70	10.	4.	4.	2.12		
HYDROGRAPH AT	2D113A	936.	1.70	159.	65.	65.	2.12		
HYDROGRAPH AT	AR310B	32.	1.30	2.	1.	1.	.01		
HYDROGRAPH AT	R113A3	28.	1.20	6.	3.	3.	.00		
3 COMBINED AT	C113O	969.	1.70	168.	68.	68.	2.13		
ROUTED TO	1R113	893.	2.15	167.	68.	68.	2.13	1277.36	2.15
DIVERSION TO	1D122	624.	2.15	87.	35.	35.	2.13		
HYDROGRAPH AT	1D113	268.	2.15	80.	33.	33.	2.13		

ROUTED TO	R114	259.	2.55	80.	33.	33.	2.13	1260.62	2.55
DIVERSION TO	2D122	1.	2.55	0.	0.	0.	2.13		
HYDROGRAPH AT	D114	259.	2.55	80.	33.	33.	2.13		
ROUTED TO	4R115	255.	2.65	79.	33.	33.	2.13	1251.29	2.65
HYDROGRAPH AT	S201	86.	1.35	9.	4.	4.	.04		
ROUTED TO	1R202	77.	1.50	9.	4.	4.	.04	1.44	1.50
HYDROGRAPH AT	S203	52.	1.35	6.	2.	2.	.03		
ROUTED TO	DT203	0.	.05	0.	0.	0.	.03	1327.56	3.55
ROUTED TO	R204	0.	.05	0.	0.	0.	.03		
HYDROGRAPH AT	S204	55.	1.35	5.	2.	2.	.03		
2 COMBINED AT	CP204	55.	1.35	5.	2.	2.	.05		
ROUTED TO	2R202	53.	1.45	5.	2.	2.	.05	1.10	1.45
HYDROGRAPH AT	S202	239.	1.35	25.	10.	10.	.13		
3 COMBINED AT	CP202	348.	1.40	39.	16.	16.	.23		
ROUTED TO	DT202	153.	1.80	15.	6.	6.	.23	1322.64	1.80
ROUTED TO	R205	151.	2.00	15.	6.	6.	.23	2.68	2.00
HYDROGRAPH AT	S205	268.	1.45	36.	15.	15.	.18		
2 COMBINED AT	CP205	268.	1.45	51.	21.	21.	.40		
ROUTED TO	1R209	268.	1.45	51.	21.	21.	.40	1.76	1.45
HYDROGRAPH AT	S206	37.	1.75	8.	3.	3.	.05		
HYDROGRAPH AT	S207	172.	1.35	19.	8.	8.	.09		
2 COMBINED AT	CP2067	180.	1.40	27.	11.	11.	.13		
ROUTED TO	R208	180.	1.40	27.	11.	11.	.13	1.96	1.40
HYDROGRAPH AT	S208	208.	1.35	22.	9.	9.	.10		
2 COMBINED AT	CP208	384.	1.35	48.	19.	19.	.23		
ROUTED TO	DT208	0.	.05	0.	0.	0.	.23	1327.88	6.20
ROUTED TO	2R209	0.	.05	0.	0.	0.	.23		
HYDROGRAPH AT	S209	150.	1.30	13.	5.	5.	.07		
3 COMBINED AT	CP209	397.	1.35	64.	26.	26.	.70		
ROUTED TO	DT209	0.	.05	0.	0.	0.	.70	1317.40	9.15
ROUTED TO	1R218	0.	.05	0.	0.	0.	.70		
HYDROGRAPH AT	S210	40.	1.25	3.	1.	1.	.02		
ROUTED TO	DT210	0.	.05	0.	0.	0.	.02	1330.17	2.75

ROUTED TO	R211	0.	.05	0.	0.	0.	.02		
HYDROGRAPH AT	S211	58.	1.35	6.	2.	2.	.04		
2 COMBINED AT	CP211	58.	1.35	6.	2.	2.	.05		
ROUTED TO	DT211	0.	.05	0.	0.	0.	.05	1325.19	3.50
ROUTED TO	1R213	0.	.05	0.	0.	0.	.05		
HYDROGRAPH AT	S212	218.	1.35	24.	10.	10.	.11		
ROUTED TO	DT212	52.	1.95	6.	2.	2.	.11	1321.31	1.95
ROUTED TO	2R213	52.	2.00	6.	2.	2.	.11	1.32	2.00
HYDROGRAPH AT	S213	70.	1.30	5.	2.	2.	.03		
3 COMBINED AT	CP213	70.	1.30	11.	4.	4.	.19		
ROUTED TO	DT213	0.	.05	0.	0.	0.	.19	1319.44	9.10
ROUTED TO	1R214	0.	.05	0.	0.	0.	.19		
HYDROGRAPH AT	S214	353.	1.30	28.	11.	11.	.14		
2 COMBINED AT	CP214	353.	1.30	28.	11.	11.	.33		
ROUTED TO	2R218	328.	1.40	28.	11.	11.	.33	3.21	1.40
HYDROGRAPH AT	S215	106.	1.45	16.	7.	7.	.07		
ROUTED TO	DT215	0.	.05	0.	0.	0.	.07	1330.04	4.35
ROUTED TO	R216	0.	.05	0.	0.	0.	.07		
HYDROGRAPH AT	S216	217.	1.35	21.	8.	8.	.11		
2 COMBINED AT	CP216	217.	1.35	21.	8.	8.	.18		
ROUTED TO	DT216	23.	2.05	3.	1.	1.	.18	1325.18	2.05
ROUTED TO	1R217A	24.	2.15	3.	1.	1.	.18	.65	2.15
HYDROGRAPH AT	S217B	104.	1.30	10.	4.	4.	.04		
2 COMBINED AT	CP217B	104.	1.30	13.	5.	5.	.22		
ROUTED TO	DT217B	52.	1.55	7.	3.	3.	.22	1320.81	1.55
ROUTED TO	2R217A	52.	1.55	7.	3.	3.	.22	.93	1.55
HYDROGRAPH AT	S217A	96.	1.45	17.	7.	7.	.09		
2 COMBINED AT	CP217A	146.	1.55	24.	10.	10.	.31		
ROUTED TO	DT217A	71.	2.15	13.	5.	5.	.31	1317.38	2.15
ROUTED TO	3R218	71.	2.20	13.	5.	5.	.31	1.04	2.20
HYDROGRAPH AT	S218	80.	1.40	9.	4.	4.	.05		
4 COMBINED AT	CP218	408.	1.40	50.	20.	20.	1.39		
ROUTED TO	DT218	108.	2.10	24.	10.	10.	1.39	1310.51	2.10

ROUTED TO	R219	108.	2.15	24.	10.	10.	1.39	1.38	2.15
HYDROGRAPH AT	S219	213.	1.20	15.	6.	6.	.07		
2 COMBINED AT	CP219	213.	1.20	39.	16.	16.	1.46		
HYDROGRAPH AT	S220	287.	1.25	23.	9.	9.	.11		
ROUTED TO	R221	271.	1.35	23.	9.	9.	.11	2.19	1.35
HYDROGRAPH AT	S221	121.	1.40	10.	4.	4.	.06		
2 COMBINED AT	CP221	389.	1.35	33.	13.	13.	.17		
ROUTED TO	R222	374.	1.40	33.	13.	13.	.17	2.95	1.40
HYDROGRAPH AT	S222	110.	1.30	10.	4.	4.	.05		
HYDROGRAPH AT	AR222	2.	1.55	1.	0.	0.	.00		
4 COMBINED AT	CP222	618.	1.35	82.	33.	33.	1.68		
ROUTED TO	DT222	0.	.05	0.	0.	0.	1.68	1299.71	13.10
HYDROGRAPH AT	AR18	28.	1.45	3.	1.	1.	.02		
HYDROGRAPH AT	S118	3.	1.50	1.	0.	0.	.00		
2 COMBINED AT	CP118	31.	1.45	3.	1.	1.	.02		
ROUTED TO	1R306	31.	1.50	3.	1.	1.	.02		
2 COMBINED AT	CP306A	31.	1.50	3.	1.	1.	1.70		
ROUTED TO	2R306	30.	1.55	3.	1.	1.	1.70		
ROUTED TO	3R306	28.	1.70	3.	1.	1.	1.70	.83	1.70
HYDROGRAPH AT	AR306	29.	1.65	5.	2.	2.	.04		
2 COMBINED AT	CP306B	56.	1.70	9.	3.	3.	1.74		
HYDROGRAPH AT	R113A1	46.	1.15	15.	6.	6.	.00		
2 COMBINED AT	CP306O	102.	1.70	23.	9.	9.	1.74		
HYDROGRAPH AT	S306	136.	1.45	14.	6.	6.	.08		
2 COMBINED AT	CP306	201.	1.45	37.	15.	15.	1.82		
ROUTED TO	DT306	79.	2.35	14.	6.	6.	1.82	1284.41	2.35
ROUTED TO	R310A	80.	2.45	14.	6.	6.	1.82	1.48	2.45
HYDROGRAPH AT	AR310A	24.	1.25	1.	1.	1.	.01		
HYDROGRAPH AT	R113A2	15.	1.20	4.	1.	1.	.00		
2 COMBINED AT	C310O	39.	1.25	5.	2.	2.	.01		
HYDROGRAPH AT	S310A	39.	1.60	5.	2.	2.	.03		
3 COMBINED AT	C310A	103.	2.35	24.	10.	10.	1.86		
ROUTED TO	1R307	101.	2.45	24.	10.	10.	1.86	1.46	2.45

HYDROGRAPH AT	S307	231.	1.35	24.	10.	10.	.11		
2 COMBINED AT	CP307A	277.	1.35	48.	19.	19.	1.97		
HYDROGRAPH AT	S309	164.	1.15	10.	4.	4.	.05		
ROUTED TO	DT309	0.	.05	0.	0.	0.	.05	1276.98	2.40
ROUTED TO	2R307	0.	.05	0.	0.	0.	.05		
2 COMBINED AT	CP307	277.	1.35	48.	19.	19.	2.01		
HYDROGRAPH AT	S311	249.	1.20	18.	7.	7.	.07		
HYDROGRAPH AT	S310C	155.	1.15	7.	3.	3.	.03		
HYDROGRAPH AT	S310B	98.	1.35	9.	4.	4.	.04		
HYDROGRAPH AT	BR113	7.	1.35	1.	1.	1.	.00		
5 COMBINED AT	CP310C	657.	1.25	84.	34.	34.	2.16		
ROUTED TO	DT310C	0.	.05	0.	0.	0.	2.16	1256.42	11.50
ROUTED TO	1R316	0.	.05	0.	0.	0.	2.16		
HYDROGRAPH AT	S308	431.	1.20	31.	12.	12.	.14		
ROUTED TO	DT308	0.	.05	0.	0.	0.	.14	1279.08	2.55
ROUTED TO	R314	0.	.05	0.	0.	0.	.14		
HYDROGRAPH AT	S314	101.	1.40	11.	4.	4.	.05		
2 COMBINED AT	CP314	101.	1.40	11.	4.	4.	.19		
ROUTED TO	DT314	0.	.05	0.	0.	0.	.19	1270.28	3.55
HYDROGRAPH AT	S315	238.	1.30	22.	9.	9.	.09		
2 COMBINED AT	CP315	238.	1.30	22.	9.	9.	.28		
ROUTED TO	DT315	0.	.05	0.	0.	0.	.28	1272.37	3.05
ROUTED TO	2R316	0.	.05	0.	0.	0.	.28		
HYDROGRAPH AT	S316	396.	1.20	27.	11.	11.	.12		
2 COMBINED AT	CP316A	396.	1.20	27.	11.	11.	.40		
ROUTED TO	DT316	0.	.05	0.	0.	0.	.40	1258.03	2.40
2 COMBINED AT	CP316B	0.	.05	0.	0.	0.	2.56		
HYDROGRAPH AT	S101	304.	1.25	24.	10.	10.	.12		
ROUTED TO	DT101	2.	2.25	1.	0.	0.	.12	1296.06	2.25
HYDROGRAPH AT	S103	208.	1.30	20.	8.	8.	.09		
DIVERSION TO	D105	100.	1.30	15.	6.	6.	.09		
HYDROGRAPH AT	D103	108.	1.30	5.	2.	2.	.09		
ROUTED TO	1R102	106.	1.35	5.	2.	2.	.09		

ROUTED TO	2R102	103.	1.40	5.	2.	2.	.09	1.91	1.40
HYDROGRAPH AT	S102	168.	1.25	13.	5.	5.	.07		
3 COMBINED AT	CP102	250.	1.35	19.	8.	8.	.27		
ROUTED TO	DT102	1.	3.75	0.	0.	0.	.27	1292.02	3.70
HYDROGRAPH AT	S105A	60.	1.20	3.	1.	1.	.02		
2 COMBINED AT	CP105A	60.	1.20	3.	1.	1.	.29		
ROUTED TO	DT105	0.	.05	0.	0.	0.	.29	1289.61	14.95
HYDROGRAPH AT	DR105	100.	1.15	15.	6.	6.	.00		
ROUTED TO	R105B	100.	1.20	15.	6.	6.	.00		
HYDROGRAPH AT	S105B	77.	1.20	5.	2.	2.	.03		
2 COMBINED AT	CP105B	177.	1.20	20.	8.	8.	.03		
2 COMBINED AT	CP105	177.	1.20	20.	8.	8.	.32		
ROUTED TO	R107B	175.	1.25	20.	8.	8.	.32	1289.12	1.25
HYDROGRAPH AT	AR3A	56.	1.35	5.	2.	2.	.03		
DIVERSION TO	D103A	55.	1.35	5.	2.	2.	.03		
HYDROGRAPH AT	DAR3A	1.	1.35	0.	0.	0.	.03		
HYDROGRAPH AT	AR16C	7.	2.15	2.	1.	1.	.02		
HYDROGRAPH AT	AR16D	23.	1.20	1.	1.	1.	.01		
3 COMBINED AT	CAR16C	23.	1.20	4.	2.	2.	.06		
HYDROGRAPH AT	E103A	20.	1.30	2.	1.	1.	.01		
ROUTED TO	1RAR3	20.	1.35	2.	1.	1.	.01		
HYDROGRAPH AT	DR102A	55.	1.35	5.	2.	2.	.00		
ROUTED TO	2RAR3	55.	1.40	5.	2.	2.	.00		
HYDROGRAPH AT	AR3	8.	1.40	1.	0.	0.	.01		
3 COMBINED AT	CAR3	82.	1.40	7.	3.	3.	.02		
ROUTED TO	RAR16A	75.	1.50	7.	3.	3.	.02	1.14	1.50
HYDROGRAPH AT	AR16A	5.	1.55	1.	0.	0.	.01		
HYDROGRAPH AT	AR16B1	8.	1.25	1.	0.	0.	.00		
HYDROGRAPH AT	S116	87.	1.25	6.	2.	2.	.03		
5 COMBINED AT	CP116	150.	1.40	18.	7.	7.	.11		
HYDROGRAPH AT	S107A	50.	1.20	3.	1.	1.	.01		
2 COMBINED AT	CP107A	179.	1.35	21.	9.	9.	.13		
ROUTED TO	DT107A	136.	1.50	13.	5.	5.	.13	1303.38	1.50

ROUTED TO	DT107B	52.	1.85	8.	3.	3.	.13	1300.98	1.85
HYDROGRAPH AT	S104	143.	1.25	12.	5.	5.	.05		
HYDROGRAPH AT	S106	87.	1.25	7.	3.	3.	.03		
3 COMBINED AT	CP104	230.	1.25	27.	11.	11.	.21		
ROUTED TO	DT104	115.	1.50	18.	7.	7.	.21	1295.64	1.50
HYDROGRAPH AT	S111	345.	1.20	26.	10.	10.	.11		
ROUTED TO	DT111	0.	.05	0.	0.	0.	.11	1289.64	2.60
HYDROGRAPH AT	S107B	185.	1.20	9.	4.	4.	.05		
4 COMBINED AT	CP107B	356.	1.20	47.	19.	19.	.69		
ROUTED TO	DT107	8.	3.45	4.	2.	2.	.69	1286.09	3.40
HYDROGRAPH AT	E100B	51.	1.45	7.	3.	3.	.04		
ROUTED TO	R100D	43.	1.85	7.	3.	3.	.04	.41	1.85
HYDROGRAPH AT	E100D	5.	1.65	2.	1.	1.	.01		
2 COMBINED AT	CP100D	47.	1.85	8.	3.	3.	.05		
HYDROGRAPH AT	E100A	27.	2.10	10.	4.	4.	.08		
ROUTED TO	1R100C	20.	4.95	9.	4.	4.	.08	.24	4.95
HYDROGRAPH AT	E100C	138.	1.60	17.	7.	7.	.13		
2 COMBINED AT	1C100C	138.	1.60	23.	11.	11.	.20		
HYDROGRAPH AT	E103B	32.	1.55	5.	2.	2.	.03		
ROUTED TO	2R100C	32.	1.60	5.	2.	2.	.03		
2 COMBINED AT	2C100C	170.	1.60	28.	13.	13.	.24		
2 COMBINED AT	C100CD	181.	1.70	36.	16.	16.	.28		
ROUTED TO	R101	181.	1.70	36.	16.	16.	.28		
DIVERSION TO	ADOT	106.	1.70	30.	14.	14.	.28		
HYDROGRAPH AT	REEMS	82.	1.70	6.	2.	2.	.28		
ROUTED TO	R108	81.	1.75	6.	2.	2.	.28		
HYDROGRAPH AT	S108	206.	1.30	18.	7.	7.	.08		
2 COMBINED AT	CP108	206.	1.30	24.	10.	10.	.37		
ROUTED TO	DT108A	77.	1.90	10.	4.	4.	.37	1289.81	1.90
ROUTED TO	DT108B	10.	2.90	2.	1.	1.	.37	1287.30	2.90
HYDROGRAPH AT	S109C	16.	1.35	2.	1.	1.	.01		
2 COMBINED AT	CP109	16.	1.35	4.	2.	2.	.37		
HYDROGRAPH AT	S109B	110.	1.20	8.	3.	3.	.04		

HYDROGRAPH AT	S109D	51.	1.20	3.	1.	1.	.01		
3 COMBINED AT	CP109D	173.	1.20	16.	6.	6.	.43		
HYDROGRAPH AT	S109A	53.	1.20	4.	2.	2.	.02		
HYDROGRAPH AT	S109E	34.	1.35	3.	1.	1.	.02		
3 COMBINED AT	CP109E	251.	1.25	23.	10.	10.	.47		
ROUTED TO	DT109	0.	.05	0.	0.	0.	.47	1282.20	14.90
HYDROGRAPH AT	S110	413.	1.25	33.	13.	13.	.14		
3 COMBINED AT	CP110	413.	1.25	37.	15.	15.	1.30		
ROUTED TO	DT110	0.	.05	0.	0.	0.	1.30	1281.99	14.95
HYDROGRAPH AT	AR16E	10.	1.30	1.	0.	0.	.00		
HYDROGRAPH AT	AR17B	11.	1.30	1.	0.	0.	.00		
HYDROGRAPH AT	AR16B2	4.	1.30	0.	0.	0.	.00		
3 COMBINED AT	CP117A	24.	1.30	2.	1.	1.	.01		
ROUTED TO	R117A	23.	1.40	2.	1.	1.	.01	.52	1.40
HYDROGRAPH AT	AR17C	23.	1.35	2.	1.	1.	.01		
HYDROGRAPH AT	AR17	18.	1.50	2.	1.	1.	.02		
HYDROGRAPH AT	S117	55.	1.35	5.	2.	2.	.03		
4 COMBINED AT	CP117B	117.	1.40	11.	4.	4.	.07		
ROUTED TO	R113B	114.	1.40	11.	4.	4.	.07	1.25	1.40
HYDROGRAPH AT	S113C	35.	1.30	4.	2.	2.	.02		
HYDROGRAPH AT	S113B	69.	1.20	5.	2.	2.	.03		
3 COMBINED AT	CP113B	193.	1.35	19.	8.	8.	.11		
HYDROGRAPH AT	S113A	71.	1.25	6.	2.	2.	.03		
2 COMBINED AT	CP113	255.	1.35	25.	10.	10.	.14		
ROUTED TO	1R114	255.	1.35	25.	10.	10.	.14	1.90	1.35
HYDROGRAPH AT	S114	216.	1.15	11.	4.	4.	.06		
2 COMBINED AT	CP114	376.	1.25	36.	15.	15.	.20		
ROUTED TO	DT114	184.	1.55	22.	9.	9.	.20	1290.02	1.55
HYDROGRAPH AT	S112	105.	1.20	7.	3.	3.	.03		
2 COMBINED AT	CP112	205.	1.50	28.	11.	11.	.24		
ROUTED TO	DT112	50.	2.20	8.	3.	3.	.24	1288.24	2.20
HYDROGRAPH AT	S115	296.	1.20	19.	8.	8.	.09		
2 COMBINED AT	CP115A	296.	1.20	27.	11.	11.	.32		

