UPPER EAST MARICOPA FLOODWAY (UEMF)
FLOODPLAIN DELINEATION STUDY
FCDMC NO. 94-26
TECHNICAL DATA NOTEBOOK

JANUARY, 1996

PREPARED FOR:
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 WEST DURANGO STREET
PHOENIX, ARIZONA 85008

PREPARED BY:

A-N WEST, INC.
7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Registered Professional Engineer (Civil)
CERTIFICATE NO.
15290
GREGORY A.
SCHUELKE
Date Signed 1/29/96
ARIZONA, U.S.A.

A-N WEST NO. 7158-03

A-N WEST INC.
Consulting Engineers
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200

Federal Emergency Management Agency

Washington, D.C. 20472

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 98-09-364P

The Honorable Wayne Brown
Mayor, City of Mesa
P.O. Box 1466
Mesa, Arizona 85211

Community: City of Mesa, Arizona
Community No.: 040048
Panels Affected: 04013C2205 E and 2215 F
Effective Date of This Revision: JUL 20 1998

102-I-A-C

Dear Mayor Brown:

This responds to a request that the Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas (the effective FIRM for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated January 16, 1998, Hasan Mushtaq, Ph.D., P.E., Engineering Division, Flood Control District of Maricopa County, requested that FEMA revise the FIRM to show the effects of more detailed topographic information and hydrologic and hydraulic analyses along the upslope side of the Roosevelt Irrigation District Canal (RIDC) from Brown Road to McKellips Road.

All data required to complete our review of this request were submitted with letters from Dr. Mushtaq.

We have completed our review of the submitted data and the flood data shown on the effective FIRM and FIS report. We have revised the FIRM to modify the elevations, floodplain boundary delineations, and zone designations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) along the upslope side of the RIDC. As a result of the modifications, base flood elevations (BFEs) were added along the upslope side of the RIDC from Brown Road to McKellips Road, and the width of the Special Flood Hazard Area (SFHA), the area that would be inundated by the base flood, decreased. The SFHA zone designation along the upslope side of the RIDC from Brown Road to McKellips Road has been changed from Zone A, an SFHA with no BFEs determined, to Zone AH, an SFHA with flood depths of 1 to 3 feet (usually areas of ponding) and BFEs determined. The modifications are shown on the enclosed annotated copies of FIRM Panel(s) 04013C2205 E dated September 4, 1991, and 04013C2215 F dated December 3, 1993. This Letter of Map Revision (LOMR) hereby revises the above-referenced panel(s) of the effective FIRM dated September 30, 1995.

The modifications are effective as of the date shown above. The map panel(s) as listed above and as modified by this letter will be used for all flood insurance policies and renewals issued for your community.

The following table is a partial listing of existing and modified BFEs:

Location	Existing BFE (feet)*	Modified BFE (feet)*
Just south of McKellips Road	None	1,351
Approximately 1,800 feet north of Brown Road	None	1,349

*Referenced to the National Geodetic Vertical Datum, rounded to the nearest whole foot

Public notification of the proposed modified BFEs will be given in the *Arizona Republic* on or about August 20 and August 27, 1998. A copy of this notification is enclosed. In addition, a notice of changes will be published in the *Federal Register*. Within 90 days of the second publication in the *Arizona Republic*, a citizen may request that FEMA reconsider the determination made by this LOMR. Any request for reconsideration must be based on scientific or technical data. All interested parties are on notice that, until the 90-day period elapses, the determination to modify the BFEs presented in this LOMR may itself be modified.

We are processing a revised FIRM and Flood Insurance Study (FIS) report for Maricopa County; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report were submitted to your community for review on December 23, 1997. We will incorporate the modifications made by this LOMR into the countywide FIRM and FIS report before they become effective.

This LOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development, and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the SFHA. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

The basis of this LOMR is, in whole or in part, a channel-modification/culvert project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management regulations. Consequently, the ultimate responsibility for maintenance of the modified channel and culvert rests with your community.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed minimum NFIP criteria. These criteria are the minimum and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications described in this LOMR. Our records show that your community has met this requirement.

A Consultation Coordination Officer (CCO) has been designated to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Dorothy M. Lacey
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
The Presidio of San Francisco, Building 105
San Francisco, California 94129-1250
(415) 923-7177

FEMA makes flood insurance available in participating communities; in addition, we encourage communities to develop their own loss reduction and prevention programs. Our Project Impact initiative, developed by FEMA Director James Lee Witt, seeks to focus the energy of businesses, citizens, and communities in the United States on the importance of reducing their susceptibility to the impact of all natural disasters, including floods, hurricanes, severe storms, earthquakes, and wildfires. Natural hazard mitigation is most effective when it is planned for and implemented at the local level, by the entities who are most knowledgeable of local conditions and whose economic stability and safety are at stake. For your information, we are enclosing a Project Impact Fact Sheet. For additional information on Project Impact, please visit our Web site at **www.fema.gov**.

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please contact the CCO for your community at the telephone number cited above. If you have any technical questions regarding this LOMR, please contact Mr. Mike Grimm of our staff in Washington, DC, either by telephone at (202) 646-2878 or by facsimile at (202) 646-4596.

Sincerely,

Mike Grimm, Project Engineer
Hazards Study Branch
Mitigation Directorate

For: Matthew B. Miller, P.E., Chief
Hazards Study Branch
Mitigation Directorate

Enclosure(s)

cc: Hasan Mushtaq, Ph.D., P.E. ✓
Engineering Division
Flood Control District
of Maricopa County

Ms. Terri Miller
State Coordinator, NFIP
Arizona Department
of Water Resources

Mr. Gregory A. Schuelke
A-N West Consulting Engineers

Federal Emergency Management Agency

FACT SHEET

Office of Emergency Information and Media Affairs, Washington, D.C. 20472 (202) 646-4600

PROJECT IMPACT
Building a Disaster Resistant Community

BACKGROUND
PROJECT IMPACT is an initiative developed by FEMA Director James Lee Witt to challenge the country to undertake actions that protect families, businesses and communities by reducing the effects of natural disasters. This initiative includes a national awareness campaign, the selection of pilot communities that demonstrate the benefits of hazard mitigation through a partnership approach, and an outreach effort to businesses and communities using a new guidebook that offers a formula for a community or business to follow to become disaster resistant.

RATIONALE
The increasing number and severity of natural disasters the past decade demands that action be taken to reduce the threat that hurricanes, severe storms, earthquakes, floods and wildfires impose upon the economic stability, economic future and safety of the citizens of the U.S. As the federal agency responsible for emergency management, FEMA is committed to reducing disaster losses by focusing the energy of businesses, citizens, and communities in the U.S. on the importance of reducing their susceptibility to the impact of natural disasters.

There are three primary tenets of the PROJECT IMPACT initiative:

- *Mitigation is a local issue.* It is best addressed by a local partnership that involves government, businesses and private citizens.

- *Private sector participation is essential.* Disasters threaten the economic and commercial growth of our cities, towns, villages and counties. Without the participation of the private sector, comprehensive solutions will not be developed.

- *Mitigation is a long-term effort that requires long-term investment.* Disaster losses will not be eliminated overnight.

PILOT COMMUNITIES
Director Witt and FEMA have worked closely with seven communities throughout the U.S. to develop a PROJECT IMPACT plan that localities, businesses and citizens can follow to build disaster resistant communities where they live and work. Director Witt will participate in events in each of these communities to congratulate them on their foresight, commitment, and contribution to a disaster resistant nation.

PROJECT IMPACT GUIDEBOOK
The guidebook presents that steps a community can take to become disaster resistant. It also provides examples of the actions and resources available to accomplish this goal.

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE CITY OF MESA, MARICOPA COUNTY, ARIZONA, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On September 30, 1995, the Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the City of Mesa, Maricopa County, Arizona, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Directorate has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified base flood elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate more detailed topographic information and hydrologic and hydraulic analyses along the upslope side of the Roosevelt Irrigation District Canal (RIDC) from Brown Road to McKellips Road and has resulted in a revised delineation of the regulatory floodway, an increase and decrease in SFHA width, and the addition of BFEs along the upslope side of the RIDC. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Just south of McKellips Road	None	1,351
Approximately 1,800 feet north of Brown Road	None	1,349

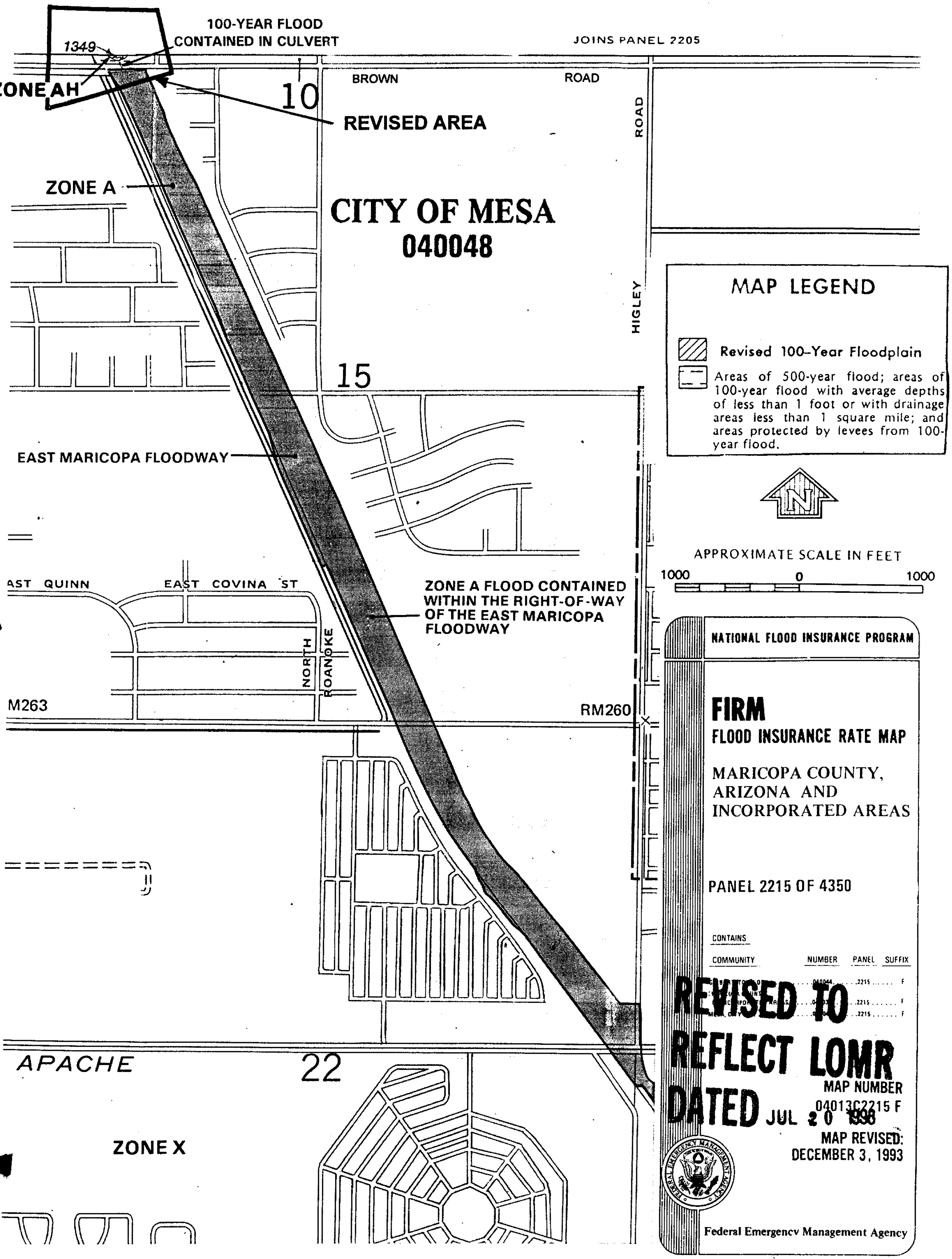
*National Geodetic Vertical Datum, rounded to nearest whole foot

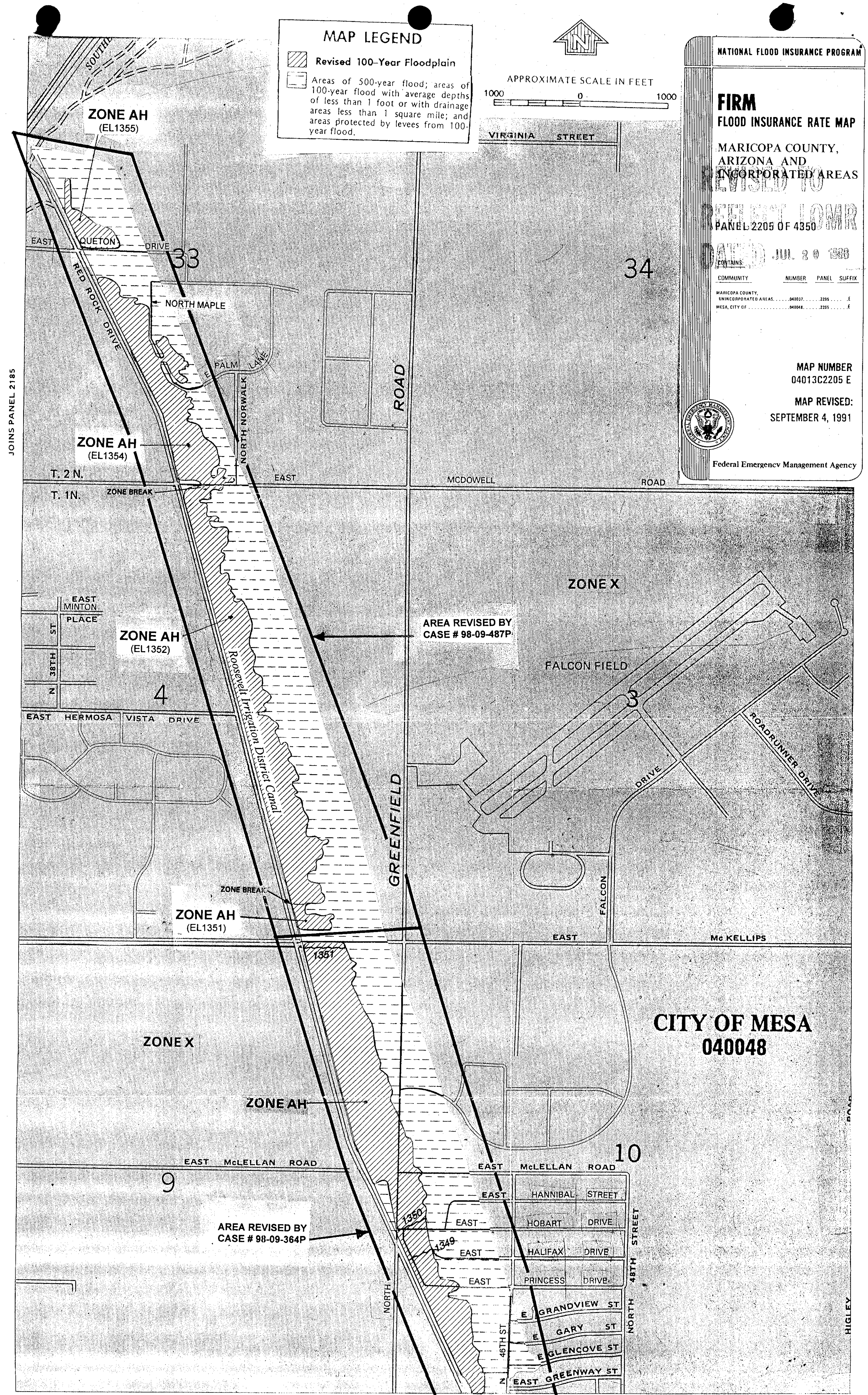
Under the above-mentioned Acts of 1968 and 1973, the Mitigation Directorate must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Directorate reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Directorate's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Wayne Brown
Mayor, City of Mesa
P.O. Box 1466
Mesa, Arizona 85211


100-YEAR FLOOD
CONTAINED IN CULVERT
JOINS PANEL 2205
1349
ZONE AH
10
BROWN
ROAD
REVISED AREA
ZONE A
CITY OF MESA
040048
HIGLEY
ROAD
MAP LEGEND
Revised 100–Year Floodplain
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.
N
APPROXIMATE SCALE IN FEET
1000
0
1000
15
EAST MARICOPA FLOODWAY
AST QUINN
EAST COVINA ST
ZONE A FLOOD CONTAINED WITHIN THE RIGHT-OF-WAY OF THE EAST MARICOPA FLOODWAY
NORTH
ROANOKE
M263
RM260
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS
PANEL 2215 OF 4350
CONTAINS
COMMUNITY
NUMBER
PANEL
SUFFIX
2215 F
2215 F
2215 F
REVISED TO REFLECT LOMR DATED JUL 20 1998
MAP NUMBER
04013C2215 F
MAP REVISED:
DECEMBER 3, 1993
APACHE
22
ZONE X
Federal Emergency Management Agency



MAP LEGEND
Revised 100-Year Floodplain
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.
APPROXIMATE SCALE IN FEET
1000
0
1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS
REVISED TO REFLECT LOMR
PANEL 2205 OF 4350
DATED JUL 2 0 1998
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS 040037 2205 E
MESA, CITY OF 040048 2205 E
MAP NUMBER
04013C2205 E
MAP REVISED:
SEPTEMBER 4, 1991
Federal Emergency Management Agency
ZONE AH
(EL1355)
VIRGINIA STREET
EAST QUETON DRIVE
33
34
RED ROCK DRIVE
NORTH MAPLE
E PALM LANE
NORTH NORWALK
ROAD
ZONE AH
(EL1354)
JOINS PANEL 2185
T. 2 N.
T. 1N.
ZONE BREAK
EAST MCDOWELL ROAD
EAST MINTON PLACE
N 38TH ST
ZONE AH
(EL1352)
ZONE X
AREA REVISED BY CASE # 98-09-487P
FALCON FIELD
4
3
Roosevelt Irrigation District Canal
EAST HERMOSA VISTA DRIVE
ROADRUNNER DRIVE
DRIVE
GREENFIELD
FALCON
ZONE BREAK
ZONE AH
(EL1351)
EAST Mc KELLIPS
1351
CITY OF MESA
040048
ZONE X
ZONE AH
10
EAST McLELLAN ROAD
EAST McLELLAN ROAD
9
EAST HANNIBAL STREET
1350
EAST HOBART DRIVE
AREA REVISED BY CASE # 98-09-364P
1349
EAST HALIFAX DRIVE
EAST PRINCESS DRIVE
NORTH
E GRANDVIEW ST
E GARY ST
E GLENCOVE ST
N EAST GREENWAY ST
46TH ST
NORTH 48TH STREET
HIGLEY
JOINS PANEL 2215

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
15290
GREGORY A.
SCHUELKE
Date Signed 1/29/96
ARIZONA, U.S.A.

UEMF TECHNICAL DATA NOTEBOOK (TDN)
STUDY DOCUMENTATION ABSTRACT

SECTION 1: GENERAL INFORMATION

1A. Community: City of Mesa

1B. Community Number: 040048

1C. County: Maricopa

1D. State: Arizona

1E. Date Study Accepted: Pending

1F. Study Contractor: A-N West, Inc.
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200
FCDMC Contract No. 94-26

Subconsultants: Aerial Mapping Company, Inc.
3141 West Clorendon Avenue
Phoenix, Arizona 85017
(602) 263-5728
Aerial Mapping

1G. FEMA Technical Reviewer: Pending

1H. FEMA Regional Reviewer: Pending

1I. State Reviewer: Arizona Department of Water Resources
(602) 417-2445

1J. Local Reviewer: Flood Control District of Maricopa County
(602) 506-1501

1K. River or Stream Name: Upper East Maricopa Floodway (UEMF)

1L. Reach Description: From 1000 feet downstream of Brown Road to McKellips Road, a distance of 1.26 River Miles. Located on FIRM Panel Nos. 2205 E and 2215 E.

1M. Study Type: Riverine

SECTION 2: MAPPING INFORMATION

2A. USGS Quad Sheets: 7.5 Minute Series; Buckhorn, AZ, 1956, Photo Rev 1982

2B. Mapping for Hydrologic Study: Same as above Section 2A, supplemented by 11/21/94 Photos Date Aerial Photo.

2C. Mapping for Hydraulic Study: Aerial Photography Flown at Scale of 1:8400. Topographic Mapping Compiled at Scale of 1" = 200' and 2 feet. C.I. Photography Flown on 7/7/95.
Mapping Consultant: Aerial Mapping, Co., Inc. of Phoenix, AZ

SECTION 3: HYDROLOGY

3A. Model or Method Used: U.S. Army Corps of Engineers HEC-1 Model, Flood Hydrograph Package Computer Model, Version 4.0, September, 1990.

Vendor: Resource Consultants and Engineers, Inc.
P.O. Box Q
Fort Collins, CO 80522
(303) 223-5556

3B. Storm Duration: 24-hour duration

3C. Hyetography Type: SCS Type II rainfall distribution

3D. Peak Flow Frequencies Estimated in Hydrologic Study: 100-year storm

3E. List of Gages Used to Calibrate Model: No specific gages used or in study area. General comparison made to Log Pierson III analysis curves of Arizona stream gages from AZ D.O.T. Drainage Manual.

3F. List of Rainfall Amounts: A 100-year - 24-hour precipitation value of 3.47 inches was generated from the Flood Control District of Maricopa County Hydrology Design Manual and aerially reduced by factor of 0.982.

3G. Description of Unique Conditions: Numerous split-flows at streets, side channels from street and storm drains as well as retention basins were analyzed as part of study.

3H. Coordination with Applicable Agencies: Peak flow results were compared to downstream EMF study results by Soil Conservation Service as well as submitted to FCDMC and City of Mesa.

SECTION 4: HYDRAULICS

4A. Model or Method Used: U.S. Corps of Engineers HEC-2 Model, Water Surface Profiles

Vendor: McTrans Center
512 Weil Hall
Gainesville, Florida 32611-2083

Version: 4.6.2, May, 1991

4B. Regime: Subcritical

4C. Frequency for which profiles computed: 100-Year Frequency Storm

4D. Method Floodway Calculation: No floodway modeled per FCDMC and City of Mesa direction.

4E. Unique Conditions and Problems: Special Problems Report No. 1 by A-N West, Dated 11/22/95, discusses comparison of UEMF study results to EMF results at border and impact of 'N' value difference.

SECTION 5: ADDITIONAL STUDY INFORMATION

Length and Area of Floodplain Delineated

Main Channel = 1.26 Miles and 53.3 Acres

Length and Area of Floodway Delineated

No Floodway Delineated.

6/13/95
Lisa Young called G.S.
U.E.M.E Study
Field meeting
Tues 6/20/95 9:00 Am at Princess Rd Basin

TELEPHONE CONVERSATION RECORD

FCD 94-26

JOB NO. A-N W 7158-03 JOB NAME UEMF DATE 1/23/96

TIME 9:30 AM

CONTACTOR A-N West

CONTACTEE Lisa Young Telephone No. 506-1501

SUBJECT Status of Prop. meeting with Mesa on Type of Flood Zone Desired For UEMF 100 Yr. Flood plain

CONVERSATION SUMMARY:

Pedro Calzo met with City last week on Zone Type
Lisa out rest the week.
Lisa will leave note for Pedro to call G.S back.
Pedro was to resolve Type of Flood plain Zone this week.

ACTION REQUIRED: None. Wait to hear from FCD

ACTION TAKEN:

TELEPHONE CONVERSATION RECORD

FCD 94-26

JOB NO. 7158-03 ANW JOB NAME UEMF FIS DATE 1/26/96

TIME

CONTACTOR Peter Knudson City of Mesa

CONTACTEE Greg Schuelke Telephone No.

SUBJECT UEMF, Floodplain Zones

CONVERSATION SUMMARY:

Peter called to discuss Zone Type AE or AH for referenced proj. Greg preferred Zone AE as more representative of flooding condition riverine, versus shallow ponding (AH).

Peter ~~to me~~ asked why our Draft Report mentioned floodways and didn't include floodway table. Greg said this was a copy from a previous report A-N west did and since it was not clear at the time whether a floodway would be used, we left the floodway discussion in. Now that a floodway was not to be include, this text discussion would be removed.

Peter asked about downstream EMF capacity. Greg said if a) (n) values didn't increase from our est. 0.05 downstream or in the future b) the same design ~~&~~ freeboard was used downstream and and c.) if discharges didn't

ACTION REQUIRED: increase ~~from~~ design Q's downstream, that the EMF would likely have 0 to 1 foot of freeboard and be contained downstream. Peter felt that the City's retention policy would prevent increases in Q and that continuing maintenance would keep vegetation in check to prevent increases

ACTION TAKEN: in (n) values and also that similar design freeboard was used downstream.

Therefore, the EMF downstream should have 100 year capacity.

1.2 (3)

1/29/96
Lisa Young, FCD called G.S.
Peter Knudson to have meeting on Thurs. to
decide zone type

1.2 (4)

TELEPHONE CONVERSATION RECORD

JOB NO. FCD 94-26 ANW 7158-13 JOB NAME UEMF FIS DATE 9:00 AM

TIME 2/5/96

CONTACTOR A-N West Inc.

CONTACTEE Ms Lisa Young Telephone No. 605-1506

SUBJECT UEMF - Zone Type Decision By C.O. Mesa, schedule

CONVERSATION SUMMARY:

Greg S. asked about zone Type decision By City
Lisa - No response yet
~~Gr~~ Lisa - Asked if prelim. Floodway had been done?
Greg - Yes and it was within R/W of EMF, Princess Basin and Princess Dr between Brown Rd and Greenfield road, thus not impacting existing houses along this area. Upstream of Greenfield Rd, the floodway would create problem of higher floodway WSEL's exceeding top of canal bank at couple of sections.

Greg told Lisa today was scheduled completion date and that we were preparing extension request letter.
Greg told Lisa the ~~FA~~ TDN note books are essentially ready except for zone type verification

Lisa to call tomorrow to verify when zone type ~~desig~~ will be decided.

ACTION REQUIRED:

ACTION TAKEN:

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 W. Durango Street
Phx, Az 85009

ATTN: Ms Lisa Young

FROM: Greg Schuelke

DATE: 7/11/95

JOB TITLE:

JOB NO.: A-N W. No. 7158-03

RE: Upper EMF FIS
FCD No 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Data Collection Summary Report

THESE ARE TRANSMITTED ☐ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File ☐ WITH ENCLOSURES

1.3 (1)

TELEPHONE CONVERSATION RECORD

FCD 94-26

JOB NO. A-N W 7158-03 JOB NAME UEMF DATE 1/23/96

TIME 9:30 AM

CONTACTOR A-N West

CONTACTEE Lisa Young Telephone No. 506-1501

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ACTION REQUIRED: None. Wait to hear from FCD

ACTION TAKEN:

1.2 (2)

TELEPHONE CONVERSATION RECORD

FCD 94-26

JOB NO. 7158-03 ANW JOB NAME UEMF FIS DATE 1/26/96

TIME

CONTACTOR Peter Knudson City of Mesa

CONTACTEE Greg Schuelke Telephone No.

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Peter ~~did not~~ asked why our Draft Report mentioned floodways and didn't include floodway table. Greg said this was a copy from a previous report A-N west did and since it was not clear at the time whether a floodway would be used, we left the floodway discussion in. Now that a floodway was not to be include, this text discussion would be removed.

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1/29/96
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Peter Knudson to have meeting on Thurs. to
decide zone type

TELEPHONE CONVERSATION RECORD

JOB NO. FCD 94-20 ANW 7158.13 JOB NAME UEMF FIS DATE 9:00 AM

TIME 2/5/96

CONTACTOR A-N West Inc.

CONTACTEE Ms Lisa Young Telephone No. 605-1506

SUBJECT UEMF - zone Type Decision By C.o. Mesa, schedule

CONVERSATION SUMMARY:

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Lisa to call tomorrow to verify when zone type ~~degis~~ will be decided.

ACTION REQUIRED:

ACTION TAKEN:

DATA COLLECTION SUMMARY REPORT

Project	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Consultant	:	7/11/95
Discussion	:	The following is a summary of the data collection effort by A-N West. More detailed documentation will be included in the Technical Data Notebook.

Contact No.	Agency/ Organization	Contact Date	Method of Contact	Data Requested and/or Obtained Requested Flood Hazard
1	ADWR - Ms. Terri Miller	6/21/95	Letter	Reports, FIRM Maps, Historical Flooding Info. LOMA/LOMR No Response Received to Date.
2	Soil Conservation Service - Mr. John Harrington	6/19/95	Meeting	Borrowed Two East Mesa Floodway Design Report Binders.
3	City of Mesa - Mr. Peter Knudson	6/22/95	Meeting	Reviewed Available Subdivision Drainage Reports. Left Data Request List for other Data Including Major Street Plan/Profile, Princess Drive Det. Basin Plans, Storm Drain Design Reports/Plans. City of Mesa Elev. Datumn Benchmarks.
4.	FCDMC - Ms. Lisa Young	6/20/95	Field Site Visit & Meeting	a.) Land Use/Soils Data from HIS Files. b.) City of Mesa Storm Drain Master Plan. c.) Partial Plans on Princess Drive Det. Basin.

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

August 9, 1995

AUG 1995
A-N WEST, INC.
PHOENIX, ARIZONA

Greg Schuelke, Vice President
A-N West, Inc.
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020

Dear Mr. Schuelke:

SUBJECT: Upper East Maricopa Floodway Flood Delineation Study

I have conducted a preliminary review of the proposed draft HEC-1 schematic map, subarea boundary and I.D. maps submitted to me on August 3, 1995. At this time, I do not have any comments. I will be conducting an in-depth review of these articles and should have any comments to you by Tuesday, August 15. You may continue with the study, but please note that I may have comments to you next week.

If you have any questions, please feel free to call me at (602) 506-1501.

Sincerely,

Lisa C. Young

Lisa C. Young
Hydrologist

Copy to: Peter Knudson, City of Mesa

1.3 (3)

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

11 September 1995

SEP 1995
A-N WEST, INC.
PHOENIX, ARIZONA

A-N West, Inc.
7600 North 15th Street
Suite 200
Phoenix, Arizona 85020

Subject: Upper East Maricopa Floodway Flood Delineation Study
FCDMC No. 94-26

Dear Greg:

I have reviewed the bluelines of the draft 200 scale 2 foot contour interval floodplain study base mapping from Aerial Mapping Co. I would like to request that the following be changed on the mapping.

1. Elevation Reference Marks were left out.

2. Scale and Contour Interval were not noted on the mapping.

3. Section and quarter section references were not included.

4. Please label the following:

   a. Roosevelt Water Conservation District (RWCD) Canal

   b. Princess Park

   c. East Maricopa Floodway (EMF)

   d. Falcon Field

I have forwarded a copy of the mapping to Peter Knudson of the City of Mesa as we discussed earlier today on the telephone.

If you have any questions on my review of the mapping, please call me at 506-4719.

Thank you,

Lisa C. Young

Lisa C. Young

1.3 (4)

FLOOD CONTROL DISTRICT
of
Maricopa County
2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

September 14, 1995

Gregg Schuelke
A-N West, Inc.
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020

Subject: Upper East Maricopa Floodway Flood Delineation Study
FCD No. 94-26

Dear Mr. Schuelke:

The Technical Data Notebook Field Reconnaissance and Hydraulic Parameter Estimation has been reviewed. In this report and in previous correspondence, the project has been referred to as the Upper East Mesa Floodway FIS. The proper name of the study is the East Maricopa Floodway Flood Delineation Study. This will need to be changed on the cover and in the text of the subject report, as well as on any further correspondence. Your selection of Manning's 'n' values are appropriate.

In reviewing the aerial photos that were received with the Field Reconnaissance Report, it was noticed that there were no labels on the photo. Label major roads, Roosevelt Water Conservation District Canal (RWCD), Princess Park Retention Basin, and the East Maricopa Floodway (EMF).

The marked up bluelines of the floodplain mapping 200 scale, showing the proposed hydraulic baseline and cross-section locations, have been reviewed. The cross-section i.d. numbers are appropriate. Recommendations for cross-section locations are as follows:

1. Cross-sections should be included at Princess Drive and Hobart Drive to anticipate weir flow.

2. The following cross-sections should be added:

    21.481

3. The following cross-sections should be moved to the noted locations:

    21.529 to 21.513
    21.991 to 22.008
    22.086 to 22.116
    22.181 to 22.185
    22.276 to 22.252
    22.333 to 22.342

1,3 (5)

4. Cross-section 21.544 should be bent to intersect the 1350' contour.

5. The green line that will be used for quality control should be used in the HEC-2 run, as it could represent weir flow.

If you have any questions on the review of the report, mapping, or cross sections, please call me at 506-4719.

Sincerely,

Lisa C. Young

Lisa C. Young
Hydrologist

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

2801 West Durango Street · Phoenix, Arizona 85009
Telephone: (602) 506-1501
Fax: (602) 506-4601
TT: (602) 506-5897

COVER SHEET

TO: Greg Schuetke

Company or Department: A-N West, **Fax #** 9431989

FROM: Lisa C. Young

Number of pages being sent including Cover Sheet: 2

Comments: Greg, I received these comments from the City of Mesa. Please address them in revisions to the report. If you have any questions, feel free to call me at 506-4719.

Thank you.
Lisa C. Young

1.3 (7)

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

12 October 1995

Greg Schuelke, P.E.
A-N West, Inc.
7600 North 15th Street
Suite 200
Phoenix, Arizona 85020

Subject: Upper East Maricopa Floodway Flood Delineation Study
FCDMC No. 94-26

Dear Mr. Schuelke:

I have reviewed the Hydrology Report for Upper East Maricopa Floodway (UEMF) Flood plain Delineation Study. I would like to request the following revisions.

1. Section 3.1, third sentence. Clarify point of sentence.

2. Page 4, Section 4.1, 'weighed' should be 'weighted'.

3. Section 4.3, page 6, rethink your position on the ponding area as described in the second paragraph, as the ponding area may be necessary for the floodplain delineation. Analyze what would occur if the groves were irrigated just prior to the event.

4. Check spelling.

5. East Mesa Floodway should be referred to as East Maricopa Floodway throughout report.

6. On the HEC-1 schematic 1031 should be in a box as it is a routing reach.

7. Subbasin SB16, SB92, SB98 assess whether the majority of impervious area is near the concentration point, if it is not, drop impervious area to zero percent.

If you have any questions on these revisions, please call me at 506-4719.

Thank you,

Lisa C. Young

Lisa C. Young
Hydrologist

copy to: Peter Knudson, City of Mesa

1.3(8)

CITY OF
MESA

September 21, 1995

Ms. Lisa Young
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Subject: Upper E.M.F. Floodplain Delineation Study

Dear Ms. Young:

We have reviewed the draft report of the referenced study and offer the following comments:

1. Section two states that the East Maricopa Floodway (E.M.F.) was designed to convey the 100-year storm event runoff. There have been some discussions concerning assumptions made in the original E.M.F. regarding the actual level of protection. The level of protection afforded by the E.M.F. should be confining.

2. Section 4.3 excludes contribution from the orange grove north of McKellips and west of Greenfield. If this area is irrigated at the time of a storm event it could very easily contribute to the study area. We therefore believe this area should be included as a contribution area.

3. Page 14 of the study shows a 100-year peak discharge at Brown Road of 603 C.F.S. The appendix contains some discussion on what the E.M.F. capacity should be but we are unclear what the present capacity is. Please verify the capacity of the E.M.F. at Brown Road and the capacity of the Brown Road bridge over the E.M.F.

Please contact me if you have any questions.

Sincerely,

Peter Knudson
Senior Civil Engineer

PK/rp
c:\wpwin\data\lisa.ren

FLOOD CONTROL DISTRICT
RECEIVED
SEP 25 1995

CHENG	P&PM
DEP	REG
ADMIN	LMGT
FINANCE	FILE
O&M	
ENGR	
REMARKS	

Engineering
20 East Main Street, Suite 400 • P.O. Box 1466 • Mesa, Arizona 85211-1466 • (602) 644-2251

1.3 (9)

printed on recycled paper

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

June 13, 1995

A-N West, Inc.
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020

ATTENTION: Mr. Greg A. Schuelke, P.E., R.L.S.

SUBJECT: Contract No. FCD 94-26
Upper EMF Floodplain Delineation Study

Dear Mr. Schuelke:

This letter will serve as confirmation of the June 7, 1995 verbal notice to proceed with the work covered by the subject contract.

A fully executed contract document is enclosed for your file. Should you have any questions, please contact Lisa Young or me at telephone 506-1501.

Sincerely,

Leanna Cumberland

Leanna Cumberland
Chief, Contracting Branch

1.4.1 (1)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 6/19/95

ATTENTION: Ms Lisa Young

FIRM: FCDMC

RE: Upper EMF FIS FCDMC No 94-26

JOB #:

FROM: Greg Schnelke

Lisa, Attached is a draft of the legal advertisement proposed for the project for your review/comment.

NUMBER OF PAGES INCLUDING COVER SHEET: 2

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX

1.4.1(2)

Draft 6/19/95

ANNOUNCEMENT OF INTENT TO PERFORM FLOOD HAZARD STUDIES

The Flood Control District of Maricopa County, (FCDMC), under authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood hazard areas in eastern Maricopa County. FCDMC has contracted A-N West, Inc. to perform studies for the upstream side of the Roosevelt Canal, between Brown Road and McKellips Road in the City of Mesa, Arizona. Flood elevations from these studies will be used to determine flood insurance rates by the Federal Emergency Management Agency (FEMA). This announcement is intended to inform all interested persons and communities of the commencement of this study so that they may have an opportunity to bring any relevant technical information to the attention of FCDMC/FEMA, so that it may be considered during the course of this study. Your comments should be addressed to Ms. Lisa Young or Mr. Pedro Calza, Hydrologists at the Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, Arizona 85009, Phone: (602)506-1501. Published: Arizona Republic, June x x, 1995.

or Mesa Tribune (As Applicable

x Publish Dates.

1.4.1 (3)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

2801 West Durango Street · Phoenix, Arizona 85009
Telephone: (602) 506-1501
Fax: (602) 506-4601
TT: (602) 506-5897

COVER SHEET

TO: Greg Schuelke

Company or Department: A-N West, Inc **Fax #** 943-1989

FROM: Lisa Young

Number of pages being sent including Cover Sheet: 2

Comments: Attached are my comments as requested. If you have any questions please call me at 506-1501.

Lisa

1.4.1 (4)

MEMORANDUM

TO:	City of Mesa	DATE:	June 14, 1995
FROM:	Greg Schuelke	RE:	Upper EMF Floodplain Delineation Study - FCDMC No. 94-26 A-N West No. 7158-03

SUBJECT: Data Request List for the City of Mesa

The following is an initial list of data requested of the City of Mesa for use in the referenced project;

1. Closest City of Mesa elevation benchmark to project.

2. Design Report and Construction Plans for;

   a. Princess Road detention basin and other City basins, such as at Airport or along 64th Street (114 Mile North of Mckellips Road).

   b. Storm drains along Roosevelt Canal, Greenfield Road and McDowell Road and McKellips Road.

3. In order to evaluate existing detention in the watershed, A-N West requests to review or borrow drainage reports of subdivisions in the study area.

4. In order to evaluate potential drainage boundaries created by major streets, A-N West requests to review or borrow major street plans in the study area.

1.4.1 (5)

MEMORANDUM

TO:	Flood Control District of Maricopa County	DATE:	June 14, 1995
FROM:	Greg Schuelke	RE:	Upper EMF Floodplain Delineation Study - FCDMC No. 94-26 A-N West No. 7158-03

SUBJECT: Data Request List for the City of Mesa

The following is an initial list of data requested of the FCDMC for use in the referenced project;

1. Two copies of District's Digital Terrain Model Mapping, Data Collection & Delivery Specifications, Release 1.0, May, 1994.

2. Two copies of District's HIS Data Delivery Specifications, Revision 2.0.

3. In order to tie this study into the reported downstream FEMA approved study per Scope Task 6.4, A-N West requests;

   a. Hydrology data from previous study, including drainage area map(s) computer model input and output and peak discharges near Brown Road.

   b. Hydraulic data from previous study including work mapping, cross-sections locations, HEC-2 computer model input and output, mapping benchmarks.

4. If District has existing land use and soil type data of study watershed in HIS files, A-N West requests a copy of this data in Auto Cadd format.

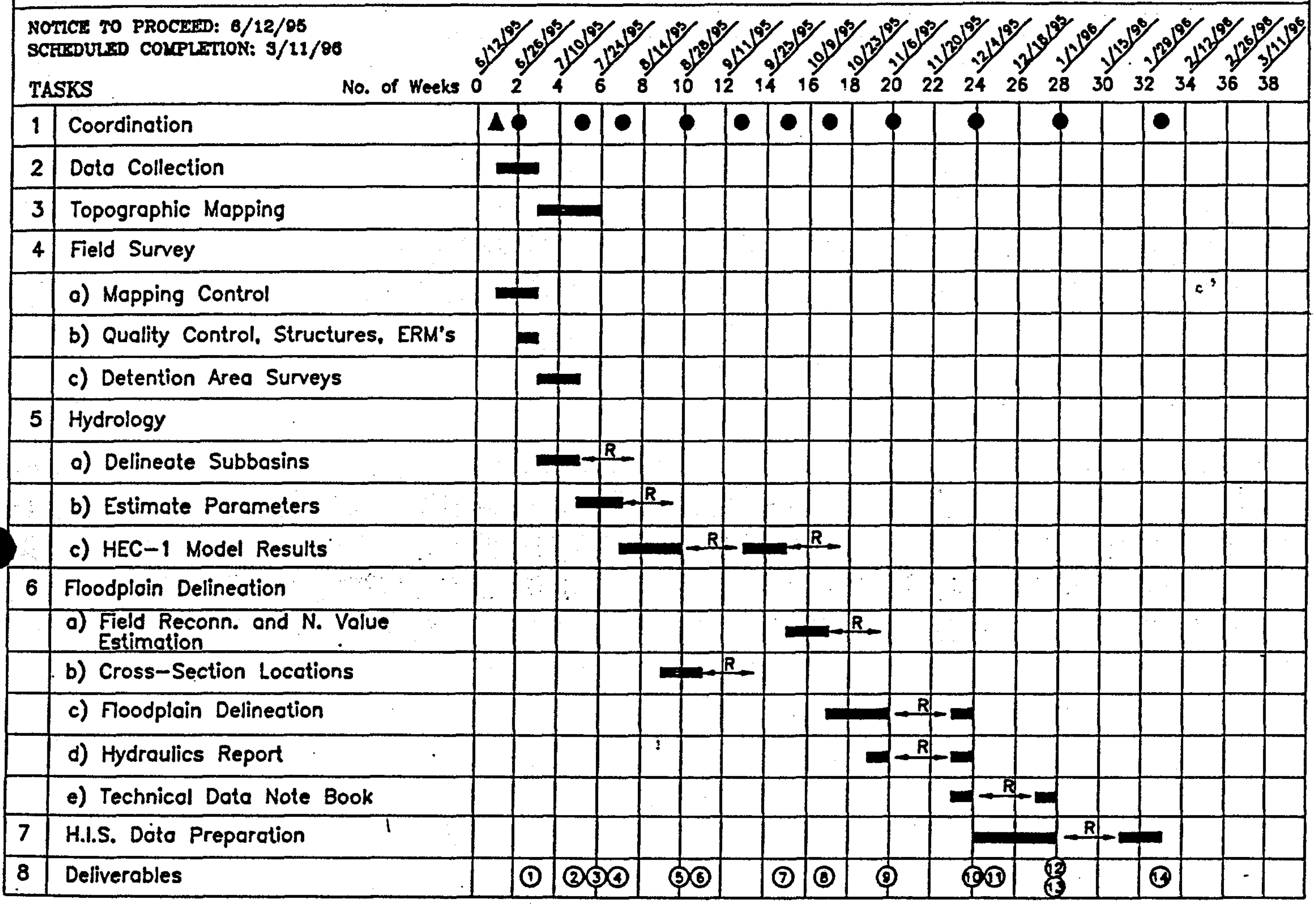
1.4.1 (6)

Greg S (A-N West)
Delivered To Lisa Young
(FCD) At 6/20/95 site
Visit

A-N WEST INC.
Consulting Engineers
NO. 7158-03

PROPOSED SCHEDULE
UPPER EAST MARICOPA FLOODWAY
FLOODPLAIN DELINEATION STUDY
FCDMC NO. 94-26

NOTICE TO PROCEED: 6/12/95
SCHEDULED COMPLETION: 3/11/96



SUBMITTALS

1. Data Collection Summary
2. Subarea Boundarys
3. Blueline Topographic Mapping
4. Estimated Parameters
5. Preliminary HEC-1 Results
6. Cross-Section Locations
7. Final Hydrology Report / HEC-1 Model
8. Floodplain Field Reconn. Report
9. Preliminary HEC-2 Model and Hydraulics Report
10. Final HEC-2 Model and Hydraulics Report
11. Preliminary Technical Data Note Book (T.D.N.)
12. Preliminary H.I.S. Files
13. Final T.D.N.
14. Final H.I.S. Files and Remaining Deliverables

EXPLANATION

▲ – Field Visit

● – Coordination Meetings Telephone Updates

1.4.1 (7)

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: Flood Control District of Mar. County
2801 West Durango st
Phx. Az 85009

DATE: 6/21/95
JOB TITLE:
JOB NO.: A-N West No 7158-03
RE: Uper EMF FIS
FCD MC No. 94-26

ATTN: Ms Lisa Young
FROM: Greg Schmelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☒ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
2		Bluelines of 1200 scale Watershed
		Photography

THESE ARE TRANSMITTED ☐ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: ☐ WITH ENCLOSURES

1.4.1 (8)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

DATE: 26 June 1995
JOB NO.: FCDMC No. 94-26
ATTENTION: Greg Schuelke
RE: Upper EMF FDS

TO: A-N West, Inc.
7600 N. 15th St, Ste 200
Phoenix, AZ 85020

JUN 1 1995

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☒ Specifications
☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
2	May 1994		FCDMC Digital Terrain Model Mapping Data Collection + Delivery Specifications, Release 1.0
2	June 1995		Data Delivery Specifications: The Hydrologic Information System (H.I.S) Rev 2.0

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return ____ corrected prints
☐ For review and comment ☐ ______
☐ FOR BIDS DUE ______ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS: If you have any questions or need additional information please feel free to call me at 506-4719.

COPY TO ______

SIGNED: Lisa C. Young

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

1.4.1 (9)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 6/28/95

ATTENTION: Ms Lisa Young

FIRM: FCD MC

RE: East Mesa Floodway FIS FCD No 94-26

JOB #:

FROM: Greg Schuelke

Lisa, Attached is a draft letter that we propose to deliver and leave on the doors of homes/businesses that we will be surveying finished floors. We would propose delivering the letters by tomm. afternoon, so please review and comment A.S.A.P. Thanks

NUMBER OF PAGES INCLUDING COVER SHEET: 2

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX.

1.4.1 (10)

A-N WEST INC.
Consulting Engineers

MEMORANDUM

TO: Flood Control District of Maricopa County DATE: June 29, 1995

FROM: Greg Schuelke RE: Upper EMF Flood Insurance Study - FCDMC No. 94-26 A-N West No. 7158-03

SUBJECT: Right-of-Entry Letter For Survey Purposes Dated 6/29/95 - Delivered on 6/29/95 to Below Addresses

---

No. Address

1. 4466 East Princess
2. 4456 East Princess
3. 4440 East Princess
4. 4428 East Princess
5. 4422 East Princess
6. 4420 East Princess
7. 4414 East Princess
8. 4425 East Hobart
9. 4424 East Hobart
10. 4428 East Hobart
11. 4439 East Hobart
12. 4450 East Hobart
13. 4429 East Halifax
14. 4432 East Halifax
15. 4433 East Halifax
16. 4439 East Halifax
17. 4455 East Halifax
18. 4454 East Halifax

1527 North Greenfield Road - Trailer Park

19. Unit 1
20. Unit 2
21. Unit 3
22. Unit 4
23. Unit 5
24. Unit 6
25. Unit 7
26. Unit 8
27. Unit 9
28. Unit 10
29. Unit 11

No. Address

1527 North Greenfield Road - Trailer Park

30. Unit 12
31. Unit 13
32. Unit 14
33. Unit 15
34. Unit 16
35. Unit 17
36. Unit 18
37. Unit 19
38. 1608 North Greenfield Road
39. 1721 North Greenfield Road - Self Development Pre-School

4301 East McKellips Road - Citrus Heights Farms

40. House
41. House
42. House
43. House
44. Office
45. Office

1.4.1 (11)

7600 North 15th Street, Suite 200 • Phoenix, Arizona 85020-4331 • Fax (602) 943-1989 • (602) 861-2200

A-N WEST INC.
Consulting Engineers

June 29, 1995

Delivered to Owner/Occupants
of Homes/Businesses along Referenced Study

Re: Floodplain Delineation Study - Along RWCD Canal
Brown to McKellips Roads
Right-of-Entry for Surveying Purposes

Dear Owner/Occupants:

The Flood Control District of Maricopa County has contracted with A-N West, Inc. to perform a detailed floodplain delineation study along the upstream side of the Roosevelt Water Conservation District Canal, (RWCD), between Brown Road and McKellips Road. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event.

The intent of this letter is to notify you of the commencement of surveying activities anticipated to occur between 6/30/95 and 7/17/95, in support of the above mentioned study. It is proposed that homes receiving a copy of the letter will have the finished floor of the inhabitable structures surveyed to verify the elevation relationship to the 100-year base flood elevation, which will be established as a result of this study. The survey will involve a measurement from outside of the structure. It will not be necessary to enter your home or your backyard to perform this survey or for you to be present for the survey. If you have any objections to the entry onto your property, you must notify Ms. Lisa Young of the Flood Control District at 506-1501. Otherwise, it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revision of Flood Insurance Rate Maps. This study will be available to the public in approximately 12 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right-of-entry, please contact Ms. Lisa Young, Hydrologist, of the Flood Control District (Phone: 506-1501) or Mr. Greg Schuelke of A-N West, Inc. (Phone: 861-2200).

Sincerely,

A-N WEST, INC.

Greg Schuelke

Gregory A. Schuelke, P.E., R.L.S.
Vice President
Project Manager

GAS/sl

grgltr11.gen

1-41 (12)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

2801 West Durango Street · Phoenix, Arizona 85009
Telephone: (602) 506-1501
Fax: (602) 506-4601
TT: (602) 506-5897

COVER SHEET

TO: Greg Schuelke

Company or Department: A-N West, Inc. Fax # 943 1989

FROM: Lisa C. Young

Number of pages being sent including Cover Sheet: 2

Comments: Attached are my comments on the draft letter. Please fax me a list of names and/or addresses where the letters will be delivered to so I can anticipate calls

Thank you!

Lisa

1.4.1 (13)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 9/29/95

ATTENTION: Ms Lisa Young

FIRM: FCD MC

RE: FCD MC No. 94-26 — Upper EMF FIS

JOB #: Right of Entry Letter for Survey Purposes and Delivery List

FROM: Greg Schuelke

NUMBER OF PAGES INCLUDING COVER SHEET: 3

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX

1.4.1(14)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

DATE: 28 June 1995
JOB NO.: FCDMC No. 94-26
ATTENTION: Greg Schuelke
RE: Upper EMF FDS

TO: A-N West, Inc
7600 N 15th St, Ste 200
Phoenix, AZ 85020

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
1			Diskette containing existing land use and soil type data of the study watershed in AutoCadd format

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return ____ corrected prints
☐ For review and comment ☐ ______
☐ FOR BIDS DUE ______ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

Please have Mr Schuelke fill out forms and have notarized before leaving.
Thanks,
Lisa

COPY TO ______

SIGNED: ______

1.4.1 (15)

6910-009 R8-9[illegible]

... ted, kindly notify us at once.

A-N WEST INC.
Consulting Engineers

7600 NO[illegible]TH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: Flood Control District of Maricopa County
2801 West Durango St
Phoenix Az 85009

DATE: July 7, 1995
JOB TITLE:
JOB NO.:
RE: Upper EMF Study
FCD No. 94-26

ATTN: Ms Lisa Young

FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☒ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Affidavit of Publication (Original)
		For Legal Ad in Az. Republic / Phx Gazette

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: Lisa, we are still awaiting response from the Mesa Tribune to our request to advertise in that paper. We will send affidavit when this ad is run.

Also, The project mapping was flown by Aerial Mapping Co. on morning of 7/7/95

REC'D. BY: DATE:

COPY TO: File

1.4.1 (16) ☐ WITH ENCLOSURES

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango St.
Phx. Az 85009

DATE: 7/10/95
JOB TITLE:
JOB NO.: A-N West No. 7158-03
RE: Upper EMF FIS
FCDMC No. 94-26

ATTN: Ms. Lisa Young
FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthly Progress Report, Month Ending 6/30/95

THESE ARE TRANSMITTED ☐ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File

1.4.1 (17)

☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	6/30/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task		Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination	10	10
Task 2	Data Collection	90	90
Task 3	Topographic Mapping	10	10
Task 4	Field Survey	30	30
Task 5	Hydrology		
	a. Delineate Subbasins	0	0
	b. Estimate Parameters	0	0
	c. HEC-1 Model and Results	0	0
Task 6	Floodplain Delineation		
	a. Field Reconnaissance	0	0
	b. Cross-Section Locations	0	0
	c. Floodplain Delineation	0	0
	d. Hydraulics Report	0	0
	e. Technical Data Notebook	0	0
Task 7	HIS Data Preparation	0	0
Task 8	Deliverables	0	0

Work Performed in Month of June, 1995.
A-N West conducted field visit with FCD Project Manager, Ms. Lisa Young, on 6/20/95.

A-N West submitted data request lists to FCDMC (Ms. Lisa Young) on 6/20/95 and City of Mesa (Mr. Peter Knudson on 6/22/95. A-N West met with Mr. Knudson to review drainage reports, available data on 6/22/95. A-N West met with Soil Conservation Service on 6/19/95 to review and borrow design data on Upper East Mesa Floodway. A-N West delivered Right-of-Entry Letters on 6/29/95 to residents that were to have finished floors surveyed. Field survey intiated for aerial mapping which was flown on morning of 7/7/95.

Work to be Accomplished in Month of July, 1995.
Compete data collection, field survey, mapping tasks and initial hydrology tasks.

1.4.1 (18)

City of Mesa

Engineering Division

LETTER OF TRANSMITTAL

CITY OF MESA * MUNICIPALLY OWNED UTILITIES * ELECTRICITY-NATURAL GAS-WATER
55 NORTH CENTER STREET * P.O. BOX 1466 * 85211-1466 * 644-2251

JUL 1995 A-N WEST, INC. PHOENIX, ARIZONA

DATE July 20, 1995

TO: Greg Schuelke
A-N West
7600 N. 15th St. Suite 200
Phoenix, AZ 85020

RE:

ATTENTION:

LADIES/GENTLEMEN:

WE ARE SENDING YOU ☐ ATTACHED ☐ UNDER SEPARATE COVER VIA

THE FOLLOWING ITEMS:

☐ PRELIMINARY DRAWINGS ☐ COPY OF LETTER ☐ SAMPLES ☐
☐ PRINTS ☐ CHANGE ORDER ☐ DETAILS ☐
☐ PLANS ☐ ADDENDUM ☐ SPECIFICATIONS ☐

JUL 1995 A-N WEST, INC. PHOENIX, ARIZONA

COPIES	DESCRIPTION
	14 Sheets 1/4 Sec. S.D. Plans 11"X17"
	Sht. 7/16 of Princess Det. Basin. 11"X17"
	12 sheets of Storm Drain Plans. 11"X17"

THESE ARE TRANSMITTED AS CHECKED BELOW:

☐ FOR APPROVAL ☐ APPROVED AS SUBMITTED ☐ RESUBMIT ____ COPIES FOR APPROVAL
☐ FOR YOUR USE ☐ APPROVED AS NOTED ☐ SUBMIT ____ COPIES FOR DISTRIBUTION
☐ AS REQUESTED ☐ RETURNED FOR CORRECTIONS ☐ RETURN ____ CORRECTED PRINTS
☐ FOR REVIEW AND COMMENT ☐ FOR PERMITS ☐ RETURN SET OF MYLAR SEPIAS
☐ ☐
☐ PLEASE RETURN BY: DATE ☐ PROPOSED BID DATE

REMARKS:

Call me if you have additional questions.

COPY TO: SIGNED:
TITLE:

Yellow Copy — PROJECT FILE 1.4.1 (19) Pink Copy — ENGR'S FILE

A-N WEST INC.
Consulting Engineers

7600 NC[illegible]TH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 W. Durango Str.
Phx, Az 85009

DATE: 8/2/95
JOB TITLE:
JOB NO.:
RE: Upper EMF FIS
FCD No. 94-26

ATTN: Ms. Lisa Young
FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☒ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Affidavit of Publication of Legal
		Notice In Mesa Tribune

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File 1.4.1 (20) ☐ WITH ENCLOSURES

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers
7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 8/2/95

ATTENTION: Mr Peter Knudson

FIRM: City of Mesa Fax No. 644-3392

RE: Upper East Mesa Floodway FCD No. 94-26

JOB #:

FROM: Greg Schuelke

Peter, I got your data of 7/20/95. Thanks, In looking through the data, I've noticed some missing data requested earlier, including;

a.) City of Mesa elev. datumns, in particular the B.C. at N.E. corner headwall of canal culvert on Brown Rd.?

b.) Is there any elevation vs. volume data on Princess Basin? We received only sht. 7 of 16 of basin plans? Any pertinent elev. control data on other shts?

c.) Is there any plans on storm drain in 64TH Street from McKellips to Hermosa Vista Dr. which show pipe size and slope?

Please let me know of this data availability at your earliest convenience. Thanks

NUMBER OF PAGES INCLUDING COVER SHEET: 1

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX.

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango Street
Phoenix Az 85009

DATE: 8/3/95
JOB TITLE:
JOB NO.: A-N West No 7158-03
RE: Upper East Mesa Fldway (E
FIS FCD No. 94-26

ATTN: Ms Lisa Young

FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Delivery

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Proposed Draft HEC-1 Schematic Map
1		Proposed Draft Subarea Boundary and I.D.
		Map on 1200 scale Quad Base
1		Proposed Draft Subarea Bdy. and I.D. Map
		on Aerial Photo Base

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED

☐ OTHER

REMARKS: Lisa, The attached is submitted for your review, comment, approval. We are proposing to evaluate several split flow locations, where flow can potentially leave the system. We are also proposing to model four detention basins of significance at this time. We are proposing to model the significant storm drains to account for their potential to carry flow by split flow locations and basins.

REC'D. BY:

DATE:

COPY TO: File

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1.4.1 (22)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 8/4/95

ATTENTION: Ms. Lisa Young

FIRM: FCDMC

RE: Upper EMF FIS Study FCD # 94-26

JOB #: ANW # 7158-03

FROM: Greg Schuelke

Lisa, Also for our scope I am requesting a copy of your Lotus spreadsheet and procedures for generating Green and Ampt parameters

NUMBER OF PAGES INCLUDING COVER SHEET: 1

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX.

1.4.1 (23)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 8/4/95

ATTENTION: Ms. Lisa Young

FIRM: FCDMC

RE: Upper EMF FIS Study FCD #94-26

JOB #: ANW # 7158-03

FROM: Greg Schuelke

Lisa, Per our scope of work, I am requesting a copy of the NOAA HYDRO-40 procedure to generate areal reduction values for the 100-year-24 hour storm.

NUMBER OF PAGES INCLUDING COVER SHEET: 1

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX.

1.4.1(24)

A-N WEST INC.
Consulting Engineers

7600 NO[illegible]H 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango St
Phoenix Az 85009

ATTN: Ms Lisa Young

FROM: Greg Schuelke

DATE: 8/4/95

JOB TITLE:

JOB NO.: A-NW # 7158-03

RE: Upper EMF FIS
FCD No. 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

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☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthly Progress Report, Month Ending 7/31/95

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☐ OTHER

REMARKS:

REC'D. BY: DATE:

1.4.1 (25)

COPY TO: ☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	7/31/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task		Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination	10	20
Task 2	Data Collection	10	100
Task 3	Topographic Mapping	25	45
Task 4	Field Survey	70	100
Task 5	Hydrology		
	a. Delineate Subbasins	100	100
	b. Estimate Parameters	0	0
	c. HEC-1 Model and Results	0	0
Task 6	Floodplain Delineation		
	a. Field Reconnaissance	0	0
	b. Cross-Section Locations	0	0
	c. Floodplain Delineation	0	0
	d. Hydraulics Report	0	0
	e. Technical Data Notebook	0	0
Task 7	HIS Data Preparation	0	0
Task 8	Deliverables	0	0

Work Performed in Month of July, 1995.
Mapping flown on 7/795.
Data collection Summary Report Transmitted on 7/11/95. Field survey completed.
Proposed HEC-1 Schematic, Drainage Area Boundaries submitted 8/3/95.

Work to be Accomplished in Month of August, 1995.
Complete hydrology task, locate cross-sections for Floodplain Analysis. Finish mapping.

1.4.1 (26)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

DATE 8 Aug 1995 | JOB NO. FCD#94-26

ATTENTION Greg Schuelke

RE: Upper EMF FIS Study
ANWest # 7158-03

TO A-N West Inc
7600 N. 15th St, Suite 200
Phoenix, AZ 85020-4331

123456789101112 ... A-N WEST INC. PHOENIX, ARIZONA AUG 1995 ... 161718192021222324252627282930 31

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ ____

COPIES	DATE	NO.	DESCRIPTION
1			Subbasin loss parameter spreadsheet on diskette
1			Procedures for use of subbasins loss parameter spreadsheet
1			Drainage design manual Volume 1 1995 Revisions
			including diskett.

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☐ For review and comment ☐ ____

☐ FOR BIDS DUE ____ 19 ____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS The NOAA Hydro-40 procedure to generate areal reductions for the 100-year 24-hour storms can be found on page 2-20 and in table 2.1a of the drainage design manual volume 1 1995 revisions.

If you have any questions regarding the spreadsheet or using hydro-40 feel free to call me at 506-1501.

COPY TO file

1.41 (27)

SIGNED: Lisa C. Young

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 8/14/95

ATTENTION: Ms Lisa Young

FIRM: FCDMC

RE: UEMF Study # 94-26

JOB #:

FROM: Greg Schuelke

Lisa; I would like to request a current copy of the ADWR state standards Attachment 1-90.

Also, I have a question on the generation of hydrologic data

I anticipate that digital data for input to HES will need to be generated for subareas, drainage paths, etc.

Specifically, Do the weighted percent of different soils and land use within a subarea need to be generated by digital methods or can this be estimated by planimeter?

NUMBER OF PAGES INCLUDING COVER SHEET: 1

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX.

1.4.1 (28)

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

DATE 15 Aug 95 JOB NO. 94-26

ATTENTION Greg Schuelke

Upper East Maricopa
Floodway Flood
Delineation Study

AUG 1995
A-N WEST, INC.
PHOENIX, ARIZONA

TO A-N West, Inc.
7600 N. 15th St, Ste 200
Phoenix, AZ 85020

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ Copy of standards.

COPIES	DATE	NO.	DESCRIPTION
1	11/18/91	1-90	Arizona Department of Water Resources
			State Standards Attachment 1-90.

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☒ As requested ☐ Returned for corrections ☐ Return ____ corrected prints

☐ For review and comment ☐ ______

☐ FOR BIDS DUE ______ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Please let me know if you need anything else.

Lisa

COPY TO ______ 1.4.1 (29)

SIGNED: Lisa C. Young

If enclosures are not as noted, kindly notify us at once.

6910-009 R8-93

A·N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango Street
Phoenix AZ 85009

DATE: 8/25/95
JOB TITLE:
JOB NO.: A-N West No 7158-03
RE: Upper East Mesa Floodway FIS
FCDMC No. 94-26

ATTN: Ms Lisa Young
FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

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☐ SHOP DRAWINGS ☒ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
2		Bluelines of Draft 200 Scale 2' C.I.
		Floodplain Study Base Mapping From
		Aerial Mapping Co.

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File

1.4.1 (30)

☐ WITH ENCLOSURES

City of Mesa

Engineering Division

LETTER OF TRANSMITTAL

CITY OF MESA * MUNICIPALLY OWNED UTILITIES * ELECTRICITY-NATURAL GAS-WATER
55 NORTH CENTER STREET * P.O. BOX 1466 * 85211-1466 * 644-2251

DATE 8/16/95

TO: A-N WEST CONSULTING
7600 N. 15TH ST.
SUITE 200
PHOENIX, AZ 85020-4331

RE: UPPER EAST MESA FREEWAY

ATTENTION: GREG SCHUELKE

LADIES/GENTLEMEN:

WE ARE SENDING YOU ☐ ATTACHED ☐ UNDER SEPARATE COVER VIA ______

THE FOLLOWING ITEMS:

☐ PRELIMINARY DRAWINGS ☐ COPY OF LETTER ☐ SAMPLES ☐ ______
☐ PRINTS ☐ CHANGE ORDER ☐ DETAILS ☐ ______
☐ PLANS ☐ ADDENDUM ☐ SPECIFICATIONS ☐ ______

COPIES	DESCRIPTION
1	B.M. LIST
1	64TH ST. S.D. PLAN

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☐ FOR REVIEW AND COMMENT ☐ FOR PERMITS ☐ RETURN SET OF MYLAR SEPIAS
☐ ______ ☐ ______
☐ PLEASE RETURN BY: DATE ______ ☐ PROPOSED BID DATE ______

REMARKS: INFORMATION REQUESTED

COPY TO: ______

SIGNED: LES BROUGHTON
TITLE: 644-2513

1.4.1 (31)

Yellow Copy — PROJECT FILE Pink Copy — ENGR'S FILE

BROWN

1267.47	T.C. NW cor Gilbert
1271.07	T.C. NE cor 22nd Street
1272.56	T.C. NE cor 23rd Street
1275.34	T.C. W/End Median E.Side 24th Street
1277.63	T.C. NW cor 26th St (Cir)
1279.97	T.C. SE cor Yale
1283.34	T.C. NW cor Lindsay
1476.52	"X" T.C. SE cor Power
1479.70	B.C. @ P.I. E of Power on curve
1493.02	T.C. E/side E D/W @ Salk Elementary School
1505.67	T.C. NE cor Terripin
1500.76	B.C. in H/H CL 72nd Street
1527.69	B.C. in H/H CL 76th Street
1553.83	B.C. in H/H CL 80th Street
1567.20	5/8" Rebar NW cor Fence S/Side Flood Cntrl Dam
1593.82	P.K. CL @ Top Flood Control Dam
1581.53	SE cor Concrete N/Side @ C.M.P. E/Side Flood Dam
1584.45	B.C. in H/H CL 84th Street
1599.64	B.C. in Asphalt CL 86th Street
1605.18	B.C. in Asphalt W/End Curve E of 86th Street
1610.08	B.C. in Asphalt W/End 2nd Curve E of 86th Street
1620.28	B.C. in Asphalt W/End 2nd Curve E of Ellsworth
1627.36	B.C. in Asphalt E/End 2nd Curve E of Ellsworth
1631.87	B.C. in CL Ellsworth
1293.69	B.C. SW cor Bridge at Eastern Canal
1295.64	T.C. SE cor Creston
1303.03	T.C. SW cor Miramar
1305.89	T.C. SW cor Mayfair
1309.14	Irr Wks SW cor Val Vista
1324.17	T.C. NE cor 40th St
1328.57	T.C. NE cor Norwalk
1637.50	T.C. SW cor 94th Street
1340.72	T.C. SW cor Greenfield
1351.57	T.C. NW cor 46th Street
1359.57	T.C. NE cor 48th Street
1427.56	T.C. NE cor Recker
1450.86	T.C. SE cor 64th Street
1443.48	T.C. NE cor 62nd Place
1457.79	T.C. SE cor Ramada
1256.62	T.C. SE cor Stapley
1257.16	T.C. SE cor Diane
1259.00	T.C. SW cor Barkley
1260.40	T.C. SE cor Kirchoff
1261.32	T.C. SE cor Harris
1262.73	T.C. SE cor Williams
1264.77	T.C. SW cor Forest
1264.76	T.C. SE cor Forest
1250.58	T.C. SE cor Mesa Dr.
1251.16	T.C. NE cor March Circle
1251.57	T.C. NE cor April Circle
1251.93	T.C. NE cor July Circle

NO CITY B.M LISTED AT B.C. HEADWALL OF CANAL

1.4.1 (32)

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango Street
Phoenix Az 85009

ATTN: Ms Lisa Young

FROM: Greg Schuelke

DATE: September 1, 1995

JOB TITLE:

JOB NO.: A-N West No. 7158-03

RE: Upper East Mesa Floodway
FCD MC No. 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Field Reconnaissance and Hydraulic
		Parameter Estimation Report
2		Bluelines of Aerial Photo Overlay 200 scale
		(2 shts.)

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File

1.4.1 (33)

☐ WITH ENCLOSURES

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango Street
Phoenix, Arizona 85009

DATE: Aug. 31, 1995
JOB TITLE:
JOB NO.: A-N West No. 7158-03
RE: Upper East Mesa Floodway
FCDMC No 94-26

ATTN: Ms Lisa Young
FROM: Greg Schmelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☒ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
2		Marked up Bluelines of Floodplain Mapping 200 Scale showing proposed Hydraulic Baseline and Cross-Section Locations

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: Lisa, Attached are proposal hydraulic baseline and cross-sections for your review and approval. The cross-section I.D. numbers proposal are in river miles increasing from intersection of EMF with S.R. 87 near Gila River floodplain. One section along Greenfield Road will not be used for HEC-2 analysis (green line) but will be used for quality control check and to satisfy District scope requirements. The section along McKellips will be use in HEC-2 analysis.

REC'D. BY: DATE:

COPY TO: File

1.4.1 (34)

☐ WITH ENCLOSURES

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

A-N WEST INC.
SEP 1995
PHOENIX, ARIZONA

DATE 6 Sept 1995 | JOB NO. 94-26

ATTENTION Greg Schuelke

RE: Upper EMF Flood Delineation Study

TO A-N West Inc.
7600 N. 15th St, Ste 200
Phoenix, AZ 85020

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ________ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ ________

COPIES	DATE	NO.	DESCRIPTION
1	9/4/91	2205	FEMA FIRM map panel 2205

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval

☑ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution

☑ As requested ☐ Returned for corrections ☐ Return ____ corrected prints

☐ For review and comment ☐ ________

☐ FOR BIDS DUE ________ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Enclosed is the FIRM map that you requested. If I can get anything else for you please call me at 506-4719.

COPY TO ________ 1.4.1 (35)

SIGNED: [signature]

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

A-N WEST INC.
Consulting Engineers

7600 NO[illegible]TH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango St.
Phoenix, Az 85009

ATTN: Ms Lisa Young

FROM: Greg Schuelke

DATE: 9/8/95

JOB TITLE:

JOB NO.: A-N West No 7158-03

RE: Upper EMF FIS
FCD No. 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☒ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthly Progress Report, Month Ending 8/31/95

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: 1.4.1 (36) DATE:

COPY TO: File ☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	8/31/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task		Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination	20	40
Task 2	Data Collection	0	100
Task 3	Topographic Mapping	65	100
Task 4	Field Survey	0	100
Task 5	Hydrology		
	a. Delineate Subbasins	100	100
	b. Estimate Parameters	80	80
	c. HEC-1 Model and Results	80	80
Task 6	Floodplain Delineation		
	a. Field Reconnaissance	100	100
	b. Cross-Section Locations	100	100
	c. Floodplain Delineation	0	0
	d. Hydraulics Report	0	0
	e. Technical Data Notebook	0	0
Task 7	HIS Data Preparation	0	0
Task 8	Deliverables	10	10

Work Performed in Month of August, 1995.
Draft Floodplain Base Mapping completed and copies transmitted 8/25/95.
Hydrology Analysis nearing completion with submittal in early September anticipated.
Field Reconnaissance and Hydraulic Parameter Report and proposed HEC-2 cross-section locations submitted on 9/1/95 for review and approval.

Work to be Accomplished in Month of September, 1995.
Complete hydrology task and begin Floodplain Analysis task.

1.4.1 (37)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 9/8/95

ATTENTION: Ms Lisa Young

FIRM: FCDMC

RE: Upper EMF FIS

JOB #: FCD #94-26

FROM: Greg Schuelke

Lisa, I got the FIRM Map # 2205 that you sent and that I requested. On review of the panel, It appears that I also need panel No. 2215. The newer map must have shifted coverage limits. Thanks

NUMBER OF PAGES INCLUDING COVER SHEET: 1

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX

1.4.1 (38)

FAX COVER SHEET

A-N WEST INC.
Consulting Engineers

7600 NORTH 15th STREET, SUITE 200 * PHOENIX, ARIZONA 85020-4331 * FAX (602)943-1989
* PHONE (602)861-2200

DATE: 9/5/95

ATTENTION: Ms. Lisa Young

FIRM: FCDMC

RE: Upper EMF FIS

JOB #: FCD # 94-26.

FROM: Greg Schmelke

Lisa, we have Panel 2205 of 4350 of FEMA FIRM maps date 4/15/88, showing study area Zone A between Brown and McKellips Rd.

Do you have a more current copy of this FIRM map that we may use for the study to; a.) reference in reports and b.) make reproducable of to show detailed study results

NUMBER OF PAGES INCLUDING COVER SHEET: 1

CONTACT SONYA OR SHEILA CONCERNING ANY PROBLEMS REGARDING THIS FAX.

1.4.1 (39)

A-N WEST INC.
Consulting Engineers

7600 NC[illegible]H 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: City of Mesa, Engineering Division
55 North Center Street
P.O. Box 1466
Mesa, Az 85211-1466
ATTN: Mr Peter Knudson
FROM: Greg Schuelke

DATE: 9/11/95
JOB TITLE:
JOB NO.: A-N West No 7158-03
RE: Upper East Mesa Floodway FIS
FCD MC No. 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		T.D.N. Section 4.2, Field Reconnaissance and Hydraulic Parameter Estimation Report, Sept, 1995

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: Per Ms Lisa Young's request, we are forwarding the attached report.

REC'D. BY: 1.4.1 (40) DATE:

COPY TO: File and Ms Young ☐ WITH ENCLOSURES

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango Street
Phoenix AZ 85009

ATTN: Ms. Lisa Young

FROM: Greg Schuelke

DATE: 9/12/95

JOB TITLE:

JOB NO.: A-N West No. 7158-03

RE: Upper EMF FIS
FCDMC No. 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Delivery

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1	Draft Final	Hydrology Report For Referenced Project.
		with Digital Data Files For
	(8)	HEC-2 Model Rating Curves, Files; UEMF, UEMF1
		UEMF2, UEMF3, UEMF4, UEMF5, UEMF6
		and UEMF10 and (1) HEC-1 Model, File
		EMF2

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: Lisa, Attached is draft final hydrology report for the referenced project for your review, comment.

REC'D. BY: 1.4.1(41) DATE:

COPY TO: Mr. Peter Knudson, City of Mesa ☒ WITH ENCLOSURES

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

DATE 8 Sept 95 | JOB NO. FCD 94-26

ATTENTION Greg Schuelke

RE: FCD 94-26
Upper EMF FDS

TO A-N West, Inc
7600 N 15th St, Ste 200
Phoenix, AZ 85020

WE ARE SENDING YOU ☑ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
			Cross Section Revisions

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval

☑ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution

☑ As requested ☐ Returned for corrections ☐ Return ____ corrected prints

☐ For review and comment ☐ ______

☐ FOR BIDS DUE ______ 19 ____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Here are the changes that I would like to see on the cross sections. If you have any questions, please call me at 506-4719.

COPY TO ______ 1.4.1 (42)

SIGNED: [signature]

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

A·N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: Aerial Mapping Co
3141 West Clarendon Ave
Phoenix Az 85017

DATE: 9/20/95
JOB TITLE:
JOB NO.: A-N West No 7158-03
RE: UEMF Study
FCDMC No.

ATTN: Mr Richard Cook

FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Delivery

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☒ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Blueline of 200 scale mapping with
		HEC-2 model Cross-Sections Noted For
		Digitizing (2 shts).

THESE ARE TRANSMITTED ☐ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: Richard, Attached are cross-section Locations For Digitizing. Please prepare at your earliest convenience. Thanks
Cross-Sections should be coded left to right looking downstream with Sta. 10,000 at Hyd. Baseline

REC'D. BY: DATE:

COPY TO: File 1.4.1 (43) ☐ WITH ENCLOSURES

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango Street
Phoenix, Az 85009

DATE: 9/20/95
JOB TITLE:
JOB NO.: A-N West Inc. # 7158-03
RE: Upper East Maricopa Floodway FIS
FCD MC 94-26

ATTN: Ms. Lisa Young
FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Bluelines of 200 Scale Aerial Photos. (2 shts)
1		Bluelines of 200 Scale Base Mapping (2 shts)
1		Field Reconnoissance Report Revised
		Pages, Title Page, Table of Contents, Page 1, 2,
		3, Figure 1, 2 and 3

THESE ARE TRANSMITTED ☐ FOR REVIEW ☐ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: The attached revised data is submitted to address your 9/14/95 review comment letter. Please insert the revised report pages to the Reconnaissance Report, which changes references of Upper East "Mesa" to "Maricopa".

The contour mapping includes ERMs, section corner references and other comment data. Please note the topo. includes A-N west supplemental survey data of Finished Floor Elevs and other survey shots which can be turned off on subsequent submittals.

REC'D. BY: DATE:

1.4.1 (44)

COPY TO: Mr Peter Knudson, C.O.M. ☒ WITH ENCLOSURES

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango St.
Phoenix Az. 85009

DATE: 10/4/95

JOB TITLE:

JOB NO.: A-N West No 7158-03

RE: Upper EMF FIS
FCD No. 94-26

ATTN: Ms Lisa Yiung

FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☐ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthly Progress Report, Month Ending 9/30/95

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File 1.4.1 (45) ☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	9/30/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task			Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination		15	55
Task 2	Data Collection		0	100
Task 3	Topographic Mapping		0	100
Task 4	Field Survey		0	100
Task 5	Hydrology			
	a.	Delineate Subbasins	0	100
	b.	Estimate Parameters	20	100
	c.	HEC-1 Model and Results	10	90
Task 6	Floodplain Delineation			
	a.	Field Reconnaissance	0	100
	b.	Cross-Section Locations	0	100
	c.	Floodplain Delineation	0	0
	d.	Hydraulics Report	0	0
	e.	Technical Data Notebook	0	0
Task 7	HIS Data Preparation		0	0
Task 8	Deliverables		10	20

Work Performed in Month of September, 1995.

Draft Floodplain Base Mapping completed and copies transmitted 8/25/95. Got FCDMC review comments on 9/11/95 on mapping. Resubmitted revised mapping, aerial photos, and Field Reconnaissance Report on 9/20/95 addressing comments.

Hydrology Analysis Report submitted on 9/12/95.

Submitted approved cross-section locations to Mapping Co. on 9/20/95 for digitizing.

Work to be Accomplished in Month of October, 1995.

Respond to hydrology report comments and begin floodplain delineation.

1.4.1 (46)

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCD MC
2801 West Durango St.
Phoenix Az 85009

DATE: 12/7/95
JOB TITLE:
JOB NO.: A-N West No. 7158-03
RE: Upper EMF FIS
FCD No. 94-26

ATTN: Ms Lisa Young

FROM: Greg Schuelke

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthly Progress Report
		Period Ending 11/30/95

THESE ARE TRANSMITTED ☐ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: 1.4.1 (47) DATE:

COPY TO: File ☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	11/30/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task		Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination	10	75
Task 2	Data Collection	0	100
Task 3	Topographic Mapping	0	100
Task 4	Field Survey	0	100
Task 5	Hydrology		
	a. Delineate Subbasins	0	100
	b. Estimate Parameters	0	100
	c. HEC-1 Model and Results	0	100
Task 6	Floodplain Delineation		
	a. Field Reconnaissance	0	100
	b. Cross-Section Locations	0	100
	c. Floodplain Delineation	85	90
	d. Hydraulics Report	85	90
	e. Technical Data Notebook	5	5
Task 7	HIS Data Preparation	0	0
Task 8	Deliverables	10	30

Work Performed in Month of November, 1995.

1. A-N West submitted on November 30, 1995, Special Problems Report No. 1 (Re: Comparison to Downstream Design WSEL).
2. Draft FIS Report with Profiles and Floodplain input/output.
3. Draft 100 yr Floodplain Delineation on 200 scale mapping.
4. Cross-Section Plots.

Work to be Accomplished in Month of December, 1995.

Respond to comments and finish Technical Data Notebook and Floodway Analysis.

A-N WEST INC.
Consulting Engineers

November 30, 1995

Ms. Lisa Young, Project Manager
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Upper East Maricopa Flood (UEMF) FIS
FCD No. 94-26

Dear Lisa:

We herewith transmit the following:

1. Special Problem Report No. 1.
2. Draft FIS Report with Profiles Exhibit and HEC-2 Input/Output (and digital data disk).
3. Draft 100-year Floodplain Delineation Mapping (2 Sheets).
4. Cross-section Plots with 'n' Values, 100-year WSEL's Encroachments and Channel Banks noted.

The attached Special Problem Report No. 1 attempts to address this study's hydraulic analysis results compared to the original EMF design. It also addresses the City of Mesa's 9/21/95 letter comments regarding the design storm and capacity of the EMF.

As discussed in the Special Problem Report, the original EMF channel was designed for a Manning's 'n' value of 0.025 which would correspond with a relatively uniform trapezoidal earth channel with very little vegetation. The current channel has significant vegetation. Originally, the 'n' value was estimated at 0.06 to account for the sideslopes which contain bushes of several feet height with grass and the invert which contains wetland type grasses of several feet height. Because flow depths were deeper than originally anticipated in estimating the 0.06 'n' value, a second evaluation of 'n' values resulted in the recommended 'n' value of 0.05 used in the floodplain analysis submitted.

At this recommended channel 'n' value of 0.05, the floodplain is contained within the channel right-of-way for the reach evaluated from 1000 feet downstream of Brown Road to the Princess Basin overflow. The channel downstream of Brown Road could convey more flow within right-of-way, however, backwater begins to cause the floodplain to spread beyond the right-of-way near Section 21.481 for higher flows or 'n' values.

A-N West used the original EMF design discharges to generate starting water surface elevations by slope area method, since backwater governs to the Princess Basin outlet, and A-N West's hydrologic analysis did not continue downstream of Brown Road (Per Scope of Work). The EMF original design discharges were for the 100-year 24-hour storm.

Although, digitized cross-sections were obtained at along the Princess Basin outlet embankment (Section 21.544), Princess Drive (Section 21.682), Hobart Street (Section 21.824) and Greenfield Road (Section

141 (49)

7600 North 15th Street, Suite 200 • Phoenix, Arizona 85020-4331 • Fax (602) 943-1989 • (602) 861-2200

21.819); these sections were not used. Three field surveyed cross-sections across the top of the Princess Basin outlet embankment were used instead of the digitized Section 21.544. The field surveyed sections formed the basis for the HEC-2 model rating curve analysis results which were input to the HEC-1 model which, in turn, generated peak ponding and outflow rates for the basis. Utilizing the same field surveyed cross-sections ensured compatibility between hydrologic and hydraulic analysis results.

The Princess Drive, Hobart Street and Greenfield Road cross-sections were not used as they were not considered normal to floodplain flow.

Cross-section 21.213 was field surveyed to provide another section beyond mapping limits to aid in providing more accurate backwater results. Section 21.307 was also field surveyed as this section was also critically important in establishing backwater results and there was concern that digitized results may have been inaccurate in the channel invert because of high grass growth.

In reviewing the Scope of Work, it was not clear that a floodway delineation was desired. We anticipate that a floodway delineation was desired. Please confirm this.

Sincerely,

A-N WEST, INC.

Greg Schuelke

Greg A. Schuelke, P.E., R.L.S.
Vice President
Project Manager

GAS/sl

enclosures

cc: Mr. Peter Knudson, City of Mesa (w/enclosures)

ghaltr13.gen

1.4.1 (5a)

A-N WEST INC.
Consulting Engineers

7600 NO...H 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCDMC
2801 West Durango St.
Phoenix Az 85009

ATTN: Ms Lisa Young

FROM: Greg Schuelke

DATE: 11/7/95

JOB TITLE:

JOB NO.: A-N West No 7158-03

RE: Upper East Maricopa Floodway FIS, FCD No. 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthy Progress Report, Period Ending 10/31/95

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File 1.4.1 (51) ☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	10/31/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task			Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination		10	65
Task 2	Data Collection		0	100
Task 3	Topographic Mapping		0	100
Task 4	Field Survey		0	100
Task 5	Hydrology			
	a.	Delineate Subbasins	0	100
	b.	Estimate Parameters	0	100
	c.	HEC-1 Model and Results	10	100
Task 6	Floodplain Delineation			
	a.	Field Reconnaissance	0	100
	b.	Cross-Section Locations	0	100
	c.	Floodplain Delineation	5	5
	d.	Hydraulics Report	5	5
	e.	Technical Data Notebook	0	0
Task 7	HIS Data Preparation		0	0
Task 8	Deliverables		0	20

Work Performed in Month of October, 1995.
A-N West received comments from FCD on hydrology report on 10/12/95 and from City of Mesa on 9/21/95.

Revised Hydrology Analysis Report submitted on 11/1/95, with response to above comments.

Work to be Accomplished in Month of November, 1995.
Perform floodplain delineation and prepare hydraulics report and begin preparation of Technical Data Notebook.

1.4.1 (52)

A-N WEST INC.
Consulting Engineers

November 1, 1995

Ms. Lisa Young
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Upper East Maricopa Floodway Floodplain Delineation Study
FCD No. 94-26
Revised Hydrology Report Submittal and Review Comment Response

Dear Lisa:

We herewith transmit one revised copy of the Hydrology Report for the referenced project, addressing the FCDMC and City of Mesa review comments.

Regarding FCD and Mesa's comment, requesting modeling of the orange grove, north of McKellips, A-N West has modeled this as Subarea I.D. 86. We have also modeled the retention along the RWCD Canal and initial flow conveyed into the canal by existing culverts with split flow and retention volume calculations included in Appendix A and B and report discussion under Sections 4.3, 4.8, 4.9 and 5.4. Per this analysis, no flow was computed to cross McKellips Road into the system. The significant retention along the canal easily stores this flow and bleeds it into the canal.

To analyze, the impact of a storm occurring after the orange groves were irrigated, the IA values were reduced from 0.5 to 0 inches. No increase in storm peak discharges were noted for this analysis as discussed in Report Section 5.4.

Per FCD comment, the percent impervious was reduced to zero on Subbasin SB98 but left, as is, at Subbasin SB16 and SB92. The impervious area percent was considered reasonable for SB16 and SB92 which do have approximately this percent of curb and guttered streets which were considered to warrant the values used.

The City of Mesa's review comment No. 1 and 3 requested information on the East Maricopa Floodway's level of protection and capacity of the box culvert under Brown Road. We propose to attempt to address these comments when digitized cross-sections are obtained and the hydraulic analysis is initiated. Downstream of the Brown Road box culvert, we propose to initiate the HEC-2 model 100-year floodplain analysis at Section 21.307 (450 feet downstream of culverts) by the slope area method and the 100-year design discharge of 1200 cfs as indicated in the EMF design consultants notes on Appendix D Page D-1. It should be noted that A-N West's Scope of Work study limits are Brown Road and hence we cannot evaluate the EMF's hydrology downstream of Brown Road. We further propose to evaluate the Brown Road culverts for A-N West's computed 100-year discharge of 603 cfs upstream to the Princess Road Basin storm drain outlet.

1.4.1 (53)

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If the box culverts under Brown Road and the channel, between Brown Road and the Princess Basin storm drain outlet, still have capacity below top of channel bank, A-N West, will as a separate analysis, evaluate the additional discharge capacity to address the City of Mesa's comment No. 3.

Should you have questions or need additional information, please call.

Sincerely,

A-N WEST, INC.

Greg Schuelke

Greg Schuelke, R.L.S., P.E.
Vice President
Project Manager

GAS/sl

cc: Mr. Peter Knudson, City of Mesa

grgltr12.gen

1.4.1 (54)

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

January 2, 1996

Mr. Greg Schuelke, P.E., R.L.S.
Vice President
A-N West, Inc.
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020-4331

Re: Upper East Maricopa Floodway (UEMF) FIS
FCD No. 94-26

Dear Mr. Schuelke:

Attached are comments regarding the review of the following:

1. Special Problem Report No. 1.
2. Draft FIS Report with Profiles Exhibit and HEC-2 Input-Output.
3. Draft 100-Year Floodplain Delineation Mapping.
4. Cross-Section Plots with, 'n' Values, 100-Year WSEL's Encroachments and Channel Banks Noted.

1 Special Problem Report No. 1.

- Although the design of the EMF had an original 'n' value of 0.025, the District agrees with the use of an 'n' value of 0.05 due to the increased amount of vegetation and applicable flows.

2. Draft FIS Report with Profiles Exhibit and HEC-2 Input-Output.

- Use of the slope-area method to determine starting surface water elevations is acceptable.
- Page numbering in report is not consistent with table of contents.
- Table 2 is not labeled.
- Exhibit 3, Flood Insurance Rate Map was not received.
  Report indicates that floodways were delineated, but they were not included in the mapping.

1.4.1 (55)

- HEC-2 input indicates that cross-section 21.307 is used, yet, cross-section plots have a note that it was not used.
- NC record in HEC-2 input after cross-section 21.513 should be entered before the cross-section per 'n' values noted in cross-section plots.

3. **Draft 100-Year Floodplain Delineation Mapping.**

- Township, range and section corners should be included on mapping.

4. **Cross-Section Plots with, 'n' Values, 100-Year WSEL's Encroachments and Channel Banks Noted.**

- Label major elevation changes. This was done for some cross-sections, but all spikes should be explained.
- Cross-sections 21.874, 22.116, 22.468, elevations indicated on cross-section plots are inconsistent with elevations on floodplain delineation mapping.
- Cross-section 21.953, further explanation on the placement of left and right stations is required.

If you have any questions, please feel free to call me at 506-4719.

Sincerely,

Lisa C. Young

Lisa C. Young
Hydrologist

1.4.1 (56)

A-N WEST INC.
Consulting Engineers

7600 NORTH 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: FCD MC
2801 West Durango St.
Phoenix, Az. 85009

ATTN: Ms Lisa Young

FROM: Greg Schuelke

DATE: 1/5/96

JOB TITLE:

JOB NO.: A-N West No. 7158-03

RE: Upper EMF FIS
FCD No 94-26

WE ARE SENDING YOU ☒ ATTACHED ☐ UNDER SEPARATE COVER VIA Mail

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		Monthly Progress Report, P/E 12/31/95

THESE ARE TRANSMITTED ☒ FOR REVIEW ☒ FOR YOUR USE ☒ AS REQUESTED
☐ OTHER

REMARKS:

REC'D. BY: DATE:

COPY TO: File 1.401 (57) ☐ WITH ENCLOSURES

MONTHLY PROGRESS REPORT

Reporting Month Ending	:	12/31/95
Project Name	:	Upper EMF Floodplain Delineation Study
FCDMC No.	:	94-26
A-N West No.	:	7158-03
Project Notice-to-Proceed	:	6/12/95
Current Schedule Completion Date	:	2/05/96

Project Task		Percent Complete Reporting Month	Cumulative Percent Complete
Task 1	Coordination	10	85
Task 2	Data Collection	0	100
Task 3	Topographic Mapping	0	100
Task 4	Field Survey	0	100
Task 5	Hydrology		
	a. Delineate Subbasins	0	100
	b. Estimate Parameters	0	100
	c. HEC-1 Model and Results	0	100
Task 6	Floodplain Delineation		
	a. Field Reconnaissance	0	100
	b. Cross-Section Locations	0	100
	c. Floodplain Delineation	10	100
	d. Hydraulics Report	10	100
	e. Technical Data Notebook	30	35
Task 7	HIS Data Preparation	0	0
Task 8	Deliverables	10	40

<u>Work Performed in Month of December, 1995</u>

A-N West received FCDMC comments on 1/2/96 for Floodplain submittal sent on 11/30/95.
The City of Mesa had no comments for the A-N West 11/30/95 submittal.
FCDMC and City of Mesa responded to A-N West on 1/4/96 that no floodway was desired for project study.
FCDMC and City of Mesa to meet to discuss type of floodplain zone designation desired.

<u>Work to be Accomplished in Month of January, 1996</u>

Respond to comments and finish Technical Data Notebook and FEMA Forms and begin HIS Data preparation.

<u>Problem Discussion</u>

A-N West is currently over budget due to the unanticipated extra work associated with;

a. The special problems report to research and document reasons for difference in matching the EMF design.
b. Assessing the larger number and difficulty of split flow and detention issues in the hydrology task.

A-N West is approximately one month behind schedule due to extra time required to address the above items, as well as receiving data from agencies. A schedule extension request is anticipated to be forwarded to FCDMC before our 2/5/96 scheduled completion.

1.4.1 (58)

A-N WEST INC.
Consulting Engineers

February 5, 1996

FCDMC
Attn: Ms. Lisa Young
2801 West Durango Street
Phoenix, Arizona 85009

Re: Upper East Maricopa Floodway (UEMF) FIS
FCD No. 94-26
A-N West No. 7158-03

Dear Ms. Young:

We herewith transmit two copies (one to FCD and one to City of Mesa) of the following draft final documents for the referenced project for your review and approval.

1. Technical Data Notebook including; Sec 8.0, Draft FIS Report (with HEC-2 Model printout & diskette and Profiles), Sec. 2.6, Draft Amended Firm Maps, Sec. 4.3.1 cross-section plots and Sec. 9.0, FEMA Forms.
2. Draft Floodplain Mapping (2 sheets) (Sec. 2.5 of T.D.N. and Exhibit 3 of FIS Report).

The HEC-2 model, diskette, profiles, cross-section plots and floodplain mapping were revised on 1/26/96 to correct a reach length error at Sections 21.817 and 21.972. The change made a slight adjustment to WSEL's.

The above data with the earlier transmitted Hydrology Report (including HEC-1 Model data on diskette), Special Problems Report No. 1 and Field Reconnaissance Report, should provide a complete package of final deliverable products, except for the HIS translation data. We offer the following responses to your January 2, 1996 review comment letter;

Comment No. 2
The FIS report has been revised to note that no floodway was analyzed. Table 2 of FIS report was labeled. Exhibit 3 of the FIS report is the Draft Floodplain Mapping (200 scale) (two 24" x 36" sheets).

The cross-section plots include two section plots for Section 21.307. One was noted to be digitized and not used, while the second was noted to be field surveyed and was used in the HEC-2 model. As noted in the HEC-2 model printout comment cards, Sections 21.213 and 21.307 were field surveyed to extend cross-sections downstream of mapping limits (in the case of 21.213) and to assure ground shots were accurate in grass growth at Sec. 21.307.

The NC values on the plots were revised for Sec. 21.513 to agree with HEC-2 model.

Comment No. 3
The Township, Range and Section Nos. were added to the index of each of the two draft mapping sheets. Section Corners and I.D.'s were already noted on the mapping.

Comment No. 4
On the cross-section plots, the major elevation changes were noted which involved fences, buildings, etc.

1.4.1(59)

7600 North 15th Street, Suite 200 • Phoenix, Arizona 85020-4331 • Fax (602) 943-1989 • (602) 861-2200

Elevation differences noted on Sections 21.874, 22.116 and 22.468 between plots and mapping were corrected.

Regarding the question on placement of left and right channel bank stations on Section 21.953. The right bank station was placed on the canal top of bank. The left bank station was chosen at a width similar to upstream and downstream section channel bank widths.

A block wall and ineffective area for existing building were not considered significant to influence placement of the channel top of banks.

We are forwarding the digital data for this project to Aerial Mapping Company to begin the HIS translation process.

Should you have questions, please call.

Sincerely,

A-N WEST, INC.

Greg A. Schuelke

Greg A. Schuelke, P.E.
Project Engineer

GAS/cr

cc: Mr. Peter Knudson, City of Mesa

enclosures

7158-03.gen

1.4 (60)

A-N WEST INC.

A-N WEST INC.
Consulting Engineers

June 21, 1995

Ms. Terri Miller
Arizona Department of Water Resources
2nd Floor
500 North 3rd Street
Phoenix, Arizona 85004-3903

Re: Upper East Mesa Floodway (EMF) Floodplain Delineation Study
Notification of Study and Request for Pertinent Information
FCDMC No. 94-26

Dear Ms. Miller:

The Flood Control District of Maricopa County has contracted with A-N West, Inc. to perform a floodplain delineation study for Upper EMF. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event.

We have enclosed an Exhibit 'A' showing the anticipated limits of new 200 scale 2' C.I. mapping to be generated for this study to utilize in delineation the floodplain. The study limits are from Brown Road to McKellips Road.

We are writing to notify you of this study and to request in general, pertinent information related to the study, such as previous flood hazard reports, historical flooding information, FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions.

A-N West has been in contact with the Soil Conservation Service to review design hydrology and plans for the EMF downstream of Brown Road.

More specifically, we are interested in any detailed FEMA FIRM maps, summary discharge tables, flood profiles for the EMF immediately downstream of Brown Road and any Letters of Map revision or amendment which may have been transmitted through ADWR for proposed development within the study limits.

Sincerely,

A-N WEST, INC.

Greg Schuelke

Gregory A. Schuelke, P.E., ~~R.L.S.~~
Vice President
Project Manager

GAS/sl

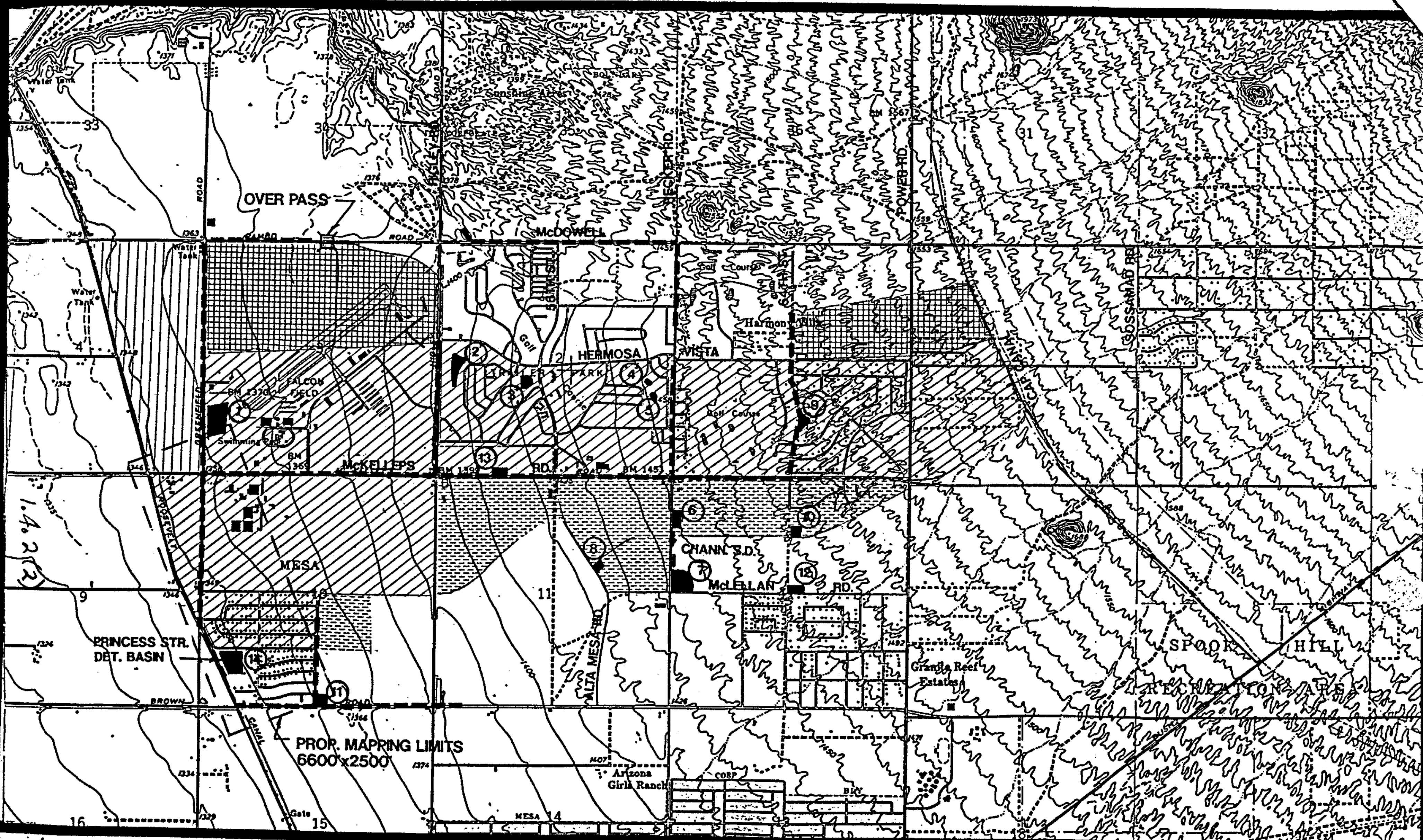
cc: Ms. Lisa Young
Flood Control District of Maricopa County

enclosures

grglr11.gen

1.4.2 (1)

7600 North 15th Street, Suite 200 • Phoenix, Arizona 85020-4331 • Fax (602) 943-1989 • (602) 861-2200



EXIST. STORM DRAIN
EXIST. DET. BASIN
MAJORITY OF DRAIN AREA CONTRIBUTES
PORTION OF DRAIN AREA BASE FLOW INTERCEPTED BY S.D. & OR STREET
PORTION OF DRAINAGE AREA PEAK FLOW MAY CONTRIBUTE
MAJOR PORTION OF RUN OFF RETAINED ALONG CANAL

A-N WEST INC.
Consulting Engineers

UPPER EMF FLOODPLAIN DELINEATION STUDY
FCDMC No.94-26

DATE: 4/26/95

EXHIBIT A

A-N WEST INC.
Consulting Engineers

7600 NO[illegible]H 15TH STREET
SUITE 200
PHOENIX, ARIZONA 85020
(602) 861-2200

Letter of Transmittal

TO: Soil Conservation Service
3003 North Central Ave
8TH Floor
Phoenix Az

DATE: 9/13/95
JOB TITLE:
JOB NO.: A-N West No 7158-03
RE: Upper East Mesa Floodway FIS
FCD MC No. 94-26

ATTN: Mr John Harrington

FROM: Greg Schuelke

WE ARE SENDING YOU ☐ ATTACHED ☐ UNDER SEPARATE COVER VIA Delivery

THE FOLLOWING ITEMS:

☐ SPECIFICATIONS ☐ ORIGINALS ☐ COPY OF LETTER
☐ SHOP DRAWINGS ☐ PRINTS ☒ REPORT
☐ PLANS ☐ SAMPLES ☐ OTHER

QUAN.	I.D./DWG. NO.	TITLE/DESCRIPTION
1		3-Ring Binder, Design Notes, Hydrology, TR-20, R.W.C.D. -Reach 6, Floodway Extension
1		3-Ring Binder, Design Notes, TR-20, Hydrology, RWCD Floodway, Reach 6 Dated: 5/85

THESE ARE TRANSMITTED ☐ FOR REVIEW ☒ FOR YOUR USE ☐ AS REQUESTED
☐ OTHER

REMARKS: John, we are returning the above two documents which you loaned to us on 6/19/95 for the referenced Flood Insurance Study between Brown and McKellips Roads along RWCD canal. Thanks for the information and sorry for the delay in returning this data.

REC'D. BY:

DATE:

COPY TO:

1.43(1)

☐ WITH ENCLOSURES

A-N WEST INC.
Consulting Engineers

October 17, 1995

National Geodetic Information Center
National Geodetic Survey N/CG617
Coast and Geodetic Survey
National Ocean Survey, NOAA
Rockville, Maryland 20852

Re: Average Bias Conversion Factors to
Convert NGVD 29 Elevation Datum To NAVD
Datum 88
A-N West No. 7158-03

Gentlemen:

We write to order a copy of your Vertcon computer program for performing the referenced conversions. We request the program on 3-1/2" diskettes and have included a check made payable to National Geodetic Survey for $30.00.

Should you need additional information, please let us know. Thank you.

Sincerely,

A-N WEST, INC.

Greg Schuelke

Greg Schuelke, R.L.S., P.E.
Vice President
Project Manager

GAS/sl

cc: File

grgltr12.gen

1.4.3 (2)

7600 North 15th Street, Suite 200 • Phoenix, Arizona 85020-4331 • Fax (602) 943-1989 • (602) 861-2200

A-N WEST INC.
Consulting Engineers

September ~~7~~ 8, 1995

National Geodetic Information Center
National Geodetic Survey N/CG617
Coast and Geodetic Survey
National Ocean Survey, NOAA
Rockville, Maryland 20852

Re: Average Bias Conversion Factors to
Convert NGVD 29 Elevation Datum To NAVD
Datum 88
Upper East Mesa Floodway FIS, FCDMC No. 94-26
A-N West No. 7158-03

Gentlemen:

A-N West is performing a detailed floodplain delineation study for the Flood Control District of Maricopa County, Arizona for the referenced project. We have been requested to prepare mapping at NGVD 1929 datumn and provide a conversion adjustment to obtain NAVD 1988 datumn.

For this purpose, we are writing to request the Average Bias Conversion Factors to Perform the Datum Conversion, per Technique Number No. 3 of the FEMA Document FIA-20, June, 1992.

The project's detailed mapping involves approximately a one mile length x 2500 foot width located on the east half of Section 9 and west half of Section 10, Township 1 North, Range 6 East, Gila and Salt River Base and Meridian in Maricopa County, Arizona (see attached Figure 1 Location Map). The latitude is approximately 33° 26' 45" and Longitude is 111° 44' 00".

Should you need additional information, please let us know. Thank you.

Sincerely,

A-N WEST, INC.

Greg Schuelke

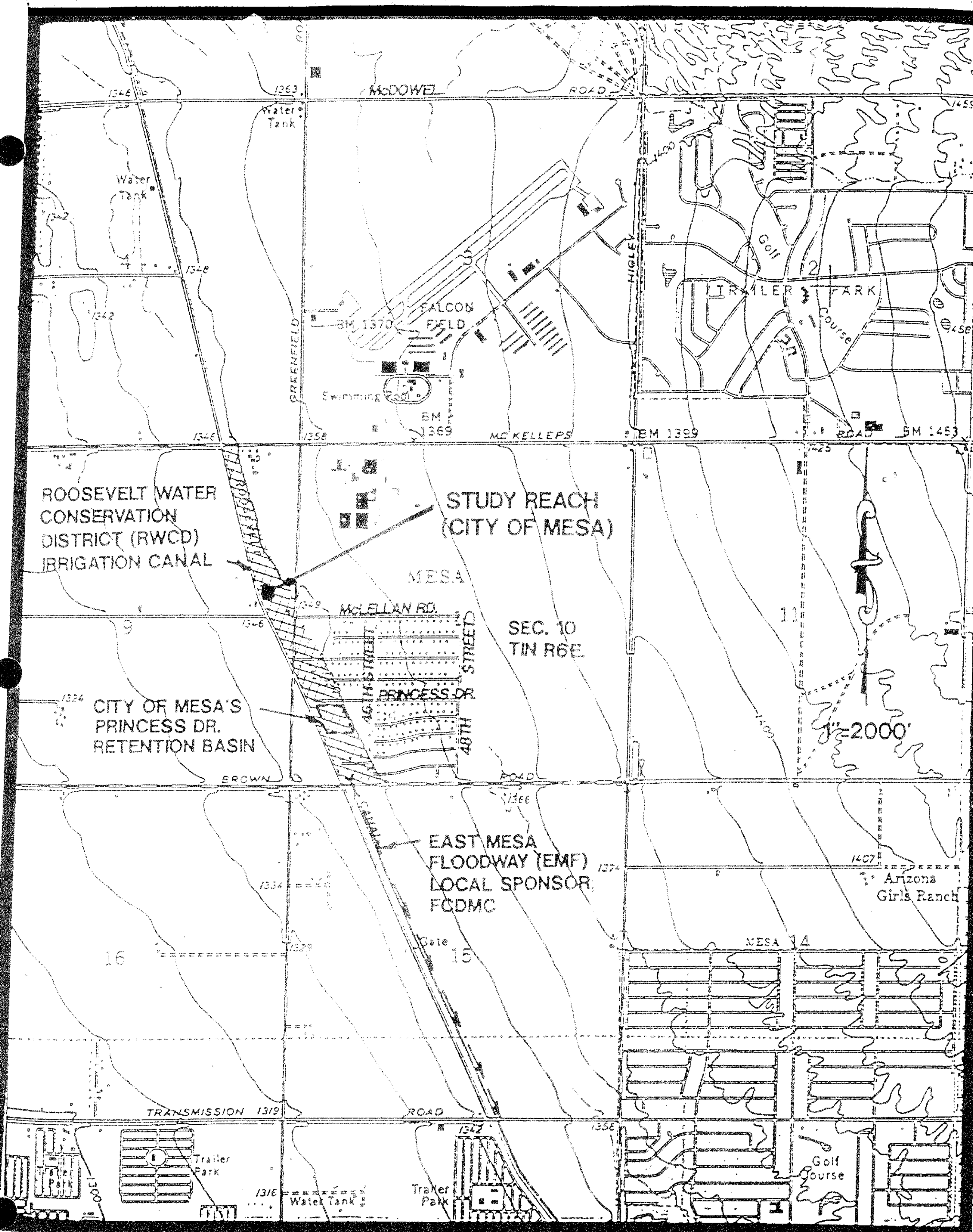
Greg Schuelke, R.L.S., P.E.
Vice President
Project Manager

GAS/sl

cc: File

grgltr12.gen

1.4.3 (3)



FCDMC No. 94-26
A-N WEST No. 7158-03

A-N WEST INC.
Consulting Engineers

EXPLANATION

- FLOOD PLAIN DELINEATION STUDY LIMITS

1.4.3 (4)

LOCATION MAP
UPPER EAST MESA
FLOODWAY FIS

FIGURE 1

Tribune NEWSPAPERS
P.O. BOX 1547 • MESA, ARIZONA 85211

P. O. Number: ____________

Invoice Number: 778533

AFFIDAVIT OF PUBLICATION

STATE OF ARIZONA
County of Maricopa

I, WENDY ERAUTT, Legal Clerk, acknowledge that the attached hereto was published in a newspaper of general circulation at Mesa, Arizona, County of Maricopa on the following dates:

07/21,28 1995

M

M - Mesa T - Tempe C - Chandler G - Gilbert S - Scottsdale

Wendy Erautt
LEGAL CLERK

Subscribed and sworn to before me this date: 28-JUL-95

Cathy Jackson
NOTARY PUBLIC

OFFICIAL SEAL
CATHY JACKSON
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires Mar. 5, 1997

ANNOUNCEMENT OF INTENT TO PERFORM FLOOD HAZARD STUDIES

The Flood Control District of Maricopa County, (FCDMC), under authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood hazard areas in eastern Maricopa County. FCDMC has contracted A-N West, Inc. to perform studies for the upstream side of the Roosevelt Water Conservation District Canal, between Brown Road and McKellips Road in the City of Mesa, Arizona. Flood elevations from these studies will be used to determine flood insurance rates by the Federal Emergency Management Agency (FEMA). This announcement is intended to inform all interested persons and communities of the commencement of this study so that they may have an opportunity to bring any relevant technical information to the attention of FCDMC/FEMA, so that it may be considered during the course of this study. Your comments should be addressed to Ms. Lisa Young, Hydrologist at the Flood Control District in Maricopa County, 2801 W. Durango Street, Phoenix, Arizona 85009, Phone: (602) 508-1501.
Pub Jul 21, 28, 1995 MG-778533

MESA TRIBUNE LEGAL ADS ARE ALSO PUBLISHED IN THE GILBERT TRIBUNE

INVOICE NO. 95304

ANNOUNCEMENT OF INTENT TO PERFORM FLOOD HAZARD STUDIES

The Flood Control District of Maricopa County (FCDMC), under authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood hazard areas in eastern Maricopa County. FCDMC has contracted A-N West, Inc. to perform studies for the upstream side of the Roosevelt Water Conservation District Canal, between Brown Road and McKellips Road in the City of Mesa, Arizona. Flood elevations from these studies will be used to determine insurance rates by the Federal Emergency Management Agency (FEMA). This announcement is intended to inform all interested persons and communities of the commencement of this study so that they may have an opportunity to bring any relevant technical information to the attention of FCDMC/FEMA, so that it may be considered during the course of this study. Your comments should be addressed to Ms. Lisa Young, Hydrologist at the Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, Arizona 85009. Phone: (602)506-1501.

Published: Arizona Republic, June 26, and July 3, 1995.

AFFIDAVIT OF PUBLICATION

The Arizona Republic/The Phoenix Gazette

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

TOM BIANCO, being first duly sworn, upon oath deposes and says: That he is the assistant legal advertising manager of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic and The Phoenix Gazette, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic
~~The Phoenix Gazette~~

JUNE 26, JULY 3, 1995

Tom Bianco

Sworn to before me this

5TH day of

JULY A.D. 1995

OFFICIAL SEAL
MARY LEE BOOHER
Notary Public - State of Arizona
MARICOPA COUNTY
My Comm. Expires March 17, 1999

Mary Lee Booher
Notary Public

1.4.7 (2)

SCOPE OF WORK
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FLOODPLAIN DELINEATION AND TOPOGRAPHIC MAPPING
FOR THE UPPER EAST MARICOPA FLOODWAY FCD 94-26

GENERAL

The project consists of approximately 1.0 river mile of floodplain delineation for the area along the Roosevelt Irrigation District Canal north of the East Maricopa Floodway from Brown Road to McKellips Road, as shown on Exhibit 1. This will require the development of the necessary topographic data and approximately 3.4 square miles of watershed hydrology. The consultant will develop the hydrology using the Corps of Engineer's HEC-1 computer model; and the floodplain delineation using primarily the HEC-1 computer model and the HEC-2 computer model if appropriate. The consultant must use sound engineering judgement in the development of the hydrologic and hydraulic models. The results of the models must be analyzed carefully and refinements made to the input parameters in order to obtain the most realistic results. All work must meet Arizona Department of Water Resources (ADWR) and Federal Emergency Management Agency (FEMA) requirements for floodplain delineations. The results of this study must be reviewed and accepted by FEMA and the City of Mesa prior to the finalization of this contract. All work under this Scope will be completed within 270 calendar days from the date of Notice to Proceed, including 60 days for District reviews.

TASK 1 - COORDINATION

1.1 The consultant will submit a project schedule showing coordination meetings and completion dates for each of the tasks in the scope within 14 days of Notice To Proceed. The consultant shall update this project schedule when appropriate.

1.2 The consultant shall participate in regular coordination meetings (at least every 6 weeks) with the District's Project Manager and in milestone coordination meetings in the development of the hydrologic and hydraulic analyses. The consultant is responsible for the minutes of any meetings. Whenever possible, coordination and milestone meetings should be combined.

1.3 The consultant will submit a quarterly estimation of the projected billing within 14 days of Notice to Proceed. Thereafter, this estimation will be updated and submitted to the District's project manager at least 10 days prior to the end of each quarter.

1.4 The consultant shall submit monthly progress reports at least 5 days before submittal of monthly invoices. The report shall be brief and should be no longer than two typed pages. At a minimum, the monthly report shall contain the following:

a. A description of the work accomplished by task during the reporting month.

b. Percent (%) completed for the month and percent (%) cumulative completed for each task.

c. A brief description of the work to be accomplished the following month.

d. A description of any problems encountered.

1.5 The consultant is responsible for placing the legal advertising at the beginning of the study, notifying the public of the study. The ad will be run in a widely circulated newspaper two times, with approximately one week between runs. The ad must also be run two times in a local newspaper that serves the area being studied. After the ad is run the consultant will supply the District with the original affidavit of publication from each of the newspapers for each day that the ad ran.

1.6 The consultant will notify all property owners and obtain any necessary Rights of Entry for the study area. The consultant will furnish the District with a list of all the property owners notified and a sample Right of Entry letter.

1.7 The consultant shall meet with officials from the City of Mesa. The purpose of this meeting is to identify local flooding problems and obtain information on current and planned public works projects, channel modifications, storm-drainage systems, development, and corporate limits.

1.8 The District will plan and conduct two public meetings in conjunction with this study. The first meeting will be to inform the public of the purpose and scope of the study. The second meeting will be to inform the public and obtain public comment on the study results, and shall take place prior to the submittal of the final report to FEMA. The consultant/District will be responsible for the preparation of the graphic displays for these meetings. One representative from the consultant will attend each of the meetings. The consultant will respond to the public's comments and make revisions to the study if necessary.

1.9 Consultant/District Performance Evaluations will be performed. An informal evaluation will be performed at the completion of the hydrologic analysis. A formal evaluation will be performed at the completion of the project upon receipt of all deliverables.

TASK 2 - DATA COLLECTION

2.1 The consultant will collect and review pertinent data from the District and other outside sources. Data to be collected will include previous flood hazard reports and hydrology for the study area; existing topographic mapping; historical flooding information; as-built plans for existing structures; FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions, and other pertinent information.

2.2 A written report summarizing the data collected will be submitted to the District for information purposes. A preliminary draft of this report is due within 90 days of Notice to Proceed.

TASK 3 - TOPOGRAPHIC MAPPING

3.1 An aerial survey subcontractor shall be retained by the consultant as part of this contract. The consultant shall coordinate all the aerial surveying work with the aerial surveying subcontractor to ensure that the specifications of the aerial surveying work are met. The consultant is responsible for ensuring that the topographic mapping covers the area of delineation. Quality control on surveys will be per FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, January 1995.

3.2 Digital contour and planimetric data developed for this study shall be delivered according to the District's *Digital Terrain Model Mapping, Data Collection & Delivery Specifications, Release 1.0, May 1994.* Digital contour and planimetric data shall be developed and delivered in accordance with the District's *HIS Data Delivery Specifications, Revision 2.0.*

3.3 Prepare topographic mapping to a 2-foot contour interval, with a scale of 1 inch = 200 feet, with spot elevations and/or 1-foot contours on all section line and mid-section line roads.

3.4 Ground Control:

a. The consultant shall provide all survey control using 1983 NAD.

b. The consultant shall systematically set panel points and establish horizontal and vertical control throughout the areas to be mapped for use in compilation by the aerial survey contractor. Where readily available, surveys will tie into the State Plane Coordinate System. Field control shall be sufficient to readily allow for compilation of maps by the aerial survey contractor at the desired map scale and contour interval, and will be based on the National Geodetic Vertical Data of 1929 (NGVD). A conversion factor, including documentation of how it was derived, will be provided by the consultant to allow comparison of NGVD 29 elevations to NAVD 88 elevations and will be included in the Technical Data Notebook. Fee proposal was based on the control being available within one mile form study area.

1.5 (3)

A conversion factor, including documentation of how it was derived, will be provided by the consultant to allow comparison to the City of Mesa datum and will be included in the Technical Data Notebook.

c. The horizontal and vertical control points shall be located and marked by the consultant. The controls for the aerial mapping shall be in sufficient numbers and shall be in locations which will be compatible with the accuracy of the mapping requirements. The controls shall be of at least third order accuracy. Section corners, quarter corners, and mid-section points shall be used for control points wherever possible.

3.5 The consultant shall provide permanent non-erasable topographic mylars of the work study drawings. The drawings shall be 24" X 36" in size, with a scale of 1 inch = 200 feet and a contour interval of 2 foot for all mapping with the exception of section line roads which will have a contour interval of 1 foot. A cover sheet will be provided with the project title, date of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. Each drawing shall include the floodplain and floodway delineations and a minimum of a north arrow, scale, section corners and quarter corners, current and proposed streets and highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section lines, channel station center line, index map, and description and elevation of elevation reference marks (ERMs). A note explaining the proper means to convert the NGVD 29 elevations to NAVD 88 elevations shall be included in "NOTES" in the map border. See Exhibit 2 for how the drawings are to be laid out. The mapping will have an accuracy such that ninety percent (90%) of all contours shall be within one-half contour of the true elevations and the remaining ten percent (10%) of the contours shall not be in error by more than one contour interval.

TASK 4 - FIELD SURVEY

4.1 Prepare topographic mapping to a 2 foot contour interval with a scale of 1 inch = 200 feet, with spot elevations or 1 foot contours on all section line and mid-section line roads, for floodplain/floodway delineation areas as identified in Task 6 or FEMA criteria, whichever is more stringent.

4.2 Ground Control for Floodplain Delineations:

4.2.1 All topographic mapping and survey work shall meet or exceed Federal Emergency Management Agency (FEMA) minimum criteria as defined in FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1993. This would include, but is not limited to: the establishment of "permanent" elevation reference marks (ERMs); field control; and verification of profiles by the ground survey profile procedure.

4.2.2 Horizontal and Vertical Control: Systematically set panel points and establish horizontal and vertical control throughout the area to be mapped for use in compilation by the aerial survey contractor. Where readily available, surveys will tie into State Plane Coordinate System 1983 NAD. Field control shall be sufficient, at least one "permanent" point per mile, such point(s) being used as Elevation Reference Marks (ERMs). Surveys will be based on National Geodetic Vertical Datum (NGVD) 1929, per FEMA guidelines. A conversion factor, including documentation of how it was derived, will be provided by the consultant to allow comparison of NGVD 29 elevations to NAVD 88 elevations and will be included in the Technical Data Notebook. "Permanent" survey points shall consist of existing monumentation, such as brass caps or similar survey monuments. Where additional monumentation is needed, survey markers conforming to Maricopa Association of Governments (MAG) Uniform Standard Detail for Public Works Construction, detail 120-1, Type C, shall be placed 2" +/- above grade, and topped with a brass cap. Elevation Reference Marks will be labelled on available maps and described in a manner which allow them to be readily located in the field.

4.2.3 All aerial targets are to be removed following completion of the topographic mapping.

4.3 The consultant shall verify the accuracy of the mapping by the procedures called for in FEMA Document 37 or other methods approved by FEMA. This shall include the verification of cross sections used in the floodplain delineation.

