Lower Salt River Floodplain Delineation Study

Phoenix, Maricopa County

Technical Support Data Notebook

Contract Number: FCD 2013C013

Prepared for:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

In Cooperation with:

City of Phoenix
200 W. Washington St.
Phoenix, AZ 85003

Registered Professional Engineer
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
ARIZONA, U.S.A.
Expires 3/31/2017

Prepared by:

WEST Consultants, Inc.
8950 S. 52nd Street, Suite 210
Tempe, Arizona 85284

May 2015

Flood Control District
of Maricopa County

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601

June 10, 2015

LOMR Manager
LOMC Clearinghouse
847 South Pickett Street
Alexandria, VA 22304-4605

Subject:	LOMR Request Lower Salt River, 91st Avenue to 44th Street, Phoenix, AZ. May 2015, by WEST Consultants (FCD Contract FCD2013C013, Work Assignments #1 and #2)
Communities:	City of Phoenix, Community No. 040051; Unincorporated Maricopa County, Community No. 040037
Flooding Sources:	Lower Salt River
FIRM panels affected:	04013C2190L, 04013C2195L, 04013C2215L, 04013C2220L, and 04013C2240L (October 16, 2013)

LOMR Manager:

Enclosed is the technical supporting study data for a Letter of Map Revision (LOMR) request regarding the Lower Salt River. The request includes the re-delineation of approximately 15 linear miles of Zone AE floodplain and floodway within the City of Phoenix (City) and Unincorporated Maricopa County (District). The study reach extends from near 91st Avenue to near 44th Street within the central area of Maricopa County. The District performed the study on behalf of the City.

Study data is contained in a one-volume Technical Support Data Notebook (TSDN) entitled "Lower Salt River Floodplain Delineation Study, Phoenix, Arizona Technical Support Data Notebook", May 2015, by WEST Consultants, Inc. Hydrologic and hydraulic information is located in Sections 4 and 5. The FEMA forms are located in Section 2. A full-size set of floodplain delineation work maps are included at the end of the report. The annotated FIRM panels are included in Section 7. Digital files of the hydrologic and hydraulic analyses are included on the data disk located just inside the back cover of the TSDN.

It is our preference that this study be processed as two (or more) LOMRs. We have been coordinating with FEMA Region IX Engineer Robert Bezek, CFM, PMP regarding this study and have his support for processing the study under multiple LOMR Case Numbers. Please contact us regarding any additional fees for the review and map production that may be needed.

If you have any questions, please contact me at (602) 506-4528, or rph@mail.maricopa.gov.

Sincerely,

Richard P. Harris

Richard P. Harris, P.E., CFM
Project Manager
Hydrology and Hydraulics Branch

Enclosures: 1 bound copy of report
Technical Review Fee Check for $8250.00
Copies without enclosure to:

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Robert Bezek, CFM, PMP.
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Dr. Hasan Mushtaq, Ph.D., P.E., CFM
Planning, Design, & Programming Division
Street Transportation Department
200 West Washington Street, 5th Floor
Phoenix, Arizona 85003-1611

Dr. Brian Wahlin, Ph.D., P.E., D.WRE
WEST Consultants, Inc.
8950 S. 52nd Street
Suite 210
Tempe, AZ 85284

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: May 18th, 2014

To: William D. Wiley, P.E., Chief Engineer and General Manager

From: Richard Harris, P.E., CFM

Subject: Lower Salt River FDS, PMR/LOMR Request and Technical Support Data Notebook, Contract FCD 2013C013 – WA #1 and WA #2

The floodplain and floodway re-study for the Lower Salt River FDS, PMR/LOMR Request, and Technical Support Data Notebook is ready for use as the best available technical information. The study documentation will be sent to FEMA for review and incorporation into the County's FIRM panels.

The re-study revised approximately 15 linear miles of existing Zone AE floodplains with floodway of the Salt River from near 91st Avenue to near 44th Street. The study was performed on behalf of the City of Phoenix, and used new topographic mapping and as-built plans to update flood elevations and boundaries for the 100-year event. New 2-foot contour interval mapping in NAVD88 vertical datum was produced by RBF (flown April 13th, 2013). The study Consultant was WEST Consultants. The project manager for the Consultant was Brian Wahlin, Ph.D., P.E., D.WRE. The project manager for the District was Richard Harris, P.E., CFM. The contact at the City of Phoenix is Hasan Mushtaq, Ph.D.,P.E., CFM.

Please concur and authorize the use of this new study by signing below. Please also sign the attached copy of FEMA's Overview and Concurrence Form (MT-2 Form 1, page 2).

Richard Harris, P.E., CFM Project Manager Date 5/18/15	Kelli Sertich, AICP, CFM Floodplain Management & Services Division Manager Date: 5/29/15
Cathy Regester, P.E., CFM Acting Hydrology/Hydraulics Branch Manager Date: 5/27/15	Don Rerick, P.E. Planning and Project Management Division Manager Date: 5/30/15
Scott Vogel, P.E. Engineering Division Manager Date: 5/29/15	William D. Wiley, P.E. Chief Engineer and General Manager Date: 6/1/15
File Copies: 1. ____ 2. ____	Pending Floodplain Posted YES Date: 6/10/15 Files ☐ GIS N/A

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

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May 2015

Table of Contents

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Certificate No.
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WAHLIN
Civil
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

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1 Introduction

1.1 Purpose of study

This study is titled the Lower Salt River (LSR) Floodplain Delineation Study (FDS). The primary purpose of this study is to delineate approximately 15 linear miles of Zone AE floodplain and floodway along the Salt River within the metropolitan Phoenix area and unincorporated Maricopa County. The study reach stretches from just upstream of 91st Avenue in Phoenix to upstream of the Interstate 10 (I-10) Bridge. Tributary tie-ins, such as Cave Creek, are also located within this reach. This study covers five existing Flood Insurance Rate Map (FIRM) Panels, including the following (listed in order from downstream to upstream): 04013C2190L, 04013C2195L, 04013C2215L, 04013C2220L, and 04013C2240L. All FIRM panels have an effective date of October 16, 2013.

The Flood Control District of Maricopa County (District) initiated this study to update flood hazard boundaries considering the significant changes in topography that have occurred in the study reach due to the active sand and gravel mining operations in the channel and overbanks since the effective study, which was completed in 1999 (Michael Baker, Jr., Inc., 1999). Other changes within the study reach included the construction of the Rio Salado Project by the U.S. Army Corp of Engineers (USACE) in 2004. This project includes a low flow channel and environmental restoration features. The Maricopa County Department of Transportation and the City of Phoenix have also funded several bridge improvement projects since the effective study, resulting in several Letters of Map Revision (LOMRs) along the study reach. The hydrology used in this study has not been changed from the hydrology used in previously approved Federal Emergency Management Agency (FEMA) studies of the reach (Michael Baker, Jr., Inc., 1999) and a re-delineation of the Salt/Gila River near the Tres Rios North Levee (WEST Consultants, Inc., 2012).

The effective Special Flood Hazard Area (SFHA) for the study reach was determined by the study entitled *Salt-Gila River Floodplain Delineation Restudy* (FCD 92-01), by Michael Baker Jr., Inc. (1999), but has been updated through LOMRs and Physical Map Revisions (PMR) in several locations. In addition, the area where Cave Creek confluences with the Salt River near 51st Avenue was analyzed in a study entitled *Cave Creek Wash Flood Insurance Re-studies, Maricopa County, Arizona (FIS)*, (FCD 88-04), by Cella Barr Associates(1989).

For this study, the 1-percent-annual-chance flood was re-delineated based on the updated topography to replace the effective SFHA for the study reach of the LSR; Cave Creek was not studied or re-delineated under this scope of study. The 10-percent, 2-percent, and 0.2 percent-annual chance floods were also modeled for the LSR in this study as well. The LSR was modeled with HEC-RAS version 4.1.0 (Hydrologic Engineering Center, 2010).

1.2 Authority for study

WEST Consultants, Inc. (WEST) prepared this FDS for the Lower Salt River under contract with the District. This study was commissioned under contract FCD 2013C013. District personnel affiliated with the project include Mr. Richard Harris, P.E., CFM (Project Manager) and Mr. Jeffery Shelton, P.E., (Assistant Project Manager). As some of the study area falls within the Phoenix boundaries, Dr. Hasan Mushtaq, Ph.D., P.E. from the City of Phoenix (COP) was also involved. WEST personnel involved included Dr. Brian Wahlin, Ph.D., P.E., D.WRE (Project Manager, Engineer of Record); Mr. Chuck Davis, P.E., CFM; Mr. Jesse Piotrowski, P.E., CFM; Ms. Suzie Monk, CFM; Dr. Om Prakash, Ph.D., P.E.; Mr. Kayson Shurtz, P.E.; and Ms. Sarah Bengtson. The project began in February 2014. WEST would also like to acknowledge the work done by our internal quality assurance team; Tom Lute, RLS, who performed subcontracted field survey work with David Evans and Associates (DEA); John Stock, RLS, who performed field survey work with the District; and the review performed internally by District and COP staff for the study.

This Technical Support Data Notebook (TSDN) has been prepared according to the standards as specified in the Arizona Department of Water Resources (ADWR) State Standard SS1-12 (Arizona Department of Water Resources, 2012). Supporting technical information has been prepared as specified in Appendix C of the FEMA Guidelines and Specifications for Flood Hazard Mapping Partners (Federal Emergency Management Agency, 2009).

1.3 Location of study reach

The study covers a section of the Lower Salt River located in central Maricopa County, some of which falls within City of Phoenix boundaries. The affected communities are the City of Phoenix and unincorporated areas of Maricopa County (FEMA NFIP Community Numbers 040051 and 040037, respectively). The study area covers the following Townships and Ranges: T1NR1E, T1NR2E, T1NR3E, and T1SR1E. A full listing of all Township, Range, and Section Numbers intersecting the topographic data collected for this study by the District can be found in Table 1-1. A vicinity map showing the study reach is shown in Figure 1-1.

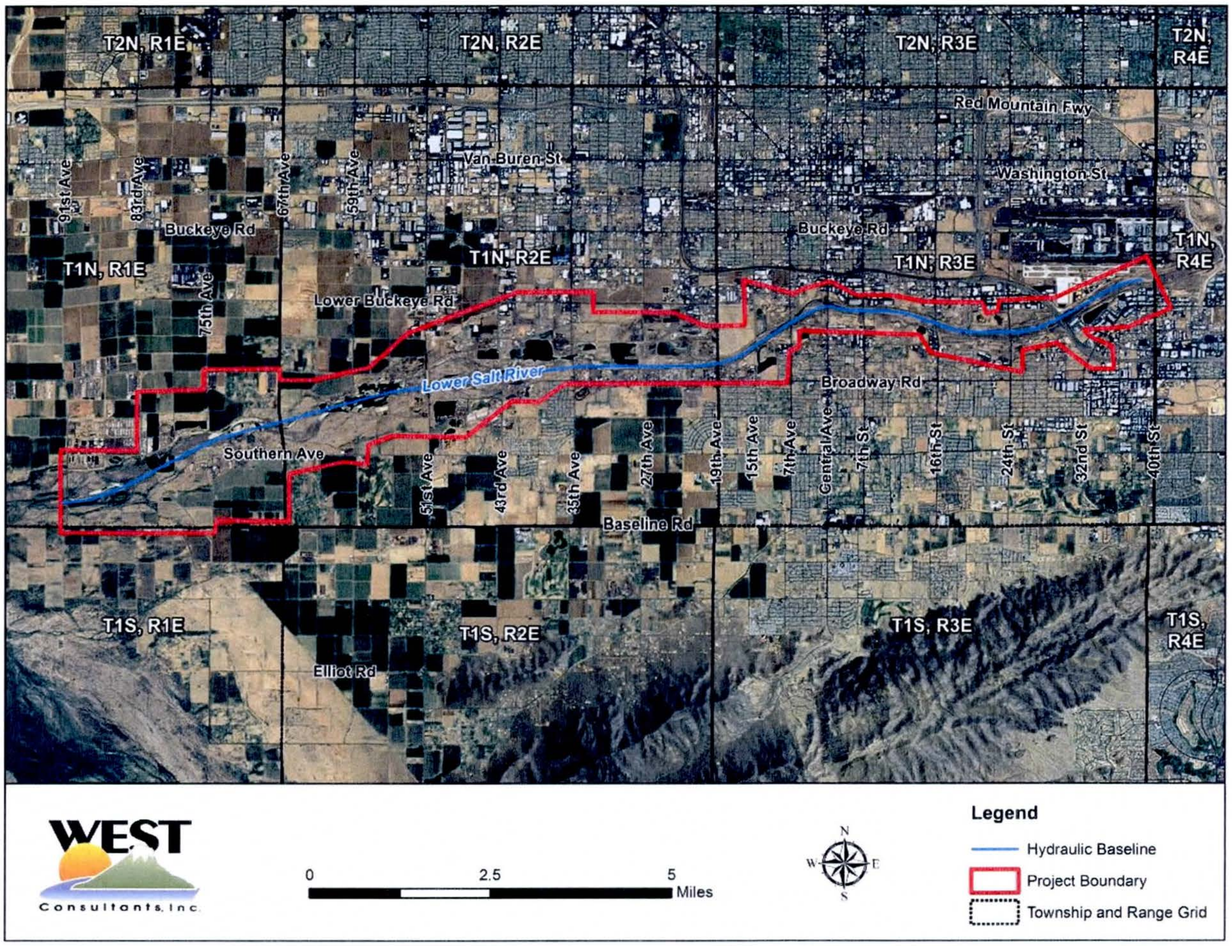

Figure 1-1. Vicinity map

Table 1-1. Township, Range, and Section numbers intersecting the topography data collected for this study

T1N-R1E-S25	T1N-R2E-S16	T1N-R2E-S29	T1N-R3E-S19
T1N-R1E-S26	T1N-R2E-S20	T1N-R2E-S30	T1N-R3E-S20
T1N-R1E-S27	T1N-R2E-S21	T1N-R2E-S31	T1N-R3E-S21
T1N-R1E-S28	T1N-R2E-S22	T1N-R2E-S32	T1N-R3E-S22
T1N-R1E-S33	T1N-R2E-S23	T1N-R2E-S33	T1N-R3E-S23
T1N-R1E-S34	T1N-R2E-S24	T1N-R3E-S14	T1N-R3E-S24
T1N-R1E-S35	T1N-R2E-S25	T1N-R3E-S15	T1N-R3E-S30
T1N-R1E-S36	T1N-R2E-S26	T1N-R3E-S16	T1S-R1E-S2
T1N-R2E-S14	T1N-R2E-S27	T1N-R3E-S17	T1S-R1E-S3
T1N-R2E-S15	T1N-R2E-S28	T1N-R3E-S18	T1S-R1E-S4

1.4 Methodology used for hydrology and hydraulics

Hydrologic analysis was not included as part of this study. HEC-RAS Version 4.1.0 was utilized for floodplain and floodway delineation (Hydrologic Engineering Center, 2010). The floodway boundaries are based upon previous floodway stationing and refined where possible using the set floodway locations (Encroachment Method 1), which is the floodway encroachment modeling criteria accepted by FEMA. In general, cross-sections are placed at approximately 500-foot intervals, similar to the effective modeling in the reach. Incorporation of spatial data into the HEC-RAS environment was achieved in a Geographic Information System (GIS) framework using ESRI's ArcGIS software suite, v. 10.1, and HEC-GeoRAS (Environmental Systems Research Institute, 2011). The details of the hydraulic analysis are described further in Section 5 below.

1.5 Acknowledgments

The District and the City of Phoenix were the primary suppliers of data needed for the study and provided technical guidance for the final product. The bulk of this study can be attributed to the ready communication and input of these two agencies. In addition, the project team would also like to acknowledge the USACE whose previous work on the Rio Salado and Rio Salado Oeste reaches were invaluable for input to the current modeling effort. Also, the project team would like to acknowledge Jim Bob Hudson, Plant Manager for the CEMEX facility just west of 19th Avenue, for his help in coordinating site survey for the 27th Avenue Bridge. Finally, the project team would like to acknowledge Mr. Tony Beuche of the District and Mr. Steve Trussell of the Arizona Rock Products Association for their invaluable input regarding the mining operations in the reach, both current and future.

1.6 Study Results

The proposed floodplains from this study are designated as Zone AE. The final proposed floodplain and floodway boundaries are shown on hydraulic work maps contained in the Exhibits section of this TSDN. Proposed Base Flood Elevations (BFEs) are lower in the study reach compared to the effective BFEs, with the exception of the most downstream 9,500 feet of the study. Proposed increases in the 1% annual-chance floodplain extent are primarily at sand and gravel mining operations (backfills), and proposed decreases in the 1% annual-chance floodplain extent are due to lower BFEs and changes in topography due to riparian restoration projects such as the Rio Salado low-flow channel, urban development, and sand and gravel operations (extractions). Internal review by the District concluded that none of the current sand and gravel mining permits in the study reach will be negatively impacted based on the results of this study.

A public meeting was held on January 15, 2015, to present the study results. In order to inform the public about the meeting ahead of time, property owners within the study reach were contacted via mailers and public notification in a local newspaper. Documentation regarding these meetings can be found in Appendix B.1 of this TSDN.

2 FEMA Forms

FEMA MT-2 Forms are provided on the following pages.

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2240L	10/16/2013
040051	City of Phoenix	AZ	04013C	2220L	10/16/2013
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2215L	10/16/2013
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2195L	10/16/2013
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2190L	10/16/2013

2. a. Flooding Source: Salt River

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)

   ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Lower Salt River Floodplain Delineation Study

4. FEMA zone designations affected: AE, A, X (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

   a. The basis for this revision request is (check all that apply)

   ☒ Physical Change ☐ Improved Methodology/Data ☒ Regulatory Floodway Revision ☐ Base Map Changes

   ☐ Coastal Analysis ☒ Hydraulic Analysis ☐ Hydrologic Analysis ☐ Corrections

   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☒ Natural Changes

   ☒ New Topographic Data ☐ Other (Attach Description)

   Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☒ Channelization ☐ Levee/Floodwall ☒ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6] Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: $ 8250

NA ☒ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are 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: Richard Harris, P.E., CFM	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 W. Durango St. Phoenix, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address: rph@mail.maricopa.gov	
Signature of Requester (required): Richard P. Harris	Date: 5/1/2015	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Mr. William D. Wiley, P.E., Chief Engineer and General Manager	Community Name: Maricopa County	
Mailing Address: 2801 W. Durango St. Phoenix, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address: williamwiley@mail.maricopa.gov	
Community Official's Signature (required):	Date: 6/1/2015	

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are 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.

Certifier's Name: Brian Wahlin, P.E.	License No.: AZ P.E. 41980	Expiration Date: 3/31/2017
Company Name: WEST Consultants, Inc.	Telephone No.: (480) 345-2155	Fax No.: (480) 345-2156
Signature:	Date: 5/1/2015	E-Mail Address: bwahlin@westconsultants.com

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☒ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41960
BRIAN THOMAS
WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

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☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2240L	10/16/2013
040051	City of Phoenix	AZ	04013C	2220L	10/16/2013
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2215L	10/16/2013
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2195L	10/16/2013
040051 & 040037	City of Phoenix & Maricopa County, respectively	AZ	04013C	2190L	10/16/2013

2. a. Flooding Source: Salt River

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
   ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Lower Salt River Floodplain Delineation Study

4. FEMA zone designations affected: AE, A, X (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

   a. The basis for this revision request is (check all that apply)

   ☒ Physical Change ☐ Improved Methodology/Data ☒ Regulatory Floodway Revision ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☐ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☒ Natural Changes
   ☒ New Topographic Data ☐ Other (Attach Description)

   Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☒ Channelization ☐ Levee/Floodwall ☒ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $____

☒ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are 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: Richard Harris, P.E., CFM	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 W. Durango St. Phoenix, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address: rph@mail.maricopa.gov	
Signature of Requester (required): Rich P. Harris	Date: 5/12/15	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Hasan Mushtaq, P.E., Ph.D, CFM, Floodplain Manager	Community Name: City of Phoenix	
Mailing Address: 200 W. Washington Street, 5th Floor Phoenix, AZ 85003	Daytime Telephone No.: (602) 262-4026	Fax No.:
	E-Mail Address: hasan.mushtaq@phoenix.gov	
Community Official's Signature (required): HMushtaq	Date: 05/20/15	

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are 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.

Certifier's Name: Brian Wahlin, P.E.	License No.: AZ P.E. 41980	Expiration Date: 3/31/2017
Company Name: WEST Consultants, Inc.	Telephone No.: (480) 345-2155	Fax No.: (480) 345-2156
Signature:	Date: 5/1/2015	E-Mail Address: bwahlin@westconsultants.com

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☒ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Registered Professional Engineer (Civil)
CERTIFICATE No.
41960
BRIAN THOMAS
WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Salt River

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

   ☒ Not revised (skip to section B) ☐ No existing analysis ☐ Improved data
   ☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

   ☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model → Specify Model: ____________
   ☐ Regional Regression Equations ☐ Other (please attach description)

   Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

   If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

   Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☐ No

   If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit*	4,000 feet u/s of 91st Ave.	RS 203.08	974.43	974.43
Upstream Limit*	6,500 feet u/s of I-10 Bridge	AP (RS 96296)	1,112.07	1,111.93

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS v 4.1.0

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

Models Submitted	**Natural Run**		**Floodway Run**		**Datum**
Duplicate Effective Model*	File Name: N/A	Plan Name: N/A	File Name: N/A	Plan Name: N/A	N/A
Corrected Effective Model*	File Name: N/A	Plan Name: N/A	File Name: N/A	Plan Name: N/A	N/A
Existing or Pre-Project Conditions Model	File Name: LowerSaltRiver_FDS	Plan Name: *.p01 (profile 1)	File Name: LowerSaltRiver_FDS	Plan Name: *.p01 (profile 2)	NAVD88
Revised or Post-Project Conditions Model	File Name: N/A	Plan Name: N/A	File Name: N/A	Plan Name: N/A	N/A
Other - (attach description)	File Name: N/A	Plan Name: N/A	File Name: N/A	Plan Name: N/A	N/A

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☒ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: 2-foot interval contour mapping & ground survey

Source: RBF Consulting (contours), DEA, and FCDMC   Date: Various, refer to Section 3 of the TSDN

Accuracy: Various, but within +/- 1 foot for 2-ft C.I. maps

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☒ Yes ☐ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:

      - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
      - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☒ Yes ☐ No

      If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☒ Yes ☐ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

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DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Salt River

Note: Fill out one form for each flooding source studied.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization..............complete Section B
Bridge/Culvert................complete Section C
Dam..............................complete Section D
Levee/Floodwall............complete Section E
Sediment Transport........complete Section F (if required)

Description Of Modeled Structure

1. Name of Structure: Interstate 10 (I-10) Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 89,582

   Upstream Limit/Cross Section: RS 89,791

2. Name of Structure: 24th Street Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 85,951

   Upstream Limit/Cross Section: RS 86,076

3. Name of Structure: 16th Street Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 80,512

   Upstream Limit/Cross Section: RS 80,635

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

- Channelization..............complete Section B
- Bridge/Culvert...............complete Section C
- Dam...............................complete Section D
- Levee/Floodwall............complete Section E
- Sediment Transport........complete Section F (if required)

Description Of Modeled Structure

4. Name of Structure: 7th Street Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 75,060

   Upstream Limit/Cross Section: RS 75,210

5. Name of Structure: Central Avenue Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 72,455

   Upstream Limit/Cross Section: RS 72,602

6. Name of Structure: 7th Avenue Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 69,403

   Upstream Limit/Cross Section: RS 69,557

7. Name of Structure: 19th Avenue Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 63,356

   Upstream Limit/Cross Section: RS 63,478

8. Name of Structure: 27th Avenue Conveyor Belt Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 57,683

   Upstream Limit/Cross Section: RS 57,722

9. Name of Structure: 35th Avenue Bridge

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: RS 52,864

   Upstream Limit/Cross Section: RS 53,001

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization...............complete Section B
Bridge/Culvert...............complete Section C
Dam...............................complete Section D
Levee/Floodwall............complete Section E
Sediment Transport........complete Section F (if required)

Description Of Modeled Structure

10. Name of Structure: 51st Avenue Bridge

Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: _____

Downstream Limit/Cross Section: RS 42,126

Upstream Limit/Cross Section: RS 42,278

B. CHANNELIZATION

Flooding Source: Salt River

Name of Structure: Rio Salado Low Flow Channel

1. Hydraulic Considerations

The channel was designed to carry 12,200 (cfs) and/or the _____-year flood.
The design elevation in the channel is based on (check one):

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

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)] ☒ Drop structures ☐ Superelevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/detention basin [Attach Section D (Dam/Basin)] ☐ Energy dissipator

☐ Weir ☐ Other (Describe):

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

Channelization study and design was not part of the current PMR, but was performed as part of the Rio Salado Low Flow Channel Design. That report and the resulting as-builts are included as Exhibit C of this TSDN.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: I-10 Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 24th Street Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 16th Street Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☒ Modified bridge/culvert previously modeled in the FIS

   ☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☒ Structure Invert Elevations – Upstream and Downstream

   ☒ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 7th Street Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☒ Modified bridge/culvert previously modeled in the FIS

   ☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☒ Structure Invert Elevations – Upstream and Downstream

   ☒ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: Central Avenue Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 7th Avenue Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 19th Avenue Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 27th Avenue Conveyor Belt Bridge

1. This revision reflects (check one):

   ☒ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

   Note that only surveyed information has been provided for this bridge as no plans, conceptual or as-built, were available.

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 35th Avenue Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

C. BRIDGE/CULVERT

Flooding Source: Salt River

Name of Structure: 51st Avenue Bridge

1. This revision reflects (check one):

   ☐ Bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☒ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)

   ☐ Shape (culverts only)

   ☒ Material

   ☐ Beveling or Rounding

   ☐ Wing Wall Angle

   ☐ Skew Angle

   ☐ Distances Between Cross Sections

   ☐ Erosion Protection

   ☒ Low Chord Elevations – Upstream and Downstream

   ☒ Top of Road Elevations – Upstream and Downstream

   ☐ Structure Invert Elevations – Upstream and Downstream

   ☐ Stream Invert Elevations – Upstream and Downstream

   ☐ Cross-Section Locations

4. Sediment Transport Considerations

   Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

The following provides clarification regarding FEMA MT-2 forms.

MT-2 Form 1, Section C (Review Fee)

This study is a Physical Map Revision (PMR) based solely on the submission of more detailed, Best Available Data (BAD). Therefore, this study is exempt from review fees.

MT-2 Form 3, Section B (Channelization)

The channelization included within the boundaries of this study was designed by the United States Army Corps of Engineers, Los Angeles District, the City of Phoenix, and the City of Tempe. WEST's current study of the Lower Salt River did not include channelization design or analysis.

3 Surveying and Mapping Information

The final topography used for floodplain mapping in this study was developed from a number of sources, the primary source being topographic survey data provided directly by the District (contract FCD 2012C015, Salt River Mapping, flight date 4/13/2013). This topographic survey was performed to provide accurate elevation data for this study. The topography extended from 91st Avenue to upstream of the I-10 Bridge on the Lower Salt River.

Other sources of topographic data used for final floodplain delineation included record drawings from the City of Phoenix for the area upstream of the I-10 Bridge; field survey of three bridges crossing the Salt River in the study reach; and field survey of the ground surface beyond the topographic survey data extent for floodplain inundation mapping in two locations. Each of these will be discussed in greater detail below.

Two sources of topographic data were considered during preliminary mapping but were ultimately not included in the final floodplain delineation (see Section 3.3 below for discussion of Laveen Farms Ground Survey and Rio Salado Oeste Topography).

3.1 Digital Projection Information

The vertical datum used for this study is the North American Vertical Datum of 1988 (NAVD88). The horizontal datum used for this study is the North American Datum of 1983 (NAD83) projected in the Arizona State Plane Central Zone coordinates. All data sources used in this study reference this horizontal projection using a High Accuracy Reference Network (HARN) with units of international feet.

Electronic data available to the project reviewers for this study include GIS shapefiles for topography data discussed in greater detail in Sections 3.2 and 3.3 below. These files are included electronically as Exhibit C.

Aerial photogrammetry used to produce topographic mapping on the work maps was provided by the District. Topographic mapping flights for this product downstream of Interstate 10 were collected in April 2013. Topographic mapping flights for the area upstream of Interstate 10 were performed in June 2006 and April 2007. Aerial photographic images for the project were provided by the District in MrSID format at 0.8-foot resolution, and the flight dates for the imagery spanned over the years of 2013 and 2014. Aerial photographic images cover the entire study reach. The images were georeferenced horizontally in the NAD83 HARN Arizona State Plane Central Zone projected coordinate system.

Elevation Reference Marks (ERMs) shown on the work study maps (see Section 5.2) were provided by the District. Further details regarding the selection of those ERMs for this study can be found in a technical memorandum developed by WEST and delivered to the District (replicated in Appendix C.4 of this report).

3.2 Field Survey Information

This section will discuss the following three major sources of field survey used to supplement the topographic survey data collected by the District:

1) field survey of three bridges crossing the Lower Salt River in the study reach;
2) field survey of the ground surface beyond the initial topographic survey data extent for floodplain inundation (backwater) mapping within the Laveen Area Conveyance Channel; and
3) field survey of the ground surface beyond the initial topographic survey data extent for floodplain inundation mapping within an existing sand and gravel mining pit located just west of the 55th Avenue alignment on the south bank of the river.

Each of these field survey sources are explained in greater detail below.

Field survey of three bridges crossing the Lower Salt River

Several bridges cross the Lower Salt River within the study reach. WEST was able to utilize as-built plans for most of these structures to input the necessary data into the HEC-RAS model to accurately represent these bridges in the hydraulic computations. For more information on each of the bridges in the study reach, please see Section 5.5.2 below.

However, three bridges were selected to be surveyed in the field in order that they might be more accurately represented in the hydraulic model: the 16th Street Bridge, 7th Street Bridge, and the conveyer belt bridge located at 27th Avenue. As noted in a technical memorandum provided to the District on April 4, 2014, the project team decided to survey the 16th Street and 7th Street Bridges because several of the piers for these bridges had exposed pier bases, the dimensions of which were not available from as-built information. As noted in the same technical memorandum, the project team decided to survey the conveyor belt bridge at 27th Avenue because no as-built information was available for this bridge. A copy of this technical memorandum can be found in Appendix E.5. Bridge surveys included pier centerlines, pier dimensions, deck high chord, deck low chord, and natural ground surveys upstream and downstream of the bridges. David Evans and Associates, Inc. (DEA) provided all three of these field surveys under sub-contract with WEST. The survey data provided by DEA, including field notes and digital data deliverables, can be found electronically in Appendix C.4 as PDFs, spreadsheets, and text files. Survey procedures were performed using a Leica GPS instrument. Observations were conducted on the NAVD datum of 1988. All coordinates are displayed in NAD 83/92 State Plane Coordinates, Arizona Central Zone. The DEA project number was WSTC0014, and the surveys of these structures were performed in April and May of 2014.

Laveen Area Conveyance Channel Field Survey

On June 26, 2014, the District's Chief Surveyor, John R. Stock, RLS, oversaw field survey collection of channel observations for the Laveen Area Conveyance Channel near Baseline Road. This channel fell outside of the extent of the original topographic mapping collected by the District, and backwater from the Lower Salt River inundated this channel up to Baseline Road. Therefore, additional survey was collected to map inundation extents properly in the channel up to Baseline Road. Survey procedures were performed using a Trimble R8 Rover connected to the AZGPS radio system. Reduction and checking were performed by Trimble Business Center software and results were provided by an Excel format spreadsheet. Field accuracy is plus or minus 0.10 at the 95% confidence level. The control used for the work was a portion of the Maricopa County Geodetic Densification and Cadastral Survey (GDACS) control network. Observations were conducted on the NAVD datum of 1988. All coordinates are displayed in NAD 83/92 State Plane Coordinates, Arizona Central Zone. A survey certification statement for this survey can be found in Appendix C.4 of this TSDN.

Sand and Gravel Mining Pit Field Survey near 55th Avenue

On December 8, 2014, John R. Stock, RLS, oversaw field survey collection of perimeter wall and ground observations for the southeast corner of an active sand and gravel mining pit operated by CEMEX near 55th Avenue and Grove Street. A small portion of this pit fell outside of the extent of the original topographic mapping collected by the District, and the modeling and mapping procedure outlined in Section 5 of this TSDN required that the pit be mapped as filled with water (ineffective flow areas). Therefore, additional survey was collected to map inundation extents properly within the pit. Survey procedures were performed using a Trimble R8 Rover connected to the AZGPS radio system. Reduction and checking were performed by Trimble Business Center software and results were provided by an excel format spreadsheet. Field accuracy is plus or minus 0.10 at the 95% confidence level. The control used for the work was a portion of the Maricopa County Geodetic Densification and Cadastral Survey (GDACS) control network. Observations were conducted on the NAVD datum of 1988. All coordinates are displayed in NAD 83/92 State Plane Coordinates, Arizona Central Zone. A survey certification statement for this survey can be found in Appendix C.4 of this TSDN.

3.3 Mapping

Primary topographic data

The primary topographic survey data used for floodplain modeling and mapping in the study reach was developed for the District by RBF Consulting, a Baker Company (Michael Baker Jr., 2013). RBF completed this work under Contract FCD 2012C015. The data delivered to the District for this work included 2-foot contour interval topographic mapping over approximately 14.5 square miles of the Lower Salt River, aerial photography, aerial control survey, and field survey of 15 cross-sections of the river bottom at approximately 1 mile intervals for aerial mapping quality control checks. The flight date was April 13, 2013. The final mapping meets both the American Society of Photogrammetry and Remote Sensing and FEMA standards for mapping at a two-foot contour interval. This dataset was based on the NAVD88 vertical datum and the NAD83 HARN Arizona State Plane Central Zone horizontal datum, international feet. A survey report for this topographic dataset can be found electronically in Exhibit C of this TSDN.

Supplemental topographic data

Record Drawings from the City of Phoenix and Topographic Data from PACE CLOMR

Originally, this study was intended to end at the I-10 Bridge. As such, the District directed topographic survey data collection only up to the I-10 Bridge during the April 2013 photogrammetric flights. During the course of the study, it was determined that the upstream limit of the model would have to be extended beyond the I-10 Bridge to meet FEMA's requirements to vertically tie-in to effective data. This was due primarily to the significant stream bed degradation that has occurred in the Lower Salt River since the effective study was completed, but also partially due to the Rio Salado low-flow channel construction. The low-flow channel project included a grade control structure just downstream of the I-10 Bridge, which likely produces a local hydraulic draw-down effect. As a result, the proposed BFEs from this study are much lower than the effective BFEs at the I-10 Bridge. The upstream tie-in is discussed in greater detail in Section 5.7.1 of this report.

To augment the topographic data collected by the District in order to extend the modeling and delineations upstream of the I-10 Bridge, WEST utilized technical documentation and topographic data from a recent LOMR in the study reach completed by the City of Phoenix's Aviation Department for improvements to Sky Harbor International Airport (TY Lin International, 2011a). The FEMA Case No is 13-09-3108P, with an effective date of October 17, 2013. This LOMR was re-issued from FEMA Case No 12-09-0762P. The technical documentation for this LOMR included record drawings for the channel bottom and final constructed channel bank modification information for the Phoenix Sky Harbor International Airport. The topographic dataset used in the Sky Harbor LOMR was developed for the Conditional Letter of Map Revision (CLOMR) that was originally filed for the Sky Harbor Improvements (developed for the City of Phoenix by Pacific Advanced Civil Engineering, Inc. (PACE) as a sub-consultant to Huitt-Zollars, Inc.). The PACE report (Pacific Advanced Civil Engineering, Inc., 2009), including certification of the survey data, is included electronically in Exhibit C as supplemental files to Appendix C.4.

Laveen Farms Ground Survey

On June 17, 2014, the District collected observations of curb and gutter elevation in the Laveen Farms area. This survey was conducted to determine the best mapping approach at 75th Avenue. As discussed in Section 5.7.1, the project team determined that floodplain mapping should be truncated at the northern end of the Laveen Farms area (see technical memorandum replicated in Appendix E.5 for more details). Therefore, this survey data was not used for floodplain mapping.

Rio Salado Oeste Topography

Topographic data from the Rio Salado Oeste study (WEST Consultants, Inc., 2002) – extending from 91st Avenue upstream to 19th Avenue – was used during preliminary mapping of the Laveen Area Conveyance Channel, the Laveen Farms development, and the sand and gravel mining pit near 55th Avenue. After collection of the other topographic sources mentioned above, the topographic data from the Rio Salado Oeste study was not necessary for floodplain mapping.

Elevation Reference Marks

ERMs shown on the work study maps (see Section 5.2 below) were provided by the District. Further details regarding the final selection of ERMs for this study can be found in a technical memorandum developed by WEST and delivered to the District (replicated in Appendix C.4 of this report). This memorandum provides detailed information regarding the status of each of these benchmarks to verify mapping accuracy if needed.

4 Hydrology

Hydrologic modeling was not performed as part of this study; effective hydrology was used. Discussion of effective flows is presented from downstream to upstream.

The flows used for hydraulic modeling near the lower limit of this study agree with the flows for the downstream Tres Rios North Levee PMR (WEST Consultants, Inc., 2012). As was documented thoroughly in that report, a slight discrepancy was found between published discharge values and the previously effective Flood Insurance Study (FIS) discharge values, as discussed below.

The 1% annual-chance-flood discharge for the Lower Salt River reach from 67th Avenue downstream to the confluence with the Gila River is 164,000 cfs with a drainage area of 12,962 square miles at the confluence according to the effective study (Michael Baker, Jr., Inc., 1999). The current version of the Maricopa County FIS also states the same (Federal Emergency Management Agency, 2005). However, the Tres Rios North Levee PMR includes a flow change location downstream of 67th Avenue. At the 83rd Avenue alignment, the Tres Rios North Levee PMR adjusted the flow down to 162,000 cfs, and that value persists to the confluence of the Gila River. It should be noted that Section 4 of the Tres Rios North Levee report (WEST Consultants, Inc., 2012) mentions that FEMA Region IX provided approval to use the final flows listed for the Tres Rios North Levee study. Appendix B.1 of this TSDN includes a copy of the email referenced in Section 4 of the Tres Rios North Levee report, confirming approval from FEMA Region IX.

Both the Michael Baker study and WEST's Tres Rios North Levee PMR study are based upon an older USACE, Los Angeles District, report titled *Section 7 Study for Modified Roosevelt Dam, Arizona: Hydrologic Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam* as the basis for the hydrology (U.S. Army Corps of Engineers, 1996). An electronic copy of the USACE Los Angeles District, report in its entirety can be found in the electronic data in Exhibit C. Additional flow change locations and values upstream of 67th Avenue from the *Section 7 Study* (U.S. Army Corps of Engineers, 1996) were used for the study herein. Table 4-1 lists all the flows used for this study.

Table 4-1. 1% annual-chance-flood discharges for the Lower Salt River

Flooding Source	Location	FEMA-approved discharge (cfs)
Lower Salt River, RS 96296	Upstream limit of study	169,000
Lower Salt River, RS 72602	Central Avenue	166,000
Lower Salt River, RS 31349	67th Avenue low flow crossing	164,000
Lower Salt River, RS 20821	83rd Avenue alignment	162,000

5 Hydraulics

5.1 Method Description

Floodplain limits and floodway boundaries are defined herein for the Lower Salt River from approximately 4,000 feet above the 91st Avenue low flow crossing in Maricopa County upstream to a point approximately 6,500 feet upstream of the I-10 Bridge in Phoenix. Throughout the project and in this project report, this reach is referred to as the "Lower Salt River." The Lower Salt River is a sand bed channel with a significant percentage of gravels and larger cobbles/boulders. The Lower Salt River flows through mostly developed areas in the study reach. The Lower Salt River is channelized from 19th Avenue to the upstream limit of the study reach.

The USACE's Hydrologic Engineering Center's River Analysis System (HEC-RAS) version 4.1.0 (Hydrologic Engineering Center, 2010) was the software used to perform the one-dimensional hydraulic modeling for the study reach to determine the floodplain limits and floodway boundaries. HEC-RAS is a one-dimensional hydraulics model, and the steady-state module of the software was used to compute flood profiles in the study reach for the 10%, 2%, 1%, and 0.2% annual-chance-flood hydrologic events. The 1% annual-chance-flood hydrologic event was the only computed water surface profile that was mapped for floodplain inundation limits or analyzed for floodway boundaries (see Chapter 4 above for more detailed discussion of the hydrologic data utilized for the hydraulic modeling). The cross-section ground points, reach lengths, and bank stations were developed from the terrain data (provided by the District as discussed in Section 3 of this report) using the HEC-GeoRAS Version 10.1 extension (Hydrologic Engineering Center, 2012) in ArcMap 10.1 (Environmental Systems Research Institute, 2011).

The downstream end of this model utilized three cross-sections from the Tres Rios North Levee Floodplain and Floodway Re-Delineation Study for the Salt and Gila Rivers (WEST Consultants, Inc., 2012), which was recently submitted to FEMA as a Physical Map Revision (PMR). The three cross-sections copied from the Tres Rios North Levee PMR HEC-RAS model were RM 202.82, 202.94 and 203.08. Note that the Tres Rios North Levee PMR river stations were used in the Lower Salt River FDS model to highlight that they were taken from the Tres Rios model. At RM 202.82, the most downstream cross-section in this study, the water surface elevation from the Tres Rios North Levee HEC-RAS model (which tied in to the effective FEMA Water Surface Elevation (WSEL) at the same location) was used as a known water surface elevation boundary condition for the 1% annual-chance floodplain simulation for the current study, a value of 972.30 feet (NAVD88). Similarly, the downstream boundary condition for the floodway profile for the 1% annual-chance event was set equal to the floodway profile computed from the Tres Rios North Levee HEC-RAS model at RM 202.82, a value of 972.65 feet (NAVD88). Note that the Tres Rios North Levee HEC-RAS model datum is in NGVD29. As part of the Tres Rios North Levee model development, the offset to convert from NGVD29 to NAVD88 vertical datum was calculated. At the location of the three cross-sections copied from the Tres Rios North Levee model, the offset is a positive 2.10 feet; this increase in elevation was applied to the Tres Rios North Levee cross-sections and to the boundary conditions for the floodway and floodway simulations.

The effective study for the majority of this reach downstream of the I-10 Bridge was completed in 1999 by Michael Baker Jr., Inc (Michael Baker, Jr., Inc., 1999). The FIRM panels from that study were published in 2001. Following that study, the FIRM panels were revised in 2005. Also in 2005, several Letter of Map Change revalidations occurred (FEMA Case No 04-09-1791V). In 2011, the City of Phoenix developed a Letter of Map Revision (LOMR) for the portion of the reach upstream of the I-10 Bridge (FEMA Case No. 12-09-0762P). In 2013, the FIRM panels were revised once again; these are the currently effective FIRM panels (effective date October 16, 2013). At that time, additional Letter of Map Change revalidations occurred (FEMA Case No 10-09-0832V). Also at that time, the City of Phoenix LOMR at and upstream of the I-10 Bridge was reissued as FEMA Case No. 13-09-3108P. Additionally, the 51st Avenue Bridge was reconstructed in 2000 and the 35th Avenue Bridge was reconstructed in 2005. The Rio Salado stream restoration project (described below) was completed in 2005.

While the model presented in this study extends to approximately 6,500 feet upstream of the I-10 Bridge, the original intent of this study was to tie in to the effective FEMA model just downstream from the I-10 Bridge. However, this was not possible because preliminary model results showed a significant decrease in WSEL at the I-10 Bridge compared to the effective study. This was primarily due to significant channel degradation and stream restoration activities in the reach between the I-10 Bridge and Central Avenue. The completion of the Rio Salado Project in 2005 for this area included a low-flow channel and grade control structures with channel excavations in the range of 8-15 feet (see design report and as-built plans, included in Exhibit C). Section 5.5.1 also includes more details on the grade control structures. The grade control structures were completed after the effective study (Michael Baker, Jr., Inc., 1999) with the intention to mitigate future degradation of the river bed. Following construction, the grade control structures were backfilled either completely or to allow for 3 foot drops, depending on the location. However, this significant change in topography created issues with regards to tying in vertically to the effective study at the I-10 Bridge. WEST needed additional geometric data above the I-10 Bridge to be able to extend the model upstream and tie in to the effective FEMA floodplain boundaries and WSEL profile.

At the upstream boundary of the LSR study, an HEC-RAS model was developed on behalf of the City of Phoenix in support of a LOMR and is the currently effective FEMA model (TY Lin International, 2011a). The City of Phoenix LOMR model extended from approximately 450 feet downstream of I-10 to approximately 2,530 feet upstream of the Hohokam Expressway (i.e., State Route 143). The FEMA Case No is 13-09-3108P, with an effective date of October 17, 2013. While the LOMR data was reported in NGVD29, the HEC-RAS model was developed referencing the NAVD88 vertical datum, so no vertical datum adjustment was required to import data into this study model. The City of Phoenix LOMR model did not include encroachments for the floodway profile. The revised floodway data table in the City of Phoenix's LOMR shows that the floodway is exactly the same elevation as the floodplain, and the line work for the floodplain and floodway in the LOMR is coincident at the lettered cross-sections. Within this reach, the 1% annual-chance WSEL floodplain boundaries are confined to the channel. Cross-sections above RS 89238 (see discussion of model stationing in the following paragraph) were copied from the City of Phoenix HEC-RAS model into the Lower Salt River FDS model. The HEC-RAS model name for this study is "LowerSaltRiver_FDS.prj".

Based on instructions from the District, River Stations (RS) were calculated for the Lower Salt HEC-RAS model in river feet as opposed to river mile. For the remainder of this report, River Station will be used to refer to stationing in feet, and River Mile (RM) will be used to refer to stationing in miles. As specified by the District, effective FEMA cross-section "A" was located at river station 1,499.52 ft along the Lower Salt River hydraulic baseline above the confluence with the Gila River. All modeled distances for this study were determined with respect to the effective hydraulic baseline and profile from the Countywide 2013 FIS Update. The distance from cross-section "A" upstream to the most-downstream cross-section in the Lower Salt River HEC-RAS model at RM 202.82 (which were stationed off the Gila River baseline from the 1999 Michael Baker Jr., Inc. study) was measured in ArcGIS. River stations in feet were assigned to all cross-sections in the LSR model except for the three cross-sections copied from the Tres Rios North Levee model which retained their original RM stations. If these cross-sections (RM 202.82, 202.94 and 203.08) were to be stationed in feet, their stationing would be 17393, 18038, and 18750, respectively. The City of Phoenix LOMR model (TY Lin International, 2011a) had to be re-stationed in river feet because HEC-RAS requires increasing numeric values for all cross-sections in the upstream direction.

It should be noted that the draft FIS profile from the Maricopa County PMR of 2015 shows an increase in the distance from the confluence with the Gila River to cross-section "A" by approximately 500 feet (at the lower end of the profile), which includes a 100-foot shift of cross-section "A" upstream due to the Tres Rios North Levee Study element of the PMR. Thus, the distance of cross-section "A" from the confluence with the Gila River in the PMR differs from what was applied when this study began. Again, this study based river stationing distances upon the effective date of the 2013 Countywide FIS Update. The hydraulic baseline developed by WEST for the current study and the effective hydraulic baseline are both included as shapefiles in Exhibit C.

5.1.1 Effective Models

Several effective studies and other pertinent studies are relevant to the current FDS, as listed below. All the HEC-RAS models listed below are included electronically in Exhibit C, except for the 75th Avenue Bridge CLOMR model (J2 Engineering and Environmental Design, 2014). That model is not included because it was not finalized as of the date of this TSDN.

1. An HEC-RAS model was developed by Michael Baker, Jr. as part of an FDS of the Salt and Gila Rivers (Michael Baker, Jr., Inc., 1999). The Michael Baker model extent exceeds the extent of the study herein.
2. The aforementioned Tres Rios North Levee Floodplain and Floodway Re-Delineation Study for the Salt and Gila Rivers (WEST Consultants, Inc., 2012) is not currently effective because it is still in the FEMA PMR process. However, the upstream end of the Tres Rios North Levee model is used for the downstream boundary condition of the current study, and that model ties in to the effective model (Michael Baker, Jr., Inc., 1999) at that location. Therefore, either of these models could have been used for the downstream tie in of the current study. WEST chose to use

the Tres Rios North Levee model because the topography supporting that analysis was more recent than the topography supporting the effective study.

3. The aforementioned HEC-RAS model developed on behalf of the City of Phoenix in support of a LOMR overlaps the upstream boundary of this FDS (TY Lin International, 2011a). WEST imported the cross-sections from the City of Phoenix model exactly from the I-10 Bridge upstream in the current model.
4. Other HEC-RAS models used in support of LOMRs or CLOMRs were considered during the development of the model as well. For example, the reconstruction of the 35th Avenue Bridge resulted in a LOMR (FEMA Case No. 08-09-1412P) with a corresponding HEC-RAS model. The Rio Salado project at 24th Street resulted in a LOMR (FEMA Case No. 09-09-1453P). Also, the Maricopa County Department of Transportation has an ongoing 75th Avenue Bridge CLOMR model (J2 Engineering and Environmental Design, 2014) under development; this model was used for updates to cross-section alignments near 75th Avenue (see Section 5.4 below). The Maricopa County Department of Transportation CLOMR study for the 75th Avenue Bridge has not been submitted to FEMA at this time; as such, no FEMA Case No. is available for the CLOMR.

WEST reviewed the effective model from Michael Baker and from LOMRs, as well as other models from PMRs and CLOMRs. All data input for this model downstream of the I-10 Bridge was based on as-built structure data (or surveyed data) and updated topography. The portion of the model upstream of the I-10 Bridge was imported directly from the City of Phoenix LOMR model (TY Lin International, 2011a). The bottom three cross-sections of the model were imported directly from the Tres Rios North Levee PMR Model (WEST Consultants, Inc., 2012).

5.1.2 Duplicate Effective Models

The duplicate effective models are included electronically in Exhibit C. The duplicate effective models are:

- The Michael Baker, Jr. model (Michael Baker, Jr., Inc., 1999);
- The Sky Harbor LOMR model (TY Lin International, 2011a); and
- The Tres Rios North Levee model (WEST Consultants, Inc., 2012).

Entellus developed a CLOMR for the 35th Avenue Bridge for the City of Phoenix (Entellus, 2008). The HEC-RAS for that CLOMR is also included in Exhibit C, even though data from that study was not used in this study. The WSELs from all duplicate effective models matched WSELs from the effective models within 0.1 feet.

5.1.3 Corrected Effective Models

No corrected effective models are submitted with this request because the existing conditions modeling addresses both updated topography and constructed features built since the effective modeling.

5.1.4 Existing or Pre-Project Conditions Models

A single HEC-RAS model was developed for this study reflecting existing conditions. As previously mentioned, cross-sections at the upstream and downstream end of the model were copied from the City of Phoenix LOMR (TY Lin International, 2011a) and Tres Rios North Levee PMR (WEST Consultants, Inc., 2012) models, respectively. Along the remainder of the reach, cross-section alignments were determined by WEST. Typically, the effective FEMA cross-section alignments were used. Near the 75th Avenue alignment, Maricopa County Department of Transportation's ongoing 75th Avenue Bridge CLOMR model cross-section alignments were used (J2 Engineering and Environmental Design, 2014). Station and elevation data were extracted from the most recent topographic data (discussed in Section 3 of this report).

5.1.5 Post-Project Conditions Models

No post-project conditions model was developed for this study, as only the existing conditions hydraulics were modeled and mapped.

5.2 Work Study Maps

Topographic work study maps (presented as Exhibit A) were developed at a scale of 1" = 400' to provide sufficient detail of the revised detailed Zone AE Floodplain and Floodway mapping along the Lower Salt River. Contour mapping depicted on the work study maps is based upon the combined topography described in Section 3. Rectified aerial photographic backgrounds are provided on sheets that are 24" x 36" in size. The study work maps reference the NAVD88 vertical datum. Each work map includes the following (when applicable): cross-section alignments, floodplain and floodway water surface elevations, 1% annual-chance-flood peak discharges, proposed floodplain/floodway boundaries, hydraulic baseline, stream/flooding source names, zone designations, elevation reference marks, road names, coordinate grid tic marks, section lines, and corporate boundaries and names. The work study maps included "Proposed Zone X" areas. In the digital files included in Exhibit C, the polygon shape files representing Proposed Zone X areas are named "X1" in the attribute table. The X1 designation is a District data deliverable standard.

The HEC-RAS geometry information for the existing conditions models is consistent with the contour mapping as it appears on the work study sheets throughout the study area, except for within the bounds of the bottom three cross-sections copied from the Tres Rios North Levee PMR model, which were developed using a different topographic surface which is presented on the Tres Rios work maps included in Appendix C.4 and Exhibit C.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

To estimate Manning's roughness coefficients for the Lower Salt River Floodplain Delineation Study, aerial photography was used to delineate areas that differed in roughness characteristics (e.g., land use, presence/density of vegetation), and this information was digitized into a polygon shapefile. The aerial photographs used to complete this delineation were obtained in April 2013 and provided to WEST by the District. The delineation was corroborated with site visits by WEST and the District.

To select the Manning's roughness coefficient for each of the delineated roughness areas, the Manning's n-values were estimated for that roughness area as outlined in "Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels, and Vegetation Maintenance Plan Guidelines for Vegetated Channels in Central Arizona" by Phillips and Tadayon (2006). That report was prepared in association with the District. In this methodology, components of the *n*-value estimated for each roughness area include the following:

- A base Manning's roughness coefficient value for a straight uniform channel;
- A correction to Manning's roughness coefficient value for degree of irregularity;
- A correction to Manning's roughness coefficient value for variation in channel cross-section;
- A correction to Manning's roughness coefficient value for the effect of obstructions;
- A correction to Manning's roughness coefficient value for the amount of vegetation; and
- A correction to Manning's roughness coefficient value for the degree of meandering.

Table 5-1 below provides the final nine (9) Manning's roughness values and associated areas for the various categories used in the modeling effort for the floodplain and floodway delineation. A copy of this shape file can be found on the disc in Exhibit C of this document.

For verification of the selected *n*-values, two different reports were utilized. The first report was "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" (Thomsen & Hjalmarson, 1991), and the second report was "Verification of Roughness Coefficients for Selected Natural and Constructed Stream Channels in Arizona" (Phillips & Ingersoll, 1998). Both of these reports were prepared in association with the District.

A more detailed report titled "Lower Salt River Floodplain Delineation Study: Selection of Manning's Roughness Coefficients" was developed by WEST for this study and approved by the District in July 2014. This report has been included in its entirety in Appendix E.1 of this document. Appendix E.1 also contains a trip log with photos from the field supporting the selection of roughness values in the study reach.

Table 5-1. Summary of the Manning's *n* categories identified for Lower Salt River

Category	Channel Areas		Overbank Areas		Manning's *n*-value
	(acres)	(%)	(acres)	(%)	
Bare Land	1401	74%	2516	24%	0.031
Heavy Vegetation	107	5.6%	67	0.6%	0.081
Medium Vegetation	142	7%	187	1.8%	0.053
Light Vegetation	238	12%	388	3.7%	0.037
Mining Areas	13	0.7%	1787	17%	0.043
Industrial/Commercial	2.6	0.14%	3271	32%	0.059
Residential (High Density)	0	0%	1023	10%	0.080
Residential (Low Density)	0.62	0.033%	354	3.4%	0.064
Agricultural Areas	0.0067	0.00035%	779	7.5%	0.045

5.3.2 Expansion and Contraction Coefficients

As recommended by HEC's "Hydraulic Reference Manual" (Hydrologic Engineering Center, 2010), the expansion and contraction coefficients were set equal to 0.1 and 0.3 along the entire study reach due to the small variation in velocity and cross-sectional area from one cross-section to the next throughout the modeled reach. HEC recommends increasing the contraction and expansion coefficients to 0.3 and 0.5, respectively, for two cross-sections upstream of bridges and one cross-section downstream of the bridge. These increased values account for the energy loss as the top width of the river is often significantly reduced at bridge entrances and enlarged at bridge exits. However, in the study reach, very little contraction and expansion occurs at the following bridges:

- 24th Street Bridge (RS 86014)
- 16th Street Bridge (RS 80576)
- 7th Street Bridge (RS 75127)
- Central Avenue Bridge (RS 72521)
- 7th Avenue Bridge (RS 69501)
- 19th Avenue Bridge (RS 63420)
- 27th Avenue Conveyor Belt Bridge (RS 57704)

At the two cross-sections immediately upstream of these bridges and the one cross-section immediately downstream, the contraction and expansion coefficients were set to 0.15 and 0.35, respectively. Significant contraction and expansion occurs at the 35th Avenue Bridge (RS 52932) and the 51st Avenue Bridge (RS 42207). At these two bridges, the contraction and expansion coefficients were set to 0.3 and 0.5, respectively. The I-10 Bridge is located within the geometry copied from the City of Phoenix LOMR HEC-RAS model. In the City of Phoenix LOMR model, the contraction and expansion coefficients were set to 0.1 and 0.3, respectively. These coefficients were not modified in the HEC-RAS model for the current study.

5.4 Cross-Section Descriptions

Typical convention was used for cross-section horizontal stationing for all HEC-RAS modeling in this study (i.e., cross-section stationing is from left to right when looking in the downstream direction). All cross-sections in the model reflect a centerline stationing (i.e., the intersection of the cross-section with the hydraulic baseline) of 20,000 feet except for the three cross-sections copied from the Tres Rios North Levee PMR. Cross-section spacing varies throughout the study area on a reach-by-reach basis depending on cross-sectional channel geometry, bed slope breaks, and location of bridges. On average, a typical cross-section spacing of 420 feet was used throughout the study reach for HEC-RAS cross-section spacing. Within the reach copied from the City of Phoenix LOMR model, cross-section spacing was 260 feet on average.

Cross-sections were generally placed at effective FEMA cross-sections. Adjustments were made to cross-section alignments at bridges. The cross-sections from RS 20821 upstream to 31826 were re-aligned in order to reflect the cross-section alignments in Maricopa County Department of Transportation's ongoing 75th Avenue Bridge CLOMR model (J2 Engineering and Environmental Design, 2014). In the left overbank, these cross-sections are re-aligned primarily south-to-north, while the effective FEMA cross-sections were aligned southeast-to-northwest. This re-alignment issue became important for mapping in the left overbank during this study (see Section 5.7.1 of this report for more detail).

The cross-section ground elevations were extracted from the final topographic data provided by the District using HEC-GeoRAS (Hydrologic Engineering Center, 2012) everywhere in the model except the three Tres Rios PMR cross-sections at the downstream end of the model and the City of Phoenix LOMR cross-sections upstream of the I-10 Bridge.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and Drop Analysis

At RS 41817 – just downstream of 51st Avenue – the 1% annual-chance WSEL profile defaulted to critical depth. The cross-section spacing in the area ranges from 300 to 500 feet. Just downstream, the bed slope is very steep (0.05 ft/ft). In a separate version of the HEC-RAS model, WEST cut new cross-sections at approximately 100 foot spacing and ran the model in mixed flow mode in an attempt to find a valid subcritical or supercritical profile. However, the model still defaulted to critical depth. WEST then removed the broken pipeline – represented as blocked obstructions as discussed in Section 5.7.1 of this report – and confirmed supercritical flow in this area. To calculate a conservative WSEL profile in this reach, the existing conditions HEC-RAS model is run in subcritical mode with the broken pipeline represented as blocked obstructions. Therefore, this default to critical depth remains in the model; however, the project team feels this is justifiable given the argument above.

As mentioned in Section 5.1, there are multiple grade control structures within the study reach. These structures were constructed as part of the Rio Salado restoration project in 2005 (see the design report and as-built plans, included in Exhibit C). The constructed features of the grade control structures were backfilled at the downstream faces either completely or to allow 3 foot drops, depending on the location. To examine the sensitivity of the WSEL to the modeling approach at grade control structures and low flow road crossings throughout the study reach, WEST made a copy of the HEC-RAS model and included an inline structure at the 67th Avenue low flow road crossing (see technical memorandum titled "Inline Structures", dated March 23, 2015 in Appendix E.4 for details). Results of this sensitivity analysis did not suggest the need to model drops – such as low flow crossings and backfilled grade control structures – using inline structures in HEC-RAS.

At RS 63356 – the downstream face of the 19th Avenue Bridge – the 1% annual-chance WSEL profile defaulted to critical depth at a grade control structure. Per the contour data (described in Section 3) the total drop at the grade control structure is 6 feet. The cross-section spacing is approximately 570 feet in this area and the channel slope is 0.015 ft/ft. In a separate version of the HEC-RAS model, WEST cut additional cross-sections at a reduced spacing of approximately 200 feet. The model still defaulted to critical depth, so WEST ran the model in mixed flow regime mode and confirmed that a valid supercritical profile exists through the bridge deck, with a mild hydraulic jump just downstream of the bridge. To calculate a conservative WSEL profile the existing conditions HEC-RAS model is run in subcritical mode. Therefore, this default to critical depth remains in the model; however, the project team feels this is justifiable given the argument above.

5.5.2 Bridges and Culverts

Ten bridges are located within the study reach. Table 5-2 lists the bridges within the study area. The District provided WEST with plans and as-built plans for most of the bridges within the study reach. These files were provided by the District on behalf of the City of Phoenix, except for the 51st Avenue Bridge plans which were provided by the Maricopa County Department of Transportation. DEA surveyed the 16th Street Bridge, 7th Street Bridge, and the 27th Avenue conveyor belt bridge due to one or more of the following reasons:

- The lack of available as-built plans (27th Avenue conveyor belt bridge);
- Poor quality of available as-built plans (7th Street Bridge); or
- Changes in the existing conditions of the bridges compared to the as-built plans (7th Street Bridge and 16th Street Bridge).

Specifically, the 7th Street Bridge and 16th Street Bridge have grouted portions of the pier foundations that were constructed below original grade. At some piers, the grouted portions have been exposed to flow due to channel bed degradation over time. These exposed foundation sections are much wider than the original piers and irregular in cross-sectional diameter. Because all piers at the 7th Avenue Bridge, the 7th Street Bridge, and the 16th Street have grouted foundations, the grouted diameter was coded into HEC-RAS for the piers with exposed foundations.

The information from the bridge plans and as-built plans were compared to existing hydraulic models, aerials, and the information in the National Bridge Inventory (NBI). The models used for comparison were the effective models (Reach 3 and Reach 4) completed in 1999 as part of the Salt-Gila River Floodplain Delineation Restudy (Michael Baker, Jr., Inc., 1999), the Rio Salado Oeste model prepared by WEST for the USACE, Los Angeles District (WEST Consultants, Inc., 2002), and the model for the Salt River between 51st and 35th Avenue used to support the CLOMR for the Avenida Rio Salado submitted to FEMA in 2013 by AZTEC (AZTEC Engineering Group, 2013). The aerials used were provided by the District as well as publicly available aerials from Bing and Google maps. The NBI database listed, among other information, the location of the bridge and its most recent construction date. This date was compared to the date of the plans to ensure that the most recent bridge plans were used.

Table 5-2. Bridge data source and datum adjustment

Bridge Name	Data Source	Increase from NGVD29 to NAVD88 (feet)
Interstate 10 (RS 89661)	Bridge as-built plans provided by the District, dated 1987	N/A
24th Street (RS 86014)	Bridge as-built plans provided by the District, dated 1982	2.140
16th Street (RS 80576)	Surveyed by DEA	N/A
7th Street (RS 75127)	Surveyed by DEA	N/A
Central Avenue (RS 72521)	Bridge as-built plans provided by the District, dated 1974	2.155
7th Avenue (RS 69501)	Surveyed by DEA	2.145
19th Avenue (RS 63420)	Bridge as-built plans provided by the District, dated 1985	2.135
27th Avenue Conveyor Belt (57704)	Surveyed by DEA	N/A
35th Avenue (RS 52932)	Bridge as-built plans provided by the District, dated 2006	2.105
51st Avenue (RS 42207)	Bridge as-built plans provided by Maricopa County Department of Transportation, dated 2001	2.090

5.5.3 Levees and Dikes

From RS 91062 upstream to RS 96296 (the upstream limit of the study), there is a levee on the left bank of the Lower Salt River. In 2011, the City of Phoenix submitted a LOMR (TY Lin International, 2011a) and a levee certification package (TY Lin International, 2011b) to FEMA for review. The LOMR Case No. is 12-09-0762P, following Conditional Case No. 09-09-1309R. This study is the aforementioned City of Phoenix LOMR (re-issued as Case No. 13-09-3108P, effective date of October 17, 2013). The certification package was approved by FEMA on August 26, 2011, and the levee was accredited. For the study herein, the BFEs decreased at every cross-section within the levee extent. Therefore, WEST's study should not affect the levee accreditation status. See email correspondence from FEMA and memo titled "Comparison of Levee Freeboard and Flow Velocities Upstream of the I-10 Bridge" in Appendix E.4 for further details.

5.5.4 Non-Levee Embankments

During the study data collection phase, it was observed there are numerous embankments in or near the main channel, separating the channel from lower-lying lands such as mining pits. Analysis of these embankments was performed to consider a modeling approach that would have addressed both "with" and "without" the embankments using two model plans (see memo within Appendix E.5 entitled "Embankment Identification", May 27, 2014; note the stationing reported in the memo is based upon the effective modeling). However, the final modeling approach used a single plan that defined ineffective flow areas for the low-lying areas behind the embankments. The floodplain was mapped beyond the embankments using the in-channel base flood elevations. This approach provides conservative estimates of base flood elevations as well as conservative estimates of floodplain extents in the event of embankment failures. For more details regarding this approach see Section 5.5.6 below.

Below the Rio Salado environmental restoration portion of the study reach (ending approximately one-half mile downstream of 7th Avenue) and near the 19th Avenue Bridge, large embankments were built to separate the river from two former landfill sites (one on the north side of the river and one on the south side of the river). As these embankments have never been certified by FEMA, the project team determined the need to map floodplain boundaries along low-lying areas on the landward side of these embankments. Small areas on the landward side of both of these embankments have been mapped into the floodplain; these areas do not significantly impact property owners at either location (private property mapped into the floodplain on the south side of the river and City of Phoenix property associated with a landfill on the north side of the river). Low-lying areas (detention basins) were also mapped at the City of Phoenix Driver Training Academy which is separated from the Salt River by high ground just east of 35th Avenue on the north bank of the river. The approach to modeling and mapping in the Driver Training Academy area is discussed in Section 5.7.1.

5.5.5 Islands and Flow Splits

The study reach does not contain any significant islands or flow splits.

5.5.6 Ineffective Flow Areas

Numerous gravel pits and mines exist within the study area. The majority of these areas do not actively convey flow, and gravel/mining pits are the primary reason for setting Ineffective Flow Areas (IFAs) in the HEC-RAS model. Discussion of the application of ineffective flow areas and blocked obstructions at individual locations throughout the study reach is presented in Appendix E.4.

In-channel pits and pits that are hydraulically connected to the main channel were defined using blocked obstructions in the bottom of the pits to account for the likelihood they would fill up with sediment during a flood event. The use of permanent IFAs was considered to model hydraulically connected pits. However, blocked obstructions better represent the possible future condition of pits filled in by sediment by increasing the hydraulic radius, while permanent IFAs do not increase the hydraulic radius. In addition, using permanent IFAs to represent in-channel pits caused the water surface elevation

(WSEL) output in the hydraulic model to default to critical at some pit locations; this is unrealistic and undesirable in the model. Blocked obstructions avoided this problem, and the hydraulic model does not default to critical depth due to the use of blocked obstructions (the model still includes defaults to critical depth not related to sand/gravel mining pits as discussed in Section 5.5.1).

In regards to mapping areas behind ineffective flow areas, or areas excluded by blocked obstructions, mining pits that are not hydraulically connected to the main channel were mapped as part of the floodplain if the mining pit was protected by an embankment. The floodplain included these types of embankments even though it may be claimed that they protect these pits from inundation by the Lower Salt River. This approach to mapping is conservative because it recognizes the possible failure of these embankments during a flood event; this approach is also commensurate with the previous mapping approach in the currently effective study (Michael Baker, Jr., Inc., 1999). If ground elevations between the Lower Salt River and the mining pit were significantly higher than the simulated water surface elevation and the distance between the mining pit and the Lower Salt River was also significant, the mining pit was not mapped as part of the floodplain. In these cases, the significant size of the land area between the river and the pit excluded the use of the term "embankment" for the land separating the river from the pit. For example, there was a mining pit in the left overbank at river station (RS) 41575. The land surface between the pit and the Lower Salt River ranged from 9 feet to 12 feet higher than the 1% annual-chance-flood water surface elevation, and the pit was approximately 500 feet away from the Lower Salt River channel. This area was not mapped as part of the floodplain because the land surface was not defined as an embankment. WEST and the District reviewed every mining pit throughout the study reach to determine if the land surface that prevents hydraulic connectivity between the Lower Salt River and the mining pit should have been considered an embankment.

Typically in other FEMA modeling studies, the floodplain is not mapped in areas where blocked obstructions are defined in the model and the top elevation of the blocked obstruction is higher than the water surface. The floodplain is typically not mapped in these areas because the obstruction represents an area where inundation would not occur. However, the current study included one area where a blocked obstruction was defined and the top elevation was higher than the water surface (see detailed description in Appendix E.4); this area was mapped into the floodplain because it represented a mining pit. The reason for mapping floodplain behind this blocked obstruction was similar to the reasoning for mapping floodplain in mining pits behind ineffective flow areas.

For detailed descriptions of how ineffective flow area modeling was applied to individual locations, please see Appendix E.4 for WEST's memo, "Modeling of In-Stream Pits", September 2014, and supplemental discussion, including ineffective flow area and blocked obstruction applications in Appendices E.4 and E.5. All information in Appendix E.4 regarding property ownership and floodplain use permitting is as of the date of this study.

5.5.7 Supercritical Flow

Subcritical flow regime was used in HEC-RAS for the Lower Salt River. With regard to ADWR modeling standards, no supercritical condition was simulated (Arizona Department of Water Resources, 1994). The two locations for which the profiles default to critical depth are discussed in Section 5.5.1 above, and these isolated locations are not indicative of supercritical flow in the study reach.

5.6 Floodway Modeling

The original floodway boundary for the Lower Salt River was determined as part of the effective study (Michael Baker, Jr., Inc., 1999) so that the encroached water surface elevations would not be more than one foot higher than the un-encroached elevations, per FEMA regulations. For this study's existing conditions model of the Lower Salt River, the effective floodway encroachments were considered when developing proposed encroachment stations; WEST attempted to not exceed the effective floodway stations at any given cross-section, if possible.