ROUTED TO	DT115A	40.	2.45	10.	4.	4.	.32	1285.27	2.45
2 COMBINED AT	CP115B	40.	2.45	10.	4.	4.	1.62		
ROUTED TO	DT115B	0.	.05	0.	0.	0.	1.62	1284.08	14.90
HYDROGRAPH AT	S303	175.	1.25	14.	6.	6.	.07		
ROUTED TO	DT303	0.	.05	0.	0.	0.	.07	1290.47	2.90
ROUTED TO	R304	0.	.05	0.	0.	0.	.07		
HYDROGRAPH AT	S304	184.	1.25	13.	5.	5.	.07		
2 COMBINED AT	CP304	184.	1.25	13.	5.	5.	.14		
ROUTED TO	DT304	0.	.05	0.	0.	0.	.14	1286.39	2.65
ROUTED TO	R305	0.	.05	0.	0.	0.	.14		
HYDROGRAPH AT	S305	121.	1.20	7.	3.	3.	.04		
2 COMBINED AT	CP305	121.	1.20	7.	3.	3.	.18		
ROUTED TO	DT305	0.	.05	0.	0.	0.	.18	1277.46	2.60
ROUTED TO	R312	0.	.05	0.	0.	0.	.18		
HYDROGRAPH AT	S312	174.	1.30	13.	5.	5.	.07		
2 COMBINED AT	CP312A	174.	1.30	13.	5.	5.	.25		
2 COMBINED AT	CP312	174.	1.30	13.	5.	5.	1.87		
ROUTED TO	DT312	0.	.05	0.	0.	0.	1.87	1270.62	2.85
HYDROGRAPH AT	S313	572.	1.30	49.	20.	20.	.24		
2 COMBINED AT	CP313	572.	1.30	49.	20.	20.	2.11		
ROUTED TO	DT313	451.	1.45	32.	13.	13.	2.11	1264.31	1.45
ROUTED TO	R317	433.	1.50	32.	13.	13.	2.11	3.29	1.50
HYDROGRAPH AT	S317	207.	1.20	13.	5.	5.	.06		
2 COMBINED AT	CP317	484.	1.45	45.	18.	18.	2.17		
ROUTED TO	DT317	303.	1.65	23.	9.	9.	2.17	1263.51	1.65
2 COMBINED AT	CP322A	303.	1.65	23.	9.	9.	4.73		
HYDROGRAPH AT	S322	424.	1.15	20.	8.	8.	.09		
2 COMBINED AT	CP322B	424.	1.15	43.	17.	17.	4.82		
HYDROGRAPH AT	BR114	7.	1.35	1.	1.	1.	.00		
ROUTED TO	5R115	6.	1.75	1.	1.	1.	.00	1250.07	1.75
HYDROGRAPH AT	BR115	6.	1.45	2.	1.	1.	.01		
2 COMBINED AT	C115W	12.	1.70	3.	1.	1.	.01		
2 COMBINED AT	CP322C	428.	1.15	46.	18.	18.	4.84		

ROUTED TO	DT322	0.	.05	0.	0.	0.	4.84	1245.49	7.25
2 COMBINED AT	C115	255.	2.65	79.	33.	33.	6.97		
HYDROGRAPH AT	S319	93.	1.25	7.	3.	3.	.04		
HYDROGRAPH AT	S320	154.	1.30	15.	6.	6.	.06		
2 COMBINED AT	CP323A	244.	1.30	22.	9.	9.	.10		
HYDROGRAPH AT	S321	158.	1.40	22.	9.	9.	.10		
2 COMBINED AT	CP323B	385.	1.30	44.	18.	18.	.20		
HYDROGRAPH AT	S323	204.	1.15	9.	3.	3.	.05		
2 COMBINED AT	CP323	475.	1.25	53.	21.	21.	.25		
ROUTED TO	DT323	0.	.05	0.	0.	0.	.25	1247.58	4.15
HYDROGRAPH AT	S302A	108.	1.25	9.	4.	4.	.04		
ROUTED TO	1R302	107.	1.25	9.	4.	4.	.04		
HYDROGRAPH AT	S302B	46.	1.10	2.	1.	1.	.01		
ROUTED TO	2R302	44.	1.20	2.	1.	1.	.01		
2 COMBINED AT	CP302A	146.	1.25	11.	5.	5.	.05		
ROUTED TO	3R302	145.	1.25	11.	5.	5.	.05		
HYDROGRAPH AT	S302	241.	1.30	24.	10.	10.	.09		
2 COMBINED AT	CP302B	383.	1.30	35.	14.	14.	.14		
HYDROGRAPH AT	S301	54.	1.60	13.	5.	5.	.05		
ROUTED TO	4R302	53.	1.60	13.	5.	5.	.05		
2 COMBINED AT	CP302C	404.	1.30	48.	19.	19.	.19		
ROUTED TO	R324	401.	1.30	48.	19.	19.	.19		
HYDROGRAPH AT	S324	195.	1.55	26.	10.	10.	.13		
2 COMBINED AT	CP324	510.	1.40	74.	30.	30.	.32		
ROUTED TO	1R402	507.	1.45	74.	30.	30.	.32		
HYDROGRAPH AT	S402	72.	1.40	11.	4.	4.	.06		
2 COMBINED AT	CP402A	578.	1.40	85.	34.	34.	.38		
HYDROGRAPH AT	S403	173.	1.35	19.	8.	8.	.09		
ROUTED TO	2R402	171.	1.35	19.	8.	8.	.09		
2 COMBINED AT	CP402	748.	1.40	105.	42.	42.	.47		
ROUTED TO	3R402	745.	1.40	105.	42.	42.	.47		
HYDROGRAPH AT	S325A	81.	1.20	5.	2.	2.	.03		
ROUTED TO	R325	79.	1.30	6.	2.	2.	.03		

HYDROGRAPH AT	S325	323.	1.20	22.	9.	9.	.11		
2 COMBINED AT	CP325	399.	1.25	28.	11.	11.	.14		
ROUTED TO	1R401	394.	1.25	28.	11.	11.	.14		
HYDROGRAPH AT	S400	191.	1.20	12.	5.	5.	.06		
ROUTED TO	2R401	187.	1.25	13.	5.	5.	.06		
2 COMBINED AT	CP401A	581.	1.25	40.	16.	16.	.20		
HYDROGRAPH AT	S401	120.	1.35	14.	5.	5.	.06		
2 COMBINED AT	CP401	689.	1.25	54.	22.	22.	.26		
ROUTED TO	R405	688.	1.30	54.	22.	22.	.26		
HYDROGRAPH AT	S405	50.	1.35	6.	2.	2.	.03		
3 COMBINED AT	CP407A	1422.	1.35	165.	66.	66.	.76		
HYDROGRAPH AT	S404	160.	1.20	11.	4.	4.	.05		
2 COMBINED AT	CP407B	1537.	1.30	176.	71.	71.	.81		
HYDROGRAPH AT	S406	108.	1.25	8.	3.	3.	.04		
2 COMBINED AT	CP407C	1638.	1.30	183.	74.	74.	.85		
HYDROGRAPH AT	S407	186.	1.20	9.	4.	4.	.06		
3 COMBINED AT	CP407	1783.	1.30	192.	77.	77.	1.16		
ROUTED TO	DT407	0.	.05	0.	0.	0.	1.16	1245.45	14.35
HYDROGRAPH AT	S119	540.	1.25	52.	21.	21.	.19		
HYDROGRAPH AT	S120	412.	1.20	34.	14.	14.	.13		
HYDROGRAPH AT	S121	273.	1.20	21.	8.	8.	.07		

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
1R306	MANE	1.66	30.70	90.24	1.34	3.00	30.64	90.00	1.34

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1711E+01 EXCESS= .0000E+00 OUTFLOW= .1710E+01 BASIN STORAGE= .2552E-06 PERCENT ERROR= .1

2R306	MANE	1.01	30.62	92.07	.02	3.00	30.32	93.00	.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1710E+01 EXCESS= .0000E+00 OUTFLOW= .1711E+01 BASIN STORAGE= .4799E-06 PERCENT ERROR= .0

1R102	MANE	1.23	106.27	80.89	.55	3.00	106.03	81.00	.54

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2573E+01 EXCESS= .0000E+00 OUTFLOW= .2633E+01 BASIN STORAGE= .7422E-04 PERCENT ERROR= -2.3

R105B	MANE	.49	100.00	70.03	-1.00	3.00	100.00	72.00	-1.00
1RAR3	MANE	1.16	20.34	81.31	1.35	3.00	20.34	81.00	1.35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7921E+00 EXCESS= .0000E+00 OUTFLOW= .7928E+00 BASIN STORAGE= .2026E-06 PERCENT ERROR= -.1

2RAR3	MANE	.49	54.58	82.13	-1.00	3.00	54.58	84.00	-1.00
2R100C	MANE	2.34	32.27	96.91	1.27	3.00	32.26	96.00	1.27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2295E+01 EXCESS= .0000E+00 OUTFLOW= .2294E+01 BASIN STORAGE= .1426E-05 PERCENT ERROR= .0

R101	MANE	.84	180.76	103.33	1.34	3.00	180.56	102.00	1.34

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2018E+02 EXCESS= .0000E+00 OUTFLOW= .2017E+02 BASIN STORAGE= .1040E-01 PERCENT ERROR= .0

R108	MANE	.83	81.79	103.55	.20	3.00	81.40	105.00	.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3026E+01 EXCESS= .0000E+00 OUTFLOW= .3031E+01 BASIN STORAGE= .1881E-07 PERCENT ERROR= -.2

1R302	MANE	.72	107.60	76.11	2.24	3.00	107.27	75.00	2.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4402E+01 EXCESS= .0000E+00 OUTFLOW= .4413E+01 BASIN STORAGE= .1369E-04 PERCENT ERROR= -.3

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          2R302  MANE        2.52     44.65     71.37      2.26      3.00     43.95     72.00        2.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1181E+01 EXCESS= .0000E+00 OUTFLOW= .1204E+01 BASIN STORAGE= .1862E-03 PERCENT ERROR=  -2.0

          3R302  MANE         .94    145.77     76.05      2.24      3.00    145.49     75.00        2.24

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5611E+01 EXCESS= .0000E+00 OUTFLOW= .5622E+01 BASIN STORAGE= .9429E-04 PERCENT ERROR=   -.2

          4R302  MANE         .42     53.57     96.99      2.30      3.00     53.41     96.00        2.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6618E+01 EXCESS= .0000E+00 OUTFLOW= .6619E+01 BASIN STORAGE= .2490E-06 PERCENT ERROR=    .0

           R324  MANE         .86    402.84     79.56      2.32      3.00    400.68     78.00        2.32

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2397E+02 EXCESS= .0000E+00 OUTFLOW= .2399E+02 BASIN STORAGE= .1694E-03 PERCENT ERROR=   -.1

          1R402  MANE         .48    510.26     85.02      2.13      3.00    506.77     87.00        2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3680E+02 EXCESS= .0000E+00 OUTFLOW= .3681E+02 BASIN STORAGE= .1372E-03 PERCENT ERROR=    .0

          2R402  MANE         .41    172.62     81.69      1.96      3.00    171.39     81.00        1.96

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9518E+01 EXCESS= .0000E+00 OUTFLOW= .9523E+01 BASIN STORAGE= .4049E-05 PERCENT ERROR=    .0

          3R402  MANE         .43    747.33     84.82      2.07      3.00    745.02     84.00        2.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5191E+02 EXCESS= .0000E+00 OUTFLOW= .5191E+02 BASIN STORAGE= .9767E-04 PERCENT ERROR=    .0

           R325  MANE        2.02     80.79     76.33      1.77      3.00     79.08     78.00        1.78

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2710E+01 EXCESS= .0000E+00 OUTFLOW= .2743E+01 BASIN STORAGE= .1869E-03 PERCENT ERROR=  -1.2

          1R401  MANE         .75    397.08     76.06      1.83      3.00    394.01     75.00        1.83

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1376E+02 EXCESS= .0000E+00 OUTFLOW= .1379E+02 BASIN STORAGE= .1045E-03 PERCENT ERROR=   -.3

          2R401  MANE        2.33    189.90     76.19      1.98      3.00    186.69     75.00        1.97

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6163E+01 EXCESS= .0000E+00 OUTFLOW= .6223E+01 BASIN STORAGE= .9756E-03 PERCENT ERROR=  -1.0

           R405  MANE         .58    688.44     76.70      1.92      3.00    687.58     78.00        1.92

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2669E+02 EXCESS= .0000E+00 OUTFLOW= .2673E+02 BASIN STORAGE= .9663E-03 PERCENT ERROR=   -.1
```

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

APPENDIX D
PROPOSED PHASE I DRAINAGE HEC-1 OUTPUT AND SUPPORTING CALCULATIONS

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
* RUN DATE  12/22/1994  TIME  10:42:32 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
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
  2           ID       DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE, ARIZONA
  3           ID       STANLEY CONSULTANTS JOB # 12291
  4           ID       HEC-1 MODEL INPUT FILENAME: P12291.DAT
  5           ID
  6           ID       ********************************
  7           ID       *                              *
  8           ID       * PHASE I DEVELOPED CONDITIONS *
  9           ID       *   100-YEAR, 2-HOUR STORM     *
 10           ID       *                              *
 11           ID       ********************************
 12           ID
 13           ID       CLARK UNIT HYDROGRAPH
 14           ID
 15           ID       100-YEAR, 2-HR STORM DISTRIBUTION
 16           ID       (FCDMC HYDROLOGIC DESIGN MANUAL; TABLE 2.2)
 17           ID       P100 = 2.77"  (NO AERIAL REDUCTION)
 18           ID
 19           ID       COMPUTATION TIME INTERVAL 3 MINUTES
 20           ID
 21           ID       GREEN-AMPT LOSS RATES AND PARAMETERS FOR DEVELOPED AND EXISTING
 22           ID       CONDITIONS:
 23           ID
 24           ID              DTHETA   VEGETATIVE            ROUGHNESS  Kb EQN. PARAMETERS
 25           ID     LAND USE CONDITION  COVER (%) RTIMP  IA  DESCRIPTION    "m"     "b"
 26           ID      ------- --------- ---------- ----- ---- ----------- --------  ------
 27           ID      Desert     DRY         25       0  0.35      Low    -0.01375   0.08
 28           ID      OPEN     NORMAL        25       1  0.35      Low    -0.01375   0.08
 29           ID      L.D.R.   NORMAL        25      25  0.15      Min    -0.00625   0.04
 30           ID      M.D.R.   NORMAL        25      35  0.15      Min    -0.00625   0.04
 31           ID      M.F.R.   NORMAL        25      55  0.15      Min    -0.00625   0.04
 32           ID      Comm     NORMAL        25      80  0.10      Min    -0.00625   0.04
 33           ID      Ag         WET         90       0  0.50      Low    -0.01375   0.08
 34           ID      Fallow     DRY         20       0  0.50      Low    -0.01375   0.08
 35           ID
 36           ID       SURFACE RETENTION LOSS IS BASED ON FCDMC HYDROLOGY MANUAL TABLE 4.1.
 37           ID
 38           ID       SUB-BASIN XKSAT VALUES ARE AREA-WEIGHTED LOGARITHMS OF THE INDIVIDUAL
 39           ID       XKSAT VALUES OCCURRING WITHIN THE SUB-BASIN.  THE BARE GROUND XKSAT
 40           ID       VALUE IS ADJUSTED FOR VEGETATIVE COVER.  THE ADJUSTMENT IS AREA-WEIGHTED
 41           ID       BY LAND USE AND THE CORRECTION PRESENTED IN FIGURE 4.4 OF THE FCDMC
 42           ID       HYDROLOGY MANUAL IS APPLIED.  THE WHITE TANKS/AGUA FRIA ADMS SOIL
 43           ID       DISTRIBUTION IS ASSUMED FOR THE EXISTING CONDITIONS. THE EXISTING XKSAT
 44           ID       SOIL DISTRIBUTION IS USED FOR PHASE I AND ASSUMED NOT TO BE AFFECTED
 45           ID       BY GRADING AND EARTHWORK FOR THE DEVELOPED CONDITIONS.
 46           ID
 47           ID       THE WETTING FRONT CAPILLARY SUCTION (PSIF) AND VOLUMETRIC SOIL MOISTURE
 48           ID       DEFICIT AT THE START OF RAINFALL (DTHETA) ARE A FUNCTION OF THE SUB-
 49           ID       BASIN SOIL, GROUND SURFACE, AND LAND USE CHARACTERISTICS.  THESE
 50           ID       VARIABLES ARE AREA-WEIGHTED BY SUB-BASIN.  DTHETA IS A FUNCTION OF THE
 51           ID       ASSUMED SOIL MOISTURE CONDITION AT THE START OF RAINFALL FOR THE LAND
 52           ID       USES PRESENTED IN THE ABOVE TABLE.
 53           ID
 54           ID       TIME OF CONCENTRATION (TC), AND STORAGE COEFFICIENT (R), IS BASED ON
 55           ID       MCUHP1 (REVISED 12-16-91). LENGTHS AND SLOPES FOR ALL EXISTING CONDITION
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  56          ID       ON-SITE AREAS ARE BASED ON EXISTING 1' CONTOUR TOPOGRAPHIC MAPPING.
  57          ID       LENGTHSAND SLOPES FOR THE PHASE I DEVELOPED AREAS ARE BASED ON
  58          ID       PRELIMINARY LOTING LAYOUTS AND MASS GRADING PLANS. CONTRIBUTING OFF-SITE
  59          ID       AREAS WEST OF SR 303L BETWEEN BELL ROAD AND UNION HILLS DRIVE ARE
  60          ID       IDENTICAL TO THE WHITE TANKS/AGUA FRIA ADMS.
  61          ID
  62          ID       Kb VALUES ARE BASED ON m AND b PARAMETERS FROM TABLE 5.1 OF HYDROLOGY
  63          ID       MANUAL.  Kb VALUES ARE AREA-WEIGHTED BY COMPOSITE LAND USE.
  64          ID
  65          ID       THE DIRECTLY CONNECTED PERCENT IMPERVIOUS (RTIMP) IS ASSUMED TO BE THE
  66          ID       SAME AS THAT USED IN THE SUN CITY WEST EXPANSION AREA MASTER DRAINAGE
  67          ID       STUDY (JULY 1993), SINCE THE PROJECTS CONTAIN SIMILAR LAND USE.
  68          ID
  69          ID       HYDROGRAPH ROUTING THRU STREETS USE KINEMATIC WAVE.  STORM DRAIN
  70          ID       CONVEYANCE IS DISREGARDED UNLESS IT IS ANTICIPATED TO CROSS SUB-BASIN
  71          ID       BOUNDARIES.
  72          ID
  73          ID       THE TIME-AREA RELATION FOR EACH SUB-BASIN IS BASED ON THE FCDMC
  74          ID       HYDROLOGY MANUAL TABLE 5.2:
  75          ID         1. OFF-SITE AREAS AND EXCEPTION PARCELS USE NATURAL TIME-AREA UA
  76          ID            RECORD.
  77          ID         2. ON-SITE DEVELOPED AREAS USE AN URBAN TIME-AREA UA RECORD EXCEPT
  78          ID            WHERE THE SUB-BASIN IS PRIMARILY GOLF COURSE, IN WHICH CASE,
  79          ID            NATURAL TIME-AREA UA RECORDS ARE USED.
  80          ID
  81          ID       HYDROGRAPH ROUTING THRU THE EXISTING WATERSHED USES NORMAL DEPTH
  82          ID       MODIFIED PULS ASSUMING:
  83          ID
  84          ID       1. 8-POINT CROSS-SECTION REPRESENTATIVE OF THE CHANNEL REACH.
  85          ID       2. WHITE TANKS/AGUA FRIA ADMS ROUTING BLOCKS WHERE APPLICABLE.
  86          ID       3. "n" VALUES BASED ON FIELD RECON GENERALLY DECREASING IN THE
  87          ID          DOWNSTREAM DIRECTION AS A RESULT OF THE INCREASED DEPTH.
  88          ID       4. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH
  89          ID          APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
  90          ID       5. INFILTRATION/PERCOLATION IS ZERO.
  91          ID       6. INITIAL DISCHARGE IS ZERO.
  92          ID
  93          ID       HYDROGRAPH ROUTING THRU GOLF COURSE CHANNELS USE NORMAL DEPTH MODIFIED
  94          ID       PULS ASSUMING:
  95          ID
  96          ID       1. 8-POINT CROSS-SECTION WITH LOW FLOW AND OVERBANKS
  97          ID       2. LOW FLOW "n" = 0.025; OVERBANK "n" = 0.030
  98          ID       3. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH
  99          ID          APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
 100          ID       4. INFILTRATION/PERCOLATION IS ZERO.
 101          ID       5. INITIAL DISCHARGE IS ZERO.
 102          ID       6. GOLF CHANNELS ARE HYPOTHETICAL WITH ARBITRARY DATUM AND SLOPE
 103          ID          BASED ON A PRELIMINARY MASS GRADING PLAN.
 104          ID
 105          ID       HYDROGRAPH ROUTING THRU RETENTION/DETENTION BASINS USES LEVEL POOL
 106          ID       MODIFIED PULS ASSUMING:
 107          ID
 108          ID       1. INFILTRATION/PERCOLATION IS ZERO.
 109          ID       2. DETENTION BASINS ARE EMPTY AT START OF MODEL.
 110          ID       3. PROPOSED PHASE I DETENTION BASINS USE MASS GRADING ELEVATIONS
```