4.4 Field surveys of bridges, culverts, and hydraulic structures are to be obtained by the consultant when as-built plans are not available or when changes significant to the HEC-2 modeling, such as sedimentation, have occurred since the date of as-built. This information should be reduced and compiled into an 11"x 17" (maximum size) drawing for inclusion in the final report. The information presented in the drawing should be in a format appropriate for use in the HEC-2 model. Field surveys of bridges, culverts, hydraulic structures, and routing reaches must also be obtained where necessary for proper hydrologic modeling. It may be necessary to field survey some structures since the as-built plans may not be on 1929 NGVD.

TASK 5 - HYDROLOGY

5.1 The hydrologic study of the watershed will be delivered to the District under separate cover from the hydraulic analysis. The consultant shall use the U.S. Army Corps of Engineers computer program HEC-1, 1991 Version, to develop a hydrologic model for the area. Using appropriate hydrologic judgement, sub-basins are to be identified that provide reasonable depiction of the watershed condition. The sub-basins must be as homogeneous as possible, using watershed area, watershed type (mountainous and flat lands or urban and undeveloped areas), and time of concentration as criteria. Sub-basin break-downs will be done in sufficient detail to provide peak discharges at structures, major road crossings, confluences, and at boundary lines. An appropriate time step and number of ordinates is to be selected that allows for complete calculation of the flood hydrograph without sacrificing resolution of the flood peak. All calculations, or assumptions used in developing sub-basin and routing parameters shall be documented and made a part of the appendix for the hydrology report. Field surveys may need to be taken for HEC-1 modeling purposes.

5.2 Four meetings associated with four tasks, and two field trips shall be held with the Flood Control District staff at the following milestones:

a. One field trip at the start of the project to scope out the critical points of the watershed and problem areas.

b. Meeting number 1: as soon as basic data are gathered and the sub-basins have been delineated. Sample HEC-1 parameter estimations should also be presented and discussed at this meeting. A copy of the draft maps of the sub-basins must be delivered to the District at this meeting.

c. Meeting number 2: after all the parameters have been estimated. A draft copy of the parameters must be delivered to the District at least one week prior to this meeting.

d. Meeting number 3: after the preliminary HEC-1 results have been obtained and a draft report has been prepared. A copy of the draft report and the copy of the HEC-1 on a floppy disc, compatible with the Districts computer, must be delivered two weeks prior to the meeting.

e. Meeting number 4: to review comments by the District. A second field trip may be scheduled for the same day so the results obtained could be discussed.

5.3 The specific hydrologic techniques to be used in this study are:

a. Rainfall Depth: Point precipitation values will be determined using the information and procedures described in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology.

Rainfall Distribution: Peak discharges and peak volumes for the 100-year 6-hour storm will be estimated using the District's Distribution(s). Peak discharges and peak volumes for the 100-year 24-hour storm will be estimated using the SCS Type II rainfall distribution.

b. Areal Reduction: The point precipitation values will be areally reduced for critical concentration points. Areal reduction for the 6 hour rainfall duration will be applied using the curves in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology. NOAA HYDRO-40 will be used with the 24 hour rainfall reduction. Copies can be obtained from the District.

c. Rainfall Excess: The Green and Ampt methodology will be utilized for estimation of rainfall losses. The Lotus spreadsheet and procedures, provided by the District, will be used to determine composite parameter values for each sub-basin.

d. Unit Hydrograph: The Clark and S-Graph method should be used following the procedures outlined in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology. The choices in methodology will be to the discretion of the consultant, with consent from the District.

e. Time of Concentration and S-Graph Lag Equation: The Papadakis method should be used with the Clark unit hydrograph, along with the MCUHP1 computer program, to determine the time of concentration. If this method results in unsuitable times of concentration, other method(s) must be used and compared for the most realistic result. The S-graph lag equation, along with the MCUHP2 computer program, should be used with the appropriate S-graph (Phoenix mountain or Phoenix Valley).

f. Channel Routing: Channel routing will be accomplished using either the Muskingum-Cunge or the Normal-Depth option of HEC-1. The choice of methodology will be at the discretion of the consultant, with consent from the District. Average cross sections will be developed utilizing available mapping and field reconnaissance data. Sufficient field cross sections will be taken to ensure that routing reaches are reasonable and representative of field conditions.

   The HEC-1 routing parameters for the reaches modeled using HEC-2 will be adjusted after the HEC-2 cross sections are available. The resulting velocities and depths, for all reaches, must be assessed for realistic values.

g. Reservoir Routing: Detailed analysis of structures and ponding areas will be accomplished using the Modified Puls reservoir routing option of HEC-1. Stage versus discharge tables for hydraulic structures will be estimated using appropriate hydraulic methodology.

h. Channel Transmission Losses: Attempts should be made to estimate infiltration losses through channel bottoms based on existing field data or literature. If sufficient data is not available, the final report must acknowledge so and explain how the peaks and volumes of flow are affected by not including the transmission losses.

5.4 The District will provide appropriate references to facilitate parameter estimation.

5.5 Output of the computer model should be reviewed to see if the peak flows and volumes are realistic. Adjustments to input for obtaining the most realistic results is normal to the scope.

5.6 Every attempt must be made to recover historic stream gage data and use it to compare with the results obtained by the hydrologic model. Major differences must be discussed in the final report.

5.7 It is required that the consultant obtain the approval of the District at each of the following steps:

a. Soil maps, watershed boundary maps, and land use maps.

b. HEC-1 parameter estimation.

c. HEC-1 flow diagram and input parameters.

d. HEC-1 results.

5.8 The Hydrologic Report

5.8.1 The findings of the hydrologic study will be presented in Section 3 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-90 (SSA 1-90). The report will be organized as specified by the District, following SSA 1-90 format.

5.8.2 Tables and Figures for the appendices:

a. Topographic base map(s) showing the sub-basins, routing reaches, Tc flow paths or lag flow paths, major man-made structures, and references (i.e. street names, Township, Range, Section, etc.) at a scale of 1 inch = 2000 feet.

b. Soils map(s) at the same scale as the base map.

c. Land use map(s) at the same scale as above.

d. Schematic map for the HEC-1 showing the sub-basins (area, Tc), the flow paths, the routing reaches (length, slope, friction, width, velocities, transmission losses, etc.), order of combining the hydrographs, channel, pipe or culvert dimensions (where appropriate).

e. Pertinent data on all the structures in the watershed (such as spillway elevation, rating curves, etc.).

f. One set of study maps (i.e. sub-basin boundary maps, flow path maps, soils maps, land use maps) to be folded and delivered in a binder.

Specific deviations from this hydrologic scope shall not be undertaken without the specific written concurrence from the Flood Control District.

TASK 6 - FLOODPLAIN DELINEATION

6.1 Floodplain delineations must be obtained using the U.S. Army Corps of Engineers HEC-2 Water Surface Profiles computer model, version 4.6.2, May 1991, and methodology acceptable to FEMA. This model will simulate the effects of floodplain geomorphology, flow changes, bridges, culverts, hydraulic roughness factors, effective flow limitations, split-flows, and other considerations. The consultant will prepare the study using the guidelines established in FEMA Document 37, Flood Insurance Study Guidelines and Specification for Study Contractors, January 1995, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, January 1990.

6.2 The delineation work shall meet requirements for floodplain and floodway delineations as prescribed by FEMA and the Arizona Department of Water Resources.

6.3 The delineation study shall be based on the final results of the hydrologic study as directed by the District.

6.4 The hydraulic analysis shall be compatible with the previous study of the East Maricopa Floodway to the south of the proposed study area and shall tie into the FEMA approved delineation to the south.

6.5 The consultant is to make refinements to the HEC-2 model based on review comments from the District, ADWR, FEMA and the Technical Evaluation Contractor. Adjustments to the input parameters for obtaining the most realistic results is normal to the Scope of Work.

6.6 The consultant must obtain District approval at each of the following steps:

a. Field reconnaissance report and estimation of Manning's "n" values.

b. Proposed location and alignment of the cross sections and channel centerline.

c. Floodplain (natural) delineation.

d. Final Hydraulics Report.

6.7 Field Reconnaissance

6.7.1 The consultant will conduct a field reconnaissance of the full study reach. This will include observation of channel and floodplain conditions for estimation of Manning's "n" values; photographic documentation of floodplain characteristics; determination of channel bank stations; observation of possible overflow areas; inspection of levees or other flood control structures; and measurement of bridge dimensions.

6.7.2 Mannings "n" values are to be determined using the methodology in the USGS report, Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991.

6.7.3 A draft report on the field reconnaissance will be submitted to the District for review and approval prior to beginning the HEC-2 modeling. The report will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. The report will also discuss floodplain conditions affecting the delineation, describe structures and obstructions, and provide color photos or photocopies of major hydraulic structures. Photo locations, structures, and "n" values will be displayed on reduced scale mapping and included in the Final Report.

6.8 Cross Sections

6.8.1 The location and alignment of cross sections and channel centerline will be submitted for the District's review and approval prior to digitizing the cross section data. Cross section stationing will be from left to right looking downstream with the thalweg as station 10,000. Cross sections will be spaced approximately every 500 feet, unless geographic or structural constraints dictate otherwise, and will extend the full width of the area inundated by 100-year flood waters. Identification of cross sections will be in river miles, increasing upstream. The stationing will tie into the specified river mile of the existing FEMA studies. Cross section orientation may need to be altered after running of HEC-2 model to ensure that sections are perpendicular to flow per FEMA criteria.

6.8.2 All cross sections will be plotted using a pen, laser, or electrostatic plotter. The cross section plots will show water surface profiles, ineffective flow areas, "n" values, encroachments, channel stationing and other pertinent information. All plots are to be accompanied by a legend. These plots are to be available at all reviews.

6.8.3 Cross section plots are limited to one plot at the following three stages of work: (a.) a plot of digitized "GR", STCHL, STCHR, centerline (station 10,000) to be used as a check of input data and for working sections during compilation of the floodplain model; (b.) a plot of the cross section for the completed floodplain run which shows the floodplain water surface elevation, ineffective flow areas, and"n" values. These cross sections will be submitted as part of the Final Report.

6.9 Bridges and culverts must be modeled in compliance with HEC-2 modeling requirements for the selected routine. Where multiple bridges occur, each bridge will be modeled separately. The HEC-2 modeling results for bridges, culverts, and other hydraulic structures must be checked by using an independent method approved by the District to analyze these structures.

6.10 Flood Zones must be clearly labelled as *Zone A* on the final drawings.

6.11 The total area of the floodplain and floodway must be determined for each reach in square miles and acres.

6.12 The findings of the floodplain delineation study will be presented in Section 4 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-90 (SSA 1-90). The report will be organized as specified by the District standards, following SSA 1-90 format.

TASK 7 - HIS DATA

7.1 Digital data will prepared in conformance with the District's HIS Data Delivery Specifications, Revision 2.0 dated February 6, 1995, for the following themes:

a. Drainage sub-basin area and ridge - DRNBSN - LP12

b. Drainage path - DRNPTH - LP15

c. Land use (if not provided by the District) - LDUSE - LP36

d. Soil type area (if modified from that provided by the District) - SOIL - LP59

e. Elevation (land) - ELV - LP17

f. Floodplain FCD Zone - FPZNFCD - LP28

g. Floodplain FCD Water Surface Elevation - FPSRFFCD - LP25

h. Canal coverage - CNL - LP7

i. Easement, FCD not a party - ESMT - LP19

j. Floodplain baseline route system - FPBLN - LP22

k. Floodplain FCD cross section - FPXFCD - LP26

l. Hydrologic land use - LDUSEHYD - LP37

m. Outfall (and field screen site) - OUTFLL - LP42

n. Structure - STRCT - LP61

o. Street detail - STRTDTL - LP63

p. Utility - UTLTY/FLTY - LP65 / 21

q. Cartographic coverages - CARTO_ARC/CARTO_PNT - LP4 / 6

r. Data quality - DQ - LP71

s. Sheet boundaries index - NDXPRJ - LP41

t. Study boundaries - PRJ - LP54

7.2 Separate check plots will be produced from either Arc-Info or Arc-CAD from the digital database(s) of each theme in 7.1. The check plots will be prepared with a minimum of annotation and will serve only to verify the information in the data base. If the hydrologic and delineation maps have not derived directly from the digital data delivered to the District, then the consultant will certify that the check plots have been examined and that the check plots faithfully represent the data and maps used in the report and /or work maps.

TASK 8 - DELIVERABLES

8.1 FEMA Submittal: The consultant will submit the following items to the District for review by FEMA and any other appropriate governmental agency. All of the following products are considered deliverables for the FEMA submittal:

8.1.1 Original Affidavits of Publication

8.1.2 Two (2) complete sets of blueline topographic base maps with the floodplain/floodway delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

8.1.3 Two (2) complete copies of the Technical Data Notebook, including HEC-1 and HEC-2 input/output files on diskettes. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-90 (SSA 1-90). The notebook will be organized as specified by the District, following SSA 1-90 format.

8.1.4 Two (2) sets of completed FEMA forms will be submitted in a notebook separate from the Final Report.

8.1.5 Three (3) sets of complete survey notes will be submitted in a notebook separate from the Final Report.

8.1.6 Two (2) copies of the current FIRM panels showing the proposed delineation.

8.2 Final Submittal: The following products are considered deliverables for the final submittal to the District after FEMA approval is issued:

8.2.1 One (1) complete set of non-erasable topographic mylars of the work study drawings. Sheets shall be 24" X 36" in size and numbered to correspond to the delineation maps.

8.2.2 One (1) complete sets of mylars and four (4) complete sets of sealed blueline topographic base maps with the floodplain/floodway delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

8.2.3 One (1) complete set of transparent overlays of photo-mylars. Sheet size, numbering, and layout shall correspond to the delineation work maps.

8.2.4 One (1) complete set of 9" X 9" contact prints of the aerial stereo photographs sequentially numbered and catalogued.

8.2.5 One (1) complete set of 9" X 9" film diapositives of the aerial stereo photographs sequentially numbered and catalogued.

8.2.6 Digitized topographic data and floodplain/floodway boundaries in conformance with the District's HIS Specifications.

8.2.7 Four (4) complete copies of the Technical Data Notebook including HEC-1 and HEC-2 input/output files on diskettes. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-90 (SSA 1-90). The notebook will be organized as specified by the District, following SSA 1-90 format. This submittal of the Technical Data Notebook shall include any correspondence and/or meeting minutes with the reviewing agencies and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, modifications to the delineation maps, the HEC-1 model, the HEC-2 model, and/or the Final Report.

SECTION 2 - MAPPING AND SURVEY INFORMATION

2.1 Description of Mapping, Map Control, etc.: A list of benchmarks at NGVD 1929 elevation datum was obtained from the Salt River Project; which was established in 1986. A-N West performed field surveys in June, 1995 to set and tie the mapping panel points and elevation benchmarks, horizontally and vertically to these benchmarks.

The mapping datum benchmark (NGVD 29) at Brown and Greenfield Road was compared to the City of Mesa Datum benchmark at this location, p. 2.0 (26), to establish that 0.40 feet must be added to mapping datum elevations to obtain Mesa datum elevations.

The Vertcon computer program results are presented on p. 2.0 (27) showing conversion of NGVD 29 to NAVD 88 vertical datum.

A-N West also field surveyed finished floors within the floodplain at NGVD 29 datum as well as supplemental surveys of box culvert and storm drain inverts, and cross-sections of detention basin overflow spillway and two channel cross-sections downstream of mapping limits, at mapping datum.

Mr. Fred L. Baker, R.L.S. of A-N West was responsible for establishing horizontal and vertical control for the new mapping and supplemental surveys on this project.

OORDINATE PLOT   FILE NAME IS 7158-03 7-13-95
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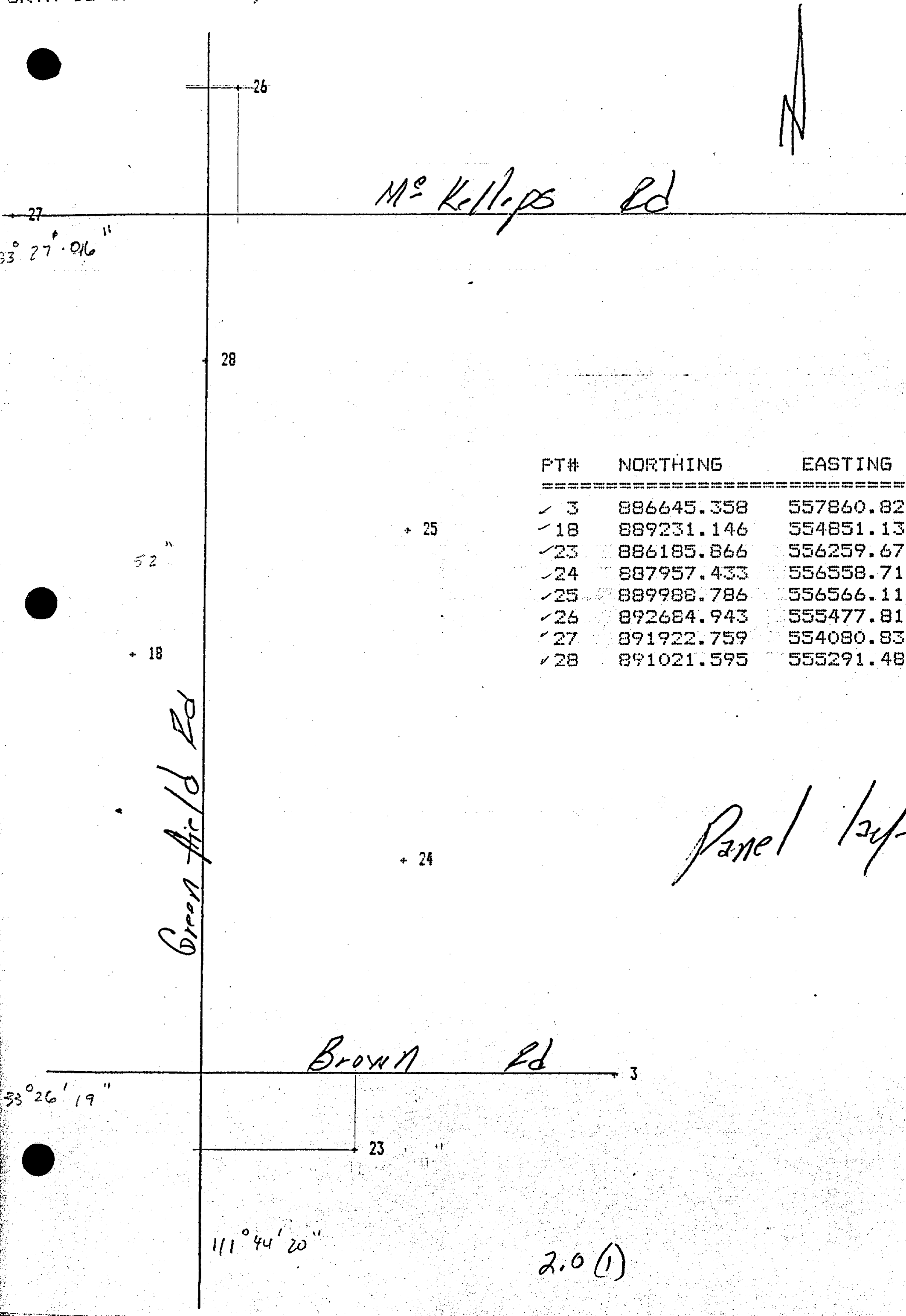

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18	889231.146	554851.135	1350.18
23	886185.866	556259.671	1349.26
24	887957.433	556558.719	1353.59
25	889988.786	556566.119	1360.35
26	892684.943	555477.816	1358.66
27	891922.759	554080.834	1352.25
28	891021.595	555291.484	1354.43

Panel layout

2.0 (1)

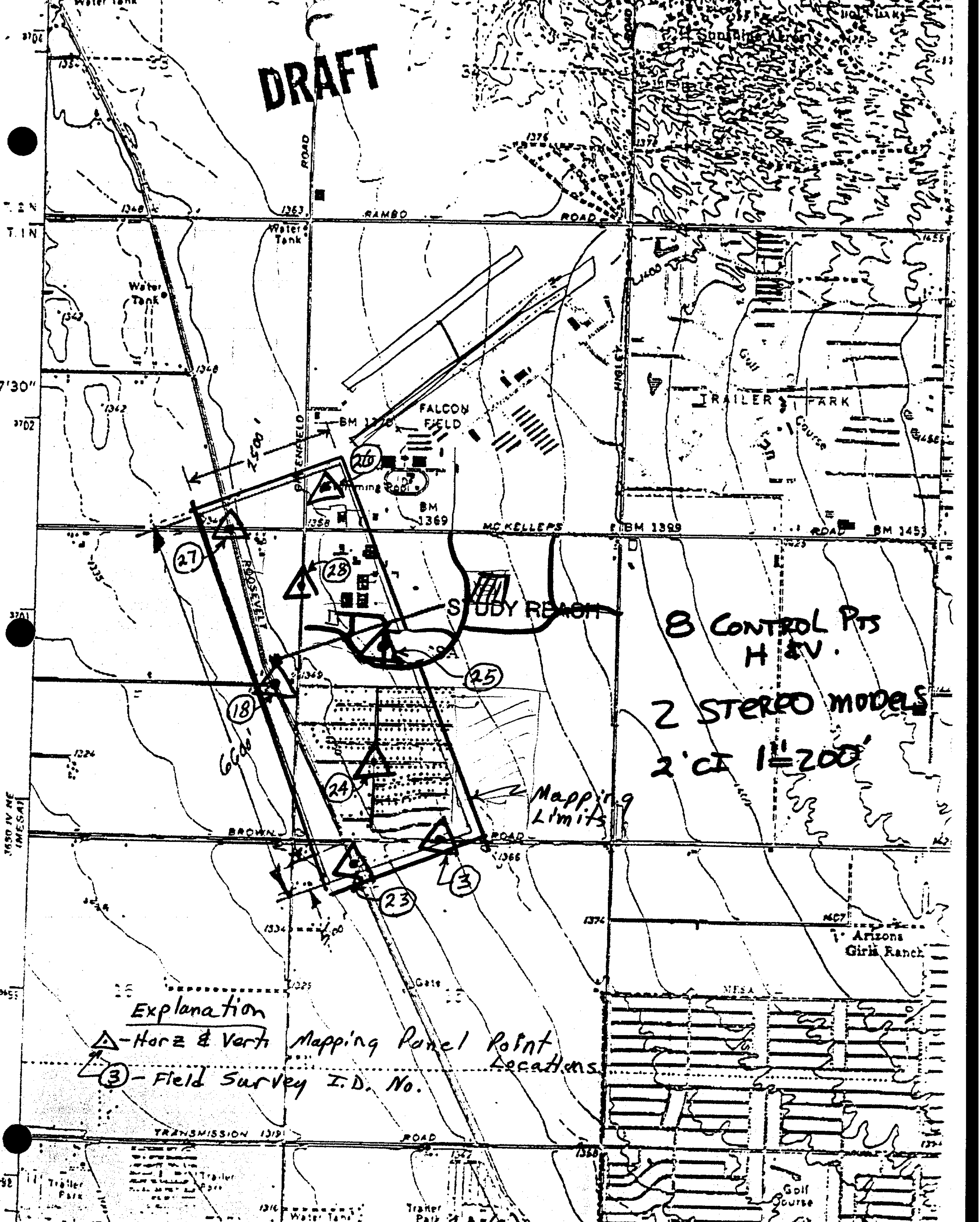
DRAFT
RAMBO
ROAD
Water Tank
Water Tank
FALCON FIELD
BM 1370
BM 1369
MC KELLEPS
BM 1399
ROAD
BM 1453
TRAILER PARK
Golf Course
HIGLEY
ROOSEVELT
GREENFIELD
STUDY REACH
8 CONTROL PTS H & V.
2 STEREO MODELS
2' CI 1"=200'
2500'
6600'
Mapping Limits
27
28
26
25
18
24
3
23
BROWN
ROAD
Arizona Girls Ranch
MESA
TRANSMISSION
ROAD
Trailer Park
Trailer Park
Water Tank
Golf Course
Explanation
Horz & Vert Mapping Panel Point Locations.
3 - Field Survey I.D. No.
2.0-(2)

Exhibit 1

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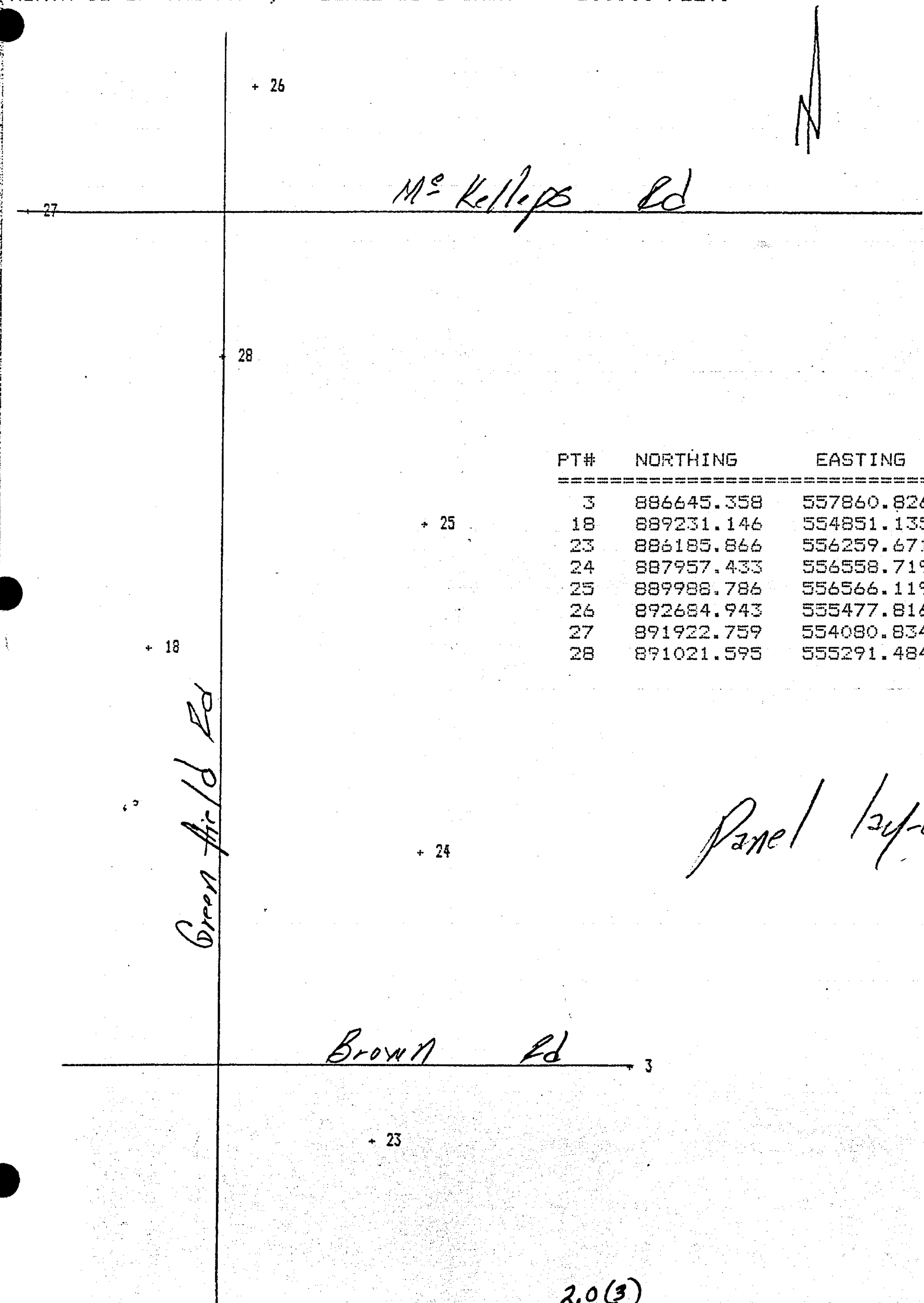

PT#	NORTHING	EASTING	ELEVATION
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18	889231.146	554851.135	1350.18
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26	892684.943	555477.816	1358.66
27	891922.759	554080.834	1352.25
28	891021.595	555291.484	1354.43

Panel layout

2.0(3)

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source order year zn northing easting elev name section/towns
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~~P&M 3 C 886666.310 560508.540 0.000 SCOR NW 14 1 N 6 E~~
SRP MESA 4 1986 C 884008.360 557856.510 1348.620 CCOR CT 15 1 N 6 E
2 SRP MESA 4 1986 C 889302.990 560535.200 1389.760 QCOR W 11 1 N 6 E
3 SRP MESA 4 1986 C 886644.770 557860.290 1358.310 QCOR N 15 1 N 6 E
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4 SRP MESA 4 1986 C 889288.400 557897.620 1368.160 CCOR CT 10 1 N 6 E
5 SRP MESA 4 1986 C 886623.500 555213.950 1340.550 SCOR NW 15 1 N 6 E
6 SRP MESA 4 1986 C 891932.160 557935.050 1375.530 QCOR N 10 1 N 6 E
7 SRP MESA 4 1986 C 889272.540 555260.940 1349.670 QCOR W 10 1 N 6 E
8 SRP MESA 4 1986 C 886618.280 552586.260 1323.130 QCOR N 16 1 N 6 E
9 SRP MESA 4 1986 C 891923.390 555307.920 1356.460 SCOR NW 10 1 N 6 E
10 SRP MESA 4 1986 C 889277.380 552626.940 1332.230 CCOR CT 9 1 N 6 E
11 SRP MESA 4 1986 C 886639.170 549965.740 1308.780 SCOR NW 16 1 N 6 E
12 SRP MESA 4 1986 C 891925.610 552667.430 1339.420 QCOR N 9 1 N 6 E
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52-90

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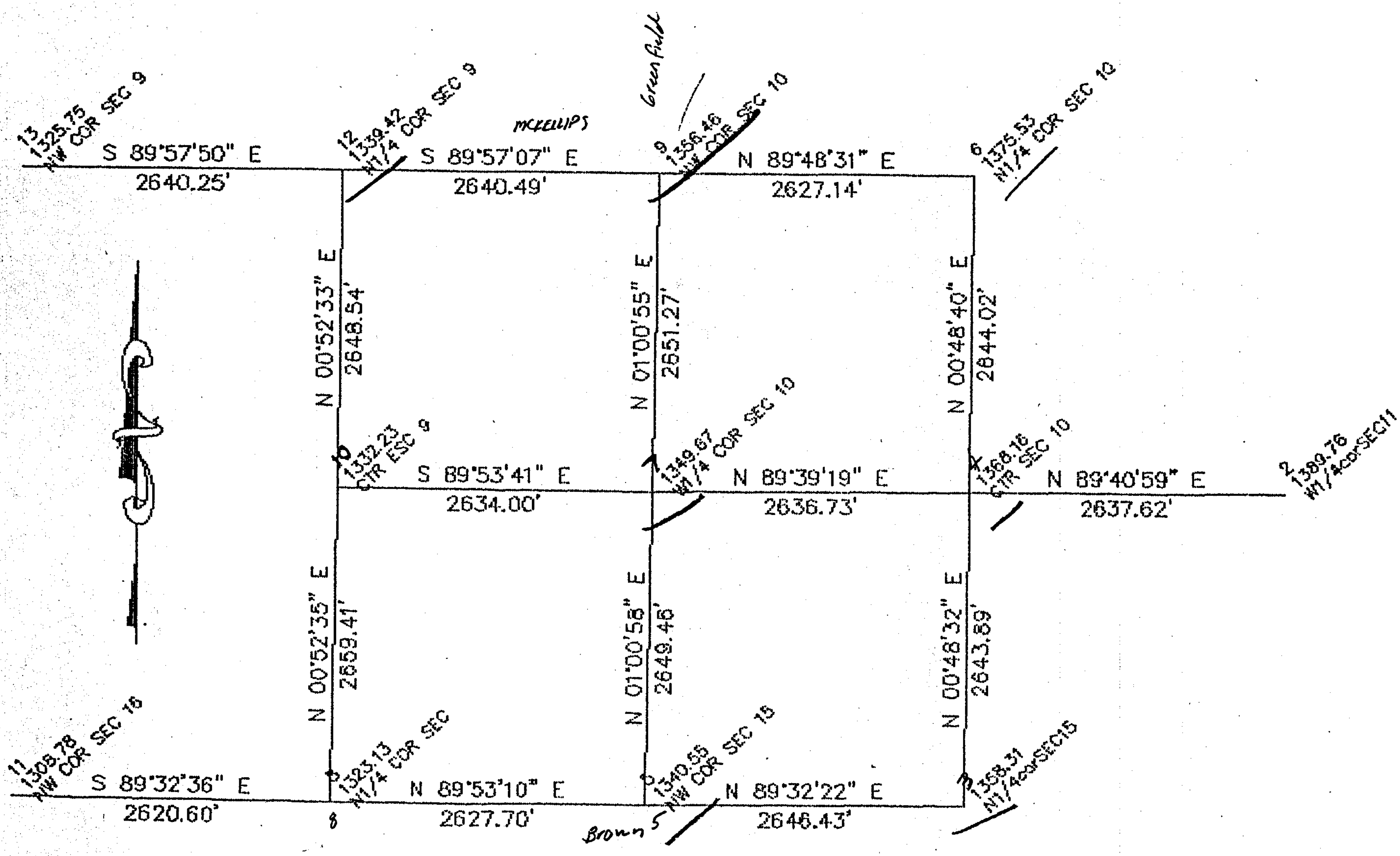
#20 BM

2.0 (4)

2.0 (5)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Greenfield
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7 1349.67 W1/4 COR SEC 10
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4 1368.16 CTR SEC 10
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2637.62'
2 1389.76 W1/4corSEC11
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2659.41'
N 01°00'58" E
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N 00°48'32" E
2643.89'
11 1308.78 NW COR SEC 16
S 89°32'36" E
2620.60'
8 1323.13 N1/4 COR SEC
N 89°53'10" E
2627.70'
5 1340.55 NW COR SEC 15
Brown
N 89°32'22" E
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3 1358.31 N1/4corSEC15

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5	22	N=	886666.033	-.002	886666.031	.017
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6	21	N=	886681.047	-.002	886681.045	.012
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7	20	N=	887325.003	.004	887325.007	.023
		E=	555868.811	.004	555868.815	.022
8	4	N=	889289.094	.021	889289.115	.086
		E=	557897.547	.000	557897.548	.091
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13	19	N=	887576.590	-.010	887576.580	.032
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		E=	556558.708	.011	556558.719	.038
15	25	N=	889988.816	-.030	889988.786	.062
		E=	556566.075	.044	556566.119	.069
16	29	N=	889279.676	-.003	889279.673	.062
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2.0 (6)

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OBSERVATION DATA

LINE	FROM	TO	OBSERVED	RESIDUAL	ADJUSTED
STD. ERROR - ANGLES = 1.0 SEC.					
1	5 BC-HH	<- 8			
		-> 7	91 07 28.0	.0"	91 07 28.1
2	5 BC-HH	<- 8			
		-> 3	179 38 26.0	.4"	179 38 26.4
3	5 BC-HH	<- 8			
		-> 21	175 56 53.0	-.1"	175 56 52.9
4	5 BC-HH	<- 8			
		-> 20	133 08 40.0	-.3"	133 08 39.7
5	7	<- 5 BC-HH			
		-> 9	179 59 55.0	-.4"	179 59 54.5
6	21	<- 5 BC-HH			
		-> 3	185 16 1.0	-.3"	185 16 .7
7	21	<- 5 BC-HH			
		-> 20	82 18 30.0	-.2"	82 18 30.0
8	20	<- 21			
		-> 19	261 17 1.0	-.0"	261 17 .8
9	19	<- 20			
		-> 24	113 31 55.0	-.2"	113 31 54.5
10	24	<- 19			
		-> 25	177 15 3.0	-.2"	177 15 3.0
11	25	<- 24			
		-> 7	61 03 21.0	.1"	61 03 21.2
12	7	<- 25			
		-> 29	209 39 41.0	.4"	209 39 41.5
13	29	<- 7			
		-> 27	252 50 45.0	.5"	252 50 45.3
14	27	<- 29			
		-> 9	286 09 40.0	3.4"	286 09 43.3
15	9	<- 7			
		-> 27	88 55 33.0	-3.1"	88 55 29.9
16	5 BC-HH	<- 8			
		-> 22	177 13 43.0	.0"	177 13 42.9
17	7	<- 5 BC-HH	2.0 (7)		
		-> 4	268 38 24.0	.0"	268 38 24.0

17	7	<- 5 BC-HH -> 4	268 38 24.0	.0"	268 38 24.0
~~18~~	~~9~~	~~<- 7~~ ~~-> 28~~	~~0 00 0~~	~~.0"~~	~~191 26 46.8~~
19	9	<- 7 -> 12	89 02 9.0	.0"	89 02 9.0
20	21	<- 5 BC-HH -> 23	246 51 34.0	.0"	246 51 33.8
21	29	<- 7 -> 18	87 52 31.0	.0"	87 52 32.3
22	9	<- 7 -> 26	191 37 4.0	.0"	191 37 4.0
23	9	<- 7 -> 6	268 47 57.0	.0"	268 47 57.1

STD. ERROR - DISTANCES = .012 FT./MTRS.

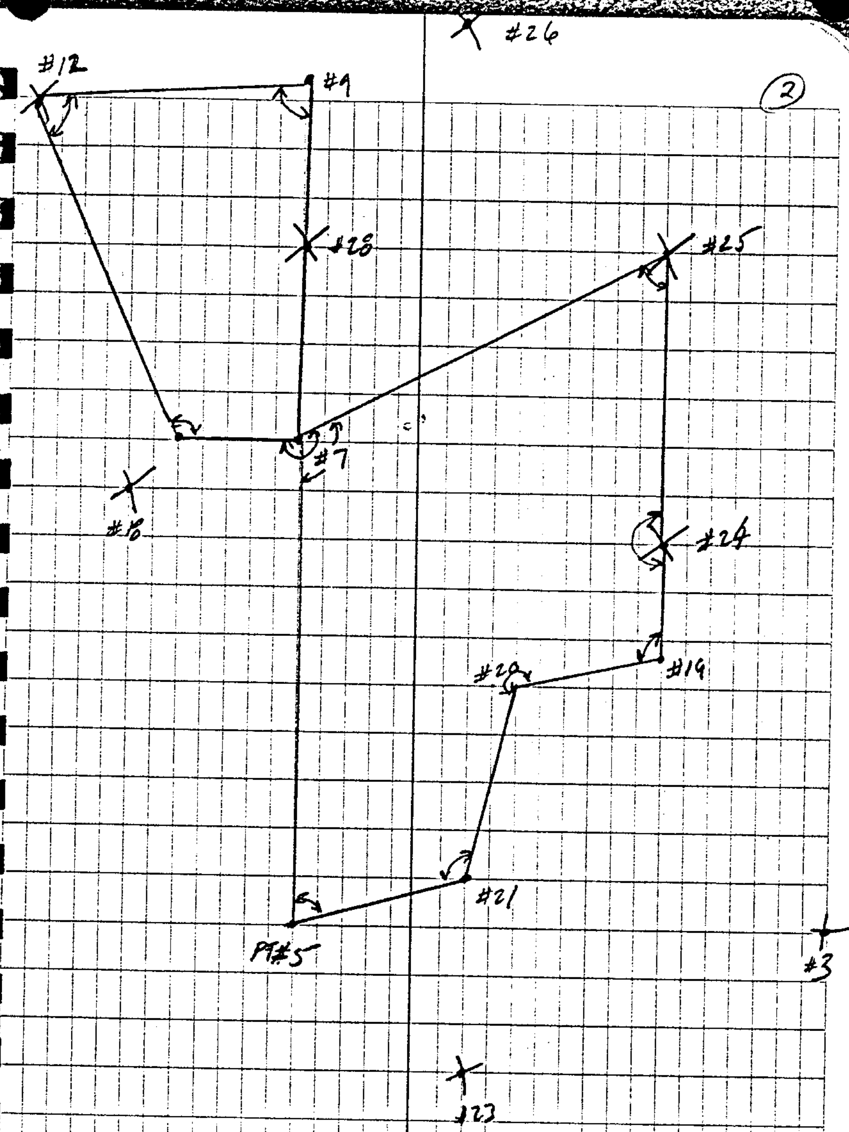
1	5 BC-HH	-> 7	2649.927	.021	2649.948
2	5 BC-HH	-> 3	2646.947	.019	2646.966
3	5 BC-HH	-> 21	792.170	-.007	792.163
4	5 BC-HH	-> 20	959.661	.005	959.667
5	7	-> 9	2651.527	.018	2651.545
6	21	-> 3	1857.161	-.012	1857.149
7	21	-> 20	658.014	-.012	658.003
8	20	-> 19	715.889	-.005	715.884
9	19	-> 24	381.365	-.004	381.361
10	24	-> 25	2031.382	-.015	2031.366
11	25	-> 7	1488.763	.010	1488.772
12	7	-> 29	410.610	.013	410.624
13	29	-> 27	2752.757	.006	2752.763
14	27	-> 9	1226.586	-.032	1226.555
15	9	-> 12	2641.040	.000	2641.040
16	5 BC-HH	-> 22	844.948	.000	844.948
17	7	-> 4	2636.907	.000	2636.907
~~18~~	~~9~~	~~-> 28~~	~~802.715~~	~~.000~~	~~932[illegible].235~~
19	21	-> 23	557.279	.000	557.279
20	29	-> 18	48.537	.000	48.538
21	9	-> 26	779.629	.000	779.629

2.0 (8)

20	29	-> 18	48.537	.000	48.538
21	9	-> 26	779.629	.000	779.629
22	9	-> 6	2627.623	.000	2627.623

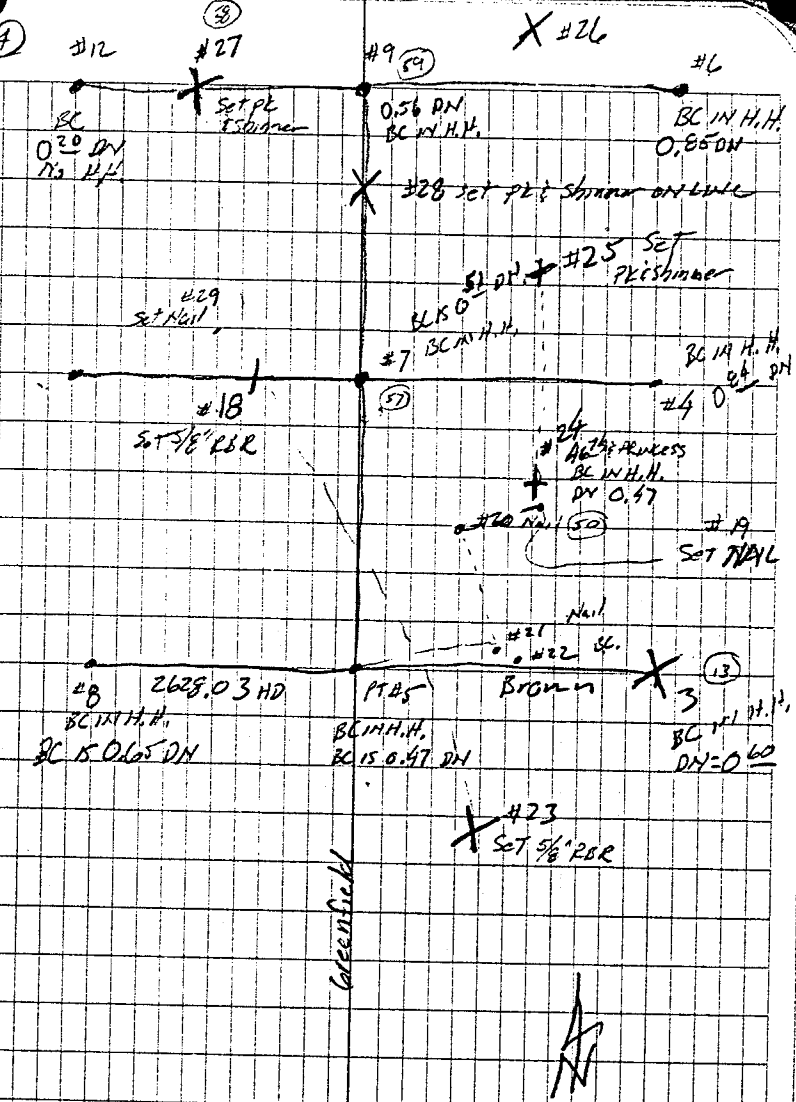
1

2



③

④


#12
BC
0.20 DN
IN H.H.
#27
Set PK
& Shiner
#9
59
0.56 DN
BC IN H.H.
#26
#6
BC IN H.H.
0.85 DN
#28 Set PK & Shiner on Line
#25 Set
PK & Shiner
BC IS 0.51 DN
BC IN H.H.
#29
Set Nail
#7
57
BC IN H.H.
0.84 DN
#4
#18
Set 5/8" RBR
#24
AG 0.75 Access
BC IN H.H.
DN 0.47
#20 Nail
50
#19
Set NAIL
Nail
#21
#22
#8
2628.03 HD
PT #5
Brown
3
13
BC IN H.H.
BC IS 0.65 DN
BC IN H.H.
BC IS 0.47 DN
BC IN H.H.
DN = 0.60
#23
Set 5/8" RBR
Greenfield

⑤ TO #20

set Nail

#21 D 0-00-32 41

R 180-00-50

M∡ 54°-53′-20″

#5 D 54-54-06 01

R 234-53-56

2.0 (12)

⑥

7

BC @ #7 (57)

BC to H.H.

#25	D	0-00-34 30	
	R	180-00-26	
			M∡ 119-44-47
#5	D	119-45-26 17	
	R	299-45-08	

2.0(13)

8

9

10

Level loop

2.0 (14)

(11)	+	HI	-	ELEV	
BM	10.67			1340.55	
	10.88	51.22			
		1351.43	1.38		
			1.25	1349.84	(1)
T.P. #21				1350.18	1349.84
	6.02	55.86			
		1356.20			
			3.37	1352.49	
T.P. #22				1352.83	1352.49
			6.60	1349.26	
T.P. #23				1349.60	1349.26
			4.69	1351.17	(2)
T.P.				1351.51	1351.17
	8.38	59.55			
		1359.89			
			1.30	1358.25	
T.P. #3				1358.59	1358.25

2.0 (1st)

(12) Desc		BK Red
PT#5 BC IN H.H. INT OF BROWN &		1340.55
Greenfield (SRP DATUM)	8.99 -6	8.79
	37.56	1337.76
	12.27	12.40
SET NAIL Trav PT	1349.83	1350.16
		7.63
		1342.53
		10.28
BC IN Hdwll N. Side Brown		1352.81
@ Conmal (ADOT EL = 1352.26 Stamped)		
		7.05
5/8" RBR Panel		1341.58
		8.96
X on Curb Ret @ INT. Brown & 46th		1351.49
N. Ret NW Cor INT	-6	11.27
		1346.22
(SRP 1358.31)		12.35
BC IN H.H. PT#3 INT. Brown & 46th		1358.57
Pannel = ~~1359.19~~ 1358.85		

(13)	+	HI	-	ELEV	
				1351.17	
T.P.				1351.51	1351.17
	6.10	57.27			
		1357.61			
			4.72	1352.55	(3)
T.P. #19				1352.29	1352.55
	6.00	58.55			
		1358.89			
			5.43	1353.12	(4)
T.P. #24				1353.46	1353.12
	7.78	60.90			
3.0 (16)		1361.24			
			4.20	1356.70	(5)
T.P.				1357.04	1356.71
	6.82	63.52			
		1363.86			
			3.18	1360.34	(6)
T.P. #25				1360.68	1360.35
	2.20	62.54			
		1362.88			
			8.30	1354.24	7
T.P.				1354.58	
	2.35	56.59			
		1356.93			
			7.16	1349.43	(8)
T.P. #7				1349.77	1349.44

(14) Desc		Bk Red
"X" on Curb INT. Brown & 46th		1351.49
		7.55
		1343.94
		8.93
Set Nail Trav PT		1352.87
		7.65
		1345.22
		8.22
BC IN H.H. INT. 46th & PRINCESS		1353.44
Panel = ~~1353.93~~ 1353.59	-6	11.87
		1341.57
		9.45
T/C on 46th		1351.02
		6.83
		1350.19
		10.47
Set Pt Panel		1360.66
		11.45
		1349.21
	-6	11.36
B/C		1354.57
		11.30
		1343.27
		6.49
BC IN H.H. ON Greenfield PT #7 (SRP 1349.67)		1349.76

(15)	+	HI	-	ELEV		(16) Desc	BK Rod
				1349.43	(8)		
T.P. #7				1349.77	1349.44	BC IN H.H. PT #7	1349.76
	7.06	56.49				(SRP 1349.67)	6.59
		1356.83					1343.17
			5.81	1350.68			7.84
T.P. #29				1351.02	1350.70	Set NAIL (Trav PT)	1351.01
			6.33	1350.16	(9)		7.32
T.P. #18				1350.50	1350.18	5/8" RBR (Panel)	1350.49
	4.73	54.89					8.92
		1355.23					1341.57
			5.03	1349.86	(10)		8.62
T.P.				1350.20		Nail	1350.19
	5.55	55.41					8.10
		1355.75					1342.09
			5.46	1349.95	(11)		8.19
T.P.				1350.29		Nail	1350.28
	5.44	55.39					8.21
		1355.73					1342.07
			3.16	1352.23	(12)		10.49
T.P. #27				1352.57	1352.75	Set PK (Panel) PT #27	1352.56
	4.50	56.73					9.15
		1357.07					1343.41
			3.32	1353.41	(13)		10.33
T.P.				1353.75		Nail	1353.74

2.0 (1)

(17)

	+	HI	-	ELEV	
				1353.61	(13)
T.P.				1353.75	
	6.30	59.71			
		1360.05			
			3.70	1356.01	(14)
T.P. #9				1356.35	1356.04
	9.10	65.11			
		1365.45			
			6.45	1358.66	
T.P. #26				1359.00	
	6.28	64.94			
		1365.28			
			8.94	1356.00	
T.P. #9				1356.34	

2.0 (18)

(18)

DESC		BK. Rock
Hail		1353.74
		7.35
		1346.39
		9.95
BC in H.W. INT. Greenfield & [illegible] (SEP 1356.46)		1356.34
	-6	10.55
		1351.79
		7.19
5/8" RBR Panel		1358.98
		7.37
		1351.61
	-6	10.71
Check in BC in H.W.		1356.32

20 (19)

(19)	+	HI	−	ELEV	
				1356.01	(14)
T.P. #9				1356.35	1356.04
	5.06	61.07			
		1361.41			
			6.67	1354.40	(15)
T.P. #28				1354.74	1354.43
	4.24	58.64			
		1358.98			
			6.88	1351.76	(16)
T.P.				1352.10	
	4.20	55.96			
		1356.30			
			6.30	1349.66	(17)
T.P.				1350.00	
	4.87	54.53			
		1354.87			
			3.95	1350.58	(18)
T.P.				1350.92	
	0.20	50.78			
		1351.12			
			7.52	1343.26	(19)
T.P.				1343.60	
	3.80	47.06			
		1347.40			
			6.55	1340.51	(20)
Bm				1340.85	1340.55

(20) Desc	Bk Rod
BC IN H.H.	1356.34
	8.59
	1347.75
Pk Shiner (Panel)	6.98
	1354.73
	9.41
	1345.32
	6.77
B/C	1352.09
	9.45
	1342.64
	7.35
B/C	1349.99
	8.78
	1341.21
	9.70
B/C	1350.91
	13.45
	1337.46
	−6 12.13
B/C	1343.59
	9.85
	1333.74
	7.10
PT #3 BC IN H.H. INT. [illegible] & Greenfield (1340.55)	1340.84

(21)	+	HI	−	ELEV	
TP #21				1350.17	1349.84
	6.50	56.34			
		1356.67			
			7.01	49.33	
TP. #20				1349.66	1349.33
	6.57	55.90			
		1356.23			
			6.07	49.83	
Check back				1350.16	
TP #27				1352.25	
	3.80				
		1356.05			
			5.52		
T.P.				1350.53	
	5.92				
		1356.45			
			5.21		
T.P. #60				1351.24	

2.0 (20)

(22) Desc	BK ROD
Set Nail PT #21	1350.17
	7.15
	1343.02
	6.64
Set Nail Trav pt #20	1349.66
	7.08
	1342.58
	7.58
PT #21 Nail	1350.16
PK (panel)	1352.25
	9.85
	1342.40
	8.13
Nail	1350.53
	7.73
	1342.80
	8.44
Set Nail PT #60	1351.24

(24)

Change Raw Data
Notes

2.0 (21)

(25)

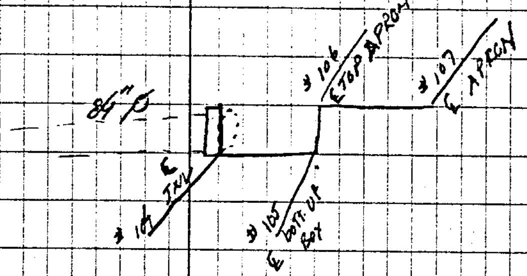
⊼@ #7 Change ⊼ ELEV TO 1349.44

⊼@ #21 Change ⊼ ELEV TO 1349.84

⊼@ #20 Check To See if backsite Az. is Correct I might not have Solved

2.0 (22)

(26)



(27)

	+	H.I.	-	ELEV
T.P. #60				1351.24
	5.68			
		1356.92		
			5.32	
T.P.				1351.60
	5.10			
		1356.70		
			5.04	
T.P. #61				1351.66
	5.59			
		1357.25		
			5.10	
T.P.				1352.15
	5.26			
		1357.41		
			5.65	
T.P. #62				1351.76

2.0 (23)

(28)

Desc	ELEV ROD
Set Nail PT #60	1351.24
	7.98
	1343.26
	8.33
Rock	1351.59
	8.55
	1343.04
	8.61
Set Nail PT #61	1351.65
	8.06
	1343.59
	8.55
Rock	1352.14
	8.39
	1343.75
	8.00
Set Nail PT #62	1351.75

(29)	+	HI	-	ELEV
T.P. #7				1349.44
	5.35			
		1354.79		
			4.66	
T.P. #63				1350.13
	~~2.45~~			
	10.97			

2.0 (24)

(30) Dex	BC Red
BC IN H.H.	1349.44
	8.30
	1341.14
	8.99
Set Nail to Tie-out FIR's	1350.13

(31)

2.0 (25)

(32)

BM Check
SW Cor of Greenfield
& Brown

10-12-95

B. Johnson
D. Hooper

(33)

	+	HI	−	ELEV
BM				1340.55
	5.16			
		1345.71		
			5.39	
TBM				1340.32

2.0 (26)

Desc	BK Rod
PT#5 BC in H.H. INT. OF Baseline & Greenfield (SRP DATUM)	1340.55
	8.44
	1332.06
	8.26
X INT/C SW cor Greenfield & Baseline S. Retrun	1340.32

City of Mesa Datum
El. For This Point is 1340.72

Elev. Eqn: Add 0.40 FT To
Mapping Datum To
Get C.O.M. Datum

CITY OF
MESA

Fax Transmission

To: GREG SCHUELKE

From: LES / ENG DEPT

Company: A-N WEST

Date: 8/15/95

Fax #: 943-1989

You should receive 2 page(s) including this one.

If you do not receive all pages, please call LES at 644-2513

Message: OUR B.M. LIST ON BROWN RD.

2.0 (27)

Engineering
20 East Main Street, Suite 400 • P.O. Box 1466 • Mesa, Arizona 85211-1466 • (602) 644-2251

BROWN

1267.47	T.C. NW cor Gilbert
1271.07	T.C. NE cor 22nd Street
1272.56	T.C. NE cor 23rd Street
1275.34	T.C. W/End Median E.Side 24th Street
1277.63	T.C. NW cor 26th St (Cir)
1279.97	T.C. SE cor Yale
1283.34	T.C. NW cor Lindsay
1476.52	"X" T.C. SE cor Power
1479.70	B.C. @ P.I. E of Power on curve
1493.02	T.C. E/side E D/W @ Salk Elementary School
1505.67	T.C. NE cor Terripin
1500.76	B.C. in H/H CL 72nd Street
1527.69	B.C. in H/H CL 76th Street
1553.83	B.C. in H/H CL 80th Street
1567.20	5/8" Rebar NW cor Fence S/Side Flood Cntrl Dam
1593.82	P.K. CL @ Top Flood Control Dam
1581.53	SE cor Concrete N/Side @ C.M.P. E/Side Flood Dam
1584.45	B.C. in H/H CL 84th Street
1599.64	B.C. in Asphalt CL 86th Street
1605.18	B.C. in Asphalt W/End Curve E of 86th Street
1610.08	B.C. in Asphalt W/End 2nd Curve E of 86th Street
1620.28	B.C. in Asphalt W/End 2nd Curve E of Ellsworth
1627.36	B.C. in Asphalt E/End 2nd Curve E of Ellsworth
1631.87	B.C. in CL Ellsworth
1293.69	B.C. SW cor Bridge at Eastern Canal
1295.64	T.C. SE cor Creston
1303.03	T.C. SW cor Miramar
1305.89	T.C. SW cor Mayfair
1309.14	Irr Wks SW cor Val Vista
1324.17	T.C. NE cor 40th St
1328.57	T.C. NE cor Norwalk
1637.50	T.C. SW cor 94th Street
1340.72	T.C. SW cor Greenfield
1351.57	T.C. NW cor 46th Street
1359.57	T.C. NE cor 48th Street
1427.56	T.C. NE cor Recker
1450.86	T.C. SE cor 64th Street
1443.48	T.C. NE cor 62nd Place
1457.79	T.C. SE cor Ramada
1256.62	T.C. SE cor Stapley
1257.16	T.C. SE cor Diane
1259.00	T.C. SW cor Barkley
1260.40	T.C. SE cor Kirchoff
1261.32	T.C. SE cor Harris
1262.73	T.C. SE cor Williams
1264.77	T.C. SW cor Forest
1264.76	T.C. SE cor Forest
1250.58	T.C. SE cor Mesa Dr.
1251.16	T.C. NE cor March Circle
1251.57	T.C. NE cor April Circle
1251.93	T.C. NE cor July Circle

NO CITY B.M LISTED AT B.C. HEADWALL OF CANAL

2.0 (28)

VERTical CONversion (VERTCON) Transformation Program
Between NGVD 29 and NAVD 88
Version 2.0

==

Station Name: ERM-1

Latitude	Longitude	NAVD 88 - NGVD 29 (meters)
33 27 6.00000	111 44 20.00000	.551

Do you want to do another computation (Y/N)?
(Default is Y)

Station Name: ERM-2

Latitude	Longitude	NAVD 88 - NGVD 29 (meters)
33 26 40.00000	111 44 20.00000	.547

Do you want to do another computation (Y/N)?
(Default is Y)

Station Name: ERM-3

Latitude	Longitude	NAVD 88 - NGVD 29 (meters)
33 26 19.00000	111 44 20.00000	.544

Do you want to do another computation (Y/N)?
(Default is Y)

Station Name: ERM-4

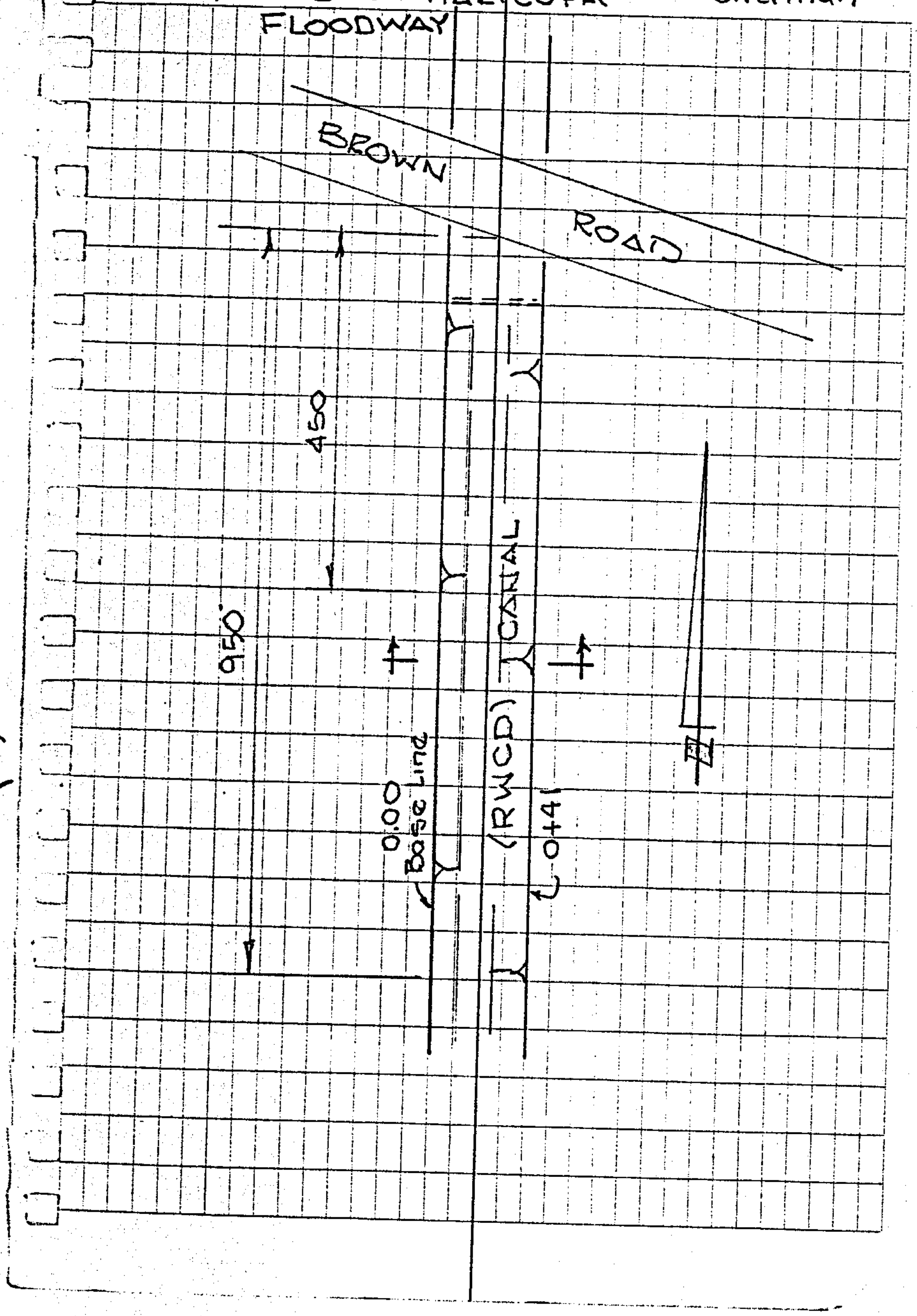
Latitude	Longitude	NAVD 88 - NGVD 29 (meters)
33 26 19.00000	111 44 11.00000	.544

Do you want to do another computation (Y/N)?
(Default is Y)

1

UPPER EAST MARICOPA FLOODWAY

Nov. 15, '95
Sherman



2.0 (30)

②

UPPER EAST MARICOPA FLOODWAY

B.M.	+	H.I.	−	Elev.	
ERM-4	2.04	1354.46		135242	
T.P.			5.10	1349.36	
	5.01	1354.37			
Sect. @ 450					
Sect. @ 950					
(1)(3) 2.0' T.P.			5.32	1349.05	
	5.28	1354.33			
ERM-4			1.91	135242	1352.42
	1.40	135382			
			4.61	1349.2	
			5.1	1348.7	

③

Nov. 15 '95
Sherman

R.W.C.D. CHANEL

Top	Toe	℄	Toe	Top
0 / 5.6	14 / 11.8	20.5 / 11.8	27 / 11.8	41 / 4.5
1348.8	1342.6	1342.6	1342.6	1349.9
0 / 4.9	14 / 11.9	20.5 / 11.9	27 / 11.9	41 / 4.6
1349.5	1342.5	1342.5	1342.5	1349.8

F.F. Elev. S'ly House

Ground @ House

④

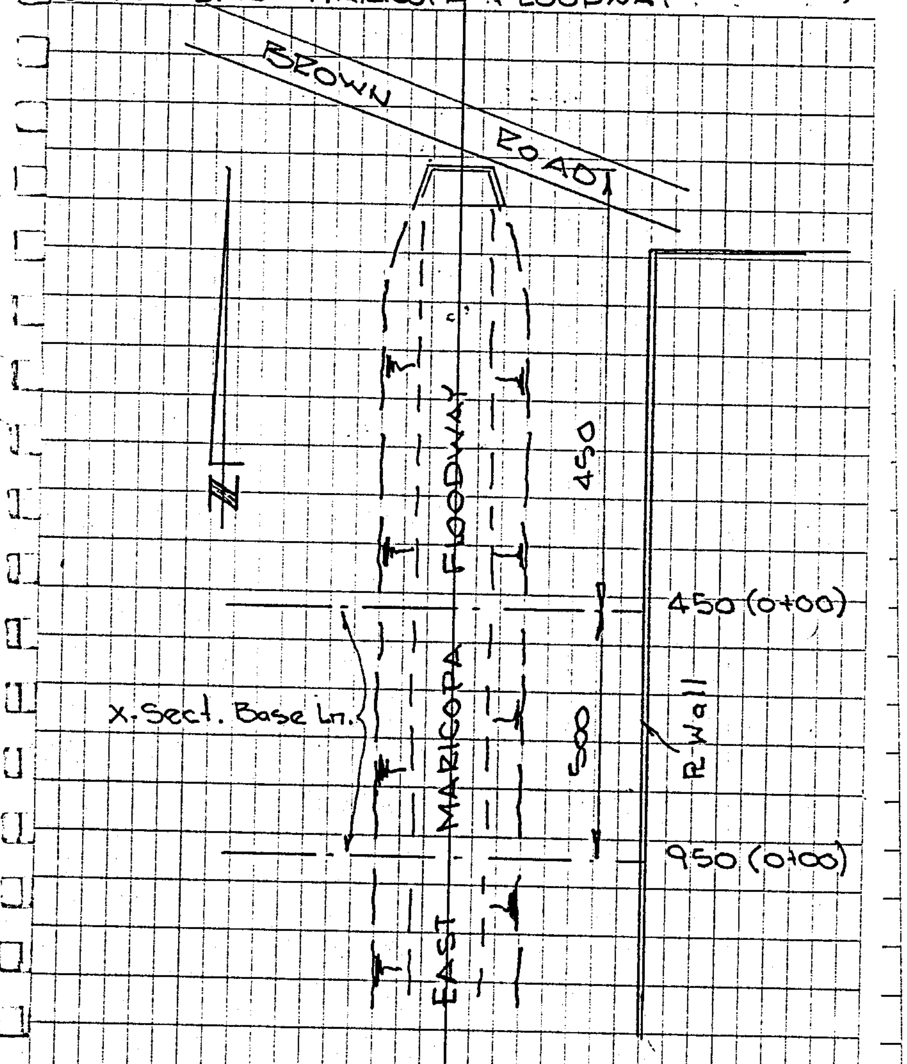
UPPER EAST MARICOPA FLOODWAY

B.M.	+	H.I.	−	Elev	
ERM-4	3.46	1355.88		1352.42	
T.P.			6.48	1349.40	
	6.02	1355.~~80~~ 42			
450			3.85	1351.~~75~~ 57	
	0.68	1352.~~43~~ 25			
T.P.			2.34	13~~50.09~~ 49.91	
	4.71	1354.~~80~~ 62			
950			4.56	1350.~~84~~ 06	
	4.28	1354.~~52~~ 34			
T.P			4.43	13~~50.09~~ 49.91	
	2.30	1352.~~39~~ 21			
2.0 (32) 450			0.65	1351.~~94~~ 56	
	3.07	~~1355.44~~ 54.63			
T.P.			5.24	13~~50.20~~ 49.39	
	6.51	13~~56.71~~ 55.90			
ERM-4			3.50	13~~53.21~~ 52.40	~~1352.42~~ 1352.42
	14.87				
	16.79				
	31.66		31.05		

⑤

UPPER EAST MARICOPA FLOODWAY

Nov. 16'95
Sherman



⑥ UPPER EAST MARICOPA FLOODWAY

Sect @	℄	TOE	TOP	TOE
950	10 / 1350.1	77 / 1347.6	91 / 1347.7	122 / 1338.2

		GB	TOP	TOP
450	10 / 1351.6	50 / 1348.5	60 / 1347.9	69 / 1346.4

2.0 (33)

⑦ UPPER EAST MARICOPA FLOODWAY

Nov. 16, '95
Sherman

TOE Ditch	TOP Ditch	TOP	RD	RD
200 / 1338.5	229 / 1347.4	246 / 1347.1	260 / 1349.5	279 / 1349.8

TOP	TOP Ditch	Toe	℄	Toe	GB
76 / 1347.6	92 / 1347.5	117 / 1339.4	158 / 1338.6	196 / 1338.4	226 / 1346.0

RD	RD	TOP
279 / 1350.0	256 / 1349.3	231 / 1347.6

T.D.N. NO.3.0

HYDROLOGY REPORT FOR UPPER EAST MARICOPA FLOODWAY (UEMF) FLOODPLAIN DELINEATION STUDY FCD NO. 94-26

SEPTEMBER, 1995
Revised October, 1995

PREPARED FOR:
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APPENDIX D

Registered Professional Engineer (Civil)
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HYDROLOGY REPORT
FOR
UPPER EAST MARICOPA FLOODWAY (UEMF)
FLOODPLAIN DELINEATION STUDY
FCD NO. 94-26

1.0 INTRODUCTION:

The purpose of this report is to present the results of an existing hydrologic analysis of the 100-year storm runoff contributing to the Upper East Maricopa Floodway (UEMF) between Brown Road and McKellips Road in the City of Mesa, Arizona (see Figure 1). The storm runoff was analyzed for the purpose of performing a detailed floodplain delineation along this reach of the UEMF or the upstream side of the Roosevelt Water Conservation District (RWCD) Irrigation Canal.

2.0 STUDY AREA:

This one mile floodplain study reach of the Upper East Maricopa Floodway is currently delineated with an approximate Flood Hazard Zone A (Reference 12).

Downstream of, and including Brown Road, is the East Maricopa Floodway (EMF) which was designed and built by the Soil Conservation Service (SCS) with the local sponsor, the Flood Control District of Maricopa County (FCDMC). The East Maricopa Floodway extends from the Gila River floodplain near SR87 upstream to Brown Road, a distance of approximately 20.4 miles along the upstream side of the RWCD Canal.

The hydrologic analysis for the EMF was performed in the mid-1980's by the Soil Conservation Service with construction of the EMF in the late 1980s. The EMF was designed to convey the 100-year storm event runoff. The floodplain along this reach of the EMF is also delineated as an approximate Flood Hazard Zone A (Reference 12).

The watershed, contributing to the UEMF study reach between Brown and McKellips Roads, extends upstream (easterly) to the Central Arizona Project (CAP) Canal (see Figures 2 and 3). The CAP Canal drains from a north-northwest to south-southeast direction across the watershed, approximately 1/3 mile east of the Bush Highway. The CAP was built by the Bureau of Reclamation in this area in the mid-1980s. Retention basins and storm channels upstream of the CAP prevent any 100-year storm runoff from upstream of the CAP Canal from entering the study watershed.

The contributing watershed to the study UEMF reach is approximately 3 1/4 miles long extending between the UEMF (or RWCD Irrigation Canal) to the CAP Canal.

The contributing watershed to the study UEMF reach is approximately 2 miles wide at its downstream end, between McDowell and Brown Roads, and less than 1/2 mile in width near the CAP Canal.

The watershed slopes to the west-southwest at slopes of approximately 0.8 percent (downstream) to 1.4 percent (upstream), and is approximately 2.5 square miles in size.

It is approximately 75% developed by a range of uses from light residential or golf courses to high residential (mobile home parks and condominiums) and commercial and industrial, including Falcon Field Airport.

3.0 EXISTING INFLUENCES ON DRAINAGE PATTERNS:

3.1 Storm Drains:

As shown on Figures 2 and 3, there are existing storm drains in several of the major streets within the study watershed. The storm drains were generally designed for only the minor storm events (2-5 Year event). The storm drain's influence storm water runoff patterns for the 100-year 24-hour storm study by intercepting base flows (to the storm drain's capacity) and conveying the flow to Greenfield Road. This storm drain flow is not subject to flow splits at street and channel intersections as surface flow is. The storm drain then conveys water along the UEMF, bypassing the Princess Road Basin and outletting into the channel upstream of Brown Road.

The majority of the storm drains are concrete pipe (CP) based on City of Mesa Master Plans, and, therefore, a Manning's 'n' of 0.012 was used for estimating capacity. For simplicity, the storm drain's capacity was estimated by computing the average ground slope along the reach of pipe being evaluated. The pipe slope was assumed to equal the ground slope over these long reaches. Pipe capacity was then computed by a pipe capacity nomograph for full flow.

The following table lists the main pipe reaches considered in the hydrologic analysis in conveying and routing flows.

TABLE 1
SUMMARY OF STORM DRAINS CONSIDERED

Location	Ave. Diameter (Inches)	Ave. Ground Slope (ft/ft)	Capacity cfs
64th Street - Hermosa Vista Dr. to McKellips Road	24 (1)	0.0020	11
McKellips - Delmon (66th St.) to Recker Road	36	0.014	86
McKellips - Recker Road to Higley Road	42	0.0102	112
McKellips - Higley Road to Greenfield Road	48	0.0081	140
Greenfield Road - McDowell to Brown Road	66	0.00095	112
Greenfield/RWCD Canal - McKellips to Princess Basin Outlet	84	0.002	310

Notes: (1) The upper reach of this storm drain was a 24-inch pipe and was of interest in analysis for its capacity to intercept base flow from Subarea 10 and convey it into study watershed rather than have Subarea 10 flow northwest out of watershed.

3.2 Streets and Channels:

Streets convey significant drainage within the watershed. McKellips Road, a major street, conveys a portion of the upstream subarea runoff west to the RWCD Canal within the watershed. An existing channel along the north side of McKellips Road from the Bush Highway to approximately Recker Road adds conveyance capacity along McKellips Road.

Several streets, north of McKellips Road, including 64th Street, Recker Road, a short (1200 foot) reach of 56th Street, Higley Road and Greenfield Road also convey runoff toward McKellips Road.

Several streets and channels also convey flow south from McKellips Road, out of the study watershed, including;

a.) a channel, just south of 66th Street, which conveys flow, west southwest, into and through the Palmas Del Sol Mobile Home Park (PDSMHP), thence, south on Recker Road.
b.) a channel, 750 feet west of 64th Street conveys flow from McKellips Road again into Palmas Del Sol Mobile Home Park, thence, south on Recker Road.
c.) Recker Road.
d.) Higley Road.

3.3. Retention Basins:

A number of developments, built before approximately 1980, did not include retention to mitigate the affects of development on increasing runoff.

However, several significant retention basins within the study watershed were inventoried and considered which are described below;

TABLE 2
SUMMARY OF RETENTION CONSIDERED

Subbasin I.D.	No. of Basin(s)	Average Peak Depth (Ft)(1)	Low Flow Drain Size/Type	Volume At Overflow Spillway (Ac. - Ft.)
16	1	7	12" S.D.	1.04
54	3	3.55	Drywells	2.12
62	2	2.86	Drywells	1.71
80	1 (Falcon Field)	6	12" S.D.	57.03
118	1 (Princess Dr.)	9.25 (2)	Pump	24.4 (El. 1348.0)
86	1 (Along RWCD)	2.5 (3)	24" & 36" (In Series)	54.6 (El. 51.70)

Notes: (1) Basin Invert to Elevation of Overflow Spillway or Top of Berm.
(2) Basin I.E. 1338.5 and Low Overflow Spillway El. 1347.74
(3) Not a Designed Basin, But Retention occurring along RWCD Canal, McKellips to McDowell Road.

4.0 HYDROLOGY METHODOLOGY:

4.1 General:

The Flood Control District's Hydrologic Design Manual for Maricopa County, dated, September, 1990 with January, 1995 revisions, was used as the basis for the hydrologic analysis. The HEC-1 computer model (Reference 2) was used for computing the peak discharges. The FCDMC Drainage Design Menu System (Reference 1) was used to compute weighted average soil and land use parameters and data input parameters to the HEC-1 program.

The USGS Quadrangle Map (Reference 4) was used for the base mapping for the analysis (see Figure 2). A recent aerial photo (Reference 5) was used to supplement the USGS base mapping to show current development, land use, etc., (see Figure 3).

4.2 Design Storm-Rainfall Depth, Distribution and Aerial Reduction:

The 100-year 24-hour duration storm was used for the analysis. A Soil Conservation Service (SCS) Type II rainfall distribution was used as developed from the FCDMC Hydrologic Design Manual Drainage Design Menu System (Reference 9). The 100-year 24-hour Storm precipitation value computed from the FCDMC Design Manual (Reference 1) was 3.47 inches (see Appendix A). The aerial reduction factor of 0.982 was used as generated by the Drainage Design Menu System (Reference 9) and Table 2.1a of the manual (Reference 1) for an approximate 3 square mile drainage area.

4.3 Drainage Subareas:

Twenty-three drainage subbasins were identified within the study watershed as shown on Figure 2 and 3. These subbasins' boundaries were identified using several criteria;

a.) drainage areas to potential split flow locations.
b.) drainage areas of similar land use.
c.) drainage areas contributing to retention basins.
d.) drainage areas of roughly equal size.
e.) drainage area size small enough that the time of concentration does not exceed the rainfall excess duration for use of Clark U.H. Method.

The drainage subarea parameters are summarized below.

TABLE 3
SUMMARY OF SUBAREA PARAMETERS

Subarea I.D.	Area Sq. Mi.	Flow Path Length (Miles)	Wtd. Kb Value	Slope (Ft/mile)	Tc Hours	R Hours
10	0.031	0.390	0.032	87.0	0.19	0.20
16	0.170	0.960	0.030	76.0	0.30	0.26
18	0.005	0.450	0.037	47.0	0.26	0.89
24	0.169	0.840	0.051	74.0	0.45	0.36
30	0.035	0.520	0.040	33.0	0.36	0.47
42	0.182	0.810	0.046	44.0	0.51	0.39
52	0.061	0.390	0.055	56.0	0.31	0.24
54	0.033	0.250	0.032	52.0	0.17	0.12
60	0.153	0.570	0.031	44.0	0.27	0.16
62	0.072	0.520	0.030	48.0	0.24	0.20
76	0.098	0.990	0.045	43.0	0.52	0.66
80	0.636	1.090	0.043	27.0	0.64	0.31
84	0.197	1.110	0.046	34.0	0.64	0.62
86	0.338	0.500	0.048	33.0	0.36	0.12
94	0.027	0.360	0.063	8.0	0.67	0.82
98	0.250	0.680	0.042	71.0	0.32	0.17
102	0.042	0.360	0.031	31.0	0.24	0.20
104	0.055	0.430	0.030	28.0	0.27	0.23
106	0.051	0.350	0.031	29.0	0.24	0.18
114	0.051	0.430	0.031	30.0	0.27	0.24
118	0.043	0.180	0.036	33.0	0.18	0.09
92	0.043	0.260	0.054	8.0	0.48	0.34
97	0.245	0.700	0.049	43.0	0.44	0.25

Two areas of 0.054 and 0.008 square miles in Subarea 80 and 76, respectively, were considered non-contributing and not included in the subarea drainage areas. On-site retention for runoff from these areas was considered sufficient to prevent runoff from the 100-year 24-hour storm.

The drainage area bounded by McKellips Road, RWCD Canal, McDowell Road and Greenfield Road was expected to be non-contributing, because; a.) this area has little runoff potential as it is an orange grove; b) any runoff to the upstream side of the RWCD canal will pond along the canal as there is little slope along the canal; and c) any nuisance flow to McKellips Road is drained into the RWCD Canal by a 24 - 36-inch culvert at McKellips Road.

This drainage area (HEC-1 I.D. No. SB86) as well as the retention created by ponding upstream of the RWCD canal and the flow split relationship of the culverts into the canal versus overflow of McKellips Road were modeled to evaluate this expected non-contributing condition. The Appendix contains the analysis of culvert capacity to the canal, storage along the canal and rating curve of flow over McKellips Road. No flow over McKellips Road into the system was noted when this subarea and associated retention was modeled in the HEC-1 model.

4.4 Land Use:

A digital file of land use in AutoCadd Version 12 format was obtained from the FCDMC's Hydrologic Information System (HIS) files (see Figure 4) to use as a basis for analyzing the impact of various types of land use and its imperviousness on runoff.

The watershed photo, Figure 3, was used to update this land use base digital data for recent construction and minor discrepancies.

The attached HIS Data Delivery Specifications Manual Lookup Table (see Appendix) provides a correlation from the digital base map I.D. numbers to a land use definition. The attached Table 4.2a (Reference 1) in Appendix A of Ia, RTIMP and Percent Vegetative Cover for various Land Uses was used as a guide for these values. The Ia and percent vegetative cover values were generally applied per Table 4.2a. Some adjustment in RTIMP (Percent, Effective Impervious Area) was made for specific subareas such as 60% for dense mobile home parks (SUB62).

4.5 Soils:

The Green and Ampt Method was used to estimate rainfall losses due to soil infiltration and initial retention.

A digital file of soils classifications in AutoCadd Version 12 format was obtained from the FCDMC's Hydrologic Information Systems (HIS) files to use as the basis for determining the soil infiltration parameters for each subarea (see Figure 5). The soils map I.D. Number of Letter correlates to a textural soils classification in the attached Appendix A and B tables from the FCDMC Manual (Reference 1) and the Drainage Design Menu System (DDMS) Computer Program (Reference 9).

The soils classifications are from the Soil Conservation Services (SCS) Soils Surveys for the Aquila/Carefree (Reference 10) and Eastern Maricopa (Reference 11) Areas.

The FCDMC Drainage Design Menu System (DDMS) Computer Program (Reference 9) subbasin preparation subroutine was used to compute Green and Ampt Loss Parameters. The (Ia), Surface Retention Loss, Vegetative Cover Percent, and RTIMP values were generally derived from the FCDMC manual (Reference 1) Tables 4.1 and 4.2a.

Soil Moisture was assumed as normal for most soils in subareas. Soil moisture was assumed dry for vacant or desert land, power stations, airport or industrial and other land not irrigated. The citrus orchards were assumed wet soil moisture to account for heavier irrigation.

Soil moisture was used to adjust the DTHETA values in the DDMS program (Reference 9). The vegetative cover percent was used to adjust the XKSAT value in the DDMS program (Reference 9).

The DDMS computer output for loss parameters is included in the Appendix A with percent and type of soils and land use and weighted average rainfall loss parameters.

4.6 Unit Hydrograph Method:

The Clark Unit Hydrograph method was used to generate Time of Concentration (Tc) and Storage Coefficient (R) values using the MCUHP1 subroutine of the DDMS (Reference 9) computer program.

Input values used to compute Tc by the Papadakis Eqn. include: flowpath length in miles (L), surface resistance coefficient (dimensionless) (K_b), slope in (ft/mile) (s) and rainfall excess intensity in inches/hour (i). Flowpath length (L) and slope (s) were computed from the base mapping (Figure 2). The surface resistance coefficients (K_b) were computed as weighted averages based on area and type of land use from the DDMS subbasin preparation subroutine.

The storage coefficient (R) was in turn computed by the MCUHP1 subroutine of the DDMS program based on the computed time of concentration (Tc), flowpath length (L) and drainage area (A) in square miles.

The urban area curve was selected for developed land and the natural time area curve was selected for vacant, desert or agricultural land as part of the MCUHP1 subroutine of the DDMS program. These time-area (T/A) curves were input for each individual subarea to the HEC-1 model to complete the Clark Unit hydrograph input parameters of Tc, R and T/A curves. For several subareas, Nos. SB84, SB97, SB98, the default T/A curve of the HEC-1 model was used where the land use was considered between a natural to a fully urban condition. See Appendix A for the MCUHP1 computer program output.

4.7 Channel Street or Storm Drain Routing:

The normal depth channel routing option of the HEC-1 model was used to route flows along channels or streets. This method included inputting an eight point representative channel cross-section using the RX, and RY records of HEC-1. Also, input on the RC record are left overbank, channel and right overbank Manning's "n' values and channel reach length in feet and slope in ft/ft. Also, included in the channel routing parameters is the NSTPS record value which is the integer number of routing steps to route flow along the reach length. Initially, the NSTPS value was computed by dividing the reach length by an estimated average travel velocity, which in turn, was divided by the 5 minute time ordinate times 60.

After the initial HEC-1 model run a second check of the NSTPS value was made by dividing the difference in peak times from start to end of the routing reach by the 5 minute time ordinate times 60. The resultant integer value was used to update the earlier estimate of NSTPS and again checked by this time difference method.

Storm water was routed in storm drains using the Muskingum-Cunge routing method of HEC-1 model or the RD record which involved inputting reach length in feet, pipe Manning's "n' value, slope in feet/feet and pipe diameter in feet.

Routing input parameters are included in the Appendix.

Channel Routing Infiltration Losses. These losses were not considered in the HEC-1 model routing. Most of the routing involved primarily streets or storm drains where infiltration was minimal. Channel routing along the RWCD Canal between McKellips and Greenfield Roads also did not involve infiltration losses as most of this reach was in orange groves, which could be flood irrigated, thus, reducing infiltration potential.

4.8 Retention Basin Routing:

The reservoir routing option of HEC-1 model was used to route flows through retention basins. This method involved inputting the storage and discharge versus elevation parameters for basins on SV, SQ and SE records. Basin storage capacity (in Acre-Feet) was entered on SV records, Basin discharge (in CFS) on SQ records and Elevation (feet) data on SE records.

Table 2 provides a summary of the significant retention basins inventoried and modeled in the study watershed. In some drainage subareas, several small basins were combined to model as one basin in the HEC-1 model to simplify the hydrologic analysis.

Retention basin routing input parameter calculations for these retention basins are included in Appendix A.

Included in the Appendix A is the modeling of retention which occurs along the RWCD Canal from McKellips to McDowell Roads. Although this is not a designed basin, it does store significant runoff from Subarea I.D. 86 before bleeding it off into the RWCD canal, by culvert or weiring over McKellips into the drainage study area. Appendix A includes a HEC-2 model rating curve analysis of cross-sections taken by A-N West along the canal.

4.9 Split Flow Analysis:

Several locations were identified within the study watershed, where stormwater can split either into or out of the study watershed. Also, the major storm drain system was modeled using the split flow option to split base flow out of the combined flow to the capacity of the storm drain at each critical storm drain location.

The following is a summary of each split flow location. Supplemental computations are provided in Appendix B for some of the more complex split flow conditions. The HEC-1 Schematic (Figure 7) shows the split flow locations and HEC-1 I.D. Numbers.

- o <u>Split Flow Location.</u> Hermosa Vista Drive and 64th Street. Subarea No. 10 is a residential Subdivision. A 24-inch diameter storm drain proceeds along 64th Street and west of Subarea No. 10 south to a retention basin, midway between Hermosa Vista Drive and McKellips Drive (See Figure 2). Storm water from Subarea No. 10, not intercepted by the 24-inch storm drain was considered to continue west as overland flow which exits the study watershed. Using the approximate pipe or street slope of 0.2 percent along this storm drain, a pipe capacity of 11 cfs was estimated for a concrete pipe with N = 0.012.

The split flow option of the HEC-1 model was used to split the base flow of the Subarea No. 10 stormwater runoff up to the 11 cfs storm drain capacity and route it into the study watershed. Any flow over this base 11 cfs was split out of the study watershed.

- <u>**Delmon Drive/66th Street and McKellips Road.**</u> At the Delmon Drive/66th Street intersection with McKellips Road is the upstream end of a 36-inch concrete pipe storm drain at street slope of 1.4 percent and 86 cfs capacity (N = 0.012). Initial base stormwater runoff of 86 cfs was split using the split flow option of HEC-1 from the Subarea No. 24 and routed west along McKellips Drive as pipe flow.

  Of the remaining surface flow, initial flows again will flow in the north ditch along McKellips Road or in the north half of McKellips Road. Larger stormwater flows can overtop the McKellips Road street centerline and then flow out of the study watershed, eventually flowing south on Recker Road. Field survey and a HEC-2 capacity analysis was performed at this surface split flow and is included in Appendix B.

- <u>**Palmas Del Sol Mobile Home Park (PDSMHP) Split at McKellips Road.**</u> The storm drain in McKellips Road proceeds from Delmon Drive/66th Street to Recker Road as a 36-inch concrete pipe at approximately 1.4 percent slope and capacity of 86 cfs was again split out using the HEC-1 split flow analysis. This insured that all of the pipe capacity was being accounted for before surface splitting was evaluated.

  A field survey and HEC-2 analysis was performed to determine the split of surface stormwater flows west along McKellips Road and south into the PDSMHP.

  A concrete channel of 2 foot bottom, 1.25 H:1V sideslopes and approximately 2.33 foot deep conveys flow south then west in the PDSMHP, eventually flowing south on Recker Road, and out of the study watershed. A HEC-2 model (File:UEMF2) was created to analyze the capacity of the concrete channel in the PDSMHP proceeding upstream through an opening in the Block wall and to the center of the McKellips Road street, where the split was assumed to occur.

The results of the concrete channel HEC-2 model (File: UEMF2) was used in a second HEC-2 model of the adjacent McKellips Road which employed the split flow option of HEC-1 to compute the split (see Appendix B for HEC-2 models and Figure B-1 for cross-section, street, channel, etc. locations).

- **Recker Road Split at McKellips Road.** At Recker Road, all surface and pipe flow was again combined. The split flow option of HEC-1 was employed to split out the storm drain capacity of 112 cfs for the larger 42-inch storm drain between Recker Road and Higley Road.

  Of the remaining surface flow, Recker Road was capable of intercepting and conveying a portion of the flow south and out of the study watershed. A field survey of critical elevations at this intersection was made. Two HEC-2 models were generated to compute elevation versus discharge capacities of McKellips and Recker Roads at this intersection. The resultant individual street rating curves were plotted on a graph together with the combined capacity curve.

  The split flow option of HEC-1 model was then employed to model the flow splitting south on Recker Road and out of the study watershed. The plan view of the intersection, field survey results, HEC-2 models and rating curves plots are included in Appendix B.

- **Higley Road Split at McKellips Road.** At Higley Road, all pipe and surface flow was again combined. The split flow option of HEC-1 was employed to split out the storm drain capacity of 140 cfs for the larger 48-inch storm drain between Higley and Greenfield Roads.

  For the remaining surface flow, Higley Road was capable of intercepting and conveying a portion of the flow south and out of the study watershed. A field survey of critical elevations at this intersection was made. Two HEC-2 models were generated to compute elevation versus discharge capacities of McKellips and Higley Roads at this intersection. The resultant individual street rating curves were plotted on a graph together with the combined capacity curve.

  The split flow option of HEC-1 model was then employed to model the flow splitting south on Higley Road and out of the study watershed. The plan view of the intersection, field survey results, HEC-2 models and rating curves plots are included in Appendix B.

- **<u>Greenfield Road Storm Drain Split to McKellips Road.</u>** All surface and pipe flow was combined at Greenfield and McKellips Roads. The split flow option of HEC-1 was employed to split out the storm drain capacity of 310 cfs for the larger 84-inch storm drain in Greenfield Road, between McKellips Road and the Princess Drive retention basin outlet.

- **<u>48th Street - East Half Street and Storm Drain Split.</u>** On 48th Street at Hobart Street, a 30-inch storm drain begins and proceeds south increasing to a 36-inch storm drain which outlets into a retention basin at Brown Road. The retention basin drains into the Brown Road storm drain which outlets south of Brown Road in the East Maricopa Floodway. The east half street of 48th Street from McLellan Road south also conveys flow with the 30-inch storm drain to the retention basin and out of the study watershed.

  The split flow option of HEC-1 was used to split the combined from the east half street capacity to top of centerline pavement and 30-inch pipe capacity for a total base flow of 25.8 cfs from Subarea 102 and the study watershed. See Appendix B for half street and storm drain capacity calculations.

- **<u>46th Street Split North of Princess Drive.</u>** Of the total flow computed for 46th Street, north of Princess Drive, a base flow equal to the east half street capacity of 46th Street or 3.8 cfs was determined to be conveyed south. The split flow option of HEC-1 was employed to model this split.

- **<u>46th Street Split, North of Brown Road.</u>** Of the total flow computed to 46th Street north of Brown Road, a base flow equal to the east half street capacity of 46th Street of 3.8 cfs was determined to be conveyed south out of the study watershed. The split flow option of HEC-1 was employed to model this split.

- **<u>Greenfield Road, Between Mckellips Road and McDowell Road.</u>** The combined capacity of the 66-inch storm drain in Greenfield Road and the full street capacity were estimated as shown in the Appendix to be 133 cfs. Since the Subarea SB84 peak 100-year discharge of 122 cfs could be conveyed in this combined street and storm drain, <u>no split flow</u> was considered to occur for flow over the road to the west.

- **<u>RWCD Canal at McKellips Road.</u>** A 24-inch CMP culvert under the east maintenance road of the RWCD Canal and a 36-inch CMP culvert under McKellips Road convey initial stormwater runoff from the Subarea I.D. 86, north of McKellips into the RWCD canal. The Appendix A culvert calculations indicate these pipes, in series, can convey 23.2 cfs before flow starts to overtop McKellips Road.

Also in Appendix A, is a HEC-2 model of rating curve analysis of critical depth flow over McKellips Road. The culvert and road weir flow data were used to model by the split flow option of HEC-1 model, the flow out of the system (by culvert) versus weir flow into the system.

5.0 RESULTS:

5.1 Discussion of Results:

Table 4 presents a Summary of Peak Discharges computed by the HEC-1 model analysis at significant concentration points. The HEC-1 model input, HEC-1 schematic and summary output hardcopy are included in Appendix C as well as digital data files. Figures 2, 3, and 7 provide locations of subareas, split flow points, retention basins, and streets as referenced in Table 4.

5.2 Comparison to Stream Gage Data:

There are no stream gage stations with the study watershed nor are there stream gage stations of similar size, development type within a close proximity per review of Reference 13. The numerous split flows and retention basins as well as storm drains, within this study watershed, make a comparison to stream gage data difficult for other than individual subareas. Several individual subareas of greater than 0.1 square miles were plotted on a Log-Pierson Type III plot of 100-year discharges obtained from the ADOT manual (Reference 14) as shown on Appendix D, page D-16. Most of these results plotted within the 75% confidence limits. The two subareas that plotted low were relatively undeveloped which may explain the lower discharges.

5.3 Comparison to Other Study Results:

Several excerpts from subdivision drainage reports were reviewed at the City of Mesa offices (Reference 8). These drainage reports addressed only local flows and/or offsite flows impacting the subdivisions. The studies generally utilized the Rational Method and were prepared in the early 1980's. Meaningful comparison to these studies was not considered appropriate.

There are no published FEMA FIS discharges along the East Maricopa Floodway (EMF) as this area was delineated as Approximate A flood hazard zone.

TABLE 4
SUMMARY OF PEAK DISCHARGES

HEC-1 I.D. (See Figure 7)	Drainage Area Square Miles	Comments Description	Peak Existing 100-Yr. 24-Hr. Discharge (CFS)
SB10	.031		41
DIV115	(1)	Split Out of System	30
DIV11P	(1)	Intercepted by 24" Pipe	11
SUB16	.170		196
CO20	(1)	Into 64th St. Basin	207
RO17	(1)	Out of 64th St. Basin	197
SUB24	.169		127
DIV255	(1)	Surface Flow At 66th St.	41
DIV270	(1)	Surface Split Out of System	16
DIV27I	(1)	Surface Split Into System	25
CO32	(1)	Total Flow to Mobile Home Park	306
DIV355	(1)	Surface Flow to Mobile Home Park	220
DIV390	(1)	Surface Split out of System	116
DIV391	(1)	Surface Split Into System	105
CO44	(1)	Total Flow at Recker Road	319
DIV475	(1)	Total Surface Flow at Recker Road	207
DIV490	(1)	Surface Split out of System	29
DIV491	(1)	Surface Split into System	178
SUB54	.033	Flow to Ten Basins Along 56th St.	54
RO51	.033	Outflow From Basins	5
CO56	(1)	Total Surface Flow at 56th St.	186
SUB62	.072	Flow to 2 Mobile Home Park Basins	108
RO64	.072	Basin Out Flow	93
CO68	(1)	Total Flow Out Higley Road	468
DIV715	(1)	Total Flow at Higley Road	328
DIV730	(1)	Surface Split out of System	131
DIV731	(1)	Surface Split into System	169
SUB84	.197	Flow North of Airport	122
SUB80	.636	Flow to Airport Basin	673
RO83	.636	Outflow Airport Basin	36
CO90	(1)	Total Flow at Greenfield/McKellips	487

HEC-1 I.D. (See Figure 7)	Drainage Area Square Miles	Comments Description	Peak Existing 100-Yr. 24-Hr. Discharge (CFS)
DIV935	(1)	Surface FLow to McKellips & UEMF	118
SUB92	.043		42
SUB94	.027		16
CO99	.495		420
CO100	(1)		429
SUB102	.042	Flow to 48th St. S.D. Split	58
DIV1031	(1)	Surface Flow into System	27
CO105	(1)	Flow to 46th St. N. of Princess	91
DIV187A	(1)	Surface Flow Split West	87
DIV107B	(1)	Surface Flow Split South	4
CO108	(1)		140
CO120	(1)	Surface Flow Into Princess Basin	564
RO121	(1)	Surface Flow Out of Princess Basin	282
CO116	(1)	Flow to 46th St. N. Brown	65
DIV1170	(1)	Surface Split Out of System	4
D117A	(1)	Surface Flow Into System	11
CO126	(1)	Total Flow UEMF, N. of Brown Rd.	603

Note: (1) Drainage Aea Not Applicable Due to Upstream Split FLows.

The Soil Conservation Service Hydrologic Analysis Design Notes (Reference 7) for the East Maricopa Floodway (EMF) formerly RWCD Floodway (Reference 5) and several hydrology studies and alternate watershed conditions were considered in developing the design 100-year 24-hour storm discharges for the EMF from Brown Road downstream.

Appendix D includes design notes and memorandums on design discharges for the Soil Conservation Service (SCS) East Maricopa Floodway (formerly RWCD channel). Pages D-1 - D-2 are the most recent notes found which discussed the 100-year 24-hour design discharges to be used by the design consultant to SCS. This summary page D-2 notes a 300 cfs discharge from Station 30+70.0 to 32+24.5 which is a 154± foot reach upstream of the existing 2 Barrel 8 ft. x 8 ft. x 138 ft. culverts under Brown Road. Page D-2 further notes a design discharge of 900 cfs from Station 32+24.53 - 35+43.0 which is a 318± foot reach from the upstream face of the Brown Road culvert downstream. Page D-2 notes a design discharge of 1200 cfs for a 4320 foot reach downstream of the 900 cfs design discharge. The design discharge for the Brown Road culverts appears to be 900 cfs.

Appendix D, pages D-3 - D-10 provide a Soil Conservation Service Summary of discharges computed at a number of critical points along the channel. This summary notes several different studies and alternate split flow assumptions at upstream drainage areas.

The SCS Summary, page D-8 appears to recommend a design discharge of 300 cfs for the short (150± foot) channel upstream of Brown Road and 1200 cfs at Brown Road as well as at Adobe Road, 1/4 mile or 1320 feet downstream of Brown Road. The drainage area map on page D-10 provides the subareas and parameters used in some of this analysis.

Appendix D, page D-11 provides some discussion by SCS on flow assumptions.

Appendix D, pages D-12 - D-13 provide a memorandum referring to a 900 cfs design discharge recommendation by SCS for the Brown Road culverts.

Appendix D, pages D-14 - D-15 show computed discharges performed by Anderson-Nichols for the FCDMC for the Eastern Maricopa County Area Drainage Master Study (Reference 15) that were considered by SCS.

The computed 100-year 24-hour discharge from this UEMF study at I.D. CO126 of 603 cfs at Brown Road is within the range of design discharges used for the EMF (RWCD) channel.

5.4 Analysis of Flooded Orange Groves:

An agency review comment requested analysis for the impact of a storm occurring after the orange groves had been flooded.

The orange groves were assumed to have saturated soil due to recent irrigation as part of the basic analysis. Referring to the green and Ampt Infiltration Parameter discussion in the manual (Reference 1), the DTHETA value (Volumetric Soil Moisture Deficit) was set equal to zero for saturated soil for modeling of irrigated land. The XKSAT (hydraulic conductivity) and PSIF (wetting front capillary suction) values were not considered affected by the irrigated condition. In order for the soil to percolate this irrigation water away, it was assumed the soils hydraulic conductivity and wetting from capillary suction would be ongoing even as water was standing on the soil.

The one value of the Green and Ampt parameters which was considered affected by this condition was the initial loss (IA) value. This value was changed from 0.5-inches for irrigated fields to zero assuming the irrigation water filled the surface depressions modelled by this parameter.

The HEC-1 model was run with the IA value changed to zero on Subarea I.D.'s 86, 92 and 94. There was no increase in peak discharges as a result of this IA value change, except at Sub92 which increased by 1 cfs.

Because of the insensitivity of adjustment of the IA value and the excess retention basin volume, available north of McKellips Road, no increase in runoff was predicted for the scenario of a storm occurring on recently irrigated orange groves. The IA values were left at 0.5 inches for orange groves land use in the HEC-1 modeling.

6.0 REFERENCES:

1. Hydrologic Design Manual for Maricopa County, Dated; September, 1990, with Revisions, Dated; January, 1995.

2. HEC-1 Flood Hydrograph Package Computer Model Version 4.0, September, 1990 U.S. Corps of Engineers, Hydrologic Engineering Center, Davis California 85616-4617.

3. HEC-2 Water Surface Profiles Computer Backwater Program, Version 4.6.2, May, 1991, by U.S. Army Corps of Engineers, Hydrologic Engineering Center, 609 Second Street, Davis, California 95616-4687.

4. US Geologic Survey 7 1/2 Minute Quadrangle Map, "Buckhorn, Arizona", Date; 1956, Photo Rev. 1982, Scale 1" = 2000'.

5. Aerial Photo Mylar at Scale 1" = 1200', Photo Date; 11/21/94, by Aerial Mapping Company, Phoenix, Arizona.

6. The Hydrologic Information System (HIS) Data Delivery Specifications, Rev. 2.0. Flood Control District of Maricopa County.

7. TR-20 Hydrology, RWCD Floodway - Reach 6, Dated; May, 1985, Original Design Notes in 3 Ring Binder, from Soil Conservation Service (SCS) Office (AKA, National Resource Conservation Service, NRCS), 3003 North Central, 8th Floor, Phoenix, Arizona.

8. Excerpts from Subdivision Drainage Reports obtained from the City of Mesa Files on June 22, 1995;

   a. Preliminary Hydrology Report - Camelot Golf Club Estates, Unit IV (4 Pages).

   b. Preliminary Drainage Report for Alta Mesa, December, 1983, by Coe and Van Loo Consulting Engineers (3 Pages).

   c. Maplewood Hydrology Report, Dated; 9/16/83, by J.D. King and Associates (3 Pages).

   d. Sonata Subdivision, Addendum to the Drainage Report, Dated; January 25, 1984, by Engineering and Surveying of Arizona, Inc. (13 Pages).

   e. Offsite Drainage Report and Channel Design for Palmas Del Sol Mobile Home Park, Mesa, Arizona by Trico International, Inc., Dated; May 28, 1980 (32 Pages).

9. Drainage Design Menu System (DDMS) Computer Program by FCDMC, January, 1995.

10. Soil Survey for Aguila/Carefree Area Part of Maricopa and Pinal Counties, Arizona by USDA, Soil Conservation Service (SCS). Date: 1978.

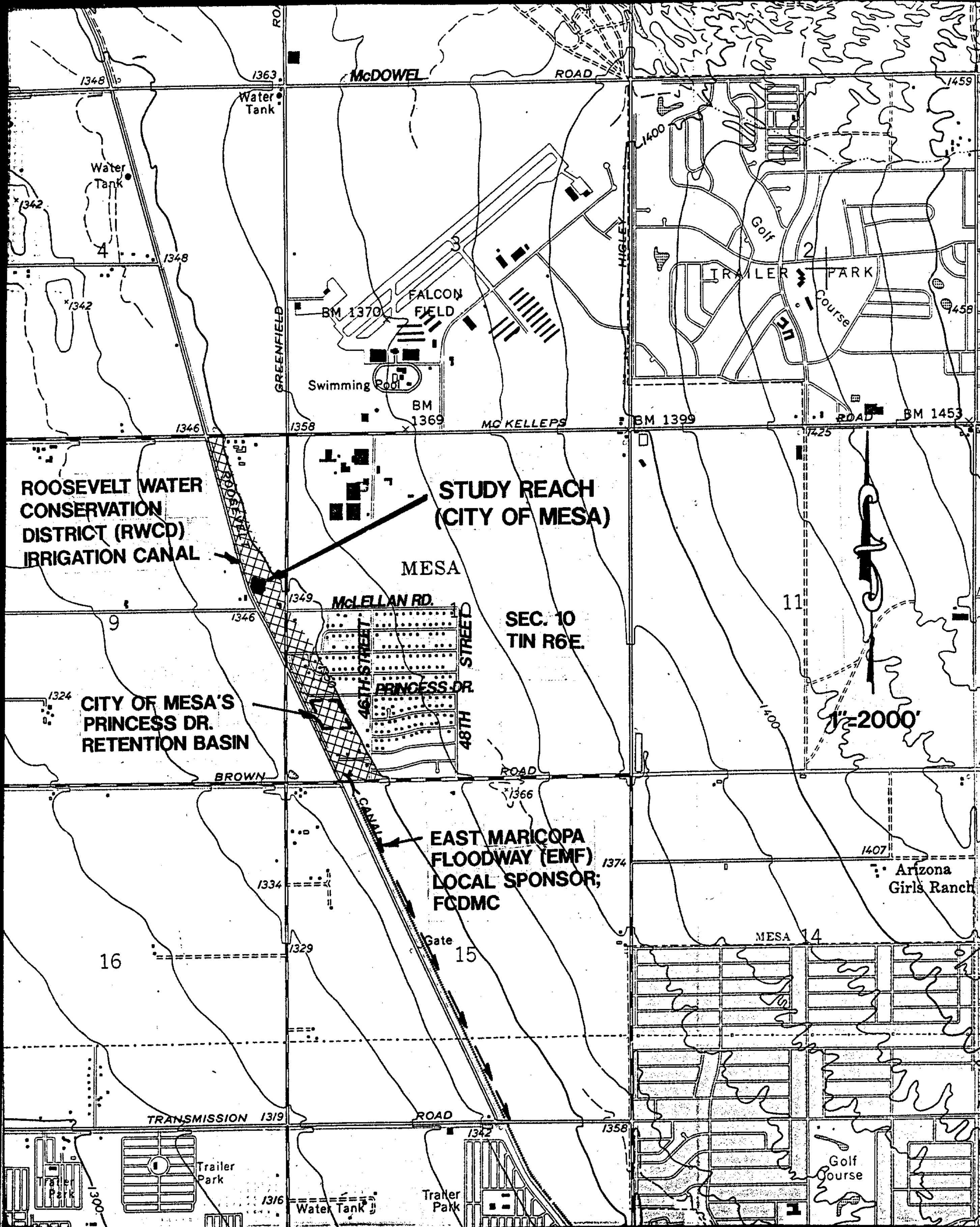
11. Soil Survey for Eastern Maricopa and Northern Pinal Counties, Arizona Area by USDA Soil Conservation Service (SCS). Date: November, 1974.

12. Flood Insurance Rate Map (FIRM) Panels 2205 and 2215 of 4350, Map Revised September 4, 1991, FEMA.

13. Basin Characteristics and Stream Flow Statistics in Arizona as of 1989, by J.M. Garrett and D.J. Gellenbeck, U.S. Geological Survey, Prepared in Cooperation with ADWR and FCDMC.

14. Arizona Department of Transportation, Highway Drainage Design Manual - Hydrology. Report No. FHwA - AZ93 - 281, March, 1993.

15. Eastern Maricopa County Area Drainage Master Study, Flood Control District of Maricopa County, Prepared by A-N West, Inc., Date: January, 1987.



FCDMC No. 94-26
A-N WEST No. 7158-03

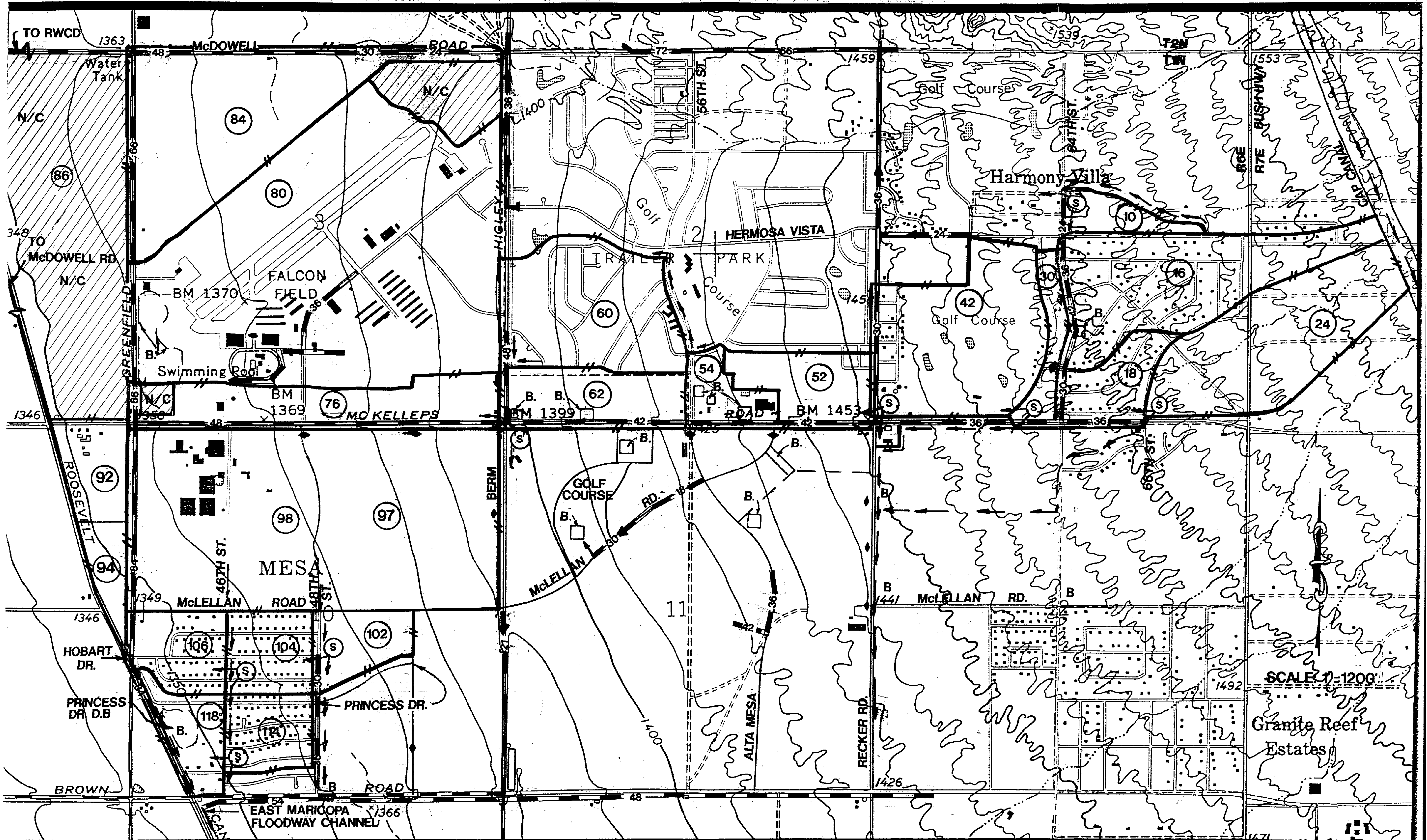
A-N WEST INC.
Consulting Engineers

EXPLANATION

– FLOOD PLAIN DELINEATION STUDY LIMITS

LOCATION MAP
UPPER EAST MARICOPA FLOODWAY FIS

FIGURE 1



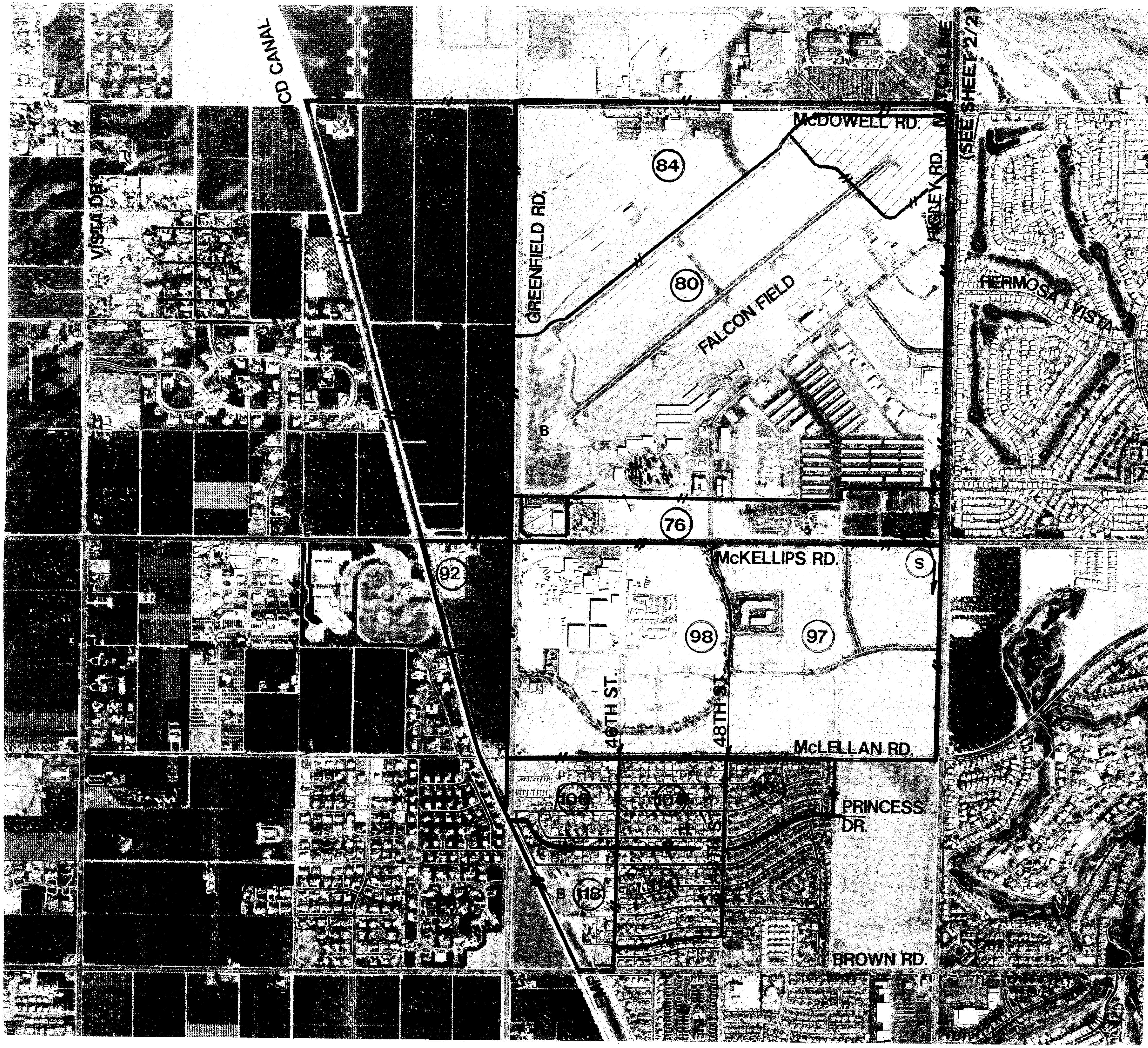
No. 7158-03

A-N WEST INC.
Consulting Engineers

LEGEND

- (10) COMPUTE HYDROGRAPH
- DRAINAGE AREA BDY.
- FLOW PATHS
- 48 STORM DRAIN AND SIZE
- B. DETENTION OR RETENTION BASIN
- N/C NON - CONTRIBUTING
- (S) POTENTIAL SPLIT FLOW
- GRADE BREAK (HI PT.) ON STREET

UPPER EMF FIS STUDY FCD No. 94-26
DRAINAGE AREA MAP
DATE: 8/2/95 FIGURE 2



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

UPPER EAST MARICOPA FLOODWAY
FLOODPLAIN DELINEATION STUDY
FCD No. 94-26

EXPLANATION

24	COMPUTE HYDROGRAPH I.D.
	SUBAREA BOUNDARY
	FLOW PATHS
B	RETENTION BASIN
N/C	NON-CONTRIBUTING
S	POTENTIAL SPLIT FLOW

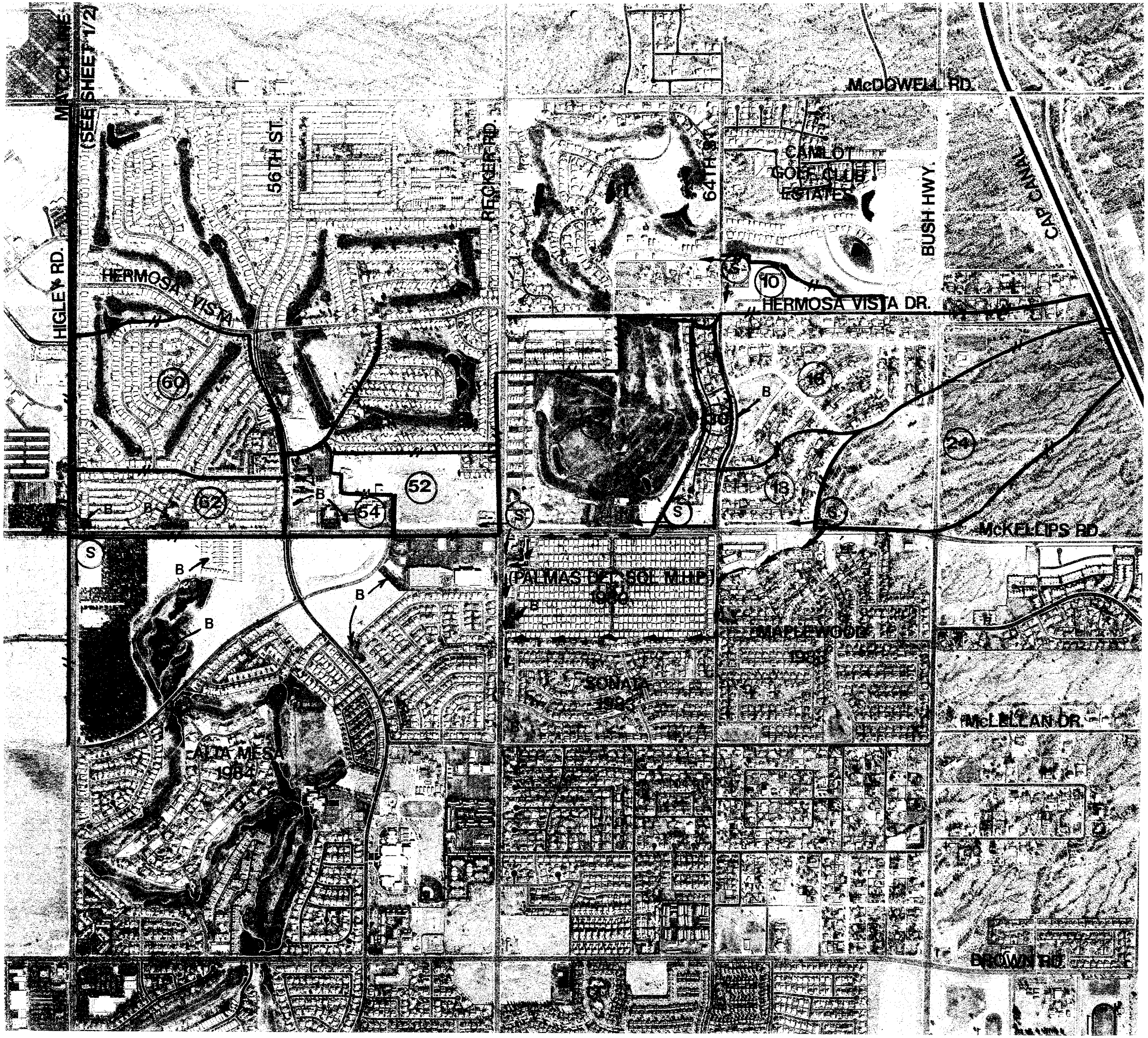
0 1200

SOURCE: AERIAL MAPPING CO.
PHOTO DATE: 11/21/94
No. 7158-03

A·N WEST INC.