The increase in the proposed encroached water surface elevations compared to the proposed existing conditions water surface elevations was less than or equal to one foot everywhere in the study reach. There are a few cross-sections where the computed floodway water surface profile dips slightly below the un-encroached flood profile (i.e., there is a negative surcharge condition). Multiple attempts were made to eliminate these small negatives surcharges; however, they could not be eliminated. These negative surcharges become zero when rounded to the nearest one tenth of a foot and were therefore ignored. Summary output tables of the floodplain and floodway water surface elevations for the proposed existing condition model are provided in Appendix E.5.

5.7 Issues Encountered During the Study

5.7.1 Special Issues and Solutions

This section discusses several special issues considered by the project team throughout the development of the final modeling and floodplain mapping. Throughout the model, ineffective flow areas were used in the overbanks to represent disconnected areas that would not actively convey flow. Also, small islands were present within the proposed floodway. These islands were not significant in size and therefore were mapped within the floodway. These two issues cause differences between the HEC-RAS reported top width and the mapped top width. A complete table of differences greater than 5 percent, along with justifications for the difference, is included in Appendix E.5.

Floodplain mapping in the Laveen Farms Area (south bank near 75th Avenue)

During model development, WEST altered the effective cross-section alignment from RS 20821 upstream to 31826 to match cross-section alignments from the Maricopa County Department of Transportation's ongoing 75th Avenue Bridge CLOMR model (J2 Engineering and Environmental Design, 2014). In the left overbank, these cross-sections are aligned primarily south-to-north, while the effective FEMA cross-sections are aligned southeast-to-northwest. This change in alignment increased the WSEL in the left overbank because the WSEL at a higher RS (i.e., further upstream) along the main channel is used to map the left overbank floodplain along 75th Avenue.

However, overall flooding depths in the extreme left overbank were shallow, leading to further investigation of the most defensible approach to floodplain inundation mapping in this area. To address this issue, the project team eventually decided to draw a Limit of Study (LOS) line along 75th Avenue north of the Laveen Farms development due to the shallow flooding depths south of this LOS line. This section describes the analysis steps to reach this conclusion, including lateral overbank flow analysis and simplified channel routing.

WEST conducted a lateral structure analysis near 75th Avenue to determine the flow entering the left overbank from the main channel. Lateral structures were digitized between each pair of cross-sections from RS 27828 downstream to RS 26015 (RS 26015 corresponds to the western edge of pavement along 75th Avenue). All of the lateral structures were digitized along natural high ground elevations to properly simulate flow leaving the main channel and entering the left overbank in this area. Based on guidance from the Hydrologic Engineering Center, a lateral weir discharge coefficient of 0.5 was used for these non-elevated overbank terrain over which lateral flow occurs (Hydrologic Engineering Center, 2014). This lateral weir discharge coefficient was selected for all lateral structures in this analysis.

Based on lateral structure analyses, there is approximately 47.1 cfs moving from the main channel to the south along 75th Avenue, a negligible amount compared to the 1% annual-chance peak flow value of 164,000 cfs at this location (0.03%). The 47.1 cfs all spills over a single lateral structure at 75th Avenue (between RS 26149 and 26015); no lateral structure flow is occurring over any of the lateral structures east of 75th Avenue. Because of the small flow rate leaving the HEC-RAS model via the lateral structure, the project team decided to use an LOS line coincident with the lateral structure location between RS 26149 and 26015. More information regarding this analysis can be found in the technical memorandum dated April 30, 2015, in Appendix E.5 of this document. As-built plans for the Laveen Farms development are included electronically in Exhibit C. Note that the Laveen Farms as-built plans are in the City of Phoenix datum. This is reported by the City of Phoenix as being equivalent to the NGVD29 datum. Elevations in the Laveen Farms as-built plans were adjusted to NAVD88 during this study.

In the final HEC-RAS model, lateral structures were not included and ineffective flow areas are defined in the left overbank. Top widths reported by HEC-RAS include ineffective areas. Therefore, in this area of the study, the top width reported by HEC-RAS does not match the mapped top width.

Exposed Pipeline downstream of 51st Avenue

Just downstream of the 51st Avenue Bridge, an exposed pipeline crosses the Lower Salt River. The pipeline is supported by reinforced concrete piers, and there is a break in the pipeline within the banks of the river. Representing this structure with blocked obstructions caused the profile to default to critical depth at this location; however, this modeling approach was considered the most accurate and was used. See Section 5.5.1 for more information regarding the modeling in this area. Also, a technical memo titled "Sensitivity Analysis for the Broken Pipeline Near 51st Avenue" is included in Appendix E.5 of this report and explains the final modeling approach for this area.

Cave Creek Confluence

Near the confluence of Cave Creek and the Lower Salt River, from RS 42278 upstream to RS 44320, preliminary mapping based on topography indicated that the proposed LSR Zone AE floodplain overlaps the Cave Creek effective Zone AE floodplain. However, at this location, the effective BFEs for Cave Creek are greater than the proposed BFEs for LSR. Therefore, the LSR proposed floodplain was truncated at the boundary of Cave Creek effective Zone AE. Because the LSR mapped width was truncated, the HEC-RAS reported top width does not match the mapped top width at this location. Cave Creek was not restudied as part of this analysis.

City of Phoenix Driver Training Academy

The City of Phoenix Driver Training Academy is located in the right overbank from RS 53248 (WSEL is 1032.3 feet) upstream to RS 54242 (WSEL is 1034.4). There is high ground that separates the Driver Training Academy from the Lower Salt River, which existed prior to the construction of the Driver Training Academy. The elevation on top of the high ground is 1040.0 feet. There are four detention basins within the Driver Training Academy (see site and maintenance plans, included electronically in Exhibit C). The Public Works Department of the City of Phoenix is responsible for maintaining these basins; the basins are inspected and maintained on an annual basis and after significant storm events (see correspondence in Appendix B.1). The average depth of water in the four basins exceeded one foot. The average depth in the Training Academy excluding the detention basins did not exceed one foot. Therefore, only the detention basins were mapped in the proposed floodplain. Because HEC-RAS calculated shallow depths at this location but no floodplain was mapped, the HEC-RAS reported top width does not match the mapped top width for these cross-sections. Also, it should be noted that no hydraulic connectivity is shown in HEC-RAS between the flow in the main channel and the flow in the overbank; the high ground discussed above completely separates these two areas in the cross-section. HEC-RAS shows the low-lying areas in the far overbank as wetted due to the single water surface elevation computed at each cross-section, a result of a one-dimensional modeling assumption.

Upstream Tie In

As previously discussed in Section 5.1, upstream tie in to the effective FIS was not possible at the I-10 Bridge due to significant channel lowering downstream of the I-10 Bridge by approximately 10 to 15 feet since the effective Michael Baker study (1999). For additional information on the Rio Salado Low Flow Channel Design (WEST Consultants, Inc., 2000) and the City of Phoenix LOMR at the I-10 Bridge (TY Lin International, 2011a) used to extend the current model upstream for tie-in purposes, see the technical memorandums included in Appendix E.5. As-built plans for the Rio Salado Low Flow Channel Design and Record Drawings for the City of Phoenix LOMR are included electronically in Exhibit C.

5.7.2 Modeling Warning and Error Messages

The CHECKRAS results for the Lower Salt River model and explanations of these messages are provided in Appendix E.5.

5.8 Calibration

No measured field data was available for model calibration.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

Table 5-3 lists a brief summary of hydraulic parameters at bridge locations within the study reach. Summary tables of the existing conditions hydraulic modeling results for the Lower Salt River for the 1% annual-chance flood are presented in two tables in Appendix E.5 (one table with no encroachments, one table with encroachments). The first table summarizes the following variables by cross-section: peak discharge, water surface elevation, critical water surface elevation, average channel velocity, top width, hydraulic depth, and Froude number. The second table summarizes the encroached WSEL, increase in WSEL as compared to the non-encroached WSEL, the energy grade, top width, discharge, encroachment stations and channel stations.

Table 5-3. Summary of hydraulic parameters at bridges for 1% chance annual flood

Location	River Station	Discharge through Structure (cfs)	Discharge over Weir (cfs)	Velocity Head (ft)	Energy Grade (ft)	WSEL (ft)	Friction Loss (ft)	Contraction and Expansion Coefficients
I-10	89661	169,000	0	2.32	1101.39	1099.06	0.00	0.1/0.3
24th St	86014	169,000	0	2.67	1090.15	1087.49	0.06	0.15/0.35
16th St	80576	169,000	0	1.33	1077.41	1076.08	0.02	0.3/0.5
7th St	75127	169,000	0	1.74	1072.39	1070.65	0.00	0.3/0.5
Central Ave	72521	166,000	0	0.98	1068.16	1067.18	0.09	0.3/0.5
7th Ave	69501	166,000	0	1.63	1062.15	1060.52	0.00	0.3/0.5
19th Ave	63420	166,000	0	4.17	1046.37	1042.20	0.00	0.3/0.5
27th Ave	57704	166,000	0	1.51	1035.99	1034.48	0.00	0.3/0.5
35th Ave	52932	166,000	0	1.51	1033.51	1031.99	0.03	0.3/0.5
51st Ave	42207	166,000	0	1.49	1013.45	1011.96	0.07	0.3/0.5

5.9.2 Verification or Comparison of Results

The input parameters for each of the HEC-RAS models were applied in a manner consistent with standard engineering practices for floodplain delineation studies. The floodplain study results appear to be reasonable for flooding sources of this nature. For comparative purposes, the floodplain water surface elevations of the effective models and those calculated for this analysis referencing the NAVD88 vertical datum are presented in graphical form in Figure 5-1 through Figure 5-4 and in tabular format in

Table 5-4. Additionally, the minimum channel elevations of the effective models and those used for this analysis referencing the NAVD88 vertical datum are also presented in graphical form in Figure 5-1 through Figure 5-4. It should be noted that some of the discrepancy in the plotted thalweg between the effective model and the proposed model can be explained by the different techniques employed to model in-stream sand and gravel mining pits (e.g., below 19th Avenue) while some of the discrepancy can be attributed to channel degradation and channelization projects (e.g., above 19th Avenue).

As mentioned in Section 5.7.1, a number of modeling issues cause differences between the HEC-RAS reported top width and the mapped top width, primarily the significant use of ineffective flow areas to represent wetted overbank areas that are not actively conveying flow (e.g., sand and gravel mining pits and the Laveen Farms subdivision area). These discrepancies remain in the model primarily for the following two reasons:

1. The project team decided to represent the areas of sand and gravel mining operations within and adjacent to the river in the model cross-sections for regulatory purposes; these cross-sections were not trimmed at the boundary between the river and the mining pits to be able to accurately map the areas within the pits as special flood hazard areas. The effective model (Michael Baker, Jr., Inc., 1999) adjusted ground points within these mining pits to the grade adjacent to the corresponding mining pit, thereby removing all representation of the mining pit from the cross-sections in the model (although these areas were mapped as floodplain in the effective study). The current study chose to maintain the representation of the mining pits within the ground points and exclude this area from active flow conveyance using ineffective flow areas.
2. The 500-year profile was computed using this model; trimming cross-sections would reduce the accuracy of the 500-year profile using this model.

These two reasons were used as justification for many areas of ineffective flow that remain in the model and cause differences between the HEC-RAS reported top width and the mapped top width. Additional reasons for differences between HEC-RAS top width and mapped top width are discussed in Section 5.7.1. A complete table of differences, along with justifications for differences greater than 5 percent, is included in Appendix E.5.

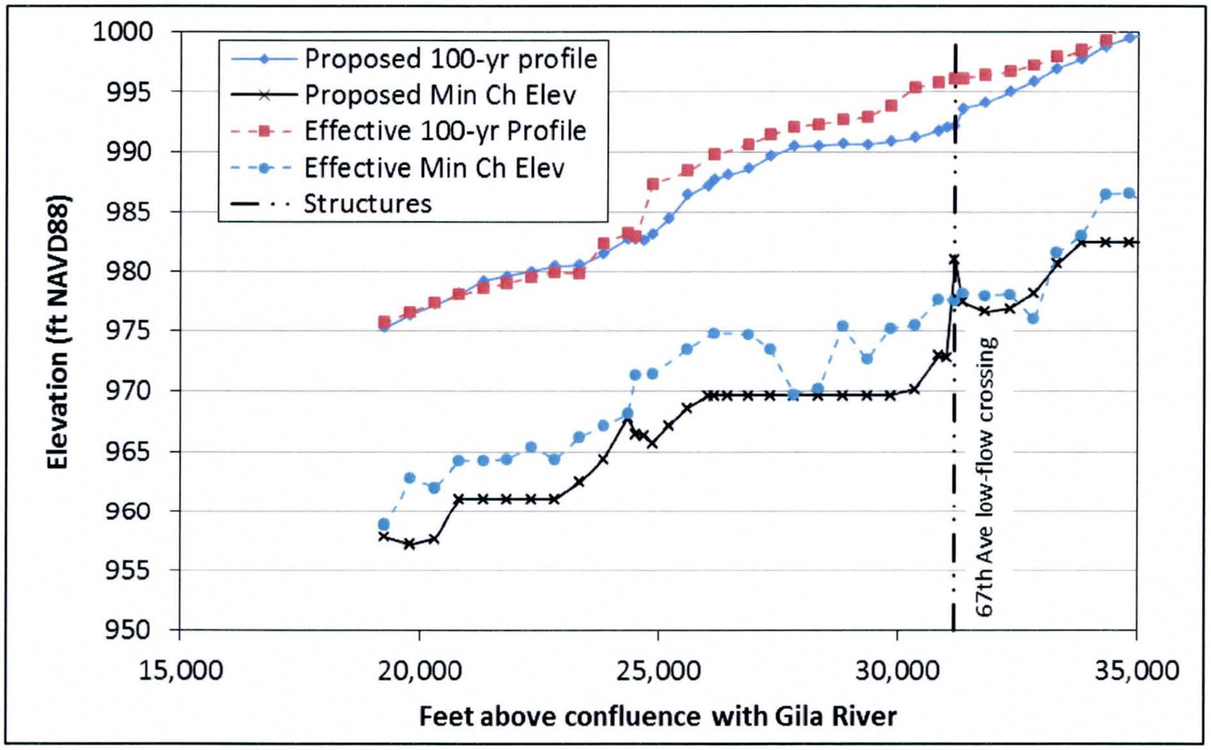

Figure 5-1. Comparison of water surface elevations for the Lower Salt River from the downstream limit of the study to upstream of 67th Avenue

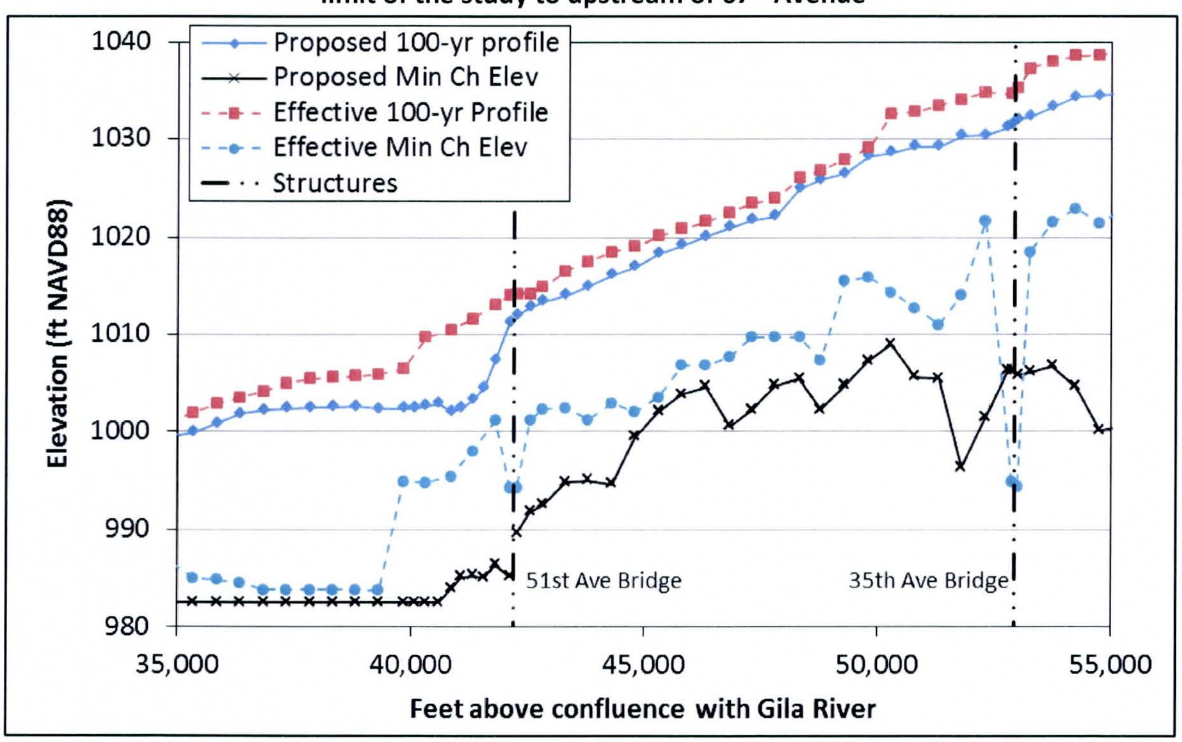

Figure 5-2. Comparison of water surface elevations for the Lower Salt River from downstream of 51st Avenue to upstream of 35th Avenue

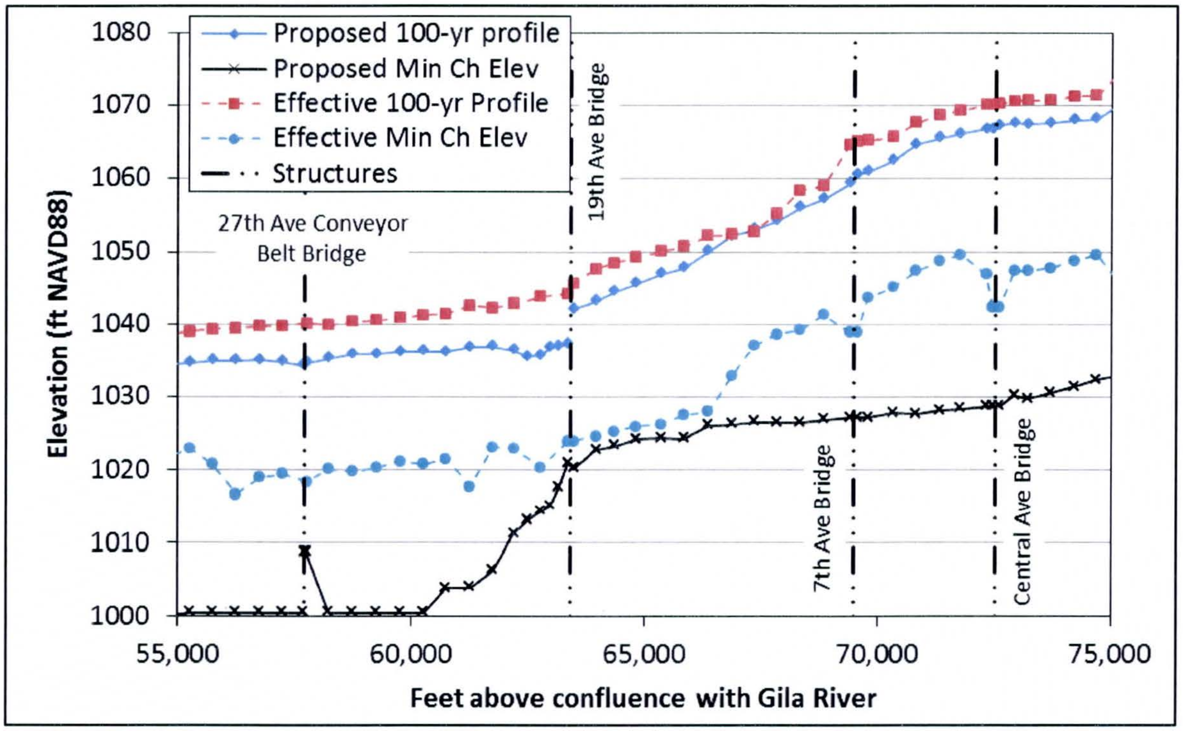

Figure 5-3. Comparison of water surface elevations for the Lower Salt River from downstream of 27th Avenue to upstream of Central Avenue

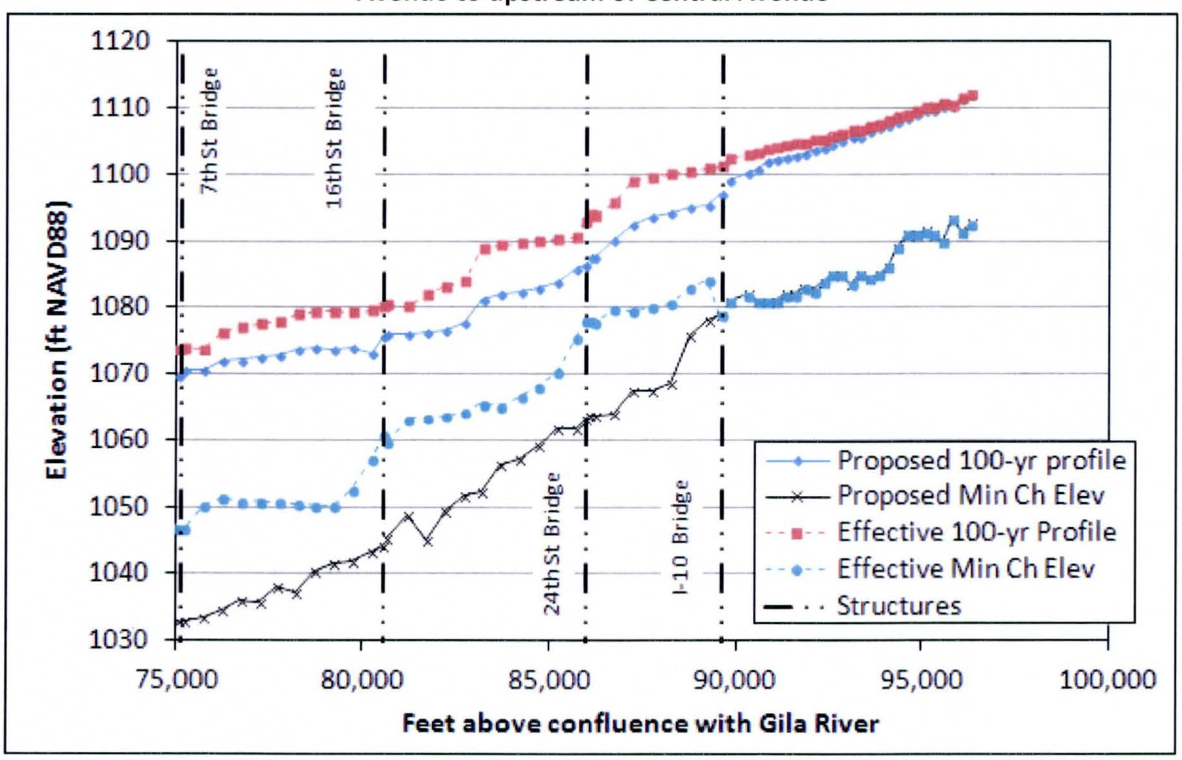

Figure 5-4. Comparison of water surface elevations for the Lower Salt River from downstream of 7th Street to upstream of I-10

Table 5-4. Comparison of water surface elevations at FEMA lettered cross-sections

FEMA XS Letter	River Mile	River Station	Effective WSEL (feet, NAVD88)	Proposed WSEL (feet, NAVD88)	Change in BFE (feet)
AP	217.76	96296	1112.1	1111.9	-0.1
AO	217.29	93818	1107.8	1107.0	-0.7
AN	216.81	91312	1104.4	1102.6	-1.8
AM	216.42	89238	1100.9	1095.4	-5.6
AL	215.94	86730	1095.8	1090.2	-5.6
AK	215.65	85191	1090.4	1083.9	-6.5
AJ	215.18	82695	1084.0	1077.8	-6.2
AI	214.78	80512	1080.2	1075.7	-4.5
AH	214.33	78208	1079.0	1073.7	-5.3
AG	213.95	76205	1076.2	1071.9	-4.3
AF	213.57	74197	1071.3	1068.0	-3.3
AE	213.21	72333	1070.1	1066.7	-3.4
AD	212.84	70329	1065.6	1062.4	-3.3
AC	212.46	68341	1058.3	1056.0	-2.3
AB	211.99	65844	1050.7	1047.8	-2.9
AA	211.54	63478	1045.8	1042.2	-3.6
Z	211.12	61261	1042.7	1037.0	-5.7
Y	210.55	58233	1039.9	1035.4	-4.6
X	210.17	56237	1039.5	1035.1	-4.5
W	209.69	53742	1038.0	1033.3	-4.7
V	209.33	51804	1034.1	1030.3	-3.8
U	208.85	49296	1027.9	1026.5	-1.4
T	208.39	46829	1022.5	1021.0	-1.5
S	207.9	44320	1018.5	1016.1	-2.4
R	207.49	42278	1014.2	1012.0	-2.2
Q	207.16	40311	1009.7	1002.6	-7.1
P	206.7	37836	1005.4	1002.4	-3.0
O	206.22	35329	1001.9	999.9	-2.0
N	205.75	32831	997.2	995.9	-1.3
M	205.34	30850	995.7	991.8	-3.9
L	204.87	28335	992.3	990.6	-1.7
K	204.42	25595	988.5	986.5	-2.0
J	203.96	23335	979.8	980.6	0.8
I	203.48	20821	978.0	978.1	0.1

6 Erosion, Sediment Transport, and Geomorphic Analysis

No erosion, sediment transport, or geomorphic analysis was performed for this study, as several previous studies have assessed the impact of erosion and sediment aggradation and/or degradation on the study reach. These studies include the Rio Salado Low Flow Channel Design (WEST Consultants, Inc., 2000), the Rio Salado Oeste study (WEST Consultants, Inc., 2002), and a study titled "Sand and Gravel Mining Impacts on Local Rivers – Historical Data Review and Analysis (River Research and Design, Inc., 2011).

7 Draft FIS Data

7.1 Summary of Discharges

As discussed in Section 4 above, the approved hydrology used herein was taken from the USACE, Los Angeles District's report (U.S. Army Corps of Engineers, 1996) as reported in the Tres Rios North Levee PMR (WEST Consultants, Inc., 2012). Table 7-1 below provides a summary of discharges for Lower Salt River. Note that FEMA Region IX provided written consent to use these flows (documented in the Tres Rios North Levee PMR, included in Appendix D), even though the effective FIS for Maricopa County does not include the flow change at RS 20821 (Federal Emergency Management Agency, 2005).

Table 7-1. 1% annual-chance flood discharges for the Lower Salt River

Flooding Source and Location	Drainage Area (sq. mi.)	Effective FEMA Discharge (cfs)
Lower Salt River, RS 96296	12,783	169,000
Lower Salt River, RS 72602	12,831	166,000
Lower Salt River, RS 31349	12,962	164,000
Lower Salt River, RS 20821	13,000*	162,000

*Estimated

7.2 Floodway Data

Table 7-2 below is the proposed floodway data table for the current study, which includes proposed regulatory floodplain and floodway WSEL values.

Table 7-2. Floodway data table for the Lower Salt River

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt	96296	684	10,030	16.9	1111.93	1111.93	1111.94	0.0
Salt	96067	734	10,623	15.9	1111.36	1111.36	1111.36	0.0
Salt	95798	788	10,626	15.9	1110.30	1110.30	1110.31	0.0
Salt	95560	853	12,818	13.2	1110.40	1110.40	1110.41	0.0
Salt	95282	950	13,428	12.6	1109.86	1109.86	1109.87	0.0
Salt	95078	1,037	15,011	11.3	1109.75	1109.75	1109.77	0.0
Salt	94827	1,088	15,140	11.2	1109.28	1109.28	1109.30	0.0
Salt	94586	1,094	14,618	11.6	1108.63	1108.63	1108.64	0.0
Salt	94316	1,080	14,925	11.3	1108.11	1108.11	1108.13	0.0
Salt	94061	1,076	14,866	11.4	1107.57	1107.57	1107.59	0.0
Salt	93818	1,059	14,750	11.5	1107.04	1107.04	1107.06	0.0
Salt	93568	1,017	14,755	11.5	1106.53	1106.53	1106.56	0.0
Salt	93311	993	14,281	11.8	1105.85	1105.85	1105.88	0.0

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt	93084	973	15,452	10.9	1105.65	1105.65	1105.69	0.0
Salt	92805	955	15,374	11.0	1105.18	1105.18	1105.22	0.0
Salt	92571	956	14,810	11.4	1104.63	1104.63	1104.67	0.0
Salt	92326	949	14,273	11.8	1103.99	1103.99	1104.04	0.1
Salt	92076	944	15,072	11.2	1103.69	1103.69	1103.75	0.1
Salt	91812	946	14,950	11.3	1103.20	1103.20	1103.27	0.1
Salt	91562	945	15,492	10.9	1102.90	1102.90	1102.97	0.1
Salt	91312	938	15,787	10.7	1102.58	1102.58	1102.65	0.1
Salt	91062	938	16,131	10.5	1102.29	1102.29	1102.37	0.1
Salt	90819	936	15,779	10.7	1101.87	1101.87	1101.95	0.1
Salt	90563	943	14,198	11.9	1100.96	1100.96	1101.07	0.1
Salt	90313	931	13,498	12.5	1100.15	1100.15	1100.28	0.1
Salt	89791	915	13,983	12.1	1099.06	1099.06	1099.25	0.2
Salt	89582	914	12,795	13.2	1097.01	1097.01	1097.31	0.3
Salt	89238	846	11,578	14.6	1095.35	1095.35	1095.57	0.2
Salt	88744	959	15,073	11.2	1095.06	1095.06	1095.33	0.3
Salt	88257	892	14,817	11.4	1094.23	1094.23	1094.42	0.2
Salt	87738	1,032	16,478	10.3	1093.61	1093.61	1093.87	0.3
Salt	87231	950	15,468	10.9	1092.40	1092.40	1092.57	0.2
Salt	86730	832	13,611	12.4	1090.17	1090.17	1090.45	0.3
Salt	86196	832	12,709	13.3	1087.63	1087.63	1088.26	0.6
Salt	86076	820	13,437	12.6	1087.49	1087.49	1088.14	0.7
Salt	85951	805	12,572	13.4	1086.41	1086.41	1087.19	0.8
Salt	85694	779	13,663	12.4	1085.92	1085.92	1086.81	0.9
Salt	85191	755	12,336	13.7	1083.89	1083.89	1084.54	0.6
Salt	84693	728	12,959	13.0	1083.06	1083.06	1083.58	0.5
Salt	84201	730	13,572	12.5	1082.56	1082.56	1082.94	0.4
Salt	83678	714	14,240	11.9	1082.08	1082.08	1082.39	0.3
Salt	83187	686	13,791	12.3	1081.30	1081.30	1081.58	0.3
Salt	82695	516	10,371	16.3	1077.82	1077.82	1078.54	0.7
Salt	82213	536	10,904	15.5	1076.59	1076.59	1077.48	0.9
Salt	81706	687	13,319	12.7	1076.39	1076.39	1077.38	1.0
Salt	81199	727	14,818	11.4	1076.13	1076.13	1077.05	0.9
Salt	80635	855	17,385	9.7	1076.08	1076.08	1076.88	0.8
Salt	80512	818	16,173	10.5	1075.67	1075.67	1076.36	0.7
Salt	80207	596	11,113	15.2	1073.35	1073.35	1073.44	0.1
Salt	79694	680	16,729	10.1	1073.95	1073.95	1074.52	0.6
Salt	79202	691	17,556	9.6	1073.89	1073.89	1074.31	0.4

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt	78704	925	23,911	7.1	1074.02	1074.02	1074.57	0.6
Salt	78208	780	21,948	7.7	1073.69	1073.69	1074.25	0.6
Salt	77706	624	18,005	9.4	1072.99	1072.99	1073.54	0.6
Salt	77208	622	16,938	10.0	1072.51	1072.51	1073.07	0.6
Salt	76695	620	16,811	10.1	1072.21	1072.21	1072.73	0.5
Salt	76205	598	16,911	10.0	1071.94	1071.94	1072.47	0.5
Salt	75692	424	13,432	12.6	1070.68	1070.68	1071.14	0.5
Salt	75210	546	15,602	10.8	1070.65	1070.65	1071.05	0.4
Salt	75060	546	15,682	10.8	1069.74	1069.74	1070.59	0.9
Salt	74675	432	13,130	12.9	1068.11	1068.11	1068.92	0.8
Salt	74197	540	15,230	11.1	1067.96	1067.96	1068.77	0.8
Salt	73698	542	15,270	11.1	1067.54	1067.54	1068.28	0.7
Salt	73205	668	16,929	10.0	1067.36	1067.36	1068.01	0.7
Salt	72915	781	20,435	8.3	1067.51	1067.51	1068.21	0.7
Salt	72602	723	20,053	8.3	1067.18	1067.18	1067.84	0.7
Salt	72455	723	19,450	8.5	1066.69	1066.69	1067.30	0.6
Salt	72333	818	21,882	7.6	1066.73	1066.73	1067.28	0.6
Salt	71781	849	22,809	7.3	1066.05	1066.05	1066.69	0.6
Salt	71336	814	21,646	7.7	1065.51	1065.51	1066.16	0.7
Salt	70830	704	18,751	8.9	1064.61	1064.61	1065.21	0.6
Salt	70329	504	13,927	11.9	1062.36	1062.36	1062.90	0.5
Salt	69789	575	15,134	11.0	1060.93	1060.93	1061.44	0.5
Salt	69557	618	16,047	10.3	1060.52	1060.52	1061.00	0.5
Salt	69403	586	15,511	10.7	1059.26	1059.26	1060.19	0.9
Salt	68843	543	12,476	13.3	1057.11	1057.11	1057.17	0.1
Salt	68341	600	13,484	12.3	1056.03	1056.03	1055.99	0.0
Salt	67844	554	12,710	13.1	1054.18	1054.18	1054.48	0.3
Salt	67348	594	13,273	12.5	1053.04	1053.04	1053.32	0.3
Salt	66866	610	13,939	11.9	1052.11	1052.11	1052.38	0.3
Salt	66361	546	12,027	13.8	1050.13	1050.13	1050.35	0.2
Salt	65844	516	10,565	15.7	1047.81	1047.81	1048.17	0.4
Salt	65352	534	10,936	15.2	1047.02	1047.02	1047.39	0.4
Salt	64832	544	10,714	15.5	1045.72	1045.72	1046.21	0.5
Salt	64362	536	10,580	15.7	1044.55	1044.55	1045.12	0.6
Salt	63964	513	9,868	16.8	1043.25	1043.25	1043.56	0.3
Salt	63478	530	10,265	16.2	1042.20	1042.20	1042.59	0.4
Salt	63356	502	7,556	22.0	1037.37	1037.37	1037.46	0.1
Salt	63159	506	8,377	19.8	1037.05	1037.05	1037.17	0.1

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt	62965	528	8,961	18.5	1036.86	1036.86	1037.02	0.2
Salt	62771	526	9,148	18.2	1035.79	1035.79	1036.56	0.8
Salt	62483	603	10,378	16.0	1035.61	1035.61	1036.52	0.9
Salt	62193	792	14,251	11.7	1036.51	1036.51	1037.31	0.8
Salt	61747	933	22,093	7.5	1037.04	1037.04	1037.78	0.7
Salt	61261	948	26,011	6.4	1036.96	1036.96	1037.69	0.7
Salt	60755	876	20,330	8.2	1036.23	1036.23	1036.99	0.8
Salt	60262	908	26,479	6.3	1036.37	1036.37	1037.12	0.8
Salt	59757	946	28,545	5.8	1036.30	1036.30	1037.07	0.8
Salt	59251	998	24,317	6.8	1035.91	1035.91	1036.72	0.8
Salt	58748	954	27,762	6.0	1035.91	1035.91	1036.71	0.8
Salt	58233	873	21,815	7.6	1035.37	1035.37	1036.19	0.8
Salt	57759	802	18,820	8.8	1034.72	1034.72	1035.63	0.9
Salt	57722	821	17,696	9.4	1034.48	1034.48	1035.43	1.0
Salt	57683	873	18,691	8.9	1034.42	1034.42	1035.37	0.9
Salt	57238	1,000	32,086	5.2	1034.88	1034.88	1035.79	0.9
Salt	56750	1,799	60,915	2.7	1035.07	1035.07	1035.98	0.9
Salt	56237	1,868	62,014	2.7	1035.06	1035.06	1035.97	0.9
Salt	55740	1,993	67,927	2.4	1035.07	1035.07	1035.97	0.9
Salt	55250	1,810	32,773	5.1	1034.72	1034.72	1035.60	0.9
Salt	54747	1,611	28,964	5.7	1034.44	1034.44	1035.32	0.9
Salt	54242	1,629	30,213	5.5	1034.35	1034.35	1035.21	0.9
Salt	53742	1,613	20,131	8.3	1033.31	1033.31	1034.30	1.0
Salt	53248	1,160	14,536	11.4	1032.29	1032.29	1032.67	0.4
Salt	53001	958	16,284	10.2	1031.99	1031.99	1032.52	0.5
Salt	52864	949	15,296	10.9	1031.43	1031.43	1031.87	0.4
Salt	52784	1,007	15,962	10.4	1031.21	1031.21	1031.83	0.6
Salt	52315	1,228	16,440	10.1	1030.43	1030.43	1031.24	0.8
Salt	51804	1,398	21,200	7.8	1030.34	1030.34	1031.17	0.8
Salt	51316	1,334	16,985	9.8	1029.21	1029.21	1029.77	0.6
Salt	50800	1,474	21,294	7.8	1029.26	1029.26	1029.79	0.5
Salt	50296	1,358	18,310	9.1	1028.60	1028.60	1028.91	0.3
Salt	49803	1,495	20,308	8.2	1028.26	1028.26	1028.58	0.3
Salt	49296	1,498	14,212	11.7	1026.50	1026.50	1026.56	0.1
Salt	48775	1,500	17,016	9.8	1025.83	1025.83	1025.85	0.0
Salt	48330	1,378	16,658	10.0	1024.91	1024.91	1025.02	0.1
Salt	47809	1,223	12,171	13.6	1022.05	1022.05	1022.13	0.1
Salt	47301	2,062	18,329	9.1	1021.74	1021.74	1021.77	0.0

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt	46829	2,185	20,010	8.3	1020.99	1020.99	1021.04	0.0
Salt	46317	2,306	20,629	8.1	1020.11	1020.11	1020.19	0.1
Salt	45806	2,599	21,292	7.8	1019.20	1019.20	1019.30	0.1
Salt	45308	2,828	21,756	7.6	1018.29	1018.29	1018.45	0.2
Salt	44806	2,633	18,894	8.8	1016.93	1016.93	1017.12	0.2
Salt	44320	2,718	20,586	8.1	1016.10	1016.10	1016.22	0.1
Salt	43805	2,322	18,701	8.9	1014.95	1014.95	1014.98	0.0
Salt	43310	2,064	19,066	8.7	1013.99	1013.99	1014.11	0.1
Salt	42821	1,858	20,155	8.2	1013.37	1013.37	1013.48	0.1
Salt	42552	1,645	18,281	9.1	1012.78	1012.78	1012.86	0.1
Salt	42278	1,567	17,238	9.6	1011.96	1011.96	1012.16	0.2
Salt	42126	1,548	16,884	9.8	1011.26	1011.26	1011.51	0.3
Salt	41817	1,392	10,624	15.6	1007.33	1007.33	1007.37	0.0
Salt	41575	1,314	11,673	14.2	1004.52	1004.52	1004.98	0.5
Salt	41330	1,200	11,670	14.2	1003.18	1003.18	1003.79	0.6
Salt	41089	1,213	13,211	12.6	1002.37	1002.37	1003.35	1.0
Salt	40865	992	13,950	11.9	1002.07	1002.07	1003.05	1.0
Salt	40590	1,077	21,016	7.9	1002.82	1002.82	1003.67	0.9
Salt	40311	1,078	21,646	7.7	1002.62	1002.62	1003.57	1.0
Salt	40074	1,096	20,541	8.1	1002.32	1002.32	1003.32	1.0
Salt	39836	1,155	23,249	7.1	1002.37	1002.37	1003.37	1.0
Salt	39315	1,185	23,436	7.1	1002.29	1002.29	1003.16	0.9
Salt	38832	1,961	40,916	4.1	1002.53	1002.53	1003.40	0.9
Salt	38333	2,072	43,013	3.9	1002.45	1002.45	1003.34	0.9
Salt	37836	2,301	47,591	3.5	1002.39	1002.39	1003.30	0.9
Salt	37337	2,371	50,118	3.3	1002.34	1002.34	1003.25	0.9
Salt	36832	1,960	38,916	4.3	1002.14	1002.14	1003.04	0.9
Salt	36333	2,038	31,264	5.3	1001.77	1001.77	1002.71	0.9
Salt	35841	1,817	20,206	8.2	1000.80	1000.80	1001.65	0.9
Salt	35329	1,842	18,028	9.2	999.88	999.88	1000.78	0.9
Salt	34831	2,143	22,411	7.4	999.47	999.47	1000.38	0.9
Salt	34334	2,007	19,748	8.4	998.74	998.74	999.41	0.7
Salt	33824	1,915	16,673	10.0	997.71	997.71	998.02	0.3
Salt	33318	2,037	18,336	9.1	996.91	996.91	997.21	0.3
Salt	32831	2,261	20,447	8.1	995.88	995.88	996.53	0.6
Salt	32330	1,982	19,925	8.3	995.00	995.00	995.69	0.7
Salt	31826	1,648	19,869	8.4	994.09	994.09	994.96	0.9
Salt	31349	1,378	16,739	9.8	993.62	993.62	993.83	0.2

River	River Sta	Floodway			1-Percent-Annual-Chance Flood Water Surface			
		Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
Salt	31186	1,293	14,383	11.4	992.20	992.20	992.95	0.8
Salt	31020	1,209	15,763	10.4	992.04	992.04	992.86	0.8
Salt	30850	1,123	15,778	10.4	991.80	991.80	992.59	0.8
Salt	30357	1,150	17,414	9.4	991.23	991.23	992.13	0.9
Salt	29847	920	18,462	8.9	990.93	990.93	991.80	0.9
Salt	29350	1,001	20,460	8.0	990.69	990.69	991.68	1.0
Salt	28840	1,153	23,687	6.9	990.73	990.73	991.62	0.9
Salt	28335	1,445	25,923	6.3	990.58	990.58	991.50	0.9
Salt	27828	1,382	24,779	6.6	990.51	990.51	991.23	0.7
Salt	27329	1,165	18,963	8.7	989.69	989.69	990.37	0.7
Salt	26883	1,057	14,550	11.3	988.68	988.68	988.88	0.2
Salt	26435	1,171	16,709	9.8	988.18	988.18	988.49	0.3
Salt	26149	1,145	16,969	9.7	987.79	987.79	988.10	0.3
Salt	26015	1,106	15,440	10.6	987.30	987.30	987.54	0.2
Salt	25595	1,308	14,980	11.0	986.50	986.50	986.65	0.2
Salt	25217	1,432	13,241	12.4	984.54	984.54	985.09	0.6
Salt	24863	1,492	11,856	13.8	983.21	983.21	983.17	0.0
Salt	24693	1,556	12,437	13.2	982.69	982.69	982.68	0.0
Salt	24524	1,607	15,841	10.4	982.81	982.81	982.89	0.1
Salt	24354	1,802	18,560	8.8	982.80	982.80	982.89	0.1
Salt	23840	1,910	17,408	9.4	981.50	981.50	981.77	0.3
Salt	23335	1,993	18,769	8.7	980.58	980.58	980.97	0.4
Salt	22828	1,969	28,822	5.7	980.51	980.51	980.90	0.4
Salt	22330	2,233	28,952	5.7	980.05	980.05	980.47	0.4
Salt	21828	2,159	30,275	5.4	979.64	979.64	980.08	0.4
Salt	21332	2,317	30,546	5.4	979.19	979.19	979.66	0.5
Salt	20821	2,375	21,988	7.4	978.13	978.13	978.63	0.5
Salt	20311	2,400	20,480	7.9	977.22	977.22	977.74	0.5
Salt	19804	2,354	20,222	8.0	976.36	976.36	976.80	0.4
Salt	19266	2,419	21,246	7.6	975.29	975.29	975.77	0.5
Salt	203.08[1]	2,442	21,916	7.4	974.43	974.43	974.87	0.4
Salt	202.94[1]	2,475	21,557	7.5	973.28	973.28	973.59	0.3
Salt	202.82[1]	2,560	23,270	7.0	972.30	972.30	972.65	0.4

[1] Tres Rios North Levee PMR stationing

7.3 Annotated Flood Insurance Rate Maps

Annotated FIRMs are included in Exhibit B. The initial intent of the study team per meeting minutes for the December 17, 2014 monthly coordination meeting was to include the TY Lin LOMR information on the Annotated FIRM panels for this study. However, the TY Lin LOMR information did not appear in the 2013 FIS panel for the area; the LOMR was shown on a partial-panel only, FEMA will likely re-publish the entire panel in the future. The Annotated FIRM Panels created for this study are based upon the 2013 FIS publication and are noted with reference to the TY Lin LOMR.

7.4 Flood Profiles

The 100-year flood profile is included electronically in DXF file format in Exhibit C.

Appendix A – References

Contents:

A.1 Data Collection Summary

The Data Collection Report is included on the following pages.

Lower Salt River Floodplain Delineation Study
91ST Avenue to the I-10 Bridge

Contract FCD 2013C013

Data Collection Technical Memorandum

Date: February 23, 2015

To: Richard Harris, Project Manager – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.
Jesse Piotrowski – WEST Consultants, Inc.

WEST Consultants, Inc.

The purpose of this technical memorandum is to describe data collected for the Lower Salt floodplain delineation study and the process used to review the data. Data was collected regarding:

- Previous studies in the area
- FEMA Letters of Map Change for the area
- Existing and previous bridges in the reach
- Existing and previous sand and gravel mines
- Spatial data, including aerials and topographic data
- Existing hydrologic data for the Salt River

Much of the data collected was provided by the FCDMC. Most bridge plans were collected from the City of Phoenix.

Additionally, an annotated bibliography has been provided along with this technical memorandum outlining all of the reports received for this study (Contract FCD 2013C013 WA#1) including the author, date of publication, document format, etc.

Previous Studies Regarding Flooding

Several studies regarding flooding have been performed for this reach of the Salt River and the surrounding areas that may be of use during this study. The reports and models for most of these studies have been obtained and were provided to WEST by the FCDMC. The studies included two studies for Cave Creek, one floodplain delineation study, and reports and models used for CLOMRs and LOMRs. Each of the studies will be discussed briefly in the following sections.

Cave Creek floodplain delineation study, 1989

The earliest pertinent report found for the Lower Salt River area was a flood insurance re-study performed on Cave Creek in 1989. This study was performed by Cella Barr Associates for the FCDMC. The model used for this study was HEC-2. The result of the study was to revise the special flood hazard areas on Cave Creek. Since the area was limited to Cave Creek and there have been subsequent studies for this area, it is likely that this study will not impact the current study.

WWTP Protection, 1995

A study of flood mitigation for the wastewater treatment plant at 91st Avenue was completed in 1995 by Simons, Li & Associates, Inc. for the City of Phoenix (Index No. S-931105). HEC-2 was used to model the existing conditions and proposed bank protection. The study also predicted future topographic changes due to sand and gravel operations in the Salt River. Channel stability and sediment transport were analyzed. Mobile bed analysis was conducted using QUASED.

Salt-Gila River FDS, 1999

A floodplain re-delineation study (FDS) on the Salt-Gila River was performed in 1999. This study was performed by Michael Baker, Jr. for the FCDMC and the model used for the study was HEC-RAS. The result of this study is the current effective floodplains for the Lower Salt River project area. This study will be useful during the current project to determine modeling assumptions and approach for the currently effective model.

Cave Creek, 2006

Cave Creek was studied again as part of the Metro Phoenix Area Drainage Master Study (ADMS) in 2006. The study was performed by Wood/Patel and Engineering and Environmental Consultants, Inc. for the FCDMC and City of Phoenix. Wood/Patel performed the hydrologic analysis, and Engineering and Environmental Consultants, Inc. performed the hydraulic analysis. The study area was bounded by the Salt River on the south, so the Salt River was not included in the hydrologic and hydraulic models. Because the study is limited to Cave Creek and other areas further north, the study will have no impact on the current study along the Salt River.

FEMA Letters of Map Change (LOMC) prior to the currently effective FIRM Panels

LOMC's include Letters of Map Revision (LOMR), Letters of Map Revision based on Fill (LOMR-F), Letters of Map Amendment (LOMA), Letters of Map Amendment based on Fill (LOMA-F), Conditional Letters of Map Revision (CLOMR), and others. This section will discuss pertinent LOMC's for the Lower Salt River FDS study reach. This section will discuss pertinent LOMC's impacting the FIRM panels that were effective prior to October 16, 2013 (i.e., the date that the current FIRM panels were made effective).

River Walk Phase 2A LOMR, 2001 (FEMA case number 01-09-867R)

David Evans and Associates performed a study on the Salt River in 2004 for the City of Phoenix. The resulting LOMR affects FIRM panel 04013C2120F. Fill was placed along the south bank of the Salt River from approximately 500 feet downstream to approximately 250 feet downstream of 51st Avenue.

LOMR for the Salt River Bridge at 35th Avenue, 2008 (FEMA case number 08-09-1412P)

The LOMR for FEMA Case No. 08-09-1412P was prepared for the City of Phoenix. This LOMR covered the area from approximately 1,100 feet downstream of 35th Avenue to approximately 1,200 feet downstream of 7th Avenue and focused on hydraulic analysis of the portion of the Salt River affected by the 35th Avenue Bridge construction. The supporting CLOMR was prepared by Entellus for the City of Phoenix.

Sunland Materials CLOMR, 2011 (FEMA case number 12-09-2513R)

Erie and Associates, Inc. completed a study for Sunland Materials, LLC. This study was to create a plan of operation for the sand and gravel mining operation near 69th Avenue on the Salt River owned by Sunland Materials. The models used in this study include an HEC-RAS model, an HEC-6T model, and a DDMSW (HEC-1) model.

Sky Harbor LOMR, 2013 (FEMA case number 13-09-3108P)

In 2011, TY Lin International developed a HEC-RAS model in support of a Letter of Map Revision, which extended "from approximately 450 feet downstream of Interstate 10 to approximately 2,530 feet upstream of Hohokam Expressway" (T.Y. Lin International, 2012). The LOMR, which is FEMA Case No. 13-09-3108P, has an effective date of October 17, 2013. This LOMR was re-issued from FEMA Case No. 12-09-0762P. The LOMR revised WSELs from FEMA cross section AM upstream to cross section AT, and from cross section BA upstream to cross section BH. The HEC-RAS model used in the LOMR included geometry of the I-10 Bridge.

Avenida Rio Salado CLOMR, 2013 (FEMA case number 14-09-0164R)

AZTEC performed a study on the Salt River in 2013 for the City of Phoenix. The study was performed on the reach between the 35th Avenue Bridge and the 51st Avenue Bridge based on new topographic mapping of the river, a proposed road along the south bank, the Avenida Rio Salado/Broadway Road, and a new maintenance ramp along the 31st Avenue alignment on the river bottom. An HEC-RAS model was created for the study and the results were submitted to FEMA in order to revise the current effective floodplain delineation. This study will need to be taken into account when creating the new model for the Lower Salt River.

Other LOMR's and LOMCs

Information for several other LOMRs and LOMC's were obtained from FEMA. The current LOMRs and CLOMRs for the study reach are shown below in Table 1. The current FIRM panels in the study reach were made effective on October 16, 2013, so LOMRs that were accepted before the most recent effective date are not included in this table. Most of these previous LOMRs were either applied to the line work on the FIRM or revalidated by FEMA with the new maps. None of the LOMCs listed in Table 1 below have been reflected in the line work of the currently effective FIRM panels.

Table 1. Current or open LOMRs and CLOMRs for the study reach.

Location	LOMC Type	Case Number	Map Panel Number	Jurisdiction	CLOMR/LOMR Status or Effective Date
Laveen Farms Phase 1	LOMR-F	14-09-0200A	04013C2190L	City of Phoenix	11/26/2013
Avenida Rio Salado	CLOMR	14-09-0164R	04013C2120G	Maricopa County* City of Phoenix	Process Request
Sunland Materials – 69th Avenue – Sand & Gravel Operations in Salt River	CLOMR	12-09-2513R	04013C2115G	Maricopa County* City of Phoenix	03/21/2013
Riverbend III; 5405, 5409 West Atlantis Avenue	LOMR-F	14-09-0203A	04013C195L	City of Phoenix	11/19/2013
Salt River 450 ft downstream of I-10 to 2530 ft upstream of Hohokam Expressway	LOMR	13-09-3108P	04013C2220L, 04013C2240L	City of Phoenix	10/17/2013

Other Pertinent Reports

EPA Superfund Record of Decision: 19th Ave Landfill (1989)

This report, dated September 1989, describes action taken at the abandoned landfill at 19th Avenue. The landfill was located on both the north and south banks of the River. The landfill was capped and embankments were built between the river channel and the landfill to prevent pollutants from entering the channel.

Hydrologic Evaluation of Water Control Plans: Salt River Project to Gila River at Gillespie Dam (1996)

In 1996, the U.S. Army Corps of Engineers, Los Angeles District, performed a hydrologic study of the Salt River, which includes the current study extents. This report was used to establish flow change locations in the effective Baker Study (1999).

Lower Cave Creek Floodplain Concept Study (1996)

Completed by Z & H Engineering in 1996 for the City of Phoenix (no contract number, FCDMC call number A026.949), this concept study discusses the potential for reducing or eliminating flooding from less than 100-year events in developed portions of Cave Creek. Detention in storage basins, additional storm drains, storm canals and infusion wells for infiltration were all considered. Because this study was an alternatives analysis, the report does not include any construction of flood control measures.

51st Avenue Bridge Scour Evaluation (1997)

Parsons Brinckerhoff evaluated scour potential at the 51st Avenue Bridge in 1997. It was found that the 51st Avenue Bridge over the Salt River is Scour Critical. HEC-2 and HEC-RAS version 1.2 were used in the analysis. The report includes historical photographs of the 51st Avenue Bridge and the broken pipeline just downstream. Photos indicate that significant deposition has occurred at the broken pipeline since 1997.

INCA Engineers, Inc. also reviewed the 51st Avenue Bridge in 1997 that focused on the effects of active gravel mines in the area and studied corrective measures for bridge scour. HEC-2 and HEC-RAS version 2.0 were used.

It should be noted that the 51st Avenue Bridge was rebuilt in 2000 due to the scour of the previous bridge being critical. This new bridge is not subject to scour and has significantly more freeboard over the Salt River.

Rio Salado Low-Flow Channel Design Reports (2000)

The reports titled "A Stable Channel Design Approach for the Rio Salado, Salt River, AZ" and "Low Flow Channel Design Analysis for Rio Salado (Salt River), Arizona" completed by WEST

Consultants in 2000 for the U.S. Army Corps of Engineers, Los Angeles District, (LACOE) were provided by the FCDMC. These reports could be useful for comparing the current status of this reach of river to the design and previous conditions. Existing hydraulic conditions were compared to the effective Baker model, sediment transport analysis was conducted, and design of the low flow channel, grade control structures and guide dikes was performed. These reports are also accompanied by LACOE's reports, summarizing WEST's findings. In 2004, the Phase 2 Final Design Submittal was completed by McGann & Associates and Novak Environmental.

Historic Aerial Imagery Comparison (2001)

JE Fuller prepared a comparison of historic and modern aerial images of the Salt River – including the current study reach – in 2001 for the Flood Control District of Maricopa County. The comparison shows the degrees of urban development and channelization of the Salt River.

75th Avenue Storm Drain Project (2005)

In 2005, Stantec performed an alternatives analysis for connecting Durango Regional Conveyance Channel (DRCC) and other related constructed drainage features to the proposed City of Phoenix 75th Avenue Storm Drain. Six alternatives were considered and it was concluded that the Santa Maria Basin should be constructed. Because this study was an alternatives analysis, the report does not include any construction of flood control measures.

Floodplains, Floodways & Aerial Photography for the Salt/Gila River (2005)

In 2005 the District created a 35 panel set of aerial photographs, including the floodway and floodplain extents. The panels extend from Granite Reef Dam to Gillespie Dam.

Salt River Hydraulic Master Plan (2009 – 2010)

Stantec developed a Hydraulic Master Plan for the Salt River in June 2010 for the FCDMC (Contract No. FCD 2007C017 Work Assignment 6). The report determined the maximum flow that can be conveyed between the Salt River levees from the Alma School Road Bridge downstream to the I-10 Bridge. The study included an analysis of the impact of variations in Manning's roughness coefficients on water surface elevations along the Salt River (Aug. 2009). The effects of vegetation on conveyance were also studied (June 2010).

Sand and Gravel Mining Impact Analysis (2011)

This July 2011 report by River Research and Design, Inc. was prepared for the FCDMC (no contract number, FCDMC call number 116.009S). The study reviewed historical data of rivers in the Phoenix area, including the Salt River. The impact of sand and gravel mining operations on sediment transport was analyzed. The report found that mining, in conjunction with channelization, has lowered the Salt River profile by 10 to 15 feet in most locations and by 20 to

26 feet in a few specific locations. The lowered channel has decreased the risk of flooding in some areas, but scour at bridges and other infrastructure has become problematic.

Survey Report Manual for Lower Salt River Delineation Study (2013)

In March 2013, RBF Consulting performed 2-foot contour interval mapping of the Lower Salt River from 24th Street to 91st Avenue for the FCDMC (Contract No.FCD 2012C015, Work Assignment No. 1). Aerial photo acquisition was conducted, along with field survey of 15 cross sections of the river bottom at approximately 1-mile intervals.

Natural Resources of Concern (2013)

A document from Arizona Fish and Wildlife was received listing "Natural Resources of Concern." This lists endangered species that may be affected by a project in this area. The list includes several birds, fishes, mammals, and reptiles. Since this project does not involve any physical changes to the river, there will be no effects on these endangered species (as stated by City of Phoenix staff in an email to WEST Consultants, which will be include in the final Technical Support Data Notebook for this study, FCD 2013C013).

Gila River Manning's n-Value Report (2014)

A report was provided by the FCDMC for the Manning's n-value assignment in the recent Lower Gila River flood delineation study (contract FCD2012C017). The report was written by Stantec in January 2014 and may be useful in determining roughness types and Manning's n-values in the Lower Salt River reach being modeled in this study.

Bridge Data Collection and Review

The FCDMC provided WEST with plans and as-builts for most of the bridges within the study reach. These files were provided by the District on-behalf of the City of Phoenix, except for the 51st avenue bridge plans which was provided by MCDOT.

The plans were reviewed to determine if the plans were readable, whether or not they had the necessary information to be able to model a bridge in HEC-RAS, and if the files had the most recent bridge construction plans, as most of the bridges have undergone some sort of maintenance or reconstruction since their original build date. A byproduct of this process was determining which bridges would have top priority for new surveys and then if any of those surveys would actually be necessary.

Once these steps were completed, the information from the bridge plans and as-builts were compared to existing hydraulic models, aerials, and the information in the National Bridge Inventory (NBI). The models used for comparison were the Effective models (Reach 3 and Reach 4) completed in 1999 as part of the Salt-Gila River Floodplain Delineation Restudy, the

Rio Salado Oeste model completed in 2001 for the L.A. District Corps of Engineers, and the model for the Salt River between 51st and 35th Avenue used to support the CLOMR for the Avenida Rio Salado submitted in 2013. The aerials used were publicly available from Bing and Google maps. The NBI database listed, among other information, the location of the bridge and its most recent construction date. This date was compared to the date of the plans to ensure that the most recent bridge plans were being used.

24th Street Bridge

Based on the plans received from the FCDMC, the original construction date was 1980 for the 24th Street Bridge. The bridge was originally constructed to replace a small double barrel box culvert located in the thalweg of the channel. It was replaced with a 12-span pre-stressed box beam bridge in 1980 and the as-builts are dated September 1982.

The plans were compared to the effective model for Reach 4 and the NBI. The bridge specifications in HEC-RAS matched the as-built plans acceptably well and the date of most recent construction listed in the NBI was 1980, which also matches the as-builts. The number of piers also matches the aerials from Bing maps, which is shown below in Figure 1.

Figure 1. 24th Street bridge crossing, looking downstream

The main difference between the HEC-RAS bridge and bridge plans is the pier width: the pier width is listed as 2.5 feet in the as-builts and 3 ft in HEC-RAS. On March 19, 2014, WEST measured the bridge piers and confirmed the as-built diameter of 2.5 feet.

16th Street Bridge

The original plans for the 16th Street Bridge received from the FCDMC were of questionable quality. Some of the numbers on the plan are difficult to read and the plans are not labeled as as-builts. The 9-span bridge, like the 24th Street Bridge, was originally constructed to replace the existing box culvert located within the channel. The plans were dated 1986.

The plans were compared to the effective model for Reach 4 and the NBI. The bridge specifications in the HEC-RAS model match the bridge plans reasonably well. The date of construction for the bridge in the NBI is 1982, which is, again, reasonably close to the plans' date of 1986. The number of piers in the plans and in the HEC-RAS model also matches the number of visible piers in the aerials from Bing maps, as shown in Figure 2.

Figure 2. 16th Street bridge crossing, looking downstream

The main difference between the bridge plans and the bridge in the HEC-RAS model is the pier diameter, which is 5 feet in the plans and 4.83 feet in the model. David Evans and Associates, Inc. (DEA) surveyed this bridge for the District on May 5, 2014 and confirmed the pier diameter of 5 feet. Rough grout is exposed around the base of piers 4 through 6, increasing the pier width to 7 feet.

<u>7th Street Bridge</u>

Plans for the 7th Street Bridge from 1969 and 1985 were included in the data received from the FCDMC. The 1985 plans for the 7th Street Bridge seemed to be of fairly good quality. The 1985 bridge specifications were used in comparison with the existing HEC-RAS model, aerial photos, and the NBI. The 1985 plans are for a 5-span bridge.

These plans were compared to the effective model for Reach 3 and the NBI. The bridge specifications and the HEC-RAS bridge match almost exactly. The NBI date of construction is 1983, which agrees with the 1985 bridge plan date. The number of piers in the model and in the plans is four, which matches the number of piers observed in the Bing maps aerials, as shown in Figure 3. DEA surveyed this bridge for the District on May 5, 2014 and measured a pier diameter of 5 feet. Rough grout is exposed around the base of piers 2 and 3, increasing the pier width to 7 feet.

Figure 3. 7th Street bridge crossing, looking downstream

Central Avenue Bridge

Bridge plans for the Central Avenue Bridge were provided by the FCDMC. There were bridge plans dated 1966 and 1974. The 1974 plans were used in these comparisons and will likely be used in defining the bridge data in the new HEC-RAS model. These plans were for a 9-span pre-stressed concrete girder bridge.

These plans were compared to the effective model for Reach 3 and the NBI. The bridge specifications and HEC-RAS bridge match acceptably well. The NBI date of construction is 1975, which agrees with the plan date of 1974. The number of piers, eight, also agrees with the number found in the Bing map aerials, which are shown below in Figure 4.

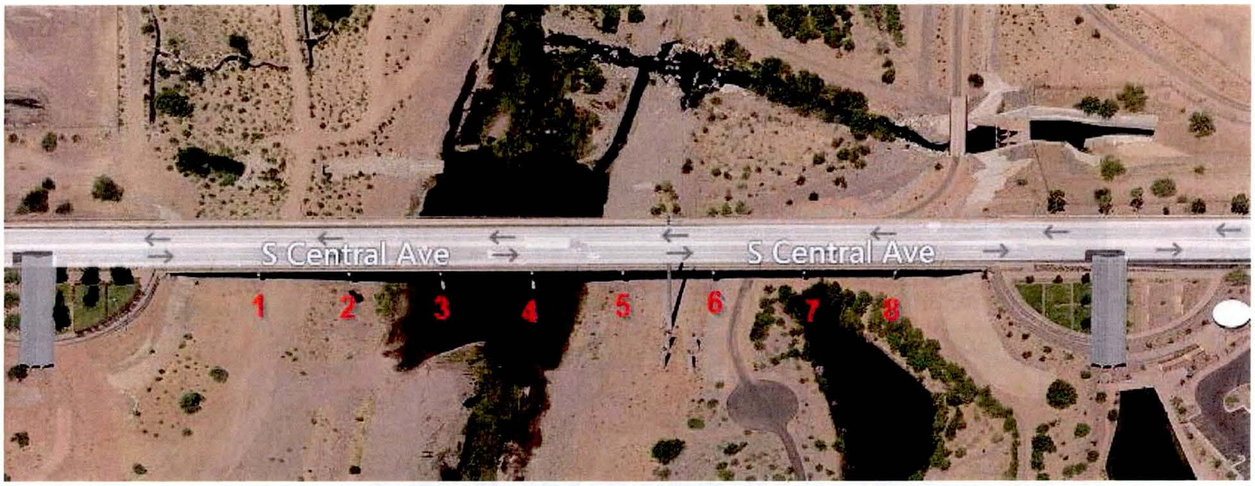

Figure 4. Central Avenue bridge crossing, looking downstream

The only major discrepancy between the HEC-RAS model and bridge plans is the pier diameter. The modeled diameter is 2.5 feet and the bridge plans state a diameter of 2 feet. WEST determined that the bridge pier diameter is 2.7 feet during a site visit on March 19, 2014.

7th Avenue Bridge

Bridge plans for the 7th Avenue Bridge were provided by the FCDMC dated 1976 and 1992. The 1992 bridge plans were compared to the HEC-RAS model, aerials, and the NBI and will likely be used in defining the bridge in the new HEC-RAS model.

The plans were compared to the effective model for Reach 3 and the NBI. The bridge specifications and the HEC-RAS bridge match acceptably well. The NBI date of construction is 1987, which is several years before the plan date, but at least supports the claim that the 1992 plans are the most recent construction plans for the bridge. In the model and in the plans, the bridge has 5 piers, which can be verified by the aerials as shown in Figure 5.

Figure 5. 7th Avenue bridge crossing, looking downstream

The only major difference between the bridge plans and the bridge as it is currently modeled is the pier diameter—4.8 ft in HEC-RAS and 5 ft in the plans. On March 19, 2014, WEST inspected the bridge piers and confirmed the 5 foot pier diameter. Rough grout is exposed around the base of piers 3 and 4, increasing the pier width to 7 feet.

Conveyer Belt Bridge at 21st Avenue

The conveyer belt bridge located at 21st Avenue was completely removed during Rio Salado environmental restoration construction (as noted in physical plans). There is no structure or remnant of a structure (i.e., pier footings) remaining as far as WEST is aware. This was verified during the site visit on March 19, 2014.

19th Avenue Bridge

Bridge plans for the 19th Avenue Bridge were provided by the FCDMC dated 1966, 1981, and 1995. The most recent plans were used to compare to the effective HEC-RAS model and the NBI and will likely be used to define the bridge specifications in the new HEC-RAS model.

The 1995 bridge plans were compared to the effective model for Reach 3 and the NBI. The bridge specifications in the model and the plans seem to match reasonably well. The NBI date of construction is 1982 which, again, is older than the 1995 plans, but supports the claim that the 1995 plans are the most recent construction on the 19th Avenue Bridge. This is also supported by the number of piers observed in the aerials. The earlier plans only show three bridge piers and there are at least four, possibly seven, piers in the Bing map aerials, as shown in Figure 6.

Figure 6. 19th Avenue bridge crossing, looking downstream

Unfortunately, no pier diameter was explicitly stated in the 1995 bridge plans, but the pier size was 5.8 feet in the HEC-RAS model. During the March 19, 2014 site visit, WEST measured a pier diameter of 6 feet.

Conveyer Belt Bridge at 27th Avenue

WEST does not currently have any plans for the conveyer belt bridge crossing at 27th Avenue and the bridge is not in the NBI. Based on the Rio Salado Oeste model report, plans for the conveyer belt bridge were obtained from United Metro Materials. Since those plans could not be obtained again, the District authorized DEA to resurvey the bridge. Pier diameter is 2.5 feet on the base and transitions to 2 feet higher up on the pier.

Figure 7. Conveyer belt bridge crossing, looking downstream

35th Avenue Bridge

The FCDMC provided bridge plans for the 35th Avenue Bridge dated 1974, 1982, 1989, 1992, 2004, 2005, and 2006. The 2004 plans were used in this comparison since they matched the specifications in the 2005 and 2006 plans and were more legible. These are likely the plans that will be used to define the bridge in the new HEC-RAS model.

The 2004 bridge plans were compared to the HEC-RAS model created by AZTEC for a CLOMR in 2013 and the NBI. The bridge plans appear to match the bridge in the AZTEC CLOMR model reasonably well. The NBI construction date is 2008, which is after the latest bridge plans that WEST has, but may still be within reason. This is supported by the fact that there are eight piers in the bridge plans, AZTEC CLOMR model, and in the Bing map aerials, as shown in Figure 8.

Figure 8. 35th Avenue bridge crossing, looking downstream

In addition to the NBI construction date discrepancy, the pier size is different in the plans and in the HEC-RAS model. The AZTEC CLOMR model has bridge piers with a 10-ft diameter while the plans state that the piers are 5-ft in diameter. During WEST's site visit on March 19, 2014, the number of piers (8) and the pier diameter (5 feet) were confirmed.

51st Avenue Bridge

Bridge plans for the 51st Avenue Bridge from 1972, 1999, and 2001were provided by the FCDMC. Based on the 1972 and 2001 plans, it appears that the bridge was rebuilt completely in 2000. The 2001 plans were used in this comparison and will likely be used to define the bridge in the new HEC-RAS model.

The 2001 bridge plans were compared to the bridge in the Rio Salado Oeste HEC-RAS model, the bridge in the AZTEC CLOMR model, and the effective model for Reach 3. The AZTEC CLOMR model and the effective model each had bridges with 15 4-ft wide piers spaced 100 ft on center while the plans and the bridge from the Rio Salado Oeste model had 12 5-ft wide piers spaced 123 feet on center. Therefore, the AZTEC CLOMR and effective models each were representing the previous 1972 bridge, and the Rio Salado Oeste model and the bridge plans were representing the newer 2000 bridge. The NBI construction date is 2000, which matches the date of the bridge plans used in this comparison. The number of piers shown in the aerials appears to match the Rio Salado Oeste model and the bridge plans, as seen in Figure 9.

Figure 9. 51st Avenue bridge crossing, looking downstream

Due to the discrepancy in the models, the study team gave specific attention during the site visit, specifically in the number and diameter of piers. As a result, the bridge is modeled in the new HEC-RAS model using data from the 2001 bridge plans. On March 19, 2014, WEST confirmed the pier diameter of 5 feet. Rough grout is exposed around the base of the piers, increasing the pier width to 7 feet in the channel thalweg.

