Salt River Channelization
Floodplain Delineation Study
Southern Pacific Railroad Salt River Bridge
to McClintock Drive Bridge

Project No. 906345B
Salt River Flood Plain Revisions

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prepared for

Rio Salado Task Force
City of Tempe
Tempe, Arizona

by

CRSS Civil Engineers, Inc.
4041 North Central Avenue, Suite 650
Phoenix, Arizona 85012

November 23, 1993

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FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM**	*O.M.B. Burden No 3067-0148* *Expires July 31, 1994*	***FEMA USE ONLY***

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*
   - ☒ Physical change
     - ☒ Existing
     - ☐ Proposed
   - ☐ Improved methodology
   - ☐ Improved data
   - ☐ Floodway revision
   - ☐ Other _____

   Explain _____

2. Flooding Source: Salt River
3. Project Name/Identifier: Salt River Channelization Phase 2
4. FEMA zone designations affected: AE
   (example: A, AH, AO, A1-A30, A99, AE, V, V1-30, VE, B, C, D, X)
5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
EX: 480301	Katy,City	Harris, Fort Bend	TX	480301	0005D	02/08/83
480287	Harris County	Harris	TX	48201C	0220G	09/28/90
040054	Tempe, City of	Maricopa	AZ	04013C	2170E	09/04/91
				04013C	2165E	09/04/91
				04013C	2160D	09/04/91

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding	Structures	Disciplines*
☒ Riverine	☒ Channelization	☒ Water Resources
☐ Coastal	☒ Levee/Floodwall	☒ Hydrology
☐ Alluvial Fan	☒ Bridge/Culvert	☒ Hydraulics
☐ Shallow Flooding *(e.g. Zones AO and AH)*	☐ Dam	☒ Sediment Transport
☐ Lakes	☐ Coastal	☐ Interior Drainage
	☐ Fill	☒ Structural
Affected by wind/wave action	☐ Pump Station	☒ Geotechnical
☐ Yes	☐ None	☒ Land Surveying
☒ No	☐ Channel Relocation	☐ Other *(describe)*
	☒ Excavation	
	☐ Other *(describe)*	

☐ Other(describe) _____ _____ _____

*** Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? ☒ Yes ☐ No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM ☒ Yes ☐ No
   If yes, give reason: Channelization realigns the floodway boundaries.

Attach copy of either a public notice distributed by the community stating the community's intent to revise the floodway or a statement by the community that it has notified all affected property owners and affected adjacent jurisdictions.

9. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP? ☒ Yes ☐ No

If yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

3. PROPOSED ENCROACHMENTS

10. With floodways:

1A. Does the revision request involve fill, new construction, substantial improvement, or other development in the floodway? ☒ Yes ☐ No

1B. If yes, does the development cause the 100-year water surface elevation to increase at any location by more than 0.000 feet? ☐ Yes ☒ No

11. Without floodways:

2A. Does the revision request involve fill, new construction, substantial improvement, or other development in the 100-year floodplain? ☒ Yes ☐ No

2B. If yes, does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the 100-year water surface elevation to increase at any location by more than one foot (*or other surcharge limit if community or state has adopted more stringent criteria*)? ☐ Yes ☒ No

If the answer to either Items 1B or 2B is yes, please provide documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

4. REVISION REQUESTOR ACKNOWLEDGMENT

12. Having read NFIP Regulations, 44 CFR Ch. 1, parts 59, 60, 61, and 72, I believe that the proposed revision ☒ is ☐ is not in compliance with the requirements of the aforementioned NFIP Regulations.

5. COMMUNITY OFFICIAL ACKNOWLEDGMENT

13. Was this revision request reviewed by the community for compliance with the community's adopted floodplain management ordinances? ☒ Yes ☐ No

14. Does this revision request have the endorsement of the community? ☒ Yes ☐ No

If no to either of the above questions, please explain: _____

Please note that community acknowledgment and /or notification is required for all requests as outlined in Section 65.4 (b) of the NFIP Regulations.

6. OPERATION AND MAINTENANCE

15. Does the physical change involve a flood control structure (e.g., levees, floodwalls, channelization, basins, dams)? ☒ Yes ☐ No

If yes, please provide the following information for each of the new flood control structures:

A. Inspection of the flood control project will be conducted periodically by Maricopa County Flood Control District (entity) with a maximum interval of 12 months between inspections.

B. Based on the results of scheduled periodic inspections, appropriate maintenance of the flood control facilities will be conducted by Flood Control District of Maricopa County (entity) to ensure the integrity and degree of flood protection of the structure.

C. A formal plan of operation, including documentation of the flood warning system, specific actions and assignments of responsibility by individual name or title, and provisions for testing the plan at intervals not less than one year, ☒ has ☐ has not been prepared for the flood control structure.

D. The community is willing to assume responsibility for ☐ performing ☒ overseeing compliance with the maintenance and operation plans of the _____ (Name)

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled "Appeals, Revisions, and Amendments to Flood Insurance Maps: A guide for Community Officials," dated January 1990, this request is for a:

_____	a.	CLOMR	A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch. I, Parts 60, 65, and 72)*.
X	b.	LOMR	A letter from FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(See 44 CFR Ch. I Parts 60 and 65.)*
_____	c.	PMR	A reprinted NFIP map incorporating changes to floodplains, floodways, or flood elevations. Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch. I, Parts 60 and 65.)*
_____	d.	Other:	Describe_____

8. FORMS INCLUDED

17. Form 2 entitled, "Certification By Registered Professional Engineer and/or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	☐ Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	☒ Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	☒ Riverine /Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	☒ Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	☒ Bridge/Culvert Form (Form 7)
• The request involves a new revised levee/floodwall system	☒ Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	☐ Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	☐ Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	☐ Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

9. INITIAL REVIEW FEE

18. The minimum initial review fee for the appropriate request category has been included. ☐ Yes ☒ No

Initial fee amount: $ _____

METHOD OF PAYMENT (Check one box)

☐ PAYMENT ENCLOSED ☐ VISA ☐ MASTERCARD

Check or money order only.
Make payable to
National Flood Insurance Program

CARD NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

EXP. Date

Signature

or

19. This request is for a project that is for public benefit and is intended to reduce the flood hazard to existing development in identified flood hazard areas as opposed to planned floodplain development. ☒ Yes ☐ No

or

20. This request is to correct an error or to include the effects of natural changes within the areas of special flood hazards. ☐ Yes ☒ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Howard A. Vargas
Signature of Revision Requester

Assistant City Engineer
Printed Name and Title of Revision Requester

City of Tempe, AZ
Company Name

12/21/93
Date

Note: Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.

X
Signature of Community Official

LEE M. QUAAS
City Engineer
Printed Name and Title of Community Official

City of Tempe
Community Name

12-21-93
Date

Does this request impact any other communities? ☒ Yes ☐ No

If yes, attach letters from all affected jurisdictions acknowledging revision request and approving changes to floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM

O.M.B. Burden No. 3067-0148
Expires July 31, 1994

FEMA USE ONLY

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1. This certification is in accordance with 44 CFR Ch. I, Section 65.2
2. I am licensed with an expertise in water resources, river engineering
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)** structural, geotechnical, land surveying.]
3. I have 19 years experience in the expertise listed above.
4. I have ☒ prepared ☐ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and /or designs, is/are being certified:
   channelization, levees, bank protection, new bridge, tributary drainage
7. Base upon the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)

   a. ☒ Viewed all phases of actual construction.
   b. ☒ Compared plans and specifications with as-built survey information.
   c. ☒ Examined plans and specifications and compared with completed projects.
   d. ☐ Other _____
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: George K. Cotton
(please print or type)

Title: Senior Water Resources Engineer
(please print or type)

Registration No. 20207 Expiration Date: 06/30/96

State Arizona

Type of License Civil

Signature

Date

Registered Professional Engineer (Civil) CERTIFICATE NO. 20207 GEORGE K. COTTON Date Signed 12/15/93 ARIZONA, U.S.A.

Seal
(Optional)

*Specify Subdiscipline

Note: Insert not applicable (N/A) when statement does not apply.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	*O.M.B. Burden No 3067-0148* *Expires July 31, 1994*	**FEMA USE ONLY**

PUBLIC BURDEN DISCLOSURE NOTICE

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Community Name: City of Tempe

Flooding Source: Salt River
(One form for each flooding source)

Project Name/Identifier: Salt River Channelization Phase 2

1. REACH TO BE REVISED

Downstream limit: Southern Pacific Railroad Bridge

Upstream limit: McClintock Drive

2. EFFECTIVE FIS

☐ Not studied

☐ Studied by approximate methods

Downstream limit of study _____

Upstream limit of study _____

☒ Studied by detailed methods

Downstream limit of study 40th Street

Upstream limit of study Country Club Road

☐ Floodway delineated

Downstream limit of Floodway _____

Upstream limit of Floodway _____

3. HYDRAULIC ANALYSIS

Why is the hydraulic analysis different from that used to develop the FIRM. *(Check all that apply)*

☐ Not studied in FIS

☐ Improved hydrologic data/analysis. Explain: _____

☐ Improved hydraulic analysis. Explain: _____

☒ Flood control structure. Explain: Construction includes channelization of Salt River floodway, continuous levees, grade control structures, bridge waterway modifications and bank protection.

☐ Other. Explain: _____

3. RIVERINE HYDRAULIC ANALYSIS FORM
Models Submitted

Full input and output listings along with files on diskette *(if available)* for each of the models listed below and summary of the source of input parameters used in the models must be provided. The summary must include a complete description of any changes made from model to model (*e.g. duplicate effective model to corrected effective model)*. Only the Duplicate Effective and the Revised or Post-Project Conditions models must be submitted. See instructions for directions on when other models may be required. Only the 100-year flood profile is required for SFHAs with a Zone A designation. For areas which do not have detailed flooding, a hydraulic model is not required; however BFE's may not be added to the revised FIRM.

☒ Duplicate Effective Model — Natural ☐ Floodway ☐

Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models *(10-, 50-, 100-, and 500-year multi-profile runs and the floodway run)* must be obtained and then reproduced on the requestor's equipment to produce the duplicate effective model. This is required to assure that the effective model input data has been transferred correctly to the requestor's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

☐ Corrected Effective Model — Natural ☐ Floodway ☐

The corrected effective model is the model that corrects any errors that occur in the duplicate effective model, adds any additional cross sections to the duplicate effective model, or incorporates more detailed topographic information than that used in the currently effective model. The corrected effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

☐ Existing or Pre-Project Conditions Model — Natural ☐ Floodway ☐

The duplicate effective or corrected model is modified to produce the existing or pre-project conditions model to reflect any modifications that have occurred within the floodplain since the date of the effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the corrected effective or duplicate effective model.

☒ Revised or Post-Project Conditions Model — Natural ☐ Floodway ☐

The existing or pre-project conditions model *(or duplicate effective or corrected effective model, as appropriate)* is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for proposed project this model should reflect proposed conditions.

☐ Other: Please attach a sheet describing all other models or calculations submitted. — Natural ☐ Floodway ☐

4. MODEL PARAMETERS *(from model used to revise 100-year water surface elevation)*

1. Discharges:

	Upstream Limit	Downstream Limit
10-year	92,000	93,000
50-year	157,000	160,000
100-year	215,000	220,000
~~500-year~~ Maximum Project	250,000	250,000

Attach diagram showing changes in 100-year discharge

2. Explain how the starting water surface elevations were determined Starting at grade control structure No. 4 from duplicate effective model.