WATERSHED PHOTO
FIGURE 3 SHT. 1/2

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
UPPER EAST MARICOPA FLOODWAY
FLOODPLAIN DELINEATION STUDY
FCD No. 94-26



EXPLANATION

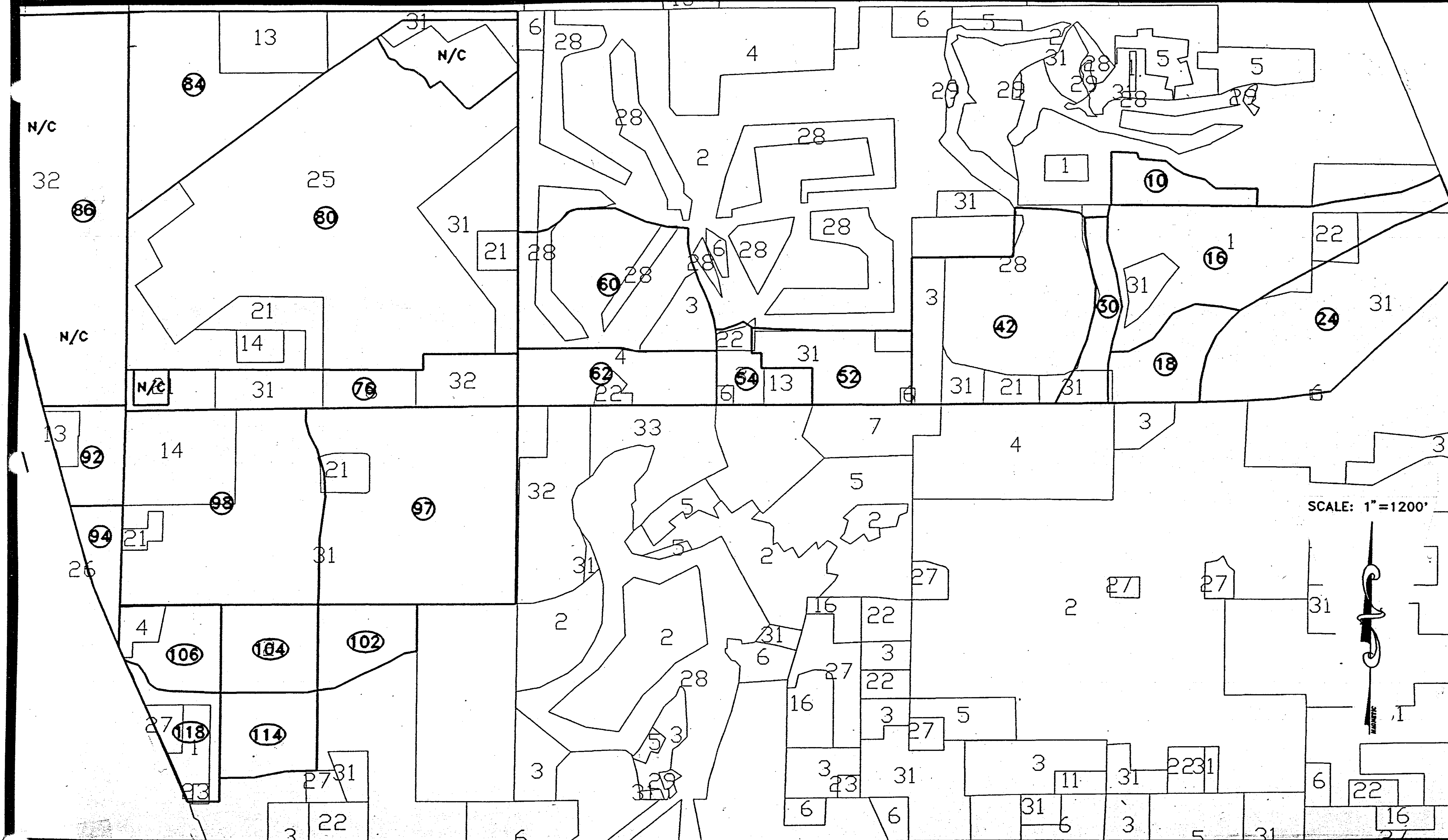
- (24) COMPUTE HYDROGRAPH I.D.
- SUBAREA BOUNDARY
- FLOW PATHS
- B RETENTION BASIN
- N/C NON-CONTRIBUTING
- (S) POTENTIAL SPLIT FLOW

0 1200

SOURCE: AERIAL MAPPING CO.
PHOTO DATE: 11/21/94
No. 7158-03

A-N WEST INC.

WATERSHED PHOTO
FIGURE 3 SHT. 2/2



7158-03

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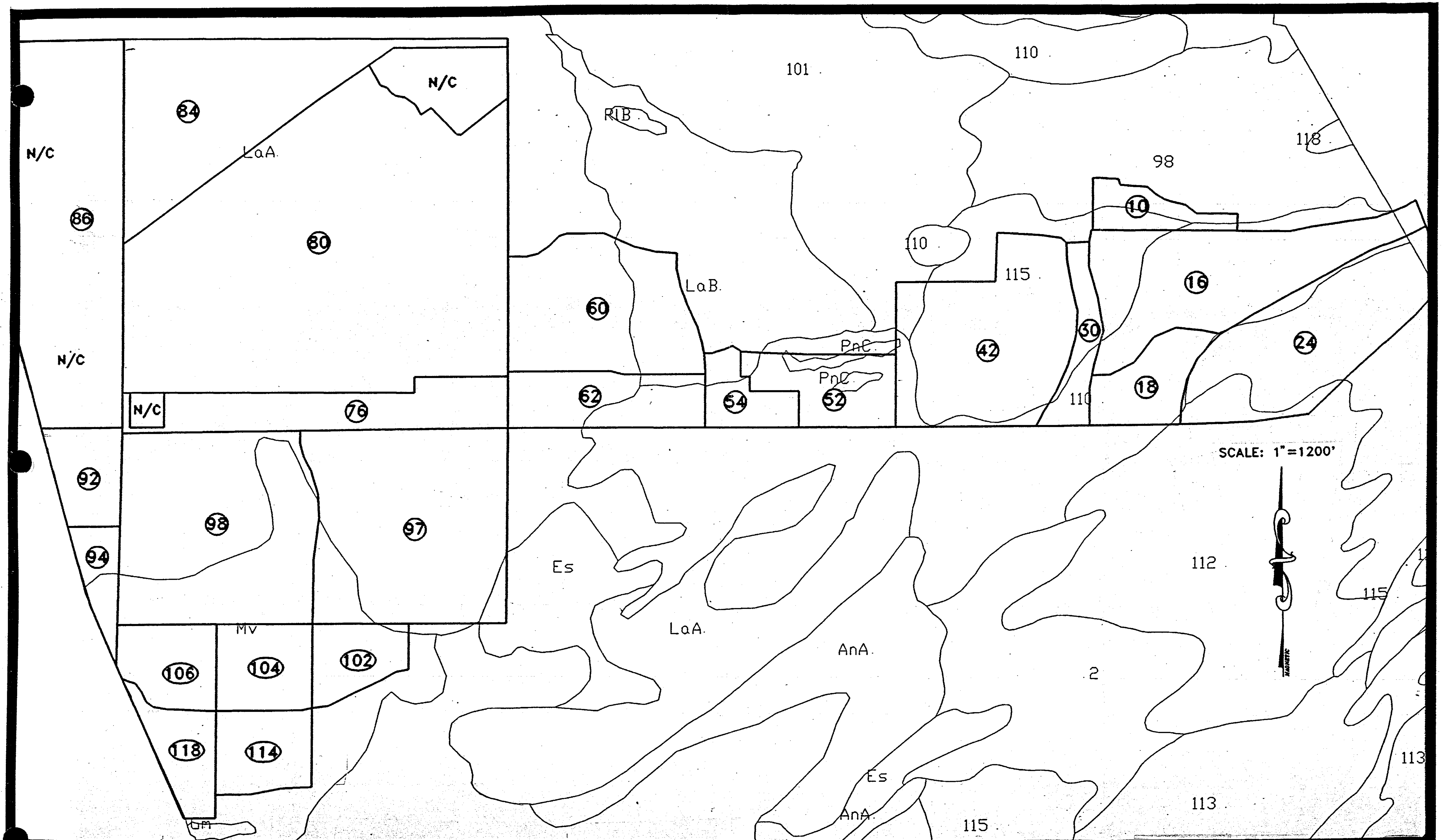
Consulting Engineers

EXPLANATION
—SUBAREA BDY
80 —SUBAREA I.D.
—LANDUSE BDY
32 —LANDUSE I.D.

UPPER EAST MARICOPA
FLOODWAY FIS
FCD NO. 94-26
LAND USE MAP

FIGURE 4



7158-03

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EXPLANATION

—SUBAREA BDY

—SOIL SUBAREA BDY

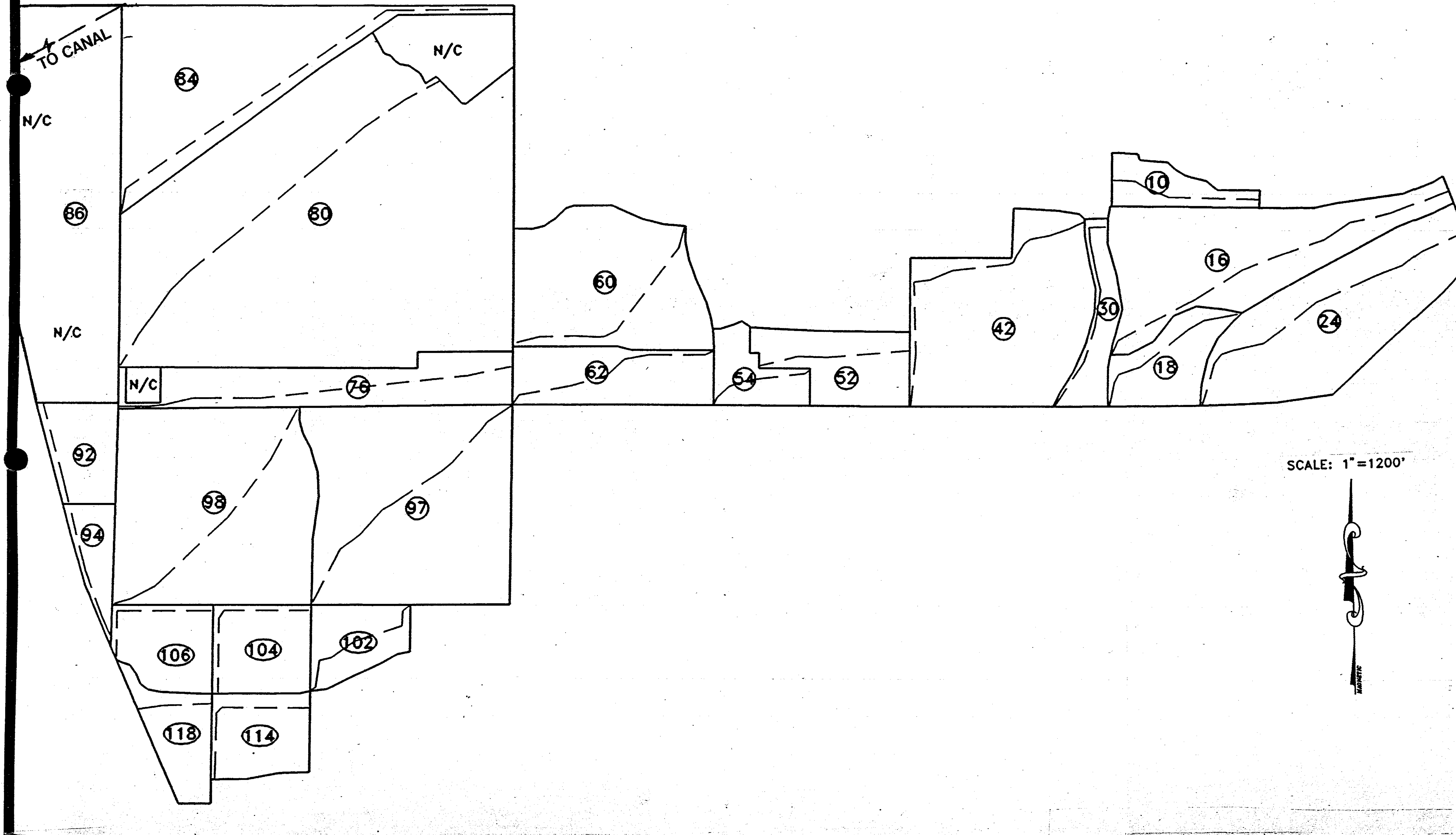
60 —SUBAREA I.D.

PnC, Es—EASTERN MARICOPA SOIL STUDY I.D'S

110, 115 —AGUILA–CAREFREE SOIL STUDY I.D'S

UPPER EAST MARICOPA
FLOODPLAIN FIS
FCD NO. 94–26
SOILS MAP W/SUBAREAS

FIGURE 5



#7158-03

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EXPLANATION

SUBAREA BOUNDARY

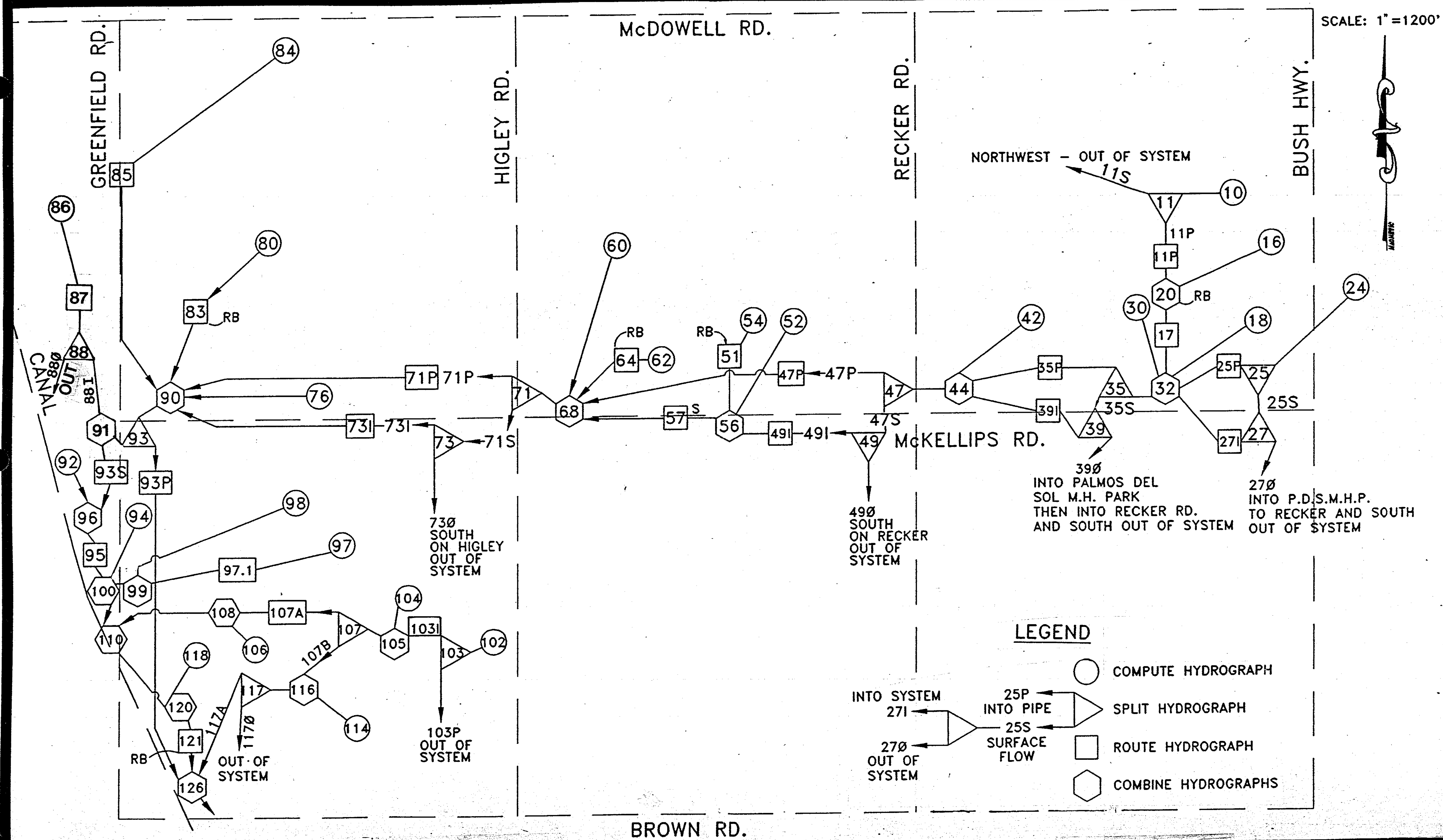
60 SUBAREA I.D.

DRAIN PATH

N/C

UPPER EAST MARICOPA
FLOODPLAIN FIS
FCD NO. 94-26
DRAIN PATH MAP
WITH SUBAREAS

FIGURE 6



7158-03

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EXPLANATION
RB – RETENTION BASIN
47P – PIPE FLOW SPLIT
47S – SURFACE FLOW SPLIT
47I – SPLIT INTO SYSTEM
47Ø – SPLIT OUT OF SYSTEM

UPPER EAST MARICOPA
FLOODPLAIN FIS
FCD NO. 94-26
HEC-1 SCHEMATIC

FIGURE 7

Appendix A

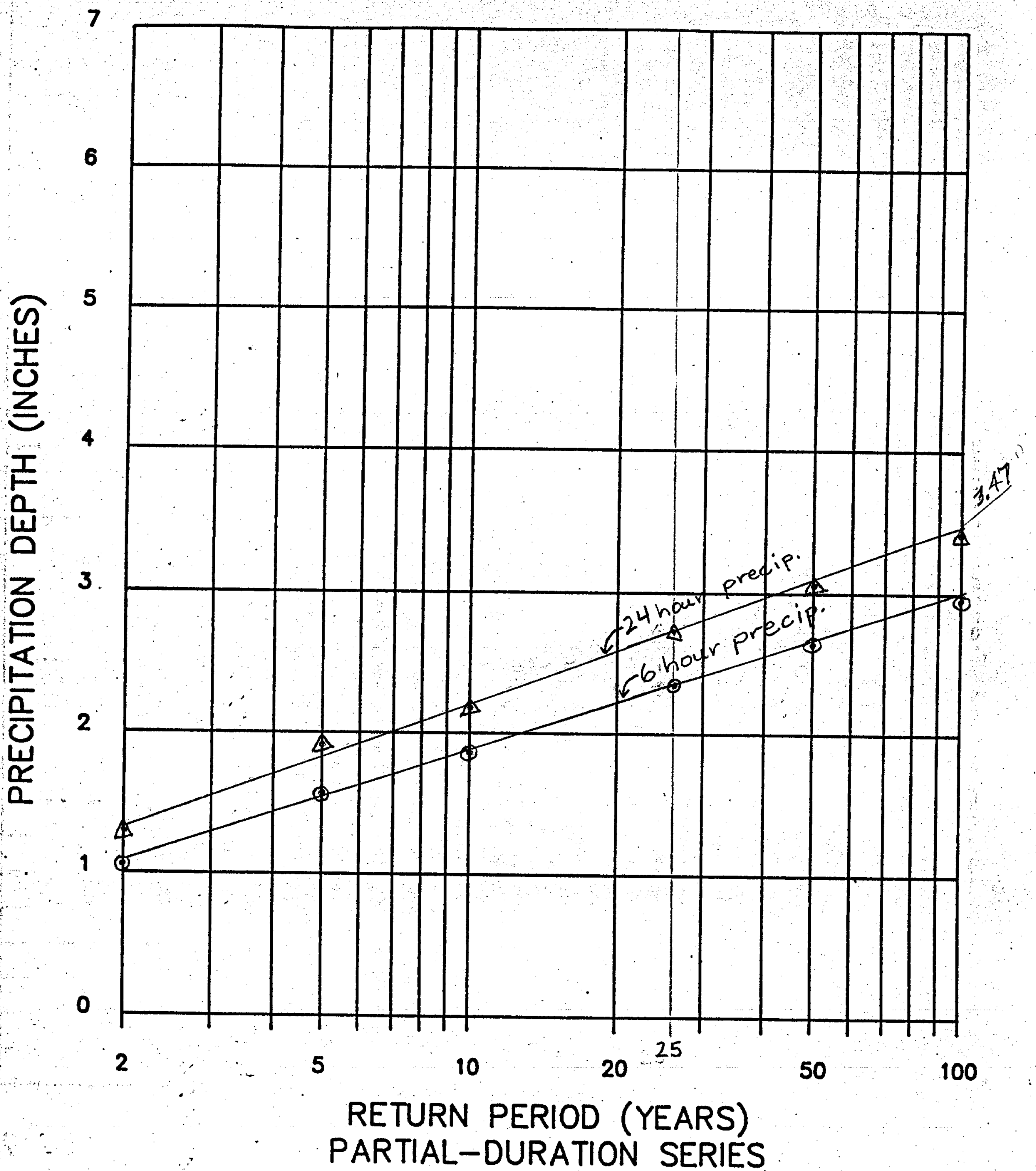


Figure 2.14
Precipitation Depth versus Return Period for Partial-Duration Series

LOOKUP TABLE: LDUSE.LUT

NAME MEANS: Type of land use

LID	CODE	DEFINITION
0		Blank/unknown/uncertain
1		Low Density Residential
2		Medium Density Residential
3		High Density Residential
4		Mobile Home or RV Park
5		Developing Residential
6		Low Intensity Commercial
7		Medium Intensity Commercial
8		Hotel or Resort
9		Regional Shopping Center
10		Commercial Warehouse
11		Low Intensity Office
12		High Intensity Office
13		Light Industrial
14		General Industrial
15		Unknown
16		Institution - School
17		Institution - College
18		Institution - University
19		Institution - Small Hospital
20		Institution - Large Hospital
21		Institution - Public Facility
22		Institution - Religious
23		Power Station
24		Railroads or Railyard
25		Airport
26		Freeway, Canal or Dam
27		Park
28		Golf Course
29		Lake
30		River
31		Vacant
32		Agriculture - Citrus
33		Agriculture - Other Crops
34		Agriculture - Stockyard
40		Undevelopable - Other
41		Undevelopable - Forest
42		Undevelopable - Mountain Range
43		Undevelopable - Gunnery Range

A-2

Table 4.2a IA, RTIMP, and Percent Vegetation Cover for Representative Land Uses in Maricopa County

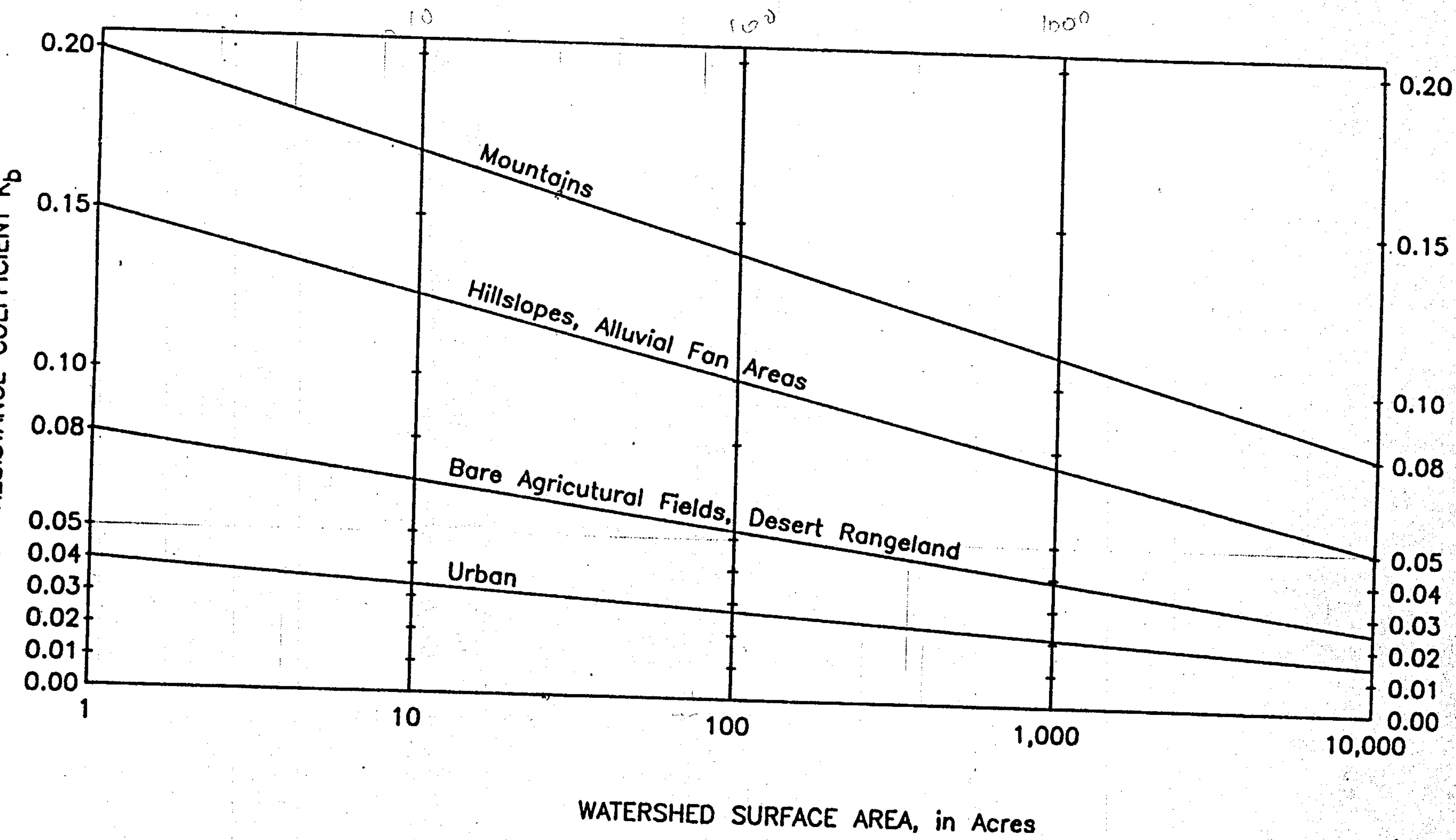
Land Use Category	IA (inches)	RTIMP ** (percent)	Percent ** Veg. Cover	Gilbert Zoning Unit	Gilbert Description	Chandler Zoning Unit	Chandler Description	Mesa Zoning Unit	Mesa Description	Tempe Zoning Unit	Tempe Description	County Zoning Unit	County Description	Phoenix Zoning Unit	Phoenix Description
Agriculture	0.5*	0*	85*	AG	Agriculture	AG-1	Agriculture	AG	Agriculture	AG	Agriculture				
Very Low Density Residential	0.3*	5*	30*					R1-90	Single Residence			RURAL-190	190,000 sq. ft./dwelling unit	S-1	Ranch or Farm Residential, > 1 acre
								SR	Suburban Ranch			RURAL-70	70,000 sq. ft./dwelling unit	S-2	Ranch or Farm Commercial
				R1-43	Rural							RURAL-43	one acre/dwelling unit	RE-43	Single Family, 1 acre minimum
Low Density Residential	0.3*	15*	50*	R1-35	Rural Residential	SF-33	Single Family	R1-35	Single Residence			R1-35	Single Family Residential,	RE-35	SF, 35,000 sq.ft min.
													35,000 sq. ft./dwelling unit	RE-24	SF, 24,000 sq.ft min.
				R1-20	SF, Residential	SF-18	Single Family					R1-18	SFR, 18,000 sq. ft./unit	R1-18	SF, 18,000 sq.ft min.
				R1-15	" "			R1-15	Single Residence	R1-15	One Family Residential			R1-14	SF, 14,000 sq.ft min.
Medium Density Residential	0.25*	30*	50*	R1-10	" "	SF-10	Single Family	R1-9	Single Residence	R1-10	One Family Residential	R1-10	SFR, 10,000 sq. ft./unit	R1-10	SF, 10,000 sq.ft min.
				R1-8	" "					R1-8	One Family Residential	R1-8	SFR, 8,000 sq. ft./unit	R1-8	SF, 8,000 sq.ft min.
				R1-7	" "	SF-7	Single Family	R1-7	Single Residence	R1-7	One Family Residential				
								R1-6	Single Residence	R1-6	One Family Residential	R1-6	SFR, 6,000 sq. ft./unit	R1-6	SF, 6,000 sq.ft min.
								TCR-1	Town Center, Single Family	RO	Residence/Office			R-O	Res. Office
Multiple Family Residential	0.25*	45*	50*	R-2 RTIMP	Duplex	MF-1	Medium Density	R-2	Restricted Multiple Resid.	R-2	Multi-Family Residential	R-2	2 Family Residence	R-2	MF, 4,000 sq.ft./unit
				R-3 36	Multi-Family, Apartments	MF-2	Multi-Family	R-3	Limited Multiple Resid.	R-3R	Multi-Family Restricted	R-3	Multiple Family, Residential	R-3	MF, 3,000 sq.ft./unit
				R-4 26	Multi-Family, General	MF-3	High Density	R-4	General Multiple Resid.	R-3	Multi-Family Limited	R-4	Multiple Family, Residential	R-4	MF, 1,500 sq.ft./unit
				R-5 45	Townhouse Residential					R-4	Multi-Family General	R-5	Multiple Family, Residential	R-4A	MF, 1,000 sq.ft./unit
										R-Th	Townhouse			R-5	MF, 1,000 sq.ft./unit
				MH 60	Mobile Home	MH-1	Mobile Homes	TCR-2	TC, Restricted Multi-Res.	RMH	Mobile Home Residence	MHR	Manufactured Housing, Resid.	CP/BP	Business Park
				CTP	Commercial Trailer Park			TCR-3	TC, General Res.	MHS	Manufactured Housing Subd.			R-H	Resort District
										TP	Trailer Park				
Industrial	0.15*	55*	60*	I-1	Garden Type Industrial			M-1	Limited Industrial	I-1	Light Industrial			IND PARK	Industrial Park
				I-2	Light Industrial	I-1	Light Industrial			I-2	General Industrial	I-2	Light Industrial	A-1	Light Industrial
				I-3	General Industrial	I-2	General Industrial	M-2	General Industrial	I-3	Heavy Industrial	I-3	Heavy Industrial	A-2	Heavy Industrial
Commercial	0.1*	80*	75*	C-1	Light Commercial	C-1	Neighborhood Commercial	C-1	Neighborhood Comm.	CCR	Convenience Commercial	C-1	Neighborhood Commercial	C-1	Neighborhood Commercial
				C-2	General Commercial	C-2	Community Commercial	C-2	Limited Comm.	C-1	Neighborhood Commercial	C-2	Intermediate Commercial	C-2	Intermediate Commercial
				C-3	Central Commercial	C-3	Regional Commercial	C-3	General Comm.	C-2	General Commercial	C-3	General Commercial	C-3	General Commercial
				RS	Residential Services			OS	Office-Serivces	CCD	Central Comm. District	C-O	Commercial Office	C-O	Commercial Office
				RCC	Residential Conveniences			TCC	TC,High Intensity Mixed Use					HR	High Rise District
								TCB-1	TC, Limited Comm./General Manufacturing						
								TCB-2	TC, General Comm./ Light Manufacturing						
				MISCELLANEOUS CATEGORIES: These zoning units should be evaluated on a case by case basis.											
				PAD	Planned Area Development	PAD	Planned Area Development			S	Private School	PD	Planned Development Overlay	PAD	Planned Area Development
				PSC-1	Planned Neighborhood Shopping										
				PSC-2	Planned Shopping Center							CS	Planned Shopping Center	PSC	Planned Shopping Center
				IB	Industrial Buffer										
						PCO	Planned C Offices	PEP	Planned Employment Park						
								PF	Public Facilities			SU	Special Uses		
												SC	Senior Citizen Overlay	PCD	Planned Community Development
												NUP	Neighborhood Plan of Development		
												RUP	Residential Plan of Development		
												IUP	Industrial Plan of Development		
														R.O.W.	Right of Way
														P-1	Parking, Open
														P-2	Parking, Structures
														D.G	Dwelling Group

NOTES

* These values have been selected to fit many typical settings in Maricopa County. However, the engineer/hydrologist should ALWAYS evaluate the specific circumstances in any particular watershed for hydrological variations from these typical values.

** RTIMP = Percent Effective Impervious Area, Including R.O.W.

** Percent Veg. Cover = Percent vegetation cover for pervious area only



A-4

Figure 5.5
Resistance Coefficient "K_b" as a Function of Watershed Type and Size

» hydraulic conductivity at natural saturation (XKSAT) equal to K_S in Equation 4.1;

» wetting front capillary suction (PSIF) equal to Ψ in Equation 4.1; and

» volumetric soil moisture deficit at the start of rainfall (DTHETA) equal to θ in Equation 4.1.

The three infiltration parameters are functions of soil characteristics, ground surface characteristics, and land management practices. The soil characteristics of interest are particle size distribution (soil texture), organic matter, and bulk density. The primary soil surface characteristics are vegetation canopy cover, ground cover, and soil crusting. The land management practices are identified as various tillages as they result in changes to soil porosity.

Values of Green and Ampt equation parameters as a function of soil characteristics alone (bare ground condition) have been obtained from published reports (Rawls and others, 1983; Rawls and Brakensiek, 1983), and average values of XKSAT and PSIF for each of the soil texture classes are shown in Columns (2) and (3) of Table 4.2. The values of XKSAT and PSIF from Table 4.2 should be used if general soil texture classification of the drainage area is available. References used to create Table 4.2 can be found in the Documentation Manual.

Table 4.2
Green and Ampt Loss Rate Parameter Values for Bare Ground

Soil Texture Classification (1)	XKSAT inches/hour (2)	PSIF inches (3)	DTHETA[1]		
			Dry (4)	Normal (5)	Saturated (6)
sand	4.6	1.9	0.35	0.30	0
loamy sand	1.2	2.4	0.35	0.30	0
sandy loam	0.40	4.3	0.35	0.25	0
loam	0.25	3.5	0.35	0.25	0
silty loam	0.15	6.6	0.40	0.25	0
silt	0.10	7.5	0.35	0.15	0
sandy clay loam	0.06	8.6	0.25	0.15	0
clay loam	0.04	8.2	0.25	0.15	0
silty clay loam	0.04	10.8	0.30	0.15	0
sandy clay	0.02	9.4	0.20	0.10	0
silty clay	0.02	11.5	0.20	0.10	0
clay	0.01	12.4	0.15	0.05	0

1 Selection of DTHETA:
Dry = Nonirrigated lands, such as desert and rangeland;
Normal = Irrigated lawn, turf, and permanent pasture;
Saturated = Irrigated agricultural land.

Table 4.1
Surface Retention Loss for Various Land Surfaces in Maricopa County

Land-use and/or Surface Cover (1)	Surface Retention Loss IA, inches (2)
Natural	
Desert and rangeland, flat slope	0.35
Hillslopes, Sonoran Desert	0.15
Mountain, with vegetated surface	0.25
Developed (Residential and Commercial)	
Lawn and turf	0.20
Desert landscape	0.10
Pavement	0.05
Agricultural	
Tilled fields and irrigated pasture	0.50

Infiltration can be controlled by percolation if the soil does not have a sustained drainage capacity to provide access for more infiltrated water. However, before percolation can be assumed to restrict infiltration for the design rainfalls being considered in Maricopa County, the extent by which percolation can restrict infiltration of rainfall should be carefully evaluated. SCS soil scientists have defined hydrologic soil group D as:

> "Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material."

This definition indicates that hydrologic soil groups A, B, or C could be classified as D if a near impervious strata of clay, caliche, or rock is beneath them. When these soils are considered in regard to long-duration rainfalls (the design events for many parts of the United States) this definition may be valid. However, when considered for short-duration and relatively small design rainfall depths in Maricopa County, this definition could result in underestimation of the rainfall losses. This is because even a relatively shallow horizon of soil overlaying an impervious layer still has the ability to store a significant amount of infiltrated rainfall.

For example, consider the situation where only 4 inches of soil covers an impervious layer. If the effective porosity is 0.30, then 1.2 inches (4 inches x 0.30) of water can be infiltrated and stored in the shallow soil horizon. For design rainfalls in Maricopa County, this represents a significant storage volume for infiltrated rainfall and so when developing loss rate parameters for areas of Maricopa County that contain significant areas classified as hydrologic soil group D, the reason for that classification should be determined.

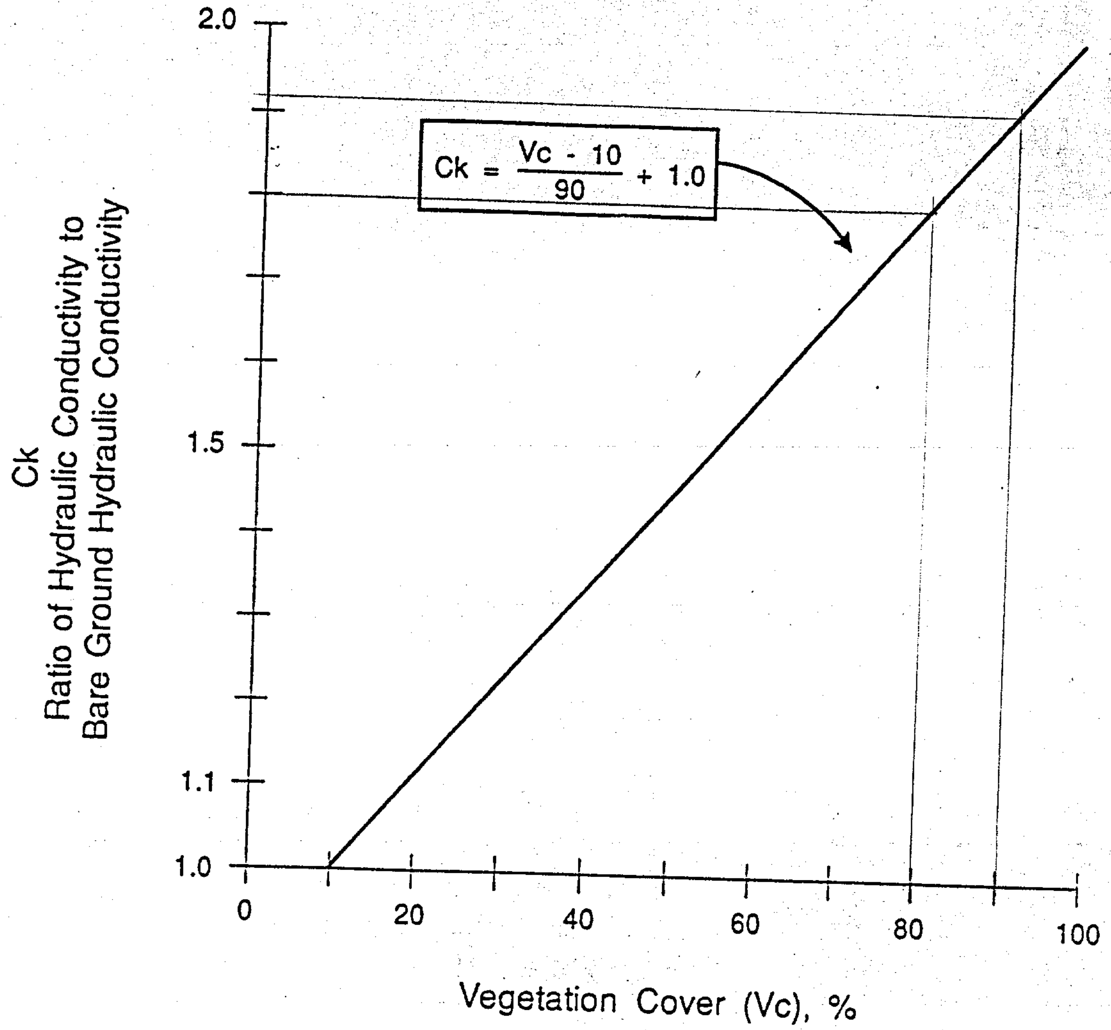
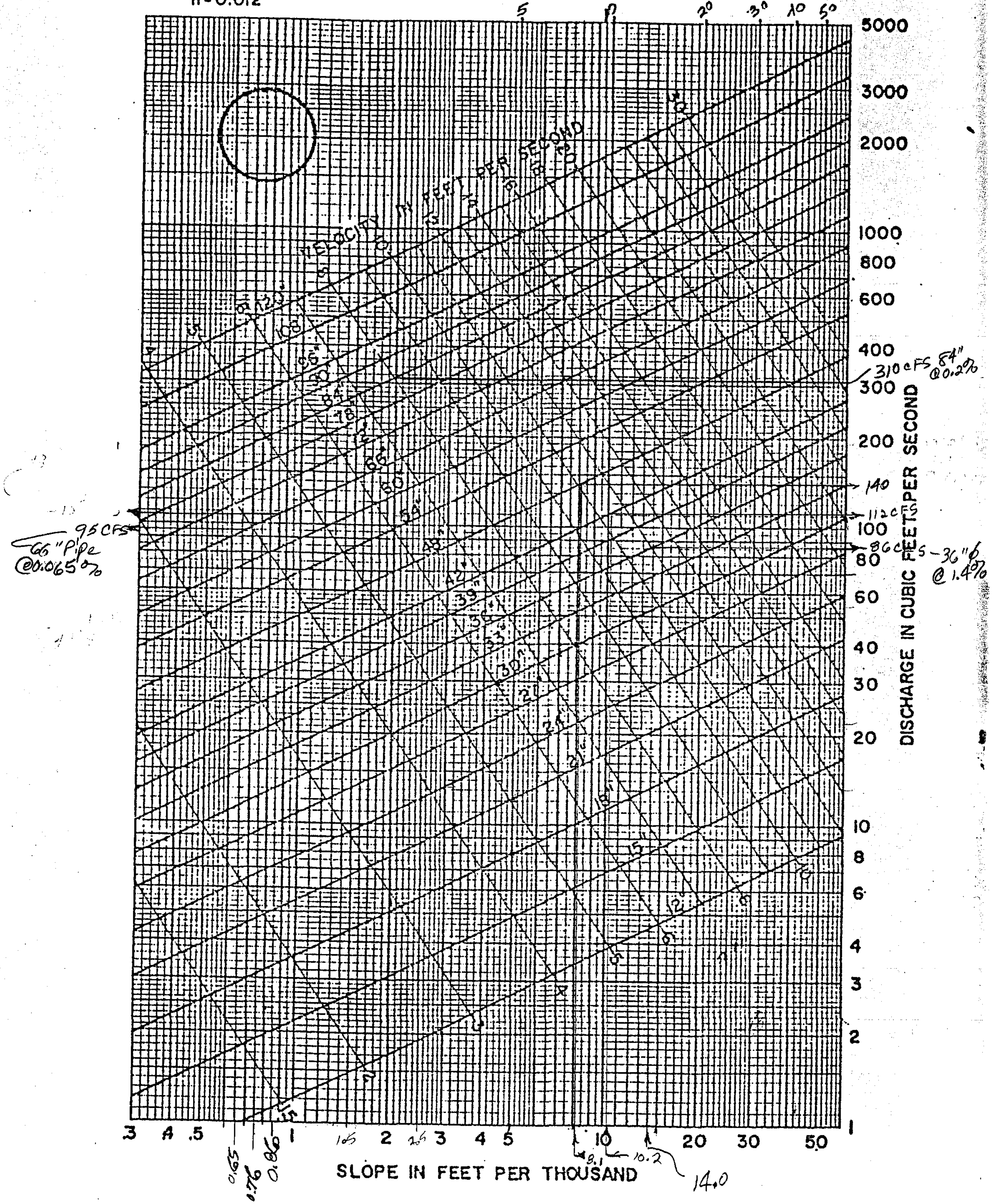


Figure 4.4
Effect of Vegetation Cover on Hydraulic Conductivity
For Hydraulic Soil Groups B, C, and D, and for all Soil Textures
other than **Sand and Loamy Sand**

on canopy cover for trees and shrubs. Note that this correction can be applied only to soils other than sand and loamy sand.

The influence of tillage results in a change in total porosity and therefore a need to modify the three Green Ampt equation infiltration parameters. The effect of tillage systems on soil porosity and the corresponding changes to hydraulic conductivity, wetting front capillary suction, and water retention is available (Rawls and Brakensiek, 1983). Although this information is available, it is not presented in this manual, nor is it recommended that these adjustments be made to the infiltration parameters for design purpose use in Maricopa County, because for most flood estimation purposes it cannot be assumed that the soil will be in any particular state of tillage at the time of storm occurrence and therefore the base condition infiltration parameters, as presented, should be used for flood estimation purposes. However, appropriate adjustments to the infiltration parameters can be made, as necessary, for special flood studies such as reconstitution of storm events.

COMPUTED FROM MANNING'S FORMULA
n=0.012



PIPE CAPACITIES FLOWING FULL

H-8

Appendix A

Aguila–Carefree Loss Rate Parameters

A-10

Map Unit #	Soil Name	U.S.D.A. Soil Texture (Control Horizon)	Fragments >0.0074 mm, %	Clay, %	Textural Class (Appendix)	XKSAT/ CNSTL (in/hr)	PSIF (in)	DTHETA (Dry)	DTHETA (Normal)	IL (in) (Dry) (Top Horizon)	IL (in) (Normal) (Top Horizon)	H.S.G.
88	Mohave	Clay Loam (2-20)	25	27.5	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
	Guest	Clay Loam (0-2)	20	35	Clay Loam	0.04	8.2	0.25	0.15	0.5	0.4	D
89	Mohave	Clay Loam (2-20)	25	27.5	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
	Tres Hermanos	Gravelly Loam (0-2)	40	17.5	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
90	Momoli	Gravelly Sandy Loam (0-3)	75	15	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
91, 92	Momoli	Very Gravelly Loam (1-60)	77.5	15	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
	Carrizo	Very Gravelly Sandy Loam (0-11)	85	10	Loamy Sand	1.20	2.4	0.35	0.30	0.8	0.8	A
93, 94	Nickel	Gravelly Loam (1-10)	65	15	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
	Cave	Loam (1-14)	50	12.5	Loam	0.25	3.5	0.35	0.25	0.6	0.5	D*
95	Ohaco	Clay (2-27)	27.5	40	Clay Loam	0.04	8.2	0.25	0.15	0.5	0.4	C
96, 97	Pinaleno	Gravelly Clay Loam (1-12)	60	35	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	B*
	Tres Hermanos	Very Gravelly Clay Loam (2-22)	47.5	25	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	B*
98, 99	Pinamt	Very Gravelly Sandy Clay Loam (1-28)	76.25	23.75	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.5	0.4	B*
	Tremant	Gravelly Loam (0-5)	65	15	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
100	Quilotosa	Extremely Gravelly Loam (2-14)	88.75	11.25	Loamy Sand	1.20	2.4	0.35	0.30	0.8	0.8	D*
	Vaiva	Very Gravelly Loam (0-3)	67.5	12.5	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	D*

Map Unit #	Soil Name	U.S.D.A. Soil Texture (Control Horizon)	Fragments >0.0074 mm, %	Clay, %	Textural Class (Appendix)	XKSAT/ CNSTL (in/hr)	PSIF (in)	DTHETA (Dry)	DTHETA (Normal)	IL (in) (Dry) (Top Horizon)	IL (in) (Normal) (Top Horizon)	H.S.G.
101, 102	Rillito	Loam (0-24)	57.5	14	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
	Rillito	Gravelly Loam (0-14)	60	14	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
103	Gachado	Very Gravelly Sandy Clay Loam (1-7)	73.75	26.25	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	D*
104, 105	Lehmans	Very Gravelly Clay Loam (0-2)	70	30	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	D*
106, 107	Sal	Very Gravelly Clay Loam (2-20)	71.75	27.75	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	D*
	Cipriano	Very Gravelly Sandy Loam (0-20)	72.5	20	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	D*
108, 109	Schenco	Very Channery Loam (2-11)	70	21	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	D*
110	Sun City	Clay Loam (1-9)	45	30	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	D*
	Cipriano	Very Gravelly Loam (0-6)	72.5	20	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	D*
112, 113, 114	Tremant	Gravelly Sandy Loam (0-9)	65	15	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
115	Tremant	Gravelly Sandy Loam (0-9)	65	15	Sandy Loam	0.40	3.5	0.35	0.25	0.7	0.6	B
	Antho	Sandy Loam (0-3)	65	10	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
116, 117	Tremant	Clay Loam (2-26)	45	32.5	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	B*
	Gunsight	Very Gravelly Sandy Loam (0-10)	85	12.5	Loamy Sand	1.20	2.4	0.35	0.30	0.8	0.8	B*
	Rillito	Gravelly Loam (2-60)	55	20.	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B

Appendix B

Eastern Maricopa/ Northern Pinal Counties Loss Rate Parameters

Eastern Maricopa/Northern Pinal Counties Loss Rate Parameters

Map Symbol	Soil Name	U.S.D.A. Soil Texture (Control Horizon)	Fragments >0.0074 mm, %	Clay, %	Textural Class (Appendix)	XKSAT/ CNSTL (in/hr)	PSIF (in)	DTHETA (Dry)	DTHETA (Normal)	IL (in) (Dry) (Top Horizon)	IL (in) (Normal) (Top Horizon)	H.S.G.
Af, Ag	Agault	Loam (0-27)	45	–	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
Am	Alluvial Land	Gravelly Sand (0-60)	55 to100	–	Loamy Sand	1.20	2.4	0.35	0.30	0.8	0.8	A
AnA, AnB, AoB	Antho	Sandy Loam, Gravelly Sandy Loam (0-46)	72.5	9	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
Av	Avondale	Clay Loam (0-13)	25	–	Clay Loam	0.04	8.2	0.25	0.15	0.5	0.4	B*
Ca, Cb	Carrizo	Fine Sandy Loam, (0-15) & Gravelly Loamy Sand	57.5	–	Sandy Loam	0.40	4.3	0.35	0.30	0.7	0.6	A*
Cc	Cashion	Clay (0-28)	10	–	Clay	0.01	12.4	0.15	0.05	0.3	0.2	C*
CeC	Cavelt	Gravelly Loam (0-10)	50	–	Loam	0.25	3.5	0.35	0.25	0.6	0.5	D*
Co	Contine	Clay Loam (0-12)	30	–	Clay Loam	0.04	8.2	0.25	0.15	0.5	0.4	C
Es	Estrella	Loam (0-26)	35	–	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
Gf, Gm	Gilman	Loam (0-13)	27.5	–	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
Gn	Glenbar	Clay Loam (0-14)	15	–	Silty Loam	0.15	6.6	0.40	0.25	0.8	0.7	B
Gr	Gravelly Alluvial Land	Very Gravelly Sandy Loam & Loamy Sand (0-60)	90	–	Loamy Sand	1.20	2.4	0.35	0.30	0.8	0.8	A
LaA, LaB, LeA	Laveen	Loam (0-14)	30	–	Silty Loam	0.15	6.6	0.40	0.25	0.8	0.7	B

A-13

Map Symbol	Soil Name	U.S.D.A. Soil Texture (Control Horizon)	Fragments >0.0074 mm, %	Clay, %	Textural Class (Appendix)	XKSAT/ CNSTL (in/hr)	PSIF (in)	DTHETA (Dry)	DTHETA (Normal)	IL (in) (Dry) (Top Horizon)	IL (in) (Normal)	H.S.G.
Mo, Mv	Mohall	Loam (0-15)	40	21	Loam	0.25	3.5	0.35	0.25	0.6	0.5	B
Pm	Pimer	Clay Loam (0-15)	15	–	Clay Loam	0.04	8.2	0.25	0.15	0.5	0.4	B*
PnA, PnC	Pinal	Gravelly Loam (0-5)	50	–	Loam	0.25	3.5	0.35	0.25	0.6	0.5	D*
Po	Pinal Variant	Loam (0-9)	45	–	Loam	0.25	3.5	0.35	0.25	0.6	0.5	C
PvA, PvC	Pinamt	Gravelly Loam (0-13)	85	–	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
R1A, R1b	Rillito	Gravelly Loam (0-13)	62.5	–	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
Ro, Ru	Rock Land	50 - 70% Rock Outcrop, Shallow Areas of Clay Loam, Sandy Loam, and Gravelly Loam.	–	–	Use Sandy Loam For Pervious Areas	0.40	4.3	0.35	0.25	0.7	0.6	B
TrB	Tremant	Gravelly Sandy Clay Loam (1-15)	60	–	Sandy Clay Loam	0.06	8.6	0.25	0.15	0.6	0.5	B*
Tx	Trix	Clay Loam (0-14)	15	–	Silty Clay Loam	0.04	10.8	0.30	0.15	0.6	0.5	B*
Va	Valencia	Sandy Loam (0-13)	65	–	Sandy Loam	0.40	4.3	0.35	0.25	0.7	0.6	B
Ve	Vecont	Clay (0-14)	15	48	Clay	0.01	12.4	0.15	0.05	0.3	0.2	C*
Vi	Vint	Loamy Fine Sand (0-12)	80	–	Loamy Sand	1.20	2.4	0.35	0.30	0.8	0.8	B*

WARNING: Hydrologic soil group does not accurately represent soil texture characteristics. Check soil description for rock outcrop, cemented hardpan, soil group associations, percent course fraction, etc.

LOSS PARAMETERS FOR SUBBASIN: SB10

Soil Survey Used Aguila/Carefree

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
98	0.017	54.8	0.37	0
110	0.003	9.7	0.13	0
115	0.011	35.5	0.39	0

TOTAL = 0.031 Sq.Miles XKSAT = 0.34 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.30
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.031	M.D.R.	100.	NORMAL	50	30	0.25		Min	0.03

0.031 = Total Area Avg. = 50 30% 0.250

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.49

IMPERVIOUS AREA: URBAN @ 100 % effective = 30
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 30

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB10	0.031	0.390	0.032	87.0	0.25	0.25	4.30	0.49	30

LOSS PARAMETERS FOR SUBBASIN: SB24
=================

Soil Survey Used Aguila/Carefree

XKSAT
=======

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
98	0.135	79.9	0.37	0
110	0.011	6.5	0.13	0
112	0.023	13.6	0.39	0

TOTAL = 0.169 Sq.Miles XKSAT = 0.35 %Rock = 0

DTHETA
========

Dry = 0.35 PSIF = 4.25
Normal = 0.25
Wet = 0.00

LAND USE
========

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.002	INST.RLG	1.2	NORMAL	50	10	0.15		Min	0.04
0.005	L.D.R.	2.9	NORMAL	50	1	0.30		Min	0.04
0.163	VACANT	95.9	DRY	30	0	0.25		Low	0.05
0.170 = Total Area			Avg. =	31	0%	0.250			

PERCENT OF SUBBASIN DRY = 96.0 %
NORMAL = 4.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.35

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.43

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB24	0.169	0.840	0.051	74.0	0.25	0.35	4.25	0.43	0

LOSS PARAMETERS FOR SUBBASIN: SB16

Soil Survey Used Aguila/Carefree

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
110	0.139	81.8	0.13	0
115	0.031	18.2	0.39	0

TOTAL = 0.170 Sq.Miles XKSAT = 0.16 %Rock = 0

DTHETA

Dry = 0.39 PSIF = 5.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.021	VACANT	12.4	DRY	30	0	0.25		Low	0.06
0.013	INST RLG	7.6	NORMAL	50	10	0.15		Min	0.03
0.136	L.D.R.	80.0	NORMAL	50	1	0.30		Min	0.03
0.170 = Total Area			Avg. =	47	2%	0.280			

PERCENT OF SUBBASIN DRY = 12.0 %
NORMAL = 88.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.27

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.23

IMPERVIOUS AREA: URBAN @ 100 % effective = 2
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 2

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB16	0.170	0.960	0.030	76.0	0.28	0.27	5.80	0.23	2

LOSS PARAMETERS FOR SUBBASIN: SB18
=================

Soil Survey Used Aguila/Carefree

XKSAT
=======

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
110	0.005	100.	0.13	0

TOTAL = 0.005 Sq.Miles XKSAT = 0.13 %Rock = 0

DTHETA
========

Dry = 0.38 PSIF = 6.40
Normal = 0.21
Wet = 0.00

LAND USE
========

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.005	L.D.R.	100.	NORMAL	50	1	0.30		Min	0.04

0.005 = Total Area Avg. = 50 1% 0.300

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.21

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.19

IMPERVIOUS AREA: URBAN @ 100 % effective = 1
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 1

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB18	0.005	0.450	0.037	47.0	0.30	0.21	6.40	0.19	1

LOSS PARAMETERS FOR SUBBASIN: SB30

Soil Survey Used Aguila/Carefree

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
115	0.020	57.1	0.39	0
110	0.015	42.9	0.13	0

TOTAL = 0.035 Sq.Miles XKSAT = 0.24 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.90
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.009	VACANT	25.0	DRY	30	0	0.25		Low	0.07
0.002	GOLF CRS	5.6	NORMAL	80	0	0.25		Low	0.08
0.025	L.D.R.	69.4	NORMAL	50	15	0.30		Min	0.03
0.036 = Total Area			Avg. =	46	10%	0.280			

PERCENT OF SUBBASIN DRY = 25.0 %
NORMAL = 75.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.28

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.34

IMPERVIOUS AREA: URBAN @ 100 % effective = 10
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 10

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB30	0.035	0.520	0.040	33.0	0.28	0.28	4.90	0.34	10

LOSS PARAMETERS FOR SUBBASIN: SB42
=================

Soil Survey Used Aguila/Carefree

XKSAT
=======

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
101	0.009	4.9	0.28	0
110	0.018	9.9	0.13	0
115	0.155	85.2	0.39	0

TOTAL = 0.182 Sq.Miles XKSAT = 0.34 %Rock = 0

DTHETA
========

Dry = 0.35 PSIF = 4.30
Normal = 0.25
Wet = 0.00

LAND USE
========

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.031	H.D.R.	17.1	NORMAL	50	40	0.25		Min	0.03
0.015	VACANT	8.3	DRY	30	0	0.25		Low	0.07
0.010	INST PFC	5.5	NORMAL	50	55	0.15		Min	0.03
0.125	GOLF CRS	69.1	NORMAL	80	0	0.25		Low	0.05

0.181 = Total Area Avg. = 71 10% 0.240

PERCENT OF SUBBASIN DRY = 8.0 %
NORMAL = 92.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.26

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.57

IMPERVIOUS AREA: URBAN @ 100 % effective = 10
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 10

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB42	0.182	0.810	0.046	44.0	0.24	0.26	4.30	0.57	10

LOSS PARAMETERS FOR SUBBASIN: SB52

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAB	0.003	4.9	0.25	0
PNC	0.049	80.3	0.40	0
PNC	0.009	14.8	0.40	0

TOTAL = 0.061 Sq.Miles XKSAT = 0.39 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.00
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.053	VACANT	88.3	DRY	30	0	0.25		Low	0.06
0.001	L.I.C.	1.7	NORMAL	75	55	0.10		Min	0.04
0.006	M.D.R.	10.0	NORMAL	50	30	0.25		Min	0.04
0.060 = Total Area			Avg. =	32	4%	0.250			

PERCENT OF SUBBASIN DRY = 88.0 %
NORMAL = 12.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.34

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.49

IMPERVIOUS AREA: URBAN @ 100 % effective = 4
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 4

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB52	0.061	0.390	0.055	56.0	0.25	0.34	4.00	0.49	4

LOSS PARAMETERS FOR SUBBASIN: SB54

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAB	0.008	24.2	0.25	0
PNC	0.025	75.8	0.40	0

TOTAL = 0.033 Sq.Miles XKSAT = 0.36 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.20
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.002	L.I.C.	6.2	NORMAL	75	55	0.10		Min	0.04
0.014	H.D.R.	43.8	NORMAL	50	10	0.25		Min	0.03
0.011	LT.INDST	34.4	NORMAL	60	55	0.15		Min	0.03
0.001	M.D.R.	3.1	NORMAL	50	40	0.25		Min	0.04
0.004	INST.RLG	12.5	NORMAL	50	45	0.15		Min	0.04

0.032 = Total Area Avg. = 53 34% 0.190

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.53

IMPERVIOUS AREA: URBAN @ 100 % effective = 34
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 34

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB54	0.033	0.250	0.032	52.0	0.19	0.25	4.20	0.53	34

LOSS PARAMETERS FOR SUBBASIN: SB60

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.104	68.0	0.25	0
LAB	0.049	32.0	0.25	0

TOTAL = 0.153 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry =	0.35	PSIF =	4.80
Normal =	0.25		
Wet =	0.00		

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.024	GOLF CRS	15.7	NORMAL	80	0	0.25		Low	0.06
0.024	H.D.R.	15.7	NORMAL	50	20	0.25		Min	0.03
0.105	RV PARK	68.6	NORMAL	50	60	0.15		Min	0.03
0.153 = Total Area			Avg. =	58	44%	0.180			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.38

IMPERVIOUS AREA: URBAN @ 100 % effective = 44
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 44

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB60	0.153	0.570	0.031	44.0	0.18	0.25	4.80	0.38	44

LOSS PARAMETERS FOR SUBBASIN: SB62

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.040	55.6	0.25	0
LAB	0.005	6.9	0.25	0
PNC	0.027	37.5	0.40	0

TOTAL = 0.072 Sq.Miles XKSAT = 0.30 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.50
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.006	INST.RLG	8.3	NORMAL	50	60	0.15		Min	0.04
0.066	RV PARK	91.7	NORMAL	50	60	0.15		Min	0.03

0.072 = Total Area Avg. = 50 60% 0.150

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.43

IMPERVIOUS AREA: URBAN @ 100 % effective = 60
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 60

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB62	0.072	0.520	0.030	48.0	0.15	0.25	4.50	0.43	60

LOSS PARAMETERS FOR SUBBASIN: SB76

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.098	100.	0.25	0

TOTAL = 0.098 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.015	INST PFC	15.3	NORMAL	50	50	0.15		Min	0.03
0.027	VACANT	27.5	DRY	0	0	0.25		Low	0.06
0.023	L.I.C.	23.5	NORMAL	75	50	0.10		Min	0.03
0.033	CITRUS F	33.7	WET	85	0	0.50		Low	0.06

0.098 = Total Area Avg. = 51 19% 0.280

PERCENT OF SUBBASIN DRY = 28.0 %
NORMAL = 39.0 %
WET = 34.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.20

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 19
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 19

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB76	0.098	0.990	0.045	43.0	0.28	0.20	4.80	0.36	19

LOSS PARAMETERS FOR SUBBASIN: SB80

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.636	100.	0.25	0

TOTAL = 0.636 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.123	VACANT	19.3	DRY	0	0	0.25		Low	0.05
0.037	INST.PFC	5.8	NORMAL	50	80	0.15		Min	0.03
0.466	AIRPORT	73.3	DRY	0	25	0.15		Low	0.05
0.010	GEN.IND	1.6	DRY	60	55	0.15		Min	0.03

0.636 = Total Area Avg. = 1 24% 0.170

PERCENT OF SUBBASIN DRY = 94.0 %
NORMAL = 6.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.34

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.22

IMPERVIOUS AREA: URBAN @ 100 % effective = 24
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 24

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB80	0.636	1.090	0.043	27.0	0.17	0.34	4.80	0.22	24

LOSS PARAMETERS FOR SUBBASIN: SB84

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.197	100.	0.25	0

TOTAL = 0.197 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA [illegible]iles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.044	LT.INDST	22.3	DRY	60	55	0.15		Min	0.03
0.153	VACANT	77.7	DRY	0	0	0.25		Low	0.05
0.197 = Total Area			Avg. =	7	12%	0.230			

PERCENT OF SUBBASIN DRY = 100. %
NORMAL = 0.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.35

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.24

IMPERVIOUS AREA: URBAN @ 100 % effective = 12
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 12

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
S[illegible]	0.197	1.110	0.046	34.0	0.23	0.35	4.80	0.24	12

A-27

LOSS PARAMETERS FOR SUBBASIN: SB92

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.043	100.	0.25	0

TOTAL = 0.043 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.033	CITRUS F	78.6	WET	85	0	0.50		Low	0.06
0.009	LT INDST	21.4	DRY	60	20	0.15		Min	0.04

0.042 = Total Area Avg. = 81 4% 0.430

PERCENT OF SUBBASIN DRY = 21.0 %
NORMAL = 0.0 %
WET = 79.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.07

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.45

IMPERVIOUS AREA: URBAN @ 100 % effective = 4
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 4

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
	0.043	0.260	0.054	8.0	0.43	0.07	4.80	0.45	4

LOSS PARAMETERS FOR SUBBASIN: SB94
=================

Soil Survey Used Eastern County

XKSAT
=======

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.015	55.6	0.25	0
MV	0.012	44.4	0.25	0

TOTAL = 0.027 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA
========

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE
========

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.027	CITRUS F	100.	WET	85	0	0.50		Low	0.06

0.027 = Total Area Avg. = 85 0% 0.500

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.46

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
S[illegible]	0.027	0.360	0.063	8.0	0.50	0.00	4.80	0.46	0

LOSS PARAMETERS FOR SUBBASIN: SB97

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.211	86.1	0.25	0
MV	0.028	11.4	0.25	0
ES	0.006	2.4	0.25	0

TOTAL = 0.245 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.006	INST PFC	2.4	NORMAL	50	80	0.15		Min	0.04
0.239	VACANT	97.6	DRY	0	0	0.25		Low	0.05

0.245 = Total Area Avg. = 0 2% 0.250

PERCENT OF SUBBASIN DRY = 98.0 %
NORMAL = 2.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.35

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.22

IMPERVIOUS AREA: URBAN @ 100 % effective = 2
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 2

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB97	0.245	0.700	0.049	43.0	0.25	0.35	4.80	0.22	2

LOSS PARAMETERS FOR SUBBASIN: SB98
=================

Soil Survey Used Eastern County

XKSAT
=======

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
LAA	0.139	55.6	0.25	0
MV	0.111	44.4	0.25	0

TOTAL = 0.250 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA
========

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE
========

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.067	GEN.IND	26.9	DRY	60	20	0.15		Min	0.03
0.012	INST.PFC	4.8	NORMAL	50	80	0.15		Min	0.03
0.170	VACANT	68.3	DRY	0	0	0.25		Low	0.05

0.249 = Total Area Avg. = 15 9% 0.220

PERCENT OF SUBBASIN DRY = 95.0 %
NORMAL = 5.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.34

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.26

IMPERVIOUS AREA: URBAN @ 100 % effective = 9
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 9

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB98	0.250	0.680	0.042	38.0	0.22	0.34	4.80	0.26	9

LOSS PARAMETERS FOR SUBBASIN: SB102

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
MV	0.041	97.6	0.25	0
LAA	0.001	2.4	0.25	0

TOTAL = 0.042 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

[illegible]EA [illegible]q.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.042	M.D.R.	100.	NORMAL	50	30	0.25		Min	0.03

0.042 = Total Area Avg. = 50 30% 0.250

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 30
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 30

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
S[illegible]2	0.042	0.360	0.031	31.0	0.25	0.25	4.80	0.36	30

LOSS PARAMETERS FOR SUBBASIN: SB104

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
MV	0.055	100.	0.25	0

TOTAL = 0.055 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.055	L.D.R.	100.	NORMAL	50	15	0.30		Min	0.03
0.055 = Total Area			Avg. =	50	15%	0.300			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 15
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 15

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB104	0.055	0.430	0.030	28.0	0.30	0.25	4.80	0.36	15

LOSS PARAMETERS FOR SUBBASIN: SB106

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
MV	0.051	100.	0.25	0

TOTAL = 0.051 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.011	RV PARK	22.0	NORMAL	50	20	0.15		Min	0.03
0.038	L.D.R.	76.0	NORMAL	50	15	0.30		Min	0.03
0.001	VACANT	2.0	DRY	0	0	0.25		Min	0.04

0.050 = Total Area Avg. = 49 16% 0.270

PERCENT OF SUBBASIN DRY = 2.0 %
NORMAL = 98.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 16
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 16

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB106	0.051	0.350	0.031	29.0	0.27	0.25	4.80	0.36	16

LOSS PARAMETERS FOR SUBBASIN: SB114

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
MV	0.051	100.	0.25	0

TOTAL =   0.051 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.051	L.D.R.	100.	NORMAL	50	15	0.30		Min	0.03
0.051 = Total Area			Avg. =	50	15%	0.300			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 15
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 15

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB114	0.051	0.430	0.031	30.0	0.30	0.25	4.80	0.36	15

LOSS PARAMETERS FOR SUBBASIN: SB118

Soil Survey Used Eastern County

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
MV	0.043	100.	0.25	0

TOTAL = 0.043 Sq.Miles XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.008	PARK	18.6	NORMAL	80	0	0.25		Low	0.07
0.017	L.D.R.	39.5	NORMAL	50	15	0.30		Min	0.03
0.002	PWR STAT	4.7	DRY	0	1	0.25		Min	0.04
0.016	L.D.R.	37.2	NORMAL	50	15	0.30		Min	0.03
0.043 = Total Area			Avg. =	54	12%	0.290			

PERCENT OF SUBBASIN DRY = 5.0 %
NORMAL = 95.0 %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.37

IMPERVIOUS AREA: URBAN @ 100 % effective = 12
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 12

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
SB118	0.043	0.180	0.036	33.0	0.29	0.25	4.80	0.37	12

Summary of MCUHP1 Input Parameters
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Input File: EMF1.M1I
Output File: EMF1.M1O

SUBBASIN	AREA sq.miles	IA ins.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Tc	R
SB10	0.031	0.250	0.250	4.30	0.490	30.0	0.19	0.20
SB24	0.169	0.250	0.350	4.25	0.430	0.0	0.45	0.36
SB16	0.170	0.280	0.270	5.80	0.230	2.0	0.30	0.26
SB18	0.005	0.300	0.210	6.40	0.190	1.0	0.26	0.89
SB30	0.035	0.280	0.280	4.90	0.340	10.0	0.36	0.47
SB42	0.182	0.240	0.260	4.30	0.570	10.0	0.51	0.39
SB52	0.061	0.250	0.340	4.00	0.490	4.0	0.31	0.24
SB54	0.033	0.190	0.250	4.20	0.530	34.0	0.17	0.12
SB60	0.153	0.180	0.250	4.80	0.380	44.0	0.27	0.16
SB62	0.072	0.150	0.250	4.50	0.430	60.0	0.24	0.20
SB76	0.098	0.280	0.200	4.80	0.360	19.0	0.52	0.66
SB80	0.636	0.170	0.340	4.80	0.220	24.0	0.64	0.31
SB84	0.197	0.230	0.350	4.80	0.240	12.0	0.64	0.62
SB86	0.338	0.500	0.000	4.80	0.460	0.0	0.36	0.12
SB92	0.043	0.430	0.070	4.80	0.450	4.0	0.48	0.34
SB94	0.027	0.500	0.000	4.80	0.460	0.0	0.67	0.82
SB97	0.245	0.250	0.350	4.80	0.220	2.0	0.44	0.25
SB98	0.250	0.220	0.340	4.80	0.260	9.0	0.41	0.22
SB102	0.042	0.250	0.250	4.80	0.360	30.0	0.24	0.20
SB104	0.055	0.300	0.250	4.80	0.360	15.0	0.28	0.23
SB106	0.051	0.270	0.250	4.80	0.360	16.0	0.24	0.18
SB114	0.051	0.300	0.250	4.80	0.360	15.0	0.27	0.24
SB118	0.043	0.290	0.250	4.80	0.370	12.0	0.18	0.09

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UPPER EAST MARICOPA FLOODWAY Project 7158-03 Sht. ___ of ___
Calc. By PV Date 9/11/95
Chkd. ______ Date ______

RD RECORDS FOR ROUTED PIPE FLOW

Field (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
RD									
Chann. Length L (ft.)	Slope (ft/ft)	Chann. Roughness (n)	Not Used	SHAPE (TRAP, DEEP or CIRC.)	Chann. width or Dia. (ft)	Z sideslopes If Req.	Not Used	N/U	N/U
KK R011P									
RD 3060	0.0020	0.012	—	CIRC	2	—	—	—	—
KK R025P									
RD 1920	0.0141	0.012	—	CIRC	3	—	—	—	—
KK R035P									
RD 1920	0.0141	0.012	—	CIRC	3	—	—	—	—
KK R047P									
RD 5280	0.0103	0.012	—	CIRC	3.5	—	—	—	—
KK R071P									
RD 5280	0.0078	0.012	—	CIRC	4	—	—	—	—
KK R085									
RD 2340	0.0095	0.012	—	CIRC	5.5	—	—	—	—
KK R093P									
RD 4800	0.0020	0.012	—	CIRC	7	—	—	—	—

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Upper East Maricopa Floodway — Project 7158-03 — Sht. __ of __

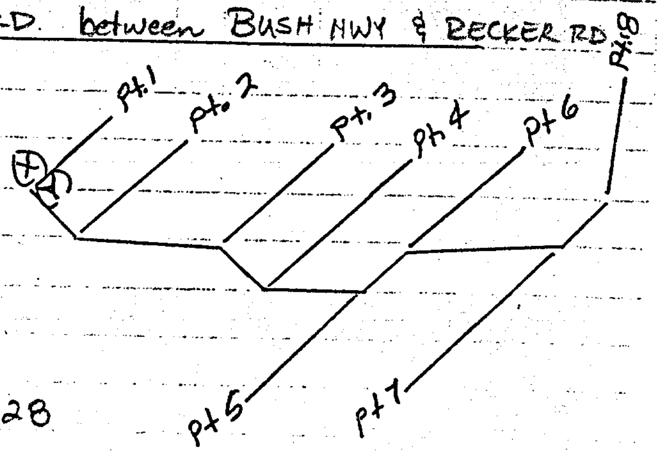
Calc. By PV — Date 9/11/95

Chkd. ____ Date ____

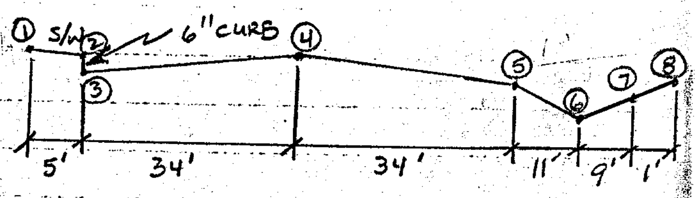
Modified Puls (Normal-Depth) Channel Routing Data

Location: ALONG McKELLIPS RD. between BUSH HWY & RECKER RD.

HEC-1 Routing I.D: R027I



$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{1920'}{5\,fps}}{5\,min \times 60s/min} = 1.28$$



WE USED NSTPS OF 1

Δt check ok !

(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 1	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC0.035	ANCH 0.015	ANR 0.035	RLNTH 1920	SEL 0.0141	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 5	X(3) 5	X(4) 39	X(5) 73	X(6) 84	X(7) 93	X(8) 94		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 100.84	Y(2) 100.76	Y(3) 100.26	Y(4) 101.16	Y(5) 100.68	Y(6) 98.82	Y(7) 100.10	Y(8) 100.24	-	

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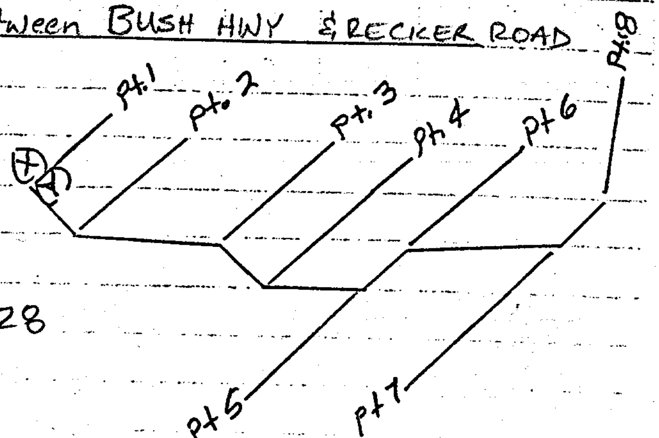
UPPER EAST MARICOPA FLOODWAY — Project 7158-03 — Sht. ___ of ___
Calc. By PV — Date 9/11/95
Chkd. ________ Date ________

Modified Puls (Normal-Depth) Channel Routing Data

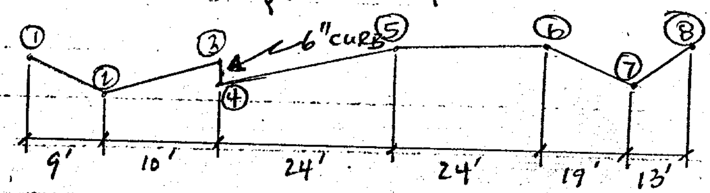
Location: ALONG McKELLIPS RD between BUSH HWY & RECKER ROAD

HEC-1 Routing I.D: R039I



$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{1920}{5\,fps}}{5\,min \times 60s/min} = 1.28$$

WE USED NSTPS OF 2



$$\Delta t_{COMPUTER} = \frac{(12.33m - 12.17m) \times 60s/min}{5}$$

$= 1.92 \approx 2$

Δt check ok!

(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 2	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .035	ANCH .015	ANR .035	RLNTH 1920	SEL .0182	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 9	X(3) 19	X(4) 19	X(5) 43	X(6) 67	X(7) 86	X(8) 99		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 98.51	Y(2) 97.34	Y(3) 97.98	Y(4) 97.48	Y(5) 98.44	Y(6) 98.54	Y(7) 97.80	Y(8) 99.55	-	

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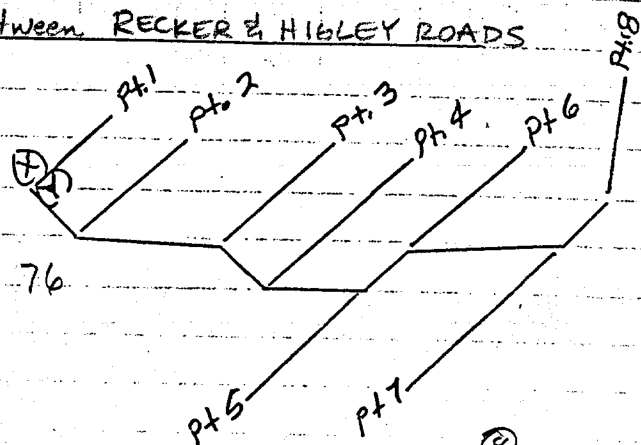
UPPER EAST MARICOPA FLOODWAY — Project 7158-03 — Sht. ___ of ___
Calc. By PV — Date 9/11/95
Chkd. ___ — Date ___

Modified Puls (Normal-Depth) Channel Routing Data

Location: ALONG McKELLIPS RD between RECKER & HIGLEY ROADS

HEC-1 Routing I.D: RO49I



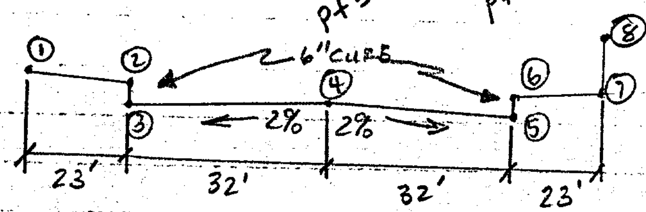
$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{2640}{5fps}}{5min \times 60s/1min} = 1.76$$

WE USED NSTPS OF 1

$$\Delta t_{COMPUTER} = \frac{(12.42-12.33) \times 60sec/min}{5}$$

$$= 1.08 \approx 1$$

Δt check ok!



(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 1	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .035	ANCH .015	ANR .035	RLNTH 2640	SEL 0.010	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 23	X(3) 23	X(4) 55	X(5) 87	X(6) 87	X(7) 110	X(8) 110		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 1.5	Y(2) .5	Y(3) 0	Y(4) .64	Y(5) 0	Y(6) .5	Y(7) .96	Y(8) 1.5	-	

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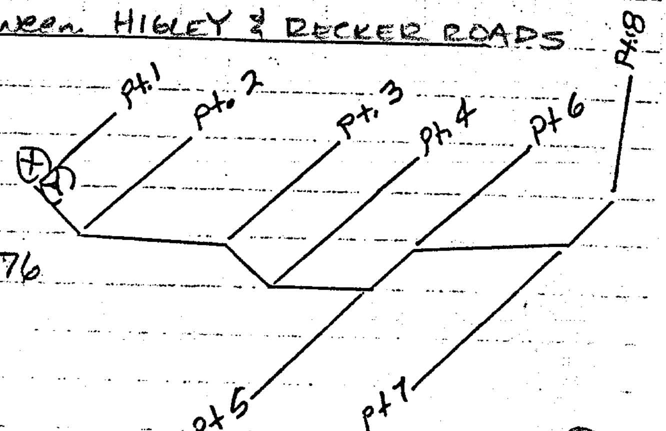
UPPER EAST MARICOPA FLOODWAY Project 7158-03 Sht. ___ of ___
Calc. By PV Date 9/11/95
Chkd. ______ Date ______

Modified Puls (Normal-Depth) channel Routing Data

Location: ALONG McKELLIPS RD between HIGLEY & RECKER ROADS

HEC-1 Routing I.D: R0575



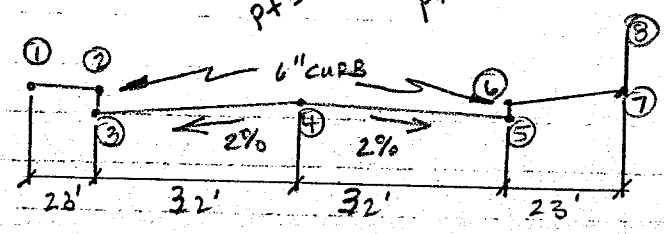
$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{2640}{5\,fps}}{5\,min \times 60\,sec/1\,min} = 1.76$$

WE USED NSTPS OF 1

$$\Delta t_{computer} = \frac{(12.50 - 12.42)\,min \times 60\,sec/min}{5}$$

$$= .96 \approx 1$$

Δt check ok!



(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 1	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .035	ANCH .015	ANR .035	RLNTH 2640	SEL .010	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 23	X(3) 23	X(4) 55	X(5) 87	X(6) 87	X(7) 110	X(8) 110		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 1.5	Y(2) .5	Y(3) 0	Y(4) .64	Y(5) 0	Y(6) .5	Y(7) .96	Y(8) 1.5	-	

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UPPER EAST MARICOPA FLOODWAY Project 7158-03 Sht.___ of ___
Calc. By PV Date 9/11/95
Chkd. ___ Date ___

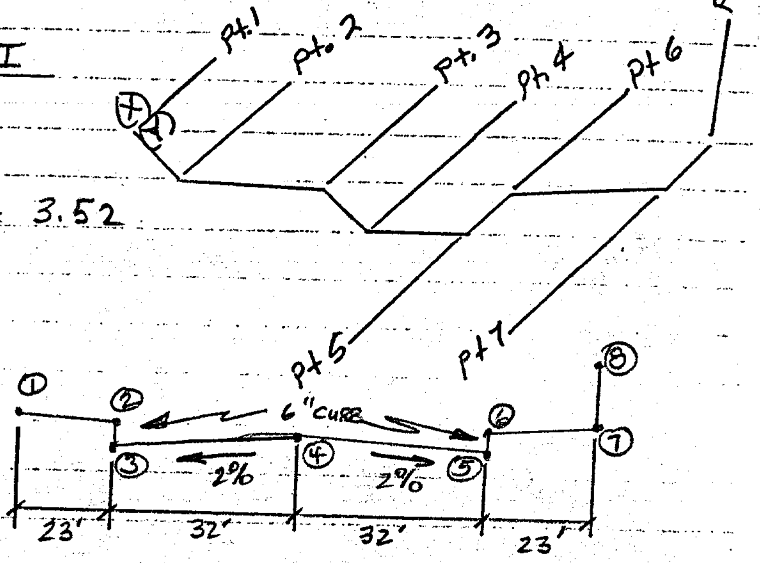
Modified Puls (Normal-Depth) Channel Routing Data

Location: ALONG MCKELLIPS ROAD BETWEEN HIGLEY & GREENFIELD RDS.

HEC-1 Routing I.D: RO73I

$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{5280}{5 fps}}{5 min \times \frac{60 sec}{1 min}} = 3.52$$

WE USED NSTPS OF 4
Δt check ok!

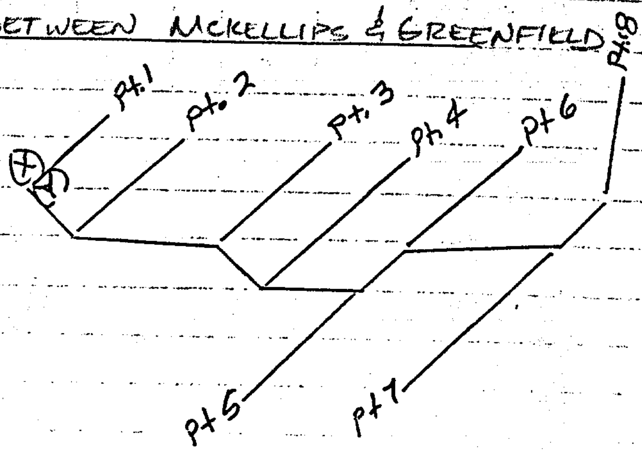


(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 4	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .035	ANCH .015	ANR .035	RLNTH 5280	SEL .0078	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 23	X(3) 23	X(4) 55	X(5) 87	X(6) 87	X(7) 110	X(8) 110		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 1.5	Y(2) .5	Y(3) 0	Y(4) .64	Y(5) 0	Y(6) .5	Y(7) .96	Y(8) 1.5	-	

Modified Puls (Normal-Depth) Channel Routing Data

Location: ALONG RWCD CANAL BETWEEN MCKELLIPS & GREENFIELD

HEC-1 Routing I.D.: RO 935



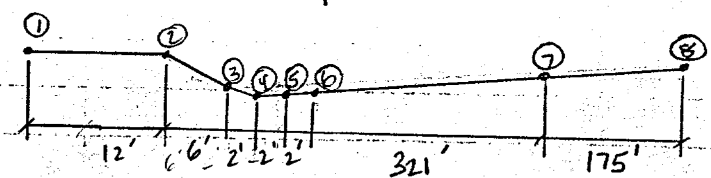
$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{1380}{1 \text{ fps}}}{5\text{min} \times \frac{60\text{sec}}{1\text{min}}} = 4.60$$

WE USED NSTPS OF 7

$$\Delta t \text{ computer} = \frac{(13.00 - 12.42)\text{ min} \times 60\text{sec/min}}{5}$$

$$= 6.96 \approx 7$$

∴ Δt check ok!



(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 7	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .060	ANCH .060	ANR .060	RLNTH 1380	SEL .0007	ELMAX				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 12	X(3) 18	X(4) 20	X(5) 22	X(6) 24	X(7) 335	X(8) 510		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 51	Y(2) 51	Y(3) 48.5	Y(4) 48	Y(5) 48	Y(6) 48.5	Y(7) 50	Y(8) 51	-	

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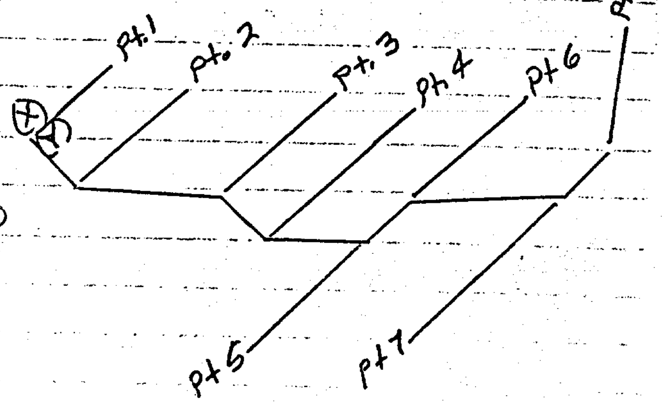
UPPER EAST MARICOPA FLOODWAY | Project 7158-03 | Sht. ___ of ___
Calc. By RV | Date 9/11/95
Chkd. ___ | Date ___

Modified Puls (Normal-Depth) Channel Routing Data

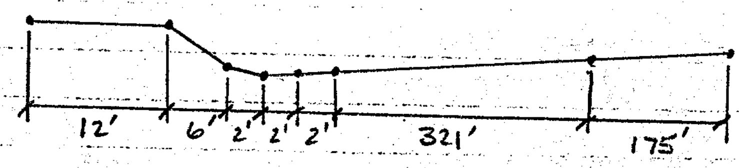
Location: ALONG RWCD CANAL BETWEEN McKELLIPS & GREENFIELD

HEC-1 Routing I.D.: R0955



$$NSTPS = \frac{RLNTH / V_{AVE}}{\Delta t} = \frac{2160 / 7 fps}{5 min \times \frac{60 sec}{1 min}} = 7.20$$

WE USED NSTPS OF 8



$$\Delta t_{computer} = \frac{(13.67 m - 13.00 m) \times 60 sec/m}{5}$$

$= 8.04 \approx 8$

Δt check ok!

(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL –	CLOSS –	PERCRT –	ELVINV –						
RS Record - Storage Routing									
NSTPS RS 8	ITYP FLOW	RSVRIC -1	X –						
RC Record - Normal Depth Channel Routing									
ANL RC .06	ANCH .060	ANR .060	RLNTH 2160	SEL .0012	ELMAX –				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 12	X(3) 18	X(4) 20	X(5) 22	X(6) 24	X(7) 335	X(8) 510		
RY Record - Cross-Section Y Coordinates									
Y(1) RY 51	Y(2) 51	Y(3) 48.5	Y(4) 48	Y(5) 48	Y(6) 48.5	Y(7) 50	Y(8) 51	-	

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UPPER EAST MARICOPA FLOODWAY

Project 7158-03 Sht. ___ of ___

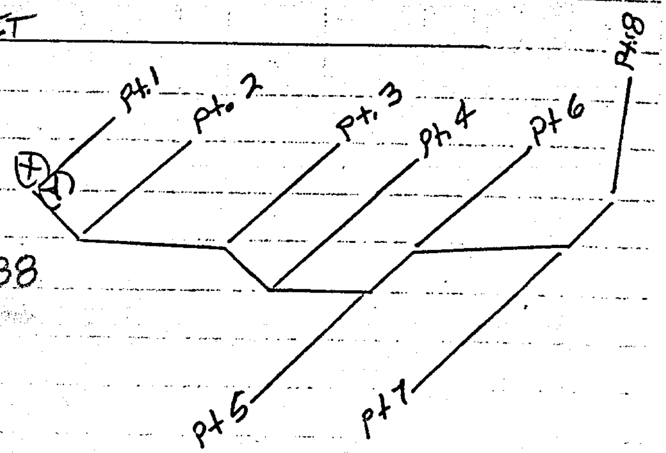
Calc. By PV Date 9/11/95

Chkd. ___ Date ___

Modified Puls (Normal-Depth) Channel Routing Data

Location: ALONG IVY/48TH STREET

HEC-1 Routing I.D: R097.1



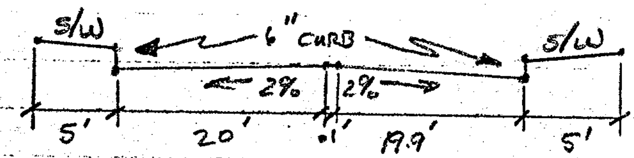
$$NSTPS = \frac{\frac{RLNTH}{VAVE}}{\Delta t} = \frac{\frac{4320}{5fps}}{5min \times \frac{60sec}{1min}} = 2.88$$

WE USED NSTPS OF 2

$$\Delta t_{computer} = \frac{(12.42m - 12.25m) \cdot 60sec/min}{5}$$

$= 2.04 \approx 2$

Δt check ok!



(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 2	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .035	ANCH .015	ANR .035	RLNTH 4320	SEL .0053	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 5	X(3) 5	X(4) 25	X(5) 25.1	X(6) 45	X(7) 45	X(8) 50		
RY Record - Cross-Section Y coordinates									
Y(1) RY .575	Y(2) .5	Y(3) 0	Y(4) .40	Y(5) .40	Y(6) 0	Y(7) .5	Y(8) .575	-	

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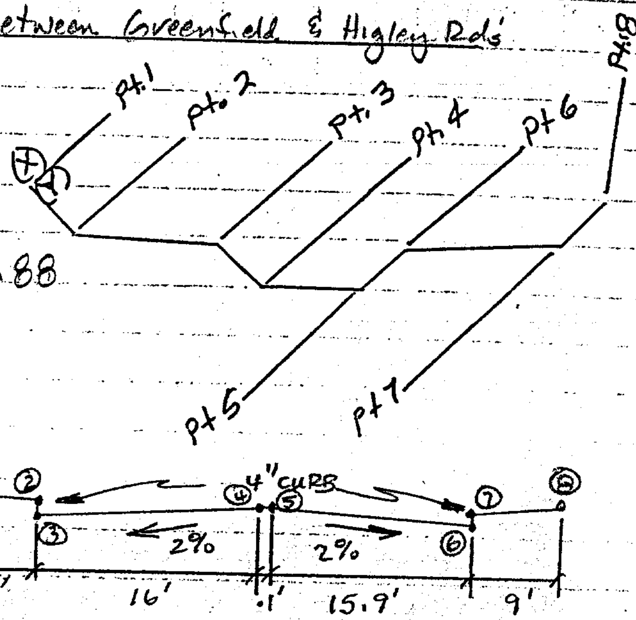
UPPER EAST MARICOPA FLOODWAY | Project 7158-03 | Sht. ___ of ___
Calc. By PV | Date 9/11/95
Chkd. ______ | Date ______

Modified Puls (Normal-Depth) Channel Routing Data

Location: ALONG McLellan Rd between Greenfield & Higley Rd's

HEC-1 Routing I.D: RO107A



$$NSTPS = \frac{\frac{RLNTH}{V_{AVE}}}{\Delta t} = \frac{\frac{1320}{5\ fps}}{5\,min \times \frac{60\,sec}{1\,min}} = 0.88$$

WE USED NSTPS OF 1
Δt check ok!

(Field) 1	2	3	4	5	6	7	8	9	10
RL Record - Channel Loss									
QLOSS RL —	CLOSS —	PERCRT —	ELVINV —						
RS Record - Storage Routing									
NSTPS RS 1	ITYP FLOW	RSVRIC -1	X —						
RC Record - Normal Depth Channel Routing									
ANL RC .035	ANCH .015	ANR .035	RLNTH 1320	SEL .0076	ELMAX —				
RX Record - Cross-Section X Coordinates									
X(1) RX 0	X(2) 9	X(3) 9	X(4) 25	X(5) 25.1	X(6) 41	X(7) 41	X(8) 50		
RY Record - Cross-Section Y Coordinates									
Y(1) RY .80	Y(2) .33	Y(3) Ø	Y(4) .32	Y(5) .32	Y(6) Ø	Y(7) .33	Y(8) .80	-	

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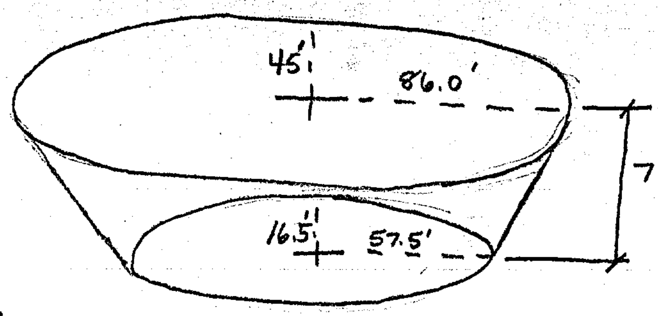
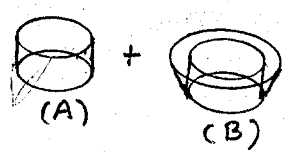
Upper East Maricopa Floodplain — Project 7158-03 — Sht. ___ of ___
64TH Street Basin Between — Calc. By PV — Date 9/11/95
McKellips and Hermosa Vista Rds. — Chkd. ___ — Date ___

R017 RETENTION BASIN VOLUME CALCULATION

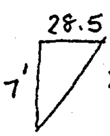


ELLIPTICAL SHAPE

VOLUME = 

(A) ELLIPSE AREA = $\pi ab = \pi(16.5)(57.5) = 2980.6$

ELLIPSE VOLUME = AREA × h = $2980.6^{sf} \times 7' = 20,864$ cf.

(B) 

× ELLIPSE PERIMETER = VOLUME

TRIANGLE AREA = $\frac{1}{2}bh = \frac{1}{2}(7)(28.5) = 99.75$ sf

PERIMETER = $\pi(a+b)\dfrac{64-3\left(\frac{b-a}{b+a}\right)}{64-16\left(\frac{b-a}{b+a}\right)^2}$

$= \pi(57.5+16.5)\dfrac{64-3\left(\frac{41}{74}\right)}{64-16\left(\frac{41}{74}\right)^2}$

= 245.3 f

VOLUME = 245.3 f × 99.75 = 24,465 cf

TOTAL VOLUME = 20,864 + 24,465 = 41,329 cf

= 0.949 acre ft

@ 7' DEPTH

AVERAGE VOLUME / DEPTH ESTIMATES FOR 10 BASINS ROUTED THROUGH R051

BASIN #	VOLUME (AC-FT)	DEPTH (FT)	% VOLUME	WEIGHTED DEPTH CONTRIBUTION
1	0.0446	2.4	2.1	0.050
2	0.0835	2.0	3.9	0.078
3	0.5705	4.0	26.9	1.076
4	0.1492	6.0	7.0	0.420
5	0.0296	2.5	1.4	0.035
6	0.2033	2.0	9.6	0.192
7	0.2687	3.0	12.7	0.381
8	0.0666	2.5	3.1	0.0775
9	0.0936	2.0	4.4	0.088
10	0.6099	4.0	28.8	1.152
Σ	2.1195 acre ft.			3.55'

AN WEST INC.
Consulting Engineers
Richmond, California
San Jose, California
Phoenix, Arizona

EMF - FIS STUDY

Project 7158-03 Sht. ___ of ___
Calc. By PV Date 9/5/95
Chkd. ___ Date ___

PLANIMETER READINGS & VOLUME CALCULATIONS FOR RETENTION BASIN AS ROUTED THROUGH RO 64.

ELEVATION (FT)	PLANIM. READING (in²)	AREA (ACRE)	AVE. AREA	DEPTH (FT)	VOLUME (AC-FT)	ACCUM VOL (AC-FT)
MCKELLIPS / HIGLEY BASIN						
98.63	∅	∅	∅	∅	∅	∅
99.00	10.122	0.0929	0.0465	0.37	0.0172	0.0172
100.00	25.141	0.2309	0.1619	1	0.1619	0.1791
101.00	33.961	0.3119	0.2714	1	0.2714	0.4505 ←
MCKELLIPS BASIN						
105.96	∅	∅	∅	∅	∅	∅
106.00	18.693	0.1717	0.0859	0.04	0.0034	0.0034
107.00	42.517	0.3904	0.2811	1	0.2811	0.2845
108.00	53.320	0.4896	0.4400	1	0.4400	0.7245
109.00	63.519	0.5833	0.5365	1	0.5365	1.2610 ←

AVERAGE VOLUME/DEPTH ESTIMATE THAT WILL BE ROUTED ALONG MCKELLIPS ROAD

VOLUME (AC-FT)	DEPTH (FT)	%VOLUME	WEIGHTED DEPTH CONTRIB.
0.4505	2.37	0.263	0.6233
1.2610	3.04	0.737	2.2405

Σ 1.7115 acre ft 2.86'

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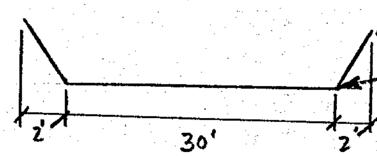
EMF - FIS STUDY

Project 7158-03 Sht.__ of__
Calc. By PV Date 9/5/95
Chkd. __ Date __

PLANIMETER READINGS & VOLUME CALCULATIONS FOR DETENTION BASIN NEAR FALCON FIELD R083

ELEVATION (FT)	PLANIM. READ. (IN^2)	AREA (ACRE)	AVE. AREA	DEPTH (FT)	VOLUME (AC-FT)	ACCUM. VOL (AC-FT)
1358.0	0	0	0	0	0	0
1359.0	139.19	11.50	5.75	1	5.75	5.75
1360.0	196.05	16.20	13.85	1	13.85	19.60
1361.0	219.08	18.11	17.16	1	17.16	36.76
1362.0	247.23	20.43	19.27	1	19.27	56.03

DETENTION BASIN SPILLWAY FLOW CALCULATION.



*FOR BROAD CRESTED WEIRS WITH CREST INCLINED SLIGHTLY DOWNWARD, C FROM EQUATION $Q_{WEIR} = CL(H)^{3/2}$ IS EQUAL TO 2.9 FROM TABLE 5-5(a) IN BRATER & KING'S 6th EDITION BOOK, "HANDBOOK OF HYDRAULICS" PUBLISHED BY MCGRAW-HILL IN 1976.

FOR ELEV = 1361.59
$L = 30'$, $H = 0'$, $Q = 0$

FOR ELEV = 1362.0
$L = 30.82'$, $H = 0.41'$, $Q = 8.11$ cfs

FOR ELEV = 1362.5
$L = 31.82'$, $H = 0.91$, $Q = 27.62$ cfs

PROJECT: UEMF STUDY
A-N-WEST INC. No. 7158-03

FALCON FIELD INVERT PIPE FOR OUTFLOW OF RETENTION BASIN

DESIGNER: RJ

DATE: 9/8/95

HYDROLOGIC AND CHANNEL INFORMATION

12" DIAMETER PIPE AT INVERT OF FALCON FIELD RETENTION BASIN. SOLVING FOR FLOW, GIVEN, THE HEADWATER AND DIAMETER OF PIPE. FOR Q OF RO 83

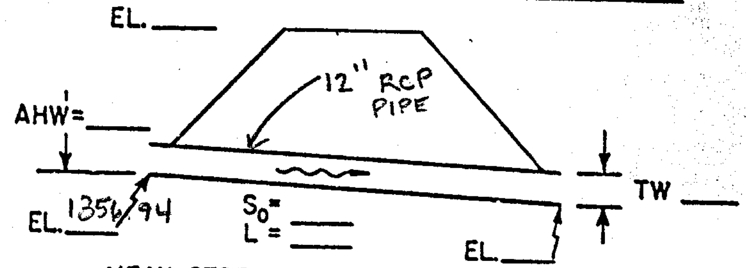
Q_1 = ______ TW_1 = ______

Q_2 = ______ TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : ______

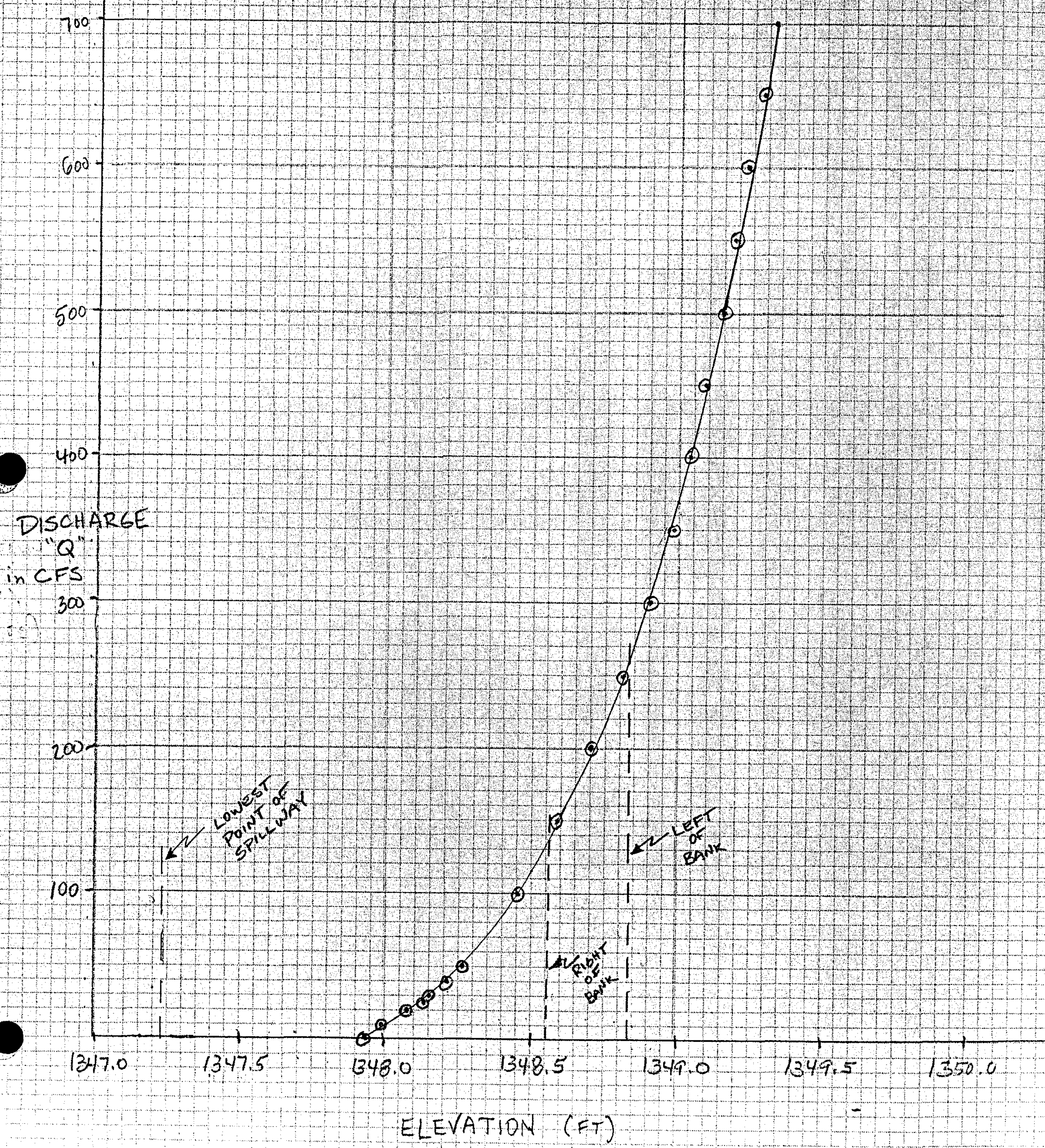


MEAN STREAM VELOCITY= ______
MAX. STREAM VELOCITY= ______

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q CFS	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	HW FT	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
SQUARE EDGE	2.5	12"	1.06	1.06												@ ELEV = 1358
SQUARE EDGE	5.0		2.06	2.06												1359
SQUARE EDGE	6.4		3.06	3.06												1360
SQUARE EDGE	7.7		4.06	4.06												1361
SQUARE EDGE	8.6		5.06	5.06												1362
SQUARE EDGE	9.5		6.06	6.06												1363

SUMMARY & RECOMMENDATIONS:

DISCHARGE VS ELEVATION CURVE FOR PRINCESS
DRIVE BASIN AT RIVER MILE 21.546
DATUM POINTS FROM HEC-2 ANALYSIS



STORAGE POND

JOB № 7158-03

LOCATION: Princess Rd Detention Basin

43,560 sf = 1 acre

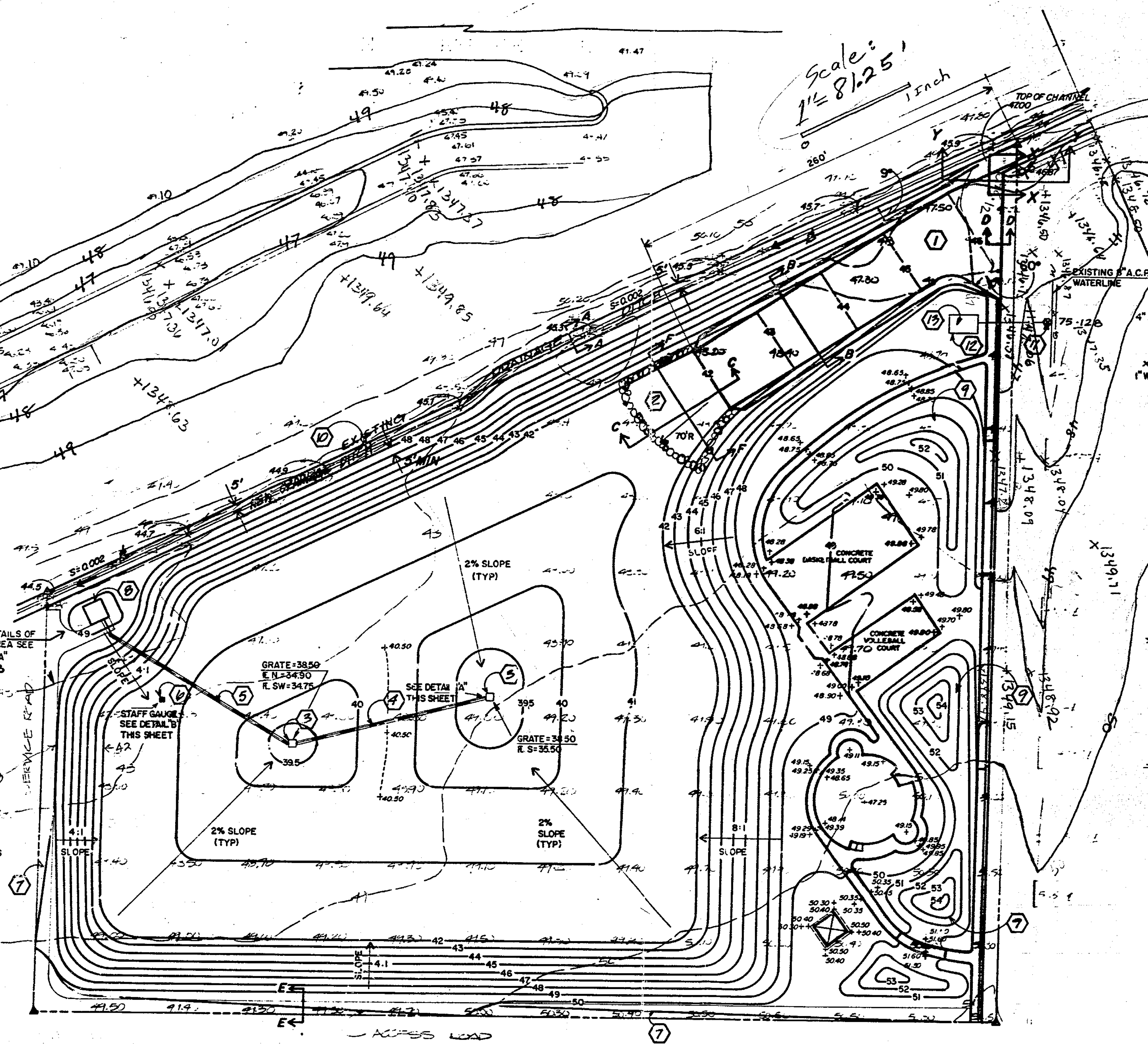
ELEVATION	PLANIMETER READING	SQ.IN.	AREA. ACRES	AVE. AREA.	DEPTH FT.	VOLUME AcFt.	ACCUM. VOL. AcFt
1338.5	Ø	Ø	Ø	Ø	Ø	Ø	Ø
1339.5	0.40300 R 0.10850 L	0.5115	0.0775	0.039	1	0.039	0.039
1340	1.81350 R 0.72850 L	2.542	0.385	0.231	0.5	0.116	0.155
1341	9.17602	→	1.391	0.888	1	0.888	1.043
1342	17.93354	→	2.718	2.055	1	2.055	3.098
1343	19.68504	→	2.983	2.851	1	2.851	5.949
1344	21.46754	→	3.253	3.118	1	3.118	9.067
1345	23.21905	→	3.519	3.386	1	3.386	12.453
1346	25.38905	→	3.848	3.684	1	3.684	16.137
1347	27.17156	→	4.118	3.983	1	3.983	20.120
1348	29.48106	→	4.468	4.293	1	4.293	24.413
ADDIT. AREAS							
1346	Ø	Ø	Ø	Ø	Ø	Ø	Ø
1347	0.0072118 0.016684	0.024	0.0036	0.0018	1	0.0018	0.0018
1348	0.0152847 0.0517744	0.067	0.0102	0.0069	1	0.0069	0.0087
1349	0.0238958 0.0798682	0.1038	0.0157	0.0130	1	0.0130	0.0217
ADJ.							
1346	25.38915	→	3.848	3.684	1	3.684	16.137
1347	27.1954558	→	4.1215	3.985	1	3.985	20.122
1348	29.54 0 11 91	→	4.4730	4.300	1	4.300	24.422
1349	0.103764	→	0.0157	2.247	1	2.247	26.669

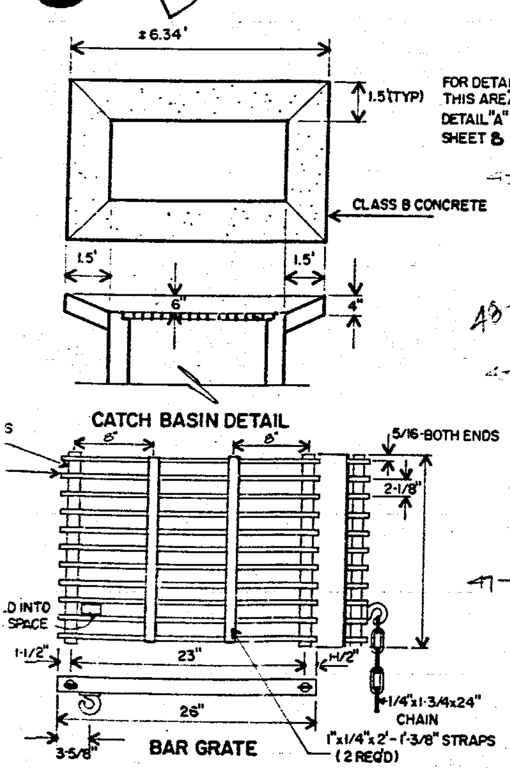
1. INSTALL 13,684 S.F. GUNITE SPILLWAY PER SECTION.
2. INSTALL 590 S.Y. RIPRAP PER M.A.G. DETAIL 555 (TYPE 2).
3. INSTALL CATCH BASIN PER DETAIL 537 WITH 4-INCH THICK CONCRETE PAD AROUND CATCH BASIN. WARP TO GRADE ELEVATION PER DETAIL A, THIS SHEET. NOTE MODIFY GRATE PER DETAIL A, THIS SHEET.
4. INSTALL 135 L.F. OF 18-INCH R.G.R.C.P. (CLASS III) SLOPE = .008.
5. INSTALL 155 L.F. OF 24-INCH R.G.R.C.P. (CLASS III) SLOPE = .008.

INSTALL STAFF GAUGE PER DETAIL SHEET 8 THIS SHEET.

INSTALL 1,065 S.Y. OF 4-INCH CRUSHED GRANITE ROADWAY ON SPECIAL ENGINEERING FABRIC. SEE SPECIAL PROVISIONS AND SECTION E-E, SHEET 10.

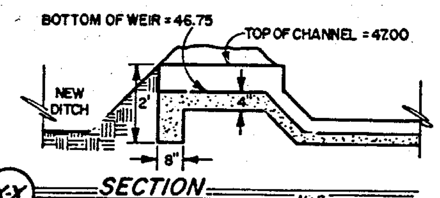
8. REFER TO DETAIL "A" SHEET 8 FOR GRADING AT PUMP STATION.
9. USE 1,170 C.Y. OF CLEAN ONSITE MATERIAL AS FILL TO SHAPE THE MOUNDS TO DESIGN CONTOURS.
10. REGRADE DRAINAGE DITCH PER SECTION A-A, SHEET 10 AT THE SAME ALIGNMENT (NO-PAY-ITEM).
11. INSTALL 4-INCH TAP SLEEVE AND VALVE PER M.A.G. DETAIL 340. CONNECT TO EXISTING 8-INCH A.C.P. WATER LINE. A.B.C. IS REQUIRED AS BACKFILL IN THE TRENCH UNDERNEATH THE STREET.
12. INSTALL STANDARD WATER METER VAULT AS PER CITY OF MESA DETAIL M-30-1 AND M-30-2.
13. INSTALL 3-INCH COMPOUND WATER METER AS PER CITY OF MESA DETAIL M-28.1 AND M-28.2.





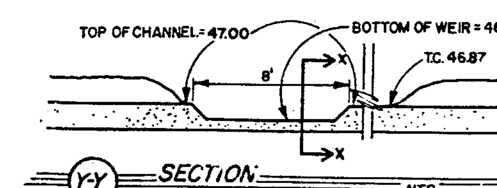
DETAIL — N.T.S.

NOTE: CHAIN ATTACHES TO WALL PER DETAIL 537



X-X SECTION N.T.S.

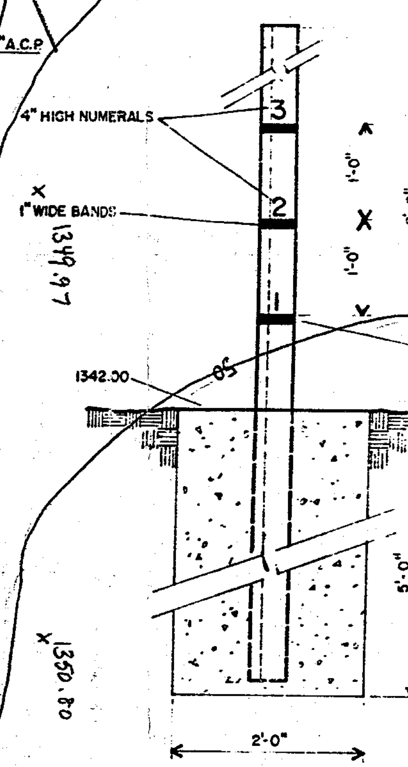
NOTE: SECTIONS A-A THRU F-F ARE LOCATED ON SHEET NO. 10
SECTIONS X-X & Y-Y ARE ON THIS SHEET.



Y-Y SECTION N.T.S.

LEGEND

49 — NEW CONTOUR LINE
EXISTING CONTOUR LINE
+49.30 NEW SPOT ELEVATION
EXISTING SPOT ELEVATION



1. PLACE STAFF GAUGE WHERE IT CAN BE READ FROM SERVICE ROAD. PLACE IN SW CORNER OF BASIN AS DIRECTED BY CITY INSPECTOR.
2. STAFF GAUGE SHALL BE PAINTED WITH 2 FIELD COATS OF WHITE ENAMEL AND BLACK ENAMEL FOR THE NUMBERS.
3. USE 3"x3" 3/8 ANGLE IRON

THE FIRST LINE SHALL BE AT ELEVATION 1343.00 AND SUCCEEDING MARKS AT 12" EVEN INTERVALS ALL THE WAY TO THE TOP

B/7 STAFF GAUGE DETAIL N.T.S.

NOTE: ALL GRADES AT PROPERTY LINE SHALL FLUSH-OUT WITH ADJACENT PROPERTY.

AS-BUILT

By S. MINCHIELLO Date

NOTE: HAUL ROUTES, DISPOSAL SITE, AND WORK HOURS; SEE SPECIAL PROVISIONS NO.35

FLD. BK. NO. 1067	Keith D. Neal 3-?-85	GRADING PLAN
W.O. NO. 2764		
PROJ. NO. 84-33		
DATE: 3-19-84	DRAWN BY / ENGINEER L. BROUGHTON / APPROVED BY K. NASH	SHEET 7 OF 16 — A28575

A-55

THIS RUN EXECUTED 20JUN80 11:13:45

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

T1 UPPER EMF FIS STUDY FCDMC NO. 94-26 FILE: UEMF10
T2 RWCD CANAL RIVER MILE 21.529 TO 21.546 BY A-N WEST, INC. PHX,AZ
T3 RATING CURVE ANALYSIS

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		2			.0001				1348	

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

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

38	43	1	53	21	22	54	51	4	8
42	5	26							

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

-10 -10

NC	0.028	0.028	0.06	.1	.3				
QT	7	50	100	150	200	250	300	350	
ET		9.1	9.1	9.1	9.1	9.1	9.1	9.1	793	1055

THIS HEC-2 MODEL COMPUTES RATING CURVE OF DISCHARGE OVER PRINCESS
DR. RETENTION BASINS OVERFLOW SPILLWAY EMBANKMENT VERSUS ELEVATION
FOR INPUT TO HEC-1 HYDROLOGY ANALYSIS.
THESE SAME CROSS-SECTIONS ARE PROPOSED TO BEUSED IN THE HEC-2
MODEL FLOODPLAIN ANALYSIS TO ASSURE COMPATABLE RESULTS.
****
CROSS-SECTION I.D. NO'S. ARE IN RIVER MILES INCREASING UPSTREAM
ALONG EAST MESA FLOODWAY(RWCD CANAL) FROM INTERSECTION WITH S.R.87
NEAR GILA RIVER FLOODPLAIN
CROSS-SECTIONS CODED FROM LEFT TO RIGHT LOOKING DOWNSTREAM WITH
STATION 1000 AT HYDRAULIC BASELINE.
CROSS-SECTIONS BASED ON FIELD SURVEY BY A-N WEST IN JULYAND AUG.,1995
SECTION 21.529 IS IN CHANNEL, 35 FT. DOWNSTREAM OF 84"STORM DRAIN
HEADWALL AND PERPENDICULAR TO CHANNEL FLOWLINE.