Proposed 75th Avenue Bridge

J2 Engineering is continuing work on a Concept Design Report for a bridge crossing the Salt River at 75th Avenue (preliminary report dated April 2013) for the MCDOT. The current draft of the report and HEC-RAS models were provided by the FCDMC. The time-frame for the design and construction of this bridge will be monitored during this study, but based upon the project status provided by the MCDOT, it is likely they will occur after this study is completed.

Sand and Gravel Mines

Lists of mine locations based on parcel and permit number within Maricopa County and the City of Phoenix were compiled by the FCDMC and given to WEST. Shapefiles representing these lists were created to facilitate future analysis.

Mines in Maricopa County

There have been eight permits granted for sand and gravel mining within the study area in unincorporated areas of Maricopa County. Six of these are active permits while one is pending and one is expired. The pending permit is for the same permittee as the expired permit, but not for the same land parcel.

Mines in City of Phoenix

There are currently seven areas within City of Phoenix jurisdiction and the Salt River floodplain where there are sand and gravel mines. These seven areas are grouped by parcel owner as the permit numbers for these areas have not been provided to WEST at this time.

Spatial Data

Topographic Data

Topographic data was provided by the FCDMC in order to make a surface for the new HEC-RAS model. The data was collected on April 13, 2013 for the project "Salt River Mapping." It has 2-ft contour intervals and a vertical datum of NAVD 88. The horizontal datum was Stateplane NAD83, HARN, Arizona Central, International Feet, as is customary for FCDMC data. The data was delivered as DTM data in ArcInfo GENERATE format (i.e., *.lf and *.pf files). Other data, including elevation lines and points as well as bridge locations, river centerlines, soils information, were included in *.dxf and *.shp format.

FDCMC Survey Data

Survey data was collected by the FCDMC and provided to WEST to augment topographic data. On June 26, 2014, FCDMC collected channel observations for the Laveen Area Conveyance Channel near Baseline Road. This channel fell outside of the extent of the original topographic mapping collected by the District, and backwater from the Salt River inundated this channel up to Baseline Road. Therefore, additional survey was collected to map inundation extents properly in the channel up to Baseline Road.

On June 17, 2014, FCDMC collected observations of curb and gutter elevation in the Laveen Farms area. This survey was conducted to determine the best mapping approach at 75th Avenue.

On December 8, 2014, FCDMC collected wall and ground observations for the southeast corner of an active sand and gravel mining pit operated by CEMEX near 55th Avenue and Grove Street. A small portion of this pit fell outside of the extent of the original topographic mapping collected by the District. Therefore, additional survey was collected to map inundation extents properly in the pit.

Aerials

Recent aerials were provided to WEST by the FCDMC to aid in the modeling process. The aerials were flown in 2013 and represent nearly current conditions. The aerials were provided as 71 geo-referenced MrSid files that cover the entire project area.

Elevation Reference Marks (ERMs)

Several datasets were provided showing possible ERMs that could be used in the mapping process. These were provided by the FCDMC as five point shapefiles from MCDOT, NGS and FCDMC. The datasets are called:

- Survey Point Corner
- Survey Point Corner Recorded MCDOT
- Survey Point Mapping FCDMC

- Survey Point Misc MCDOT
- Survey Point NGS

The points within each mapping panel determined to be of the highest quality will be used as ERMs on the final hydraulic work maps for this study (FCD 2013C013).

National Land Cover Database (NLCD)

Data from the National Land Cover Database was obtained to supplement data used in determining land use types and Manning's n-values. The land cover and percent impervious datasets from the 2006 survey were downloaded.

Hydrology

Hydrology for this reach of the Salt River was last studied by the LACOE in 1996 (see "Other Pertinent Reports" section). The effective FIS used the LACOE study to define flow change locations but did not use the flow change at RM 203.48 (the 83rd Avenue alignment). However, the floodplain redelineation in support of the Tres Rios North Levee Physical Map Revision did incorporate this flow change location into the final modeling. The LACOE hydrology study, the Tres Rios North Levee Physical Map Revision Study, and the effective FIS will be considered when setting flow change locations for the current study. LOMRs for the study area will also be consulted for any changes to the effective hydrology.

A.2 Referenced Documents

A list of references is included on the following pages.

Works Cited

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Appendix B – General Documentation and Correspondence

Due to significant length, this appendix is included electronically as a PDF in Exhibit C.

Appendix C – Survey Field Notes

Contents:

C.1 Digital Projection Information

All survey data was collected using vertical datum of NAVD88, feet, and horizontal datum of NAD83, HARN State Plane Coordinates, Arizona Central Zone, FIPS 0202, International feet.

Survey data is enclosed in electronic form in Exhibit C of this TSDN.

C.2 Survey Field Notes For Aerial Mapping Control

Survey field notes for aerial mapping control are presented as a digital copy of the report developed by RBF' Consulting titled *Survey Report Manual for Lower Salt River Delineation Study Contract FCD 2012C015 Assignment No. 1*, dated March 2013. RBF's report is included electronically in Exhibit C of this TSDN.

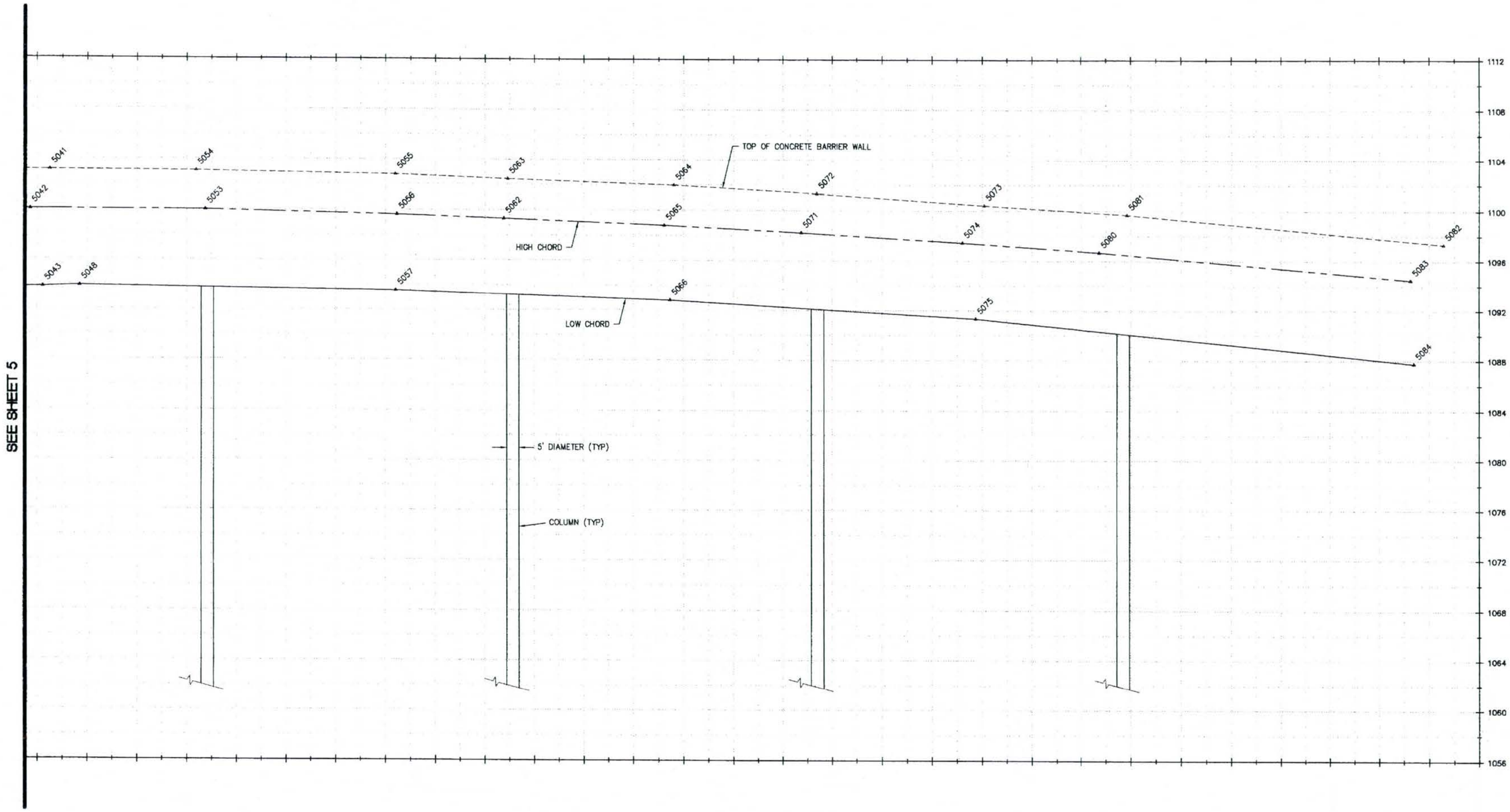
C.3 Survey Field Notes For Hydrologic Modeling

This study did not include any Hydrologic Modeling.

C.4 Survey Field Notes For Hydraulic Modeling

The following pages include survey field notes for hydraulic modeling and bridge-as-builts. Sealed drawings for bridge surveys are included on the electronic disk. This appendix also includes work maps from the Tres Rios North Levee FDS that overlap the current study.

In addition to these notes, Record Drawings from TY LIN's LOMR, Bridge As-builts, As-builts from the Rio Salado low flow channel restoration project, and As-builts from the Laveen Farms residential development are included electronically in Exhibit C of this TSDN.



16TH STREET BRIDGE

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VERT: 1"=4'

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5048	879,714.66	660,130.65	1093.89	BRDG_LC
5053	879,765.27	660,130.65	1099.98	BRDG_DCK
5054	879,760.88	660,124.00	1103.02	BARR_JER
5055	879,840.87	660,117.16	1102.77	BARR_JER
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POINT TABLE				
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5080	880,123.88	660,100.05	1096.68	BRDG_DCK
5081	880,134.39	660,092.09	1099.69	BARR_JER
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5083	880,248.71	660,089.39	1094.47	BRDG_DCK
5084	880,249.76	660,087.22	1087.75	BRDG_LC

COORDINATE DATA

HORIZONTAL DATUM: NAD 83(HARN)
PROJECTION: ARIZONA STATE PLANE - CENTRAL ZONE
UNITS: INTERNATIONAL FOOT
VERTICAL DATUM: NAVD 88

REVISION | DATE | BY

DRAWN BY: RCH
CHECKED BY: TJL
DATE: 5/2014

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ARIZONA U.S.A.
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LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY FOR WEST CONSULTANTS, INC. PHOENIX, AZ

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RANGE: 2E & 3E
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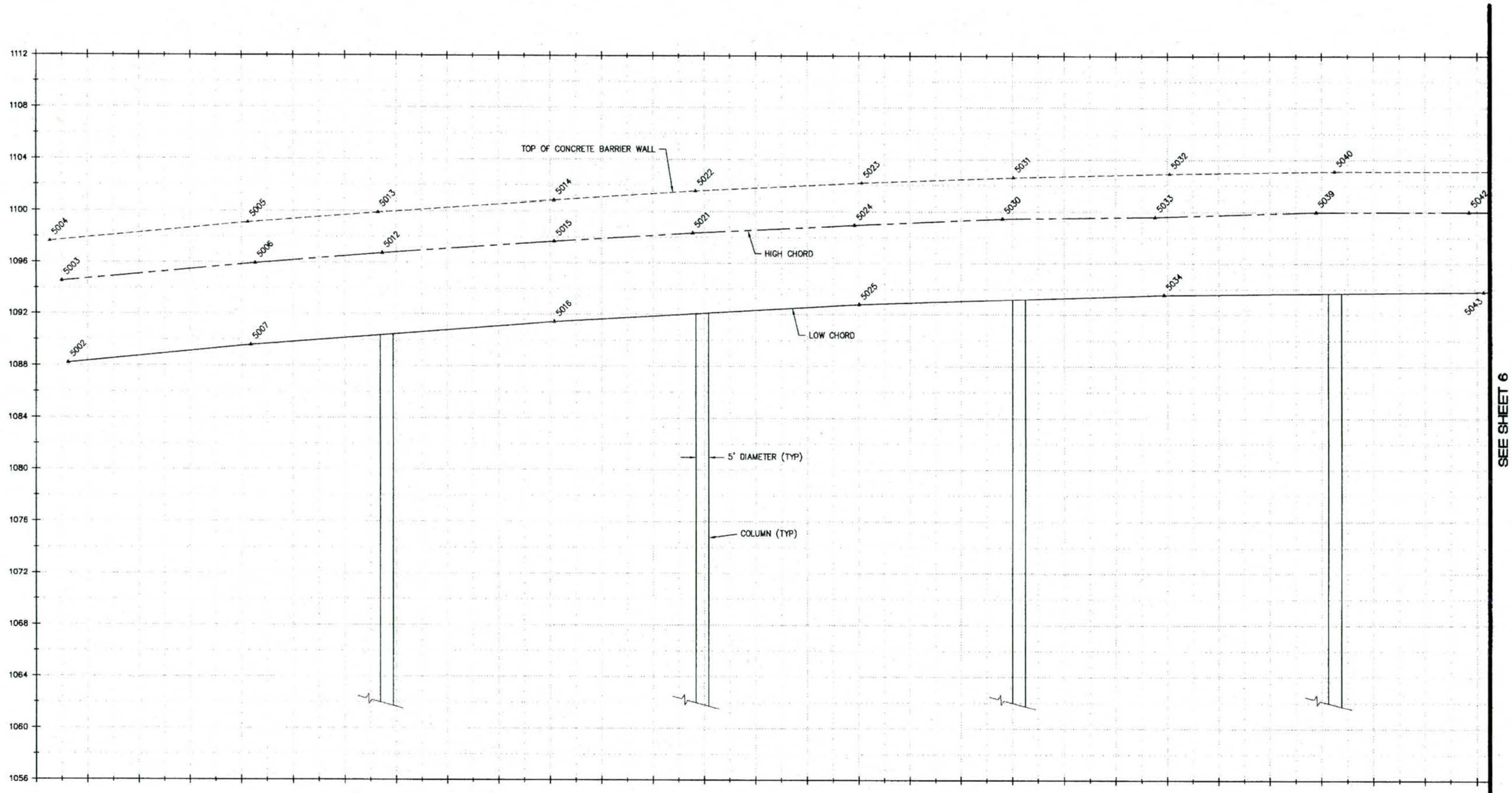

SEE SHEET 6

16TH STREET BRIDGE

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5006	879,225.15	660,176.71	1095.93	BRDG_DCK
5007	879,223.06	660,172.57	1089.59	BRDG_LC
5012	879,274.16	660,172.58	1096.73	BRDG_DCK
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5040	879,642.62	660,133.97	1103.07	BARR_JER
5042	879,695.26	660,136.59	1100.00	BRDG_DCK
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PROJECTION: ARIZONA STATE PLANE – CENTRAL ZONE
UNITS: INTERNATIONAL FOOT
VERTICAL DATUM: NAVD 88

REVISION	DATE	BY

DRAWN BY: RCH
CHECKED BY: T.L.
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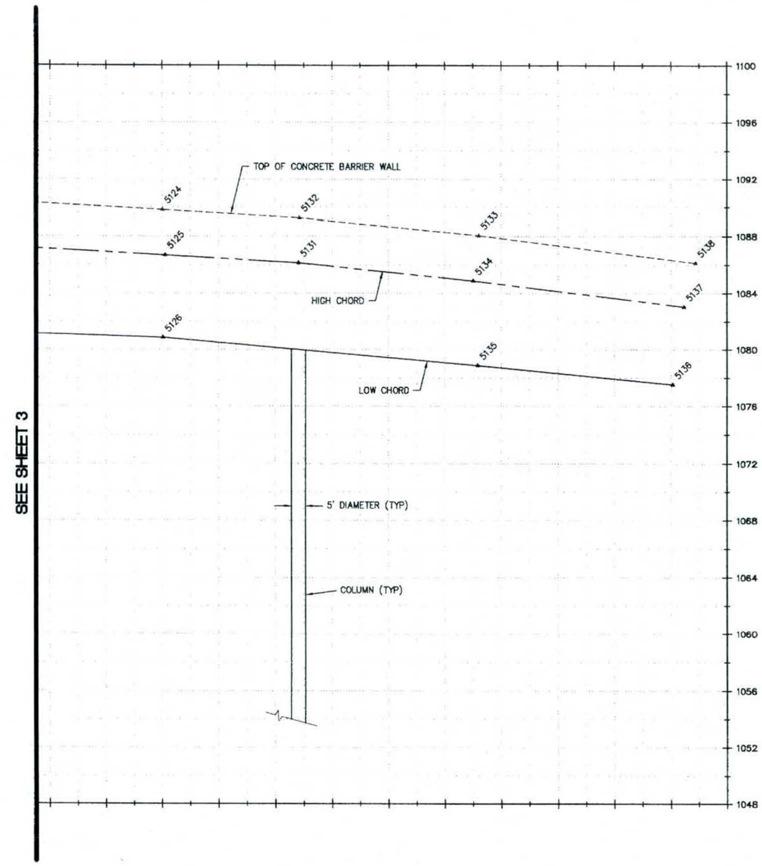

7TH STREET BRIDGE

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5131	880,869.19	654,813.68	1086.15	BRDG_DCK
5132	880,869.33	654,807.73	1089.24	BARR_JER
5133	880,933.01	654,805.94	1088.05	BARR_JER
5134	880,931.20	654,811.94	1084.88	BRDG_DCK
5135	880,932.62	654,807.19	1078.88	BRDG_LC

POINT TABLE				
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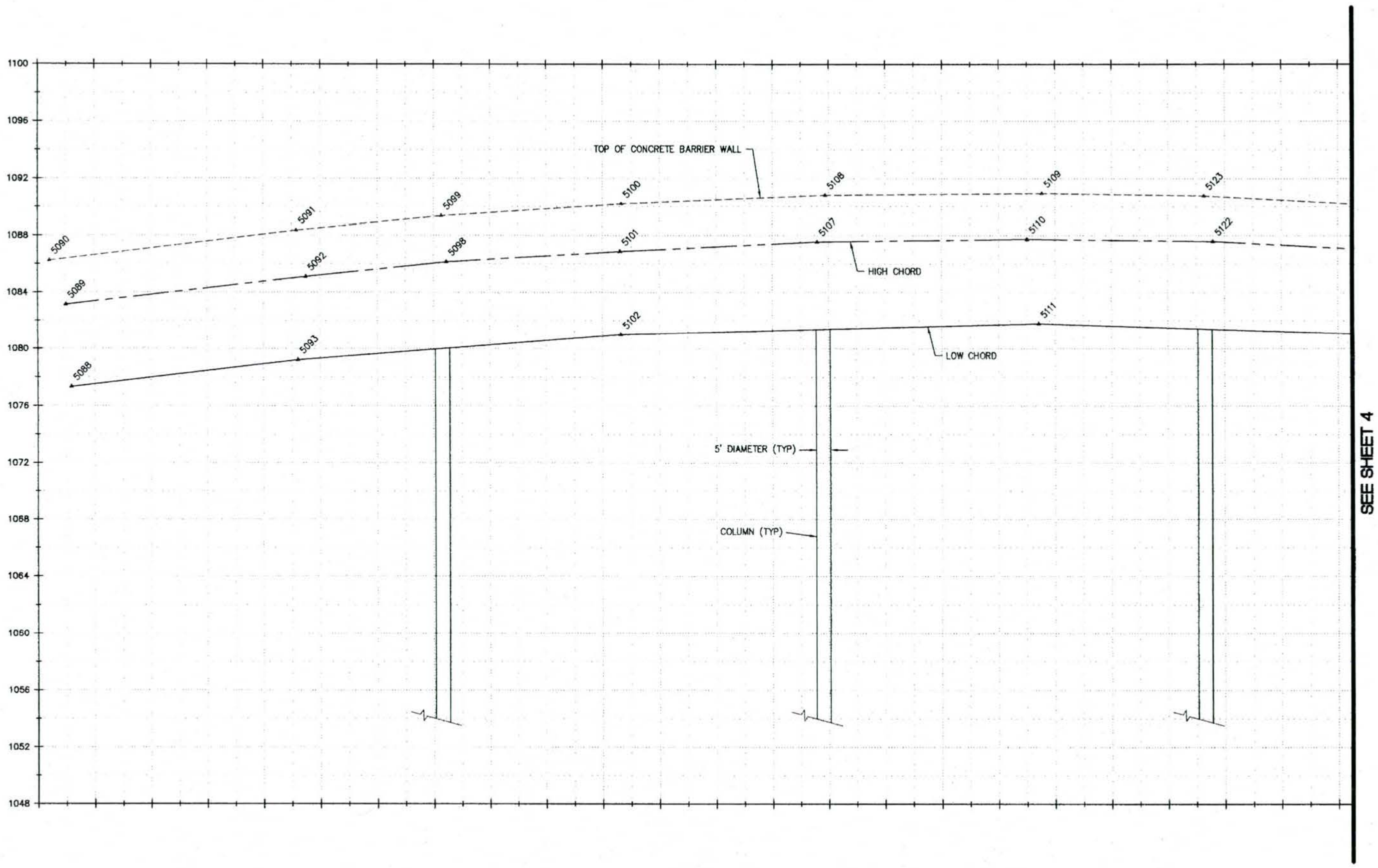

7TH STREET BRIDGE
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5091	880,412.74	654,820.45	1088.35	BARR_JER
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5093	880,413.35	654,821.48	1079.20	BRDG_LC
5098	880,465.82	654,824.95	1086.13	BRDG_DCK
5099	880,463.89	654,819.03	1089.35	BARR_JER

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5102	880,527.60	654,818.36	1080.99	BRDG_LC
5107	880,597.13	654,821.26	1087.55	BRDG_DCK
5108	880,599.80	654,815.26	1090.80	BARR_JER
5109	880,676.33	654,813.08	1090.93	BARR_JER
5110	880,671.25	654,819.17	1087.74	BRDG_DCK
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POINT	NORTHING	EASTING	ELEVATION	CODE
5122	880,737.07	654,817.40	1087.59	BRDG_DCK
5123	880,733.66	654,811.52	1090.76	BARR_JER

COORDINATE DATA

HORIZONTAL DATUM: NAD 83(HARN)
PROJECTION: ARIZONA STATE PLANE – CENTRAL ZONE
UNITS: INTERNATIONAL FOOT
VERTICAL DATUM: NAVD 88

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DATE | REVISION | BY

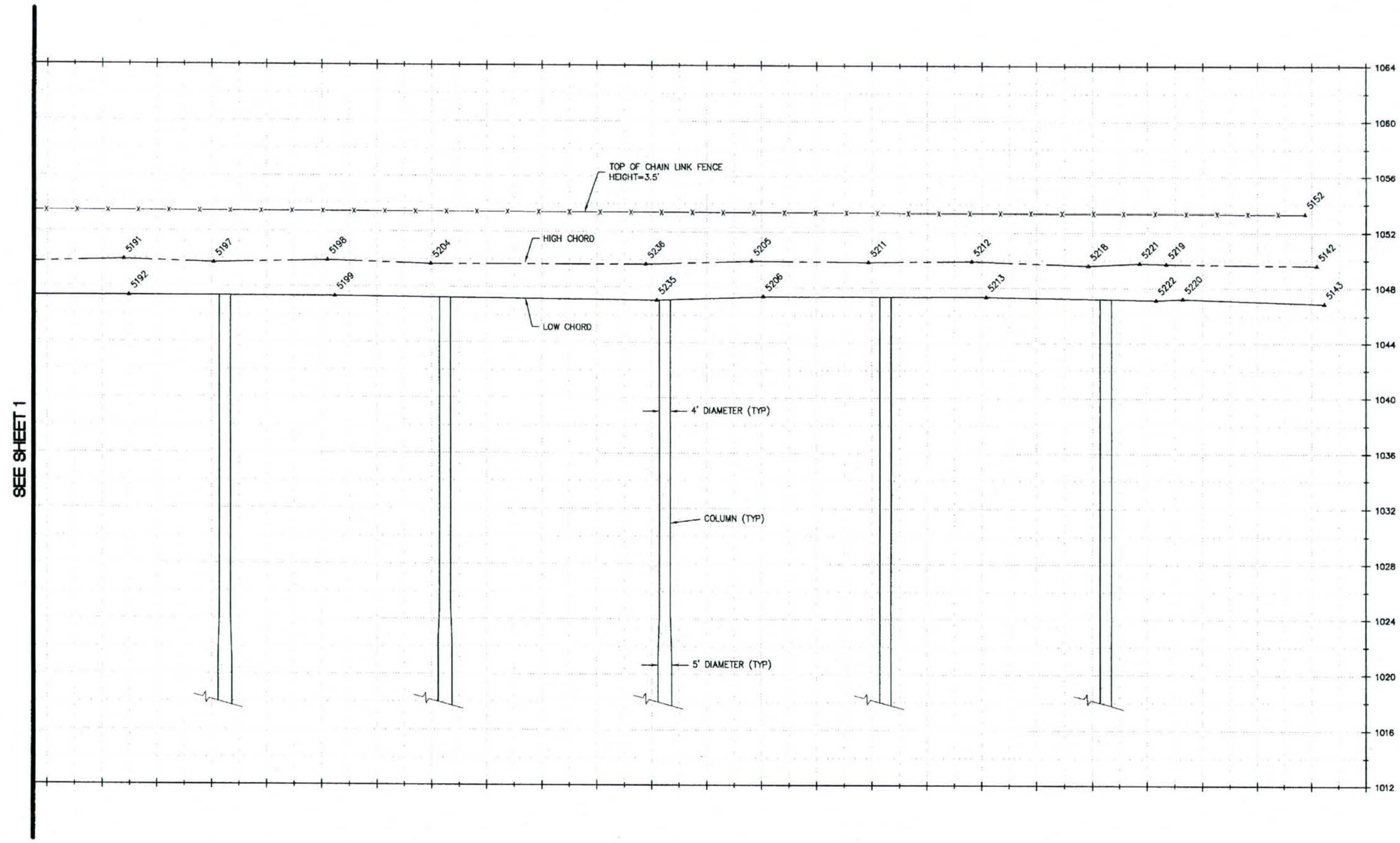
DRAWN BY: RCH
CHECKED BY: TJL
DATE: 5/2014

DAVID EVANS AND ASSOCIATES INC.
4600 E. Washington Street, Suite 430
Phoenix Arizona 85034
Phone: 602.678.5151

14959
THOMAS J LUTE
EXPIRES: 6/30/2015

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY FOR WEST CONSULTANTS, INC. PHOENIX, AZ

SCALE: AS NOTED
SECTION: VARIES
TWNSHP: 1N
RANGE: 2E & 3E
SHEET 3 OF 6
JOB NO.: WSTC00000014



CONVEYOR BRIDGE
HORZ: 1"=20'
VERT: 1"=4'

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	CODE
5142	877,309.82	638,477.96	1049.61	BRDG_DCK
5143	877,312.57	638,475.59	1046.88	BRDG_LC
5152	877,305.63	638,478.17	1053.34	FNC_CLF
5191	876,876.29	638,496.82	1049.91	BRDG_DCK
5192	876,878.15	638,494.43	1047.33	BRDG_LC
5197	876,909.22	638,495.41	1049.71	BRDG_DCK
5198	876,950.48	638,493.61	1049.88	BRDG_DCK
5199	876,953.12	638,491.19	1047.32	BRDG_LC

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	CODE
5204	876,987.99	638,491.98	1049.65	BRDG_DCK
5205	877,104.67	638,486.93	1049.89	BRDG_DCK
5206	877,108.99	638,484.42	1047.33	BRDG_LC
5211	877,147.02	638,485.08	1049.83	BRDG_DCK
5212	877,184.48	638,483.45	1049.91	BRDG_DCK
5213	877,189.65	638,480.90	1047.35	BRDG_LC
5218	877,226.65	638,481.61	1049.61	BRDG_DCK
5219	877,254.91	638,480.37	1049.73	BRDG_DCK

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	CODE
5220	877,260.81	638,477.79	1047.22	BRDG_LC
5221	877,245.40	638,480.78	1049.78	BRDG_DCK
5222	877,251.22	638,478.20	1047.14	BRDG_LC
5235	877,070.04	638,486.13	1047.08	BRDG_LC
5236	877,066.11	638,488.64	1049.66	BRDG_DCK

COORDINATE DATA

HORIZONTAL DATUM: NAD 83(HARN)
PROJECTION: ARIZONA STATE PLANE – CENTRAL ZONE
UNITS: INTERNATIONAL FOOT
VERTICAL DATUM: NAVD 88

REVISION | DATE | BY

DRAWN BY: RCH
CHECKED BY: TJL
DATE: 5/2014

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14959
THOMAS J. LUTE
EXPIRES: 6/30/2015

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY FOR WEST CONSULTANTS, INC. PHOENIX, AZ

SCALE: AS NOTED
SECTION: VARIES
TWNSHP: 1N
RANGE: 2E & 3E
SHEET 2 OF 6
JOB NO.: WSTC00000014

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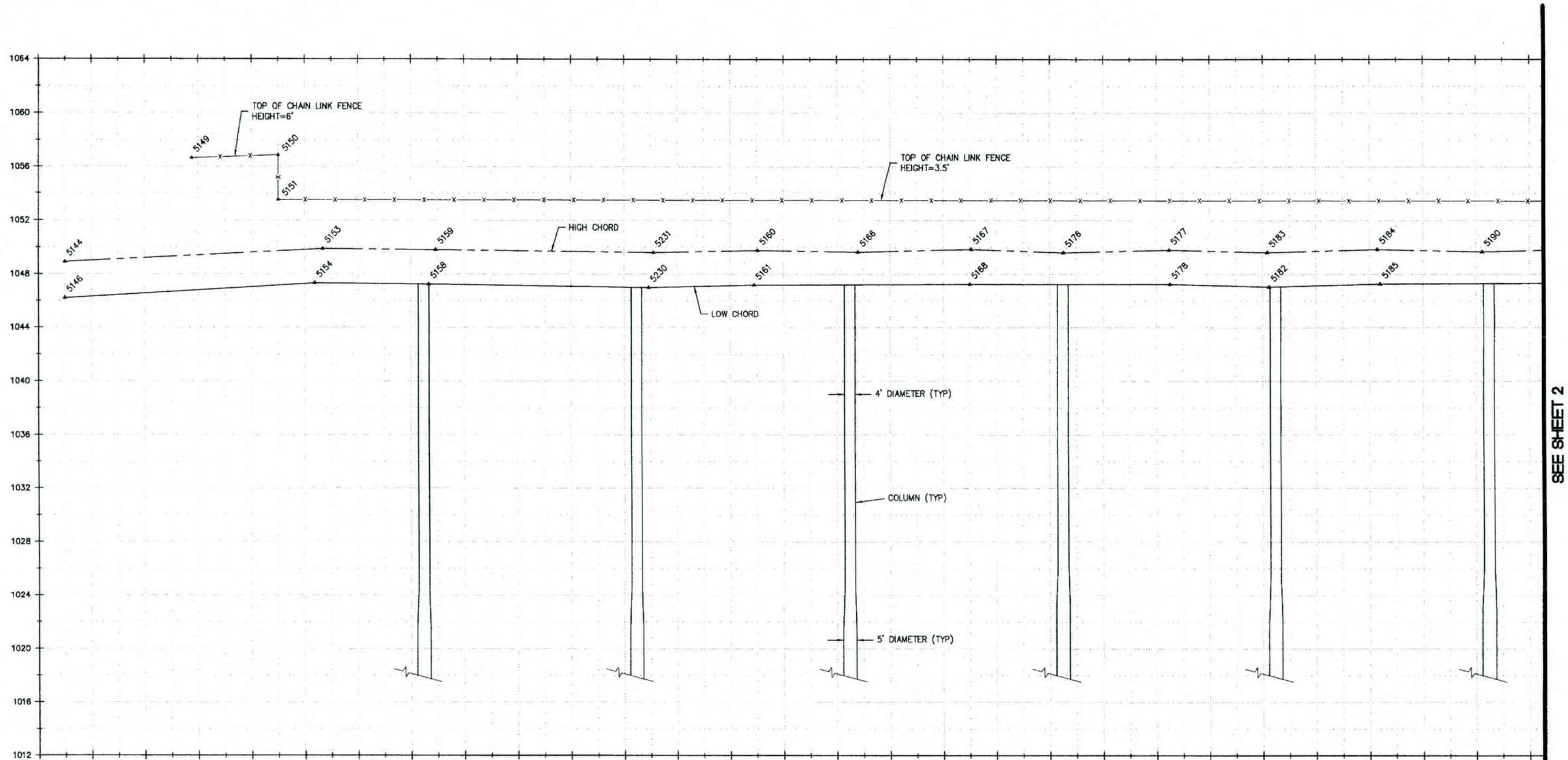

CONVEYOR BRIDGE
HORZ: 1"=20'
VERT: 1"=4'

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	CODE
5144	876,299.04	638,522.12	1048.91	BRDG_DCK
5146	876,298.85	638,519.58	1046.20	BRDG_LC
5149	876,346.65	638,519.50	1056.65	FNC_CLF
5150	876,379.09	638,518.12	1056.87	FNC_CLF
5151	876,379.09	638,518.09	1053.49	FNC_CLF
5153	876,395.83	638,517.48	1049.89	BRDG_DCK
5154	876,392.64	638,515.30	1047.32	BRDG_LC
5158	876,435.51	638,513.47	1047.25	BRDG_LC

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	CODE
5159	876,438.30	638,515.66	1049.82	BRDG_DCK
5160	876,559.12	638,510.46	1049.77	BRDG_DCK
5161	876,557.61	638,508.21	1047.18	BRDG_LC
5166	876,596.68	638,508.82	1049.65	BRDG_DCK
5167	876,639.25	638,507.03	1049.86	BRDG_DCK
5168	876,638.58	638,504.71	1047.25	BRDG_LC
5176	876,673.84	638,505.58	1049.61	BRDG_DCK
5177	876,713.49	638,503.84	1049.81	BRDG_DCK

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	CODE
5178	876,713.62	638,501.50	1047.25	BRDG_LC
5182	876,750.93	638,499.87	1047.05	BRDG_LC
5183	876,750.41	638,502.22	1049.62	BRDG_DCK
5184	876,791.57	638,500.45	1049.85	BRDG_DCK
5185	876,792.53	638,498.10	1047.27	BRDG_LC
5190	876,831.06	638,498.74	1049.67	BRDG_DCK
5230	876,517.97	638,509.94	1047.00	BRDG_LC
5231	876,519.90	638,512.17	1049.62	BRDG_DCK

COORDINATE DATA

HORIZONTAL DATUM: NAD 83(HARN)
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VERTICAL DATUM: NAVD 88

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REVISION	DATE	BY

DRAWN BY: RCH
CHECKED BY: TJL
DATE: 5/2014

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4600 E. Washington Street, Suite 430
Phoenix Arizona 85034
Phone: 602.678.5151

14959
THOMAS J LUTE
ARIZONA U.S.A.
EXPIRES: 6/30/2015

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY FOR WEST CONSULTANTS, INC. PHOENIX, AZ

SCALE: AS NOTED
SECTION: VARIES
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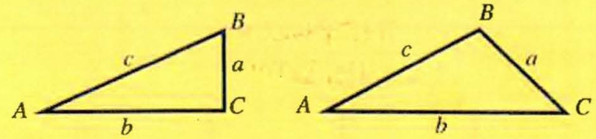
SHEET 1 OF 6
JOB NO.: WSTC00000014

FORMULAE FOR SOLVING RIGHT TRIANGLES



$\text{Sin } A = \frac{a}{c} = \text{Cos } B$ $\quad$ $\text{Cot } A = \frac{b}{a} = \text{Tan } B$

$\text{Cos } A = \frac{b}{c} = \text{Sin } B$ $\quad$ $\text{Sec } A = \frac{c}{b} = \text{Cosec } B$

$\text{Tan } A = \frac{a}{b} = \text{Cot } B$ $\quad$ $\text{Cosec } A = \frac{c}{a} = \text{Sec } B$

Given	Required	Solution
A, c	B, a, b	$B = 90° — A, a = c \sin A, b = c \cos A.$
A, b	B, a, c	$B = 90° — A, a = b \tan A, c = \frac{b}{\cos A.}$
A, a	B, b, c	$B = 90° — A, b = a \cot A, c = \frac{a}{\sin A.}$
$a. c$	A, B, b	$\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c + a)(c — a)}$
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2}$

FORMULAE FOR SOLVING OBLIOUE TRIANGLES

Given	Required	Solution
A, a, b	B, c	$\sin B = \frac{b \sin A}{a}, c = \frac{a \sin C}{\sin A}$
A, B, a	b	$b = \frac{a \sin B}{\sin A}$
a, b, C	A, c	$A + B = 180° — C, c = \frac{a \sin C}{\sin A}$
a, b, c	Area	$\text{side} \frac{a + b + c}{2}$, $\text{area} = \sqrt{s(s — a)(s — b)(s — c)}$
A, b, c	Area	$\text{area} = \frac{bc \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

MADE IN CHINA

WSTC0014
LOWER SALT RIVER FDS
4/15/2014

D.A. LUTE

CONTROL CALIBRATION

LEICA GPS

FILE: 20140415

#	CODE	DESC
100	113	SHOT 1BH1 (TWIN 3MIN 180° TURN SHOT)
~~101~~	~~113~~	~~SHOT MCDOT~~ "
~~102~~	~~113~~	~~SHOT 2BD1~~ "

RE-SHOT CONTROL 4/16/2014 AZCORS TEMPE

D.A LOTE

FILE: ~~[illegible]~~ 20140216

#	CODE	DESC
100	113	SHOT 1BH1
101	113	1BC1
102	113	2BD1

SE COR MCKEMY (N+S) & 9TH ST (E+W) IN TEMPE

NOT USED

WSTC 0014
LOWER SALT RIVER
BRIDGE LOCATIONS
(16TH STREET)

04/18/2014

GPS
FILE: 20140418 WSTC14
LEICA GS14
HT= 6.79

LEICA MS50
FILE: 20140418_ms50

D.A. LUTE
L.S. OSBORN

#	CODE	DESC
1	103	SET 1/2" RB W/DEA CONTROL Alum CAP ON N. SIDE NEAR BRIDGE
2	103	" " N. SIDE NEAR STREET + GATE
3	103	" S. SIDE S. OF N. PATH IN CLEARING SOUTH KNOLL BY GATE
4	103	SET MAG SPIKE IN S. ASPH RAMP

π@ 3	5.06
BS@2	5.08

#	CODE	DESC
5000	199	✓ TO #2 ✓
5001	199	✓ TO #4 ✓
5002	~~605~~ 607	SOUTH ABUTMENT @ LOW CHORD
5003	~~605~~ 600	" @ HIGH CHORD
5004	~~699~~ 314	TOP PARAPET WALL @ ABUTMENT
5005	~~699~~ 314	" MID SPAN
5006	~~699~~ 314	HIGH CHORD "
5007	607	LOW CHORD "
5008-	602	SHOTS ON COLUMN
5010	602	"
5011	607	LOW CHORD @ PIER
5012	~~699~~ ~~314~~ 600	HIGH CHORD "
5013	~~699~~ 314	PARAPET "
5014	~~699~~ 314	" @ MID SPAN
5015	~~699~~ 600	HIGH CHORD "
5016	607	LOW CHORD "

*GPS CONTROL
SHOT TWICE 180s EACH

#	CODE	DESC
5017~	602	COLUMN
5019	602	"
5020	607	LOW CHORD
5021	~~699~~ 600	HIGH CHORD
5022	~~699~~ 314	TOP PARAPET
5023	699 314	" @ MID SPAN
5024	~~699~~ 600	HIGH CHORD "
5025	607	LOW CHORD "
5026-	602	COLUMN
5028	602	"
5029	607	LOW CHORD
5030	~~699~~ 600	HIGH CHORD
5031	~~699~~ 314	TOP PARAPET
5032	~~699~~ 314	" @ MID SPAN
5033	~~699~~ 600	HIGH CHORD
5034	607	LOW CHORD
5035~	602	COLUMN
5037	602	"
5038	607	LOW CHORD
5039	~~699~~ 600	HIGH CHORD
5040	699 314	PARAPET
5041	~~699~~ 314	" @ MID SPAN
5042	~~699~~ 600	HIGH CHORD "
5043	607	LOW CHORD "
5044	199	✓TO #2

STA	HT
π@1	5.09
BS@4	5.03

#	CODE	DESC
5045	199	√ TO #4
5046	199	√ TO #2
5047	607	LOW CHORD @ ± #5038 √
5048	607	" NEAR #5043 √
5049-	602	COLUMN
5051	602	"
5052	607	LOW CHORD
5053	~~699~~ 600	HIGH CHORD
5054	~~699~~ 314	PARAPET
5055	~~699~~ 314	" @ MID SPAN
5056	~~699~~ 600	HIGH CHORD @ MID
5057	607	LOW CHORD @ MID
5058-	602	COLUMN
5060	602	"
5061	607	LOW CHORD
5062	~~699~~ 600	HIGH CHORD
5063	~~699~~ 314	PARAPET
5064	~~699~~ 314	" @ MIDSPAN
5065	~~699~~ 600	HIGH CHORD "
5066	607	LOW CHORD "

#	CODE	DESC
5067-	602	COLUMN
5069	602	"
5070	607	LOW CHORD
5071	~~699~~600	HIGH CHORD
5072	~~699~~314	PARAPET
5073	~~699~~314	" @ MID SPAN
5074	~~699~~600	HIGH CHORD "
5075	607	LOW CHORD "
5076-	602	COLUMN
5078	602	"
5079	607	LOW CHORD
5080	~~699~~600	HIGH CHORD
5081	~~699~~314	PARAPET
5082	~~699~~314	" @ ABUTMENT
5083	~~605~~600	HIGH CHORD "
5084	~~605~~607	LOW CHORD "
5085	199	✓4

PIER SCAN 4/21/2014

STA	HT
TI@1	5.29
BS@2	5.11

SCAN PIER 3 FROM NORTH OR 6 FROM SOUTH

SCAN 1 @ 0.05' x 0.05' (16TH ST)

WSTC 0014

LOWER SALT RIVER FDS

4/21/2014

(7TH STREET)

D.A. LUTE

L.S. OSBORN

LEICA GPS GS14

FILE: 20140418 WSTC14

HT=6.79

LEICA MS50

FILE: 20140418_MS50

LEICA MS50

FILE WSTC14SCAN

#	CODE	DESC
5	103 "	SET 1/2" RB W/ DEA CONTROL ALUM CAP
6	103	" N. SIDE ON LOWER PATH
7	103	" S. SIDE NEXT TO PATH
8	103	" " NEAR BRIDGE ALONG PATH

STA	HT	TOPO
π@8	5.14	
BS@6	5.00	

#	CODE	DESC
5086	199	✓ TO #6 ✓
5087	199	✓ TO #7 ✓
5088	~~608~~ 607	LOW CHORD @ ABUTMENT
5089	~~608~~ 600	HIGH CHORD "
5090	~~699~~ 314	TOP PARAPET
5091	~~699~~ 314	" @ MID SPAN
5092	~~699~~ 600	HIGH CHORD "
5093	607	LOW CHORD
5094-	602	COLUMN
5096	602	"
5097	607	LOW CHORD
5098	~~699~~ 600	HIGH CHORD
5099	~~699~~ 314	TOP PARAPET

N. SIDE RIVER ON LOWER PATH NEAR BRIDGE

* GPS CONTROL SHOT TWICE 180s EACH

#	CODE	DESC		
5100	~~699~~314	PARAPET MID SPAN		
5101	~~699~~600	HIGH CHORD "		
5102	607	LOW CHORD "		
5103	602	COLUMN		
5105	602	"		
5106	607	LOW CHORD		
5107	~~699~~600	HIGH CHORD		
5108	~~699~~314	TOP PARAPET		
5109	~~699~~314	PARAPET @MID SPAN		
5110	~~699~~600	HIGH CHORD "		
5111	607	LOW CHORD		
5112	607	LOW CHORD @ PIER3		
5113	199	✓ TO #6	+0.09 N	+0.04 E
5114	199	✓ TO #7	−0.02 N	+0.04 E

−0.01' VT

— VT

PIER SCAN

STA	HT
⊼@8	5.14
BS@6	5.00

SCAN PIER 2 FROM SOUTH

SCAN 1 @ 0.10' x 0.10'

SCAN 2 @ 0.05' x 0.05'

(7TH ST.)

TOPO

~~#~~	~~CODE~~	
STA	HT	
π@5	5.13	
BS@7	6.90	

#	CODE	DESC		
5115	199	✓ TO 7 ✓		
5116	199	✓ TO ~~8~~ 6 ✓		
5117	607	NEAR 5111	(ALIGN ✓)	
5118	607	NEAR 5112		
5119-	602	COLUMN		
5121	602	"		
5122	~~699~~ 600	HIGH CHORD		
5123	~~699~~ 314	TOP PARAPET		
5124	~~699~~ 314	"	@	MID SPAN
5125	~~699~~ 600	HIGH CHORD		"
5126	607	LOW		
5127-	602	COLUMN		
5129	602	"		
5130	607	LOW CHORD		
5131	~~699~~ 600	HIGH CHORD		
5132	~~699~~ 314	TOP PARAPET		
5133	~~699~~ 314	"	@	MID SPAN
5134	~~699~~ 600	HIGH CHORD		"
5135	607	LOW CHORD		"

#	CODE	DESC		
5136	60~~3~~7	LOW CHORD @ ABUTMENT		
5137	60~~8~~0	HIGH CHORD		"
5138	~~699~~314	TOP PARAPET		
5139	199	✓ TO #6 ✓		
5140	199	✓ TO #7 ✓		

WSTC 0014
LOWER SALT RIVER
BRIDGE LOCATIONS

4/22/2014

D.A. LUTE
L.S OSBORN

LEICA GS14
HT=6.79
FILE: WSTC_20140422

LEICA MS50 (CTR 16)
FILE: 20140422_WSTC14

LEICA MS50 (SCAN)
FILE: 20140422_SCAN

#	CODE	DESC
5141	~~699~~600	HIGH CHORD 6" FROM EDGE
5142	~~699~~600	" @ END
5143	607	LOWCHORD "
5144	~~699~~ 600	HIGH CHORD @ END
5145	~~699~~600	" @ END ±6'CLF
5146	607	LOW CHORD @ END
~~5147~~		
9	103	SET 1/2" RB W/ DEA CONTROL ALUM.CAP
10	103	X ON ROCK IN CONC.
11	103	SET 1/2" RB W/DEA CONTROL ALUM CAP
103	113	1BF1

TOPO (GUN)

STA	HT
TC@ 9	5.03
BS@10	5.11
FS@11	6.90

#	CODE	DESC
5147	199	√TO 10
5148	199	√TO 11
5149	300	TOP CLF W/RAZOR WIRE ±6'H
5150	300	"
5151	300	TO CLF ALONG BRIDGE 42"H
5152	300	"
5153	~~699~~600	HIGH CHORD
5154	607	LOW CHORD

42"

#	CODE	DESC	
5155-	602	COLUMN	
5157	602	"	
5158	607	LOW CHORD	
5159	~~699~~ 600	HIGH CHORD	
5160	~~699~~ 600	"	@ MID SPAN
5161	607	LOW CHORD	
5162-	602	COLUMN	
5164	602		
5165	607	LOW CHORD	
5166	~~699~~ 600	HIGH CHORD	
5167	~~699~~ 600	"	@ MID SPAN
5168	607	LOW CHORD	"
5169-	602	COLUMN	(4TH FROM SOUTH SCAN)
5174	602	"	
5175	607	LOW CHORD	
5176	~~699~~ 600	HIGH CHORD	
5177	~~699~~ 600	"	@ MID SPAN
5178	607	LOW CHORD	"
5179-	602	COLUMN	
5181	602	"	
5182	607	LOW CHORD	
*5183	~~699~~ 600	HIGH CHORD	
5184	~~699~~ 600	"	@ MID SPAN
5185	607	LOW CHORD	"

#	CODE	DESC		
5186-	602	COLUMN		
5188	602	"		
5189	607	LOW CHORD		
5190	~~699~~ 600	HIGH CHORD		
5191	~~699~~ 600	"	@ MID SPAN	
5192	607	LOW CHORD	"	
5193-	602	COLUMN		
5195	602	"		
5196	607	LOW CHORD		
5197	~~699~~ 600	HIGH CHORD		
5198	~~699~~ 600	"	@ MIDSPAN	
5199	607	LOW CHORD		
5200-	602	COLUMN		
5202	602	"		
5203	607	LOW CHORD		
5204	~~699~~ 600	HIGH CHORD		
5205	~~699~~ 600	"	@ MIDSPAN	
5206	607	LOW CHORD	'	
5207-	602	COLUMN		
5209	602	"		
5210	607	LOW CHORD		
5211	~~699~~ 600	HIGH CHORD		
5212	~~699~~ 600	"	@ MID SPAN	
5213	607	LOW CHORD		

#	CODE	DESC		
5214-	602	COLUMN		
5216	602	"		
5217	607	LOW CHORD		
5218	~~699~~ 600	HIGH CHORD		
5219	~~699~~ 600	"	@ MID SPAN	
5220	607	LOW CHORD	"	
5221	~~699~~ 600	HIGH CHORD ✓		
5222	607	LOW CHORD ✓		
5223	199	✓ 11	✓	
5224	199	✓ 10	✓	

STA	HT	SCAN
TC@9	5.03	
BS@10	5.11	

SCAN PIER 4 FROM SOUTH

SCAN 1 @ 0.05' X 0.05' (CONVEYOR)

#9
N 876701.569
E 638721.934
EL: 1013.358

#10
N 876531.334
E 633490.872
EL 1010.854

WSTC 0014

BRIDGE CHECKS

4/29/2014

D.A. LUTE

L.S. OSBORN

LEICA MS50

FILE: 20140429

COPIED FILE: 20140418 MS50

STA	HT
T@1	$5.^{\underline{20}}$
BS@4	$5.^{\underline{17}}$
9@2	$6^{\underline{90}}$

#	CODE	DESC	HR
6045	199	√TO #4	$5^{\underline{17}}$
6046	199	√TO #2	$6^{\underline{90}}$
6052	"	√5052	RL
6053	"	√5053	"
6056	"	√5056	"
6057	"	√5057	"
6079	"	√5079	"
6080	"	√5080	"
6085	"	√4	$5^{\underline{17}}$
6086	"	√2	$6^{\underline{90}}$

WSTC 0014

CONVEYOR BRIDGE

5/1/2014

D.A. LUTE

L.S. OSBORN

LEICA M350

FILE: 20140501

STA	HT
Λ@9	5.04
BS@10	5.29
i@11	6.90

#	CODE	DESC
5225	199	√TO 10
5226	199	√TO 11
5227-	602	COLUMN
5229	602	"
5230	607	LOW CHORD
5231	600	HIGH CHORD
5232-	602	COLUMN
5234	602	"
5235	607	LOW CHORD
5236	600	HIGH CHORD
5237-	602	COLUMN@ HIGH TRANSITION
5243	602	"
5244	199	√TO 10
5245	199	√TO 11

RBF CONSULTING
A Baker Company

SURVEYOR'S SUMMARY AND CERTIFICATION

BACKGROUND

This project involved the production of 2 foot contour interval floodplain mapping over approximately 14.5 square miles of the Lower Salt River Corridor from approximately the 24th Street Bridge on I-10 westerly to approximately 91st Avenue, all located in Phoenix, Arizona.

RBF Consulting performed a field survey to establish 28 aerial control panels prior to aerial photo acquisition, a field survey of 3 Airborne GPS Base Stations during the aerial photo acquisition and a field survey of 15 cross sections of the river bottom at approximately 1 mile intervals throughout the project for aerial mapping quality control checks.

The post processing of the Airborne GPS Base Stations and Aircraft Onboard GPS data was compiled by A Team Professional Associates, Inc. while the Digital Terrain Model (DTM) and mapping was compiled from aerial imagery by AeroTech Mapping, Inc., both subconsultants to RBF Consulting. The DTM and mapping meets the American Society of Photogrammetry and Remote Sensing (ASPRS) standards for mapping at a two-foot contour interval.

Maricopa County Flood Control District provided 9 blind aerial control panels and random DTM observations for aerial mapping quality control checks.

PROJECT DATUM

The survey is based on the Maricopa County Geodetic Densification and Cadastral Survey (GDACS) (which is based on the North American Datum of 1983 (1992 epoch) Arizona Central Zone). The following GDACS control points were held as primary control for this project:

Name	NGS PID	Northing (ft)	Easting (ft)	Ellipse Hgt. (ft)
1BB1	AJ3821	882898.922	596287.574	896.97
1BC1	AJ3666	885252.336	614851.421	929.91
1BF1	AJ3668	879158.133	660049.338	994.52
MDOT	AJ3667	883372.028	637238.617	950.46

The vertical datum for the project is the North American Vertical Datum of 1988 (NAVD88). The following National Geodetic Survey (NGS) benchmarks and GDACS control points were held as primary vertical control for this project (elevations for the GDACS control points were obtained from Maricopa County Department of Transportation Approved Primary Control list, updated 3-13-2013). Geoid model GEOID09 (CONUS) was used in the data processing.

Name	NGS PID	NAVD 88 Elev. (ft)
B 519	DV2291	1110.93
C 519	DV2292	1099.69
D 519	DV2293	1099.89
D 521	DV2337	1039.43
W 519	DV2311	975.24
1BB1	AJ3821	996.13
1BC1	AJ3666	1028.80
1BF1	AJ3668	1092.37
MDOT	AJ3667	1048.82

SURVEY SUMMARY

RBF Consulting used accepted standard Global Positioning Systems (GPS) fast static and real-time kinematic (RTK) field surveying procedures to establish the aerial control panels and to survey the cross sections of the river bottom.

Aerial Control Panel Survey

The first task of this project was to establish the aerial control panels needed to perform aerial mapping for the project. This was accomplished by collecting static observations on two GDACS control points (1BC1, 1BF1 or MDOT) with two Trimble 5700 receivers collecting at a 5 second epoch rate while using two Trimble R8 receivers to collect a minimum of 8 minute fast static sessions at a 5 second epoch rate on the 28 aerial control panels and 5 NGS benchmarks. Fixed height tripods/fixed height poles were used for every occupation to eliminate antenna height errors. Two fast static sessions were collected on all points with a minimum of a 3 hour time separation between each session to ensure redundant measurements to all points. All of the GPS data collected for the aerial control panels was post-processed and ran through network adjustments in MicroSurvey Star*Net-Pro. A minimally constrained network adjustment was first performed holding only GDACS control point 1BC1. The results of the remaining primary control was then checked against published GDACS/NGS values for quality control. Once it was determined the results showed good agreement with the published values, a fully constrained network adjustment holding the primary control noted in the

Project Datum section above was performed yielding the final coordinate values for the aerial control panels.
(See Section 2 of this Survey Report Manual for more information)

Cross Sections Survey

The second task of this project was to survey 15 cross sections of the river bottom at approximately 1 mile intervals throughout the project for aerial mapping quality control checks. This was accomplished using GPS RTK survey methods by having a Trimble 5700 receiver base station set on a GDACS control point (or an aerial control panel if the radio connection between the base station and rover became unreliable) and a Trimble R8 receiver as a rover unit. Fixed height tripods/fixed height poles were used for every occupation to eliminate antenna height errors. Additionally check shots were taken prior to and after completion of each cross section on aerial control panels. All of the GPS data collected for the cross sections was processed in Trimble Business Center. Cross section data was checked against a preliminary Digital Terrain Model prepared by AeroTech and the data checked within the American Society of Photogrammetry and Remote Sensing (ASPRS) standards for mapping at a two-foot contour interval
(See Section 3 of this Survey Report Manual for more information)

Airborne GPS Survey

The third task of this project was to provide three ground base stations on GDACS control points (1BC1, 1BF1 and MDOT) for airborne GPS post-processing purposes. These three setups utilized fixed height tripods and two Trimble 5700 receivers along with one Trimble R8 receiver, all collecting data at 10hz. Coordination regarding the date of flight and requirements for the airborne collection was performed with AeroTech Mapping, Inc. and A Team Professional Associates, Inc. The ground base station data was delivered to A Team Professional Associates, Inc. for post-processing with the aircraft onboard GPS data.
(See Section 4 of this Survey Report Manual for more information)

Surveyors Certification

I, Scott A. Nelson, an Arizona Registered Land Surveyor, hereby certify that this survey was performed under my direct supervision, and that the report and values/coordinates shown herein are true and accurate to the best of my knowledge and belief.

Scott A. Nelson
AZ RLS #21782

S. A. Nelson

REGISTERED LAND SURVEYOR
CERTIFICATE NO
21782
SCOTT A.
NELSON
Date Signed 6-20-13
ARIZONA U.S.A.

EXPIRES 9-30-15

TESTING & CERTIFICATION REPORT – PHOTOGRAMMETRIC MAPPING OF THE OPERATING EXTENTS

CITY OF PHOENIX AVIATION DEPARTMENT

Geographic Information System Implementation Project

Phoenix Sky Harbor International Airport
City of Phoenix, Arizona

August 2008

Prepared by Woolpert, Inc.
4050 East Cotton Center Boulevard
Building 3, Suite 39
Phoenix, Arizona 85040
www.woolpert.com

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
18539
GARY C.
BILOW
Date Signed 08-22-2008
ARIZONA U.S.A.
Expires 03-31-2011

2.4 Analysis and Conclusions

While NSSDA describes a testing method, the actual accuracy threshold for this project was described in the original RFP as ASPRS Class 1. The specified map scale for the operating extents was 1 inch equals 40 feet, or 1:480. The TIN was to support 1 foot contours. While ASPRS no longer publishes map standards, the 1990 ASPRS Accuracy Standards for Large-Scale Maps are included in Appendix 3-D of the NSSDA. This standard sets a Class 1 limiting Root-Mean-Square Error (RMSE) for X and Y coordinates at 0.4 feet for 1:480 scale maps. To meet the Class 1 vertical standard, the limiting RMSE for elevations is one-third the contour interval – in this case 0.33 feet.

RMSE is calculated separately for X, Y and Elevation to determine if the ASPRS Standard has been met. This value is the square root of the sum of the differences between the map-derived coordinate and the test coordinate squared divided by the number of test points. This requires evaluating three equations as follows:

$$RMSE(X)=\sqrt{[\sum(X(mapi)-X(surveyedi)^2/n]}$$
$$RMSE(Y)=\sqrt{[\sum(Y(mapi)-Y(surveyedi)^2/n]}$$
$$RMSE(Z)=\sqrt{[\sum(Z(mapi)-Z(surveyedi)^2/n]}$$

Equation Key: X = East Coordinate, Y = North Coordinate, Z = Elevation, I = observation number (integer between 1 and n) and n = integer number of observations

Woolpert computed the RMSE values for 50 test points as follows:

RMSE(X) = 0.279	Limiting RMSE(X) = 0.400
RMSE(Y) = 0.286	Limiting RMSE(Y) = 0.400
RMSE(Z) = 0.279	Limiting RMSE(Z) = 0.333

The RMSE values for the test points fall below the limiting RMSE values for the 1990 ASPRS Class 1 Standard indicating that the standard has been met. Refer to Appendix F for a spreadsheet of calculations.

The NSSDA requires that accuracies be expressed in ground units at the 95% confidence level. They also use a single number to represent horizontal accuracy. These numbers can be calculated from the RMSE values used to determine the ASPRS classification as follows:

Horizontal Accuracy — Since RMSE(X) ≠ RMSE(Y) and the ratio 0.279/0.286 is between 0.6 and 1.0 (actually 0.98), the NSSDA specifies the following formula be used:

NSSDA Accuracy	~	2.477 * 0.5 * [RMSE(X) + RMSE(Y)]	
		2.477 * 0.5 * [0.279 + 0.286]	= 0.70 foot

Vertical Accuracy

NSSDA Accuracy	=	1.96 * RMSE(Z)	
		1.96 * 0.279	= 0.55 foot

Since Woolpert delivered the photogrammetrically-derived data digitally, there is no map on which to affix a certification and seal. Woolpert offers the following certification which applies to the tested digital map products:

The digital data consisting of map features and a digital terrain model covering the operating extents of Phoenix Sky Harbor International Airport listed in Appendix A, compiled photogrammetrically from aerial photography dated June 12 and June 19, 2006 and April 28, 2007, and delivered to the City of Phoenix, Aviation Department on various dates in 2007, was checked and found to conform to the ASPRS Standard for Class 1 Map Accuracy dated 1990. In addition, the data tested 0.70 foot horizontal accuracy at the 95% confidence level and tested 0.55 foot vertical accuracy at the 95% confidence level as defined in Part 3: National Standards for Spatial Data Accuracy of the FGDC's Geospatial Positioning Accuracy Standards dated 1998.

Registered Land Surveyor
Certificate No. 18539
Gary C. Bilow
Date Signed 03-22-2008
Arizona U.S.A.
Expires 03-31-2011

Gary C. Bilow

Gary C. Bilow, AZ RLS # 18539

Survey Certification Statement

Field survey for additions to the Lower Salt River Floodplain Delineation Study were conducted as follows:

1) 6/17/14 Additional topography taken at Laveen Farms Subdivision on 75th Avenue south of Baseline Road.
2) 6/26/14 Wall observations taken at the Cemex Pit near 55th Avenue and Grove Street.
3) 12/08/14 Additional channel observations taken at Laveen Area Conveyance Channel near Baseline Road.

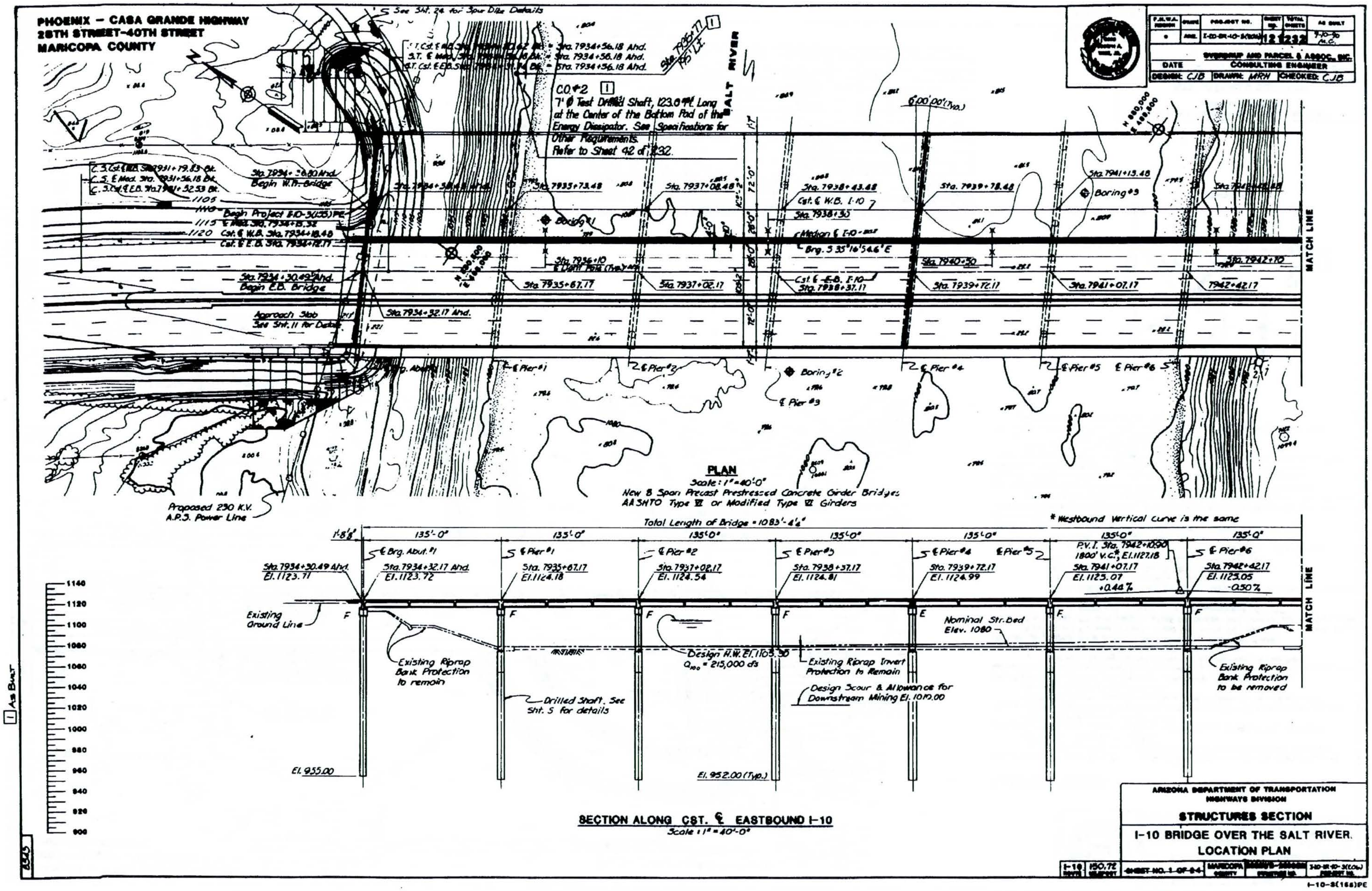
   Survey procedures were performed using a Trimble R8 Rover connected to the AZGPS radio system. Reduction and checking were performed by Trimble Business Center software and results were provided by an excel format spreadsheet. Field accuracy is plus or minus 0.10 at the 95% confidence level. The control used for the work was a portion of the Maricopa County Geodetic Densification and Cadastral Survey (GDACS) control network. Observations were conducted on the NAVD datum of 1988. All coordinates are displayed in NAD 83/92 State Plane Coordinates, Arizona Central Zone.

This survey was conducted under my direct supervision and the information herein is true and correct to the best of my knowledge and belief.

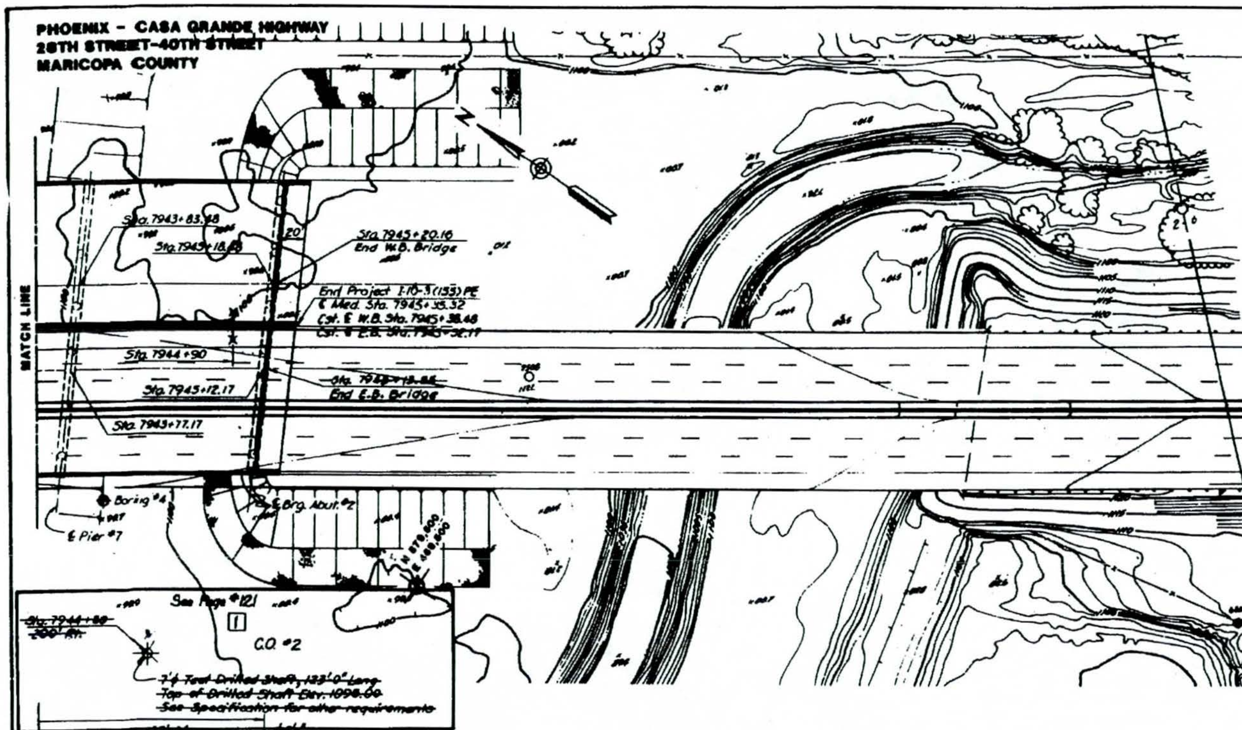
Registered Land Surveyor
CERTIFICATE NO.
25087
JOHN R.
STOCK
Date Signed 12-17-14
ARIZONA, U.S.A.