3. Give range of friction loss coefficients (*Manning's "N"*) Channel 0.035

Overbanks ..... 0.035 - 0.050

If friction loss coefficients are different anywhere along the revised reach from those used to develop the FIRM, give location, value used in the effective FIS, and revised values and an explanation as to how the revised values were determined.

Location	FIS			Revised		
21.399 - 21.837	0.050	0.050	0.035	0.050	0.050	0.035
21.837 - 23.000	0.040	0.040	0.030	0.035	0.035	0.035
23.000 - 23.667	0.050	0.050	0.035	0.035	0.035	0.035

Explain: The channelized Salt River has constant roughness throughout section. Where overbank terraces are present, the roughness is increased.

4. Describe how the cross section geometry data were determined (*e.g., field survey, topographic map, taken from previous study*) and list cross sections that were added.

Cross sections determined from construction plans.

5. Explain how reach lengths for channel and overbanks were determined:

Measured from construction drawings.

5. RESULTS *(from model used to revise 100-year water surface elevations)*

1. Do the results indicate:

a. Water surface elevations higher than end points of cross sections? ☐ Yes ☒ No

b. Supercritical depth? ☐ Yes ☒ No

c. Critical depth? ☐ Yes ☒ No

d. 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, tables, and maps.

2. What is the maximum change in energy gradient between cross-sections? 0.90 feet

Specify location 21.798 - 21.809

3. What is the distance between the cross-sections in 2 above? 60 feet

Specify location 21.798 - 21.809

4. What is the maximum distance between cross-sections? 285 feet

Specify location 23.252

5. Floodway determination

a. What is the maximum surcharge allowed by the community or State? 1.0 foot

b. What is the maximum surcharge for the revised conditions? NA foot

Specify location NA

c. What is the maximum velocity? NA fps

Specify location NA

Explain: The project reach is completely channelized. Since the 100-year flood is conveyed by the channel with freeboard, no floodway was computed.

d. Are there any negeative surcharge values at any cross-section ☐ Yes ☒ No

If yes, the floodway may need to widen. If it is not widened, please explain and indicate the maximum negative surcharge.

6. Is the discharge value used to determine the floodway anywhere different from that used to determine the natural 100-year flood elevations? ..... ☐ Yes ☒ No

If Yes, explain:

7. Do 100-year water surface elevations increase at any location? ..... ☒ Yes ☐ No

If yes, please attach a list of the locations where the increases occur, state whether or not the increases are located on the requestor's property, and provide an explanation of the reason for the increases.

Increases occur locally near the existing Mill Avenue and new Second Mill Avenue bridges.

Please attach a completed comparison table entitled: Water Surface Elevation Check (See page 6)

6. REVISED FIRM/FBFM AND FLOOD PROFILES

A. The revised water surface elevations tie into those computed by the effective FIS Model *(10-, 50-, 100-, and 500-year)*, downstream of the project at cross-section 21.399 within 0 feet and upstream of the project at cross section 23.667 within 0 feet.

B. The revised floodway elevations tie into those computed by the effective FIS model, dowstream of the project at cross section 21.399 within 0 feet and upstream of the project at cross section 21.667 within 0 feet.

C. Attach profiles, at the same vertical and horizontal scale as the profiles in the effective FIS report, showing stream bed and profiles of all floods studied (without encroachment). Also, label all cross sections, road crossings (including low chord and top-of-road data), culverts, tributaries, corporate limits, and study limits. If channel distance has changed, the stationing should be revised for all profile sheets.

D. Attach a Floodway Data Table showing data for each cross section listed in the published Floodway Data Table in the FIS report.

Proceed to Riverine /Coastal Mapping Form

FEDERAL EMERGENCY MANAGMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODIND SOURCE	PROJECT NAME /IDENTIFIER
Tempe	Salt River	Salt River Channelization

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
21.809				1155.99									1156.10		
21.837				1155.97									1156.28		
21.937				1156.36									1157.34		
22.037				1156.48									1157.93		
22.137				1158.34									1158.44		

COMMENTS:

This is a local increase caused by two effects:

1) Alternative modeling of the Mill Avenue bridge (21.809)
2) Addition of the Second Mill Avenue bridge (21.851)

1-100-year (natural) Water Surface Elevation 2-Encroachment (floodway) Water Surface Elevation 3-Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

Sheet _____ of _____

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE/COASTAL MAPPING FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1994*	*FEMA USE ONLY*

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Community Name: Tempe, City of

Flooding Source: Salt River

Project Name/Identifier: Salt River Channelization, Phase 2

1. MAPPING CHANGES

1. A topographic work map of suitable scale, contour interval, and planimetric definition must be submitted showing *(indicate N/A when not applicable)*:

		Included		
A.	Revised approximate 100-year floodplain boundaries (Zone A)	☐ Yes	☐ No	☒ N/A
B.	Revised detailed 100- and 500-year floodplain boundaries	☒ Yes	☐ No	☐ N/A
C.	Revised 100-year floodway boundaries	☐ Yes	☐ No	☒ N/A
D.	Location and alignment of all cross sections used in the revised hydraulic model with stationing control indicated	☒ Yes	☐ No	☐ N/A
E.	Stream alignments, road and dam alignments	☒ Yes	☐ No	☐ N/A
F.	Current community boundaries	☒ Yes	☐ No	☐ N/A
G.	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	☒ Yes	☐ No	☐ N/A
H.	Tie-ins between the effective and revised 100- and 500-year floodplains and 100-year floodway boundaries	☒ Yes	☐ No	☐ N/A
I.	The requestor's property boundaries and community easements	☐ Yes	☒ No	☐ N/A
J.	The signed certification of a registered professional engineer	☒ Yes	☐ No	☐ N/A
K.	Location and description of reference marks	☒ Yes	☐ No	☐ N/A
L.	Vertical datum (example: NGVD, NAVD etc.)	☒ Yes	☐ No	☐ N/A
M.	Coastal zone designations tie into adjacent areas not being revised	☐ Yes	☐ No	☒ N/A
N.	Location and alignment of all coastal transects used to revise the coastal analyses	☐ Yes	☐ No	☒ N/A

If any of the items above are marked no or N/A, please explain: A) See B; C) Floodway and floodplain coincide; M & N) Riverine environment

2. What is the source and date of the updated topographic information *(example: orthophoto maps, July 1985; field survey, May 1979, beach profiles, June 1987, etc.)*? aerial survey December 1988

3. What is the scale and contour interval of the following workmaps?
   a. Effective FIS 1" = 200' scale 5' Contour interval
   b. Revision Request 1" = 100' scale 2' Contour interval

NOTE: Revised topographic information must be of equal or greater detail.

4. Attach an annotated FIRM and FBFM at the scale of the effective FIRM and FBFM showing the revised 100-year and 500-year floodplains and the 100-year floodway boundaries and how they tie into those shown on the effective FIRM and FBFM downstream and upstream of the revision or adjacent to the area of revision for coastal studies.

Attach additional pages if needed.

5. Flood Boundaries and 100-year water surface elevations:

Has the 100-year floodplain been shifted or increased or the 100-year water surface elevation increased at any location on property other than the requestor's or community's ? ☐ Yes ☒ No

If yes, please give the location of shift or increase and an explanation for the increase.

a. Have the affected property owners been notified of this shift or increase and the effect it will have on their property? ..... ☐ Yes ☐ No

If yes, please attach letters from these property owners stating they have no objections to the revised flood boundaries if a LOMR is being requested.

b. What is the number of insurable structures that will be impacted by this shift or increase?_____

6. Have the floodway boundaries shifted or increased at any location compared to those shown on the effective FBFM or FIRM? ..... ☐ Yes ☒ No

If yes, explain:

7. If a V- zone has been designated, has it been delineated to extend landward to the heel of the primary frontal dune? ☐ Yes ☐ No

If no, explain:

8. Manual or digital map submission:

☒ Manual

☐ Digital

Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance of submission as possible.

2. EARTH FILL PLACEMENT

1. The fill is: ☒ Existing ☐ Proposed

2. Has fill been/will be placed in the regulatory floodway? ..... ☒ Yes ☐ No
   If yes, please attach completed Riverine Hydraulic Analysis Form.

3. Has fill been/will be placed in floodway fringe *(area between the floodway and 100-year floodplain boundaries)*? ..... ☒ Yes ☐ No

   If yes, then complete A, B, C, and D below.

   A. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ..... ☐ Yes ☒ No

      If yes, justify steeper slopes_____

      _____

   B. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? *(Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)* ..... ☒ Yes ☐ No

      If no, describe erosion protection provided_____

      _____

   C. Has all fill placed in revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☒ Yes ☐ No

   D. Can structures conceivably be constructed on the fill at any time in the future? ☒ Yes ☐ No

   If yes, provide certification of fill compaction (item C. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer.

4. Has fill been/will be placed in a V-zone? ☐ Yes ☒ No

   If yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall? ☐ Yes ☐ No

   If yes, attach the coastal structures form.

FEDERAL EMERGENCY MANAGEMENT AGENCY
CHANNELIZATION FORM

O.M.B. Burden No. 3067-0148
Expires July 31, 1994

FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Tempe, City of

Flooding Source: Salt River

Project Name/Identifier: Salt River Channelization, Phase 2

1. EXTENT OF CHANNELIZATION

Downstream limit: River mile 21.400

Upstream limit: River mile 23.667

2. CHANNEL DESCRIPTION

1. Describe the inlet to the channel The floodplain is confined by the Salt River channel banks and by the roadway approach embankment to the McClintock Drive bridge.

2. Briefly describe the shape of the channel *(both cross sectional and planimetric configuration)* and its lining *(channel bottom and sides)* Channel is essentially compound trapezoidal section with a terrace of variable width on both banks. Bank protection is soil cement and gabion slope mattress.

3. Describe the outlet from the channel The channelization aligns directly with the Phase 1 channelization of the Salt River (40th Street to Southern Pacific Railroad Bridge).

4. The channelization includes:

   - ☒ Levees *(Attach Levee Form)*
   - ☒ Drop structures
   - ☐ Superelevated sections
   - ☒ Transitions in cross sectional geometry
   - ☐ Debris basin/detention basin
   - ☐ Energy dissipater
   - ☐ Other

5. Attach the following:

   a. Certified engineering drawings showing channel alignment and locations of inlet, outlet, and items checked in item 4

   b. Typical cross sections and profiles of channel banks and invert

3. HYDRAULIC CONSIDERATIONS

1. What is the 100-year discharge? ..... 210,000-220,000 cfs
2. Do the cross sections in the hydraulic model match the typical cross sections in the plans? ☒ Yes ☐ No
3. Are the channel banks higher than the 100- year flood elevations everywhere? ..... ☒ Yes ☐ No
4. Are the channel banks higher than the 100-year flood energy grade lines everywhere? .. ☒ Yes ☐ No
5. Is the land on both sides of the channel above the adjacent 100-year flood elevation at all points along the channel? ..... ☐ Yes ☒ No
6. What is the range of freeboard? ..... 4.0 – 4.5 feet
7. What is the range of the 100-year flood velocities? ..... 6.3 – 13.0 ft/sec
8. What is the lining type? (both bottom and sides) Bottom is unlined, sides-soil cement, gabions

   Explain how the channel lining prevents erosion and maintains channel stability *(attach documentation)*
   See 5.1, 5.3.1 and Chapter VI of the Technical Data Notebook.