X1	21.529	9	960	1055	0	0	0			
GR	1355.4	778	1349.4	778.1	1348.8	810	1348.4	872	1346.0	960
GR	1339.0	980	1338.75	1000	1339.0	1020	1348.0	1055		

```
NC   0.028    0.028    0.028       .3        .5
ET               9.1      9.1      9.1      9.1       9.1       9.1       9.1       778      1074
      SECTIONS 21.539 THRU 21.546 MODEL THE 35+/- FT WIDE TOP OF BERM
      THE OVERFLOW SPILLWAY EMBANKMENT OF THE PRINCESS DR. BASIN.
X1   21.539       11      860     1061       20        80        52
GR   1355.4      763   1349.4    763.1   1348.8       795   1348.48       860   1348.59       910
GR   1347.3      976  1347.54     1000  1348.28      1025    1349.3      1061    1349.3      1074
GR   1349.8     1074

ET               9.1      9.1      9.1      9.1       9.1       9.1       9.1       781      1102
      SECTION 21.544 IS ALONG A CONCRETE CURB APPROX. FLUSH WITH AND ALONG
      THE TOP OF THE EMBANKMENT.
X1   21.544        9      867     1074       21        21        21
GR   1355.4      754  1349.39    754.1  1348.79       786   1348.27       867   1347.74       945
GR   1347.9      976  1348.27      989   1349.8      1074   1351.01      1102

      SECTION 21.546 IS ALONG THE NORTH TOP OF BANK OF THE BASIN
      A 6 FT.HIGH BLOCK WALL FORMS THE WEST EDGE OF SECTION 21.546
      THE EFFECTIVE AREA ENCROACHMENT OPTION WAS USED TO BLOCK OUT
      FLOW AT A 30 DEGREE FLARE ANGLE DOWNSTREAM OF SECTION 21.546
      AT SECTIONS 21.539-21.544.
X1   21.546        9      864     1060       10        10        10
GR   1354.8      782   1348.8    782.1  1348.56       864   1348.45       897   1347.23       940
GR   1347.4      972  1348.81     1020  1348.84      1060    1350.4      1081
```

THIS RUN EXECUTED 20JUN80 11:13:46

****
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

ATING CURVE ANALYSIS

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
	21.529	50.00	1341.43	973.07	960.00	1055.00	1029.43	.00	56.36	2.68	1338.75	1.00	.41
	21.529	100.00	1342.64	969.60	960.00	1055.00	1034.16	.00	64.57	3.89	1338.75	1.00	.51
	21.529	150.00	1343.59	966.87	960.00	1055.00	1037.87	.00	71.00	4.84	1338.75	.99	.58
	21.529	200.00	1344.37	964.66	960.00	1055.00	1040.88	.00	76.22	5.62	1338.75	1.00	.63
	21.529	250.00	1345.08	962.63	960.00	1055.00	1043.64	.00	81.02	6.33	1338.75	.99	.67
	21.529	300.00	1345.68	960.92	960.00	1055.00	1045.98	.00	85.06	6.93	1338.75	1.00	.71
	21.529	350.00	1346.23	951.70	960.00	1055.00	1048.10	.00	96.40	7.48	1338.75	1.00	.74
*	21.539	50.00	1347.80	950.67	860.00	1061.00	1008.62	6.37	57.94	.49	1347.30	178.83	3.05
*	21.539	100.00	1347.97	941.47	860.00	1061.00	1014.69	5.33	73.23	.67	1347.30	160.01	3.55
*	21.539	150.00	1348.11	934.59	860.00	1061.00	1019.23	4.51	84.64	.81	1347.30	150.49	3.87
*	21.539	200.00	1348.22	928.94	860.00	1061.00	1022.96	3.85	94.02	.92	1347.30	144.64	4.11
*	21.539	250.00	1348.31	924.14	860.00	1061.00	1026.18	3.23	102.04	1.01	1347.30	141.48	4.32
*	21.539	300.00	1348.39	920.03	860.00	1061.00	1029.02	2.71	108.99	1.09	1347.30	141.00	4.52
*	21.539	350.00	1348.52	852.32	860.00	1061.00	1033.39	2.29	144.59	1.22	1347.30	134.54	4.33
	21.544	50.00	1348.16	882.52	867.00	1074.00	985.29	.37	102.77	.42	1347.74	91.41	1.99
*	21.544	100.00	1348.34	857.25	867.00	1074.00	992.48	.37	135.23	.60	1347.74	69.79	2.23
*	21.544	150.00	1348.48	834.79	867.00	1074.00	1000.49	.37	165.70	.74	1347.74	51.54	2.32
*	21.544	200.00	1348.60	815.41	867.00	1074.00	1007.40	.38	191.98	.86	1347.74	42.07	2.38
*	21.544	250.00	1348.71	797.64	867.00	1074.00	1013.74	.40	216.10	.97	1347.74	35.46	2.40
*	21.544	300.00	1348.82	784.29	867.00	1074.00	1019.67	.43	235.38	1.08	1347.74	30.31	2.39
*	21.544	350.00	1348.90	781.00	867.00	1074.00	1024.03	.38	243.03	1.16	1347.74	28.79	2.45
*	21.546	50.00	1348.24	904.31	864.00	1060.00	1000.69	.08	96.38	1.01	1347.23	4.68	.84
*	21.546	100.00	1348.43	897.76	864.00	1060.00	1007.01	.09	109.24	1.20	1347.23	8.79	1.27
*	21.546	150.00	1348.56	860.83	864.00	1060.00	1011.81	.08	150.97	1.33	1347.23	14.94	1.55
*	21.546	200.00	1348.67	825.84	864.00	1060.00	1015.30	.07	189.45	1.44	1347.23	16.68	1.78
*	21.546	250.00	1348.77	791.31	864.00	1060.00	1018.74	.06	227.43	1.54	1347.23	17.05	1.93
	21.546	300.00	1348.88	782.10	864.00	1060.00	1060.48	.06	278.38	1.65	1347.23	20.49	1.97
	21.546	350.00	1348.95	782.10	864.00	1060.00	1061.52	.05	279.42	1.72	1347.23	19.23	2.04

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=     21.539  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     21.539  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     21.539  PROFILE=  3  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  3  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  3  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     21.539  PROFILE=  4  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  4  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  4  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     21.539  PROFILE=  5  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  5  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  5  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     21.539  PROFILE=  6  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  6  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  6  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     21.539  PROFILE=  7  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     21.539  PROFILE=  7  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     21.539  PROFILE=  7  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=     21.544  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.544  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.544  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.544  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.544  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.544  PROFILE=  7  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     21.546  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.546  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.546  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.546  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     21.546  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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AH WEST INC. Consulting Engineers

Upper EMF FIS | Project 7158-03 | Sht. ___ of ___
Calc. By GAS | Date 10/16/95
Chkd. ___ | Date ___

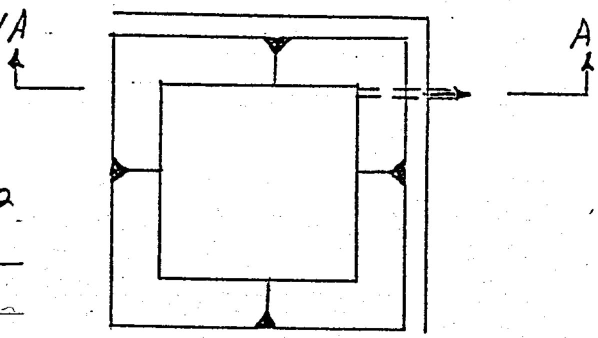
Retention / Detention Basin Data

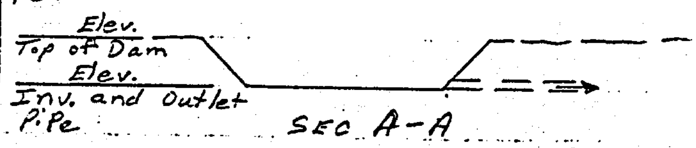
Location: Along E. Side RWCD, McKellips To McDowell Rd.

Basin I.D. No. SB86
HEC-1 Concentration Point (C.P.) No. R087

* Inlet Pipe I.E. of 36" Pipe Under McKellips

Elevation	Area (Ac.)	Accumulated Vol. (Ac-Ft)	Under McKellips in 36" RCP Pipe Discharge (cfs)	Over McKellips Weir Flow	Total cfs
46.84*	0	0	0		0
51.71		54.6	23.2 ①		23.2
51.81		57.7	23.7 ①	6.3	30
51.91		62.7	① 23.5	26.5	50
52.03		69.6	24.0 ①	76.0	100
52.11		74.2	24.5 ①	125.5	150
52.14		76.5	24.5 ①	155.5	180

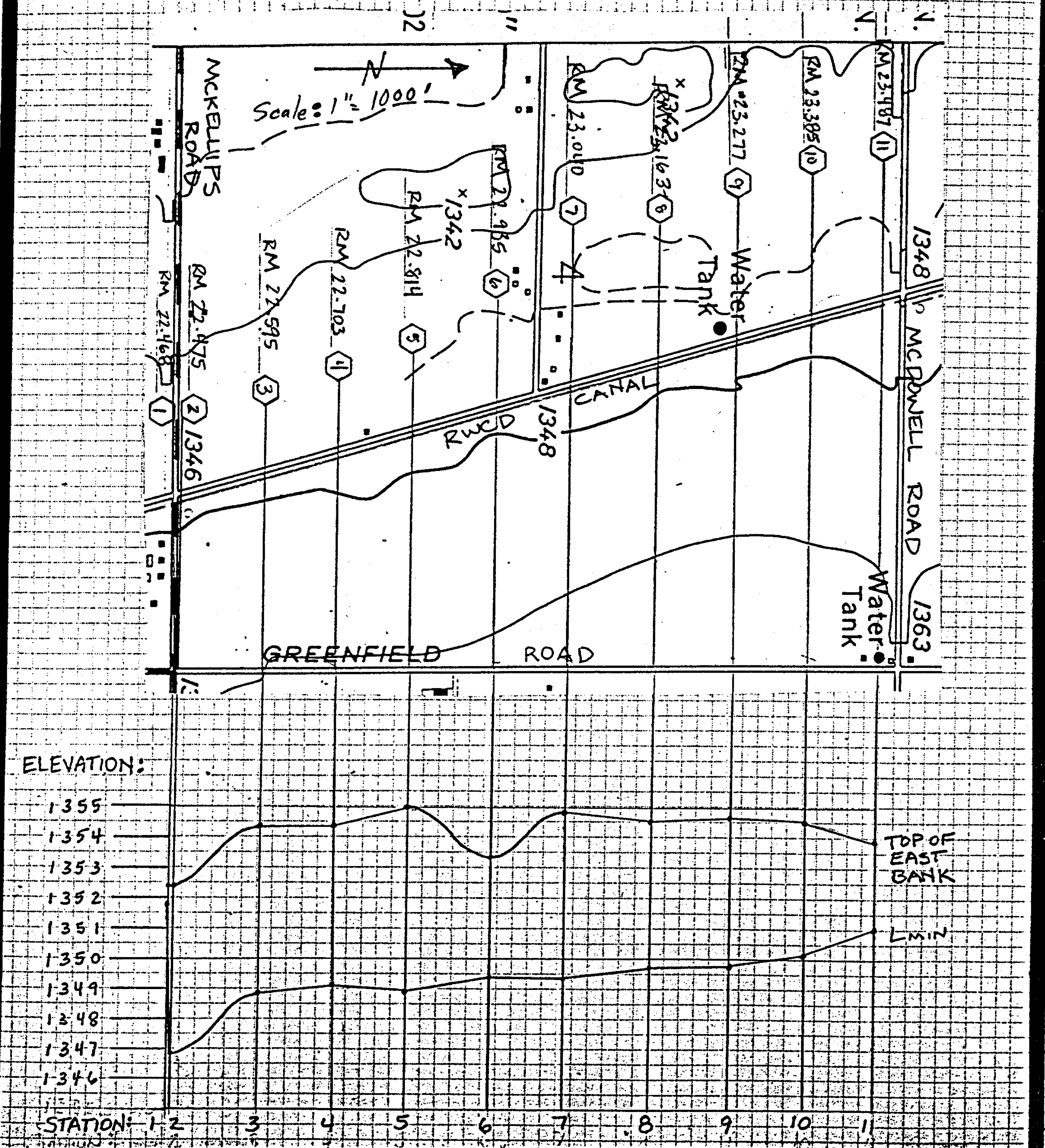




① From Pipe Rating Curve

HEC-1 Routing Input Data

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10
RS Record – Storage Routing									
RS 1	STOR or FLOW	0 -1							
SV Record – Reservoir Storage									
SV 0	54.6	57.7	62.7	69.6	74.2	76.5			
SQ Record – Discharge									
SQ 0	23.2	30	50	100	150	180			
SE Record – Elevation									
SE 46.84	51.71	51.81	51.91	52.03	52.11	52.14			
SS Record – Spillway Characteristics									
SS									
ST Record – Top of Dam Overflow									
ST									



A-N WEST JOB # 7158-03

PLAN PROFILE OF RWCD CANAL
FROM McKELLIPS RD. TO McDOWELL RD.

UPPER EAST MARICOPA FLOODWAY FIS
FCD NO. 94-26

A-N WEST INC.
Consulting Engineers

(#) RIVER MILE I.D. #

FIGURE A-1

THIS RUN EXECUTED 27JUL80 17:25:55

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

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


T1     UPPER EMF FIS STUDY   FCDMC NO. 94-26                 FILE:  UEMF8
T2     ORANGE GROVE NORTH OF MCKELLIPS RD.         BY A-N WEST, INC. PHX AZ
T3     RATING CURVE ANALYSIS                      DATE:  10/6/95

J1  ICHECK     INQ      NINV      IDIR      STRT      METRIC    HVINS     Q        WSEL      FQ

     0          2                            0                                   1351.73

J2  NPROF      IPLOT     PRFVS     XSECV     XSECH     FN       ALLDC     IBW      CHNIM     ITRACE

    1                    -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

   38         43         1         53         21         22         54         51         4          8
   42          5        26

NC     .015       .015      .015        .1         .3
QT       6         6.3      26.5        76       125.5      155.5          1
       THIS HEC-2 MODEL WAS PREPARED TO GENERATE A RATING CURVE OF WATER
       SURFACE ELEV. VS. STORAGE OCCURING ALONG THE RWCD CANAL BETWEEN
       MCKELLIPS AND MCDOWELL ROADS.
       THE CROSS-SECTIONS WERE GENERATED FROM A FIELD SURVEY BY A-N WEST
       TAKEN ALONG THE CANAL. BECAUSE OF THE HEAVY ORANGE GROVE COVER
       THE FIELD SURVEY WAS LIMITED TO APPROX. 100 FT. FROM THE CANAL.
       THE EASTERN MOST POINT OF EACH CROSS-SECTION WAS ESTIMATED BY
       PROJECTING OUT AT APPROX. 1.0 PERCENT BASED ON QUADRANGLE  MAPPING.
       CROSS-SECTIONS PROCEED UPSTREAM FROM MCKELLIPS RD. CENTERLINE IN
       RIVER MILES WITH SEC.22.468 AT CENTERLINE.
       SECTIONS ARE CODED FROM LEFT TO RIGHT LOOKING UPSTREAM WITH STA. 1000
       AT LOW FLOW POINT.
       THERE IS A 24 INCH CMP UNDER THE EAST MAINT. RD. OF THE CANAL AND SOUTH
       OF MCKELLIPS RD. THERE IS ALSO A 36 INCH CMP UNDER MCKELLIPS CONNECTING
       THIS 24 INCH PIPE. THESE TWO PIPES ,IN SERIES, CAN CONVEY 23.2 CFS
       INTO THE CANAL BEFORE OVERTOPPING OF MCKELLIPS RD. BEGINS AT EL 51.7.
       ************
       FLOW OVERTOPPING MCKELLIPS RD. CONTRIBUTES TO THE UPPER EMF STUDY
       WHICH IS THE REASON FOR THIS ANALYSIS OF DETENTION ALONG THE CANAL.
       ************
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← weir Flow over Mckellips

A RATING CURVE OF DISCHARGE VS. EL. OF CRITICAL FLOW DEPTH OVER
WAS MADE FOR SECTION 22.468 AT CENTERLINE OF MCKELLIPS ROAD AS
FILE:UEMF8A.
THIS WEIR FLOW RATING CURVE WAS COMBINED WITH A RATING CURVE OF THE
PIPES UNDER MCKELLIPS RD AND THE CANAL TO DETERMINE STARTING WSELS
AT SECTION 22.475.
****
FLOW FROM THE ORANGE GROVE WAS ESTIMATED TO FLOW WEST TO THE CANAL.
AT THE CANAL PONDING WOULD OCCUR AND EVENTUALLY SOME HYDRAULIC GRADE
WOULD BE GENERATED ALONG THIS MILD SLOPED BASIN TOWARD MCKELLIPS RD.
SOME ADDITIONAL STORAGE FROM A LEVEL WATER SURFACE WOULD BE GENERATED
IN THE PROCESS OF CREATING THIS HYD. GRADE. THE DISCHARGE TO EACH
CROSS-SECTION ALONG THE CANAL WAS INCREASED FROM MCDOWELL TO MCKELLIPS
IN PROPORTION TO CONTRIBUTING DRAINAGE AREA FOR EACH RATING CURVE
DISCHARGE AT MCKELLIPS TO MORE ACCURATELY ESTIMATE THE STORGE VOLUME
OCCURING ALONG THE CANAL.

X1	22.468	16	618	1370	0	0	0			
GR	1352.3	618	1352.18	665	1352.33	713	1352.22	759	1352.03	807
GR	1352.1	855	1352.05	903	1351.89	951	1351.70	1000	1351.81	1046
GR	1352.0	1094	1352.25	1142	1352.51	1189	1352.71	1237	1353.25	1323
GR	1353.5	1370								
NC	.06	.06	.06	.1	.3					
QT	6	30	50	100	150	180	1	Total Flow Just upstream of Mckellips		
X1	22.475	5	949	1480	38	38	38			
GR	1352.4	949	1346.83	1000	1350.00	1012	1352.00	1305	1354.00	1480
QT	6	27.9	46.5	93.0	139.5	162.8	1			
X1	22.595	9	939	1565	632	632	632			
GR	1354.4	939	1353.13	959	1349.09	970	1351.18	979	1351.15	987
GR	1348.8	1000	1348.79	1057	1349.06	1115	1354.42	1565		
QT	6	25.2	42.0	84.0	126.0	147.0	1			
X1	22.703	9	897	1491	570	570	570			
GR	1354.4	897	1353.42	917	1350.33	929	1350.65	933	1350.71	944
GR	1349.4	956	1349.15	1000	1349.66	1087	1354.41	1491		
QT	6	22.8	38.0	76.0	114.0	133.0	1			
X1	22.814	8	901	1589	588	588	588			
GR	1355.0	901	1353.78	921	1349.74	931	1349.74	944	1349.08	951
GR	1348.9	1000	1349.49	1084	1354.99	1589				
QT	6	19.2	32.0	64.0	96.0	112.0	1			
X1	22.935	8	887	1374	639	639	639			
GR	1353.4	887	1351.88	915	1350.41	919	1350.3	931	1349.5	943
GR	1349.4	1000	1349.95	1080	1353.36	1374				
QT	6	16.5	27.5	55.0	82.5	96.3	1			
X1	23.040	8	935	1569	553	553	553			
GR	1354.8	935	1353.64	955	1350.55	965	1350.26	993	1349.35	1000
GR	1349.5	1064	1349.69	1105	1354.76	1569				

QT	6	12.6	21.0	42.0	63.0	73.5	1			
X1	23.163	8	935	1475	649	649	649			
GR	1354.5	935	1353.44	958	1350.43	967	1350.49	994	1349.68	1000
GR	1349.8	1046	1350.13	1127	1354.45	1475				
QT	6	8.7	14.5	29.0	43.5	50.8	1			
X1	23.277	6	950	1454	601	601	601			
GR	1354.7	950	1353.49	973	1350.37	980	1350.67	995	1349.70	1000
GR	1354.7	1454								
QT	6	5.1	8.5	17.0	25.5	29.8	1			
X1	23.385	8	898	1457	572	572	572			
GR	1354.5	898	1353.51	920	1350.56	930	1351.08	945	1350.25	950
GR	1350.2	1000	1350.56	1068	1354.47	1457				
X1	23.487	5	900	1293	541	541	541			
GR	1353.9	900	1352.85	926	1351.99	980	1350.98	1000	1353.91	1293

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

*PROF 1

CCHV= .100 CEHV= .300
*SECNO 22.468
3720 CRITICAL DEPTH ASSUMED

THIS HEC-2 MODEL WAS PREPARED TO GENERATE A RATING CURVE OF WATER SURFACE ELEV. VS. STORAGE OCCURING ALONG THE RWCD CANAL BETWEEN MCKELLIPS AND MCDOWELL ROADS.
THE CROSS-SECTIONS WERE GENERATED FROM A FIELD SURVEY BY A-N WEST TAKEN ALONG THE CANAL. BECAUSE OF THE HEAVY ORANGE GROVE COVER THE FIELD SURVEY WAS LIMITED TO APPROX. 100 FT. FROM THE CANAL.
THE EASTERN MOST POINT OF EACH CROSS-SECTION WAS ESTIMATED BY PROJECTING OUT AT APPROX. 1.0 PERCENT BASED ON QUADRANGLE MAPPING.
CROSS-SECTIONS PROCEED UPSTREAM FROM MCKELLIPS RD. CENTERLINE IN RIVER MILES WITH SEC.22.468 AT CENTERLINE.
SECTIONS ARE CODED FROM LEFT TO RIGHT LOOKING UPSTREAM WITH STA. 1000 AT LOW FLOW POINT.
THERE IS A 24 INCH CMP UNDER THE EAST MAINT. RD. OF THE CANAL AND SOUTH OF MCKELLIPS RD. THERE IS ALSO A 36 INCH CMP UNDER MCKELLIPS CONNECTING THIS 24 INCH PIPE. THESE TWO PIPES ,IN SERIES, CAN CONVEY 23.2 CFS INTO THE CANAL BEFORE OVERTOPPING OF MCKELLIPS RD. BEGINS AT EL 51.7.
****
FLOW OVERTOPPING MCKELLIPS RD. CONTRIBUTES TO THE UPPER EMF STUDY WHICH IS THE REASON FOR THIS ANALYSIS OF DETENTION ALONG THE CANAL.
****
A RATING CURVE OF DISCHARGE VS. EL. OF CRITICAL FLOW DEPTH OVER WAS MADE FOR SECTION 22.468 AT CENTERLINE OF MCKELLIPS ROAD AS FILE:UEMF8A.
THIS WEIR FLOW RATING CURVE WAS COMBINED WITH A RATING CURVE OF THE PIPES UNDER MCKELLIPS RD AND THE CANAL TO DETERMINE STARTING WSELS AT SECTION 22.475.
****
FLOW FROM THE ORANGE GROVE WAS ESTIMATED TO FLOW WEST TO THE CANAL. AT THE CANAL PONDING WOULD OCCUR AND EVENTUALLY SOME HYDRAULIC GRADE WOULD BE GENERATED ALONG THIS MILD SLOPED BASIN TOWARD MCKELLIPS RD. SOME ADDITIONAL STORAGE FROM A LEVEL WATER SURFACE WOULD BE GENERATED IN THE PROCESS OF CREATING THIS HYD. GRADE. THE DISCHARGE TO EACH CROSS-SECTION ALONG THE CANAL WAS INCREASED FROM MCDOWELL TO MCKELLIPS IN PROPORTION TO CONTRIBUTING DRAINAGE AREA FOR EACH RATING CURVE DISCHARGE AT MCKELLIPS TO MORE ACCURATELY ESTIMATE THE STORGE VOLUME OCCURING ALONG THE CANAL.

22.468	.11	1351.81	1351.81	1351.73	1351.85	.03	.00	.00	1352.30
6.3	.0	6.3	.0	.0	4.5	.0	.0	.0	1353.50
.00	.00	1.41	.00	.000	.015	.000	.000	1351.70	970.35
.009021	0.	0.	0.	0	25	0	.00	76.88	1047.23

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

CCHV= .100 CEHV= .300
*SECNO 22.475

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = *****

22.475	5.02	1351.85	.00	.00	1351.85	.00	.00	.00	1352.40
30.0	.0	30.0	.0	.0	406.9	.0	.2	.2	1354.00
.14	.00	.07	.00	.000	.060	.000	.000	1346.83	954.05
.000007	38.	38.	38.	2	0	0	.00	328.81	1282.86

*SECNO 22.595

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.36

22.595	3.06	1351.85	.00	.00	1351.85	.00	.00	.00	1354.40
27.9	.0	27.9	.0	.0	726.1	.0	8.4	5.4	1354.42
4.71	.00	.04	.00	.000	.060	.000	.000	1348.79	962.49
.000001	632.	632.	632.	2	0	0	.00	386.73	1349.22

*SECNO 22.703

22.703	2.70	1351.85	.00	.00	1351.85	.00	.00	.00	1354.40
25.2	.0	25.2	.0	.0	575.3	.0	16.9	10.2	1354.41
8.33	.00	.04	.00	.000	.060	.000	.000	1349.15	923.09
.000002	570.	570.	570.	0	0	0	.00	350.42	1273.51

*SECNO 22.814

22.814	2.95	1351.85	.00	.00	1351.85	.00	.00	.00	1355.00
22.8	.0	22.8	.0	.0	669.7	.0	25.3	15.1	1354.99
13.12	.00	.03	.00	.000	.060	.000	.000	1348.90	925.77
.000001	588.	588.	588.	0	0	0	.00	375.12	1300.89

*SECNO 22.935

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .70

22.935	2.45	1351.85	.00	.00	1351.85	.00	.00	.00	1353.40
19.2	.0	19.2	.0	.0	511.6	.0	34.0	20.3	1353.36
17.85	.00	.04	.00	.000	.060	.000	.000	1349.40	915.07
.000001	639.	639.	639.	0	0	0	.00	329.00	1244.08

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

*SECNO 23.040

23.040	2.50	1351.85	.00	.00	1351.85	.00	.00	.00	1354.80
16.5	.0	16.5	.0	.0	519.8	.0	40.5	24.5	1354.76
22.69	.00	.03	.00	.000	.060	.000	.000	1349.35	960.78
.000001	553.	553.	553.	0	0	0	.00	342.21	1302.99

*SECNO 23.163

23.163	2.17	1351.85	.00	.00	1351.85	.00	.00	.00	1354.50
12.6	.0	12.6	.0	.0	421.3	.0	47.5	29.3	1354.45
28.72	.00	.03	.00	.000	.060	.000	.000	1349.68	962.74
.000001	649.	649.	649.	0	0	0	.00	303.15	1265.89

*SECNO 23.277

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .49

23.277	2.15	1351.85	.00	.00	1351.85	.00	.00	.00	1354.70
8.7	.0	8.7	.0	.0	241.6	.0	52.1	32.9	1354.70
33.36	.00	.04	.00	.000	.060	.000	.000	1349.70	976.67
.000002	601.	601.	601.	0	0	0	.00	218.97	1195.64

*SECNO 23.385

23.385	1.66	1351.86	.00	.00	1351.86	.00	.00	.00	1354.50
5.1	.0	5.1	.0	.0	289.7	.0	55.6	36.1	1354.47
42.38	.00	.02	.00	.000	.060	.000	.000	1350.20	925.61
.000000	572.	572.	572.	0	0	0	.00	271.29	1196.89

*SECNO 23.487

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .09

23.487	.88	1351.86	.00	.00	1351.86	.00	.00	.00	1353.90
5.1	.0	5.1	.0	.0	46.0	.0	57.7	38.5	1353.91
43.74	.00	.11	.00	.000	.060	.000	.000	1350.98	982.65
.000060	541.	541.	541.	0	0	0	.00	104.94	1087.60

Accumulated Vol. of 57.7 Ac-Ft along canal for weir flow of 6.3 CFS over McKellips Rd & 23.7 cfs through 24"/36" culverts into RWCD canal.

THIS RUN EXECUTED 27JUL80 17:25:57

****
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

ATING CURVE ANALYSIS

SUMMARY PRINTOUT

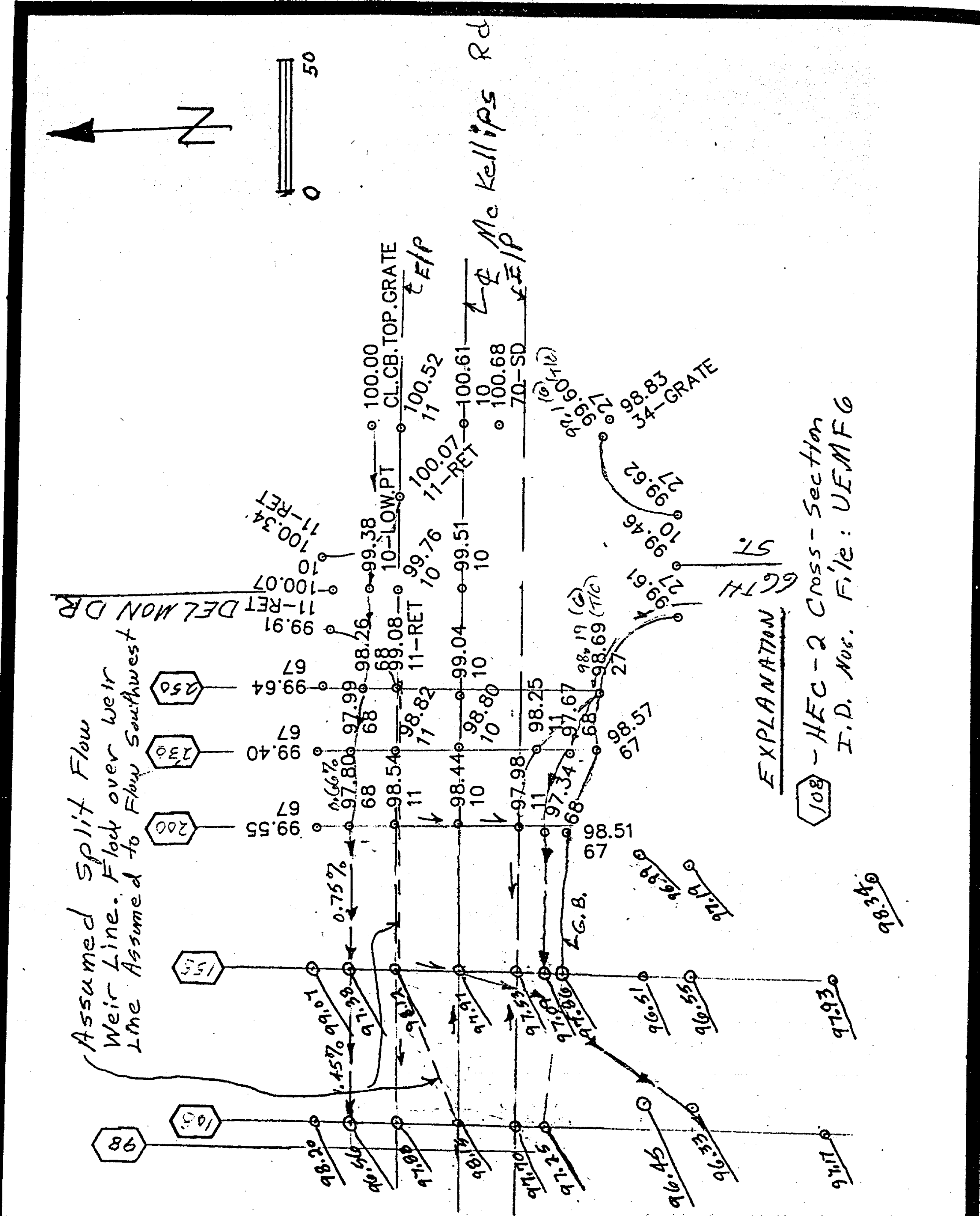
	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	22.468	6.30	1351.81	970.35	618.00	1370.00	1047.23	.00	76.88	.11	1351.70	90.21	1.41
	22.468	26.50	1351.92	941.99	618.00	1370.00	1073.79	.00	131.80	.22	1351.70	53.01	1.72
*	22.468	76.00	1352.03	910.51	618.00	1370.00	1098.80	.00	188.30	.33	1351.70	59.52	2.36
*	22.468	125.50	1352.11	787.32	618.00	1370.00	1114.72	.00	327.40	.41	1351.70	62.98	2.35
*	22.468	155.50	1352.14	779.92	618.00	1370.00	1120.34	.00	340.43	.44	1351.70	58.16	2.46
	22.468	1.00	1352.70	618.00	618.00	1370.00	1234.60	.00	616.60	1.00	1351.70	.00	.00
*	22.475	30.00	1351.85	954.05	949.00	1480.00	1282.86	.03	328.81	5.02	1346.83	.07	.07
*	22.475	50.00	1351.97	952.92	949.00	1480.00	1300.85	.05	347.93	5.14	1346.83	.14	.11
*	22.475	100.00	1352.12	951.53	949.00	1480.00	1315.81	.10	364.28	5.29	1346.83	.42	.20
*	22.475	150.00	1352.21	950.75	949.00	1480.00	1323.30	.10	372.55	5.38	1346.83	.80	.28
*	22.475	180.00	1352.25	950.37	949.00	1480.00	1326.86	.11	376.49	5.42	1346.83	1.06	.33
	22.475	1.00	1352.70	949.00	949.00	1480.00	1366.25	.00	417.25	5.87	1346.83	.00	.00
*	22.595	27.90	1351.85	962.49	939.00	1565.00	1349.22	.00	386.73	3.06	1348.79	.01	.04
*	22.595	46.50	1351.98	962.15	939.00	1565.00	1359.65	.00	397.50	3.19	1348.79	.02	.06
*	22.595	93.00	1352.13	961.72	939.00	1565.00	1372.80	.01	411.08	3.34	1348.79	.08	.11
*	22.595	139.50	1352.23	961.47	939.00	1565.00	1380.56	.02	419.09	3.44	1348.79	.15	.16
*	22.595	162.80	1352.28	961.35	939.00	1565.00	1384.38	.03	423.04	3.49	1348.79	.20	.18
*	22.595	1.00	1352.70	960.17	939.00	1565.00	1420.59	.00	460.42	3.91	1348.79	.00	.00
	22.703	25.20	1351.85	923.09	897.00	1491.00	1273.51	.00	350.42	2.70	1349.15	.02	.04
	22.703	42.00	1351.98	922.59	897.00	1491.00	1284.31	.00	361.71	2.83	1349.15	.04	.07
	22.703	84.00	1352.14	921.94	897.00	1491.00	1298.62	.01	376.69	2.99	1349.15	.11	.12
	22.703	126.00	1352.24	921.55	897.00	1491.00	1307.14	.01	385.59	3.09	1349.15	.22	.17
	22.703	147.00	1352.29	921.39	897.00	1491.00	1310.65	.01	389.26	3.14	1349.15	.28	.20
	22.703	1.00	1352.70	919.80	897.00	1491.00	1345.55	.00	425.76	3.55	1349.15	.00	.00
	22.814	22.80	1351.85	925.77	901.00	1589.00	1300.89	.00	375.12	2.95	1348.90	.01	.03
	22.814	38.00	1351.98	925.46	901.00	1589.00	1312.49	.00	387.03	3.08	1348.90	.02	.05
	22.814	76.00	1352.14	925.05	901.00	1589.00	1327.77	.01	402.72	3.24	1348.90	.06	.10
	22.814	114.00	1352.25	924.79	901.00	1589.00	1337.48	.01	412.69	3.35	1348.90	.12	.14
	22.814	133.00	1352.30	924.65	901.00	1589.00	1342.35	.01	417.70	3.40	1348.90	.16	.16
	22.814	1.00	1352.70	923.67	901.00	1589.00	1378.73	.00	455.06	3.80	1348.90	.00	.00

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	22.935	19.20	1351.85	915.07	887.00	1374.00	1244.08	.00	329.00	2.45	1349.40	.01	.04
	22.935	32.00	1351.98	913.15	887.00	1374.00	1255.04	.00	341.89	2.58	1349.40	.03	.06
	22.935	64.00	1352.15	910.03	887.00	1374.00	1269.67	.00	359.64	2.75	1349.40	.09	.10
	22.935	96.00	1352.26	907.99	887.00	1374.00	1279.20	.01	371.20	2.86	1349.40	.17	.15
	22.935	112.00	1352.31	906.97	887.00	1374.00	1283.98	.01	377.01	2.91	1349.40	.21	.17
	22.935	1.00	1352.70	899.90	887.00	1374.00	1317.09	.00	417.20	3.30	1349.40	.00	.00
	23.040	16.50	1351.85	960.78	935.00	1569.00	1302.99	.00	342.21	2.50	1349.35	.01	.03
	23.040	27.50	1351.98	960.37	935.00	1569.00	1314.69	.00	354.32	2.63	1349.35	.02	.05
	23.040	55.00	1352.15	959.81	935.00	1569.00	1330.42	.00	370.61	2.80	1349.35	.06	.09
	23.040	82.50	1352.27	959.45	935.00	1569.00	1340.78	.01	381.33	2.92	1349.35	.12	.12
	23.040	96.30	1352.32	959.26	935.00	1569.00	1345.99	.01	386.73	2.97	1349.35	.15	.14
	23.040	1.00	1352.70	958.04	935.00	1569.00	1380.47	.00	422.43	3.35	1349.35	.00	.00
	23.163	12.60	1351.85	962.74	935.00	1475.00	1265.89	.00	303.15	2.17	1349.68	.01	.03
	23.163	21.00	1351.98	962.36	935.00	1475.00	1276.25	.00	313.90	2.30	1349.68	.02	.05
	23.163	42.00	1352.16	961.83	935.00	1475.00	1290.36	.00	328.53	2.48	1349.68	.06	.08
	23.163	63.00	1352.27	961.48	935.00	1475.00	1299.82	.01	338.33	2.59	1349.68	.11	.11
	23.163	73.50	1352.33	961.31	935.00	1475.00	1304.59	.01	343.29	2.65	1349.68	.13	.13
	23.163	1.00	1352.70	960.21	935.00	1475.00	1334.03	.00	373.81	3.02	1349.68	.00	.00
*	23.277	8.70	1351.85	976.67	950.00	1454.00	1195.64	.00	218.97	2.15	1349.70	.02	.04
*	23.277	14.50	1351.98	976.38	950.00	1454.00	1207.37	.00	230.99	2.28	1349.70	.04	.05
*	23.277	29.00	1352.16	975.98	950.00	1454.00	1223.43	.00	247.45	2.46	1349.70	.10	.09
*	23.277	43.50	1352.28	975.71	950.00	1454.00	1234.28	.01	258.57	2.58	1349.70	.18	.13
*	23.277	50.80	1352.34	975.58	950.00	1454.00	1239.78	.01	264.20	2.64	1349.70	.22	.14
*	23.277	1.00	1352.70	974.77	950.00	1454.00	1272.40	.00	297.63	3.00	1349.70	.00	.00
	23.385	5.10	1351.86	925.61	898.00	1457.00	1196.89	.00	271.29	1.66	1350.20	.00	.02
	23.385	8.50	1351.99	925.17	898.00	1457.00	1209.85	.00	284.69	1.79	1350.20	.01	.03
	23.385	17.00	1352.16	924.56	898.00	1457.00	1227.78	.00	303.22	1.96	1350.20	.02	.04
	23.385	25.50	1352.29	924.14	898.00	1457.00	1240.07	.01	315.93	2.09	1350.20	.04	.06
	23.385	29.80	1352.35	923.93	898.00	1457.00	1246.26	.01	322.34	2.15	1350.20	.05	.07
	23.385	1.00	1352.70	922.75	898.00	1457.00	1280.90	.00	358.15	2.50	1350.20	.00	.00
*	23.487	5.10	1351.86	982.65	900.00	1293.00	1087.60	.00	104.94	.88	1350.98	.60	.11
*	23.487	8.50	1351.99	980.07	900.00	1293.00	1100.65	.00	120.58	1.01	1350.98	.80	.14
*	23.487	17.00	1352.17	968.82	900.00	1293.00	1118.80	.00	149.97	1.19	1350.98	1.38	.20
*	23.487	25.50	1352.29	960.98	900.00	1293.00	1131.30	.01	170.32	1.31	1350.98	1.82	.24
*	23.487	29.80	1352.36	957.04	900.00	1293.00	1137.56	.01	180.52	1.38	1350.98	1.93	.26
*	23.487	1.00	1352.70	935.42	900.00	1293.00	1171.99	.00	236.57	1.72	1350.98	.00	.01

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO=	22.468	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	22.468	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	22.468	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	22.468	PROFILE=	5	CRITICAL DEPTH ASSUMED
WARNING SECNO=	22.475	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.475	PROFILE=	2	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.475	PROFILE=	3	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.475	PROFILE=	4	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.475	PROFILE=	5	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.595	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.595	PROFILE=	2	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.595	PROFILE=	3	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.595	PROFILE=	4	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.595	PROFILE=	5	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.595	PROFILE=	6	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	22.935	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.277	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.277	PROFILE=	2	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.277	PROFILE=	3	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.277	PROFILE=	4	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.277	PROFILE=	5	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.277	PROFILE=	6	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.487	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.487	PROFILE=	2	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.487	PROFILE=	3	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.487	PROFILE=	4	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.487	PROFILE=	5	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=	23.487	PROFILE=	6	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

Appendix B



#7158-03

A-N WEST INC.
Consulting Engineers

UPPER EMF FIS FCDMC #94-26
ANALYSIS SPLIT FLOW-PLAN VIEW
DELMON DR. / 66TH ST AND
McKELLIPS ROAD INTERSECTION
FIGURE B-1

THIS RUN EXECUTED 16JUN80   17:50:13

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

 Version   4.6.2;  May 1991
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SPLIT FLOW BEING PERFORMED

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SF


TW
WS     2     108     155      -1     2.8
WC     0   98.15      60   98.12

TW
WS     2     155     200      -1     2.8
WC     0   98.12      55   98.54

TW
WS     2     200     230      -1     2.8
WC     0   98.54      30   98.82

TW
WS     2     230     250      -1     2.8
WC     0   98.82      20   99.08
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T1      UPPER EMF FIS STUDY   FCDMC NO. 94-26                FILE:UEMF6
T2      MCKELLIPS RD AT DELMON RD/66TH STREET        BY A-N WEST INC. PHX.AZ.
T3      SPLIT FLOW RATING CURVE ANALYSIS                    DATE:9/6/95

J1  ICHECK   INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

             2                          .013                                98.0

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

    1                 -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38       43       1        53       21       22       54       51       4        8
    42       5        26

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

    -10      -10

NC    .035     .035     .015     .1       .3
QT     6       25       50       75       100      125      150
      CROSS-SECTIONS OF MCKELLIPS ROAD FIELD SURVEYED BY A-N WEST, INC. IN
      AUGUST, 1995 TO EVALUATE POTENTIAL SURFACE WATER SPLIT TO SOUTHWEST
      OUT OF WATERSHED AT THIS LOCATION.  CROSS SECTIONS ARE CODED FROM
      LEFT TO RIGHT LOOKING DOWNSTREAM WITH STATION 100 AT PAVEMENT
      CENTERLINE.  CROSS SECTION I.D. NOS IN FEET INCREASING UPSTREAM.
      AT SECTION 98 AND 100, STREET IS NORMAL CROWN AND FLOW NORTH OF
      CENTERLINE WILL FLOW WEST ALONG MCKELLIPS AND REMAIN IN THE STUDY
      WATERSHED.  SECTIONS 155 THROUGH 250 HAVE ONE-WAY CROSS SLOPE TO
      SOUTH WITH SUMP CONDITION AT SECTION 155.  FLOW WEIRING OVER THE NORTH
      EDGE OF STREET BETWEEN SECTION 155 TO 230 WAS ASSUMED TO FLOW SOUTH
      WEST EXITING THE STUDY WATERSHED.  THE SPLIT FLOW OPTION OF HEC-2 MODEL
      WAS EMPLOYED TO MODEL THIS WEIR FLOW TO SOUTHWEST.  SEE ASSOCIATED
      FIGURE B-1 FOR PLAN VIEW.
X1     98       4        100      124      0        0        0
GR    98.01     100      97.74    124      96.42    142      98.06    156

X1     108      4        100      124      10       10       10
GR    98.15     100      97.88    124      96.56    142      98.20    156

NC    .035     .035     .035     .1       .3
X1     155      3        124      157      60       60       60
GR    98.12     124      97.38    142      99.07    157

X1     200      3        124      151      55       55       55
GR    98.54     124      97.80    142      99.55    151
```

X1	230	3	125	155	30	30	30
GR	98.82	125	97.99	142	99.40	155	
X1	250	3	125	154	20	20	20
GR	99.08	125	98.26	138	99.64	154	

HEC-2 Output
File: VEMF6

THIS RUN EXECUTED 16JUN80 17:50:18

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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

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

Surface Flow Spliting west along North Side McKellips PER HEC-1 Model I.D. 27I

SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
98.000	21.25	97.26	130.52	100.00	124.00	149.19	.00	18.67	.84	96.42	129.30	.00
98.000	27.74	97.35	129.32	100.00	124.00	149.94	.00	20.62	.93	96.42	129.63	.00
98.000	33.20	97.41	128.44	100.00	124.00	150.49	.00	22.05	.99	96.42	129.73	.00
98.000	37.75	97.46	127.79	100.00	124.00	150.90	.00	23.11	1.04	96.42	130.85	.00
98.000	42.09	97.51	127.18	100.00	124.00	151.28	.00	24.10	1.09	96.42	129.99	.00
98.000	46.60	97.55	126.59	100.00	124.00	151.65	.00	25.06	1.13	96.42	129.38	.00
108.000	21.25	97.39	130.59	100.00	124.00	149.14	.13	18.55	.83	96.56	133.77	.00
108.000	27.74	97.48	129.39	100.00	124.00	149.90	.13	20.51	.92	96.56	133.55	.00
108.000	33.20	97.54	128.51	100.00	124.00	150.45	.13	21.94	.98	96.56	133.36	.00
108.000	37.75	97.59	127.79	100.00	124.00	150.90	.13	23.11	1.03	96.56	130.85	.00
108.000	42.09	97.64	127.25	100.00	124.00	151.23	.13	23.99	1.08	96.56	133.23	.00
108.000	46.60	97.68	126.66	100.00	124.00	151.60	.13	24.94	1.12	96.56	132.67	.00
155.000	21.25	98.13	124.00	124.00	157.00	148.70	.74	24.70	.75	97.38	100.89	2.25
155.000	27.96	98.21	124.00	124.00	157.00	149.37	.73	25.37	.83	97.38	99.51	2.47
155.000	33.92	98.26	124.00	124.00	157.00	149.92	.72	25.92	.88	97.38	97.39	2.62
155.000	39.18	98.31	124.00	124.00	157.00	150.31	.72	26.31	.93	97.38	100.29	2.78
155.000	44.62	98.36	124.00	124.00	157.00	150.72	.72	26.72	.98	97.38	100.61	2.91
155.000	50.37	98.40	124.00	124.00	157.00	151.09	.72	27.09	1.02	97.38	103.11	3.06
200.000	23.10	98.63	124.00	124.00	151.00	146.27	.50	22.27	.83	97.80	85.26	2.30
200.000	36.95	98.75	124.00	124.00	151.00	146.87	.54	22.87	.95	97.80	104.97	2.91
200.000	49.60	98.83	124.00	124.00	151.00	147.28	.56	23.28	1.03	97.80	123.45	3.41
200.000	61.66	98.90	124.00	124.00	151.00	147.65	.59	23.65	1.10	97.80	136.01	3.80
200.000	73.91	98.96	124.00	124.00	151.00	148.00	.60	24.00	1.16	97.80	146.20	4.15
200.000	86.53	99.02	124.00	124.00	151.00	148.30	.62	24.30	1.22	97.80	157.61	4.49
230.000	24.82	98.88	125.00	125.00	155.00	150.17	.24	25.17	.89	97.99	71.41	2.14
230.000	45.39	99.04	125.00	125.00	155.00	151.69	.30	26.69	1.05	97.99	91.35	2.85
* 230.000	64.76	99.17	125.00	125.00	155.00	152.84	.34	27.84	1.18	97.99	104.06	3.36
* 230.000	83.39	99.27	125.00	125.00	155.00	153.78	.37	28.78	1.28	97.99	113.57	3.76
* 230.000	101.71	99.36	125.00	125.00	155.00	154.58	.40	29.58	1.37	97.99	122.69	4.11
* 230.000	120.89	99.44	125.00	125.00	155.00	155.00	.43	30.00	1.45	97.99	126.14	4.41

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	250.000	25.00	99.04	125.54	125.00	154.00	147.11	.16	21.56	.78	98.26	168.54	2.95
	250.000	50.00	99.23	125.00	125.00	154.00	149.30	.19	24.30	.97	98.26	198.94	3.89
*	250.000	75.00	99.38	125.00	125.00	154.00	150.94	.21	25.94	1.12	98.26	218.17	4.58
*	250.000	100.00	99.52	125.00	125.00	154.00	152.59	.25	27.59	1.26	98.26	211.12	4.95
*	250.000	125.00	99.66	125.00	125.00	154.00	154.00	.30	29.00	1.40	98.26	195.83	5.18
*	250.000	150.00	99.76	125.00	125.00	154.00	154.00	.31	29.00	1.50	98.26	196.03	5.56

Total Inflow Surface Discharge To HEC-1
SPIT FLOW I.D. 27

THIS RUN EXECUTED 09JUN80 18:03:04

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

 Version  4.6.2;  May 1991
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T1      UPPER EMF FIS STUDY   FCDMC NO. 94-26            FILE: UEMF2
T2      MCKELLIPS & PALMES DEL SOL MOBILE HOME PARK     BY A-N WEST INC. PHX.AZ.
T3      SPLIT FLOW RATING CURVE ANALYSIS                 DATE:8/3/95

J1  ICHECK    ING      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

                2                        .0114                               96.0

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

     1                -1

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       43       1        53       21       22       54       51       4        8
     42       5        26

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

    -10      -10

NC    .013     .013     .013     .1       .3
QT      6       25       50       75      100      125      150
       THE PALMAS DEL SOL M.H. PARK IS LOCATED ON THE SOUTH SIDE OF MCKELLIPS
       RD BETWEEN RECKER RD. AND 64 TH STREET.
       A CONCRETE CHANNEL DRAINS FLOW FROM MCKELLIPS RD INTO THE M.H.PARK
       AND ULTIMATELY SOUTH ON RECKER RD.
       THE CONCRETE DITCH TRAPEZOIDAL CROSS SECTION IS CODED FROM LEFT TO RT.
       LOOKING DOWNSTREAM.  THE TRAPEZOIDAL SECTION IS DIMENSIONED LOOKING D/S
       FROM LT. TO RT. WITH 3.92'WIDE LEFT SLOPE,2' WIDE BOTTOM,AND 2.92' WIDE
       RT. SLOPE AT 1.25(H):1(V).
       THE NORTH (RT.)SIDE OF CHANNEL IS A BLOCK WALL AND THE SOUTH SIDE (LT.)
       SIDE IS A 6 INCH VERT. CURB>
       THE 6 INCH VERT. CURB WAS NOT MODELED BUT FLOW CAN RISE 6 INCHES ABOVE
       LT. BANK ELEV. BEFORE BREAKING OUT TO INTERIOR STREET SOUTH OF CHANN.
       SECT. NOS. INCR. UPSTREAM BEGINNING AT 0.00 AND PROGRESS TO 273.00.
       SECTION 273 OF THIS FILE: UEMF2 IS ALONG THE CENTERLINE OF MCKELLIPS &
       AT THE FILE: UEMF3 MODEL'S SECTION 398, WHERE FLOW WAS ASSUMED TO SPLIT.
       THIS MODEL GENERATED SEVERAL PROFILES FOR A RANGE OF DISCHARGES AND THE
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      RESULTANT DISCHARGE VERSUS WSE. AT SECTION 273 WAS USED FOR INPUT TO
      FILE:UEMF3 TO MODEL  SPLIT FLOW.
X1       0        5        0     8.84        0        0        0
GR   98.09        0    94.95     3.92    94.95     5.92    97.28     8.84    98.24     8.84

X1     100        5        0     8.84      100      100      100
GR   99.40        0    96.26     3.92    96.26     5.92    98.55     8.84    99.55     8.84

X1     200        5        0     8.84      100      100      100
GR  100.51        0    97.38     3.92    97.38     5.92    99.71     8.84   100.71     8.84

NC                                 .3       .5
      SECTION 218 MODELS A 3 FT. HIGH OPENING IN BLOCK WALL WITH 29 FT. BOTTOM
      WIDTH AND 40 FT. TOPWIDTH.    FOUR 1.5 FT. PIERS WERE NOT MODELED BUT
      CHANNEL SECTION WIDTH WAS REDUCED BY 6 FT. TO ACCOUNT FOR THIS.
X1     218        4        0       34       18       18       18
GR  100.63        0    97.63        6    97.63       29   100.63       34

      THIS SECTION 238 MODELS THE SOUTH SIDE OF MCKELLIPS TOP OF CURB AT WALL
      OPENING.
X1     238        4        0      203       20       20       20
GR  101.86        0   100.04      148   100.04      149   100.99      203

      THIS SECTION IS ALONG THE CENTERLINE OF MCKELLIPS RD NORTH OF THE WALL
      OPENING AND IS THE SECTION USED AS THE POINT WHERE FLOW SPLITS WEST
      IN MCKELLIPS OR SOUTH TO THE CHANNEL.
X1     273        4        0      203       35       35       35
GR  102.08        0   100.74      148   100.74      149   101.18      203
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THIS RUN EXECUTED 09JUN80 18:03:06

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HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	.000	25.00	96.23	2.32	.00	8.84	7.53	.00	5.21	1.28	94.95	32.23	5.39
*	.000	50.00	96.80	1.61	.00	8.84	8.24	.00	6.63	1.85	94.95	29.73	6.26
*	.000	75.00	97.22	1.09	.00	8.84	8.76	.00	7.68	2.27	94.95	28.50	6.83
*	.000	100.00	97.55	.67	.00	8.84	8.84	.00	8.17	2.60	94.95	27.88	7.34
*	.000	125.00	97.83	.33	.00	8.84	8.84	.00	8.51	2.88	94.95	28.34	7.84
*	.000	150.00	98.10	.00	.00	8.84	8.84	.00	8.84	3.15	94.95	28.21	8.22
*	100.000	25.00	97.54	2.32	.00	8.84	7.56	1.31	5.24	1.28	96.26	32.03	5.38
*	100.000	50.00	98.10	1.62	.00	8.84	8.27	1.30	6.66	1.84	96.26	29.79	6.26
*	100.000	75.00	98.52	1.09	.00	8.84	8.81	1.30	7.71	2.26	96.26	28.49	6.83
*	100.000	100.00	98.84	.70	.00	8.84	8.84	1.29	8.14	2.58	96.26	28.51	7.40
*	100.000	125.00	99.13	.33	.00	8.84	8.84	1.31	8.51	2.87	96.26	28.23	7.83
*	100.000	150.00	99.40	.01	.00	8.84	8.84	1.30	8.83	3.14	96.26	28.32	8.23
*	200.000	25.00	98.67	2.31	.00	8.84	7.53	1.12	5.22	1.29	97.38	32.02	5.38
*	200.000	50.00	99.23	1.60	.00	8.84	8.24	1.13	6.64	1.85	97.38	29.71	6.26
*	200.000	75.00	99.65	1.08	.00	8.84	8.77	1.13	7.69	2.27	97.38	28.32	6.81
*	200.000	100.00	99.98	.67	.00	8.84	8.84	1.13	8.17	2.60	97.38	28.11	7.36
*	200.000	125.00	100.26	.31	.00	8.84	8.84	1.13	8.53	2.88	97.38	28.08	7.82
*	200.000	150.00	100.52	.00	.00	8.84	8.84	1.13	8.84	3.14	97.38	28.16	8.22
*	218.000	25.00	99.24	2.77	.00	34.00	31.69	.58	28.93	1.61	97.63	.17	.60
*	218.000	50.00	100.01	1.23	.00	34.00	32.97	.78	31.74	2.38	97.63	.18	.77
*	218.000	75.00	100.57	.10	.00	34.00	33.91	.92	33.81	2.94	97.63	.19	.90
*	218.000	100.00	101.05	.00	.00	34.00	34.00	1.07	34.00	3.42	97.63	.20	1.00
*	218.000	125.00	101.47	.00	.00	34.00	34.00	1.21	34.00	3.84	97.63	.20	1.09
*	218.000	150.00	101.86	.00	.00	34.00	34.00	1.34	34.00	4.23	97.63	.21	1.18
	238.000	25.00	100.41	117.70	.00	203.00	170.18	1.17	52.48	.37	100.04	44.15	2.51
*	238.000	50.00	100.53	107.83	.00	203.00	177.08	.52	69.24	.49	100.04	40.26	2.88
*	238.000	75.00	100.62	100.66	.00	203.00	182.09	.05	81.44	.58	100.04	38.13	3.13
*	238.000	100.00	101.04	66.43	.00	203.00	203.00	-.01	136.57	1.00	100.04	3.73	1.42
*	238.000	125.00	101.48	29.87	.00	203.00	203.00	.01	173.13	1.44	100.04	.81	.89
	238.000	150.00	101.88	.00	.00	203.00	203.00	.02	203.00	1.84	100.04	.35	.70

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	273.000	25.00	101.04	114.44	.00	203.00	186.29	.63	71.85	.30	100.74	47.30	2.26
*	273.000	50.00	101.14	103.29	.00	203.00	198.68	.61	95.38	.40	100.74	41.74	2.56
*	273.000	75.00	101.21	96.01	.00	203.00	203.00	.59	106.99	.47	100.74	40.73	2.86
*	273.000	100.00	101.27	89.82	.00	203.00	203.00	.22	113.18	.53	100.74	38.63	3.09
*	273.000	125.00	101.46	68.73	.00	203.00	203.00	-.03	134.27	.72	100.74	12.24	2.23
*	273.000	150.00	101.87	22.13	.00	203.00	203.00	-.01	180.87	1.13	100.74	1.94	1.22

These Discharges and CWSEL's From File: UEMF2 output provide rating curve on capacity of concrete channel in P.D.S. M.H.P to convey flow from split. These values input to split flow option of File UEMF3 to compute flow down McKellips and split flow to P.D.S. M.H.P.

THIS RUN EXECUTED 19MAY80 16:20:07

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

 Version   4.6.2;  May 1991
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SPLIT FLOW BEING PERFORMED

```
SF

TC                                                      Q    CWSEL
CS     6     398     398      -1
CR    25  101.04      50  101.14      75  101.21     100  101.27     125  101.46
CR   150  101.87
```

Input rating curve data of discharge and CWSEL from File VEMF2 of concrete channel capacity in P.D.S, M.H.P,

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T1     UPPER EMF FIS STUDY   FCDMC NO. 94-26              FILE:UEMF3
T2     MCKELLIPS & PALMES DEL SOL MOBILE HOME PARK    BY A-N WEST INC. PHX.AZ.
T3     SPLIT FLOW RATING CURVE ANALYSIS                 DATE:8/7/95

J1 ICHECK    INQ     NINV     IDIR     STRT     METRIC    HVINS    Q      WSEL     FQ

                2                      .0119                              96.5

J2 NPROF    IPLOT    PRFVS    XSECV    XSECH    FN      ALLDC    IBW     CHNIM    ITRACE

    1                 -1


J3 VARIABLE CODES FOR SUMMARY PRINTOUT

    38       43        1        53        21        22        54        51        4        8
    42        5       26

NC    .015     .035     .015      .1      .3
QT      8       25       50       75     100      125      150      175      200
       THIS HEC-2 MODEL (FILE:UEMF3) MODELS MCKELLIPS ROAD IN FRONT OF THE
       PALMAS DEL SOL M.H. PARK
       CROSS SECTIONS ARE CODED FROM LEFT TO RIGHT LOOKING DOWNSTREAM WITH
       STA. 100 AT CENTERLINE.
       SECTION ID. NOS. ARE IN FEET INCREASING UPSTREAM.
       THIS HEC-2 MODEL WHICH MODELS SPLIT FLOW WEST ON MCKELLIPS AND SOUTH
       INTO THE PALMES DEL SOL M.H. PARK WAS RUN FOR SEVERAL DISCHARGES
       TO DEVELOP A SPLIT FLOW RELATIONSHIP FOR THE HYDROLOGY MODEL OF
       THE WATERSHED FOR THIS FIS STUDY ALONG THE RWCD CANAL.
X1      0        6        0       68        0        0        0
GR    97.4       0    96.90        0    97.37       34    96.57       68    96.04       81
GR   96.72      99

X1     50        6        0       68       50       50       50
GR   97.99       0    97.49        0    97.96       34    97.16       68    96.63       81
GR   97.31      99

X1    290        6        0       68      240      240      240
GR  101.26       0   100.76        0   101.16       34   100.68       68    98.82       81
GR  100.10      90

X1    340        6        0       68       50       50       50
GR  101.49       0   100.99        0   101.18       34   100.98       68    99.20       77
GR  101.94      93

      SECTION 398 IS PERPENDICULAR TO AN OPENING IN A BLOCK WALL AT THE
      PALMAS DEL SOL M.H. PARK.
      THIS CROSS SECTION WAS USED AS THE POINT WHERE TOTAL FLOW FROM THE
```

NORTHEAST WILL SPLIT WEST ALONG MCKELLIPS RD. OR SOUTH INTO PALMAS
DEL SOL M.H. PARK AND THEN SOUTH ON RECKER RD.
THE SPLIT FLOW OPTION WAS USED AT THIS SECTION 398 TO DIVERT FLOW
INTO PALMAS DEL SOL. THE RATING CURVE DATA IS FROM A SECOND HEC-2
MODEL (FILE UEMF2) WHICH MODELS CAPACITY OF THE PALMAS DEL SOL CHANNEL.

X1	398	6	0	68	58	58	58			
GR	100.54	0	100.04	0	100.74	34	100.81	68	99.79	80
GR	102.70	94								

THIS RUN EXECUTED 19MAY80 16:20:11

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HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

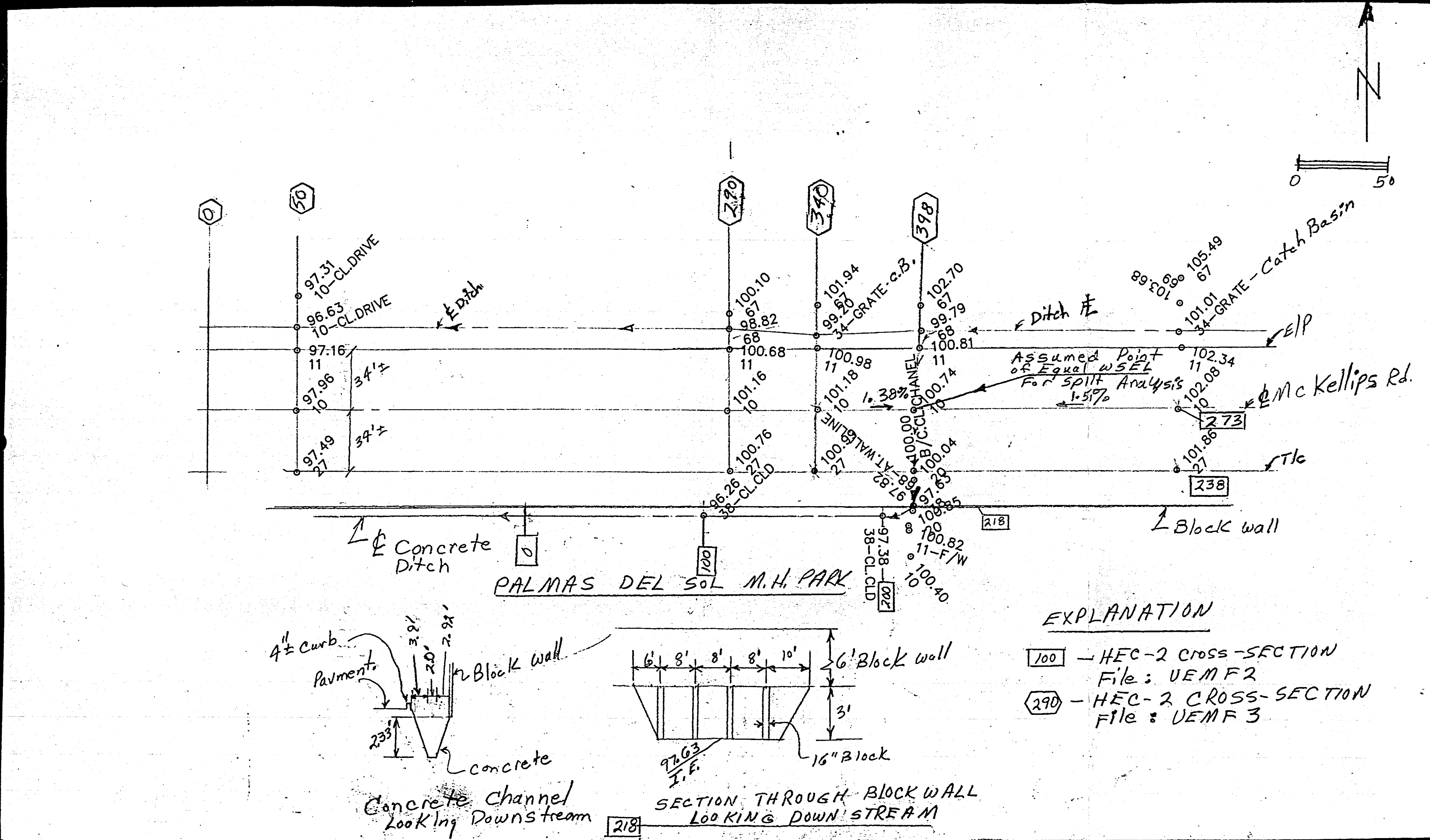
NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
.000	25.00	96.69	62.90	.00	68.00	98.21	.00	35.31	.65	96.04	118.84	1.66
.000	42.42	96.81	57.85	.00	68.00	99.00	.00	41.15	.77	96.04	117.78	2.61
.000	48.34	96.84	56.45	.00	68.00	99.00	.00	42.55	.80	96.04	117.33	2.83
.000	55.11	96.87	55.09	.00	68.00	99.00	.00	43.91	.83	96.04	119.07	3.08
.000	61.30	96.90	.00	.00	68.00	99.00	.00	45.41	.86	96.04	118.85	3.23
.000	66.23	96.93	.00	.00	68.00	99.00	.00	48.38	.89	96.04	117.31	3.15
.000	72.96	96.96	.00	.00	68.00	99.00	.00	51.49	.92	96.04	119.27	3.19
50.000	25.00	97.28	62.90	.00	68.00	98.21	.59	35.31	.65	96.63	118.84	1.66
50.000	42.42	97.40	57.85	.00	68.00	99.00	.59	41.15	.77	96.63	117.78	2.61
50.000	48.34	97.43	56.46	.00	68.00	99.00	.59	42.54	.80	96.63	117.34	2.83
50.000	55.11	97.47	55.09	.00	68.00	99.00	.60	43.91	.84	96.63	119.07	3.08
50.000	61.30	97.50	.00	.00	68.00	99.00	.59	45.41	.87	96.63	118.85	3.23
50.000	66.23	97.52	.00	.00	68.00	99.00	.59	48.38	.89	96.63	117.32	3.15
50.000	72.96	97.55	.00	.00	68.00	99.00	.60	51.49	.92	96.63	119.27	3.19
290.000	25.00	99.93	73.27	.00	68.00	88.78	2.64	15.52	1.11	98.82	104.93	.00
290.000	42.42	100.15	71.76	.00	68.00	90.00	2.75	18.24	1.33	98.82	115.26	.00
290.000	48.34	100.20	71.38	.00	68.00	90.00	2.78	18.62	1.38	98.82	118.57	.00
290.000	55.11	100.26	70.92	.00	68.00	90.00	2.79	19.08	1.44	98.82	118.29	.00
290.000	61.30	100.31	70.56	.00	68.00	90.00	2.81	19.44	1.49	98.82	120.59	.00
290.000	66.23	100.35	70.33	.00	68.00	90.00	2.83	19.67	1.53	98.82	124.88	.00
290.000	72.96	100.40	69.93	.00	68.00	90.00	2.85	20.07	1.58	98.82	124.29	.00
340.000	25.00	100.43	70.78	.00	68.00	84.18	.50	13.40	1.23	99.20	99.69	.00
340.000	42.42	100.69	69.48	.00	68.00	85.69	.54	16.21	1.49	99.20	104.03	.00
340.000	48.34	100.76	69.11	.00	68.00	86.11	.56	17.01	1.56	99.20	104.71	.00
340.000	55.11	100.83	68.78	.00	68.00	86.50	.57	17.72	1.63	99.20	109.26	.00
340.000	61.30	100.89	68.47	.00	68.00	86.85	.58	18.39	1.69	99.20	111.08	.00
340.000	66.23	100.94	68.19	.00	68.00	87.17	.60	18.97	1.74	99.20	109.61	.00
340.000	72.96	101.00	.00	.00	68.00	87.50	.60	24.11	1.80	99.20	111.34	.40

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	398.000	25.00	100.71	.00	.00	68.00	84.43	.28	47.84	.92	99.79	13.04	1.70
*	398.000	50.00	100.97	.00	.00	68.00	85.70	.28	85.70	1.18	99.79	7.96	1.49
*	398.000	75.00	101.05	.00	.00	68.00	86.06	.29	86.06	1.26	99.79	10.53	1.92
*	398.000	100.00	101.12	.00	.00	68.00	86.41	.29	86.41	1.33	99.79	12.03	2.25
*	398.000	125.00	101.18	.00	.00	68.00	86.70	.29	86.70	1.39	99.79	13.42	2.55
*	398.000	150.00	101.23	.00	.00	68.00	86.94	.29	86.94	1.44	99.79	15.07	2.85
*	398.000	175.00	101.29	.00	.00	68.00	87.20	.29	87.20	1.50	99.79	15.92	3.09



#7158-03

A-N WEST INC.
Consulting Engineers

B-16

FCDMC #94-26
SPLIT FLOW AT
McKELLIPS ROAD AND PALMAS DEL SOL
M.H. PARK

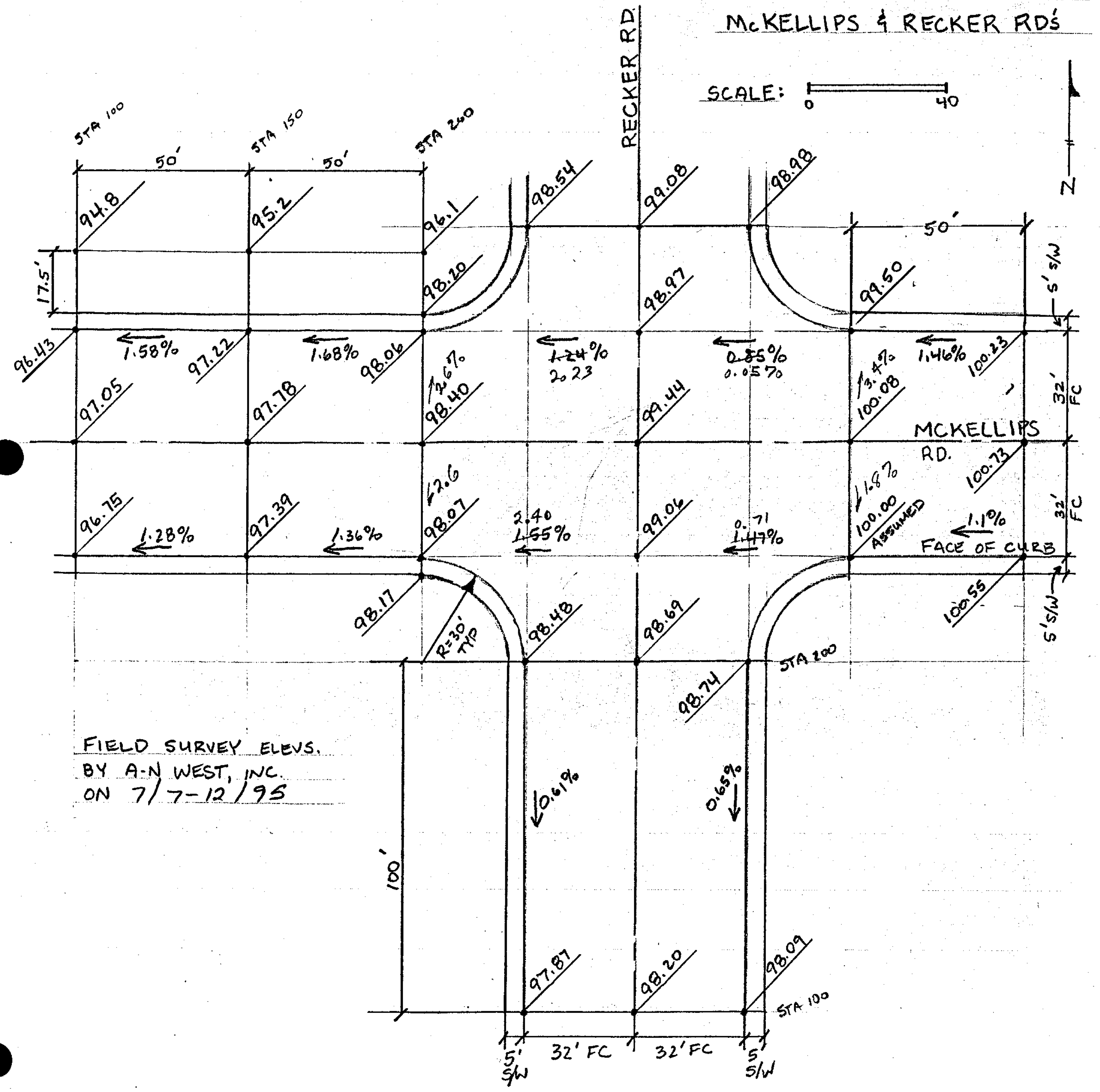
FIGURE B-2

A-N WEST INC.
Consulting Engineers
Richmond, California
San Jose, California
Phoenix, Arizona

Upper EMF FIS Study
Split Flow Analysis at
McKellips Rd and Recker Rd

Project 7158-03 Sht. ___ of ___
Calc. By ___ Date 8/8/95
Chkd. GAS Date 9/1/95

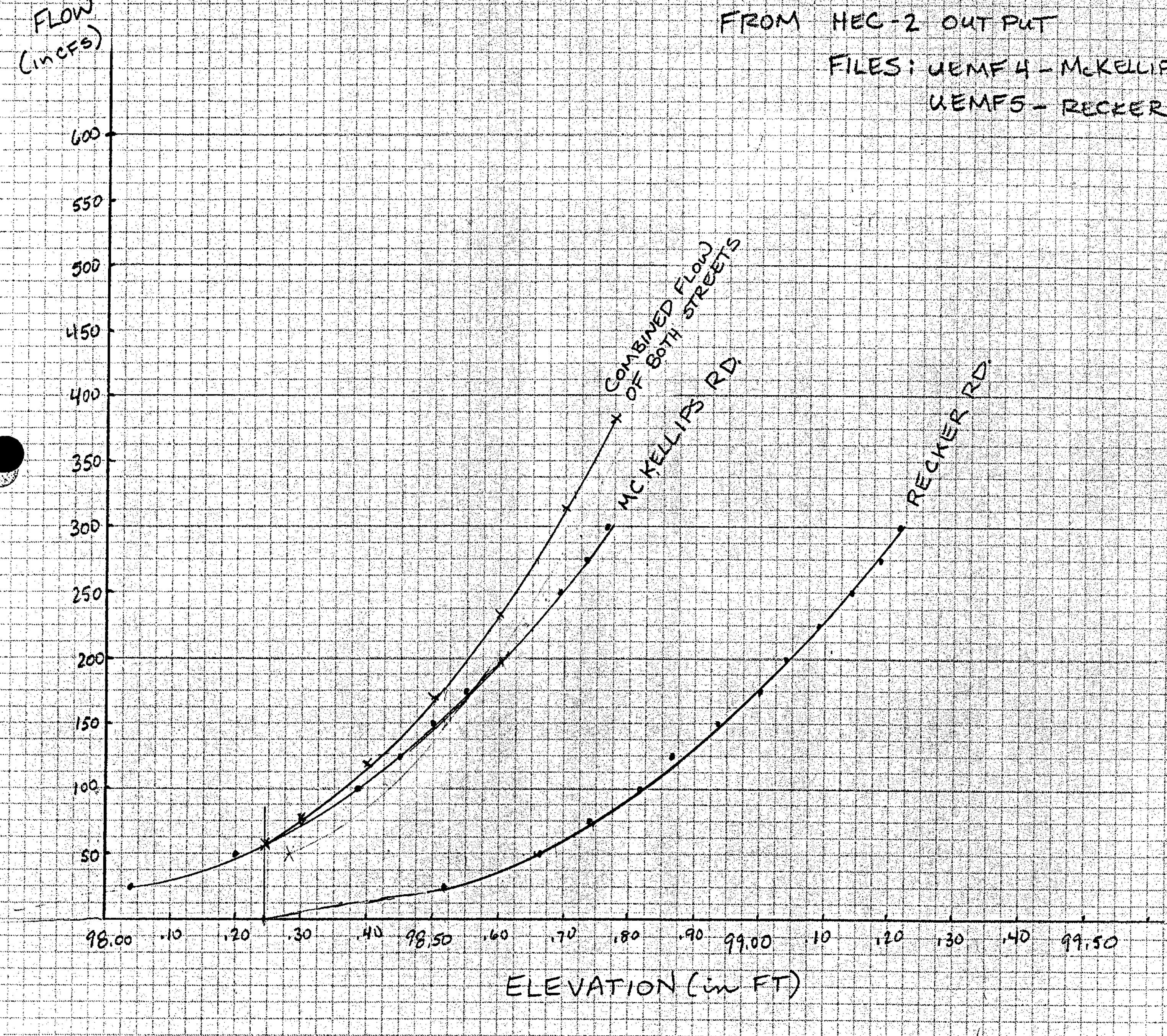
SPLIT FLOW ANALYSIS
McKELLIPS & RECKER RD'S



FIELD SURVEY ELEVS.
BY A-N WEST, INC.
ON 7/7-12/95

FIGURE B-3

SPLIT FLOW ANALYSIS
McKELLIPS & RECKER RDS
SITE
STREET RATING CAPACITY CURVE
FROM HEC-2 OUT PUT
FILES: UEMF4 - McKELLIP
UEMF5 - RECKER



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                                                              THIS RUN EXECUTED 09JUN80    19:39:53
 ************************************
  HEC-2 WATER SURFACE PROFILES

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


T1      UPPER EMF FIS STUDY   FCDMC NO. 94-26                 FILE:UEMF4
T2      MCKELLIPS AND RECKER RDS. (MCKELLIPS VIEW)      BY A-N WEST INC. PHX.AZ.
T3      SPLIT FLOW RATING CURVE ANALYSIS                  DATE:8/9/95

J1  ICHECK    INQ      NINV      IDIR      STRT      METRIC    HVINS      Q        WSEL      FQ

                2                           .013                                    95.5

J2  NPROF     IPLOT    PRFVS     XSECV     XSECH     FN        ALLDC     IBW      CHNIM     ITRACE

      1                 -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        43        1        53        21        22        54        51        4         8
     42         5       26

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

    -10       -10

NC      .04       .04      .015       .1        .3
QT        6       175       200       225       250       275       300
       THE MCKELLIPS RD CROSSSECTION IS CODED (IN FEET) LOOKING   UPSTREAM
       WITH STATION 100 AT THE STREET CENTERLINE.  THE RIGHT OF WAY LIMITS
       EXTEND 55' FROM THE LEFT AND RIGHT OF CENTERLINE.  THE STREET IS 64'
       WIDE AND INCLUDES A 6" CURB AND 5.5' SIDEWALK WIDTHS WITH A DOWNWARD
       TO CENTERLINE SLOPE OF 2%.  SECTION I.D. NUMBERS INCREASE GOING UP
       STREAM BEGINNING AT 0.00' AND PROGRESS TO 200.00' SIX PROFILES OF
       DISCHARGE FORM 175 CFS TO 300 CFS ARE CALCULATED OVER THE RECKER ROAD
       CROSS SECTION.
X1        0         9      62.5     137.5         0         0         0
GR    95.76        45     95.41      62.5     95.30        68     94.80      68.1     95.90       100
GR    95.12     131.9     95.62       132     95.73     137.5     96.08       155

X1      100         9      62.5     137.5       100       100       100
GR    96.89        45     96.54      62.5     96.43        68     95.93      68.1     97.05       100
GR    96.25     131.9     96.75       132     96.86     137.5     97.21       155
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B-19

X1	150	9	62.5	137.5	50	50	50			
GR	97.68	45	97.33	62.5	97.22	68	96.72	68.1	97.78	100
GR	96.89	131.9	97.39	132	97.50	137.5	97.85	155		
X1	200	9	62.5	137.5	50	50	50			
GR	98.52	45	98.17	62.5	98.06	68	97.56	68.1	98.40	100
GR	97.57	131.9	98.07	132	98.18	137.5	98.53	155		

THIS RUN EXECUTED 09JUN80 19:39:56

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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

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	.000	175.00	95.97	45.00	62.50	137.50	149.36	.00	104.36	1.17	94.80	43.14	4.20
*	.000	200.00	96.01	45.00	62.50	137.50	151.73	.00	106.73	1.21	94.80	41.86	4.39
	.000	225.00	96.07	45.00	62.50	137.50	154.32	.00	109.32	1.27	94.80	39.37	4.51
*	.000	250.00	96.11	45.00	62.50	137.50	155.00	.00	110.00	1.31	94.80	37.86	4.64
*	.000	275.00	96.16	45.00	62.50	137.50	155.00	.00	110.00	1.36	94.80	36.59	4.76
*	.000	300.00	96.19	45.00	62.50	137.50	155.00	.00	110.00	1.39	94.80	37.55	4.96
*	100.000	175.00	97.11	45.00	62.50	137.50	150.17	1.15	105.17	1.18	95.93	40.84	4.13
*	100.000	200.00	97.16	45.00	62.50	137.50	152.55	1.15	107.55	1.23	95.93	39.79	4.32
*	100.000	225.00	97.21	45.00	62.50	137.50	154.90	1.14	109.90	1.28	95.93	38.53	4.47
*	100.000	250.00	97.25	45.00	62.50	137.50	155.00	1.14	110.00	1.32	95.93	37.86	4.63
*	100.000	275.00	97.29	45.00	62.50	137.50	155.00	1.13	110.00	1.36	95.93	37.53	4.79
*	100.000	300.00	97.33	45.00	62.50	137.50	155.00	1.14	110.00	1.40	95.93	36.52	4.92
*	150.000	175.00	97.85	45.00	62.50	137.50	154.76	.73	109.76	1.13	96.72	38.80	4.08
*	150.000	200.00	97.90	45.00	62.50	137.50	155.00	.74	110.00	1.18	96.72	35.44	4.17
*	150.000	225.00	97.94	45.00	62.50	137.50	155.00	.73	110.00	1.22	96.72	37.04	4.42
*	150.000	250.00	97.97	45.00	62.50	137.50	155.00	.72	110.00	1.25	96.72	38.49	4.66
*	150.000	275.00	98.01	45.00	62.50	137.50	155.00	.72	110.00	1.29	96.72	37.89	4.81
*	150.000	300.00	98.05	45.00	62.50	137.50	155.00	.72	110.00	1.33	96.72	37.38	4.95
*	200.000	175.00	98.55	45.00	62.50	137.50	155.00	.71	110.00	.99	97.56	38.61	4.10
*	200.000	200.00	98.60	45.00	62.50	137.50	155.00	.70	110.00	1.04	97.56	37.85	4.29
*	200.000	225.00	98.64	45.00	62.50	137.50	155.00	.71	110.00	1.08	97.56	37.17	4.46
*	200.000	250.00	98.69	45.00	62.50	137.50	155.00	.72	110.00	1.13	97.56	36.61	4.62
*	200.000	275.00	98.73	45.00	62.50	137.50	155.00	.72	110.00	1.17	97.56	36.13	4.77
*	200.000	300.00	98.77	45.00	62.50	137.50	155.00	.72	110.00	1.21	97.56	35.69	4.91

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO=	.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	.000	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	.000	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	.000	PROFILE=	5	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	.000	PROFILE=	6	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	1	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	100.000	PROFILE=	1	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	100.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	2	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	100.000	PROFILE=	2	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	100.000	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	3	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	100.000	PROFILE=	3	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	100.000	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	4	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	100.000	PROFILE=	4	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	100.000	PROFILE=	5	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	5	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	100.000	PROFILE=	5	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	100.000	PROFILE=	6	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	100.000	PROFILE=	6	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	100.000	PROFILE=	6	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	150.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	150.000	PROFILE=	1	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	150.000	PROFILE=	1	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	150.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	150.000	PROFILE=	2	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	150.000	PROFILE=	2	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	150.000	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	150.000	PROFILE=	3	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	150.000	PROFILE=	3	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	150.000	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	150.000	PROFILE=	4	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	150.000	PROFILE=	4	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	150.000	PROFILE=	5	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	150.000	PROFILE=	5	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	150.000	PROFILE=	5	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	150.000	PROFILE=	6	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	150.000	PROFILE=	6	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	150.000	PROFILE=	6	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	200.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	200.000	PROFILE=	1	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	200.000	PROFILE=	1	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=	200.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION SECNO=	200.000	PROFILE=	2	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=	200.000	PROFILE=	2	20 TRIALS ATTEMPTED TO BALANCE WSEL

B-22

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CAUTION SECNO=   200.000  PROFILE=  3  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   200.000  PROFILE=  3  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   200.000  PROFILE=  3  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   200.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   200.000  PROFILE=  4  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   200.000  PROFILE=  4  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   200.000  PROFILE=  5  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   200.000  PROFILE=  5  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   200.000  PROFILE=  5  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   200.000  PROFILE=  6  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   200.000  PROFILE=  6  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   200.000  PROFILE=  6  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

THIS RUN EXECUTED 09JUN80 19:44:47

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

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


T1      UPPER EMF FIS STUDY   FCDMC NO. 94-26              FILE:UEMF5
T2      MCKELLIPS AND RECKER RDS. (RECKER VIEW)        BY A-N WEST INC. PHX.AZ.
T3      SPLIT FLOW RATING CURVE ANALYSIS                DATE:8/9/95

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC    HVINS    Q       WSEL     FQ

               2                          .061                                97.5

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH     FN       ALLDC    IBW     CHNIM    ITRACE

     1                 -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        43        1        53        21        22        54        51        4        8
     42         5       26

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

   -10       -10

NC      .04       .04      .015       .1        .3
QT        6       175       200       225       250       275       300
        THE MCKELLIPS ROAD CROSS SECTION IS CODED (IN FEET) LOOKING DOWN STREAM
        WITH STATION 100 AT THE STREET CENTERLINE.  THE RIGHT OF WAY LIMITS
        EXTEND 55' FROM LEFT AND RIGHT OF CENTERLINE.  THE STREET IS 64' WIDE
        AND INCLUDES 6" CURBS, 5.5' SIDEWALK WIDTHS, AND A DOWNWARD TO CENTER
        LINE SLOPE OF 2%.  SECTION I.D. NUMBERS INCREASE UPSTREAM BEGINNING AT
        0.00' AND PROGRESS TO 200.00'.  SIX PROFILES OF DISCHARGE FROM 175 CFS
        TO 300 CFS ARE CALCULATED OVER THE RECKER ROAD CROSS SECTION.
X1        0         9      62.5     137.5         0         0         0
GR     97.9        45     97.55      62.5     97.44        68     96.94      68.1     97.77       100
GR    97.16     131.9     97.66       132     97.77     137.5     98.12       155

X1      100         9      62.5     137.5       100       100       100
GR    98.33        45     97.98      62.5     97.87        68     97.37      68.1     98.20       100
GR    97.59     131.9     98.09       132      98.2     137.5     98.55       155

X1      200         9      62.5     137.5       100       100       100
GR    98.94        45     98.59      62.5     98.48        68     97.98      68.1     98.69       100
GR    98.24     131.9     98.74       132     98.85     137.5     99.20       155
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THIS RUN EXECUTED 09JUN80 19:44:49

****
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

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	.000	175.00	97.99	45.00	62.50	137.50	148.34	.00	103.34	1.05	96.94	39.37	4.13
*	.000	200.00	98.04	45.00	62.50	137.50	151.00	.00	106.00	1.10	96.94	37.29	4.28
*	.000	225.00	98.08	45.00	62.50	137.50	153.03	.00	108.03	1.14	96.94	37.64	4.49
*	.000	250.00	98.13	45.00	62.50	137.50	155.00	.00	110.00	1.19	96.94	36.46	4.63
*	.000	275.00	98.17	45.00	62.50	137.50	155.00	.00	110.00	1.23	96.94	35.78	4.77
*	.000	300.00	98.21	45.00	62.50	137.50	155.00	.00	110.00	1.27	96.94	34.96	4.90
*	100.000	175.00	98.42	45.00	62.50	137.50	148.33	.43	103.33	1.05	97.37	39.42	4.14
*	100.000	200.00	98.46	45.00	62.50	137.50	150.66	.42	105.66	1.09	97.37	38.81	4.33
*	100.000	225.00	98.51	45.00	62.50	137.50	153.17	.43	108.17	1.14	97.37	37.08	4.47
*	100.000	250.00	98.56	45.00	62.50	137.50	155.00	.43	110.00	1.19	97.37	35.79	4.60
*	100.000	275.00	98.60	45.00	62.50	137.50	155.00	.43	110.00	1.23	97.37	35.29	4.75
*	100.000	300.00	98.64	45.00	62.50	137.50	155.00	.43	110.00	1.27	97.37	34.95	4.90
*	200.000	175.00	99.00	45.00	62.50	137.50	144.79	.58	99.79	1.02	97.98	37.96	4.10
*	200.000	200.00	99.04	45.00	62.50	137.50	147.23	.58	102.23	1.06	97.98	37.07	4.29
*	200.000	225.00	99.09	45.00	62.50	137.50	149.63	.58	104.63	1.11	97.98	36.05	4.45
*	200.000	250.00	99.14	45.00	62.50	137.50	151.86	.58	106.86	1.16	97.98	35.44	4.61
*	200.000	275.00	99.18	45.00	62.50	137.50	154.04	.58	109.04	1.20	97.98	34.76	4.75
*	200.000	300.00	99.22	45.00	62.50	137.50	155.00	.58	110.00	1.24	97.98	33.80	4.87

SUMMARY OF ERRORS AND SPECIAL NOTES

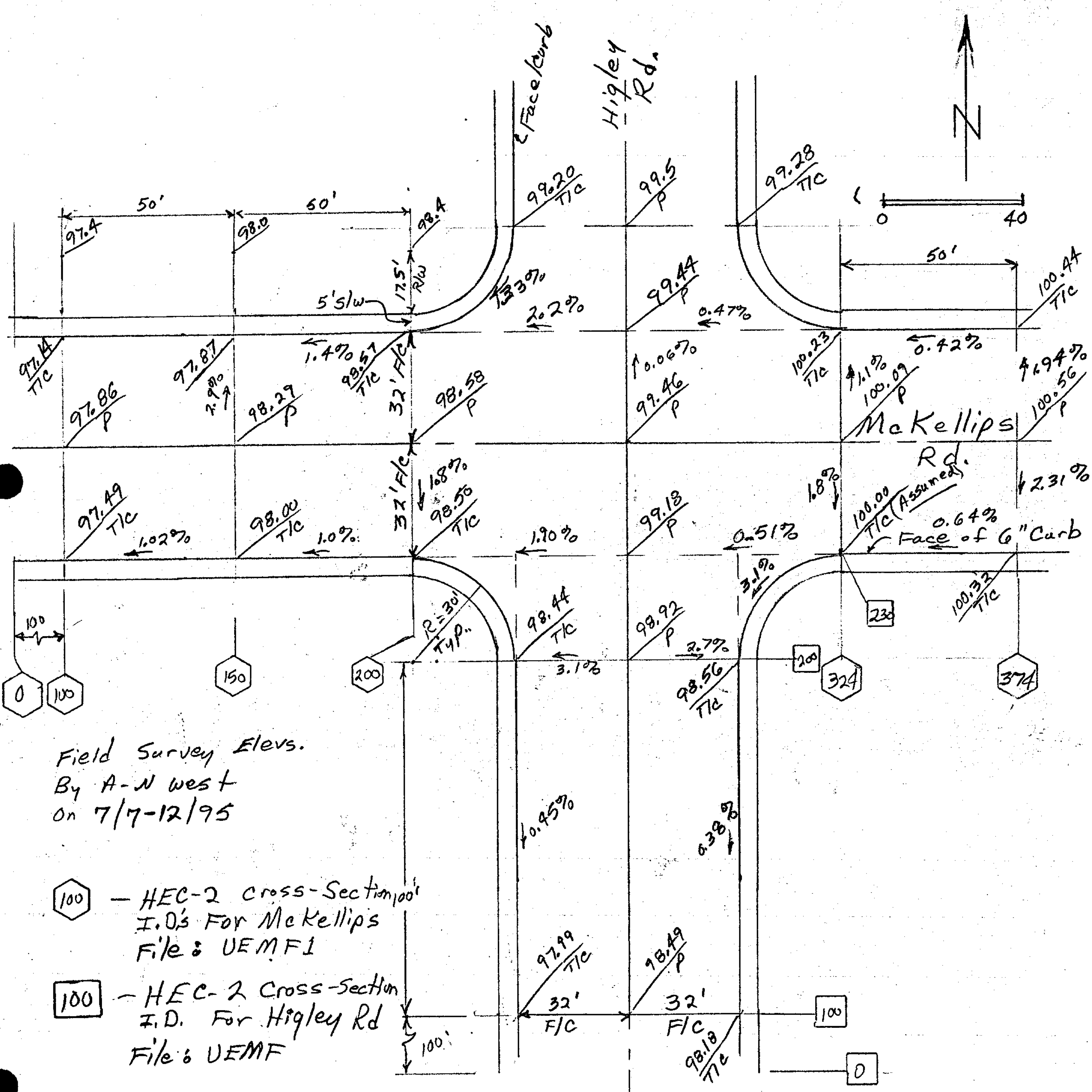
CAUTION	SECNO=	.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	.000	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	.000	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	.000	PROFILE=	5	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	.000	PROFILE=	6	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	100.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	2	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	100.000	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	3	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	100.000	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	4	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	100.000	PROFILE=	5	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	5	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	100.000	PROFILE=	6	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	100.000	PROFILE=	6	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	200.000	PROFILE=	1	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	2	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	200.000	PROFILE=	2	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	3	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	200.000	PROFILE=	3	MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	4	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	200.000	PROFILE=	4	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	4	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION	SECNO=	200.000	PROFILE=	5	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	200.000	PROFILE=	5	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	5	20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION	SECNO=	200.000	PROFILE=	6	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	200.000	PROFILE=	6	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	200.000	PROFILE=	6	20 TRIALS ATTEMPTED TO BALANCE WSEL

AN WEST INC.
Consulting Engineers
Richmond, California
San Jose, California
Phoenix, Arizona

Upper EMF FIS
FCD #94-26

Project 7158-03 Sht. ___ of ___
Calc. By GAS Date 8/2/95
Chkd. ______ Date ______

Split Flow Analysis - McKellips Road and Higley Rd.

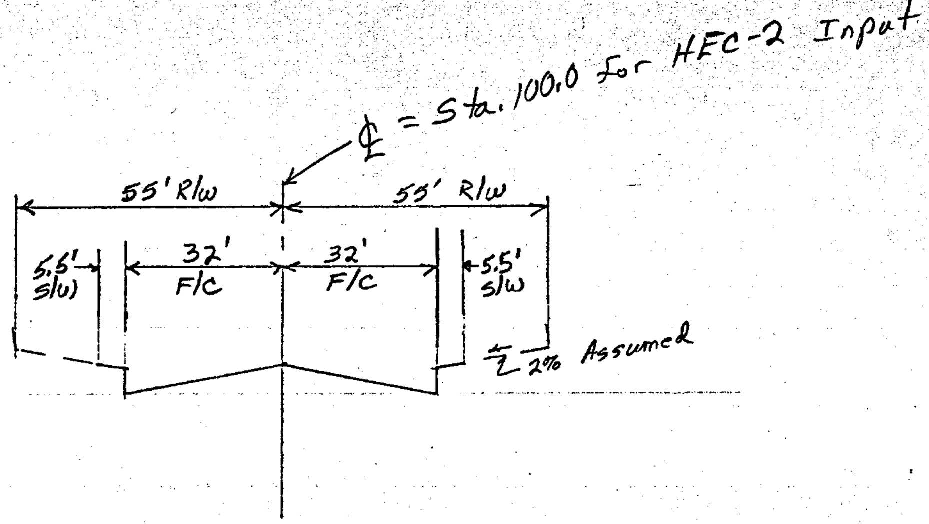


Field Survey Elevs.
By A-N West
On 7/7-12/95

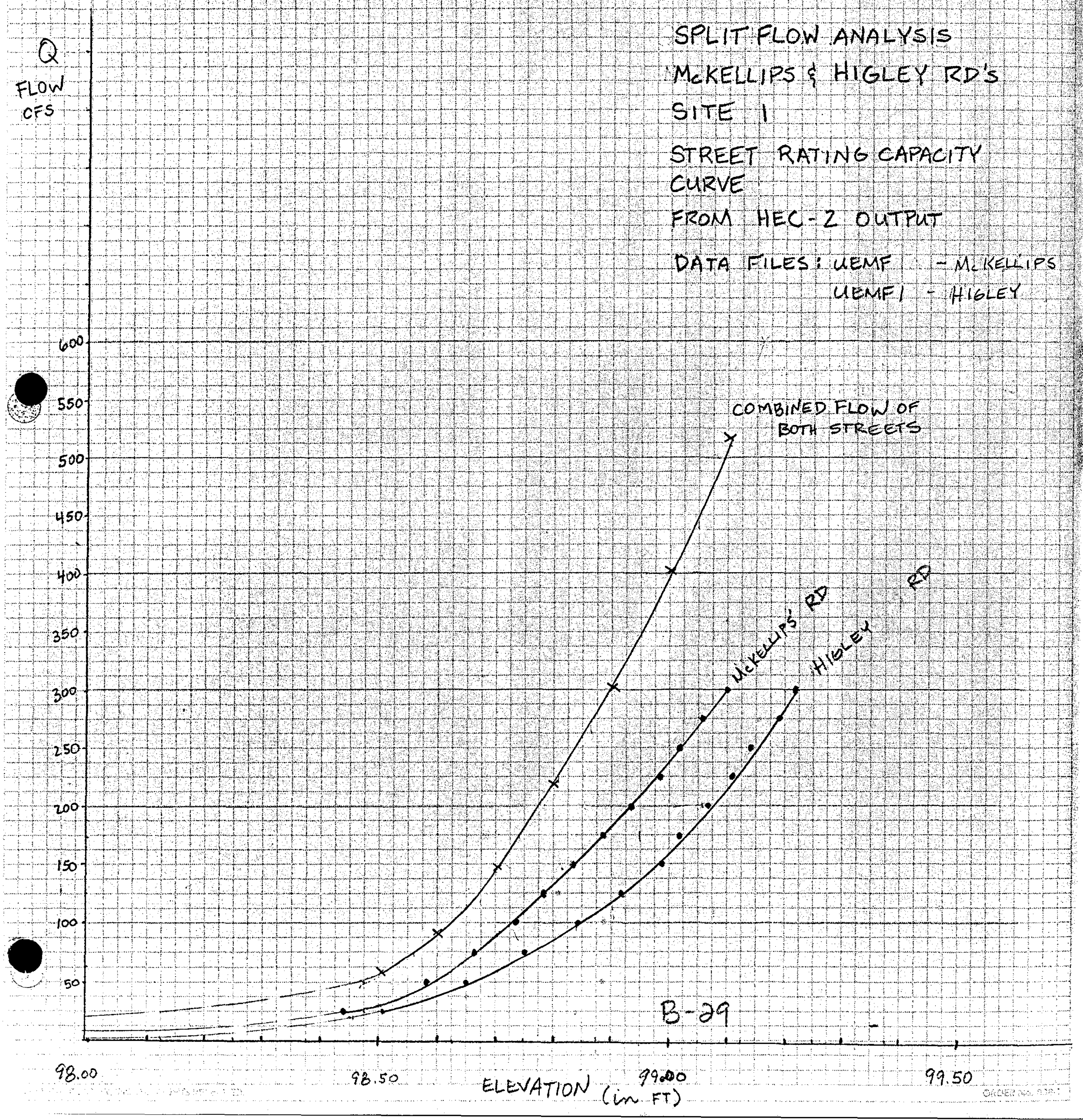
(100) - HEC-2 cross-Section 100' I.D.'s For McKellips
File: UEMF1

[100] - HEC-2 Cross-Section I.D. For Higley Rd
File: UEMF

Figure B-4



Typical Major Street Cross-Section
McKellips and Higley Rds


SPLIT FLOW ANALYSIS
McKELLIPS & HIGLEY RD'S
SITE 1
STREET RATING CAPACITY CURVE
FROM HEC-2 OUTPUT
DATA FILES: UEMF - McKELLIPS
UEMF1 - HIGLEY
Q
FLOW
CFS
600
550
500
450
400
350
300
250
200
150
100
50
COMBINED FLOW OF BOTH STREETS
McKELLIPS' RD
HIGLEY RD
98.00
98.50
99.00
99.50
ELEVATION (in FT)

B-29

THIS RUN EXECUTED 12MAY80 13:11:51

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

HEC-2 Input
HIGLEY Road

T1 UPPER EMF FIS STUDY FCDMC NO. 94-26 FILE:UEMF
T2 MCKELLIPS AND HIGLEY RDS. BY A-N WEST INC. PHX.AZ.
T3 SPLIT FLOW RATING CURVE ANALYSIS DATE:8/3/95

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		2			.003				97.7	

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

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

38	43	1	53	21	22	54	51	4	8
42	5	26							

J5	LPRNT	NUMSEC	********REQUESTED SECTION NUMBERS********
	-10	-10	

Another Run made for 25-150 CFS @ 25 CFS Intervals.

NC	.04	.04	.015	.1	.3					
QT	6	175	200	225	250	275	300			
X1	0	9	62.5	137.5	0	0	0			
GR	98.12	45	97.77	62.5	97.69	68	97.19	68.1	98.19	100
GR	97.38	131.9	97.88	132	97.96	137.5	98.31	155		
X1	100	9	62.5	137.5	100	100	100			
GR	98.4	45	98.07	62.5	97.99	68	97.49	68.1	98.49	100
GR	97.68	131.9	98.18	132	98.26	137.5	98.61	155		
X1	200	9	62.5	137.5	100	100	100			
GR	98.87	45	98.52	62.5	98.44	68	97.94	68.1	98.92	100
GR	98.06	131.9	98.56	132	98.64	137.5	98.99	155		
X1	230	5	38	162.1	30	30	30			
GR	99.0	38	98.5	38.1	99.18	100	99.5	162	100	162.1

THIS RUN EXECUTED 12MAY80 13:11:52

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

HEC-2 Output
HIGLEY Rd.
File: UEMF.DAT

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

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
	.000	175.00	98.33	45.00	62.50	137.50	155.00	.00	110.00	1.14	97.19	30.49	3.79
	.000	200.00	98.38	45.00	62.50	137.50	155.00	.00	110.00	1.19	97.19	30.27	3.97
	.000	225.00	98.42	45.00	62.50	137.50	155.00	.00	110.00	1.23	97.19	30.13	4.15
	.000	250.00	98.47	45.00	62.50	137.50	155.00	.00	110.00	1.28	97.19	30.06	4.32
	.000	275.00	98.51	45.00	62.50	137.50	155.00	.00	110.00	1.32	97.19	30.03	4.48
	.000	300.00	98.54	45.00	62.50	137.50	155.00	.00	110.00	1.35	97.19	30.61	4.66
	100.000	175.00	98.64	45.00	62.50	137.50	155.00	.31	110.00	1.15	97.49	29.51	3.75
	100.000	200.00	98.68	45.00	62.50	137.50	155.00	.30	110.00	1.19	97.49	29.73	3.95
	100.000	225.00	98.73	45.00	62.50	137.50	155.00	.30	110.00	1.24	97.49	29.84	4.14
	100.000	250.00	98.77	45.00	62.50	137.50	155.00	.30	110.00	1.28	97.49	29.89	4.31
	100.000	275.00	98.81	45.00	62.50	137.50	155.00	.30	110.00	1.32	97.49	29.91	4.47
	100.000	300.00	98.85	45.00	62.50	137.50	155.00	.31	110.00	1.36	97.49	29.73	4.62
*	200.000	175.00	99.02	45.00	62.50	137.50	155.00	.38	110.00	1.08	97.94	37.90	4.05
*	200.000	200.00	99.06	45.00	62.50	137.50	155.00	.38	110.00	1.12	97.94	37.33	4.24
*	200.000	225.00	99.11	45.00	62.50	137.50	155.00	.38	110.00	1.17	97.94	36.84	4.42
*	200.000	250.00	99.14	45.00	62.50	137.50	155.00	.37	110.00	1.20	97.94	38.29	4.65
*	200.000	275.00	99.18	45.00	62.50	137.50	155.00	.37	110.00	1.24	97.94	37.74	4.81
*	200.000	300.00	99.22	45.00	62.50	137.50	155.00	.37	110.00	1.28	97.94	37.26	4.95
*	230.000	175.00	99.48	38.00	38.00	162.10	158.47	.46	120.47	.98	98.50	44.69	3.60
*	230.000	200.00	99.53	38.00	38.00	162.10	162.01	.47	124.01	1.03	98.50	40.04	3.63
*	230.000	225.00	99.57	38.00	38.00	162.10	162.01	.46	124.01	1.07	98.50	38.77	3.77
*	230.000	250.00	99.61	38.00	38.00	162.10	162.02	.47	124.02	1.11	98.50	37.80	3.90
*	230.000	275.00	99.62	38.00	38.00	162.10	162.02	.43	124.02	1.12	98.50	43.36	4.22
*	230.000	300.00	99.65	38.00	38.00	162.10	162.03	.43	124.03	1.15	98.50	42.42	4.34

Values For HIGLEY Rd. capacity curve

THIS RUN EXECUTED 08JUN80 19:43:47

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

Version  4.6.2;  May 1991
*************************************
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HEC-2 Input
Mckellips Rd

```
T1      UPPER EMF FIS STUDY    FCDMC NO. 94-26              FILE:UEMF1
T2      MCKELLIPS AND HIGLEY RDS.                     BY A-N WEST INC. PHX.AZ.
T3      SPLIT FLOW RATING CURVE ANALYSIS                 DATE:8/3/95

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

               2                          .0086                              97.0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

     1                  -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38        43        1        53       21       22       54       51       4        8
    42        5         26

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

   -10       -10

NC      .04       .04      .015       .1       .3
QT       6        175       200       225      250       275       300
```

Another Run made for 25 - 150 cfs @ 25 cfs Interv

```
        THE HIGLEY ROAD CROSS SECTION IS CODED (IN FEET) LOOKING DOWN STREAM
        WITH STATION 100' AT THE STREET CENTERLINE.  THE RIGHT OF WAY LIMITS
        EXTEND 55' FROM THE LEFT AND RIGHT OF CENTERLINE.  THE STREET IS 64'
        WIDE AND INCLUDES 6" CURBS AND 5.5' SIDEWALK WIDTHS WITH A DOWNWARD TO
        CENTERLINE SLOPE OF 2%.  SECTION I.D. NUMBERS INCREASE GOING UPSTREAM
        BEGINNING AT 0.00' AND PROGRESS TO 200.00'.  SIX PROFILES OF DISCHARGE
        FROM 175 CFS TO 300 CFS ARE CALCULATED OVER THE HIGLEY ROAD CROSS
        SECTION.
X1       0         9       62.5     137.5       0        0        0
GR     97.4       45      97.04      62.5     96.96      68     96.46     68.1     97.0      100
GR    96.81     131.9     97.31      132      97.39    137.5     97.7      155

X1      100        9       62.5     137.5      100      100      100
GR     97.4       45      97.22      62.5     97.14      68     96.64     68.1     97.86     100
GR    96.99     131.9     97.49      132      97.57    137.5    97.92      155
```

[illegible]	150	9	62.5	137.5	50	50	50			
GR	98.0	45	97.95	62.5	97.87	68	97.37	68.1	98.29	100
GR	97.50	131.9	98.00	132	98.08	137.5	98.43	155		
X1	200	9	62.5	137.5	50	50	50			
GR	98.4	45	98.65	62.5	98.57	68	98.07	68.1	98.58	100
GR	98.0	131.9	98.50	132	98.58	137.5	98.93	155		

THIS RUN EXECUTED 08JUN80 19:43:50

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

HEC-2 Output
McKellips Rd
File: UEMF1.DAT

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

SPLIT FLOW RATING CURVE

SUMMARY PRINTOUT

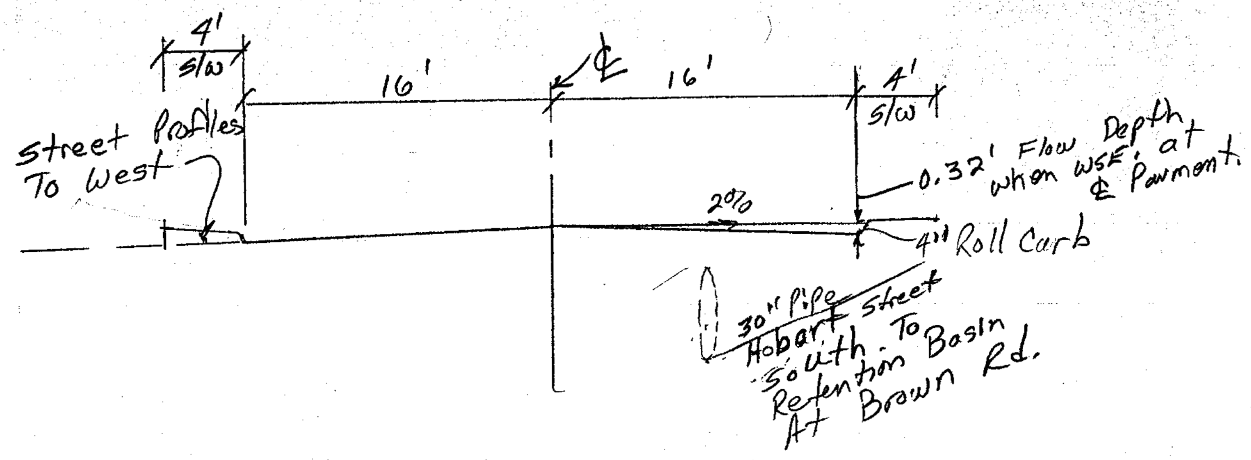
	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	.000	175.00	97.42	45.00	62.50	137.50	139.28	.00	94.28	.96	96.46	39.63	4.16
*	.000	200.00	97.47	45.00	62.50	137.50	142.26	.00	97.26	1.01	96.46	37.83	4.32
*	.000	225.00	97.52	45.00	62.50	137.50	144.73	.00	99.73	1.06	96.46	37.62	4.52
*	.000	250.00	97.56	45.00	62.50	137.50	147.30	.00	102.30	1.10	96.46	36.78	4.67
*	.000	275.00	97.61	45.00	62.50	137.50	149.78	.00	104.78	1.15	96.46	35.99	4.82
*	.000	300.00	97.65	45.00	62.50	137.50	152.35	.00	107.35	1.19	96.46	34.83	4.93
	100.000	175.00	97.86	45.00	62.50	137.50	151.36	.43	105.56	1.22	96.64	43.69	4.17
	100.000	200.00	97.89	45.00	62.50	137.50	153.36	.42	108.36	1.25	96.64	44.82	4.41
	100.000	225.00	97.94	45.00	62.50	137.50	155.00	.42	110.00	1.30	96.64	43.24	4.57
*	100.000	250.00	97.97	45.00	62.50	137.50	155.00	.41	110.00	1.33	96.64	42.66	4.74
*	100.000	275.00	98.01	45.00	62.50	137.50	155.00	.41	110.00	1.37	96.64	41.74	4.89
*	100.000	300.00	98.05	45.00	62.50	137.50	155.00	.40	110.00	1.41	96.64	40.97	5.03
*	150.000	175.00	98.40	45.00	62.50	137.50	153.54	.54	108.54	1.03	97.37	42.61	4.16
*	150.000	200.00	98.45	45.00	62.50	137.50	155.00	.55	110.00	1.08	97.37	41.28	4.34
*	150.000	225.00	98.49	45.00	62.50	137.50	155.00	.56	110.00	1.12	97.37	40.47	4.52
*	150.000	250.00	98.53	45.00	62.50	137.50	155.00	.56	110.00	1.16	97.37	39.72	4.68
*	150.000	275.00	98.57	45.00	62.50	137.50	155.00	.56	110.00	1.20	97.37	39.08	4.83
*	150.000	300.00	98.61	45.00	62.50	137.50	155.00	.56	110.00	1.24	97.37	38.49	4.97
*	200.000	175.00	98.88	45.00	62.50	137.50	152.51	.48	107.51	.88	98.00	41.22	4.15
*	200.000	200.00	98.93	45.00	62.50	137.50	155.00	.48	110.00	.93	98.00	39.01	4.30
*	200.000	225.00	98.98	45.00	62.50	137.50	155.00	.48	110.00	.98	98.00	38.43	4.48
*	200.000	250.00	99.02	45.00	62.50	137.50	155.00	.48	110.00	1.02	98.00	37.80	4.64
*	200.000	275.00	99.06	45.00	62.50	137.50	155.00	.48	110.00	1.06	98.00	37.25	4.79
*	200.000	300.00	99.10	45.00	62.50	137.50	155.00	.48	110.00	1.10	98.00	36.79	4.93

Values used for McKellips Rd. Capacity Curve

AN WEST INC.
Consulting Engineers
Richmond, California
San Jose, California
Phoenix, Arizona

Upper EMF FIS
Calculation of street capacity
To Divert Base Flow South
out of System For Subarea 102

Project 7158-03 Sht. ___ of ___
Calc. By GAS Date 8/11/95
Chkd. ___ Date ___



Assumed Typical Street Section
48TH Street (Looking North)

Street and Storm Drain slope Estimated at 0.25%

Half Street capacity with WSE @ ℄ Pavement = 3.8 CFS
for $n = 0.015$
$S_x = 2.0\%$
$S_o = 0.25\%$

Pipe Capacity @ 0.25% = 22 CFS
for $n = 0.012$
$S_o = 0.25\%$

120 CFS

AN WEST INC.
Consulting Engineers

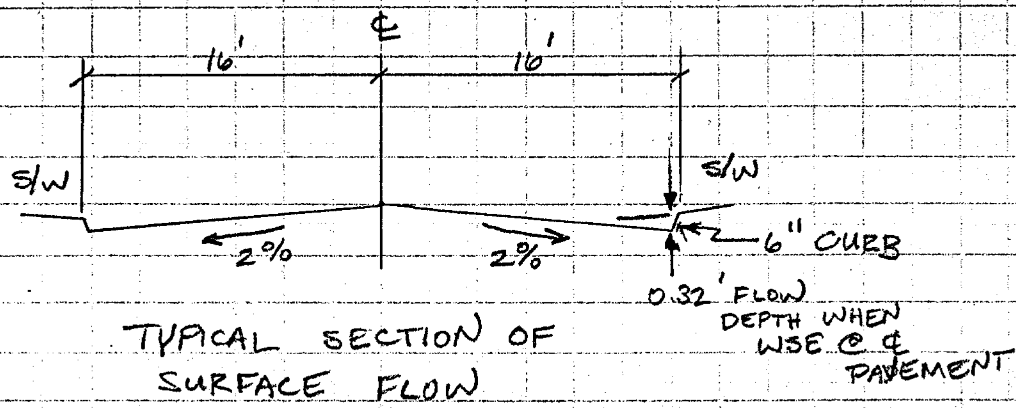
UPPER EMF FIS

Project 7158-03 Sht. ___ of ___

Calc. By PV Date 8/11/95

Chkd. ___ Date ___

STREET FLOW CAPACITY



TYPICAL SECTION OF SURFACE FLOW ALONG 46TH STREET

STREET & STORM DRAIN SLOPE ESTIMATED AT 0.25%
HALF STREET CAPACITY WITH WSE @ ℄ PAVEMENT

$Q = 3.8$ CFS

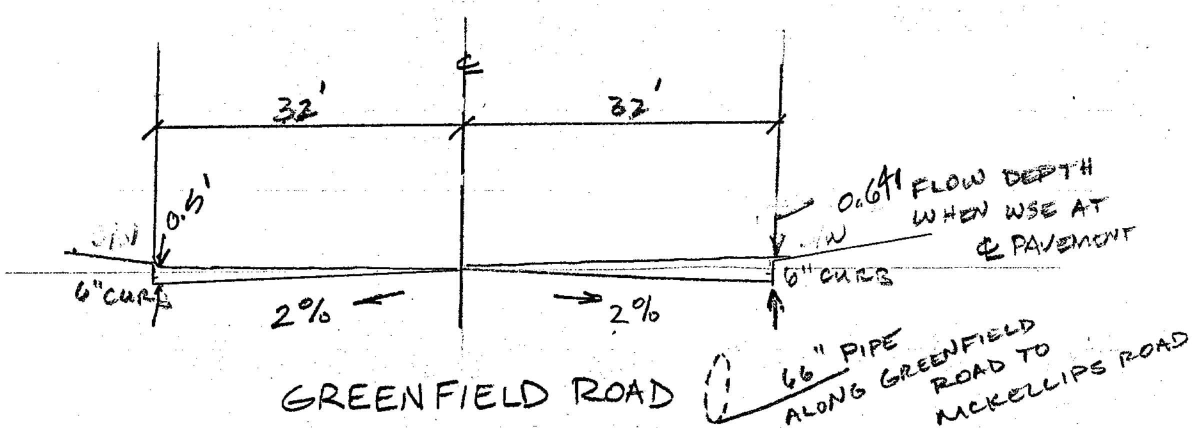
FOR $n = 0.015$

$S_x = 2.0\%$

$S_o = 0.25\%$

AN WEST INC.
Consulting Engineers
Richmond, California
San Jose, California
Phoenix, Arizona

UPPER EMF FIS Project 7158-03 Sht. ___ of ___
Calculation of Street Capacity Calc. By PV Date 8/30/95
GREENFIELD ROAD NORTH OF MCKELLIPS Chkd. ___ Date ___



GREENFIELD ROAD
TYPICAL SECTION

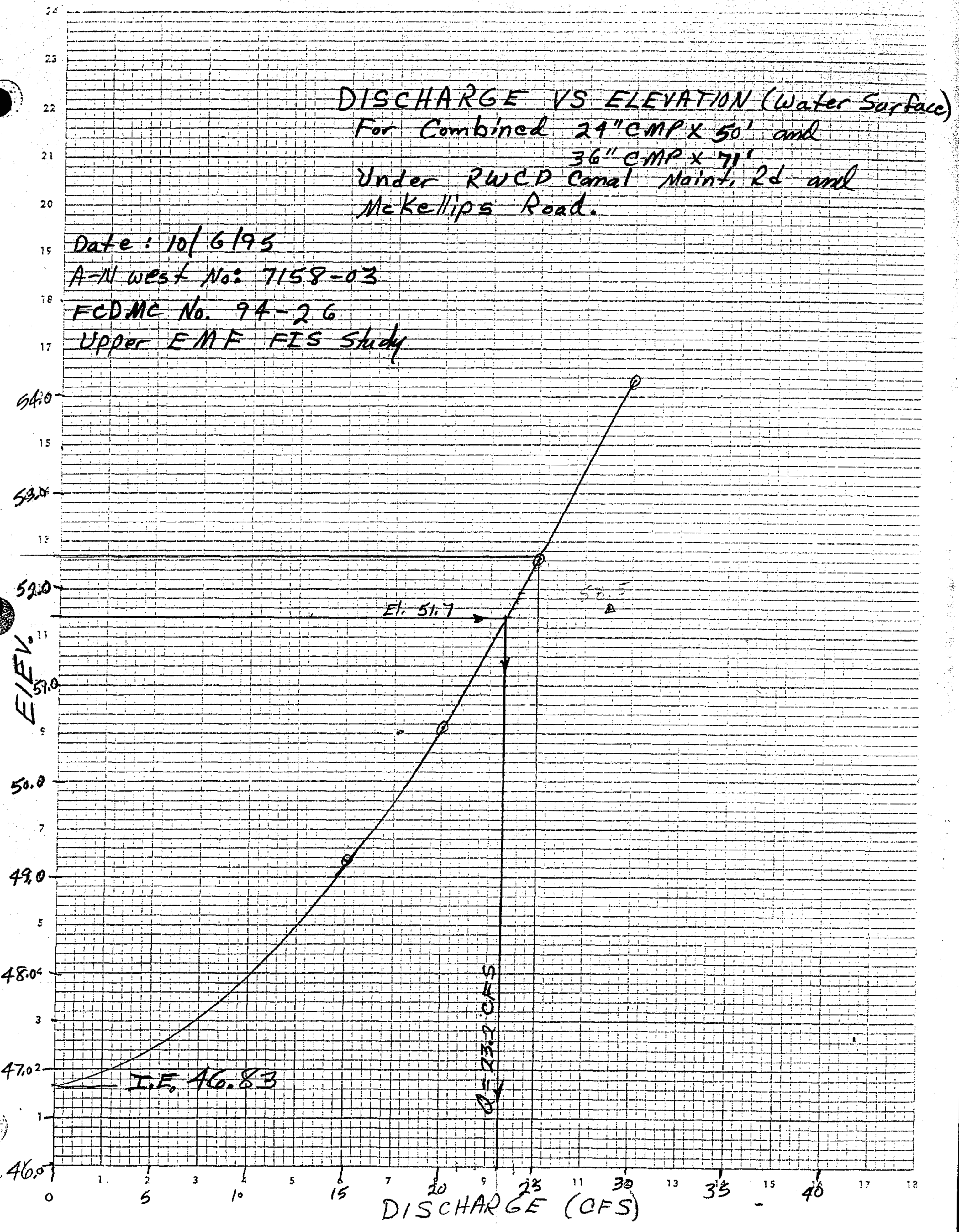
STREET & STORM DRAIN SLOPE ESTIMATED AT .095 % SLOPE

FULL STREET CAPACITY WITH WSE @ Top of Curb (Left - west side) and ℄ Top Pavement Right - East side) = 122.8 CFS

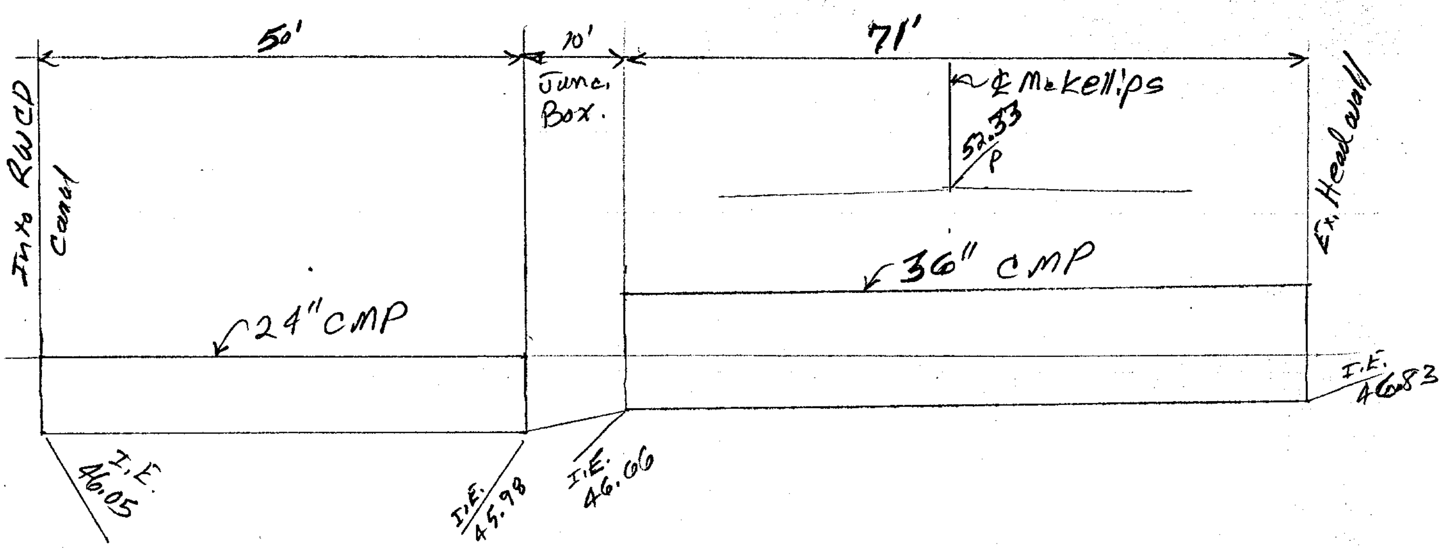
$n = 0.015$
$S_x = 2\%$
$S_o = 0.095\%$

PIPE CAPACITY @ 0.095% SLOPE = 110 CFS

for $N = 0.012$
$S_o = 0.095\%$



DISCHARGE VS ELEVATION (Water Surface)
For Combined 24" CMP X 50' and 36" CMP X 71'
Under RWCD Canal Maint. Rd and McKellips Road.
Date: 10/6/95
A-N west No: 7158-03
FCDMC No. 94-26
Upper EMF FIS Study
54.0
53.0
52.0
51.0
50.0
49.0
48.0
47.0
46.0
ELEV.
El. 51.7
52.5
Q = 23.2 CFS
I.E. 46.83
0
5
10
15
20
25
30
35
40
DISCHARGE (CFS)



Profile of 24" and 36" CMP's
In series under East Maint. Rd
canal and McKellips Rd.