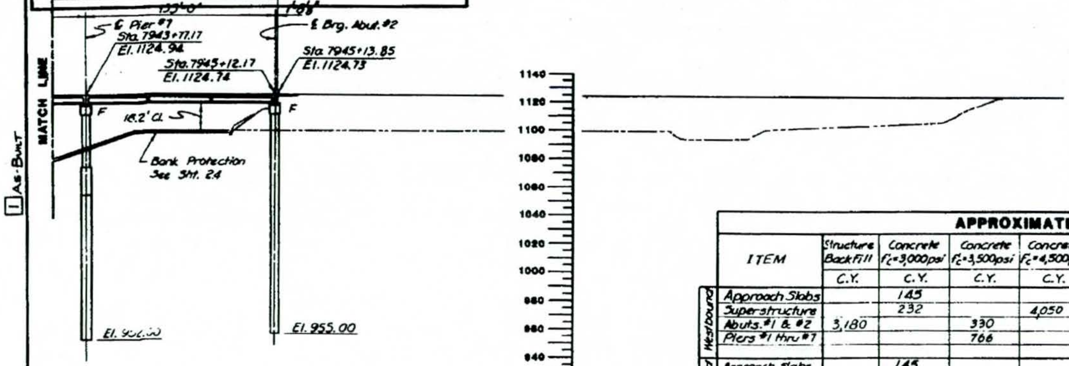
Expires 6/30/2016

Interstate 10 Bridge As-builts


PHOENIX – CASA GRANDE HIGHWAY
28TH STREET–40TH STREET
MARICOPA COUNTY
See Sht. 24 for Spur Dike Details
SALT RIVER
CO.#2
7' ∅ Test Drilled Shaft, 123.0 ft Long at the Center of the Bottom Pad of the Energy Dissipator. See Specifications for Other Requirements.
Refer to Sheet 42 of 232.
Sta. 7934+56.18 Ahd.
Begin W.B. Bridge
Begin Project I-10-3(155)PE
Begin E.B. Bridge
Approach Slab See Sht. 11 for Details
Sta. 7934+30.49 Ahd.
Sta. 7934+32.17 Ahd.
Sta. 7935+73.48
Sta. 7937+08.48
Sta. 7938+43.48
Sta. 7939+78.48
Sta. 7941+13.48
Sta. 7935+67.17
Sta. 7937+02.17
Sta. 7938+37.17
Sta. 7939+72.17
Sta. 7941+07.17
7942+42.17
Sta. 7942+10
Sta. 7940+50
Sta. 7938+35
Sta. 7936+10
Boring #1
Boring #2
Boring #3
Brg. S 35°16'54.6" E
€ Pier #1
€ Pier #2
€ Pier #3
€ Pier #4
€ Pier #5
€ Pier #6
MATCH LINE
PLAN
Scale: 1" = 40'-0"
New 8 Span Precast Prestressed Concrete Girder Bridges
AASHTO Type VI or Modified Type VI Girders
Proposed 230 K.V. A.P.S. Power Line
* Westbound Vertical Curve is the same
Total Length of Bridge = 1083'-4¼"
135'-0"
€ Brg. Abut. #1
Sta. 7934+30.49 Ahd. El. 1123.71
Sta. 7934+32.17 Ahd. El. 1123.72
Sta. 7935+67.17 El. 1124.18
Sta. 7937+02.17 El. 1124.54
Sta. 7938+37.17 El. 1124.81
Sta. 7939+72.17 El. 1124.99
P.V.I. Sta. 7942+10.90 1800' V.C. El. 1127.18
Sta. 7941+07.17 El. 1125.07
+0.46%
Sta. 7942+42.17 El. 1125.05
-0.50%
Existing Ground Line
Existing Riprap Bank Protection to remain
Drilled Shaft. See Sht. 5 for details
Design H.W. El. 1105.30 Q_{100} = 215,000 cfs
Existing Riprap Invert Protection to Remain
Design Scour & Allowance for Downstream Mining El. 1010.00
Nominal Str. bed Elev. 1080
Existing Riprap Bank Protection to be removed
El. 955.00
El. 952.00 (Typ.)
SECTION ALONG CST. € EASTBOUND I-10
Scale: 1" = 40'-0"
AS BUILT
SVERDRUP AND PARCEL & ASSOC. INC.
CONSULTING ENGINEER
DESIGN: CJB
DRAWN: MRH
CHECKED: CJB
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
LOCATION PLAN
SHEET NO. 1 OF 24
MARICOPA
I-10-3(155)PE

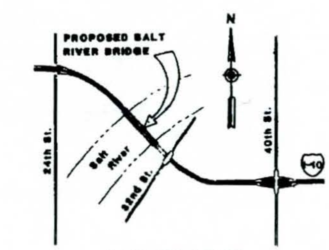
PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY





GENERAL NOTES

Construction – "Standard Specifications for Road and Bridge Construction" by the State of Arizona Department of Transportation, Edition of 1982, revised to date.
Design – "Standard Specifications for Highway Bridges" by AASHTO, 1977 Edition, revised to date.
Dead Load – Dead Load includes allowances for 25 pounds per square foot for future wearing surface and 15 pounds per square foot for stay-in-place steel forms.
Loading Class – HS20-44 and/or Alternate Military Loading.
Composite Design – Dead Load carried by girders only. Live Load, barriers and future wearing surface carried by composite section.
All Concrete shall be Class S unless otherwise noted.
Reinforcing Steel shall conform to ASTM Specification A615.
Bar sizes #6 and smaller shall be Grade 40, unless otherwise noted.
Bar sizes #7 and larger shall be Grade 60, unless otherwise noted.
Stresses
f'_c = 4500 psi Deck Slab, Diaphragms (f_c = 1400)
f'_c = 4000 psi Drilled Shafts and Pier Caps
f'_c = 3500 psi Abutment Caps, Wingwalls & Formed Columns
f'_c = 3000 psi Barriers & Approach Slabs.
f_s = 20,000 psi Grade 40 reinforcing steel.
f_s = 24,000 psi Grade 60 reinforcing steel.
f'_s = 270,000 psi Prestressing steel, ½"⌀ 7 wire strand.
f'_c = See Sheet 14 for girder concrete.
Girders shall be prestressed by the pretensioning method only.
Spans are continuous for Live Load.
All dimensions for reinforcing steel shall be to center to center of bars, unless noted otherwise. Bending diagram dimensions shall be out to out.
All reinforcing bars shall have 2" clear cover unless noted otherwise.
Chamfer all exposed edges of concrete ¾" unless noted otherwise.
Barriers and curbs shall be constructed after slab has been cast.
Slab formwork shall be designed for actual dead load plus a construction load of 50 pounds per square foot.
DO NOT SCALE DRAWINGS. Follow dimensions.
For additional horizontal and vertical geometric information, see Geometric Data Sheet on Project Plans.



LOCATION PLAN

APPROXIMATE QUANTITIES *

	ITEM	Structure BackFill	Concrete f'_c=3,000psi	Concrete f'_c=3,500psi	Concrete f'_c=4,500psi	Reinf. Steel	Drilled Shaft Foundation		AASHTO Type VI Girders	Concrete f'_c=4000psi
		C.Y.	C.Y.	C.Y.	C.Y.	Lbs.	6'⌀ L.F.	7'⌀ L.F.	Ea.	C.Y.
Westbound	Approach Slabs		145			22,980				
	Superstructure		232		4,050	960,030			104	
	Abuts. #1 & #2	3,180		330		50,397	926			
	Piers #1 thru #7			766		673,983		2,583		1,085
Eastbound	Approach Slabs		145			22,980				
	Superstructure		231		4050	960,030			104	
	Abuts. #1 & #2	3,130		330		50,397	926			
	Piers #1 thru #7			766		673,733		2,583		1,085
	TOTALS	6,[illegible]	7[illegible]3	2,192	8,100	3,414,530	1,852	5,289**	208	2,170

* See Proposal Form for Pay Items
** Includes Test Drilled Shaft

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-3(206)	122	232	9-8-90 M.C.

SVERDRUP AND PARCEL & ASSOC., INC.
DATE | CONSULTING ENGINEER
DESIGN: CJB | DRAWN: MRH | CHECKED: CJB

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
LOCATION PLAN

I-10 | 150.72 | SHEET NO. 8 OF 86 | MARICOPA COUNTY | I-10-3R-10-3(206)

AS-BUILT

3545

I-10-3(155)PE

PHOENIX – CASA GRANDE HIGHWAY
28TH STREET–40TH STREET
MARICOPA COUNTY

#1 #2

7635 7636 7637 7638 7639 7640

℄ MED. I-10

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
8	ARIZ.	I-10-3(1-3)-3(?)	123	232	9-10-86 M.C.

SVERDRUP AND PARCEL & ASSOC., INC.
DATE — CONSULTING ENGINEER
DESIGN: DRAWN: MAH CHECKED: C.IB

BORING 1

STATION: 7636 + 10.06
OFFSET: 20.11 FEET LEFT
SURFACE ELEVATION: 1079.0 FEET
DATE(S): 7/18/83 TO 7/19/83

DEPTH IN FEET — BLOWS/FT.* — SAMPLES — SYMBOLS — DESCRIPTION

- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, TRACE OF BOULDERS; PREDOMINATELY MEDIUM TO POORLY GRADED, ROUNDED TO SUB-ROUNDED GRAIN SHAPES
- WATER INJECTED FOR DRILLING PURPOSES BELOW 15 FEET
- GM — MEDIUM BROWN SANDY GRAVEL WITH SILT, SOME COBBLES AND BOULDERS; NO PLASTICITY, MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- CONSIDERABLE WATER RETURN FROM 31 TO 40 FEET
- SP — LIGHT TO MEDIUM BROWN SAND, SOME GRAVEL, TRACE OF SILT, TRACE OF COBBLES; POORLY GRADED, ROUNDED GRAIN SHAPES
- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, TRACE OF BOULDERS; MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES

BORING 1 (cont'd.)

- GP — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE OF SILT, TRACE OF BOULDERS; POORLY GRADED, SUB-ROUNDED TO ROUNDED GRAIN SHAPES
- GRAY WATER RETURN CONTAINING SOME SMALL BLACK CHIPS FROM 65 1/2 TO 67 FEET
- SP — MEDIUM BROWN SAND, TRACE OF SOME GRAVEL; POORLY GRADED, ROUNDED GRAIN SHAPES
- GP — MEDIUM BROWN SANDY GRAVEL, SOME COBBLES, TRACE OF SILT; MEDIUM TO POORLY GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GP/GM — MEDIUM BROWN TO GRAYISH BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, TRACE OF BOULDERS; POORLY GRADED, ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GP — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME BOULDERS, TRACE OF SILT; POORLY GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- SP — DARK BROWN GRAVELLY SAND, TRACE OF SILT; POORLY GRADED, WELL-ROUNDED GRAIN SHAPES
- CONSIDERABLE WATER RETURN FROM 103 1/2 TO 110 1/2 FEET

BORING 1 (cont'd.)

- GP — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME BOULDERS, TRACE OF SILT; POORLY GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME SILT; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- DRILL BIT POSSIBLY CLOGGED FROM 122 TO 124 FEET
- GP — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME BOULDERS, TRACE OF SILT; POORLY GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- INCREASED PERCENTAGE OF COBBLES AND BOULDERS LIKELY FROM 135 TO 138 FEET
- GP/SP — LIGHT TO MEDIUM BROWN SAND AND GRAVEL, SOME COBBLES, TRACE OF CLAY; POOR TO MEDIUM GRADED, ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- SP — MEDIUM BROWN GRAVELLY SAND, TRACE OF SILT; POOR TO MEDIUM GRADED, ROUNDED GRAIN SHAPES
- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, TRACE OF BOULDERS; PREDOMINATELY MEDIUM TO POORLY GRADED, ROUNDED TO SUB-ROUNDED GRAIN SHAPES

BORING TERMINATED AT 157 FEET ON 7/19/83.
GROUNDWATER LEVEL AT APPROXIMATELY 15 FEET BELOW GROUND SURFACE FOLLOWING REMOVAL OF DRILL PIPE.
*PARENTHESES DENOTE BLOW COUNTS OBTAINED FOR HAMMER ENERGIES LESS THAN 8000 FOOT-POUNDS PER BLOW.
"X" DENOTES UNAVAILABLE DATA.

BORING 2

STATION: 7636 + 50.56
OFFSET: 125.86 FEET RIGHT
SURFACE ELEVATION: 1079.0 FEET
DATE(S): 7/19/83 TO 7/20/83

DEPTH IN FEET — BLOWS/FT.* — SAMPLES — SYMBOLS — DESCRIPTION

- GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, SOME BOULDERS NEAR SURFACE; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GW/GC — MEDIUM BROWN SANDY GRAVEL, SOME COBBLES, SOME CLAY, TRACE OF BOULDERS; MEDIUM TO WELL GRADED, ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- WATER INJECTED FOR DRILLING PURPOSES BELOW 39 FEET
- INCREASED PERCENTAGE OF COBBLES BELOW 39 FEET
- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE OF BOULDERS; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES

BORING 2 (cont'd.)

DEPTH IN FEET	BLOWS/FT.*
80–85	55, 72, 53, 93, 71
85–90	65, 84, 87, 38, 64
90–95	75, 77, 80, 52, 56
95–100	71, 94, 102, 96, 53
100–105	171, 136, 110, 125, 95
105–110	120, 200, 111, 115, 129
110–115	116, 63, 95, 141, 63
115–120	78, 134, 112, 96, 45
120–125	49, 53, 75, 86, 56
125–130	204, 433, 204, 316, 220
130–135	194, 90, 101, 23, 39
135–140	49, 75, 62, 92, 52
140–145	47, 33, X, 62, 87
145–150	260, 160, 150, 239, 152

- GP/GC — MEDIUM BROWN SANDY GRAVEL, SOME COBBLES, SOME CLAY, TRACE OF BOULDERS; MEDIUM TO WELL GRADED, ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- DECREASED PERCENTAGE OF COBBLES AND BOULDERS BELOW 90 FEET
- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE OF BOULDERS; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GW/GC — MEDIUM BROWN SANDY GRAVEL, SOME COBBLES, SOME CLAY, TRACE OF BOULDERS; MEDIUM TO WELL GRADED, ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GP/GM — MEDIUM BROWN SANDY GRAVEL, SOME SILT, TRACE OF COBBLES, TRACE OF BOULDERS; MEDIUM GRADED, ROUNDED GRAIN SHAPES
- BLACKISH BROWN WATER RETURN FROM 112 TO 113 FEET
- INCREASED PERCENTAGE OF SAND BELOW 118 1/2 FEET
- DECREASED PERCENTAGE OF SILT AND INCREASED PERCENTAGES OF COBBLES AND BOULDERS BELOW 125 FEET
- GP — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE OF BOULDERS, TRACE OF SILT; POORLY GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- SP — MEDIUM BROWN SAND, TRACE OF GRAVEL, TRACE OF SILT; POORLY GRADED, WELL-ROUNDED GRAIN SHAPES
- INCREASED PERCENTAGE OF GRAVEL BELOW 137 FEET
- GW/GC — MEDIUM BROWN SANDY GRAVEL, SOME COBBLES, SOME CLAY; MEDIUM PLASTICITY, MEDIUM TO WELL GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
- GP/GM — MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME BOULDERS, SOME SILT; MEDIUM GRADED, ROUNDED GRAIN SHAPES

BORING TERMINATED AT 150 FEET ON 7/20/83.
GROUNDWATER LEVEL AT APPROXIMATELY 15 FEET BELOW GROUND SURFACE FOLLOWING REMOVAL OF DRILL PIPE.
*PARENTHESES DENOTE BLOW COUNTS OBTAINED FOR HAMMER ENERGIES LESS THAN 8000 FOOT-POUNDS PER BLOW.
"X" DENOTES UNAVAILABLE DATA.

LEGEND OF SOIL SYMBOLS

GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES

NOTES

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Information is developed as accurately as possible by the methods utilized, however, the State accepts no responsibility for any conditions encountered which may be at variance from information contained herein.

The absence of a ground water indication does not constitute a representation that the ground water will not be present during construction. Ground water is indicated herein only when found during the foundation investigation and represents that condition only on the date of the investigation.

Classification of materials is in accordance with AASHTO "Manual on Foundation Investigations" and is based upon field inspection and is not to be construed to imply mechanical analysis.

Penetration of the soils depicted on these sheets was accomplished by the Becker Hammer Drill procedure. This procedure advances a double wall drive pipe with a Link-Belt diesel pile hammer rated at 8000 ft-lbs per blow. Pipe diameter is 6 5/8" O.D., 4 7/8" I.D. Air is blown down the annulus between the pipe walls and is returned up the center with the cuttings. Cuttings were continuously logged; blow counts per foot were recorded and bulk samples were obtained.

BC4:

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
BORING LOGS

I-10 ROUTE	150.72 MILEPOST	~~SHEET NO. 8 OF 24~~	MARICOPA COUNTY	STRUCTURE NO.	I-10-I(?) PROJECT NO.

I-10-3(165)PE

PHOENIX – CASA GRANDE HIGHWAY
28TH STREET–40TH STREET
MARICOPA COUNTY

7840 7841 7842 7843 7844

℄ MED. I-10

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	[illegible]	124	232	9-10-90 P.I.C.

SVERDRUP AND PARCEL & ASSOC., INC.
DATE CONSULTING ENGINEER
DESIGN: DRAWN: MPH CHECKED: CJE

BORING 3

STATION: 7041 + 42.30
OFFSET: 45.65 FEET LEFT
SURFACE ELEVATION: 1000.3 FEET
DATE(S): 7/14/83 TO 7/16/83

Blows/ft.* (0–55 ft): X, X, (16), (25), (23), (24), X, (30), 112, 140, 100, 177, 210, 83, 125, 98, 102, 60, 52, 76, 110, 65, 54, 110, 143, 100, 75, 80, 60, 83, 101, 100, 183, 120, 110, 75, 81, 88, 93, 88, 102, 150, 75, 140, 75, 100, X, 75, 85, 98, 77, 78, 100, 111, 97

SYMBOLS	DESCRIPTION
GM	LIGHT BROWN SANDY GRAVEL, SOME SILT, TRACE TO SOME GRAVEL AND COBBLES; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
	WATER INJECTED FOR DRILLING PURPOSES BELOW 12 1/2 FEET
GP/GM-GC	MEDIUM BROWN SANDY GRAVEL WITH COBBLES, SOME SILT AND CLAY, TRACE OF BOULDERS; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
GP	LIGHT TO MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE OF BOULDERS, TRACE OF SILT AND CLAY; POOR TO MEDIUM GRADED, SUB-ROUNDED TO ROUNDED GRAIN SHAPES
	INCREASED PERCENTAGE OF BOULDERS BELOW 54 FEET

BORING 3 (cont'd.)

Blows/ft.* (55–110 ft): 143, 130, 132, 138, 138, 103, 140, 105, 138, 133, 180, 146, 148, 140, 188, 138, 105, 105, 108, 93, 76, 102, 176, X, 112, 92, 120, 83, 221, 228, 178, 188, 130, 111, 175, 205, 175, 215, 247, 103, 192, X, 207, 243, 187, 318, 210, 98, 147, 172, 200, 130, 138, 138, 322

SYMBOLS	DESCRIPTION
	INCREASED PERCENTAGE OF SAND BELOW 70 FEET
GW	MEDIUM BROWN TO DARK BROWN SANDY GRAVEL, SOME COBBLES, TRACE OF BOULDERS, TRACE OF SILT; MEDIUM TO WELL GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
	CONSIDERABLE WATER RETURN BELOW 97 FEET

BORING 3 (cont'd.)

Blows/ft.* (110–153 ft): 205, X, X, 908, 720, 290, 683, 333, 287, 1354, 772, 228, 255, 362, 628, 988, 910, 904, 837, 795, 762, 312, 678, 888, 568, 407, 157, 330, 436, 140, 348, 413, 138, 361, 301, 318, 70, 68, 46, 38, 38, 150, 582

SYMBOLS	DESCRIPTION
	INCREASED COBBLES AND BOULDERS BELOW 112 FEET LIKELY
SP	LIGHT TO MEDIUM BROWN GRAVELLY SAND; POORLY GRADED, ROUNDED GRAIN SHAPES
GW	MEDIUM BROWN TO DARK BROWN SANDY GRAVEL, SOME COBBLES, TRACE OF BOULDERS, TRACE OF SILT; MEDIUM TO WELL GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
	REDDISH BROWN WATER RETURN FROM 126 TO 126 1/2 FEET
	DECREASED PERCENTAGE OF COBBLES AND BOULDERS BELOW 134 FEET
CL	DARK BROWN SANDY CLAY; MEDIUM PLASTICITY, POORLY GRADED, ROUNDED GRAIN SHAPES
GW/GC	MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE TO SOME CLAY, TRACE OF BOULDERS; MEDIUM PLASTICITY, MODERATELY WELL GRADED, ROUNDED GRAIN SHAPES
SP	MEDIUM BROWN SAND, SOME GRAVEL, TRACE OF CLAY; MEDIUM GRADED, WELL-ROUNDED GRAIN SHAPES
GP	MEDIUM TO LIGHT BROWN SANDY GRAVEL, TRACE OF COBBLES; POORLY GRADED, SUB-ROUNDED TO ROUNDED GRAIN SHAPES

BORING TERMINATED AT 153 FEET ON 7/16/83.
HOLE CAVED DURING REMOVAL OF DRILL PIPE; HOWEVER, GROUNDWATER LEVEL EXPECTED AT APPROXIMATELY 16 FEET BELOW GROUND SURFACE.
*PARENTHESES DENOTE BLOW COUNTS OBTAINED FOR HAMMER ENERGIES LESS THAN 8000 FOOT-POUNDS PER BLOW.
"X" DENOTES UNAVAILABLE DATA.

BORING 4

STATION: 7043 + 80.30
OFFSET: 121.57 FEET RIGHT
SURFACE ELEVATION: 1000.7 FEET
DATE(S): 7/12/83 TO 7/14/83

Blows/ft.* (0–80 ft): (56), (76), (94), (108), (78), (91), (45), 46, 50, 66, 83, 59, 38, 42, 63, 39, 112, 80, 51, 60, 62, 103, 104, 67, 34, 32, 38, 42, 46, 38, 49, 40, 75, 100, 104, 56, 61, 85, 86, 82, 102, 112, 52, 80, 88, 86, 101, 105, 121, 142, 111, 106, 103, 155, 126, 191, 199, 212, 246, 266, 154, 270, 272, 156, 202, X, X, 172, 240, 182, 202, 182, 180, 283, 104, 83, 93, 120, 262, 203

SYMBOLS	DESCRIPTION
GP/GM	MEDIUM BROWN SANDY GRAVEL, SOME COBBLES, TRACE OF BOULDERS; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES WATER INJECTED FOR DRILLING PURPOSES BELOW SURFACE
	INCREASED PERCENTAGE OF SAND BELOW 25 FEET
GW/GC	BROWN TO DARK BROWN SANDY GRAVEL, SOME COBBLES, SOME SILT AND CLAY; MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES
GP	BROWN TO DARK BROWN SANDY GRAVEL WITH COBBLES, TRACE OF BOULDERS; POOR TO MEDIUM GRADED, SUB-ROUNDED TO WELL-ROUNDED GRAIN SHAPES

BORING 4 (cont'd.)

Blows/ft.* (80–136 1/2 ft): 233, 250, 248, 403, 700, 468, 166, 138, 138, 201, 175, 104, 177, 183, 180, 273, 250, 175, 183, 210, 130, 165, 187, 325, 262, 170, 201, 221, 220, 200, 206, 228, 455, 435, 295, 210, 233, 380, 550, 283, 200, 170, 146, 216, 281, 360, 530, 167, 175, 505, 800, 465, 412, 302, 966, 1700, Y

SYMBOLS	DESCRIPTION
GP/GM	MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE TO SOME BOULDERS, TRACE TO SOME SILT; MEDIUM GRADED, SUB-ROUNDED TO ROUNDED GRAIN SHAPES
	INCREASED PERCENTAGE OF BOULDERS AT 84 FEET
GM	GRAVEL AND SAND, SOME SILT, SOME COBBLES; MEDIUM GRADED, ROUNDED GRAIN SHAPES INCREASED WATER RETURN FROM 91 1/2 TO 95 FEET
GP/GM	MEDIUM BROWN SANDY GRAVEL WITH COBBLES, TRACE TO SOME BOULDERS, TRACE TO SOME SILT; MEDIUM GRADED, SUB-ROUNDED TO ROUNDED GRAIN SHAPES
GM	GRAVEL AND SAND, SOME SILT, SOME COBBLES; MEDIUM GRADED, ROUNDED GRAIN SHAPES
GW	BROWN GRAVEL WITH SAND AND COBBLES, TRACE OF BOULDERS, TRACE OF SILT; MODERATELY WELL GRADED, ROUNDED GRAIN SHAPES
GM	GRAVEL AND SAND, SOME SILT, SOME COBBLES; MEDIUM GRADED, ROUNDED GRAIN SHAPES
GW/GM	BROWN TO DARK BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, TRACE OF BOULDERS; MODERATELY WELL GRADED, ROUNDED GRAIN SHAPES
GW	BROWN GRAVEL WITH SAND AND COBBLES, TRACE OF BOULDERS, TRACE OF SILT; MODERATELY WELL GRADED, ROUNDED GRAIN SHAPES
GW/SM	BROWN TO DARK BROWN SANDY GRAVEL WITH COBBLES, SOME SILT, TRACE OF BOULDERS; MODERATELY WELL GRADED, ROUNDED GRAIN SHAPES

BORING TERMINATED UPON REFUSAL TO PENETRATION AT 136 1/2 FEET ON 7/14/83.
HOLE CAVED DURING REMOVAL OF DRILL PIPE, GROUNDWATER LEVEL NOT DETERMINED.

*PARENTHESES DENOTE BLOW COUNTS OBTAINED FOR HAMMER ENERGIES LESS THAN 8000 FOOT-POUNDS PER BLOW.
"X" DENOTES UNAVAILABLE DATA.
"Y" DENOTES 860 BLOWS FROM 136 TO 136 1/2 FEET, DRILL PIPE WAS THEN PULLED AND REDRIVEN TO REFUSAL AT 136 1/3 FEET.

LEGEND OF SOIL SYMBOLS

GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SM	SILTY SANDS, SAND-SILT MIXTURES
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS

NOTES

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Penetration of the soils depicted on these sheets was accomplished by the Becker Hammer Drill procedure. This procedure advances a double wall drive pipe with a Link-Belt diesel pile hammer rated at 8000 ft-lbs per blow. Pipe diameter is 6 5/8" O.D., 4 7/8" I.D. Air is blown down the annulus between the pipe walls and is returned up the center with the cuttings. Cuttings were continuously logged; blow counts per foot were recorded and bulk samples were obtained.

3543

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

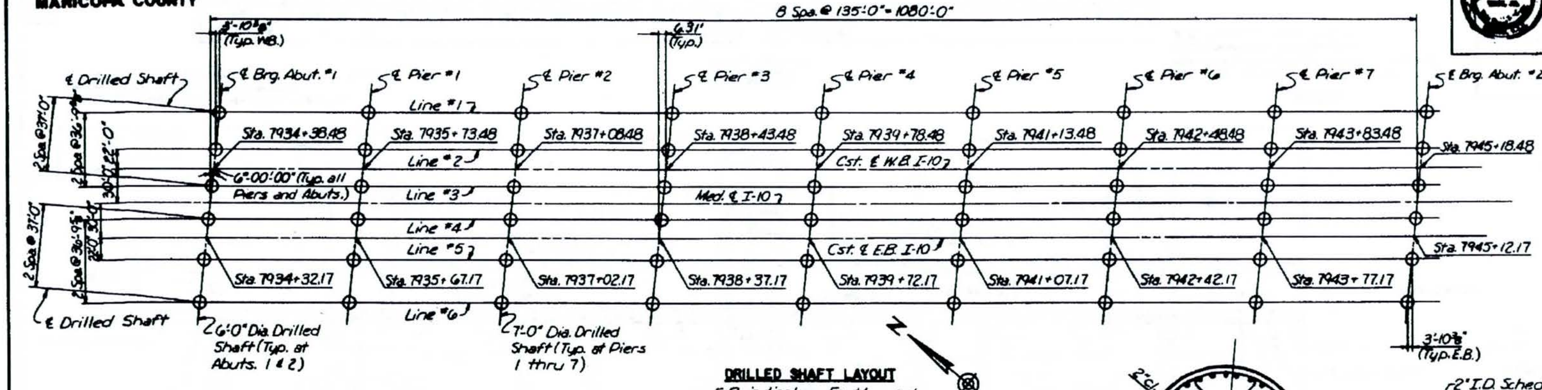
STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
BORING LOGS

I-10 ROUTE	152.72 MILEPOST	~~SHEET NO. 4 OF 24~~	MARICOPA COUNTY	~~2002WB-2002EB~~ STRUCTURE NO.	I-10-3R-[illegible] PROJECT NO.

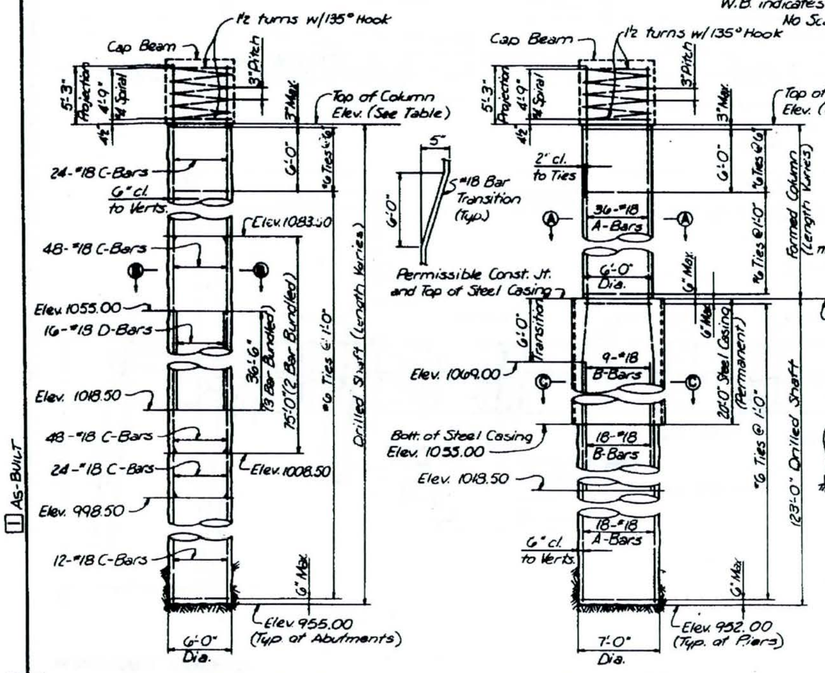
I-10-3(155)PE

PHOENIX – CASA GRANDE HIGHWAY
28TH STREET–40TH STREET
MARICOPA COUNTY



DRILLED SHAFT LAYOUT
E.B. indicates Eastbound.
W.B. indicates Westbound.
No Scale

TOP OF COLUMN ELEVATIONS		
LOCATION	DRILLED SHAFT LINE NO. 1,2,3	4,5,6
Abutment #1	1108.83	1108.75
Pier #1	1109.28	1109.22
Pier #2	1109.64	1109.59
Pier #3	1109.90	1109.87
Pier #4	1109.82	1109.80
Pier #5	1110.14	1110.13
Pier #6	1110.11	1110.12
Pier #7	1109.99	1110.02
Abutment #2	1109.78	1109.82



DRILLED SHAFT ELEVATION – ABUTMENTS 1 AND 2
No Scale

DRILLED SHAFT ELEVATION – PIERS 1 THRU 7
No Scale

Top of Column Elev. (See Table)

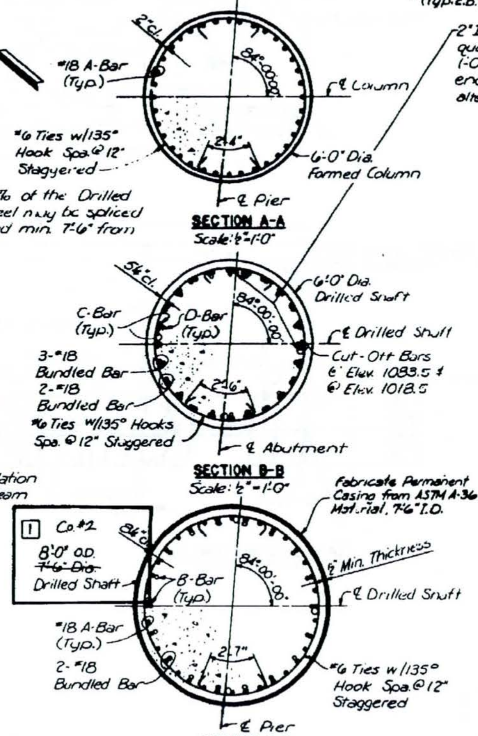
Note: No more than 50% of the Drilled Shaft Reinforcing Steel may be spliced at any section located min. 7'-6" from Cut-Off Elevations.

Approx. Channel Elev. 1080.00

Top of Drilled Shaft Elev. 1075.00 (Typ. at Piers 1 thru 7)

Design Scour & Degradation Allowance for Downstream Mining Elev. 1010.00

CUT-OFF ELEVATIONS	
NO. & SIZE	B-BAR
9-#18	1069.00
9-#18	1053.50
18-#18	1018.50
NO. & SIZE	A-BAR
18-#18	992.50



SECTION A-A
Scale: ½" = 1'-0"

SECTION B-B
Scale: ½" = 1'-0"

SECTION C-C
Scale: ½" = 1'-0"

2" I.D. Sched. 40 Electrical Conduit (placed in quadrants as shown) from bottom of cage to 1'-0" above top of drilled shaft with glued cap bottom end, threaded cap top end, securely attached to alternate ties. (Typ. for all drilled shafts.)

FOUNDATION NOTES

Drilled Shafts shall be cast-in-place concrete, 28-day strength = 4000 psi.

Excavation of Drilled Shafts in any Pier or Abutment will not be permitted until 48 hrs. after the adjacent Drilled Shaft has been concreted.

Any construction joint not shown on the project plans will require the approval of the Engineer prior to construction.

Tops of Drilled Shafts shall be within 3" of plan locations. Drilled Shafts below Steel Casing shall not deviate more than 1" in 10 ft. from plumb.

Reinforcing steel shall conform to ASTM A 615. All drilled shaft reinforcing shall be grade 60.

Contractor shall be responsible for providing support of reinforcing cages during fabrication, erection and placement of concrete. Plans showing reinforcing cage support and methods of erection shall be submitted to the Engineer for review and approval prior to construction. Splices of #18 bars shall be made of full welded or full mechanical connections. A full welded or full mechanical connection shall develop not less than 125 percent of the specified yield strength (fy) of the bar.
Installation shall be in accordance with Manufacturer's Recommendations.

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DESIGN: C.W. DRAWN: L.A.M. CHECKED: C.W.

1 AS-BUILT

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
FOOTING LAYOUT

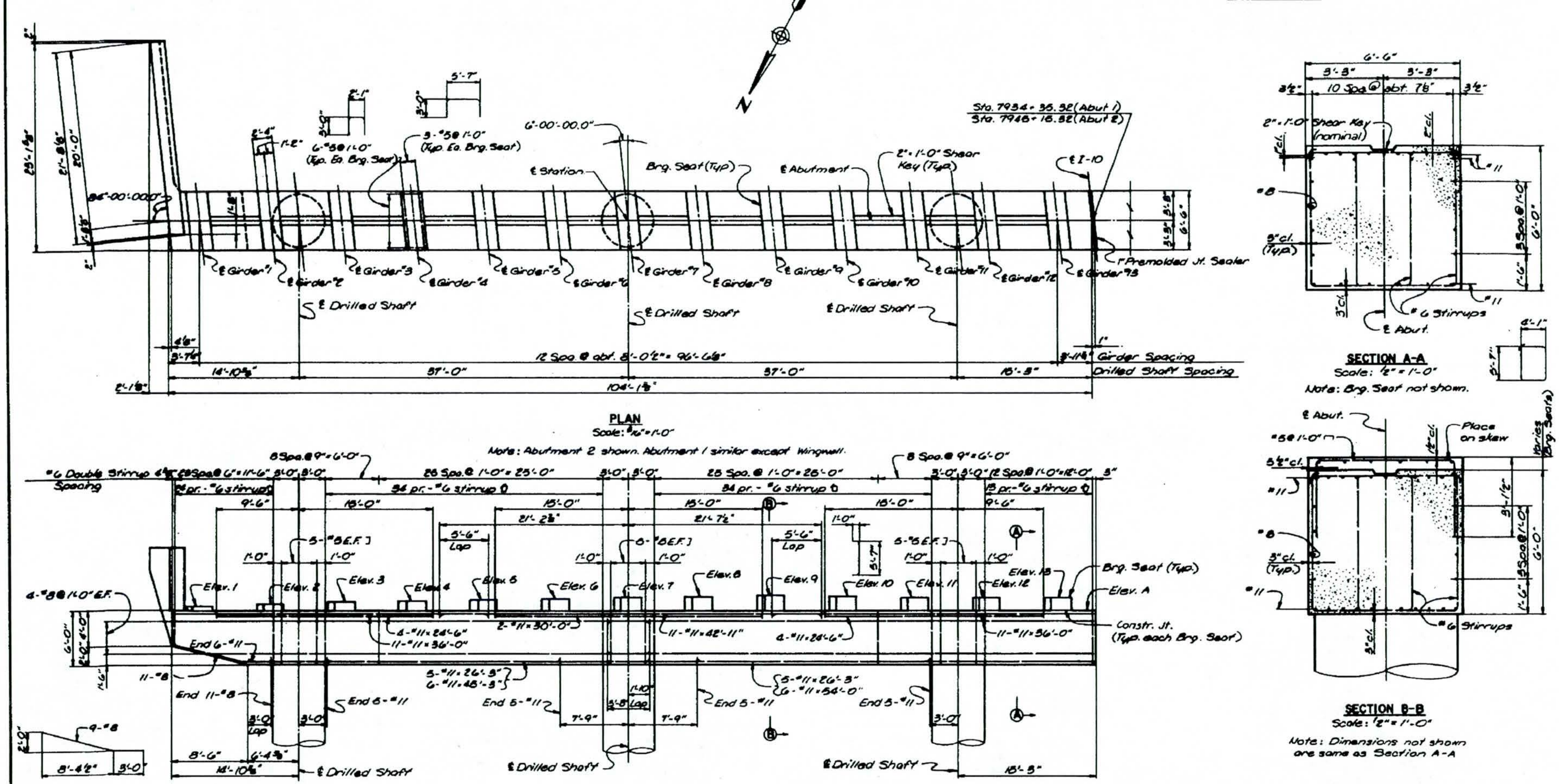
I-10-3(155) PE

PHOENIX — CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
6	ARIZ.	I-10-3R-10-3(206)	126	232	7-10-90 M.C.

DATE | SVERDRUP AND PARCEL & ASSOC., INC. CONSULTING ENGINEER

DESIGN: C.W. | DRAWN: SGK | CHECKED: C.W.



Note: Adjust cap beam reinforcement as required to clear drilled shaft reinforcement. (See Footing Layout, Sheet 5.)

ELEVATION
Scale: 3/16" = 1'-0"

NOTES

For Wingwall details, see Sheet 8.
For Drilled Shaft details, see Sheet 5.
W.B. indicates Westbound.
E.F. indicates Each Face.

ABUTMENT NO.	℄ STATION	ABUTMENT ELEVATIONS													
		ELEV. A	ELEV. 1	ELEV. 2	ELEV. 3	ELEV. 4	ELEV. 5	ELEV. 6	ELEV. 7	ELEV. 8	ELEV. 9	ELEV. 10	ELEV. 11	ELEV. 12	ELEV. 13
1	7934+40.79	1114.85	1115.17	1115.48	1115.68	1115.84	1115.99	1116.15	1116.31	1116.46	1116.62	1116.70	1116.58	1116.37	1116.21
2	7946+20.79	1115.78	1116.11	1116.43	1116.63	1116.80	1116.96	1117.12	1117.28	1117.44	1117.60	1117.69	1117.53	1117.37	1117.21

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
W.B. ABUTMENT

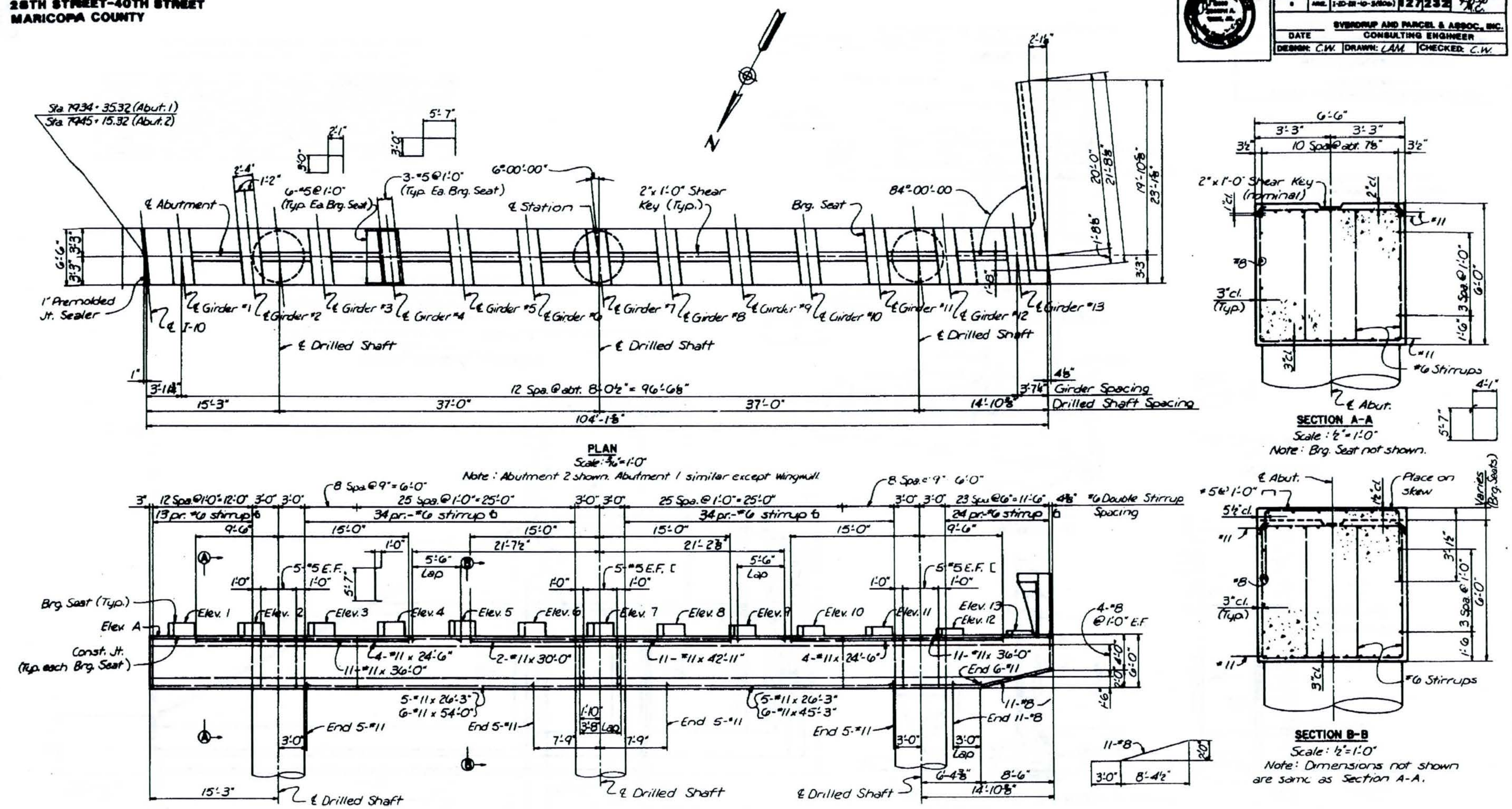
SHEET NO. 6 OF 34	I-10 ROUTE	150.72 MILE POST	MARICOPA COUNTY	STRUCTURE NO.	I-10-3R-10-3(206) PROJECT NO.

I-10-3(155) PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-3(206)	127	232	

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DATE
DESIGN: C.W. DRAWN: L.A.M. CHECKED: C.W.



Note: Adjust cap beam reinforcement as required to clear drilled shaft reinforcement. (See Footing Layout, Sheet 5.)

ABUTMENT NO.	℄ STATION	ABUTMENT ELEVATIONS													
		ELEV. A	ELEV. 1	ELEV. 2	ELEV. 3	ELEV. 4	ELEV. 5	ELEV. 6	ELEV. 7	ELEV. 8	ELEV. 9	ELEV. 10	ELEV. 11	ELEV. 12	ELEV. 13
1	7934+29.86	1114.75	1116.21	1116.36	1116.52	1116.68	1116.59	1116.43	1116.27	1116.10	1115.94	1115.78	1115.61	1115.41	1115.09
2	7945+09.86	1115.82	1117.21	1117.37	1117.54	1117.70	1117.62	1117.46	1117.30	1117.14	1116.99	1116.83	1116.67	1116.47	1116.15

NOTES

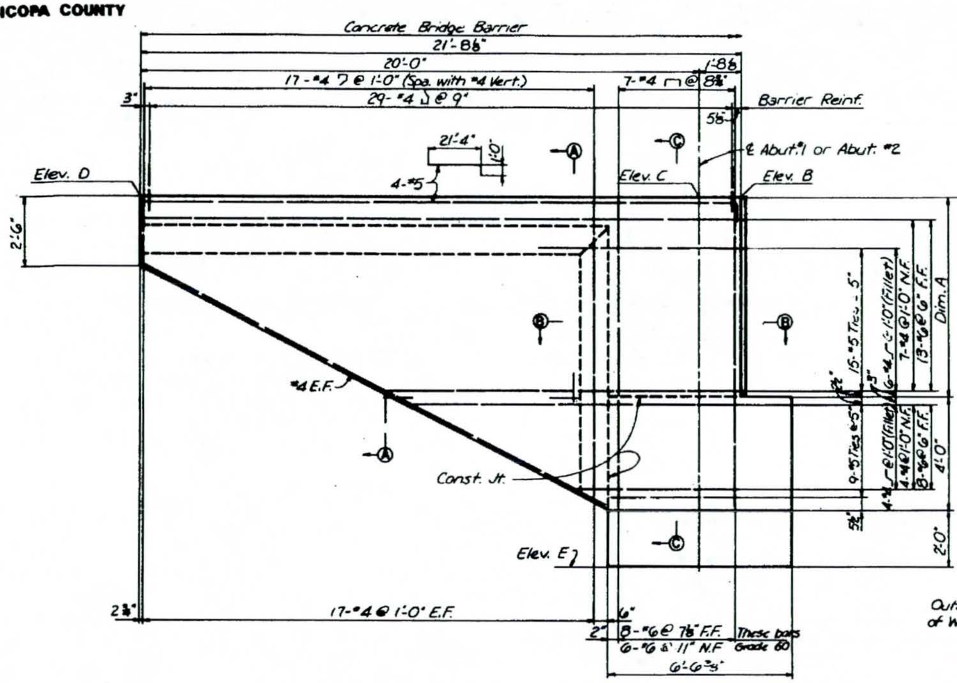
For Wingwall details, see Sheet 8.
For Drilled Shaft details, see Sheet 5.
E.B. indicates Eastbound.
E.F. indicates Each Face.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
E.B. ABUTMENT

I-10 ROUTE | 150.7E MILEPOST | SHEET NO. 7 OF 24 | MARICOPA COUNTY | STRUCTURE NO. | I-10-3(206) PROJECT NO.
I-10-3(155) PE

8545 85330

PHOENIX – CASA GRANDE HIGHWAY
26TH STREET–40TH STREET
MARICOPA COUNTY



TYPICAL WINGWALL ELEVATION

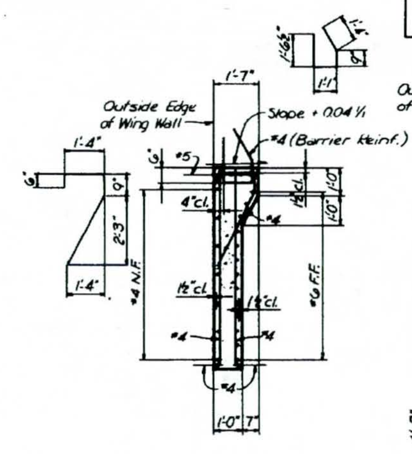
Scale: 1/2" = 1'-0"

Northwest wing wall of Abut. 1 E.B. & southeast wingwall of Abut. 2 W.B. shown; Northeast wingwall of Abut. 1 W.B. & southwest wingwall of Abut. 2 E.B. similar.

Note: Longitudinal dimensions shown parallel to Const. ℄ I-10.

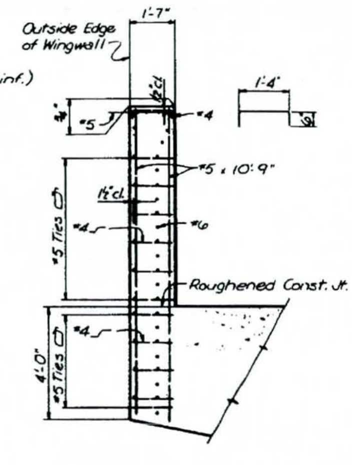
ABUTMENT NO.	WINGWALL LOCATION	DIM. A.	ELEVATIONS			
			B	C	D	E
1 E.B.	Northwest	7'-2 3/8"	1121.95	1121.94	1121.87	1108.75
1 W.B.	Northeast	7'-2 3/8"	1122.03	1122.02	1121.95	1108.83
2 E.B.	Southwest	7'-2 3/8"	1123.01	1123.01	1122.97	1104.82
2 W.B.	Southeast	7'-2 1/4"	1122.97	1122.97	1122.93	1109.78

Note: Dimensions and Elevations are measured at outside edge of wingwall.



SECTION A-A

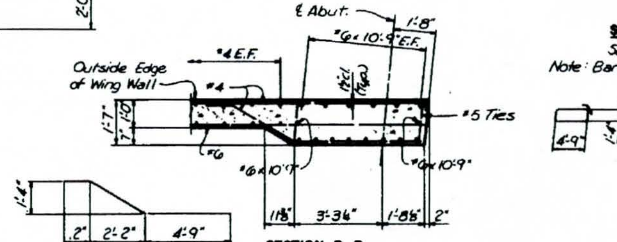
Scale: 1/2" = 1'-0"



SECTION C-C

Scale: 1/2" = 1'-0"

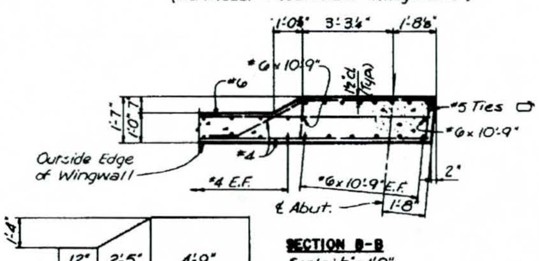
Note: Barrier Reinf. not shown



SECTION B-B

Scale: 1/2" = 1'-0"

(Northeast & Southwest Wingwalls)



SECTION B-B

Scale: 1/2" = 1'-0"

(Northwest & Southeast Wingwalls)

NOTES

E.F. indicates each face.
N.F. indicates near face.
F.F. indicates far face.

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER

DESIGN: C.W. | DRAWN: L.A.M. | CHECKED: C.W.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

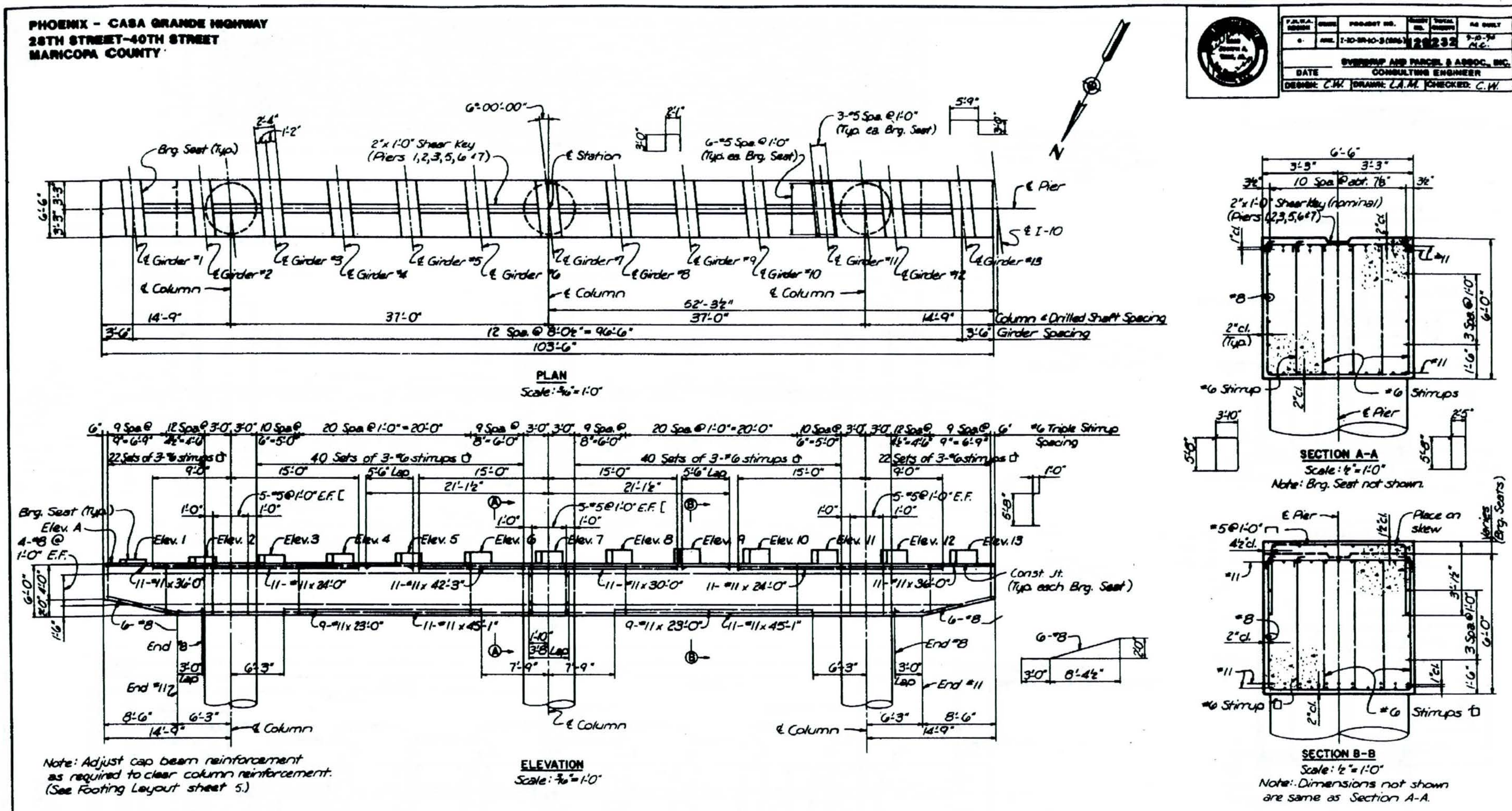
STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
ABUTMENT DETAILS

I-10 | 150.72 | MARICOPA | I-10-3(206)

1-10-3(155) PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY



PLAN
Scale: 3/16" = 1'-0"

ELEVATION
Scale: 3/16" = 1'-0"

Note: Adjust cap beam reinforcement as required to clear column reinforcement. (See Footing Layout sheet 5.)

SECTION A-A
Scale: ½" = 1'-0"
Note: Brg. Seat not shown.

SECTION B-B
Scale: ½" = 1'-0"
Note: Dimensions not shown are same as Section A-A.

NOTES
For Column details, see Sheet 5.
E.B. indicates Eastbound.
E.F. indicates Each Face.

PIER NO.	℄ STATION	PIER ELEVATIONS													
		ELEV. A	ELEV. 1	ELEV. 2	ELEV. 3	ELEV. 4	ELEV. 5	ELEV. 6	ELEV. 7	ELEV. 8	ELEV. 9	ELEV. 10	ELEV. 11	ELEV. 12	ELEV. 13
1	7935+75.79	1115.28	1115.62	1115.98	1116.13	1116.29	1116.45	1116.60	1116.76	1116.92	1117.08	1117.15	1116.99	1116.83	1116.67
2	7937+10.79	1115.64	1115.97	1116.29	1116.49	1116.65	1116.81	1116.96	1117.12	1117.28	1117.44	1117.52	1117.35	1117.19	1117.03
3	7938+45.79	1115.90	1116.23	1116.55	1116.75	1116.91	1117.07	1117.23	1117.39	1117.55	1117.70	1117.78	1117.62	1117.46	1117.30
4	7939+80.79	1115.82	1116.15	1116.47	1116.67	1116.83	1116.99	1117.15	1117.31	1117.47	1117.62	1117.70	1117.54	1117.38	1117.22
5	7941+15.79	1116.14	1116.47	1116.79	1116.99	1117.15	1117.31	1117.47	1117.63	1117.79	1117.95	1118.03	1117.87	1117.71	1117.55
6	7942+60.79	1116.11	1116.45	1116.77	1116.97	1117.13	1117.29	1117.45	1117.61	1117.77	1117.93	1118.01	1117.85	1117.69	1117.53
7	7943+85.79	1115.99	1116.33	1116.65	1116.85	1117.01	1117.17	1117.33	1117.49	1117.65	1117.81	1117.90	1117.74	1117.58	1117.42

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DESIGN: C.W. DRAWN: L.A.M. CHECKED: C.W.

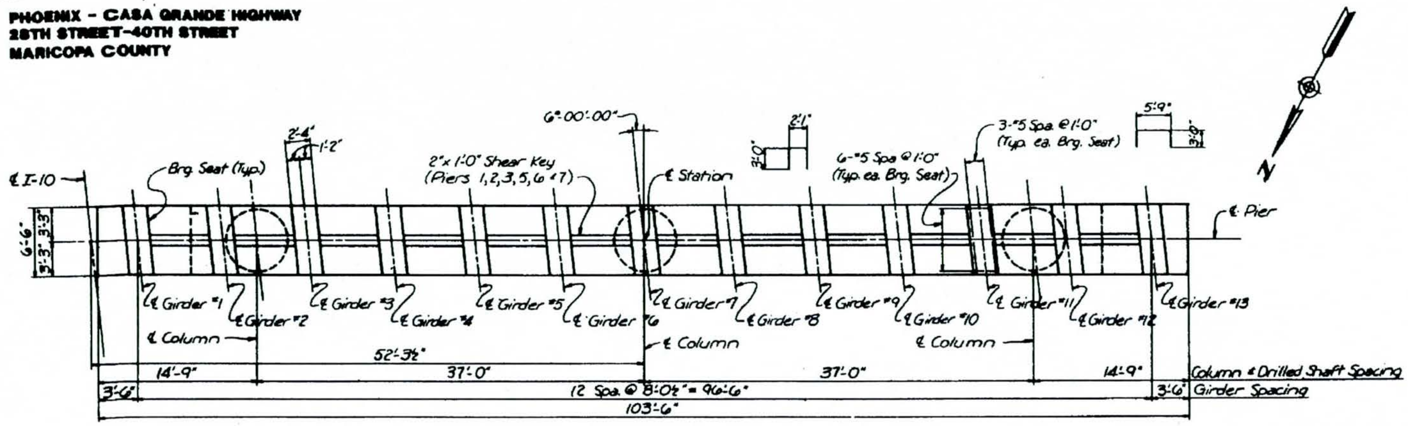
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
W.B. PIERS 1 THRU 7

I-10-3(155)PE

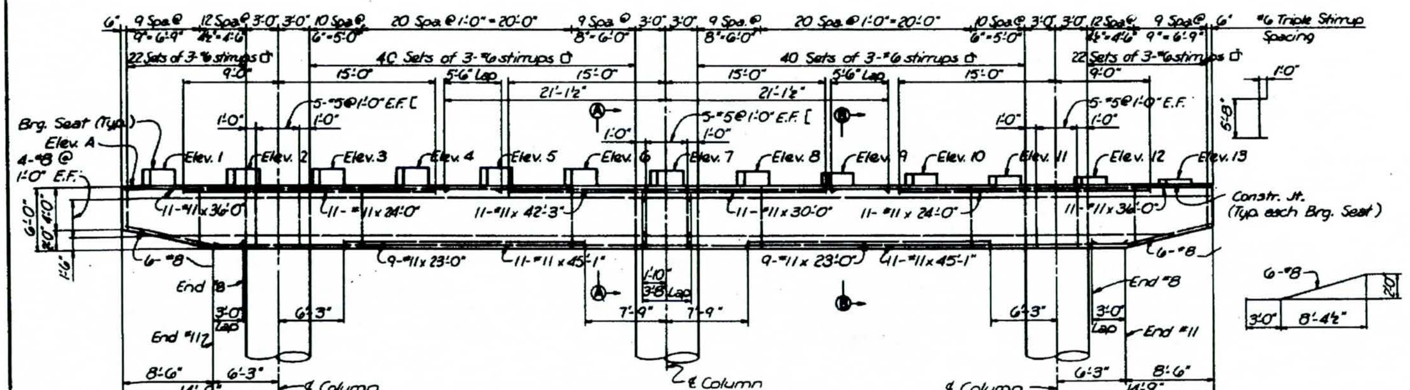
PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
8	ARIZ.	I-10-3(206)	130	232	9-10-90 M.C.

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DATE
DESIGN: C.W. DRAWN: L.A.M. CHECKED: C.W.

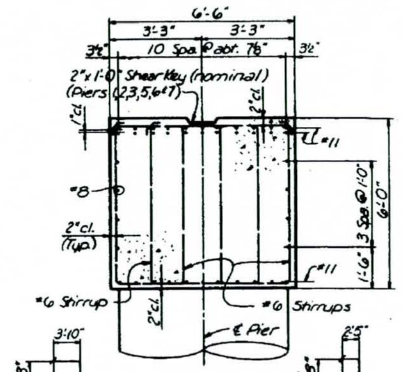


PLAN
Scale: 3/16" = 1'-0"

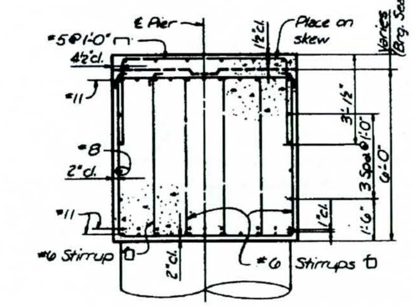


Note: Adjust cap beam reinforcement as required to clear column reinforcement. (See Footing Layout sheet 5.)

ELEVATION
Scale: 3/16" = 1'-0"



SECTION A-A
Scale: ½" = 1'-0"
Note: Brg. Seat not shown.



SECTION B-B
Scale: ½" = 1'-0"
Note: Dimensions not shown are same as Section A-A.

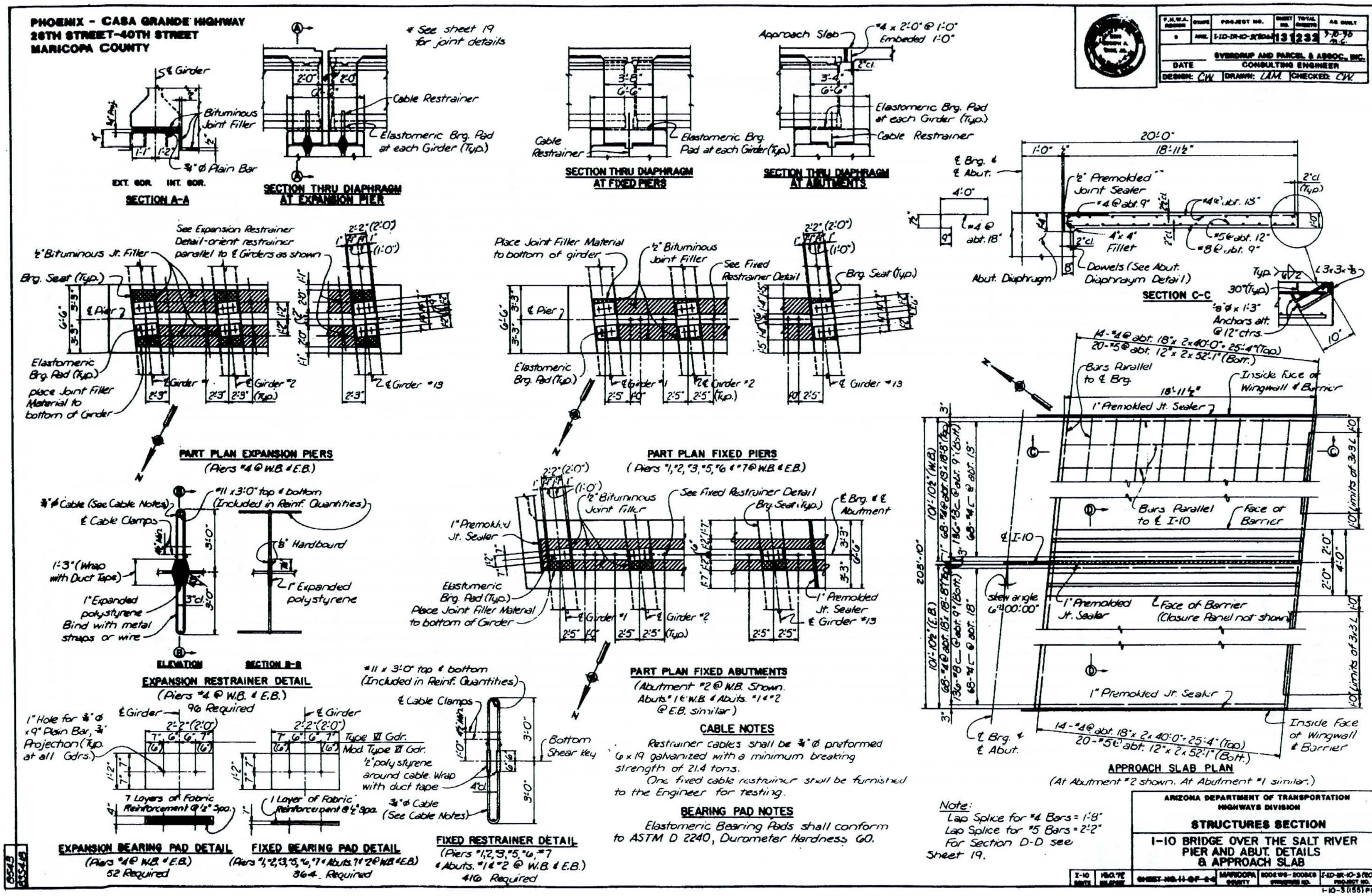
NOTES

For Column details, see Sheet 5.
E.B. indicates Eastbound.
E.F. indicates Each Face.

PIER NO.	℄ STATION	PIER ELEVATIONS													
		ELEV. A	ELEV. 1	ELEV. 2	ELEV. 3	ELEV. 4	ELEV. 5	ELEV. 6	ELEV. 7	ELEV. 8	ELEV. 9	ELEV. 10	ELEV. 11	ELEV. 12	ELEV. 13
1	7935+64.86	1115.22	1116.66	1116.82	1116.98	1117.14	1117.05	1116.89	1116.73	1116.57	1116.40	1116.24	1116.08	1115.88	1115.55
2	7936+99.86	1115.59	1117.03	1117.19	1117.34	1117.50	1117.42	1117.26	1117.10	1116.93	1116.77	1116.61	1116.45	1116.25	1115.92
3	7938+34.86	1115.87	1117.30	1117.46	1117.61	1117.77	1117.69	1117.53	1117.37	1117.21	1117.05	1116.88	1116.72	1116.52	1116.20
4	7939+69.86	1115.80	1117.22	1117.38	1117.54	1117.70	1117.62	1117.46	1117.30	1117.13	1116.97	1116.81	1116.65	1116.45	1116.13
5	7941+04.86	1116.13	1117.55	1117.71	1117.87	1118.03	1117.95	1117.79	1117.63	1117.47	1117.31	1117.15	1116.99	1116.79	1116.47
6	7942+39.86	1116.12	1117.53	1117.69	1117.85	1118.01	1117.93	1117.77	1117.61	1117.45	1117.29	1117.14	1116.98	1116.78	1116.46
7	7943+74.86	1116.02	1117.42	1117.58	1117.74	1117.90	1117.82	1117.66	1117.51	1117.35	1117.19	1117.03	1116.87	1116.67	1116.35

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
E.B. PIERS 1 THRU 7

I-10 | 16.076 | SHEET NO. 10 OF 24 | MARICOPA COUNTY | 2002 WS-3000 | I-10-3R-10-3(206)
I-10-3(IL8) PE

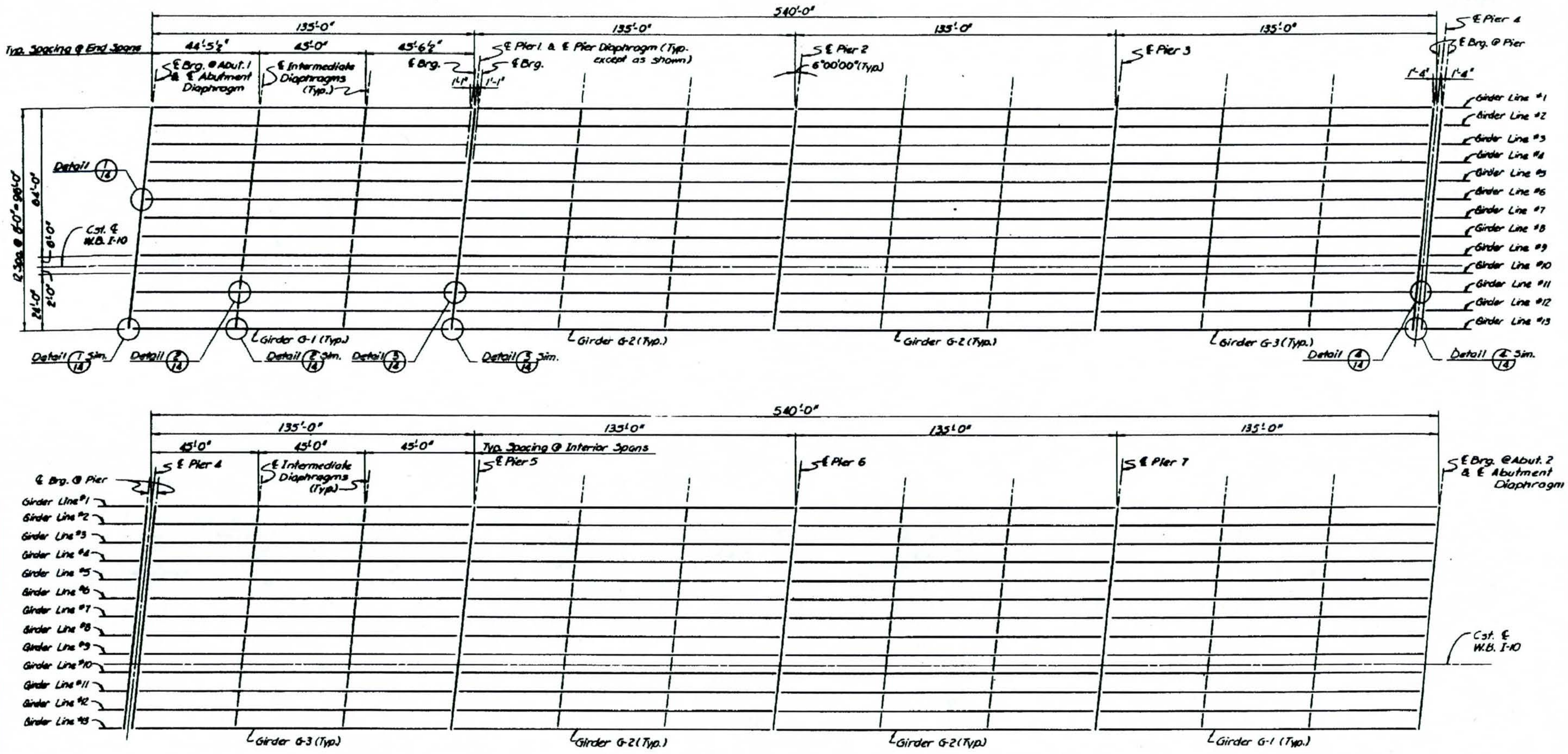

PHOENIX - CASA GRANDE HIGHWAY
26TH STREET-40TH STREET
MARICOPA COUNTY
* See sheet 19 for joint details
SECTION A-A
SECTION THRU DIAPHRAGM AT EXPANSION PIER
SECTION THRU DIAPHRAGM AT FIXED PIERS
SECTION THRU DIAPHRAGM AT ABUTMENTS
PART PLAN EXPANSION PIERS
(Piers #4 @ W.B. & E.B.)
PART PLAN FIXED PIERS
(Piers #1, #2, #3, #5, #6 & #7 @ W.B. & E.B.)
SECTION C-C
ELEVATION
SECTION B-B
EXPANSION RESTRAINER DETAIL
(Piers #4 @ W.B. & E.B.)
96 Required
PART PLAN FIXED ABUTMENTS
(Abutment #2 @ W.B. Shown. Abuts. #1 @ W.B. & Abuts. #1 & #2 @ E.B. similar)
APPROACH SLAB PLAN
(At Abutment #2 shown. At Abutment #1 similar.)
EXPANSION BEARING PAD DETAIL
(Piers #4 @ W.B. & E.B.)
52 Required
FIXED BEARING PAD DETAIL
(Piers #1, #2, #3, #5, #6, #7 & Abuts. #1 & #2 @ W.B. & E.B.)
364 Required
FIXED RESTRAINER DETAIL
(Piers #1, #2, #3, #5, #6, #7 & Abuts. #1 & #2 @ W.B. & E.B.)
416 Required
CABLE NOTES
Restrainer cables shall be ¾" ø preformed 6 x 19 galvanized with a minimum breaking strength of 21.4 tons.
One fixed cable restrainer shall be furnished to the Engineer for testing.
BEARING PAD NOTES
Elastomeric Bearing Pads shall conform to ASTM D 2240, Durometer Hardness 60.
Note:
Lap Splice for #4 Bars = 1'-8"
Lap Splice for #5 Bars = 2'-2"
For Section D-D see Sheet 19.
SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DESIGN: CW
DRAWN: LLM
CHECKED: CW
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
PIER AND ABUT. DETAILS
& APPROACH SLAB
MARICOPA
I-10-3(155)PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-3(206)	132	232	9-10-90 M.C.