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

 111          ID          WHERE AVAILABLE.
 112          ID       4. EXISTING TOPOGRAPHY USED TO DEVELOP SA/SE RELATIONS FOR PROPOSED
 113          ID          TEMPORARY DETENTION BASINS.
 114          ID       5. GOLF COURSE RETENTION BASINS UTILIZE EMERGENCY SPILLWAYS.  THE
 115          ID          CONCEPT IS TO RETAIN AND RECHARGE THE LOCAL STORMWATER RUNOFF.
 116          ID       6. PRELIMINARY GOLF COURSE GRADING PLANS WERE USED TO DEVELOP SA/SE
 117          ID          RELATIONS FOR THE DETENTION/RETENTION BASINS.
 118          ID
 119          ID       ALL FLOW SPLITS WERE ESTIMATED ON THE BASIS OF HYDRAULIC ANALYSES.  THE
 120          ID       ANALYSES GERERALLY UTILIZED EITHER STEP-BACKWATER, NORMAL DEPTH, WEIR
 121          ID       FLOW METHODS OR COMBINATIONS THEREOF.
 122          ID
              *DIAGRAM
 123          IT      3                    300
 124          IO      5

 125          KK    S101
 126          KM   SUB-BASIN S101
 127          BA    .116
 128          IN      5
 129          KM   RAINFALL DEPTH OF 2.77 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 130          PB   2.770
 131          KM   THE FOLLOWING PC RECORD USED A 2-HOUR RAINFALL DISTRIBUTION
 132          PC    .000    .011    .018    .023    .028    .032    .046    .071    .100    .137
 133          PC    .176    .232    .327    .601    .743    .863    .901    .930    .954    .962
 134          PC    .970    .979    .982    .992   1.000
 135          LG    .190    .250   6.000    .180  20.000
 136          UC    .246    .158
 137          UA       0       5      16      30      65      77      84      90      94      97
 138          UA     100

 139          KK   DT101
 140          KM        GOLF COURSE LAKE
 141          RS       1    STOR       0       0
 142          SA       0    1.39    1.72    2.31    2.85    3.24    3.69    4.27    4.73    4.73
 143          SE  1291.4  1291.5  1292.5  1293.5  1294.5    1295  1295.5    1296  1296.5    1297
 144          SS    1296      45     3.0     1.5

 145          KK    S103
 146          KM   SUB-BASIN S103
 147          BA    .090
 148          LG    .133    .250   4.650    .320  46.000
 149          UC    .275    .228
 150          UA       0       5      16      30      65      77      84      90      94      97
 151          UA     100

 152          KK    D103
 153          KM        DIVERT 10-YEAR STORM DRAIN THROUGH S105 (48")
 154          DT    D105
 155          DI       0     100     200     500
 156          DQ       0     100     100     100
```

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

 157          KK   1R102     ROUTE D103 THRU S102, ARTERIAL STREET R.O.W.
 158          RK    1200   .0042    .016            TRAP      60    0.05

 159          KK   2R102
 160          KM        ROUTE FLOW FROM R102B TO CP102
 161          RS       2    FLOW      -1
 162          RC    .035    .035    .035     500   .0024
 163          RX       0      10      12      14      25      27      35      47
 164          RY     2.5     1.5      .5       0       0      .5     1.5     2.5

 165          KK    S102
 166          KM   SUB-BASIN S102
 167          BA    .067
 168          LG    .181    .250   4.900    .280  21.000
 169          UC    .225    .168
 170          UA       0       5      16      30      65      77      84      90      94      97
 171          UA     100

 172          KK   CP102     COMBINE HYDROGRAPHS DT101, 2R102, S102
 173          HC       3

 174          KK   DT102
 175          KM        GOLF COURSE LAKE
 176          RS       1    STOR       0       0
 177          SA       0    1.56    1.94    2.53    3.03    3.52    3.77    3.77
 178          SE  1288.4  1288.5    1289    1290    1291    1292  1292.5    1293
 179          SS    1292     115     3.0     1.5

 180          KK   S105A
 181          KM   SUB-BASIN S105A
 182          BA    .019
 183          LG    .297    .250   4.400    .410   7.000
 184          UC    .133    .079
 185          UA       0       3       5       8      12      20      43      75      90      96
 186          UA     100

 187          KK  CP105A     COMBINE HYDROGRAPHS DT102, AND S105A
 188          KM        ROADWAY CROSSING OF GOLF COURSE (ELMIN = 1289.3')
 189          HC       2

 190          KK   DT105
 191          KM        GOLF COURSE LAKE
 192          RS       1    STOR       0       0
 193          SA       0    0.75    0.96    1.36    1.82    3.58    3.58
 194          SE  1287.5    1288    1289    1290    1291    1292  1292.5
 195          SS    1292      35     3.0     1.5

 196          KK   DR105
 197          KM        RECALL 10-YEAR STORM DRAIN THROUGH S105
 198          DR    D105
```

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

 199          KK   R105B     ROUTE 10-YEAR STORM DRAIN THRU S105
 200          RK     900   .0033    .012            CIRC       4

 201          KK   S105B
 202          KM   SUB-BASIN S105B
 203          BA    .026
 204          LG    .150    .250   4.400    .370  28.000
 205          UC    .158    .118
 206          UA       0       5      16      30      65      77      84      90      94      97
 207          UA     100

 208          KK  CP105B     COMBINE HYDROGRAPHS R105B, AND S105B
 209          KM        CONCENTRATION PT. BEFORE ENTERING GOLF COURSE
 210          HC       2

 211          KK   CP105     COMBINE HYDROGRAPHS CP105B, AND DT105
 212          KM        ROADWAY CROSSING OF GOLF COURSE
 213          HC       2

 214          KK   R107B
 215          KM        ROUTE HYDROGRAPH  CP105 TO  CP107B GOLF CHANNEL
 216          RS       1    FLOW      -1
 217          RC     .03    .025     .03     600   .0035
 218          RX     500     512     533     545     555     567     588     600
 219          RY    1292    1290    1290    1287    1287    1290    1290    1292

 220          KK    AR3A
 221          KM   SUB-BASIN AR3A
 222          BA    .032
 223          LG    .350    .350   4.800    .290    .000
 224          UC    .283    .254
 225          UA       0       3       5       8      12      20      43      75      90      96
 226          UA     100

 227          KK   DAR3A
 228          KM       DIVERT AR3A ( 2-24" RCP TO S103A )
 229          DT   D103A
 230          DI       0      10      50      54     100     150     200     250
 231          DQ       0      10      50      54      67      67      67      67

 232          KK   AR16C
 233          KM   SUB-BASIN AR16C
 234          BA    .017
 235          LG    .350    .350   4.800    .290    .000
 236          UC   1.158   1.696
 237          UA       0       3       5       8      12      20      43      75      90      96
 238          UA     100

 239          KK   AR16D
 240          KM   SUB-BASIN AR16D
 241          BA    .007
 242          LG    .350    .290   8.400    .070    .000
 243          UC    .138    .101
 244          UA       0       3       5       8      12      20      43      75      90      96
```

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

 245          UA     100

 246          KK  CAR16C
 247          KM       ADD HYDROGRAPHS AT CAR16C - DAR3A, AR16C, AR16D
 248          HC       3

 249          KK   E103A
 250          KM   SUB-BASIN E103A
 251          BA    .011
 252          LG    .350    .350   4.800    .290    .000
 253          UC    .204    .238
 254          UA       0       3       5       8      12      20      43      75      90      96
 255          UA     100

 256          KK   1RAR3
 257          KM        ROUTE E103A TO CAR3
 258          RK     840   .0030    .020            TRAP       5       1

 259          KK  DR102A
 260          KM       RECALL D102A ( FROM S102A )
 261          DR   D103A

 262          KK   2RAR3
 263          KM        ROUTE D103A TO CAR3
 264          RK     460   .0030    .020            TRAP       5       1

 265          KK     AR3
 266          KM   SUB-BASIN AR3
 267          BA    .006
 268          LG    .350    .370   5.200    .250    .000
 269          UC    .296    .428
 270          UA       0       3       5       8      12      20      43      75      90      96
 271          UA     100

 272          KK    CAR3
 273          KM       ADD HYDROGRAPHS 1RAR3, 2RAR3, AR3
 274          HC       3

 275          KK  RAR16A
 276          KM        ROUTE HYDROGRAPH CAR3 TO C116, GOLF CHANNEL
 277          RS       2    FLOW      -1
 278          RC     .03    .025     .03    1480   .0030
 279          RX     500     512     533     545     555     567     588     600
 280          RY       3       2       1       0       0       1       2       3

 281          KK   AR16A
 282          KM   SUB-BASIN AR16A
 283          BA    .006
 284          LG    .350    .390   6.200    .160    .000
 285          UC    .454   1.686
 286          UA       0       5      16      30      65      77      84      90      94      97
 287          UA     100
```

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

 288          KK  AR16B1
 289          KM   SUB-BASIN AR16B1
 290          BA    .003
 291          LG    .350    .250   9.700    .050    .000
 292          UC    .146    .174
 293          UA       0       3       5       8      12      20      43      75      90      96
 294          UA     100

 295          KK    S116
 296          KM   SUB-BASIN S116
 297          BA    .031
 298          LG    .329    .190   6.600    .150   4.000
 299          UC    .208    .135
 300          UA       0       3       5       8      12      20      43      75      90      96
 301          UA     100

 302          KK    C116
 303          KM       ADD HYDROGRAPHS CAR16C, RAR16A, AR16A, AR16B1 S116
 304          HC       5

 305          KK   S107A
 306          KM   SUB-BASIN S107A
 307          BA    .014
 308          LG    .293    .150   8.400    .080   8.000
 309          UC    .133    .088
 310          UA       0       3       5       8      12      20      43      75      90      96
 311          UA     100

 312          KK  CP107A
 313          KM       ADD HYDROGRAPHS C116 AND S107A
 314          HC       2

 315          KK  DT107A
 316          KM        GOLF COURSE LAKE
 317          RS       1    STOR       0       0
 318          SA       0    1.08    1.25    1.44    1.74    1.74
 319          SE  1299.5    1300    1301    1302    1303    1304
 320          SS    1303     190     3.0     1.5

 321          KK  DT107B
 322          KM        GOLF COURSE LAKE
 323          RS       1    STOR       0       0
 324          SA       0    0.56    0.72    1.24    1.37    1.37
 325          SE  1297.9    1298    1299    1300  1300.5    1301
 326          SS  1300.4      40     3.0     1.5

 327          KK    S104
 328          KM   SUB-BASIN S104
 329          BA    .054
 330          LG    .201    .210   6.400    .150  26.000
 331          UC    .221    .172
 332          UA       0       5      16      30      65      77      84      90      94      97
 333          UA     100
```

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

 334          KK    S106
 335          KM   SUB-BASIN S106
 336          BA    .032
 337          LG    .150    .190   6.600    .140  25.000
 338          UC    .192    .173
 339          UA       0       5      16      30      65      77      84      90      94      97
 340          UA     100

 341          KK   CP104     COMBINE HYDROGRAPHS DT107B, S104 AND S106
 342          HC       3

 343          KK   DT104
 344          KM        GOLF COURSE LAKE
 345          RS       1    STOR       0       0
 346          SA       0    1.02    1.20    1.71    2.30    2.75    2.75
 347          SE  1291.9    1292    1293    1294    1295  1295.5    1296
 348          SS    1295      75     3.0     1.5

 349          KK    S111
 350          KM   SUB-BASIN S111
 351          BA    .113
 352          LG    .177    .190   6.600    .140  32.000
 353          UC    .204    .124
 354          UA       0       5      16      30      65      77      84      90      94      97
 355          UA     100

 356          KK   DT111
 357          KM        2 - GOLF COURSE LAKES
 358          RS       1    STOR       0       0
 359          SA       0    1.16    2.62    3.58    4.91    6.49    7.24    7.24
 360          SE  1285.9    1286    1287    1288    1289    1290  1290.5    1291
 361          SS    1290     140     3.0     1.5

 362          KK   S107B
 363          KM   SUB-BASIN S107B
 364          BA    .051
 365          LG    .328    .190   6.600    .160   4.000
 366          UC    .146    .068
 367          UA       0       3       5       8      12      20      43      75      90      96
 368          UA     100

 369          KK  CP107B     COMBINE HYDROGRAPHS R107B, DT104 ,DT111, S107B
 370          HC       4

 371          KK   DT107
 372          KM        GOLF COURSE DRIVING RANGE
 373          RS       1    STOR       0       0
 374          SA       0     .67    2.72    5.03    8.19   10.35   11.75   11.75
 375          SE  1281.5    1282    1283    1284    1285    1286  1286.5    1287
 376          SS    1286     110     3.0     1.5
```

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

 377          KK   E100B
 378          KM   SUB-BASIN E100B
 379          BA    .035
 380          LG    .280    .250   4.900    .280  23.000
 381          UC    .346    .456
 382          UA       0       3       5       8      12      20      43      75      90      96
 383          UA     100

 384          KK   R100D
 385          KM        ROUTE E100B TO C100D
 386          RS       8    FLOW      -1       0
 387          RC    .035    .035    .035    3150   .0054
 388          RX       0      50      75      90     100     130     150     160
 389          RY       1       1       0       0       0       0       1       1

 390          KK   E100D
 391          KM   SUB-BASIN E100D
 392          BA    .010
 393          LG    .350    .250   4.900    .280   1.000
 394          UC    .533   1.689
 395          UA       0       3       5       8      12      20      43      75      90      96
 396          UA     100

 397          KK   C100D
 398          KM        ADD HYDROGRAPHS R100D, E100D
 399          HC       2

 400          KK   E100A
 401          KM   SUB-BASIN E100A
 402          BA    .092
 403          LG    .500    .350   4.900    .270    .000
 404          UC    .750    .668

 405          KK  1R100C
 406          KM        ROUTE E100A TO 1C100C
 407          RS      44    FLOW      -1       0
 408          RC      .1      .1      .1    3650   .0056
 409          RX       0      20     445     915     940     970     990    1000
 410          RY       1      .5     .25       0       0      .5       1       2

 411          KK   E100C
 412          KM   SUB-BASIN E100C
 413          BA    .125
 414          LG    .500    .350   4.900    .270    .000
 415          UC    .529    .459
 416          UA       0       3       5       8      12      20      43      75      90      96
 417          UA     100

 418          KK  1C100C
 419          KM        ADD HYDROGRAPHS 1R100C, E100C
 420          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 421          KK   E103B
 422          KM   SUB-BASIN E103B
 423          BA    .034
 424          LG    .500     .350   4.800    .280    .000
 425          UC    .429     .589
 426          UA       0        3       5       8      12      20      43      75      90      96
 427          UA     100

 428          KK  2R100C
 429          KM        ROUTE E103B TO 2C100C
 430          RK    1500   .0024    .022            TRAP       5       4

 431          KK  2C100C
 432          KM        ADD HYDROGRAPHS 1C100C, 2R100C
 433          HC       2

 434          KK  C100CD
 435          KM        ADD HYDROGRAPHS 2C100C, C100D
 436          HC       2

 437          KK    R101
 438          KM        ROUTE C100CD TO ADOT CULVERT
 439          RK     850   .0024    .022            TRAP       5       4

 440          KK   REEMS
 441          KM        DIVERT C100CD TO ADOT CULVERT
 442          DT    ADOT
 443          DI       0      60     100     120     140     150     200
 444          DQ       0      60     100     106     104     103      96

 445          KK    R108
 446          KM        ROUTE REEMS TO C108
 447          RK     850    .005    .022            TRAP      10       6

 448          KK    S108
 449          KM   SUB-BASIN S108
 450          BA    .084
 451          LG    .229     .150   7.300    .110  15.000
 452          UC    .271     .205
 453          UA       0        5      16      30      65      77      84      90      94      97
 454          UA     100

 455          KK    C108
 456          KM       ADD HYDROGRAPHS R108  AND S108
 457          HC       2

 458          KK  DT108A
 459          KM        GOLF COURSE LAKE
 460          RS       1    STOR       0       0
 461          SA       0    1.74    2.15    2.61    3.06    3.06
 462          SE  1285.9    1286    1287    1288    1289    1290
 463          SS    1289      35     3.0     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 464          KK  DT108B
 465          KM        GOLF COURSE LAKE
 466          RS       1    STOR       0       0
 467          SA       0    1.04    1.10    1.23    1.41    1.41
 468          SE  1283.9    1284    1285    1286    1287    1288
 469          SS    1287      20     3.0     1.5

 470          KK   S109C
 471          KM   SUB-BASIN S109C
 472          BA    .008
 473          LG    .150    .150   9.700    .050  25.000
 474          UC    .275    .367
 475          UA       0       5      16      30      65      77      84      90      94      97
 476          UA     100

 477          KK   CP109     COMBINE HYDROGRAPHS DT108B, S109C
 478          HC       2

 479          KK   S109B
 480          KM   SUB-BASIN S109B
 481          BA    .036
 482          LG    .150    .170   6.800    .130  29.000
 483          UC    .179    .132
 484          UA       0       5      16      30      65      77      84      90      94      97
 485          UA     100

 486          KK   S109D
 487          KM   SUB-BASIN S109D
 488          BA    .015
 489          LG    .286    .150   9.700    .050   9.000
 490          UC    .142    .096
 491          UA       0       5      16      30      65      77      84      90      94      97
 492          UA     100

 493          KK  CP109D     COMBINE HYDROGRAPHS CP109, S109B, S109D
 494          HC       3

 495          KK   S109A
 496          KM   SUB-BASIN S109A
 497          BA    .020
 498          LG    .150    .250   5.200    .250  27.000
 499          UC    .162    .161
 500          UA       0       5      16      30      65      77      84      90      94      97
 501          UA     100

 502          KK   S109E
 503          KM   SUB-BASIN S109E
 504          BA    .022
 505          LG    .304    .250   4.350    .420   7.000
 506          UC    .338    .322
 507          UA       0       5      16      30      65      77      84      90      94      97
 508          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 509          KK  CP109E     COMBINE HYDROGRAPHS CP109D,S109A, S109E
 510          HC       3

 511          KK   DT109
 512          KM        GOLF COURSE LAKE
 513          RS       1    STOR       0       0
 514          SA       0    1.67    3.28    4.40    6.00    9.43   13.08   13.08
 515          SE  1279.4  1279.5    1280    1281    1282    1283    1284    1285
 516          SS    1284      70     3.0     1.5

 517          KK    S110
 518          KM   SUB-BASIN S110
 519          BA    .138
 520          LG    .204    .150   8.400    .070  29.000
 521          UC    .262    .132
 522          UA       0       5      16      30      65      77      84      90      94      97
 523          UA     100

 524          KK   CP110     COMBINE HYDROGRAPHS DT107, DT109, S110
 525          HC       3

 526          KK   DT110
 527          KM        GOLF COURSE LAKE
 528          RS       1    STOR       0       0
 529          SA       0    6.06    6.61    7.69    8.94   10.42   11.46
 530          SQ       0       0       0       0       0       0       0
 531          SE  1279.4  1279.5    1280    1281    1282  1282.5    1283

 532          KK   AR16E
 533          KM   SUB-BASIN AR16E
 534          BA    .005
 535          LG    .350    .350   4.800    .290    .000
 536          UC    .225    .211
 537          UA       0       3       5       8      12      20      43      75      90      96
 538          UA     100

 539          KK   AR17B
 540          KM   SUB-BASIN AR17B
 541          BA    .005
 542          LG    .350    .380   5.400    .220    .000
 543          UC    .192    .192
 544          UA       0       3       5       8      12      20      43      75      90      96
 545          UA     100