PROJECT: 7158-03

DESIGNER: GAS

DATE: 10/6/95

HYDROLOGIC AND CHANNEL INFORMATION

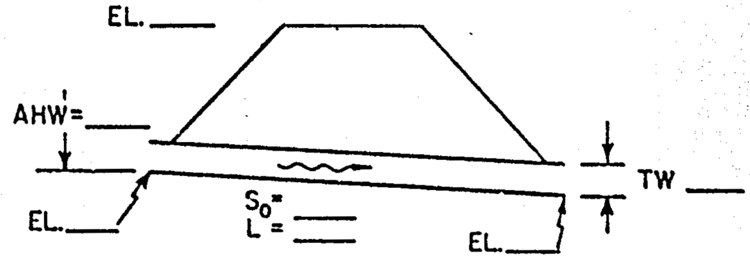
Q_1 = ______ TW_1 = ______

Q_2 = ______ TW_2 = ______

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

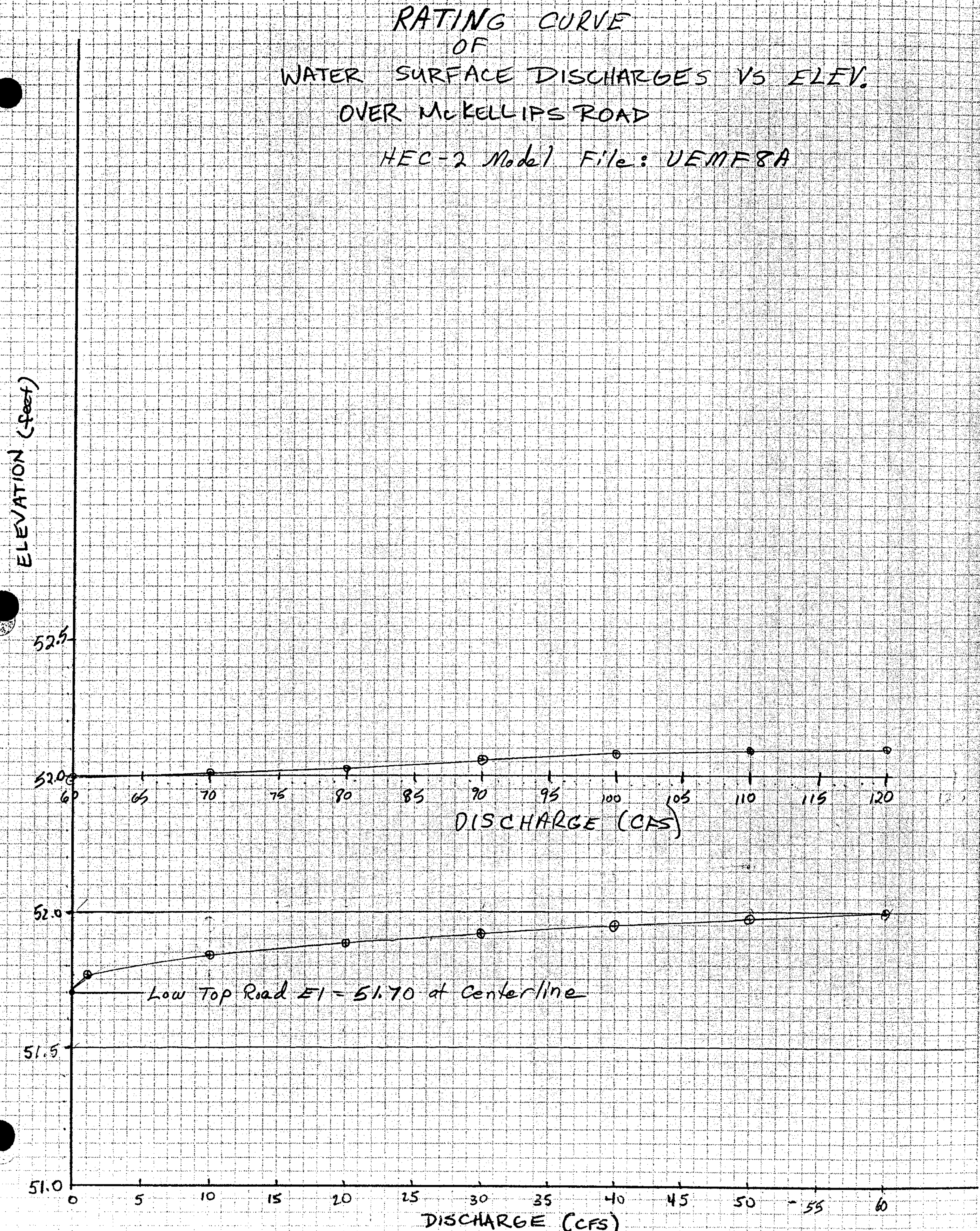
STATION : ______



MEAN STREAM VELOCITY= ______
MAX. STREAM VELOCITY= ______

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS	
Headwall	15	24"	1.1	2.2	0.5	1.3	1.4	1.7	*	1.7	-0.07	3.07	3.07			outlet C	Hw = 49.05
"	20	CMP	1.42	2.8	"	2.3	1.6	1.8		1.8	"	4.17	4.17			"	Hw = 50.15
"	25	"	1.85	3.7	"	3.7	1.75	1.88		1.88	"	5.65	5.66			"	Hw = 51.63
"	30	"	2.35	4.7	"	5.25	1.85	1.93		1.93	"	7.25	7.25			"	Hw = 53.23
Headwall	15	36"	0.58	1.74	0.5	0.2	1.2	2.1	2.33	2.33	0.17	2.36	2.36			outlet C	Hw = 49.19
"	20	CMP	0.69	2.07	"	0.4			3.49	3.49	"	3.72	3.72			"	Hw = 50.55
"	25	"	0.79	2.37	"	0.68			4.97	4.97	"	5.48	5.48			"	Hw = 52.31
"	30	"	0.89	2.67	"	0.95			6.57	6.57	"	7.35	7.35			"	Hw = 54.18

SUMMARY & RECOMMENDATIONS: * Assume No T.W., currently Outlet 24" I.E. ≈ Canal WSEL


RATING CURVE
OF
WATER SURFACE DISCHARGES VS ELEV.
OVER McKELLIPS ROAD
HEC-2 Model File: UEMF8A
ELEVATION (feet)
52.5
52.0
51.5
51.0
60 65 70 75 80 85 90 95 100 105 110 115 120
DISCHARGE (CFS)
Low Top Road El = 51.70 at Centerline
0 5 10 15 20 25 30 35 40 45 50 55 60
DISCHARGE (CFS)

THIS RUN EXECUTED 26JUL80 14:04:57

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

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


T1     UPPER EMF FIS STUDY   FCDMC NO. 94-26              FILE:  UEMF8A
T2     ORANGE GROVE NORTH OF MCKELLIPS RD.         BY A-N WEST, INC. PHX AZ
T3     SPLIT FLOW RATING CURVE ANALYSIS            DATE:  10/6/95

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC     HVINS     Q        WSEL      FQ

       0         2                            -1                                     1352.0

J2  NPROF      IPLOT     PRFVS     XSECV     XSECH     FN         ALLDC     IBW      CHNIM     ITRACE

      1                   -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        43         1        53        21         22         54        51         4         8
     42         5        26

NC     .015      .015      .015       .1         .3
QT       6         1        10        20         30         40         50
        THIS HEC-2 MODEL WAS PREPARED TO GENERATE A RATING CURVE OF WATER
        SURFACE ELEV. VS. STORAGE OCCURING ALONG THE RWCD CANAL BETWEEN
        MCKELLIPS AND MCDOWELL ROADS.
        THE CROSS-SECTIONS WERE GENERATED FROM A FIELD SURVEY BY A-N WEST
        TAKEN ALONG THE CANAL. BECAUSE OF THE HEAVY ORANGE GROVE COVER
        THE FIELD SURVEY WAS LIMITED TO APPROX. 100 FT. FROM THE CANAL.
        THE EASTERN MOST POINT OF EACH CROSS-SECTION WAS ESTIMATED BY
        PROJECTING OUT AT APPROX. 1.0 PERCENT BASED ON QUADRANGLE  MAPPING.
        CROSS-SECTIONS PROCEED UPSTREAM FROM MCKELLIPS RD. CENTERLINE IN
        RIVER MILES WITH SEC.22.468 AT CENTERLINE.
        SECTIONS ARE CODED FROM LEFT TO RIGHT LOOKING UPSTREAM WITH STA. 1000
        AT LOW FLOW POINT.
        THERE IS A 24 INCH CMP UNDER THE EAST MAINT. RD. OF THE CANAL AND SOUTH
        OF MCKELLIPS RD. THERE IS ALSO A 36 INCH CMP UNDER MCKELLIPS CONNECTING
        THIS 24 INCH PIPE. THESE TWO PIPES ,IN SERIES, CAN CONVEY 23.2 CFS
        INTO THE CANAL BEFORE OVERTOPPING OF MCKELLIPS RD. BEGINS AT EL 51.7.
        ************
        FLOW OVERTOPPING MCKELLIPS RD. CONTRIBUTES TO THE UPPER EMF STUDY
        WHICH IS THE REASON FOR THIS ANALYSIS OF DETENTION ALONG THE CANAL.
        ************
```

A RATING CURVE OF DISCHARGE VS. EL. OF CRITICAL FLOW DEPTH OVER
WAS MADE FOR SECTION 22.468 AT CENTERLINE OF MCKELLIPS ROAD AS
FILE:UEMF8A.
THIS WEIR FLOW RATING CURVE WAS COMBINED WITH A RATING CURVE OF THE
PIPES UNDER MCKELLIPS RD AND THE CANAL TO DETERMINE STARTING WSELS
AT SECTION 22.475.
****
FLOW FROM THE ORANGE GROVE WAS ESTIMATED TO FLOW WEST TO THE CANAL.
AT THE CANAL PONDING WOULD OCCUR AND EVENTUALLY SOME HYDRAULIC GRADE
WOULD BE GENERATED ALONG THIS MILD SLOPED BASIN TOWARD MCKELLIPS RD.
SOME ADDITIONAL STORAGE FROM A LEVEL WATER SURFACE WOULD BE GENERATED
IN THE PROCESS OF CREATING THIS HYD. GRADE. THE DISCHARGE TO EACH
CROSS-SECTION ALONG THE CANAL WAS INCREASED FROM MCDOWELL TO MCKELLIPS
IN PROPORTION TO CONTRIBUTING DRAINAGE AREA FOR EACH RATING CURVE
DISCHARGE AT MCKELLIPS TO MORE ACCURATELY ESTIMATE THE STORGE VOLUME
OCCURING ALONG THE CANAL.

X1	22.468	16	618	1370	0	0	0			
GR	1352.3	618	1352.18	665	1352.33	713	1352.22	759	1352.03	807
GR	1352.1	855	1352.05	903	1351.89	951	1351.70	1000	1351.81	1046
GR	1352.0	1094	1352.25	1142	1352.51	1189	1352.71	1237	1353.25	1323
GR	1353.5	1370								

THIS RUN EXECUTED 26JUL80 14:04:58

****
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

PLIT FLOW RATING CURVE A

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	22.468	1.00	1351.76	985.71	618.00	1370.00	1023.15	.00	37.44	.06	1351.70	112.68	.96
	22.468	10.00	1351.84	963.97	618.00	1370.00	1053.50	.00	89.53	.14	1351.70	78.56	1.53
	22.468	20.00	1351.88	952.42	618.00	1370.00	1064.82	.00	112.40	.18	1351.70	73.58	1.81
*	22.468	30.00	1351.92	942.10	618.00	1370.00	1073.70	.00	131.60	.22	1351.70	68.52	1.96
*	22.468	40.00	1351.95	933.76	618.00	1370.00	1080.74	.00	146.98	.25	1351.70	66.59	2.08
*	22.468	50.00	1351.97	926.43	618.00	1370.00	1086.90	.00	160.47	.27	1351.70	64.53	2.18

Appendix C

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

ID   EXISTING CONDITION HYDROLOGY                                  FILE:EMF2.DAT
ID   UPPER EAST MARICOPA FLOODWAY (UEMF) FIS FOR FCDMC (NO 94-26)
ID   100 YEAR - 24 HOUR STORM             BY A-N WEST,INC.,PHX.AZ.DATE:9/21/95
ID                 REVISED:10/20/95 TO ADDRESS FCDMC AND CITY/MESA COMMENTS.
*DIAGRAM
IT       5                   300
IO       5

KK    SB10
KM   SUB-BASIN SB10
KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
KM     L =  .39  Kb = .032  Adj. Slope =   87.0
BA    .031
IN      15
KM   RAINFALL DEPTH OF 3.47 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
PB   3.408
KM   THE FOLLOWING PC RECORD USED A 24-HR SCS TYPE II STORM
PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
PC    .983    .986    .989    .992    .995    .998   1.000
LG    .250    .250   4.300    .490  30.000
UC    .188    .197
UA       0       5      16      30      65      77      84      90      94      97
UA     100

KK  DIV11P
KM   BASE FLOW OF 11 CFS (24" RCP @ 0.2 PERCENT SLOPE) DIVERTED AS DIV11P INTO
KM   SYSTEM REMAINING PEAK FLOW EXITS SYSTEM AS DIV11S
DT  DIV11S
DI       0      10      11      12      20      30      40      50      60
DQ       0       0       0       1       9      19      29      39      49

KK   RO11P
KM   ROUTING THROUGH 24" PIPE (SLOPE = 0.25%) ALONG 64TH STREET BETWEEN HERMOSA
KM   VISTA DRIVE AND MCDOWELL ROAD
RD   3060   .0020    .012            CIRC       2

KK    SB16
KM   SUB-BASIN SB16
KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .982
KM   L = .96  Kb = .030  ADJ. SLOPE = 76.0
BA    .170
LG    .280    .270   5.800    .230   2.000
UC    .304    .262
UA       0       5      16      30      65      77      84      90      94      97
UA     100
```

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

 51         KK    CO20
 52         KM    COMBINED HYDROGRAPHS (SB16 AND RO11P) AT THE INTERSECTION ON 64TH STREET
 53         KM    BETWEEN HERMOSA VISTA DRIVE AND MCKELLIPS ROAD
 54         HC       2

 55         KK    RO17
 56         KM    ROUTING THROUGH RETENTION BASIN NEAR 64TH STREET.  BASIN IS DRAINED BY
 57         KM    12" PIPE AT 0.2% SLOPE WHICH HAS GATE VALVE.  A BASE DRAIN RATE OF 1 CFS
 58         KM    WAS ASSUMED UNTIL FLOW REACHED TOP OF BASIN WHERE WEIR FLOW OVER TOP OF
 59         KM    BANK OF SEVERAL HUNDRED FEET COULD OCCUR.  THE OVERFLOW WEIR FLOW WAS
 60         KM    ASSUMED TO OUTLET PEAK FLOW AT NO MORE THAN 1 FOOT OVER TOP OF BANK.
 61         RS       1    STOR       0
 62         SV       0   0.949   1.949
 63         SQ       0       1     200
 64         SE       0       7       8

 65         KK    SB24
 66         KM    SUB-BASIN SB24
 67         KM    24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 68         KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 69         KM      L =  .84  Kb = .051  Adj. Slope =   74.0
 70         BA    .169
 71         LG    .250    .350   4.250    .430    .000
 72         UC    .446    .362
 73         UA       0       3       5       8      12      20      43      75      90      96
 74         UA     100

 75         KK  DIV25S
 76         KM    BASE FLOW OF 86 CFS (26" RCP @ 1.4 PERCENT SLOPE) DIVERTED AS DIV25P INTO
 77         KM    SYSTEM REMAINING PEAK FLOW AS DIV25S TO SURFACE SPLIT FLOW
 78         DT  DIV25P
 79         DI       0      28      30      40     100     200
 80         DQ       0      86      86      86      86      86

 81         KK  DIV27I
 82         KM    SPLIT SURFACE IN FLOW (DIV25S) AS FLOW INTO SYSTEM (DIV27I) ALONG MCKELLIPS
 83         KM    ROAD DITCH AND FLOW OUT OF SYSTEM (DIV27O) TO RECKER ROAD
 84         DT  DIV27O
 85         DI       0      25      50      75     100     125     150
 86         DQ       0    3.71   22.26   41.80   62.25   82.91  103.40

 87         KK   RO27I
 88         KM    ROUTING SURFACE FLOW ALONG MCKELLIPS ROAD BETWEEN BUSH
 89         KM    HIGHWAY AND 64TH STREET
 90         RS       1    FLOW      -1
 91         RC    .035    .015    .035    1920   .0141
 92         RX       0       5       5      39      73      84      93      94
 93         RY  100.84  100.76  100.26  101.16  100.68   98.82  100.10  100.24
```

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

  94          KK    SB18
  95          KM   SUB-BASIN SB18
  96          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
  97          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
  98          KM     L =  .45  Kb = .037  Adj. Slope =   47.0
  99          BA    .005
 100          LG    .300    .210   6.400    .190   1.000
 101          UC    .258    .891
 102          UA       0       5      16      30      65      77      84      90      94      97
 103          UA     100

 104          KK    SB30
 105          KM   SUB-BASIN SB30
 106          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 107          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 108          KM     L =  .52  Kb = .040  Adj. Slope =   33.0
 109          BA    .035
 110          LG    .280    .280   4.900    .340  10.000
 111          UC    .358    .474
 112          UA       0       5      16      30      65      77      84      90      94      97
 113          UA     100

 114          KK  DIV25P
 115          KM   RETRIEVE DIV25P 36" PIPE FLOW
 116          DR  DIV25P

 117          KK   RO25P
 118          KM   ROUTE FLOW THROUGH 36" PIPE ALONG MCKELLIPS ROAD BETWEEN 64TH & 66TH STREETS
 119          RD    1920   .0141    .012            CIRC       3

 120          KK    CO32
 121          KM   COMBINED HYDROGRAPHS (SB18, RO17, RO25P, SB30, AND RO27I) AT INTERSECTION OF
 122          KM   64TH STREET AND MCKELLIPS ROAD
 123          HC       5

 124          KK  DIV35S
 125          KM   SPLIT FLOW OF 86 CFS (36" RCP CAP @ 1.4 PERCENT SLOPE) DIVERTED AS DIV35P
 126          KM   INTO SYSTEM.  REMAINING FLOW AS DIV35S TO SURFACE SPLIT FLOW ALONG
 127          KM   MCKELLIPS ROAD
 128          DT  DIV35P
 129          DI       0      28      30      40     100     200     350
 130          DQ       0      86      86      86      86      86      86

 131          KK  DIV39I
 132          KM   SPLIT SURFACE FLOW AS DIV39I INTO SYSTEM ALONG MCKELLIPS RD AND DIVERT FLOW
 133          KM   AS DIV39O OUT OF SYSTEM INTO CONCRETE CHANNEL IN PALMAS DEL SOL M.H. PARK
 134          DT  DIV39O
 135          DI       0      25      50      75     100     125     150     175     200     225
 136          DI     250
 137          DQ       0       0    7.58   26.66   44.89   63.70   83.77  102.04  110.24  116.87
 138          DQ  124.11
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 139          KK   R039I
 140          KM   ROUTING SURFACE FLOW ALONG MCKELLIPS ROAD BETWEEN 64TH
 141          KM   STREET AND RECKER ROAD
 142          RS        2    FLOW      -1
 143          RC     .035    .015    .035    1920   .0182
 144          RX        0       9      19      19      43      67      86      99
 145          RY    98.51   97.34   97.98   97.48   98.44   98.54   97.80   99.55

 146          KK    SB42
 147          KM   SUB-BASIN SB42
 148          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 149          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 150          KM     L =  .81  Kb = .046  Adj. Slope =   44.0
 151          BA     .182
 152          LG     .240    .260   4.300    .570  10.000
 153          UC     .508    .390
 154          UA        0       3       5       8      12      20      43      75      90      96
 155          UA      100

 156          KK   DIV35P
 157          KM   RETRIEVE DIV35P
 158          DR   DIV35P

 159          KK   R035P
 160          KM   ROUTING THROUGH 36" PIPE (SLOPE = 1.41%) ALONG MCKELLIPS ROAD BETWEEN 64TH
 161          KM   STREET AND RECKER ROAD
 162          RD     1920   .0141    .012            CIRC       3

 163          KK    C044
 164          KM   COMBINED HYDROGRAPHS (R035P, R039I, AND SB42) AT INTERSECTION OF RECKER
 165          KM   ROAD AND MCKELLIPS ROAD
 166          HC        3

 167          KK   DIV47S
 168          KM   BASE FLOW OF 112 CFS (42" RCP CAP @1.02 PERCENT) DIVERTED AS DIV47P.
 169          KM   REMAINING PEAK FLOW AS DIV47S TO SURFACE SPLIT FLOW
 170          DT   DIV47P
 171          DI        0     112     120     200     300    1000
 172          DQ        0     112     112     112     112     112

 173          KK   DIV49I
 174          KM   SPLIT SURFACE FLOW OF FLOW INTO SYSTEM ALONG MCKELLIPS STREET AS DIV49I AND
 175          KM   FLOW OUT OF SYSTEM AS DIV49O DOWN RECKER ROAD
 176          DT   DIV49O
 177          DI        0      25      50      55      75     100     125     150     175     200
 178          DI      225     250     275     300     325     350     388
 179          DQ        0       0       0       0    7.69   11.54   15.38   19.23   23.08   26.92
 180          DQ    34.62   42.31   48.08   57.69   65.38   73.08   82.69
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

181          KK   R049I
182          KM   ROUTE SURFACE FLOW FROM DIV49I ALONG MCKELLIPS ROAD FROM RECKER ROAD TO
183          KM   56TH STREET
184          RS      1    FLOW      -1
185          RC   .035    .015    .035    2640    .010
186          RX      0      23      23      55      87      87     110     110
187          RY    1.5      .5       0     .64       0      .5     .96     1.5

188          KK    SB52
189          KM   SUB-BASIN SB52
190          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
191          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
192          KM     L =  .39  Kb = .055  Adj. Slope =   56.0
193          BA   .061
194          LG   .250    .340   4.000   0.490   4.000
195          UC   .313    .236
196          UA      0       3       5       8      12      20      43      75      90      96
197          UA    100

198          KK    SB54
199          KM   SUB-BASIN SB54
200          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
201          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
202          KM     L =  .25  Kb = .032  Adj. Slope =   52.0
203          BA   .033
204          LG   .190    .250   4.200   0.530  34.000
205          UC   .175    .123
206          UA      0       5      16      30      65      77      84      90      94      97
207          UA    100

208          KK    R051
209          KM   ROUTING THROUGH COMBINED AVERAGE OF 10 RETENTION BASINS NEAR MCKELLIPS ROAD
210          KM   BETWEEN HIGLEY AND RECKER ROADS.  LOW FLOW OUTLET BY DRY WELLS, 1 CFS LOW
211          KM   FLOW ASSUMED.  OVERFLOW OCCURS OVER BERMS AND TOP OF BANKS.  OVERFLOW
212          KM   DISCHARGE ASSUMED HIGH ENOUGH TO PASS PEAK OUTFLOW WITH NO MORE THAN 1 FOOT
213          KM   OF HEAD OVER TOP OF BANKS.
214          RS      1    STOR       0
215          SV      0    2.12    3.12
216          SQ      0       1     100
217          SE      0    3.55    4.55

218          KK    C056
219          KM   COMBINED HYDROGRAPHS (SB52, R049I, AND R051) AT 56TH STREET AND
220          KM   MCKELLIPS ROAD
221          HC      3

222          KK    R057S
223          KM   ROUTING SURFACE FLOW ALONG MCKELLIPS ROAD BETWEEN 56TH STREET
224          KM   AND HIGLEY ROAD
225          RS      1    FLOW      -1
226          RC   .035    .015    .035    2640    .010
227          RX      0      23      23      55      87      87     110     110
228          RY    1.5      .5       0     .64       0      .5     .96     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 229          KK    SB60
 230          KM   SUB-BASIN SB60
 231          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 232          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF   .982
 233          KM     L =  .57  Kb = .031  Adj. Slope =    44.0
 234          BA    .153
 235          LG    .180    .250   4.800    .380  44.000
 236          UC    .271    .161

 237          KK    SB62
 238          KM   SUB-BASIN SB62
 239          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 240          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF   .982
 241          KM     L =  .52  Kb = .030  Adj. Slope =    48.0
 242          BA    .072
 243          LG    .150    .250   4.500    .430  60.000
 244          UC    .242    .203
 245          UA       0       5      16      30      65      77      84      90      94      97
 246          UA     100

 247          KK    RO64
 248          KM   ROUTING THROUGH COMBINED AVERAGE OF 2 RETENTION BASINS NEAR MCKELLIPS AND
 249          KM   HIGLEY ROAD INTERSECTION.  THE LOW FLOW OUTLET INVOLVES DRYWELLS AND A 1 CFS
 250          KM   DRAIN RATE WAS ASSUMED FOR THIS.  THE OVERFLOW OCCURS OVER A LONG TOP OF
 251          KM   BANK AND THE OVERFLOW DISCHARGE WAS ASSUMED TO PASS THE PEAK OUTFLOW WITH
 252          KM   NO MORE THAN 1 FOOT OF HEAD ABOVE TOP OF BANK.
 253          RS       1    STOR       0
 254          SV       0  1.7115  2.7115
 255          SQ       0       1     100
 256          SE       0    2.86    3.86

 257          KK  DIV47P
 258          KM   RETRIEVE DIV47P (SPLIT FLOW TO 42 INCH PIPE AT MCKELLIPS AND RECKER RD.)
 259          DR  DIV47P

 260          KK   RO47P
 261          KM   ROUTING THROUGH 42" PIPE (SLOPE = 1%) ALONG MCKELLIPS ROAD BETWEEN RECKER
 262          KM   AND HIGLEY ROADS
 263          RD    5280    .010    .012            CIRC     3.5

 264          KK    CO68
 265          KM   COMBINED HYDROGRAPHS (SB60, RO64, RO47P, AND RO57S) AT INTERSECTION OF HIGLEY
 266          KM   ROAD AND MCKELLIPS ROAD
 267          HC       4

 268          KK  DIV71S
 269          KM   BASE FLOW OF 140 CFS (48" RCP CAP @ 0.81 PERCENT SLOPE) DIVERTED AS DIV71P
 270          KM   REMAINING PEAK FLOW AS DIV71S TO SURFACE SPLIT FLOW ALONG MCKELLIPS ROAD
 271          DT  DIV71P
 272          DI       0     140     150     200     300     500
 273          DQ       0     140     140     140     140     140
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LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

274     KK  DIV73I
275     KM   SPLIT SURFACE FLOW OF FLOW INTO SYSTEM ALONG MCKELLIPS ROAD AS DIV73I AND
276     KM   SURFACE FLOW OUT OF SYSTEM AS DIV730 DOWN HIGLEY ROAD
277     DT  DIV730
278     DI       0      25      50      75     100     125     150     175     200     225
279     DI     250     275     300     350     400     450     500     515
280     DQ       0    3.85   21.15   32.69   44.23   53.85   61.54   69.23   78.85   88.46
281     DQ  100.00  107.69  119.23  140.38  165.38  188.46  215.38  219.23

282     KK   R073I
283     KM   ROUTING SURFACE FLOW FROM DIV73I ALONG MCKELLIPS ROAD FROM HIGLEY ROAD TO
284     KM   GREENFIELD ROAD
285     RS       4    FLOW      -1
286     RC    .035    .015    .035    5280   .0078
287     RX       0      23      23      55      87      87     110     110
288     RY     1.5      .5       0     .64       0      .5     .96     1.5

289     KK    SB76
290     KM   SUB-BASIN SB76
291     KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
292     KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
293     KM     L = 0.99  Kb = .045  Adj. Slope =   43.0
294     BA    .098
295     LG    .280    .200   4.800    .360  19.000
296     UC    .517    .663

297     KK  DIV71P
298     KM   RETRIEVE DIV71P FROM SPLIT FLOW ALONG MCKELLIPS ROAD
299     DR  DIV71P

300     KK   R071P
301     KM   ROUTING THROUGH 48" PIPE (SLOPE = 0.86%) DIV71P FROM HIGLEY ROAD TO
302     KM   GREENFIELD ROAD ALONG MCKELLIPS ROAD
303     RD    5280   .0078    .012            CIRC       4

304     KK    SB80
305     KM   SUB-BASIN SB80
306     KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
307     KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
308     KM     L = 1.09  Kb = .043  Adj. Slope =   27.0
309     BA    .636
310     LG    .170    .340   4.800    .220  24.000
311     UC    .642    .314
312     UA       0       3       5       8      12      20      43      75      90      96
313     UA     100

314     KK    R083
315     KM   ROUTING FROM SB80 INTO FALCON FIELD RETENTION BASIN.  THE LOW FLOW OUTLET
316     KM   IS A 12" RCP INTO THE GREENFIELD ROAD STORM DRAIN.  AN INLET CONTROL
317     KM   DISCHARGE CAPACITY WAS USED TO ESTIMATE THE 12" PIPE CAPACITY.  THE
318     KM   EMERGENCY OVERFLOW WAS A SLOPED CONCRETE BROAD CRESTED WEIR OF 30 FEET
319     KM   WIDTH AT I.E. OF 1361.59'
320     RS      -1    STOR       0
321     SV       0    5.75   19.60   36.76   56.03   57.03
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ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

SQ    2.5     5.0     6.4     7.7  116.71  156.63
SE   1358    1359    1360    1361    1362    1363

KK    SB84
KM   SUB-BASIN SB84
KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982   THE DEFAULT T/A CURVE
KM   WAS USED.
KM     L = 1.11  Kb = .046  Adj. Slope =   34.0
BA    .197
LG    .230    .350   4.800    .240  12.000
UC    .642    .620

KK    RO85
KM   ROUTING THROUGH 66" PIPE (SLOPE = 0.095%) ALONG GREENFIELD ROAD
KM   BETWEEN MCDOWELL ROAD AND MCKELLIPS ROAD
RD    2340  .00095    .012            CIRC     5.5

KK    CO90
KM   COMBINED HYDROGRAPHS (SB76, RO73I, RO71P, RO83, AND RO85) AT GREENFIELD ROAD
KM   AND MCKELLIPS ROAD INTERSECTION
HC       5

KK  DIV93S
KM   SPLIT FLOW AT GREENFIELD AND MCKELLIPS RDS WITH DIV93P ROUTED DOWN
KM   GREENFIELD ROAD VIA 84" PIPE (310 CFS) AND DIV93S SPLIT AS SURFACE FLOW
DT  DIV93P
DI       0     310     311     350     400     500     600
DQ       0     310     310     310     310     310     310

KK    SB86
KM   SUB-BASIN SB86
KM   THIS SUBAREA IS BOUNDED BY MCDOWELL RD.,GREENFIELD RD.,MCKELLIPS RD.AND RWCD
KM   CANAL AND INVOLVES AN EXISTING ORANGE GROVE.
KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .982
KM   L = 0.5  Kb = 0.048  ADJ. SLOPE = 33.0
BA    .338
LG   0.50     0.0    4.80    .460     0.0
UC     .36     .12
UA       0       3       5       8      12      20      43      75      90      96
UA     100

KK    RO87
KM        DETENTION ROUTING ALONG RWCD CANAL BETWEEN MCDOWELL AND MCKELLIPS ROADS
KM        THIS LINEAR STORAGE AREA WAS MODELED BY HEC-2 MODEL (FILE:UEMF8) TO
KM        ESTIMATE STORAGE ALONG THE CANAL VS. WSEL AND DISCHARGE WEIRING OVER
KM        MCKELLIPS AND INTO SYSTEM.
KM        A 36 " CMP UNDER MCKELLIPS IN SERIES WITH A 24" CMP UNDER THE RWCD
KM        CANAL EAST MAINT. RD. ARE CAPABLE OF CONVEYING THE INITIAL 23.2 CFS
KM        INTO THE CANAL BEFORE WATER BEGINS TO FLOW OVER MCKELLIPS INTO THE
KM        SYSTEM. THESE PIPES REACH MAXIMUM CAPACITY OF APPRX. 24.5 CFS AT
KM        WSEL.=52.14
RS       1    STOR       0
SV       0    54.6    57.7    62.7    69.9    74.2    76.5
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 371        SQ       0    23.2      30      50     100     150     180
 372        SE   46.84   51.71   51.81   51.91   52.03   52.11   52.14

 373        KK  DIV88I
 374        KM   SPLIT SURFACE FLOW AS FLOW INTO SYSTEM (DIV88I) ALONG RWCD CANAL AND FLOW
 375        KM   OUT OF SYSTEM INTO RWCD CANAL AS DIV88O.
 376        DT  DIV88O
 377        DI       0    23.2      30      50     100     150     180
 378        DQ       0    23.2    23.5    23.5    24.0    24.5    24.5

 379        KK    CO91
 380        KM   COMBINED HYDROGRAPHS (RO87 AND DIV93S)
 381        HC       2

 382        KK   RO93S
 383        KM   ROUTING SPLIT SURFACE FLOW FROM DIV93S ALONG RWCD CANAL
 384        RS       7    FLOW      -1
 385        RC    .060    .060    .060    1380   .0007
 386        RX       0      12      18      20      22      24     335     510
 387        RY      51      51    48.5      48      48    48.5      50      51

 388        KK    SB92
 389        KM   SUB-BASIN SB92
 390        KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 391        KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 392        KM     L =  .26  Kb = .054  Adj. Slope =    8.0
 393        BA    .043
 394        LG    .430    .070   4.800    .450   4.000
 395        UC    .483    .338
 396        UA       0       3       5       8      12      20      43      75      90      96
 397        UA     100

 398        KK    CO96
 399        KM   COMBINED HYDROGRAPHS (RO93S AND SB94) ALONG RWCD CANAL
 400        HC       2

 401        KK    RO95S
 402        KM   ROUTING SURFACE FLOW ALONG RWCD CANAL
 403        RS       8    FLOW      -1
 404        RC    .060    .060    .060    2160   .0015
 405        RX       0      12      18      20      22      24     335     510
 406        RY      51      51    48.5      48      48    48.5      50      51

 407        KK    SB97
 408        KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 409        KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982  THE DEFAULT T/A CURVE
 410        KM   WAS USED
 411        KM     L = 0.70  Kb = .049  ADJ. SLOPE =  43.0
 412        BA    .245
 413        LG    .250    .350   4.800    .220   2.000
 414        UC    .440    .250
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 415        KK  RO97.1
 416        KM   ROUTING SURFACE FLOW ALONG IVY STREET
 417        RS       2    FLOW      -1
 418        RC    .035    .015    .035    4320   .0053
 419        RX       0     115     125   125.1   145.1   185.1   185.2   310.2
 420        RY     1.5     .58      .5       0      .4       0      .5     1.5

 421        KK    SB98
 422        KM   SUB-BASIN SB98
 423        KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 424        KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982  THE DEFAULT T/A CURVE
 425        KM   WAS USED.
 426        KM     L =  .70  Kb = .042  Adj. Slope =   38.0
 427        BA    .250
 428        LG    .220    .340   4.800    .260   9.000
 429        UC    .410    .220

 430        KK    CO99
 431        KM   COMBINED HYDROGRAPHS (RO97.1 AND SB98)
 432        HC       2

 433        KK    SB94
 434        KM   SUB-BASIN SB94
 435        KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 436        KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 437        KM     L = .36  Kb = .063  ADJ. SLOPE = 8.0
 438        BA    .027
 439        LG    .500     0.0   4.800    .460     0.0
 440        UC    .671    .822
 441        UA       0       3       5       8      12      20      43      75      90      96
 442        UA     100

 443        KK   CO100
 444        KM   COMBINED HYDROGRAPHS (RO95, SB94, AND CO99) ALONG RWCD CANAL
 445        KM   BETWEEN MCKELLIPS ROAD AND BROWN ROAD
 446        HC       3

 447        KK   SB102
 448        KM   SUB-BASIN SB102
 449        KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 450        KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 451        KM     L =  .36  Kb = .031  Adj. Slope =   31.0
 452        BA    .042
 453        LG    .250    .250   4.800    .360  30.000
 454        UC    .237    .202
 455        UA       0       5      16      30      65      77      84      90      94      97
 456        UA     100

 457        KK  DV103I
 458        KM   BASE FLOW OF 25.3 CFS DIVERTED AS DV103I AND DV103P FLOWS OUT VIA 36" PIPE
 459        KM   ALONG 48TH STREET
 460        DT  DV103P
 461        DI       0    25.3      40      50      60      70
 462        DQ       0    25.3    25.3    25.3    25.3    25.3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 463          KK  R0103I
 464          KM   ROUTING SURFACE FLOW ALONG MCLELLAN ROAD
 465          RS        1    FLOW      -1
 466          RC   0.035   0.015   0.035    1320   .0076
 467          RX       0       9       9      25    25.1      41      41      50
 468          RY    0.80    0.33       0    1.32    0.32       0    0.33    0.80

 469          KK   SB104
 470          KM   SUB-BASIN SB104
 471          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 472          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 473          KM     L =  .43  Kb = .030  Adj. Slope =   28.0
 474          BA    .055
 475          LG    .300    .250   4.800    .360  15.000
 476          UC     .28    .227
 477          UA       0       5      16      30      65      77      84      90      94      97
 478          UA     100

 479          KK   C0105
 480          KM   COMBINED HYDROGRAPHS (R0103I AND SB107)
 481          HC        2

 482          KK  DV107A
 483          KM   BASE FLOW OF 3.8 CFS DIVERTED AS DV107A SURFACE FLOW AND DV107B SURFACE FLOWS
 484          KM   ALONG 46TH STREET
 485          DT  DV107B
 486          DI       0     3.8      10      20      30      40     110
 487          DQ       0     3.8     3.8     3.8     3.8     3.8     3.8

 488          KK  R0107A
 489          KM   ROUTING SURFACE FLOW ALONG MCLELLAN ROAD
 490          RS        1    FLOW      -1
 491          RC   0.035   0.015   0.035    1320   .0076
 492          RX       0       9       9      25    25.1      41      41      50
 493          RY    0.80    0.33       0    0.32    0.32       0    0.33    0.80

 494          KK   SB106
 495          KM   SUB-BASIN SB106
 496          KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 497          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 498          KM     L =  .35  Kb = .031  Adj. Slope =   29.0
 499          BA    .051
 500          LG    .270    .250   4.800    .360  16.000
 501          UC    .242    .180
 502          UA       0       5      16      30      65      77      84      90      94      97
 503          UA     100

 504          KK   C0108
 505          KM   COMBINED HYDROGRAPHS (SB106 AND R0107A)
 506          HC        2
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 507           KK   CO110
 508           KM   COMBINED HYDROGRAPHS (CO108 AND CO100) ALONG RWCD CANAL AT GREENFIELD ROAD
 509           KM   AND HOBART DRIVE INTERSECTION
 510           HC       2

 511           KK   SB118
 512           KM   SUB-BASIN SB118
 513           KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 514           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .982
 515           KM   L = .18  Kb = .036  ADJ. SLOPE = 33.0
 516           BA    .043
 517           LG    .290    .250   4.800    .370  12.000
 518           UC    .183    .086
 519           UA       0       5      16      30      65      77      84      90      94      97
 520           UA     100

 521           KK   CO120
 522           KM   COMBINED HYDROGRAPHS (SB118 AND CO110) ALONG RWCD CANAL BY BROWN ROAD
 523           HC       2

 524           KK   RO121
 525           KM   ROUTING CO120 THROUGH PRINCESS PARK RETENTION BASIN.  LOW FLOW DRAINING OF
 526           KM   BASIN IS BY PUMP.  A 1 CFS LOW FLOW DRAIN RATE WAS ASSUMED.  OVERFLOW OCCURS
 527           KM   OVER AN EMBANKMENT WITH RATING CURVE RATES ESTIMATED BY HEC-2 MODEL.  LOW
 528           KM   TOP OF EMBANKMENT OVERFLOW IS ELEVATION 1347.74.
 529           RS       1    STOR       0
 530           SV       0    .039    .155   1.043   3.098   5.949   9.067  12.453  16.137  20.122
 531           SV  24.422  25.545  26.669
 532           SQ       0       1       1       1       1       1       1       1       1       7
 533           SQ       9     115     370
 534           SE  1338.5  1339.5    1340    1341    1342    1343    1344    1345    1346    1347
 535           SE    1348  1348.5    1349

 536           KK  DV107B
 537           KM   RETRIEVE DV107B AS SURFACE FLOW
 538           DR  DV107B

 539           KK   SB114
 540           KM   SUB-BASIN SB114
 541           KM   24-HOUR SCS TYPE II RAINFALL WAS USED TO FIND TC & R FOR THIS BASIN
 542           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .982
 543           KM     L =  .43  Kb = .031  Adj. Slope =   30.0
 544           BA    .051
 545           LG    .300    .250   4.800    .360  15.000
 546           UC    .267    .237
 547           UA       0       5      16      30      65      77      84      90      94      97
 548           UA     100

 549           KK   CO116
 550           KM   COMBINED HYDROGRAPHS (RO107B AND SB114)
 551           HC       2
```

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

 552        KK  DV117A
 553        KM   SPLIT SURFACE FLOW WITH FLOW OUT OF SYSTEM TO BROWN ROAD ALONG DV1170 AND
 554        KM   REST OF FLOW THROUGH DV117A
 555        DT  DV1170
 556        DI       0     3.8      10      20      30      40
 557        DQ       0     3.8     3.8     3.8     3.8     3.8

 558        KK  DIV93P
 559        KM   RETRIEVE DIV93P
 560        DR  DIV93P

 561        KK   R093P
 562        KM   ROUTING THROUGH 84" PIPE (SLOPE = 0.20%) FROM GREENFIELD ROAD
 563        RD    4800   .0020    .012            CIRC       7

 564        KK   C0126
 565        KM   COMBINED HYDROGRAPHS (R093P, DV117A, AND R0121) AT UPSTREAM SIDE OF BROWN RD.
 566        HC       3
 567        ZZ
```

```
                  SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   7           SB10
                  .
                  .
  34              .------->  DIV11S
  31         DIV11P
                  V
                  V
  37          RO11P
                  .
                  .
  41              .        SB16
                  .           .
                  .           .
  51          CO20.............
                  V
                  V
  55          RO17
                  .
                  .
  65              .        SB24
                  .           .
                  .           .
  78              .           .------->  DIV25P
  75              .       DIV25S
                  .           .
                  .           .
  84              .           .------->  DIV270
  81              .       DIV27I
                  .           V
                  .           V
  87              .        RO27I
                  .           .
                  .           .
  94              .           .       SB18
                  .           .          .
                  .           .          .
 104              .           .          .        SB30
                  .           .          .           .
                  .           .          .           .
 116              .           .          .           .           .<-------  DIV25P
 114              .           .          .           .      DIV25P
                  .           .          .           .           V
                  .           .          .           .           V
 117              .           .          .           .       RO25P
                  .           .          .           .           .
                  .           .          .           .           .
              CO32................................................
                  .
                  .
 128              .------->  DIV35P
 124        DIV35S
                  .
                  .
 134              .------->  DIV390
```

```
131      DIV39I
            V
            V
139      R039I
            .
            .
146         .         SB42
            .            .
            .            .
158         .            .           .<------- DIV35P
156         .            .       DIV35P
            .            .            V
            .            .            V
159         .            .        R035P
            .            .            .
            .            .            .
163       C044.......................
            .
            .
170         .-------> DIV47P
167      DIV47S
            .
            .
176         .-------> DIV490
173      DIV49I
            V
            V
181      R049I
            .
            .
188         .         SB52
            .            .
            .            .
198         .            .        SB54
            .            .            V
            .            .            V
208         .            .        R051
            .            .            .
            .            .            .
218       C056.......................
            V
            V
222       R057
            .
            .
229         .         SB60
            .            .
            .            .
237         .            .        SB62
            .            .            V
            .            .            V
247         .            .        R064
            .            .            .
            .            .            .
259         .            .            .            .<------- DIV47P
257         .            .            .        DIV47P
            .            .            .             V
            .            .            .             V
            .            .            .        R047P
            .            .            .             .
            .            .            .             .
264       C068....................................
            .
            .
271         .-------> DIV71P
268      DIV71S
```

```
          .
          .
 277      .-------> DIV730
 274    DIV73I
          V
          V
 282    R073I
          .
          .
 289      .         SB76
          .            .
          .            .
 299      .            .          .<------- DIV71P
 297      .            .      DIV71P
          .            .           V
          .            .           V
 300      .            .      R071P
          .            .           .
          .            .           .
 304      .            .           .       SB80
          .            .           .          V
          .            .           .          V
 314      .            .           .       R083
          .            .           .          .
          .            .           .          .
 324      .            .           .          .        SB84
          .            .           .          .           V
          .            .           .          .           V
 333      .            .           .          .        R085
          .            .           .          .           .
          .            .           .          .           .
 337    C090...................................................
          .
          .
 344      .-------> DIV93P
 341    DIV93S
          .
          .
 347      .         SB86
          .            V
          .            V
 359      .         R087
          .            .
          .            .
 376      .            .-------> DIV880
 373      .         DIV88I
          .            .
          .            .
 379    C091............
          V
          V
 382    R093S
          .
          .
 388      .         SB92
          .            .
          .            .
 398    C096............
          V
          V
 401    R095
          .
          .
 407      .         SB97
          .            V
          .            V
```

C-16

```
415      .     RO97.1
         .        .
         .        .
421      .        .      SB98
         .        .         .
         .        .         .
430      .     C099..........
         .        .
         .        .
433      .        .      SB94
         .        .         .
         .        .         .
443    C0100.....................
         .
         .
447      .     SB102
         .        .
         .        .
460      .        .-------> DV103P
457      .     DV103I
         .        V
         .        V
463      .     RO103I
         .        .
         .        .
469      .        .      SB104
         .        .         .
         .        .         .
479      .     C0105..........
         .        .
         .        .
485      .        .-------> DV107B
         .     DV107A
         .        V
         .        V
488      .     RO107A
         .        .
         .        .
494      .        .      SB106
         .        .         .
         .        .         .
504      .     C0108..........
         .        .
         .        .
507    C0110..........
         .
         .
511      .     SB118
         .        .
         .        .
521    C0120..........
         V
         V
524    RO121
         .
         .
538      .        .<------- DV107B
536      .     DV107B
         .        .
         .        .
539      .        .      SB114
         .        .         .
         .        .         .
549      .     C0116..........
         .        .
         .        .
```

C-17