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER

DATE		
DESIGN: CJB	DRAWN: MRH	CHECKED: CJB



WESTBOUND GIRDER FRAMING PLAN

Scale: 1" = 20'-0"

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRUCTURES SECTION

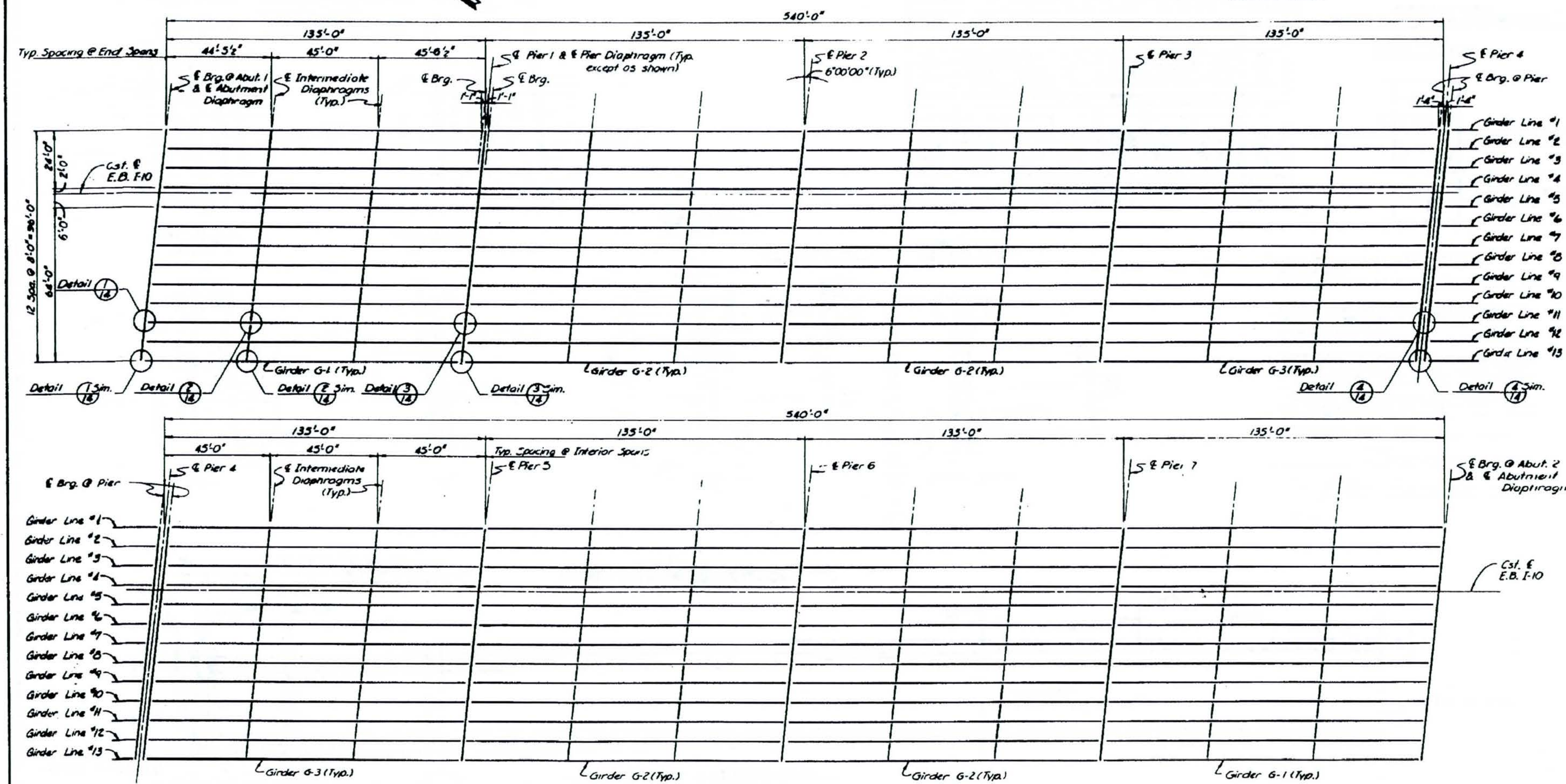
I-10 BRIDGE OVER THE SALT RIVER
WESTBOUND GIRDER FRAMING PLAN

I-10-3(155)PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-3R-10-3(206)	133	232	9-10-96 M.C.

OVERDRUP AND PARCEL & ASSOC., INC.
DATE CONSULTING ENGINEER
DESIGN: CJB DRAWN: MRH CHECKED: CJB



EASTBOUND GIRDER FRAMING PLAN

Scale: 1" = 20'-0"

8543

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
EASTBOUND GIRDER FRAMING PLAN

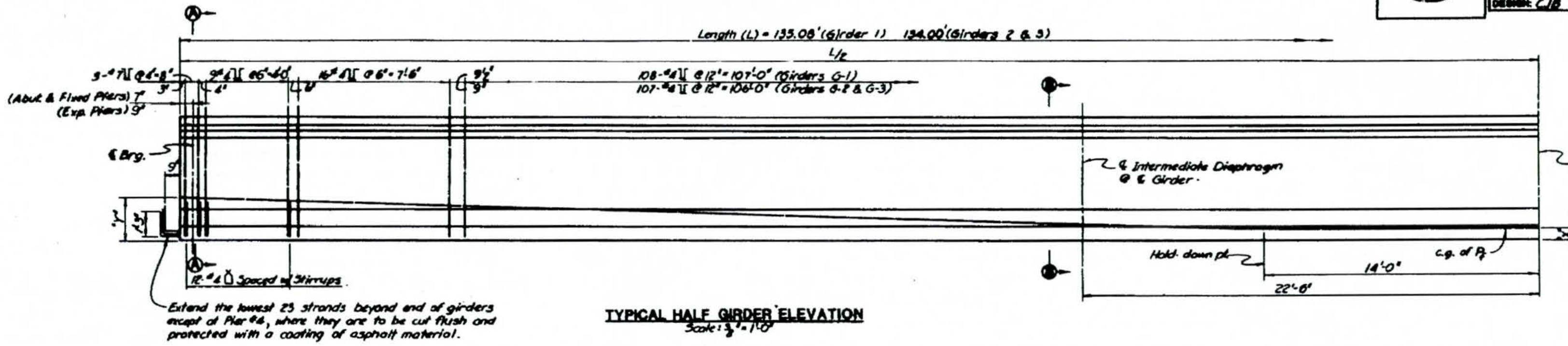
I-10 ROUTE	150.72 MILEPOST	SHEET NO. 10 OF 24	MARICOPA COUNTY	2003 EB STRUCTURE NO.	I-10-3R-10-3(206) PROJECT NO.

I-10-3(155)PE

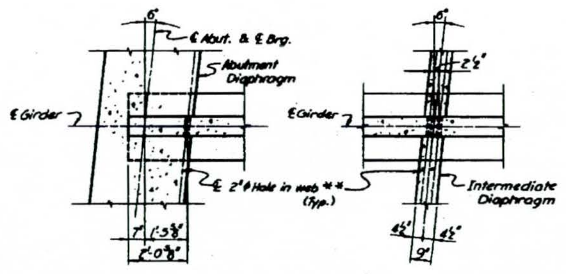
PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
•	ARIZ.	I-10-3(R-10-3(206))	134	232	9-10-90 M.C.

GREINER AND PARCEL & ASSOC., INC.
DATE — CONSULTING ENGINEER
DESIGN: CJB — DRAWN: MRH — CHECKED: CJB

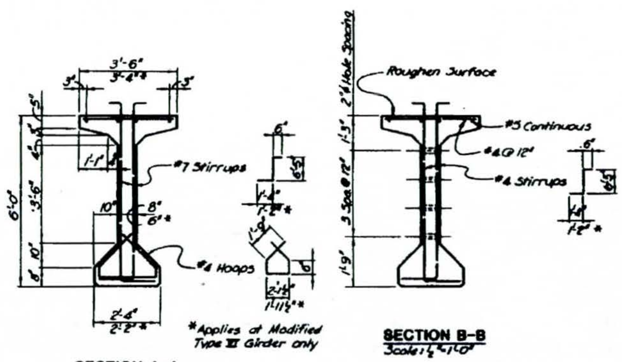


TYPICAL HALF GIRDER ELEVATION
Scale: 3/8" = 1'-0"



DETAIL 1
Scale: 1/2" = 1'-0"

DETAIL 2
Scale: 1/2" = 1'-0"

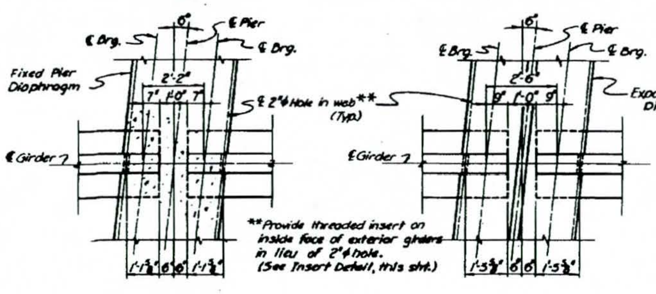


SECTION A-A
Scale: 1/2" = 1'-0"

SECTION B-B
Scale: 1/2" = 1'-0"

NOTES:

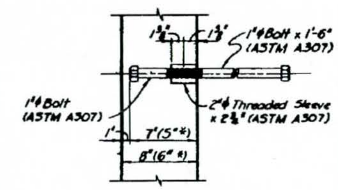
1. P_f is the final effective prestressing force remaining in girder at mid-span after all losses due to creep, shrinkage, relaxation, friction, elastic shortening, etc. have occurred.
2. Concrete strength: f'_c is minimum strength at 28 days. f'_{ci} is minimum strength at time of release or detensioning.
3. Minimum spacing of pre-tensioning strand shall be 2" measured between centers of adjacent strands.
4. Pre-tensioning steel shall conform to ASTM A416 for uncoated, seven-wire, stress-relieved strand with an ultimate tensile strength f'_s=270,000 psi. Initial stress before losses = 189,000 psi.
5. Reinforcing steel shall conform to ASTM A615, Grade 40, except that the Contractor, at his option, may substitute ASTM A615, Grade 60, but without extra compensation. Detailing shall be in accordance with the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" published by ACI.
6. The top surface of the girders shall receive a rough finish. Curing compound shall not be applied.
7. The Contractor shall adjust the dimensions shown to account for elastic shortening, creep and shrinkage occurring between time of casting and erection of girder.
8. Pick-up devices shall be anchored only to the end zones of the girders. The Contractor shall submit for approval proposed pick-up or lifting devices.
9. Girders may be alternates #1, #2 or #4. Alternate #3 not used.



DETAIL 3
Scale: 1/2" = 1'-0"

DETAIL 4
Scale: 1/2" = 1'-0"

NOTE: See Girder Framing Plans for locations of Details 1 thru 4.



INSERT DETAIL
No Scale

Girder	L (ft.)	P_f (Kips)	"X" (in.)	"Y" (in.)	f'_c (psi)	f'_{ci} (psi)	P/S Loss (ksi)
ALTERNATE 1 (Type VI Girder with Stress Relieved Strand)							
G-1	135.08	1511.6	7.97	26.39	6,000	5,000	59
G-2	134.00	1443.1	7.39	25.39	6,000	5,000	58
G-3	134.00	1511.6	7.97	26.39	6,000	5,000	59
ALTERNATE 2 (Type VI Girder with Stress Relieved, Low Relaxation Strand)							
G-1	135.08	1519.0	6.91	23.38	6,000	4,500	43
G-2	134.00	1439.4	6.47	22.78	6,000	4,500	42
G-3	134.00	1519.0	6.91	23.38	6,000	4,500	43
ALTERNATE 3 (Not Used)							
ALTERNATE 4 (Mod. Type VI Girder with Stress Relieved, Low Relaxation Strand)							
G-1	135.08	1410.0	7.19	20.69	6,400	5,000	45
G-2	134.00	1375.5	6.90	19.55	6,400	5,000	44
G-3	134.00	1410.0	7.19	20.69	6,400	5,000	45

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

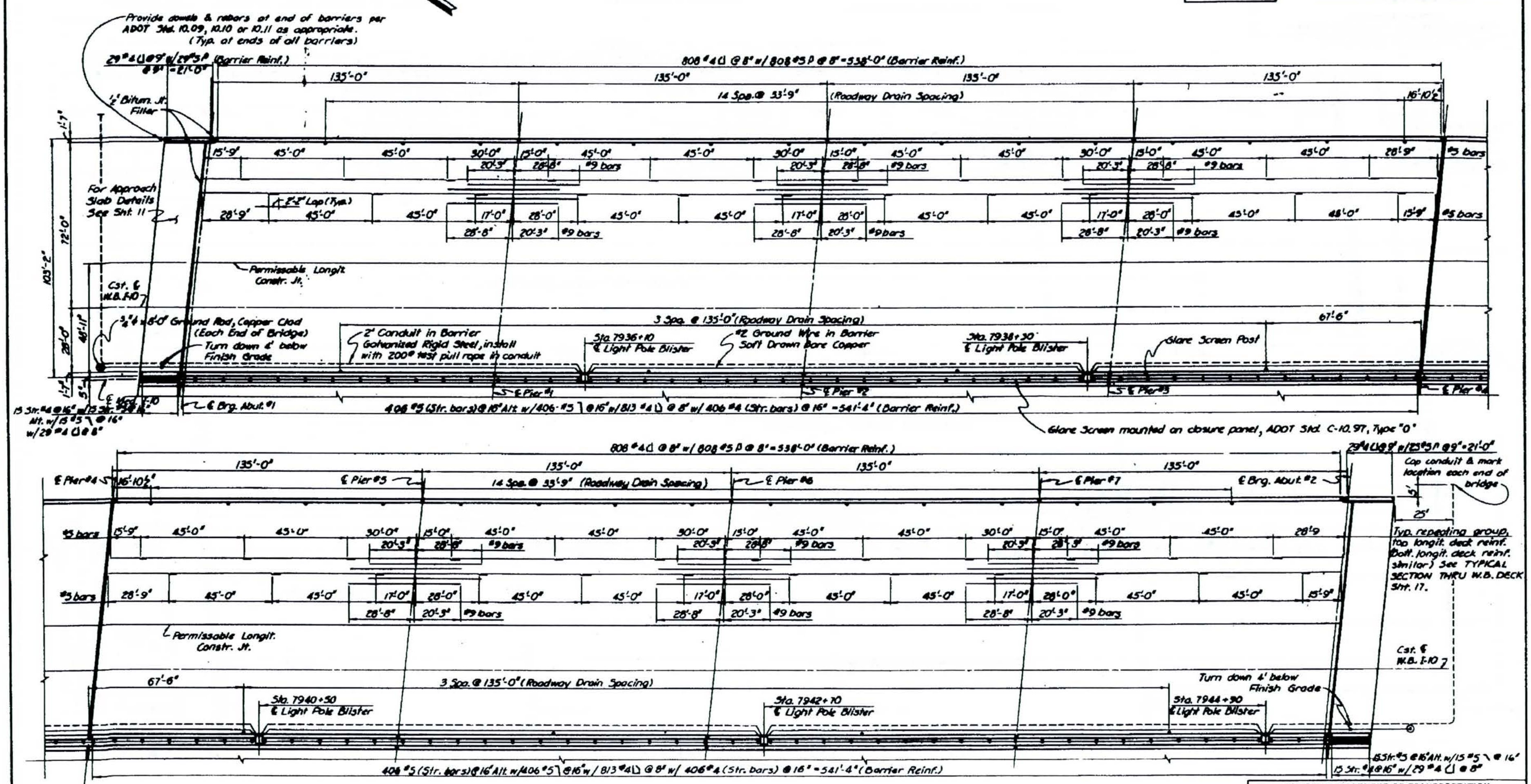
STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
PRETENSIONED GIRDER DETAILS

I-10 | 150.78 | SHEET NO. 14 OF 24 | MARICOPA COUNTY | I-10-3(R-10-3(206)) PROJECT NO.

I-10-3(166)PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY



WESTBOUND SLAB PLAN

Scale: 1" = 20'-0"

NOTE: See E.B. Slab Plan for Transverse Reinf. and Typ. Transverse Constr. Jt. Sht. 18.
See Slab Details for Roadway Drain Details. Sht. 19.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
WESTBOUND SLAB PLAN

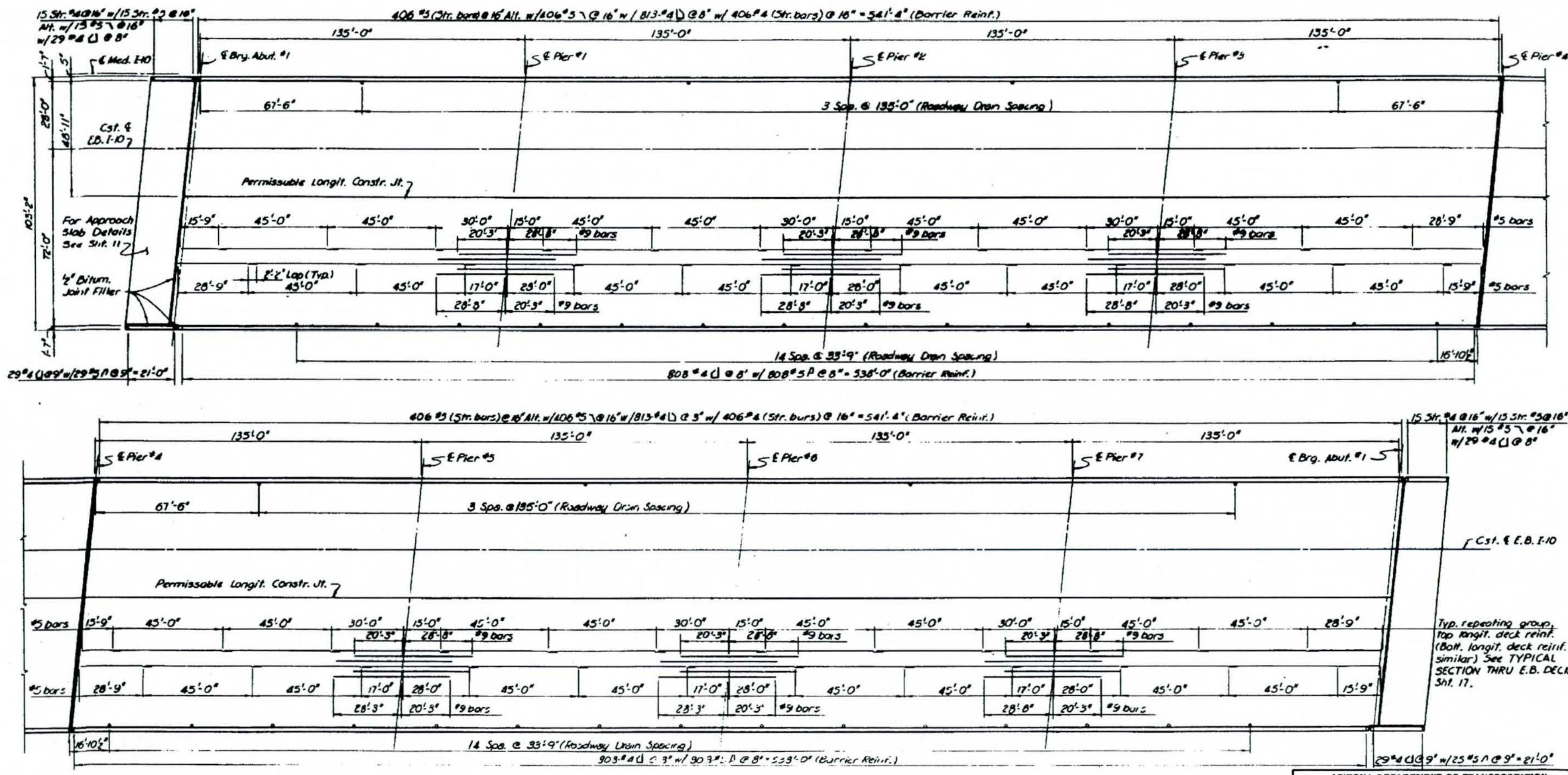
SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DESIGN: CJB DRAWN: MRH CHECKED: CJB

I-10-3(186)PE

PHOENIX – CASA GRANDE HIGHWAY
28TH STREET–40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
6	ARIZ.	I-10-3(206)	136	232	9-10-90 M.C.

OVERSTRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DATE
DESIGN: CJB DRAWN: MRH CHECKED: CJB



Longitudinal Reinf.

TYP. CONSTR. JT.

Transverse Constr. Jts. where required may be normal to Cst. ℄ E.B. I-10 or parallel to ℄ Piers and shall be located at 15'-0" from ℄ Pier. Sections over piers may not be poured until midspan sections are in place.

EASTBOUND SLAB PLAN
Scale: 1" = 20'-0"

NOTE: See Slab Details for Roadway Drain Details, Sht. 19.

TRANSVERSE DECK REINFORCING NOTE:
Transverse reinf. shall be placed parallel to ℄ Piers. Alternate truss bars and straight bars as shown in SPLICE DETAIL, Sht. 19.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
EASTBOUND SLAB PLAN

I-10 ROUTE	150.72 MILEPOST	SHEET NO. 14 OF 24	MARICOPA COUNTY	2003 EB STRUCTURE NO.	I-10-3(206) PROJECT NO.

I-10-3(188)PE

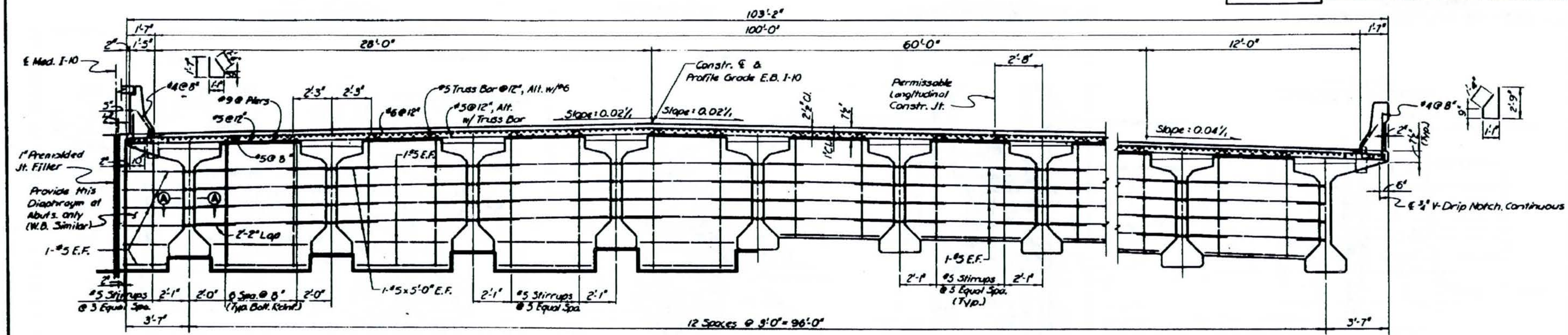
PHOENIX - CASA GRANDE HIGHWAY
26TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-3(206)	137	232	9-10-90 M.C.

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER

DATE

DESIGN: CJB | DRAWN: MRH | CHECKED: CJB



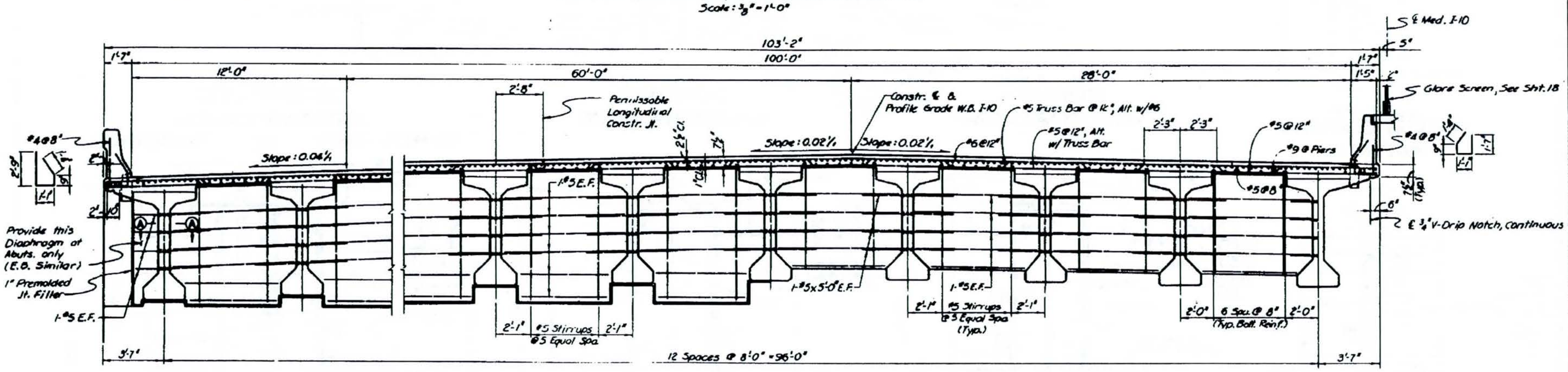
PART SECTION AT PIERS & ABUTMENTS

PART SECTION AT INTERMEDIATE DIAPHRAGM

NOTE:
For Section A-A see Sht. 18

TYPICAL SECTION THRU EASTBOUND DECK

Scale: 3/8" = 1'-0"

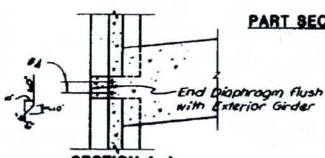


PART SECTION AT PIERS & ABUTMENTS

PART SECTION AT INTERMEDIATE DIAPHRAGM

TYPICAL SECTION THRU WESTBOUND DECK

Scale: 3/8" = 1'-0"



SECTION A-A

Scale: 3/8" = 1'-0"

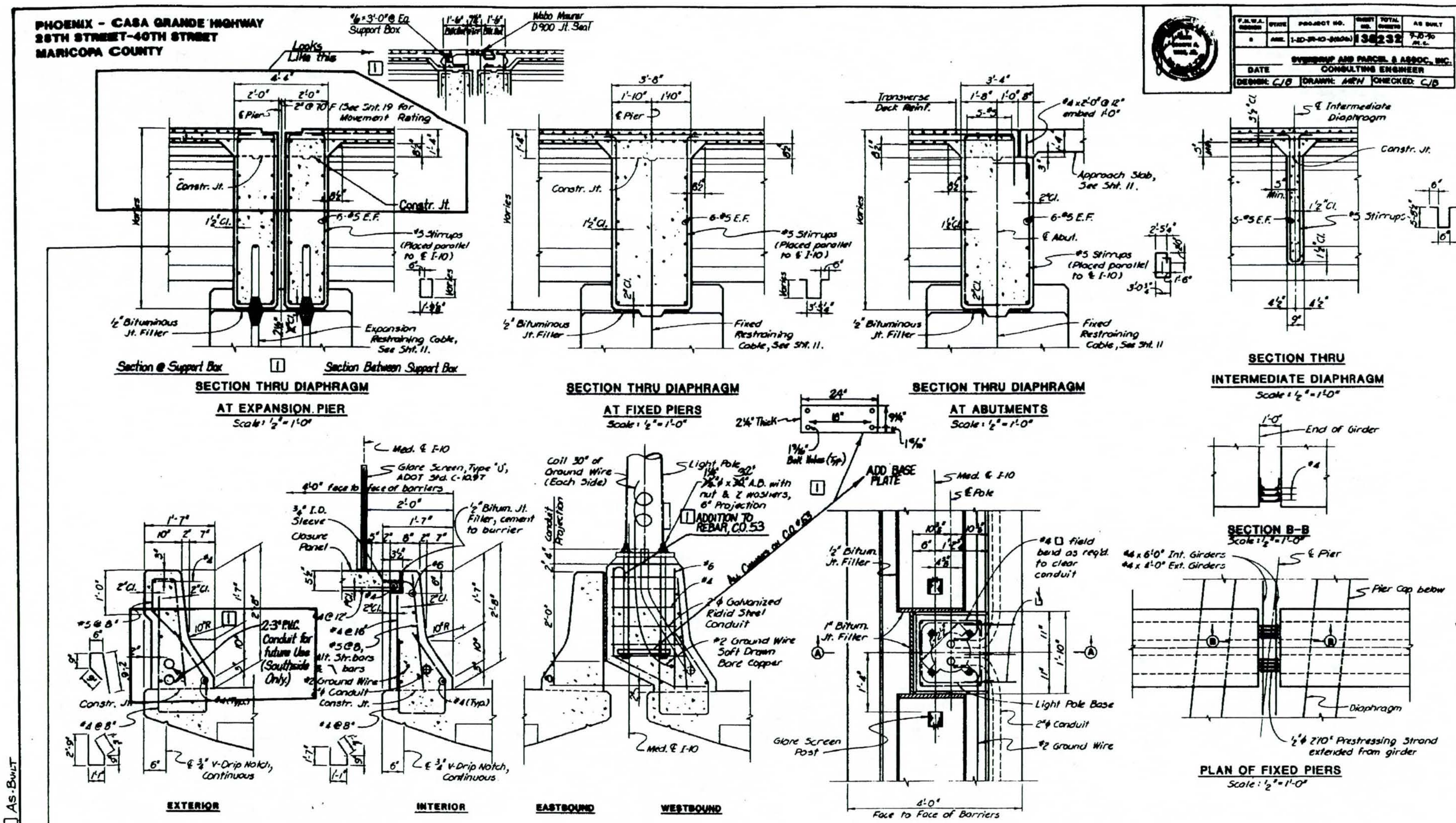
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
SLAB DETAILS

I-10 | 150.7 | SHEET NO. 17 OF 54 | MARICOPA COUNTY | 1-10-3R-10-3(206)

I-10-3(156)PE



BARRIER DETAILS

Scale: 1" = 1'-0"
(Additional Details, Sht. 19)

Barrier Note:
Barriers shall have construction jts. at 22'-6" Max. with reinforcement continuous thru jts.
Barriers shall have 1/4" open jts. at piers.
Jts. in closure panel to match barrier jts.

C.O. #39
See M-12
PVC Expansion Fitting

SECTION A-A

Scale: 1" = 1'-0"

PLAN OF LIGHT POLE BLISTER

Scale: 1" = 1'-0"

Note:
No Barrier Joint shall be located closer than 5'-0" to Light Pole Blister.

AS-BUILT

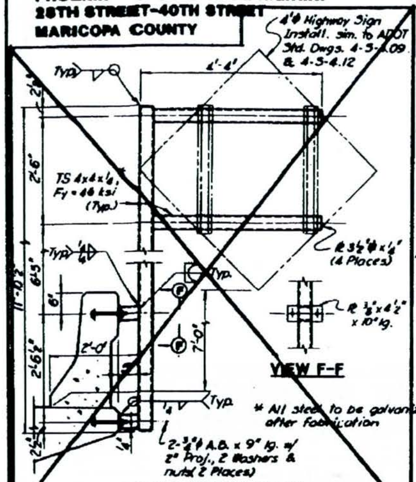
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRUCTURES SECTION

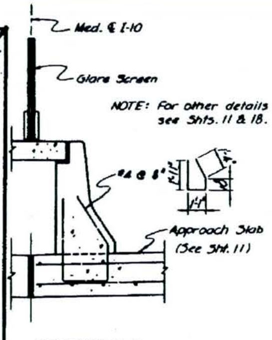
I-10 BRIDGE OVER THE SALT RIVER
SLAB DETAILS

I-10-3(156)PE

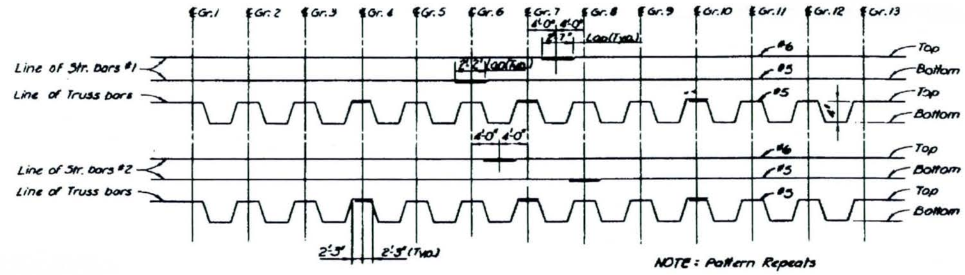
PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY



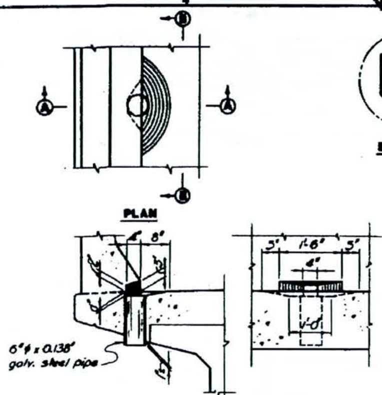
SIGN SUPPORT DETAIL
Scale: ¾" = 1'-0"



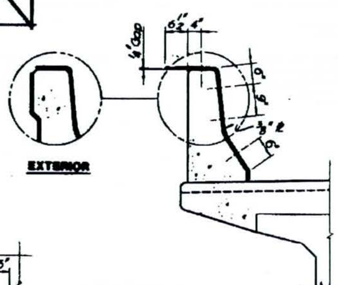
SECTION D-D
Scale: ¾" = 1'-0"
(This section cut on Sht. 11)



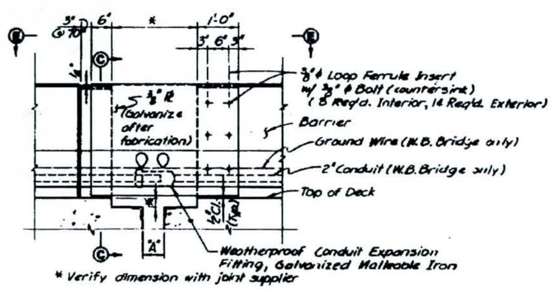
SPLICE DETAILS
Scale: None



DRAIN DETAILS
Scale: ¾" = 1'-0"



SECTION C-C
(Interior shown, exterior similar)



JOINT DETAIL
Scale: ¾" = 1'-0"

JOINT NOTE:

The Contractor shall provide modular or steel reinforced elastomeric expansion joint with the following movement capability:
- Joint opens 2.6" due to creep and shrinkage
- Joint opens 3.1" due to temperature fall = 40°F
- Joint closes 2.3" due to temperature rise = 30°F

The joint shall be watertight on the deck & continuous thru the barriers.

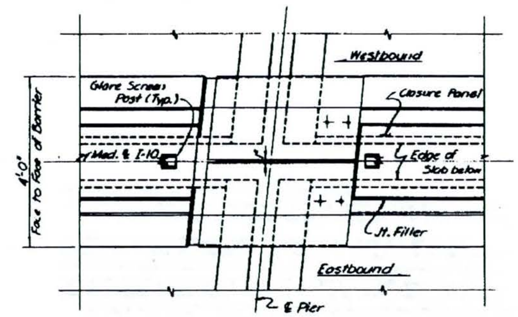
The joint seals and supports shall be removable and replaceable with minimum interruption to traffic.

Cast-in-place support anchorages only will be allowed.

The Contractor shall submit complete details and supportive test data to the Engineer a sufficient time in advance of placing deck concrete in order that acceptability of the joint can be determined by the Engineer without delay to construction.

See Special Provisions for additional joint requirements.

JOINT OPENING	
Ambient Air Temp. (°F)	Dimension "A" (inches)
30	7.1
40	6.3
50	5.6
60	4.8
70	4.0
80	3.2
90	2.4
100	1.7



SECTION E-E
Scale: ¼" = 1'-0"

SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DATE
DESIGN: CJB DRAWN: MRH CHECKED: CJB
PROJECT NO. I-10-3(206) SHEET NO. 139 TOTAL SHEETS 232 AS BUILT 9-10-90 M.C.

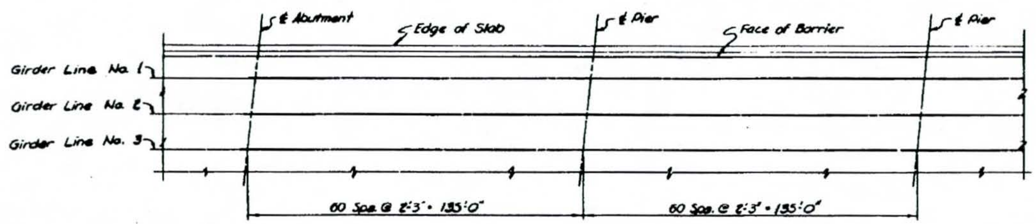
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
SLAB DETAILS

I-10 150.72 MARICOPA COUNTY
I-10-3(155)PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

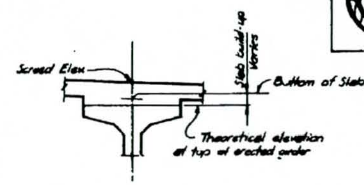
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-3R-10-3(206)	140	232	9-D-90 M.C.

OVERDRUP AND PARCEL & ASSOC., INC.
DATE — CONSULTING ENGINEER
DESIGN: C.J.B. DRAWN: M.R.H. CHECKED: C.J.B.



PARTIAL PLAN-ELEVATION LAYOUT

NOTE: In addition to the points indicated above, elevations will be furnished along profile grade and cross slope break line.

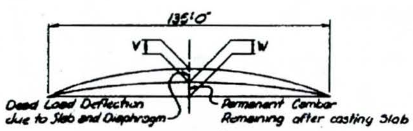


NOTE:

Finish grade elevations, screed elevations, estimated slab build-up and estimated top of erected girder will be furnished to the Contractor upon request.

The Theoretical Top of Erected Girder Elevations include an allowance for deflection of the girders due to their own dead load. The Top of Erected Girder Elevations shall be checked in the field. If the measured elevation is lower than the theoretical elevation, the difference shall be added to the Build-up. If the measured elevation is higher, the difference shall be subtracted from the Build-up.

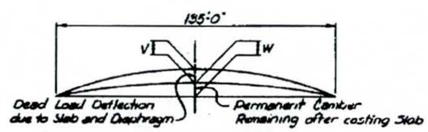
The Screed Elevation includes an allowance for the dead load of the concrete deck and shall be used as shown regardless of the measured top of erected girder elevations.



DEFLECTION DIAGRAM
END GIRDER

TABLE OF VARIABLES

Alternate No.	V (inches) Span Point					W (inches) Span Point				
	.1/.9	.2/.8	.3/.7	.4/.6	.5	.1/.9	.2/.8	.3/.7	.4/.6	.5
1	0.70	1.32	1.81	2.12	2.23	0.35	0.56	0.71	0.81	0.84
2	0.70	1.32	1.81	2.12	2.23	0.32	0.49	0.58	0.64	0.65
4	0.76	1.44	1.97	2.31	2.42	0.47	0.73	0.87	0.95	0.97



DEFLECTION DIAGRAM
INTERIOR GIRDER

TABLE OF VARIABLES

Alternate No.	V (inches) Span Point					W (inches) Span Point				
	.1/.9	.2/.8	.3/.7	.4/.6	.5	.1/.9	.2/.8	.3/.7	.4/.6	.5
1	0.70	1.32	1.81	2.12	2.23	0.30	0.47	0.58	0.65	0.67
2	0.70	1.32	1.81	2.12	2.23	0.24	0.33	0.37	0.39	0.39
4	0.76	1.44	1.97	2.31	2.42	0.46	0.70	0.82	0.88	0.90

6543

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
SLAB ELEVATIONS

I-10 ROUTE | 150.72 MILEPOST | MARICOPA COUNTY | I-10-3R-10-3(206) PROJECT NO.

I-10-3(155)PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

EXISTING SUBSTRUCTURE DEMOLITION TABLE											
Exist. Abut. or Pier No.	Exist. Grade (Approx.)	Approx. Bott. of Footing Elev.	Cut-Off Elevation*	Exist. Abut. or Pier No.	Exist. Grade (Approx.)	Approx. Bott. of Footing Elev.	Cut-Off Elevation*	Exist. Abut. or Pier No.	Exist. Grade (Approx.)	Approx. Bott. of Footing Elev.	Cut-Off Elevation*
Abut. 1	1114	1084.9	1108.0	Pier 7	1080	1067	Total Removal	Pier 14	1100	1078	1095
Pier 1	1080	1072 ★	~~Total Removal~~	Pier 8		1067		Pier 15		1078	1095
Pier 2		1072	Temp. Removal	Pier 9		1067		Pier 16		1078	1095
Pier 3		1073		Pier 10		1074	Total Removal	Pier 17		1077	1095
Pier 4		1073		Pier 11, S.B.	1080	See DETAIL 1	~~1082.75~~	Pier 18		1077	1095
Pier 5		1073		Pier 11, N.B.	1080	1078	Total Removal	Pier 19	1100	1077	1095
Pier 6	1080	1067	Total Removal	Pier 12	1100	1078	1095	Abut. 2	1116.5	1084.9	1114.9
				Pier 13	1100	1078	~~1095~~				

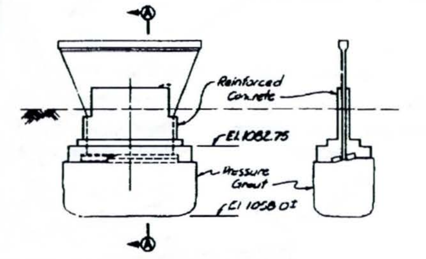
*Remove Abutment or Pier above this elevation

Total Removal 1

1 ★-Removed to Below Rip-Rap Elevation

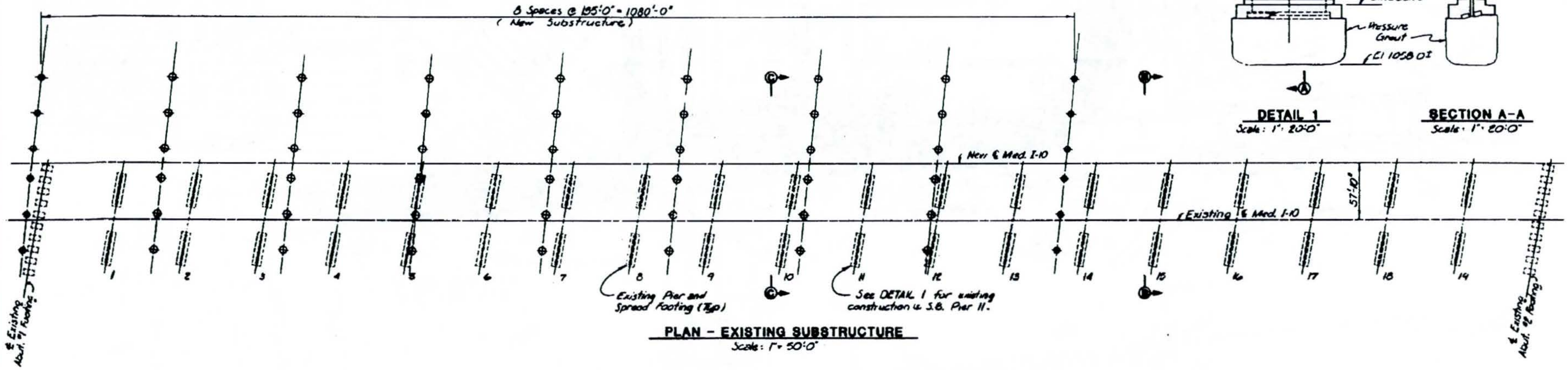
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-IO-IR-10-3(80W)	141	232	9-8-90 M.C.

SVERDRUP AND PARCEL & ASSOC., INC.
DATE CONSULTING ENGINEER
DESIGN: C.J.B. DRAWN: M.R.H. CHECKED: C.J.B.

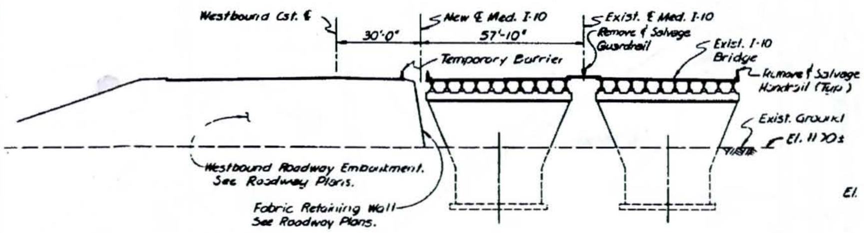


DETAIL 1
Scale: 1" = 20'-0"

SECTION A-A
Scale: 1" = 20'-0"

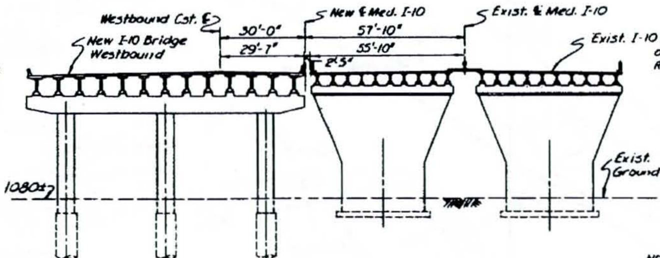


PLAN - EXISTING SUBSTRUCTURE
Scale: 1" = 50'-0"

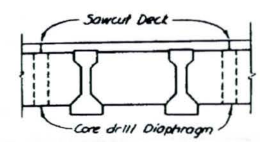


SECTION B-B
Prior to constructing Eastbound Bridge
Scale: 1" = 20'-0"

NOTE:
See "As-Built" Drawings for Existing I-10 Bridge construction.



SECTION C-C
Prior to constructing Eastbound Bridge
Scale: 1" = 20'-0"



NOTE: Superstructure shall be removed to storage in 2-girder units by sawcutting & core drilling as shown. See Special Provisions

SALVAGE DETAIL
No Scale

1 As-Built

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

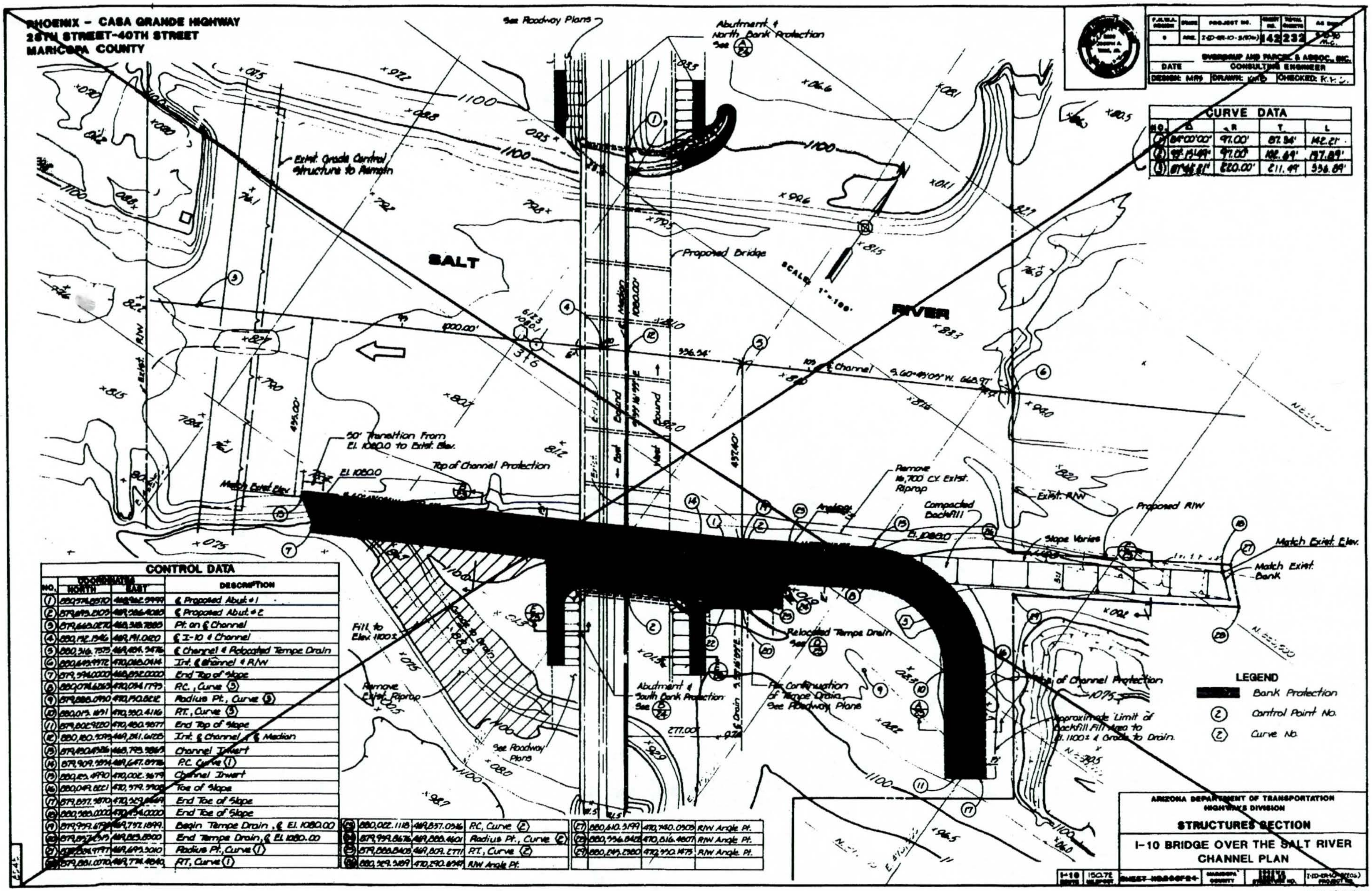
STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
SUBSTRUCTURE DEMOLITION PLAN

I-10 ROUTE	150.72 MILEPOST	~~SHEET NO. 3-10F-84~~	MARICOPA COUNTY	STRUCTURE NO.	I-10-IR-10-3(80W) PROJECT NO.

8543

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-6R-10-3(10?)	142	232	M.C.

OVERDAMP AND PARCEL & ASSOC., INC.
DATE — CONSULTING ENGINEER
DESIGN: MRS — DRAWN: — CHECKED: K.Y.

CURVE DATA

NO.	Δ	R	T	L
1	84°00'00"	97.00'	87.34'	142.21'
2	93°13'49"	97.00'	102.69'	157.89'
3	87°46'81"	220.00'	211.49'	336.89'

CONTROL DATA

NO.	COORDINATES NORTH	COORDINATES EAST	DESCRIPTION
1	880,374.0510	469,962.9999	℄ Proposed Abut. #1
2	879,893.2103	469,986.4080	℄ Proposed Abut. #2
3	879,660.0270	468,318.7880	Pt. on ℄ Channel
4	880,192.1946	469,191.0120	℄ I-10 & Channel
5	880,316.7575	469,484.3476	℄ Channel & Relocated Tempe Drain
6	880,649.9972	470,086.0414	Int. ℄ Channel & R/W
7	879,596.0000	468,892.0000	End Top of Slope
8	880,078.6265	470,094.1795	P.C., Curve 3
9	879,886.0990	470,150.8212	Radius Pt., Curve 3
10	880,013.1891	470,380.4116	P.T., Curve 3
11	879,802.9220	470,480.9677	End Top of Slope
12	880,180.5095	469,241.6125	Int. ℄ Channel & ℄ Median
13	879,830.4926	468,793.5867	Channel Invert
14	879,909.5936	469,647.8778	P.C. Curve 1
15	880,123.4990	470,002.3679	Channel Invert
16	880,049.8221	470,579.5908	Toe of Slope
17	879,837.5870	470,529.6669	End Toe of Slope
18	880,385.0000	470,454.0000	End Toe of Slope
19	879,959.6798	469,752.1899	Begin Tempe Drain, ℄ El. 1080.00
20	879,872.4919	469,823.8900	End Tempe Drain, ℄ El. 1080.00
21	879,804.9797	469,693.3010	Radius Pt., Curve 1
22	879,881.0070	469,734.4840	P.T., Curve 1
23	880,022.1118	469,837.0316	P.C., Curve 2
24	879,959.8676	469,888.4601	Radius Pt., Curve 2
25	879,888.8405	469,809.2771	P.T., Curve 2
26	880,329.5189	470,290.8349	R/W Angle Pt.
27	880,610.3199	470,740.0303	R/W Angle Pt.
28	880,336.8408	470,816.4807	R/W Angle Pt.
29	880,249.2380	470,550.1475	R/W Angle Pt.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
CHANNEL PLAN

I-10 | 150.7E

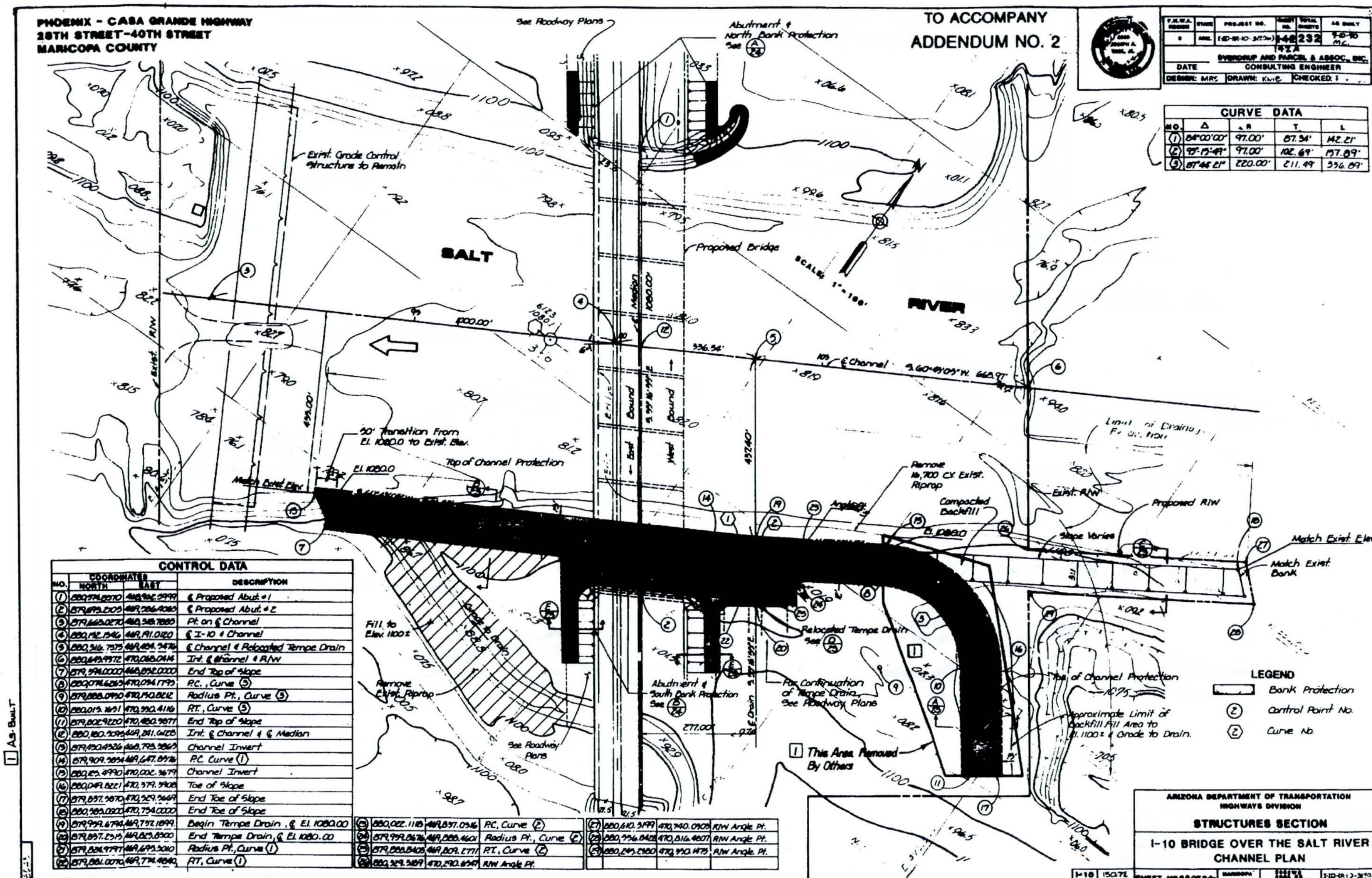
I-10-3(156)PE

PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

TO ACCOMPANY ADDENDUM NO. 2

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
8	ARIZ.	I-ID-IR-10-3(150)	~~142~~ 142A	232	9-10-90 MC

SVERDRUP AND PARCEL & ASSOC., INC.
DATE — CONSULTING ENGINEER
DESIGN: MRS DRAWN: KME CHECKED:



CURVE DATA

NO.	Δ	R	T	L
1	84°00'00"	97.00'	87.34'	142.21'
2	93°15'49"	97.00'	102.69'	157.89'
3	87°46'21"	220.00'	211.49'	336.89'

CONTROL DATA

NO.	COORDINATES NORTH	COORDINATES EAST	DESCRIPTION
1	880,974.8570	468,962.5999	℄ Proposed Abut. #1
2	879,893.2105	469,286.4080	℄ Proposed Abut. #2
3	879,663.0270	469,348.7885	Pt. on ℄ Channel
4	880,152.1946	469,191.0120	℄ I-10 & Channel
5	880,316.7575	469,404.3476	℄ Channel & Relocated Tempe Drain
6	880,649.9572	470,068.0414	Int. ℄ Channel & R/W
7	879,594.0000	468,852.0000	End Top of Slope
8	880,074.6263	470,094.1795	P.C., Curve (3)
9	879,888.0950	470,150.8212	Radius Pt., Curve (3)
10	880,013.1631	470,330.4116	P.T., Curve (3)
11	879,802.9220	470,480.9877	End Top of Slope
12	880,180.5095	469,241.6126	Int. ℄ Channel & ℄ Median
13	879,450.4526	468,793.5865	Channel Invert
14	879,909.3834	469,647.8976	P.C. Curve (1)
15	880,125.4990	470,002.3679	Channel Invert
16	880,049.8221	470,579.5908	Toe of Slope
17	879,837.5870	470,529.5669	End Toe of Slope
18	880,385.0300	470,754.0000	End Toe of Slope
19	879,939.6794	469,752.1899	Begin Tempe Drain, ℄ El. 1080.00
20	879,837.2315	469,823.8300	End Tempe Drain, ℄ El. 1080.00
21	879,834.9797	469,695.5010	Radius Pt., Curve (1)
22	879,881.0070	469,774.4840	P.T., Curve (1)
23	880,022.1118	469,837.0316	P.C., Curve (2)
24	879,939.8676	469,888.4601	Radius Pt., Curve (2)
25	879,888.8405	469,809.2771	P.T., Curve (2)
26	880,329.3189	470,290.6347	R/W Angle Pt.
27	880,610.3199	470,740.0905	R/W Angle Pt.
28	880,736.8428	470,816.4807	R/W Angle Pt.
29	880,249.2980	470,930.1475	R/W Angle Pt.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
CHANNEL PLAN

I-10	150.75	SHEET NO.	MARICOPA COUNTY		I-ID-IR-10-3(150) PROJECT NO.

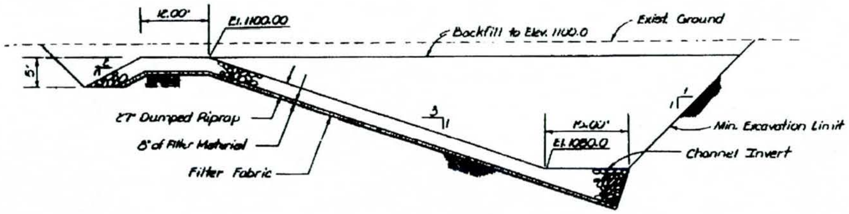
1 AS-BUILT

I-10-3(155)PE

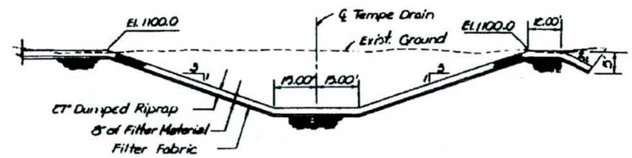
PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
8	ARIZ.	I-10-BR-10-3(106)	143	232	9-20-90 M.C.

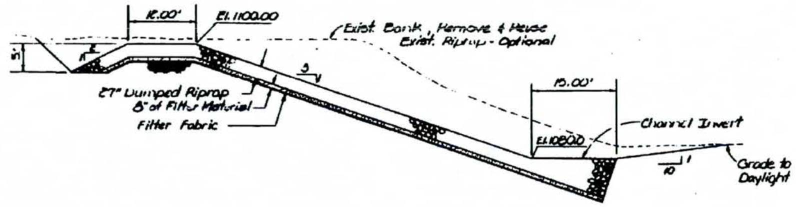
SVERDRUP AND PARCEL & ASSOC., INC.
DATE — CONSULTING ENGINEER
DESIGN: MRS | DRAWN: KMD | CHECKED: R.P.O.



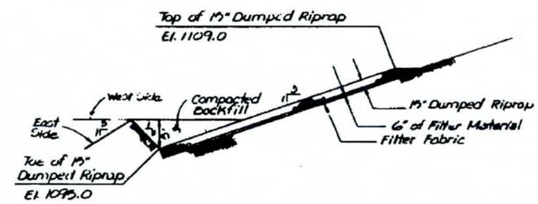
A/22 **TYPICAL SECTION - BANK PROTECTION**
1" = 10'



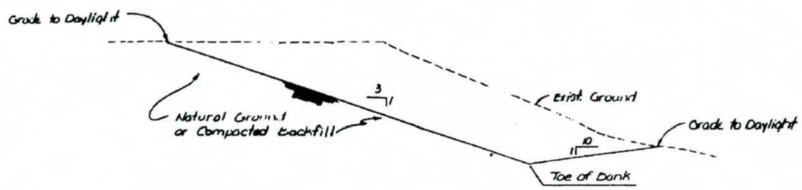
D/22 **TYPICAL SECTION - TEMPE DRAIN**
1" = 20'



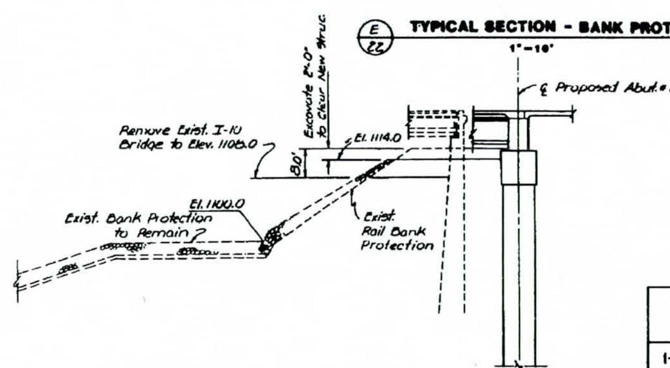
B/22 **TYPICAL SECTION- BANK PROTECTION**
1" = 10'



E/22 **TYPICAL SECTION - BANK PROTECTION**
1" = 10'



C/22 **TYPICAL SECTION - BANK PROTECTION**
1" = 10'

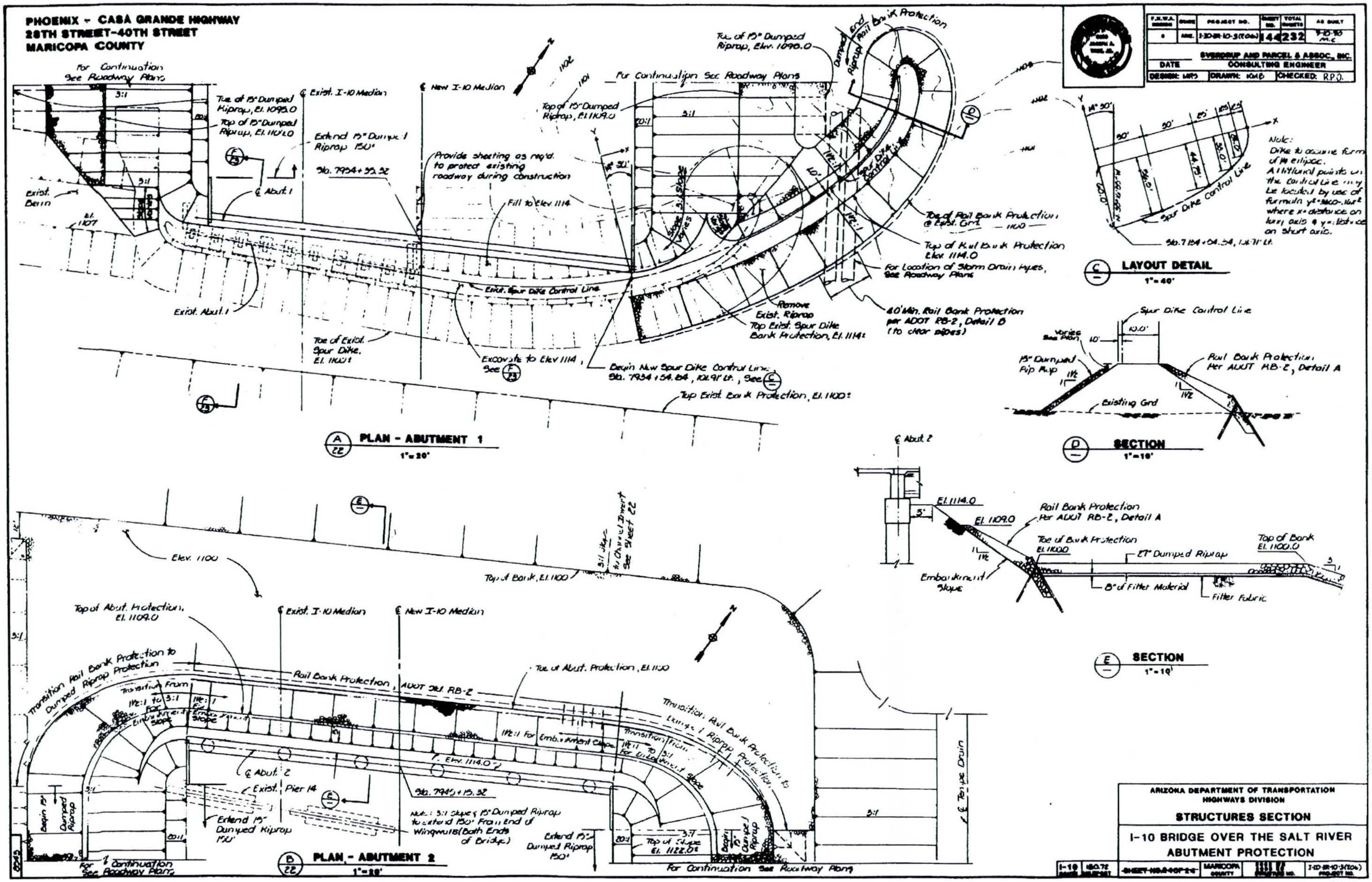


F/24 **SECTION**
1" = 10'

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION

I-10 BRIDGE OVER THE SALT RIVER
TYPICAL SECTIONS

I-10 ROUTE	149.72 MILEPOST	SHEET NO.	MARICOPA COUNTY	STRUCTURE NO.	I-10-BR-10-3(106) PROJECT NO.


PHOENIX - CASA GRANDE HIGHWAY
28TH STREET-40TH STREET
MARICOPA COUNTY
SVERDRUP AND PARCEL & ASSOC., INC.
CONSULTING ENGINEER
DESIGN: MRS
DRAWN: KMB
CHECKED: R.P.O.
PLAN - ABUTMENT 1
1"=20'
LAYOUT DETAIL
1"=40'
SECTION
1"=10'
SECTION
1"=10'
PLAN - ABUTMENT 2
1"=20'
For Continuation See Roadway Plans
Top of 15" Dumped Riprap, El. 1109.0
Extend 15" Dumped Riprap 150'
Provide sheeting as req'd. to protect existing roadway during construction
Fill to Elev 1114
Exist. Spur Dike Control Line
Excavate to Elev 1114
Begin New Spur Dike Control Line
Top Exist. Bank Protection, El. 1100±
Top of Rail Bank Protection @ Exist. Grd
Top of Rail Bank Protection Elev. 1114.0
For Location of Storm Drain Pipes, See Roadway Plans
40' Min. Rail Bank Protection per ADOT RB-2, Detail B (to clear pipes)
Remove Exist. Riprap
Dumped End Riprap Rail Bank Protection
Note: Dike to assume form of an ellipse. Additional points on the Control Line may be located by use of formula $y^2 = 3600 - 1.44x^2$ where x = distance on long axis & y = distance on short axis.
Spur Dike Control Line
Rail Bank Protection Per ADOT RB-2, Detail A
Existing Grd
Abut 2
El. 1114.0
El. 1109.0
Rail Bank Protection Per ADOT RB-2, Detail A
Toe of Bank Protection El. 1100.0
27" Dumped Riprap
Top of Bank El. 1100.0
Embankment Slope
8" of Filter Material
Filter Fabric
Elev. 1100
Top of Bank, El. 1100
Top of Abut. Protection, El. 1109.0
Exist. I-10 Median
New I-10 Median
Transition Rail Bank Protection to Dumped Riprap Protection
Rail Bank Protection, ADOT Std. RB-2
Toe of Abut. Protection, El. 1100
Transition Rail Bank Protection to Dumped Riprap Protection
Exist. Pier 14
Sta. 7945+15.32
Note: 3:1 Slope & 15" Dumped Riprap to extend 150' From End of Wingwalls (Both Ends of Bridge)
Extend 15" Dumped Riprap 150'
Top of Slope El. 1122.0±
For Continuation See Roadway Plans
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STRUCTURES SECTION
I-10 BRIDGE OVER THE SALT RIVER
ABUTMENT PROTECTION

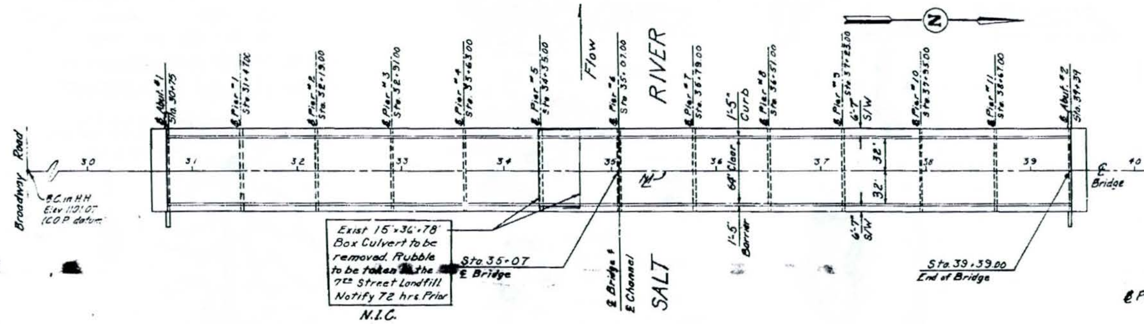
I-10-3(156)PE

24th Street Bridge As-builts

PHOENIX STREETS-MARICOPA CO.