9. What is the design elevation in the channel based on?

   ☒ Subcritical flow
   ☐ Critical flow
   ☐ Supercritical flow
   ☐ Energy grade line

   Is 100-year flood profile based on the above type of flow? ..... ☒ Yes ☐ No

   If no, explain:

10. Is there the potential for a hydraulic jump at the following locations?

    Inlet to channel ..... ☐ Yes ☒ No
    Outlet of channel ..... ☐ Yes ☒ No
    At Drop Structures ..... ☒ Yes ☐ No
    At Transitions ..... ☐ Yes ☒ No
    Other locations. Explain:

    If the answer to any of the above is yes, please explain how the hydraulic jump is controlled and the effects of the hydraulic jump on the stability of the channel.

    Explain: In the range of discharge up to about 95,000 cfs, critical depth controls the stage at Grade Control Structure No. 5 (River Mile 23.611). HEC-2 calculations show an influence by this drop structure for a discharge up to 250,000. The hydraulic jump is contained in a stilling basin below the drop (see 5.3.2 of TDN).

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water surface elevations and/or the capacity of the channel? ..... ☒ Yes ☐ No

   B. Based on the conditions of the watershed and stream bed, is there a potential for sediment transport (including scour and deposition) to affect the 100-year water surface elevations and /or the capacity of the channel? ..... ☐ Yes ☒ No

2. If the answer to either 1A or 1B is yes:

   A. What is the estimated sediment (bed) load?
   NA cfs (attach gradation curve)

   Explain method used to estimate load See section 5.1, TDN.

   B. Is the 100-year flood velocity anywhere within the channel less than the 100-year flood velocity of the inlet? ☐ Yes ☒ No

   C. Will sediment accumulate anywhere within the channel? ☐ Yes ☒ No

   D. Will deposition or scour occur at or near the inlet? ☐ Yes ☒ No

   E. Will deposition or scour occur at or near the outlet? ☐ Yes ☒ No

Attach documentation showing affects on the Hydrologic and Hydraulic analyses

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1994*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

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Community Name: Tempe, City of

Flooding Source: Salt River

Project Name/Identifier: Salt River Channelization, Phase 2

1. IDENTIFIER

1. Name of roadway, railroad, etc.: Mill Avenue
2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier): River Mile 21.809
3. This revision reflects *(check one of the following)*:
   - ☐ New bridge/culvert not modeled in the FIS
   - ☒ Modified bridge/culvert previously modeled in the FIS
   - ☐ New analysis of bridge/culvert previously modeled in the FIS

   (Explain why new analysis was performed)

2. BACKGROUND

Provide the following information about the structure:

1 Dimension, material, and shape (e.g. two 10 x 5 feet reinforced concrete box culvert; three 30-foot span bridge with 2 rows of two 3- foot diameter circular piers; 40-foot wide ogee shape spillway) The bridge is an open-spandrel reinforced concrete fixed arch with an overall length of 1,577 feet, (1,488 between abutment piers).

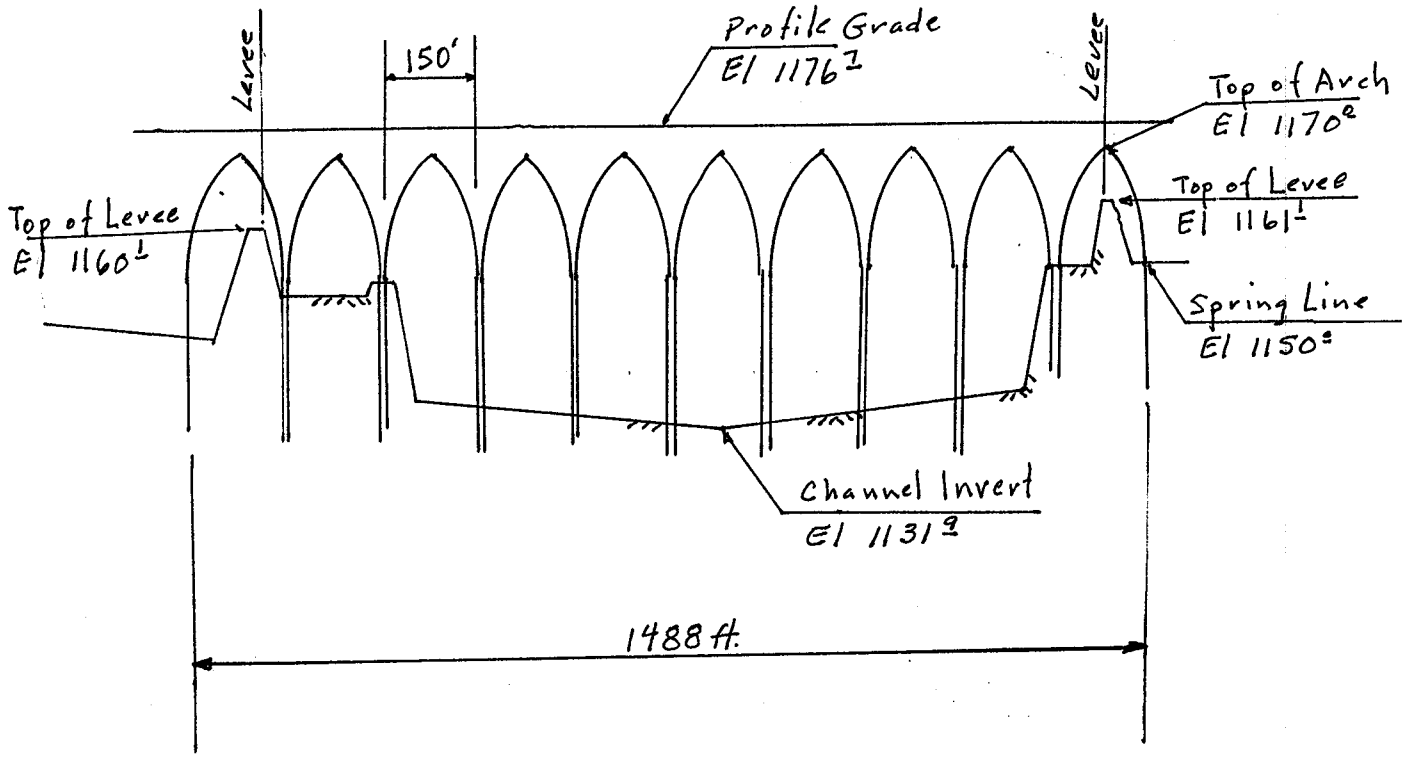
2. Entrance geometry of culvert/type of bridge opening (e.g. 30° - 75° wing walls with square top edge, sloping embankments and vertical abutments) Vertical abutments, skewed; 15 degrees to the channel direction.

3. Hydraulic model used to analyze the structure (*e.g., HEC-2 with special bridge routine, WSPRO, HY8*) HEC-2 with supplemental rating (see Appendix B, part 3 TDN).

If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

Note: If any items do not apply to submitted hydraulic analysis, indicate by N/A
*** One form per new/revised bridge/culvert**

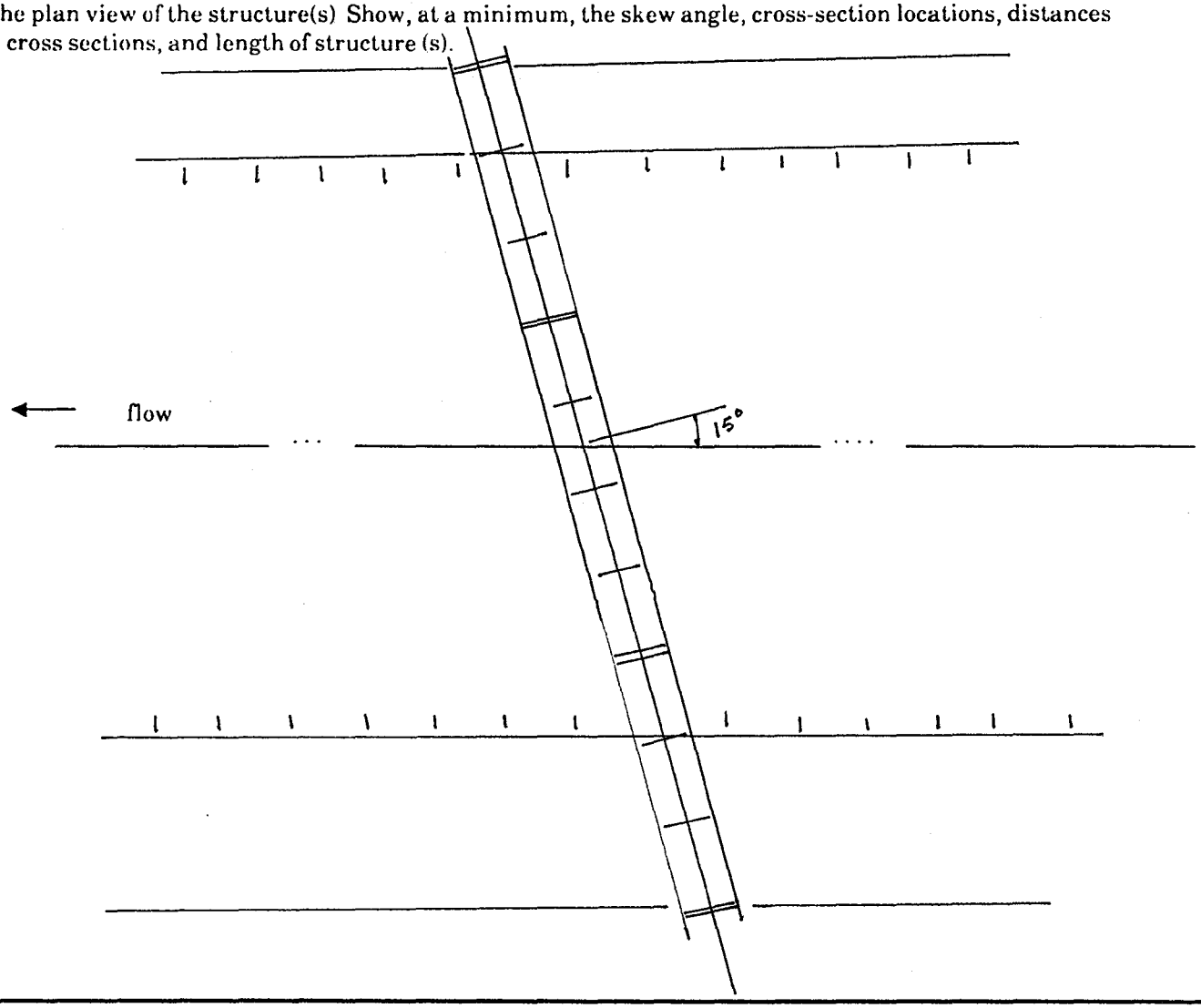
Sketch the downstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, minimum top of road elevation, and ineffective flow widths.



Sketch the upstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, and minimum top of road elevation.

Same as above.

Sketch the plan view of the structure(s) Show, at a minimum, the skew angle, cross-section locations, distances between cross sections, and length of structure (s).



Attach plans of the structure (s) certified by a registered Professional Engineer.

Culvert length or bridge width (ft)	48 feet
Calculated culvert/bridge area (ft 2) by the hydraulic model, if applicable	21,400 square feet
Total culvert/bridge area (ft 2)	

Elevations Above Which Flow is Effective for Overbanks

	Left Overbank	Right Overbank
Upstream face		
Downstream face		

Minimum Top of Road Elevation

	Left Overbank	Right Overbank
Upstream face	1176.7	1176.7
Downstream face	1176.7	1176.7

100-Year Elevations	Water Surface Elevations	Energy Gradient Elevations
Upstream face	1156.1	1157.9
Downstream face	1154.9	1157.0

Discharge	Low Flow	Pressure Flow	Weir Flow	Total Flow
Amount of flow through/over the structure (s) (cfs)	215,000	0	0	215,000

The maximum depth of flow over the roadway/railroad (ft.) ..... 0.