 546          KK  AR16B2
 547          KM   SUB-BASIN AR16B2
 548          BA    .002
 549          LG    .350    .350   4.800    .290    .000
 550          UC    .188    .238
 551          UA       0       3       5       8      12      20      43      75      90      96
 552          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 553          KK  CP117A     COMBINE HYDROGRAPHS AR16E, AR17B AND AR16B2
 554          HC       3

 555          KK   R117A
 556          KM        ROUTE HYDROGRAPH CP117A TO CP117B, GOLF CHANNEL
 557          RS       2    FLOW      -1
 558          RC     .03    .025     .03    1250   .0114
 559          RX     500     512     533     545     555     567     588     600
 560          RY       5       3       3       0       0       3       3       5

 561          KK   AR17C
 562          KM   SUB-BASIN AR17C
 563          BA    .012
 564          LG    .350    .350   4.800    .290    .000
 565          UC    .258    .213
 566          UA       0       3       5       8      12      20      43      75      90      96
 567          UA     100

 568          KK    AR17
 569          KM   SUB-BASIN AR17
 570          BA    .016
 571          LG    .350    .370   5.200    .250    .000
 572          UC    .396    .519
 573          UA       0       3       5       8      12      20      43      75      90      96
 574          UA     100

 575          KK    S117
 576          KM   SUB-BASIN S117
 577          BA    .028
 578          LG    .325    .250   6.000    .190   4.000
 579          UC    .283    .253
 580          UA       0       3       5       8      12      20      43      75      90      96
 581          UA     100

 582          KK  CP117B     COMBINE HYDROGRAPHS R117A, AR17C, AR17, S117
 583          HC       4

 584          KK   R113B
 585          KM        ROUTE HYDROGRAPH CP117B TO CP113B, GOLF CHANNEL
 586          RS       1    FLOW      -1
 587          RC     .03    .025     .03    1000   .0114
 588          RX     500     512     533     545     555     567     588     600
 589          RY       5       3       3       0       0       3       3       5

 590          KK   S113C
 591          KM   SUB-BASIN S113C
 592          BA    .019
 593          LG    .150    .250   4.600    .330  25.000
 594          UC    .229    .332
 595          UA       0       5      16      30      65      77      84      90      94      97
 596          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 597          KK   S113B
 598          KM   SUB-BASIN S113B
 599          BA    .026
 600          LG    .242    .250   4.800    .310  14.000
 601          UC    .183    .134
 602          UA       0       5      16      30      65      77      84      90      94      97
 603          UA     100

 604          KK  CP113B     COMBINE HYDROGRAPHS R113B, S113B, S113C
 605          HC       3

 606          KK   S113A
 607          KM   SUB-BASIN S113A
 608          BA    .029
 609          LG    .150    .250   4.700    .300  25.000
 610          UC    .204    .187
 611          UA       0       5      16      30      65      77      84      90      94      97
 612          UA     100

 613          KK   CP113     COMBINE HYDROGRAPHS CP113B AND S113A
 614          HC       2

 615          KK   1R114
 616          KM        ROUTE HYDROGRAPH CP113 TO  CP114, GOLF CHANNEL
 617          RS       1    FLOW      -1
 618          RC     .03    .025     .03     700   .0114
 619          RX     500     512     533     545     555     567     588     600
 620          RY       5       3       3       0       0       3       3       5

 621          KK    S114
 622          KM   SUB-BASIN S114
 623          BA    .059
 624          LG    .210    .250   4.800    .300  19.000
 625          UC    .129    .059
 626          UA       0       5      16      30      65      77      84      90      94      97
 627          UA     100

 628          KK   CP114     COMBINE HYDROGRAPHS 1R114, S114
 629          HC       2

 630          KK   DT114
 631          KM        GOLF COURSE LAKE
 632          RS       1    STOR       0       0
 633          SA       0    2.04    2.04    2.49    3.21    3.89    3.89
 634          SE  1285.9    1286    1287    1288    1289    1290    1291
 635          SS    1289      60     3.0     1.5

 636          KK    S112
 637          KM   SUB-BASIN S112
 638          BA    .034
 639          LG    .260    .250   5.600    .230  27.000
 640          UC    .154    .109
 641          UA       0       5      16      30      65      77      84      90      94      97
 642          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 643          KK   CP112     COMBINE HYDROGRAPHS DT114, S112
 644          HC       2

 645          KK   DT112
 646          KM        GOLF COURSE LAKE
 647          RS       1    STOR       0       0
 648          SA       0    1.57    1.94    2.70    3.59    4.39    4.39    4.39
 649          SE  1284.4  1284.5    1285    1286    1287  1287.5    1288    1289
 650          SS    1288     140     3.0     1.5

 651          KK    S115
 652          KM   SUB-BASIN S115
 653          BA    .085
 654          LG    .205    .250   6.000    .180  40.000
 655          UC    .183    .080
 656          UA       0       5      16      30      65      77      84      90      94      97
 657          UA     100

 658          KK  CP115A     COMBINE HYDROGRAPHS DT112, S115
 659          HC       2

 660          KK  DT115A
 661          KM        GOLF COURSE LAKE AT DOWNSTREAM END OF PHASE I (OUTFALL)
 662          RS       1    STOR       0       0
 663          SA       0    2.32    3.06    3.28    3.49    4.03    4.46    4.46
 664          SE  1282.4  1282.5    1283  1283.5    1284    1285  1285.5    1286
 665          SS    1285      95     3.0     1.5

 666          KK  CP115B
 667          KM        OUTFALL FROM DT110, DT115A
 668          HC       2

 669          KK  DT115B
 670          KM        GOLF COURSE LAKE
 671          RS       1    STOR       0       0
 672          SA       0    0.11    0.84    1.25    1.45    1.64    1.83    2.09    2.67
 673          SQ       0       0       0       0       0       0       0       0       0
 674          SE  1279.5    1280    1281    1282  1282.5    1283  1283.5    1284    1285

 675          KK    AR18
 676          KM   SUB-BASIN AR18
 677          BA    .020
 678          LG    .350    .350   4.650    .320    .000
 679          UC    .354    .359
 680          UA       0       3       5       8      12      20      43      75      90      96
 681          UA     100

 682          KK    S118
 683          KM   SUB-BASIN S118
 684          BA    .004
 685          LG    .350    .250   4.650    .320   1.000
 686          UC    .379    .968
 687          UA       0       3       5       8      12      20      43      75      90      96
 688          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 689          KK    C118     COMBINE HYDROGRAPHS AR18 AND S118
 690          HC       2

 691          KK  1R107C
 692          KM        ROUTE FLOW FROM C118 TO C106BC
 693          RS       7    FLOW      -1
 694          RC    .075    .075    .075    1140   .0060
 695          RX       0       5      10      15     115     120     125     130
 696          RY     1.5       1       1       0       0       1       1     1.5

 697          KK   E102A
 698          KM   SUB-BASIN E102A
 699          BA    .156
 700          LG    .350    .360   5.000    .270    .000
 701          UC    .404    .252
 702          UA       0       3       5       8      12      20      43      75      90      96
 703          UA     100

 704          KK   R102B
 705          KM        ROUTE E102A TO C102B
 706          RS       2    FLOW      -1       0
 707          RC    .035    .027    .035    1300   .0023
 708          RX       0       5    15.5      18      25    29.5      40      44
 709          RY     3.5     3.5       0       0       0       0     3.5     3.5

 710          KK   E102B
 711          KM   SUB-BASIN E102B
 712          BA    .384
 713          LG    .484    .360   5.000    .260    .000
 714          UC    .879    .632
 715          UA       0       3       5       8      12      20      43      75      90      96
 716          UA     100

 717          KK   C102B
 718          KM        ADD HYDROGRAPHS R102B AND E102B
 719          HC       2

 720          KK  DT102B
 721          KM    DETENTION BASIN (TEMPORARY)
 722          KM    LOW-LEVEL OUTLET 1-24" CMP INLET CONTROL ASSUMED
 723          RS       1    STOR       0       0
 724          SA       0    2.50    5.70    9.90   14.40   24.90
 725          SQ       0       0       0       0       0       0
 726          SE    1310    1311    1312    1313    1314    1315

 727          KK   E108A
 728          KM   SUB-BASIN E108A
 729          BA    .008
 730          LG    .350    .390   6.200    .160    .000
 731          UC    .192    .214
 732          UA       0       3       5       8      12      20      43      75      90      96
 733          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 734          KK   E107A
 735          KM   SUB-BASIN E107A
 736          BA    .026
 737          LG    .350    .350   4.800    .290    .000
 738          UC    .275    .226
 739          UA       0       3       5       8      12      20      43      75      90      96
 740          UA     100

 741          KK   C107A
 742          KM        ADD HYDROGRAPHS E108A, E107A
 743          HC       2

 744          KK   E107B
 745          KM   SUB-BASIN E107B
 746          BA    .019
 747          LG    .350    .350   4.900    .280    .000
 748          UC    .213    .161
 749          UA       0       3       5       8      12      20      43      75      90      96
 750          UA     100

 751          KK   C107B
 752          KM        ADD HYDROGRAPHS C107A AND E107B
 753          HC       2

 754          KK    E101
 755          KM   SUB-BASIN E101
 756          BA    .163
 757          LG    .350    .370   5.200    .250    .000
 758          UC    .675    .429
 759          UA       0       3       5       8      12      20      43      75      90      96
 760          UA     100

 761          KK   R106A
 762          KM        ROUTE FLOW FROM E101 TO C106A
 763          RS      18    FLOW      -1       0
 764          RC    .075    .075    .075    3889   .0046
 765          RX       0       5      10      30     245     290     420     550
 766          RY       3       2       1       0       0       1       2       3

 767          KK   E106A
 768          KM   SUB-BASIN E106A
 769          BA    .349
 770          LG    .390    .345   5.600    .250    .000
 771          UC    .796    .540
 772          UA       0       3       5       8      12      20      43      75      90      96
 773          UA     100

 774          KK   C106A
 775          KM        ADD HYDROGRAPHS AT C106A - DT102B, C107B, R106A, E106A
 776          HC       4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 777          KK  DT106A
 778          KM    DETENTION BASIN (TEMPORARY)
 779          KM    LOW-LEVEL OUTLET 1-36" CMP ASSUME VARIABLE CONTROL (GATE STRUCTURE)
 780          RS      1    STOR      0      0
 781          SA      0    1.14   3.99   7.57  13.95  20.37  27.61
 782          SQ      0       0      0      0      0      0      0
 783          SE 1306.9    1307   1308   1309   1310   1311   1312

 784          KK   E106B
 785          KM   SUB-BASIN E106B
 786          BA    .373
 787          LG    .350    .380  5.600   .210   .000
 788          UC    .708    .522
 789          UA      0       3      5      8     12     20     43     75     90     96
 790          UA    100

 791          KK   C106B
 792          KM        ADD HYDROGRAPHS AT C106B - DT106A, E106B
 793          HC      2

 794          KK    E105
 795          KM   SUB-BASIN E105
 796          BA    .178
 797          LG    .350    .380  5.400   .220   .000
 798          UC    .504    .356
 799          UA      0       3      5      8     12     20     43     75     90     96
 800          UA    100

 801          KK   R106C
 802          KM        ROUTE FLOW FROM E105 TO C106C
 803          RS      3    FLOW     -1      0
 804          RC   .035    .035   .035   2498  .0044
 805          RX      0      26     39     54     65     70     83     88
 806          RY    2.5       2      1      0      0      1      2    2.5

 807          KK   E106C
 808          KM   SUB-BASIN E106C
 809          BA    .036
 810          LG    .350    .380  5.600   .210   .000
 811          UC    .446    .549
 812          UA      0       3      5      8     12     20     43     75     90     96
 813          UA    100

 814          KK   C106C
 815          KM        ADD HYDROGRAPHS C106B, R106C, E106C
 816          HC      3

 817          KK  C106BC
 818          KM        ADD HYDROGRAPHS C106C AND 1R107C
 819          HC      2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 820          KK  2R107C
 821          KM        ROUTE C106BC TO C107C
 822          RS      18    FLOW      -1
 823          RC    .075    .030    .030    5600   .0034
 824          RX    1000    1430    1860    1890    1940    1960    1969    1970
 825          RY    1292    1291    1290  1289.5  1289.5    1290  1290.5  1290.5

 826          KK   E107C
 827          KM   SUB-BASIN E107C
 828          BA    .167
 829          LG    .500    .250   4.900    .270    .000
 830          UC    .813    .905
 831          UA       0       3       5       8      12      20      43      75      90      96
 832          UA     100

 833          KK   C107C
 834          KM        ADD HYDROGRAPHS AT C107C - DT115B, 2R107C, E107C
 835          HC       3

 836          KK   1R115
 837          KM        ROUTE FLOW FROM C107C TO C115
 838          RS      11    FLOW      -1       0
 839          RC    .035    .035    .075    6880   .0042
 840          RX    1000    1001    1002    1030    1100    1370    1900    2290
 841          RY    1259    1259    1259    1258    1258    1260    1262    1264

 842          KK   S302B
 843          KM   SUB-BASIN S302B
 844          BA    .010
 845          LG    .150    .150   8.000    .080  25.000
 846          UC    .083    .039
 847          UA       0       5      16      30      65      77      84      90      94      97
 848          UA     100

 849          KK  1R108B
 850          KM   ROUTE S302B TO C108B1
 851          RS       2    FLOW      -1
 852          RC    .035    .027    .035    1270   0.003
 853          RX       0       5    10.4      11      13    14.4    19.8      20
 854          RY     1.8     1.8       0       0       0       0     1.8     1.8

 855          KK   S302A
 856          KM   SUB-BASIN S302A
 857          BA    .037
 858          LG    .150    .150   8.400    .070  25.000
 859          UC    .192    .156
 860          UA       0       5      16      30      65      77      84      90      94      97
 861          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 862          KK  2R108B
 863          KM    ROUTE S302A TO C108B1
 864          RS       1    FLOW      -1
 865          RC    .035    .027    .035     580   0.005
 866          RX       0       5      11      14      16      19      25      26
 867          RY       2       2       0       0       0       0       2       2

 868          KK  C108B1
 869          KM        ADD HYDROGRAPHS 1R108B, 2R108B
 870          HC       2

 871          KK  3R108B
 872          KM    ROUTE C108B1 TO C108B2
 873          RS       1    FLOW      -1
 874          RC    .035    .027    .035     580   0.003
 875          RX       0       5      14      16      19      22      31      32
 876          RY       3       3       0       0       0       0       3       3

 877          KK    S301
 878          KM   SUB-BASIN S301
 879          BA    .054
 880          LG    .144    .150   8.000    .080  37.000
 881          UC    .488   1.025
 882          UA       0       3       5       8      12      20      43      75      90      96
 883          UA     100

 884          KK  4R108B
 885          KM    ROUTE S301 TO C108B2
 886          RS       1    FLOW      -1
 887          RC    .035    .027    .035     350   0.005
 888          RX       0       5    11.9      15      16    19.9    26.8      28
 889          RY     2.3     2.3       0       0       0       0     2.3     2.3

 890          KK   E108B
 891          KM   SUB-BASIN E108B
 892          BA    .048
 893          LG    .350    .390   6.200    .160    .000
 894          UC    .358    .378
 895          UA       0       3       5       8      12      20      43      75      90      96
 896          UA     100

 897          KK  C108B2
 898          KM        ADD HYDROGRAPHS 3R108B, 4R108B, E108B
 899          HC       3

 900          KK   DT108
 901          KM     TEMPORARY DETENTION BASIN
 902          KM     LOW-LEVEL OUTLET 1-24" CMP ASSUME VARIABLE CONTROL (GATE STRUCTURE)
 903          RS       1    STOR      -1
 904          SA       0    0.05    0.68    2.20    5.26    8.13    9.59
              *      0     0.2       4      12      20      27      30
 905          SQ       0       0       0       0       0       0       0
 906          SE  1271.9    1272    1273    1274    1275    1276    1277
```

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

 907          KK   2R115
 908          KM        ROUTE FLOW FROM DT108 TO C115
 909          RS     51    FLOW      -1       0
 910          RC   .035    .035    .075    5249   .0055
 911          RX   1000    1001    1002    1030    1100    1370    1900    2290
 912          RY   1259    1259    1259    1258    1258    1260    1262    1264

 913          KK   E108C
 914          KM   SUB-BASIN E108C
 915          BA   .128
 916          LG   .500    .062   6.200    .240    .000
 917          UC   .433    .301
 918          UA      0       3       5       8      12      20      43      75      90      96
 919          UA    100

 920          KK   D108C
 921          KM        DIVERT C108C TO C109C (SEE HEC-2 ANALYSIS:REEMS.OUT)
 922          DT  1D109C
 923          DI      0     500    1000    1500    2000
 924          DQ      0     227     533     864    1207

 925          KK   3R115
 926          KM        ROUTE FLOW FROM D108C TO C115
 927          RS     22    FLOW      -1       0
 928          RC   .035    .035    .075    5844   .0031
 929          RX   1000    1001    1002    1030    1100    1370    1900    2290
 930          RY   1259    1259    1259    1258    1258    1260    1262    1264

 931          KK    E111
 932          KM   SUB-BASIN E111
 933          BA   .500
 934          LG   .395    .252   5.100    .300    .000
 935          UC   .842    .528
 936          UA      0       3       5       8      12      20      43      75      90      96
 937          UA    100

 938          KK    D111
 939          KM        DIVERT TO  C119 FROM  C111
 940          DT    D119
 941          DI      0      32     109     228     389     599     858    1170    1539    1967
 942          DQ      0      11      39      83     145     228     333     462     617     799

 943          KK   1R112
 944          KM        ROUTE REMAINDER FROM  E111 TO  C112
 945          RS     14    FLOW      -1       0
 946          RC   .075    .035    .035    5280   .0040
 947          RX   1000    1570    2040    2370    2440    2468    2469    2470
 948          RY   1312    1310    1308    1306    1306    1307    1307    1307
```

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

 949          KK   E104
 950          KM   SUB-BASIN E104
 951          BA    .150
 952          LG    .350    .380   5.600    .210    .000
 953          UC    .546    .350
 954          UA       0       3       5       8      12      20      43      75      90      96
 955          UA     100

 956          KK   2R112
 957          KM        ROUTE FLOW FROM  E104 TO  C112
 958          RS      51    FLOW      -1       0
 959          RC    .075    .075    .075    6552   .0056
 960          RX    1000    1001    1230    1270    1750    2000    2380    2650
 961          RY    1321    1321    1320    1318    1318    1319    1318    1320

 962          KK    E112
 963          KM   SUB-BASIN E112
 964          BA    .970
 965          LG    .325    .125   5.600    .280  28.000
 966          UC    .529    .246

 967          KK    C112
 968          KM        ADD HYDROGRAPHS FROM E112, 1R112 & 2R112
 969          HC       3

 970          KK   D112A
 971          KM        DIVERT TO  C120 FROM  C112
 972          DT    D120
 973          DI       0      48     165     355     625     981    1434    1990
 974          DQ       0      16      55     118     208     327     478     663

 975          KK   D112B
 976          KM        DIVERT TO  C121A FROM  C112
 977          DT  1D121A
 978          DI       0      32     110     237     417     654     956    1327
 979          DQ       0      16      55     118     208     327     478     663

 980          KK   R113A
 981          KM        ROUTE REMAINDER FROM  C112 TO  C113A
 982          RS       8    FLOW      -1       0
 983          RC    .075    .035    .035    2640   .0023
 984          RX    1000    1490    1830    2600    2770    2788    2789    2790
 985          RY    1290    1288    1286    1284    1284    1285    1285    1285

 986          KK   E113A
 987          KM   SUB-BASIN E113A
 988          BA    .500
 989          LG    .500    .000   5.800    .300    .000
 990          UC    .567    .320
 991          UA       0       3       5       8      12      20      43      75      90      96
 992          UA     100
```

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

 993          KK  1D113A
 994          KM        DIVERT TO C113 FROM C113A (6 CROSS-CULVERTS UNDER SR 303)
 995          DT    D113
 996          DI       0      89     100     200     400     800
 997          DQ       0      89      89      89      89      89

 998          KK   C113A
 999          KM        ADD HYDROGRAPHS FROM R113A & 1D113A
1000          HC       2

1001          KK  2D113A
1002          KM        DIVERT TO  C121A FROM  C113A
1003          DT  2D121A
1004          DI       0     185     545     642     893    1913
1005          DQ       0       0       0      12      74     467

1006          KK   1R113
1007          KM        ROUTE REMAINDER FROM  C113A TO  C113
1008          RS      12    FLOW      -1       0
1009          RC    .075    .035    .035    2740   .0058
1010          RX    1000    1080    2620    2725    2735    2798    2799    2800
1011          RY    1278    1277    1277    1276    1276    1277    1277    1277

1012          KK  DR113A
1013          KM        RECALL 1D113A (EAST)
1014          DR    D113

1015          KK   2R113
1016          KM        ROUTE CROSS-CULVERT FLOW FROM C113A TO C113
1017          RS      10    FLOW      -1       0
1018          RC    .075    .035    .035    2740   .0058
1019          RX    1000    1080    2620    2725    2735    2798    2799    2800
1020          RY    1278    1277    1277    1276    1276    1277    1277    1277

1021          KK    E113
1022          KM   SUB-BASIN E113
1023          BA    .517
1024          LG    .500    .312   6.400    .160    .000
1025          UC    .804    .538
1026          UA       0       3       5       8      12      20      43      75      90      96
1027          UA     100

1028          KK    C113
1029          KM        ADD HYDROGRAPHS FROM 1R113, 2R113, E113
1030          HC       3

1031          KK   1D113
1032          KM        DIVERT TO  C122 FROM  C113
1033          DT   1D122
1034          DI       0     105     354     622    1153    1882
1035          DQ       0       0     195     395     845    1480
```