FED. ROAD REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	BR-79159.03	16	34	

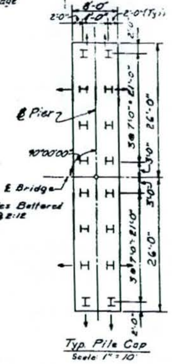
ADAM, HAMLYN, ANDERSON CONSULTING ENGINEERS INC.

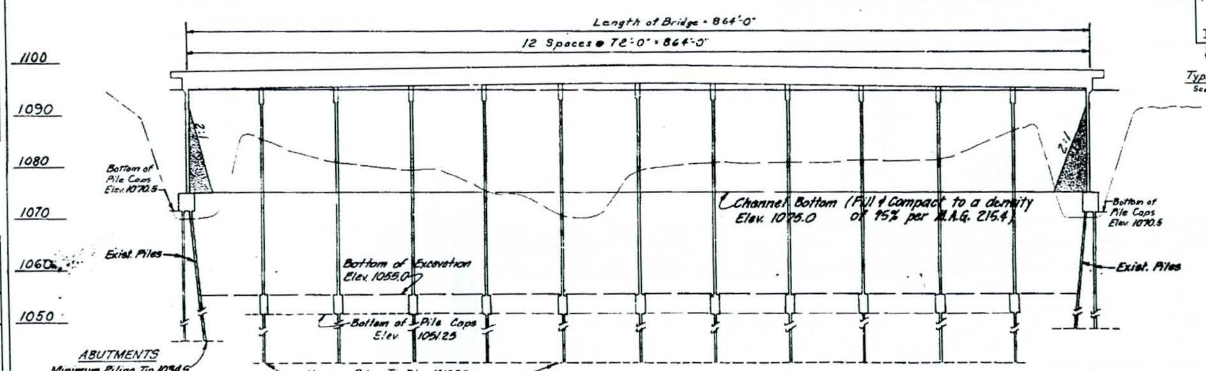


12-SPAN PRESTRESSED BOX BEAM BRIDGE

Scale: 1" = 50'

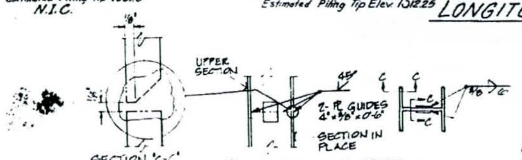
Q=150,000 c.f.s. W.S. Elev=1095.0
Q=180,000 c.f.s. (Pressure flow condition for limited periods of time.)





LONGITUDINAL BRIDGE SECTION

Scale: Horiz. 1" = 50'
Vert. 1" = 10'



PILE SPLICE DETAIL

Note
Welding Rods Shall Be Type 'E70XX'

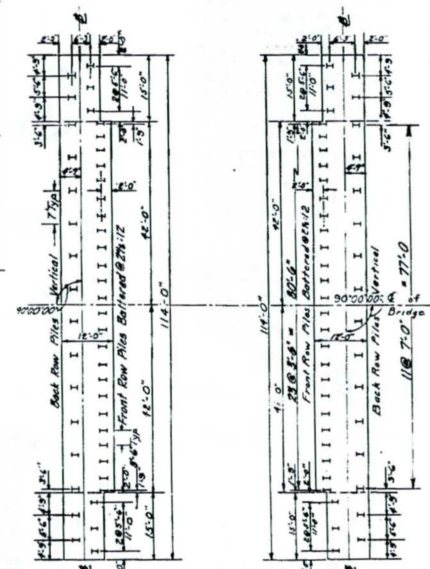
NOTE: Top of Piles shall be cut-off at elev. 1052.25 @ ℄ of pile at piers. 1071.5 @ ℄ of pile at abutments.

GENERAL NOTES

Construction: Uniform Standard Specifications For Public Works Construction Of Maricopa Association Of Governments 1979.

Pile points shall be A.P.F. "Hard Bite" HP77750 Driving Point installed per manufacturers specifications.

All piles shall be driven to Minimum Ultimate Capacity of 300 Tons as determined by the appropriate Wave Equation Analysis Curve.



ABUTMENT No 1
Pile Cap
Sta. 30+75.00
N.T.S.

ABUTMENT No 2
Pile Cap
Sta. 39+39.00
N.T.S.

NOTES:

1. N.I.C. Means "Not In Contract."
2. Abutment piles have been driven by a separate contract and are in place. This contract includes construction of reinforced concrete abutments per attached structural drawings.
3. This contract includes pile driving and structural concrete work for all piers.

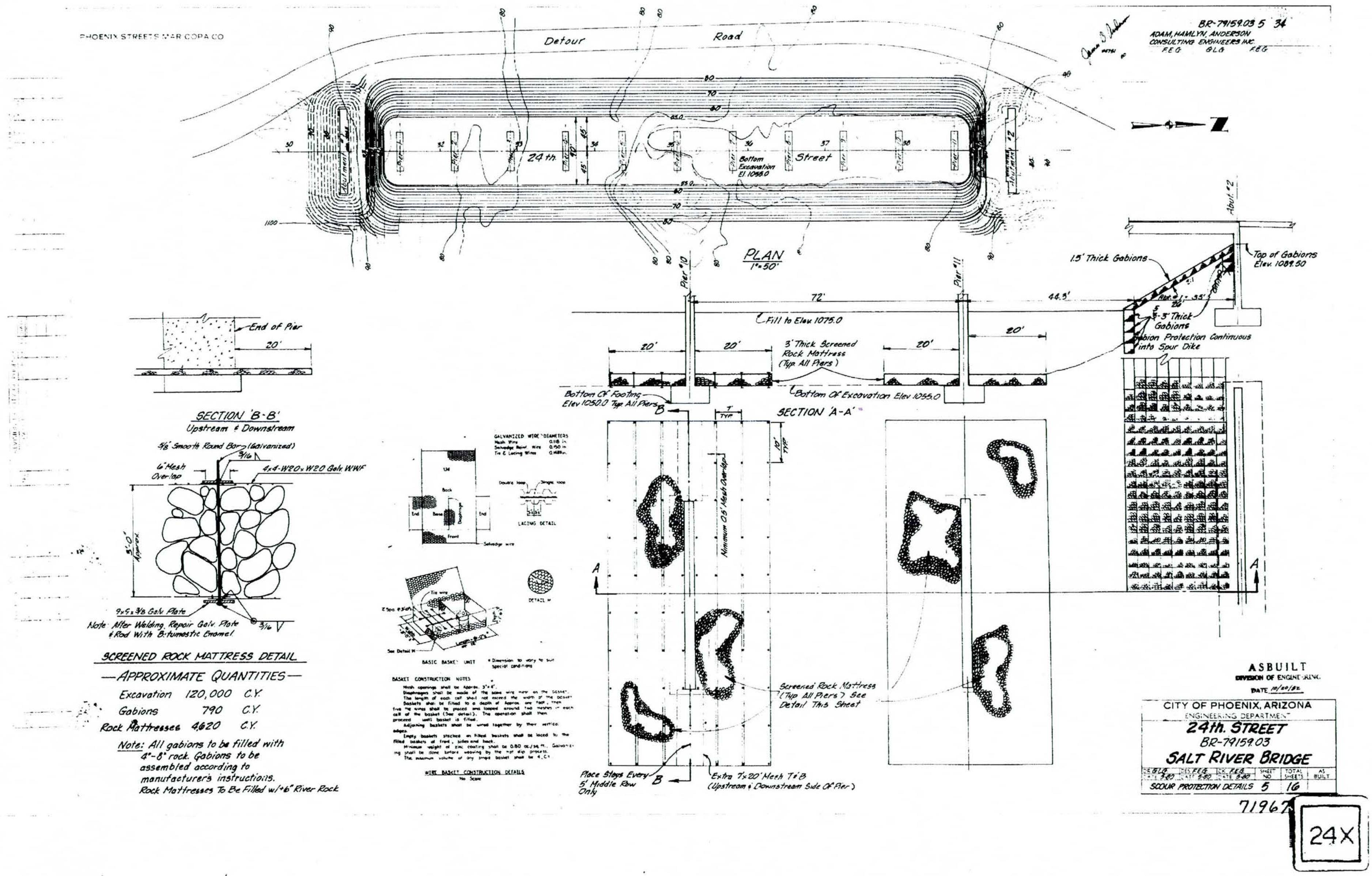
ASBUILT
DIVISION OF ENGINEERING
DATE 10/20/82

71978

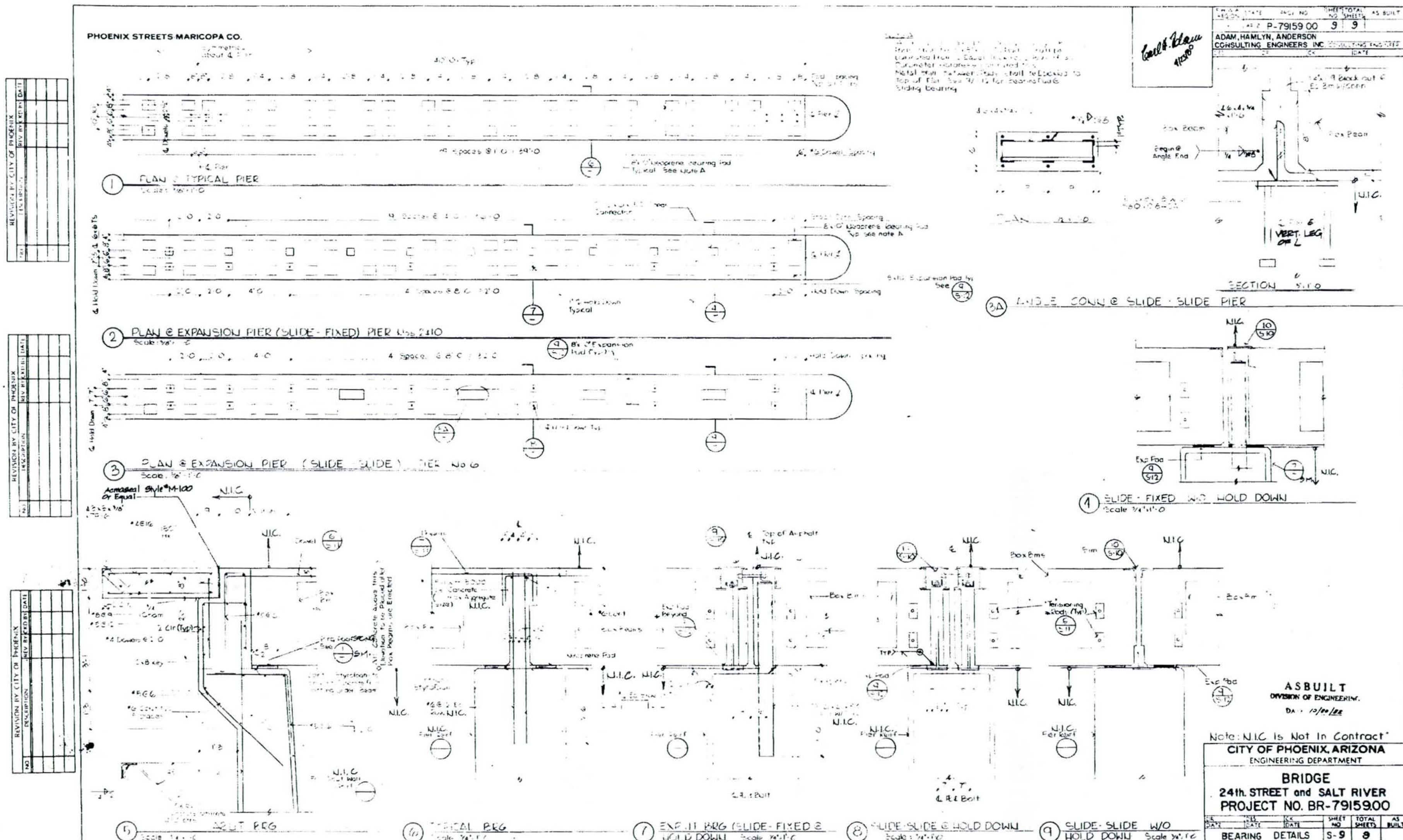
PILE DRIVING
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
BRIDGE
24th STREET and SALT RIVER
PROJECT NO. BR-79159.03

LOCATION PLAN | 16 | 16

24X



PHOENIX STREETS MARICOPA CO
BR-79159.03 5 34
ADAM, HAMLYN, ANDERSON CONSULTING ENGINEERS INC.
F.E.G. G.L.G. F.E.G.
Detour Road
24th. Street
Bottom Excavation El. 1055.0
Abutment #1
Abutment #2
PLAN
1"=50'
Pier #10
Pier #11
Abut. #2
72'
44.5'
1.5' Thick Gabions
Top of Gabions Elev. 1089.50
Fill to Elev. 1075.0
3' Thick Screened Rock Mattress (Typ. All Piers)
1.5' Thick Gabions
Gabion Protection Continuous into Spur Dike
Bottom Of Footing Elev 1050.0 Typ. All Piers
Bottom Of Excavation Elev 1055.0
SECTION 'A-A'
End of Pier
20'
SECTION 'B-B'
Upstream & Downstream
5/8" Smooth Round Bar (Galvanized)
6" Mesh Overlap
4x4-W20xW20 Galv. WWF
3'-0" Approx.
9x9x3/8 Galv. Plate
Note: After Welding Repair Galv. Plate & Rod With Bitumastic Enamel
SCREENED ROCK MATTRESS DETAIL
GALVANIZED WIRE DIAMETERS
LACING DETAIL
DETAIL H
BASIC BASKET UNIT
BASKET CONSTRUCTION NOTES
WIRE BASKET CONSTRUCTION DETAILS
No Scale
Minimum 0.5' Mesh Overlap
Screened Rock Mattress (Typ. All Piers) See Detail This Sheet
Place Stays Every 5' Middle Row Only
Extra 7'x20' Mesh T's B (Upstream & Downstream Side Of Pier)
— APPROXIMATE QUANTITIES —
Excavation 120,000 C.Y.
Gabions 790 C.Y.
Rock Mattresses 4,620 C.Y.
Note: All gabions to be filled with 4"-8" rock. Gabions to be assembled according to manufacturer's instructions.
Rock Mattresses To Be Filled w/+6" River Rock
ASBUILT
DIVISION OF ENGINEERING
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
24th. STREET
BR-79159.03
SALT RIVER BRIDGE
SCOUR PROTECTION DETAILS 5 16
7196
24X

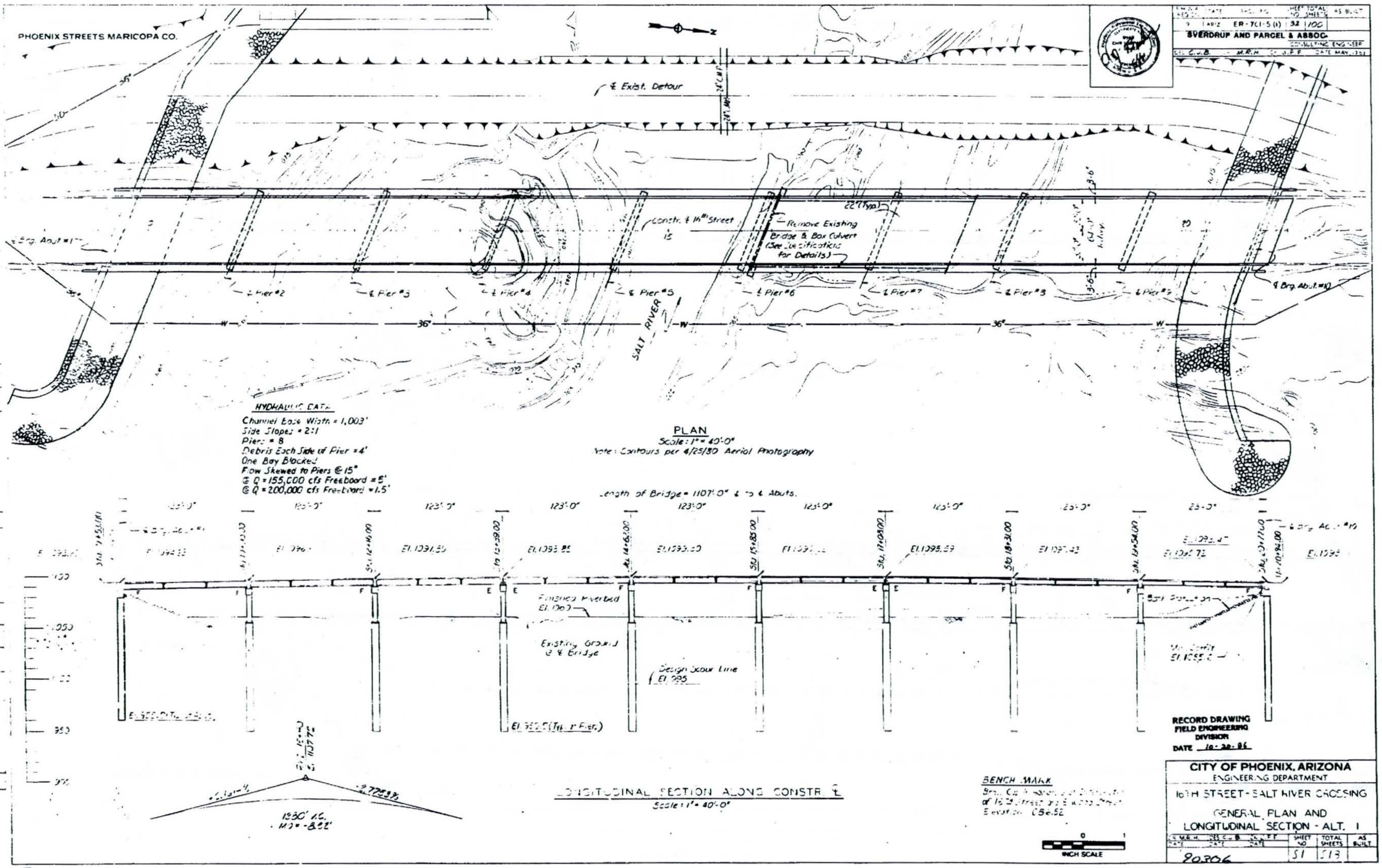


PHOENIX STREETS MARICOPA CO.
P-7915900
ADAM, HAMLYN, ANDERSON
CONSULTING ENGINEERS INC
PLAN @ TYPICAL PIER
PLAN @ EXPANSION PIER (SLIDE - FIXED) PIER Nos. 2 & 10
PLAN @ EXPANSION PIER (SLIDE - SLIDE) PIER No 6
ANGLE CONN @ SLIDE - SLIDE PIER
SECTION
SLIDE - FIXED W/O HOLD DOWN
ABUT BRG
TYPICAL BRG
EXP. JT BRG (SLIDE - FIXED) & HOLD DOWN
SLIDE - SLIDE @ HOLD DOWN
SLIDE - SLIDE W/O HOLD DOWN
ASBUILT
DIVISION OF ENGINEERING
Note: N.I.C Is Not In Contract
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
BRIDGE
24th. STREET and SALT RIVER
PROJECT NO. BR-7915900
BEARING DETAILS
S-9
9

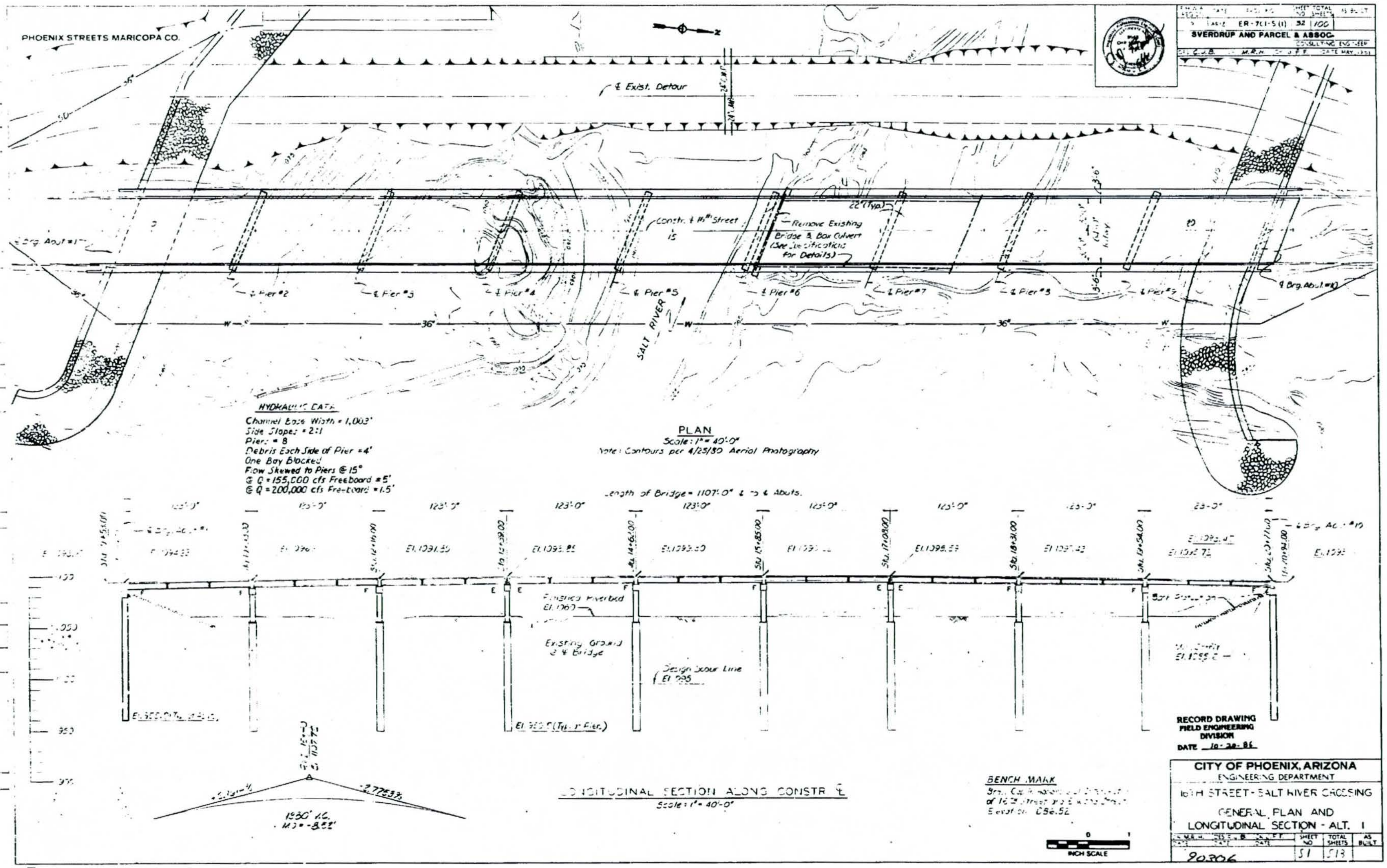
71952

24X

16th Street Bridge As-builts



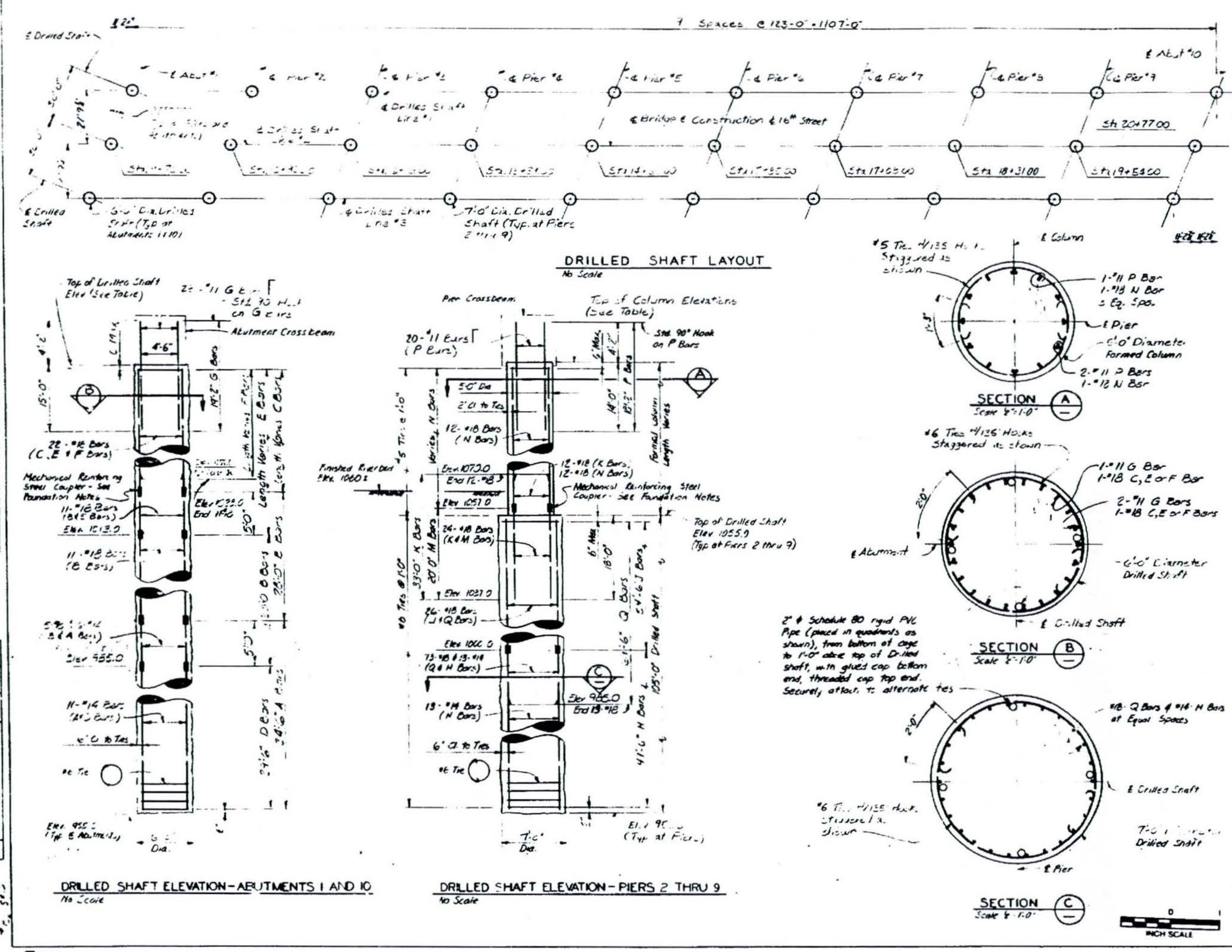
PHOENIX STREETS MARICOPA CO.
SVERDRUP AND PARCEL & ASSOC.
CONSULTING ENGINEERS
ER-7C1-5(1)
℄ Exist. Detour
Constr. ℄ 16th Street
Remove Existing Bridge & Box Culvert (See Specifications for Details)
22° (Typ.)
℄ Brg. Abut. #1
℄ Pier #2
℄ Pier #3
℄ Pier #4
℄ Pier #5
℄ Pier #6
℄ Pier #7
℄ Pier #8
℄ Pier #9
℄ Brg. Abut. #10
SALT RIVER
HYDRAULIC DATA
Channel Base Width = 1,003'
Side Slopes = 2:1
Piers = 8
Debris Each Side of Pier = 4'
One Bay Blocked
Flow Skewed to Piers @ 15°
@ Q = 155,000 cfs Freeboard = 5'
@ Q = 200,000 cfs Freeboard = 1.5'
PLAN
Scale: 1" = 40'-0"
Note: Contours per 4/25/80 Aerial Photography
Length of Bridge = 1107'-0" ℄ to ℄ Abuts.
123'-0"
Finished Riverbed
Existing Ground @ ℄ Bridge
Design Scour Line
LONGITUDINAL SECTION ALONG CONSTR. ℄
Scale: 1" = 40'-0"
BENCH MARK
RECORD DRAWING
FIELD ENGINEERING DIVISION
DATE 10-20-86
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
16TH STREET - SALT RIVER CROSSING
GENERAL PLAN AND
LONGITUDINAL SECTION - ALT. 1
SHEET NO. S1
TOTAL SHEETS S13
AS BUILT
90306
INCH SCALE


PHOENIX STREETS MARICOPA CO.
SVERDRUP AND PARCEL & ASSOC.
ER-701-5(1)
℄ Exist. Detour
Constr. ℄ 16th Street
Remove Existing Bridge & Box Culvert (See Specifications for Details)
22' (Typ.)
℄ Pier #2
℄ Pier #3
℄ Pier #4
℄ Pier #5
℄ Pier #6
℄ Pier #7
℄ Pier #8
℄ Pier #9
SALT RIVER
HYDRAULIC DATA
Channel Base Width = 1,003'
Side Slopes = 2:1
Piers = 8
Debris Each Side of Pier = 4'
One Bay Blocked
Flow Skewed to Piers @ 15°
@ Q = 155,000 cfs Freeboard = 5'
@ Q = 200,000 cfs Freeboard = 1.5'
PLAN
Scale: 1" = 40'-0"
Note: Contours per 4/25/80 Aerial Photography
Length of Bridge = 1107'-0" ℄ to ℄ Abuts.
123'-0"
Existing Riverbed
Existing Ground ℄ Bridge
Design Scour Line
RECORD DRAWING
FIELD ENGINEERING DIVISION
DATE 10-20-86
LONGITUDINAL SECTION ALONG CONSTR. ℄
Scale: 1" = 40'-0"
BENCH MARK
INCH SCALE
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
16TH STREET - SALT RIVER CROSSING
GENERAL PLAN AND
LONGITUDINAL SECTION - ALT. 1
SHEET NO
TOTAL SHEETS
AS BUILT
90306
S1
S13

PHOENIX STREETS-MARICOPA CO.

FHWA REGION	STATE	PROJ NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ	ER-701-5 (1)	36	100	

SVERDRUP AND PARCEL & ASSOC.
CONSULTING ENGINEER
DES PRB | DR TT | CK PRB | DATE MAY, 1981



TOP OF COLUMN ELEVATIONS

Location	Drilled Shaft Line #1	Drilled Shaft Line #2	Drilled Shaft Line #3
*Abut #1	1030.75	[illegible]75	[illegible]75
Pier #2	1083.31	[illegible]	[illegible]
Pier #3	1084.5[illegible]	1084.56	1084.56
Pier #4	1085.2[illegible]	[illegible]	[illegible]
Pier #5	1086.16	1086.16	1086.16
Pier #6	1086.05	[illegible]05	[illegible]
Pier #7	1085.05	1085.05	1085.05
Pier #8	1084.13	[illegible]13	1089.13
Pier #9	1082.36	1082.36	1082.36
*Abut #10	1050.00	1050.00	1050.00

*Top of Drilled Shaft at Abutments 1 & 10.

FOUNDATION NOTES:

Drilled shafts shall be cast-in-place concrete, 28-day strength = 4000 psi.

Excavation of Drilled Shafts in any Pier or Abutment will not be permitted until 48 hours after the adjacent Drilled Shaft has been concreted.

Any construction joint not shown on the project plans will require the approval of the Engineer prior to construction.

Tops of Drilled Shafts shall be within 3" of plan locations. Drilled Shafts shall not deviate more than 1% from plumb.

Reinforcing steel shall conform to ASTM A-615.
All drilled shaft reinforcing shall be grade 60.

Contractor shall be responsible for providing support of reinforcing cages during fabrication, erection and placement of concrete. Plans showing reinforcing cage support and [illegible] of erection shall be submitted to the Engineer for review and approval prior to construction.
Mechanical Reinforcing Steel Coupler shall develop not less than 125 percent of the specified yield strength of the unspliced reinforcing bar.
Installation shall be in accordance with Manufacturer's recommendations.

The following [illegible] were used in the [illegible]:
1. Angle of [illegible], ϕ = 3[illegible]
2. Cohesion constant, C = 0
3. [illegible] in-place density, γ_{sub} = 81 pcf

RECORD DRAWING
FIELD ENGINEERING DIVISION
DATE 10-29-86

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

16TH STREET-SALT RIVER CROSSING
FOUNDATION LAYOUT ALT. 1

DR TT DATE 1-81	DES PRB DATE 1-81	CK PRB DATE 2-81	SHEET NO	TOTAL SHEETS	AS BUILT
90310			55	518	

7th Street Bridge As-builts

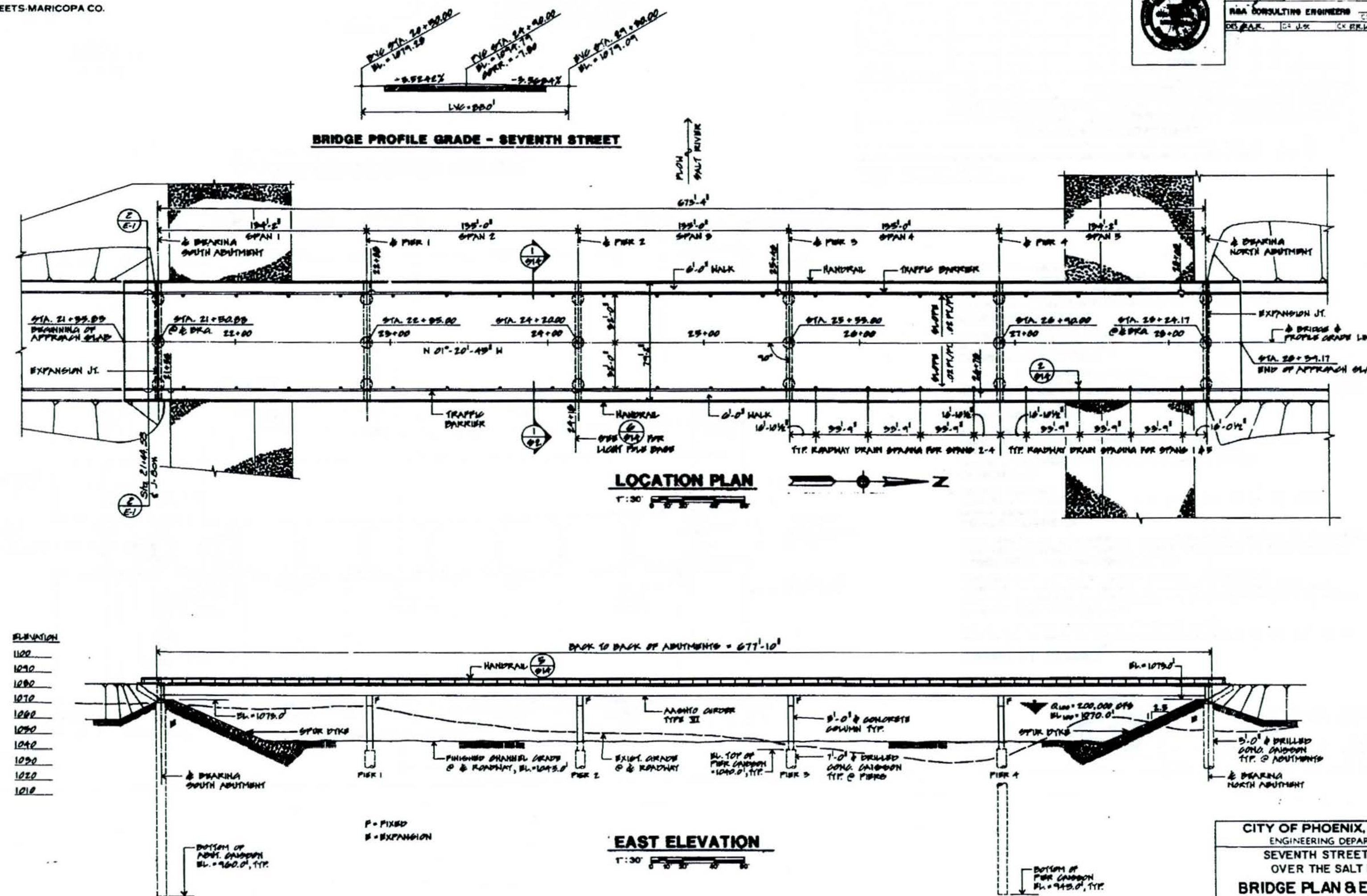
PHOENIX STREETS-MARICOPA CO.

FHWA REGION	STATE	PROJ NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ	ER-900(14)II	39	57	11-27-85 R.G.G.

RBA CONSULTING ENGINEERS

CONSULTING ENGINEER

DES R.A.R. | DR J.K. | CK R.R.L., K.Z. | DATE 7/27/88



CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

SEVENTH STREET BRIDGE
OVER THE SALT RIVER

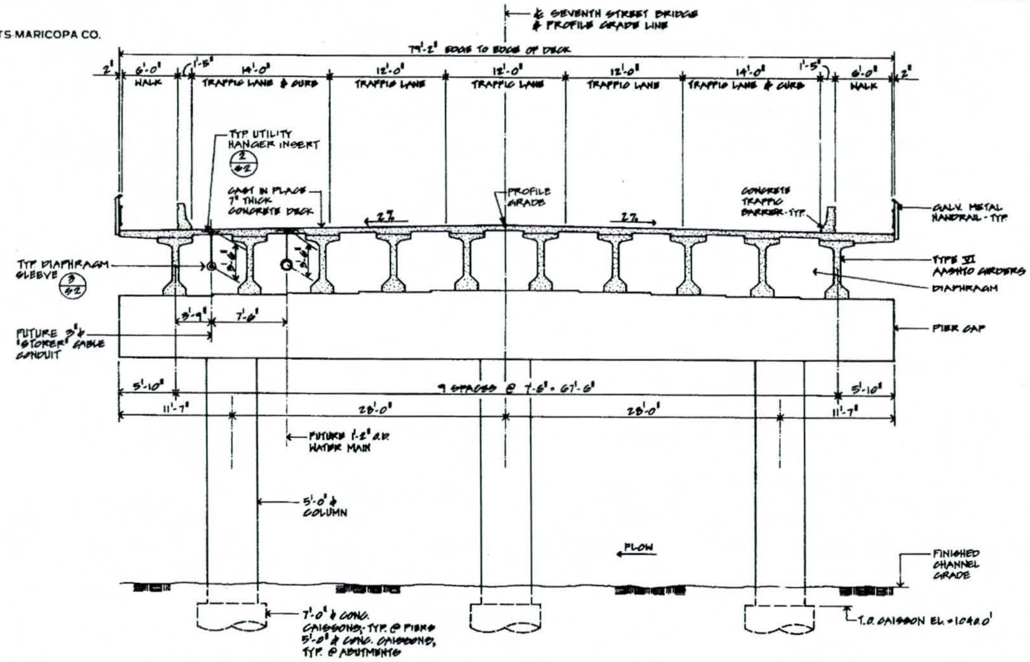
BRIDGE PLAN & ELEVATION

DR J.R.	DES R.A.R.	CK R.R.L., K.Z.	SHEET NO	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE 7/27/88	S-1	57	

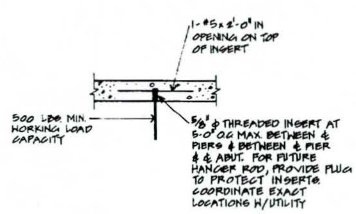
10.4606

7 | ER-900 (14) Ph II | 39 of 57

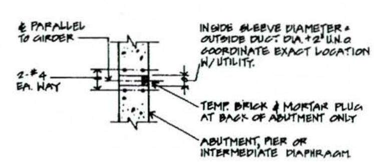
PHOENIX STREETS MARICOPA CO.



1 **TYP. BRIDGE CROSS SECTION**
3/16" = 1'-0"



2 **HANGER INSERT DETAIL**



3 **TYP. DIAPHRAGM UTILITY OPENING**

RGA CONSULTING ENGINEERS

GENERAL NOTES

DETAILS SHOWN SHALL BE INCORPORATED INTO THE PROJECT AT ALL APPROPRIATE LOCATIONS WHETHER SPECIFICALLY CALLED OUT OR NOT.

DESIGN SPECIFICATIONS:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 12TH EDITION DATED 1977, AND THE 1978, 79, 80 & 81 AASHTO INTERIM SPECIFICATIONS.

CONSTRUCTION SPECIFICATIONS:

STANDARD SPECIFICATIONS, ARIZONA HIGHWAY DEPARTMENT OF TRANSPORTATION DATED 1969, 1978 SUPPLEMENTAL SPECIFICATIONS AND THE SPECIAL PROVISIONS.

DESIGN LOADING:

BRIDGE AASHTO HS 20-44
DEAD LOAD INCLUDES ALLOWANCE OF 25 POUNDS PER SQ. FT. FOR FUTURE WEARING SURFACE.

CONCRETE:

CLASS S, F'c = 3000 PSI - BARRIERS & APPROACH SLABS.
CLASS S, F'c = 4500 PSI - DECK SLAB & DIAPHRAGMS
CLASS S, F'c = 4000 PSI - CAISSONS, PIER CAPS AND WING WALLS
SEE SHEET S13 FOR GIRDER CONCRETE.

REINFORCEMENT:

ALL REINFORCING BARS SHALL BE ASTM A615 DEFORMED BILLET STEEL GRADE 60, Fy MIN. = 60,000 PSI. U.N.O. BARS TO BE BENT ACCORDING TO THE MANUAL OF STANDARD PRACTICE A.C.I. ALL REINFORCING STEEL SHALL HAVE 2" CLEAR COVER UNLESS OTHERWISE INDICATED.

CONSTRUCTION JOINTS:

NO CONSTRUCTION JOINTS SHALL BE USED, EXCEPT BY PERMISSION OF THE ENGINEER OR AS SHOWN ON THE PLANS.

STRUCTURAL STEEL:

STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:
STEEL TUBING - ASTM A500, GRADE B, Fy = 46 KSI
STEEL PIPE - ASTM A501, Fy = 36 KSI
MISC. STEEL - ASTM A36

STRUCTURAL EXCAVATION = 104 C.Y.
SPECIAL BACKFILL = 110 C.Y.
STRUCTURAL EXCAVATION & SPECIAL BACKFILL PAYMENT LIMITS PER A.D.O.T. STD. DRAWING C-13-12.

APPROXIMATE QUANTITIES

	CLASS "S" CONCRETE			PRECAST GIRDERS TYPE VI		REINF. STEEL (2)	C.I.P. CAISSONS (1)	TRAFFIC BARRIER	METAL HANDRAIL
	F'c = 3000 PSI	F'c = 4000 PSI	F'c = 4500 PSI						
	C.Y.	C.Y.	C.Y.	NO.	LENGTH	LBS.	L.F.	L.F.	L.F.
SOUTH ABUTMENT	37	89	–	–	–	20,800	376	–	–
PIER #1	–	159	–	–	–	60,800	285	–	–
PIER #2	–	162	–	–	–	68,800	285	–	–
PIER #3	–	162	–	–	–	63,000	285	–	–
PIER #4	–	159	–	–	–	60,800	285	–	–
NORTH ABUTMENT	37	89	–	–	–	20,800	376	–	–
SUPERSTRUCTURE	–	–	1659	50	4717	371,900	–	1407	1390
TOTAL	74	820	1659	50	4717	688,100	1,892	1407	1390

(1) PIER CAISSON LIMITS ARE 1040.0' AT T.O. CAISSON TO 945.0' AT B.O. CAISSON.
ABUTMENT CAISSON LIMITS ARE 1070.3 AT T.O. CAISSON TO 945.0' AT B.O. CAISSON (TEST CAISSON QUANTITY IS NOT INCLUDED.)

(2) QUANTITIES DO NOT INCLUDE CAISSON CAGE REINF. OR TRAFFIC BARRIER REINF. SEE SPECIAL PROVISIONS. CAISSON CAGE INCLUDES BAR EXTENSIONS IN ABUTMENT CAP BUT DOES NOT INCLUDE COLUMN BARS IMBEDDED IN TOP OF PIER CAISSONS. TRAFFIC BARRIER/DECK TIES (L) ARE CONSIDERED TRAFFIC BARRIER REINF. AND ARE NOT INCLUDED IN REINF. STEEL QUANTITY.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
SEVENTH STREET BRIDGE
OVER THE SALT RIVER
BRIDGE SECTION & GENERAL NOTES

M18.7.97

DR. JG	DES. SAR	CHK'D. DRL, KZ DATE 7/27/82	SHEET NO.	TOTAL SHEETS	AS BUILT
104607			S-2	57	

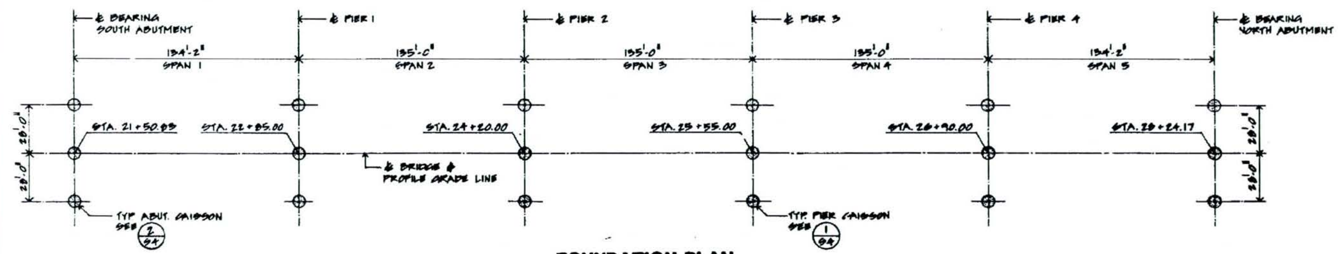
7 | ER-900 (14) Ph II | 40 of 57

PHOENIX STREETS-MARICOPA CO.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	ER-900(14) II	42	57	11-27-85 R.L.G.

RGA CONSULTING ENGINEERS — CONSULTING ENGINEER

DES. G.A.R. DR. J.G. CK. BRL, K.Z. DATE 7/27/82



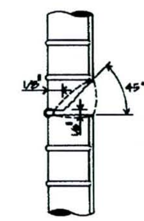
FOUNDATION PLAN

1" : 30'

FOUNDATION DATA	PIER PILE	ABUT. PILE
CAPACITY @ MAX. SCOUR	3300K	1600K
MAX. DESIGN SCOUR ELEVATION	1005'	1005'

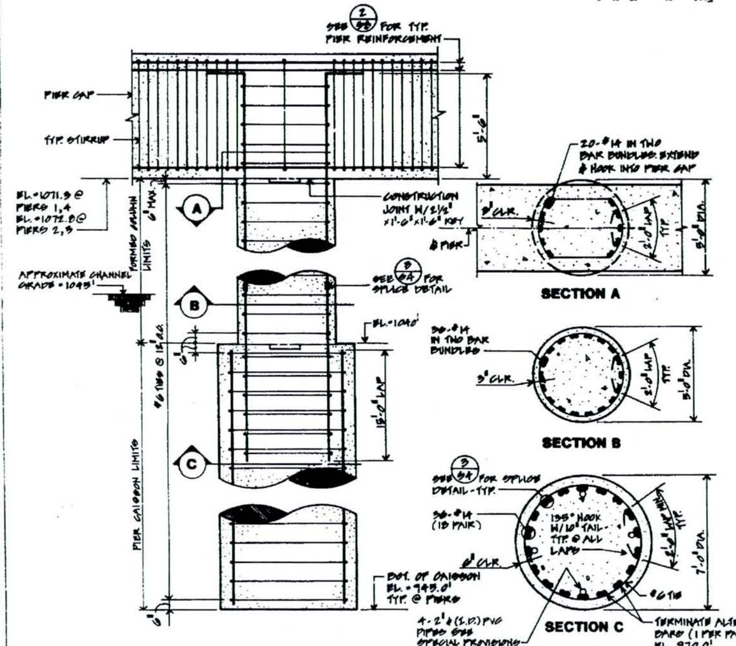
NOTES:

1. LOCATE SPLICES IN MIDDLE 1/3 OF CAISSON OR COLUMN HEIGHT ONLY.
2. STAGGER ADJ. SPLICES 4'-0" O.C. MIN.
3. REINF. STEEL SHALL BE ASTM A706, GRADE 60 WHERE WELDED SPLICES ARE USED.
4. A MECHANICAL REINFORCING STEEL COUPLER IS AN ACCEPTABLE ALTERNATE SPLICE. THE COUPLER SHALL DEVELOP NOT LESS THAN 125 PERCENT OF THE SPECIFIED YIELD STRENGTH OF THE UNSPLICED REINFORCING BAR.



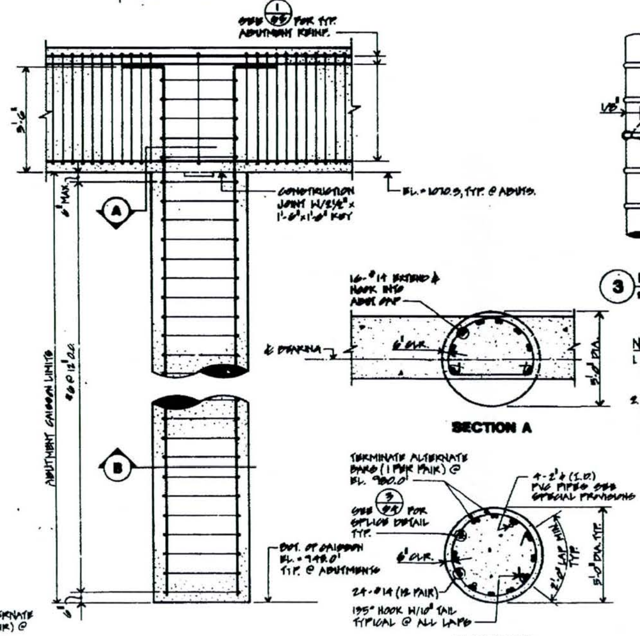
3 REINFORCING STEEL SPLICE DETAIL

NO SCALE



1 TYP. PIER CAISSON

3/8" : 1'-0"



2 TYP. ABUTMENT CAISSON

3/8" : 1'-0"

NOTES:

1. TEST CAISSON: THE CONTRACTOR SHALL CONSTRUCT ONE FULL DEPTH TEST CAISSON IN ACCORDANCE WITH THE DETAILS SHOWN FOR THE PIER CAISSONS. SEE SPECIAL PROVISIONS.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SUPPORT OF REINFORCING CAGES DURING FABRICATION, ERECTION AND PLACEMENT OF CONCRETE. PLANS SHOWING REINFORCING CAGE SUPPORT AND METHODS OF ERECTION SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

SEVENTH STREET BRIDGE
OVER THE SALT RIVER

FOUNDATION PLAN

M 18.7.198

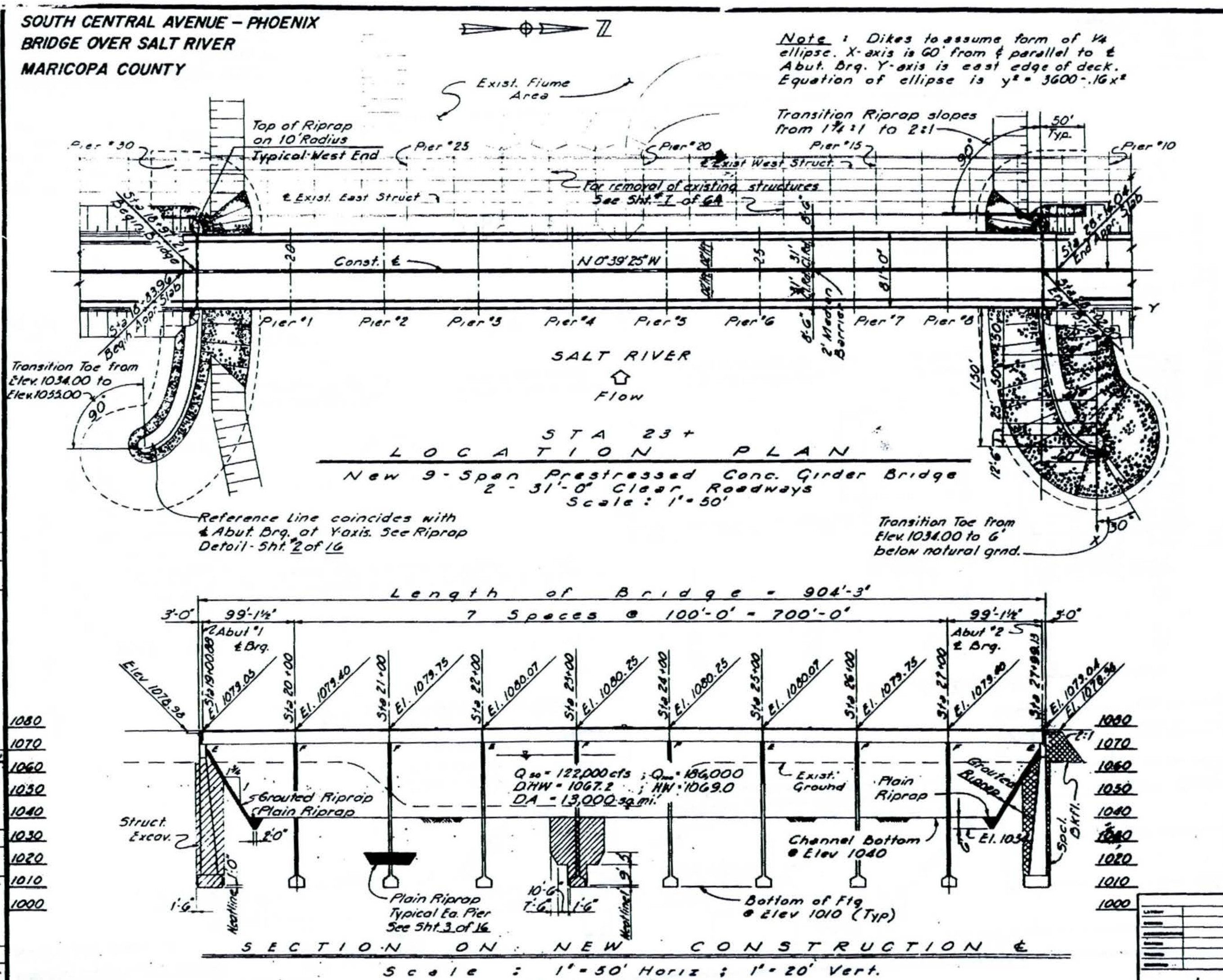
DR. J.G. DATE	DES. G.A.R. DATE	CK. BRL, K.Z. DATE 7/27/82	SHEET NO.	TOTAL SHEETS	AS BUILT
104609			S-4	57	

Central Ave Bridge As-builts

Ø9324

Ø9324

SOUTH CENTRAL AVENUE – PHOENIX
BRIDGE OVER SALT RIVER
MARICOPA COUNTY



ER-221(7) 49 62 6-14-77 44

GENERAL NOTES

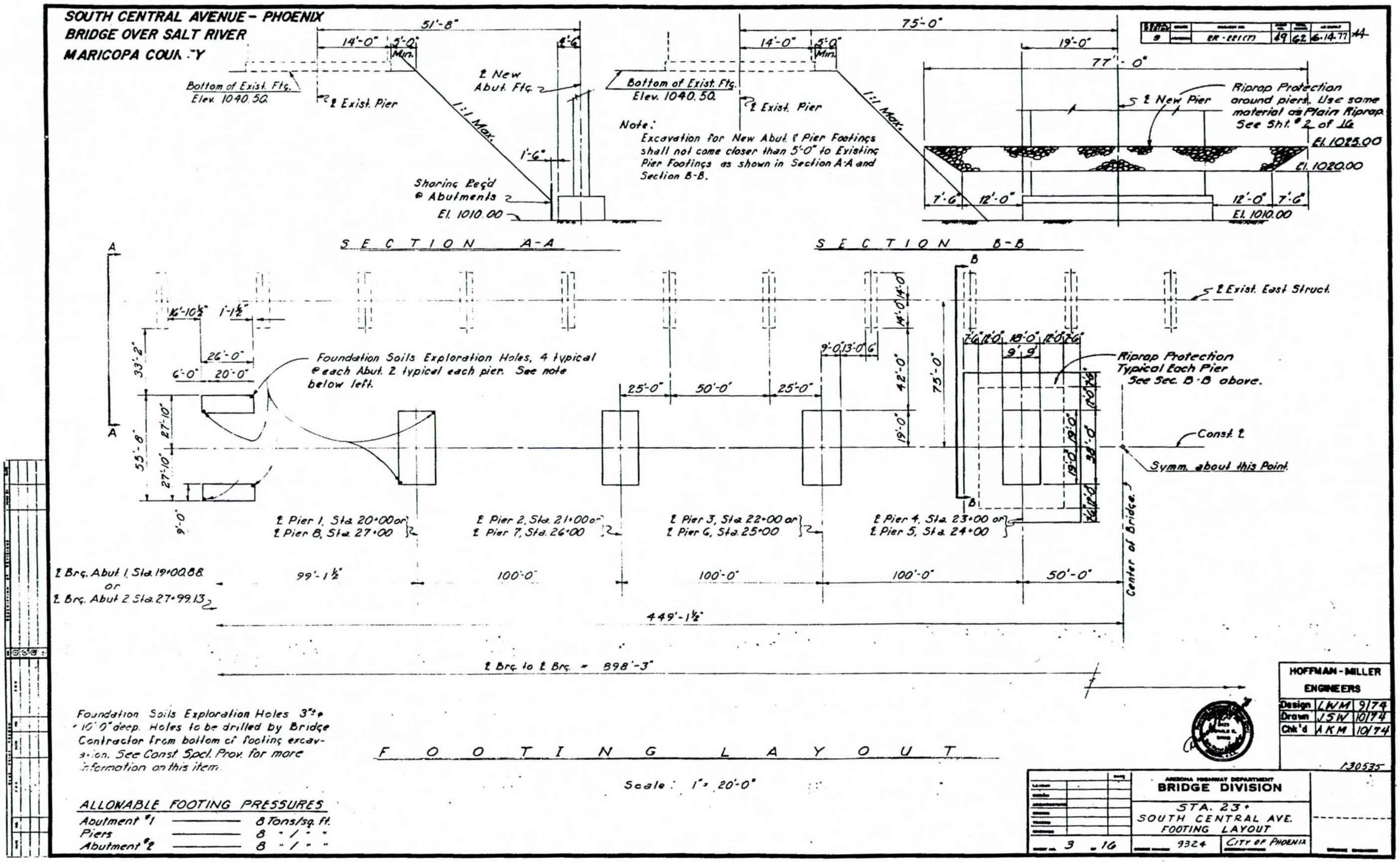
Construction: Arizona Department of Transportation Ed. of 1969, rev. to date.
Design: A.A.S.H.T.O. Std. Spec's for Highway Bridges, 1973, revised to date. Girder design - 3-span continuous for liveload, simple span for deadload. Composite design - deadload by Girders only.
Loading Class: HS 20-44.
Allowable Stresses:
Class "A" Conc. - fc = 1000 psi ; n = 12
Class "D" Conc - fc = 1200 psi ; n = 10
Class "S" Conc - f'c = 5250 psi ; n = 6
Reinf. Steel - fs = 20,000 or 24,000 psi
Struct. Steel - fs = 20,000 psi
Prestressing Steel shall be Type 270K, 7 wire, uncoated, stress-relieved strand. Min. ultimate Strength for 1/2" ϕ strand (A = .153□") = 41,300#. ASTM Spec. A416
Reinforcing Steel shall conform to ASTM Spec. A615 Grade 40 or 60.
Struct. Steel shall conform to ASTM A36
All Welding shall conform to the requirements of the special provisions.
Paint and Painting shall conform to Std. Spec's. Contact surfaces shall not be painted. Struct. steel to have one shop coat paint #1A or #1B, #3 and #10. No field paint reqd.
Dimensions shall not be scaled from drwgs.
All dimensions for Reinf. Steel shall be to center of bars unless otherwise noted.
Arizona State Highway Dept. Foundation Data Sheet for the Central Avenue Bridge over Salt River - 1946 - will be available at Arizona Dept. of Transportation for informational purposes only.
Dead Load: Includes allowance for future wearing surface of 25 psf.
All reinforcing steel shall have 2" clear cover unless noted otherwise.

HOFFMAN - MILLER ENGINEERS

Design	LWM	9/74
Drawn	JSN	9/74
Chk'd.	LWM	12/74

130533

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION
STA 23+
SOUTH CENTRAL AVE
LOCATION PLAN
1 - 16 9324 CITY OF PHOENIX



SOUTH CENTRAL AVENUE - PHOENIX
BRIDGE OVER SALT RIVER
MARICOPA COUNTY
9 ER-221(7) 19 62 6-14-77
51'-8"
14'-0" 5'-0" Min.
2'-6"
Bottom of Exist. Ftg. Elev. 1040.50
℄ Exist. Pier
℄ New Abut. Ftg.
1:1 Max.
1'-6"
Shoring Req'd @ Abutments
El. 1010.00
SECTION A-A
75'-0"
14'-0" 5'-0" Min.
Bottom of Exist. Ftg. Elev. 1040.50
℄ Exist. Pier
Note: Excavation for New Abut. & Pier Footings shall not come closer than 5'-0" to Existing Pier Footings as shown in Section A-A and Section B-B.
1:1 Max.
19'-0"
77'-0"
℄ New Pier
Riprap Protection around piers. Use same material as Plain Riprap. See Sht. # 2 of 16
El. 1025.00
El. 1020.00
7'-6" 12'-0" 12'-0" 7'-6"
El. 1010.00
SECTION B-B
℄ Exist. East Struct.
16'-10½" 1'-1½"
26'-0"
6'-0" 20'-0"
33'-2"
55'-8"
27'-10" 27'-10"
9'-0"
Foundation Soils Exploration Holes, 4 typical @ each Abut. 2 typical each pier. See note below left.
25'-0" 50'-0" 25'-0"
9'-0 13'-0 6'
14'-0 14'-0
42'-0"
75'-0"
19'-0"
7'-6 12'-0 19'-0" 12'-0 7'-6
9' 9'
Riprap Protection Typical Each Pier See Sec. B-B above.
Const. ℄
Symm. about this Point
℄ Pier 1, Sta. 20+00 or ℄ Pier 8, Sta. 27+00
℄ Pier 2, Sta. 21+00 or ℄ Pier 7, Sta. 26+00
℄ Pier 3, Sta. 22+00 or ℄ Pier 6, Sta. 25+00
℄ Pier 4, Sta. 23+00 or ℄ Pier 5, Sta. 24+00
Center of Bridge
℄ Brg. Abut 1, Sta. 19+00.88 or ℄ Brg. Abut 2 Sta. 27+99.13
99'-1½" 100'-0" 100'-0" 100'-0" 50'-0"
449'-1½"
℄ Brg. to ℄ Brg. = 898'-3"
Foundation Soils Exploration Holes 3"± φ × 10'-0" deep. Holes to be drilled by Bridge Contractor from bottom of footing excavation. See Const. Spcl. Prov. for more information on this item.
FOOTING LAYOUT
Scale: 1" = 20'-0"
ALLOWABLE FOOTING PRESSURES
Abutment #1 — 8 Tons/sq. ft.
Piers — 8 " / " "
Abutment #2 — 8 " / " "
HOFFMAN-MILLER ENGINEERS
Design LWM 9/74
Drawn JSW 10/74
Chk'd AKM 10/74
130535
ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION
STA. 23+
SOUTH CENTRAL AVE.
FOOTING LAYOUT
3 16
9324
CITY OF PHOENIX

7th Ave Bridge As-builts

Ø9898

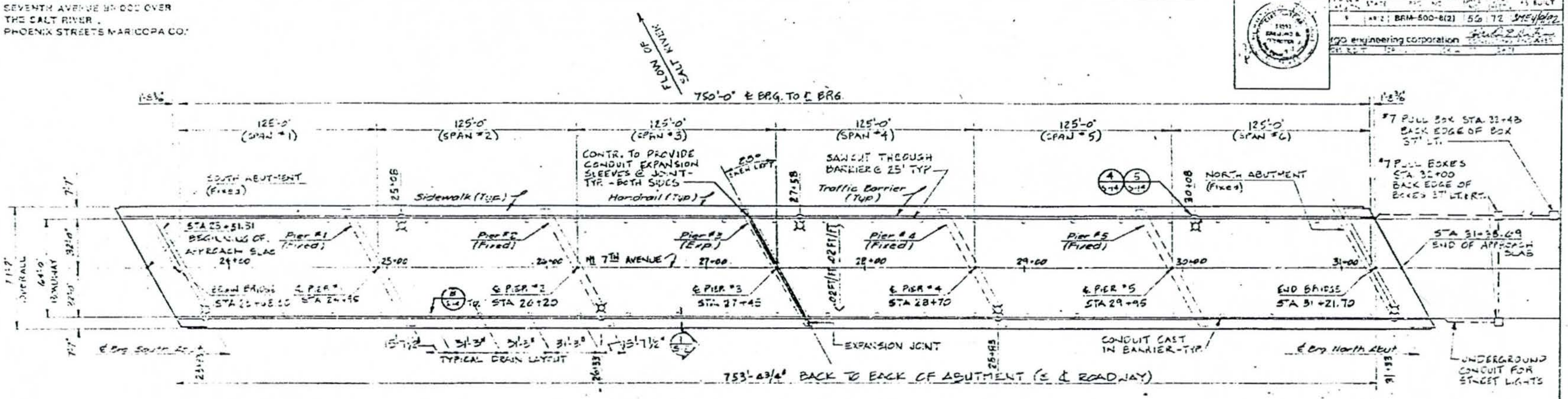
Ø9898

Structure No. 9898

SEVENTH AVENUE BRIDGE OVER
THE SALT RIVER
PHOENIX STREETS MARICOPA CO.

	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	BRM-500-8(2)	56	72	

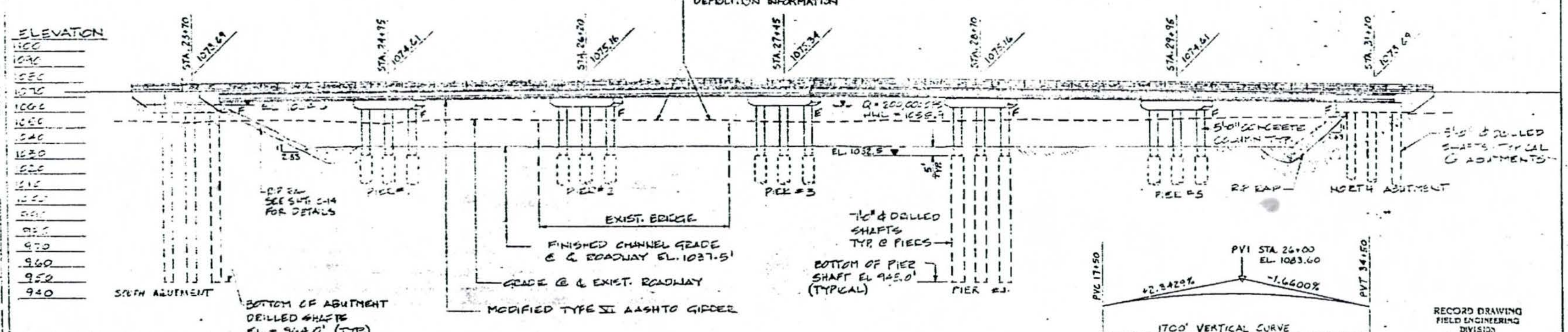
argo engineering corporation



New Six Span Prestressed Concrete Girder Bridge
Skew 28° Left STRUCTURE No. 9898

LOCATION PLAN
SCALE: 1" = 30'-0"

SEE CIVIL SHEET #C-7 FOR EXISTING BRIDGE & ROADWAY DEMOLITION INFORMATION



PROFILE GRADE

EAST ELEVATION
SCALE: 1" = 30'-0"

STRUCTURAL SHEET INDEX

S-1	BRIDGE PLAN & ELEV. & BRIDGE LIGHTING PLAN
S-2	BRIDGE SECTION & NOTES
S-3	SOIL BORING LOG
S-4	FOUNDATION PLAN & DETAILS
S-5	TYPICAL ABUTMENT
S-6	WING WALL & APPROACH
S-7 TO S-8	PIER DETAILS
S-9	FRAMING PLAN & DETAILS
S-10	GIRDER DETAILS
S-11 TO S-13	DIAPHRAGM DETAILS
S-14	HANDRAIL & BARRIER
S-15 TO S-17	DECK ELEVATIONS

LIGHTING NOTES

1. 2" Ø, 90° HEAT RATED, DIRECT BURIED GREY CONDUIT. CURVES SHALL BE SCHEDULE 40 OR 80 WITH A 24" MINIMUM RADIUS. PROVIDE MINIMUM OF 24" COVER WHERE DIRECT BURIED. CONDUIT SHALL BE SUPPLIED AND INSTALLED BY CONTRACTOR.
2. PULL ROPE (3/16" NYLON) SHALL BE SUPPLIED AND INSTALLED IN CONDUIT BY CONTRACTOR.
3. PULL BOXES TO BE SUPPLIED AND INSTALLED BY CONTRACTOR. PULL BOX LIDS SHALL BE MARKED "APS ELECTRIC."
4. STREET LIGHTS AND POLES TO BE SUPPLIED AND INSTALLED BY UTILITY CO.