Weir length (ft.) ..... 1488.

Top Widths

	Floodplain	Floodway
Upstream face	1090	1090
Downstream face	1092	1092

Top Widths

	Effective Flow	Effective and Ineffective Flow
Upstream face		
Downstream face		

Loss Coefficients

Entrance loss coefficient	NA
Manning's "n" value assigned to the structure(s)	NA
Friction loss coefficient through structure (s)	0.035
Other loss coefficients (e.g., bend manhole, etc.)	NA
Total loss coefficient	NA
Weir coefficient	NA
Pier coefficient	NA
Contraction loss coefficient	0.3
Expansion loss coefficient	0.5

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport *(including scour and deposition)* can affect the 100-year water surface elevations? ..... ☒ Yes ☐ No

   B Based on the conditions *(such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions)*, is there a potential for debris and sediment transport *(including scour and deposition)* to affect the 100-year water surface elevations and/or conveyance capacity through the bridge/culvert? ..... ☐ Yes ☒ No

2. If the answer to either 1A or 1B is yes:

   A. What is the estimated sediment *(bed material)* load?
   NA cfs *(attach gradation curve)*

   Explain method used to estimate the sediment transport and the depth of scour and/or deposition The depth of scour at bridge is presented in Appendix C of the TDN.

   B. Will sediment accumulate anywhere through the bridge/culvert? ☐ Yes ☒ No

   If yes, explain the impact on the conveyance capacity through the bridge/culvert?

5. FLOODWAY ANALYSIS

Explain method of bridge encroachment (floodway run) not conducted

Comments *(explain any unusual situations)*:

The arched super structure and alignment of the bridge relative to the Salt River floodway dictated a special hydraulic analysis. The bridge has remained operational during the largest floods that have occurred since its construction in 1931 (180,000 cfs, January 1979).

Attach analysis.

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1994*	**FEMA USE ONLY**

PUBLIC BURDEN DISCLOSURE NOTICE

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Community Name: Tempe, City of

Flooding Source: Salt River

Project Name/Identifier: Salt River Channelization, Phase 2

1. IDENTIFIER

1. Name of roadway, railroad, etc.: Second Mill Avenue
2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier): River Mile 21.851
3. This revision reflects *(check one of the following)*:
   - ☒ New bridge/culvert not modeled in the FIS
   - ☐ Modified bridge/culvert previously modeled in the FIS
   - ☐ New analysis of bridge/culvert previously modeled in the FIS

   (Explain why new analysis was performed) _____

2. BACKGROUND

Provide the following information about the structure:

1 Dimension, material, and shape (e.g. two 10 x 5 feet reinforced concrete box culvert; three 30-foot span bridge with 2 rows of two 3- foot diameter circular piers; 40-foot wide ogee shape spillway) The bridge is a flush-haunched reinforced concrete box girder with an overall length of 1500 feet.

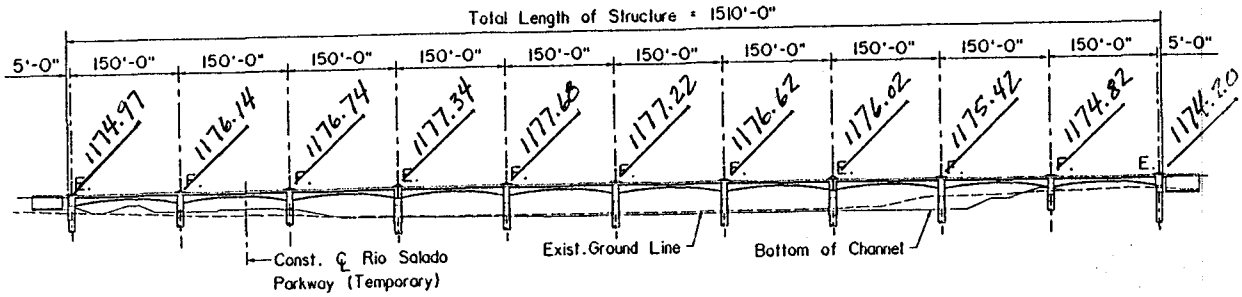
2. Entrance geometry of culvert/type of bridge opening (e.g. 30° - 75° wing walls with square top edge, sloping embankments and vertical abutments) Vertical abutments, with a variable skew to the river (from 0 degrees to 15 degrees).

3. Hydraulic model used to analyze the structure (*e.g., HEC-2 with special bridge routine, WSPRO, HY8*) HEC-2 with special bridge.

If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

Note: If any items do not apply to submitted hydraulic analysis, indicate by N/A
*** One form per new/revised bridge/culvert**

Sketch the downstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, minimum top of road elevation, and ineffective flow widths.



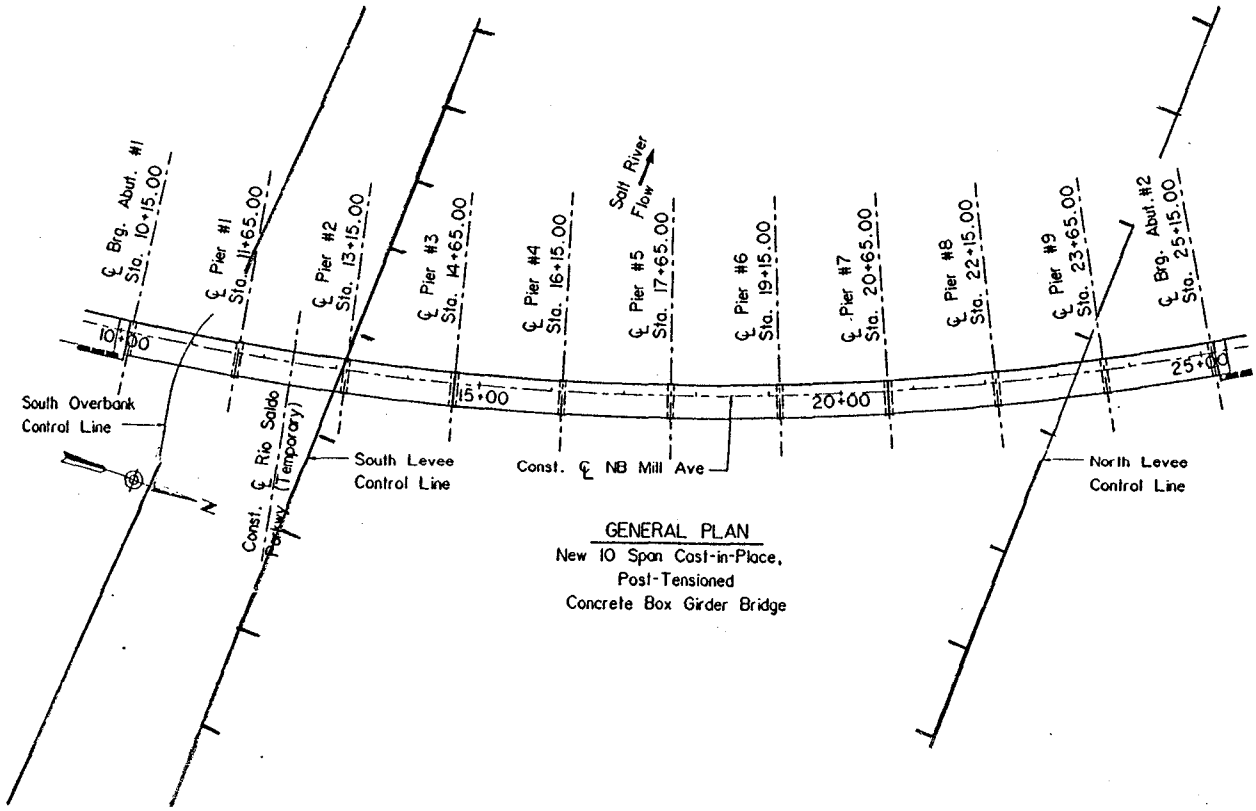
LONGITUDINAL SECTION

Haunch is 5.0 feet deep at mid-span and 12.0 feet deep at pier. Maximum low chord = 1172.51; channel invert = 1132.10.

Sketch the upstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, and minimum top of road elevation.

Same as above.

Sketch the plan view of the structure(s) Show, at a minimum, the skew angle, cross-section locations, distances between cross sections, and length of structure (s).



Attach plans of the structure (s) certified by a registered Professional Engineer.

Culvert length or bridge width (ft)	48'
Calculated culvert/bridge area (ft²) by the hydraulic model, if applicable	
Total culvert/bridge area (ft²)	

Elevations Above Which Flow is Effective for Overbanks

	Left Overbank	Right Overbank
Upstream face	1151.88	1148.40
Downstream face	1151.88	1148.40

Minimum Top of Road Elevation

	Left Overbank	Right Overbank
Upstream face	1174.97	1174.20
Downstream face	1174.97	1174.20

100-Year Elevations	Water Surface Elevations	Energy Gradient Elevations
Upstream face	1156.81	1158.60
Downstream face	1156.28	1158.18

Discharge	Low Flow	Pressure Flow	Weir Flow	Total Flow
Amount of flow through/over the structure (s) (cfs)	215,000	0	0	215,000

The maximum depth of flow over the roadway/railroad (ft.) 0

Weir length (ft.) ..... 1500.

Top Widths

	Floodplain	Floodway
Upstream face	1100	NA
Downstream face	1096	NA

Top Widths

	Effective Flow	Effective and Ineffective Flow
Upstream face	1100	NA
Downstream face	1096	NA

Loss Coefficients

Entrance loss coefficient	NA
Manning's "n" value assigned to the structure(s)	NA
Friction loss coefficient through structure (s)	0.035
Other loss coefficients (e.g., bend manhole, etc.)	NA
Total loss coefficient	1.56
Weir coefficient	2.67
Pier coefficient	1.11
Contraction loss coefficient	0.3
Expansion loss coefficient	0.5

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport *(including scour and deposition)* can affect the 100-year water surface elevations? ..... ☒ Yes ☐ No

   B Based on the conditions *(such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions)*, is there a potential for debris and sediment transport *(including scour and deposition)* to affect the 100-year water surface elevations and/or conveyance capacity through the bridge/culvert? ..... ☐ Yes ☒ No

2. If the answer to either 1A or 1B is yes:

   A. What is the estimated sediment *(bed material)* load?
   NA cfs *(attach gradation curve)*

   Explain method used to estimate the sediment transport and the depth of scour and/or deposition See Appendix C (pmts 4-25) TDN.

   B. Will sediment accumulate anywhere through the bridge/culvert? ☐ Yes ☒ No

   If yes, explain the impact on the conveyance capacity through the bridge/culvert?

5. FLOODWAY ANALYSIS

Explain method of bridge encroachment (floodway run) NA

Comments *(explain any unusual situations)*:

Attach analysis.