```
552          .          DV117A
             .               .
             .               .
560          .               .             .<------- DIV93P
558          .               .        DIV93P
             .               .             V
             .               .             V
561          .               .         RO93P
             .               .             .
             .               .             .
564     CO126.......................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************                    **************************************
*                                      *                    *                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS     *
*           SEPTEMBER 1990             *                    *   HYDROLOGIC ENGINEERING CENTER    *
*             VERSION 4.0              *                    *         609 SECOND STREET          *
*                                      *                    *     DAVIS, CALIFORNIA 95616        *
*  RUN DATE  08/08/1980  TIME  12:33:34 *                   *         (916) 756-1104             *
*                                      *                    *                                    *
****************************************                    **************************************
```

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                    EXISTING CONDITION HYDROLOGY                                FILE:EMF2.DAT
                    UPPER EAST MARICOPA FLOODWAY (UEMF) FIS FOR FCDMC (NO 94-26)
                    100 YEAR - 24 HOUR STORM            BY A-N WEST,INC.,PHX.AZ.DATE:9/21/95
                                  REVISED:10/20/95 TO ADDRESS FCDMC AND CITY/MESA COMMENTS.

  6 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	SB10	41.	12.08	4.	1.	1.	.03		
DIVERSION TO	DIV11S	30.	11.83	2.	0.	0.	.03		
HYDROGRAPH AT	DIV11P	11.	11.83	3.	1.	1.	.03		
ROUTED TO	RO11P	11.	12.08	3.	1.	1.	.03		
HYDROGRAPH AT	SB16	196.	12.08	18.	5.	4.	.17		
2 COMBINED AT	CO20	207.	12.08	21.	6.	5.	.20		
ROUTED TO	RO17	197.	12.17	20.	5.	5.	.20	7.99	12.17
HYDROGRAPH AT	SB24	127.	12.33	14.	3.	3.	.17		
DIVERSION TO	DIV25P	86.	12.33	12.	3.	3.	.17		
HYDROGRAPH AT	DIV25S	41.	12.33	2.	0.	0.	.17		
DIVERSION TO	DIV27O	16.	12.33	0.	0.	0.	.17		
HYDROGRAPH AT	DIV27I	25.	12.33	1.	0.	0.	.17		
ROUTED TO	RO27I	21.	12.42	1.	0.	0.	.17	99.66	12.42
HYDROGRAPH AT	SB18	3.	12.17	1.	0.	0.	.00		
HYDROGRAPH AT	SB30	27.	12.17	4.	1.	1.	.04		
HYDROGRAPH AT	DIV25P	86.	12.17	12.	3.	3.	.00		
ROUTED TO	RO25P	86.	12.25	12.	3.	3.	.00		
5 COMBINED AT	CO32	306.	12.25	37.	10.	9.	.41		
DIVERSION TO	DIV35P	86.	12.25	19.	5.	5.	.41		
HYDROGRAPH AT	DIV35S	220.	12.25	18.	4.	4.	.41		
DIVERSION TO	DIV39O	116.	12.25	9.	2.	2.	.41		
HYDROGRAPH AT	DIV39I	105.	12.25	9.	2.	2.	.41		
ROUTED TO	RO39I	99.	12.33	9.	2.	2.	.41	98.27	12.33
HYDROGRAPH AT	SB42	134.	12.33	17.	5.	5.	.18		
HYDROGRAPH AT	DIV35P	86.	11.92	19.	5.	5.	.00		
ROUTED TO	RO35P	87.	12.00	19.	5.	5.	.00		
3 COMBINED AT	CO44	319.	12.33	45.	12.	12.	.58		

DIVERSION TO	DIV47P	112.	12.33	28.	8.	8.	.59		
HYDROGRAPH AT	DIV47S	207.	12.33	17.	4.	4.	.59		
DIVERSION TO	DIV490	29.	12.33	2.	0.	0.	.59		
HYDROGRAPH AT	DIV49I	178.	12.33	15.	4.	4.	.59		
ROUTED TO	R049I	152.	12.42	15.	4.	4.	.59	.74	12.42
HYDROGRAPH AT	SB52	61.	12.17	5.	1.	1.	.06		
HYDROGRAPH AT	SB54	54.	12.00	5.	1.	1.	.03		
ROUTED TO	R051	5.	12.50	1.	1.	1.	.03	3.59	12.50
3 COMBINED AT	C056	186.	12.42	21.	6.	6.	.69		
ROUTED TO	R057	169.	12.50	21.	6.	6.	.69	.77	12.50
HYDROGRAPH AT	SB60	231.	12.08	25.	8.	8.	.15		
HYDROGRAPH AT	SB62	108.	12.08	14.	5.	4.	.07		
ROUTED TO	R064	93.	12.17	13.	4.	4.	.07	3.79	12.17
HYDROGRAPH AT	DIV47P	112.	12.00	28.	8.	8.	.00		
ROUTED TO	R047P	116.	12.17	28.	8.	8.	.00		
4 COMBINED AT	C068	468.	12.17	87.	25.	25.	.91		
DIVERSION TO	DIV71P	140.	12.17	49.	16.	15.	.91		
HYDROGRAPH AT	DIV71S	328.	12.17	38.	9.	9.	.91		
DIVERSION TO	DIV730	131.	12.17	15.	4.	4.	.91		
HYDROGRAPH AT	DIV73I	197.	12.17	23.	6.	5.	.91		
ROUTED TO	R073I	169.	12.42	23.	6.	5.	.91	.80	12.42
HYDROGRAPH AT	SB76	62.	12.33	13.	4.	4.	.10		
HYDROGRAPH AT	DIV71P	140.	11.92	49.	16.	15.	.00		
ROUTED TO	R071P	143.	12.08	49.	16.	15.	.00		
HYDROGRAPH AT	SB80	673.	12.42	92.	27.	26.	.64		
ROUTED TO	R083	36.	13.67	22.	9.	9.	.64	1361.26	13.67
HYDROGRAPH AT	SB84	122.	12.42	24.	7.	6.	.20		
ROUTED TO	R085	116.	12.50	24.	7.	6.	.20		
5 COMBINED AT	C090	487.	12.42	128.	41.	40.	1.84		
DIVERSION TO	DIV93P	310.	12.42	112.	37.	36.	1.84		
HYDROGRAPH AT	DIV93S	177.	12.42	16.	4.	4.	1.84		
HYDROGRAPH AT	SB86	558.	12.17	40.	10.	10.	.34		
ROUTED TO	R087	8.	12.75	8.	4.	3.	.34	48.56	12.75

DIVERSION TO	DIV880	8.	.08	8.	4.	3.	.34		
HYDROGRAPH AT	DIV88I	0.	.08	0.	0.	0.	.34		
2 COMBINED AT	C091	177.	12.42	16.	4.	4.	2.18		
ROUTED TO	R093S	118.	13.08	16.	4.	4.	2.18	49.91	13.08
HYDROGRAPH AT	SB92	42.	12.33	5.	1.	1.	.04		
2 COMBINED AT	C096	124.	13.08	20.	5.	5.	2.22		
ROUTED TO	R095	92.	13.83	20.	5.	5.	2.22	49.60	13.83
HYDROGRAPH AT	SB97	256.	12.25	27.	7.	7.	.25		
ROUTED TO	R097.1	200.	12.42	27.	7.	7.	.25	.81	12.42
HYDROGRAPH AT	SB98	279.	12.17	29.	8.	7.	.25		
2 COMBINED AT	C099	420.	12.25	55.	15.	14.	.50		
HYDROGRAPH AT	SB94	16.	12.50	3.	1.	1.	.03		
3 COMBINED AT	C0100	429.	12.25	78.	20.	20.	2.75		
HYDROGRAPH AT	SB102	58.	12.08	6.	2.	2.	.04		
DIVERSION TO	DV103P	25.	12.08	5.	1.	1.	.04		
HYDROGRAPH AT	DV103I	33.	12.08	1.	0.	0.	.04		
ROUTED TO	R0103I	27.	12.17	1.	0.	0.	.04	.49	12.17
HYDROGRAPH AT	SB104	67.	12.08	6.	2.	2.	.05		
2 COMBINED AT	C0105	91.	12.08	8.	2.	2.	.10		
DIVERSION TO	DV107B	4.	12.08	2.	1.	1.	.10		
HYDROGRAPH AT	DV107A	87.	12.08	6.	2.	2.	.10		
ROUTED TO	R0107A	84.	12.17	6.	2.	2.	.10	.64	12.17
HYDROGRAPH AT	SB106	70.	12.08	6.	2.	2.	.05		
2 COMBINED AT	C0108	140.	12.17	12.	3.	3.	.15		
2 COMBINED AT	C0110	543.	12.25	91.	24.	23.	2.89		
HYDROGRAPH AT	SB118	75.	12.00	5.	1.	1.	.04		
2 COMBINED AT	C0120	564.	12.17	96.	25.	24.	2.94		
ROUTED TO	R0121	282.	12.58	50.	15.	15.	2.94	1348.83	12.58
HYDROGRAPH AT	DV107B	4.	11.67	2.	1.	1.	.00		
HYDROGRAPH AT	SB114	61.	12.08	6.	2.	2.	.05		
2 COMBINED AT	C0116	65.	12.08	8.	2.	2.	.05		
DIVERSION TO	DV1170	4.	12.08	2.	1.	1.	.05		
HYDROGRAPH AT	DV117A	61.	12.08	5.	1.	1.	.05		

HYDROGRAPH AT	DIV93P	310.	12.25	112.	37.	36.	.00
ROUTED TO	RO93P	310.	12.75	112.	37.	36.	.00
3 COMBINED AT	CO126	603.	12.58	166.	53.	52.	2.99

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
R011P	MANE	5.00	11.06	725.00	1.07	5.00	11.06	725.00	1.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1772E+01 EXCESS= .0000E+00 OUTFLOW= .1767E+01 BASIN STORAGE= .1214E-02 PERCENT ERROR= .2

R025P	MANE	1.98	87.30	733.81	-1.00	5.00	86.07	735.00	-1.00
R035P	MANE	1.98	87.38	719.93	-1.00	5.00	87.30	720.00	-1.00
R047P	MANE	5.00	116.20	730.00	-1.00	5.00	116.20	730.00	-1.00
R071P	MANE	5.00	143.42	725.00	-1.00	5.00	143.42	725.00	-1.00
R085	MANE	5.00	115.90	750.00	1.23	5.00	115.90	750.00	1.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1305E+02 EXCESS= .0000E+00 OUTFLOW= .1295E+02 BASIN STORAGE= .8038E-02 PERCENT ERROR= .7

R093P	MANE	5.00	310.00	770.00	-1.00	5.00	310.00	770.00	-1.00

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

Appendix D

Hydraulics for the main floodway has been reviewed and approved by SCS for Trial #2 in Preliminary Design Report. Water surface profile calculations in the floodway were performed with design flows of Q_{100} for aged condition and with design flows of 50% of Q_{100} for as-built conditions. Design flows were obtained from the final hydrology meeting with SCS using the Alternate No. 3 condition. Flows ranged from 300 cfs to 2400 cfs for Q_{100}.

A list of contents for this section is provided as follows:

1. Summary of Design Flows in the Main Floodway.
2. Hydraulics for the Main Floodway (Trial #2).
3. Sketches of the Channel Geometry.
4. Cross Section Sketches for the Main Floodway.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: SCK RWCD Floodway Reach 6-E10101
Description: Summary of Design Flows in the Main Floodway for the Final Hydraul
Calculated by: B. Gary Sun Date: 11/17/86 Sheet No. 1
Checked by: M.S.B. Date: of 1

Summary of Design Flows in Main Floodway

Station — Station	Q_{100}	50% of Q_{100}	Q_{10}
30+70.00 – 32+24.53 N. Brown ℄ Brown Rd = 33+12.99	300 cfs	150 cfs	154 cfs
32+24.53 – 35+42.00 Brown Box	900 cfs	450 cfs	154 cfs
35+42.00 – 78+63.00 Adobe Rd.	1,200 cfs	600 cfs	193 cfs
78+63.00 – 89+51.00 Trans. Easement	1,800 cfs	900 cfs	296 cfs
89+51.00 – 93+97.84 University Dr.	1,840 cfs	920 cfs	460 cfs
93+97.84 – 120+76.00 S. of University Dr.	1,840 cfs	920 cfs	453 cfs
120+76.00 – 130+04.54 Apache Blvd.	1,900 cfs	950 cfs	721 cfs
130+04.54 – 140+00.00 S/E. of Higley Road	2,400 cfs	1,200 cfs	1,029 cfs
140+00.00 – 161+30.00 S. of Broadway Rd.	2,400 cfs	1,200 cfs	1,014 cfs

United States
Department of
Agriculture

Soil
Conservation
Service

West National Technical Center
511 N. W. Broadway, Room 547
Portland, Oregon 97209-3489

Subject: ENG - Hydrology = RWCD Floodway, Reach 6 Design Flows, Morrison County, Arizona

Date: October 21, 1985

To: Harry Millsaps, Hydraulic Engineer, SCS, Phoenix, Arizona

File Code:

The documentation for the design flows for Reach 6 has been reviewed. The recommended flows are acceptable.

As we discussed by phone last week, the design flows for the end of Reach 6 should be consistent with the design of Reach 5 and the Leisure World greenway.

You have done a good job in evaluating the differing, and often conflicting, changes in watershed conditions that have occurred since the plan was prepared.

The documentation is returned.

Wendell A Styner

WENDELL A. STYNER
Hydraulic Engineer

Attachment

cc:
Jack C. Stevenson, Head, Engineering Staff, WNTC, Portland, Oregon

Source: Report Ref. 7

9/11/85
[illegible]

RWCD REACH 6

INLET HYDROLOGY

SUMMARY OF PEAK DISCHARGE FOR DESIGN

Four separate alternatives were investigated during this analysis. These were as follows:

Alt. #1. Present 1985 Conditions, i.e. no channel upstream of Brown Road with present level of development and curve numbers. (70% - 30% split west & south)

Alt. #2. Year 2000 Conditions, with 1-inch storage assumed on new developments between 1985 and 2000 and with 200 and 300 cfs channel assumed upstream of Brown Road. This analysis also basically assumes a 70% to 30% split of runoff to the west and south, respect~~fully~~ively, for selected drainage areas. (See TR-20 Schematic Map).

Alt. #3. This alternate is the same as Alternate #2 described above except for subareas 3 & 4 shown on the Schematic Map, a 90% to 10% split of flows to the south and west, respectively is assumed. This latter split is an attempt to evaluate the effect of the Alta Mesa Develoment on flows originating to the north of Brown Road and east of Recker Road. The division of flows at Adobe and Higley Roads also were reversed over that assumed in Alternate #2. (See Schematic Map).

Alt. #4. This final alternate is again the same as the year 2000 conditions described above in Alternate 2 with the exception that a 100-year flood control channel is assumed upstream of Brown Road. This assumes that no flow overtops the RWCD Canal above Brown Road for any storm equal-to or less than the 100-year flood.

The results of these analyses, with reference to Peak Discharges, are shown on the attached table which compares the computed peaks to those estimated by Anderson-Nichols in their Master Drainage Plan Study and in Bob Bartel's Study which is presently being used for the design of the RWCD. There are major differences in the computed flows based on the various assumptions, especially for the RWCD and Side Inlets for the drainage areas lying north of University Drive. For instance at Brown Road, the design discharge for the RWCD Floodway itself can vary from a minimum of 460 cfs (Alt. 3) to a maximum of 1601 cfs (Alt. 4). The peaks for the side inlet at this location vary between 357 cfs and 862 cfs for the same two respective alternates.

For the Side Inlet at Brown Road it is recommended that the smaller value (i.e. 357 cfs) be used for design. This takes into account the effect of the Alta Mesa Subdivision on storm runoff originating to the east of Recker Road and north of Brown Road.

For the Floodway itself at Brown Road, it would be adequate to design the floodway for 460 cfs as computed under the assumptions of Alternate #3. However, the original design as developed by Bartel's in 1974 called for a design discharge of 1160 or 1200 cfs at this location. Based on Bartel's

Source: UEMF FIS Report Ref. 7

data, some pre-design excavation by a developer has already occurred between Brown Road and Apache Trail; therefore, it is recommended that the 1200 cfs discharge be maintained from Brown Road downstream to the intersection of the Powerline Channel proposed by Anderson-Nichols in their Master Drainage Plan Study. The Powerline Channel is located about halfway beween Adobe Road and University Drive. The above suggested discharge will also provide the needed capacity in this reach should a 100-year channel be installed upstream of Brown Road sometime in the future. The Anderson-Nichols flows for the RWCD Channel (dated 9/10/85) should then be maintained downstream until exceeded by computed flows from Alternate #3.

For the remainder of the side inlets to the south of Brown Road it is again recommended that the Alternate #3 discharges be used for design, except for the Powerline Channel Inlet. At this location, it is recommended that Anderson-Nichols discharge of 1565 cfs be used. The final recommended discharges for each location is shown in Tabular form following the peak discharge comparison table. It should be recognized, however, that once the Master Drainage Plan is completed, the Inlet Structures at University and locations to the south, will be over-designed, as will the RWCD from Higley Road downstream to Leisure World.

Note, Alternate #3 discharges instead of Alternate #1, present condition 1985 discharges, were recommended since they show the effect of the Alta Mesa Subdivision. A revised Alternate #1 would be needed if "present condition" discharges are to be used. However, by comparing Alternates #1 and #2 it can be seen that there is not much difference in the estimated "present" and "future peaks with 1-inch of storage " when the same assumptions are made with reference to Alta Mesa. Therefore, Alternate #3, gives about the same peaks as would be obtained if Alternate #1 was revised to show the effect of Alta Mesa Development on present (1985) discharges.

Source : UEMF FIS Report Ref. 7

Az.
RWCD Reach -6, Inlet Hydrology
H. Millsaps 6-7-85
1 / 2

Comparison of 100 yr. peak discharges — Future Condition, year 2000 w/1-inch storage on new developments & 85 (Present) condition

Location	1974 Calc. Design Peaks (Ignoring reach 6 ext. D.A.)	1985 Calc. (w/200 & 300 CFS Chan. on Reach 6 Ext. D.A.) Alt #2	Alt #3	1985 Calc. (w/ 100yr. Chan. on Reach-6 D.A.) Alt #4	1985 calc. of Present (85) cond. No chan. Reach-6 Ext. D.A. Alt #1	1985 Calc. by And-Nichols for yr. 2000. Rec'd 4/29/85	A-N Rev. 9/10/85
BROWN ROAD							
Reach 6 EXT.	–	297	297	874	150		
From East (109)	1160	862	357	862	741	750	365
RWCD (110)	1160	867	460	1601	891	1150	365
ADOBE Rd. (1/2 mi. S. of Br. Rd)							
Inlet (119)		534	306	534	438	525	100
RWCD (110)	1160	1174	561	1594	1217	1500	375
3/4 mi. S. of Brown Rd. (D-6)							
Inlet (121)	–	213	576	213	176	1150	1565
RWCD (120)	1160	1313	1090	1682	1347	1800	1800
UNIVERSITY DR.							
Inlet (128)	990	600	618	600	543	250	400
RWCD (122)	1965	1516	1562	1817	1539	1965	1840
1/4 mi. S. of UNVER. Dr.							
Inlet (12)	–	110	110	110	113	–	–
RWCD (129)	1965	1500	1530	1807	1510	1965	1840
APACHE TRAIL							
Inlet (133)	–	986	994	986	900	500	435
RWCD (147)	1965	1687	1876	1942	1720	2300	1900
SE of HIGLEY RD.							
INLET (142)	570	503	503	503	502	–	–
RWCD (148)	2290	2121	2374	2221	2158	2300	1900

COMPUTATION SHEET

SCS-ENG-523A Rev. 9-69

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE: Az.
PROJECT: RWCD Reach-6, Inlet Hydrology

BY: H. Millsaps
DATE: 6-7-85
CHECKED BY:
DATE:
JOB NO.:
SHEET 2 OF 2

SUBJECT: Comparison of 100 yr. peak discharges — Future condition, year 2000 w/1-inch storage on new developments & 85 (Present) condition

Location	1974 Calc. Design Peaks (Ignoring reach 6 ext. D.A.)	1985 Calc. (w/200 & 300 CFS Chan. on Reach 6 Ext. D.A.) Alt #2	Alt #3	1985 Calc. (w/ 100yr. Chan. on Reach-6 D.A.) Alt #4	1985 calc. of Present (85) cond. No chan. Reach 6 Ext. D.A. Alt #1	1985 Calc. by And-Nichols for yr. 2000.	
BROADWAY ROAD							
INLET (17)	—	324	* 220	324	306	70	220
RWCD (149)	2290	2119	*2361	2229	2152	—	—
500 Ft. S. of Broadway							
INLET (146)	750	1479	1486	1479	809		1750
RWCD (151)	3050	3309	3350	3310	2674		2465

* NOTE: D.A. decreased by 0.09 due to diversion into Broadway Rd. channel. Adjusted

$$Q = \frac{0.28 - 0.09}{0.28}(324) = 220 \text{ cfs}$$

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE	PROJECT		
ARIZONA	RWCD REACH 5, Inlet Hydrology		
BY: Hm DATE: 8/19/85	CHECKED BY: Rev 9/11/85	DATE	JOB NO.
SUBJECT: RECOMMENDED PEAK DISCHARGE			SHEET ___ OF ___

FOR DESIGN OF RWCD & SIDE INLETS

LOCATION	CALC. PEAKS	RECOMMENDED DESIGN DISCHARGE [1]	SOURCE
BROWN ROAD			
REACH 6 EXT	297	300 (Really needs to be determined by MCFCD.)	Reach 6 EXT. STUDY
From East (109)	357	360	Alt #3, 1985 Study
RWCD	1160	1200	Bartel's 1974 STUDY
ADOBE ROAD (1/2-Mi. S. of Br. Rd)			
Inlet (119)	306	310	Alt #3, 1985 Study
RWCD (110)	1160	1200	Bartel's 1974 Study
3/4-MILE S. OF BR. ROAD			
Inlet (121)	~~155~~ 1565	~~150~~ 1600	Anderson-Nichols Study (Rev 9/
RWCD (120)	~~1160~~ 1800	~~1200~~ 1800	~~Bartel's 1974 Study~~ Anderson-Nichols (Rev 9/85)
UNIVERSITY DR			
Inlet (128)	618	620	Alt #3 1985 Study
RWCD (122)	~~1562~~ 1840	~~1550~~ 1840	~~Alt #3 1985 Study~~ Anderson-Nichols (Rev 9/85)
1/4-MILE S. OF UNIV. DR			
Inlet (12)	110	110	Alt #3 1985 Study
RWCD (129)	~~1555~~ 1840	~~1555~~ 1840	~~Alt #3 1985 Study~~ Anderson-Nichols (Rev 9/85)
APACHE TRAIL			
Inlet (133)	994	1000	Alt #3, 1985 Study
RWCD (147)	1876	1900	Alt #3, 1985 Study
JUST S.E. OF HIGLEY ROAD			
Inlet (142)	503	500	Alt #3, 1985 Study
RWCD (148)	2374	2400	Alt #3, 1985 Study
BROADWAY ROAD			
Inlet (47)	220	220	Alt #3, 1985 Study Adj for D.A.
RWCD (149)	2361	2400	Alt #3, 1985 Study
AT ~~500' S. OF~~ BROADWAY Rd CHAN. INTERSECTION			
Inlet (146)	1486	1500	Alt #3 1985 Study
RWCD (151)	3350	3350	Alt #3 1985 Study

1) SEE Attached Write-up

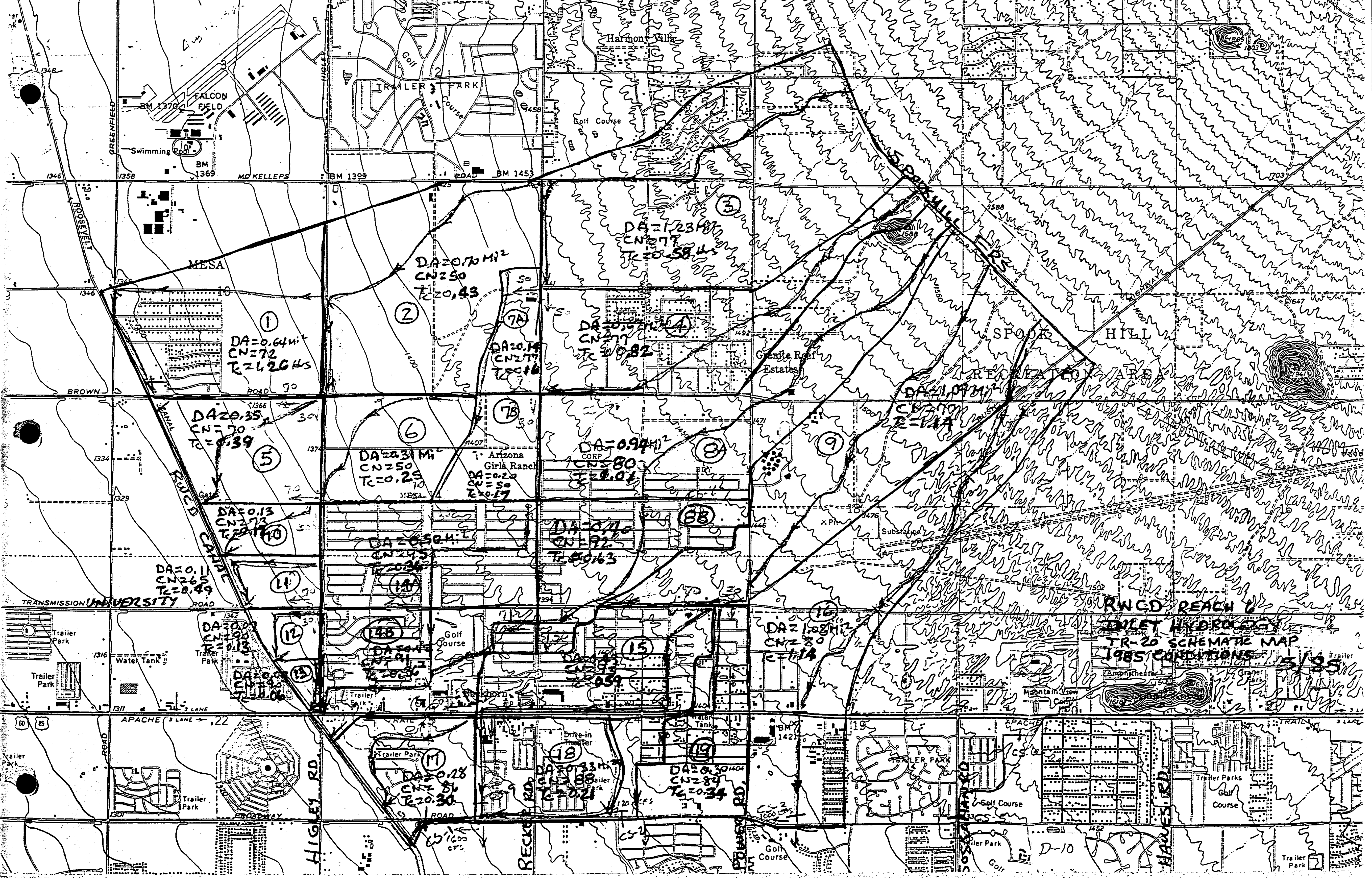
COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE	PROJECT		
ARIZONA	RWCD REACH 5, INLET HYDROLOGY		
BY Hem	DATE 9/4/85	CHECKED BY	DATE	JOB NO.
SUBJECT ALT #3 10-YEAR DISCHARGES			SHEET ___ OF ___

LOCATION	CALC 10-YEAR DISCHARGE (CFS)
BROWN ROAD	
REACH 6 EXT	154
FROM EAST (109)	86
ADOBE ROAD (½-Mi. S. of Br. Rd)	
Inlet (119)	89
RWCD (110)	193
3/4-MILE S. of Br. Road	
Inlet (121)	167
RWCD (120)	296
UNIVERSITY DR.	
Inlet (128)	296
RWCD (122)	460
1/4-MILE S. of Univer. Dr.	
Inlet (12)	55
RWCD (129)	453
APACHE TRAIL	
Inlet (133)	490
RWCD (147)	721
JUST S.E OF HIGLEY ROAD	
Inlet (142)	358
RWCD (148)	1029
BROADWAY ROAD	
Inlet (17)	93 (Adj for reduced D.A.)
RWCD (149)	1014
500' S. OF BROADWAY RD.	
Inlet (146)	391
RWCD (151)	1317

Source: UEMF FIS Report Ref. 7


RWCD REACH 6
INLET HYDROLOGY
TR-20 SCHEMATIC MAP
1985 CONDITIONS
5/85
Harmony Villa
TRAILER PARK
Golf Course
FALCON FIELD
BM 1370
GREENFIELD
Swimming Pool
BM 1369
MC KELLEPS ROAD
BM 1399
BM 1453
ROOSEVELT
MESA
SPOOK HILL
RECREATION AREA
SPOOK HILL FRS
Granite Reef Estates
BROWN ROAD
Arizona Girls Ranch
Substation
TRANSMISSION
UNIVERSITY ROAD
RWCD CANAL
APACHE
TRAIL
BROADWAY
ROAD
HIGLEY RD.
RECKER RD.
POWER RD.
SOSSAMAN RD.
HAWES RD.
Trailer Park
Water Tank
Drive-in Theater
Amphitheater
Mountain View
DA=0.64 Mi²
CN=72
Tc=1.26 Hrs
DA=0.70 Mi²
CN=50
Tc=0.43
DA=1.23 Mi²
CN=77
Tc=0.58 Hrs
DA=0.14
CN=77
Tc=0.16
DA=0.35
CN=70
Tc=0.39
DA=0.31 Mi²
CN=50
Tc=0.25
DA=0.20
CN=50
Tc=0.17
DA=0.94 Mi²
CN=80
DA=1.07 Mi²
DA=0.13
DA=0.50 Mi²
DA=0.11
CN=65
Tc=0.49
DA=1.08 Mi²
CN=80
Tc=1.14
DA=0.28
CN=86
Tc=0.30
DA=0.33 Mi²
CN=88
Tc=0.21
DA=0.30
CN=84
Tc=0.34
CS-1
CS-2
CS-3
D-10

United States Department of Agriculture

Soil Conservation Service

201 East Indianola
Suite 200
Phoenix, Arizona 85012

Subject: PDM - Inlet Hydrology for RWCD Floodway, Reach 6, E. Maricopa County, AZ

Date: September 19, 1985

To: Wendell Styner
Hydraulic Engineer
Portland, OR

File Code: 390-11-13-19

Enclosed for your review and comment is the documentation for hydrologic studies made to estimate required inlet capacities for the RWCD from the intersection of the Broadway Road channel (located about 500 to 600 feet south of Broadway Road) upstream to about 230 feet north of Brown Road. This reach is referred to as Reach 6 in the design and construction phase of the RWCD.

From the documentation it will be noted that the final recommended design discharges for both the RWCD and the side inlets are dependent to some extent on both present and future conditions. A present condition that has greatly altered the distribution of flows along the RWCD (over those used in the Work Plan) is the construction of the Alta Mesa Subdivision. This Subdivision has detention storage sufficient to store the total on-site runoff from a 50-year, 24-hour storm, but off-site runoff from drainage areas (Subareas 3 and 4) located to the east of the subdivision and north of Brown Road are diverted to the south before they can enter the RWCD Floodway.

A future condition which must be accounted for in the Final Design is the effect of a Master Drainage Plan presently being studied by Anderson-Nichols and Associates for Maricopa County Flood Control District. One proposal in the Master Drainage Plan is a flood control channel intersecting the RWCD about half way between Adobe Road and University Drive. This channel not only affects the design capacity of the side inlet but also affects the magnitude of the recommended discharges for the RWCD at this location and points downstream.

A contract has already been issued by the SCS to Greiner Engineers for the design of the subject reach; therefore, should any discrepancies be found in the documentation, please notify the State as soon as possible. Also, since the enclosed data is the original documentation for this study, please return it as soon as your review is completed.

Harry C. Millsaps for
W. Wayne Killgore
ASTC(W)

Enclosures

CC: Ralph Arrington, SCE, SCS, Phoenix, AZ
Harry C. Millsaps, Hyd. Engr., SCS, Phoenix, AZ

Source: UEMF FIS Report Ref. 7

Greiner Engineering

Route : File

~~Ralph A.~~ KG

~~Bill P.~~ HBP

~~Harry M.~~

MEMORANDUM

To: File

From: Michael Shapiro

Subject: RWCD Floodway Reach 6
Contract No. 53-9457-00469
Pre-Hydrology Meeting
Job No. E-101-012

Date: September 4, 1985

A meeting was held September 4, 1985, at 8:00 a.m. at the Soil Conservation Service. The following were present:

Mr. Don Paulus, Soil Conservation Service
Mr. Harry Milsap, Soil Conservation Service
Mr. Michael Shapiro, Greiner Engineering

A summary of peak discharge for the RWCD Reach 6 for inlet hydrology was handed out by Mr. Milsap and discussed at length. In our discussion, it was decided that the peak flows for the channel north of Brown Road would be 300 c.f.s. The bridge at Brown Road was also discussed at length. Range in 100-year design flows for this bridge is 300-1,200 c.f.s. Mr. Milsap recommended that the bridge be designed for a peak flow of 900 c.f.s. It was decided that Mr. Paulus would get in touch with the Flood Control District and discuss all the options for this bridge design and report back to us. It was also decided that Alternate #3 would be used for our inlet and floodway design with the exception of the inlet at the powerline easement between University Drive and Adobe Road. This inlet would be designed for a peak flow of ~~1,500~~ 1150 c.f.s. as addressed in the Anderson-Nichol's Master Drainage Plan Study. Inlets north of Apache Boulevard would be overdesigned once the Anderson-Nichol plan was constructed, but until that time these inlets would be designed to handle present conditions.

Mr. Paulus stated that the SCS would like Greiner Engineering to deliver off-site drainage into the main floodway as soon as possible and not to collect them in a minor channel east of the east maintenance road. It was also decided that Greiner Engineering would develop cross sections at all inlet locations along major streets to determine how much flow goes north and south to limit the size of the inlet structure. It was ~~also~~ decided that in some cases south of these major streets that the flow entering the inlets would be so wide that not all of it could enter into one inlet. In these cases it

Source: UEMF FIS Report Ref. 7

Greiner Engineering

Memorandum to File
Job No. E-101-012

would be necessary to design a small collector channel and place another inlet 100-200 feet downstream if there was not enough area to let it collect in a small pounded area.

Mr. Shapiro showed some concern about intermediate points between the major inlets where existing and/or proposed subdivisions would be outletting storm runoff that was not addressed in Mr. Milsap's hydrology study. Mr. Shapiro did not want to design a collector channel using the large inlet flows because this would create a floodway outside of a floodway and cause additional maintenance problems. Mr. Shapiro suggested getting all the drainage studies done for these developments and using them as a guideline in designing a minor collector channel. This was agreed upon.

Mr. Milsap had developed a summary sheet of his recommended peak flow for the 100-year storm event for inlet designs and for the design of the main channel. Mr. Shapiro advised Mr. Milsap that the 10-year peak flows were also necessary for their backwater analysis. Mr. Milsap said that he would develop a summary sheet for the 10-year storm and would give him a copy of both summary sheets at a later date.

Mr. Shapiro advised Mr. Paulus that he had not yet received the backwater analysis done for Leisure World up to Broadway Road. He had only received this analysis up to Southern Avenue. Mr. Paulus advised him that the analysis up to Southern Avenue had not been approved by the Soil Conservation Service as of yet. As soon as this was approved, he would give us the backwater analysis up to Broadway.

Mr. Shapiro asked Mr. Paulus for bid tabulations and maintenance and operating manuals prepared for Reaches 2 and 3 so they could be evaluated during their Comparative Design Study. Mr. Shapiro also handed Mr. Paulus a detailed schedule and approach for their Comparative Design Study and asked Mr. Paulus to comment. Mr. Shapiro also recommended that they meet with the Flood Control District in the near future to get their feedback on maintenance and operating procedures for Reach 6. Access to the area north of Brown Road was discussed so that soil pits could be dug on Thursday morning, the 5th of September. Mr. Paulus said that the gate would be left open, but gave him the name and number of Michael Leonard from the RWCD just in case there were any problems.

cc: Bob Berkowitz
Don Paulus
Mustafa Chudnoff
Gary Sun

Source: UEMF FIS Report Ref 7

Anderson-Nichols
4120 North 20th Street
Phoenix, Arizona 85016
(602) 957-3681

Woodrow C. Scoutten, P.E.
Vice President

September 10, 1985

Ms. Kebba Buckley
Flood Control District of
Maricopa County
3335 West Durango Street
Phoenix, AZ 85009

Re: RWCD Reach 6 Hydrology
East Maricopa County Master Drainage Plan

Dear Ms. Buckley:

Enclosed is the information requested by the Soil Conservation Service's letter dated July 16, 1985 (copy attached). Their letter requested particular channel inflow design information for one location along the RWCD Reach 6.

We have remodeled the watershed for this area based on the selected alternative scheme and have enclosed a sketch displaying the new 100-year peak discharges along Reach 6.

If you have any questions or comments, please feel free to call myself or Darrel Wood.

Sincerely,

ANDERSON-NICHOLS & COMPANY, INC.

L Steve Miller

Steve Miller, P.E.
Project Engineer

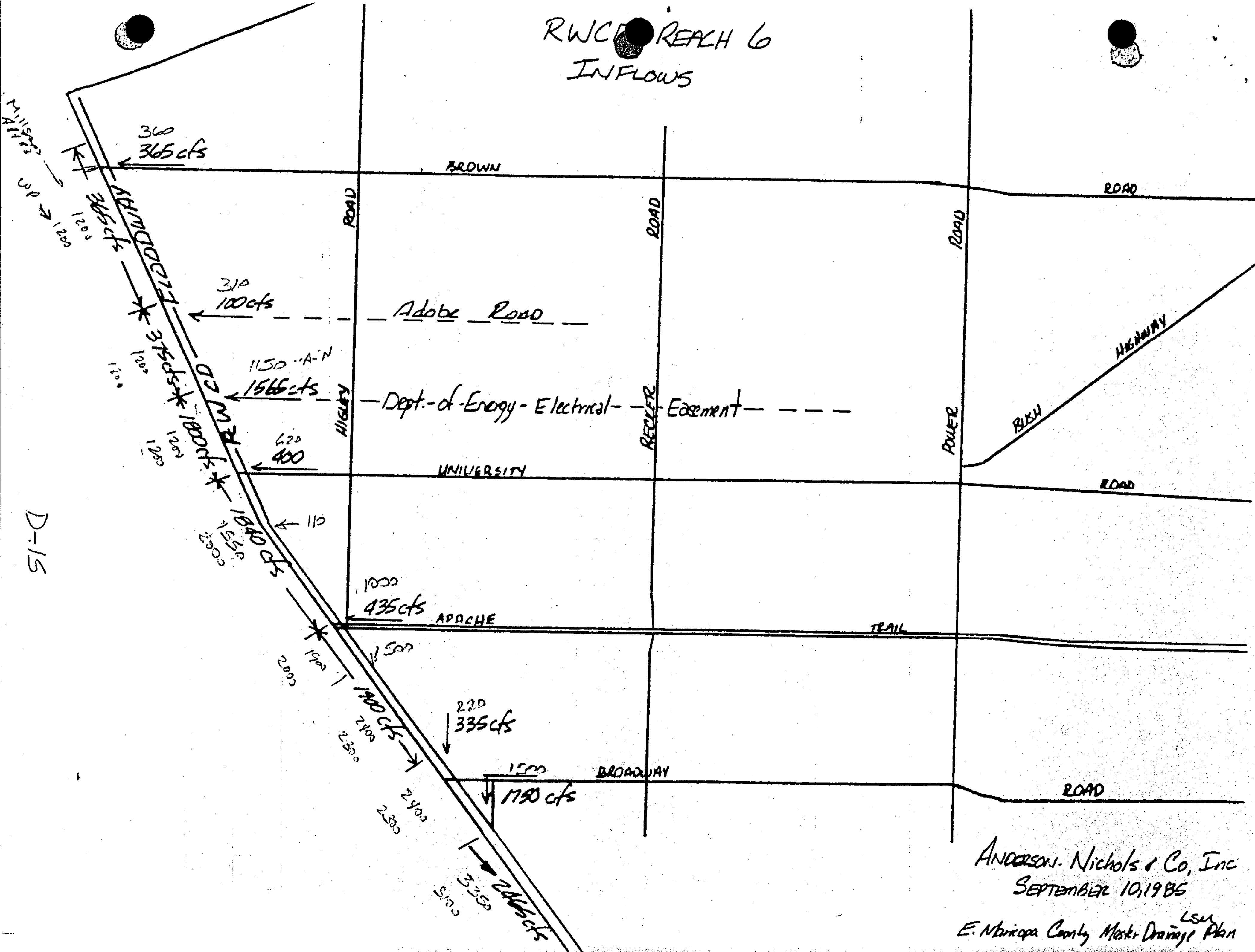
SM/sld

enclosures

cc: Mr. Harry Millsaps
Soil Conservation Service

Source : UEMF FIS Report Ref. 7

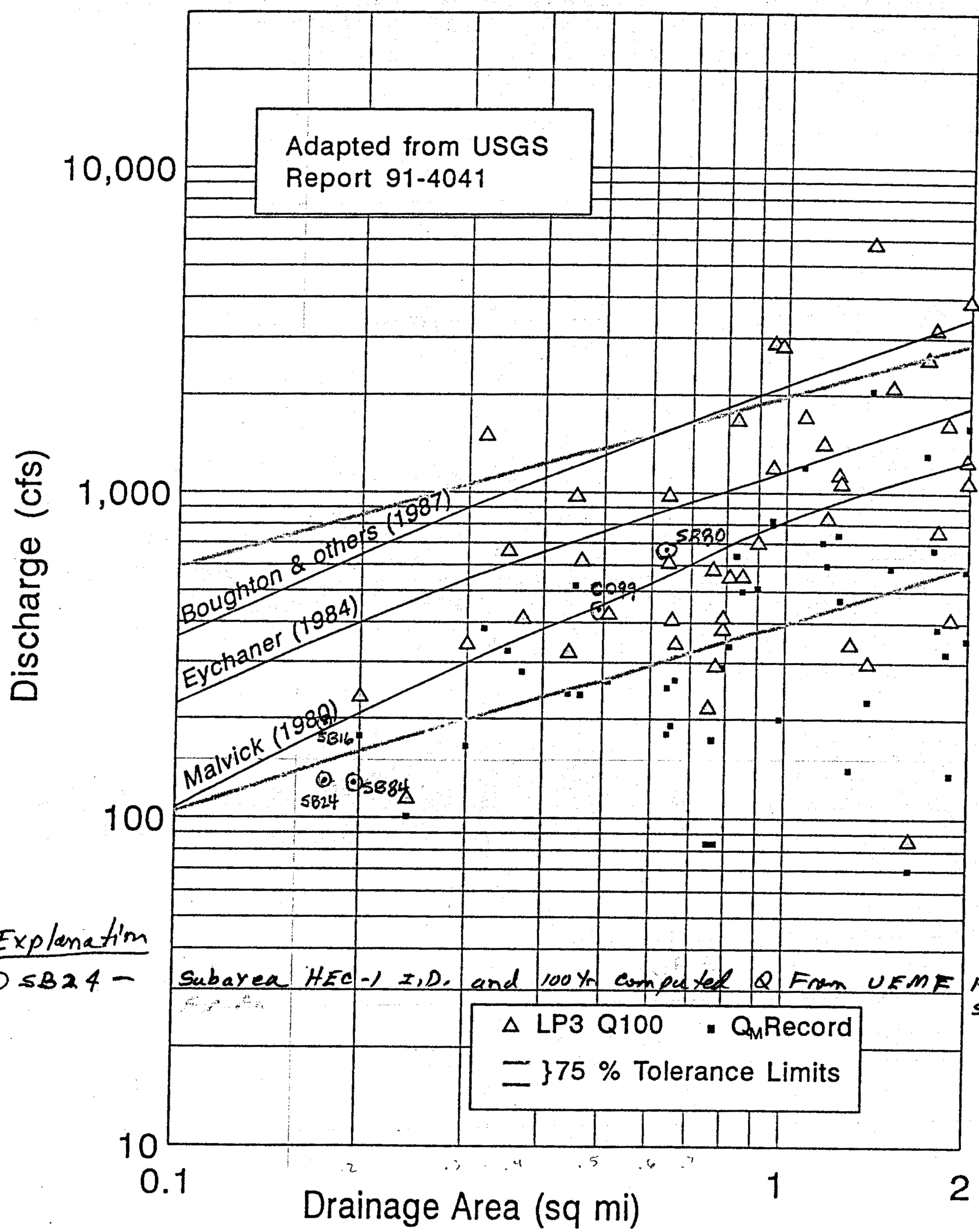
RWCD REACH 6 INFLOWS



ANDERSON-Nichols & Co, Inc
SEPTEMBER 10, 1985
E. Maricopa County Master Drainage Plan
LSH

FIGURE 10-3

100-YEAR PEAK DISCHARGE BY LP3 ANALYSIS (LP3 Q100) AND MAXIMUM RECORDED DISCHARGE (Q_M RECORD) vs. DRAINAGE AREA FOR 0.1 TO 2.0 SQUARE MILES



Explanation

⊙ SB24 – Subarea HEC-1 I.D. and 100 Yr computed Q From UEMF FIS study.

Source: ADOT Highway Drainage Design Manual - Hyd -

CITY OF
MESA

September 21, 1995

Ms. Lisa Young
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Subject: Upper E.M.F. Floodplain Delineation Study

Dear Ms. Young:

We have reviewed the draft report of the referenced study and offer the following comments:

1. Section two states that the East Maricopa Floodway (E.M.F.) was designed to convey the 100-year storm event runoff. There have been some discussions concerning assumptions made in the original E.M.F. regarding the actual level of protection. The level of protection afforded by the E.M.F. should be confining.

2. Section 4.3 excludes contribution from the orange grove north of McKellips and west of Greenfield. If this area is irrigated at the time of a storm event it could very easily contribute to the study area. We therefore believe this area should be included as a contribution area.

3. Page 14 of the study shows a 100-year peak discharge at Brown Road of 603 C.F.S. The appendix contains some discussion on what the E.M.F. capacity should be but we are unclear what the present capacity is. Please verify the capacity of the E.M.F. at Brown Road and the capacity of the Brown Road bridge over the E.M.F.

Please contact me if you have any questions.

Sincerely,

Peter Knudson
Senior Civil Engineer

PK/rp
c:\wpwin\data\lisa.ren

FLOOD CONTROL DISTRICT
RECEIVED
SEP 25 1995

CHENG	P&PM
DEP	REG
ADMIN	LMGT
FINANCE	FILE
O&M	
ENGR	
REMARKS	

Engineering
20 East Main Street, Suite 400 • P.O. Box 1466 • Mesa, Arizona 85211-1466 • (602) 644-2251

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

12 October 1995

Greg Schuelke, P.E.
A-N West, Inc.
7600 North 15th Street
Suite 200
Phoenix, Arizona 85020

OCT 1995

Subject: Upper East Maricopa Floodway Flood Delineation Study
FCDMC No. 94-26

Dear Mr. Schuelke:

I have reviewed the Hydrology Report for Upper East Maricopa Floodway (UEMF) Flood plain Delineation Study. I would like to request the following revisions.

1. Section 3.1, third sentence. Clarify point of sentence.

2. Page 4, Section 4.1, 'weighed' should be 'weighted'.

3. Section 4.3, page 6, rethink your position on the ponding area as described in the second paragraph, as the ponding area may be necessary for the floodplain delineation. Analyze what would occur if the groves were irrigated just prior to the event.

4. Check spelling.

5. East Mesa Floodway should be referred to as East Maricopa Floodway throughout report.

6. On the HEC-1 schematic 1031 should be in a box as it is a routing reach.

7. Subbasin SB16, SB92, SB98 assess whether the majority of impervious area is near the concentration point, if it is not, drop impervious area to zero percent.

If you have any questions on these revisions, please call me at 506-4719.

Thank you,

Lisa C. Young

Lisa C. Young
Hydrologist

copy to: Peter Knudson, City of Mesa

A-N WEST INC.
Consulting Engineers

November 1, 1995

Ms. Lisa Young
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Upper East Maricopa Floodway Floodplain Delineation Study
FCD No. 94-26
Revised Hydrology Report Submittal and Review Comment Response

Dear Lisa:

We herewith transmit one revised copy of the Hydrology Report for the referenced project, addressing the FCDMC and City of Mesa review comments.

Regarding FCD and Mesa's comment, requesting modeling of the orange grove, north of McKellips, A-N West has modeled this as Subarea I.D. 86. We have also modeled the retention along the RWCD Canal and initial flow conveyed into the canal by existing culverts with split flow and retention volume calculations included in Appendix A and B and report discussion under Sections 4.3, 4.8, 4.9 and 5.4. Per this analysis, no flow was computed to cross McKellips Road into the system. The significant retention along the canal easily stores this flow and bleeds it into the canal.

To analyze, the impact of a storm occurring after the orange groves were irrigated, the IA values were reduced from 0.5 to 0 inches. No increase in storm peak discharges were noted for this analysis as discussed in Report Section 5.4.

Per FCD comment, the percent impervious was reduced to zero on Subbasin SB98 but left, as is, at Subbasin SB16 and SB92. The impervious area percent was considered reasonable for SB16 and SB92 which do have approximately this percent of curb and guttered streets which were considered to warrant the values used.

The City of Mesa's review comment No. 1 and 3 requested information on the East Maricopa Floodway's level of protection and capacity of the box culvert under Brown Road. We propose to attempt to address these comments when digitized cross-sections are obtained and the hydraulic analysis is initiated. Downstream of the Brown Road box culvert, we propose to initiate the HEC-2 model 100-year floodplain analysis at Section 21.307 (450 feet downstream of culverts) by the slope area method and the 100-year design discharge of 1200 cfs as indicated in the EMF design consultants notes on Appendix D Page D-1. It should be noted that A-N West's Scope of Work study limits are Brown Road and hence we cannot evaluate the EMF's hydrology downstream of Brown Road. We further propose to evaluate the Brown Road culverts for A-N West's computed 100-year discharge of 603 cfs upstream to the Princess Road Basin storm drain outlet.

7600 North 15th Street, Suite 200 • Phoenix, Arizona 85020-4331 • Fax (602) 943-1989 • (602) 861-2200

If the box culverts under Brown Road and the channel, between Brown Road and the Princess Basin storm drain outlet, still have capacity below top of channel bank, A-N West, will as a separate analysis, evaluate the additional discharge capacity to address the City of Mesa's comment No. 3.

Should you have questions or need additional information, please call.

Sincerely,

A-N WEST, INC.

Greg Schuelke

Greg Schuelke, R.L.S., P.E.
Vice President
Project Manager

GAS/sl

cc: Mr. Peter Knudson, City of Mesa

grgltr12.gen

TECHNICAL DATA NOTEBOOK
UPPER EAST MARICOPA FLOODWAY FIS
SECTION 4.2 FIELD RECONNAISSANCE AND HYDRAULIC PARAMETER ESTIMATION
FCD NO. 94-26

SEPTEMBER, 1995

PREPARED FOR:
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 WEST DURANGO STREET
PHOENIX ARIZONA 85009

AND

CITY OF MESA
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55 NORTH CENTER STREET
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Registered Professional Engineer (Civil)
CERTIFICATE NO.
15290
GREGORY A.
SCHUELKE
Date Signed 9/1/95
ARIZONA, U.S.A.

A-N WEST NO. 7158-03

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APPENDIX A

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ARIZONA, U.S.A.

G. Schuelke

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4.2 FIELD RECONNAISSANCE & HYDRAULIC PARAMETER ESTIMATION

4.2.1 Manning's 'n' Values

4.2.1.1 Introduction. On August 16, 1995, A-N West, Inc. made a reconnaissance field trip to the Upper East Maricopa Floodway (UEMF) to photograph and evaluate Manning's 'n' values. The study reach proceeded from the McKellips Road and Greenfield Road intersection, west to the Roosevelt Water Conservation District (RWCD) Irrigation Canal, and then south along the RWCD Canal to Brown Road, a distance of approximately 1.3 miles. The UEMF study reach area is shown on Figures 1, 2, and 3. Figure 1 shows the extent of the study in reference to the surrounding area. Figure 2 shows the location of photograph I.D. numbers and their directions. Figure 3 shows the aerial photo of the respective UEMF study reach from the detailed mapping and photography flown on 7/7/95.

4.2.1.2 Methodology. Manning's 'n' values were estimated using two references. The first document, "Estimated Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona", was prepared by U.S. Geological Survey (USGS) Water Resources Division by B.W. Thompson and H.W. Hyalmarsen for the Flood Control District of Maricopa County, dated, April, 1991 (Reference 1). The other reference used was "Open Channel Hydraulics" which was written by Ven Te Chow, Ph.D.; published by McGraw Hill Book Company in 1959 (Reference 2).

Field visit observations of vegetation, and channel and overbank 'n' value characteristics were noted and representative photographs were taken. The photos are included in this report and are referenced with orientation of photo, estimated 'n' values and location by geographical proximity to landmarks such as streets, RWCD Canal, or Princess Park Retention Basin. Aerial photo contact prints were also used to evaluate changes in channel widths, vegetation types and densities and to determine appropriate reach limits of similar 'n' values. These aerial photo contact prints are included in the following report, as Figure 3.

Using the USGS document, "Open Channel Hydraulics," field photos, site observations, and aerial photos, Manning's 'n' values were estimated at several key locations of the floodplain just east of the RWCD Canal. In some cases, a typical cross section will indicate overbanks with different 'n' values to account for different vegetation. Dr. Chow's text, "Open Channel

Hydraulics", was used for special topography like the citrus grove and swamp grass because the USGS document did not cover this vegetation adequately.

It is anticipated that the NC record option of the HEC-2 model will be used to subdivide the distinct 'n' value sub-elements which were noted in the channel and overbank areas.

4.2.2 Expansion and Contraction Coefficients:

Expansion and contraction of flows due to changes in channel cross section were estimated to be relatively gradual and small for the majority of the study reach. Much of the lower half of the study is uniform excavated channels, streets or graded basin. Therefore, expansion and contraction coefficients of 0.3 and 0.1, respectively, are proposed based on the HEC-2 model user manual's discussion of these parameters.

4.2.3 Hydraulic Jump/Drop Analysis:

A hydraulic jump is expected to occur at the Princess Basin inlet spillway for initial flows into the basin. As the basin fills, the hydraulic jump will be drowned out. The peak discharge into the Princess Basin is anticipated to coincide with a less than full basin. The HEC-2 analysis is anticipated to assume a peak discharge into the basin without backwater from the basin. The HEC-1 hydrologic analysis will determine peak ponding in the basin, and backwater from the basin will be superimposed on the hydrologic analysis profile to show the backwater affect. The HEC-2 model is proposed to be used to analyze the hydraulics through this basin inlet spillway. The sub-critical flow regime of the HEC-2 model is expected to be utilized for the full length of UEMF Study. If overflow from the Princess Basin's emergency overflow outlet spillway into the Upper East Mesa Floodway occurs, a short reach of supercritical flow may occur in this reach.

This short reach of supercritical flow is not expected to adversely affect the hydraulic results upstream or downstream of the basins emergency overflow outlet spillway.

4.2.4 Inventory of Road Crossings & Drainage Structures:

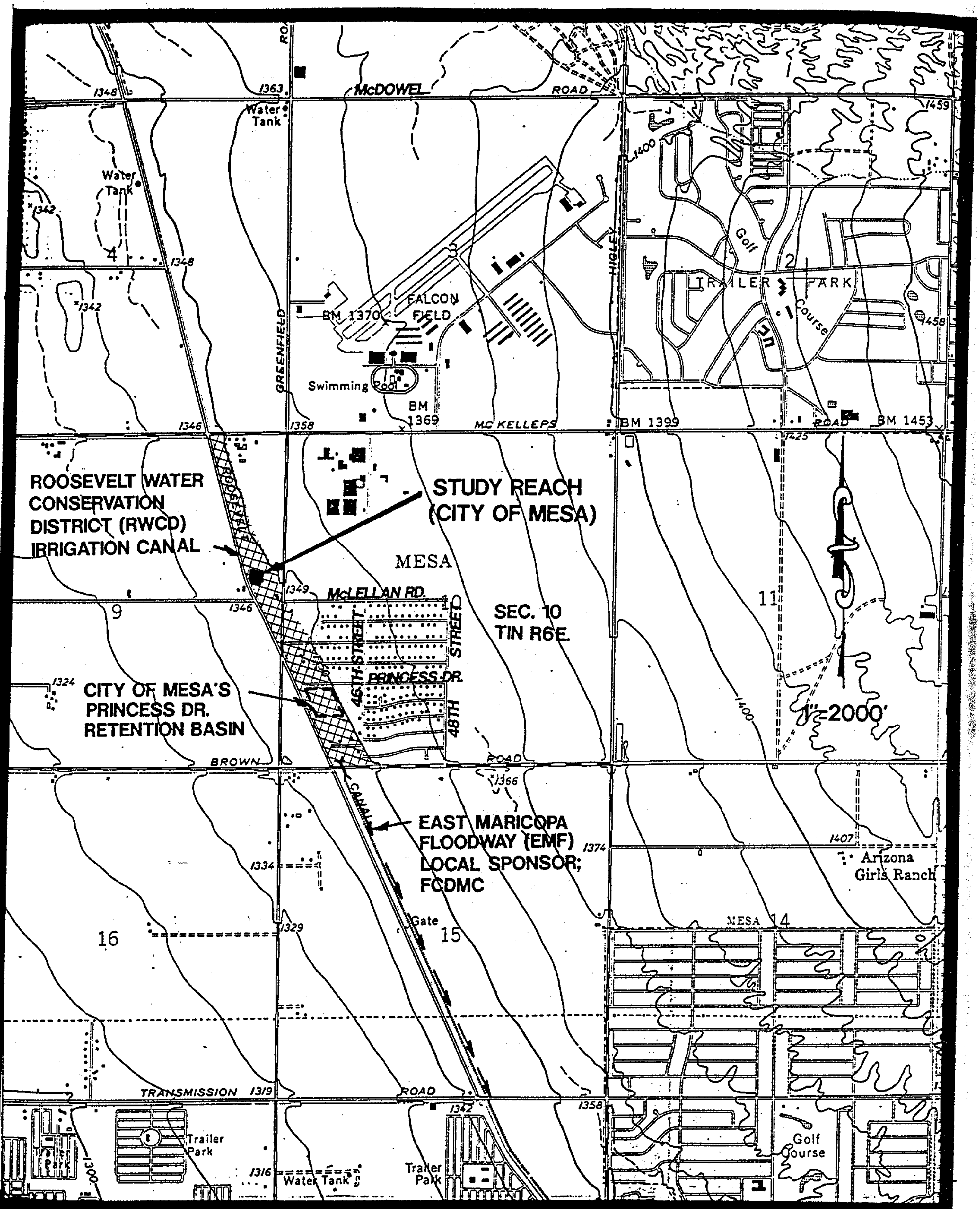
The following Table 1 shows an inventory of road crossings, drainage structures and sizes along the UEMF study limits.

TABLE 1
Road Crossing & Drainage Structure Summary

Location	Description	Type	Drainage Structure Size
McKellips Road	Major Street *1	Asphalt Pavement	None
Greenfield Road	Major Street *2	Asphalt Pavement	None
Brown Road	Major Street	Asphalt Pavement	Double Barrel 8' x 8' x 139'

*Note 1 - A 36" diameter 72' long pipe which conveys storm runoff from the north side of McKellips Road, brings the water to a junction structure where water is then conveyed to the RWCD Canal in a 24" diameter and 51' long pipe.

*Note 2 - An 84" storm drain, with catch basins that intercept minor flows, is located under and parallel to Greenfield Road and conveys stormwater to the EMF Channel, downstream of the Princess Drive Basin.



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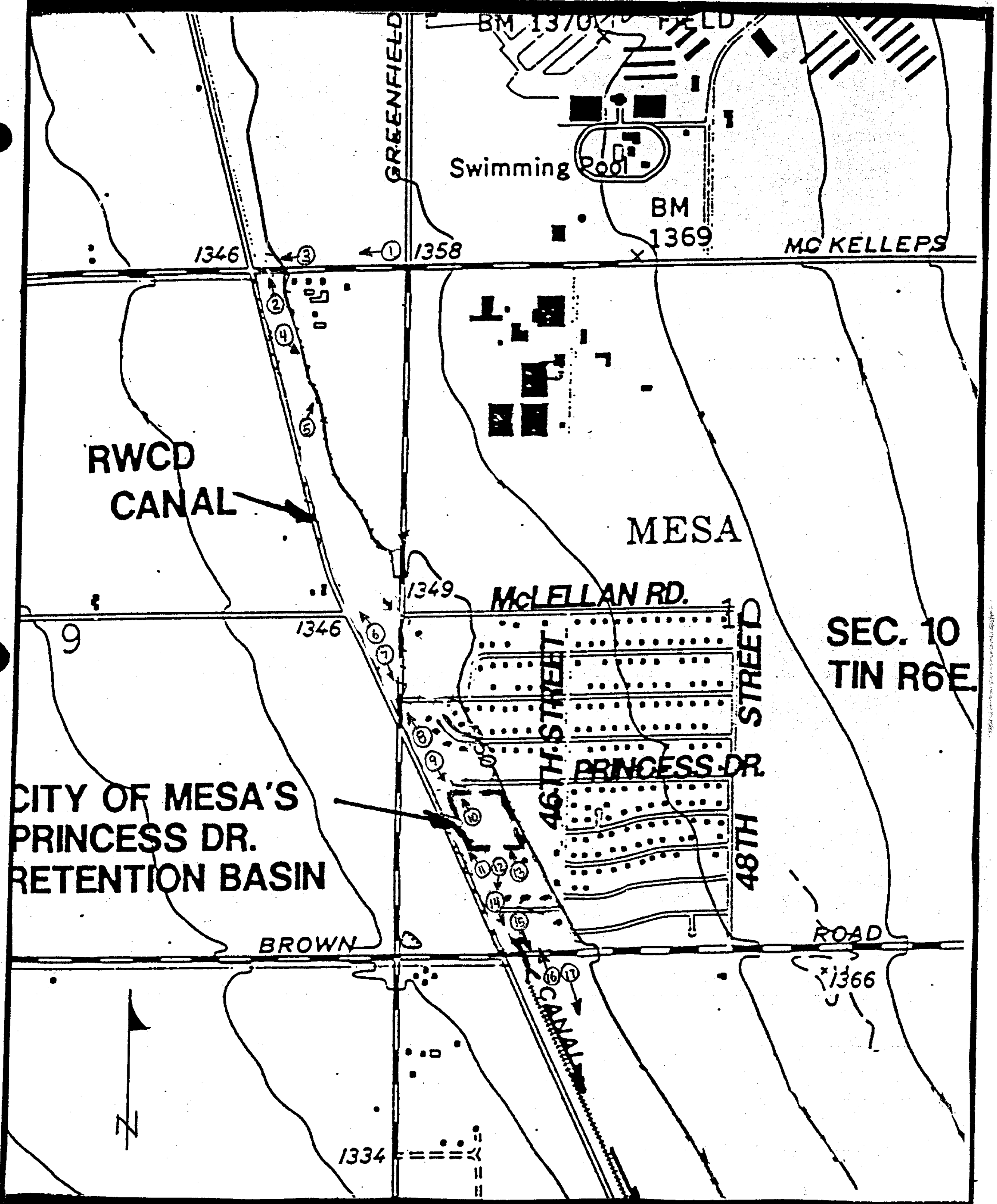
EXPLANATION

– FLOOD PLAIN DELINEATION STUDY LIMITS

LOCATION MAP
UEMF
FLOODWAY FIS

FIGURE 1



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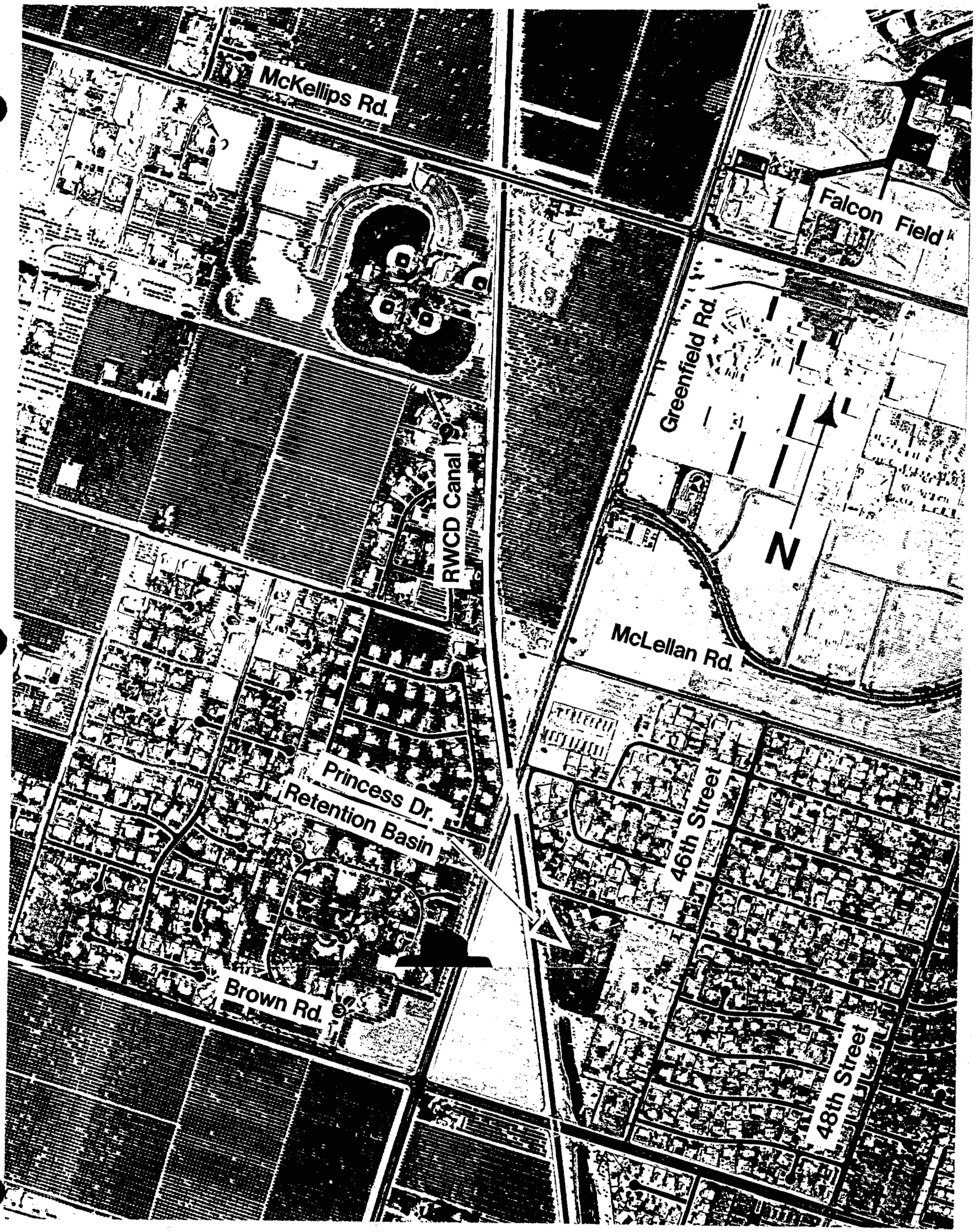
Legend:
- Photo I.D. No. & Direction

LOCATION MAP
UEMF
FLOODWAY FIS

FIGURE 2



UEMF FLOODWAY FIS AERIAL PHOTO FIGURE 3

FCDMC No. 94-26 AN-WEST No. 7158-03

No. 7

Looking South Along RWCD Canal, at East Side, at Greenfield Road Intersection.

No. 8

Looking North Along RWCD Canal, at East Side, at Greenfield Road Intersection.

Channel = From Top of Bank of Canal to East 30'± Width
Channel N = 0.060
Overbank N = 0.040

No. 9

Looking South at Princess Drive Park and Basin, North Edge Along RWCD Canal (East Side) Between Greenfield & Brown Road.

Channel = Street
Street N = 0.015
Overbank N = 0.035

No. 10

Looking North at Princess Drive Park and Basin, North Edge Along RWCD Canal, East Side, Between Greenfield & Brown Road.

Channel = Concrete
Concrete N = .015
Grass N = 0.028
Rock N = 0.035

No. 11

Looking Northwest at Outlet Structure of 84" Storm Drain Into Channel South of Princess Park Detention Basin Along RWCD Canal, East Side, Between Greenfield & Brown Road.

Grass/Gravel N = 0.028
(Top and Groomed Sideslopes)

No. 12

Looking South at Channel South of Princess Park Detention Basin Along RWCD Canal, East Side, Between Greenfield & Brown Road (Brown Road Culverts in Background).

Channel N = ~~0.060~~ 0.050(1)
Channel = Top Bank to Top Bank

No. 13

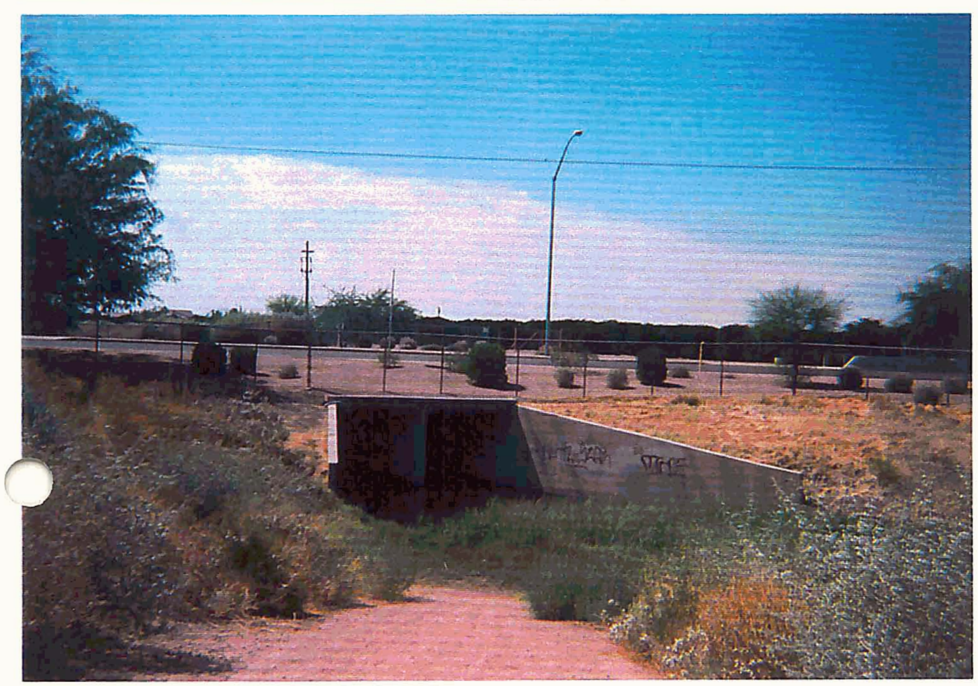
Looking North From South Edge of Princess Park Detention Basin Along RWCD Canal East Side Between Greenfield & Brown Road.

Grass/Gravel N = 0.028

No. 14

Looking South at Channel from North of Brown Road on East Side of RWCD Canal.

Channel N = ~~0.060~~ 0.05(1)
Channel = Top Bank to Top Bank

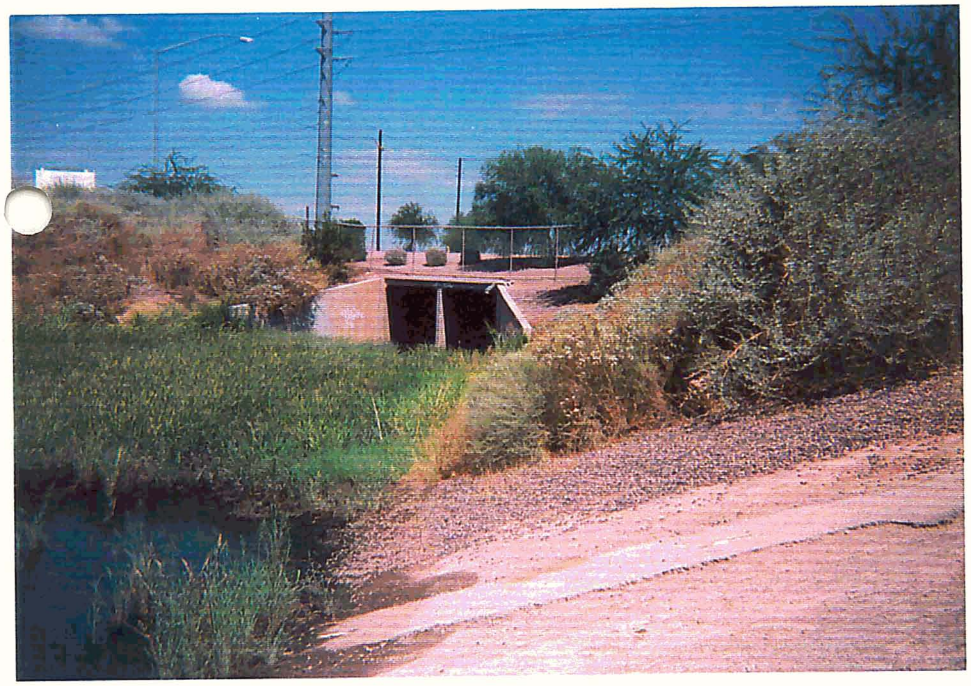


No. 15

Looking South at Brown Road Culvert Crossing of Channel. 2-Barrel 8'x8'x138' Long. Rounded Soffit and Pier.

Culvert N = 0.013
Channel N = ~~0.06~~ 0.05(1)

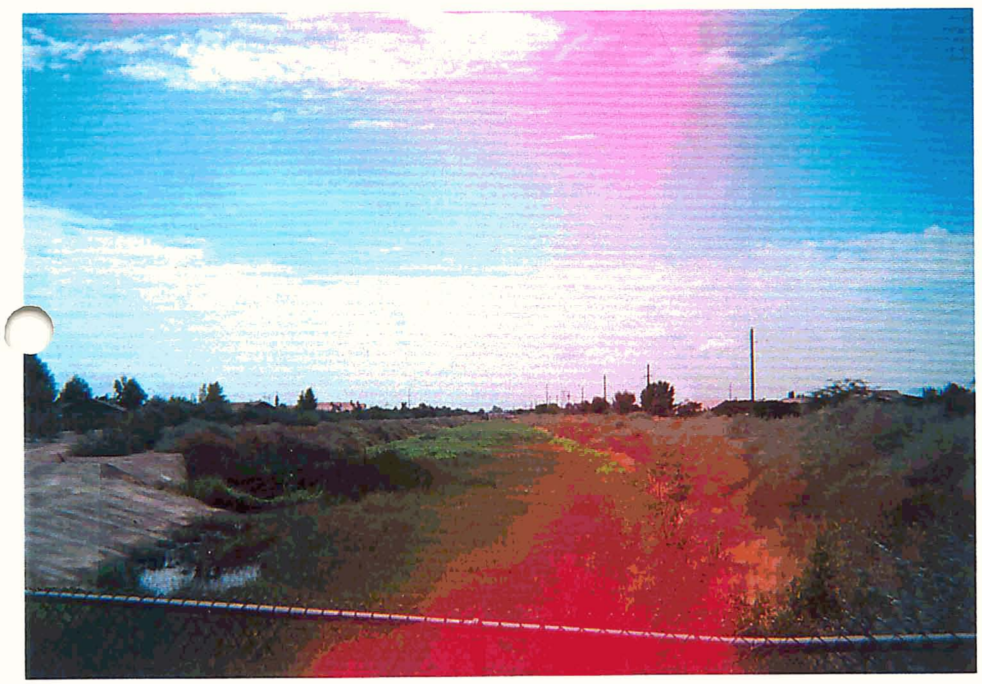
Note 1:(N) VALUES REVISED PER SPECIAL PROBLEM REPORT NO.1 (date:11/22/95)



No. 16

Looking North at Brown Road Culvert and East of RWCD Canal.

Channel N = ~~0.060~~ 0.050(1)
Culvert N = 0.013



No. 17

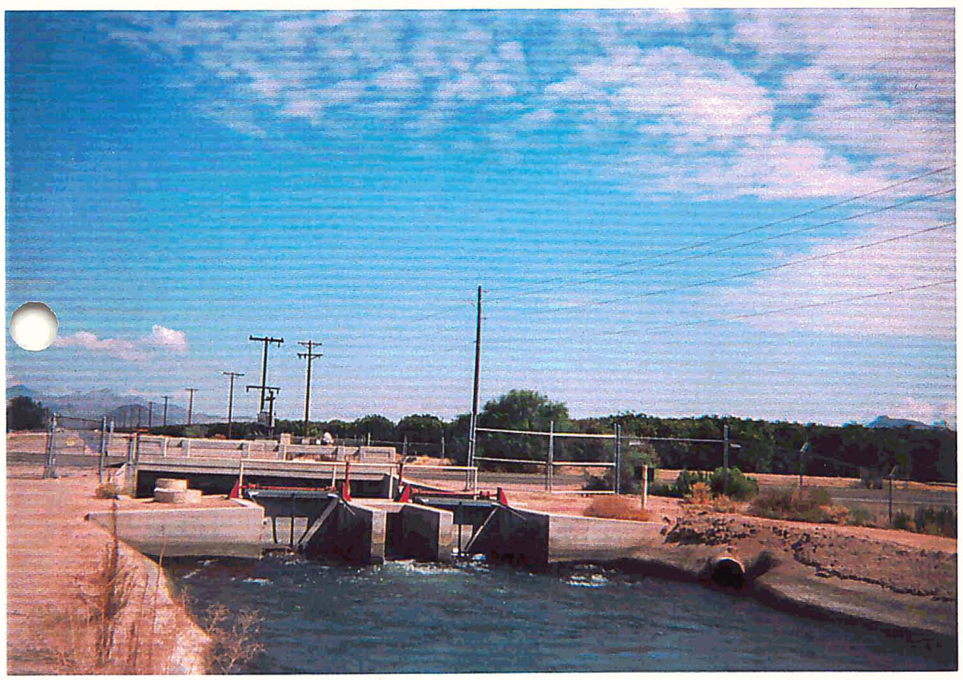
Looking South From Brown Road at Channel East of RWCD Canal.

Channel = Top Bank to Top Bank
Channel N = ~~0.060~~ 0.050(1)

No. 1

Looking West at Northwest Corner of McKellips Road & Greenfield Road Intersection.

Pavement N = 0.015
Orange Grove and Buildings/Storage Site N = 0.060



No. 2

Looking North Along RWCD Canal at McKellips Road, South Side of Street and Outlet of 24" Pipe Under McKellips Road.

No. 3

Looking Southwest at Inlet of 36" Concrete Pipe Draining Into RWCD Canal at McKellips Road on North Side of Road.

No. 4

Looking South Along RWCD Canal, at East side between McKellips Road & McLellan Road at North Edge of Orange Grove and South Edge of Storage Yard for Old Cars, RV's, etc.

Orange Grove and Storage Yard N = 0.060
Channel and Overbank

No. 5

Looking North Along RWCD Canal, at East Side Between McKellips Road & McLellan Road at South Edge of Orange.

Orange Grove N = 0.060
Channel and Overbank

No. 6

Looking North Along East Side of RWCD Canal Between McLellan & Greenfield Roads.

Channel = From Top of Bank of Canal to East 30'± Width
Channel N = 0.06
E. Overbank N = 0.04

No. 10

Looking North at Princess Drive Park and Basin, North Edge Along RWCD Canal, East Side, Between Greenfield & Brown Road.

Channel = Concrete
Concrete N = .015
Grass N = 0.028
Rock N = 0.035

No. 11

Looking Northwest at Outlet Structure of 84" Storm Drain Into Channel South of Princess Park Detention Basin Along RWCD Canal, East Side, Between Greenfield & Brown Road.

Grass/Gravel N = 0.028
(Top and Groomed Sideslopes)

No. 12

Looking South at Channel South of Princess Park Detention Basin Along RWCD Canal, East Side, Between Greenfield & Brown Road (Brown Road Culverts in Background).

Channel N = ~~0.060~~ 0.050(1)
Channel = Top Bank to Top Bank

UEMF STUDY

Location of Cross Section: Orange grove east of RWCD Canal, between McKellips & Greenfield Roads.

Description of Area: Tilled broken soil, orange trees aligned in rows with low lying branches similar to Chow's Handbook (Reference 2) picture designation number 20 (see Appendix) and in Table 5-6 for trees in cleared land with tree stumps and heavy growth of sprouts (see Appendix) in floodplain setting.

Subdivision of Cross Section and Evaluation of 'n': Cross section was subdivided by Perimeter Method.

Components & Weighted & Composite Values of Manning's 'n'

100-Year Flood Portion of area of Wetted Perimeters		Components	Weighted Composite Values
Subsection A - 1.00 (by Perimeter)	Channel	$n_b = 0.024$ $n_1 = 0.008$ $n_2 = 0.008$ $n_3 = 0.020$ $n = 0.060$	0.060

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UEMF STUDY

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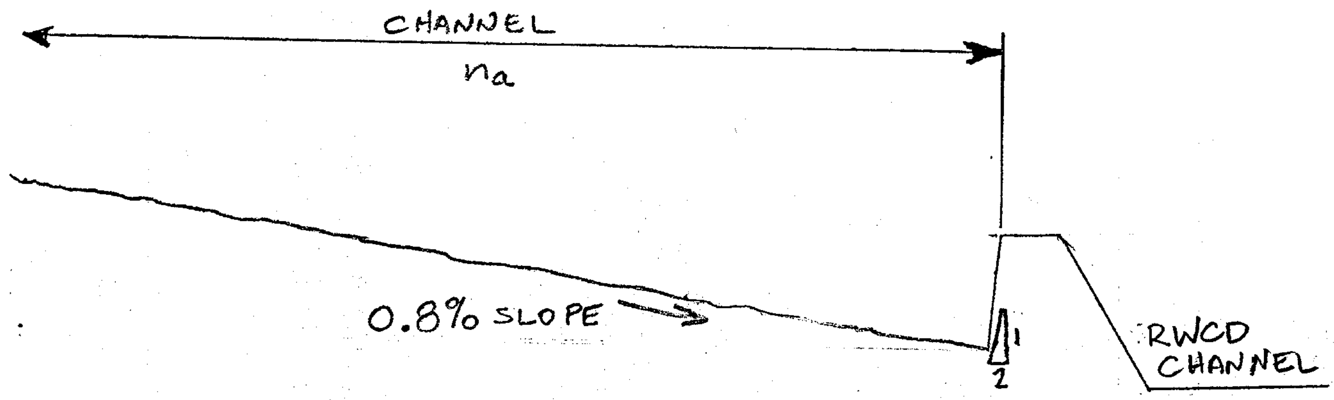
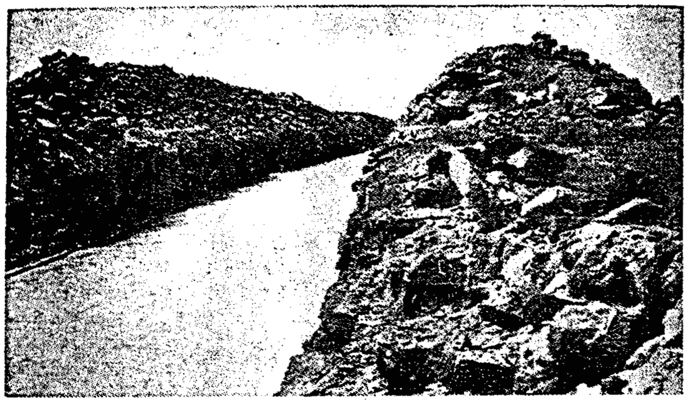
Calc. By ___ Date 8/28/95
Chkd. GAS Date 9/1/95

TYPICAL SECTION:

ORANGE GROVE EAST OF RWCD CANAL, BETWEEN McKELLIPS AND GREENFIELD ROADS LOOKING DOWNSTREAM



SCALE: H: 1" = 100'
V: 1" = 5'

(19)


Simllior to
Orange Groove
(20)


(21)


FIG. 5-5 (19–21)

19. $n = 0.050$. Dredge channel with very irregular side slopes and bottom, in dark-colored waxy clay, with growth of weeds and grass. Slight variation in shape of cross section for variation in size.

20. $n = 0.060$. Ditch in heavy silty clay; irregular side slopes and bottom; practically entire section filled with large-size growth of trees, principally willows and cottonwoods. Quite uniform cross section.

21. $n = 0.080$. Dredge channel in black slippery clay and gray silty clay loam, irregular wide slopes and bottom, covered with dense growth of bushy willows, some in bottom; remainder of both slopes covered with weeds and a scattering growth of willows and poplars, no foliage; some silting on bottom.

Reference 2 : Chows Open Channel Hydraulics

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT *n* (*continued*)

Type of channel and description	Minimum	Normal	Maximum
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
similior To orange Groove → 3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The *n* value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

Reference 2: Chow's Open Channel Hydraulics

UEMF STUDY

Location of Cross Section: Field east of RWCD Canal, south of orange grove between McLellan and Greenfield Roads.

Description of Area: Bare ground, scattered debris, grass and shrubs in field. Within 30' of RWCD Canal banks are more trees and shrubs.

Subdivision of Cross Section and Evaluation of 'n': Cross section was subdivided by Perimeter Method.

Components & Weighted & Composite Values of Manning's 'n'

100-Year Flood Portion of area of Wetted Perimeters	Components	Weighted Composite Values
Subsection A - Channel	$n_b = 0.024$	
1.00 (by Perimeter)	$n_1 = 0.008$	
	$n_2 = 0.008$	
	$n_3 = 0.020$	
	$n = 0.060$	0.060
Subsection B - Overbank	$n_b = 0.024$	
1.00 (by Perimeter)	$n_1 = 0$	
	$n_2 = 0$	
	$n_3 = 0.016$	
	$n = 0.040$	0.040

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UEMF STUDY

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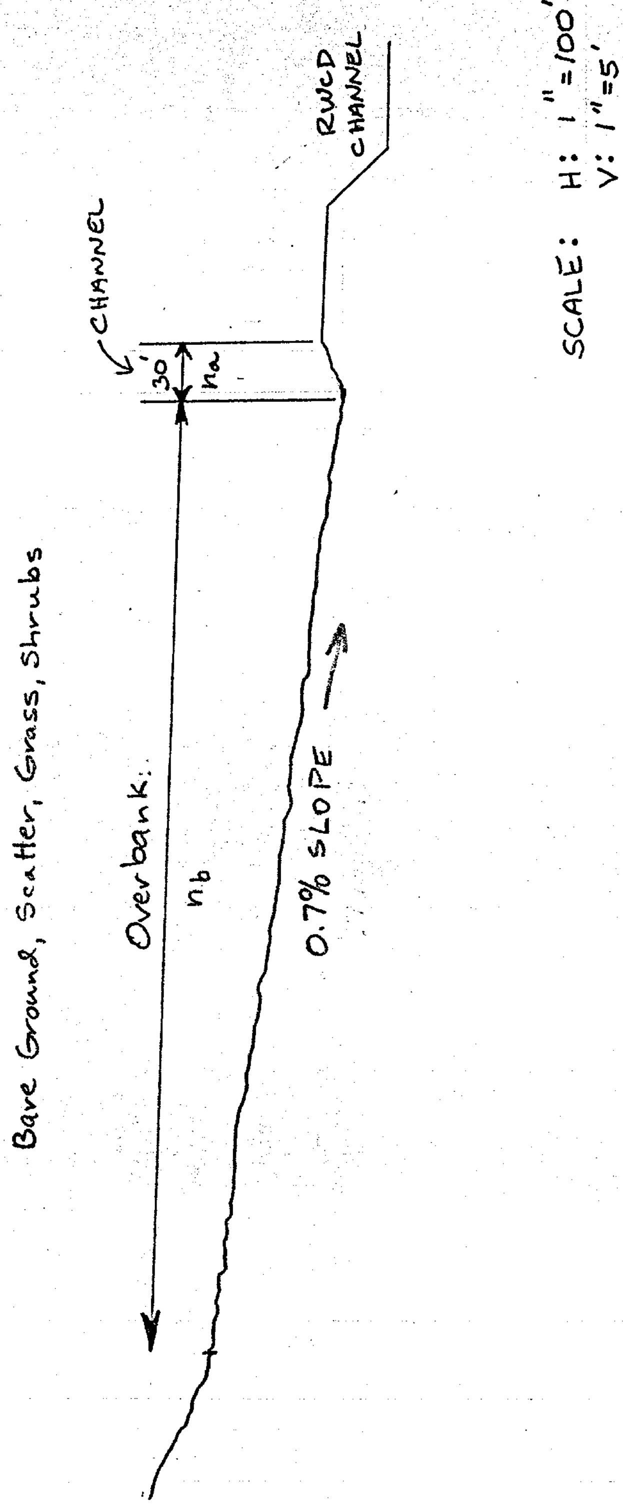
Chkd. GAS | Date 9/1/95

TYPICAL SECTION:

FIELD EAST OF RWCD CANAL, SOUTH OF ORANGE GROVE BETWEEN McLELLAN & GREENFIELD ROADS LOOKING DOWNSTREAM



UEMF STUDY

Location of Cross Section: Road along RWCD Canal east side between Greenfield Road and Princess Park Detention Basin.

Description of Area: Channel area is roadway asphalt. Overbanks have assorted short grasses, sparse trees, shrubs and desert landscaping.

Subdivision of Cross Section and Evaluation of 'n': Cross section was subdivided by Perimeter Method.

Components & Weighted & Composite Values of Manning's 'n'

100-Year Flood Portion of area of Wetted Perimeters	Components	Weighted Composite Values
Subsection A - [illegible] Channel 1.00 (by Perimeter)	$n = 0.015$	0.015
Subsection B - Overbank 1.00 (by Perimeter)	$n_b = 0.024$ $n_1 = 0$ $n_2 = 0.004$ $n_3 = 0.007$ $n = 0.035$	0.035

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UEMF STUDY

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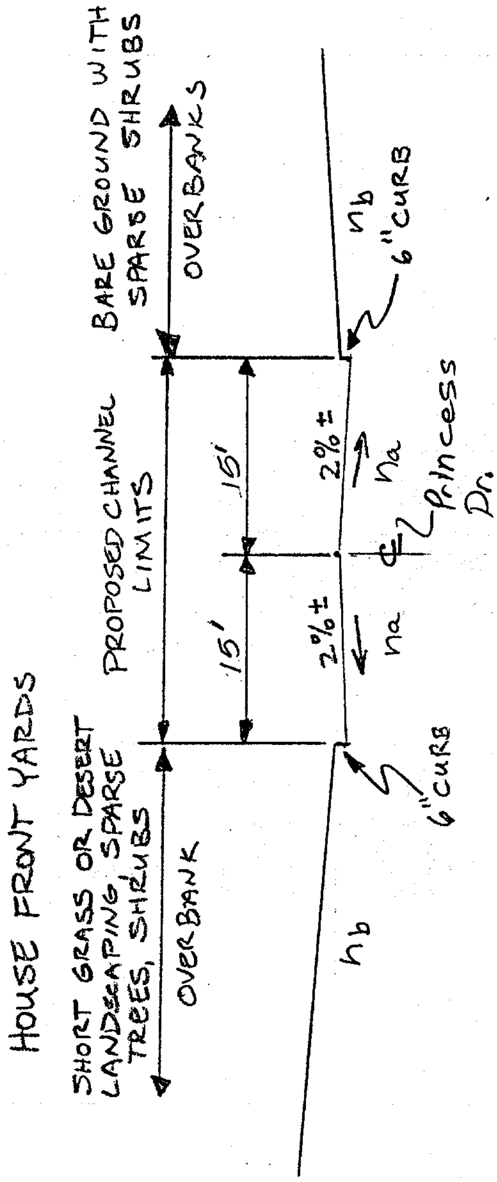
TYPICAL SECTION:

Princess Dr. ALONG RWCD CANAL, EAST SIDE, BETWEEN GREENFIELD ROAD AND PRINCESS PARK DETENTION BASIN



SCALE: H: 1" = 20'
V: 1" = 10'

UEMF STUDY

Location of Cross Section: Princess Park Retention Basin on RWCD Canal east side between Greenfield & Brown Roads.

Description of Area: The spillway area is lined on the bottom with concrete. The spillway sides are lined with maintained short grass. The entire basin area is lined with maintained short grass with sparse trees.

Subdivision of Cross Section and Evaluation of 'n': Cross section was subdivided by Perimeter Method.

Components & Weighted & Composite Values of Manning's 'n'

100-Year Flood Portion of area of Wetted Perimeters	Components	Weighted Composite Values
Subsection A - Channel 1.00 (by Perimeter)	$n = 0.016$	0.016
Subsection B Channel Bank and Basin	$n_b = 0.024$ $n_1 = 0$ $n_2 = 0$ $n_3 = 0.006$ $n = 0.030$	0.030

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UEMF STUDY

Project 7158-03 Sht. ___ of ___
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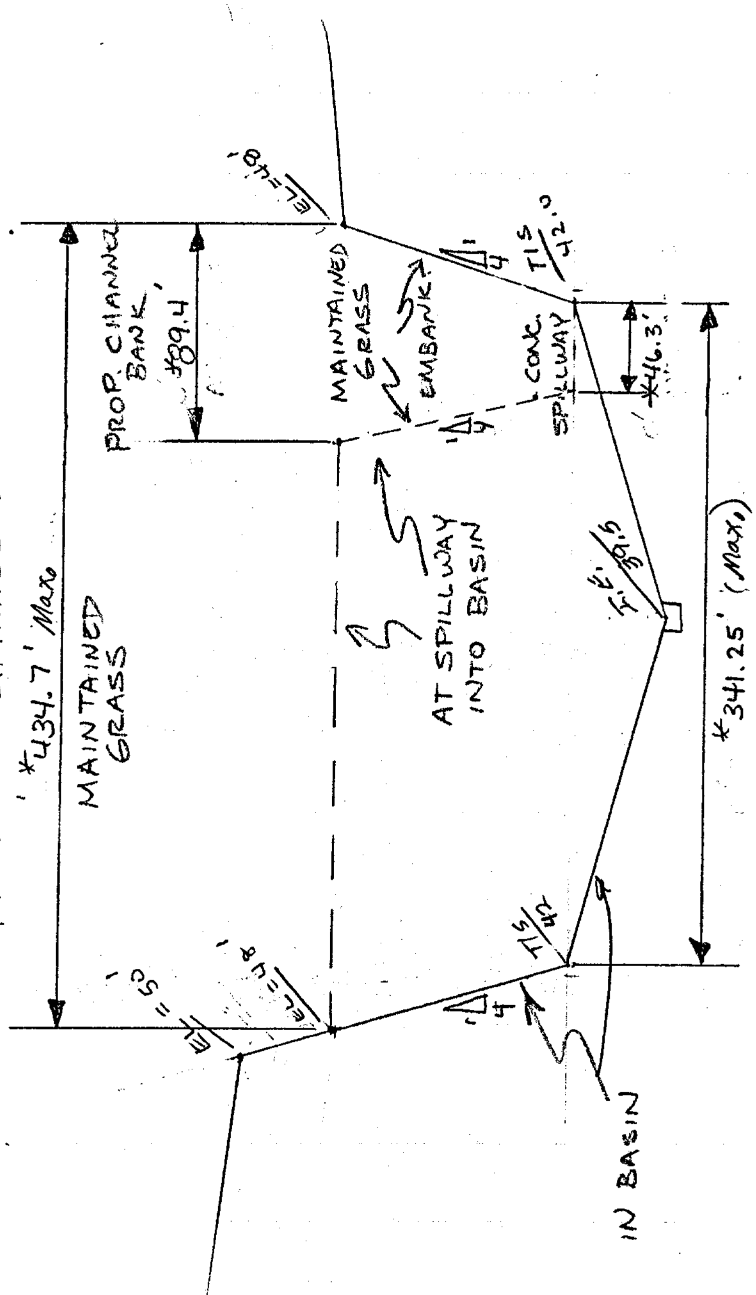
Chkd. GAS Date 9/1/95

TYPICAL SECTION:

THE PRINCESS PARK RETENTION BASIN ON RWCD CANAL EAST SIDE BETWEEN GREENFIELD & BROWN ROADS.



SCALE: H: 1" = 100'
V: 1" = 5'

*DIMENSION NOTE: THE RETENTION BASIN VARIES IN SIZE.

UEMF STUDY

Location of Cross Section: Storm drain channel between Princess Park Drainage Basin outlet and Brown Road just east of RWCD Canal.

Description of Area: Earthen channel bottom and sides, marsh grass growth along channel bottom, grass and shrubs along banks of channel. An estimate of 'n' value was made using Chow's Manual (Reference 2) for 2' tall grass with high (B) vegetal retardance and velocity x hydraulic radius of 5.5 according to Table 7-4 and chart Figure 7-14b (Reference 2). The result is an estimated 'n' value of 0.060.

Subdivision of Cross Section and Evaluation of 'n': Cross section was subdivided by Perimeter Method.

Components & Weighted & Composite Values of Manning's 'n'

100-Year Flood Portion of area of Wetted Perimeters		Components	Weighted Composite Values
Subsection A - 1.00 (by Perimeter)	Channel	$n_b = 0.024$	
		$n_1 = 0$	
		$n_2 = 0$	
		$n_3 = 0.036$	
		$n = 0.060$	~~0.060~~ 0.050(1)

NOTE 1:

(N) VALUE REVISED PER SPECIAL PROBLEM REPORT NO.1 (date:11/22/95)

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UEMF STUDY

Project 7158-03 Sht. ___ of ___
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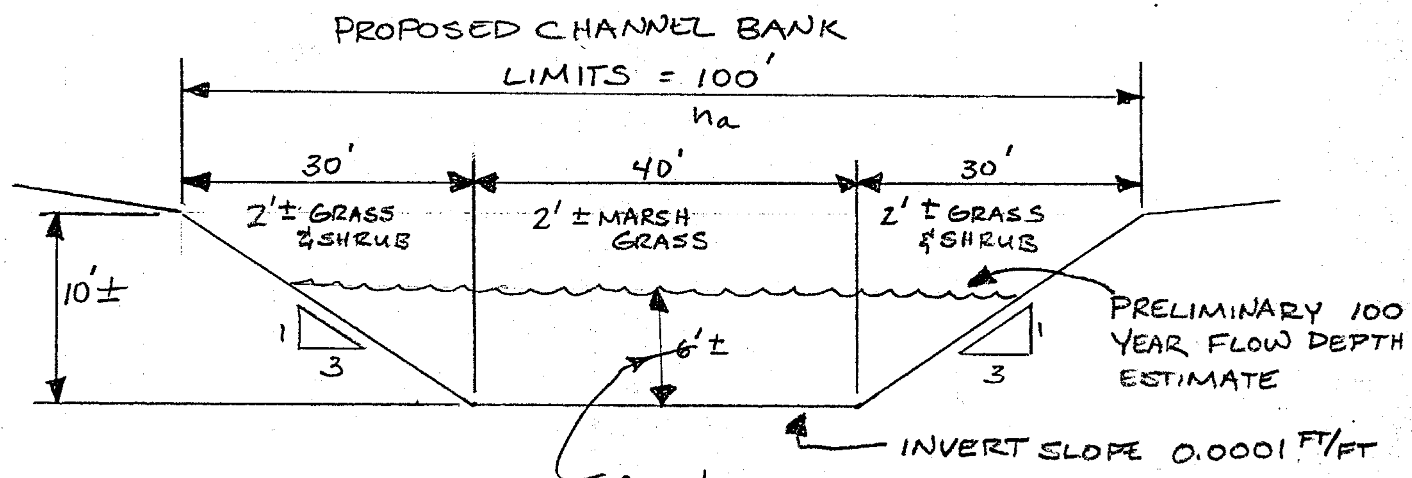
Chkd. GAS Date 9/1/95

TYPICAL SECTION:

UEMF CHANNEL BETWEEN PRINCESS
PARK DRAINAGE BASIN OUTLET AND BROWN ROAD
LOOKING DOWN STREAM



Q_{100} d = 9.55 ft for n = 0.050
at Sec. 21.481 by HEC-2 model/
Per special Prob. Report No. 1 (11/22/95)

SCALE: H: 1" = 20'
V: 1" = 10'

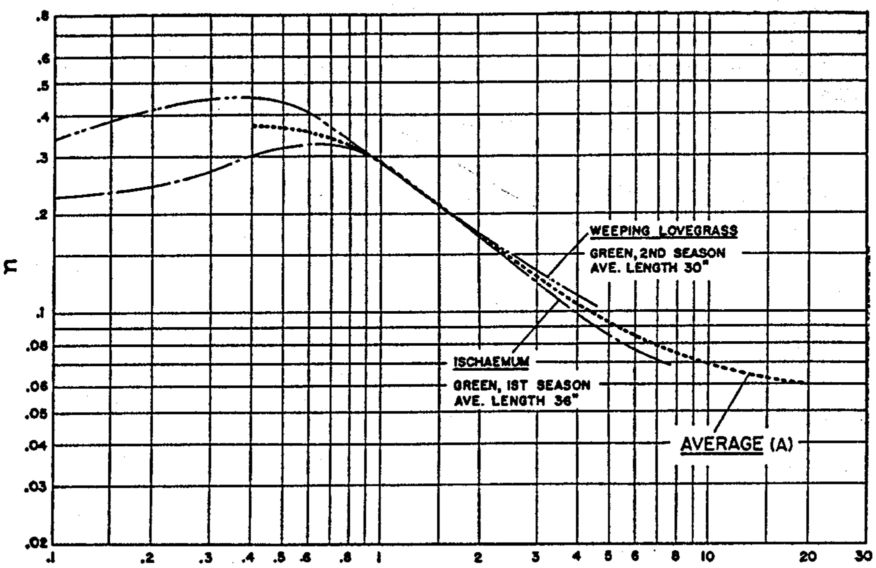
TABLE 7-4. CLASSIFICATION OF DEGREE OF RETARDANCE FOR VARIOUS KINDS OF GRASS*

Retardance	Cover	Condition
A Very high	Weeping love grass	Excellent stand, tall (av 30 in.)
	Yellow bluestem ischaemum	Excellent stand, tall (av 36 in.)
B High	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (av 12 in.)
	Native grass mixture (little bluestem, blue grama, and other long and short Midwest grasses)	Good stand, unmowed
	Weeping love grass	Good stand, tall (av 24 in.)
	Lespedeza sericea	Good stand, not woody, tall (av. 19 in.)
	Alfalfa	Good stand, uncut (av 11 in.)
	Weeping love grass	Good stand, mowed (av 13 in.)
	Kudzu	Dense growth, uncut
	Blue grama	Good stand, uncut (av 13 in.)
C Moderate	Crab grass	Fair stand, uncut (10 to 48 in.)
	Bermuda grass	Good stand, mowed (av 6 in.)
	Common lespedeza	Good stand, uncut (av 11 in.)
	Grass-legume mixture—summer (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (6 to 8 in.)
	Centipede grass	Very dense cover (av 6 in.)
	Kentucky bluegrass	Good stand, headed (6 to 12 in.)
D Low	Bermuda grass	Good stand, cut to 2.5 in. height
	Common lespedeza	Excellent stand, uncut (av 4.5 in.)
	Buffalo grass	Good stand, uncut (3 to 6 in.)
	Grass-legume mixture—fall, spring (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (4 to 5 in.)
	Lespedeza sericea	After cutting to 2 in. height, very good stand before cutting
E Very low	Bermuda grass	Good stand, cut to 1.5 in. height
	Bermuda grass	Burned stubble

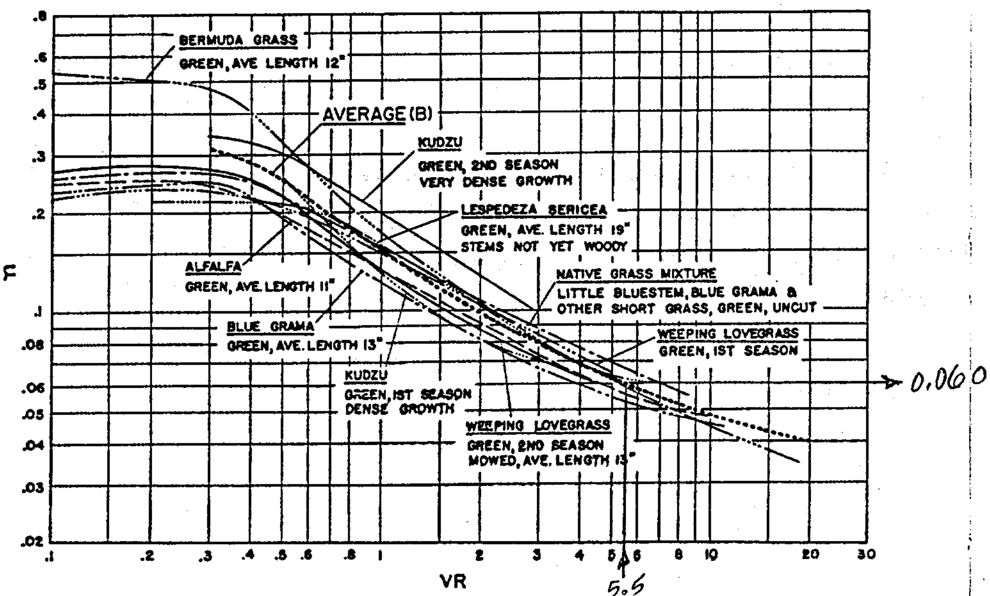
Estimated Channel Bed and Bank Grass and shrubs classification for UEMF channel between Brown Road and Princess Basin.

* U.S. Soil Conservation Service [41].

Reference 2: Chows, Open Channel Hydraulics



(*a*) Curves for A or very high vegetal retardance.



(*b*) Curves for B or high vegetal retardance.

Fig. 7-14. Experimental *n-VR* curves. (*U.S. Soil Conservation Service.*)

Reference 2 : Chows, Open Channel Hydraulics

Preliminary Estimate of Channel Velocity (V) ≈ ~~1.0~~ 1.01 (1) fps!
for s = 0.0001 '/FT, n = 0.06, R = ~~5.5~~ 8.6(1) ft
and Hydraulic Radius (R) ≈ 5.5 ft

From Average B curve above for VR = ~~5.5~~ 8.6 (1), n = ~~0.060~~ 0.050(1)

(1) Revised per A-N West Special Problem Report No. 1 (date: 11/22/95)

A-20

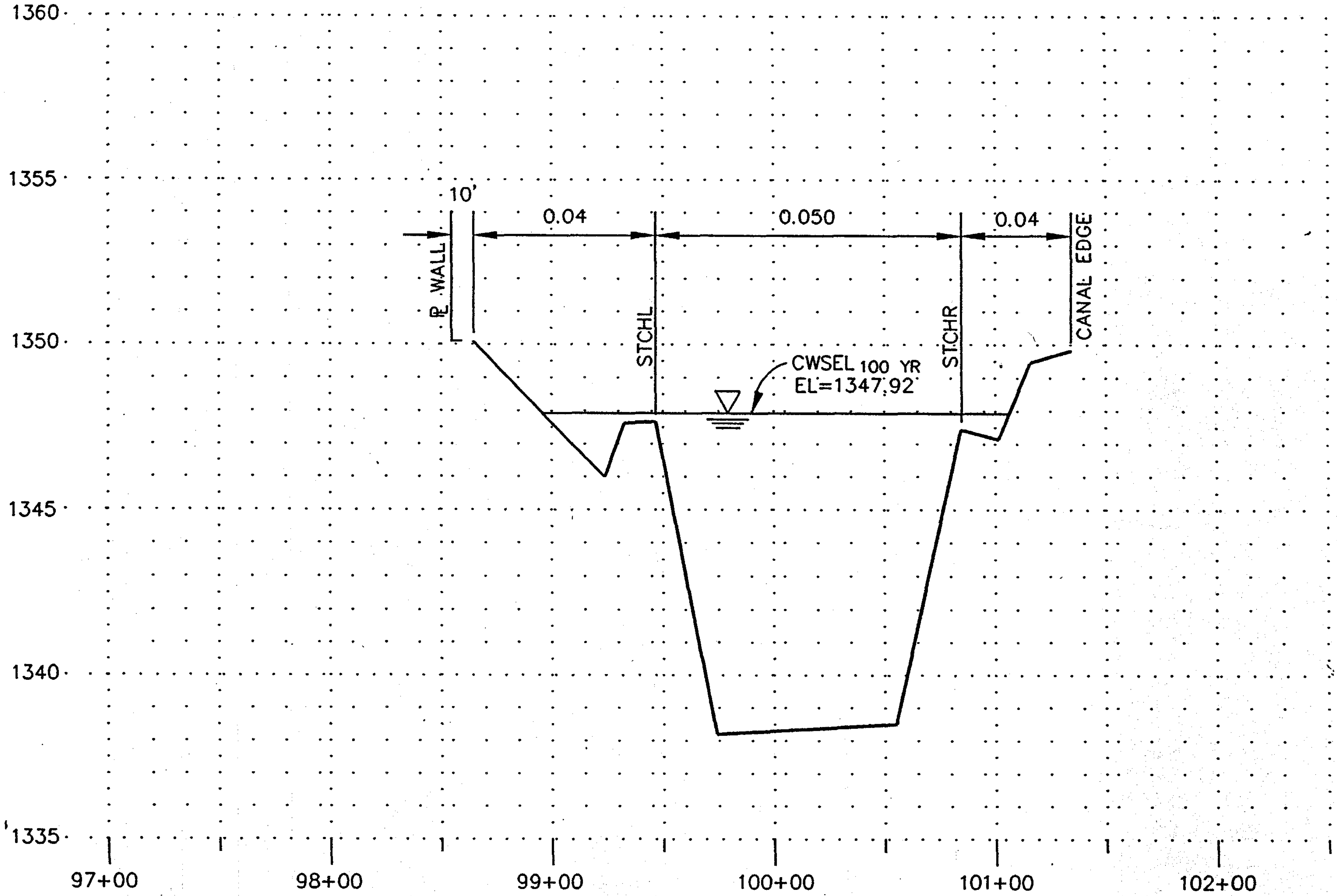
T.D.N.NO.4.3.1

CROSS-SECTION PLOTS
FCDMC NO.94-26

SUBMITTED:11/30/95

REVISED: 1/26/96

A-N WEST INC.
Consulting Engineers
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200



RM-21.213
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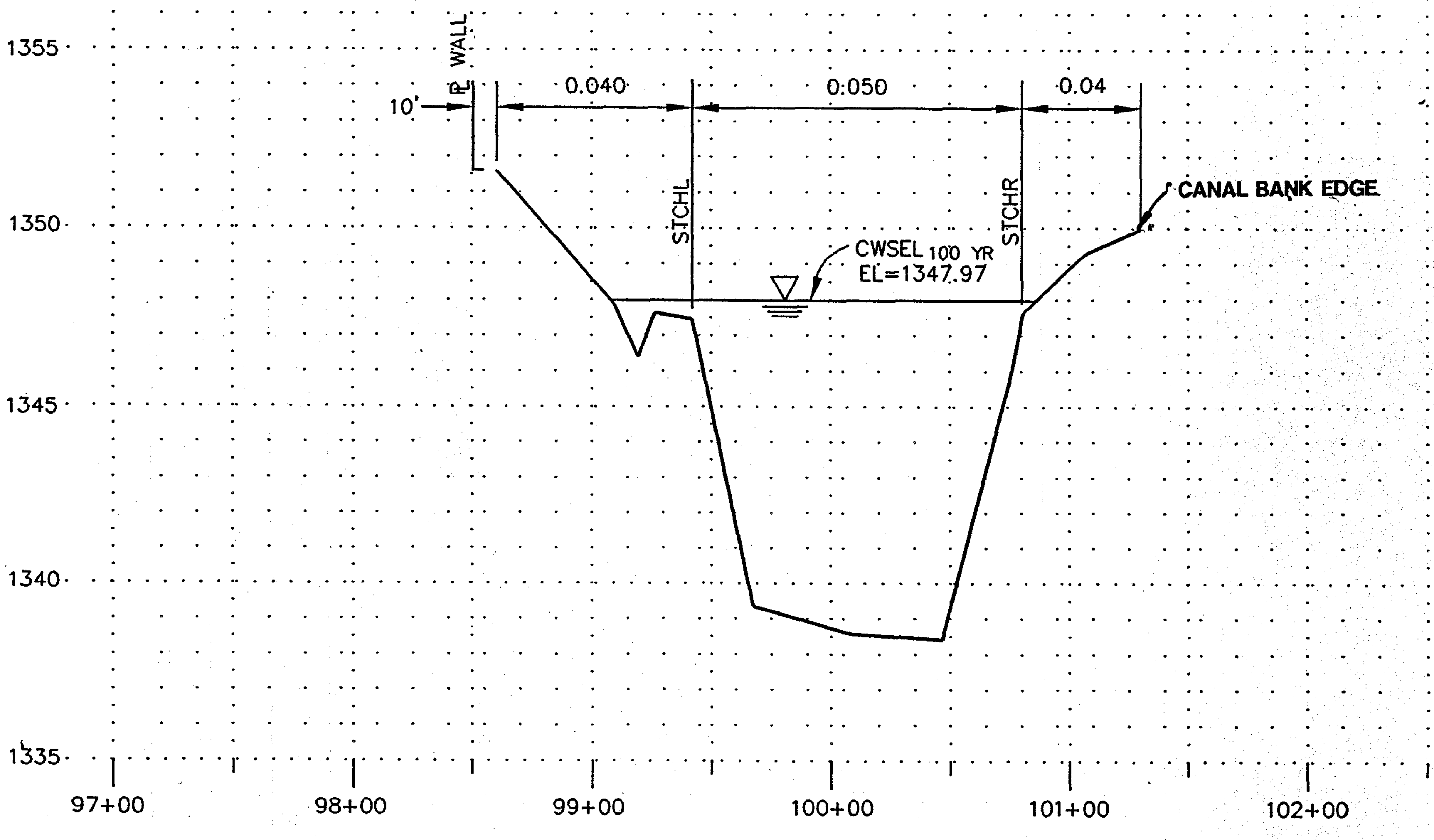

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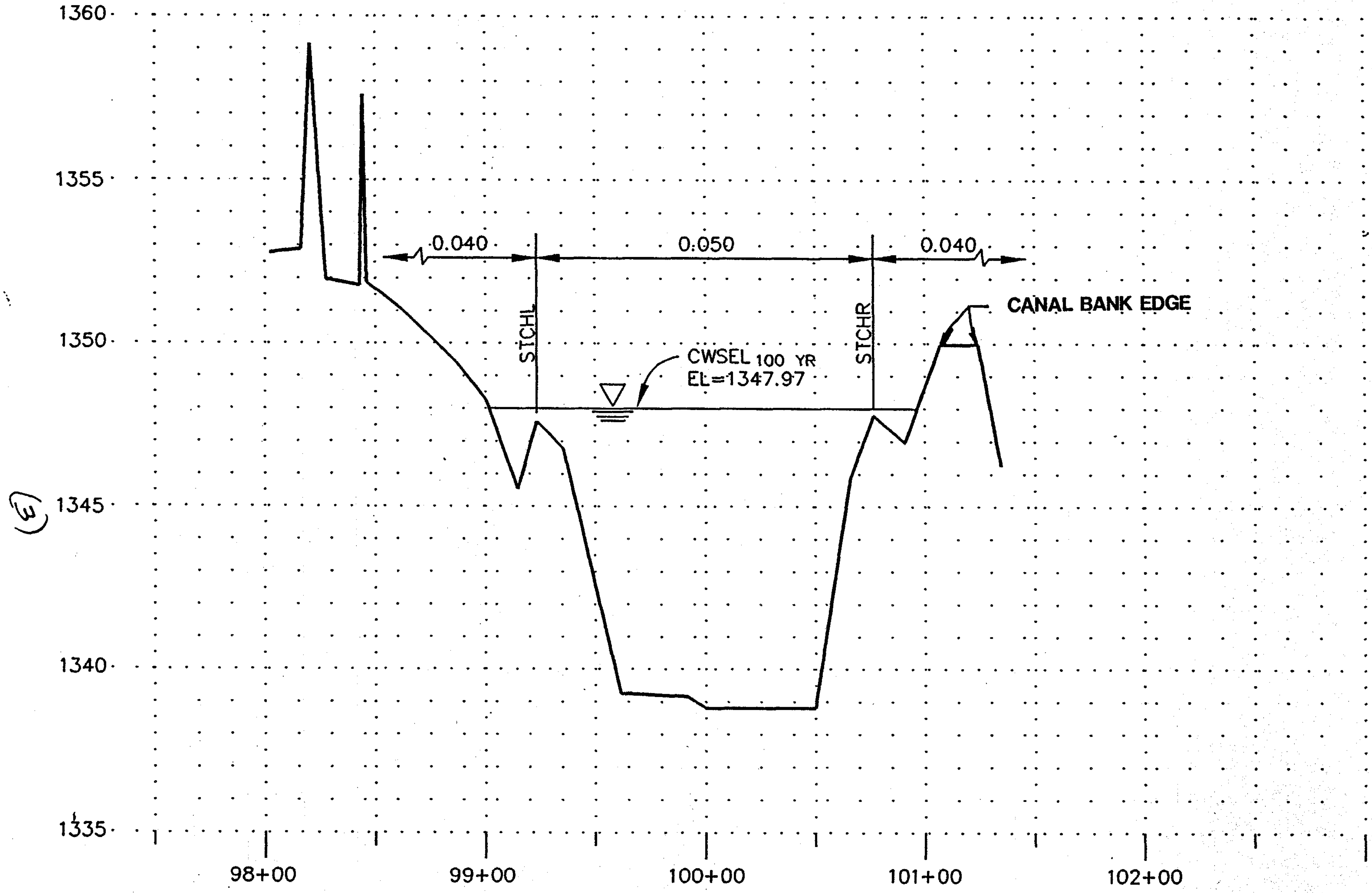

RM−21.307
(DIGITIZED − NOT USED)

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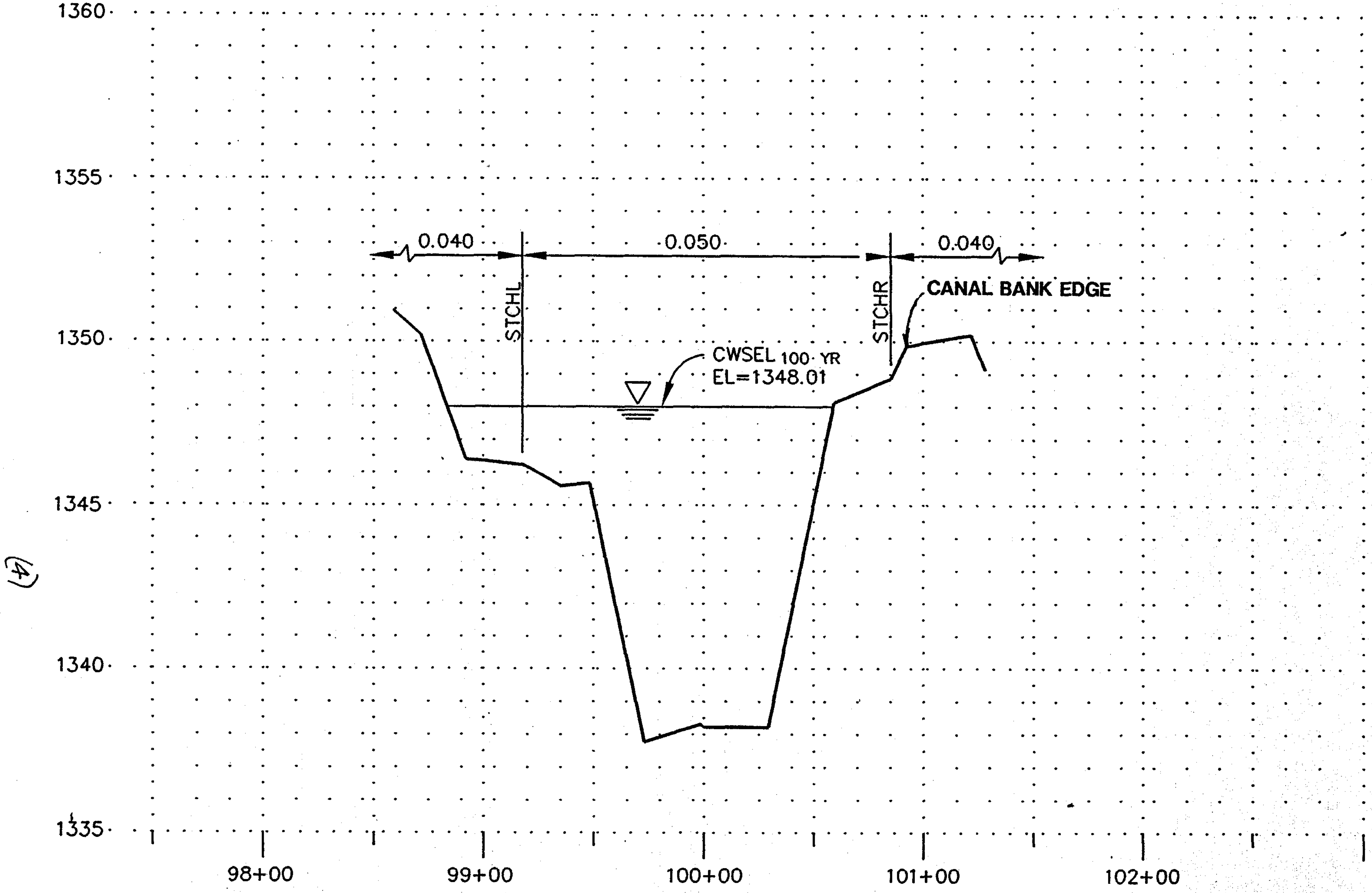

RM-21.364

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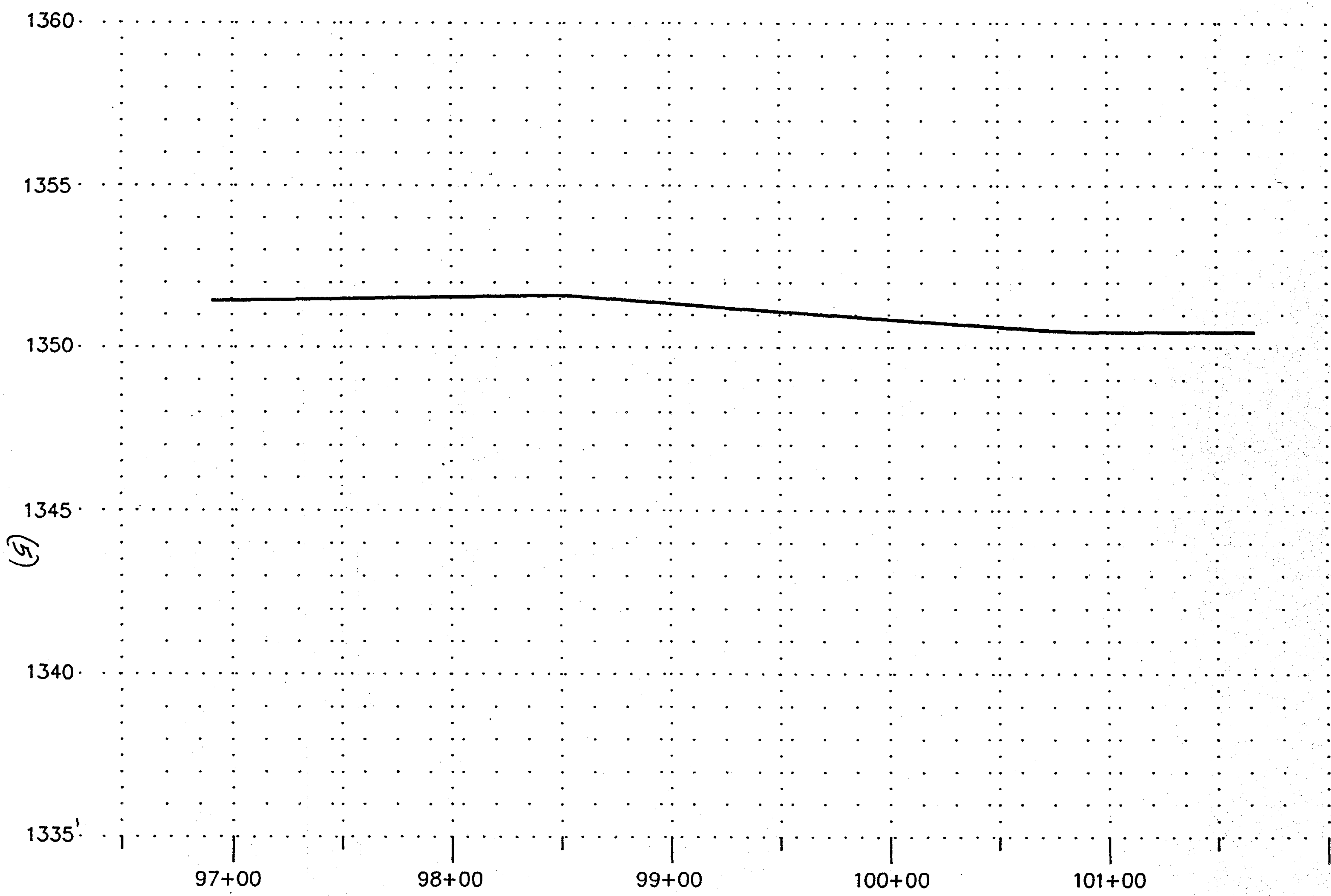

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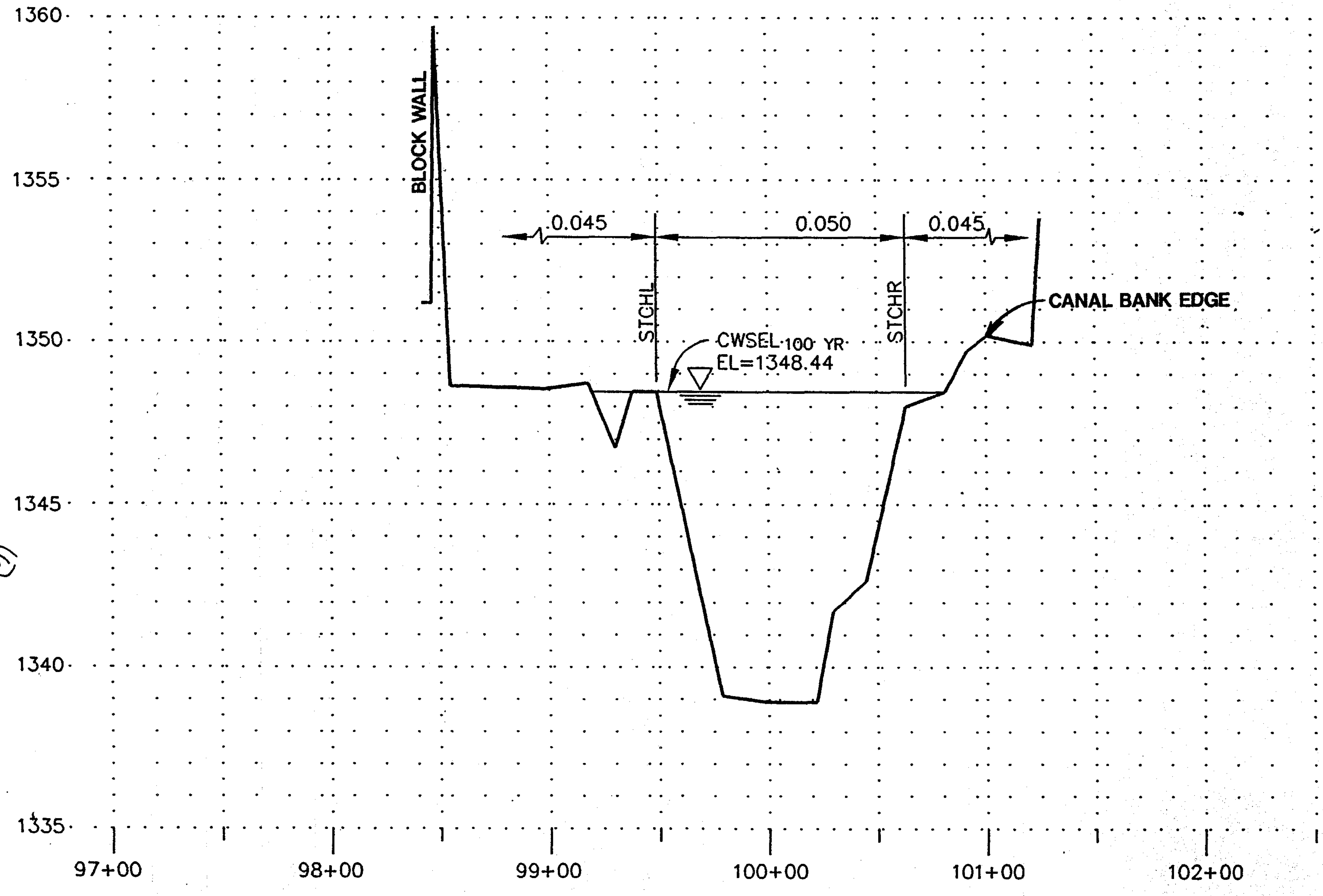
RM-21.402

TOP OF BROWN RD. PROFILE-USED IN SPECIAL BRIDGE



RM-21.434

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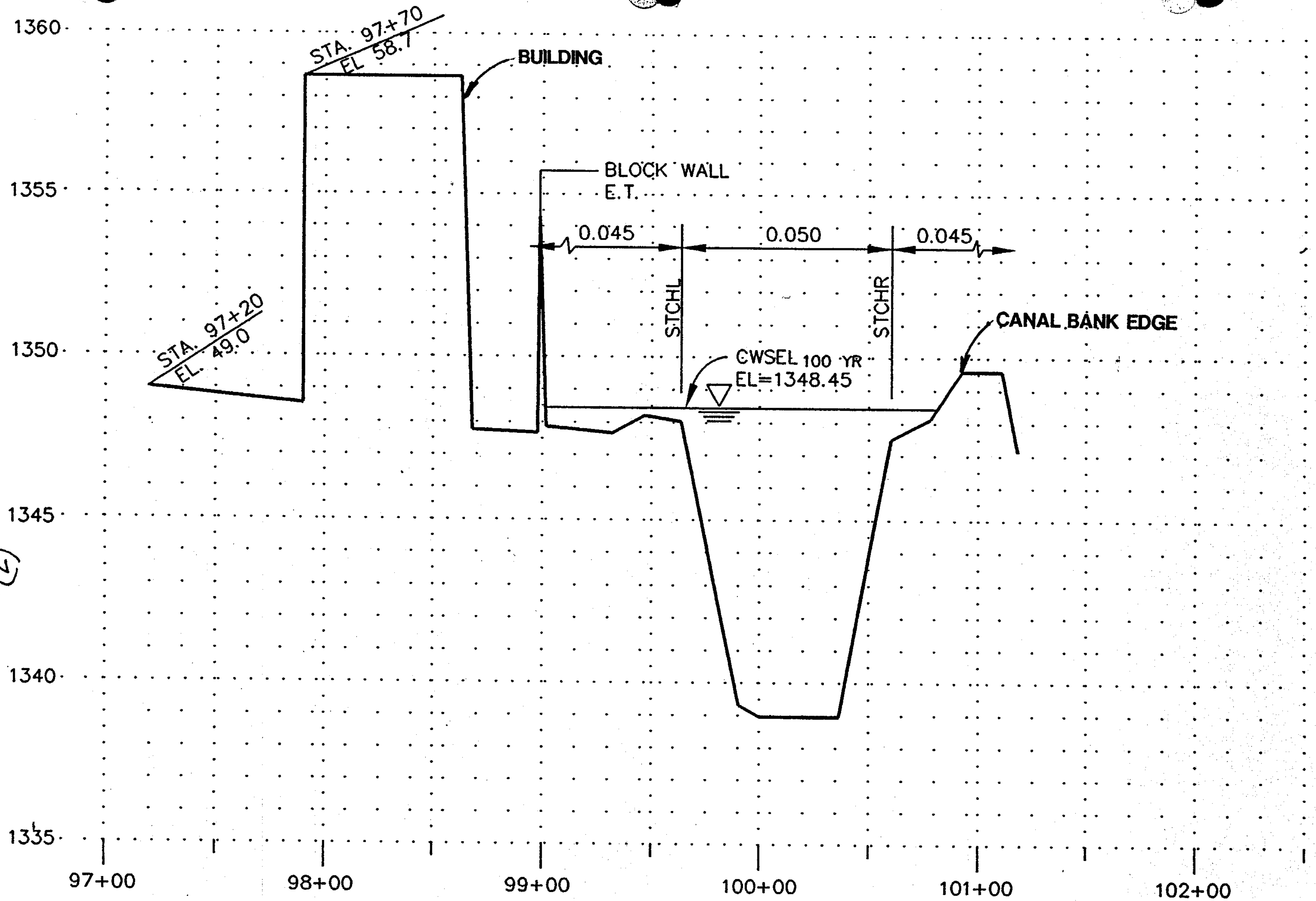

RM-21.481

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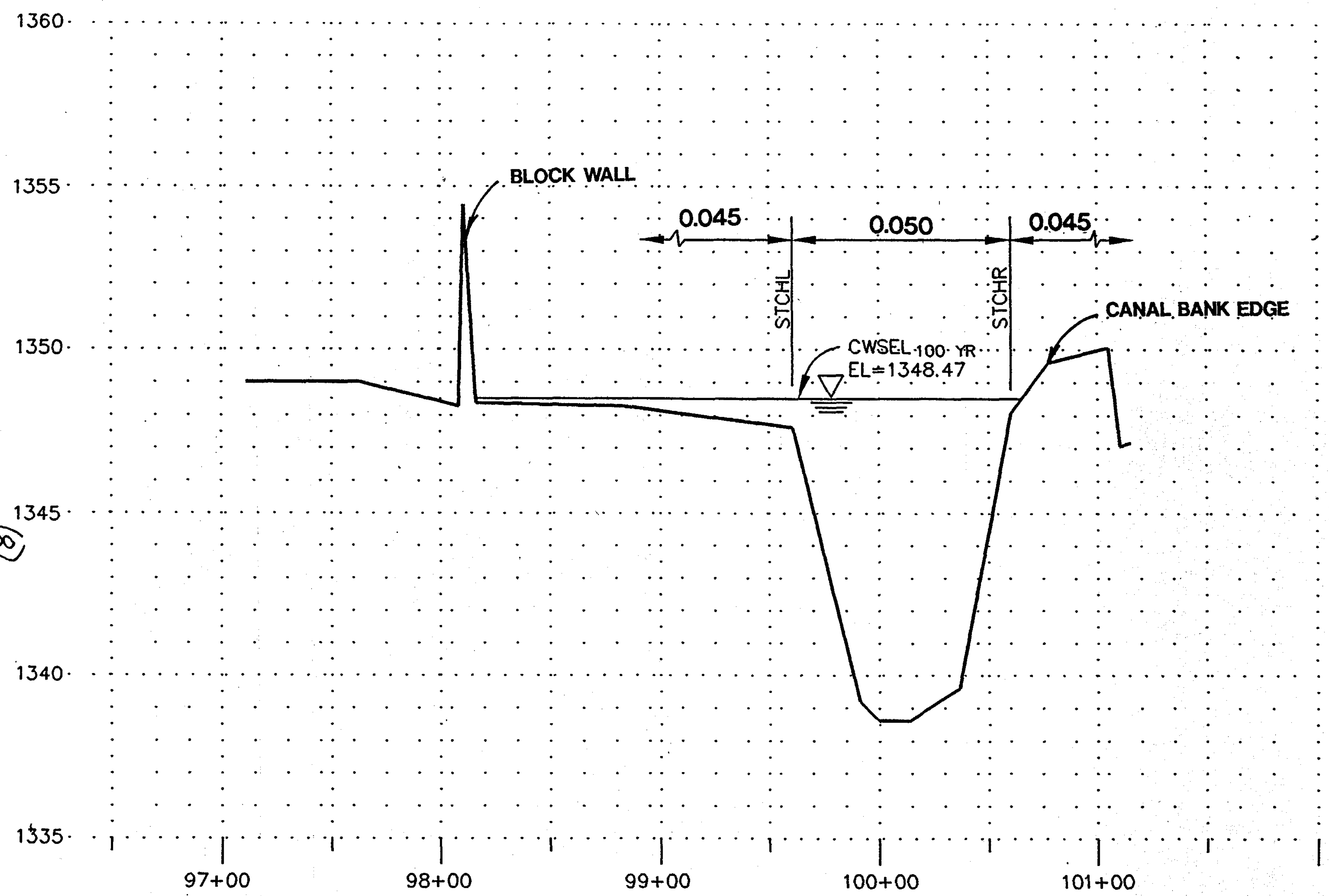

(8)

RM-21.513

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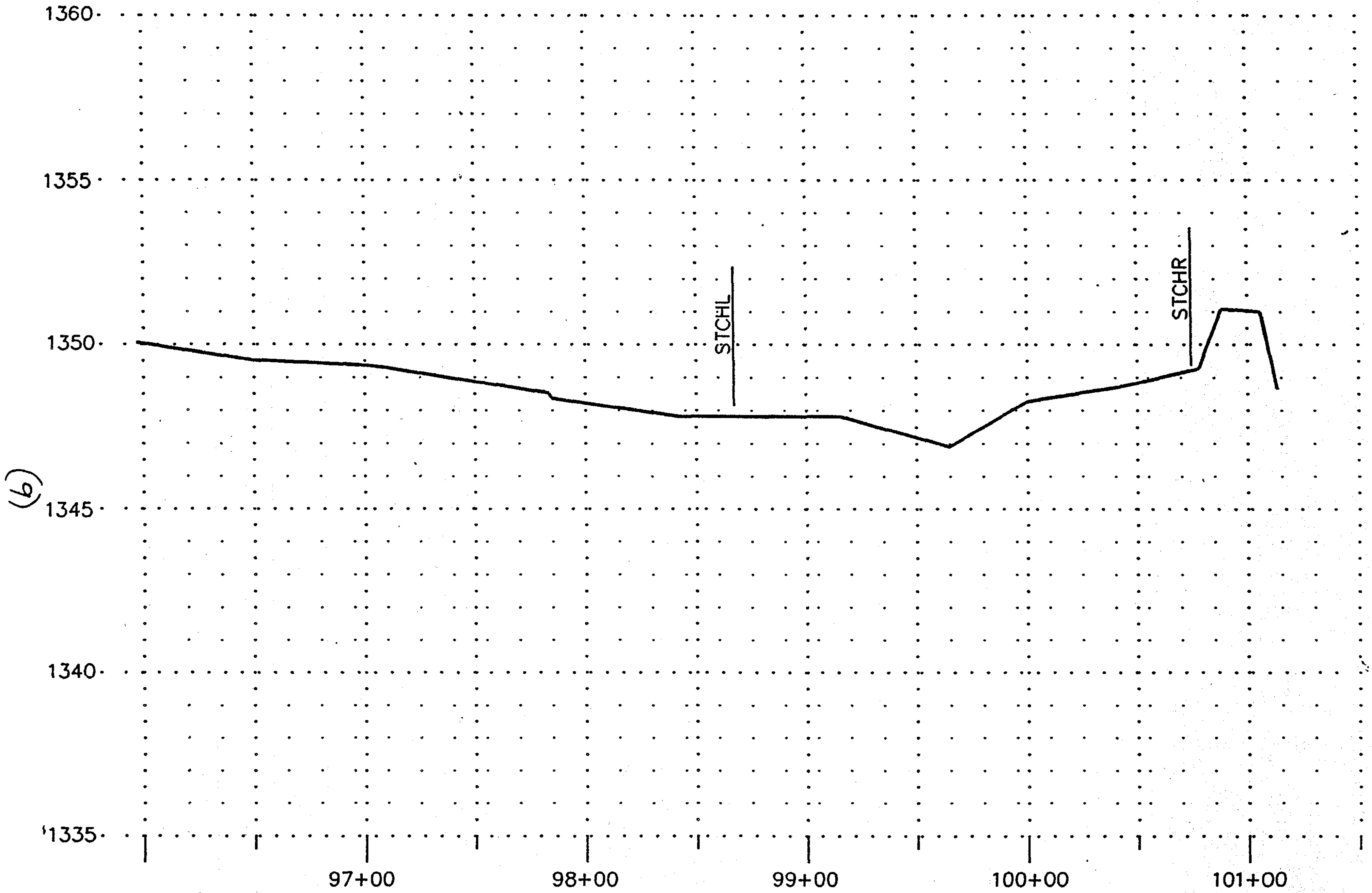

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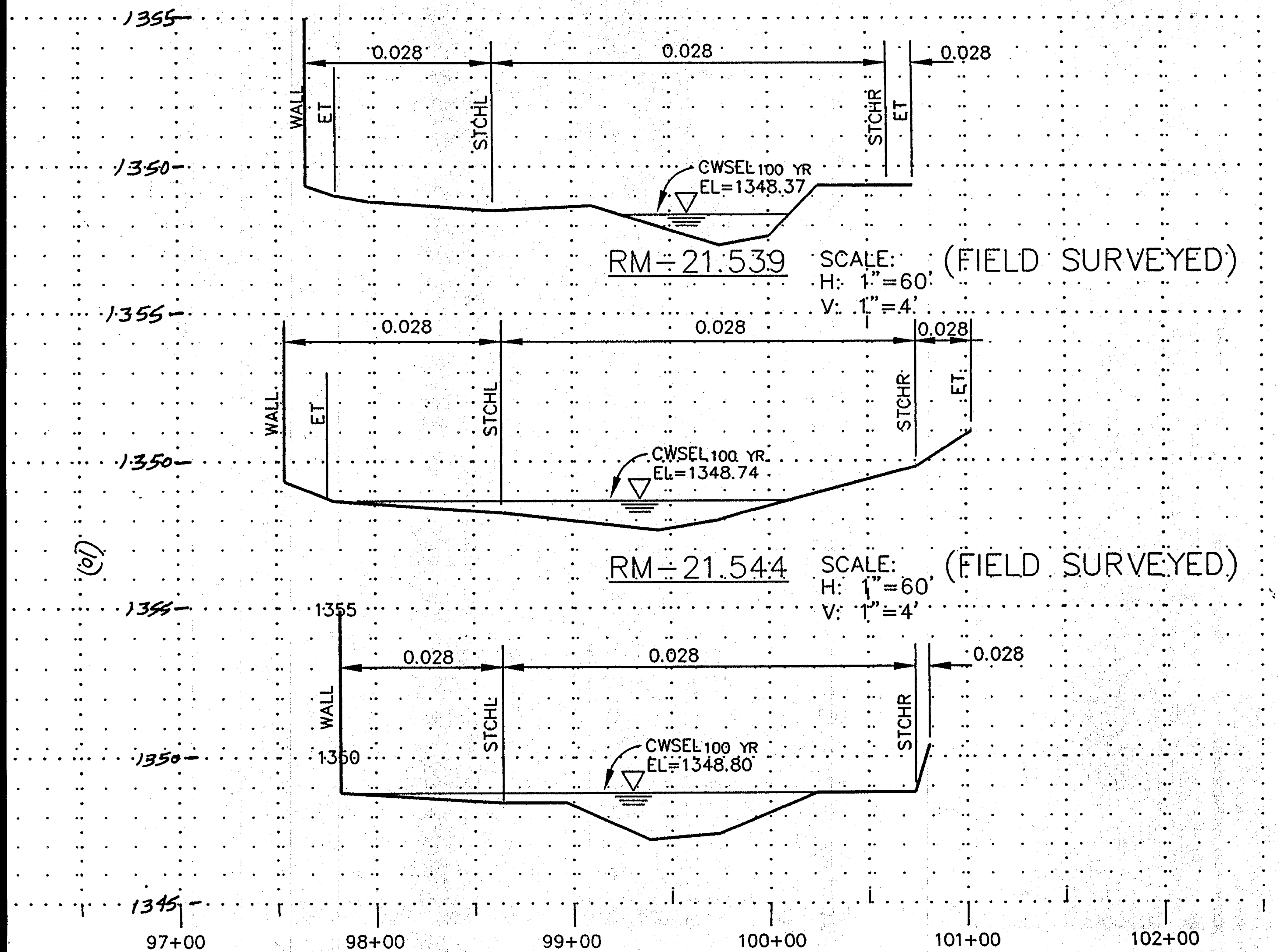
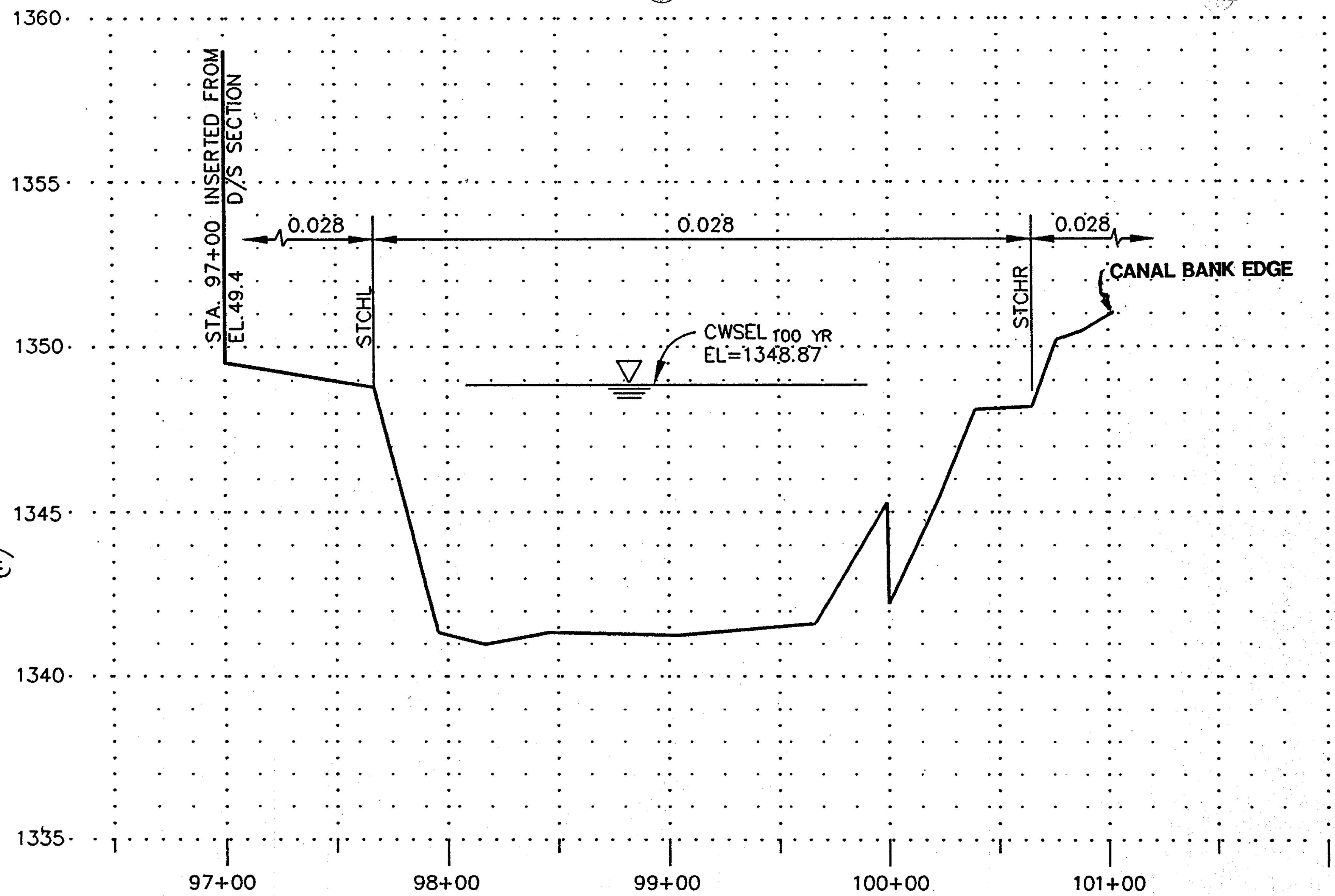


RM-21.546 SCALE: H: 1"=60' V: 1"=4' (FIELD SURVEYED)



RM-21.554

SCALE:
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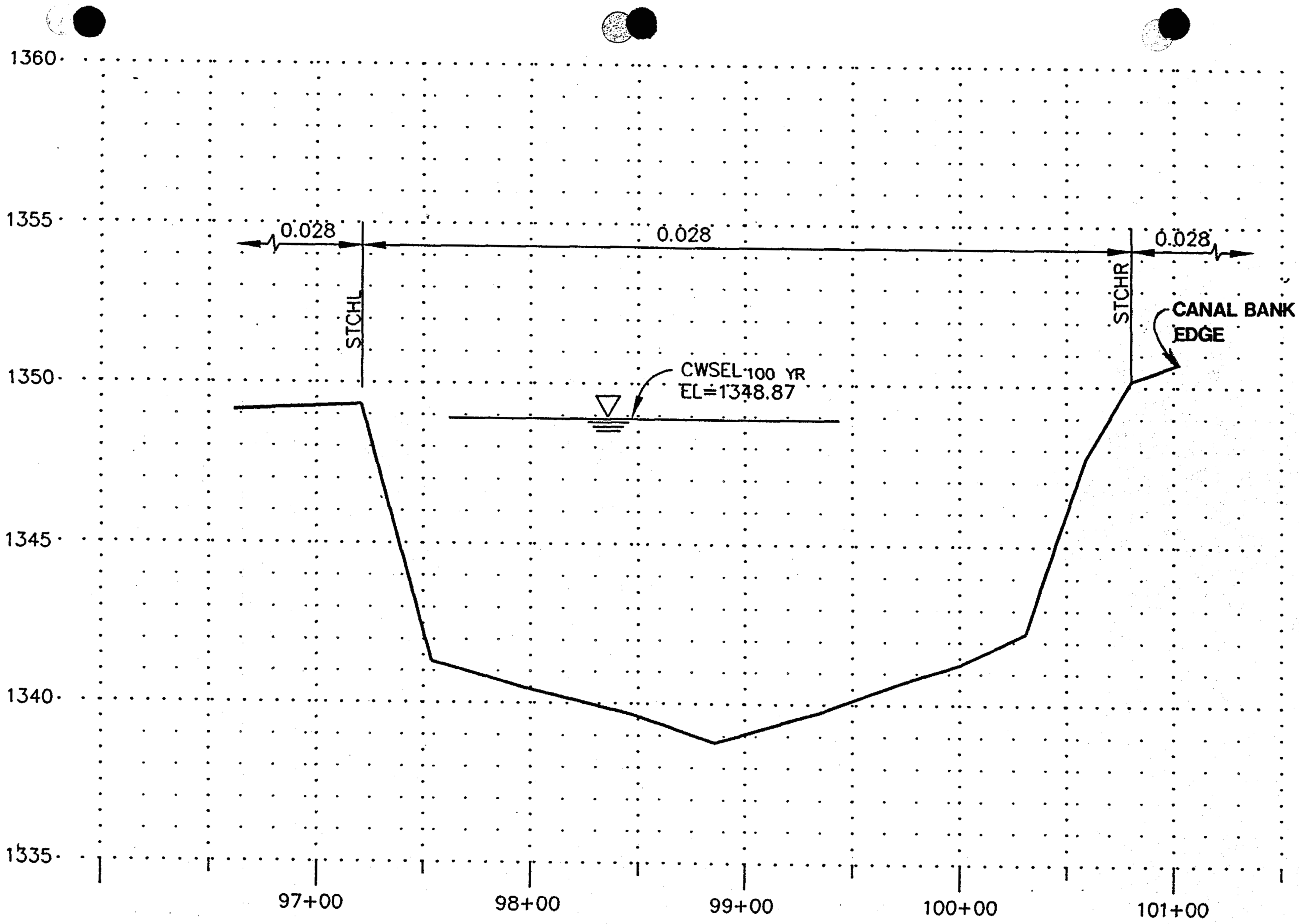
(12)



RM-21.575

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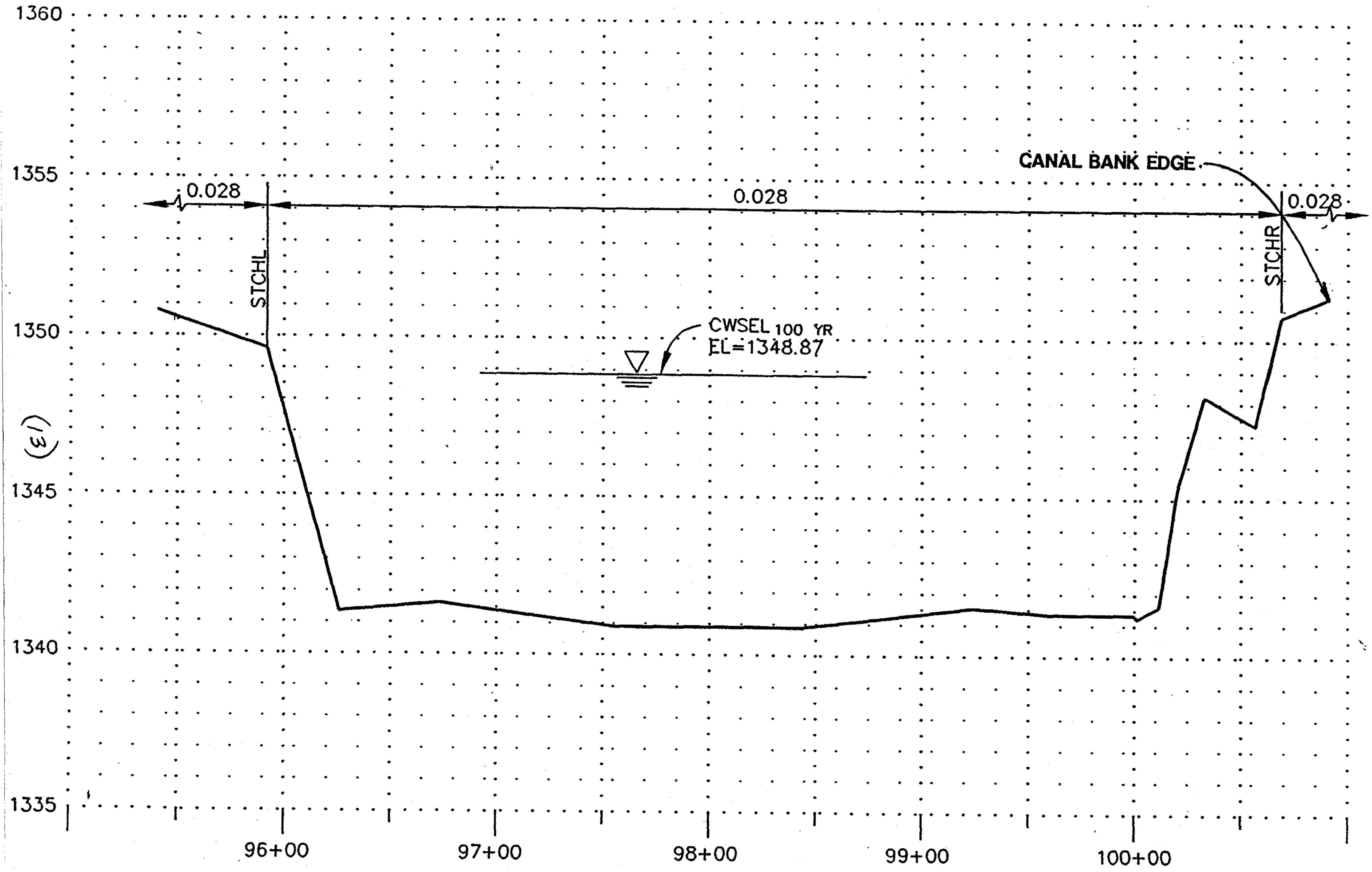

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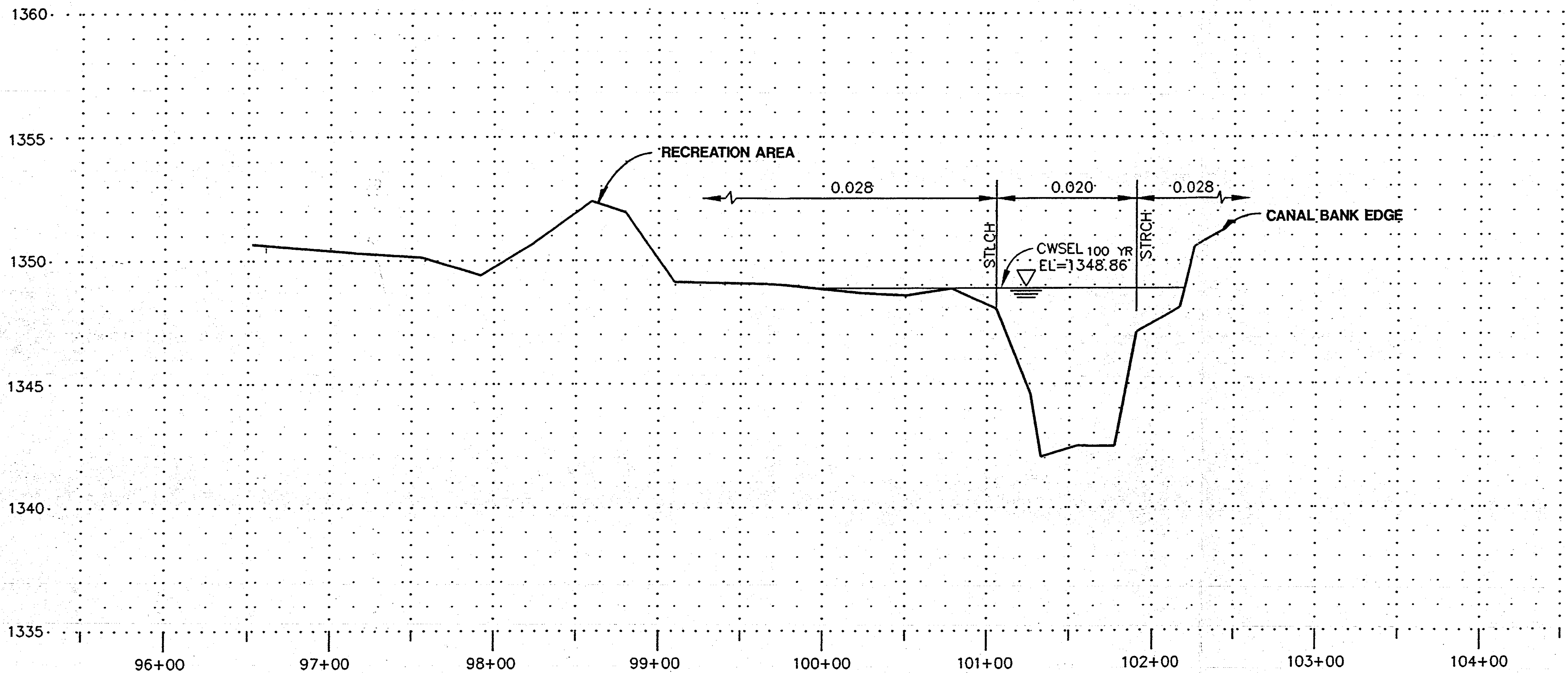

RM–21.640

SCALE:
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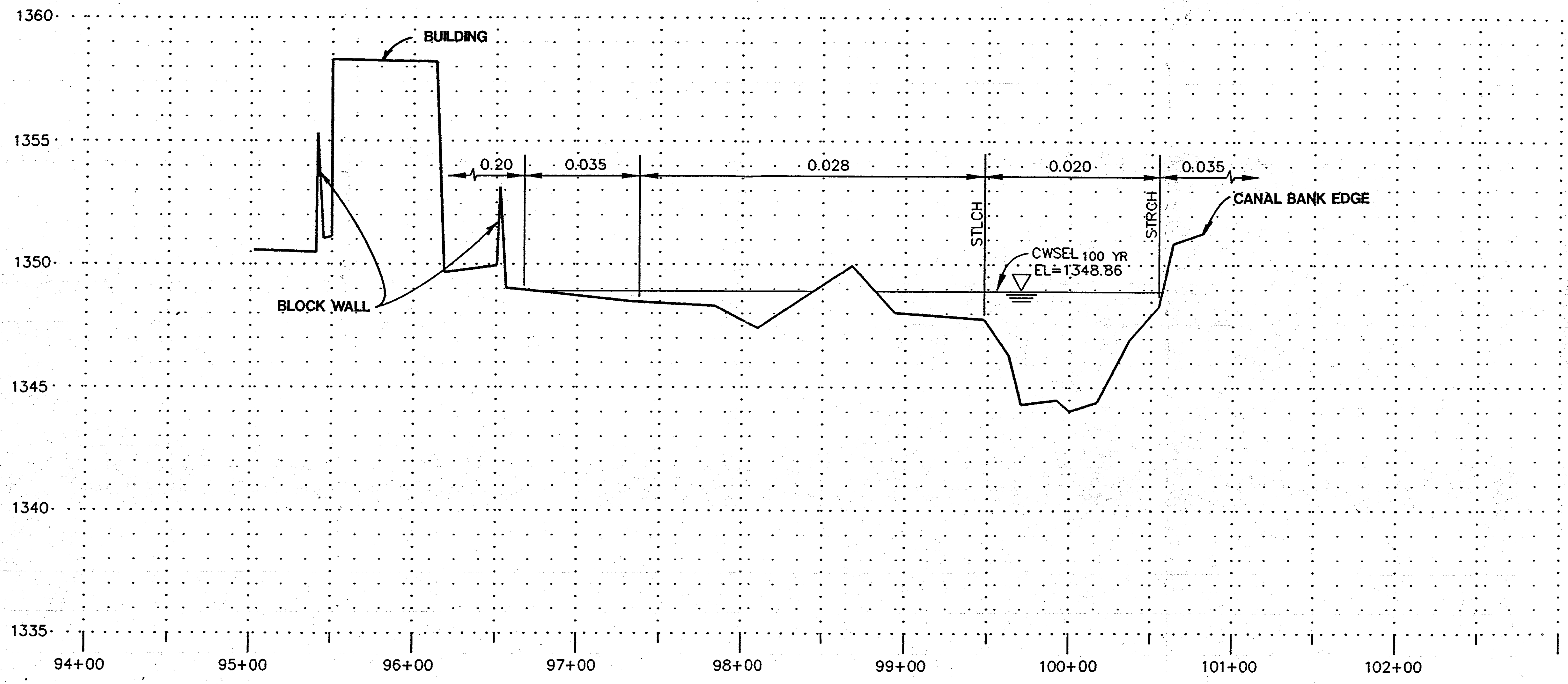
(14)



RM–21.659

SCALE:
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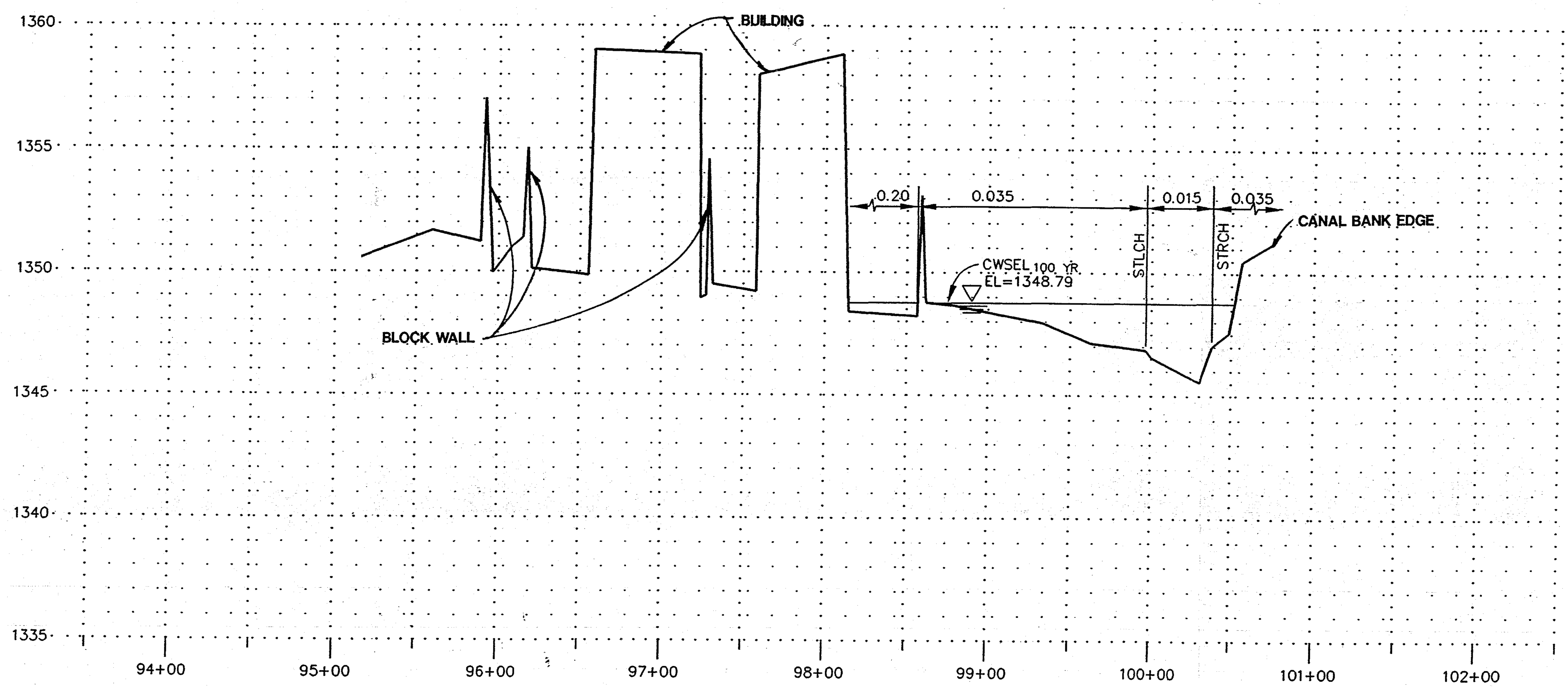
(15)



RM-21.678

SCALE:
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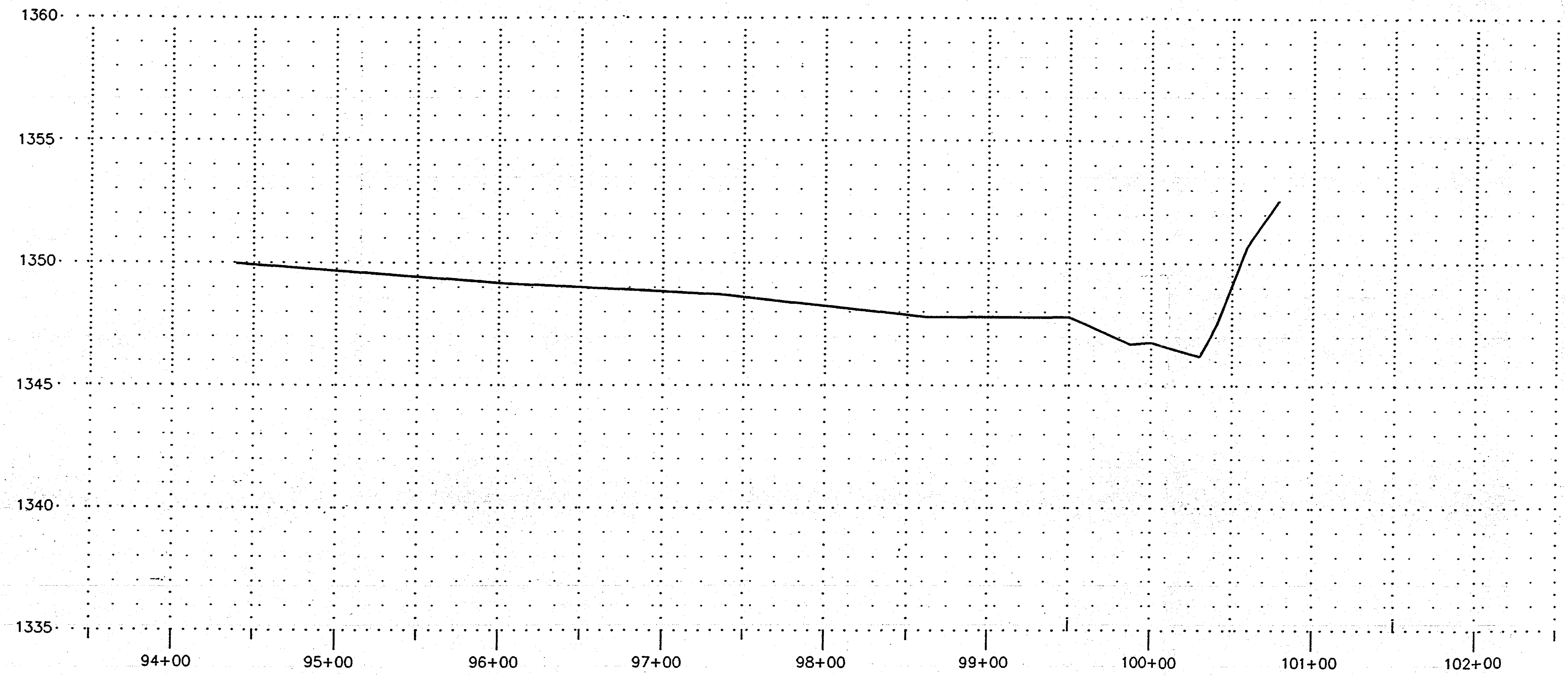
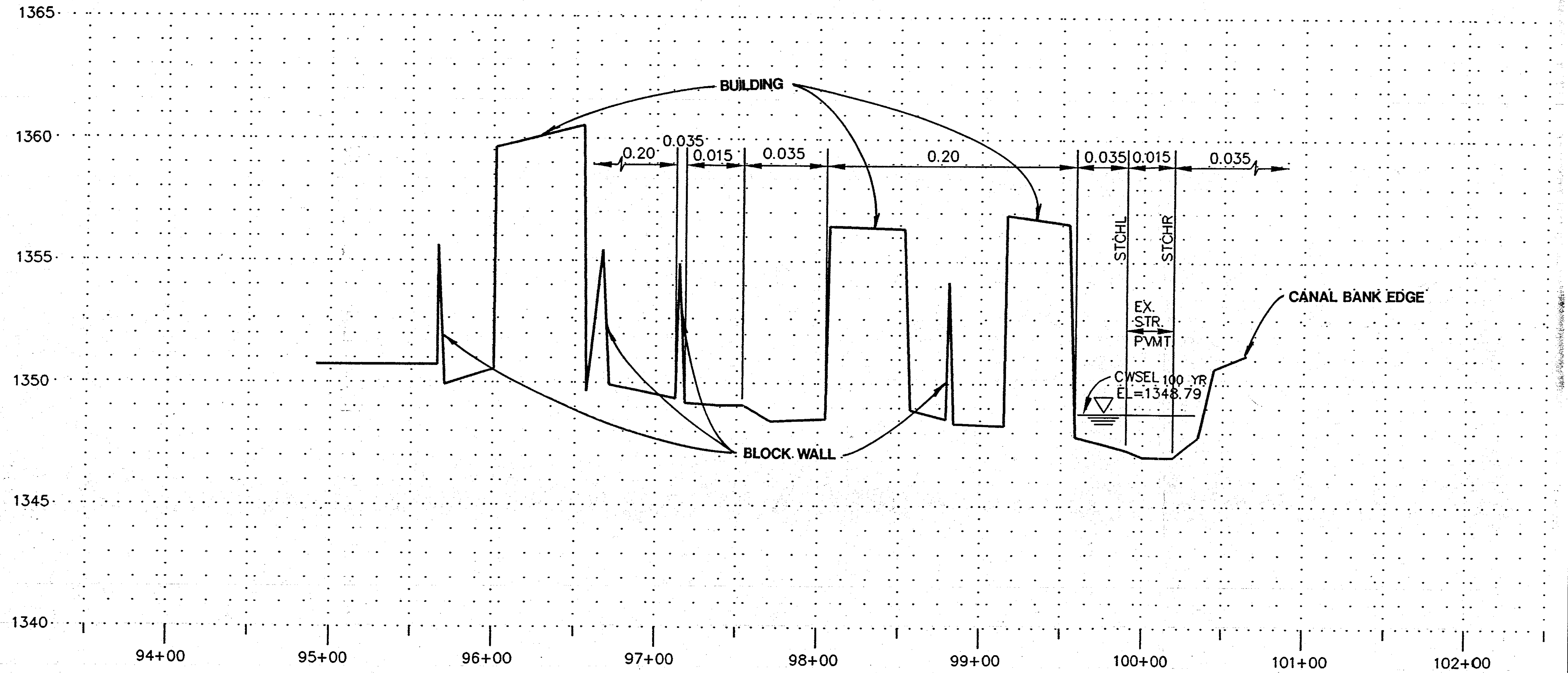
V: 1"=4'

(16)



RM–21.682 SCALE:
H: 1"=60'
V: 1"=4'
(ALONG PRINCESS DR.–NOT USED)

(17)



RM−21.735

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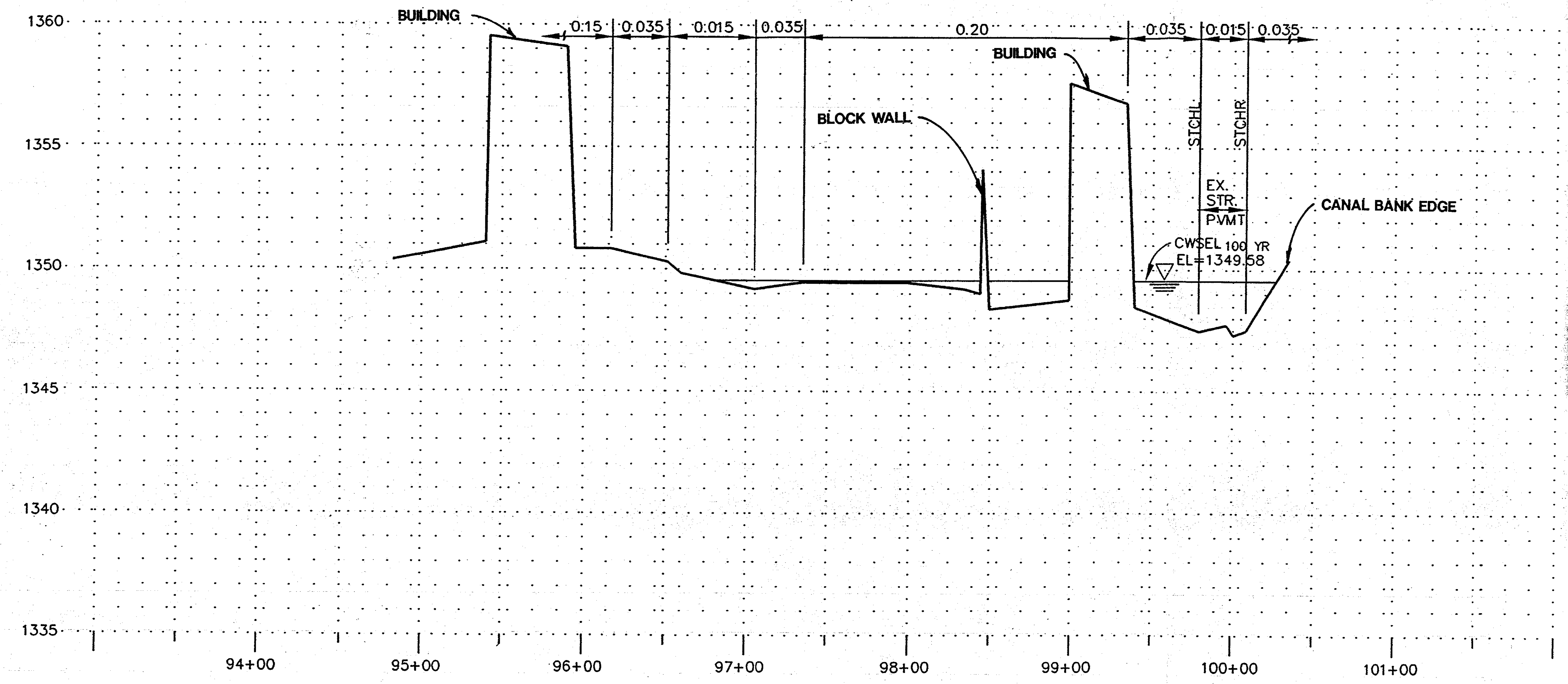
(18)



RM−21.792

SCALE:
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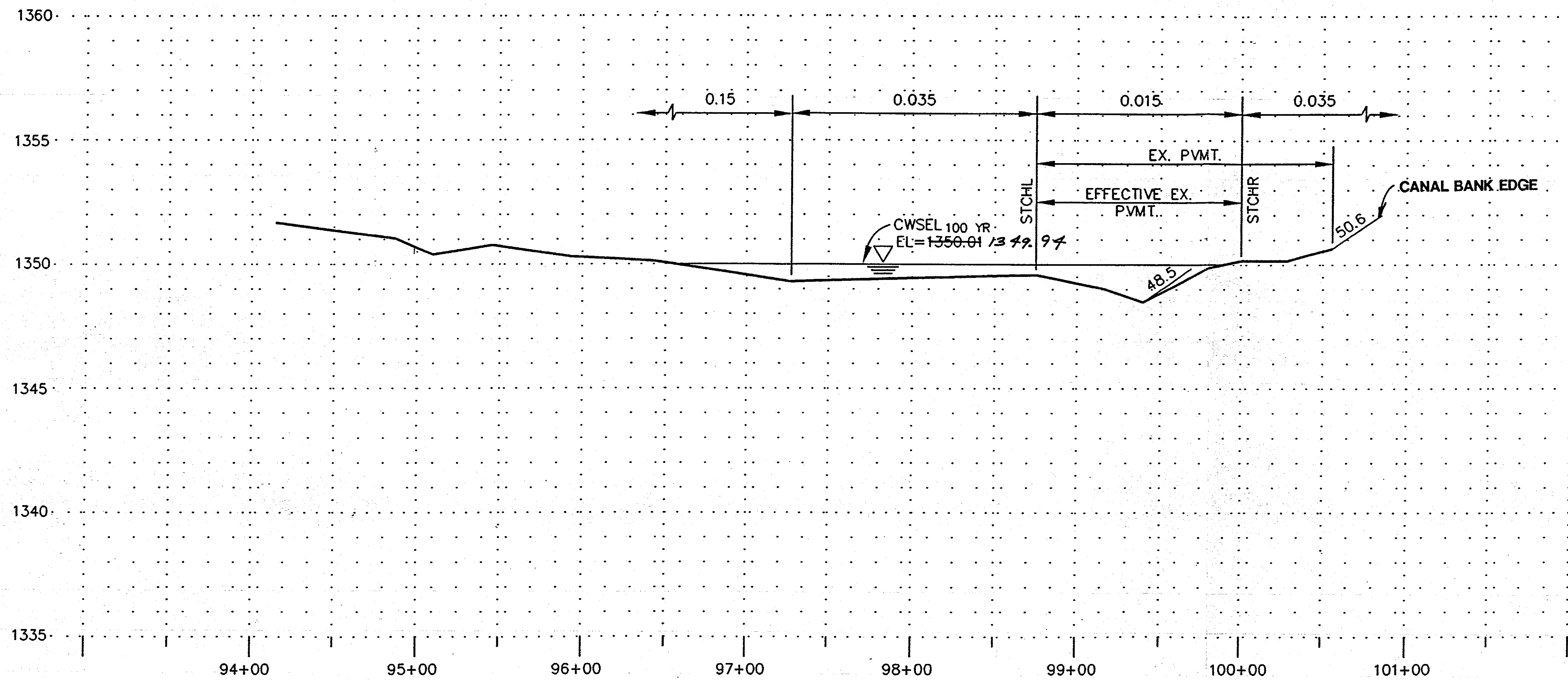
(19)



RM–21.817

SCALE:
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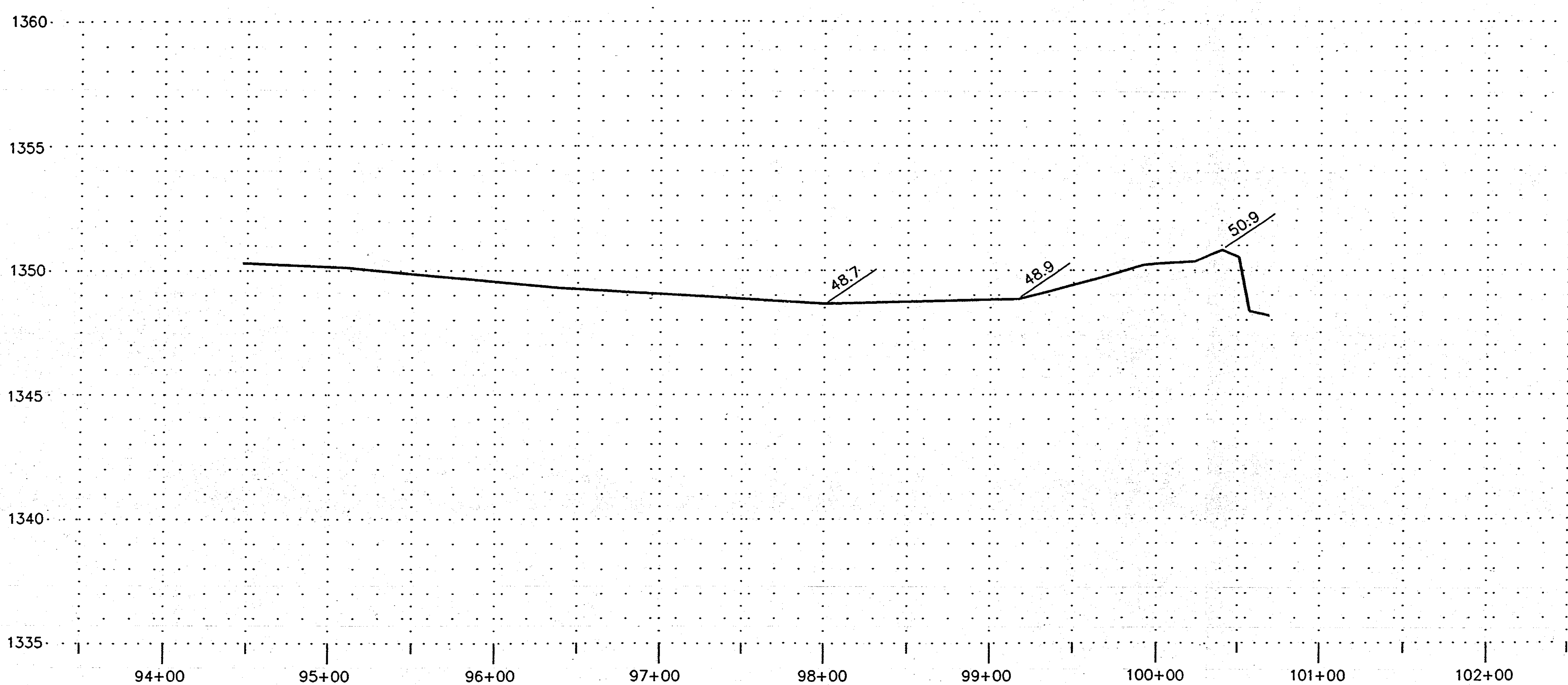
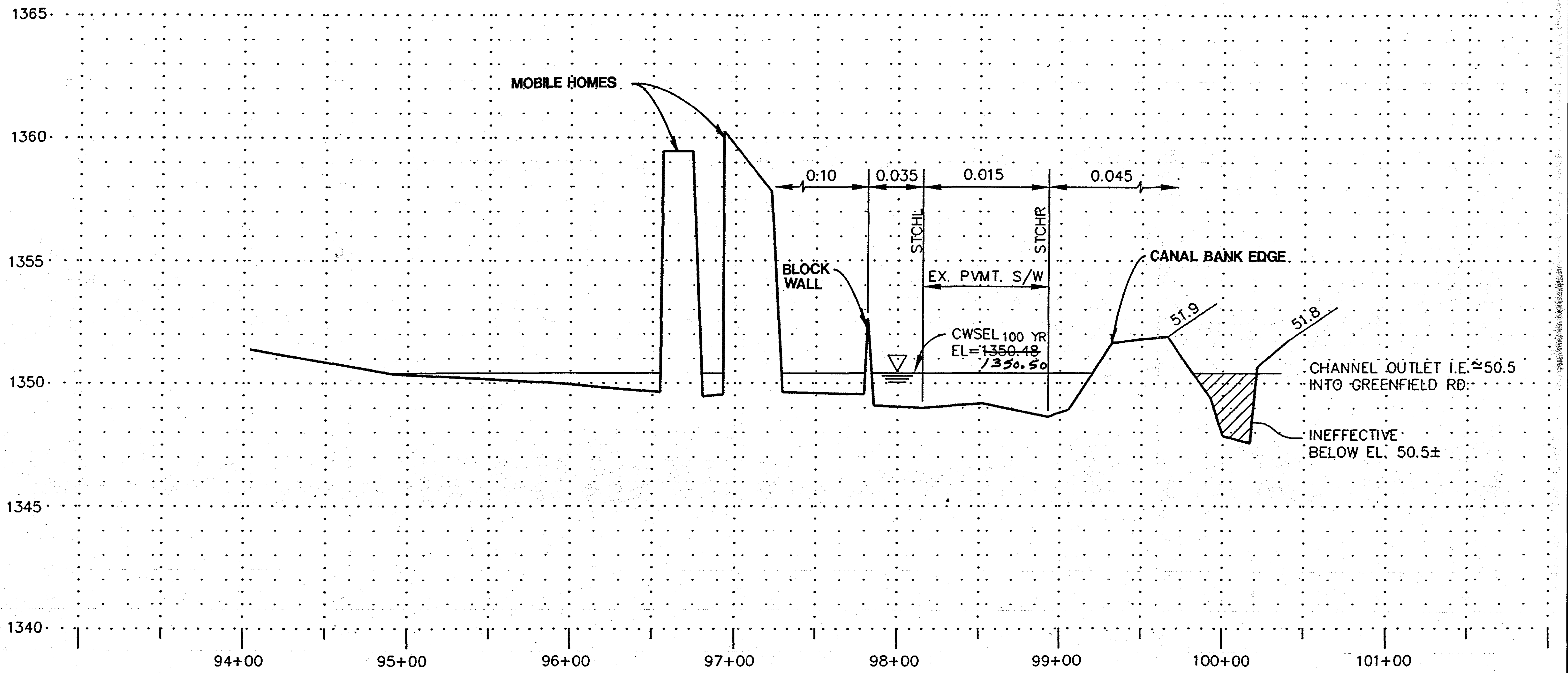
(20)



RM–21.824 SCALE: H: 1"=60' V: 1"=4' ALONG HOBART STREET (NOT USED)

(21)



RM–21.874

SCALE:
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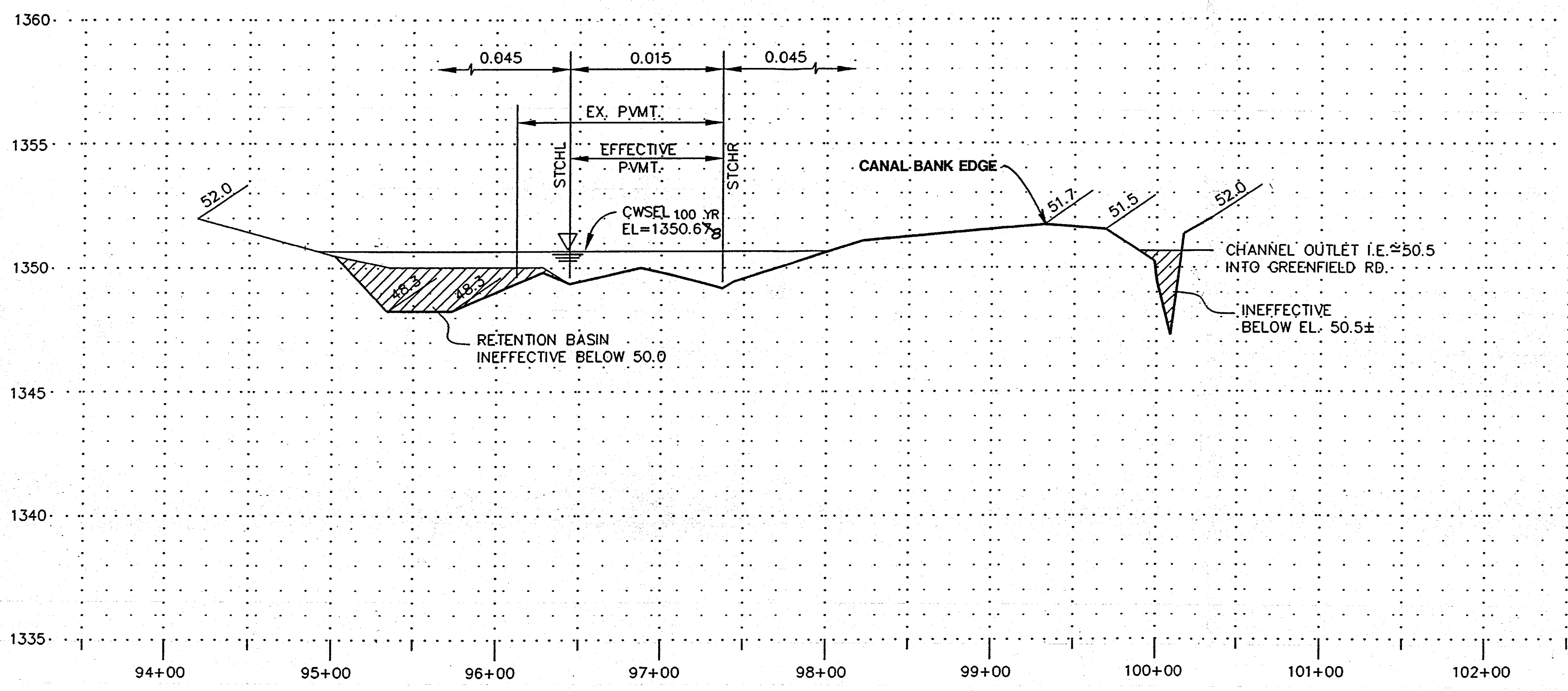
(22)



RM-21.934

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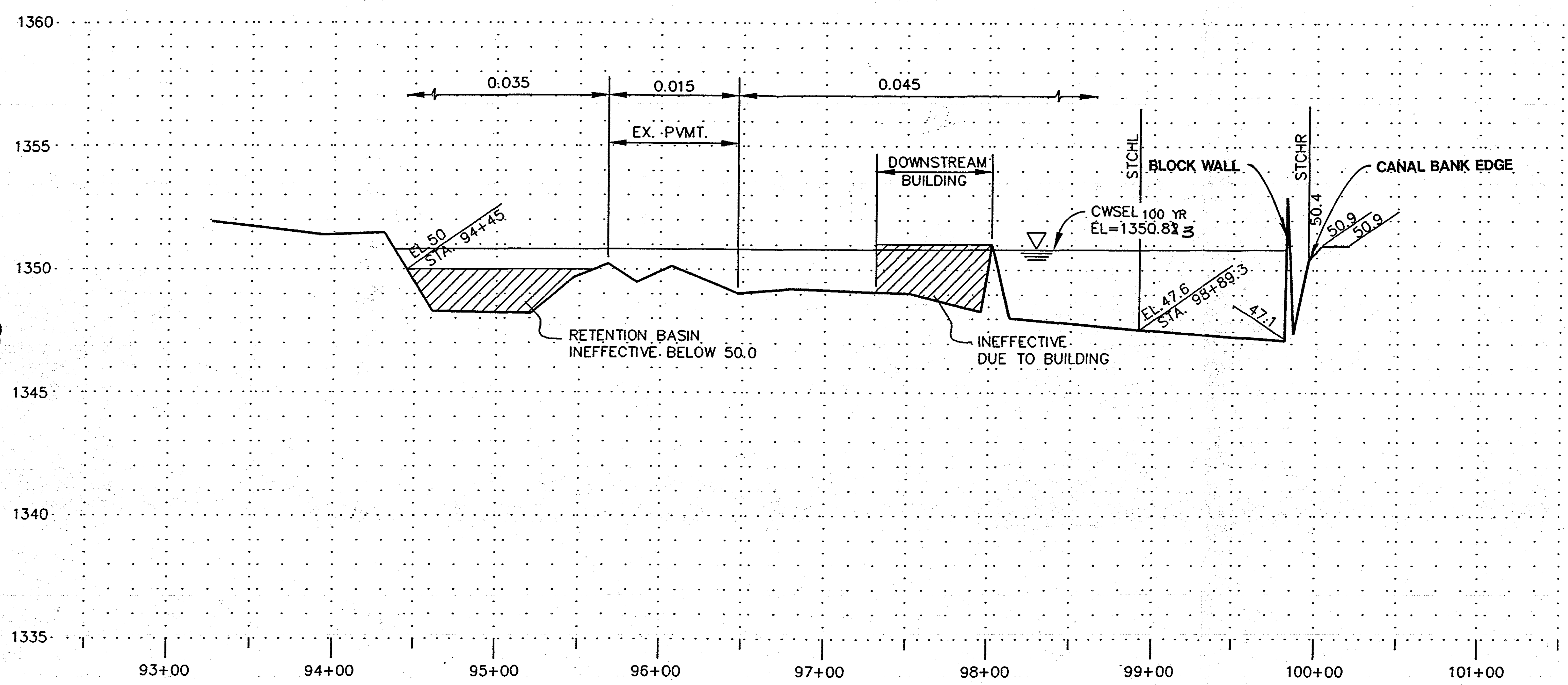
(23)



RM−21.9~~53~~ 72

SCALE:
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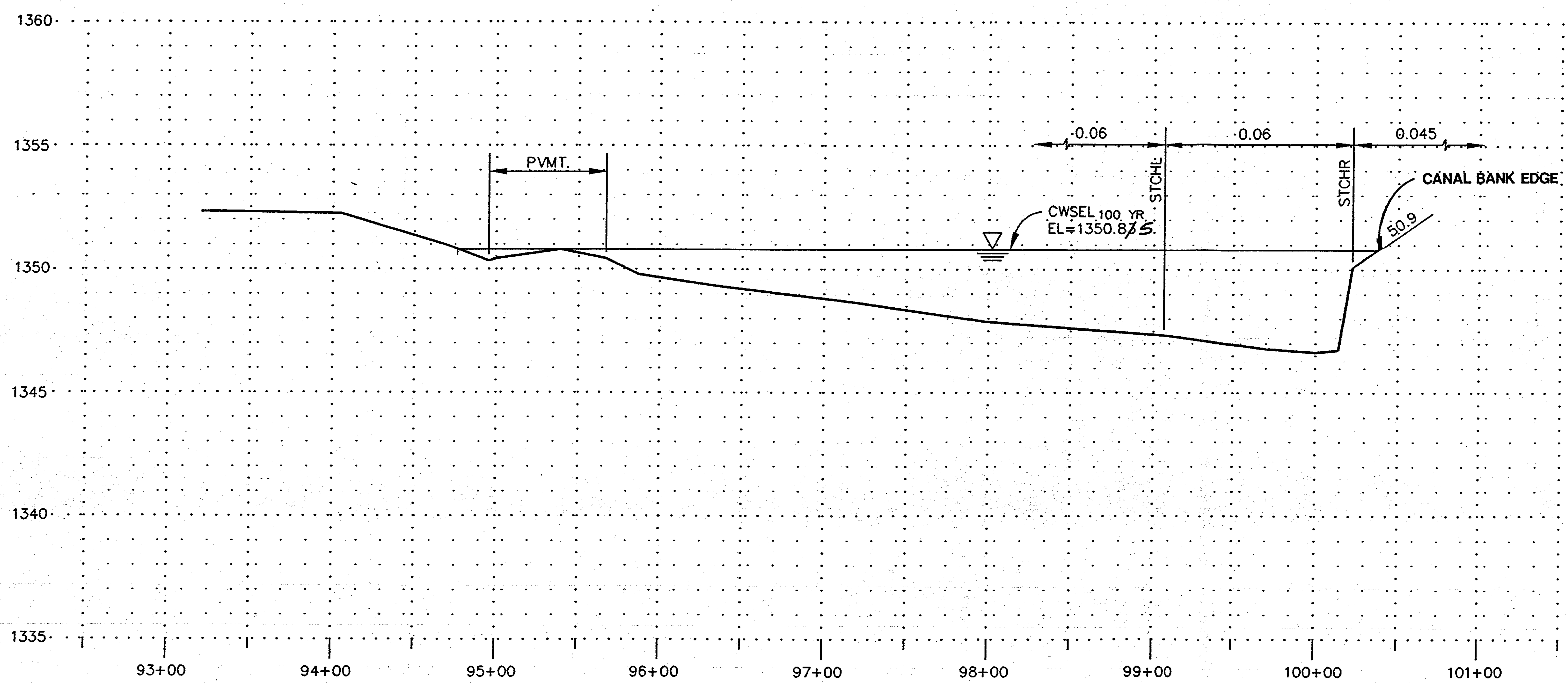
(24)



RM-22.0~~08~~27

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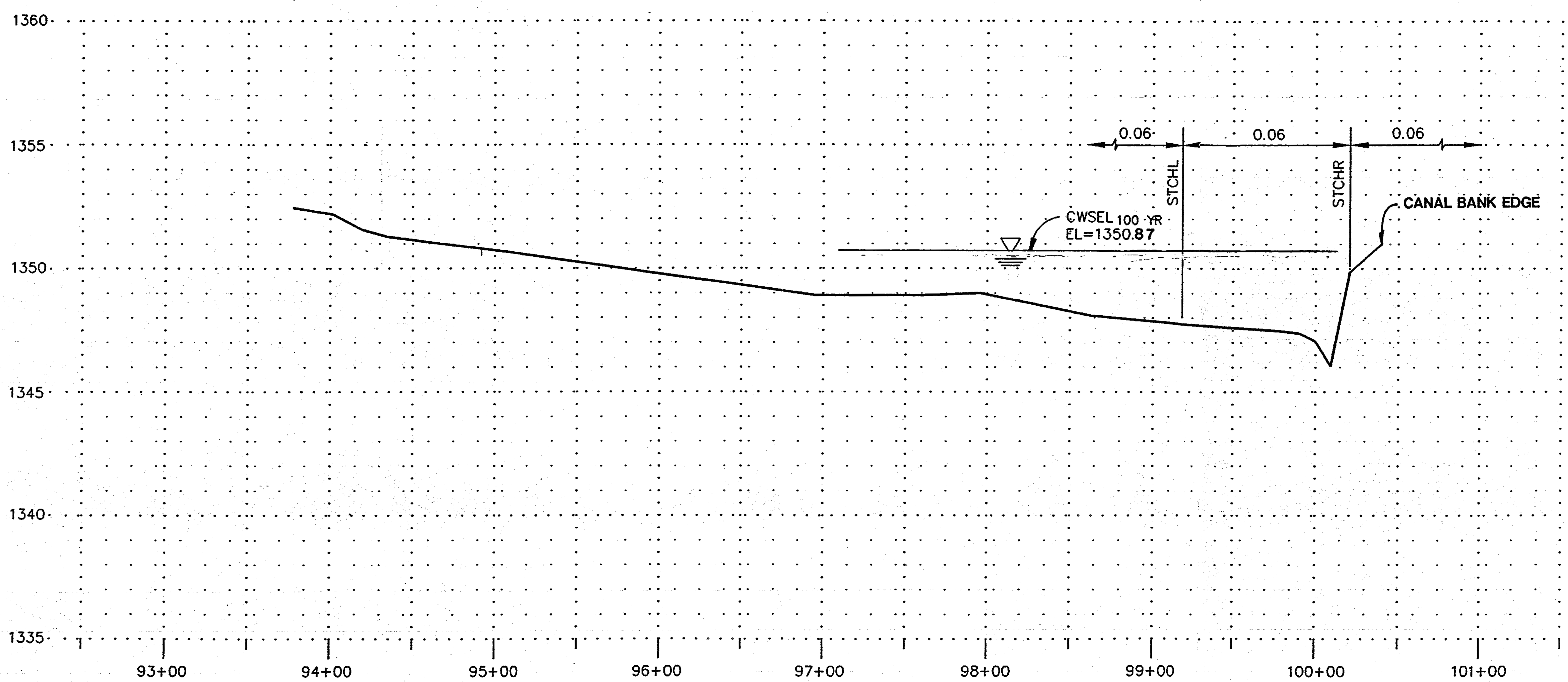
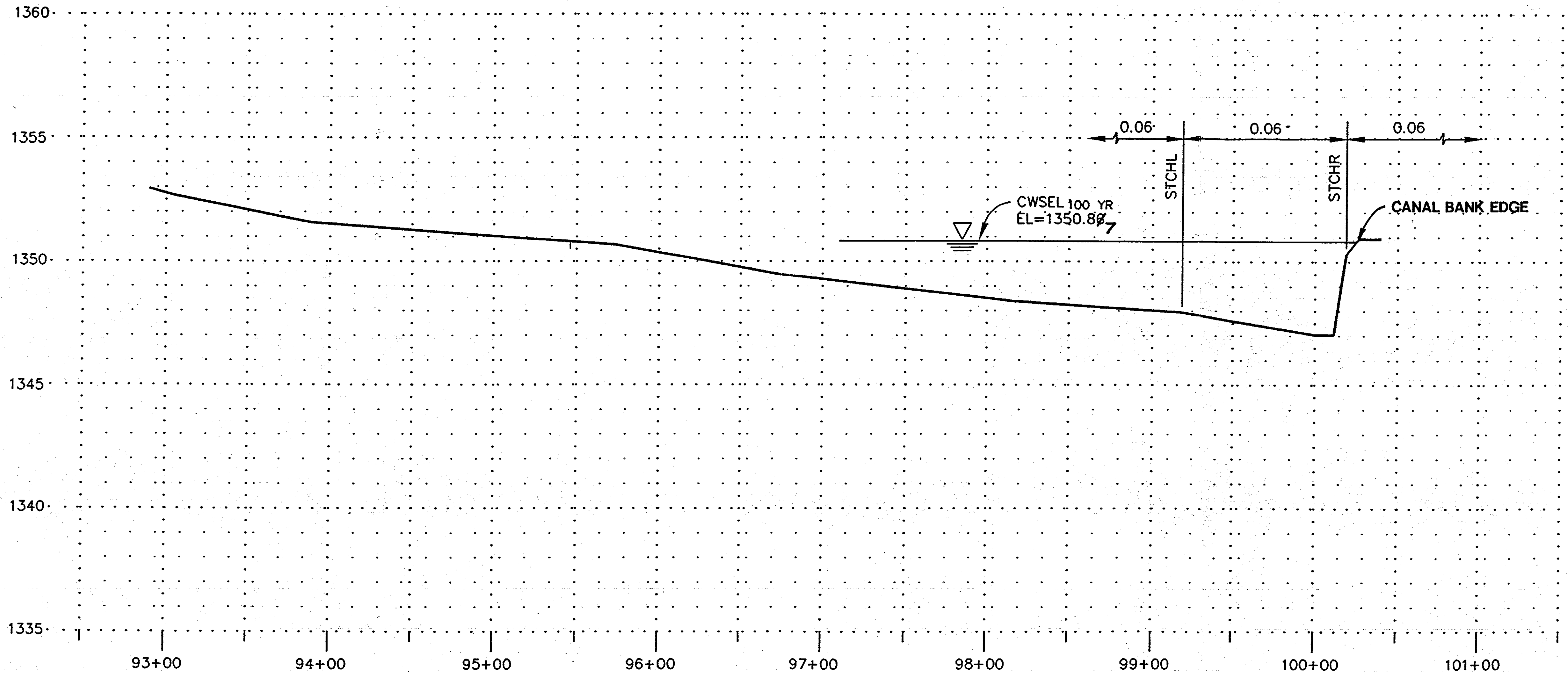
(25)



RM-22.1~~16~~ 34

SCALE:
H: 1"=60'
V: 1"=4'

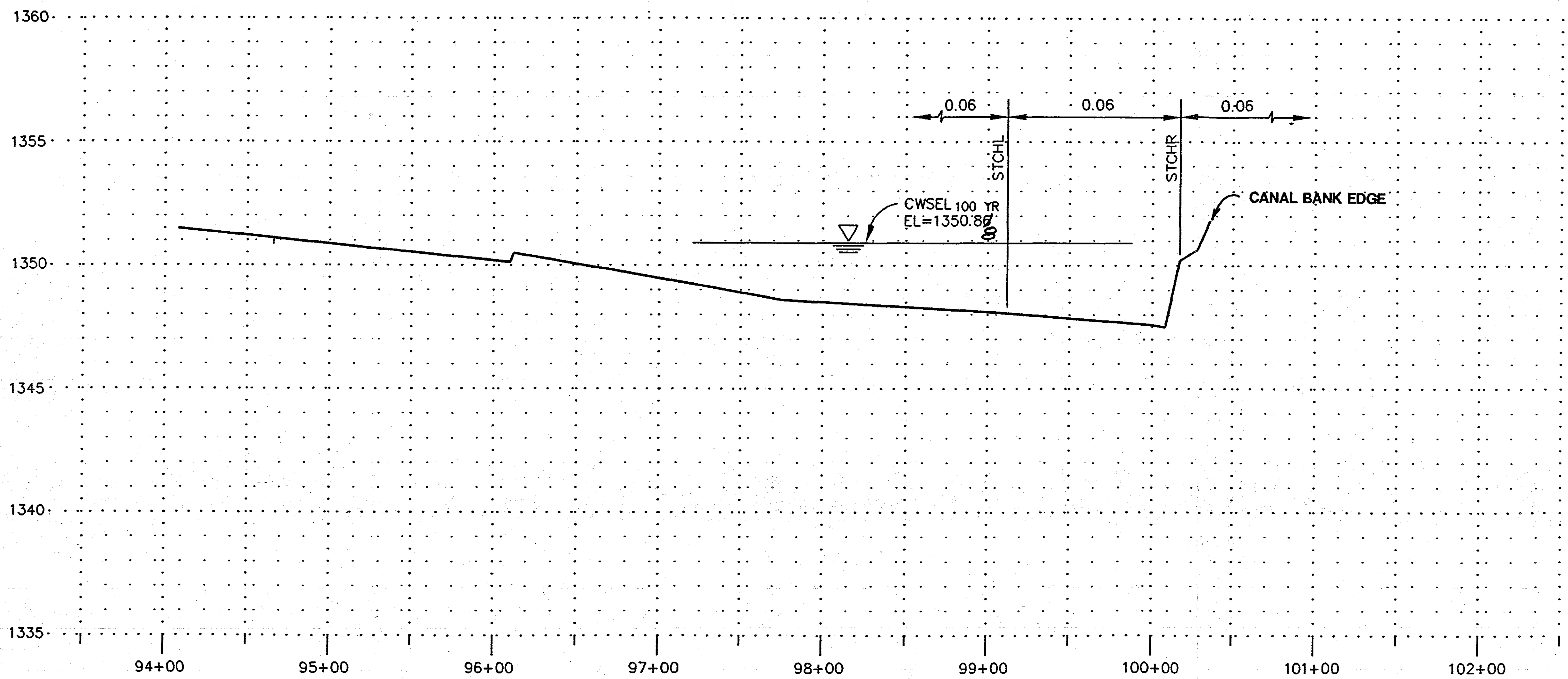
(26)



RM–22.~~185~~ 203

SCALE:
H: 1"=60'
V: 1"=4'

(27)



RM–22.2~~50~~71

SCALE:
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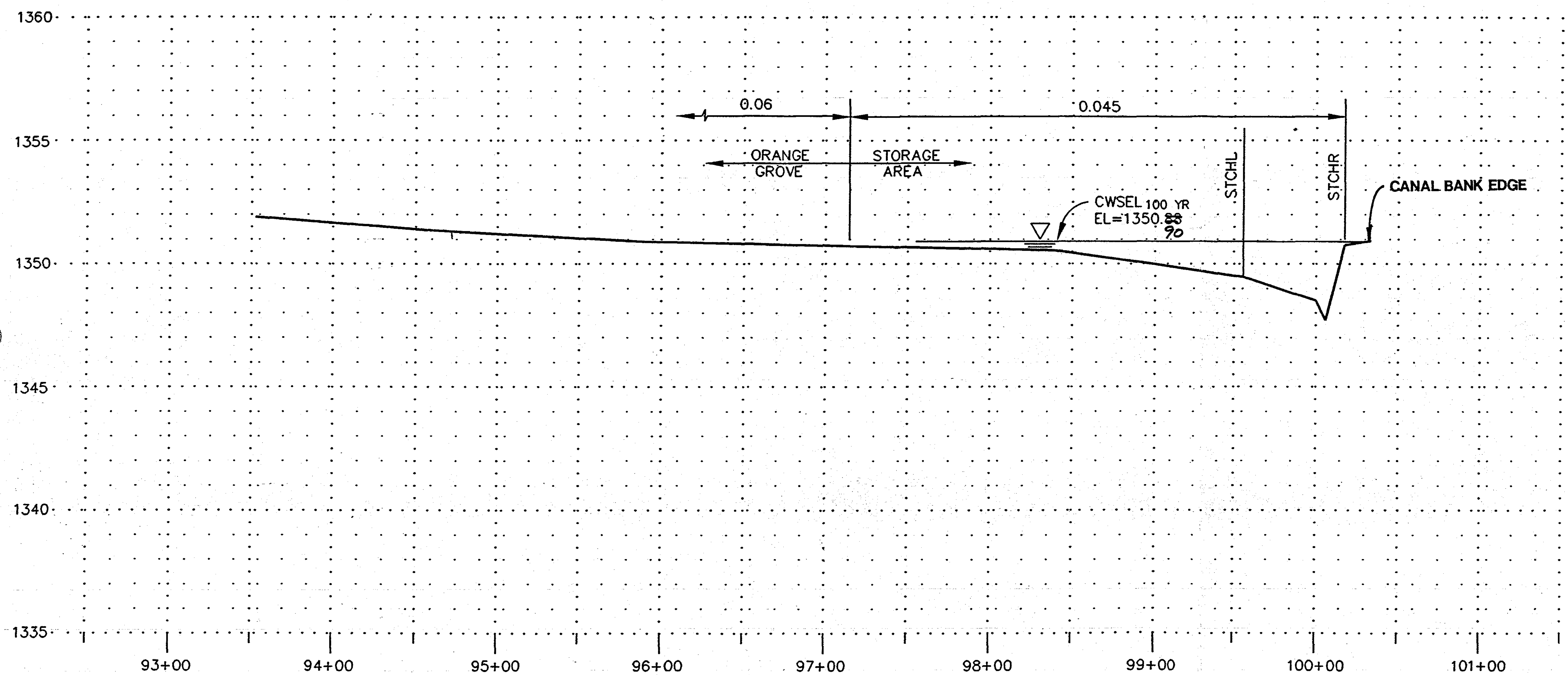
V: 1"=4'

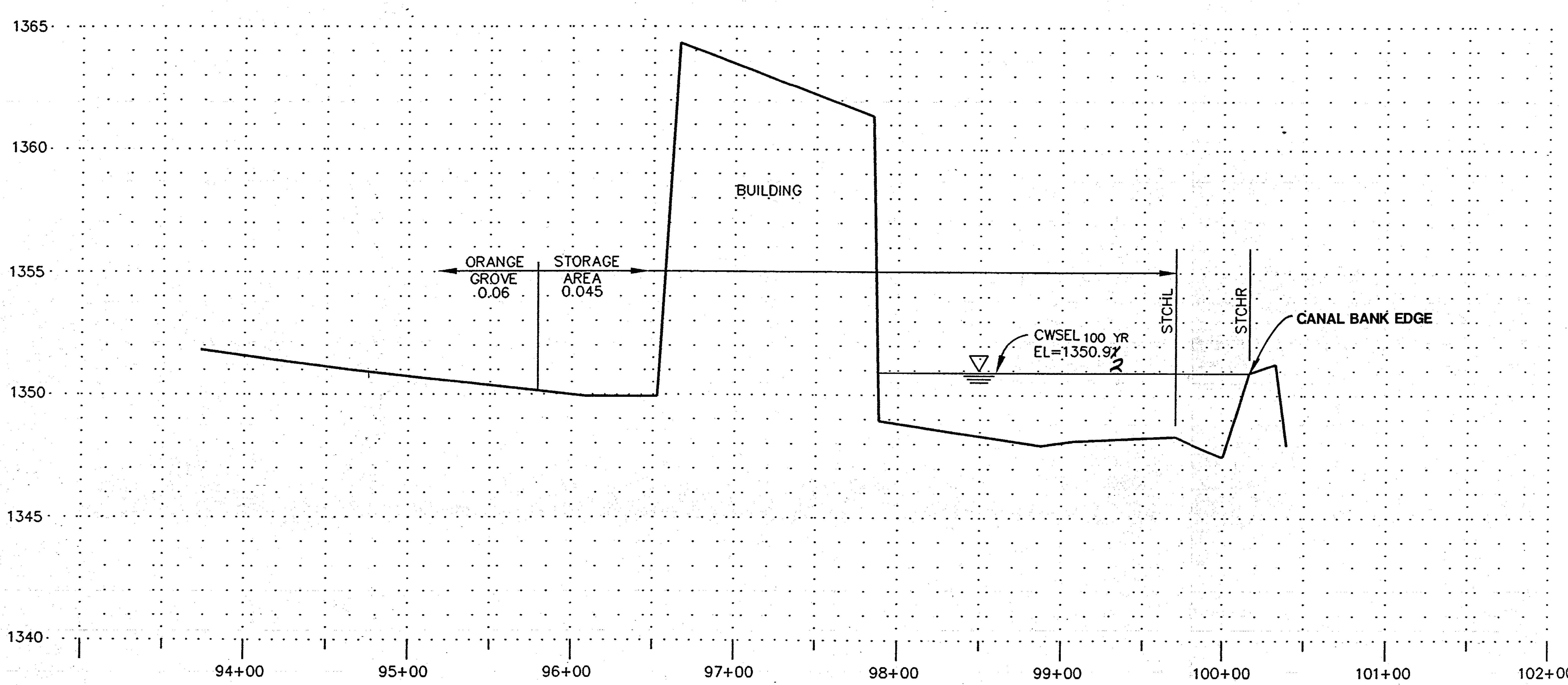
(28)



RM−22.3~~42~~ 63

SCALE:
H: 1"=60'
V: 1"=4'

(29)



RM–22.~~390~~ 411

SCALE:
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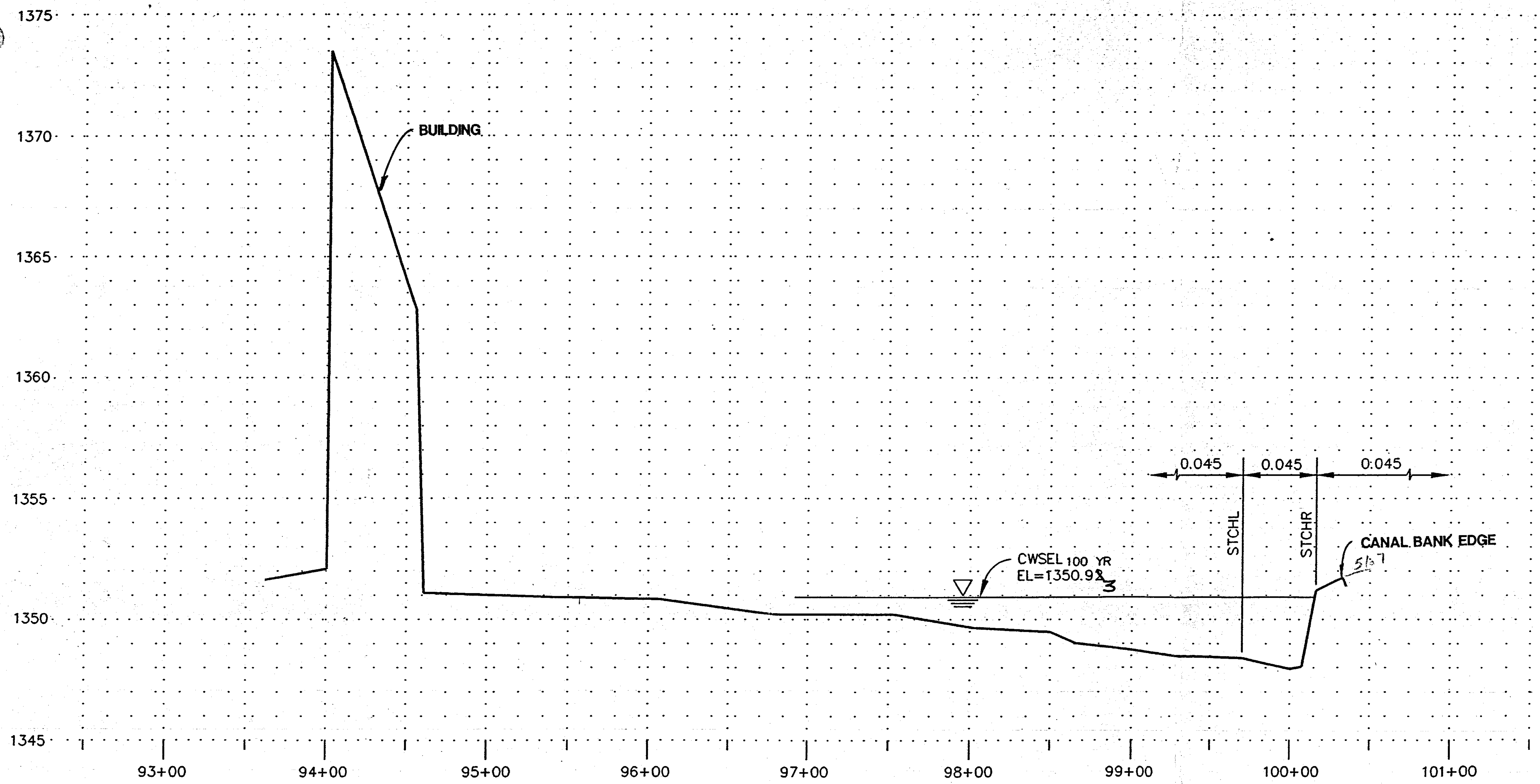
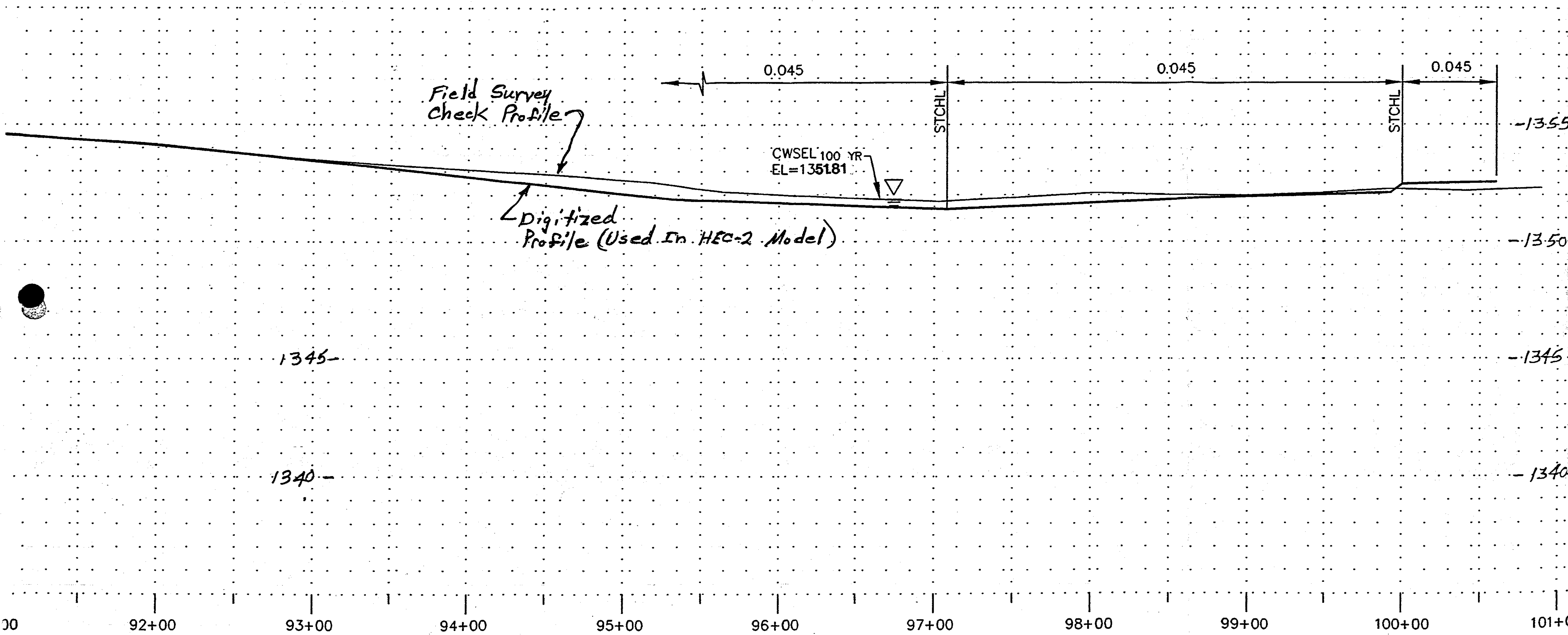
V: 1"=4'



RM-22.4~~47~~ 68

SCALE:
H: 1"=60'
V: 1"=4'

(31)



(32)

RM–22.4~~68~~ 85 SCALE: H: 1"=60' V: 1"=4' (ALONG McKELLIPS ROAD)

T.D.N. NO.4.5

SPECIAL PROBLEMS REPORT NO. 1
UPPER EAST MARICOPA FLOODWAY (UEMF)
FLOODPLAIN DELINEATION STUDY
FCD NO. 94-26

NOVEMBER 22, 1995

PREPARED FOR:
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 WEST DURANGO STREET
PHOENIX ARIZONA 85009

AND

CITY OF MESA
ENGINEERING DEPARTMENT
55 NORTH CENTER STREET
MESA, ARIZONA 85211-1466

Registered Professional Engineer (Civil)
CERTIFICATE NO.
15290
GREGORY A.
SCHUELKE
Date Signed 11/22/95
ARIZONA, U.S.A.

A-N WEST NO. 7158-03

A-N WEST INC.
Consulting Engineers
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200

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FIGURES

APPENDIX A

Registered Professional Engineer (Civil)
CERTIFICATE NO.
15290
GREGORY A.
SCHUELKE
Date Signed 11/22/95
ARIZONA, U.S.A.

SPECIAL PROBLEMS REPORT NO. 1
UPPER EAST MARICOPA FLOODWAY (UEMF)
FLOODPLAIN DELINEATION STUDY
FCD NO. 94-26

1.0 INTRODUCTION

The Upper East Maricopa Floodway's (UEMF) scope of work involved performing a detailed hydraulic analysis for the 100-year floodplain from Brown Road upstream along the RWCD Canal to McKellips Road. This study scope (Scope Item No. 6.4) requested that the hydraulic analysis be "compatible with the previous study of the East Maricopa Floodway to the south of the proposed study area and shall tie into the FEMA approved delineation to the south".

2.0 PROBLEM STATEMENT

The existing effective FEMA delineation along the RWCD Canal from Panel 2205 (Effective Date: 9/4/91) and Panel 2215 (Effective Date: 12/3/93) of 4350 for Maricopa County shows the study reach (McKellips Road to Brown Road) and the area to the south (to the map limits as a Special Flood Hazard Zone A. No 100-year base flood elevations are discharges are provided for this approximate 100-year Zone A zone. The Zone A floodplain width is shown as approximately 200 feet near Brown Road and to the south, which is compatible with this study's results.

A problem was revealed when the Soil Conservation Service (SCS) Reach 6 RWCD Floodway (Now East Maricopa Floodway) hydraulic analysis (Reference 1) was compared with this study's results. The main channels design Manning's 'n' value for aged condition was 0.025. Approximately six, 2-3" thick three-ring binders of design consultant notes (Reference 1) were reviewed. Pertinent excerpts from this data are included in Appendix A.

Design notes on design Manning's 'n' values, freeboard and design vegetative cover for the channel were limited. Excerpts from the computer hydraulic analysis for the aged condition 100-year discharge is included in Appendix A (Page A-27 - A-45). On Page A-30 the input is noted where channel 'n' values of 0.025 are used for the channel on each side of Brown Road, and an 'n' = 0.013 was used for the 2 - 8' x 8' x 114' box culverts modelled.

On Page A-49 (4th Paragraph), a reference to design freeboard indicates that one foot freeboard from lowest bank of channel or one foot within box culverts was required.

On Page A-51, (Bottom Paragraph) Manning's 'n' values for the channel of 0.02 for as-built were noted with aged condition per support of NEH5 manual.

On Page A-53 is a Table 5.4-1 obtained from NEH5 which appears to be the source of the 0.025 'n' value.

A-N West's initial estimate of Manning's 'n' value for the SCS East Maricopa Floodway (EMF) channel at Brown Road and to the south was 0.06 per Hydraulic Parameter Estimation Report (Reference 4) of 9/95. The bank's of the channel contained shrubs of several feet height. The channel invert which was designed at longitudinal slope 0.0001 1/Ft appeared to pond water and the bottom contained a good growth of grasses to several feet height.

The EMF was landscaped (Reference 2) sometime after 6/26/95 by the FCDMC. The landscape plan called for grasses and shrubs on the sideslopes of the EMF, with some wetland plant materials to be planted on portions of the invert by others.

The 'n' value of 0.06 was utilized by A-N West in initially modelling the East Maricopa Floodway. The SCS design discharge of 1200 and 900 cfs downstream of Brown Road were used to establish water surface elevations.

Section 21.213 was field surveyed to obtain a cross-section beyond mapping limits, downstream of Brown Road which could aid in establishing starting water surface. Section 21.307 was also field surveyed.

Detailed hydrology (Reference 3) for this study was performed from Brown Road upstream. The detailed study 100-year discharge was utilized through the Brown Road culverts and upstream. The SCS design discharges of 1200 and 900 cfs were utilized downstream of Brown Road.

Figure 1, profiles shows the HEC-2 model results by A-N West for 'n' values of 0.06, 0.05 and 0.025. The initial 0.06 'n' value profile resulted in backwater upstream to Section 21.817. The resulting 100-year WSEL of 1349.22 for 'n' = 0.06 is at the finished floor elevation of 1349.2 for an existing house on the east side of the channel at this section.

A-N West's initial 'n' value estimate was based on an estimated 6 foot flow depth in the EMF. Since the HEC-2 model analysis at n = 0.06 was producing flow depths of 10 feet it seemed prudent to re-evaluate the selected 'n' value for the greater depth. The relative effect of greater depth to the vegetation was to reduce the 'n' value. A trial run at 0.05 'n' value was made. The Hydraulic Radius (R) for the channel (defined as flow area divided by channel bank to bank top width) was estimated at Sections 21.213 as 7.5 feet with channel velocity of 1.13 fps.

Based on the Chow's Handbook Figure 7-14 'n' value estimation chart, Page A-57, using a Velocity (V) times (R) of 8.6 results in an 'n' = 0.05 for a high vegetal retardance. This chart was initially used in estimating the 0.06 'n' value A-N West (Reference 4).

The 100-year water surface profile for 'n' = 0.05 has also been plotted on Figure 1. Backwater does no proceed upstream of Section 21.544, the Princess Basin outlet embankment for this 'n' value.

Also plotted on Figure 1 is the 100-year water surface profile by this study's HEC-2 model at 'n' = 0.025. One SCS elevation benchmark is also ERM - 4 for this study. To adjust SCS datum to this study mapping (NGVD29) add 0.79 feet to the SCS data. To further compare the SCS computer hydraulic results to this study's HEC-2 model, the SCS water surface and invert's results (Reference 1) were adjusted to NGVD29 datum and plotted on Figure 1.

The 'n' = 0.025 water surface profiles are within 0.25 feet where common design discharges exist downstream of Brown Road. The channel inverts are within 0.2 feet at the box culvert and vary by 0.2± feet upstream and downstream of Brown Road. The 'n' = 0.025 profiles compare favorably from this study to the SCS designs. The small differences are attributed to construction tolerance from design and plan, local scour and deposition.

3.0 CONCLUSION AND RECOMMENDATIONS

The existing EMF channel 'n' value from Section 21.213 to 21.513 (excluding Brown Road culverts) is recommended to be 0.05 for the UEMF FIS.

The difference in 100-year SCS design to existing water surface profile elevations of 3.0± feet in this reach is explained by the effect of vegetation which has occurred. Since the original design, which did not assume significant vegetation.

The higher 'n' value 100-year water surface profile of 0.05 still results in the floodplain essentially contained within the EMF right-of-way for the limits of this study with no backwater into the Princess basin. No flooding of adjacent houses along the EMF was expected within the study reach.

It is recommended that the operation and maintenance of the EMF by the FCDMC include limiting or reducing further vegetation growth within the EMF, such that the 'n' value and resultant water surface elevations does not increase further.

4.0 REFERENCES

1. Final Design Folder (3-Ring Binder) For SCS (Soil Conservation Service) RWCD (now EMF) Reach 6, Contract No. 53-9457-00469, Job No. E 101012, December, 1986 by Greiner Engineering Services, Inc.

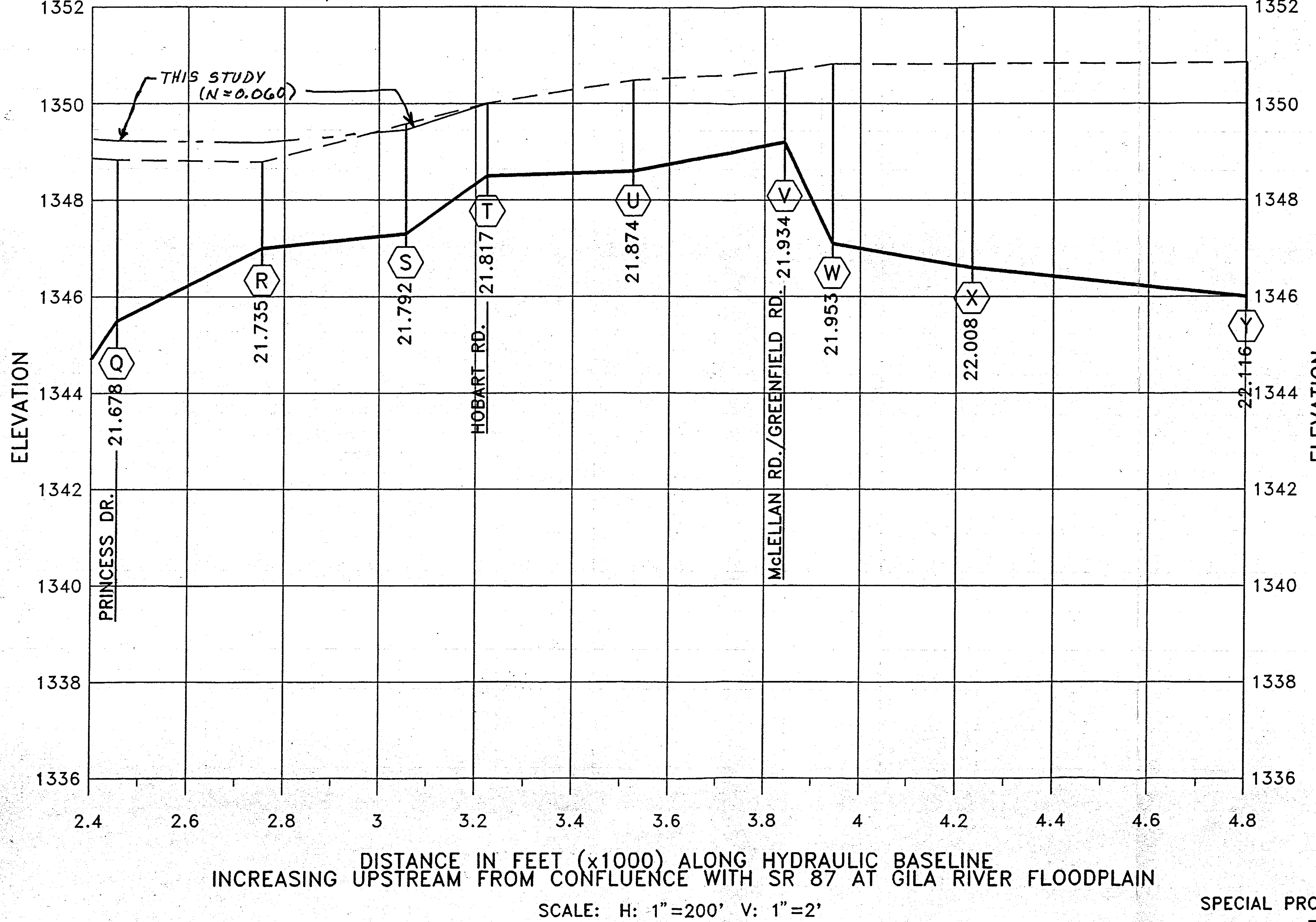
   Also under separate cover by Greiner Engineering; Input/Output to Hydraulic Backwater Computer Program, "Water Surface Profile Edit Program Version 03.01", Input File Name: rwcd_t2.dat, Date: 6/17/86, for 100-year Design Flows Hydraulics for Main Channel, Trial No. 2 RWCD, Reach 6, Preliminary Design.

2. Landscape Plans for RWCD Floodway, Reach 6 (East Maricopa Floodway) by DMJM for Flood Control District of Maricopa County 100% Submittal Seal and Submittal Dates: 6/26/95. (32 Sheets).

3. Hydrology Report for Upper East Maricopa Floodway (UEMF) by A-N West, Dated: September, 1995, Revised October, 1995 for FCDMC and City of Mesa FCD No. 94-26.

4. Technical Data Notebook; Upper East Maricopa Floodway FIS, Section 4.2, Field Reconnaissance and Hydraulic Parameter Estimation Report, FCD No. 94-26 by A-N West; Dated, September, 1995.

A-N West No. 7158-03, FCDMC No. 94-26

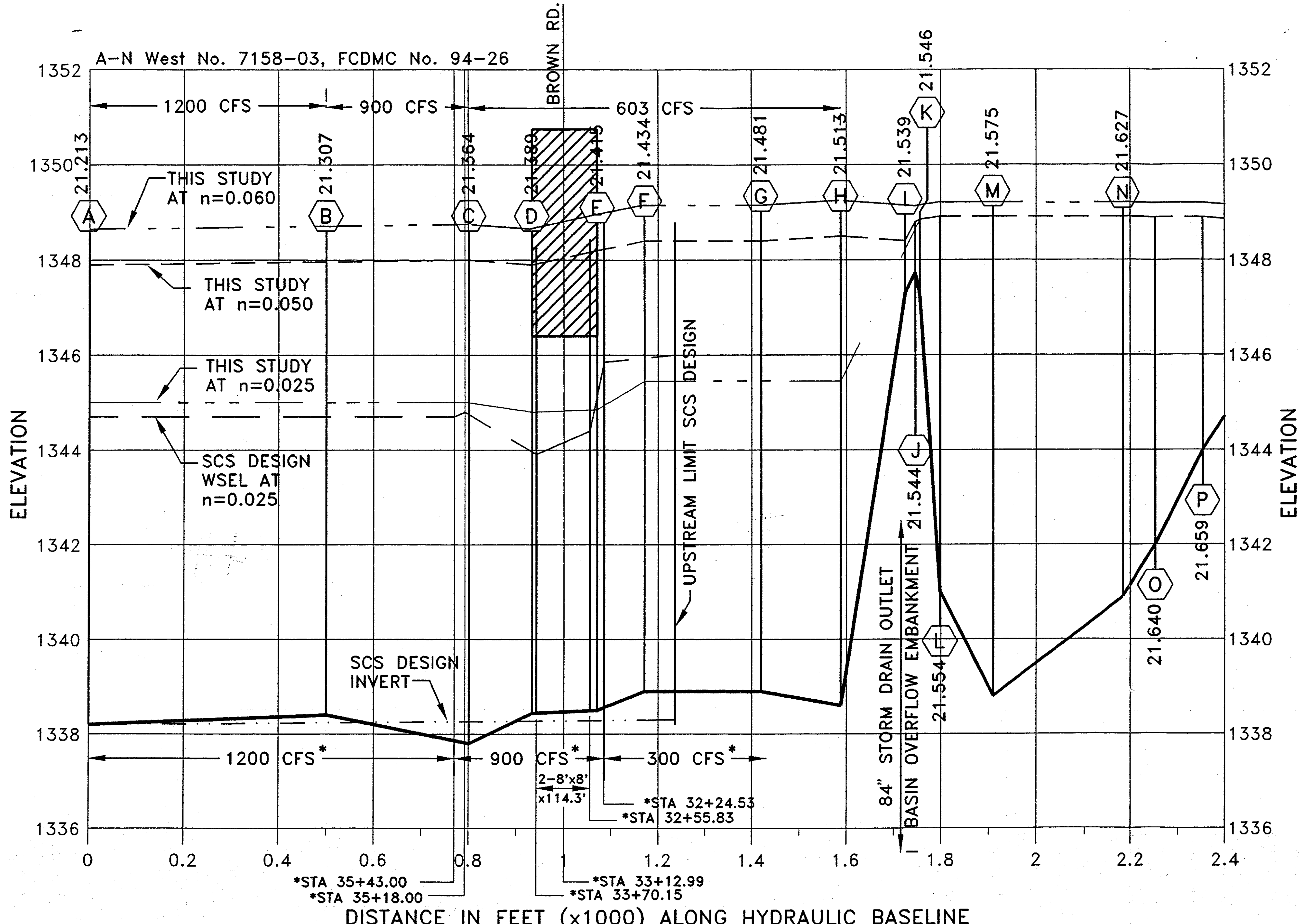


FLOOD PROFILES
FEDERAL EMERGENCY MANAGEMENT AGENCY
UPPER EAST MARICOPA FLOODWAY F.I.S.
CITY OF MESA, MARICOPA COUNTY, ARIZONA

LEGEND
100 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

02 P
EXHIBIT 1

SPECIAL PROBLEM REPORT No. 1
FIGURE 1



FLOOD PROFILES
FEDERAL EMERGENCY MANAGEMENT AGENCY
UPPER EAST MARICOPA FLOODWAY F.I.S.
CITY OF MESA, MARICOPA COUNTY, ARIZONA

01 P
EXHIBIT 1

NOTE:
* THESE STATIONING AND DISCHARGES ARE FROM SCS EMF DESIGN

SPECIAL PROBLEM REPORT No. 1
FIGURE 1

Appendix A

Greiner

Greiner Engineering Sciences Inc.

7310 N. 16th Street, Suite 160
Phoenix, Arizona 85020

FINAL DESIGN FOLDER FOR SCS RWCD FLOODWAY REACH6

CONTRACT NO.
53-9457-00469

JOB NO. E 101012

DECEMBER, 1986

United States
Department of
Agriculture

Soil
Conservation
Service

201 E. Indianola Avenue
Suite 200
Phoenix, Arizona 85012

Subject: ENG - EMF Reach 6
O&M Plan and Agreement

Date: October 30, 1990

To: Larry Flintie
State Administrative Officer

File Code: 210

Although letters of transmittal are in the files, neither the Flood Control District or the SCS can find the Operations and Maintenance Plan and Agreement for the subject project.

We have written a new O&M Plan and prepared our Agreement (enclosed) for transmittal to the FCD for signatures.

John M. Harrington

JOHN M. HARRINGTON
State Design Engineer

Enclosure

cc:
Ralph Arrington, SCE
Bart Ambrose, ASTC (P)

OPERATION AND MAINTENANCE PLAN
FOR
EAST MARICOPA FLOODWAY - REACH 6
(Formerly RWCD Floodway)

This plan applies to East Maricopa Floodway (EMF), Reach 6 along with all associated works of improvement. The Flood Control District of Maricopa County is responsible for the features covered under this plan.

GENERAL

The East Maricopa Floodway was enlarged and extended under this project to reduce frequency and extent of inundation of developed lands within the watershed. This reach is the sixth of six planned and extends from Station 29+08 near Brown Road to Station 161+30 near Broadway Road.

A regular program of inspection and maintenance will point out areas that need to be monitored closely. This program will ensure that excessive erosion, sedimentation or destruction of the floodway or appurtenances are prevented from occurring.

While no improvements in this reach require control or operation, maintenance is essential for the project to function as intended over its design life. Identified maintenance items are listed below.

MAINTENANCE

Main Channel - It is anticipated that some erosion and deposition will occur within the floodway right-of-way. The reach between Station 128+79 and Station 140+00 shall be monitored for evidence of erosion of the bed and banks. The channel downstream from Brown Road shall be monitored where continuous presence of nuisance water softens the channel bottom, making it vulnerable to erosion. Unidentified localized areas of dispersive soils may exist. Timely maintenance is particularly critical in the following locations of higher turbulence and stress:

Along the channel bottom at the toe of the channel slopes.

Adjacent to ramps, bridge piers and other discontinuities in the channel geometry.

Adjacent to side inlets and culvert outlets.

Adjacent to transition areas for bridge and box structures.

Make repairs to eroded areas by replacing lost material with compacted earth, soil-cement or other suitable erosion-resistant material in accordance with the design report and the original construction specifications. SCS assistance is available in determining the extent of repair needed or suitability of differing materials.

Remove deposits of loose material in the channel following significant flow events and successive small events. Remove or destroy excessive woody vegetation within the flow area of the channel and side inlets. Also, remove any trash or other objects dumped in the channel.

Inspect the concrete channel lining under the Broadway Road bridge for evidence of uplift and report to SCS for recommendations on remedial action. Repair all cracking and chipping of this section by using the following methods.

Only those cracks that are open wide enough to permit the entry of a pourable joint filler or a mechanical routing tool should be filled. Tightly closed cracks should be left alone. Each side of the open crack must be refaced so that the surfaces are completely free of dust, dirt, debris, and anything else that might prevent bonding of the new filler material.

Special tools such as random-cut saw or crack grinders and vertical-bit routers should be used. The crack should be refaced for one inch minimum or full depth without deepening, whichever is less, and then blown out with compressed air immediately ahead of refilling.

High-strength epoxy resin adhesives should not be used to rebond and seal any cracks where subsequent appreciable movement is expected, since this could lead to cracking elsewhere in the lining. A flexible epoxy or an elastomeric filler should be used in cracks that move.

Concrete chips should be removed. A saw cut should be made around the chipped area, and material removed to create a squared-off recess which will accommodate repair. Exposed surfaces shall be blown clean with compressed air. A coating of bonding grout shall be applied and patching mortar compacted in place, finished and wet cured.

Particular care should be taken to ensure that the texture and color of the repair will match the surrounding concrete.

Repair cracks and damaged areas of the soil-cement. Cracks wider than about 1/8 inch should be filled. The cracks should be cleaned thoroughly and all spalled pieces of surface removed. The cracks should then be filled with a suitable joint sealant material. If it is necessary to replace any areas of soil-cement, the replacement shall be for the full depth, with vertical cuts, using either soil-cement or colored concrete. No skin patches should be permitted. Particular care should be taken to ensure that the texture and color of the repair will match the surrounding soil-cement.

<u>Side Inlets and Collections Systems</u> - Inspect the soil-cement lining for evidence of uplift, settling or displacement or loss of drainfill within the spillway area. Check for evidence of excessive erosion within the collection systems and approach channels that could lead to undermining of spillway structure and repair using the same methods as specified under the main channel. Remove accumulations of debris and sediment to ensure the discharge capabilities of the side inlets. Note any damage or

deterioration of the maintenance road in the collection system, and regrade or fill as necessary. Replace animal guards in the soil-cement spillway drains if necessary.

Examination should be made of the box culvert structure and the concrete channel located south of Apache Boulevard and the headwalls at Station 36+02.00 and 92+04.61. Remove debris, trash and other obstructions. The concrete surfaces should be examined for erosion, cracks, joint separation or leakage at cracks or joints. Cracks or chips in the channel lining or floor of the box culvert or headwalls should be repaired using the same methods as specified for concrete channel lining in the main channel. Concrete for the repair should be similar to the old concrete in maximum size of aggregate and water cement ratio.

Forming shall be required for large repairs in vertical surfaces.

Particular care should be taken to ensure that the texture and color of the concrete repair will match the surrounding concrete.

Where joint filler has failed, the old filler shall be cut and removed to a depth that will accommodate new sealant plus any backer rod that is to be inserted. The same procedures and sealant materials for filling cracks should be used for refilling joints.

Pipe handrails and pipe barriers should be inspected and repaired as needed. Weld or reweld breaks. Clean away rust with wire brush and paint with galvanizing paint. Replace broken or rusted hinge pins, shearpins, nuts and miscellaneous items with new galvanized parts.

<u>Collector Channel and Pipe Inlets</u> - Remove debris and sediment from the collector channel and pipe inlets on a regular periodic basis and following significant channel flows. The inlet structure and all features should be examined for any conditions which may impose constraints on their proper functioning. The collector channels should be regraded as necessary, replacing lost material from any eroded areas with compacted earth. Pipe inlets should be inspected and repaired as needed. Weld or reweld breaks. Replace broken or rusted bars, bolts, nuts and other items as necessary to maintain the steel trash rack and corrugated metal pipes. Rusted items not requiring replacement should be cleaned with wire brush and coated with galvanizing paint. All steel replacement items should be galvanized.

Inspect the maintenance roads for ruts left by passage of maintenance vehicles and regrade with a cross slope of 1.75% into the collector channel as necessary.

<u>Fencing</u> - Repair or replace any damaged or destroyed fencing. Repaint exposed metal surfaces as necessary.