253-1100

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE

DO NOT SCALE DRAWINGS.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
SEVENTH AVENUE BRIDGE
OVER THE SALT RIVER
BR-845479

BRIDGE PLAN & ELEVATION

SCALE: 1" = 30'-0"	SHEET NO.	TOTAL SHEETS	AS BUILT
	56	72	

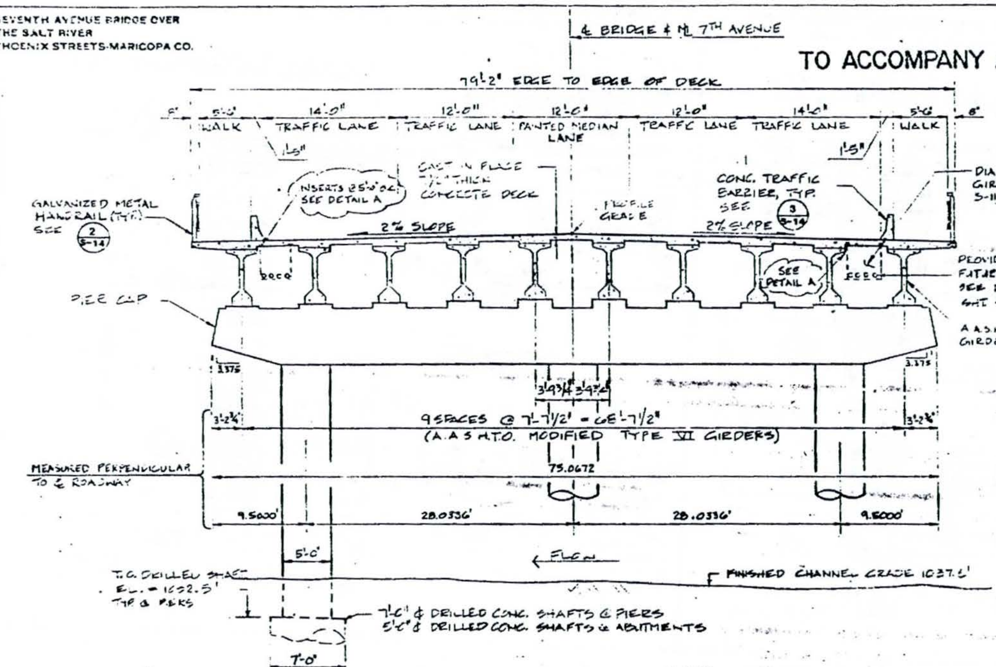
17 (BRM-500-8(2)) 56 of 72 S-1

RQA PROJECT #85018

SEVENTH AVENUE BRIDGE OVER
THE SALT RIVER
PHOENIX STREETS-MARICOPA CO.

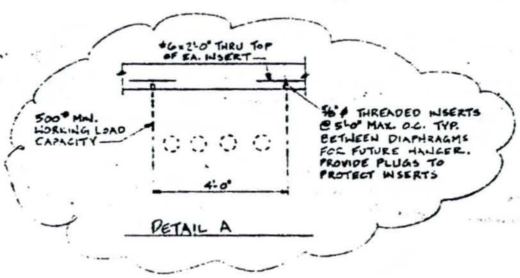
Structure No. 9398

TO ACCOMPANY ADDENDUM NO. 3



NOTE
VIEW IS PERPENDICULAR TO ROADWAY CENTERLINE. SUBSTRUCTURE IS SHOWN AS A SKEWED PROJECTION.

1 TYPICAL SECTION
SCALE 3/16" = 1'-0"



DETAIL A

NOTES

CONSTRUCTION SPECIFICATIONS
ARIZONA DEPARTMENT OF TRANSPORTATION, "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION," 1982 EDITION, AND 1985 SUPPLEMENTAL SPECIFICATIONS.

DESIGN SPECIFICATIONS
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, THIRTEENTH EDITION, INCLUDING 1984 INTERIM SPECIFICATIONS FOR BRIDGES.

SEISMIC DESIGN
GUIDE SPECIFICATIONS FOR SEISMIC DESIGN OF HIGHWAY BRIDGES 1983. SEISMIC PERFORMANCE CATAGORY A.

DESIGN LOADING
BRIDGE AASHTO HS 20-44; DESIGN INCLUDES ALLOWANCE FOR 25 PSF FOR FUTURE WEARING SURFACE; SPANS ARE CONTINUOUS FOR LIVE LOADING.

CONCRETE
CLASS S, f'c = 3000 psi - BARRIERS AND APPROACH SLABS.
CLASS S, f'c = 4500 psi - DECK SLAB & DIAPHRAMS.
f c = 1400 psi
CLASS S, f'c = 4000 psi - DRILLED SHAFTS, COLUMNS, PIER CAPS, ABUTMENTS, AND WING WALLS.
SEE GIRDER DETAILS FOR GIRDER CONCRETE. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4" UNLESS NOTED OTHERWISE.

REINFORCEMENT
ALL REINFORCING BARS SHALL BE A615 DEFORMED BILLET STEEL GRADE 60, Fy MIN. 60,000 psi. fs = 24000 psi; fs = 20000 psi FOR DECK AND DIAPHRAGMS ONLY. BARS TO BE BENT ACCORDING TO AASHTO SPECIFICATION, SECTION 8.23. ALL REINFORCING STEEL SHALL HAVE 2" CLEAR COVER UNLESS OTHERWISE INDICATED. ALL REINFORCING STEEL DIMENSIONS ARE TO CENTER OF BARS UNLESS NOTED OTHERWISE.

CONSTRUCTION JOINTS
NO CONSTRUCTION JOINTS SHALL BE USED OTHER THAN AS SHOWN ON THE PLANS, EXCEPT BY PERMISSION OF THE ENGINEER.

STRUCTURAL STEEL
STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:
STEEL TUBING - ASTM A 500, GRADE B, FY = 46 K.S.I.
STEEL PIPE - ASTM A 53, GRADE B, FY = 35 K.S.I.
MISC. SHAPES, PLATES & BARS - ASTM A 36, FY = 36 K.S.I.
ALL WELDING SHALL CONFORM TO AWSD1.1 - 80, AND OF THE AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.

RECORD DRAWING
FIELD ENGINEERING DIVISION
DATE 12-4-88

APPROXIMATE QUANTITIES

ITEM	CLASS "S" CONCRETE 3000 PSI C.Y.	CLASS "S" CONCRETE 4000 PSI C.Y.	CLASS "S" CONCRETE 4500 PSI C.Y.	GIRDERS MOD. TYPE VI NO.	GIRDERS MOD. TYPE VI LENGTH	REINF. STEEL LBS.	DRILLED SHAFT L.F.	TRAFFIC BARRIER L.F.	METAL HANDRAIL L.F.
SOUTH ABUTMENT	—	59	—	—	—	16,074	290	—	—
PIER #1	—	176	—	—	—	25,233	253.5	—	—
PIER #2	—	178	—	—	—	25,316	253.5	—	—
PIER #3	—	194	—	—	—	26,708	253.5	—	—
PIER #4	—	178	—	—	—	25,316	253.5	—	—
PIER #5	—	176	—	—	—	25,233	253.5	—	—
NORTH ABUTMENT	—	59	—	—	—	16,074	290	—	—
SUPERSTRUCTURE	97	—	2040	60	7461	583167	—	1574	1538
TOTAL	97	1020	2040	60	7461	743,121	1847.5	1574	1538

TEST CAISSON SHALL BE AS DETAILED FOR PIERS = 84.5 L.F.

DO NOT SCALE DRAWINGS.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
SEVENTH AVENUE BRIDGE
OVER THE SALT RIVER
BR-845479

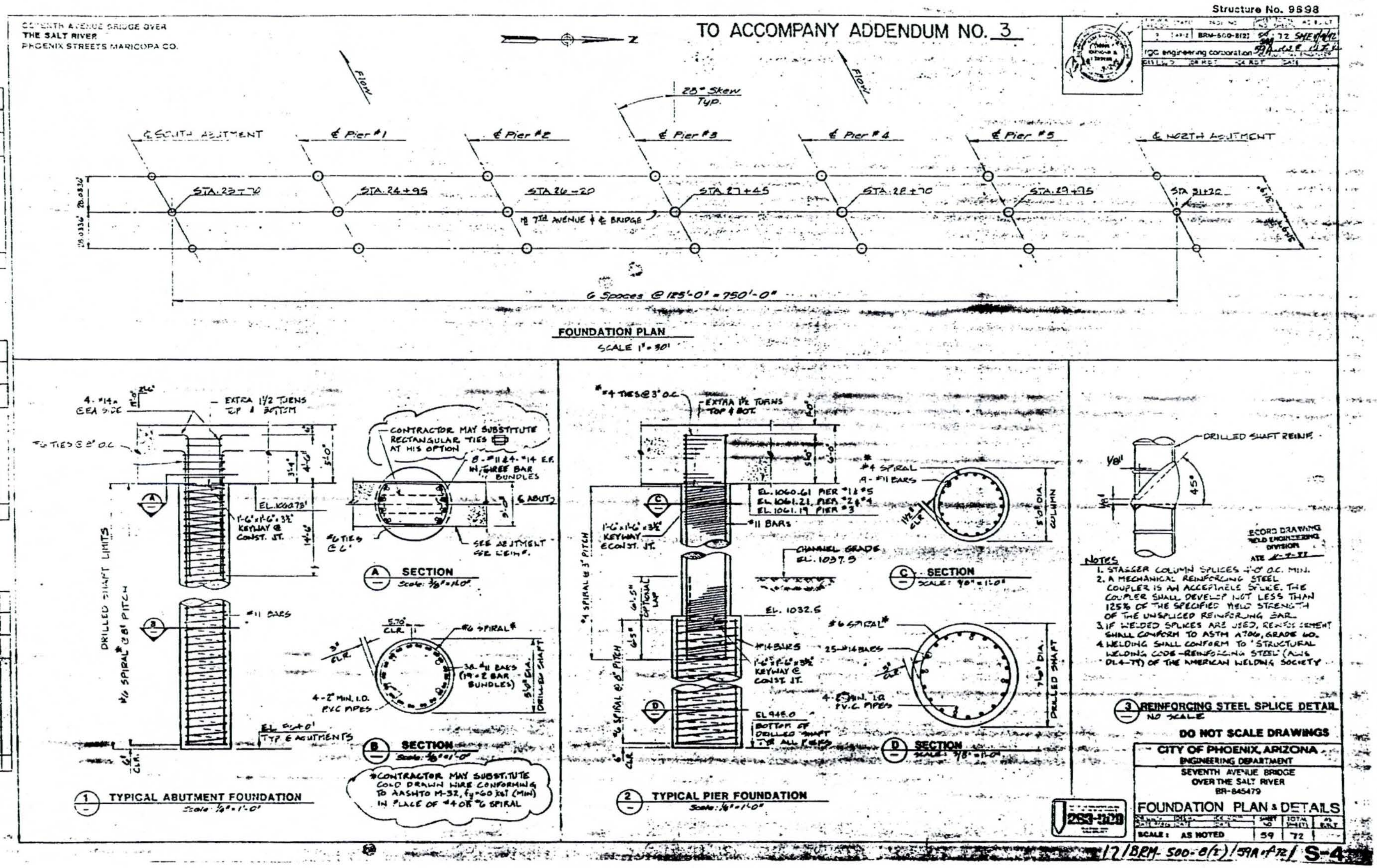
BRIDGE SECTION & NOTES

SCALE: AS NOTED | SHEET NO. 57 | TOTAL SHEETS 72

BRM-500-8(2) 578 of 72 S-2

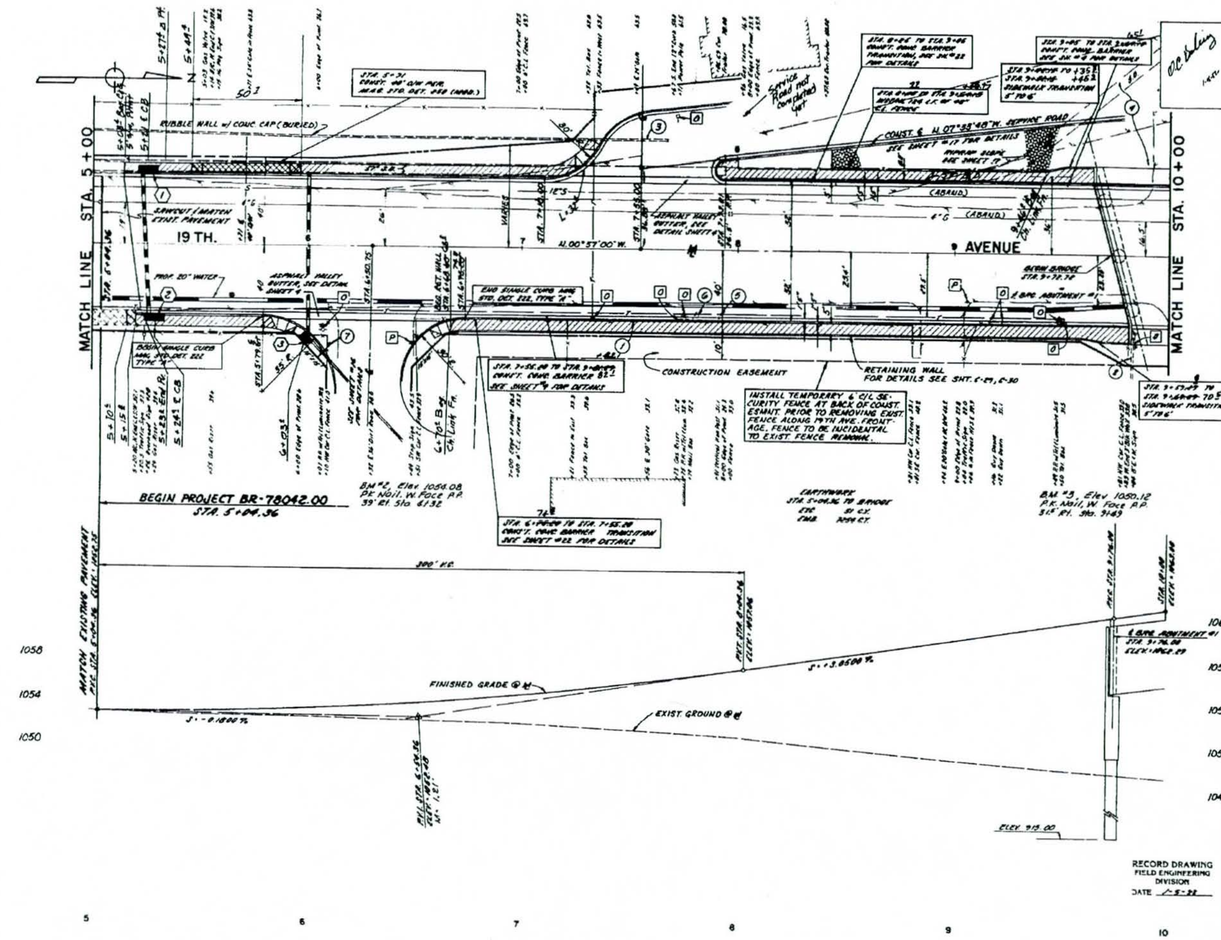
rgo engineering corporation

712



Structure No. 9898
TO ACCOMPANY ADDENDUM NO. 3
SEVENTH AVENUE BRIDGE OVER
THE SALT RIVER
PHOENIX STREETS MARICOPA CO.
FLOW
28° Skew Typ.
℄ SOUTH ABUTMENT
℄ Pier #1
℄ Pier #2
℄ Pier #3
℄ Pier #4
℄ Pier #5
℄ NORTH ABUTMENT
STA. 23+70
STA. 24+95
STA. 26+20
STA. 27+45
STA. 28+70
STA. 29+95
STA. 31+20
℄ 7th AVENUE & ℄ BRIDGE
6 Spaces @ 125'-0" = 750'-0"
FOUNDATION PLAN
SCALE 1" = 30'
CONTRACTOR MAY SUBSTITUTE RECTANGULAR TIES AT HIS OPTION
EXTRA 1 1/2 TURNS TOP & BOTTOM
KEYWAY @ CONST. JT.
DRILLED SHAFT LIMITS
#11 BARS
SECTION A
SECTION B
#6 SPIRAL
4-2" MIN. I.D. P.V.C. PIPES
TYP. @ ABUTMENTS
*CONTRACTOR MAY SUBSTITUTE COLD DRAWN WIRE CONFORMING TO AASHTO M-32, fy=60 ksi (MIN) IN PLACE OF #4 OR #6 SPIRAL
1 TYPICAL ABUTMENT FOUNDATION
#4 TIES @ 3" O.C.
EXTRA 1 1/2 TURNS TOP & BOT.
#4 SPIRAL
EL. 1060.61 PIER #1 & #5
EL. 1061.21 PIER #2 & #4
EL. 1061.19 PIER #3
#11 BARS
CHANNEL GRADE EL. 1037.5
EL. 1032.6
#6 SPIRAL
#14 BARS
25-#14 BARS
KEYWAY @ CONST. JT.
BOTTOM OF DRILLED SHAFT TYP. ALL PIERS
SECTION C
SECTION D
COLUMN
DRILLED SHAFT
2 TYPICAL PIER FOUNDATION
DRILLED SHAFT REINF.
45°
NOTES
1. STAGGER COLUMN SPLICES 4'-0" O.C. MIN.
2. A MECHANICAL REINFORCING STEEL COUPLER IS AN ACCEPTABLE SPLICE. THE COUPLER SHALL DEVELOP NOT LESS THAN 125% OF THE SPECIFIED YIELD STRENGTH OF THE UNSPLICED REINFORCING BAR.
3. IF WELDED SPLICES ARE USED, REINFORCEMENT SHALL CONFORM TO ASTM A706, GRADE 60.
4. WELDING SHALL CONFORM TO "STRUCTURAL WELDING CODE-REINFORCING STEEL" (AWS D1.4-79) OF THE AMERICAN WELDING SOCIETY
3 REINFORCING STEEL SPLICE DETAIL
NO SCALE
DO NOT SCALE DRAWINGS
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
SEVENTH AVENUE BRIDGE
OVER THE SALT RIVER
BR-845479
FOUNDATION PLAN & DETAILS
SCALE: AS NOTED
59
72
S-4

19th Ave Bridge As-builts



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	ER-500-7(7)	C-7		

DATE

JOHANNESSEN & GIRAND
CONSULTING ENGINEERS, INC.

DESIGN: C.B. DRAWN: J.M. CHECKED: C.B.

FOR RIGHT-OF-WAY SEE SHT. 2

302± LF
1-30' Gate
1-20' Gate

REMOVALS

(1) STA. 6+51 (55' RT.) TO STA. 9+81 (50' RT.) REMOVE 6' C.L. FENCE 394 L.F.

(3) STA. 7+23 TO STA. 7+67 LT. REMOVE CONC. CURB 44 LF.

(4) REMOVE A.C. PAVEMENT 1226 S.Y. DETOUR ROADWAY

(7) REMOVE 22 L.F. C.L. FENCE AN RECONSTRUCT 22 L.F. C.L. FENCE @ R/W LINE

MISCELLANEOUS REMOVALS

(2) STA. 9+83 (33.8' TO 50' RT.) REMOVE CONC. BLOCK WALL. 16 L.F.

(5) STA. 7+91 RT. REMOVE IRON POST.

~~(6) STA. 7+79 RT. REMOVE MAILBOX.~~ No Such Thing

[O] TO BE REMOVED BY OWNER

[P] TO BE REMOVED BY CITY OF PHOENIX

Removals:
5+08 - 5+14 Lt 6 LF
C & G - 5' S/W
5+11 - 5+20 Rt 9 LF
C & G

See Inspector

CATCH BASINS & LATERAL PIPES

NO.	STATION	TYPE	SIZE
1	5+18.23 32' LT.	M1-6	15" × 6'
2	5+21.71 32' RT.	M1-6	15" × 67'
3	6+00 42.5' LT.	F	15" × 77'

FOR LATERAL PROFILES, SEE SHEET 18

CONC. PIPE COLLAR, MAG STD. DET. 503 2 EA.

0 1
INCH SCALE

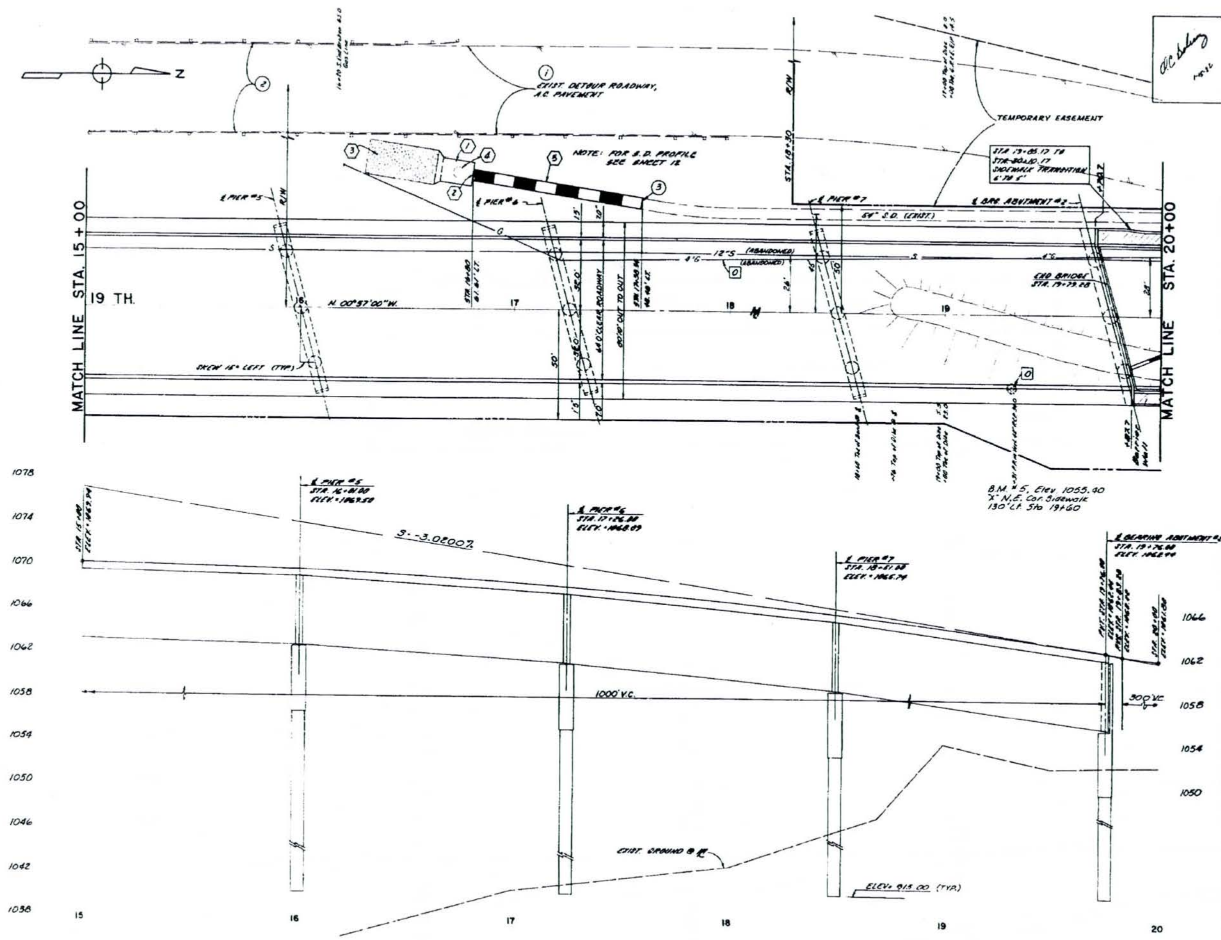
PAVING PLANS

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

19TH AVE. BRIDGE OVER SALT RIVER
PROJECT NO. BR-78042.00
19TH AVENUE

DES. C.C.B. DATE 7-80	DR. J.T.M. DATE 7-80	CK. C.C.B. DATE 7-80	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 20' HORIZONTAL, 4' VERTICAL			C-7		

100502



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	ER-500-7(7)	C-11		

DATE

JOHANNESSEN & GIRAND
CONSULTING ENGINEERS, INC.

DESIGN: C.B. DRAWN: J.M. CHECKED: C.B.

FOR BRIDGE PLANS SEE SHEETS S-1 - S-20 AND S-4 - S-23A

REMOVALS

(1) STA. 15+00 TO STA. 20+00 40' Wide REMOVE A.C. PAVEMENT ~~2212 SY~~ DETOUR ROADWAY 40' WIDE

(2) REMOVE EXIST. GUARD RAIL ~~426~~ L.F. 1294

(3) REMOVE EXIST. PLUG AND CONNECT TO EXIST. 54" PIPE.

(1) CONST. OUTLET STRUCTURE SEE SHEET 25 FOR DETAILS

(2) INSTALL BARRIER GRATE FOR 54" PIPE SEE SHEET 26 FOR DETAILS

(3) PLACE 807 CU.YDS. OF DUMPED RIP-RAP SEE SHEET 25 FOR DETAILS INCIDENTAL TO OUTLET STRUCTURE.

(4) 62.79' LT. OF STA. 16+78.00 - CENTER OF DRILLED TEST CAISSION

[0] TO BE REMOVED BY OWNER

STORM DRAIN

NO.	STA. TO STA.	SIZE	L.F.
(5)	16+80 TO 17+58.54	54"	80'

0 1
INCH SCALE

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 1-5-88

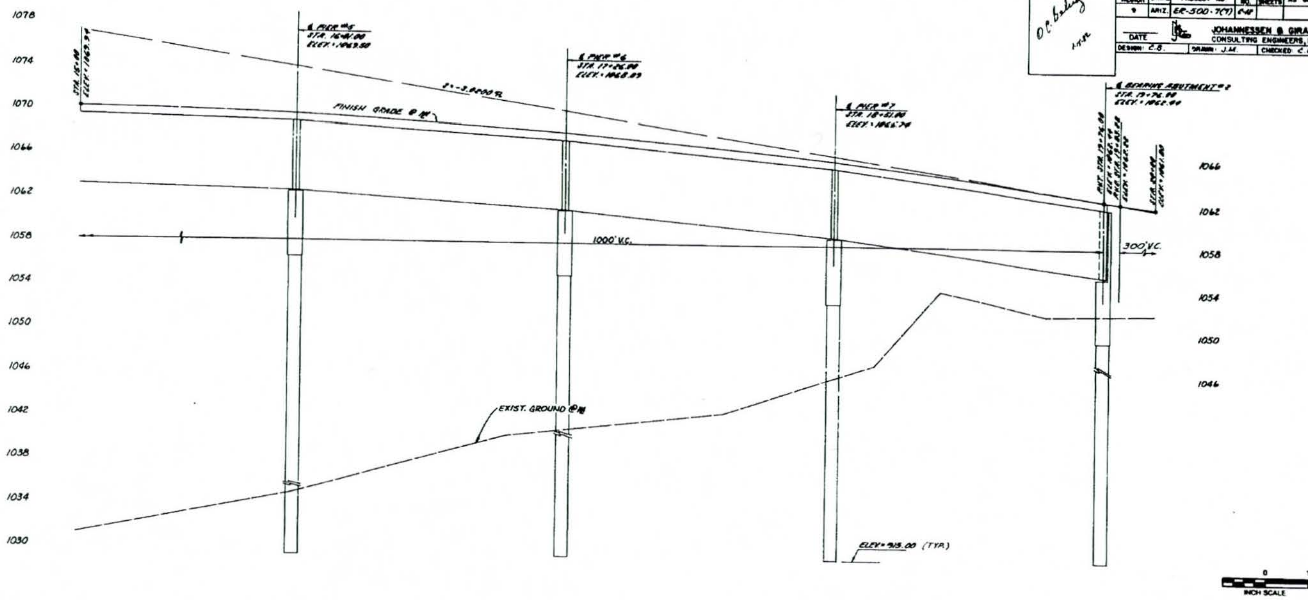
PAVING PLANS

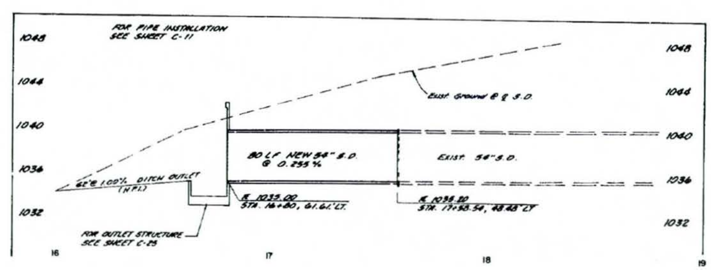
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

19TH AVE. BRIDGE OVER SALT RIVER
PROJECT NO. BR-78042.00
19TH AVENUE

DES. C.C.B. DATE 7-80	DR. J.T.M. DATE 7-80	CK. C.C.B. DATE 7-80	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 20' HORIZONTAL, 4' VERTICAL			C-11		

100506





O.C. Baling

F.H.W.A. REGION	STATE	PROJECT NO	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	ER-500-7(7)	C-10		

DATE

JOHANNESSEN & GIRAND
CONSULTING ENGINEERS, INC.

DESIGN: C.B. | DRAWN: J.M. | CHECKED: C.B.

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 1-5-88

20

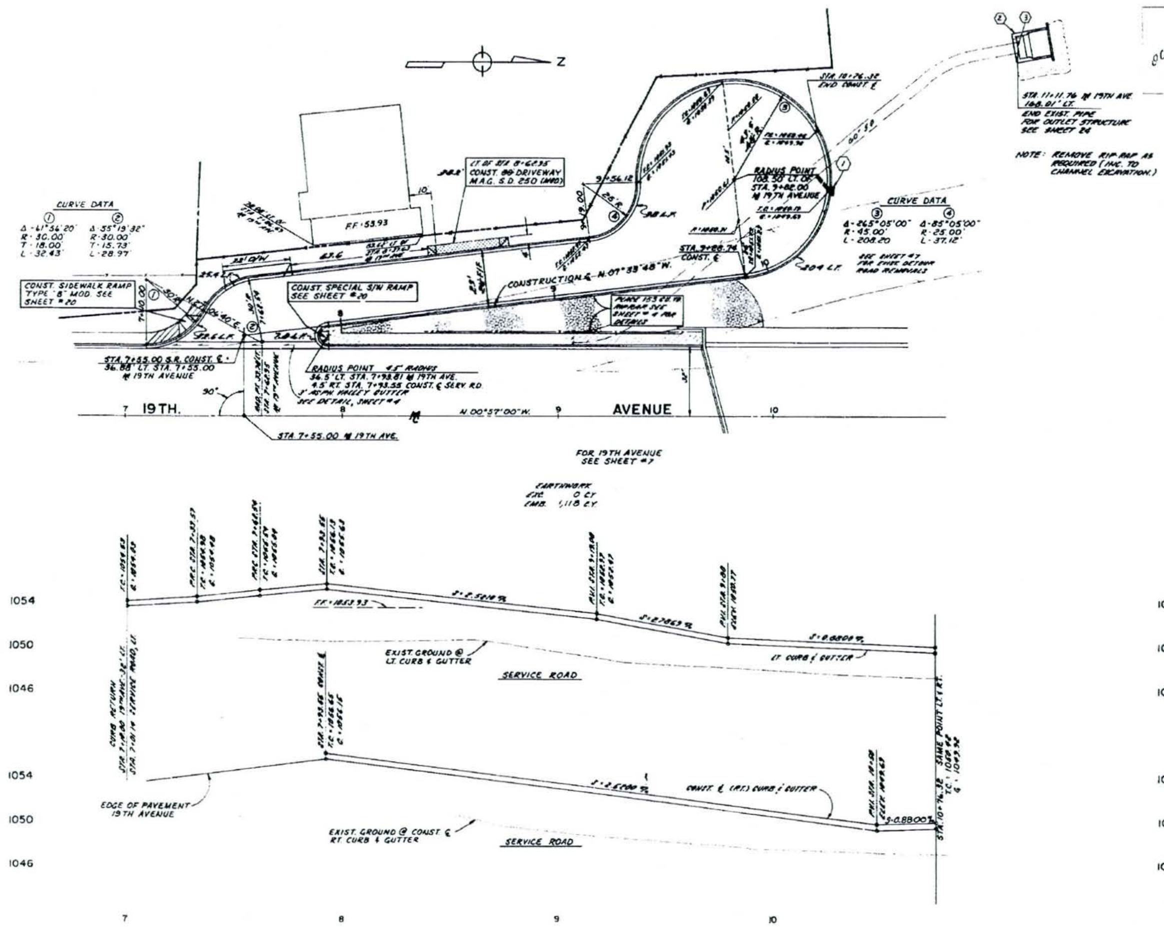
PAVING PLANS

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

19TH AVE. BRIDGE OVER SALT RIVER
PROJECT NO. BR-78042.00
19TH AVENUE

DES. O.C.B. DATE 7-80	DR. J.T.M. DATE 7-80	CK. O.C.B. DATE 7-80	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 20' HORIZONTAL, 4' VERTICAL			C-10		

100507



CATCH BASINS & LATERAL PIPES

NO	STATION	TYPE	SIZE
1	10+50	M-1-6	15"x21'

FOR LATERAL PROFILES, SEE SHEET #18

2. CONST. OUTLET STRUCTURE FOR 60" S.D. SEE SHEET C-24 FOR DETAILS.
3. INSTALL BARRIER GRATE FOR 60" S.D. SEE SHEET C-26 FOR DETAILS.

RECORD DRAWING
FIELD ENGINEERING
DIVISION
DATE 1-5-83

PAVING PLANS

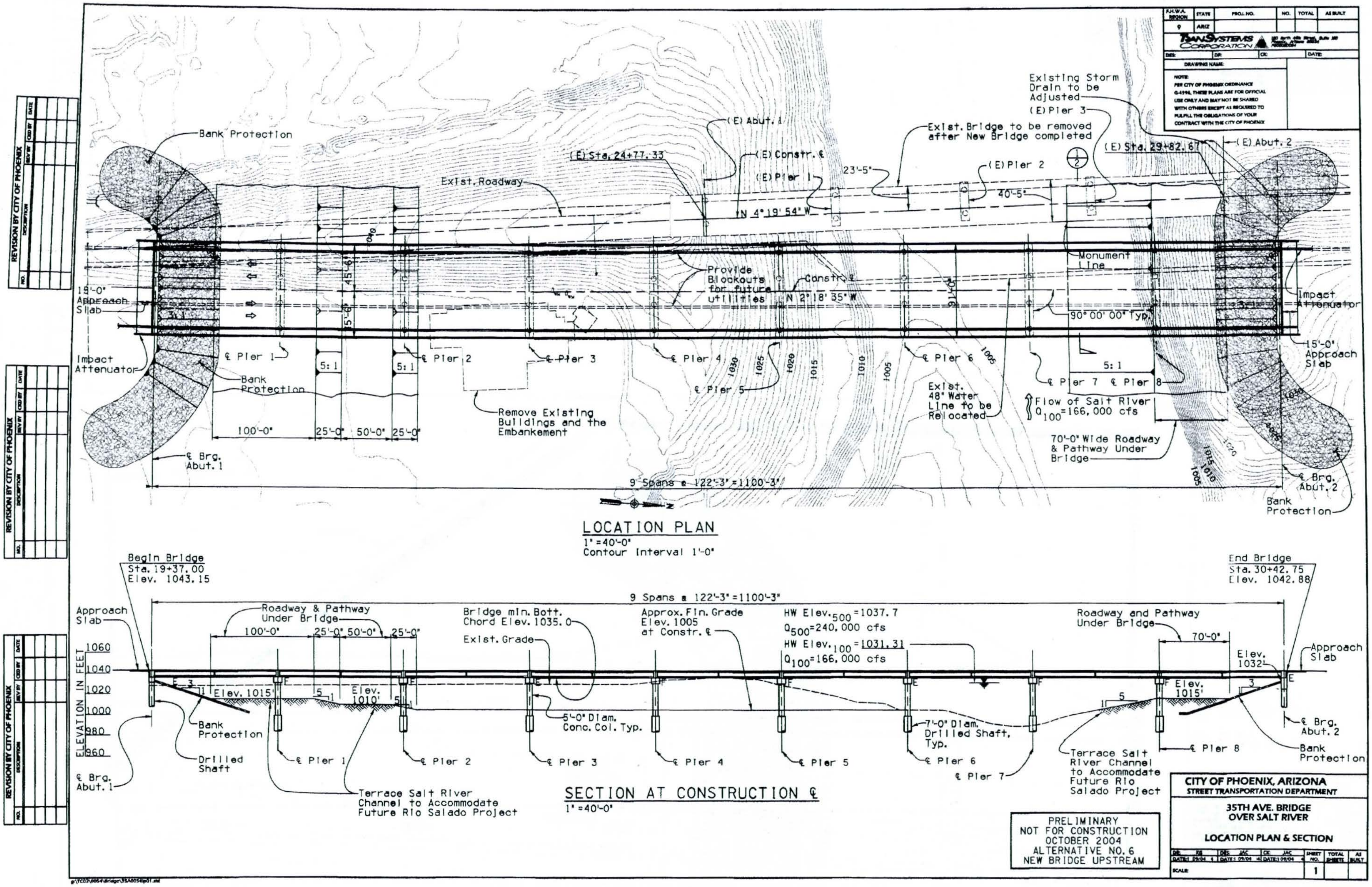
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

19TH AVE. BRIDGE OVER SALT RIVER
PROJECT NO. BR-78042.00
19TH AVENUE

DES. O.C.B. DATE 9-80	DR. J.T.M. DATE 9-80	CK. O.C.B. DATE 9-80	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 20 HORIZONTAL, 4 VERTICAL			C-17		

100512

35th Ave Bridge As-builts

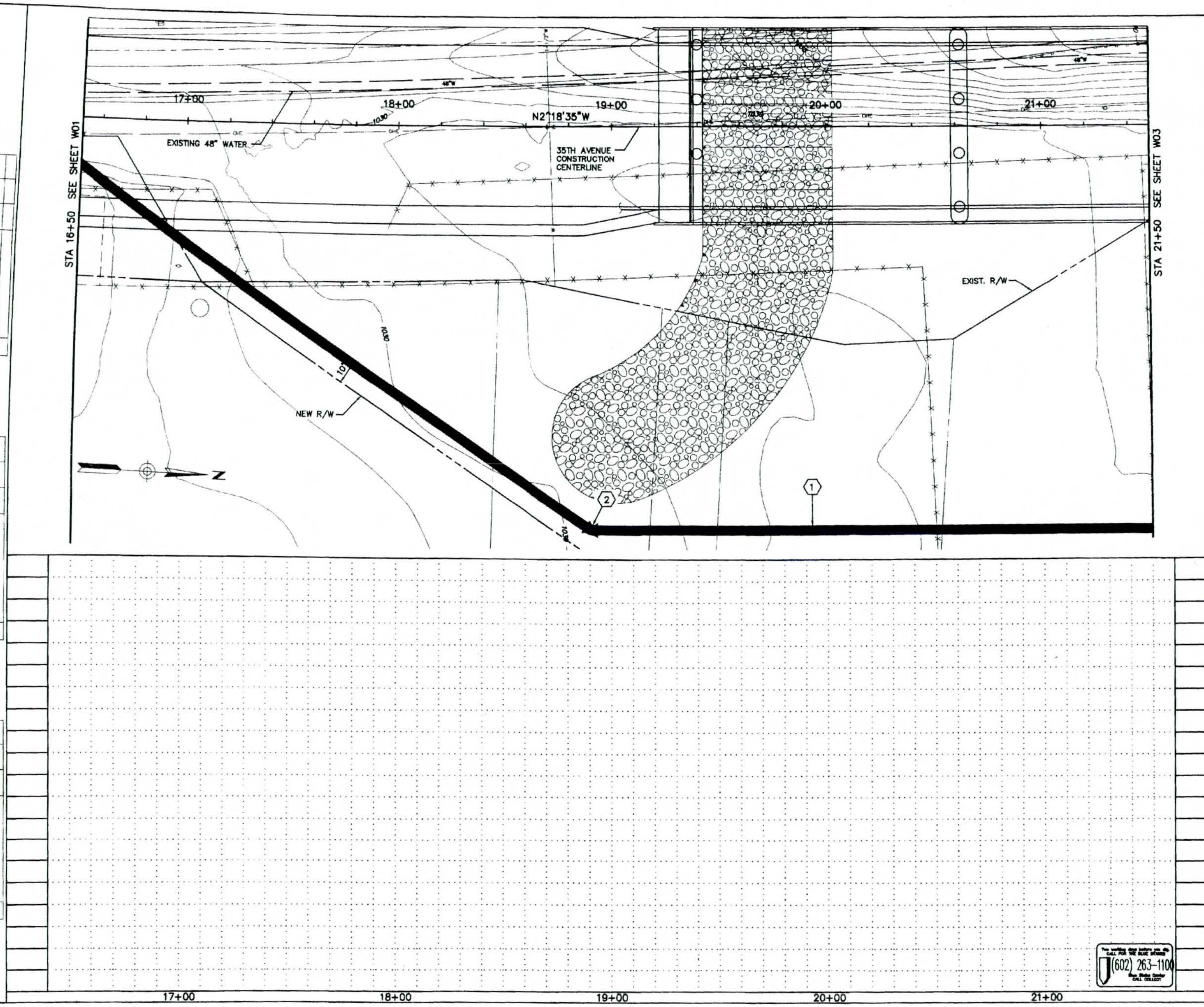


F.H.W.A. REGION
STATE
PROJ. NO.
NO.
TOTAL
AS BUILT
9
ARIZ
TRANSYSTEMS CORPORATION
DES:
DR:
CK:
DATE:
DRAWING NAME:
NOTE:
PER CITY OF PHOENIX ORDINANCE G-4596, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX
REVISION BY CITY OF PHOENIX
NO.
DESCRIPTION
REV BY
CKD BY
DATE
Bank Protection
(E) Abut. 1
(E) Sta. 24+77.33
(E) Constr. ℄
(E) Pier 1
Exist. Roadway
23'-5"
N 4° 19' 54" W
Exist. Bridge to be removed after New Bridge completed
(E) Pier 2
40'-5"
Existing Storm Drain to be Adjusted
(E) Pier 3
(E) Sta. 29+82.67
(E) Abut. 2
45'-6"
5'-6"
Provide Blockouts for future utilities
Constr. ℄
N 2° 18' 35" W
Monument Line
90° 00' 00" Typ.
15'-0" Approach Slab
Impact Attenuator
℄ Pier 1
℄ Pier 2
℄ Pier 3
℄ Pier 4
℄ Pier 5
℄ Pier 6
℄ Pier 7
℄ Pier 8
5:1
Bank Protection
Remove Existing Buildings and the Embankement
Exist. 48" Water Line to be Relocated
Flow of Salt River Q_{100}=166,000 cfs
70'-0" Wide Roadway & Pathway Under Bridge
100'-0"
25'-0"
50'-0"
25'-0"
℄ Brg. Abut. 1
℄ Brg. Abut. 2
9 Spans @ 122'-3" = 1100'-3"
15'-0" Approach Slab
LOCATION PLAN
1" = 40'-0"
Contour Interval 1'-0"
Begin Bridge
Sta. 19+37.00
Elev. 1043.15
End Bridge
Sta. 30+42.75
Elev. 1042.88
9 Spans @ 122'-3" = 1100'-3"
Approach Slab
Roadway & Pathway Under Bridge
Bridge min. Bott. Chord Elev. 1035.0
Exist. Grade
Approx. Fin. Grade Elev. 1005 at Constr. ℄
HW Elev.$_{500}$=1037.7
Q_{500}=240,000 cfs
HW Elev.$_{100}$=1031.31
Q_{100}=166,000 cfs
Roadway and Pathway Under Bridge
70'-0"
Elev. 1032
Elev. 1015
Elev. 1010
Elev. 1015
ELEVATION IN FEET
1060
1040
1020
1000
980
960
5'-0" Diam. Conc. Col. Typ.
7'-0" Diam. Drilled Shaft, Typ.
Bank Protection
Drilled Shaft
Terrace Salt River Channel to Accommodate Future Rio Salado Project
SECTION AT CONSTRUCTION ℄
1" = 40'-0"
PRELIMINARY
NOT FOR CONSTRUCTION
OCTOBER 2004
ALTERNATIVE NO. 6
NEW BRIDGE UPSTREAM
CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT
35TH AVE. BRIDGE
OVER SALT RIVER
LOCATION PLAN & SECTION
DR: KB
DES: JAC
CK: JAC
DATE: 09/04
SHEET NO.
TOTAL SHEETS
AS BUILT
SCALE:
1

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV BY	CKD BY	DATE



F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ	ST85100050			

PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4 PHOENIX, AZ 85021
PHONE (602) 906-1901

DES: TB | DR: JG | CK: LM | DATE: 10/04

DRAWING NAME:

NOTE:
PER CITY OF PHOENIX ORDINANCE G-4396, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX

PRELIMINARY
STAGE 30%
REVIEW
NOT FOR CONSTRUCTION OR RECORDING

CONSTRUCTION NOTES:

1	STA 16+50 TO 21+50 48" PIPE	551 LF
2	STA 18+90.44, 186.2' RT 48" 34°20'50" BEND	1 EACH

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

35TH AVENUE BRIDGE
OVER SALT RIVER

WATER LINE RELOCATION
STA 16+50 TO 21+50

DR JG DATE: 10/04	DES TB DATE: 10/04	CK LM DATE: 10/04	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE HORIZ. 1" = 20' VERT. 1" =	SHEET W02		—	—	

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ	ST85100050			

PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4 PHOENIX, AZ 85021
PHONE (602) 906-1901

DES: TB | DR: JG | CK: LM | DATE: 10/04

DRAWING NAME:

NOTE:
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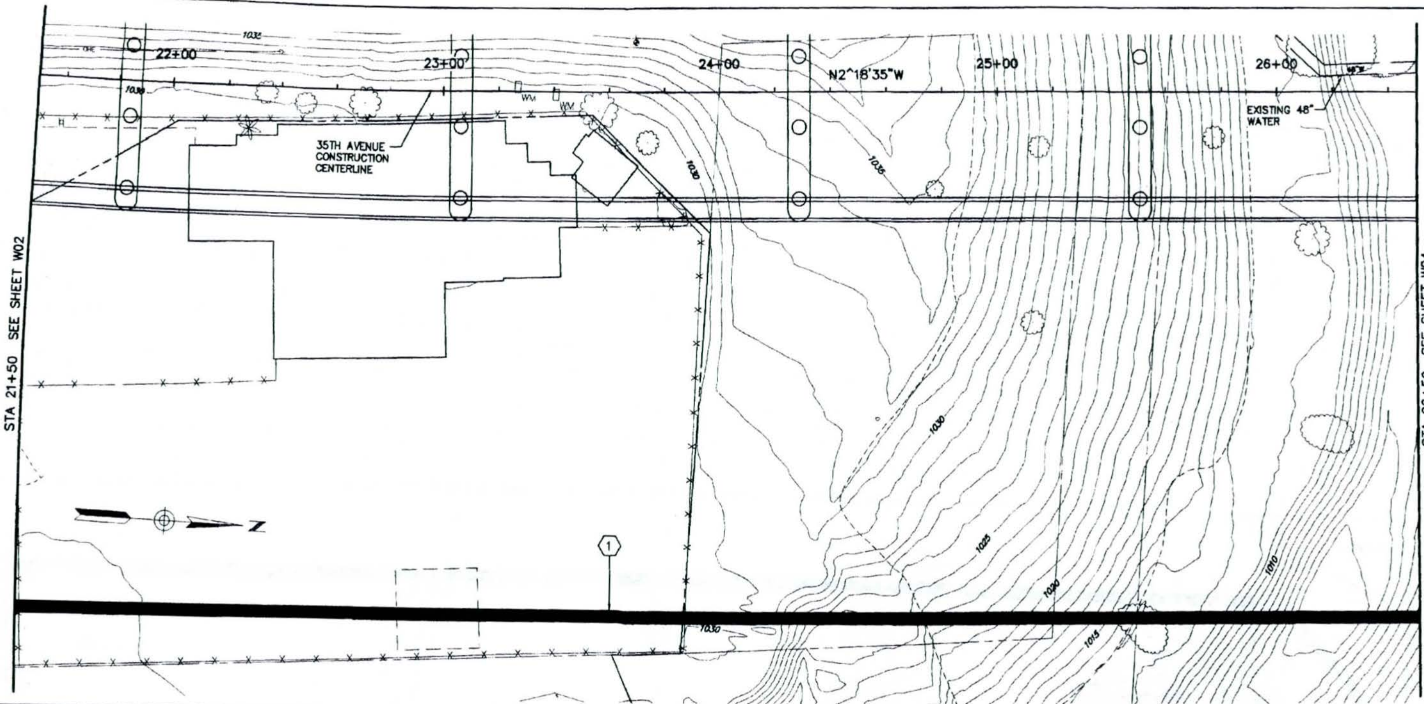
PRELIMINARY
STAGE 30%
REVIEW
NOT FOR CONSTRUCTION OR RECORDING

CONSTRUCTION NOTES:

1	STA 21+50 TO 26+50 48" PIPE	500 LF



REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

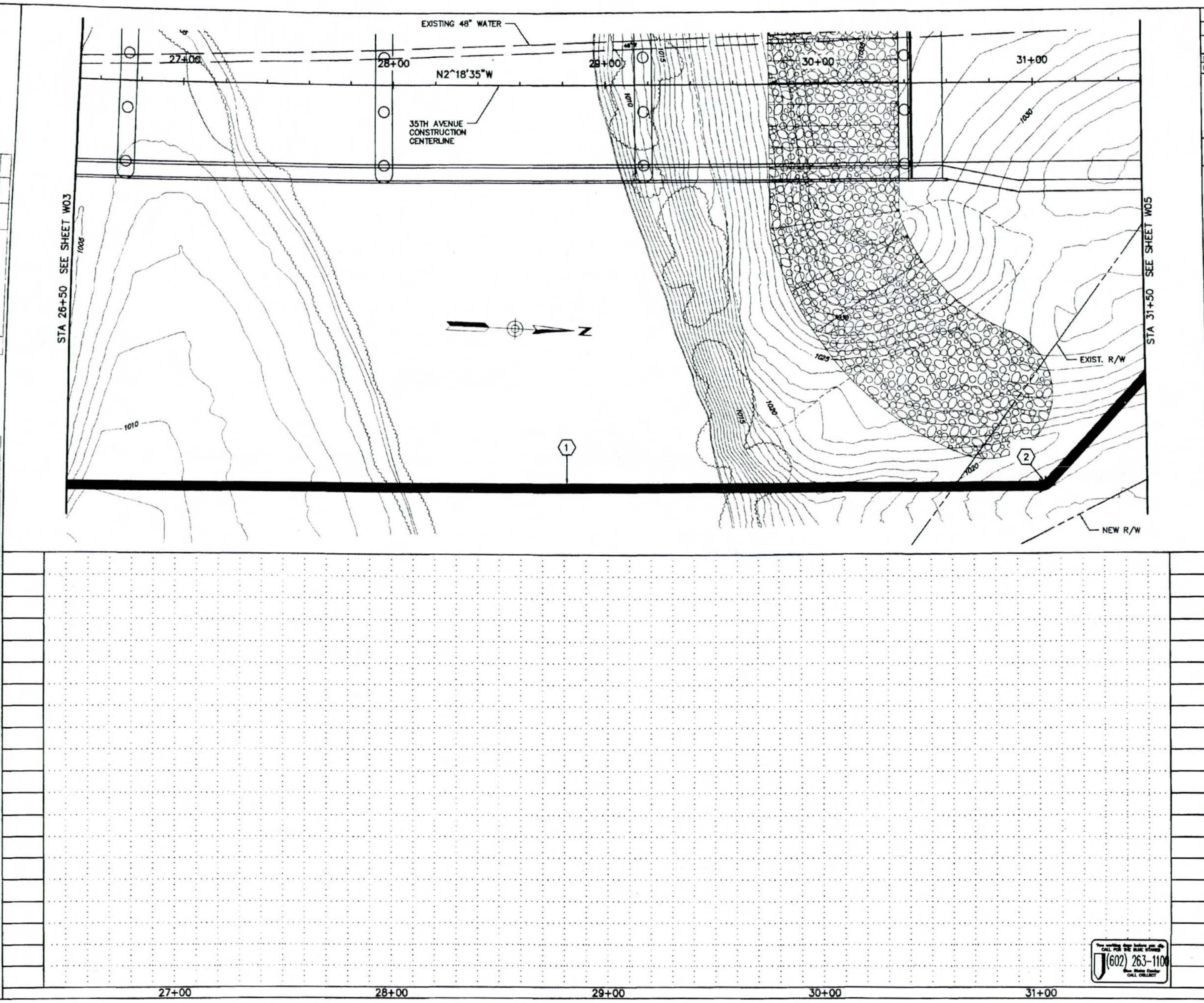
(602) 263-1100

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

35TH AVENUE BRIDGE
OVER SALT RIVER

WATER LINE RELOCATION
STA 21+50 TO 26+50

DR: JG | DES: TB | CK: LM | SHEET NO. | TOTAL SHEETS | AS BUILT



F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ	ST85100050			

PROJECT ENGINEERING CONSULTANTS, LTD.
3310 W. MISSION LANE, STE. 4 PHOENIX, AZ 85021
PHONE (602) 906-1901

DES: TB | DR: JG | CK: LM | DATE: 10/04

DRAWING NAME:

NOTE:
PER CITY OF PHOENIX ORDINANCE G-4396, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX

PRELIMINARY
STAGE 30%
REVIEW
NOT FOR CONSTRUCTION OR RECORDING

CONSTRUCTION NOTES:

1	STA 26+50 TO 31+50 48" PIPE	522 LF
2	STA 31+03.63, 186.2' RT 48" 47°02'39" BEND	1 EACH

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

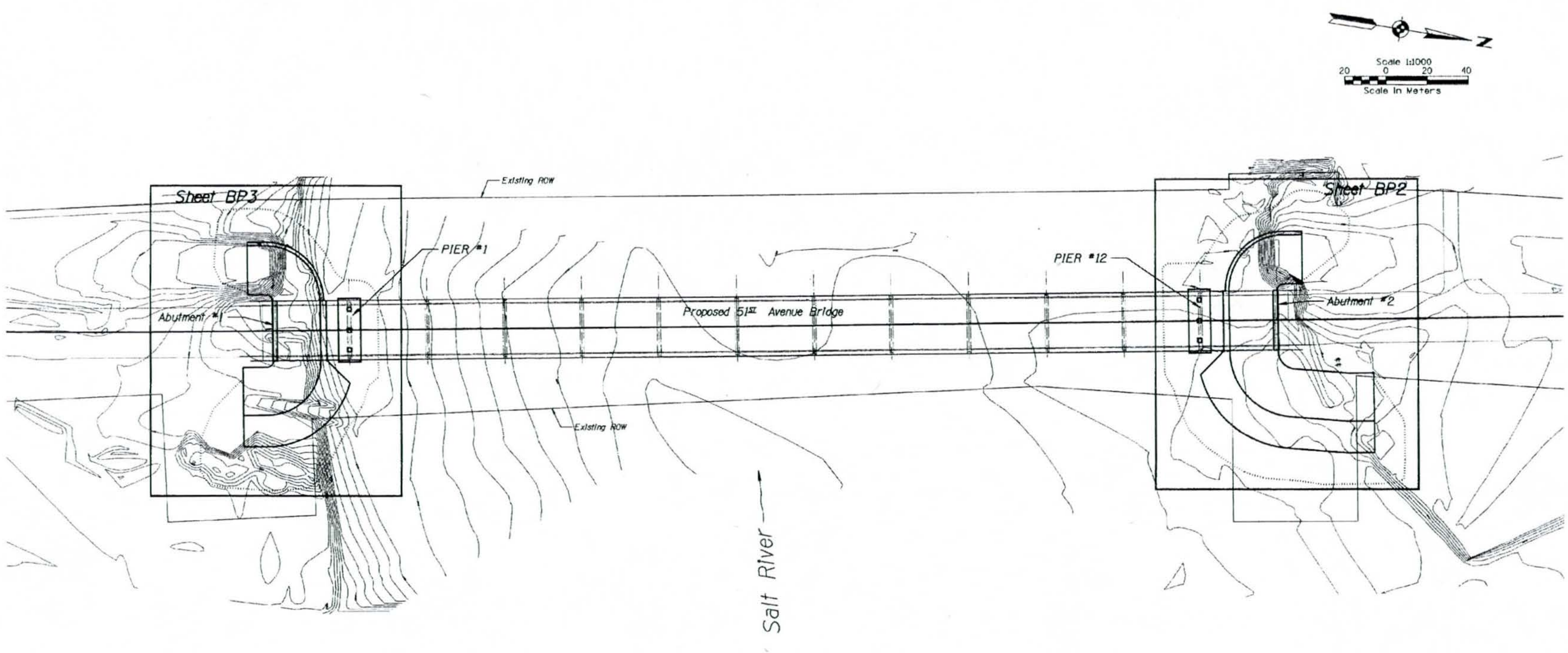
35TH AVENUE BRIDGE
OVER SALT RIVER

WATER LINE RELOCATION
STA 26+50 TO 31+50

DR JG DATE: 10/04	DES TB DATE: 10/04	CK LM DATE: 10/04	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE HORIZ 1" = 20' VERT. 1" =	SHEET W04		--	--	

51st Ave Bridge As-builts

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	23	63	1-15-01



BRIDGE ABUTMENT PROTECTION PLAN

TWO WORKING DAYS BEFORE YOU DIG, CALL
263-1100
BLUE STAKE

NO.	APPROVED FOR CONSTRUCTION	DATE
3		
2		
1		

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	R. BROWN	06/00
DRAWN	C. CHRISTIANSEN	07/00
CHECKED	B. BERGENDAHL	07/00

TETRA TECH, INC.

LOCATION PLAN

SHEET BP1

NOTES: 1. Contours Reflect Ground Elevations Prior To Any Construction Activity Associated With The Proposed 51st Avenue Bridge.

2. All Elevations Represent Bottom Of Gabions Unless Noted Otherwise.

FHWA REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS	RECORD DRAWING
9	AZ	68951	24	63	1-15-01

☐ REMOVAL/RELOCATE ☐

1

CONSTRUCTION

(1) Grade For Gabion Bank Protection Per Details Sheet BP4

(2) Grade For Gabion Pier Mat Per Details Sheet BP4

(3) Contractor Shall Protect Existing 2440 mm Storm Drain And Outlet Structure, As Required, To Maintain Its Function During The Placement Of The Gabion Bank Protection. Contractor Shall Be Responsible For Any Damage To The 2440 mm Storm Drain And Outlet Structure During Placement Of The Gabion Bank Protection.

TWO WORKING DAYS BEFORE YOU DIG, CALL 263-1100 BLUE STAKE

NO.	APPROVED FOR CONSTRUCTION	DATE
3		
2		
1		

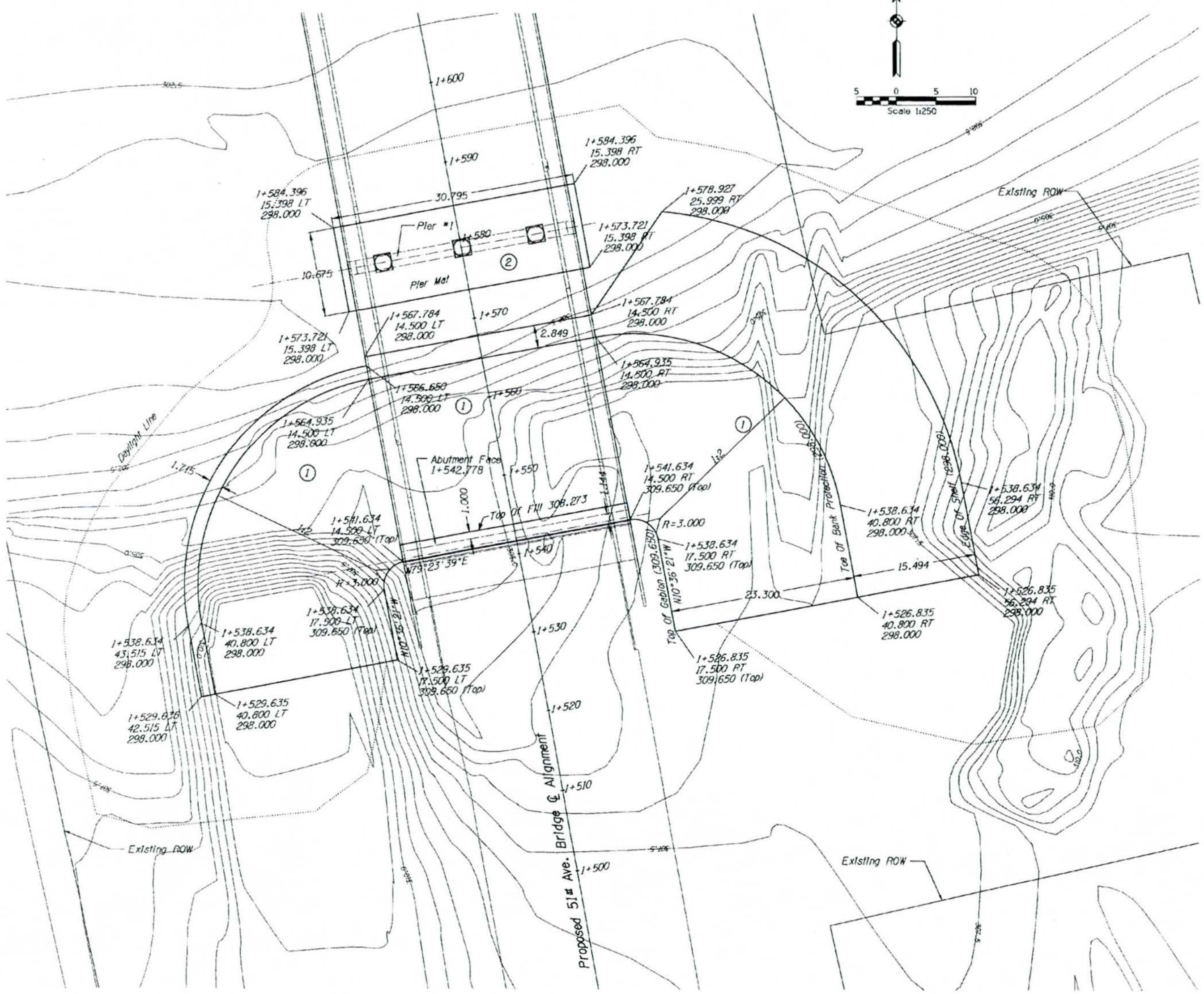
MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	R. BROWN	06/00
DRAWN	C. CHRISTIANSEN	

NOTES: 1. Contours Reflect Ground Elevations Prior To Any Construction Activity Associated With The Proposed 51st Avenue Bridge.

2. All Elevations Represent Bottom Of Gabions Unless Noted Otherwise



GABION BANK PROTECTION

FHWA REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS	RECORD DRAWING
9	AZ	68951	25	63	1-15-01

☐ REMOVAL/RELOCATE ☐

CONSTRUCTION

1 Grade For Gabion Bank Protection Per Details Sheet BP4

2 Grade For Gabion Pier Mat Per Details Sheet BP4

TWO WORKING DAYS BEFORE YOU DIG, CALL 263-1100 BLUE STAKE

NO.	APPROVED FOR CONSTRUCTION	DATE
3		
2		
1		

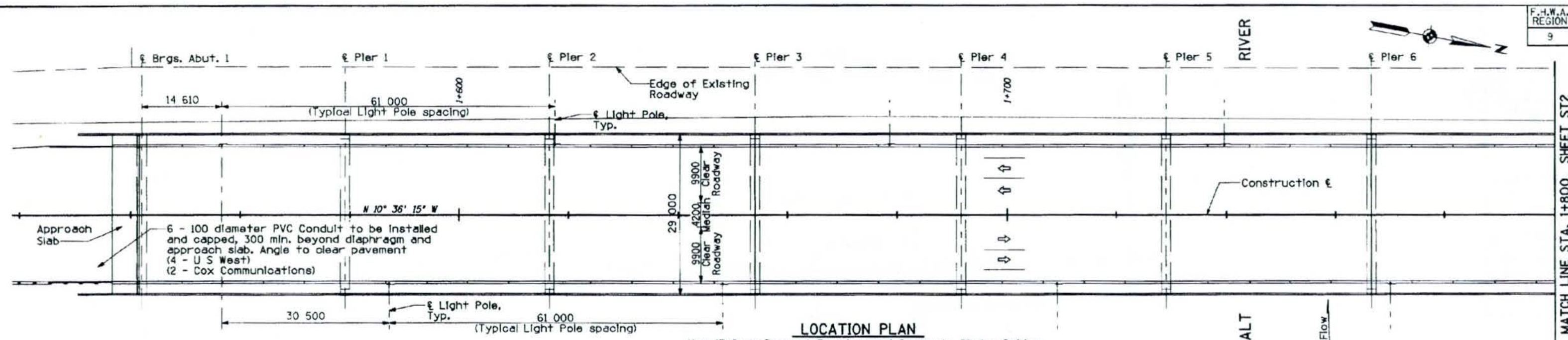
MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

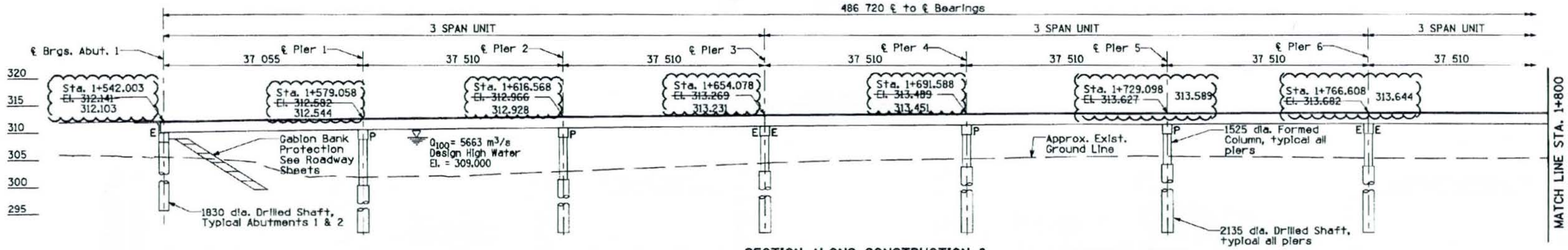
	BY	DATE
DESIGNED	R. BROWN	06/00
DRAWN	C. CHRISTIANSEN	07/00
CHECKED	B. BERGENDAHL	07/00

TETRA TECH, INC.

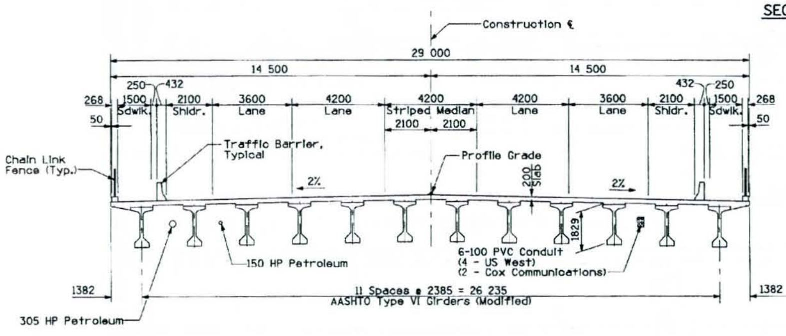
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	27	63	01/15/01



LOCATION PLAN
New 13 Span Precast Prestressed Concrete Girder Bridge
AASHTO Type VI Girders (Modified)
Scale 1:400



SECTION ALONG CONSTRUCTION ℄
Scale 1 : 400



TYPICAL BRIDGE CROSS SECTION
Scale 1:100

INDEX TO BRIDGE PLANS

SHEET NO.	TITLE
ST1	LOCATION PLAN - 1
ST2	LOCATION PLAN - 2
ST3	FOUNDATION PLAN
ST4	DRILLED SHAFT DETAILS
ST5	TYPICAL ABUTMENT
ST6	ABUTMENT DETAILS
ST7	ABUTMENT AND WINGWALL DETAILS
ST8	PIER PLAN AND ELEVATION
ST9	PIER DETAILS
ST10	MISCELLANEOUS DETAILS - 1
ST11	GIRDER LAYOUT
ST12	GIRDER DETAILS - 1
ST13	GIRDER DETAILS - 2
ST14	DECK DETAILS - 1
ST15	DECK DETAILS - 2
ST16	DECK DETAILS - 3
ST17	DECK DETAILS - 4
ST18	DECK DETAILS - 5
ST19	DECK JOINT DETAILS
ST20	APPROACH SLAB DETAILS
ST21	MISCELLANEOUS DETAILS - 2

GENERAL NOTES:

CONSTRUCTION:
Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction, 1999 Metric Edition, including all supplements and amendments by MCDOT and the Project Special Provisions.

DESIGN:
AASHTO Standard Specifications for Highway Bridges, 1996 Edition, revised to date. S.I. Units.

DEAD LOAD:
Dead Load includes allowance of 1.2 kN/m_2 for future wearing surface.

LOADING CLASS: AASHTO MS22.5-44

STRESSES:

CONCRETE:

Abutments	f'c = 25 MPa	Class A
Piers	f'c = 25 MPa	Class A
Deck	f'c = 31 MPa	Class AA
Girders	f'c = 45 MPa	Class Special
All other Concrete	f'c = 20 MPa	Class B

REINFORCING STEEL: ASTM A615M
Grade 400 f's = 138 MPa

PRESTRESSING STEEL:
12.54 mm dia. 7-wire low-relaxation strand f's = 1860 MPa

Prestressing Steel shall conform to ASTM A416M.

STRUCTURAL STEEL: ASTM A709M

All placement dimensions for reinforcing steel shall be to the center of the bar unless otherwise noted.

All bend dimensions for reinforcing steel shall be measured out to out unless otherwise noted.

All reinforcing steel shall have a minimum 50 mm clear cover unless otherwise noted.

Chamfer all exposed concrete edges and corners 20 mm, unless otherwise noted.

All welding shall conform to the requirements of the American Welding Society Structural Welding Code D1.1-92, revised to date.

Dimensions shall not be scaled from drawings.

All dimensions are in millimeters (mm) and all elevations are in meters (m).