FEDERAL EMERGENCY MANAGEMENT AGENCY **LEVEE/FLOODWALL SYSTEM ANALYSES FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1994*	**FEMA USE ONLY**

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.0. hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Tempe, City of

Flooding Source: Salt River

Project Name/Identifier: Salt River Channelization, Phase 2

REACH TO BE REVISED

Downstream limit: River Mile 21.40

Upstream limit: River Mile 23.67

This Levee/Floodwall analysis is based on:

- ☐ upgrading of an existing levee/floodwall system
- ☒ a newly constructed levee/floodwall system
- ☐ reanalysis of an existing levee/floodwall system

LEVEE/FLOODWALL SYSTEM ELEMENTS

1. Levee elements and locations are:

- ☒ earthen embankment, dike, berm etc. — Station 400+00 to 522+80 south bank
- ☐ structural floodwall — Station 45+00 to 100+00 north bank
- ☐ other (describe)_____ — Station _____ to _____

Structural Type:

- ☐ monolithic cast-in place reinforced concrete
- ☐ reinforced concrete masonry block
- ☐ sheet piling
- ☐ other (describe)_____

2. Has this levee/floodwall system been certified by a Federal agency to provide protection against the 100-year flood event?

☐ Yes ☒ No

If yes, by which agency?_____

If yes, complete only the interior drainage section on pages 7 and 8 of this form and the operation and maintenance section of Revision Requestor and Community Official Form.

3. Attach certified drawings containing the following information (indicate drawing sheet numbers):

a. Plan of the levee embankment and floodwall structures. Sheet Numbers 506-520 north levee, 521-534 south levee

b. A profile of the levee/floodwall system showing the 100-year water surface elevation, levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers see above

c. A profile of the 100-year water surface elevation, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure device. Sheet Numbers 535-551

d. A layout detail for the embankment protection measures. Sheet Numbers 506-507

e. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers 535-551

FREEBOARD

1. The minimum freeboard provided above the 100-year water surface elevation is:

Riverine

3.0 feet or more at the downstream end and throughout	☒ Yes	☐ No
3.5 feet or more at the upstream end	☒ Yes	☐ No
4.0 feet immediately upstream of all structures and constrictions	☒ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave for the 100-year stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above 100-year stillwater surge elevation	☐ Yes	☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Part 65.10 (b) (1) (ii) of the National Flood Insurance Program regulations.

If no is answered to any of the above, please explain where and why: _____

2. Tabulate the elevations at critical locations (tabulate values at each levee crest grade change)

Station	Location	100-Year Water Surface Elevation	Levee Crest	Freeboard (ft.)
	Upper end			
		(see Table 2 TDN)		
	Lower end			

(Extend table on an added sheet as needed and reference)

SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water surface elevations?

☒ Yes ☐ No

B. Based on the conditions (such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions), is there a potential for debris and sediment transport (including scour and deposition) to affect the 100-year water surface elevations and/or the freeboard for the levee/floodwall?

☐ Yes ☒ No

2. If the answer to either 1A or 1B is yes:

A. What is the estimated sediment (bed material) load?

NA cfs (attach gradation curve)

Explain method used to estimate the sediment transport and the depth of scour and/or deposition

Salt River is a gravel bed channel with significant bed armoring. Sediment supply is low and sediment transport capacity is large. Degradation is controlled by in-channel grade control structure (see Appendix 3-5 TDN).

B. Will sediment accumulate anywhere along the levee/floodwall (such as along any bends in the channel)?

☐ Yes ☒ No

If yes, what is the minimum freeboard at these locations? _____ feet.

CLOSURES

1. Openings through the levee system:

☒ exist ☐ do not exist

If openings exist, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device
	See Table 2, page 21, TDN.			

(Extend table on an added sheet as neded and reference)

Geotechnical and geologic data:

In addition to the required detail analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following levee system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers EM-1110-2-1906 Form 2086).

EMBANKMENT PROTECTION

1. The maximum levee slope landside is 3:1

2. The maximum levee slope floodside is 3:1

3. The range of 100-year riverine flood velocities along the levee? 6.3 fps (min.) to 13.0 fps (max.)

4. Embankment material is protected by (describe the kind): From terrace to channel bed is soil cement, and from terrace to top-of-levee is gabion slope mattress.

5. Riprap Design Parameters: (Include references) ☐ Velocity; ☒ Tractive stress

Reach	Sideslope	Flow depth	Velocity	Curve or Straight	Stone Riprap D_{100}	D_{50}	Thickness	Depth of Toedown
Sta_____to_____								
Sta_____to_____								
Sta_____to_____								

(see Appendix C, part 6)

(Extend table on an added sheet as needed and reference)

6. Has a bedding/filter analysis and design been included ☒ Yes ☐ No

Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Special analysis of the stability of the soil cement bank protection was performed, related to uplift pressures and piping (see Appendix C, parts 2 and 6).

Note: Attach engineering analysis to support construction plans.

1. Describe the basis for selection of critical location for analysis:

☐ Overall height: Sta_____, height_____ft.

☐ Limiting foundation soil strength:

Sta_____, depth_____to_____

strength Ø = _____degrees, c = _____psf

☐ slope: SS = _____(h) to_____(v)

(Repeat as needed on an added sheet for additional locations)

2. Specify the embankment stability analyses methodology used (e.g. circular arc, sliding block, infinite slope, etc.):_____

3. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction	1.4	1.3
II	Sudden drawdown	1.4	1.0
III	Critical flood stage	2.3	1.4
IV	Steady seepage at flood stage	2.3	1.4
VI	Earthquake (Case I or III)		1.0

(Reference: U.S. Army Corps of Engineers EM-1110-2-1913 Table 6-1)

4. Was a seepage analysis for the embankment performed? ☒ Yes ☐ No

Describe methodology used: (see Appendix C, part 2)

5. Was a seepage analysis for the foundation performed? ☒ Yes ☐ No

Were uplift pressures at the embankment landside toe checked? ☒ Yes ☐ No

Were seepage exit gradients checked for piping potential? ☒ Yes ☐ No

6. The duration of 100-year flood hydrograph against the embankment is 10 Hrs.

Note: Attach engineering analysis to support construction plans.

1. Describe analysis submittal based on Code:

☐ UBC (1988) or ☐ Other (specify)_____

2. Stability analysis submitted provides for:
☒ Overturning; ☒ Sliding; If not, explain_____

_____

3. Loading included in the analyses were:

☐ Lateral earth @ P_A = _____psf; P_p = _____psf

☐ Surcharge--Slope @_____ , ☐ surface_____psf

☐ Wind @ P_w = _____psf

☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = _____%g

☐ 100-year significant wave height_____ft.

☐ 100-year significant wave period_____sec.

4. Summary of Stability Analysis Results: Factors of Safety. Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta_____	To_____	Sta_____	To_____
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5	_____	_____	_____	_____
Dead & Soil	1.5	1.5	_____	_____	_____	_____
Dead, Soil, Flood & Impact	1.5	1.5	_____	_____	_____	_____
Dead, Soil & Seismic	1.3	1.3	_____	_____	_____	_____

(Ref: FEMA 114 Sept 1986; COE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

5. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load	Short Term Load
Computed design maximum	_____psf	_____psf
Maximum allowable	_____psf	_____psf

6. Foundation scour protection ☐ is, ☐ is not provided, (describe)

_____

Note: Attach engineering analysis to support construction plans.

SETTLEMENT

1. Anticipated potential settlement has been determined and incorporated into the specified construction elevations to maintain the established freeboard margin.
   ☒ Yes ☐ No

2. The computed range of settlement is 0.3 in ft. to 1.2 ft.

3. Settlement of the levee crest is determined to be primarily from:

   ☒ Foundation consolidation
   ☐ Embankment compression
   ☐ Other (describe)_____

4. Differential settlement of floodwalls

   ☒ has ☐ has not been accommodated in the structural design and construction.

Note: Attach engineering analysis to support construction plans.

INTERIOR DRAINAGE

1. Specify size of each interior watershed

   Draining to pressure conduit _____

   Draining to ponding area _____

2. Relationships Established

   Ponding elevation vs. storage ☐ Yes ☐ No
   Ponding elevation vs. gravity flow ☐ Yes ☐ No
   Differential head vs. gravity flow ☐ Yes ☐ No

3. The river flow duration curve is enclosed ☐ Yes ☐ No

4. Specify the discharge capacity of the head pressure conduit _____

5. Which Flooding Conditions Were Analyzed?

   - Gravity flow (Interior Watershed) ☐ Yes ☐ No
   - Common storm (River Watershed) ☐ Yes ☐ No
   - Historical ponding probability ☐ Yes ☐ No
   - Coastal wave overtopping ☐ Yes ☐ No

   If no, explain why:_____

6. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection.
   ☐ Yes ☐ No

   If no, explain why:_____

7. The rate of seepage through the levee system for the 100-year flood is_____cfs

1. The length of levee system used to drive this seepage rate is _____ ft.

9. Will a pumping plant(s) be used for interior drainage? ☐ Yes ☐ No

If yes, include the number of pumping plants: _____

For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operations be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: U.S. Army Corps of Engineers EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Note: Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

OTHER DESIGN CRITERIA

1. The following items have been addressed as stated:

Liquifaction ☐ is ☒ is not a problem.

Hydrocompaction ☐ is ☒ is not a problem

Heave differential movement due to soils of high shrink/swell ☐ is ☒ is not a problem.

2. For each of these problems, state the basic facts and corrective action taken.

_____

_____

_____

_____

If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure? ☐ Yes ☐ No

Note: Attach supporting documentation

The planned/installed works are in full compliance with NFIP regulations, Section 44 CFR Ch. 1. 65.10

☒ Yes ☐ No

1. The operation plan incorporates all the provisions for closure devices as required in Section 65.10 (c) (1), of the NFIP regulations

☒ Yes ☐ No

2. The operation plan incorporates all the provisions for interior drainage as required in Section 65.10 (c) (2), of the NFIP regulations