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

1036          KK    R114
1037          KM        ROUTE REMAINDER FROM  C113 TO  C114
1038          RS       5    FLOW      -1       0
1039          RC    .075     .04     .04    1997   .0040
1040          RX    1000    1020    1100    1850    2030    2048    2049    2050
1041          RY    1266    1264    1262    1260    1260    1261    1261    1261

1042          KK    E114
1043          KM   SUB-BASIN E114
1044          BA    .377
1045          LG    .500    .000   7.600    .150    .000
1046          UC    .621    .449
1047          UA       0       3       5       8      12      20      43      75      90      96
1048          UA     100

1049          KK    C114
1050          KM        ADD HYDROGRAPHS FROM R114 & E114
1051          HC       2

1052          KK    D114
1053          KM        DIVERT TO  C122 FROM  C114
1054          DT   2D122
1055          DI       0     235     313     480     717    1056
1056          DQ       0       0       2      81     225     462

1057          KK   4R115
1058          KM        ROUTE REMAINDER FROM C114 TO C115
1059          RS       3    FLOW      -1       0
1060          RC     .06    .022    .035    2578   .0035
1061          RX    1000    1380    1790    1800    1840    1850    1899    1900
1062          RY    1258    1256    1254    1250    1250    1252    1253    1253

1063          KK    E115
1064          KM   SUB-BASIN E115
1065          BA    .504
1066          LG    .500    .109   5.800    .270    .000
1067          UC    .762    .499
1068          UA       0       3       5       8      12      20      43      75      90      96
1069          UA     100

1070          KK   E116B
1071          KM   SUB-BASIN E116B
1072          BA    .024
1073          LG    .500    .350   4.800    .280    .000
1074          UC    .742   1.069
1075          UA       0       3       5       8      12      20      43      75      90      96
1076          UA     100

1077          KK    C115
1078          KM        ADD HYDROGRAPHS 1R115, 2R115, 3R115, 4R115, E115, E116B
1079          HC       6
```

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

1080          KK  DR108C
1081          KM        RECALL D108C (EAST)
1082          DR  1D109C

1083          KK   R109C
1084          KM        ROUTE 1D109C TO C109C
1085          RS       8    FLOW      -1       0
1086          RC    .075    .035    .035    2536   .0036
1087          RX    1000    1430    1860    1890    1940    1960    1969    1970
1088          RY    1292    1291    1290  1289.5  1289.5    1290  1290.5  1290.5

1089          KK   E109C
1090          KM   SUB-BASIN E109C
1091          BA    .245
1092          LG    .500    .360   5.000    .260    .000
1093          UC    .708    .503
1094          UA       0       3       5       8      12      20      43      75      90      96
1095          UA     100

1096          KK   C109C
1097          KM        ADD HYDROGRAPHS AT C109C - R109C, E109C
1098          HC       2

1099          KK   D109C
1100          KM        DIVERT C109C TO C116A
1101          DT   D116A
1102          DI       0       9      59     173     390     450     500     550     622     650
1103          DQ       0       0       0       0       0      60     110     160     232     260

1104          KK   R109D
1105          KM        ROUTE FLOW FROM C109C TO C109D
1106          RS       2    FLOW      -1       0
1107          RC    .025    .025    .025    2600   .0054
1108          RX       0       0      32      55      65      66      72      79
1109          RY  1256.4  1255.9  1254.4  1255.5  1255.8    1256    1256  1256.4

1110          KK   E109D
1111          KM   SUB-BASIN E109D
1112          BA    .095
1113          LG    .500    .115   5.000    .380    .000
1114          UC    .442    .339
1115          UA       0       3       5       8      12      20      43      75      90      96
1116          UA     100

1117          KK   C109D
1118          KM        ADD HYDROGRAPHS AT C109D - R109D, E109D
1119          HC       2

1120          KK   D109D
1121          KM        DIVERT C109D SOUTH TO KINGSWOOD PARK
1122          DT  D109DS
1123          DI       0      26     197     250     301     360     423     488     568
1124          DQ       0       0       0      15      26      40      58      78     105
```

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

1125          KK  1R110A
1126          KM       ROUTE D109D TO C110A
1127          RS       2    FLOW      -1       0
1128          RC    .022    .022    .022    1620   .0081
1129          RX       0       1       3      14      15      34      63      69
1130          RY    4.45    4.45    2.45       0       0    1.41    1.66    3.66

1131          KK   E100E
1132          KM   SUB-BASIN E100E
1133          BA    .012
1134          LG    .350    .350   4.900    .270    .000
1135          UC    .158    .130
1136          UA       0       3       5       8      12      20      43      75      90      96
1137          UA     100

1138          KK  1R109A
1139          KM        ROUTE E100E TO C109A
1140          RS      25    FLOW      -1       0
1141          RC    .075    .075    .075    3190   .0065
1142          RX       0      65     200     275     285     320     440     620
1143          RY     1.5       1      .5       0       0      .5       1     1.5

1144          KK    S400
1145          KM   SUB-BASIN S400
1146          BA    .059
1147          LG    .150    .250   5.200    .250  30.000
1148          UC    .162    .097
1149          UA       0       5      16      30      65      77      84      90      94      97
1150          UA     100

1151          KK  1R109B
1152          KM    ROUTE S400 TO C109B1
1153          RK     300    .004    .022            TRAP      65      10

1154          KK   S325A
1155          KM   SUB-BASIN S325A
1156          BA    .029
1157          LG    .150    .250   4.100    .440  25.000
1158          UC    .162    .126
1159          UA       0       5      16      30      65      77      84      90      94      97
1160          UA     100

1161          KK  2R109B
1162          KM    ROUTE S325A TO C109B1
1163          RS       1    FLOW      -1
1164          RC    .035    .027    .035     800   0.005
1165          RX       0       5    10.4      13      16    18.4    23.8      25
1166          RY     1.8     1.8       0       0       0       0     1.8     1.8
```

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

1167          KK  C109B1
1168          KM        ADD HYDROGRAPHS 1R109B, 2R109B
1169          HC       2

1170          KK  DT109B
1171          KM     TEMPORARY DETENTION BASIN
1172          KM     LOW-LEVEL OUTLET 1-12" CMP ASSUME VARIABLE CONTROL (GATE STRUCTURE)
1173          RS       1    STOR      -1
1174          SA       0    6.13    7.63      10
              *      0     2.2     4.5       6
1175          SQ       0       0       0       0
1176          SE  1273.9    1274    1275    1276

1177          KK   E109B
1178          KM   SUB-BASIN E109B
1179          BA    .069
1180          LG    .500    .250   5.000    .260    .000
1181          UC    .554    .507
1182          UA       0       3       5       8      12      20      43      75      90      96
1183          UA     100

1184          KK  C109B2
1185          KM        ADD HYDROGRAPHS DT109B, E109B
1186          HC       2

1187          KK  E109B1
1188          KM   SUB-BASIN E109B1
1189          BA    .032
1190          LG    .500    .250   5.000    .260    .000
1191          UC    .296    .287
1192          UA       0       3       5       8      12      20      43      75      90      96
1193          UA     100

1194          KK  2R109A
1195          KM        ROUTE E109B1 TO C109A
1196          RS      14    FLOW      -1       0
1197          RC    .075    .075    .075    2000   .0044
1198          RX       0      65     200     275     285     320     440     620
1199          RY     1.5       1      .5       0       0      .5       1     1.5

1200          KK   E109A
1201          KM   SUB-BASIN E109A
1202          BA    .122
1203          LG    .500    .360   5.000    .260    .000
1204          UC    .438    .330
1205          UA       0       3       5       8      12      20      43      75      90      96
1206          UA     100

1207          KK   C109A
1208          KM        ADD HYDROGRAPHS 1R109A, C109B2, 2R109A, E109A
1209          HC       4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1210          KK   R109E
1211          KM        ROUTE C109A TO C109E
1212          RS      11    FLOW      -1       0
1213          RC    .075    .075    .075    2640   .0067
1214          RX       0      10      30      80     265     330     380     430
1215          RY       2       1      .5       0       0     .25      .5       1

1216          KK   E109E
1217          KM   SUB-BASIN E109E
1218          BA    .173
1219          LG    .500    .223   5.000    .320    .000
1220          UC    .463    .314
1221          UA       0       3       5       8      12      20      43      75      90      96
1222          UA     100

1223          KK   C109E
1224          KM        ADD HYDROGRAPHS AT C109E - R109E, E109E
1225          HC       2

1226          KK  2R110A
1227          KM        ROUTE C109E TO C110A
1228          RS      16    FLOW      -1       0
1229          RC    .075    .075    .075    2000   .0045
1230          RX       0      10      30      80     265     330     380     430
1231          RY       2       1      .5       0       0     .25      .5       1

1232          KK   E110A
1233          KM   SUB-BASIN E110A
1234          BA    .088
1235          LG    .455    .370   6.600    .140    .000
1236          UC    .504    .466
1237          UA       0       3       5       8      12      20      43      75      90      96
1238          UA     100

1239          KK   C110A
1240          KM        ADD HYDROGRAPHS AT C110A (1R110A, 2R110A, E110A)
1241          HC       3

1242          KK  DR109C
1243          KM        RECALL D109C
1244          DR   D116A

1245          KK   R116A
1246          KM        ROUTE D116A TO C116A
1247          RS       1    FLOW      -1       0
1248          RC    .075    .075    .075    2000   .0025
1249          RX       0      30      45      60     120     145     170     195
1250          RY     1.5       1      .5       0       0      .5       1     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1251          KK   E116A
1252          KM   SUB-BASIN E116A
1253          BA    .321
1254          LG    .500    .350   4.800    .280    .000
1255          UC    .792    .501
1256          UA       0       3       5       8      12      20      43      75      90      96
1257          UA     100

1258          KK   C116A
1259          KM        ADD HYDROGRAPHS AT C116A - DR109C, E116A
1260          HC       2
1261          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 125        S101
               V
               V
 139       DT101
               .
               .
 145           .        S103
               .          .
               .          .
 154           .          .------->    D105
 152           .        D103
               .          V
               .          V
 157           .       1R102
               .          V
               .          V
 159           .       2R102
               .          .
               .          .
 165           .          .        S102
               .          .          .
               .          .          .
 172       CP102.......................
               V
               V
 174       DT102
               .
               .
 180           .       S105A
               .          .
               .          .
 187      CP105A............
               V
               V
 190       DT105
               .
               .
 198           .          .<-------    D105
 196           .       DR105
               .          V
               .          V
 199           .       R105B
               .          .
               .          .
 201           .          .       S105B
               .          .          .
               .          .          .
 208           .      CP105B............
               .          .
               .          .
 211       CP105............
               V
               V
 214       R107B
               .
               .
 220           .        AR3A
               .          .
               .          .
```

```
229          .          .-------->  D103A
227          .      DAR3A
             .          .
             .          .
232          .          .      AR16C
             .          .          .
             .          .          .
239          .          .          .      AR16D
             .          .          .          .
             .          .          .          .
246          .      CAR16C.......................
             .          .
             .          .
249          .          .      E103A
             .          .          V
             .          .          V
256          .          .      1RAR3
             .          .          .
             .          .          .
261          .          .          .          .<-------   D103A
259          .          .          .     DR102A
             .          .          .          V
             .          .          .          V
262          .          .          .      2RAR3
             .          .          .          .
             .          .          .          .
265          .          .          .          .        AR3
             .          .          .          .          .
             .          .          .          .          .
272          .          .      CAR3........................
             .          .          V
             .          .          V
275          .          .     RAR16A
             .          .          .
             .          .          .
281          .          .          .      AR16A
             .          .          .          .
             .          .          .          .
288          .          .          .          .     AR16B1
             .          .          .          .          .
             .          .          .          .          .
295          .          .          .          .          .       S116
             .          .          .          .          .          .
             .          .          .          .          .          .
302          .      C116.............................................
             .          .
             .          .
305          .          .      S107A
             .          .          .
             .          .          .
312          .      CP107A............
             .          V
             .          V
315          .      DT107A
             .          V
             .          V
321          .      DT107B
             .          .
             .          .
327          .          .      S104
             .          .          .
             .          .          .
334          .          .          .      S106
             .          .          .          .
             .          .          .          .
341          .      CP104........................
```

```
                .          V
                .          V
343             .       DT104
                .          .
                .          .
349             .          .        S111
                .          .          V
                .          .          V
356             .          .       DT111
                .          .          .
                .          .          .
362             .          .          .       S107B
                .          .          .          .
                .          .          .          .
369         CP107B.................................
                V
                V
371         DT107
                .
                .
377             .       E100B
                .          V
                .          V
384             .       R100D
                .          .
                .          .
390             .          .       E100D
                .          .          .
                .          .          .
397             .       C100D............
                .          .
                .          .
400             .          .       E100A
                .          .          V
                .          .          V
405             .          .      1R100C
                .          .          .
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411             .          .          .       E100C
                .          .          .          .
                .          .          .          .
418             .          .      1C100C............
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                .          .          .
421             .          .          .       E103B
                .          .          .          V
                .          .          .          V
428             .          .          .      2R100C
                .          .          .          .
                .          .          .          .
431             .          .      2C100C............
                .          .          .
                .          .          .
434             .      C100CD............
                .          V
                .          V
437             .       R101
                .          .
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442             .          .-------->    ADOT
440             .      REEMS
                .          V
                .          V
445             .       R108
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448          .          .        S108
             .          .          .
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455          .       C108............
             .          V
             .          V
458          .     DT108A
             .          V
             .          V
464          .     DT108B
             .          .
             .          .
470          .          .      S109C
             .          .          .
             .          .          .
477          .      CP109............
             .          .
             .          .
479          .          .      S109B
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             .          .          .
486          .          .          .       S109D
             .          .          .          .
             .          .          .          .
493          .     CP109D......................
             .          .
             .          .
495          .          .      S109A
             .          .          .
             .          .          .
502          .          .          .       S109E
             .          .          .          .
             .          .          .          .
509          .     CP109E......................
             .          V
             .          V
511          .      DT109
             .          .
             .          .
517          .          .       S110
             .          .          .
             .          .          .
524     CP110......................
            V
            V
526     DT110
            .
            .
532          .      AR16E
             .          .
             .          .
539          .          .      AR17B
             .          .          .
             .          .          .
546          .          .          .      AR16B2
             .          .          .          .
             .          .          .          .
553          .     CP117A......................
             .          V
             .          V
555          .      R117A
             .          .
             .          .
561          .          .      AR17C
             .          .          .
             .          .          .
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568          .          .          .       AR17
             .          .          .          .
             .          .          .          .
575          .          .          .          .        S117
             .          .          .          .          .
             .          .          .          .          .
582          .     CP117B.................................
             .          V
             .          V
584          .     R113B
             .          .
             .          .
590          .          .      S113C
             .          .          .
             .          .          .
597          .          .          .      S113B
             .          .          .          .
             .          .          .          .
604          .     CP113B.......................
             .          .
             .          .
606          .          .      S113A
             .          .          .
             .          .          .
613          .     CP113............
             .          V
             .          V
615          .     1R114
             .          .
             .          .
621          .          .       S114
             .          .          .
             .          .          .
628          .     CP114............
             .          V
             .          V
630          .     DT114
             .          .
             .          .
636          .          .       S112
             .          .          .
             .          .          .
643          .     CP112............
             .          V
             .          V
645          .     DT112
             .          .
             .          .
651          .          .       S115
             .          .          .
             .          .          .
658          .     CP115A............
             .          V
             .          V
660          .     DT115A
             .          .
             .          .
666     CP115B............
             V
             V
669     DT115B
             .
             .
675          .       AR18
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682   .        .      S118
      .        .        .
      .        .        .
689   .      C118.........
      .        V
      .        V
691   .     1R107C
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      .        .
697   .        .     E102A
      .        .       V
      .        .       V
704   .        .     R102B
      .        .       .
      .        .       .
710   .        .       .      E102B
      .        .       .        .
      .        .       .        .
717   .        .     C102B.........
      .        .       V
      .        .       V
720   .        .    DT102B
      .        .       .
      .        .       .
727   .        .       .      E108A
      .        .       .        .
      .        .       .        .
734   .        .       .        .      E107A
      .        .       .        .        .
      .        .       .        .        .
741   .        .       .      C107A.........
      .        .       .        .
      .        .       .        .
744   .        .       .        .      E107B
      .        .       .        .        .
      .        .       .        .        .
751   .        .       .      C107B.........
      .        .       .        .
      .        .       .        .
754   .        .       .        .       E101
      .        .       .        .         V
      .        .       .        .         V
761   .        .       .        .      R106A
      .        .       .        .        .
      .        .       .        .        .
767   .        .       .        .        .      E106A
      .        .       .        .        .        .
      .        .       .        .        .        .
774   .        .     C106A.......................
      .        .       V
      .        .       V
777   .        .    DT106A
      .        .       .
      .        .       .
784   .        .       .      E106B
      .        .       .        .
      .        .       .        .
791   .        .     C106B.........
      .        .       .
      .        .       .
794   .        .       .       E105
      .        .       .         V
      .        .       .         V
801   .        .       .      R106C
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807          .          .          .          .      E106C
             .          .          .          .          .
             .          .          .          .          .
814          .          .      C106C.......................
             .          .          .
             .          .          .
817          .     C106BC............
             .          V
             .          V
820          .     2R107C
             .          .
             .          .
826          .          .      E107C
             .          .          .
             .          .          .
833     C107C.......................
            V
            V
836     1R115
             .
             .
842          .      S302B
             .          V
             .          V
849          .     1R108B
             .          .
             .          .
855          .          .      S302A
             .          .          V
             .          .          V
862          .          .     2R108B
             .          .          .
             .          .          .
868          .     C108B1............
             .          V
             .          V
871          .     3R108B
             .          .
             .          .
877          .          .       S301
             .          .          V
             .          .          V
884          .          .     4R108B
             .          .          .
             .          .          .
890          .          .          .      E108B
             .          .          .          .
             .          .          .          .
897          .     C108B2.......................
             .          V
             .          V
900          .      DT108
             .          V
             .          V
907          .      2R115
             .          .
             .          .
913          .          .      E108C
             .          .          .
             .          .          .
922          .          .          .-------> 1D109C
920          .          .      D108C
             .          .          V
             .          .          V
925          .          .      3R115
             .          .          .
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931          .         .         .        E111
             .         .         .          .
             .         .         .          .
940          .         .         .          .-------->    D119
938          .         .         .        D111
             .         .         .          V
             .         .         .          V
943          .         .         .       1R112
             .         .         .          .
             .         .         .          .
949          .         .         .          .        E104
             .         .         .          .          V
             .         .         .          .          V
956          .         .         .          .       2R112
             .         .         .          .          .
             .         .         .          .          .
962          .         .         .          .          .        E112
             .         .         .          .          .          .
             .         .         .          .          .          .
967          .         .         .        C112.......................
             .         .         .          .
             .         .         .          .
972          .         .         .          .-------->    D120
970          .         .         .       D112A
             .         .         .          .
             .         .         .          .
977          .         .         .          .-------->  1D121A
975          .         .         .       D112B
             .         .         .          V
             .         .         .          V
980          .         .         .       R113A
             .         .         .          .
             .         .         .          .
986          .         .         .          .       E113A
             .         .         .          .          .
             .         .         .          .          .
995          .         .         .          .          .-------->    D113
993          .         .         .          .      1D113A
             .         .         .          .          .
             .         .         .          .          .
998          .         .         .       C113A............
             .         .         .          .
             .         .         .          .
1003         .         .         .          .-------->  2D121A
1001         .         .         .      2D113A
             .         .         .          V
             .         .         .          V
1006         .         .         .       1R113
             .         .         .          .
             .         .         .          .
1014         .         .         .          .          .<-------    D113
1012         .         .         .          .     DR113A
             .         .         .          .          V
             .         .         .          .          V
1015         .         .         .          .       2R113
             .         .         .          .          .
             .         .         .          .          .
1021         .         .         .          .          .        E113
             .         .         .          .          .          .
             .         .         .          .          .          .
1028         .         .         .        C113.......................
             .         .         .          .
             .         .         .          .
1033         .         .         .          .-------->   1D122
1031         .         .         .       1D113
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                .          .          .          V
                .          .          .          V
1036            .          .          .       R114
                .          .          .          .
                .          .          .          .
1042            .          .          .          .       E114
                .          .          .          .          .
                .          .          .          .          .
1049            .          .          .       C114............
                .          .          .          .
                .          .          .          .
1054            .          .          .          .-------->   2D122
1052            .          .          .       D114
                .          .          .          V
                .          .          .          V
1057            .          .          .      4R115
                .          .          .          .
                .          .          .          .
1063            .          .          .          .       E115
                .          .          .          .          .
                .          .          .          .          .
1070            .          .          .          .          .       E116B
                .          .          .          .          .          .
                .          .          .          .          .          .
1077        C115.......................................................
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                .
1082            .          .<-------  1D109C
1080            .     DR108C
                .          V
                .          V
1083            .      R109C
                .          .
                .          .
1089            .          .      E109C
                .          .          .
                .          .          .
1096            .      C109C............
                .          .
                .          .
1101            .          .-------->   D116A
1099            .      D109C
                .          V
                .          V
1104            .      R109D
                .          .
                .          .
1110            .          .      E109D
                .          .          .
                .          .          .
1117            .      C109D............
                .          .
                .          .
1122            .          .-------->  D109DS
1120            .      D109D
                .          V
                .          V
1125            .     1R110A
                .          .
                .          .
1131            .          .      E100E
                .          .          V
                .          .          V
1138            .          .     1R109A
                .          .          .
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1144    .       .       .     S400
        .       .       .       V
        .       .       .       V
1151    .       .       .    1R109B
        .       .       .       .
        .       .       .       .
1154    .       .       .       .      S325A
        .       .       .       .          V
        .       .       .       .          V
1161    .       .       .       .     2R109B
        .       .       .       .          .
        .       .       .       .          .
1167    .       .       .    C109B1............
        .       .       .       V
        .       .       .       V
1170    .       .       .    DT109B
        .       .       .       .
        .       .       .       .
1177    .       .       .       .      E109B
        .       .       .       .          .
        .       .       .       .          .
1184    .       .       .    C109B2............
        .       .       .       .
        .       .       .       .
1187    .       .       .       .     E109B1
        .       .       .       .          V
        .       .       .       .          V
1194    .       .       .       .     2R109A
        .       .       .       .          .
        .       .       .       .          .
1200    .       .       .       .          .      E109A
        .       .       .       .          .          .
        .       .       .       .          .          .
1207    .       .    C109A.....................................
        .       .       V
        .       .       V
1210    .       .    R109E
        .       .       .
        .       .       .
1216    .       .       .     E109E
        .       .       .       .
        .       .       .       .
1223    .       .    C109E............
        .       .       V
        .       .       V
1226    .       .   2R110A
        .       .       .
        .       .       .
1232    .       .       .     E110A
        .       .       .       .
        .       .       .       .
1239    .    C110A........................
        .       .
        .       .
1244    .       .       .<-------   D116A
1242    .       .   DR109C
        .       .       V
        .       .       V
1245    .       .    R116A
        .       .       .
        .       .       .
1251    .       .       .     E116A
        .       .       .       .
        .       .       .       .
1258    .       .    C116A............
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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  12/22/1994  TIME  10:42:32 *
*                                      *
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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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DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE, ARIZONA
STANLEY CONSULTANTS JOB # 12291
HEC-1 MODEL INPUT FILENAME: P12291.DAT

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********************************
*                              *
* PHASE I DEVELOPED CONDITIONS *
*   100-YEAR, 2-HOUR STORM     *
*                              *
********************************
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CLARK UNIT HYDROGRAPH

100-YEAR, 2-HR STORM DISTRIBUTION
(FCDMC HYDROLOGIC DESIGN MANUAL; TABLE 2.2)
P100 = 2.77" (NO AERIAL REDUCTION)

COMPUTATION TIME INTERVAL 3 MINUTES

GREEN-AMPT LOSS RATES AND PARAMETERS FOR DEVELOPED AND EXISTING CONDITIONS:

LAND USE	DTHETA CONDITION	VEGETATIVE COVER (%)	RTIMP	IA	ROUGHNESS DESCRIPTION	Kb EQN. PARAMETERS "m"	"b"
Desert	DRY	25	0	0.35	Low	-0.01375	0.08
OPEN	NORMAL	25	1	0.35	Low	-0.01375	0.08
L.D.R.	NORMAL	25	25	0.15	Min	-0.00625	0.04
M.D.R.	NORMAL	25	35	0.15	Min	-0.00625	0.04
M.F.R.	NORMAL	25	55	0.15	Min	-0.00625	0.04
Comm	NORMAL	25	80	0.10	Min	-0.00625	0.04
Ag	WET	90	0	0.50	Low	-0.01375	0.08
Fallow	DRY	20	0	0.50	Low	-0.01375	0.08

SURFACE RETENTION LOSS IS BASED ON FCDMC HYDROLOGY MANUAL TABLE 4.1.

SUB-BASIN XKSAT VALUES ARE AREA-WEIGHTED LOGARITHMS OF THE INDIVIDUAL XKSAT VALUES OCCURRING WITHIN THE SUB-BASIN. THE BARE GROUND XKSAT VALUE IS ADJUSTED FOR VEGETATIVE COVER. THE ADJUSTMENT IS AREA-WEIGHTED BY LAND USE AND THE CORRECTION PRESENTED IN FIGURE 4.4 OF THE FCDMC HYDROLOGY MANUAL IS APPLIED. THE WHITE TANKS/AGUA FRIA ADMS SOIL DISTRIBUTION IS ASSUMED FOR THE EXISTING CONDITIONS. THE EXISTING XKSAT SOIL DISTRIBUTION IS USED FOR PHASE I AND ASSUMED NOT TO BE AFFECTED BY GRADING AND EARTHWORK FOR THE DEVELOPED CONDITIONS.

THE WETTING FRONT CAPILLARY SUCTION (PSIF) AND VOLUMETRIC SOIL MOISTURE DEFICIT AT THE START OF RAINFALL (DTHETA) ARE A FUNCTION OF THE SUB-BASIN SOIL, GROUND SURFACE, AND LAND USE CHARACTERISTICS. THESE VARIABLES ARE AREA-WEIGHTED BY SUB-BASIN. DTHETA IS A FUNCTION OF THE ASSUMED SOIL MOISTURE CONDITION AT THE START OF RAINFALL FOR THE LAND USES PRESENTED IN THE ABOVE TABLE.

TIME OF CONCENTRATION (TC), AND STORAGE COEFFICIENT (R), IS BASED ON MCUHP1 (REVISED 12-16-91). LENGTHS AND SLOPES FOR ALL EXISTING CONDITION ON-SITE AREAS ARE BASED ON EXISTING 1' CONTOUR TOPOGRAPHIC MAPPING. LENGTHSAND SLOPES FOR THE PHASE I DEVELOPED AREAS ARE BASED ON PRELIMINARY LOTING LAYOUTS AND MASS GRADING PLANS. CONTRIBUTING OFF-SITE AREAS WEST OF SR 303L BETWEEN BELL ROAD AND UNION HILLS DRIVE ARE IDENTICAL TO THE WHITE TANKS/AGUA FRIA ADMS.

Kb VALUES ARE BASED ON m AND b PARAMETERS FROM TABLE 5.1 OF HYDROLOGY MANUAL. Kb VALUES ARE AREA-WEIGHTED BY COMPOSITE LAND USE.

THE DIRECTLY CONNECTED PERCENT IMPERVIOUS (RTIMP) IS ASSUMED TO BE THE SAME AS THAT USED IN THE SUN CITY WEST EXPANSION AREA MASTER DRAINAGE STUDY (JULY 1993), SINCE THE PROJECTS CONTAIN SIMILAR LAND USE.

HYDROGRAPH ROUTING THRU STREETS USE KINEMATIC WAVE. STORM DRAIN CONVEYANCE IS DISREGARDED UNLESS IT IS ANTICIPATED TO CROSS SUB-BASIN BOUNDARIES.

THE TIME-AREA RELATION FOR EACH SUB-BASIN IS BASED ON THE FCDMC HYDROLOGY MANUAL TABLE 5.2:

1. OFF-SITE AREAS AND EXCEPTION PARCELS USE NATURAL TIME-AREA UA RECORD.
2. ON-SITE DEVELOPED AREAS USE AN URBAN TIME-AREA UA RECORD EXCEPT WHERE THE SUB-BASIN IS PRIMARILY GOLF COURSE, IN WHICH CASE, NATURAL TIME-AREA UA RECORDS ARE USED.

HYDROGRAPH ROUTING THRU THE EXISTING WATERSHED USES NORMAL DEPTH MODIFIED PULS ASSUMING:

1. 8-POINT CROSS-SECTION REPRESENTATIVE OF THE CHANNEL REACH.
2. WHITE TANKS/AGUA FRIA ADMS ROUTING BLOCKS WHERE APPLICABLE.
3. "n" VALUES BASED ON FIELD RECON GENERALLY DECREASING IN THE DOWNSTREAM DIRECTION AS A RESULT OF THE INCREASED DEPTH.
4. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
5. INFILTRATION/PERCOLATION IS ZERO.
6. INITIAL DISCHARGE IS ZERO.

HYDROGRAPH ROUTING THRU GOLF COURSE CHANNELS USE NORMAL DEPTH MODIFIED PULS ASSUMING:

1. 8-POINT CROSS-SECTION WITH LOW FLOW AND OVERBANKS
2. LOW FLOW "n" = 0.025; OVERBANK "n" = 0.030
3. NSTPS WERE DETERMINED TO ESTIMATE THE TRAVEL TIME THROUGH THE REACH APPROXIMATING THE FULLY DEVELOPED FLOOD WAVE TRAVEL TIME.
4. INFILTRATION/PERCOLATION IS ZERO.
5. INITIAL DISCHARGE IS ZERO.
6. GOLF CHANNELS ARE HYPOTHETICAL WITH ARBITRARY DATUM AND SLOPE BASED ON A PRELIMINARY MASS GRADING PLAN.

HYDROGRAPH ROUTING THRU RETENTION/DETENTION BASINS USES LEVEL POOL MODIFIED PULS ASSUMING:

1. INFILTRATION/PERCOLATION IS ZERO.
2. DETENTION BASINS ARE EMPTY AT START OF MODEL.
3. PROPOSED PHASE I DETENTION BASINS USE MASS GRADING ELEVATIONS WHERE AVAILABLE.
4. EXISTING TOPOGRAPHY USED TO DEVELOP SA/SE RELATIONS FOR PROPOSED TEMPORARY DETENTION BASINS.
5. GOLF COURSE RETENTION BASINS UTILIZE EMERGENCY SPILLWAYS. THE CONCEPT IS TO RETAIN AND RECHARGE THE LOCAL STORMWATER RUNOFF.
6. PRELIMINARY GOLF COURSE GRADING PLANS WERE USED TO DEVELOP SA/SE RELATIONS FOR THE DETENTION/RETENTION BASINS.

ALL FLOW SPLITS WERE ESTIMATED ON THE BASIS OF HYDRAULIC ANALYSES. THE ANALYSES GERERALLY UTILIZED EITHER STEP-BACKWATER, NORMAL DEPTH, WEIR FLOW METHODS OR COMBINATIONS THEREOF.