<u>Bridges, Box Culverts and Utilities</u> - Inspect for signs of stress or undercutting of support structures or other problems that may affect safe performance of bridges, box culverts or utilities within the flood-way-right-of-way. Report any items noted to appropriate owners.

Vegetation - Remove vegetation which will affect flow in the inlet structures or channels. Remove all vegetation, such as shrubs, bunch grasses, etc., which might create turbulent flow.

State O&M Handbook - The SCS National Operation and Maintenance Manual and the SCS State of Arizona Watershed Operation and Maintenance Handbook are herein incorporated as part of this Operation and Maintenance Plan.

OPERATION AND MAINTENANCE AGREEMENT

THIS AGREEMENT made on ___________ day of ____________ is between the Soil Conservation Service, United States Department of Agriculture, hereinafter referred to as SCS, and the following organizations(s), hereinafter referred to as the Sponsor(s):

The Flood Control District of Maricopa County

The Sponsor(s) and SCS agree to carry out the terms of this agreement for the operation and maintenance of the practice in the State of Arizona. The practices covered by this agreement are identified as follows:

East Maricopa Floodway Reach 6

I. GENERAL

A. The Sponsor(s) will:

1. Be responsible for operating and performing or having performed all needed maintenance of practices, as determined by either SCS or the Sponsor(s), without cost to SCS.

2. Obtain prior SCS approval of all plans, designs, and specifications for maintenance work deviating from he O&M plan and of plans and specifications for any alteration to the structural practice.

3. Be responsible for the replacement of parts or portions of the practice(s) which have a physical life of less duration that the evaluated life of the practice(s).

4. Prohibit the installation of any structure or facility that will interfere with the operation or maintenance of all or any part of the project practice(s).

5. Notify SCS of any agreement to be entered into with other parties for the operation or maintenance of all or any part of the project practice(s), and provide SCS with a copy of the agreement after it has been signed by the Sponsor(s) and the other party.

6. Comply with the PROPERTY MANAGEMENT STANDARDS set forth in 7 CFS 3015.160-3015.176, and all applicable federal, state and local laws.

7. Provide SCS personnel the right of free access to the project practice(s) at any reasonable time for the purpose of carrying out the terms of the agreement.

B. The SCS will:

1. Upon request of the Sponsor(s) and to the extent that its resources permit, provide consultative assistance in the operation, maintenance, and replacement of practices.

II. OPERATION AND MAINTENANCE PLAN (O&M PLAN)

An O&M plan for each practice included in this agreement is attached to and hereby becomes a part of this agreement.

III. INSPECTIONS AND REPORTS

A. The Sponsors(s) will inspect the practices as specified in the O&M plan.

B. SCS or Federal land-administering agency may inspect the practices at any reasonable time during the period covered by this agreement. At the discretion of the State Conservationist, Service personnel may assist the Sponsor(s) in inspections.

C. A written report will be made of each inspection and provided to others as outlined in the O&M plan.

IV. TIME AND RESPONSIBILITY

The Sponsor(s)' responsibility for operation and maintenance begins when a practice is partially done or completed and accepted or is determined complete by SCS. This responsibility shall continue until the expiration of the evaluated life of all the installed project practices. This does not relieve the Sponsor(s)' liability which continues throughout the life of the measure or until the measure is modified to remove potential loss of life or property.

V. RECORDS

The Sponsor will maintain in a centralized location a record of all inspections and significant actions taken, cost of performance and completion date with respect to operation and maintenance. The SCS may inspect these records at any reasonable time during the term of the agreement.

VI. EFFECTIVE DATE

This agreement shall become effective on the date it is filed with the Secretary of State pursuant to Arizona Revised Statutes 11-952, as amended.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

By: ______________________________

Title: ______________________________

Date: ______________________________

This action was authorized at an official meeting of the Sponsor named immediate above on ______________ at ______________.

Attest: ______________ Title:

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

By: ______________________________

Title: ______________________________

Date: ______________________________

INDEX

Greiner

December 1, 1986

Re: Soil Conservation Service
RWCD Floodway Reach 6
Buckhorn - Mesa - Apache Junction -
Gilbert Watersheds
Final Design Report
Contract No. 53-9457-00469
Greiner Job No. E-101-012

List of Deliverables

- One (1) set of sepia mylars of the construction drawings.
- Seven (7) sets of blue line construction drawings.
- Two (2) copies of the design folder including the construction performance schedule and time estimate, the final cost estimate and bid schedule, and the Operation and Maintenance agreement.
- Two (2) sets of final construction specifications.
- One (1) set of final tractive power calculations.
- One (1) set of computer printouts for:

  Box culvert south of Apache/Higley for 50% Q_{100}.
  Hydraulics for side inlet at Transmission Line Easement.
  Final hydraulics for 54" concrete pipe south of Brown Road.

- Final earthwork calculations
- One (1) set of sepia mylars for the survey control data.
- Two (2) sets of blue line prints for the survey control data.

Work Completed in the Preliminary Design Phase.

1. Final hydraulics for the main floodway for the Q_{100} and the 50% Q_{100}.

2. Final hydraulics for the twelve (12) major inlet structures.

3. Final hydraulics for the east and west side collector channels.

4. Erosion protection for the main floodway, major side inlets and collection systems for the major side inlets.

5. Final earthwork calculations for the main floodway.

6. Preparation of preliminary specifications, including soil-cement specifications.

7. Computations of quantities and preparation of the preliminary cost estimates and bid schedule.

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8. Preliminary construction drawings including:

   a. Revision to the right-of-way north of Brown Road.

   b. Adjustments to the construction centerline due to the changes by the Flood Control District in their final design of the structure at Apache/Higley.

   c. Establishing final grades for the east and west side collector channels.

   d. Finalize the design for the floodway invert and the tops of banks.

   e. All utilities crossing the floodway have been plotted in profile on the one hundred (100) scale construction drawings.

   f. All the temporary construction easements (TCE) have been identified on the plan portion of the one hundred (100) scale construction drawings.

   g. All utilities needing relocation have been identified on the plan portion of the one hundred (100) scale construction drawings.

   h. Typical sections have been completed.

   i. Side inlet and floodway transition details have been completed for:
      -- Sta. 29+00.00 to Sta. 37+00.00
      -- Sta. 39+00.00 to Sta. 80+00.00
      -- Sta. 87+00.00 to Sta. 95+00.00
      -- Sta. 143+00.00
      -- Sta. 117+74.12 to Sta. 131+00.00
      -- Sta. 150+00.00 to Sta. 158+90.67

   j. Typical side inlets and maintenance ramp details have been completed.

   k. Headwall details for outlet pipes at Station 92+40.61 and 36+02.00 are completed.

   l. Erosion protection for outlet pipes at Station 92+40.61 and 36+02.00 are completed.

   m. Channel lining details at Broadway Road Bridge is completed.

   n. Soil-cement erosion protection detail is completed.

   o. Typical collector channel inlet including trash rack detail is completed.

   p. Concrete pipe collar detail is completed.

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Work Completed in Final Design Phase.

1. Prepare final specifications.
2. Computation of final quantities and preparation of final cost estimates and bid schedule.
3. Prepare construction performance schedule.
4. Prepare operation and maintenance plan.
5. Prepare final design report and design folder.
6. Structural design for the two (2) barrel 6'x7' RBC inlet and headwalls south of Apache Blvd.
7. Revise the structural design for the concrete lined channels south of Apache Blvd. and under the Broadway Road Bridge.
8. Hydraulic calculations and final design for all major inlet structures including erosion protection.
9. Final construction drawings including:
   a. Barrier details for the outlet pipes at Station 92+40.61 and 36+02.00.
   b. Structural details for the two (2) barrel 6'x7' RCB inlet and headwalls south of Apache Blvd.
   c. Revise the structural detail for the concrete lined channels south of Apache Blvd and under the Broadway Road Bridge.
   d. Manhole adjustment and watertight frame and cover details for manholes within the collection system for some of the major side inlets.
   e. Curb cut details for driveways for the maintenance roads at University Drive and Broadway Road.
   f. Backfill, pavement and surface replacement details for some of the existing roadways.
   g. Erosion protection details for the collector channel inlets and pipe connections from adjacent subdivisions.
   h. Clearing and grubbing limits for the collection system for the major side inlets.
   i. Removal items for existing structures called out on the plans.

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j. Excavation and backfill pay limits for all structures.

10. A prism for excavation has been identified in the final design folder, so that permitting can take place within the floodway to remove excavation.

11. A temporary construction easement has been identified north of Brown Road, west of the most westerly right-of-way and for approximately thirty (30) feet north of the most northerly right-of-way to grade to the existing ditch on the east side of the RWCD canal maintenance road and to construct the north floodway terminus, respectively.

12. The power pole at approximate Station 31+50, 55 feet right (north of Brown Road) must be relocated (by others).

13. Certain locations have been identified along the west side of the floodway where an agreement for a joint maintenance road with the RWCD canal maintenance road is needed. The locations are as follows:

-- Sta. 59+17.36
-- Sta. 70+19.36
-- Sta. 117+72.36
-- Sta. 133+69.36
-- Sta. 151+73.92

Description of Job

Major features are:

1. An excavated earth floodway channel extending approximately 13,222 feet on centerline from the end of the sedimentation basin at Leisure World approximately 530 feet south of Broadway Road at Sta. 161+30 to Sta. 29+08 at the upstream end approximately 405 feet north of Brown Road.

2. Thirteen (13) major side inlet structures have been designed for this project. Ten (10) of these structures are designed with a collection system picking up overland flows from streets or an existing retention facility and delivering flows to side inlets notched into the east bank of the floodway. The other three (3) inlets are culverts discharging storm drain facilities from the City of Mesa or the Flood Control District of Maricopa County to the RWCD Floodway.

3. At the north terminus of the floodway an inlet conveys overland flows and intercepts flows from a ditch on the east side of the RWCD Canal and discharges flows into the entrance of the floodway.

4. Soil-cement has been utilized for all erosion protection for the major inlet structures and their collection systems, outlet for the 36" pipe south of University Drive and protection for the main floodway banks and

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bottom. A plating method was designed for all areas which have a maximum side slope of 3:1. A stair step method was designed for all side slopes steeper than 3:1. A concrete lining was designed for the inlet channel south of Apache Blvd. and for the floodway underneath the existing Broadway Road Bridge. A concrete basin has been designed for outlet protection for the 54" concrete pipe south of Brown Road.

5. Channel grades and sections per the Comparative Design Study have been utilized during the final design phase.

Design Objective

The floodway design objective is to safely and economically convey flood flows from the project area, thereby reducing flood water damage on urban land.

Basis for Design

Work Plan
SCS TR-20 RWCD Floodway Reach 6, May, 1985
Greiner Engineering Comparative Design Study for Reach 6
SCS National Engineering Handbook Sections 5, 6 & 20
SCS Design Folder A & E Contract Reach 6
SCS RWCD Channel Stability Analysis & Erosion Study
Soil Mechanic Report RWCD Floodway Reach 6
Geologic Report RWCD Floodway Reach 6
SCS, Design of Open Channels TR-25
Soil-Cement for Water Resources, Portland Cement Institute
Soil-Cement Application and use in Pima County for Flood Control Project
SCS National Engineering Manual
SCS TR-55
Road and right-of-Way Location by the Flood Control District
Engineering Design Standards - Far West States
SCS TR-67
SCS TR-5

Location and Layout

The channel alignment parallels and adjoins on the east of the RWCD Irrigation Canal throughout Reach 6. The alignment was based on the original work plan by SCS dated October 1974, with the amendments due to Modification No. 3 and No. 4 of Greiner's contract.

The design of major inlet structures and collection systems on the east side of the floodway are to collect off-site drainage.

The east and west side collector channels were designed to drain the storm water between the maintenance road and the right-of-way.

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Hydrology

Design flows were obtained from the final hydrology meeting with SCS using the Alternative No. 3 condition. The design flow is a 100-year, 24-hour storm event. Design flows in the floodway varies from 300 cfs to 2,400 cfs. For further documentation of design flows in the floodway see the Comparative Design Study.

Hydrologic analysis was performed to establish peak flows for subdivisions adjacent to the floodway. This was done by using the SCS's TR-20 program. The range of design flows for major side inlets is from 17 cfs to 727 cfs.

The rational method was used for hydrologic design of the east and west side collector channels. The 100-year, 24-hour storm event with a rainfall depth of 3.40 inches was utilized.

After re-analysis of the drainage from Apache Trail Mini Park, it was determined that the retention basin has the adequate capacity to handle the 100-year, 24-hour storm event. Therefore, there is no need for the design of a new side inlet from this subdivision.

Hydraulic Design

1. The Main Channel

   The channel geometry and grade were based on the recommendation in the Comparative Design Report, with minor changes in design. Adjustment to the centerline of the floodway was made between Sta. 129+98.28 and Sta. 117+74.12 due to the final design of the Flood Control District structure at Apache/Higley Road. Channel inverts were adjusted in this reach. A side slope of 3:1 adjacent to the north/east end level wingwall was used at the upstream side of this structure. The toe of the right embankment in the transition north of Apache/Higley Road has been revised as per Soil Conservation Service comments in the preliminary design review.

   The north/east tapered wingwall of the proposed Brown Road box culvert has been changed to a level wingwall approximate 25 feet in length. The reason was that a revision was made to the rights-of-way north of Brown Road.

   Water surface profile calculations in the floodway were performed with design flows of Q_{100} for aged condition and with design flows of 50% of Q_{100} for as-built conditions.

2. Major Side Inlets

   Water surface profile calculations for high flow and low flow in the floodway were performed to finalize the design of twelve major side

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inlets. Ten (10) of these structures consist of a collection system and a spillway. Final sizing of the spillway for these structures was based on the assumption that maximum allowable velocity of 15 fps in the spillway for the low flow condition in the floodway. The spillway ties into the invert of the floodway with an invert slope of 3:1. An invert slope of 5:1 was used for side inlet structures north of University Drive, north of Apache Blvd, and at the Transmission Line Easement. The inlet at the north terminus of this project has a spillway invert slope of 0.0381 ft/ft.

The concept of shifting the maintenance road over the weir portion of the side inlet was used at Sta. 143+66.00. This eliminates the removal of existing 42" pipe and headwall. The side inlet at Sta. 150+66.00 was re-designed to pick up the storm water within the right-of-way line.

Final sizing of the box culvert south of Apache Blvd. for Modification No. 4 of Greiner's contract was achieved. Selected structure is a double barrel 6'x7' box culvert with wingwalls. The box culvert with 29 lineal feet in length has an invert slope of 0.0353 ft/ft. The structural design has been performed as per SCS requirements.

3. Collector Channels

The grade for the east and west side collector channels was designed to reflect the new top of banks of the floodway and to assure reasonable velocities. The hydraulic design for the east collector channel also assures that the water will not get outside the east right-of-way. Two summary tables show the design of the collector channels and are included in Section 4 of the final design folder.

Erosion Protection

1. Main Floodway

Areas within the floodway have been identified using the tractive power method to establish the limits of erosion protection. Soil-cement as recommended in the Comparative Design Study is used for this purpose. The bottom of the floodway is to be plated with 2-6" lifts of soil-cement which extend 3' beyond the toe of the left and right embankment. The embankments are plated with 8" soil-cement in areas with side slopes of 3:1 and the stairstep method of placement is used with 8' wide x 8" thick layers on slopes steeper than 3:1. Cutoff walls are used on all sides of the soil-cement.

2. Major Side Inlets

The side inlets were evaluated using the tractive power method for assessing the need for erosion protection. The upstream end of the collector systems were plated with 8" soil-cement which extends from the

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R/W to the toe of the inlet and typically 5' beyond the toe of the inlet and further if erosive conditions were indicated. Other areas within the collection system were evaluated and erosion protection was applied accordingly. The upstream side of the spillway was protected for a distance of 14' upstream of the crest in most cases. If the velocities were high enough to create erosive conditions, then it was extended. The spillway area is protected with 8" soil-cement and an outlet apron was designed to extend a distance beyond the toe such that the velocity dropped below erosive conditions. The flare angle on the apron is 12.5°. Cutoff walls are used on all sides of the structures. A soil-cement apron was also designed for the 36" pipe south of University.

Conrete channel lining is used underneath Broadway Road Bridge and upstream of the 2-6'x7' box culvert south of Apache.

3. Collector Channels

Erosion protection for the collector channel outlet structures consist of an 8" soil-cement apron 10' in length and 3.5' wide at the upstream end with a flare angle of 12.5°. A cutoff wall is provided around the perimeter of the outlet apron.

Design Folder

The design folder is set up with eight (8) sections as follows:

Section 1 - Design Report, O & M Manual, Const. Perf. Schedule
Section 2 - Hydraulics for Main Floodway
Section 3 - Hydraulics for Side Inlets
Section 4 - Hydraulics for Collector Channels
Section 5 - Erosion Protection
Section 6 - Earthwork Calculations
Section 7 - Structural Calculations
Section 8 - Quantities, Cost Estimate, and Bid Schedule

Each section contains backup information, calculations, sketches, rationale for design decisions, results and recommenations for all design features within the Final Design Phase.

RWCD REACH 6

Operation and Maintenance Manual

OPERATION AND MAINTENANCE PLAN
RWCD FLOODWAY - REACH 6

This plan applied to the RWCD Floodway Reach 6 along with all associated works of improvement. The Flood Control District of Maricopa County is responsible for the features covered under this plan.

GENERAL

The RWCD Floodway is being enlarged and extended under this project to reduce frequency and extent of inundation of developed lands within the watershed. This reach is the sixth of six planned and extends from Station 29+08 near Brown Road to Station 161+30 near Broadway Road.

A regular program of inspection and maintenance will point out areas that need to be monitored closely. This program will ensure that excessive erosion, sedimentation or destruction of the floodway or appurtenances is not occurring.

While no improvements in this reach require control or operation, maintenance is essential for the project to function as intended over its design life. Identified maintenance items are listed below:

MAINTENANCE

Main Channel. It is anticipated that some erosion and deposition will occur within the floodway right-of-way. The reach between Station 128+79 and Station 140+00 shall be monitored for evidence of erosion of the bed and banks. Construct and extend soil-cement as needed. Unidentified localized areas of dispersive soils may exist. Timely maintenance is particularly critical in the following locations of higher turbulence and stress:

Along the channel bottom at the toe of the channel slopes.

Adjacent to ramps, bridge piers and other discontinuities in the channel geometry.

Adjacent to side inlets and culvert outlets.

Adjacent to transition areas for bridge and box structures.

Make repairs of eroded areas by replacing lost material compacted earth, soil-cement or other suitable erosion resistant material in accordance with the design report and the original construction specifications. SCS assistance is available in determining the extent of repair needed or the suitability of differing materials.

Remove deposits of loose material in the channel following significant flow events and successive small events. Remove or destroy excessive woody vegetation within the flow area of the channel and side inlets. Also remove any trash or other objects dumped in the channel.

Inspect the concrete channel lining under the Broadway Road Bridge for evidence of uplift and report to SCS for remedial action. Repair all cracking and chipping to this section using the following methods.

Only those cracks that are open wide enough to permit the entry of a pourable joint filler or a mechanical routing tool should be filled. Tightly closed cracks should be left alone. Each side of the open crack must be refaced so that the surfaces are completely free of dust, dirt, debris, and anything else that might prevent bonding of the new filler material.

Special tools such as random-cut saws or crack grinders and vertical-bit routers should be used. The crack should be refaced for 1-in. minimum or full depth without deepening, whichever is less, and then blown out with compressed air immediately ahead of refilling.

Tight-strength epoxy resin adhesives should not be used to rebond and seal any cracks where subsequent appreciable movement is expected, since this could lead to cracking elsewhere in the lining. A flexibilized epoxy or an elastomeric filler should be used in cracks that move.

Chipped concrete should be removed preferably by a sawcut along the perimeter (for larger areas) to at least 2-in. minimum depth, and the area blown clean. A coating of bonding grout should then be applied and the patching mortar compacted into place, finished, and wet-cured.

Particular care should be taken to ensure that the texture and color of the repair will match the surrounding concrete.

Repair cracks and damaged areas of the soil-cement and report to SCS for remedial action. Cracks wider than about 1/8 inch should be filled. The cracks should be cleaned thoroughly and all spalled pieces of surface removed. The cracks are then filled, using a hand squeegee and broom, with an asphalt-emulsion slurry or light grade asphalt mixed with fine sand. The crack should be sealed with liquid asphalt. An asphalt kettle, hand-pouring pot, and hand squeegee are the most common methods. Joint sealing compounds and heavier bodied asphalt material should be used to fill large cracks. If necessary to replace any areas of soil-cement, the replacement shall be for the full depth, with vertical cuts, using either soil-cement or concrete. No skin patches should be permitted. Particular care should be taken to ensure that the texture and color of the repair will match the surrounding soil-cement.

<u>Side Inlets and Collection Systems</u>. Inspect the soil-cement lining for evidence of uplift, settling or displacement or loss of drainfill within the spillway area. Check for evidence of excessive erosion within the collection systems and approach channels that could lead to undermining of spillway structure and repair using the same methods as specified under the Main Channel. Remove accumulations of debris and sediment to ensure the discharge capabilities of the side inlets. Note any damage or deterioration capabilities of the side inlets. Note any damage or deterioration of the maintenance road in the collection system, and regrade or fill as necessary. Replace animal guards in the soil-cement spillways if necessary.

Examination should be made to the box culvert structure and the concrete channel located south of Apache Boulevard and the headwalls at Station 36+02.00 and 92+40.61. Remove debris, trash and other obstructions. The concrete surfaces should be examined for erosion, cracks, joint separation or leakage at cracks or joints. Cracks or chips in the channel lining or floor of the box culvert or headwalls should be repaired using the same methods as specified for concrete channel lining in the Main Channel.

Concrete replacement is the desired method if there is honeycomb or deterioration in the box culvert and headwalls which goes entirely through the wall or beyond the reinforcement, or if the quantity is large. Considerable concrete removal is required for this type of repair. Excavation of affected areas should continue until there is no questions that sound concrete has been reached. Additional chipping may be necessary to accommodate the repair method and shape the cavity properly.

Concrete for the repair should be similar to the old concrete in maximum size of aggregate water-cement ratio.

Forming shall be required for large repairs in vertical surfaces.

Particular care should be taken to ensure that the texture and color of the repair will match the surrounding concrete.

Where joint filler has failed, the old filler must be cut and removed to a depth that will accommodate the new sealant plus any backer rod that is to be inserted. The same procedures and sealant materials for filling cracks should be used for refilling joints.

Pipe handrails and pipe barriers should be inspected and repaired as needed. Reweld, replace hinge pins, shearpins, nuts and miscellaneous items and regalvanize as necessary.

Collector Channels and Pipe Inlets. Remove debris and sediment from the collector channel and pipe inlets on a regular periodic basis and following significant channel flows. The inlet structure and all features should be examined for any conditions which may impose constraints on their proper functioning. The collector channels should be regraded as necessary, replacing lost material from any eroded areas with compacted earth. Pipe inlets should be inspected and repaired as needed. Reweld, replace bars, bolts, nuts and regalvanize as necessary on the trash rack steel and corrugated metal pipes.

Inspect the maintenance roads for ruts left by passage of maintenance vehicles and regrade with a cross slope of 1.75% into the collector channel as necessary.

Fencing. Repair or replace any damaged or destroyed fencing. Repaint exposed metal surfaces as necessary.

<u>Bridges, Box Culverts and Utilities</u>. Inspect for signs of stress or undercutting of support structures or other problems that may affect safe performance of bridges, box culverts or utilities within the floodway right-of-way. Report any items noted to appropriate owners.

<u>Vegetation</u>. Large dead or dying vegetation near the inlet structures that could affect flow to the inlets or in the channels should be removed. Remove all vegetation, such as shrubs, bunch grasses, etc., which might create turbulent flow.

<u>State O&M Handbook</u>. The SCS National Operation and Maintenance Manual and the SCS State of Arizona Watersheds Operation and Maintenance Handbook are herein part of this Operation and Maintenance Plan.

Hydraulics for the main floodway has been reviewed and approved by SCS for Trial #2 in Preliminary Design Report. Water surface profile calculations in the floodway were performed with design flows of Q_{100} for aged condition and with design flows of 50% of Q_{100} for as-built conditions. Design flows were obtained from the final hydrology meeting with SCS using the Alternate No. 3 condition. Flows ranged from 300 cfs to 2400 cfs for Q_{100}.

A list of contents for this section is provided as follows:

1. Summary of Design Flows in the Main Floodway.
2. Hydraulics for the Main Floodway (Trial #2).
3. Sketches of the Channel Geometry.
4. Cross Section Sketches for the Main Floodway.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job SCR RWCD Floodway Reach 6-E10101:
Description Summary of Design Flows in the Main Floodway for the Final Hydrauli
Calculated by B. Gary Sun Date 11/17/86 Sheet No. 1
Checked by M.S.B. Date of 1

Summary of Design Flows in Main Floodway

Station — Station	Q_{100}	50% of Q_{100}	Q_{10}
30+70.00 – 32+24.53 N. Brown	300 cfs	150 cfs	154 cfs
32+24.53 – 35+42.00 Brown Box	900 cfs	450 cfs	154 cfs
35+42.00 – 78+63.00 Adobe Rd.	1,200 cfs	600 cfs	193 cfs
78+63.00 – 89+51.00 Trans. Easement	1,800 cfs	900 cfs	296 cfs
89+51.00 – 93+97.84 University Dr.	1,840 cfs	920 cfs	460 cfs
93+97.84 – 120+76.00 S. of University Dr.	1,840 cfs	920 cfs	453 cfs
120+76.00 – 130+04.54 Apache, Blvd.	1,900 cfs	950 cfs	721 cfs
130+04.54 – 140+00.00 S/E. of Higley Road	2,400 cfs	1,200 cfs	1,029 cfs
140+00.00 – 161+30.00 S. of Broadway Rd.	2,400 cfs	1,200 cfs	1,014 cfs

Greiner Engineering

Greiner Engineering Sciences, Inc.

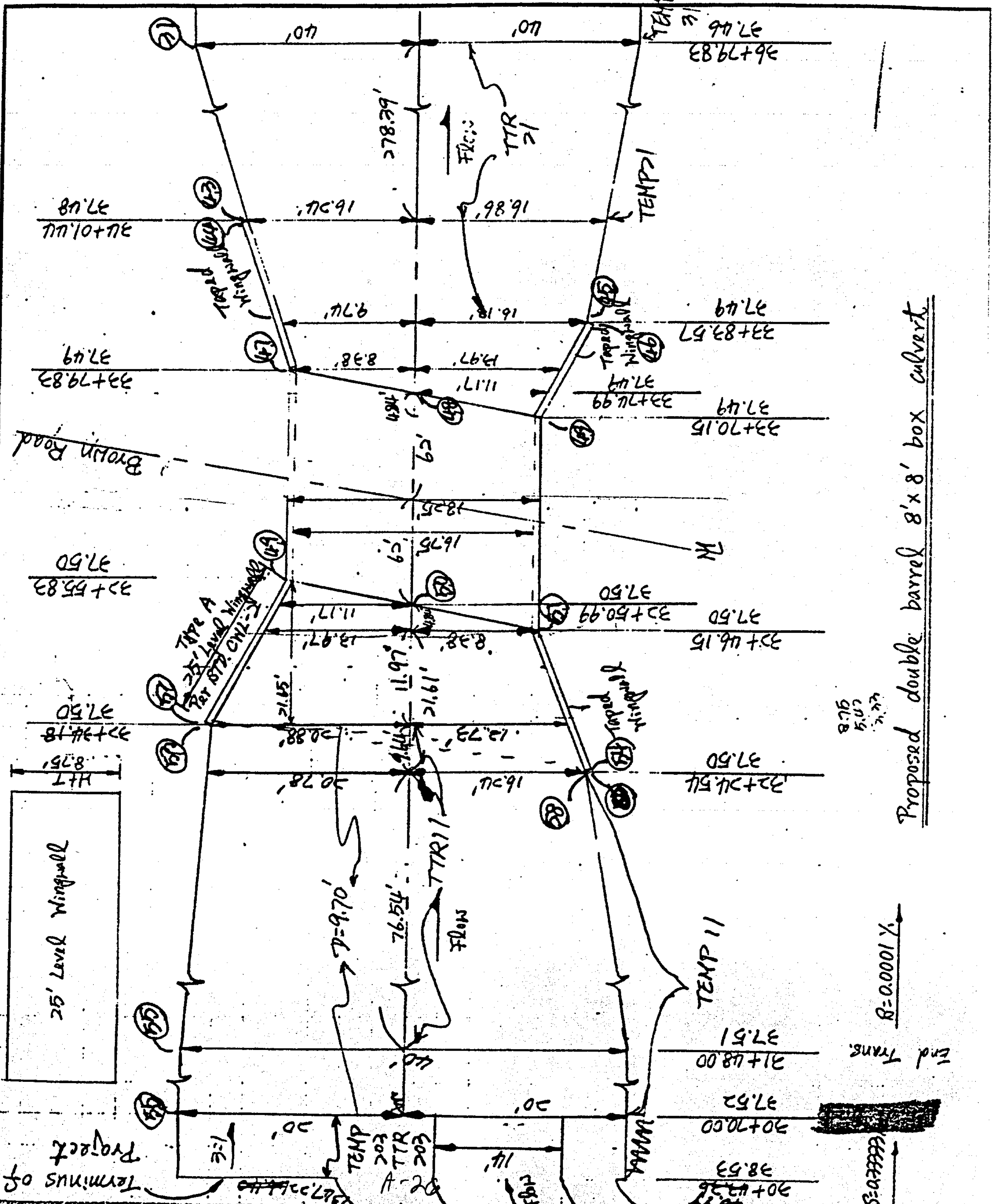
Tucson 602 327-3413
Phoenix 602 275-5400

Job [illegible]

Description Preliminary Design Hydraulics for Main Channel

Calculated by B. Gary Sun Date 4/22/86 Sheet No. 1

Checked by RB Date 10-2-86 of 5



INDEX

DESCRIPTION

Main Channel

1. RWCD_T2.DAT, RWCD_T2.OUT and Q_RWCD_T2.OUT

   Aged condition with Q_{100}, Trial #2

2. RWCD_T250.DAT, RWCD_T250.OUT and Q_RWCD_T250.OUT

   As-built condition with 50% of Q_{100}, Trial #2

Side Inlets

1. NBROWN_T1.DAT, Q_NBROWN_T1.OUT, NBROWN_T11.DAT and Q_NBROWN_T11.OUT

   North of Brown Road at Sta. 30+40.99; Q_{100} = 196 cfs

2. SBROWN_T1.DAT, Q_SBROWN_T1.OUT, SBROWN_T11.DAT and Q_SBROWN_T11.OUT

   South of Brown Road at Sta. 35+18.00, Q_{100} = 201 cfs

3. BROWN54_T1P1.DAT, Q_BROWN54_T1P1.OUT, BROWN54_T1P2.OUT, BROWN54_T11P1.DAT, Q_BROWN54_T11P1.OUT and BROWN54_T11P2.OUT

   South of Brown Road with 54" Pipe, Q_{100} = 159 cfs or 195 cfs

4. NADOBE_P1T2.DAT, Q_NADOBE_P1T2.OUT, NADOBE_P2T2.DAT, Q_NADOBE_P2T2.OUT, NADOBE_P1T21.DAT and Q_NADOBE_P1T21.OUT

   North of Adobe Road at Sta. 60+72.50, Q_{100} = 194 cfs

5. SADOBE_T1.DAT, Q_SADOBE_T1.OUT, SADOBE_T11.DAT, Q_SADOBE_T11.OUT

   South of Adobe Road at Sta. 64+04.50, Q_{100} = 116 cfs

6. NUNIV_T2.DAT, Q_NUNIV_T2.OUT, NUNIV_T21.DAT and Q_NUNIV_T21.OUT

   North of University Drive at Sta. 89+11.00, Q_{100} = 600 cfs

7. UDSD_T2.Dat, Q_UDSD_T2.OUT, UDSD_T1.OUT, UDSD_T21.DAT, Q_UDSD_T21.OUT and UDSD_T11.OUT

   South of University Drive with 36" Pipe, Q_{100} = 20 cfs

8. SUNIV_T1.DAT, Q_SUNIV_T1.OUT, SUNIV_T11.DAT and Q_SUNIV_T11.OUT

   South of University Drive at Sta. 93+98.00, Q_{100} = 133 cfs

DESCRIPTION

Side Inlets (Cont'd)

9. NW_APHIG4_DAT, Q_NW_APHIG4_OUT, NW_APHIG41_DAT and Q_NW_APHIG41.OUT

   North of Apache Blvd. at Sta. 128+63.00, Q_{100} = 727 cfs

10. SAPACHE_T1.DAT, Q_SAPACHE_T1.OUT, SAPACHE_T11.DAT and Q_SAPACHE_T11.OUT

    South of Apache Blvd. At Sta. 128+63.00, Q_{100} = 500 cfs

11. MESAP_T2.DAT, Q_MESAP_ T2.OUT; MESAP_T21.DAT and Q_MESAP_T21.OUT

    Mesa Shadows East with 42" Pipe at Sta 143+66, Q_{100} = 220 cfs

12. MSE_T2.DAT, Q_MSE_T2.OUT, MSE_T21.DAT and Q_MSE_T21.OUT

    Mesa Shadows East Spillway at Sta. 150+66, Q_{100} = 17 cfs

Collector Channels

1. E_COL2.DAT, Q_E_COL2.OUT, E_COL21.DAT and Q_E_COL21.OUT

   East collector channel

2. W_COL2.DAT, Q_W_COL2.OUT, W_COL21.DAT and Q_W_COL21.OUT

   West collector channel

Earthwork

1. RWCD_4.COM and RWCD_4.OUT

   Earthwork calculation No. 4 (without shrinkage factors)

2. RWCD_3.COM, RWCD_3.DES, RWCD_3.TER, RWCD_3.OUT and RWCD_3.FFILE

   Earthwork calculation No. 3 (with shrinkage factors)

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File _DUA1:[USERS.E101012.ENGR.SUN.PREL]RWCD_T2.DAT;3 (2774,22,0), last revised on 17-JUN-1986 07:00, is a 19 block sequential file owned by UIC [PHXGREIN,SUN]. The records are variable length with implied (CR) carriage control. The longest record is 68 bytes.

Job RWCD_T2 (1695) queued to SYS$PRINT on 10-JUL-1986 10:05 by user SUN, UIC [PHXGREIN,SUN], under account ENGR at priority 4, started on printer _OPA0: on 10-JUL-1986 10:43 from queue SYS$PRINT.


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T1 SCS RWCD REACH 6 PRELIMINARY DESIGN
T2 HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2
T3    6-17-86  ** 100 YEAR DESIGN FLOWS
SD   9820.00  30.25  1                N Values   40.05
TS   9943.00  31.20  2      .035
TS  10000.00  31.24  3      .035
R   10175.00  31.44  3      .025                      1452.53
R   10200.00  31.47  3      .025                      1452.53
R   10239.33  31.52  3      .025                      1452.53
TS  10311.00  31.60 81      .025
TS  10466.82  31.78  4      .018
BX                  64
TS  10478.66  31.80  5      .015
TS  10490.50  31.81  6      .013
R   10568.16  31.90  6      .013
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BE                  67
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TS  10698.00  32.05 82      .018
TS  10710.00  32.07 83      .018
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R   10980.00  32.38  9      .025                      1346.63
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R   13125.46  34.87  3      .025
JX  13131.72  34.88  3 74   .015   500.0     34.88        37.00
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TS  13333.92  35.20102      .025
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TS  13458.78  35.40 13      .013
TS  13553.54  35.55 14      .013
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R   13553.55  35.55 15      .013
R   13905.28  36.19 15      .013
TS  13924.78  36.23 16      .013
WE                  18
R   13944.28  36.26 18      .013
TS  14019.36  36.39 19      .013
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TS  14054.00  36.43109      .018
JX  14109.00  36.49107108   .018    60.0     36.49        90.00
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TS  14355.88  36.76 24      .025
R   15881.61  36.83 24      .025
R   16421.63  36.85 24      .025                      2456.83
R   16532.16  36.85 24      .025
R   16732.16  36.86 24      .025                      1994.99
TS  16932.16  36.89 25      .025
TS  16946.77  36.89 26      .025
BX                  86
TS  16971.74  36.89 27      .025
TS  16996.71  36.90 28      .025
R   17035.55  36.90 28      .025
TS  17060.52  36.91 29      .025
BE                  89
TS  17085.49  36.91 30      .025
TS  17179.00  36.92 77      .025
JX  17219.00  36.92 78 73   .020    40.0     36.91        90.00
TS  17259.00  36.93 79      .025
TS  17282.16  36.94 31      .025
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 R    17482.16  36.96 31          .025   Mannings
 R    18267.00  37.04 31          .025   N Value          1134.04
 JX   18317.00  37.05 31 72       .020   600.0         37.05        90.00
 R    18367.00  37.05 31          .025
 R    19623.98  37.17 31          .025
 TS   19823.97  37.19 32          .025
 TS   19823.98  37.19 33          .024
 TS   19845.59  37.20 34          .022
 WX                   35
 R    19856.98  37.20 35          .020
 TS   19856.99  37.20 36          .018
 TS   19870.41  37.20 37          .013
 R    19945.59  37.21 37          .013
 TS   19959.01  37.21 38          .018
 TS   19959.02  37.21 39          .020
 WE                   40
 R    19970.41  37.21 40          .022
 TS   19992.02  37.21 41          .024
 TS   19992.03  37.21 32          .025
 TS   20192.02  37.23 31          .025  ← Sta (SCS) 59+37.98 N. Value
 R    22587.00  37.47 31          .025  ← Sta. (SCS) 35+43  N Value
 JX   22612.00  37.48 31 71       .020   300.0         37.48        90.00
 R    22637.00  37.48 31          .025
 TS   22728.56  37.49 43          .025
 TS   22728.57  37.49 44          .024
 TS   22746.43  37.49 45          .023
 TS   22746.44  37.49 46          .022
 TS   22750.17  37.49 47          .018
 WX                   48
 R    22755.01  37.49 48          .013
 TS   22759.85  37.49 49          .013  ⎫
 R    22874.17  37.50 49          .013  ⎬ 2-8'x8' Box Culvert (N) Values
 TS   22879.01  37.50 50          .013  ⎭
 WE                   80
 TS   22883.85  37.50 51          .018
 TS   22895.82  37.50 52          .022
 TS   22895.83  37.50 53          .022
 TS   22905.46  37.50 54          .024
 TS   22905.47  37.50 58          .025
 JX   22910.47  37.50 58 42       .025   600.0         37.50        90.00
 R    22915.47  37.50 58          .025
 TS   22982.00  37.51 55          .025
 R    23060.00  37.52 55          .025  ← Sta (SCS) 30+70  N Value
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 CD    2  1                 14.80   80.00 3.60 4.18
 CD    3  1                  9.50   90.00 3.00 3.00
 CD    4  1                  9.50   36.54 1.20 1.00
 CD    5  5   1   2.00               0.00
 CD    6  6   2   2.00               0.00 0.00
 CD    7  5   1   2.00               0.00
 CD    8  1                  9.50   36.38 1.00 1.22
 CD    9  1                  9.50   81.00 3.00 3.00
 CD   10  1                  9.50   88.00 2.83 2.83
 CD   11  1                  9.50   80.00 2.05 2.05
 CD   12  1                  9.50   64.39 1.00 1.00
 CD   13  2                  8.00   64.39
 CD   14  2                  7.80   55.00
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 CD   16  5   2   0.83               0.00 0.00
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CD	23	1			9.50	106.00	2.83	3.00	
CD	24	1			9.50	110.00	3.00	3.00	
CD	25	1			9.50	110.00	2.15	2.05	
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CD	28	6	4	1.33		0.00	0.00	0.00	0.00
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CD	30	1			9.50	106.00	2.00	2.10	
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CD	36	5	2	0.75		0.00	0.00		
CD	37	3	4	0.75	8.00	43.00			
CD	38	5	2	0.75		0.00	0.00		
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CD	42	4			10.00				
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CD	45	5							
CD	46	5							
CD	47	5							
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CD	49	3	1	0.75	8.00	16.75			
CD	50	5	1	0.75		0.00			
CD	51	2			8.75	22.34			
CD	52	5							
CD	53	5							
CD	54	5							
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CD	72	1			5.57	100.00	3.00	3.00	
CD	73	1			3.91	80.00	3.00	3.00	
CD	74	2			7.00	12.52			
CD	75	1			4.60	90.00	3.00	3.00	
CD	76	1			9.50	92.04	3.00	1.76	
CD	77	1			9.50	94.00	2.53	2.53	
CD	78	1			9.50	88.00	2.72	2.72	
CD	79	1			9.50	83.00	2.90	2.90	
CD	80	2			8.75	19.55			
CD	81	1			9.50	72.00	2.40	2.40	
CD	82	1			9.50	60.00	2.18	2.18	
CD	83	1			9.50	63.00	2.30	2.30	
CD	86	1	2	1.33	9.50	110.00	2.12	2.00	
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CD	101	1			9.50	82.17	2.39	2.39	

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CD 109  1                 9.50   79.29 1.21 3.00
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PTS       60.75  5.25 77.25  8.00
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PTS       84.75  8.00
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PTS 44 5  0.00  9.50 28.50  0.00 61.60  0.00 61.60  5.42 86.08  9.50
PTS 45 5  0.00  9.50 28.50  0.00 54.37  0.00 54.37  8.17 62.35  9.50
PTS 46 6  0.00  9.50 25.50  5.25 25.50  0.00 51.37  0.00 51.37  8.17
PTS       59.35  9.50
PTS 47 5  0.00  8.75 15.12  6.23 15.12  0.00 37.46  0.00 37.46  8.75
PTS 48 6  0.00  8.00  3.06  7.49  3.06  0.00 14.24  0.00 22.61  0.00
PTS       22.61  8.00
PTS 50 5 10.00  8.00 10.00  0.00 18.37  0.00 29.55  0.00 29.55  8.75
PTS 52 5  0.00  8.75  3.48  8.17  3.48  0.00 37.09  0.00 37.09  8.75
PTS 53 5  0.00  9.50  7.98  8.17  7.98  0.00 41.59  0.00 70.09  9.50
PTS 54 5  0.00  9.50 24.48  5.42 24.48  0.00 61.50  0.00 90.00  9.50
PTS 67 4  0.00 10.20 10.20  0.00 41.63  0.00 52.95 10.20
PTS 89 4  0.00  8.41 16.82  0.00125.30  0.00142.54  8.41
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                                        S      U   U  NN  N
                                         SSS   U   U  N N N
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                                        SSSS   UUUUU  N   N

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   QQ      QQ        RR     RR  WW      WW  CC         DD      DD               TT              22
   QQ      QQ        RR     RR  WW      WW  CC         DD      DD               TT              22
   QQ      QQ        RRRRRRRR   WW      WW  CC         DD      DD               TT            22
   QQ      QQ        RRRRRRRR   WW      WW  CC         DD      DD               TT            22
   QQ  QQ  QQ        RR  RR     WW  WW  WW  CC         DD      DD               TT          22
   QQ  QQ  QQ        RR  RR     WW  WW  WW  CC         DD      DD               TT          22
   QQ    QQ          RR    RR   WWWW  WWWW  CC         DD      DD               TT        22
   QQ    QQ          RR    RR   WWWW  WWWW  CC         DD      DD               TT        22
     QQQQ  QQ        RR     RR  WW      WW   CCCCCCCC  DDDDDDDD                 TT      2222222222
     QQQQ  QQ        RR     RR  WW      WW   CCCCCCCC  DDDDDDDD  ____________   TT      2222222222

                          OOOOOO    UU      UU  TTTTTTTTTT   ;;;;       11
                          OOOOOO    UU      UU  TTTTTTTTTT   ;;;;       11
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                        OO      OO  UU      UU      TT                  11
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                  ....  OO      OO  UU      UU      TT         ;;       11
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                  ....    OOOOOO    UUUUUUUUUU      TT       ;;       111111
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File _DUA1:[USERS.E101012.ENGR.SUN.PRELIQ_RWCD_T2.OUT;1 (721,52,0), last revised on 10-JUL-1986 10:05, is a 133 block sequential file owned by UIC [PHXGREIN,SUN]. The records are variable length with FORTRAN (FTN) carriage control. The longest record is 133 bytes.

Job Q_RWCD_T2 (1698) queued to SYS$PRINT on 10-JUL-1986 10:11 by user SUN, UIC [PHXGREIN,SUN], under account ENGR at priority 4, started on printer _DPA0: on 10-JUL-1986 10:50 from queue SYS$PRINT.

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HOWKDS, W.S.ELEV = INV + DC

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GREINER ENGINEERING

INPUT FILE : q_rwcd_12.dat

WATER SURFACE PROFILE PROGRAM
VERSION 03.01

PAGE 1

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WATER SURFACE PROFILE LISTING

SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
9820.00 163+10.00	30.25	9.800	40.050	2400.0	1.90	0.056	40.106		3.284			1		0	0.00
TRANS STR	0.00772					.000250	0.03								
9943.00 161+87.00	31.20	8.856	40.056	2400.0	2.37	0.087	40.143	0.00	2.891		14.80	80.00	3.60	0	0.00
TRANS STR	0.00070					.000235	0.01						4.18		
10000.00 161+30.00	31.24	8.833	40.073	2400.0	2.33	0.084	40.157	0.01	2.720		9.50	90.00	3.00	0	0.00
175.00	0.00114					.000115	0.02			4.576			3.00		
10175.00 159+55.00	31.44	8.650	40.090	2400.0	2.39	0.089	40.179	0.01	2.720		9.50	90.00	3.00	0	0.00
25.00	0.00120					.000120	0.00			4.512			3.00		
10200.00 159+30.00	31.47	8.622	40.092	2400.0	2.40	0.090	40.182	0.01	2.720		9.50	90.00	3.00	0	0.00
39.33	0.00127					.000125	0.00			4.437			3.00		
10239.33 158+90.67	31.52	8.576	40.096	2400.0	2.42	0.091	40.187	0.00	2.720		9.50	90.00	3.00	0	0.00
TRANS STR	0.00112					.000170	0.01						3.00		
10311.00 158+19.00	31.60	8.464	40.064	2400.0	3.07	0.147	40.211	0.00	3.141		9.50	72.00	2.40	0	0.00
TRANS STR	0.00115					.000360	0.06						2.40		
10466.82 156+63.18	31.78	7.897	39.677	2400.0	6.72	0.701	40.378	0.00	4.864		9.50	36.54	1.20	0	0.00
BRIDGE EXIT													1.00		
10466.82 156+63.18	31.78	7.807	39.587	2400.0	7.13	0.789	40.376	0.00	5.025		9.50	36.54	1.20	1	2.00
TRANS STR	0.00169					.000765	0.01						1.00		
10478.66 156+51.34	31.80	7.673	39.473	2400.0	7.79	0.943	40.416		5.256			5		1	2.00
TRANS STR	0.00084					.001160	0.01								
10490.50 156+39.50	31.81	7.164	38.974	2400.0	10.10	1.584	40.558		5.927			6		2	2.00

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GREINER ENGINEERING

WATER SURFACE PROFILE PROGRAM
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WATER SURFACE PROFILE LISTING

SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
77.66	0.00116					.001650	0.13			8.040					
10568.16 155+61.84	31.90	7.245	39.145	2400.0	9.96	1.542	40.687		5.927			6		2	2.00
TRANS STR	0.00084					.001555	0.02								
10580.00 155+50.00	31.91	7.814	39.724	2400.0	8.15	1.032	40.756		5.316			7		1	2.00
BRIDGE ENTRANCE															
10580.00 155+50.00	31.91	8.086	39.996	2400.0	7.43	0.857	40.853		5.316			67		0	0.00
TRANS STR	0.00169					.000635	0.01								
10591.84 155+38.16	31.93	8.336	40.266	2400.0	6.31	0.618	40.884	0.00	4.874		9.50	36.38	1.00	0	0.00
TRANS STR	0.00113					.000325	0.03						1.22		
10698.00 154+32.00	32.05	8.724	40.774	2400.0	3.48	0.188	40.962	0.00	3.518		9.50	60.00	2.18	0	0.00
TRANS STR	0.00167					.000135	0.00						2.18		
10710.00 154+20.00	32.07	8.726	40.796	2400.0	3.31	0.170	40.966	0.00	3.409		9.50	63.00	2.30	0	0.00
TRANS STR	0.00114					.000190	0.01						2.30		
10780.00 153+50.00	32.15	8.735	40.885	2400.0	2.56	0.102	40.987	0.01	2.901		9.50	81.00	3.00	0	0.00
200.00	0.00115					.000150	0.03			4.836			3.00		
10980.00 151+50.00	32.38	8.529	40.909	2400.0	2.64	0.108	41.017	0.00	2.901		9.50	81.00	3.00	0	0.00
TRANS STR	0.00117					.000190	0.22						3.00		
12130.00 140+00.00	33.72	7.384	41.104	2400.0	2.90	0.130	41.234	0.00	2.720		9.50	90.00	3.00	0	0.00
298.63	0.00115					.000235	0.07			4.562			3.00		
12428.63 137+01.37	34.07	7.095	41.160	2400.0	3.04	0.143	41.303	0.00	2.720		9.50	90.00	3.00	0	0.00
297.85	0.00115					.000270	0.08			4.562			3.00		

GREINER ENGINEERING

INPUT FILE : q_rwcd_t2.dat

WATER SURFACE PROFILE PROGRAM
VERSION 03.01

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WATER SURFACE PROFILE LISTING

SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

A-37

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
12726.48 134+03.52	34.41	6.816	41.225	2400.0	3.19	0.158	41.383	0.00	2.720	9.50	90.00	3.00	0	0.00
299.04	0.00115					.000310	0.09		4.562			3.00		
13025.52 131+04.48	34.75	6.547	41.301	2400.0	3.34	0.174	41.475	0.00	2.720	9.50	90.00	3.00	0	0.00
99.94	0.00115					.000335	0.03		4.562			3.00		
13125.46 130+04.54	34.87	6.460	41.330	2400.0	3.40	0.179	41.509	0.00	2.720	9.50	90.00	3.00	0	0.00
JUNCT STR	0.00160					.000100	0.00					3.00		
13131.72 129+98.28	34.88	6.476	41.356	1900.0	2.68	0.112	41.468	0.00	2.338	9.50	90.00	3.00	0	0.00
TRANS STR	0.00160					.000250	0.02					3.00		
13231.72 128+98.28	35.04	6.312	41.352	1900.0	3.10	0.149	41.501	0.00	2.489	9.50	82.17	2.39	0	0.00
TRANS STR	0.00157					.000350	0.04					2.39		
13333.92 127+96.08	35.20	6.143	41.343	1900.0	3.64	0.206	41.549	0.00	2.674	9.50	74.16	1.76	0	0.00
TRANS STR	0.00160					.000280	0.03					1.76		
13458.77 126+71.23	35.40	5.881	41.281	1900.0	4.60	0.328	41.609	0.00	2.956	9.50	64.39	1.00	0	0.00
TRANS STR	0.00000					.000205	0.00					1.00		
13458.78 126+71.22	35.40	5.825	41.225	1900.0	5.07	0.398	41.623	0.00	3.002	8.00	64.39	0.00	0	0.00
TRANS STR	0.00158					.000310	0.03					0.00		
13553.54 125+76.46	35.55	5.541	41.091	1900.0	6.23	0.604	41.695	0.00	3.335	7.88	55.00	0.00	0	0.00
WALL EXIT												0.00		
13553.54 125+76.46	35.55	5.541	41.091	1900.0	6.86	0.730	41.821	0.00	3.553	7.00	53.33	0.00	4	0.83
0.01	0.00000					.000990	0.00		0.000			0.00		
13553.55 125+76.45	35.55	5.541	41.091	1900.0	6.86	0.730	41.821	0.00	3.553	7.00	53.33	0.00	4	0.83

GREINER ENGINEERING

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SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

A-38

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
242.70	0.00182					.001055	0.26			4.415			0.00		
13796.25 123+33.75	35.99	5.283	41.275	1900.0	7.19	0.803	42.078	0.00	3.553		7.00	53.33	0.00	4	0.83
109.03	0.00182					.001155	0.13			4.415			0.00		
13905.28 122+24.72	36.19	5.178	41.368	1900.0	7.34	0.836	42.204	0.00	3.553		7.00	53.33	0.00	4	0.83
TRANS STR	0.00205					.000840	0.02						0.00		
13924.78 122+05.22	36.23	5.486	41.716	1900.0	5.87	0.535	42.251		3.182			16		2	0.83
WALL ENTRANCE															
13924.78 122+05.22	36.23	5.674	41.904	1900.0	5.23	0.425	42.329	0.00	3.014		8.00	64.00	0.00	0	0.00
19.50	0.00154					.000260	0.01			3.231			0.00		
13944.28 121+85.72	36.26	5.645	41.905	1900.0	5.26	0.430	42.335	0.00	3.014		8.00	64.00	0.00	0	0.00
TRANS STR	0.00173					.000220	0.02						0.00		
14019.36 121+10.64	36.39	5.670	42.060	1900.0	4.42	0.304	42.364	0.00	2.694		8.00	75.77	0.00	0	0.00
TRANS STR	0.00000					.000295	0.00						0.00		
14019.37 121+10.63	36.39	5.761	42.151	1900.0	3.78	0.222	42.373	0.00	2.630		9.50	75.77	1.00	0	0.00
TRANS STR	0.00115					.000240	0.01						3.00		
14054.00 120+76.00	36.43	5.750	42.180	1900.0	3.62	0.203	42.383	0.00	2.553		9.50	79.29	1.21	0	0.00
JUNCT STR	0.00109					.000210	0.01						3.00		
14109.00 120+21.00	36.49	5.750	42.240	1840.0	3.27	0.166	42.406	0.00	2.392		9.50	84.88	1.53	0	0.00
TRANS STR	0.00105					.000180	0.01						3.00		
14156.44 119+73.56	36.54	5.727	42.267	1840.0	3.10	0.150	42.417	0.00	2.306		9.50	89.72	1.81	0	0.00
TRANS STR	0.00111					.000295	0.03						3.00		

GREINER ENGINEERING

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SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

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STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.SL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
14255.88 (118+74.12)	36.65	5.676	42.326	1840.0	2.81	0.123	42.449	0.00	2.151		9.50	99.83	2.41	0	0.00
TRANS STR	0.00110					.000250	0.02						3.00		
14355.88 (117+74.12)	36.76	5.612	42.372	1840.0	2.58	0.104	42.476	0.00	2.018		9.50	110.00	3.00	0	0.00
1389.66	0.00005					.000215	0.30			8.884			3.00		
15745.54 (103+84.46)	36.82	5.853	42.677	1840.0	2.46	0.094	42.771	0.00	2.018		9.50	110.00	3.00	0	0.00
136.07	0.00005					.000195	0.03			8.884			3.00		
15881.61 (102+48.39)	36.83	5.874	42.704	1840.0	2.45	0.094	42.798	0.01	2.018		9.50	110.00	3.00	0	0.00
540.02	0.00004					.000190	0.10			9.438			3.00		
16421.63 (97+08.37)	36.85	5.960	42.810	1840.0	2.41	0.091	42.901	0.00	2.018		9.50	110.00	3.00	0	0.00
110.53	0.00000					.000185	0.02			0.000			3.00		
16532.16 (95+97.84)	36.85	5.981	42.831	1840.0	2.40	0.090	42.921	0.01	2.018		9.50	110.00	3.00	0	0.00
200.00	0.00005					.000180	0.04			8.670			3.00		
16732.16 (93+97.84)	36.86	6.008	42.868	1840.0	2.39	0.089	42.957	0.00	2.018		9.50	110.00	3.00	0	0.00
TRANS STR	0.00015					.000185	0.04						3.00		
16932.16 (91+97.84)	36.89	6.009	42.899	1840.0	2.50	0.097	42.996	0.00	2.030		9.50	110.00	2.15	0	0.00
TRANS STR	0.00000					.000190	0.00						2.05		
16946.77 (91+83.23)	36.89	6.012	42.902	1840.0	2.50	0.097	42.999	0.00	2.030		9.50	110.00	2.12	0	0.00
BRIDGE EXIT													2.00		
16946.77 (91+83.23)	36.89	6.007	42.897	1840.0	2.56	0.102	42.999	0.00	2.062		9.50	110.00	2.12	2	1.33
TRANS STR	0.00000					.000250	0.01						2.00		
16971.74 (91+58.26)	36.89	6.014	42.904	1840.0	2.56	0.102	43.006		2.062			27		2	1.33

INPUT FILE : q_rwcd_t2.dat

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WATER SURFACE PROFILE LISTING

SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 AA 100 YEAR DESIGN FLOWS

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
TRANS STR	0.00040					.000285	0.01								
16996.71 91+33.29	36.90	6.007	42.907	1840.0	2.62	0.107	43.014		2.097			28		4	1.33
38.84	0.00000					.000320	0.01			0.000					
17035.55 90+94.45	36.90	6.020	42.920	1840.0	2.62	0.106	43.026		2.097			28		4	1.33
TRANS STR	0.00040					.000285	0.01								
17060.52 90+69.48	36.91	6.020	42.930	1840.0	2.59	0.104	43.034		2.082			29		2	1.33
BRIDGE ENTRANCE															
17060.52 90+69.48	36.91	6.030	42.940	1840.0	2.53	0.099	43.039		2.049			89		0	0.00
TRANS STR	0.00000					.000195	0.00								
17085.49 90+44.51	36.91	6.032	42.942	1840.0	2.58	0.103	43.045	0.00	2.079		9.50	106.00	2.00	0	0.00
TRANS STR	0.00011					.000225	0.02						2.10		
17179.00 89+51.00	36.92	6.029	42.949	1840.0	2.79	0.121	43.070	0.00	2.237		9.50	94.00	2.53	0	0.00
JUNCT STR	0.00000					.000165	0.01						2.53		
17219.00 89+11.00	36.92	6.035	42.955	1800.0	2.86	0.127	43.082	0.00	2.295		9.50	88.00	2.72	0	0.00
TRANS STR	0.00025					.000275	0.01						2.72		
17259.00 88+71.00	36.93	6.029	42.959	1800.0	2.97	0.137	43.096	0.00	2.376		9.50	83.00	2.90	0	0.00
TRANS STR	0.00043					.000300	0.01						2.90		
17283.16 88+47.84	36.94	6.021	42.961	1800.0	3.05	0.144	43.105	0.02	2.428		9.50	80.00	3.00	0	0.00
200.00	0.00010					.000305	0.06			3.260			3.00		
17482.16 86+47.84	36.96	6.064	43.024	1800.0	3.02	0.142	43.166	0.00	2.428		9.50	80.00	3.00	0	0.00
784.84	0.00010					.000285	0.22			3.216			3.00		

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GREINER ENGINEERING

INPUT FILE : q_rwcd_t2.dat

WATER SURFACE PROFILE PROGRAM
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WATER SURFACE PROFILE LISTING

SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
18267.00 78+63.00	37.04	6.218	43.258	1800.0	2.93	0.134	43.392	0.00	2.420		9.50	80.00	3.00	0	0.00
JUNCT STR	0.00020					.000125	0.01						3.00		
18317.00 78+13.00	37.05	6.364	43.414	1200.0	1.90	0.056	43.470	0.00	1.867		9.50	80.00	3.00	0	0.00
50.00	0.00000					.000110	0.01			0.000			3.00		
18367.00 77+63.00	37.05	6.370	43.420	1200.0	1.90	0.056	43.476	0.00	1.867		9.50	80.00	3.00	0	0.00
1256.98	0.00010					.000110	0.14			6.666			3.00		
19623.98 65+06.02	37.17	6.391	43.561	1200.0	1.89	0.056	43.617	0.00	1.867		9.50	80.00	3.00	0	0.00
TRANS STR	0.00010					.000150	0.03						3.00		
19823.97 63+06.03	37.19	6.376	43.566	1200.0	2.37	0.088	43.654	0.00	2.226		9.50	60.14	3.00	0	0.00
TRANS STR	0.00000					.000200	0.00						3.00		
19823.98 63+06.02	37.19	6.356	43.546	1200.0	2.69	0.113	43.659		2.269			33		0	0.00
TRANS STR	0.00046					.000220	0.00								
19845.59 62+84.41	37.20	6.320	43.520	1200.0	3.12	0.152	43.672	0.00	2.508		8.75	51.28	3.00	0	0.00
WALL EXIT													0.00		
19845.59 62+84.41	37.20	6.321	43.521	1200.0	3.23	0.162	43.683		2.572			35		2	0.75
11.39	0.00000					.000330	0.00			0.000					
19856.98 62+73.02	37.20	6.325	43.525	1200.0	3.23	0.162	43.687		2.572			35		2	0.75
TRANS STR	0.00000					.000350	0.00								
19856.99 62+73.01	37.20	6.271	43.471	1200.0	3.85	0.230	43.701		2.642			36		2	0.75
TRANS STR	0.00000					.000390	0.01								
19870.41 62+51.59	37.20	6.166	43.366	1200.0	4.87	0.368	43.734	0.00	3.036		8.00	43.00	0.00	4	0.75

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SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
75.18	0.00013					.000555	0.04			8.000			0.00		
19945.59 61+84.41	37.21	6.202	43.412	1200.0	4.84	0.363	43.775	0.00	3.036		8.00	43.00	0.00	4	0.75
TRANS STR	0.00000					.000730	0.01						0.00		
19959.01 61+70.99	37.21	6.367	43.577	1200.0	3.78	0.222	43.799		2.642			38		2	0.75
TRANS STR	0.00000					.000410	0.00								
19959.02 61+70.98	37.21	6.441	43.651	1200.0	3.16	0.155	43.806		2.572			39		2	0.75
WALL ENTRANCE															
19959.02 61+70.98	37.21	6.463	43.673	1200.0	3.05	0.144	43.817	0.00	2.508		8.75	51.28	0.00	0	0.00
11.39	0.00000					.000235	0.00			0.000			3.00		
19970.41 61+59.59	37.21	6.466	43.676	1200.0	3.04	0.144	43.820	0.00	2.508		8.75	51.28	0.00	0	0.00
TRANS STR	0.00000					.000245	0.01						3.00		
19992.02 61+37.98	37.21	6.513	43.723	1200.0	2.61	0.106	43.829		2.269			41		0	0.00
TRANS STR	0.00000					.000200	0.00								
19992.03 61+37.97	37.21	6.540	43.750	1200.0	2.30	0.082	43.832	0.00	2.226		9.50	60.14	3.00	0	0.00
TRANS STR	0.00010					.000135	0.03						3.00		
20192.02 59+37.98	37.23	6.581	43.811	1200.0	1.83	0.052	43.863	0.00	1.867		9.50	80.00	3.00	0	0.00
2394.98	0.00010					.000100	0.24			6.576			3.00		
22587.00 35+43.00	$\boxed{37.47}$	6.581	44.051	1200.0	1.83	0.052	44.103	0.00	1.867		9.50	80.00	3.00	0	0.00
JUNCT STR	0.00040					.000050	0.00						3.00		
22612.00 35+18.00	37.48	6.618	44.098	900.0	1.36	0.029	44.127	0.00	1.548		9.50	80.00	3.00	0	0.00
25.00	0.00000					.000060	0.00			0.000			3.00		

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SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
22637.00 34+93.00	37.48	6.619	44.099	900.0	1.36	0.029	44.128	0.00	1.548		9.50	80.00	3.00	0	0.00
TRANS STR	0.00011					.000155	0.01						3.00		
22728.56 34+01.44	37.49	6.563	44.053	900.0	2.60	0.105	44.158	0.00	2.616		9.50	33.10	3.00	0	0.00
TRANS STR	0.00000					.000305	0.00						3.00		
22728.57 34+01.43	37.49	6.522	44.012	900.0	3.18	0.157	44.169		2.724			44		0	0.00
TRANS STR	0.00000					.000435	0.01								
22746.43 33+83.57	37.49	6.465	43.955	900.0	3.91	0.230	44.193		3.143			45		0	0.00
TRANS STR	0.00000					.000780	0.00								
22746.44 33+83.56	37.49	6.291	43.781	900.0	5.42	0.456	44.237		3.351			46		0	0.00
TRANS STR	0.00000					.000875	0.00								
22750.17 33+79.83	37.49	6.122	43.612	900.0	6.58	0.672	44.284		3.695			47		0	0.00
WALL EXIT															
22750.17 33+79.83	37.49	6.122	43.612	900.0	7.82	0.949	44.561		4.145			48		1	0.75
4.84	0.00000					.001270	0.01			0.000					
22755.01 33+74.99	37.49	6.131	43.621	900.0	7.81	0.947	44.568		4.145			48		1	0.75
TRANS STR	0.00000					.001840	0.01								
22759.85 33+70.15	37.49✓	5.679	43.169	900.0	9.90	1.523	44.692	0.00	4.616		8.00	16.75	0.00	1	0.75
63.53	0.00009					.002270	0.14			8.000			0.00		
22823.38 33+06.62	37.50	5.956	43.452	900.0	9.44	1.385	44.837	0.00	4.616		8.00	16.75	0.00	1	0.75
50.79	0.00009					.002055	0.10			8.000			0.00		
22874.17 32+55.83	37.50	6.136	43.636	900.0	9.17	1.305	44.941	0.00	4.616		8.00	16.75	0.00	1	0.75

2-8'x8' x114.3' Long Box culverts

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SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
TRANS STR	0.00000					.001490	0.01						0.00		
22879.01 32+50.99	37.50	6.710	44.210	900.0	7.13	0.790	45.000		4.145			50		1	0.75
WALL ENTRANCE															
22879.01 32+50.99	37.50	6.860	44.360	900.0	6.71	0.699	45.059	0.00	4.039		8.75	19.55	0.00	0	0.00
TRANS STR	0.00000					.000850	0.00						0.00		
22883.85 32+46.15	37.50	7.081	44.581	900.0	5.69	0.503	45.084	0.00	3.695		8.75	22.34	0.00	0	0.00
TRANS STR	0.00000					.000660	0.01						0.00		
22895.82 32+34.18	37.50	7.420	44.920	900.0	3.61	0.202	45.122		2.814			52		0	0.00
TRANS STR	0.00000					.000245	0.00								
22895.83 32+34.17	37.50	7.522	45.022	900.0	2.67	0.110	45.132		2.699			53		0	0.00
TRANS STR	0.00000					.000195	0.00								
22905.46 32+24.54	37.50	7.549	45.049	900.0	2.38	0.088	45.137		2.546			54		0	0.00
TRANS STR	0.00000					.000160	0.00								
22905.47 32+24.53	37.50	7.579	45.079	900.0	1.99	0.061	45.140	0.00	2.460		9.50	37.02	3.00	0	0.00
JUNCT STR	0.00000					.000065	0.00						3.00		
22910.47 32+19.53	37.50	7.688	45.188	300.0	0.65	0.007	45.195	0.00	1.226		9.50	37.02	3.00	0	0.00
5.00	0.00000					.000010	0.00			0.000			3.00		
22915.47 32+14.53	37.50	7.688	45.188	300.0	0.65	0.007	45.195	0.00	1.226		9.50	37.02	3.00	0	0.00
TRANS STR	0.00015					.000010	0.00						3.00		
22982.00 31+48.00	37.51	7.680	45.190	300.0	0.62	0.006	45.196	0.00	1.169		9.50	40.00	3.00	0	0.00
78.00	0.00013					.000010	0.00			3.977			3.00		

WATER SURFACE PROFILE LISTING

SCS RWCD REACH 6 PRELIMINARY DESIGN

HYDRAULICS FOR MAIN CHANNEL TRIAL NO. 2

6-17-86 ** 100 YEAR DESIGN FLOWS

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
23060.00	37.52	7.671	45.191	300.0	0.62	0.006	45.197	0.00	1.169	9.50	40.00	3.00	0	0.00
30+70.00														

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RWCD
REACH
6
Corresp.
&
ENG NOTES
BOOK #1

United States Department of Agriculture

Soil Conservation Service

A-46

SCS

Greiner

Greiner Engineering Sciences, Inc.
3240 E. Camelback Road
Phoenix, Arizona 85018
(602) 275-5400

A Greiner Engineering, Inc. Company

MEMORANDUM

TO: File

FROM: Michael Shapiro

SUBJECT: RWCD Floodway Reach 6 -
Contract No. 53-9457-00469
Comparative Design Study Meeting
Job No. E-101-012

DATE: October 21, 1985

A meeting was held October 10, 1985, at 10:00 a.m. at the Greiner Engineering Sciences, Inc. The following were present:

Mr. Don Paulus, Soil Conservation Service
Mr. Bill Osterquist, Soil Conservation Service
Mr. R.W. Shobe, Flood Control District
Mr. Michael Shapiro, Greiner Engineering Sciences
Mr. Gary Sun, Greiner Engineering Sciences

The meeting was held to get input for our comparative design studies on maintenance problems from existing reaches and how we could incorporate these ideas into our design to alleviate potential problems. We also went over the status of the job.

The first topic for discussion was the spacing of maintenance ramps for this project and to why in past projects, did maintenance ramps line up on either side of the floodway? Mr. Shobe stated that maintenance ramps should be at all major intersections and that there was no rationale as to why they had to line up on either side of the floodway. Further discussion took place for each of the major intersections as follows:

At Broadway Road it would be necessary to have maintenance ramps on both sides of the bridge (upstream and down-stream) because the channel under the bridge was only 30 feet wide and would most likely require either dumped rip-rap or grooted rip-rap because of high velocities. If other protection, such as, soils cement or a concrete lining were used, the number of ramps could be revaluated.

At Apache Boulevard it will be necessary to access from the north side of Apache Boulevard and the east side of Higley Road because there will be a box culvert in place and access through the box would be restrictive.

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At University Drive it will only be necessary to access through either the north or south side or to have one ramp on either side of the floodway, one to the north and one to the south, because access to either side could be handled through the bridge.

At Brown Road it would be necessary to have maintenance ramps on the north and south side because, most likely, this crossing will be a box culvert.

At this point, Mr. Shobe brought up that the City of Mesa was pushing for a bridge at Adobe Road and asked us if we could locate the inlets north and south to consider this future bridge. It was made clear that we would consider the bridge when designing our inlets but not during our backwater analysis. Therefore, it might be necessary to design a larger bridge structure.

The second topic for discussion was the collector ditch on either side of the maintenance road on both sides of the floodway. Mr. Shapiro stated that the cross slope for the maintenance road would be designed to drain away from the main channel to eliminate ruts on the main channel banks from nuisance drainage. This minor drainage would be collected in minor collector ditches, on the east side of the floodway discharging into the major inlet structures, and on the west side of the floodway discharging through a pipe into the floodway. It was established that on the west side of the floodway a constant spacing for the inlet pipe would be set and used for the entire project. Questions were raised at this point as to maintenance problems in the minor collector ditches due to sedimentation and if there could possibly be more maintenance due to the collector ditch? Mr. Shapiro stated the velocities would be kept high enough to eliminate sedimentation in the collector ditch, therefore eliminating most maintenance. Mr. Shobe asked what would happen to the loss of material from the maintenance roads? Mr. Shapiro stated that cross slope for the maintenance roads would be established steep enough so loss of material would not be evident. ?? Mr. Paulus stated that on the past projects, cross slopes were approximately at 1.75 percent. Mr. Shobe asked if there could be any way to prevent slippage off the maintenance roads, because if a maintenance vehicle were to slip off the roadway, the vehicle would either slide into the main channel or into the collector ditch? Mr. Shapiro stated that slippage would most likely occur away from the main channel and towards the collector ditch and the collector ditch could be designed with a four to one side slope so that in the event of slippage a vehicle could get out. Mr. Shapiro also stated that we would look into the use of chemically treating the maintenance road to make it more stable. Mr. Shapiro also stated that he would work to determine a friction coefficient for the maintenance roads to determine the maximum cross slope before slippage would occur.

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Mr. Shapiro asked if it was possible to grade outside of the floodways west right-of-way to connect to the existing RWCD Canal maintenance road. Mr. Paulus and Mr. Shobe saw no problem with this but said they would contact the RWCD to make sure. Mr. Shapiro asked if the side collector ditch could be placed outside of the west right-of-way. Mr. Shobe said they would like to see this ditch kept within the floodway right-of-way.

The third topic for discussion was the erosion problems along the maintenance roads at the major inlets. Mr. Shapiro asked if they should consider asphalt with concrete cut off walls or possibly the use of concrete in this area. Mr. Shobe and Mr. Paulus thought that this would be too expensive and would not be necessary. design of inlets @ Signal Butte + Reach-3 have been proven to work!

The fourth topic was access to the maintenance roads from major intersections. Mr. Shapiro asked if they could use the existing curb cuts from the RWCD Canal maintenance road. Mr. Shobe indicated that he would rather not use the existing curb cuts but would rather put in new ones. Mr. Shapiro indicated that his survey crews did not cross section any of the existing roadways at the major intersections per their scope of work and contract. Mr. Shapiro asked if they could state on their final plans to match into existing curb and gutter for these curb cuts. Mr. Shobe and Mr. Paulus stated that this would be adequate.

The fifth topic was the freeboard requirements for box culvert at Apache Boulevard and Higley Road and the box culvert at Brown Road. Mr. Shapiro asked if the one foot freeboard requirement was from the lowest bank of the channel or one foot within the box itself. Mr. Paulus stated that it was one foot within the box itself and would take a waiver if we recommended anything else.

The sixth topic was the design for connecting proposed "approved" storm drain facilities into the main channel. Mr. Shapiro asked if they needed to design our facility at this time to accept these proposed structures or do they design for the existing conditions? (East Brown Road and University Drive) Mr. Paulus stated that we do need to incorporate these proposed structures into our design at this time. have approved plans for construction. DAP

Mr. Shapiro asked if there were any freeboard requirements for the collector ditches? Mr. Paulus stated that there were no such requirements but freeboard should be considered and should be recommended by Greiner Engineering.

Mr. Shapiro stated that retention basins adjacent to the east right-of-way of the floodway have only been designed for the 50 year 24 hour storm and therefore, they need to design and provide inlets for the 100 year 24 hour discharge.

Greiner

The next topic for discussion was the maintenance road across the powerline easement channel. Mr. Shapiro stated that because the limitation of space within the right-of-way and the channel having a 6.5 foot depth with approximately 4 foot of water with a flow of 1150 /1500 cfs, it may be virtually impossible to provide a dip section for the maintenance road. Mr. Shapiro stated that it might be necessary to bridge this channel or use a box culvert. Mr. Shobe and Mr. Paulus agreed with Mr. Shapiro. Mr. Shapiro said that if we can grade outside of the floodway right-of-way into the powerline easement they might be able to transition the inlet channel and provide a dip section for the maintenance road. Mr. Paulus said that he would check into this. (Mr. Shapiro brought up the point that they would also have to consider the effects of providing an interceptor for the proposed powerline easement channel on the existing retention basins located within this easement at this time.) ? Called Mike — Meant to say he will study effects of discharge from present retention basins and the future major interceptor.

At this time, Greiner Engineering presented there computerized cross section plots showing the preliminary floodway design against the existing ground at 100 foot intervals.

Mr. Shapiro and Mr. Sun went over the status of the RWCD Reach 6 project to date.

Mr. Paulus asked Mr. Shapiro to check the traverse for their panel points because he could not follow the computer printout and how it relates to the field book. Mr. Shapiro said that he would check into it.

The meeting was then adjourned.

cc: B. Berkowitz
D. Paulus
R.W. Shobe
M. Chudnoff
G. Sun

Greiner Engineering

MEMORANDUM

To: File

From: Michael Shapiro

Subject: RWCD Floodway Reach 6
Contract No. 53-9457-00469
Clarification of Erosion Analysis
Job No. E-101-012

Date: September 4, 1985

A meeting was held August 14, 1985, at 2:00 p.m. at the Soil Conservation Service. The following were present:

Mr. Don Paulus, Soil Conservation Service
Mr. Aubrey Sanders, Soil Conservation Service
Mr. Bill Payne, Soil Conservation Service
Mr. Ralph Arrington, Soil Conservation Service
Mr. Craig Wiedeman, Western Technologies, Inc.
Mr. Michael Shapiro, Greiner Engineering

SCS stated that if a tractive stress approach is used, Dr. Thur's approach is not applicable. With slow velocities, we may not need to use the tractive power approach (if we're not close to the line in TR25 Figure 6-15). It was agreed upon to first use the tractive power approach and compare it to the tractive stress analysis with discreet particles and to use the most conservative results.

Mr. Wiedeman had a question on sediment loads for erosion analysis. We were informed that in the Chandler Williams Watershed study, suspended sediment was calculated for a 2-year, 10-year, and 100-year storm event for Reach 6.

Mr. Wiedeman asked if there is anything special required for dispersive soils. SCS informed us that there is no special analysis, but velocities must be lower.

Mr. Wiedeman asked what the criteria is for erosion stability analysis. SCS stated that we must use a Q100, a 50% Q100 or a Q10, whichever was more conservative, and test for an as-built and an aged condition within the channel. It was stated that the preliminary work plan should be used for the soils mechanics report and that the soils mechanics report does not have to be the final analysis for the floodway. "N" values will change between as-built and aged conditions. We should start with an "N" value of .02. The "N" values we use should be supported by the "N" values shown in NEH5.

cc: Bob Berkowitz
Don Paulus
Craig Wiedeman

ENGINEERING HANDBOOK

hydraulics

section 5

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

A-52

A-53

TABLE 5.4-1. VALUES OF ROUGHNESS COEFFICIENT, n

Type of Conduit and Description	Values of n			References
	Min.	Design	Max.	
Pipe				
Cast-iron, coated	0.010	0.012 - 0.014	0.014	1
Cast-iron, uncoated	0.011	0.013 - 0.015	0.015	1
Wrought iron, galvanized	0.013	0.015 - 0.017	0.017	1
Wrought iron, black	0.012		0.015	1
Steel, riveted and spiral	0.013	0.015 - 0.017	0.017	1
Corrugated	0.021	0.025	0.0255	2
Wood stave	0.010	0.012 - 0.013	0.014	1
Neat cement surface	0.010		0.013	1
Concrete	0.010	0.012 - 0.017	0.017	1,6
Vitrified sewer pipe	0.010	0.013 - 0.015	0.017	1
Clay, common drainage tile	0.011	0.012 - 0.014	0.017	1
Lined Channels				
Metal, smooth semicircular	0.011		0.015	1,5
Metal, corrugated	0.0228	0.024	0.0244	2
Wood, planed	0.010	0.012	0.015	1,5
Wood, unplaned	0.011	0.013	0.015	1,5
Neat cement-lined	0.010		0.013	1,5
Concrete	0.012	0.014 - 0.016	0.018	1,5
Cement rubble	0.017		0.030	1,5
Vegetated, small channels, shallow depths				
Bermuda grass; long - 13", green	0.042			3
Long - 13", dormant	0.035		0.28	3
Short - 3", green	0.034			3
Short - 3", dormant	0.034			3
Sericea Lespedeza; long -16", green	0.076		0.22	3
Long - 16", dormant	0.050			3
Short - 2", green	0.033			3
Short - 2", dormant	0.034			3
*Unlined Channels				
Earth; straight and uniform	0.017	0.0225	0.025	1
Dredged	0.025	0.0275	0.033	1
*Winding and sluggish	0.0225	* 0.025	0.030	1
Stony bed, weeds on bank	0.025	0.035	0.040	1
Earth bottom, rubble sides	0.028	0.030 - 0.033	0.035	1

A-N * Possible source of Aged Condition
west
Note: n value for RWCD Reach 6 channel

(Continued on next page)

TABLE 5.4-1 (Continued). VALUES OF ROUGHNESS COEFFICIENT, n

Type of Conduit and Description	Values of n			References
	Min.	Design	Max.	
Unlined Channels—Continued				
Rock cuts; smooth and uniform	0.025	0.033	0.035	1
Jagged and irregular	0.035		0.045	1
Natural Streams				
(1) Clean, straight banks, full stage, no rifts or deep pools	0.025		0.033	1,4
(2) Same as (1) but more weeds and stones	0.030		0.040	1,4
(3) Winding, some pools and shoals, clean	0.033		0.045	1,4
(4) Same as (3), lower stages, more ineffective slopes and sections	0.040		0.055	1,4
(5) Same as (3), some weeds and stones	0.035		0.050	1,4
(6) Same as (4), stony sections	0.045		0.060	1,4
(7) Sluggish reaches, rather weedy, very deep pools	0.050		0.080	1,4
(8) Very weedy reaches	0.075		0.150	1,4

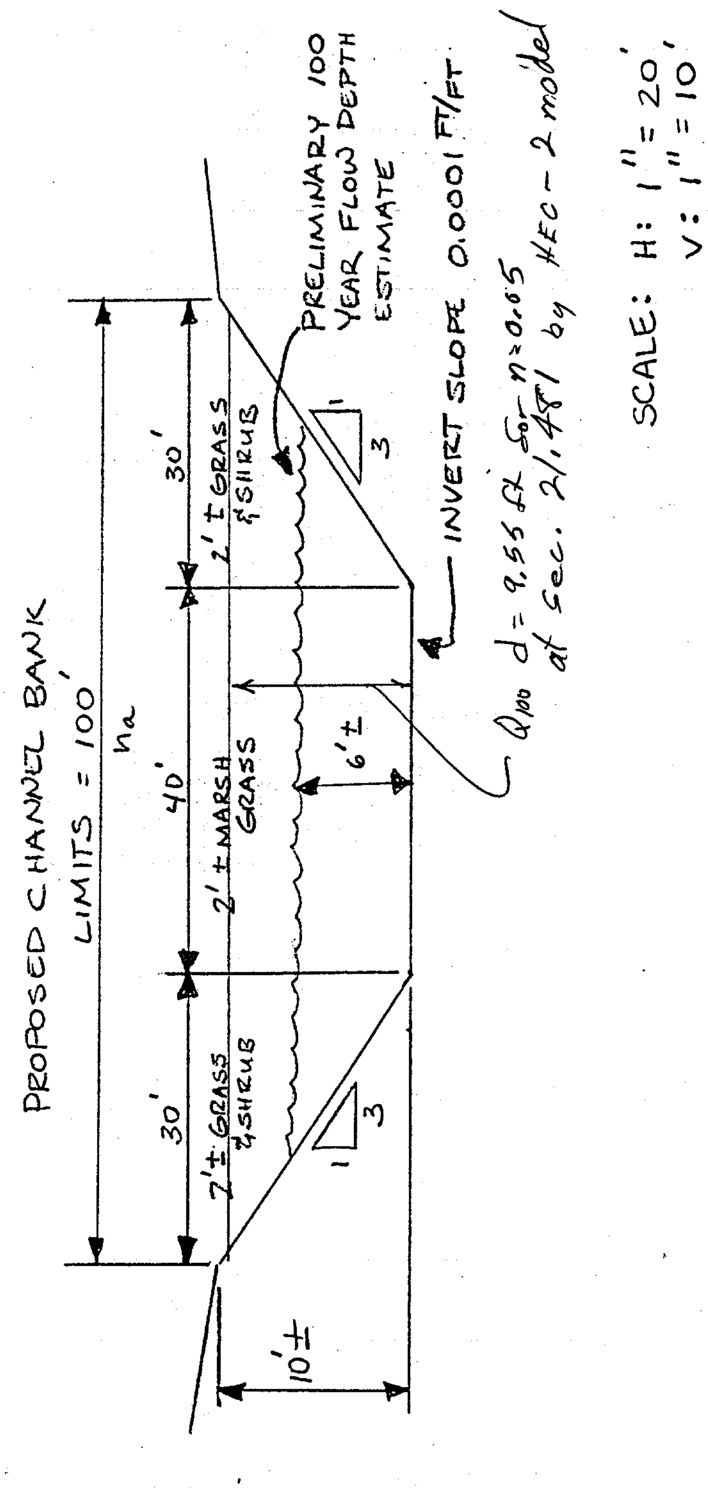
REFERENCES:

1. "King's Handbook", pp. 182 and 268.
2. "Hydraulics of Corrugated Metal Pipes" by H. M. Morris, St. Anthony Falls Hydraulic Laboratory, University of Minnesota.
3. "Flow of Water in Channels Protected by Vegetative Linings" by W. O. Ree and V. J. Palmer; and USDA Technical Bulletin No. 967, February 1949.
4. "Low Dams" by National Resources Committee, U. S. Government Printing Office, Washington, D. C., pp. 227-233.
5. "The Flow of Water in Flumes" by Fred C. Scobey; USDA Technical Bulletin No. 393, Dec. 1933.
6. "Hydraulic Studies of Twenty-four Inch Culverts", studies by St. Anthony Falls Hydraulic Laboratory, University of Minnesota; The American Concrete Pipe Association; and the Portland Cement Association.
7. "The Flow of Water in Irrigation Channels" by Fred C. Scobey, USDA Bulletin 194, 1914.
8. "Flow of Water in Drainage Channels" by C. E. Ramser, USDA Technical Bulletin No. 129, 1929.