☒ Yes ☐ No

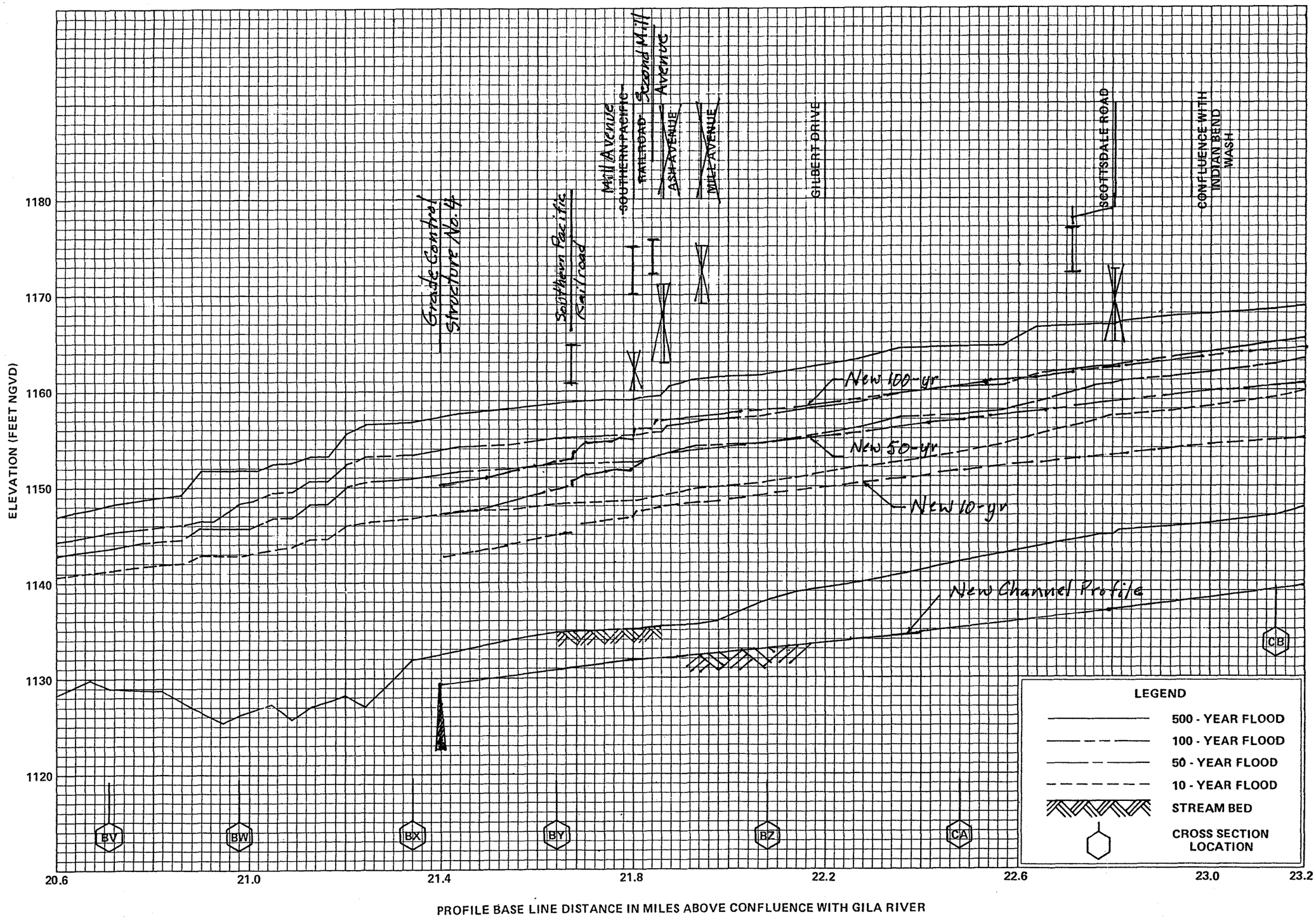
If no to either of the above, please explain.

_____

_____

_____

_____

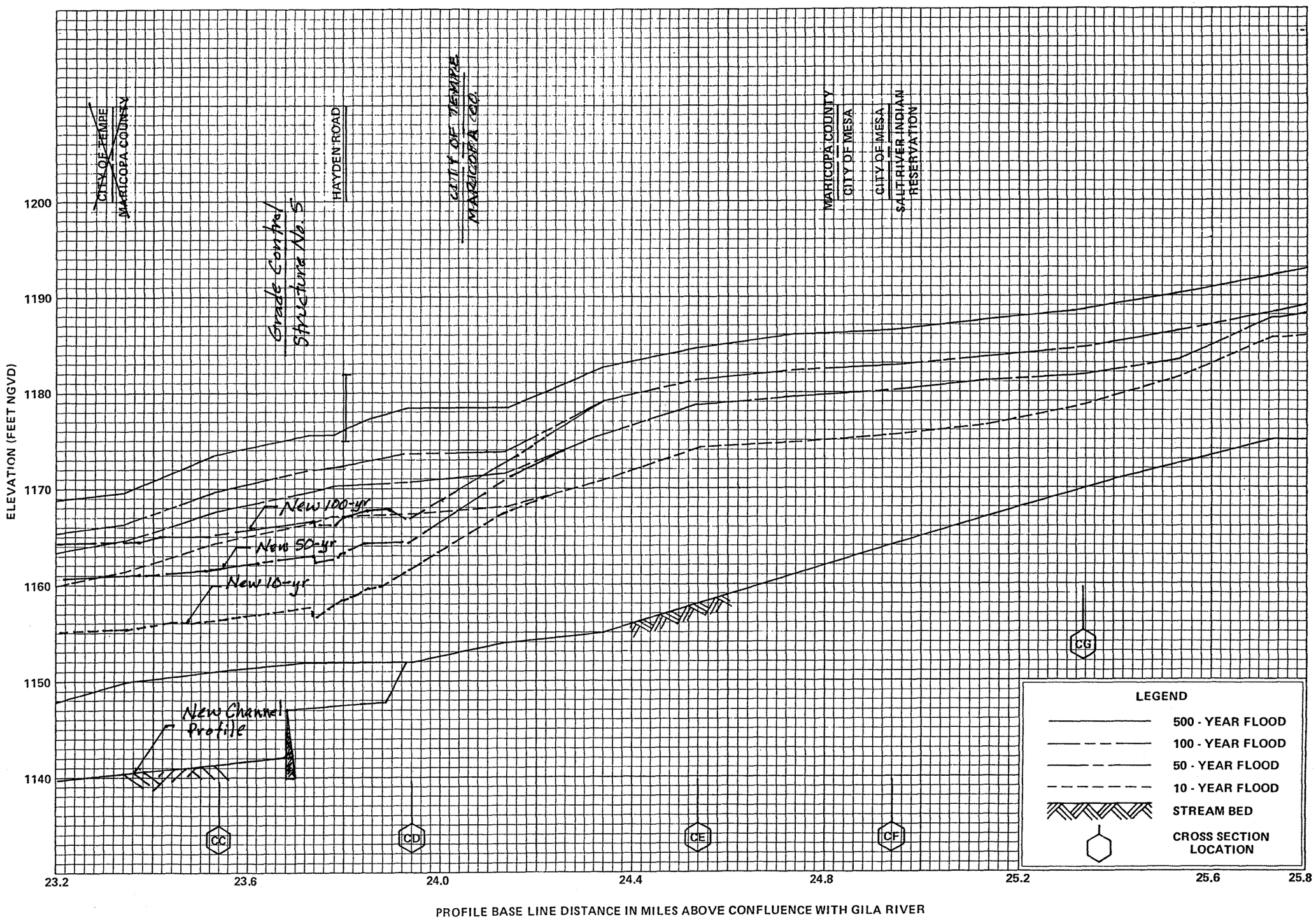


FLOOD PROFILES

SALT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS



FLOOD PROFILES

SALT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

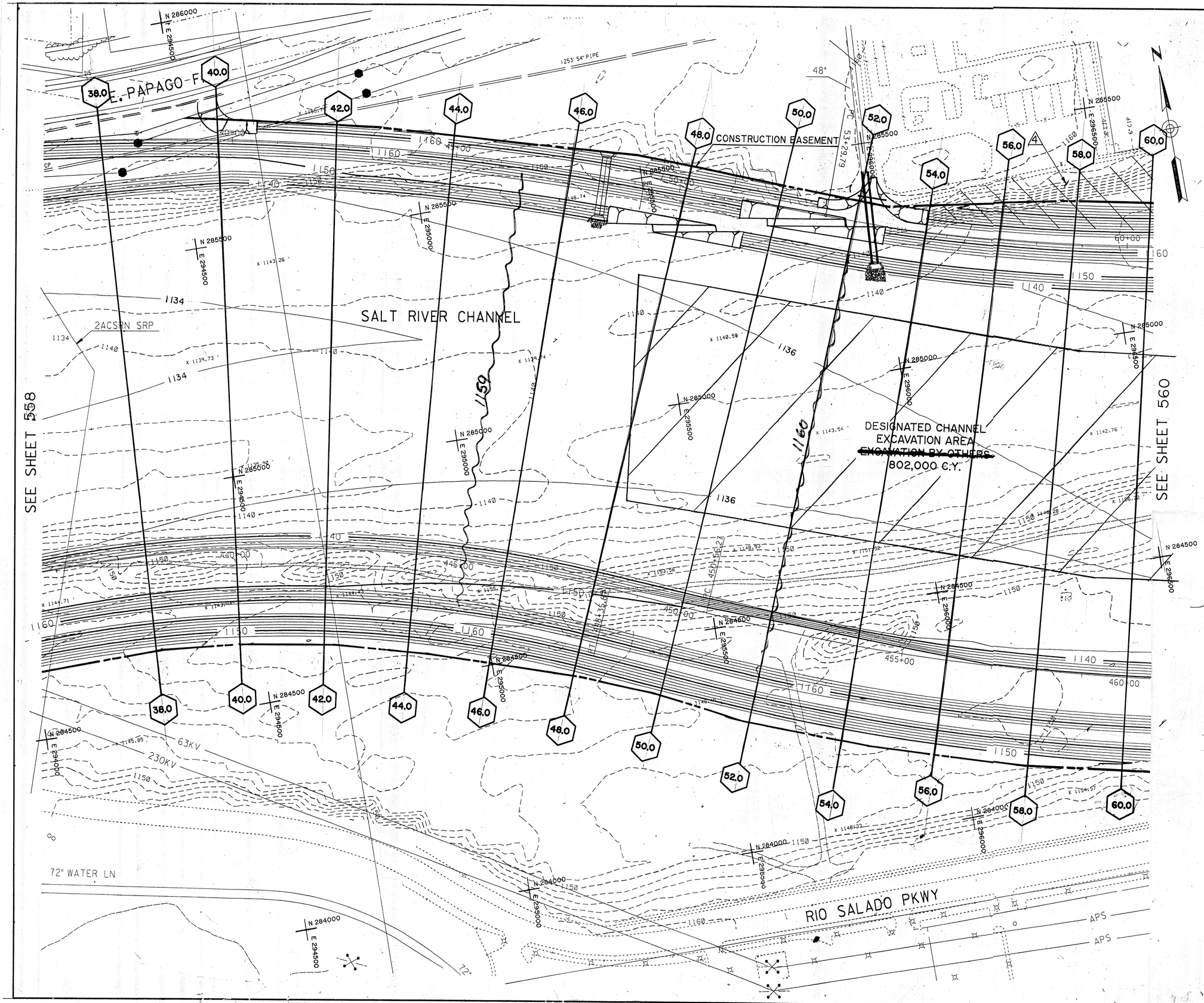
MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

285P

F.H.W.A. REGION	STATE	PROJECT NOS.		AS BUILT
9	AZ.	RAM 600-5-509	220 L MA 4	

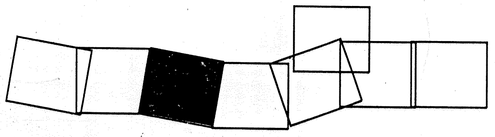
CONSTRUCTION NOTES

~~4 WASTE FILL AREA (SEE SHEET 560)~~



Rio Salado HEC-2 Stationing

Station	River Mile
38.000	22.099
40.000	22.140
42.000	22.182
44.000	22.224
46.000	22.266
48.000	22.308
50.000	22.345
52.000	22.380
54.000	22.412
56.000	22.445
58.000	22.478
60.000	22.512