```
124 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN          3  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       1457  ENDING TIME
                    ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 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

        *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

        *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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        *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

        *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

        *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  2
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*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	S101	304.	1.25	24.	10.	10.	.12		
ROUTED TO	DT101	2.	2.25	1.	0.	0.	.12	1296.06	2.25
HYDROGRAPH AT	S103	208.	1.30	20.	8.	8.	.09		
DIVERSION TO	D105	100.	1.30	15.	6.	6.	.09		
HYDROGRAPH AT	D103	108.	1.30	5.	2.	2.	.09		
ROUTED TO	1R102	106.	1.35	5.	2.	2.	.09		
ROUTED TO	2R102	103.	1.40	5.	2.	2.	.09	1.91	1.40
HYDROGRAPH AT	S102	168.	1.25	13.	5.	5.	.07		
3 COMBINED AT	CP102	250.	1.35	19.	8.	8.	.27		
ROUTED TO	DT102	1.	3.75	0.	0.	0.	.27	1292.02	3.70
HYDROGRAPH AT	S105A	60.	1.20	3.	1.	1.	.02		
2 COMBINED AT	CP105A	60.	1.20	3.	1.	1.	.29		
ROUTED TO	DT105	0.	.05	0.	0.	0.	.29	1289.61	14.95
HYDROGRAPH AT	DR105	100.	1.15	15.	6.	6.	.00		
ROUTED TO	R105B	100.	1.20	15.	6.	6.	.00		
HYDROGRAPH AT	S105B	77.	1.20	5.	2.	2.	.03		
2 COMBINED AT	CP105B	177.	1.20	20.	8.	8.	.03		
2 COMBINED AT	CP105	177.	1.20	20.	8.	8.	.32		
ROUTED TO	R107B	175.	1.25	20.	8.	8.	.32	1289.12	1.25
HYDROGRAPH AT	AR3A	56.	1.35	5.	2.	2.	.03		
DIVERSION TO	D103A	55.	1.35	5.	2.	2.	.03		
HYDROGRAPH AT	DAR3A	1.	1.35	0.	0.	0.	.03		
HYDROGRAPH AT	AR16C	7.	2.15	2.	1.	1.	.02		
HYDROGRAPH AT	AR16D	23.	1.20	1.	1.	1.	.01		
3 COMBINED AT	CAR16C	23.	1.20	4.	2.	2.	.06		
HYDROGRAPH AT	E103A	20.	1.30	2.	1.	1.	.01		
ROUTED TO	1RAR3	20.	1.35	2.	1.	1.	.01		
HYDROGRAPH AT	DR102A	55.	1.35	5.	2.	2.	.00		
ROUTED TO	2RAR3	55.	1.40	5.	2.	2.	.00		

HYDROGRAPH AT	AR3	8.	1.40	1.	0.	0.	.01		
3 COMBINED AT	CAR3	82.	1.40	7.	3.	3.	.02		
ROUTED TO	RAR16A	75.	1.50	7.	3.	3.	.02	1.14	1.50
HYDROGRAPH AT	AR16A	3.	1.55	1.	0.	0.	.01		
HYDROGRAPH AT	AR16B1	8.	1.25	1.	0.	0.	.00		
HYDROGRAPH AT	S116	87.	1.25	6.	2.	2.	.03		
5 COMBINED AT	C116	149.	1.40	18.	7.	7.	.11		
HYDROGRAPH AT	S107A	50.	1.20	3.	1.	1.	.01		
2 COMBINED AT	CP107A	178.	1.35	21.	9.	9.	.13		
ROUTED TO	DT107A	133.	1.50	13.	5.	5.	.13	1303.38	1.50
ROUTED TO	DT107B	50.	1.90	8.	3.	3.	.13	1300.96	1.90
HYDROGRAPH AT	S104	143.	1.25	12.	5.	5.	.05		
HYDROGRAPH AT	S106	87.	1.25	7.	3.	3.	.03		
3 COMBINED AT	CP104	230.	1.25	27.	11.	11.	.21		
ROUTED TO	DT104	115.	1.50	18.	7.	7.	.21	1295.64	1.50
HYDROGRAPH AT	S111	345.	1.20	26.	10.	10.	.11		
ROUTED TO	DT111	0.	.05	0.	0.	0.	.11	1289.64	2.60
HYDROGRAPH AT	S107B	185.	1.20	9.	4.	4.	.05		
4 COMBINED AT	CP107B	356.	1.20	47.	19.	19.	.69		
ROUTED TO	DT107	8.	3.55	4.	2.	2.	.69	1286.08	3.50
HYDROGRAPH AT	E100B	51.	1.45	7.	3.	3.	.04		
ROUTED TO	R100D	43.	1.85	7.	3.	3.	.04	.41	1.85
HYDROGRAPH AT	E100D	5.	1.65	2.	1.	1.	.01		
2 COMBINED AT	C100D	47.	1.85	8.	3.	3.	.05		
HYDROGRAPH AT	E100A	68.	1.75	13.	5.	5.	.09		
ROUTED TO	1R100C	42.	3.95	12.	5.	5.	.09	.32	3.95
HYDROGRAPH AT	E100C	138.	1.60	17.	7.	7.	.13		
2 COMBINED AT	1C100C	138.	1.60	28.	12.	12.	.22		
HYDROGRAPH AT	E103B	32.	1.55	5.	2.	2.	.03		
ROUTED TO	2R100C	32.	1.60	5.	2.	2.	.03		
2 COMBINED AT	2C100C	170.	1.60	33.	14.	14.	.25		
2 COMBINED AT	C100CD	181.	1.70	41.	17.	17.	.30		
ROUTED TO	R101	181.	1.70	41.	17.	17.	.30		

DIVERSION TO	ADOT	106.	1.70	35.	15.	15.	.30		
HYDROGRAPH AT	REEMS	82.	1.70	6.	2.	2.	.30		
ROUTED TO	R108	81.	1.75	6.	2.	2.	.30		
HYDROGRAPH AT	S108	206.	1.30	18.	7.	7.	.08		
2 COMBINED AT	C108	206.	1.30	24.	10.	10.	.38		
ROUTED TO	DT108A	77.	1.90	10.	4.	4.	.38	1289.81	1.90
ROUTED TO	DT108B	10.	2.90	2.	1.	1.	.38	1287.30	2.90
HYDROGRAPH AT	S109C	16.	1.35	2.	1.	1.	.01		
2 COMBINED AT	CP109	16.	1.35	4.	2.	2.	.39		
HYDROGRAPH AT	S109B	110.	1.20	8.	3.	3.	.04		
HYDROGRAPH AT	S109D	51.	1.20	3.	1.	1.	.01		
3 COMBINED AT	CP109D	173.	1.20	16.	6.	6.	.44		
HYDROGRAPH AT	S109A	53.	1.20	4.	2.	2.	.02		
HYDROGRAPH AT	S109E	34.	1.35	3.	1.	1.	.02		
3 COMBINED AT	CP109E	251.	1.25	23.	10.	10.	.48		
ROUTED TO	DT109	0.	.05	0.	0.	0.	.48	1282.20	14.90
HYDROGRAPH AT	S110	413.	1.25	33.	13.	13.	.14		
3 COMBINED AT	CP110	413.	1.25	36.	15.	15.	1.31		
ROUTED TO	DT110	0.	.05	0.	0.	0.	1.31	1281.99	14.95
HYDROGRAPH AT	AR16E	10.	1.30	1.	0.	0.	.00		
HYDROGRAPH AT	AR17B	11.	1.30	1.	0.	0.	.00		
HYDROGRAPH AT	AR16B2	4.	1.30	0.	0.	0.	.00		
3 COMBINED AT	CP117A	24.	1.30	2.	1.	1.	.01		
ROUTED TO	R117A	23.	1.40	2.	1.	1.	.01	.52	1.40
HYDROGRAPH AT	AR17C	23.	1.35	2.	1.	1.	.01		
HYDROGRAPH AT	AR17	18.	1.50	2.	1.	1.	.02		
HYDROGRAPH AT	S117	55.	1.35	5.	2.	2.	.03		
4 COMBINED AT	CP117B	117.	1.40	11.	4.	4.	.07		
ROUTED TO	R113B	114.	1.40	11.	4.	4.	.07	1.25	1.40
HYDROGRAPH AT	S113C	35.	1.30	4.	2.	2.	.02		
HYDROGRAPH AT	S113B	69.	1.20	5.	2.	2.	.03		
3 COMBINED AT	CP113B	193.	1.35	19.	8.	8.	.11		
HYDROGRAPH AT	S113A	71.	1.25	6.	2.	2.	.03		