9. "Some Better Kutter's Formula Coefficients" by R. E. Horton, Engineering News, February 24, May 4, 1916.

A-54

TYPICAL SECTION:

UEMF CHANNEL BETWEEN PRINCESS
PARK DRAINAGE BASIN OUTLET AND BROWN ROAD
LOOKING DOWN STREAM



Source: A-N West Mannings 'n' value estimation report
Ref. 4

~~A-18~~ old A-55

TABLE 7-4. CLASSIFICATION OF DEGREE OF RETARDANCE FOR VARIOUS KINDS OF GRASS*

Retardance	Cover	Condition
A Very high	Weeping love grass	Excellent stand, tall (av 30 in.)
	Yellow bluestem ischaemum	Excellent stand, tall (av 36 in.)
B High	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (av 12 in.)
	Native grass mixture (little bluestem, blue grama, and other long and short Midwest grasses)	Good stand, unmowed
	Weeping love grass	Good stand, tall (av 24 in.)
	Lespedeza sericea	Good stand, not woody, tall (av. 19 in.)
	Alfalfa	Good stand, uncut (av 11 in.)
	Weeping love grass	Good stand, mowed (av 13 in.)
	Kudzu	Dense growth, uncut
	Blue grama	Good stand, uncut (av 13 in.)
C Moderate	Crab grass	Fair stand, uncut (10 to 48 in.)
	Bermuda grass	Good stand, mowed (av 6 in.)
	Common lespedeza	Good stand, uncut (av 11 in.)
	Grass-legume mixture—summer (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (6 to 8 in.)
	Centipede grass	Very dense cover (av 6 in.)
	Kentucky bluegrass	Good stand, headed (6 to 12 in.)
D Low	Bermuda grass	Good stand, cut to 2.5 in. height
	Common lespedeza	Excellent stand, uncut (av 4.5 in.)
	Buffalo grass	Good stand, uncut (3 to 6 in.)
	Grass-legume mixture—fall, spring (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (4 to 5 in.)
	Lespedeza sericea	After cutting to 2 in. height, very good stand before cutting
E Very low	Bermuda grass	Good stand, cut to 1.5 in. height
	Bermuda grass	Burned stubble

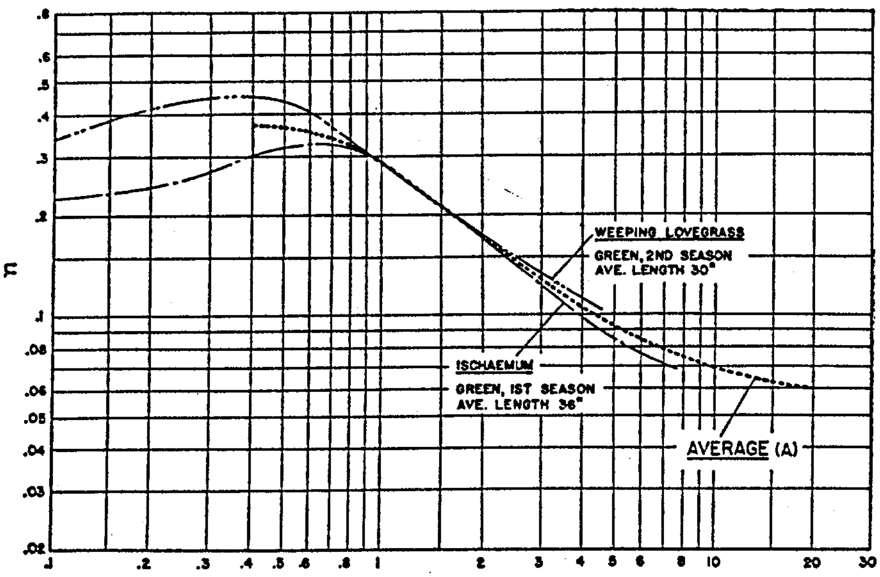
* U.S. Soil Conservation Service [41].

Estimated Channel Bed and Bank Grass and shrubs Classification for UEMF channel between Brown Road and Princess Basin.

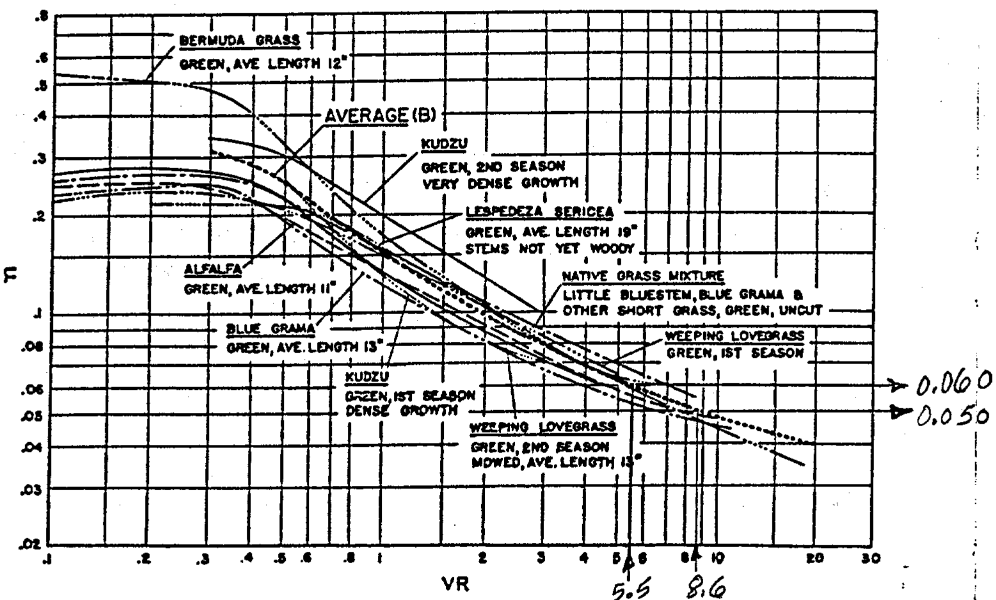
Reference 2: Chows, Open Channel Hydraulics

Source: A-N West Manning's 'n' value estimation report
Ref. 4

~~A-19~~ old A-56



(a) Curves for A or very high vegetal retardance.



(b) Curves for B or high vegetal retardance.

Fig. 7-14. Experimental n-VR curves. (*U.S. Soil Conservation Service.*)

Reference 2: Chows, Open Channel Hydraulics

Preliminary Estimate of Channel Velocity (V) ≈ ~~1.0~~ 1.1 fps

for s = 0.0001 '/FT, n = 0.06, R = ~~5.5~~ 8.6 ft

and Hydraulic Radius (R) ≈ 5.5 ft

From Average B curve above for VR = ~~5.5~~ 8.6, n = ~~0.060~~ 0.050

Source: A-N west West Manning's 'n' value estimation report
Ref. 4

~~A-20~~ A-57

T.D.N. NO. 8.0
FLOOD INSURANCE STUDY
UPPER EAST MARICOPA FLOODWAY (UEMF)
CITY OF MESA
MARICOPA COUNTY, ARIZONA

PREPARED FOR:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 WEST DURANGO STREET
PHOENIX ARIZONA 85009
AND
CITY OF MESA
ENGINEERING DEPARTMENT
55 NORTH CENTER STREET
MESA, ARIZONA 85211-1466

NOVEMBER, 1995
REVISED: JANUARY 31, 1996

Registered Professional Engineer (Civil)
CERTIFICATE NO. 15290
GREGORY A. SCHUELKE
Date Signed 2/2/96
ARIZONA, U.S.A.

FCDMC NO. 94-26
A-N WEST, INC. JOB NO. 7158-03

A-N WEST INC.
Consulting Engineers
7600 North 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200

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EXHIBITS

Registered Professional Engineer (Civil)
CERTIFICATE NO.
15290
GREGORY A.
SCHUELKE
Date Signed 2/2/98
ARIZONA, U.S.A.

FLOOD INSURANCE STUDY
UPPER EAST MARICOPA FLOODWAY (UEMF)
CITY OF MESA, MARICOPA COUNTY, ARIZONA

1.0 INTRODUCTION:

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in Maricopa County, Arizona, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management.

1.2 Authority and Acknowledgments

The hydrologic and hydraulic analysis for this study were performed by A-N West, Inc. for the Flood Control District of Maricopa County, under contract No. FCD 94-26. This study was completed in November, 1995.

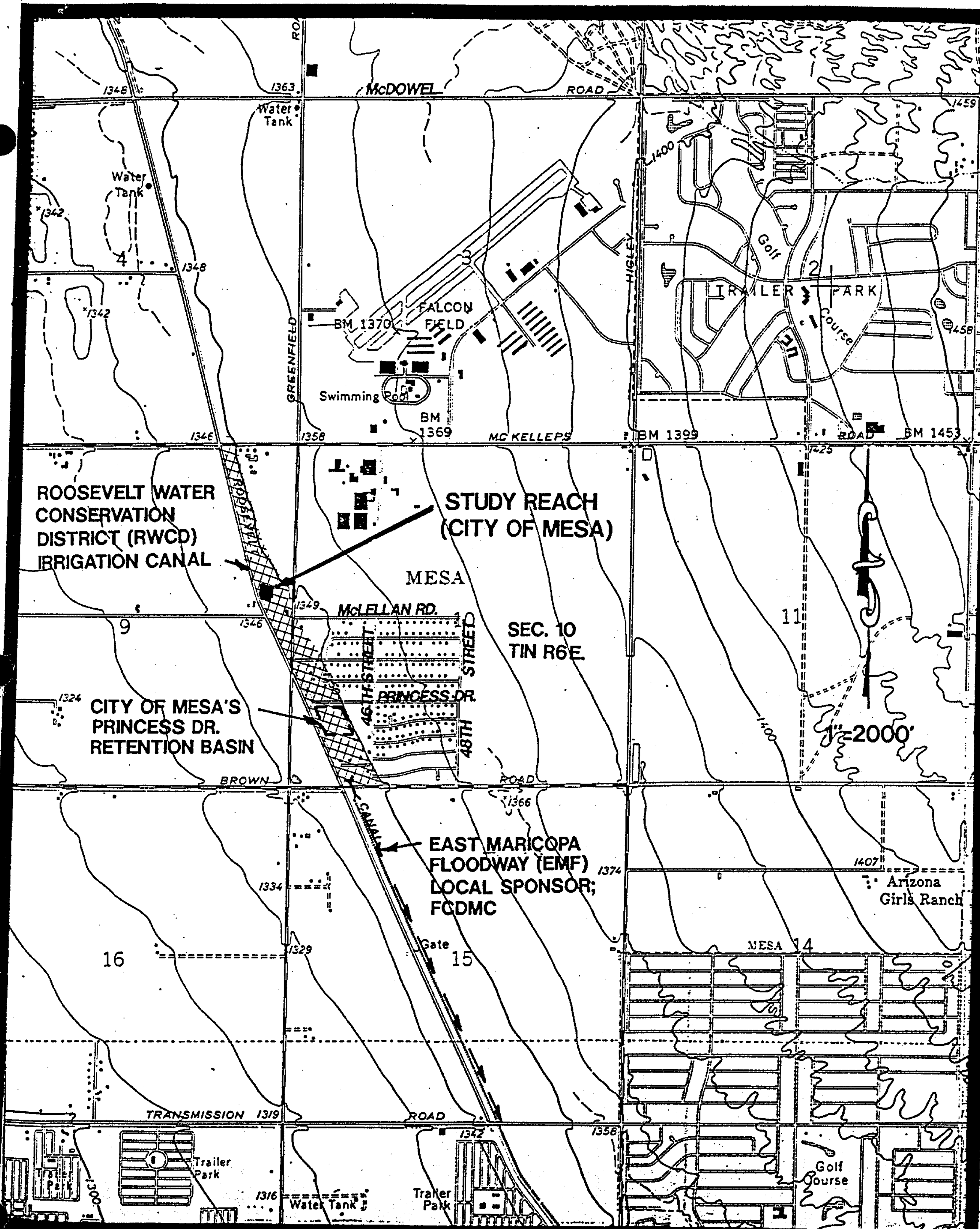
1.3 Coordination

The areas to be studied were provided by the Flood Control District of Maricopa County during contract negotiations in April, 1995.

A public notice was published in the Arizona Republic/Phoenix Gazette on June 26 and July 3, 1995 and the Mesa Tribune on July 21 and 28, 1995 to notify all interested parties of the commencement of this study.

On June 29, 1995, a letter was delivered to all property owners within the mapping limits of the study to notify of commencement of the study and to solicit any objections to property access for surveys.

The following agencies and companies were contacted to obtain information on the study; Flood Control District of Maricopa County, Arizona Department of Water Resources, Soil Conservation Service (AKA, National Resource Conservation Service), and City of Mesa.



FCDMC No. 94-26
A-N WEST No. 7158-03
A-N WEST INC.
Consulting Engineers

EXPLANATION
— FLOOD PLAIN DELINEATION STUDY LIMITS

LOCATION MAP
UPPER EAST MARICOPA
FLOODWAY FIS

FIGURE 1

2.0 AREA STUDIED

2.1 Scope of Study

The limits of detailed study in these areas of the City of Mesa, Maricopa County, Arizona were determined by the Flood Control District of Maricopa County in association with the City of Mesa and were forwarded to the study contractor during contract negotiations in April, 1995. The detailed study areas included the Upper East Maricopa Floodway (UEMF) along the upstream side of the Roosevelt Water Conservation District (RWCD) Canal from Brown to McKellips Road, a distance of approximately 1.0 mile.

The general study area is shown on the Vicinity Map (Figure 1).

2.2 Community Description

The study area is currently in the City of Mesa corporate limits of Maricopa County, Arizona. The floodplain study area from Brown Road to 700 feet north is currently an excavated channel. From 700 to 1450 feet north of Brown Road is the City of Mesa's Princess Road retention basin and Park facility. From 1450 feet to 2400 feet north of Brown Road are single-family residences and a mobile home park east of the RWCD Canal, with a paved street of 30 foot width between the RWCD Canal and the houses. From 2400 to 3150 feet north of Brown Road is a mostly vacant parcel of land between the RWCD canal and Greenfield Road with one commercial business office building. From 3150 feet north of Brown Road to McKellips Road is an existing orange grove. Just south of McKellips Road are several residences and a storage yard.

The study area lies at an elevation of approximately 1350 feet.

The climate of the study area is typically desert in character with short, mild winters and long, hot summers. Wide diurnal temperature variations are also characteristic. Temperatures generally range between 35 degrees Fahrenheit (^{o}F) and 105^{o} F, with an annual average of 71^{o} F. The prevailing winds are from the east and are usually light, although severe windstorms occur occasionally during the summary thunderstorm season. The annual precipitation for the study area averages approximately 7.4 inches.

There are two separate rainfall seasons. The first occurs during the winter months from November to March, when the area is subject to storms from the Pacific Ocean. While this is classified as a rainfall season, there can be periods of a month or more, in this or any other season, when practically no precipitation falls. No significant snowfall occurs over the study area. The second rainfall season occurs during July and August when Arizona is subject to widespread thunderstorm activity. These thunderstorms are extremely variable in intensity and location. The spring and fall months are generally dry, although precipitation in substantial amounts has fallen on occasion during every month of the year.

2.3 Principal Flood Problems

The current UEMF floodplain is approximately half developed, with approximately, 45 permanent inhabited residential structures along the floodplain near the middle and northern study limits.

Several residential houses have experienced flooding in an area between Princess Drive and McLellan Road and east of the RWCD Canal as late as approximately 1984.

2.4 Flood Protection Measures

The Granite Reef Aqueduct (Central Arizona Project Canal) which parallels the UEMF 3-1/2 miles to the east intercepts stormwater from the east. The CAP Canal was built by and is owned, by the U.S. Bureau of Reclamation. The Central Arizona Water Conservation District (CAWCD) is responsible for inspection and maintenance.

The City of Mesa constructed an 84-inch storm drain in Greenfield Road and the Princess Road retention basin and park in approximately 1985.

This flood insurance study is intended to be utilized in the planning and regulation of future development within the study area to provide for adequate drainage and flood proofing of development.

3.0 ENGINEERING METHODS

3.1 Hydrologic Analysis

The hydrology for the Upper East Maricopa Floodway (UEMF) was performed for this study and is summarized in a hydrology report (Reference 4). The peak discharges were computed for the 100-year 24-hour storm event by the HEC-1 computer model (Ref. 5) using the Flood Control District of Maricopa County Hydrology Manual (Ref. 6).

A summary of drainage area - peak discharge relationships for the UEMF at several locations along the study reach from Reference 1 is shown in Table 1.

TABLE 1
Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	100-Year 24-Hour Storm Peak Discharge (Cubic Feet per Second)
Upper East Maricopa Floodway (UEMF)		
1000' to 450' Downstream Brown Road	N/A (Note 1)	1200 (Note 2)
450' to 130' Downstream Brown Road	N/A (Note 1)	900 (Note 2)
At Brown Road	N/A (Note 2)	603
Exiting City of Mesa Princess Drive Retention Basin	N/A	282
Entering City of Mesa Princess Drive Retention Basin	N/A	564
At Hobart Drive	N/A	543
At McLellan Road	N/A	429
At McKellips Road	N/A	177

Note 1: Due to numerous split-flow conditions where surface flow exits the study watershed, the drainage area is not applicable. The gross-study watershed, except for Subarea SB86, was 2.65 square miles.

Note 2: The original EMF 100-year 24-hour storm design discharges (Reference 4 and 10) were used to start the detailed hydraulic analysis, since this study's hydrology ended at Brown Road, but back water from the EMF proceeded upstream to the Princess Basin outlet.

3.2 Hydraulic Analysis

Cross-sections were digitized from topographic mapping (Reference 1) that was compiled photogrammetically from aerial photos. The Brown Road culverts were field surveyed for inlet and outlet inverts and the length and wingwall configuration was obtained from as-built plans and site visits.

Water-surface elevations for floods for the 100-year recurrence interval were computed using the COE HEC-2 step-backwater computer program (Reference 2). Starting water surface elevations were determined using the slope-area method, starting 1000 feet downstream of the Brown Road culverts.

The detailed hydrology for this study did not include the area south of the Brown Road culverts. Starting water surface elevation at the first and second cross-sections, No. 21.213 and 21.307 located 1000 and 450 feet downstream of the Brown Road culvert outlet was based on the original East Maricopa Floodway 100-year design discharge of 1200 cfs. The discharge at Section 21.364, 130 feet downstream of the Brown Road culvert outlet utilized the EMF design discharge of 900 cfs. This study's hydrology discharges were utilized through the Brown Road culverts and upstream.

Locations of selected cross-sections used in the hydraulic analysis are shown on the Flood Profiles (Exhibit 1) and Flood Insurance Rate Maps (Exhibit 3). For stream segments for which a floodway was computed (Sections 4.2) selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 3).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen using procedures from References 7 and 8 and based on field observations of the stream and floodplain areas. A summary of the Manning's "n" values used in the floodplain modeling of the study wash follows in Table 2:

TABLE 2

Summary of Roughness Coefficients

Stream	Channel	Overbank
Upper East Maricopa Floodway (UEMF)		
Brown Road to 700 ft. Upstream	0.050	0.040 - 0.045
700 ft. to 1450 ft. Upstream of Brown Road	0.020 - 0.028 (Short Grass)	0.028
1450 ft. to 2460± ft. Upstream of Brown Road	0.015 (Pavement)	0.035 - 0.20 (Note 1)
2450± ft. to 3150 ft. Upstream of Brown Road	0.015 to 0.045	0.035 to 0.045
3150 ft Upstream of Brown Road to McKellips Road	0.045 to 0.060	0.045 to 0.060

Note 1 - A horizontal varied 'n' value (NH record) was used with 'n' = 0.10 to 'n' = 0.20 where houses or houses with fenced yards occurred.

A Manning's 'n' of 0.013 was used for the concrete box culverts at Brown Road.

The hydraulic analyses for this study were based on unobstructed flow. Flow profiles were not compared to historical events. No information exists on flood elevations and historical discharges for the study streams with which to make this comparison.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks and descriptions used in this study are shown on the maps (Exhibit 3) and summarized in this report (Exhibit 2). A conversion to North American Vertical Datum 1988 (NAVD88) is also included in Exhibit 2.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

4.1 Floodplain Boundaries

For the streams studied in detail 100-year flood boundaries were delineated using the topographic maps at a scale of 1:2,400 and with contour interval of 2 feet (Reference 1).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map, (Exhibit 3). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazard. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

No floodway was prepared for this study.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AO

Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depth are between 1.0 and 3.0 feet; depths are shown, but no FHFs are determined.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. The BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, and areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding, where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 OTHER STUDIES

No previous FEMA Flood Insurance Studies were found for the study area or the East Maricopa Floodway immediately downstream. The effective FEMA Flood Hazard Zone for the study area and EMF downstream was an approximate Zone A (no discharges or BFE's presented).

No drainage reports were found through the City of Mesa for the Princess Drive retention basin and 84-inch storm drain along Greenfield Road.

As discussed in the Hydrology Report (Reference 4), the Soil Conservation Service (SCS) with the Flood Control District of Maricopa County (FCDMC) as local sponsor, designed and constructed the East Maricopa Floodway from approximately 240 feet upstream (north) of the Brown Road Centerline, downstream to the south. The Hydrology report (Reference 4) includes design notes and correspondence summarizing the SCS design discharges for the EMF. (Reference 7) The SCS 100-year 24-hour storm hydrology evaluated four alternate conditions, including an existing condition and future conditions involving different assumptions of upstream flow splits and amount of contributing flow from the watershed north of Brown Road. The range of 100-year discharges in the EMF immediately downstream of Brown Road presented in the SCS design notes for the alternates considered, ranged from 365 to 1601 cfs.

The SCS design consultants notes show the EMF 100-year design discharge as; 300 cfs from 240 ft to 89 ft upstream of Brown Road centerline; 900 cfs from 89 ft upstream to 230 ft downstream of Brown Road centerline and; 1200 cfs from 230 ft to 4550 ft downstream of Brown Road centerline.

A comparison of this study's 100-year water surface profile to the original EMF's design results indicated that this study's water surface profile is approximately 3.2 feet higher than the original EMF design. The reason for this increase is attributed to a current estimated channel 'n' value of 0.05 versus the original design value of 0.025. A special problem report (Reference 10) was prepared to discuss this evaluation in more detail. The current EMF channel has a substantial vegetation growth which results in the higher 'n' value which was not accounted for in the original design. The 100-year floodplain is contained within the EMF right-of-way for the limits analyzed for this study.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Presidio of San Francisco, Building 105, San Francisco, California 94129.

8.0 BIBLIOGRAPHY AND REFERENCES

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2. U.S. Department of Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California 95616, HEC-2, Computer Program, Water Surface Profiles Version 4.6.2. Dated: May, 1992

3. U.S. Geological Survey, Water Resources Division, 375 South Euclid Avenue, Tucson, Arizona 85719, Estimated Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona, by B.W. Thomson and H.W. Hjalmarson, for Flood Control District of Maricopa County; April, 1991.

4. Hydrology Report for Upper East Maricopa Floodway (UEMF) Floodplain Delineation Study, FCD No. 94-26 by A-N West, Inc., Date: September, 1995, Revised: October, 1995.

5. US Department of Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California 95616, HEC-1, Flood Hydrograph Package Computer Program, Version 4.0, September, 1990.

6. Hydrologic Design Manual for Maricopa County, Arizona, Prepared by Special Projects Branch, Hydrology Division, Flood Control District of Maricopa County, Dated: September, 1990 with June, 1992 Revisions.

7. Estimating Manning's Roughness Coefficients for Stream Channels and Floodplain in Maricopa County, Arizona, Prepared by US Geological Survey, Water Resources Division, Prepared for Flood Control District of Maricopa County, April, 1991.

8. TR-20 Hydrology, RWCD Floodway (Now Called East Maricopa Floodway) Reach 6, Dated: May, 1985, Original Design Notes in 3 Ring Binder, From Soil Conservation Service (SCS) Office (AKA National Resource Conservation Service, 3003 North Central Avenue, Phoenix, Arizona.

9. Chow, Ven T., Open Channel Hydraulics, New York: McGraw-Hill Book Company 1959.

10. Final Design Folder (3-Ring Binder) for SCS (Soil Conservation Service) RWCD (now EMF) Reach 6, Contract No. 53-9457-00469, Job No. E 101012, December 1986 by Greiner Engineering Services, Inc.

Also under separate cover by Greiner Engineering; Input/Output to Hydraulic Backwater Computer Program, "Water Surface Profile Edit Program Version 03.01", Input File Name: rwcd_t2.dat, Date: 6/17/86, for 100-year Design Flows Hydraulics for Main Channel, Trial No. 2 RWCD, Reach 6, Preliminary Design.

11. Special Problems Report No. 1, Upper East Maricopa Floodway (UEMF) Floodplain Delineation Study, FCD No. 94-26, By A-N West, Inc., Date: November 22, 1995, for FCDMC and City of Mesa.

Ernest F. Brater and Horace Williams King, Handbook of Hydraulics, Sixth Edition, New York: McGraw-Hill Book Company, 1976.

U.S. Geological Survey, Topographic Maps, 7.5 Minute Series: Buckhorn, Arizona; 1956, Photo Revision, 1982.

U.S. Department of Transportation, Federal Highway Administration Hydraulic Charts for the Selection of Highway Culverts, Hydrologic Engineering Circular No. 5 (HEC-5), December, 1965.

EXHIBIT 2

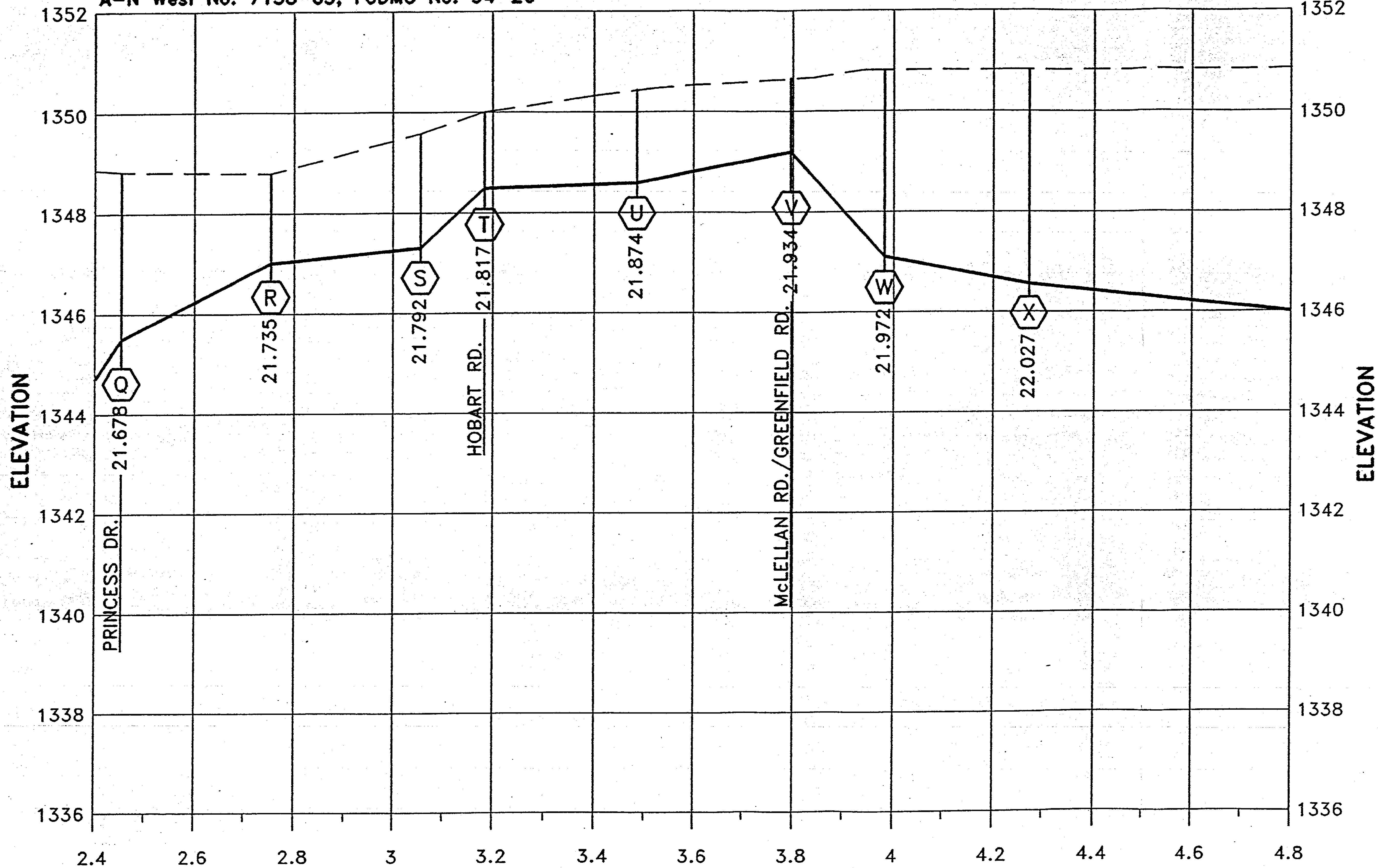
ELEVATION REFERENCE MARKS (ERM) DESCRIPTIONS

Note: All Elevations are Based on National
Geodetic Vertical Datum of 29

I.D. Number	Elevation (Ft)	Description/Location	Latitude	Longitude	NAVD 88 - NGVD 29 (Meters)
ERM-1	1356.04	Brass CAP in Hand Hole at Intersection of Greenfield and McKellips Roads.	33° 27' 06"	111° 44' 20"	0.551
ERM-2	1349.44	Brass CAP in Hand Hole, Intersection of Greenfield and McLellan Roads.	33° 26' 40"	111° 44' 20"	0.547
ERM-3	1340.55	Brass CAP in Hand Hole, Intersection of Greenfield and Brown Roads.	33° 26' 19"	111° 44' 20"	0.544
ERM-4	1352.42	Brass CAP in West Top Concrete Sidewalk Barrier Wall, North Side Brown Road Over RWCD Canal. (Stamped with SCS Datum Elev. of 1351.63)	33° 26' 19"	111° 44' 11"	0.544

Note: NAVD88 Conversion Factor Generated from VERTCON (Vertical Conversion Transformation Computer Program) Version 2.0 Obtained from National Geodetic Survey, N/CG617, Coast and Geodetic Survey, National Ocean Survey, NOAA, Rockville, Maryland 20852.

A-N West No. 7158-03, FCDMC No. 94-26



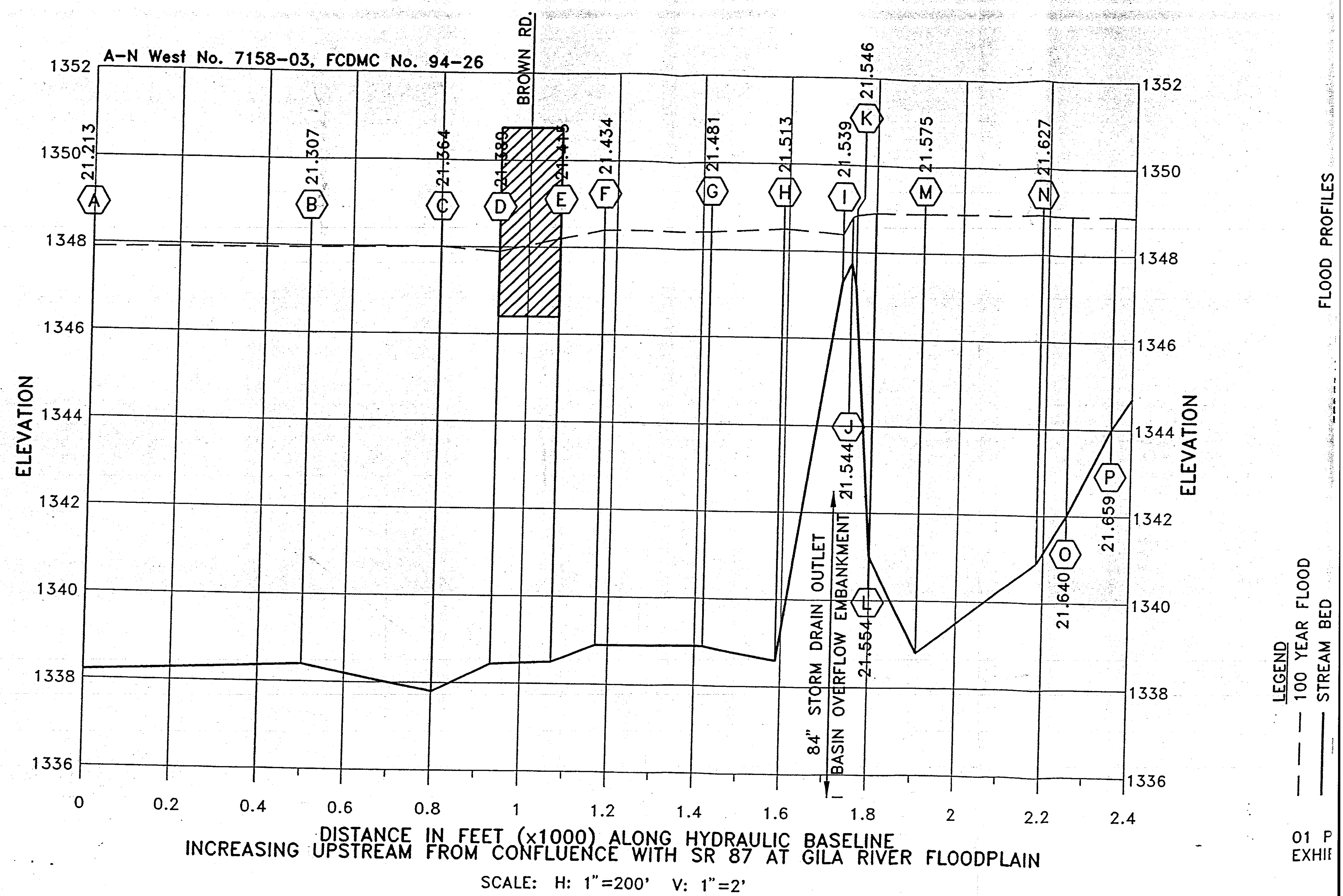
DISTANCE IN FEET (x1000) ALONG HYDRAULIC BASELINE
INCREASING UPSTREAM FROM CONFLUENCE WITH SR 87 AT GILA RIVER FLOODPLAIN

SCALE: H: 1"=200' V: 1"=2'

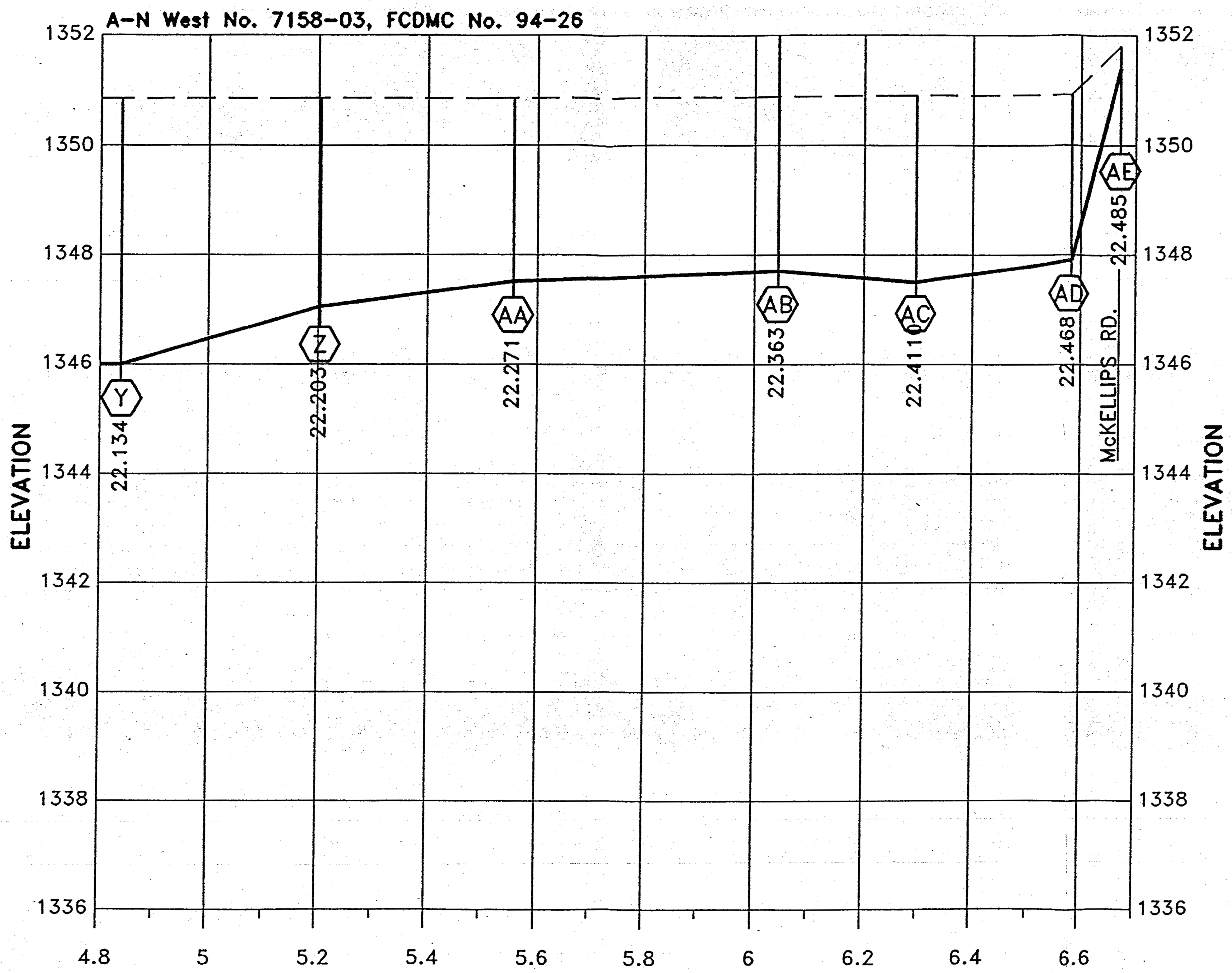
FLOOD PROFILES
FEDERAL EMERGENCY MANAGEMENT AGENCY
UPPER EAST MARICOPA FLOODWAY F.I.S.

LEGEND
100 YEAR FLOOD
STREAM BED
L CROSS SECTION LOCATION

02 P
EXHIBIT


A-N West No. 7158-03, FCDMC No. 94-26
BROWN RD.
ELEVATION
1352
1350
1348
1346
1344
1342
1340
1338
1336
21.213
21.307
21.364
21.389
21.415
21.434
21.481
21.513
21.539
21.546
21.575
21.627
21.544
21.554
21.640
21.659
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
84" STORM DRAIN OUTLET
BASIN OVERFLOW EMBANKMENT
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
DISTANCE IN FEET (x1000) ALONG HYDRAULIC BASELINE
INCREASING UPSTREAM FROM CONFLUENCE WITH SR 87 AT GILA RIVER FLOODPLAIN
SCALE: H: 1"=200' V: 1"=2'
LEGEND
100 YEAR FLOOD
STREAM BED
FLOOD PROFILES
01 P
EXHI

A-N West No. 7158-03, FCDMC No. 94-26



DISTANCE IN FEET (x1000) ALONG HYDRAULIC BASELINE
INCREASING UPSTREAM FROM CONFLUENCE WITH SR 87 AT GILA RIVER FLOODPLAIN

SCALE: H: 1"=200' V: 1"=2'

FLOOD PROFILES
FEDERAL EMERGENCY MANAGEMENT AGENCY
UPPER EAST MARICOPA FLOODWAY F.I.S.
CITY OF MESA, MARICOPA COUNTY, ARIZONA

LEGEND
100 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

03 P
EXHIBIT 1

FORM 1

CERTIFICATION OF COMPLIANCE

This form must be signed by a senior representative of the firm who is registered as a Professional Engineer (private study contractors) or by the responsible official (government agencies).

This is to certify that all work accomplished in the conduct of this Flood Insurance Study for the community of: City of Mesa, Upper East Maricopa Floodway

____

______________________________ **was done in accordance with the Statement of Work and General Provisions of Contract Number** FCD No. 94-26 **(or, in the case of Federal agencies, Inter-Agency Agreement Number ______________________________), and all amendments thereto, together with all such modifications, either written or oral, as the Regional Project Officer (PO) and/or the Contracting Officer or their representatives have directed, as such modifications affect this contract, and that all such work has been accomplished in accordance with the provisions contained in Guidelines and Specifications for Study Contractors, and in accordance with sound and accepted engineering practice within the contract provisions for respective phases of the work.**

This is also to certify that:

- **For Contiguous Communities: (Check one or more which apply)**

X **The draft FIS is entirely within the corporate limits of the studied community and no contiguous communities are impacted.**

X **The Base (100-year) Flood Elevations (BFEs), floodplains, and floodways computed and depicted for this draft Flood Insurance Study (FIS), are in complete agreement with all effective FISs for the contiguous communities and all discrepancies have been resolved, or**

___ **Draft FIS revisions have also been submitted for affected contiguous communities, or**

___ **The discrepancies with the effective FISs for the contiguous communities could not be resolved; these discrepancies have been coordinated with the PO and documented and approved by the PO (attach documentation).**

This is also to certify that:

- Within the Flood Insurance Study for this Community: (Check one or both if applicable)

___ The BFEs, 100-year floodplain and floodway for the revised portion(s) of the stream(s) restudied in this draft FIS, tie into the effective FIS (BFEs must tie-in within 0.5 foot), or

X if a tie-in could not be achieved, it was coordinated with the PO and documented and approved by the PO. (attach documentation)

- For each flooding source studied:

An Internal Agreement (consistency) check has been performed to ensure agreement between maps, profiles, hydrologic and hydraulic models, and FIS report for channel distances, BFEs, and floodway widths as recommended in the Flood Insurance Study Guidelines and Specifications for Study Contractors.

- Levee/floodwall systems shown in the draft FIS as providing protection from the 100-year flood meet the provisions of Section 65.10 of the National Flood Insurance Program (NFIP) regulations.

Name: Gregory A. Schuelke
(please type or print)

Title: Vice President
(please type or print)

Firm/Agency: A-N West, Inc. 7600 N. 15th St, Suite 200 Phoenix AZ 85020
(please type or print)

Registration No. 15290
(if applicable)

Expiration Date: 6/30/98
(if applicable)

State Arizona
(if applicable)

Gregory A Schuelke
Signature

1/26/96
Date

Registered Professional Engineer (Civil) CERTIFICATE NO. 15290 GREGORY A. SCHUELKE Date Signed 1/26/96 ARIZONA, U.S.A.

Seal
(optional)

FORM 2

CHECKLIST OF SUBMITTED ITEMS FORM

All items described in the Guidelines and Specifications for Study Contractors (G&S) shall be organized in the form of a Technical Support Data Notebook (TSDN) and shall be submitted to the Technical Evaluation Contractor as identified by the Regional Project Officer.

The specific requirements for the data to be included in the five major sections of the TSDN are described in the G&S. Check each item that has been included.

General Documentation

X	i)	Special Problem Reports
X	ii)	Contact (Telephone Conversation) Reports
X	iii)	Meeting Minutes/Reports
X	iv)	General Correspondence

Engineering Analyses

X	i)	Hydrologic Analyses (in printout form and computer diskette if applicable)
X	ii)	Hydraulic Analyses (in printout form and computer diskette)
X	iii)	Supporting hand calculations, sketches, and figures used to compute hydrologic and hydraulic analyses.
	iv)	Key to Cross-Section Labeling
	v)	Key to Transect Labeling

Draft FIS Report Data

X	i)	Profiles for all detailed study streams
	ii)	Tables
X		Summary of Discharges
		Summary of Stillwater Elevations
X		Floodway Data
		Transect Description
		Transect Data
	iii)	General descriptive paragraphs
	iv)	Photographs of historic flooding
X	v)	Elevation Reference Mark Descriptions

Mapping Information

X	i)	Riverine Mapping
	ii)	Coastal Mapping
	iii)	Alluvial Fan Mapping

Forms Included:

Check forms submitted:

Forms 1, 2, and 3 must be submitted.

X	Form 1	Certification of Compliance Form
X	Form 2	Checklist of Submitted Items Form
X	Form 3	Scope of Study and Community Information Form

The following forms must be included, as applicable to the study:

(check forms included)

X	Form 4	Hydrologic Analysis Form
X	Form 5	Riverine Hydraulic Analysis Form
X	Form 6	Riverine Mapping Form
___	Form 7	Coastal Analysis Form
___	Form 8	Coastal Structures Form
___	Form 9	Coastal Mapping Form
___	Form 10	Levee/Floodwall System Analysis Form
___	Form 11	Dam Form
___	Form 12	Alluvial Fan Analysis Form
___	Form 13	Ice Jam Analysis Form

Miscellaneous Reference Materials

Provide a list of all reference materials submitted with this draft study.

See Technical Data Notebook, Jan. 1996 By A-N West Inc. For Flood Control District of Maricopa County, FCD. No. 94-26.

FORM 3

SCOPE OF STUDY AND COMMUNITY INFORMATION FORM

Flood Insurance Study
Community Coordination

City of Mesa	Maricopa	Arizona
Community Name	**County**	**State**

If study impacts more than one community, attach a listing of all impacted communities.

Study Contractor: A-N West, Inc. 7600 N. 15th St. Suite 200 Phoenix AZ 85020

Subcontractor (if applicable): Aerial Mapping Co., Inc. 3141 W. Clarendon Ave. Phoenix, AZ 85017

Completion Date (month and year): Feb. 96

Initial Consultation and Coordination Officer's (CCO's) meeting date: April, 1995

A list of attendees and agencies represented at the initial CCO meeting is attached. ☐ Yes ☒ No ☐ N/A

Does the state have jurisdiction over floodplains or their adoption by communities participating in the NFIP? ☒ Yes ☐ No

If yes, has the state approved the analyses? * ☒ Yes ☐ No ☐ N/A

* AZ Dept of Water Resources has IGA allowing FCD of Maricopa Co. to approve on ADWR's behalf.

If no, has the analyses been submitted to the appropriate state agency? ☒ Yes ☐ No ☐ N/A

Scope of Study

Were analyses performed for the 10-, 50-, 100-, and 500-year floods? ☐ Yes ☒ No

If no, please explain:

100-year flood only.

List flooding sources studied and check type of study:

Riverine Sources:

Name	Detailed		Approximate
Upper East Maricopa Floodway	☐ with floodway	☒ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate
	☐ with floodway	☐ w/o floodway	☐ approximate

Coastal:

Name	Detailed	Approximate
	☐ detailed	☐ approximate
	☐ detailed	☐ approximate
	☐ detailed	☐ approximate
	☐ detailed	☐ approximate

Alluvial Fan Flooding:

Name	Detailed	Approximate
	☐ detailed	☐ approximate
	☐ detailed	☐ approximate
	☐ detailed	☐ approximate
	☐ detailed	☐ approximate

USGS Quad Maps showing the limits of study must be provided.

FIS Report Information

If there is no published FIS Report or the FIS Report contains inadequate descriptions, the following must be provided:

Community Description

Provided?

- A general description of the community's location within the county and state. — [X] Yes [ ] No
- A list of surrounding communities and their locations with respect to the subject community. — [ ] Yes [X] No
- A brief description of the community. — [X] Yes [ ] No

  This description may include patterns of residential and commercial development; the extent and nature of floodplain development; natural features that affect flood hazards in the community; and sufficient description of climatic, physiographic, and land use factors to support the discussion of flood problems.

Principal Flood Problems

- Discharges and Annual Exceedance Probability of major floods. — [ ] Yes [X] No
- Gage name and number for all gages used for studied streams: — [ ] Yes [X] No
- Photos, if available, of flooding, flood control structures, etc., with date, subject, and location of photo noted. — [ ] Yes [X] No

Flood Protection Measures

- Description of all flood protection structures and floodplain management measures used to reduce potential flood damage in the watersheds studied. Provide names of government entities responsible for operations and maintenance. — [X] Yes [ ] No [ ] N/A
- A list of dams on the watersheds studied used for purposes other than flood control. — [ ] Yes [ ] No [X] N/A

Other Sections

- Complete descriptive data as outlined in the Guidelines and Specifications for Study Contractors. — [X] Yes [ ] No

FORM 4

HYDROLOGIC ANALYSIS FORM

Community Name: City of Mesa, Maricopa County, AZ

Flooding Source: Upper East Maricopa Floodway (UEMF)

For each flooding source to be studied by detailed methods, provide the following information:

A. Evaluation of currently available Flood Flow Information

1. If the stream has not been studied by any local, State, or Federal Agency, proceed to Section C.

2. The stream was studied in the effective FIS as:

   [XX] Approximate study stream (Zone A); proceed to Section C
   [ ] Detailed study stream (state methodology and record the 100-year discharges from the effective FIS at appropriate locations on Attachment E). ______

3. Has a flood flow frequency analysis been performed by more than one Federal (including FEMA), state, or local agency?

   [ ] Yes [ ] No

   If no flood flow frequency analysis has been performed, proceed to Section C. If only one flood flow frequency analysis has been performed, proceed to Section A5. If more than one flood flow frequency analysis has been performed, are the discharges different?

   [ ] Yes [ ] No

   If yes, attach documentation of resolution of differences with affected agencies and select appropriate analysis.

4. Was the effective FIS analysis selected?

   [ ] Yes [ ] No [ ] N/A

   If yes, proceed to Section A5, unless a statistical analysis was used then proceed to Section B2.

   If no, or N/A, indicate below what type of analysis, was selected:

   [ ] Statistical analysis - proceed to Section B2
   [ ] Regional regression equations
   [ ] Rainfall/runoff model
   [ ] Other (specify) ______

5. If the discharges from the above analysis are to be used directly in the hydraulic analysis without any modifications, record the discharges on Attachment E and proceed to Section B2. If the above analysis is to be modified, proceed to Section B.

B. Preliminary Analysis - A preliminary analysis is to be performed to test whether a restudy should be conducted based on revised discharges.

1. Determine the revised 100-year discharges for the existing watershed conditions at the same locations as above. Project Officer approval should be obtained to create a new model if the model for the above analysis is not available on computer disk.

   An analysis different from the current analysis may be used to determine the revised discharges.

   a. The revised 100-year discharges are being determined by:

      - ☐ Statistical Analysis
      - ☐ Regional Regression Equations
      - ☐ Rainfall/Runoff Model
      - ☐ Other (specify): ____________________

   b. Explain the reasons for selecting the analysis to determine the revised discharges:

      ____

   c. Record the revised 100-year discharges on Attachment E.

Evaluation of Effective Information

2. a. If a statistical analysis of gage records was performed, the confidence limits must be evaluated (complete Attachment F).

   b. Is the effective 100-year discharge within the 50% confidence interval of the revised 100-year discharge?

      ☐ Yes ☐ No

      1) If no, proceed to Section B2c.

      2) If yes, is there reason to update the hydraulic analysis? ☐ Yes ☐ No

         If no, the flooding source should not be restudied.

         If yes, the flooding source should be restudied using revised discharges.

   c. If effective 100-year water-surface elevations are available, do the revised 100-year flood discharges cause a change in the effective water-surface elevations of more than 0.5 foot? (Use Attachment E). (Revised 100-year water-surface elevations for the revised discharges may be interpolated from the effective study printouts, profiles, or computations).

      ☐ Yes ☐ No ☐ N/A

If yes, the hydrologic analysis should be revised. Provide any additional reasons below why a restudy based on revised hydrology is justified, and proceed to Section C.

If no, the flooding source should not be restudied unless there are reasons to update the hydraulic analysis. If so, proceed to Section C.

C. Methodology for Final Analysis

Before selection of methodology for final analysis, the following should be evaluated:

1. Is watershed being developed and/or is it projected to undergo development? [XX] Yes [ ] No

2. Are there reservoirs or flood control features in the watershed? [XX] Yes [ ] No

3. Refer to Guidelines and Specifications for Study Contractors for selection of appropriate hydrologic methods. Indicate method selected.

- [ ] Current discharges will be used in the hydraulic analysis
- [ ] Statistical analysis of gage records (use Attachment B)
- [ ] Regional regressional equations (use Attachment C)
- [XX] Rainfall/Runoff Model (use Attachment D)
- [ ] Other (specify): ____________________
  and provide a full bibliographical reference and pertinent analysis

Explain the reasons for selecting the method to determine the discharges.
No detailed current discharges were available.

Record the computed discharges at selected locations on Attachment A.

D. Approval of Analysis

[ ] Approved by FEMA Region ______________ Project Officer
(Name: ____________________)
(Date: ____________________)

Approved by other Federal, State, or local government agency(ies) if required:
(Please provide evidence of approval.)

[X] Agency Flood Control District of Maricopa Co date 10/12/95
City of Mesa date 9/21/95
______________ date ______

* [XX] Approval by other Federal, State, or local government agency not required.
* State Agency, ADWR has IGA allowing FCDMC to review on ADWR's behalf.

Attachment A - Summary of Discharges

Stream	Location	Drainage Area (mi²)	Peak Discharges (cfs)			
			10-year	50-year	100-year	500-year

Attachment B: Statistical Analysis of Gage Records

Flooding Source: N/A

Gaging Station Name and Number: ______

Gage Location (relative to the Limit of Study): ______

Drainage Area at the gage: ______

1. Was Log-Pearson Type III distribution used? ☐ Yes ☐ No

   If no, attach explanation.

2a. Systematic record ______ years
From: ____ To: ____
From: ____ To: ____

b. Are there any historical records available? ☐ Yes ☐ No

   If yes, indicate historical period. ______ years

   List the historical events. ____ cfs ____ year; ____ cfs ____ year
   ____ cfs ____ year; ____ cfs ____ year

   Comparison of results from systematic and historically adjusted analyses and decisions made in selection of analysis must be submitted.

3. Does record represent a mixed population? (e.g., rainfall and snowmelt). ☐ Yes ☐ No

   If yes, submit frequency analysis for each population and analysis of combined frequency curves.

   Explain why a combination was necessary and how the combination was made.

4. Is the data homogeneous? ☐ Yes ☐ No

   If no, attach an explanation of how the data was analyzed, based upon Bulletin 17B recommendations.

5. Were there any adjustments made to the data? ☐ Yes ☐ No

   If yes, attach an explanation of how the data was adjusted, based upon Bulletin 17B recommendations.

6. Are there any discharges above the high outlier threshold? ☐ Yes ☐ No

   If yes, does the analysis include historical period? ☐ Yes ☐ No

   If no, attach explanation.

7. Are there any discharges below the low outlier threshold? ☐ Yes ☐ No

   If yes, is the threshold value input into the model? ☐ Yes ☐ No

Attachment B: Statistical Analysis of Gage Records (Cont'd)

If yes, justify inputting a low outlier value.

8. Number of zero events ____________

   Explain how the zero events are considered in the analysis:

   ____

   ____

9. Are the final discharges based on expected probability? ☐ Yes ☐ No

   [FEMA does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS].

10. Were the results compared with other analyses? ☐ Yes ☐ No

    If yes, indicate which attachments are included.

    ☐ Attachment C: Regional Regression Equation
    ☐ Attachment D: Rainfall/Runoff Model
    ☐ Attachment E: Comparison of Results

    If no, explain why the results were not compared.

    ____

    ____

11. Provide the following information:

    a. Mean .... ____________ cfs
    b. Standard deviation .... ____________
    c. Generalized skew .... ____________
    d. Station skew .... ____________
    e. Adopted skew .... ____________

12. Results

    10-year discharge .... ____________ cfs
    50-year discharge .... ____________ cfs
    100-year discharge .... ____________ cfs
    500-year discharge .... ____________ cfs

13. Were any other methods used to determine the discharges at ungaged locations, (such as regional frequency curves, transfer equations, etc.). ☐ Yes ☐ No

    If yes, specify method, equations, and provide sketch showing the locations.

    ____

    ____

    ____

    ____

    ____

    ____

Attach analysis including plot of flood frequency curve.

HYDROLOGIC ANALYSIS FORM

Attachment C: Regional Regression Equation Analysis

Flooding Source: N/A

1. **State the publication used:** ______________________

   ____

   (Attach a copy of title page, table of contents, and pertinent pages including equations.)

2. **Does the stream under study have a gaging station?** ☐ Yes ☐ No

   If no, use regional regression equations directly.

   If yes, provide the following information, and compute weighted discharges as recommended in the publication, where applicable.

   a. **Station number:** ______________________
   b. **Drainage area at the gaging station:** ______________________ mi^2;
   c. **Location: relative to the limit of study:** ______________________

3. **Is the watershed under study within one hydrologic region?** ☐ Yes ☐ No

   If no, attach an explanation of how the discharges are computed.

4. **State the limitations of equations:**

   ____

   ____

5. **Equation Parameters and Results (use separate sheet if necessary)**

   a. **Complete for rural conditions (less than 10% urbanized) using the stated publication.**

Reference Point(s)*	1	2	3	4	5	6
Parameters:						
Results						
10-year discharge (cfs)						
50-year discharge (cfs)						
100-year discharge (cfs)						
500-year discharge (cfs)**						

***Describe reference points in Summary of Discharges Table (Attachment A).**
****The 500-year discharge should be extrapolated from the flow frequency curve.**

Attach computations, figures, and maps.

Attachment C: Regional Regression Equation Analysis (Cont'd)

b. **Complete for urban conditions, (more than 10% urbanized) by adjusting the rural discharges from the previous table if the equations from USGS Water Supply Paper 2207 dated 1983 Flood Characteristics of Urban Watersheds in the United States are used,or obtain parameters and discharges from other urban studies.**

Reference Point(s)*	1	2	3	4	5	6
Parameters:						
Results						
10-year discharge (cfs)						
50-year discharge (cfs)						
100-year discharge (cfs)						
500-year discharge (cfs)**						

Attach any supplementary calculations, maps, and figures.

***Describe reference points in Summary of Discharges Table (Attachment A)**
****The 500-year discharge should be extrapolated from the flow frequency curve if necessary.**

Attachment D. Rainfall/Runoff Model

Flooding Source: Upper East Maricopa Floodway (UEMF)

Model Used: U.S.C.O.E. HEC-1 **Version:** 4.0 **Date:** Sept. 1990

Type of model: [XX] Single Event Model [ ] Continuous Streamflow Simulation Model

If continuous model is used, attach separate technical report.

For each flooding source, provide the following information. If the response is "no" to any of the following questions, attach an explanation for each.

A. **Preparation of Hydrology Model and Data submitted.**

1. **The following information is submitted.**

   a. [XX] A disk copy of the rainfall/runoff model.

   b. [XX] A topographic map with basin boundaries

   c. [XX] Schematic diagram of the hydrologic model.

   d. [X] Information to support the selection of parameters relating to initial loss and loss rates.

   e. [X] Information to support the selection of parameters related to impervious areas/urbanization.

   f. [X] Information to support the selection of parameters for unit hydrograph/kinematic wave method.

   g. [X] Information to support the selection of parameters for routing methods.

2. Was a U.S. Geological Survey (USGS) 7.5-minute quadrangle map used to delineate the basin boundaries? [XX] Yes [ ] No

3. Was the watershed subdivided into subbasins in such a way that each tributary to the main stream is considered in the modeling? [X] Yes [ ] No

4. Were channel routing reaches considered between the tributaries of the main stream, where applicable? [X] Yes [ ] No

5. Was reservoir routing performed at the locations of structures where there is impoundment? [X] Yes [ ] No

6. Are consistent identification symbols for subbasins, nodes, reach lengths, etc., shown on the schematic diagram, watershed map and the printout? [X] Yes [ ] No

Attachment D. Rainfall/Runoff Model (Cont'd)

B. Total Rainfall and Rainfall Distribution

1. If rainfall selected is not determined from National Weather Service (NWS) publications, was the NWS consulted? If no, attach explanation. [XX] Yes [ ] No

2. Rainfall distribution is selected from Soil Conservation Service distribution, or U.S. Army Corps of Engineers' hypothetical distribution, or others (localized storm from cloud burst or general winter storm): Check one box.

   [X] SCS [ ] COE [ ] Other (attach explanation)

3. Rainfall duration selected: Check one box.

   [ ] 3 hrs [ ] 6 hrs [ ] 12 hrs [XX] 24 hrs [ ] Others ________

   Does the selected duration produce maximum peak discharges? [XX] Yes [ ] No

   If no, please explain:

   ____

4. Computation time interval, Δt is 5 minutes. If Δt is greater than 0.29 of the smallest lag time used in the watershed model, attach explanation.

5. Timing of maximum rainfall increment (e.g., 3rd hour, 12th hour) 12th hour

6. Point rainfall values are adjusted for areal distribution? [XX] Yes [ ] No

   If no, please explain:

   ____

C. Loss Rate Method

1. The following loss rate methods are used.

   [ ] Initial and uniform [ ] Curve number [XX] Green-Ampt [ ] Holtan
   [ ] Other (specify) ________

2. Are the loss rates determined from hydrograph reconstitution/calibration runs? [ ] Yes [XX] No

3. Do the loss rates vary with different storm frequencies? [ ] Yes * [XX] No

* Only one storm event used.

Attachment D. Rainfall/Runoff Model (Cont'd)

D. Unit Hydrograph/Transformation Method.

1. The following unit hydrograph method/transformation method is selected.

☐ Snyder ☒ Clark ☐ SCS ☐ Kinematic Wave ☐ Other (Explain):

2. Were unit hydrograph or transformation method parameters obtained from calibration runs? ☐ Yes ☒ No

3. Is base flow considered in the modeling? ☐ Yes ☒ No ☐ N/A

4. Is snowmelt considered in the modeling? ☐ Yes ☒ No ☐ N/A

E. Routing Method

The following routing method is used.

☒ Muskingum-Cunge For Pipes ☐ Muskingum ☒ Modified Puls For channels

☐ Att-Kin ☐ Other (specify) ________________

1. Were roughness coefficients in Muskingum-Cunge method obtained from calibration runs? ☐ Yes ☒ No ☐ N/A

2. Were Parameters K and X in Muskingum method obtained from calibration runs? ☐ Yes ☐ No ☒ N/A

3. Was the number of steps in the Modified Puls channel routing method obtained from calibration runs? ☒ Yes ☐ No ☐ N/A

F. General Consideration

1. If the model was calibrated to known flood events, is a summary of the calibration procedures, calibrated parameters, and the results attached? ☐ Yes ☒ No

2. Were watershed development conditions ~~are~~ for existing conditions and not for the future conditions? (FEMA does not accept future conditions.) ☒ Yes ☐ No

3. Were the results compared with the results from other methods? ☐ Yes ☒ No

If yes, indicate which attachments are included:

☐ Attachment B, Statistical Analysis of Gage Records
☐ Attachment C, Regression Analysis
☐ Attachment E, Comparison of Results

Attachment D. Rainfall/Runoff Model (Cont'd)

SEE HYDROLOGY REPORT

G. **Evaluation of results for each subbasin. Complete the following form with requested information and use it for evaluating the reasonableness of rainfall, losses, lag time, and discharges.**

Number of Subbasins: ________________

Subbasin						
Drainage Area (mi^2)						
Longest Hydraulic length (ft.)						
Rainfall						
Total Depth: 10-year (in)						
50-year (in)						
100-year (in)						
500-year (in)						
100-Year Initial Loss, inch						
100-Year Total Loss, inch						
Impervious Area (%)						

Lag time (hours)						
Final Results						
10-year discharges (cfs)						
50-year discharges (cfs)						
100-year discharges (cfs)						
500-year discharges (cfs)						
100-year discharge/drainage area (cfs/mi^2)						

Note: Attach additional sheets if necessary.

Attach rainfall/runoff model, Hydrologic Model Schematic, and supporting maps.

Attachment E - Comparison of Results

☐ Preliminary* ☐ Final | ☐ Discharges ☐ Water-Surface Elevations

Stream: Not Applicable

Method (1): ____________________

Method (2): ____________________

Location	Drainage Area	10-year		50-year		100-year		500-year	
		1	2	1	2	1	2	1	2

Note: *Only 100-year discharge and corresponding water-surface elevations should be considered for preliminary analysis.

Attachment F: Confidence Limits Evaluation

Flooding Source: Not Applicable

Gaging Station Name and Number: ______

100-year discharge

Effective	**Revised**
______ **cfs**	______ **cfs**

Confidence intervals of the revised 100-year discharge

90% Confidence Interval:	**5% limit** ______	**cfs**
	95% limit ______	**cfs**
50% Confidence Interval:	**25% limit** ______	**cfs**
	75% limit ______	**cfs**

An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

RIVERINE HYDRAULIC ANALYSIS FORM

Community Name: City of Mesa, Maricopa County, AZ
Flooding Source: Upper East Maricopa Floodway (UEMF)

For each flooding source delineated as approximate or shallow flooding, this form is not required. Attach hydrologic and hydraulic computations used to determine depth of shallow flooding or approximate floodplain, indicating data used and its source.

For each flooding source studied by detailed methods provide the following information:

Model Used: [XX] HEC-2 [ ] WSPRO [ ] WSP2 [ ] Other ______

Reach Studied

Downstream limit River Mile No. 21.213
Upstream limit River Mile No. 22.468

Effective FIS

[ ] **Not studied**

[XX] **Studied by approximate methods**
Downstream limit of study Several miles downstream of R.M. 21.213
Upstream limit of study 1 3/4 miles upstream of R.M. 22.468

[ ] **Studied by detailed methods**
Downstream limit of study ______
Upstream limit of study ______

[ ] **Floodway delineated**
Downstream limit of floodway ______
Upstream limit of floodway ______

Hydraulic Analysis

1. **Why is the hydraulic analysis different from that used to develop the FIRM? (check all that apply and explain below).**

   [XX] Not studied in FIS
   [XX] Improved hydrologic data/analysis
   [XX] Improved hydraulic analysis
   [ ] Flood control structure
   [ ] Other ______

2. **For streams studied by detailed methods in the effective FIS, has the effective model been used?** [ ] Yes [ ] No [XX] N/A
   If no, has Regional Project Officer approval been obtained? [ ] Yes [ ] No

RIVERINE HYDRAULIC ANALYSIS FORM

Model Parameters

(from model used to revise 100-year water surface elevations)

1. **Have the discharges used in the hydraulic model been changed at appropriate locations based on the hydrologic analysis?** ☒ Yes ☐ No

   If no, explain: ______________________

   Attach diagram showing locations of changes in 100-year discharge value and show discharge value. (Quad map used to show study limits may be used to show discharge change locations).

2. a. **Indicate how the starting water surface elevations were determined.**

   ☒ Slope Area
   ☐ Known water surface elevation (explain)
   ☐ Critical Depth
   ☐ Other (Explain)

   b. **Is there a structure located immediately downstream of the starting point in the model?** ☐ Yes ☒ No

   If yes, were the backwater effects of the structure considered? ☐ Yes ☐ No

   If no, explain: ______________________

3. a. **Were channel overbank roughness coefficients (Manning's "n") determined by field inspection?** ☒ Yes ☐ No

   b. **If no, explain how coefficients were determined.** ______________________

   c. **Give range of Manning's "n" coefficients used, excluding structures:**

   channel 0.015 - 0.060 **overbanks** 0.028 - 0.20

   d. **If channel Manning's "n" coefficients are less than 0.025 at locations other than at structures, please explain:**

   For Pavement & Sidewalks N = 0.015 was used.

   e. **Give range of contraction and expansion loss coefficients along the stream excluding the coefficients at the structures.** (0.1) Contr. to 0.3 (Exp.)

4. **Describe how the cross section geometry data were determined (e.g., field survey, topographic map, or taken from previous study).**

   Most cross-sections digitized from the topo. mapping

   Approx. five cross-sections field surveyed.

Model Parameters (Cont'd)
(from model used to revise 100-year water surface elevations)

5. **Describe how the dimensions of hydraulic structures were determined:**
Inverts of hydraulic structures were field surveyed at mapping datum and sizes and lengths were field verified with as-built plans.

6. **Explain how reach lengths for channel and overbanks were determined:**
Reach lengths were measured from topo. mapping with bank stations noted on mapping.

Does the main channel length represent the meandering of the stream and river bends, and the overbank lengths follow the pattern of the 100-year flood? ☒ Yes ☐ No

Explain: ______

7. **Are there areas of ineffective flow along the studied flooding source, including at road crossings?** ☒ Yes ☐ No

If yes, explain how they were modeled:
In eff. areas blocked out at Roads by ET or X3 record option. GR Elevations modified to remove ineffective areas at retention basins or behind berms where continuous flow not possible.

Results
(from model used to revise 100-year water surface elevations)

1. **Are water surface elevations higher than end points of cross sections or have cross section end points been artificially raised to contain flooding?** ☐ Yes ☒ No

If yes, were cross-sections shortened or raised to exclude ineffective flow areas? ☐ Yes ☐ No

If no, the cross-sections may need to be widened. If they were not widened, please explain:

______

2. **Does the stream exhibit supercritical flow?** ☐ Yes ☒ No

Was supercritical flow analysis performed? ☐ Yes ☒ No

If yes, please note that supercritical flow analysis should only be performed for those streams that have been channelized and designed specifically for supercritical flow. Otherwise, critical depth should be used to generate flood profiles.

Results
(from model used to revise 100-year water surface elevations) (Cont'd)

3. **Do the results indicate:**

   a. **Split flows?** ☐ Yes ☒ No

   b. **Other unique situations?** ☐ Yes ☒ No

   If yes to any of the above, attach an explanation that discusses the situation and how it is presented on the profiles, maps, and tables. Reference this form, page, and section number.

4. **Was a divided flow analysis performed at a series of consecutive cross-sections because the friction slope of each divided flow path cannot be considered the same?** ☐ Yes ☒ No ☐ N/A

   If no, please explain:

5. **For each stream studied:**

   a. **Does the conveyance change message appear at cross sections other than at structure locations where the difference in velocity head between cross sections is more than 0.5 foot?** ☒ Yes ☐ No

   If yes, additional intermediate cross sections should be added.

   If cross sections are not added, explain why:
   The KRATIO message does appear at several cross-sections. However, the Diff. in HV between these sections was less than 0.5 ft.

   b. **Do the revised 10-, 50-, 100-, and 500-year water-surface elevations tie-in to the unrevised 10-, 50-, 100-, and 500-year water-surface elevations, if available, at both upstream and downstream revised study limits?** ☐ Yes ☒ No ☐ N/A

   If no, provide explanation (attach additional sheets and reference this form, page, and section number.)
   See A-N West Special Problems Report No. 1 FCD No. 94-26, Dated 11/22/95, which explains descrepency in UEMF study results at downstream end where compared to upstream end of original EMF design.

RIVERINE HYDRAULIC ANALYSIS FORM

Floodway N/A

1. If a floodway is determined on the effective FIRM or FBFM, is the same floodway from the effective study duplicated in the restudy? N/A ☐ Yes ☐ No

2. If a floodway was not established before, was the equal conveyance reduction method used to determine the floodway for the restudy? ☐ Yes ☐ No

3. Has the (revised) floodway configuration been approved by the community officials? ☐ Yes ☐ No

4. Floodway determination

   a. What is the maximum surcharge allowed by State law? _____ foot

   b. What is the maximum surcharge for the modeled conditions? _____ foot

   The surcharge at all cross-sections must not be greater than the maximum surcharge allowed by State Law.

   c. Are there any negative surcharge values at any cross sections? ☐ Yes ☐ No

   If yes, the floodway width may need to be widened. If it is not widened, please explain and indicate the maximum negative surcharge.

   ____

   ____

   ____

   d. If results indicate supercritical flow, was the floodway based on the rise in energy grade line? ☐ Yes ☐ No

   e. Is the floodway at confluences computed independently from backwater from the receiving stream? ☐ Yes ☐ No

   f. Has the backwater elevation been shown on the profile and in the Regulatory column of the Floodway Data Table? ☐ Yes ☐ No

   g. Is the discharge value used to determine the floodway the same everywhere as that used to determine the natural 100-year flood elevations? ☐ Yes ☐ No

   h. Is the floodway topwidth less than or equal to the natural 100-year topwidth at all cross sections? ☐ Yes ☐ No

   i. Are encroachment stations outside or equal to the channel stations at all cross sections? ☐ Yes ☐ No

Floodway (Cont'd)

j. Does the floodway reflect an unobstructed flowpath (i.e., are existing subdivisions and large structures excluded from the floodway?) ☐ Yes ☐ No

If no to any of the above, please explain:

Bridges, Culverts, and Minor Structures

1. Are there any structures crossing the stream that are not modeled? ☐ Yes ☒ No

   If yes, explain:

2. Complete Attachments A and B as appropriate for each structure modeled. ☒ Complete

   If the type of flow at structures modeled was determined by the energy gradient elevation, does the upstream water-surface elevation at each structure correspond with the type of flow? ☒ Yes ☐ No

4. For HEC-2 models indicating low flow conditions, are the topwidths at the upstream and downstream cross-sections of the structure the same as the width between abutments? ☐ Yes ☐ No ☒ N/A

5. For weir flow is the weir length about the same as the upstream topwidth? ☐ Yes ☐ No ☒ N/A

   If no, explain:

6. For weir flow conditions, are the downstream, road profile, and upstream floodway widths the same? ☐ Yes ☐ No ☒ N/A

   If no, explain:

7. For HEC-2 models, have structures been encroached using the HEC-2 bridge encroachment option where weir flow is exhibited? ☐ Yes ☐ No ☒ N/A

Attachment A: Bridge Information

Community Name: N/A

Flooding Source: ______________________

Roadway/Railroad Name: ______________________

Hydraulic Model Used: ______________________

Location (in terms of stream distance or cross-section identifier): ______________________

Bridge Sheet _______ **of** _________

Physical Data	Width Between Abutments	Wingwall Angle	Skew Angle	Low Chord Elevation @ Stream Centerline	Road Elevation at Stream Centerline	Minimum Road Elevation

Loss Coefficients	Entrance Loss Coefficient	Friction Loss Coefficient	Other Loss Coefficient	Pier Loss Coefficient	Weir Loss Coefficient	Orifice Loss Coefficient	Total Loss Coefficient	Contraction Loss Coefficient	Expansion Loss Coefficient

	Cross-sectional Pier Shape	Pier Width	Number of Piers	Manning's "n" Coefficients		
				Downstream	Through Bridge	Upstream
Shape 1						
Shape 2						
Shape 3						

100-year Flood Discharge			100-year Flood Elevations					
Total Discharge	Discharge Due to Low or Pressure Flow	Discharge Due to Weir Flow	Elevation of Upstream Energy Gradient	Elevation of Downstream Energy Gradient	Upstream Water-Surface Elevation	Downstream Water-Surface Elevation	Upstream Floodway Water-Surface Elevation	Downstream Floodway Water-Surface Elevation

100-year Flood Widths					
Topwidth Upstream Floodplain	Weir Length	Topwidth Downstream Floodplain	Topwidth Upstream Floodway	Floodway Weir Length	Topwidth Downstream Floodway

Attachment B: Culvert Information

Community Name: City of Mesa

Flooding Source: Upper East Maricopa Floodway (UEMF)

Roadway/Railroad Name: Brown Road

Hydraulic Model Used: HEC-1, Special Bridge Routine

Location (in terms of stream distance or cross-section identifier): RM 21.389 - 21.415

Culvert Sheet 1 **of** 1

Shape	Material	Number of Barrels	Span	Rise	Space Between Barrels	Length of Barrel	Upstream Invert Elevation	Downstream Invert Elevation
BOX	CONCRETE	2	8 ft.	8 ft.	1 ft.	138 ft	1338.52	1338.44

Inlet Geometry			Manning's "n" Coefficients			Velocity Distribution Coefficient	Entrance Loss Coefficient	Friction Loss Coefficient	Pier Loss Coefficient
Wingwall Angle	Headwall	Other	Downstream	Through Culvert	Upstream				
24.3°	Rounded Soffit	-	0.050	0.013	0.050	1.0	0.11	0.27	0.90

Weir Coefficient	Orifice Coefficient	Total Loss Coefficient	Contraction Loss Coefficient	Expansion Loss Coefficient	Road Elevation at Stream Centerline	Minimum Road Elevation
2.8 N/A	N/A	1.43	0.3	0.5	1350.80	1350.50

100-year Flood Discharge			100-year Flood Elevations					
Total Discharge	Discharge Due to Low or Pressure Flow	Discharge Due to Weir Flow	Elevation of Upstream Energy Gradient	Elevation of Downstream Energy Gradient	Upstream Water-Surface Elevation	Downstream Water-Surface Elevation	Upstream Floodway Water-Surface Elevation	Downstream Floodway Water-Surface Elevation
603	603	0	1348.38	1348.11	1348.17	1347.89	N/A	N/A

100-year Flood Widths					
Topwidth Upstream Floodplain	Weir Length	Topwidth Downstream Floodplain	Topwidth Upstream Floodway	Floodway Weir Length	Topwidth Downstream Floodway
17	N/A	17	N/A	N/A	N/A

FORM 6

RIVERINE MAPPING FORM

Community Name: City of Mesa, Maricopa County, AZ

Flooding Sources: Upper East Maricopa Floodway (UEMF)

Mapping Requirements

1. An original mylar topographic work map of suitable scale, contour interval, and planimetric definition must be submitted showing:

		INCLUDED?		
a.	100-year floodplain boundary (Zone A)	[XX] Yes	[ ] No	[ ] N/A
b.	100- and 500-year floodplain boundaries (Detailed) * 100 Year Floodplain only.	* [XX] Yes	[ ] No	[ ] N/A
c	100-year floodway boundary	[ ] Yes	[XX] No	[ ] N/A
d.	Shallow flooding	[ ] Yes	[ ] No	[X] N/A
e.	Location and alignment of cross sections used in the hydraulic model with hydraulic base line indicated if different from the stream centerline	[XX] Yes	[ ] No	[ ] N/A
f.	Stream alignments, road and dam alignments	[XX] Yes	[ ] No	[ ] N/A
g.	Current community boundaries	[XX] Yes	[ ] No	[ ] N/A
h.	Effective 100- and 500-year floodplain and 100-year floodway boundaries from the FIRM/FBFM reduced or enlarged to the scale of the topographic work map	[XX] Yes	[ ] No	[ ] N/A
i.	Tie-ins between the effective and revised 100- and 500-year floodplains and 100-year floodway boundaries	[XX] Yes	[ ] No	[ ] N/A
j.	Location and elevation of reference marks as described in the G&S for study contractors	[XX] Yes	[ ] No	[ ] N/A
k.	Base Flood Elevations plotted from the profiles.	[XX] Yes	[ ] No	[ ] N/A
l.	Vertical datum	[XX] NGVD 1929	[ ] NAVD 1988	[ ] Other
m.	If NAVD88 has not been used, has authorization been given by the Project Officer? * Conversion Factor to NAVD88 Provided.	* [XX] Yes	[ ] No	[ ] N/A
n.	Levees if present. (include Levee/Floodwall System Analysis Form).	[ ] Yes	[XX] No	[ ] N/A

If any of the items above are marked No or N/A, please provide explanation, referencing this form, page, and section number.

Mapping Requirements (Cont'd)

2. Base Flood Elevations must be drawn on the maps based on the profiles, and in accordance with the following guidelines:

   a. Each separate detailed flooding zone including isolated and backwater areas have at least one BFE. — [X] Yes [ ] No [ ] N/A

   b. Minimum and maximum whole foot BFEs are represented at downstream and upstream limits of detailed study. — [X] Yes [ ] No [ ] N/A

   c. BFEs are located within 1/2 inch of panel edges, corporate limits, and confluences of detailed study streams. — [X] Yes [ ] No [ ] N/A

   d. BFEs are plotted perpendicular to the direction of 100-year flow, not necessarily perpendicular to the stream centerline direction. — [X] Yes [ ] No [ ] N/A

   e. Hydraulic structures such as bridges which cause backwater ponding have a BFE placed parallel and next to the structure and the same BFE has been plotted at the upstream limit of the backwater. — [X] Yes [ ] No [ ] N/A

   f. Lacustrine areas with uniform BFEs have been identified by labeling the uniform elevation as: (EL XXX) below the zone label. — [X] Yes [ ] No [ ] N/A

   g. BFEs are plotted at significant profile inflection points. (where the profile slope changes) — [X] Yes [ ] No [ ] N/A

   h. BFEs between inflection points, should represent a relatively uniform slope and should therefore be relatively evenly spaced at whole foot elevations. — [XX] Yes [ ] No [ ] N/A

   i. Plot intermediate BFEs based on the following criteria:

      1). Gentle gradient - If BFEs rise less than 1 foot per 1 inch of map distance, BFEs are plotted at every whole foot of elevation rise. — [XX] Yes [ ] No [ ] N/A

      2). Moderate gradient - If BFEs rise more than 1 foot but less than 5 feet per inch of map distance, BFEs are plotted at approximately 1 inch intervals. — [ ] Yes [ ] No [X] N/A

      3). Step gradient - If BFEs rise 5 feet or more per inch of map distance BFEs are plotted at 1/2 inch or 5 foot BFE intervals, whichever results in the wider BFE spacing. — [ ] Yes [ ] No [X] N/A

   j. A profile plotted from the BFEs shown on the work map will reproduce the original profile within ± 1/2 foot. — [X] Yes [ ] No [ ] N/A

Mapping Requirements (Cont'd)

3. What is the source and date of the updated topographic information? (example, orthophoto maps, July 1985, field survey, May 1979.) July 7, 1995 Photo Date Topographic Maps

4. What is the scale and contour interval of the work maps?

   Scale 1" = 200'

   Contour Interval 2 foot

5. Complete Internal Agreement Check (Attachment A) for each stream studied by detailed methods.

   Are channel distances, floodway widths, and base flood elevation in agreement among the printout, profile, work map, and floodway data table? [X] Yes [ ] No

6. List all contiguous communities affected by the flooding sources studied.

   Contiguous Community Information (All contiguous communities affected by the flooding sources studied must be listed. Attach additional page if necessary.)

Contiguous Community name	Date (effective or preliminary)	Shared Flooding Source(s) if Applicable
Not applicable		

Complete Attachment B: Contiguous Study Check for each shared flooding source or contiguous study.

7. Manual or digital map submission:

   [X] Manual
   [ ] Digital

   Describe Electronic Media Submitted:

   Digital map submissions must be coordinated with FEMA Headquarters as far in advance of submission as possible.

Attachment A: Internal Agreement Check P. 3/3

Stream: UEMF **Date:** 1/29/96

Prepared by: GAS **Study:** UEMF FIS

Lettered x-sec	x-sec Number	Physical Feature	Cumm. Channel Distance			Distance between x-sec			Floodway Width			Base Flood Elevation		
			Table	Work Map	Print Out	Profile	Print Out	Work Map	Table	Print Out	Work Map	Table	Print Out	Work Map
AD														
AE	22.468	McKellips Rd	—	6713	6708	301	301	301						
						90	90	90				→	✓	1351.8

Comments:

Attachment A: Internal Agreement Check

p. 1/3

Stream: UEMF **Date:** 1/29/96

Prepared by: GAS **Study:** Upper East Maricopa Floodway (UEMF)

Lettered x-sec	x-sec Number	Physical Feature	Cumm. Channel Distance			Distance between x-sec			Floodway Width N/A			Base Flood Elevation		
			Table	Printout ~~Work Map~~	Work Map ~~Print Out~~	Profile	Print Out	Work Map	Table	Print Out	Work Map	Table	Print Out	Work Map
A	21.213		—	—	—							—	✓	1347.92
B	21.307		—	500	500	500	500	500				—	✓	47.97
C	21.364		—	801	800	300	301	300				—	✓	48.01
D	21.389			933	930	132	132	130				—	✓	47.89
E	21.415	2-8'x8' RCB's	Brown Rd.	1071	1068	138	138	138				—	✓	48.17
F	21.434			1171	1168	100	100	100				—	✓	48.44
G	21.481			1419	1416	248	248	248				—	✓	48.45
H	21.513			1589	1585	170	170	169				—	✓	48.47
I	21.539			1724	1722	137	135	137				—	✓	48.37
J	21.544			1746	1743	21	22	21				—	✓	48.74
K	21.546			1756	1753	10	10	10				—	✓	48.80
L	21.554			1798	1795	42	42	42				—	✓	48.87
M	21.575			1910	1906	110	112	111				—	✓	48.87
N	21.627			2185	2181	275	275	275				—	✓	48.87
O	21.640			2255	2250	70	70	69				—	✓	48.86

Comments:

Attachment A: Internal Agreement Check p. 2/3

Stream: UEMF

Date: 1/29/96

Prepared by: GAS

Study: UEMF FIS

Lettered x-sec	x-sec Number	Physical Feature	Cumm. Channel Distance			Distance between x-sec			Floodway Width N/A			Base Flood Elevation		
			Table	Printout ~~Work Map~~	Work Map ~~Print-Out~~	Profile	Print Out	Work Map	Table	Print Out	Work Map	Table	Print Out	Work Map
P	21.659			2355	2360									
Q	21.678	Princess Dr.		2455	2450	100	100	100				–	✓	48.86
R	21.735			2755	2751	100	100	100				–	✓	48.79
S	21.792			3055	305	301	300	301				–	✓	48.79
T	21.817	Hobart Rd.		3187	3184	301	300	301				–	✓	49.58
U	21.874			3488	3484	132	132	132				–	✓	50.94
V	21.934	McLellan/Greenfield		3805	3799	301	301	300				–	✓	50.50
W	21.972			4005	3999	320	317	315				–	✓	50.68
X	22.027			4295	4289	200	200	200				–	✓	50.83
Y	22.134			4865	4859	295	290	290				–	✓	50.85
Z	22.203			5229	5224	570	570	570				–	✓	50.87
AA	22.271			5583	5574	364	364	365				–	✓	50.87
AB	22.363			6069	6064	360	354	350					✓	50.88
AC	22.411			6322	6317	486	486	490				–	✓	50.90
AD	22.468			6623	6618	253	253	253				–	✓	50.95
Comments:												–	✓	1350.93

RIVERINE MAPPING FORM

Attachment B: Contiguous Study Check

City of Mesa	Maricopa	Az.
Community Name	County	State

For each shared flooding source, or contiguous study make the following comparisons:

Contiguous Study Name: N/A

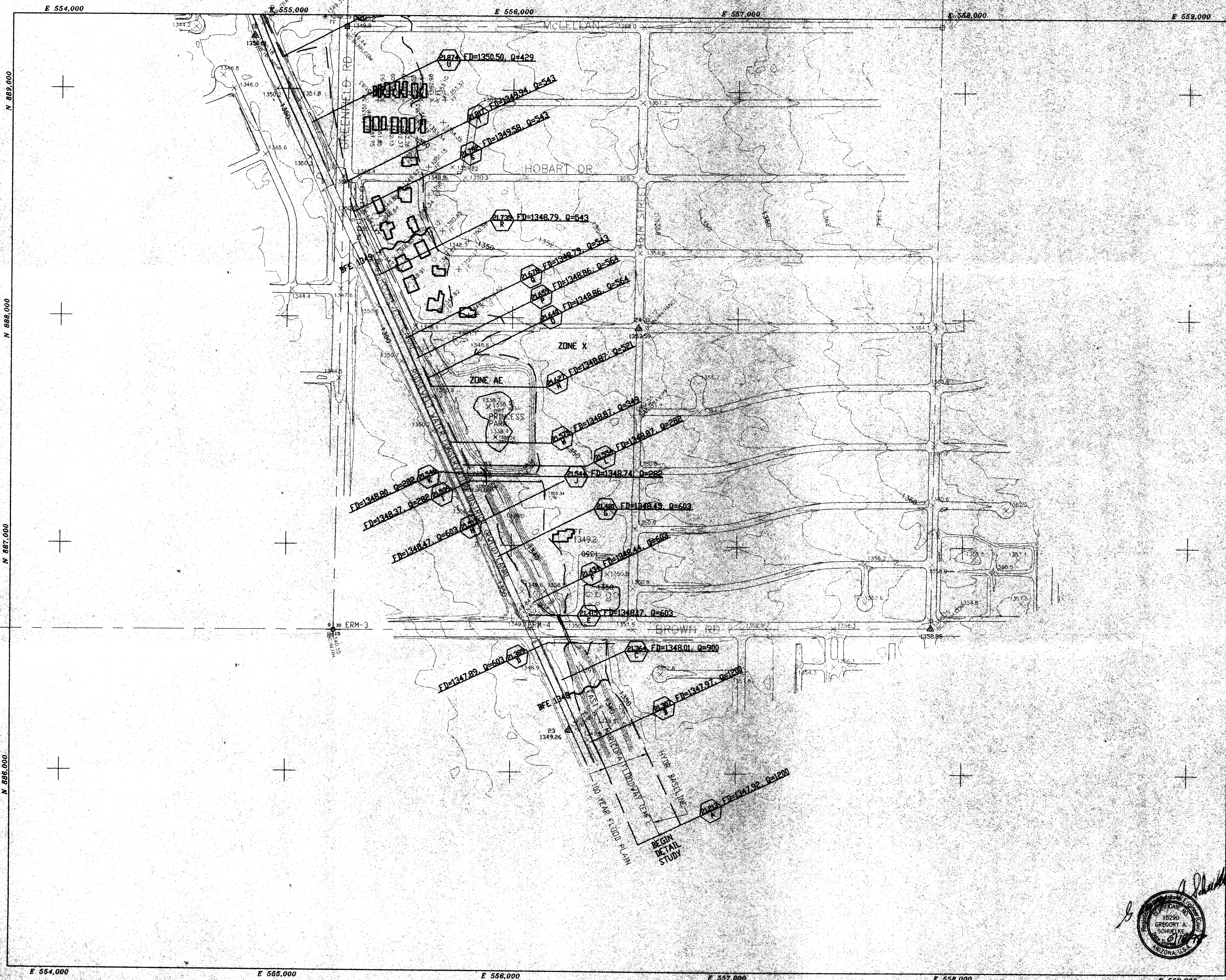
Shared Flooding Source:

ITEMS TO BE CHECKED	Tolerance	Within Tolerance?		COMMENTS (e.g.: the extent of mismatch; Please attach explanation)
		Yes	No	
A. MAPS 1. BFEs	Match			
2. 100- & 500-Year Floodplain Boundaries	Match			
3. Floodway Widths & Boundaries	Match			
4. Approximate Floodplain Boundaries	Match			
B. PROFILE 1. 100- & 500-Year Flood Profiles	±0.5 ft.			
2. Channel Invert	Match			
C. NARRATIVE 1. Discharges	Match			

Contiguous Study Name:

Shared Flooding Source:

ITEMS TO BE CHECKED	Tolerance	Within Tolerance?		COMMENTS (e.g.: the extent of mismatch; Please attach explanation)
		Yes	No	
A. MAPS 1. BFEs	Match			
2. 100- & 500-Year Floodplain Boundaries	Match			
3. Floodway Widths & Boundaries	Match			
4. Approximate Floodplain Boundaries	Match			
B. PROFILE 1. 100- & 500-Year Flood Profiles	±0.5 ft.			
2. Channel Invert	Match			
C. NARRATIVE 1. Discharges	Match			



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF UPPER EAST MARICOPA FLOODWAY

F.C.D. CONTRACT NO. 94-26

LEGEND

DETAIL STUDY 100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 M13.0
CROSS SECTION	FD=100 Yr WSE FW=Floodway WSE
ELEVATION REFERENCE MARK	ERM3 X
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE A
CORPORATE LIMITS	
COUNTY OR STATE JURISDICTIONAL BOUNDARY	
SECTION CORNER	4 3 9 10
QUARTER SECTION	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 29

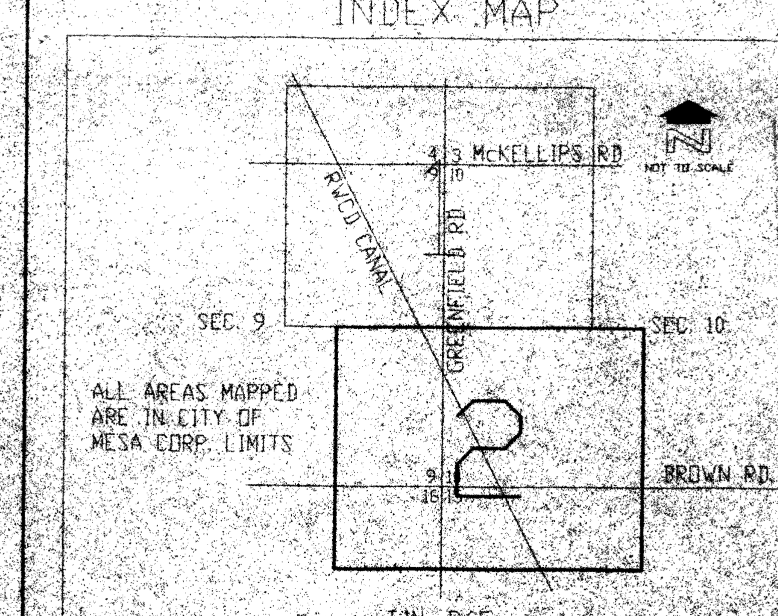
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM-2	1349.44	BRASS CAP IN HAND HOLE, INTERSECTION OF GREENFIELD AND McLELLAN ROADS
ERM-3	1340.55	BRASS CAP IN HAND HOLE, INTERSECTION OF GREENFIELD AND BROWN ROADS
ERM-4	1352.42	BRASS CAP IN WEST TOP CONCRETE SIDEWALK BARRIER WALL, NORTH SIDE BROWN ROAD OVER RWCD CANAL

NOTES

1. CROSS-SECTION STA. 10,000.00 IS HYDRAULIC BASELINE
2. CONVERSION FACTOR PER VERTCON, VERSION 2.0, COMPUTER PROGRAM FOR NAVD 88 DATUM 13

ERM No.	NAVD 88 - NGVD 29 (METERS)
ERM-1	0.551
ERM-2	0.547
ERM-3	0.544
ERM-4	0.544

INDEX MAP



200 0 200 400

SCALE: 1" = 200 FEET

CONTOUR INTERVAL = 2 FEET

A-N WEST INC.

	BY	DATE
DESIGN		
DESIGN CHK.		
PLANS		
PLANS CHK.		
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

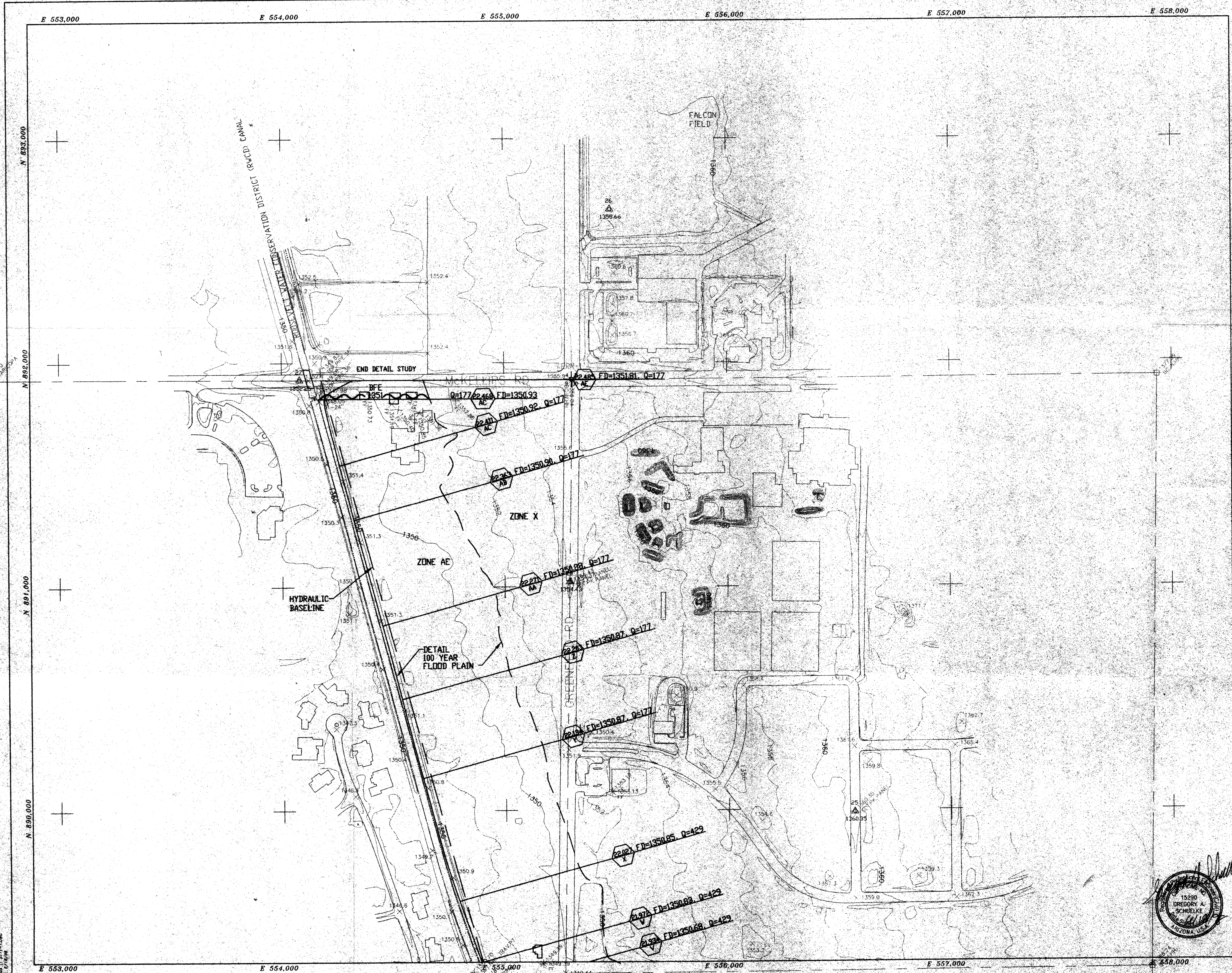
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 2 OF 2

T.D.N. SEC. 2.5

AERIAL MAPPING COMPANY, INC.
SURVEYING AND PHOTOGRAMMETRY
FLIGHT DATE: 7/7/95

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS
1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS AND BASED ON GROUND
DATA PROVIDED BY A-N WEST INC.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF UPPER EAST MARICOPA FLOODWAY

F.C.D. CONTRACT NO. 94-26

LEGEND

DETAIL STUDY 100-YR FLOODPLAIN BOUNDARY (NOTE 3)	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 M13.0
CROSS SECTION	FD=100 Yr. WSE FW=Floodway WSE
ELEVATION REFERENCE MARK	ERM3 X
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	
COUNTY OR STATE JURISDICTIONAL BOUNDARY	
SECTION CORNER	4 3 9 10
QUARTER SECTION	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 29

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM-1	1356.04	BRASS CAP IN HAND HOLE AT INTERSECTION OF GREENFIELD AND McKELLIPS ROADS

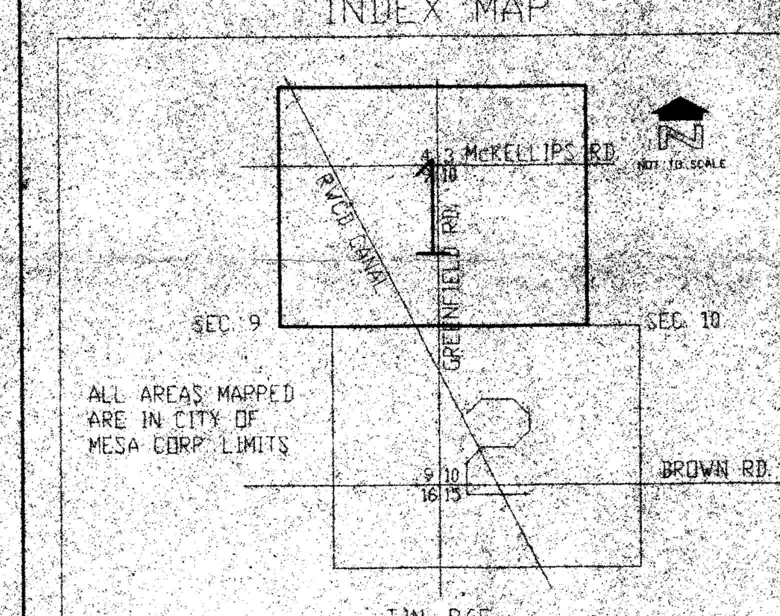
NOTES

1. CROSS-SECTION STA. 10,000.00 IS HYDRAULIC BASELINE
2. CONVERSION FACTOR PER VERTCON, VERSION 2.0, COMPUTER PROGRAM FOR NAVD 88 DATUM 13

ERM No.	NAVD 88 - NGVD 29 (METERS)
ERM-1	0.551
ERM-2	0.547
ERM-3	0.544
ERM-4	0.544

3. DETAIL 100YR FLOODPLAIN NOT PROPOSED PER REPORT DISCUSSION.

INDEX MAP



200 0 200 400

SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 2 FEET

GREGORY A. SCHUELKE 15290 ARIZONA, U.S.A.

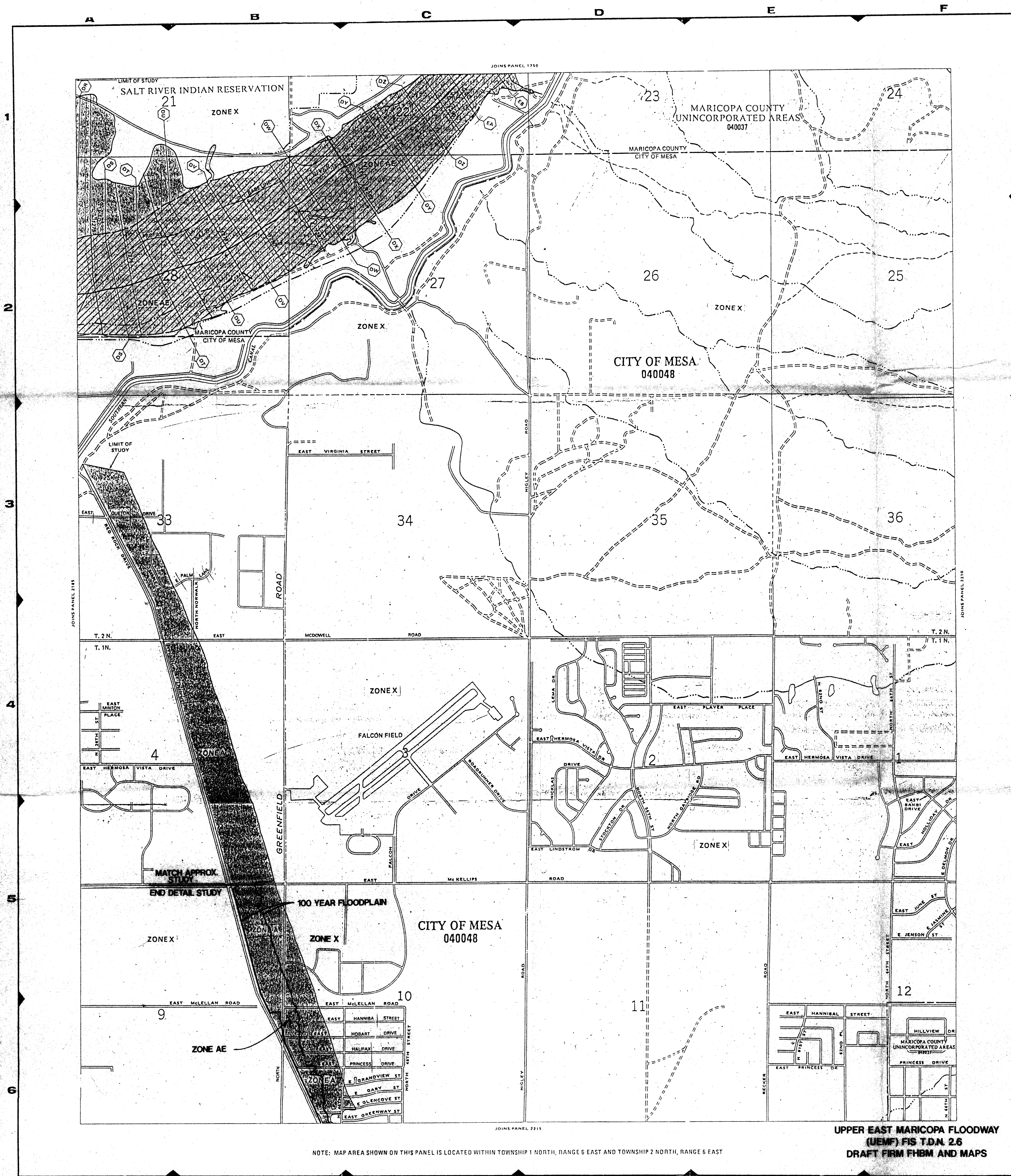
A-N WEST INC.

	BY	DATE	
DESIGN			FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.			RECOMMENDED BY: DATE
PLANS			APPROVED BY: DATE
PLANS CHK.			CHIEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY: DATE			SHEET 1 of 2

T.D.N. SEC. 2.5

AERIAL MAPPING COMPANY, INC.
SURVEYING AND PHOTOGRAMMETRY
FLIGHT DATE: 7/7/95

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS
1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS AND BASED ON GROUND CONTROL
DATA PROVIDED BY A-N WEST INC.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 1 NORTH, RANGE 6 EAST AND TOWNSHIP 2 NORTH, RANGE 6 EAST

UPPER EAST MARICOPA FLOODWAY (UEMF) FIS T.D.N. 2.6 DRAFT FIRM FHBM AND MAPS

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 A0	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.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D Cross Section Line

(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 AND VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of the map.

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index

MAP REPOSITORY

Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:

APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL:

Map revised September 4, 1991 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names and to incorporate previously issued letter of map revision.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET

1000 0 1000

2205

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2205 OF 4350

CONTAINS

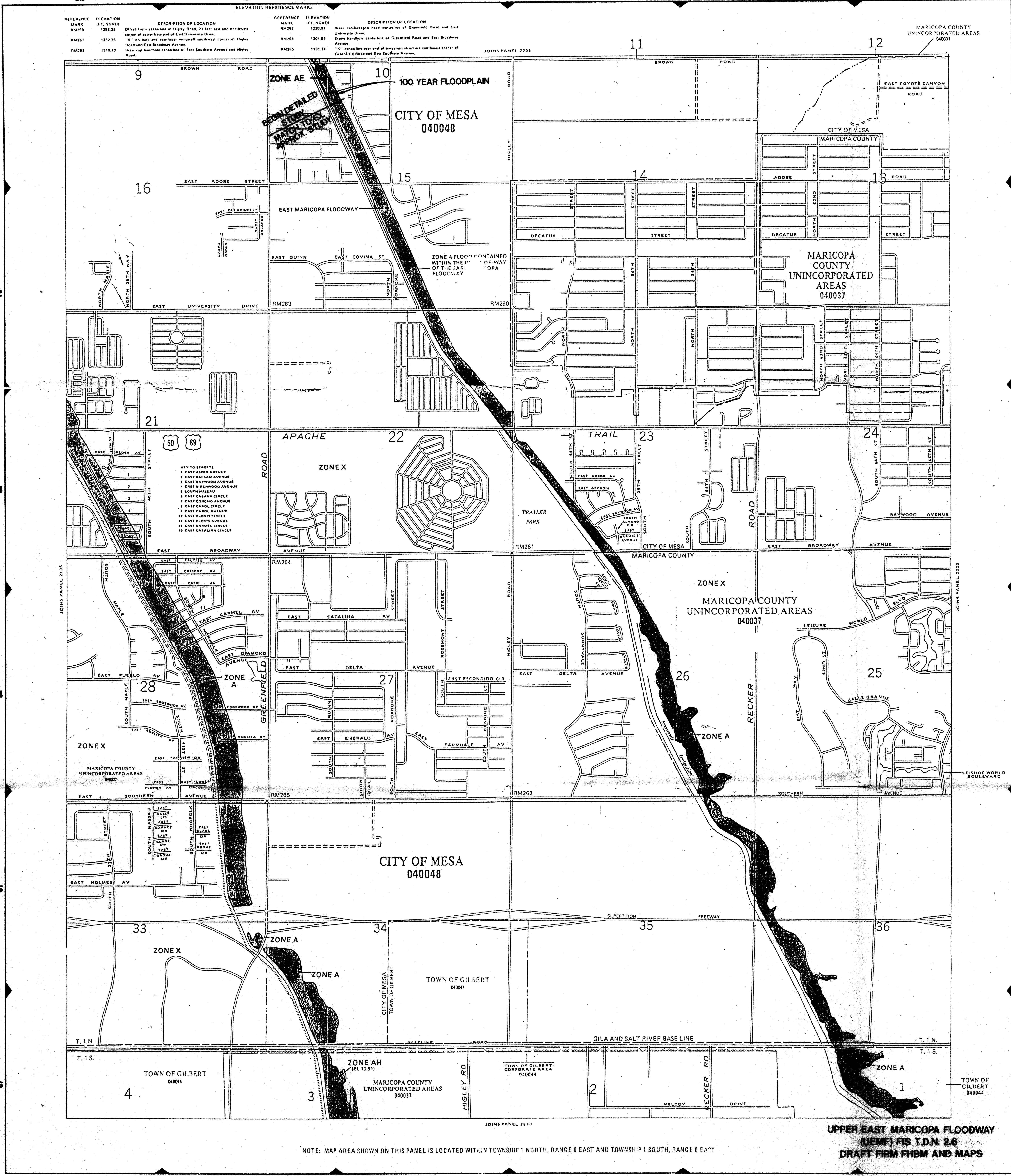
COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	2205	E
MESA, CITY OF	040048	2205	E

MAP NUMBER
04013C2205 E

MAP REVISED:
SEPTEMBER 4, 1991

Federal Emergency Management Agency

A-N WEST #7158-03 FCD 94-26



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 A0	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.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

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(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

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Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of the map.

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL:

Map revised September 4, 1991 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names and to incorporate previously issued letter of map revision.

Map revised DECEMBER 3, 1993 to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names, to reflect updated topographic information, and to incorporate previously issued letters of map revision.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 633-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

2215 F

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY,
ARIZONA AND
INCORPORATED AREAS

PANEL 2215 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
GILBERT, TOWN OF	040044	2215	F
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	2215	F
MESA, CITY OF	040048	2215	F

MAP NUMBER
04013C2215 F

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency

A-N WEST #7158-03 FCD 94-26