NO.	DATE	DESCRIPTION	APPROVAL
3			
2			
1	09/21/90	Sheet Completely Revised	

REVISIONS

CRSS, INC.
PHOENIX, ARIZONA

RIO SALADO CHANNEL DESIGN

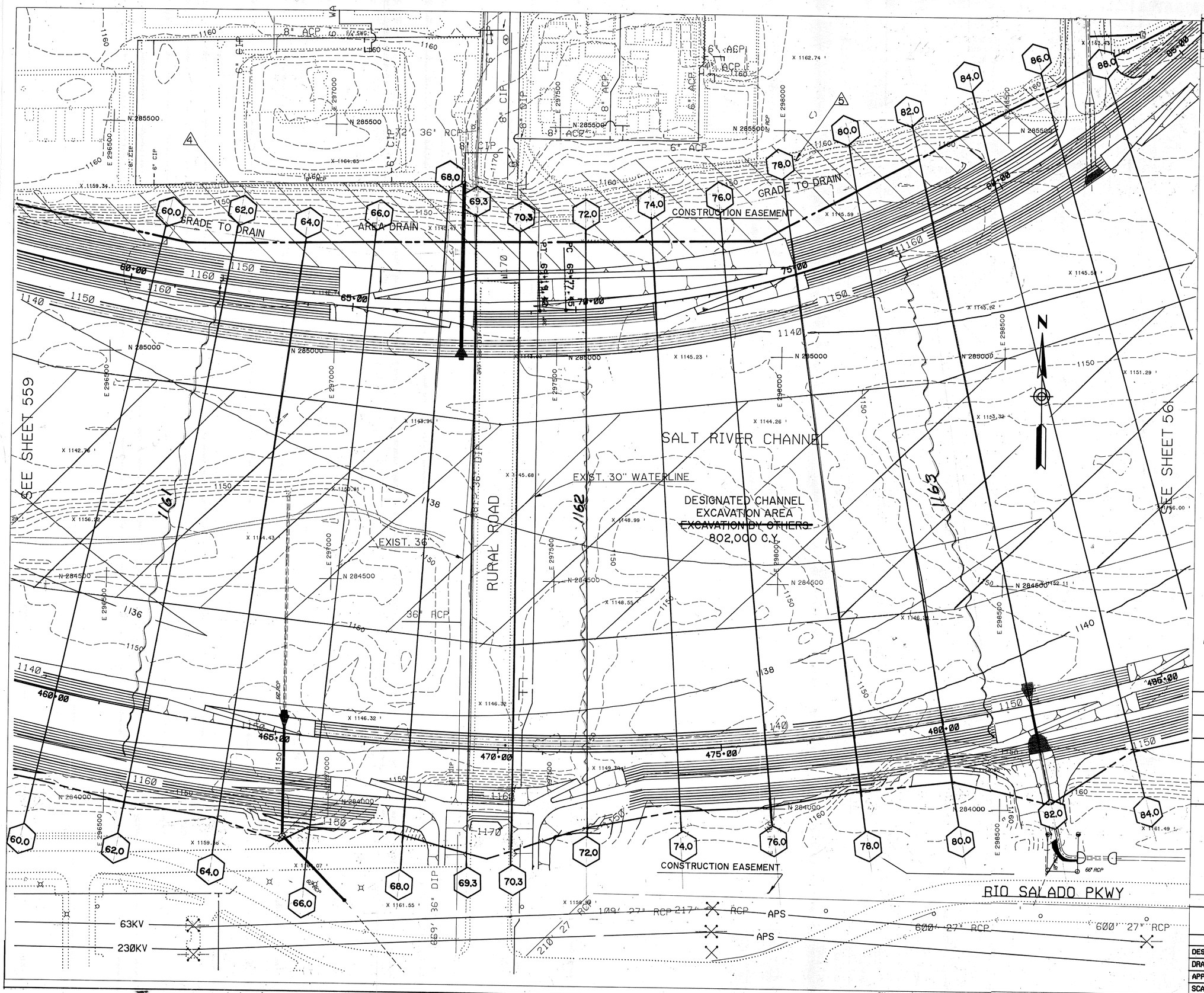
DEPARTMENT OF PUBLIC WORKS
CITY OF TEMPE
DIVISION OF ENGINEERING
P.O. BOX 5002 TEMPE, ARIZONA

DESIGNED: JFM
DRAWN: PMP
APPROVED: GKC
SCALE: 1:00

CHANNEL GRADING PLAN

DATE 7-30-90
PROJECT NO. 876191
SHT 45 OF 622

F.H.W.A. REGION	STATE	PROJECT NOS.		AS BUILT
9	AZ.	RAM 600-5-509	220 L MA 4	



CONSTRUCTION NOTES

~~4 WASTE FILL AREA (WEST OF AREA DRAIN)~~

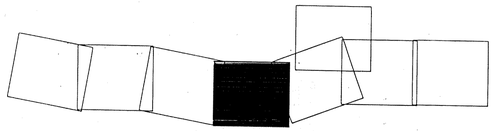
~~AVERAGE FILL ELEVATION 1158.0~~
~~APPROX. VOLUME 71,670 CY~~
~~COMP. TO 85% OF MAX DENSITY~~

~~5 WASTE FILL AREA (EAST OF AREA DRAIN)~~

~~AVERAGE FILL ELEVATION 1162.0~~
~~APPROX. VOLUME 120,880 CY~~
~~COMP. TO 85% OF MAX DENSITY~~

Rio Salado HEC-2 Stationing

Station	River Mile
60.000	22.512
62.000	22.545
64.000	22.578
66.000	22.610
68.000	22.644
69.300	22.664
70.300	22.681
72.000	22.710
74.000	22.742
76.000	22.775
78.000	22.808
80.000	22.841
82.000	22.874
84.000	22.907
86.000	22.940
88.000	22.973



NO.	DATE	DESCRIPTION	APPROVAL
3			
2			
1	9-20-90	Revised Entire Sheet	GKC

REVISIONS

CRSS, INC.
PHOENIX, ARIZONA

RIO SALADO
CHANNEL DESIGN

DEPARTMENT OF PUBLIC WORKS
CITY OF TEMPE
DIVISION OF ENGINEERING
P.O. BOX 5002 TEMPE, ARIZONA

DESIGNED: JFM	CHANNEL GRADING PLAN	DATE 7-30-90
DRAWN: PMP		PROJECT NO. 876191
APPROVED: GKC		SHT 46 OF 622
SCALE: 100		CH-5.9

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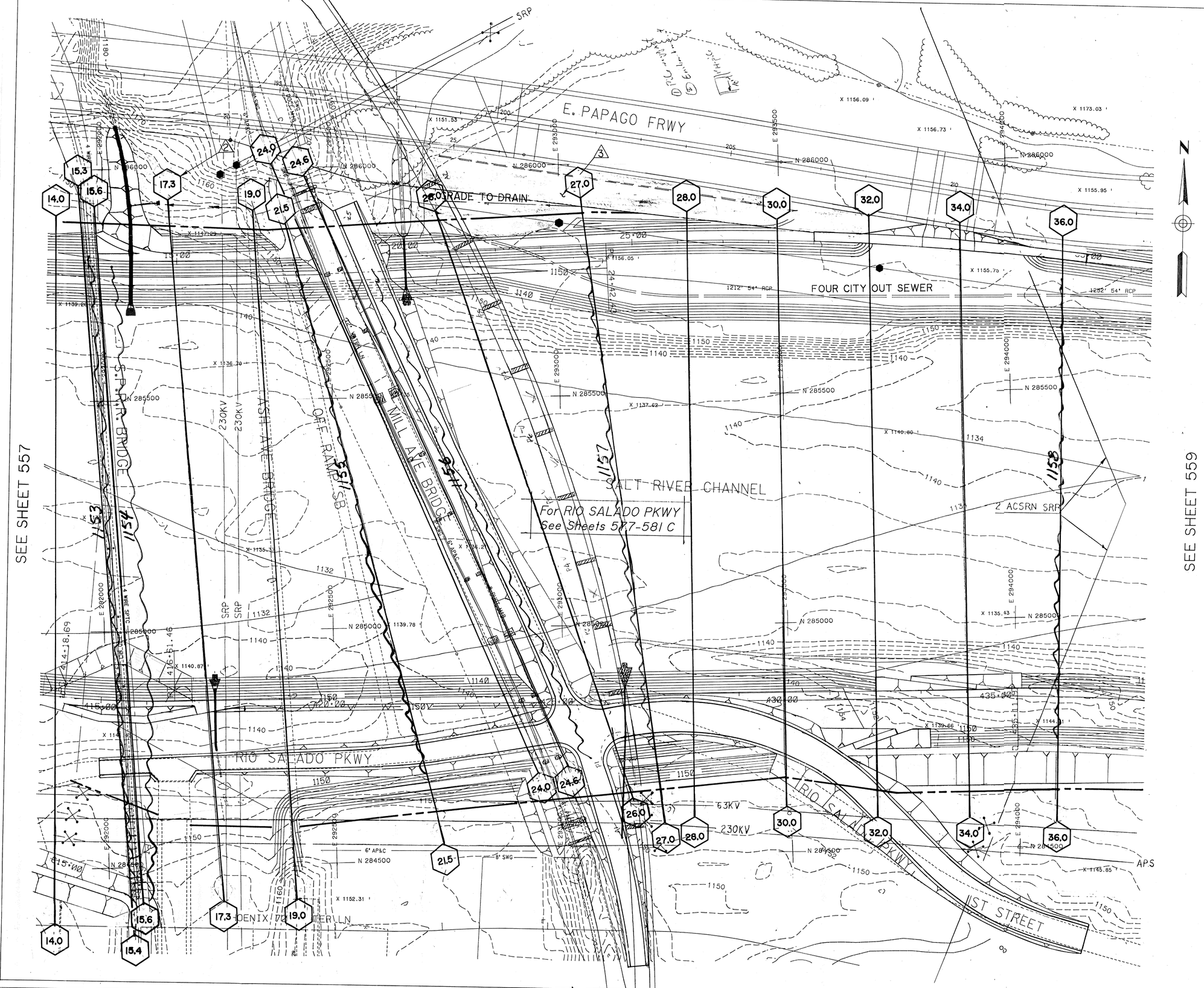

F.H.W.A. REGION	STATE	PROJECT NOS.		AS BUILT
9	AZ.	RAM 600-5-511	202L MA 6	

CONSTRUCTION NOTES

2 WASTE FILL AREA
AVERAGE FILL ELEVATION 1158.0
APPROX. VOLUME 11,090 CY
COMPACT TO 85% OF MAX. DENSITY

3 WASTE FILL AREA
AVERAGE FILL ELEVATION 1160.0
APPROX. VOLUME 12,990 CY
COMPACT TO 85% OF MAX. DENSITY

Rio Salado HEC-2 Stationing

Station	River Mile
14.000	21.649
15.400	21.672
15.600	21.675
17.300	21.704
19.000	21.737
21.500	21.771
24.000	21.798
24.600	21.809
26.000	21.843
26.450	21.851
27.000	21.879
28.000	21.908
30.000	21.945
32.000	21.981
34.000	22.018
36.000	22.057