2 COMBINED AT	CP113	255.	1.35	25.	10.	10.	.14		
ROUTED TO	1R114	255.	1.35	25.	10.	10.	.14	1.90	1.35
HYDROGRAPH AT	S114	216.	1.15	11.	4.	4.	.06		
2 COMBINED AT	CP114	376.	1.25	36.	15.	15.	.20		
ROUTED TO	DT114	184.	1.55	22.	9.	9.	.20	1290.02	1.55
HYDROGRAPH AT	S112	105.	1.20	7.	3.	3.	.03		
2 COMBINED AT	CP112	205.	1.50	28.	11.	11.	.24		
ROUTED TO	DT112	45.	2.25	7.	3.	3.	.24	1288.23	2.25
HYDROGRAPH AT	S115	296.	1.20	19.	8.	8.	.09		
2 COMBINED AT	CP115A	296.	1.20	26.	11.	11.	.32		
ROUTED TO	DT115A	36.	2.45	9.	4.	4.	.32	1285.25	2.45
2 COMBINED AT	CP115B	36.	2.45	9.	4.	4.	1.63		
ROUTED TO	DT115B	0.	.05	0.	0.	0.	1.63	1283.96	14.95
HYDROGRAPH AT	AR18	28.	1.45	3.	1.	1.	.02		
HYDROGRAPH AT	S118	3.	1.50	1.	0.	0.	.00		
2 COMBINED AT	C118	31.	1.45	3.	1.	1.	.02		
ROUTED TO	1R107C	26.	1.75	3.	1.	1.	.02	.34	1.75
HYDROGRAPH AT	E102A	268.	1.45	23.	9.	9.	.16		
ROUTED TO	R102B	258.	1.50	23.	9.	9.	.16	2.76	1.50
HYDROGRAPH AT	E102B	315.	1.85	53.	21.	21.	.38		
2 COMBINED AT	C102B	447.	1.75	76.	30.	30.	.54		
ROUTED TO	DT102B	0.	.05	0.	0.	0.	.54	1314.67	5.15
HYDROGRAPH AT	E108A	17.	1.30	1.	1.	1.	.01		
HYDROGRAPH AT	E107A	49.	1.35	4.	2.	2.	.03		
2 COMBINED AT	C107A	65.	1.35	5.	2.	2.	.03		
HYDROGRAPH AT	E107B	43.	1.30	3.	1.	1.	.02		
2 COMBINED AT	C107B	106.	1.35	8.	3.	3.	.05		
HYDROGRAPH AT	E101	191.	1.70	24.	10.	10.	.16		
ROUTED TO	R106A	131.	2.60	24.	10.	10.	.16	.61	2.60
HYDROGRAPH AT	E106A	336.	1.80	50.	20.	20.	.35		
4 COMBINED AT	C106A	356.	1.75	82.	33.	33.	1.11		
ROUTED TO	DT106A	0.	.05	0.	0.	0.	1.11	1311.21	8.10
HYDROGRAPH AT	E106B	394.	1.70	57.	23.	23.	.37		

2 COMBINED AT	C106B	394.	1.70	57.	23.	23.	1.48		
HYDROGRAPH AT	E105	252.	1.55	27.	11.	11.	.18		
ROUTED TO	R106C	229.	1.70	27.	11.	11.	.18	2.00	1.70
HYDROGRAPH AT	E106C	39.	1.55	5.	2.	2.	.04		
3 COMBINED AT	C106C	656.	1.70	89.	36.	36.	1.69		
2 COMBINED AT	C106BC	678.	1.70	93.	37.	37.	1.72		
ROUTED TO	2R107C	535.	2.60	93.	37.	37.	1.72	1290.86	2.60
HYDROGRAPH AT	E107C	115.	1.85	25.	10.	10.	.17		
3 COMBINED AT	C107C	590.	2.60	117.	47.	47.	3.52		
ROUTED TO	1R115	524.	3.20	117.	47.	47.	3.52	1259.26	3.20
HYDROGRAPH AT	S302B	46.	1.10	2.	1.	1.	.01		
ROUTED TO	1R108B	36.	1.20	2.	1.	1.	.01	1.49	1.20
HYDROGRAPH AT	S302A	108.	1.25	9.	4.	4.	.04		
ROUTED TO	2R108B	107.	1.25	9.	4.	4.	.04	1.78	1.25
2 COMBINED AT	C108B1	142.	1.25	11.	5.	5.	.05		
ROUTED TO	3R108B	139.	1.30	11.	5.	5.	.05	2.32	1.30
HYDROGRAPH AT	S301	54.	1.60	13.	5.	5.	.05		
ROUTED TO	4R108B	53.	1.65	13.	5.	5.	.05	1.23	1.65
HYDROGRAPH AT	E108B	71.	1.45	8.	3.	3.	.05		
3 COMBINED AT	C108B2	219.	1.35	32.	13.	13.	.15		
ROUTED TO	DT108	0.	.05	0.	0.	0.	.15	1276.46	7.20
ROUTED TO	2R115	0.	.05	0.	0.	0.	.15	1258.00	.00
HYDROGRAPH AT	E108C	230.	1.50	23.	9.	9.	.13		
DIVERSION TO	1D109C	105.	1.50	11.	4.	4.	.13		
HYDROGRAPH AT	D108C	126.	1.50	13.	5.	5.	.13		
ROUTED TO	3R115	81.	2.60	13.	5.	5.	.13	1258.53	2.60
HYDROGRAPH AT	E111	499.	1.80	75.	30.	30.	.50		
DIVERSION TO	D119	188.	1.80	28.	11.	11.	.50		
HYDROGRAPH AT	D111	310.	1.80	47.	19.	19.	.50		
ROUTED TO	1R112	262.	2.50	47.	19.	19.	.50	1306.89	2.50
HYDROGRAPH AT	E104	210.	1.60	23.	9.	9.	.15		
ROUTED TO	2R112	84.	4.15	23.	9.	9.	.15	1318.25	4.15
HYDROGRAPH AT	E112	1793.	1.50	203.	81.	81.	.97		

3 COMBINED AT	C112	1793.	1.50	269.	110.	110.	1.62		
DIVERSION TO	D120	597.	1.50	90.	37.	37.	1.62		
HYDROGRAPH AT	D112A	1196.	1.50	179.	73.	73.	1.62		
DIVERSION TO	1D121A	597.	1.50	90.	37.	37.	1.62		
HYDROGRAPH AT	D112B	598.	1.50	90.	37.	37.	1.62		
ROUTED TO	R113A	514.	1.90	89.	37.	37.	1.62	1284.95	1.90
HYDROGRAPH AT	E113A	930.	1.60	104.	42.	42.	.50		
DIVERSION TO	D113	89.	1.60	25.	10.	10.	.50		
HYDROGRAPH AT	1D113A	841.	1.60	79.	32.	32.	.50		
2 COMBINED AT	C113A	1083.	1.70	169.	68.	68.	2.12		
DIVERSION TO	2D121A	147.	1.70	10.	4.	4.	2.12		
HYDROGRAPH AT	2D113A	936.	1.70	159.	65.	65.	2.12		
ROUTED TO	1R113	847.	2.30	158.	65.	65.	2.12	1277.34	2.30
HYDROGRAPH AT	DR113A	89.	1.20	25.	10.	10.	.00		
ROUTED TO	2R113	89.	2.05	25.	10.	10.	.00	1276.72	1.95
HYDROGRAPH AT	E113	526.	1.80	80.	32.	32.	.52		
3 COMBINED AT	C113	1209.	2.25	262.	107.	107.	2.64		
DIVERSION TO	1D122	893.	2.25	158.	63.	63.	2.64		
HYDROGRAPH AT	1D113	315.	2.25	104.	43.	43.	2.64		
ROUTED TO	R114	305.	2.50	103.	43.	43.	2.64	1260.67	2.50
HYDROGRAPH AT	E114	598.	1.65	85.	34.	34.	.38		
2 COMBINED AT	C114	626.	1.70	187.	77.	77.	3.01		
DIVERSION TO	2D122	170.	1.70	24.	9.	9.	3.01		
HYDROGRAPH AT	D114	456.	1.70	163.	68.	68.	3.01		
ROUTED TO	4R115	454.	1.80	163.	68.	68.	3.01	1251.79	1.80
HYDROGRAPH AT	E115	580.	1.75	84.	34.	34.	.50		
HYDROGRAPH AT	E116B	14.	1.80	3.	1.	1.	.02		
6 COMBINED AT	C115	1047.	1.75	378.	155.	155.	7.34		
HYDROGRAPH AT	DR108C	105.	1.50	11.	4.	4.	.00		
ROUTED TO	R109C	86.	1.90	11.	4.	4.	.00	1290.14	1.90
HYDROGRAPH AT	E109C	243.	1.70	34.	13.	13.	.25		
2 COMBINED AT	C109C	307.	1.80	44.	18.	18.	.25		
DIVERSION TO	D116A	0.	1.80	0.	0.	0.	.25		

HYDROGRAPH AT	D109C	307.	1.80	44.	18.	18.	.25		
ROUTED TO	R109D	292.	1.90	44.	18.	18.	.25	1256.17	1.90
HYDROGRAPH AT	E109D	143.	1.50	15.	6.	6.	.09		
2 COMBINED AT	C109D	350.	1.85	59.	24.	24.	.34		
DIVERSION TO	D109DS	38.	1.85	3.	1.	1.	.34		
HYDROGRAPH AT	D109D	312.	1.85	56.	23.	23.	.34		
ROUTED TO	1R110A	310.	1.95	56.	23.	23.	.34	2.02	1.95
HYDROGRAPH AT	E100E	30.	1.25	2.	1.	1.	.01		
ROUTED TO	1R109A	12.	2.50	2.	1.	1.	.01	.40	2.50
HYDROGRAPH AT	S400	191.	1.20	12.	5.	5.	.06		
ROUTED TO	1R109B	189.	1.20	12.	5.	5.	.06		
HYDROGRAPH AT	S325A	81.	1.20	5.	2.	2.	.03		
ROUTED TO	2R109B	78.	1.25	5.	2.	2.	.03	1.51	1.25
2 COMBINED AT	C109B1	261.	1.20	18.	7.	7.	.09		
ROUTED TO	DT109B	0.	.05	0.	0.	0.	.09	1275.23	3.25
HYDROGRAPH AT	E109B	76.	1.60	10.	4.	4.	.07		
2 COMBINED AT	C109B2	76.	1.60	10.	4.	4.	.16		
HYDROGRAPH AT	E109B1	54.	1.40	5.	2.	2.	.03		
ROUTED TO	2R109A	37.	2.10	5.	2.	2.	.03	.64	2.10
HYDROGRAPH AT	E109A	170.	1.50	17.	7.	7.	.12		
4 COMBINED AT	C109A	238.	1.55	34.	13.	13.	.32		
ROUTED TO	R109E	183.	2.10	34.	13.	13.	.32	.61	2.10
HYDROGRAPH AT	E109E	254.	1.50	25.	10.	10.	.17		
2 COMBINED AT	C109E	254.	1.50	58.	23.	23.	.50		
ROUTED TO	2R110A	223.	1.95	58.	23.	23.	.50	.75	1.95
HYDROGRAPH AT	E110A	108.	1.55	14.	6.	6.	.09		
3 COMBINED AT	C110A	591.	1.95	127.	52.	52.	.92		
HYDROGRAPH AT	DR109C	0.	.05	0.	0.	0.	.00		
ROUTED TO	R116A	0.	.05	0.	0.	0.	.00		
HYDROGRAPH AT	E116A	308.	1.75	44.	18.	18.	.32		
2 COMBINED AT	C116A	308.	1.75	44.	18.	18.	.32		

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
1R102	MANE	1.23	106.27	80.89	.55	3.00	106.03	81.00	.54

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2573E+01 EXCESS= .0000E+00 OUTFLOW= .2633E+01 BASIN STORAGE= .7422E-04 PERCENT ERROR= -2.3

R105B	MANE	.49	100.00	70.03	-1.00	3.00	100.00	72.00	-1.00
1RAR3	MANE	1.16	20.34	81.31	1.35	3.00	20.34	81.00	1.35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7921E+00 EXCESS= .0000E+00 OUTFLOW= .7928E+00 BASIN STORAGE= .2026E-06 PERCENT ERROR= -.1

2RAR3	MANE	.49	54.58	82.13	-1.00	3.00	54.58	84.00	-1.00
2R100C	MANE	2.34	32.27	96.91	1.27	3.00	32.26	96.00	1.27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2295E+01 EXCESS= .0000E+00 OUTFLOW= .2294E+01 BASIN STORAGE= .1426E-05 PERCENT ERROR= .0

R101	MANE	.84	180.76	103.33	1.34	3.00	180.56	102.00	1.34

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2119E+02 EXCESS= .0000E+00 OUTFLOW= .2119E+02 BASIN STORAGE= .5265E-04 PERCENT ERROR= .0

R108	MANE	.83	81.79	103.55	.19	3.00	81.40	105.00	.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3026E+01 EXCESS= .0000E+00 OUTFLOW= .3031E+01 BASIN STORAGE= .1823E-07 PERCENT ERROR= -.2

1R109B	MANE	.49	190.14	72.80	1.96	3.00	189.33	72.00	1.96

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6163E+01 EXCESS= .0000E+00 OUTFLOW= .6168E+01 BASIN STORAGE= .3572E-06 PERCENT ERROR= -.1

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

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: KV JRM Date: 10-14-94 12-14-94

LOCATION DATA

Location: D105

Project Name: GAP Subarea id: S103

Drainage Area Cover: RESIDENTIAL, COMMERCIAL

DESIGN DATA

Drainage Area 57.8000 acres

Watercourse Length 3100.0000 feet

Top Elevation 1313.0000 feet

Bottom Elevation 1299.0000 feet

Slope 0.452 % feet/feet

Roughness Coefficient (Kb) 0.0290

10-year, 6-Hour Rainfall 2.0800 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	60	86	106	149	191	231
C	0.560	0.560	0.560	0.616	0.672	0.700
Tc (min)	24.5	21.5	19.8	18.1	17.0	16.0
i (in/hr)	1.9	2.6	3.3	4.2	4.9	5.7

STANLEY CONSULTANTS

Computed by JRM Date 12-9-94
Checked by _____ Date _____
Reviewed by _____ Date _____
Approved by _____ Date _____

Job No. 12291-3-700 Page No. _____
Subject GRAND AVENUE PROPERTY
COMPARISON OF ADMS
AND SCI HEC-1 MODELS
Sheet No. _____ of _____

SUB-BASIN	WHITE TANKS/ AGUA FRIA ADMS Q_p	V	SCI HEC-1 Q_p	V
104	238	10	210	11
111	447	36	499	37
113A	412	53	930	52

THE 3 SUB-BASINS COMPARED ABOVE ASSUME COMMON LAND USE AND SOIL TYPES. THE WHITE TANKS/AGUA FRIA ADMS UTILIZES "S" GRAPH UNITGRAPH METHODOLOGY WHILE SCI'S MODEL UTILIZES CLARK UNITGRAPH METHODOLOGY. GENERALLY THE PEAK DISCHARGES AND RUNOFF VOLUMES ARE GREATER UTILIZING THE CLARK UNITGRAPH METHODOLOGY WITH THE NON-AERIAL REDUCED 100-YEAR, 2-HOUR DESIGN STORM.

V = VOLUME, AC-FT
Q_p = PEAK DISCHARGE, CFS

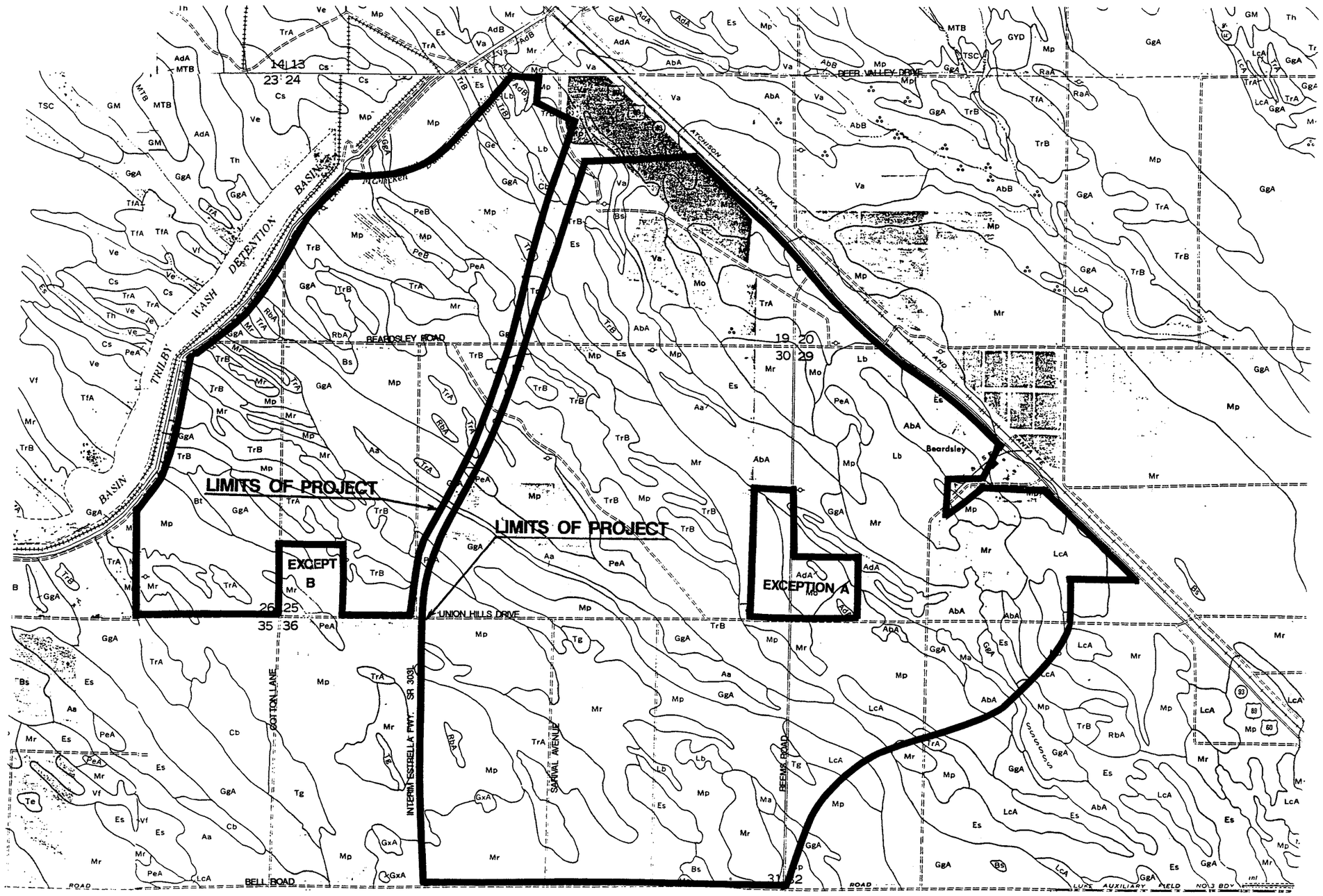
THE TOTAL RUNOFF VOLUME FOR THE SCI 100-YEAR, 2-HOUR EXISTING CONDITION MODEL IS 692 ac-ft. THE TOTAL RUNOFF VOLUME FOR THE SCI 100-YEAR, 6-HOUR EXISTING CONDITION MODEL IS 592 ac-ft. THE NON-AERIALLY REDUCED 100-YEAR, 2-HOUR STORM GENERATES SIGNIFICANTLY GREATER RUNOFF VOLUMES THAN THE 100-YEAR, 6-HOUR STORM.

MAP UNIT NO.	Green and Ampt Parameters for Bare Ground			
	XKSAT	Soil Texture Classification	XKSAT	PSIF
AbA	0.38	sandy loam	0.40	4.30
AdA	0.40	sandy loam	0.40	4.30
AdB	0.39	sandy loam	0.40	4.30
Bs	0.39	sandy loam	0.40	4.30
Cb	0.40	sandy loam	0.40	4.30
CrB	0.40	sandy loam	0.40	4.30
Lb	0.40	sandy loam	0.40	4.30
Ma	0.40	sandy loam	0.40	4.30
Mo	0.39	sandy loam	0.40	4.30
PeA	0.37	sandy loam	0.40	4.30
PeB	0.38	sandy loam	0.40	4.30
Va	0.39	sandy loam	0.40	4.30
Aa	0.26	loam	0.25	3.50
Bt	0.25	loam	0.25	3.50
Es	0.25	loam	0.25	3.50
Ge	0.26	loam	0.25	3.50
GgA	0.25	loam	0.25	3.50
GxA	0.23	loam	0.25	3.50
LcA	0.25	loam	0.25	3.50
Mp	0.25	loam	0.25	3.50
RbA	0.26	loam	0.25	3.50
RbA	0.26	loam	0.25	3.50
Te	0.25	loam	0.25	3.50
Ve	0.25	loam	0.25	3.50
Mr	0.05	clay loam	0.04	8.20
Tg	0.04	clay loam	0.04	8.20
TrA	0.11	clay loam	0.04	8.20
TrB	0.13	clay loam	0.04	8.20

DEL WEBB'S

GRAND AVENUE PROPERTY in SURPRISE, ARIZONA

PRE-DEVELOPMENT SOILS



1" = 2100'±

SOURCE: SOIL SURVEY OF MARICOPA COUNTY, ARIZONA, CENTRAL PART, SOIL CONSERVATION SERVICE, SEPTEMBER 1977, SHEET NO. 8

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK RD. Suite 130
PHOENIX, ARIZONA 85016
(602) 912-6500

APPENDIX E
DESIGN CRITERIA AND DEVELOPMENT AGREEMENT WITH CITY OF SURPRISE

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14393
RICHARD B.
HOPPE
Date Signed 2-27-97
ARIZONA, U.S.A.