NO.	DATE	DESCRIPTION	APPROVAL
3			
2			
1	9-20-90	Revised Entire Sheet	

REVISIONS

CRSS, INC.
PHOENIX, ARIZONA

RIO SALADO
CHANNEL DESIGN

DEPARTMENT OF PUBLIC WORKS
CITY OF TEMPE
DIVISION OF ENGINEERING
P.O. BOX 5002 TEMPE, ARIZONA

DESIGNED: JFM
DRAWN: PMP
APPROVED: GKC
SCALE: 1:00

CHANNEL GRADING PLAN

DATE
PROJECT NO. 876191
SHT 558 OF 585

CH-5.2

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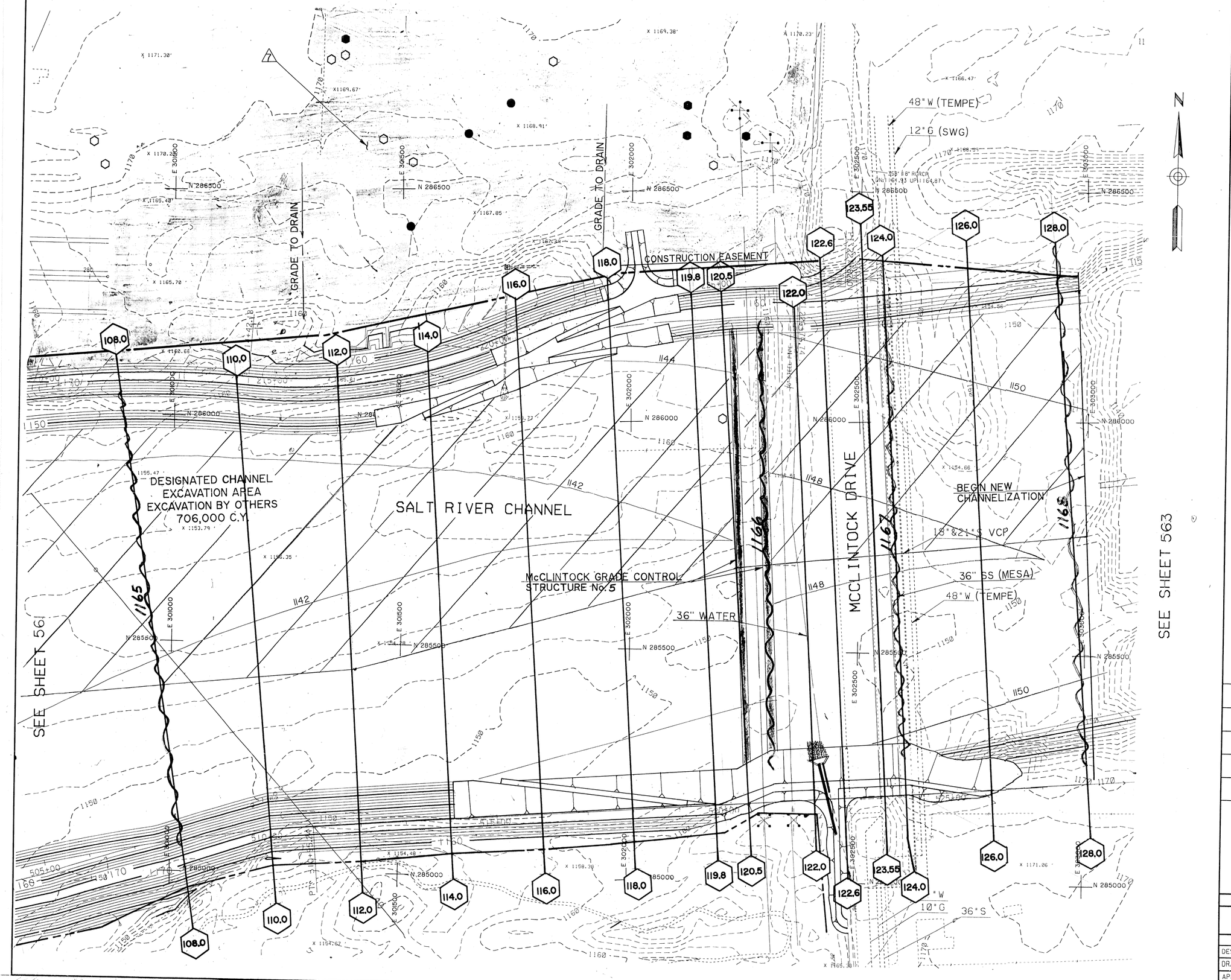


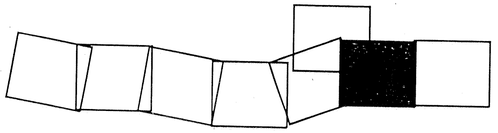
F.H.W.A. REGION	STATE	PROJECT NOS.		AS BUILT
9	AZ.	RAM 600-5-511	202L MA 6	

CONSTRUCTION NOTES

7 WASTE FILL AREA
AVERAGE FILL ELEVATION 1170.0
APPROX. VOLUME 137,110 CY
COMPACT TO 85% OF MAX. DENSITY
GRADE TO DRAIN AREA TOWARD THE LEVEE

Rio Salado HEC-2 Stationing

Station	River Mile
108.000	23.375
110.000	23.417
112.000	23.456
114.000	23.492
116.000	23.529
118.000	23.566
119.800	23.601
120.420	23.610
120.500	23.611
122.000	23.639
122.650	23.651
123.550	23.667
124.000	23.676
126.000	23.713
128.000	23.751



NO.	DATE	DESCRIPTION	APPROVAL
3			
2			
1	9-20-90	Revised Entire Sheet	GKC

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CRSS, INC.
PHOENIX, ARIZONA

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CHANNEL DESIGN

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CITY OF TEMPE
DIVISION OF ENGINEERING
P.O. BOX 5002 TEMPE, ARIZONA

DESIGNED: JFM
DRAWN: PMP
APPROVED: GKC
SCALE: 100

CHANNEL GRADING PLAN

DATE 7-30-90
PROJECT NO. 876191
SHT 562 OF 585

F.H.W.A. REGION	STATE	PROJECT NOS.		AS BUILT
9	AZ.	RAM 600-5-509	220 L MA 4	

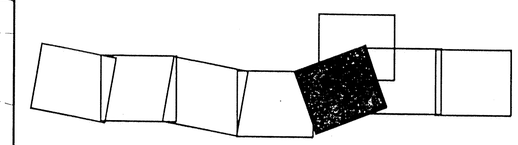
CONSTRUCTION NOTES

~~5. WASTE FILL AREA (SEE SHEET 560)~~

~~6. WASTE FILL AREA AVERAGE FILL ELEVATION 1170.0 APPROX. VOLUME 12,690 CY COMPACT TO 85% OF MAX. DENSITY~~

Rio Salado HEC-2 Stationing

Station	River Mile
86.000	22.940
88.000	22.973
90.000	23.005
92.000	23.038
94.000	23.070
96.000	23.109
98.000	23.153
100.000	23.200
102.000	23.252
104.000	23.293
106.000	23.334
108.000	23.375



NO.	DATE	DESCRIPTION	APPROVAL
3			
2			
1	9-20-90	Revised Entire Sheet	GKC

REVISIONS

CRSS, INC.
PHOENIX, ARIZONA

RIO SALADO
CHANNEL DESIGN

DEPARTMENT OF PUBLIC WORKS
CITY OF TEMPE
DIVISION OF ENGINEERING
P.O. BOX 5002 TEMPE, ARIZONA

DESIGNED: JFM
DRAWN: PMP
APPROVED: GKC
SCALE: 100

CHANNEL GRADING PLAN

DATE 7-30-90
PROJECT NO. 876191
SHT 47 OF 622

CH-5.5

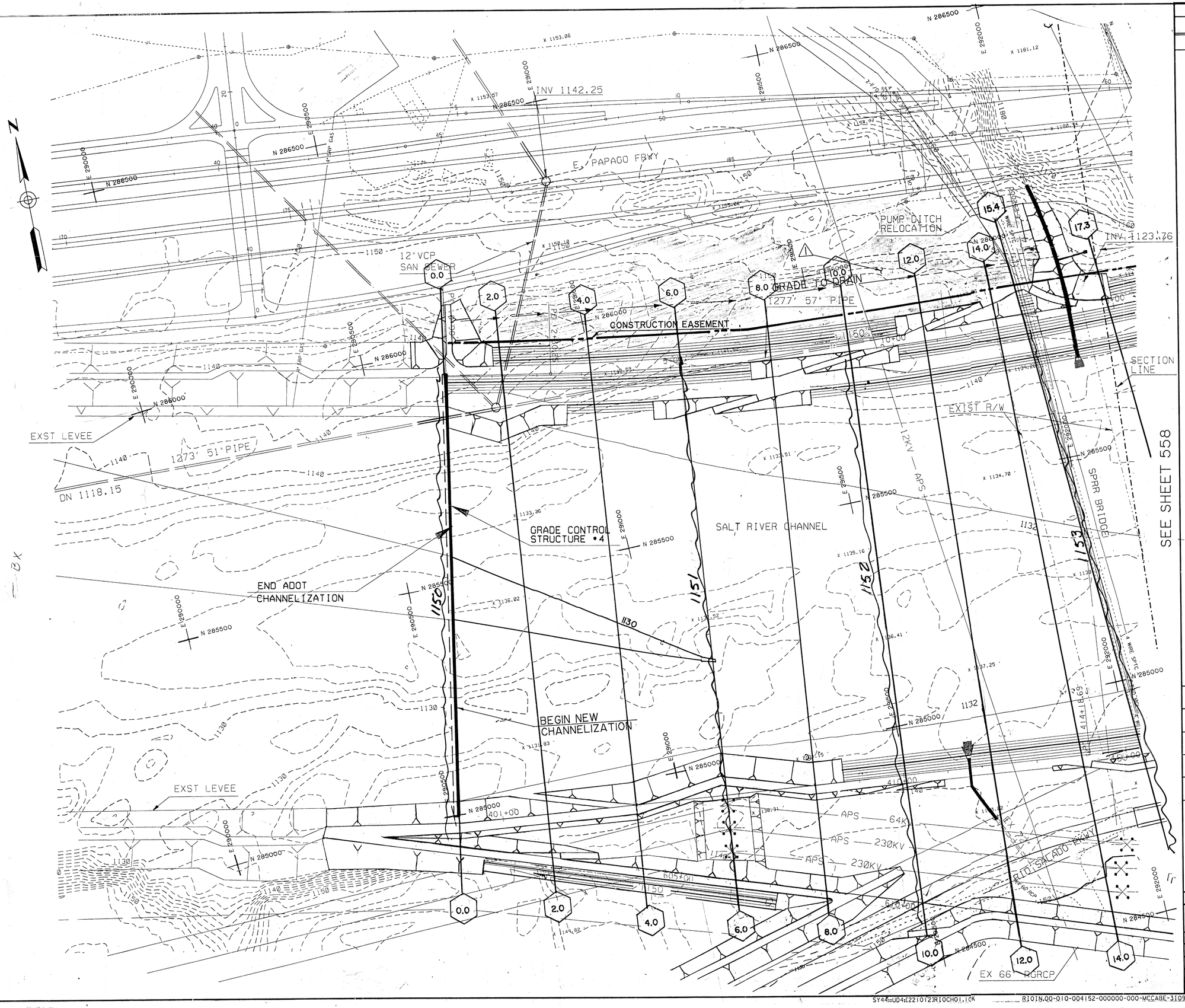
F.H.W.A. REGION	STATE	PROJECT NOS.		AS BUILT
9	AZ.	RAM 600-5-511	202L MA 6	

CONSTRUCTION NOTES

⚠ WASTE FILL AREA
AVERAGE FILL ELEVATION 1152.0
APPROX. VOLUME 69,000 CY
COMPACT TO 85% OF MAX. DENSITY

Rio Salado HEC-2 Stationing

Station	River Mile
0.000	21.399
2.000	21.429
4.000	21.467
6.000	21.505
8.000	21.543
10.000	21.581
12.000	21.619
14.000	21.649



NO.	DATE	DESCRIPTION	APPROVAL
3			
2			
1	9-20-90	Revised Entire Sheet	GKC

REVISIONS

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PHOENIX, ARIZONA

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CITY OF TEMPE
DIVISION OF ENGINEERING
P.O. BOX 5002 TEMPE, ARIZONA

DESIGNED: JFM
DRAWN: PMP
APPROVED: GKC
SCALE: 100

CHANNEL GRADING PLAN

DATE 7-30-90
PROJECT NO. 876191
SHT 557 OF 585

CH-5.1

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