ADDITIONAL PROPERTIES

DRAINAGE CONCEPT PLAN

(FOR PROPERTY NORTH AND SOUTH OF UNION HILLS)

Hydrologic Features

Del Webbs's Grand Avenue property and its contributing drainage area comprise approximately 5,700 acres and are bounded by the McMicken Dam to the northwest, the Beardsley Canal to the north and Grand Avenue to the northeast and Bell Road and Bullard Avenue to the south and east respectively. The hydrologic character of this area is typical of the flat desert plain of the Lower Sonoran Desert. The existing desert and graded farm fields rise gently to the northwest at a slope of about 0.005 ft/ft or 26.4 ft/mile. Within the area, the existing drainage patterns are controlled by arterial roads and various roadways and drainage canals in the north-south and east-west direction. Local drainage is typically either east or south in quarter, half and one mile increments as directed by these roads and canals. With the proposed development, it is expected that a majority of these existing controls will be removed within the developed area but that the general routing of all runoff will continue to be in a southeasterly direction.

Runoff in the project area generally consists of sheet flow and shallow concentrated flow except for occasional washes and drainageways formed by roads and irrigation canals which tend to redirect and concentrate flow. A majority of the existing area is undeveloped desert or is in agricultural use. Approximately 60 percent of the area has some history of agricultural use: primarily orchards, market vegetables or fruits, and fallow lands. More than 30 percent is in its natural desert state covered with grasses, cactus and brush. The less than 10 percent that is developed primarily consists of the Kingswood Parke and Sun Village developments in the southeast corner of the area. In addition to

these two developments, there is another development which lies in a half square mile area west of Cotton Lane and north of Bell Road which may potentially contribute runoff to the project.

Hydrology of the project area has been studied in past reports. The Flood Control District of Maricopa County has contracted with the WLB Group to perform an "Area Drainage Master Study" (ADMS) of the White Tanks - Agua Fria area of which this project is a part. This study is still in progress but hydrology is essentially complete. The White Tanks - Agua Fria ADMS study indicates existing drainage outfall locations south across Bell Road at Litchfield Road, Bullard Avenue, Reems Road, 1/2 mile west of Reems Road, Sarival Avenue and the Interim 303 roadway. This discharge is in the form of shallow overland and street flow.

Prior to the White Tanks - Agua Fria ADMS, a master drainage report was prepared for phase one of the Kingswood Parke Development by Coe and Van Loo Engineers. This report also includes some adjacent Sun Village drainage and indicates a major outfall onto Bell Road just east of Bullard Avenue. A combination of stormwater retention and detention is provided within these developments for both onsite and offsite flows.

The White Tanks - Agua Fria ADMS has designed approximately seven miles of Reems Road south from Beardsley Road as an Approximate Flood Zone "A". This includes the two miles of Reems Road in the project area between Beardsley Road and Bell Road. This floodplain in the project area will not exist with the proposed drainage improvements associated with the project development. A change to the report is necessary to have the draft floodplain designation amended to eliminate the approximate "A" Zone within the project limits before final adoption of the ADMS.

Site Master Plan Drainage Features

The overall concept for the proposed development drainage plan is to control all the runoff from the 100-year, 2-hour storm in a combination of retention and detention basins distributed throughout the development area. The 100-year, 2-hour design storm is set forth in the attached "Del Webb's Grand Avenue Property Drainage Standards (hereinafter referred to as "Drainage Standards").

Detention will be provided within the topographic features of the golf courses and the open space associated with the development. It is intended for these basins within the golf courses to drain down within 24 hours of the end of the storm. Retention will provide longer term storage of runoff for up to four days from the end of storm as presented in the Drainage Standards. The retention basins will be located at the downstream limits of the project area along Bell Road and Reems Road as shown on the Conceptual Drainage Plan.

The controlled outlets of the golf course detention basins will typically consist of culverts under the project roadways. Runoff is bled from the proposed retention basins by a proposed storm drain outlet conduit to the Agua Fria River. The capacity of this conduit is anticipated to be between 100 and 200 cfs. The conduit will convey outflow east along Bell Road to the existing Sun City West drainage channel and then by this channel to the Aqua Fria River. This concept represents a regional approach to controlling drainage. The general arrangement of flow paths and detention and retention features are shown on the Conceptual Drainage Plan. Upon compliance with City Standards, the outlet conduit will be turned over to the City of Surprise. The City may tie into the drainage pipe (or outlet conduit) at any point which is to the East of the property for the purpose of capturing and transporting storm runoff through any excess available capacity in the pipe which is over and above developer's usage.

All runoff from the 100-year, 2-hour storm that is tributary to Reems Road will be routed through the retention basins located north of Reems Road and Bell Road. A portion of the flows generated by the proposed development and its contributing drainage area may cross Reems Road and enter the areas immediately tributary to Kingswood Parke and Sun Village. Runoff that is generated within the Kingswood Parke parcels that lie southeast of Reems Road will be accommodated with local retention and detention facilities located within that development in accordance with the approved Kingswood Parke Phase One Master Drainage Report prepared by Coe and Van Loo Consulting Engineers in 1987.

The intent of the drainage concept is to control runoff up to the 100-year, 2-hour storm and, therefore, eliminate or significantly reduce downstream discharge to Bell Road and Kingswood Parke.

Specific Plan Elements

Within each developed subdivision, stormwater will be collected and conveyed to the golf course and open space drainage routes by the methods provided for in the attached Drainage Standards.

The drainage concept plan will require at least four major drainage crossings of the proposed Estrella Freeway. These will be located as shown on the Conceptual Drainage Plan. There is a potential to employ the existing highway culverts for this purpose but for this conceptual plan, it has been assumed that the existing facilities are to be abandoned.

Preliminary peak flow rates and times to peak have been estimated for various locations throughout the project area under the proposed condition. In general, the peak flow rate reaching any retention or detention facility is in the range of 200 to 800 cfs. The time to peak for these flows ranges from about 1.5 to 15 hours. The controlled outflow from the detention basins is in the range of 50 to 200 cfs. The maximum depth of flow for the golf course/open space routing channels is less than three

feet and the velocities are less than six feet per second. Most golf course/open space channels throughout the site will have base widths of 10 to 30 feet and maximum side slopes of 1V to 4H. For applications accommodating greater flows or potentially erosive velocities, channels will be stabilized and have base widths at 10 to 15 feet, 1V to 1.5H side slopes and depths as required to accommodate the flows.

For a 100-year, 2-hour precipitation of 2.77 inches and an estimated project area of about 3,715 acres, the required storage volume is on the order of 590 acre-feet.

The proposed golf course detention basins will require storage volumes in the 10 to 50 acre-feet range. The storage volumes of the proposed retention basins range from 50 to 100 acre-feet. The planform geometry of the basins will be configured to meet development layout and landscaping requirement. Proposed detention/retention basins are shown schematically on the Conceptual Drainage Plan. The maximum depth of the basins will be about eight (8) feet above the elevation where stormwater storage begins as presented in Drainage Standards.

DEL WEBB'S GRAND AVENUE PROPERTY IN SURPRISE
DRAINAGE STANDARDS

Conceptual Drainage Plan & Report

A conceptual storm water collection and retention/detention plan shall be submitted with a preliminary plat or site development plan and approved prior to the approval of such plat or plan. In the design of the development, every effort shall be made to maintain or not exceed existing drainage outfall locations and peak discharges. The plan shall include but not be limited to the following:

A. Method of collection (surface and/or sub-surface).
B. Depth, side slopes and areas of retention/detention.
C. Calculations of volume required and volume provided.
D. High water elevation.
E. Any other data to form a complete plan.

A final drainage report must be submitted with the final plans showing compliance with the conceptual drainage plan, and shall be received and approved by the City Engineer.

Development Regulations

A. All water from a one hundred (100) year storm of a two (2) hour duration, which falls within the area being developed, included the respective one-half (1/2) of all abutting streets (whether or not it is a dedicated street which may exist by an improvement district and owned by the City) shall be detained/retained within the boundaries of the developed land. No detention/retention shall be allowed in public rights of way. The method of collection and retention/detention shall be approved by the City.

B. Two or more developers may join together to provide a common retention facility. A letter of agreement signed by all developers participating in the common retention area must be presented to the City and the recorded plat shall indicate that the retention area is a joint facility. The joint retention area must meet all criteria as a single area.

C. All retention/detention basins shall have a design capacity to preclude a water depth in excess of eight (8) feet (exclusive of lakes). In no event shall storm water stand in the retention basins longer then ninety six (96) hours. The retention/detention basins shall be operated in conformance with the Maricopa County Vector Control Regulations.

D. No retention/detention basin will be controlled or owned by the City. They shall be maintained by the owner. All retention basin areas shall be designated as easement areas for retention purposes and shall have a recorded restrictive covenant requiring perpetual maintenance.

E. Curbed streets shall be designed and constructed to carry the storm water runoff from a ten (10) year storm at a water surface no higher than 0.10' above top of curb. When peak flows from the designed storm exceed the street capacity, an open area drainage and retention/detention system shall be designed to carry the excess storm water.

F. Peak flows from a fifty (50) year storm shall be carried within the cross section between buildings (front yards and street). The finished floor elevation of all buildings finished floors shall be minimum of 14 inches above the low out-fall of the site.

G. For non-residential areas the required retention/detention may be held upon asphalt, concrete or other hard surface. In residential areas the parking areas may not hold retention/detention volume.

H. The City of Surprise shall not be responsible for the design, performance, operation or maintenance of the retention basin.

Retention/Detention Calculation, Drainage Flows, and Dry Wells

The retention/detention calculations will be performed in accordance with the methodology presented in the Drainage Design Manual of Maricopa County, Volume 1, Hydrology dated June 1, 1992.

A HEC-1 computer model for the 100-year 2-hour storm in accordance with methodology from the County's drainage manual will be the basis for retention/detention design. The HEC-1 Computer Model will also be performed for a 100-year 6-hour storm to check the outfall conditions.

Infiltration into the dry-well cannot be considered to reduce the size of the retention area. The property owner of record shall be responsible for the design, performance, operation or maintenance of dry-wells used with on-site retention.

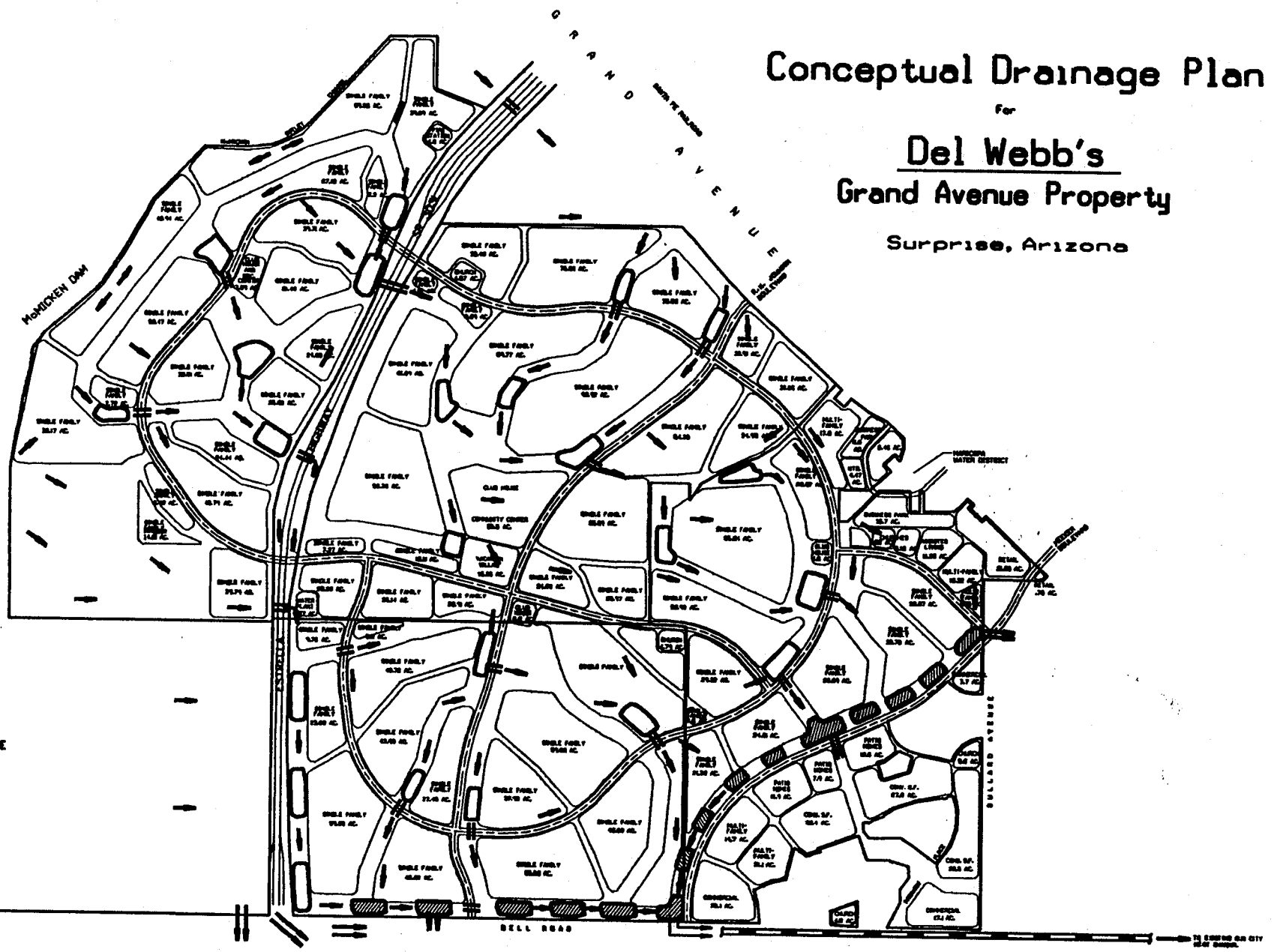
Conceptual Drainage Plan

For

Del Webb's

Grand Avenue Property

Surprise, Arizona



January 10, 1994

STANLEY CONSULTANTS, INC.

APPENDIX F
SUMMARY OF FINDINGS REGARDING MCMICKEN DAM

SUMMARY OF FINDINGS
REGARDING MCMICKEN DAM

McMicken Dam and its outlet channel were constructed in 1955 through a joint effort of the Corps of Engineers, Maricopa County, Agua Fria Soil Conservation District and Maricopa County Municipal Water Conservation District No. 1. The dam is a compacted earth fill flood control structure located west of the Beardsley Canal and south of Grand Avenue. It was constructed to protect Luke Air Force Base and the surrounding improved agricultural areas from flooding. The dam's construction was prompted by several floods which caused extensive damage to this area. The contributing drainage area of McMicken Dam consists of approximately 247 square miles of (primarily) undeveloped desert which encompasses the major tributaries of Trilby Wash, Iona Wash and Me Wash as well as numerous minor washes.

The primary outlet for the dam consists of a 20 foot wide by 11 foot high concrete discharge structure just south of Grand Avenue. Flow from this structure enters an earth channel (The McMicken Dam Outlet Channel) which passes under Grand Avenue and carries the flow in a northeasterly direction with eventual outfall to the Agua Fria River via one of the river's local tributary washes. The dam was originally called the Trilby Wash Detention Basin after its largest tributary and later named McMicken Dam after a long time proponent, Kenneth B. McMicken, of the Agua Fria Soil Conservation District.

McMicken Dam replaced two interim earthfill flood control dams called the SCS Dams Nos. 3 and 4 which had just recently been completed as a joint project of the Soil Conservation Service and local sponsors. McMicken Dam is approximately 9.4 miles in length, has a maximum height above ground of 34 feet and a total storage capacity of 23,800 acre feet including 5 feet of freeboard. It was designed to handle the Corps of Engineers "Standard Project Flood" (SPF) which uses a rainfall depth of 8.6 inches centered over the contributing watershed. The peak inflow for this flood is 35,000 cfs

and the peak unregulated discharge through the principal spillway is 4450 cfs. The SPF does not have a specific return frequency associated with it but is considered significantly more extreme than the 100-year flood. The total drawdown time for the SPF is estimated at between 3 and 4½ days.

The emergency spillway, which is located at the north end of the dam is designed for a "Maximum Probable Flood" (MPF) with a peak inflow of 52,000 cfs. In addition to the principal and emergency spillways, there are two gated 24-inch diameter concrete pipes which are used to drain local depressions in the impound basin.

Ownership, maintenance and operation of the dam was given to Maricopa County in 1956. The Flood Control District of Maricopa County (FCD), which was formed in 1959, now assumes ownership, maintenance and operation of the flood control aspects of the dam. Transverse cracks, rodent holes and surface irregularities in the main embankment were discovered during routine annual maintenance inspections beginning in about 1963. The extent of these deficiencies created concern by the FCD and Corps of Engineers for the possibility of catastrophic failure. After many years of study and evaluation, it was decided to breach the dam in two locations to prevent the possibility of it filling and breaching itself through failure of the earth fill.

These breaches were made in the summer of 1977 by physically removing about a 700 foot long section of the main structure at its highest point near the inflow of trilby wash and another 110 foot long section near the principal spillway. A feasibility study to repair the dam and fill in the breaches was begun in 1981. Subsequently, repairs were made consisting of a longitudinal trench down the middle of the dam which was then lined with geotextile fabric and backfilled with gravel. The breach

sections were repaired at the same time and the dam was fully restored to its original flood control function.

Maintenance inspection of McMicken Dam and its outlet channel is made semi-annually by the FCD. Inspection includes the main dam embankment, all spillways, access roads, fencing and any other feature pertinent to its operation and function. There was also a system of benchmarks which were installed on the dam after repairs were made to evaluate the potential for settling and land subsidence. These benchmarks are leveled on a 2 to 5 year basis. According to the FCD Operations Division, the dam is in good operating condition and there is no evidence of settling or subsidence.

Since McMicken Dam is designed for greater than the 100-year flood and because it has been restored to its original viability, it is generally considered as the upstream limit of contributing drainage area for those areas downstream which it protects. This was the assumption made in the drainage report for the Sun Village and Kingswood Parke developments in the City of Surprise as well as for the White Tanks - Agua Fria Area Drainage Master Study (ADMS) currently in progress.

Because of the dam's size and status under Arizona Revised Statues 45-701 through 45-717, the Arizona Department of Water Resources (ADWR) Office of Dam Safety requires a dam break analysis to be made to determine the area that would be at substantial risk downstream in the event of failure. Such a study was undertaken by the FCD in April 1987. This study considered numerous potential hypothetical failure breach locations for the dam's main embankment but narrowed this down to three specific locations for analysis. Of these three locations, the one of primary interest for the City of Surprise and surrounding area is the first scenario which considered a failure breach located at the existing outlet channel.

The following paragraph is presented from the Discussion of Results section of the Dam-Break Analysis of McMicken Dam.

> "If the dam were to fail at the outlet channel, the communities of Surprise and El Mirage south of Grand Avenue would sustain most of the damage. The depth of flow would be 1 to 2 feet deep with average velocities of about 2.5 feet per second (fps). It would take approximately 3 hours for the flood waters to reach Surprise, and 5 hours to reach the Agua Fria River. Since there is some warning time available, loss of life could be prevented under this scenario."

This conclusion is based on an estimated peak discharge through the failure breach of 23,200 cfs which is based on MPF inflow to the dam. An exhibit was included in the report showing the area most likely to be inundated in this scenario. A copy of this exhibit is attached. The flooded area in this report is not recognized by the Federal Emergency Management Agency (FEMA) or used for floodplain management because of its subjectivity and extremely rare probability.

BIBLIOGRAPHY

1. Design Memorandum No. 1, Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel; United Stated Army Corps of Engineers, Los Angeles District; November 1953.

2. Design Memorandum No. 2, Design Analysis for Trilby Wash Detention Basin and Outlet Channel; United States Army Corps of Engineers, Sacramento District; March 1, 1954.

3. Dam Break Analysis of McMicken Dam, Maricopa County, Arizona; Flood Control District of Maricopa County; April 1987.

4. Wittmann Area Discharge Master Study, Part A, Hydrology and Hydraulics; The WLB Group; March 10, 1989.