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V. Wismer	7/99
DRAWN	J. Gilmore	7/99
CHECKED	D. Davis	9/99

Vincent W. Wismer 1-15-01

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

LOCATION PLAN - 1 | SHEET ST1

D:\PROJECTS\642767\USTN\STR\68951LP01.DGN
01/14/01
01:24:54 PM
MB.DCN 12/02/94

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
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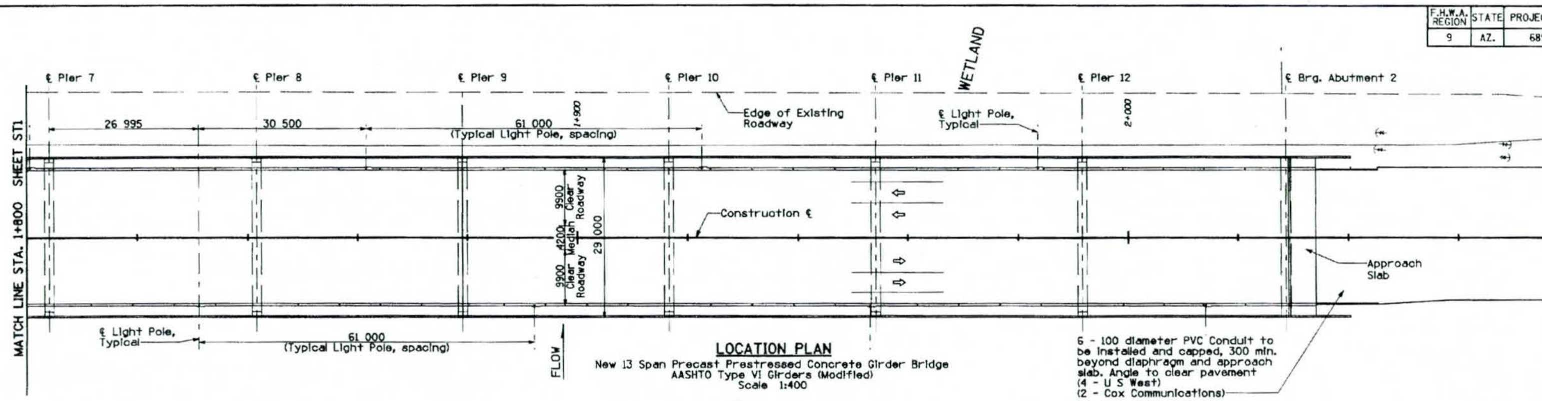
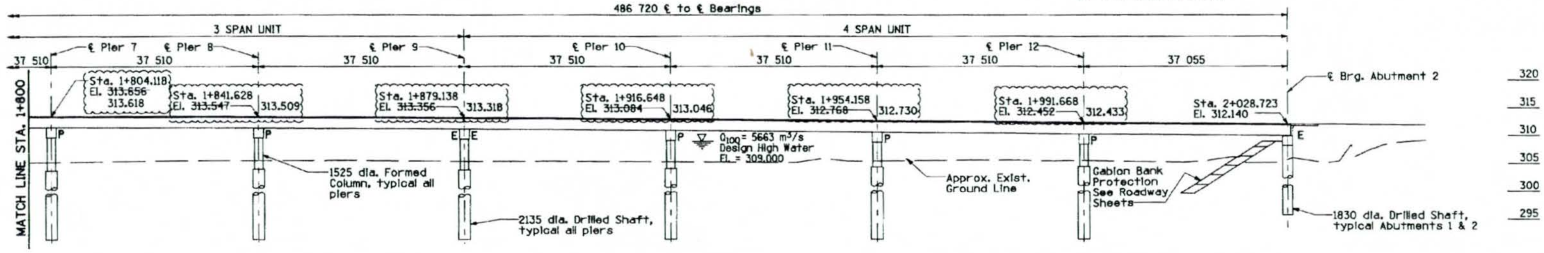


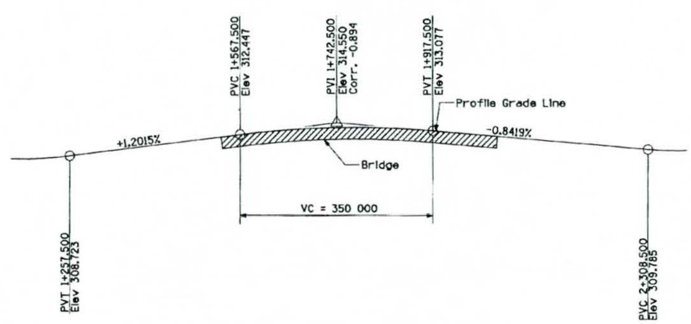
LOCATION PLAN

New 13 Span Precast Prestressed Concrete Girder Bridge
AASHTO Type VI Girders (Modified)
Scale 1:400



SECTION ALONG CONSTRUCTION ℄

Scale 1:400



CONSTRUCTION ℄ AND PROFILE GRADE LINE

N.T.S.

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V. Wismer	7/99
DRAWN	J Gilmore	7/99
CHECKED	D. Davis	9/99

Vincent W. Wismer 1.15.01

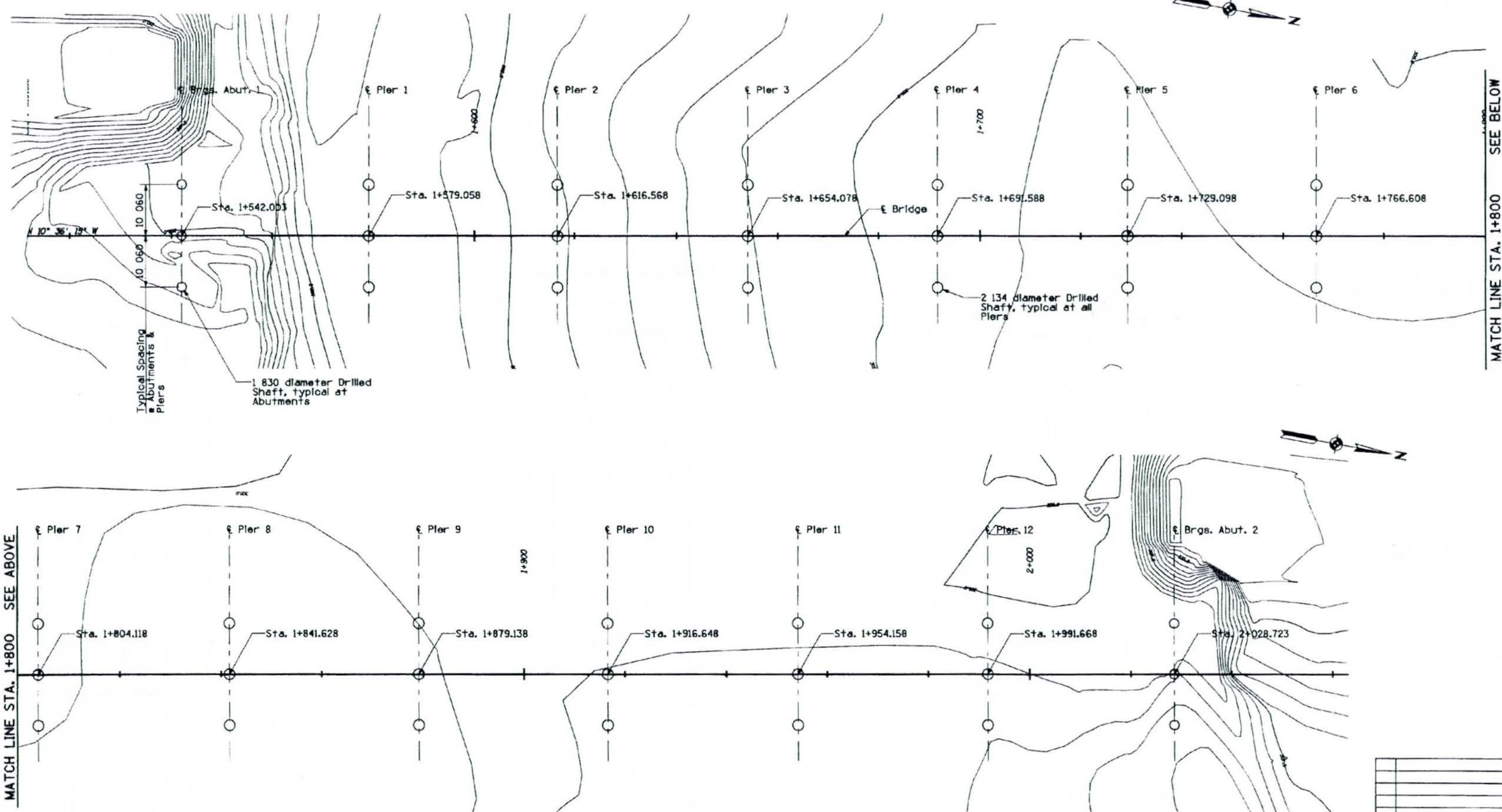
8173 VINCENT W. WISMER ARIZONA, U.S.A.

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

LOCATION PLAN - 2

SHEET ST2

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	29	63	01/15/01



FOUNDATION PLAN
Scale 1:400

Contour Interval = 0.5 meter

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	D. R. Davis	7/99
DRAWN	J Gilmore	7/99
CHECKED	V. W. Wismer	7/99

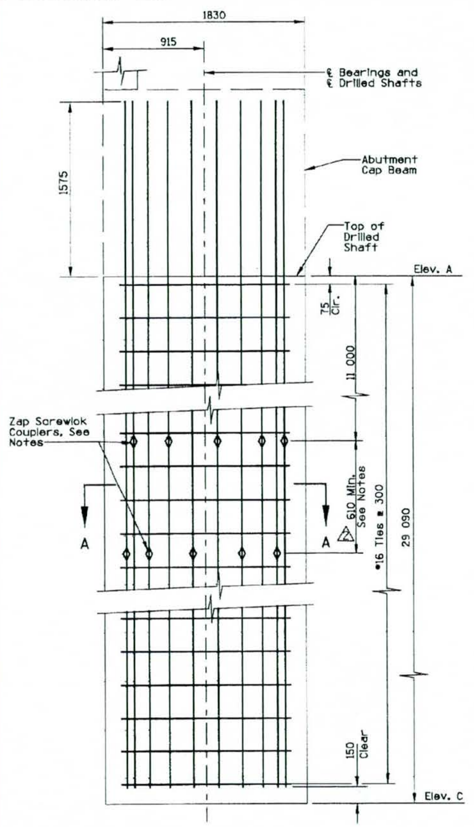
DONALD R. DAVIS

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

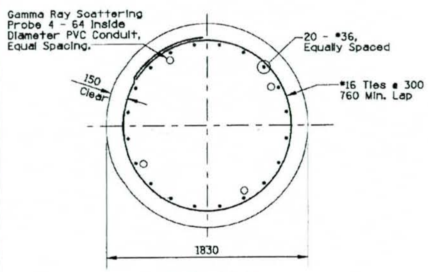
FOUNDATION PLAN

SHEET
ST3

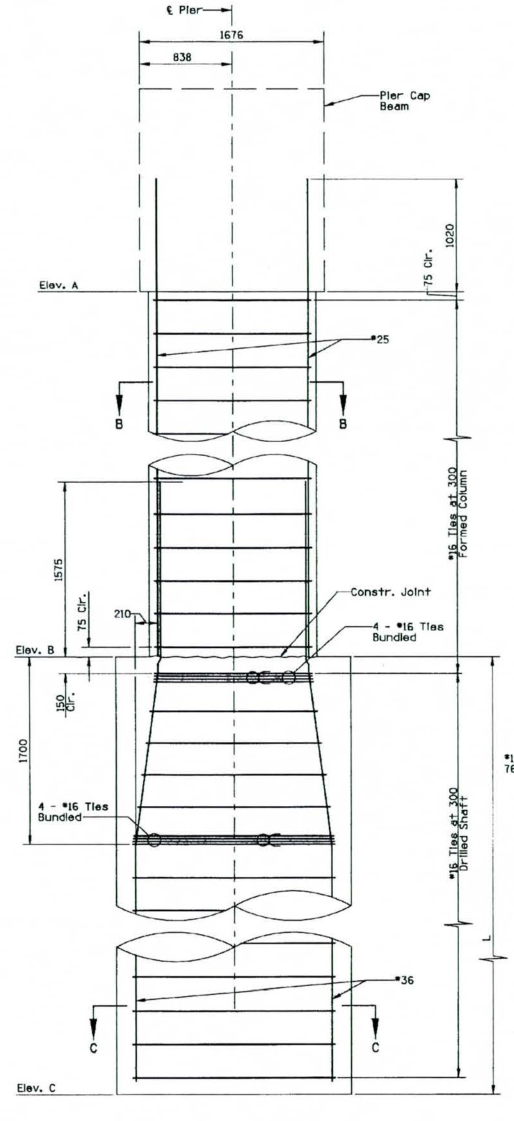
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	30	63	01/15/01



DRILLED SHAFT SECTION AT ABUTMENTS
Scale 1:20



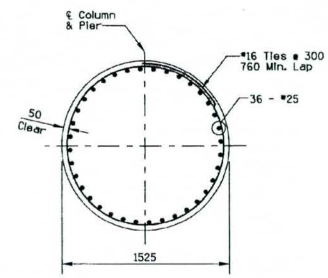
SECTION A-A
Scale 1:20



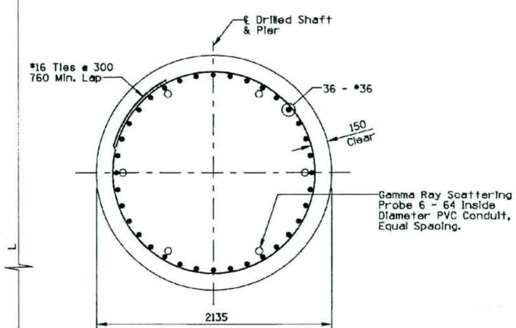
TYPICAL PIER SECTION
Scale 1:20

NOTES

1. Reinforcing bars are to be spliced with Zap Screwlok Couplers and shall be staggered with adjacent bars 610 minimum.
2. Splices at Abutments shall be made 14 000 maximum from the top of the Shaft.
3. Splices at Piers shall be made a maximum distance below the top of the 2135# Shaft as shown below:
   - Pier 1........................9460
   - Pier 2......................10 460
   - Pier 3......................12 260
   - Piers 4 thru 12......14 000



SECTION B-B
Scale 1:20



SECTION C-C
Scale 1:20

Pier 1 West
B Elev = 301.20

COLUMN & DRILLED SHAFT ELEVATIONS

LOCATION	A	B	C	Length (L)
Abutment 1	307.995	N/A	278.88	N/A
Pier 1	308.329	300.20	272.57	27 630
Pier 2	308.714	301.20	272.57	28 630
Pier 3	308.965	303.00	272.57	30 430
Pier 4	309.239	304.20	272.57	31 630
Pier 5	309.377	304.20	272.57	31 630
Pier 6	309.381	304.20	272.57	31 630
Pier 7	309.407	304.20	272.57	31 630
Pier 8	309.298	304.20	272.57	31 630
Pier 9	309.028	304.20	272.57	31 630
Pier 10	308.807	304.20	272.57	31 630
Pier 11	308.491	304.20	272.57	31 630
Pier 12	308.175	304.20	272.57	31 630
Abutment 2	307.970	N/A	278.88	N/A

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V. W. Wismer	11/99
DRAWN	J. Gilmore	11/99
CHECKED	W. Zapfel	11/99

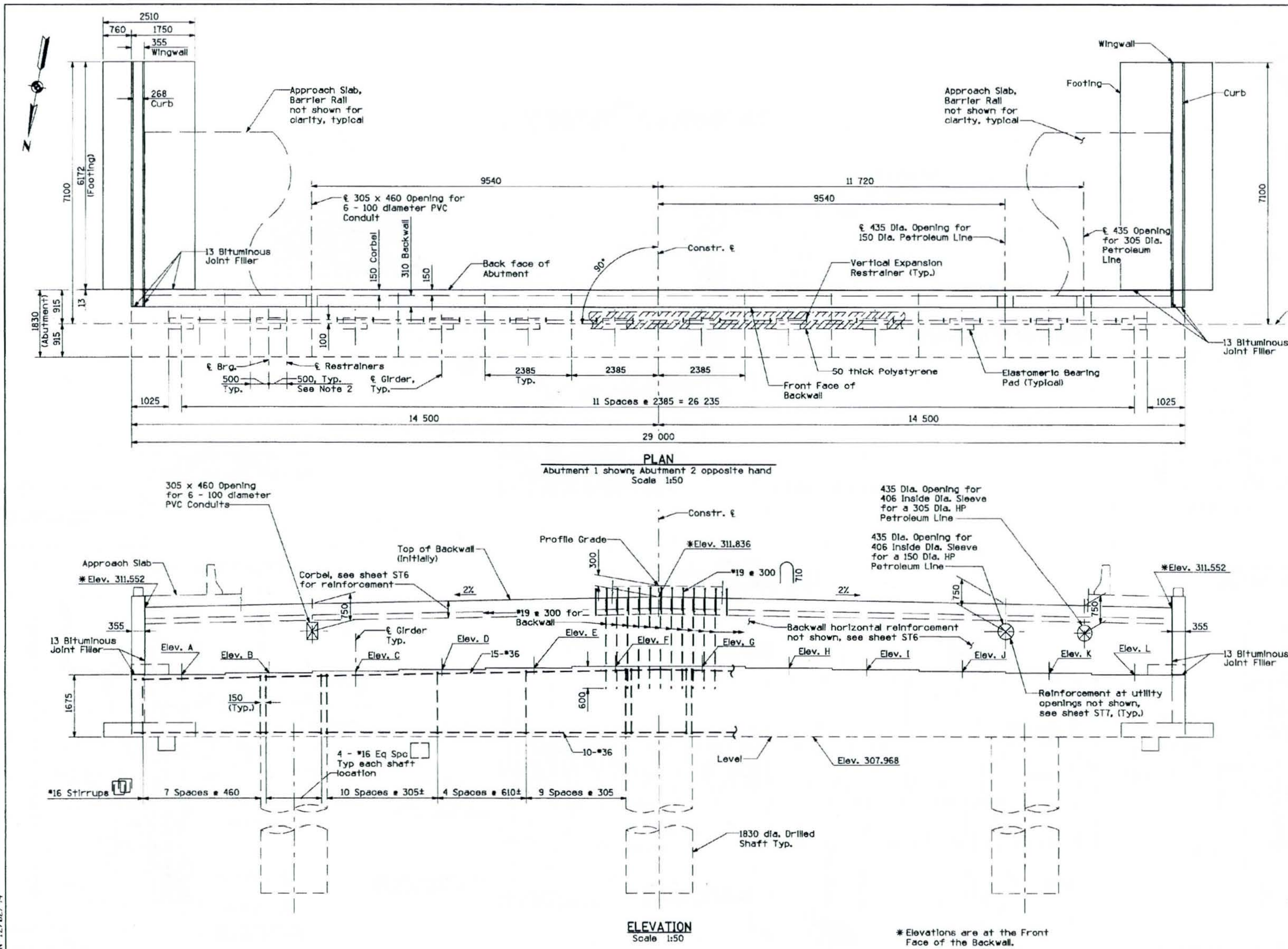
Vincent W. Wismer

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

DRILLED SHAFT DETAILS

SHEET ST4

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	31	63	01/15/01



*Elevations are at the Front Face of the Backwall.

NOTES:
1. Chamfer all exposed edges 20 mm.
2. Restrainer locations may be adjusted to avoid interference with Utility Blockouts in Backwall.

ABUTMENT ELEVATIONS		
El.	Abutment 1	Abutment 2
A	309.670	309.644
B	309.717	309.692
C	309.765	309.739
D	309.813	309.787
E	309.860	309.835
F	309.908	309.882
G	309.908	309.882
H	309.860	309.835
I	309.813	309.787
J	309.765	309.739
K	309.717	309.692
L	309.670	309.644

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V Wismer	10/99
DRAWN	J Gilmore	10/99
CHECKED	W Zapfel / D Davis	10/99

VINCENT W. WISMER
Date Signed 1-15-01
ARIZONA, U.S.A.

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

TYPICAL ABUTMENT

SHEET ST5

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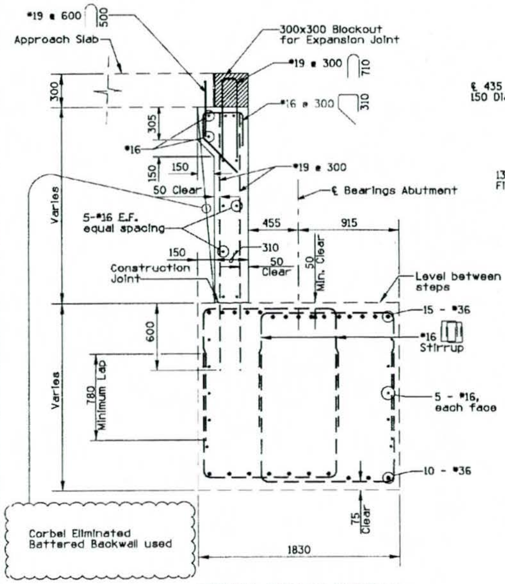
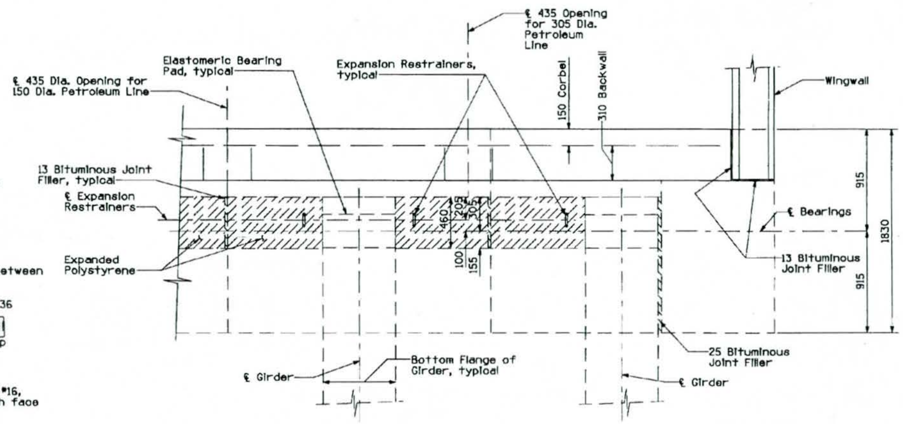
04:28:15 PM
MB.DGN 12/02/94

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	32	63	01/15/01



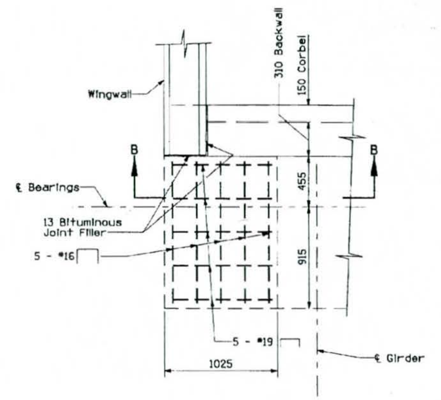
TYPICAL SECTION BETWEEN DRILLED SHAFTS

Scale 1:20



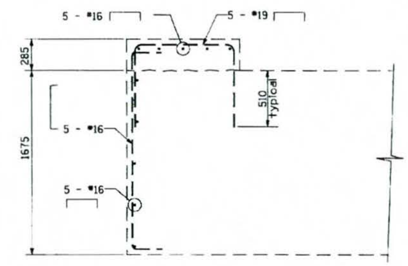
PARTIAL ABUTMENT PLAN

Scale 1:20



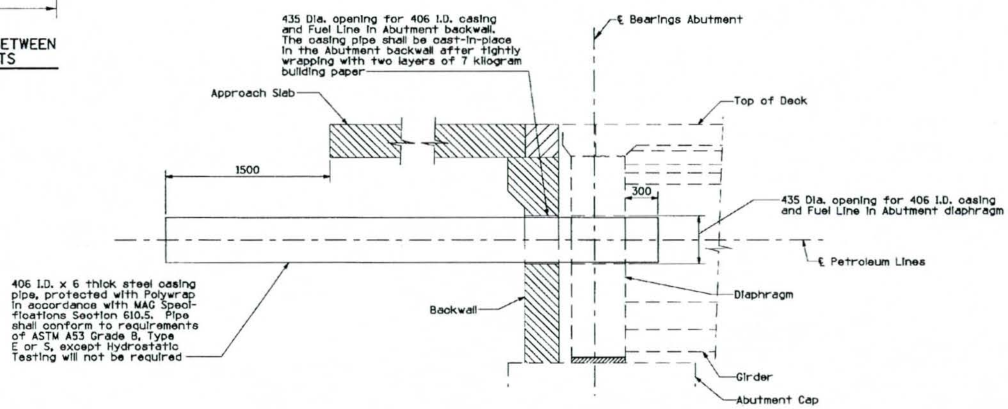
LATERAL RESTRAINING BLOCK DETAIL

Scale 1:20



SECTION B-B

Scale 1:20



STEEL CASING PIPE FOR PETROLEUM LINES

Scale 1:20

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V. Wismer	10-99
DRAWN	J. Gilmore	10-99
CHECKED	W. Zapfel / D. Davis	10-99

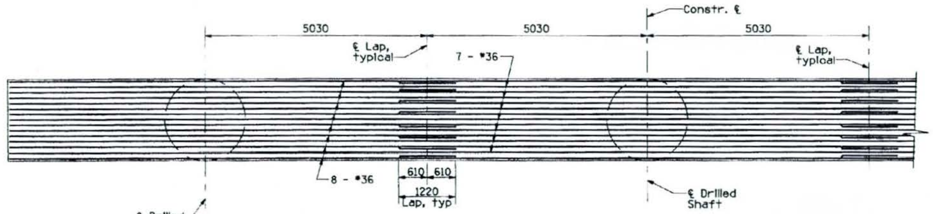
VINCENT W. WISMER — ARIZONA, U.S.A. — 1-15-01

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

ABUTMENT DETAILS

SHEET ST6

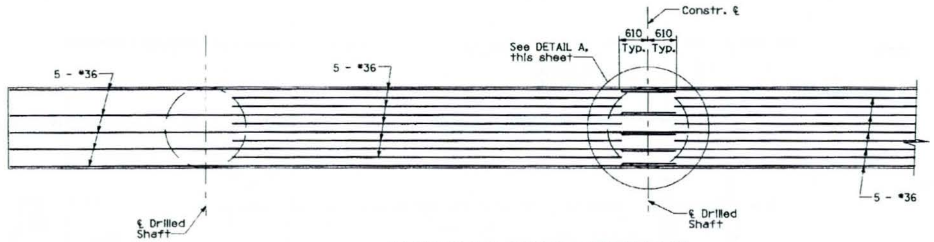
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	33	63	01/15/01



ABUTMENT CAP TOP REINFORCEMENT

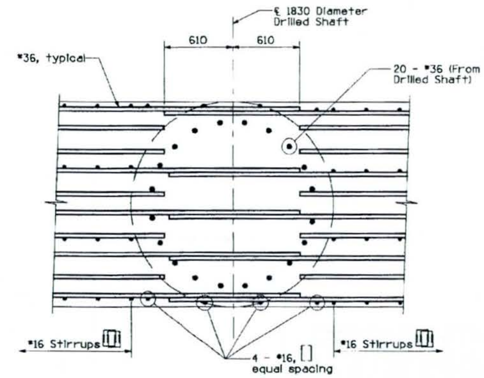
Scale 1:50

NOTE:
Reinforcement is symmetrical about Construction ℄.



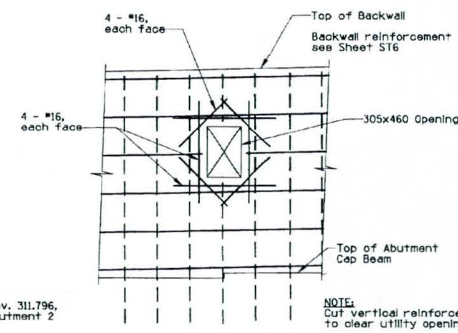
ABUTMENT CAP BOTTOM REINFORCEMENT

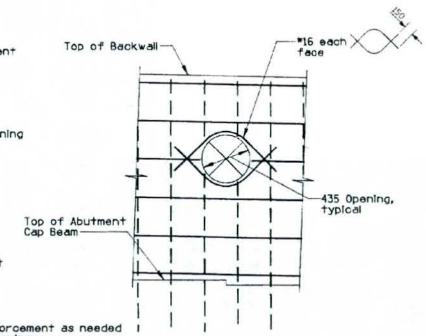
Scale 1:50



DETAIL A

Scale 1:20





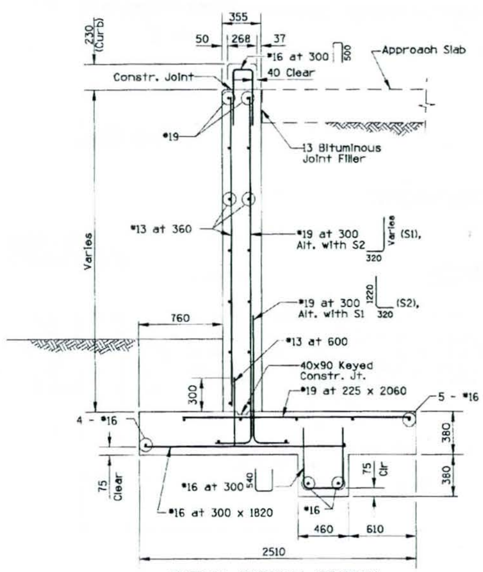
NOTE:
Cut vertical reinforcement as needed to clear utility openings.

TYPICAL OPENING AT 6 DUCT PVC CONDUIT

TYPICAL OPENING AT PETROLEUM LINES

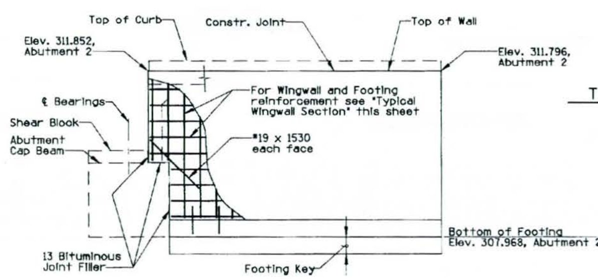
ABUTMENT BACKWALL OPENING DETAILS

Scale 1:20



TYPICAL WINGWALL SECTION

Scale 1:20



NOTE:
Curb concrete shall not be placed until fence post anchorages & curb reinforcing has been placed.

TYPICAL WINGWALL ELEVATION

Scale 1:50

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V. Wismer	10-99
DRAWN	J. Gilmore	10-99
CHECKED	W. Zapfel / D. Davis	10-99

Vincent W. Wismer
8173 VINCENT W. WISMER 1-15-01

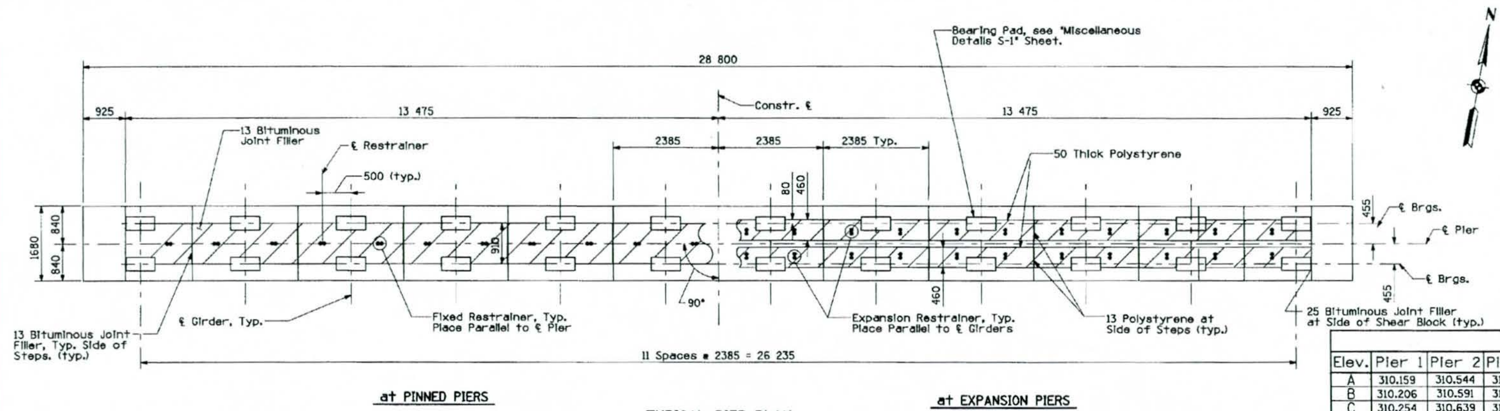
PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

ABUTMENT AND WINGWALL DETAILS

SHEET ST7

G:\PROJECTS\642767\USTN\STR\68951WD01.DGN
01/14/01
12:07:51 PM
MB.DGN 12/02/94

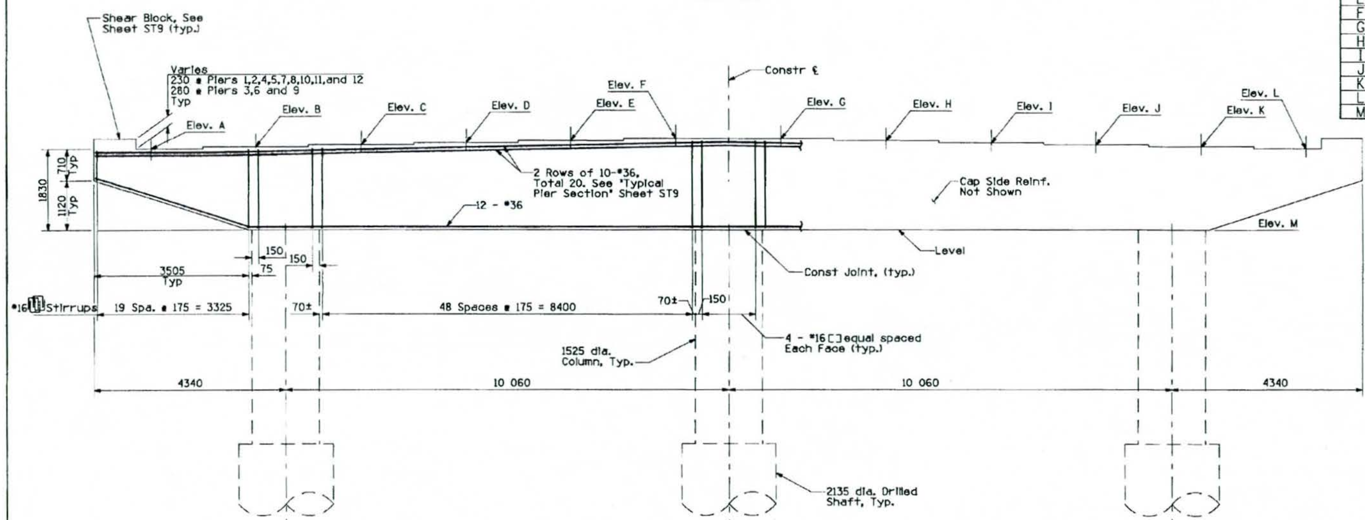
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68951	34	63	01/15/01



TYPICAL PIER PLAN
Scale 1:50

PIER ELEVATIONS									
Elev.	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7	Pier 8	Pier 9
A	310.159	310.544	310.795	311.069	311.207	311.211	311.237	311.128	310.858
B	310.206	310.591	310.842	311.116	311.254	311.258	311.287	311.175	310.905
C	310.254	310.639	310.890	311.164	311.302	311.306	311.332	311.223	310.953
D	310.302	310.687	310.938	311.212	311.350	311.354	311.380	311.271	311.001
E	310.349	310.734	310.985	311.259	311.397	311.401	311.427	311.318	311.048
F	310.397	310.782	311.033	311.307	311.445	311.449	311.475	311.366	311.096
G	310.397	310.782	311.033	311.307	311.445	311.449	311.475	311.366	311.096
H	310.349	310.734	310.985	311.259	311.397	311.401	311.427	311.318	311.048
I	310.302	310.687	310.938	311.212	311.350	311.354	311.380	311.271	311.001
J	310.254	310.639	310.890	311.164	311.302	311.306	311.332	311.223	310.953
K	310.206	310.591	310.842	311.116	311.254	311.258	311.287	311.175	310.905
L	310.159	310.544	310.795	311.069	311.207	311.211	311.237	311.128	310.858
M	308.329	308.714	308.965	309.239	309.377	309.381	309.407	309.298	309.028

PIER ELEVATIONS			
Elev.	Pier 10	Pier 11	Pier 12
A	310.637	310.321	310.005
B	310.684	310.368	310.052
C	310.732	310.416	310.100
D	310.780	310.464	310.148
E	310.827	310.511	310.195
F	310.875	310.559	310.243
G	310.875	310.559	310.243
H	310.827	310.511	310.195
I	310.780	310.464	310.148
J	310.732	310.416	310.100
K	310.684	310.368	310.052
L	310.637	310.321	310.005
M	308.807	308.491	308.175



TYPICAL PIER ELEVATION
Scale 1:50

NO.	APPROVED FOR CONSTRUCTION	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

51ST AVENUE BRIDGE AT SALT RIVER
DESIGN/BUILD PROJECT
PROJECT NO. 68951

	BY	DATE
DESIGNED	V. Wismer	11/99
DRAWN	J. Gilmore	11/99
CHECKED	W. Zapfel	11/99

VINCENT WISMER

PARSONS TRANSPORTATION GROUP
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

PIER PLAN AND ELEVATION

SHEET ST8

G:\PROJECTS\642767\USTN\STR\68951PD01.DGN
01/14/01
12:08:26 PM
MB.DGN 12/02/94

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY
91ST AVENUE TO THE I-10 BRIDGE

CONTRACT FCD 2013C013 WORK ASSIGNMENT #1

ELEVATION REFERENCE MARKS TECHNICAL MEMORANDUM

Date: February 23, 2015

To: Richard Harris, Project Manager – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Chuck Davis – WEST Consultants, Inc.
Jesse Piotrowski – WEST Consultants, Inc.

INTRODUCTION

The purpose of this technical memorandum is to identify appropriate data points to use as Elevation Reference Marks (ERMs) as required by the Flood Control District of Maricopa County (District) for work map development and by the Federal Emergency Management Agency (FEMA) for Flood Insurance Rate Map (FIRM) development. These data will be displayed on the work maps developed by WEST Consultants, Inc. (WEST) for the Lower Salt River Floodplain Delineation Study (FDS): From 91st Avenue to Upstream of the I-10 Bridge, Contract FCD 2013C013 Work Assignment #2. The final deliverable accompanying this memorandum is an ArcGIS shapefile depicting ERMs throughout the study reach of the Lower Salt River hydraulic model. This hydraulic model and all accompanying supporting documentation is supporting pending FEMA flood map revisions of the floodplain and floodway delineations for Lower Salt River.

The following sections of this technical memorandum provide detailed information regarding (1) guidance provided by the District to WEST regarding the selection of ERMs from the District's survey records and (2) the explanation and reasoning for WEST's selection of the individual ERMs for the Lower Salt River FDS represented in the attached ArcGIS shape file.

DISTRICT GUIDANCE REGARDING THE BASIS FOR SELECTING ERMS

The District provided WEST with ArcGIS shape files representing elevation points that could be used for ERMs in this study. These shape files are described briefly below:

1) National Geodetic Survey (NGS) monuments, maintained by the National Oceanic and Atmospheric Administration (NOAA), in the vicinity of the study reach. All NGS monuments were delivered in shapefiles named "SurveyPoint_NGS".

2) Geodetic Densification and Cadastral Survey (GDACS) project monuments demarcating section and quarter section corners and other monuments, maintained by the Maricopa County Department of Transportation (MCDOT), in the vicinity of the study reach. These were divided into shapefiles with the following titles:

    a. Survey_Point_Corner

    b. Survey_Point_Corner_Record_MCDOT

    c. Survey_Point_Misc_MCDOT

3) Aerial control points for a single topographic dataset collected by the District. A shapefile (titled "Survey_Point_Mapping_FCDMC.shp") was delivered including control points for the Lower Salt River Delineation Study Mapping topography collected in 2013. While these points do not take precedence over NGS higher-quality monuments, the District requested that they be included whenever possible.

It should be noted that the GDACS dataset includes NGS monuments. The GDACS data is prioritized in the following order at all section and quarter section corners: (a) NGS published vertical monuments; (b) NGS published horizontal monuments of A or B order stability only; and (c) MCDOT surveyed section or quarter section corners. Therefore, GDACS monuments can be coincident with NGS monuments.

The District has several criteria for selecting ERMs. First, there should be at least two ERMs per map panel if possible, and the highest quality monuments available in a panel should be selected as the two ERMs per map panel.

Second, the quality of the monuments to be used as ERMs should be ranked in the following order: (a) NGS approved monuments, then (b) GDACS approved monuments, and finally (c) aerial control points used to develop topographic datasets used in the development of the final surface used for creating hydraulic models and delineating floodplain/floodway boundaries for the Lower Salt River FDS.

Third, for any of these monument types, the ERMs should represent monuments that have been recorded in recent surveys as being easily identifiable, if possible. Additionally, if possible, the ERM should be brass caps in concrete, not rebar or other survey markers that were found in place or put in place to represent section or quarter section corners.

Finally, the District indicated that as much backup documentation as is available should be included in the ArcGIS shape file developed as the final ERM deliverable to provide to the District that is attached to this technical memorandum. For example, supporting documentation for NGS and GDACS monuments are available online; the URLs to these websites providing supporting documentation for a specific site should be included in the attribute table of the shape file for that location. This data tagging provides metadata for the ERM points built directly into the shape file that can eventually be delivered to FEMA in support of map changes for the Lower Salt River. Also, WEST will provide a PDF of all of the websites documenting the monuments with the final Technical Support Data Notebook (TSDN) for this project.

SELECTION OF ERM POINTS FOR THE LOWER SALT RIVER FDS STUDY

The draft work map panel layout WEST provided to the District contains 13 map panels. Every map panel contained at least two viable ERM locations. This draft layout is shown in Figure 1 below. The panels in Figure 1 are uniquely numbered.

Based on the different monument shapefiles provided by the District and the priority given to certain survey monument data sources over others, the selection of the ERM points was divided into sections based on the source of the ERM itself. The data sources used in the final ERM dataset development are discussed individually below.

ERMs from the shapefile titled 'SurveyPoint_NGS'

ERMs from the 'SurveyPoint_NGS' dataset were given highest priority over other possible survey monuments. WEST identified ERMs from this shapefile for 9 of the 12 panels shown in Figure 1 below, and 12 of the 25 ERMs shown in Figure 2 were selected from this shapefile. Monuments from this shapefile make up all of the reference marks in 3 of those 8 panels. Table 1 below presents the information for the NGS monuments used as reference marks.

Note that Panel 11 has three ERMs as opposed to the typical two ERMs per panel elsewhere in the study area. NGS ERMs AJ3668, DV2292, and DV2293 were specifically selected after consultation with the District because these ERMs were used by RBF Consulting to establish survey control in support of Contract FCD2012C015 Assignment No. 1. All other survey control points from FCD2012C015 were outside of the current study area.

Note that monument AJ3668 is also included in MCDOT's GDACS dataset, but because NGS monuments are ranked higher than GDACS in the District's criteria, these two monuments are considered NGS monuments for the purpose of this report.

Table 1. NGS points used as Elevation Reference Monuments

Panel Number	Selected ERM 'ObjectID' from the NGS point shapefile	Selected ERM 'PID' from the NGS point shapefile	Selected ERM 'Name' from the NGS point shapefile	Stability	Elevation (M NAVD88)	Elevation (FT NAVD88)	URL (beginning with "http://www.ngs.noaa.gov/cgi-bin/ds_mark.prl?PidBox=")
1	15985	DV2309	U 519	A	300.772	986.78	DV2309
1	15701	DV0457	TWIN RM 1	C	299.560	982.81	DV0457
3	13024	DV2305	R 519	A	307.257	1008.06	DV2305
3	14024	DV2306	S 519	A	304.491	998.98	DV2306
6	12643	DV2304	Q 519	A	308.409	1011.84	DV2304
7	9811	DV2300	L 519	A	317.009	1040.06	DV2300
9	9369	DV2299	K 519	A	320.072	1050.10	DV2299
10	12086	DV0474	PHOENIX RM 2	C	326.290	1070.51	DV0474
11	1070	AJ3668	1BF1	A	332.950	1092.36	AJ3668
11	5071	DV2292	C 519	B	335.187	1099.69	DV2292
11	5948	DV2293	D 519	B	335.246	1099.89	DV2293
12	12104	DV0690	PHX AP STA B	C	337.380	1106.89	DV0690

ERMs from the shapefile titled 'SurveyPointCorner_MCDOT'

WEST identified ERMs from this shapefile for 8 of the 12 panels shown in Figure 1 below, and 10 ERMs of the 25 total ERMs shown in Figure 2 were identified from this shapefile within these 8 panels. Monuments from this shapefile make up both of the reference marks in 2 panels. All of the monuments are brass- or aluminum-capped disk monuments. Since several of the panels contained far more than two high quality corner points, the highest quality GDACS monuments were used whenever possible while considering the spacing between the two points for each panel. Two high quality monuments located very close together were not chosen if there was another monument of comparable quality further away within the panel to provide better spatial coverage across the panel. A table of these points with their corresponding identification data is provided in Table 2 below.

Table 2. GDACS corner points used as Elevation Reference Monuments

Panel Number	Selected ERM Survey Point Monument Number	Selected ERM Survey Point Monument Name	Description	Elevation (FT NAVD88)	URL*
2	4473	54319-Z1	SET 3" MCHD BC FL STAMPED "T1NR1E 1/4 S33 S34 2004 37174" NOTE- SET CAP IN CONC	959.018	4473
5	11837	65051-1	FD 4" MC ENG DEPT BC IN HH 0.5' DN NO STAMPING	1026.748	11837
5	11864	65037-1	FD 3" AZ HWY DPT BC IN HH 0.8' DN STAMPED "STA 36+83.149 ELEV 1017.14"	1018.815	11864
6	10248	65015-2M	SET 3" MARICOPA COUNTY BC FL STAMPED "T1NR2E 1/4 S29 S32 2006 RLS31610"	1012.526	10248
7	11431	65056-3M	SET 3 INCH MARICOPA COUNTY BRASS CAP IN HAND HOLE 0.3 FEET DOWN STAMPED "T1NR2E 1/4 S16 S15 2005 RLS 31610"	1040.124	11431
8	11853	65028-2	FD 3" PHOENIX BC IN HH 0.5' DN STAMPED "T1N R2E S22 S23 S27 S26 1995 103459"	1036.352	11853
8	13092	65021-Z1	SET 3 INCH MARICOPA COUNTY BRASS CAP FLUSH STAMPED "T1NR2E 1/4 S27 S26 2005 RLS 31610"	1035.042	13092
9	11852	65025-1M	SET 3 INCH MARICOPA COUNTY BRASS CAP FLUSH STAMPED "T1NR2E 1/4 S24 S25 2005 RLS 31610" NOTE- REPLACE CPS WITH CAP	1052.927	11852
10	11819	65531-1	FD 3" PHOENIX BC IN HH 0.6' DN NO STAMPING	1062.407	11819
12	11612	65536-Z1	SET 3" MARICOPA COUNTY BC FL STAMPED "T1NR3E 1/4 S23 S24 2005 RLS 31610"	1106.811	11612

Each URL begins with* **http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsplsspts=

ERMs from the shapefile titled 'SurveyPointMisc MCDOT'

This dataset resulted in the smallest number of ERMs for the Lower Salt River FDS Study Area. WEST identified ERMs from this shapefile in 2 of the 12 panels shown in Figure 1 below, and 3 ERMs of the 25 total ERMs shown in Figure 2 were identified from this shapefile within these two panels. All 3 of the monuments are brass capped. Table 3 lists these points and their corresponding identification.

Table 3. GDACS miscellaneous points used as Elevation Reference Monuments

Panel Number	Selected ERM Survey Point Monument Number	Selected ERM Survey Point Monument Name	Description	Elevation (FT NAVD88)	URL*
2	30300	3035	MBCS	982.871	30300
4	1129	51402-1	FD 2 3/4" MCDOT BC IN HH 0.6' DN STAMPED "T1N R1E 6"	992.129	1129
4	30301	3036	MBCS	984.075	30301

Each URL begins with* **http://www.fcd.maricopa.gov/maps/gismaps/apps/gdacs/application/reportsurvey.cfm?gdacsmiscpts=

Other shapefiles not used in Selection of ERMs

The best available data was used in selecting the initial ERMs. The next best available shapefile was only used when all points from higher quality shapefiles were exhausted. All of the ERMs in each panel were selected using only the NGS dataset and the GDACS corner and miscellaneous points. The lesser quality ERM shapefiles that were not required were the shapefile containing aerial control points for various topographic datasets collected by the District (as these points overlapped with NGS points and did not include unique points) and the shapefile labeled "Survey Point Corner Recorded MCDOT".

SUMMARY OF THE FINAL ELEVATION REFERENCE MONUMENTS

WEST identified 2 monuments for each of the 12 panels in Figure 2 except for Panel 11, which included three monuments used to establish aerial control by RBF Consulting in support of FCD2012C015 Assignment No. 1. Twenty-five (25) ERMs are in the final ERM dataset. In Figure 1, panels shown with striped colors correspond to the panels that have ERMs from different sources. Note that striped panels in Figure 1 also indicate ERMs from different subsets of the same source, because the GDACS dataset contains multiple subsets. Monument selection was based on monument dataset priority and quality of the monument while considering the spatial locations of the available monuments within the panel as well (i.e., WEST attempted to choose points on opposite sides of the panel when possible).

Twelve ERMs of the total twenty-five were selected from the NGS dataset for eight separate panels. Monuments from this shapefile represent all of the reference marks in three of those eight panels. Panels 1, 3, 6, 7, 9 and 11 include monument(s) of the highest quality stability rating. Seven 'A' rated NGS monuments were identified for these six panels. Panel 11 includes two NGS monuments with a "B" stability rating. Panels 2, 10, and 12 include NGS monument(s) with a "C" stability rating. None of the panels contain monuments with a "D" stability rating.

ERMs were selected from GDACS points for nine of the twelve panels shown in Figure 1 below. ERMs from the GDACS datasets make up both of the reference marks in three of those twelve panels. In panel 2, one monument is from the "Misc MDOT" subset and the other point is from the "Corner MDOT" subset of the GDACS dataset. In panels 5 and 8, both monuments are from the "Corner MDOT" subset. In panel 4, both monuments are from the "Misc MDOT" subset. In panels 6, 7, 9, 10 and 12, one monument is from the "Corner MDOT" subset of the GDACS dataset and the other ERMs is from the NGS dataset.

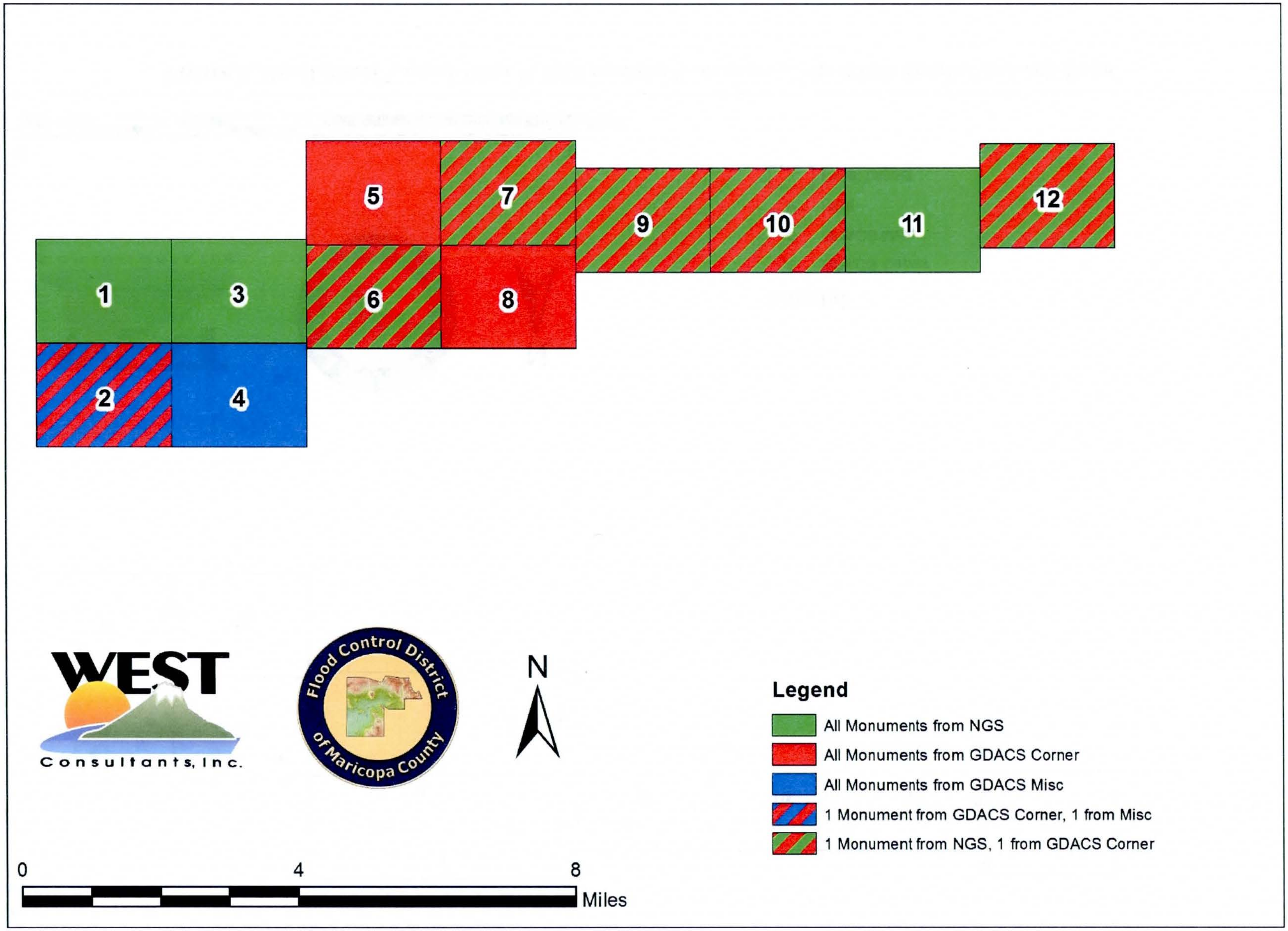


Figure 1. Draft Panel Layout from WEST and the Source of the ERM Points for Each Panel

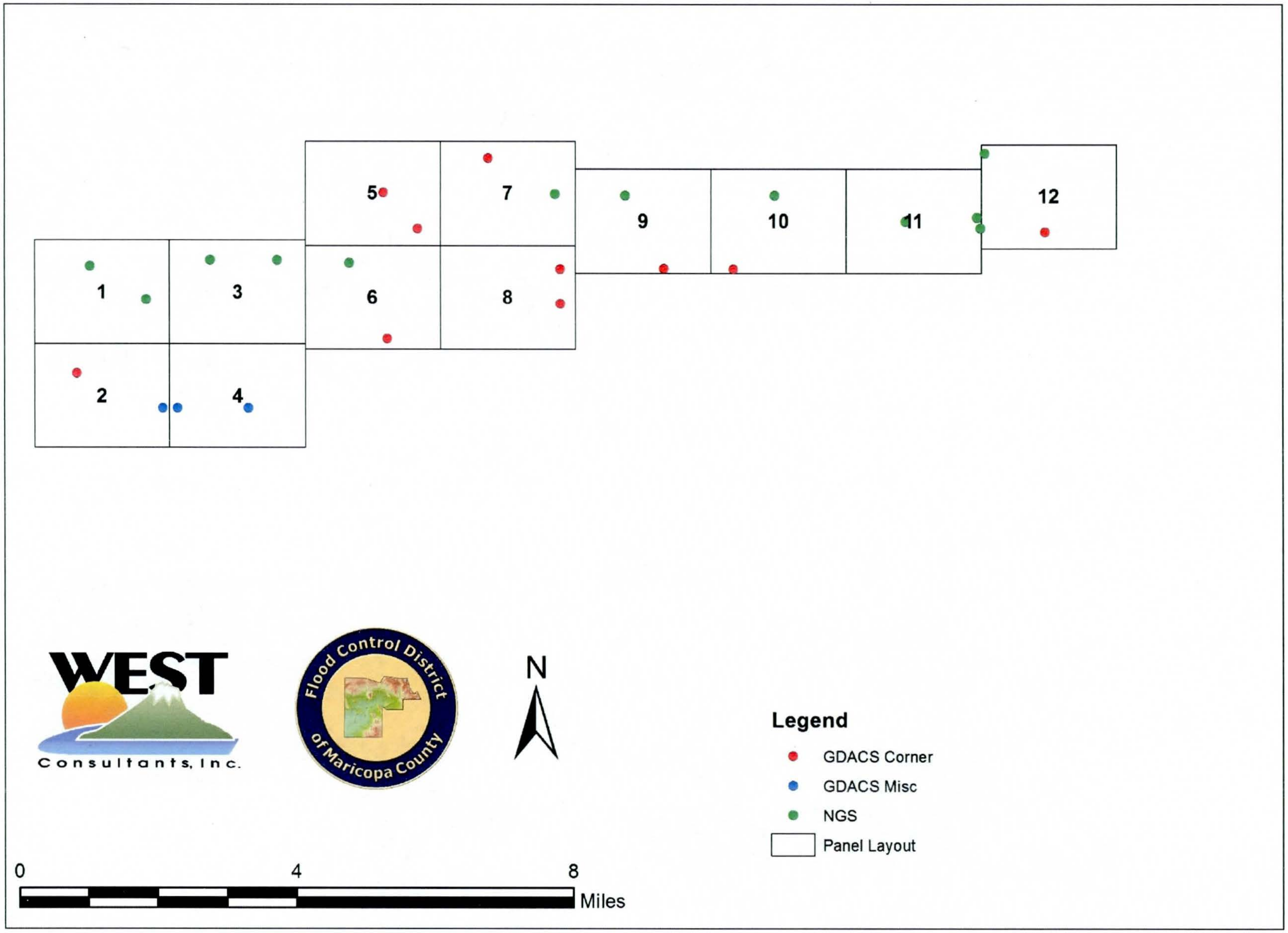
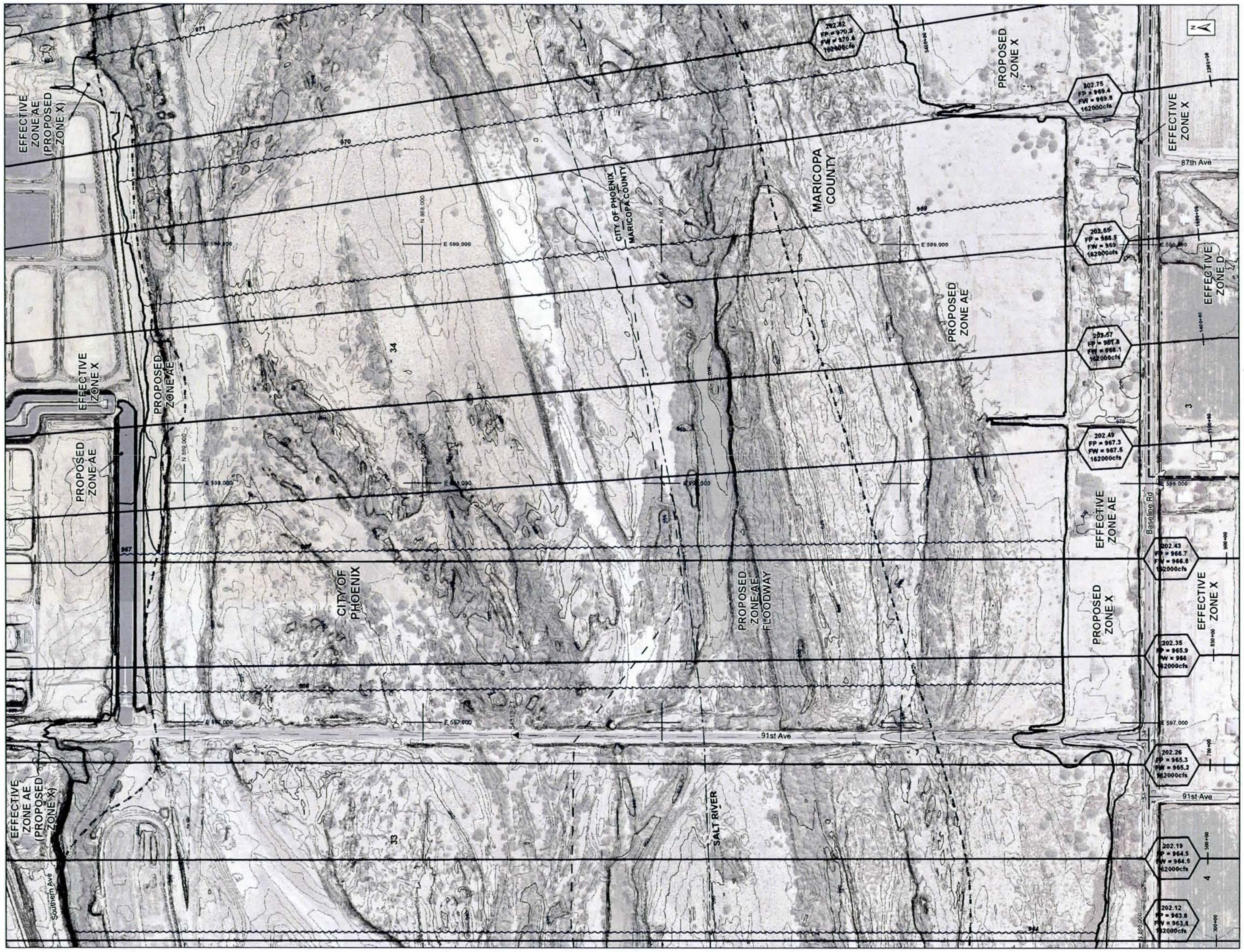


Figure 2. Draft Panel Layout from WEST and the Locations of the ERM Points for Each Panel

The two following work maps are from the Tres Rios North Levee study (WEST Consultants, Inc., 2012). The two work maps display the three cross-sections copied from the Tres Rios HEC-RAS model, at River Mile 202.82, 202.94 and 203.08.

MATCH LINE SHEET 18



MATCH LINE SHEET 15

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FLIGHT DATE VARIES FROM SEPTEMBER THROUGH DECEMBER, 2011

200 100 0 200 400

SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 1' IN CHANNEL, 2' AND 4' ELSEWHERE

LEGEND

1% ANNUAL CHANCE FLOOD BOUNDARIES — Revised / Effective

FLOODWAY BOUNDARIES — Revised / Effective

ZONE D BOUNDARY

BASE FLOOD ELEVATION

Cross Section River Mile Designation — 1,009
Floodplain Water Surface Elevation — FP = 2222.33
Floodway Water Surface Elevation — FW = 2222.33
100-year Discharge — 3333 cfs

HYDRAULIC BASELINE

ELEV. REFERENCE MARK

SECTION LINE AND ID — 5

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
ELEVATION CONVERSION FACTOR:
NAVD88 ELEV. = NGVD29 ELEV. + 2.1 FT.

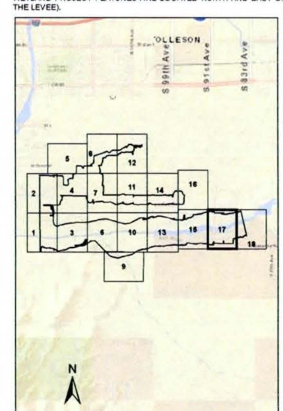
I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
54319-Z1	956.9	SET 3" MCHD BC FL STAMPED "T1NR1E 1/4 S33 S34 2004 37174"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE UNSHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 1W, SECTION 36, AND TOWNSHIP 1S, RANGE 1W, SECTION 1.

3) GROUND ELEVATION CONTOUR MAPPING MAY NOT REFLECT MORE RECENT CONSTRUCTION IN THE VICINITY OF THE LEVEE AND ATTENDANT PROJECT FEATURES. UPDATED AS-BUILT GEOMETRIC INFORMATION HAS BEEN ADDED TO THE MODEL FROM APPROXIMATELY THE LEVEE ALIGNMENT TO THE NORTH (OVERBANK WETLAND PROJECT FEATURES ARE LOCATED NORTH AND EAST OF THE LEVEE).



SHEET INDEX MAP

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

TRES RIOS NORTH LEVEE FLOODPLAIN DELINEATION STUDY

F.C.D. CONTRACT NUMBER 2010C027
ASSIGNMENT NUMBER 6

41960 BRIAN THOMAS WAHLIN ARIZONA, U.S.A.
Expires 3/31/2014

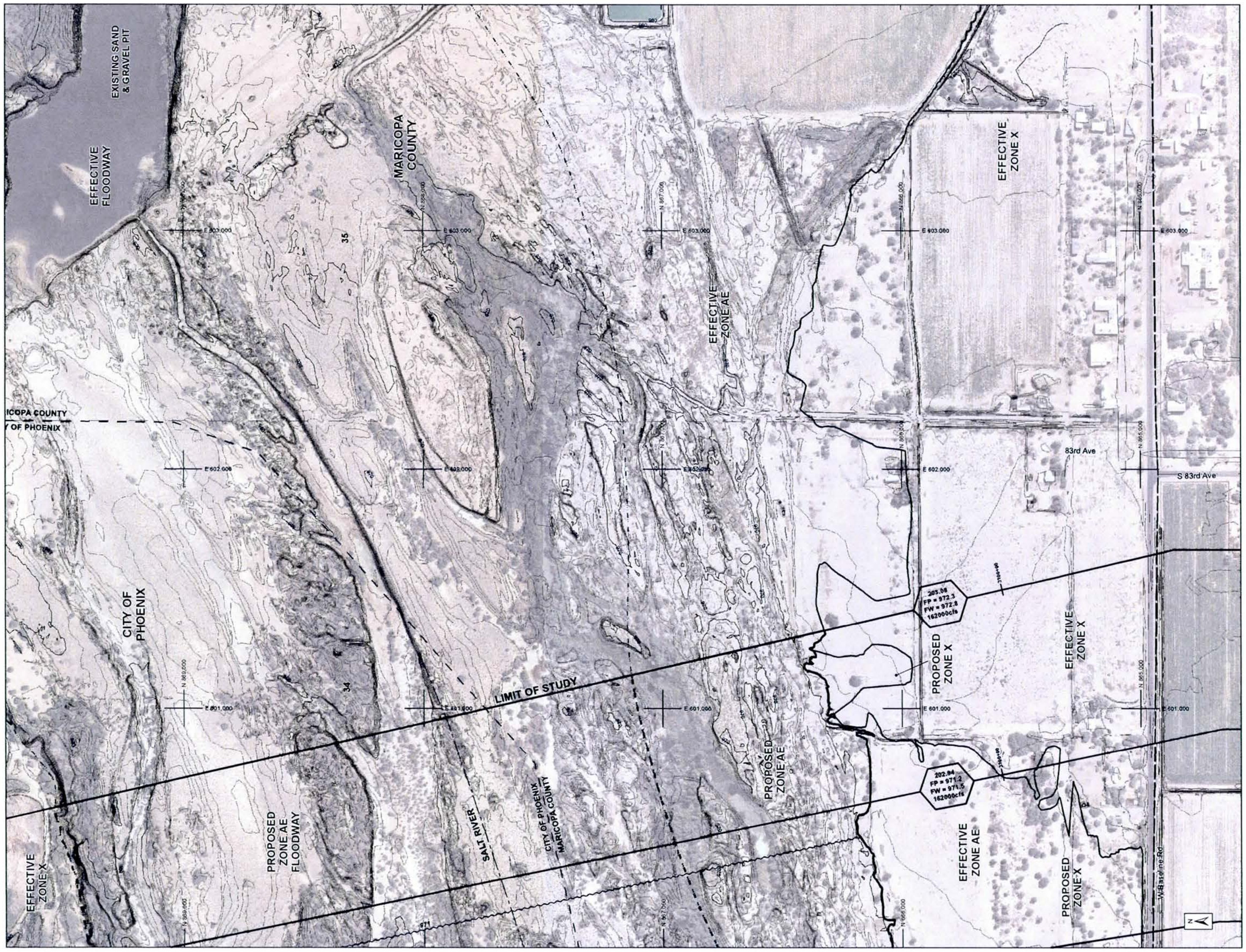
WEST Consultants, Inc.

	BY	DATE
DESIGN	—	—
DESIGN CHECK	—	—
PLANS	SJV	9/12
PLANS CHECK	BTW	9/12

SHEET 17 OF 18

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

CONTOUR MAPPING FOR THE FLOODPLAIN AND FLOODWAY IN THE CHANNEL BASED UPON 1-FOOT PHOTOGRAMMETRY PROVIDED BY TOWILL, 10/23/2001.



AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FLIGHT DATE VARIES FROM SEPTEMBER THROUGH DECEMBER, 2011

MATCH LINE SHEET 17

200 100 0 200 400

SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 1' IN CHANNEL, 2' AND 4' ELSEWHERE

LEGEND

- 1% ANNUAL CHANCE FLOOD BOUNDARIES — Revised / Effective
- FLOODWAY BOUNDARIES — Revised / Effective
- ZONE D BOUNDARY
- BASE FLOOD ELEVATION
- Cross Section River Mile Designation — 1,009
- Floodplain Water Surface Elevation — FP = 2222.33
- Floodway Water Surface Elevation — FW = 2222.33
- 100-year Discharge — 3333 cfs
- HYDRAULIC BASELINE
- ELEV. REFERENCE MARK
- SECTION LINE AND ID — 5

ELEVATION REFERENCE MARKS

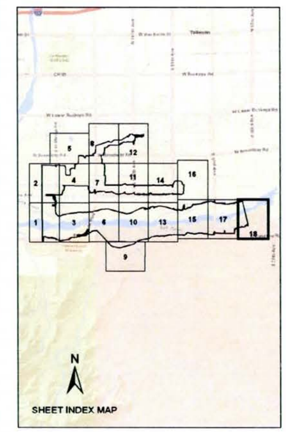
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
ELEVATION CONVERSION FACTOR:
NAVD88 ELEV. = NGVD29 ELEV. + 2.1 FT.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
54307-1M	979.9	FD 1/2" RB W/O ID 1.3' DN, AFFIXED 2" AL CAP, STAMPED "T1NR1E S26 S27 S34 S35 2003 37174"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE UNSHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 1E, SECTIONS 26-27, 34-35.



SHEET INDEX MAP

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

TRES RIOS NORTH LEVEE
FLOODPLAIN DELINEATION STUDY

F.C.D. CONTRACT NUMBER 2010C027
ASSIGNMENT NUMBER 6

41980 BRIAN THOMAS WAHLIN ARIZONA, U.S.A.
Expires 3/31/2014

WEST Consultants, Inc.

	BY	DATE
DESIGN	—	—
DESIGN CHECK	—	—
PLANS	SJV	9/12
PLANS CHECK	BTW	9/12

SHEET 18 OF 18

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

CONTOUR MAPPING FOR THE FLOODPLAIN AND FLOODWAY IN THE CHANNEL BASED UPON 1-FOOT PHOTOGRAMMETRY PROVIDED BY TOWILL, 10/23/2001.

Appendix D – Hydrologic Analysis Supporting Documentation

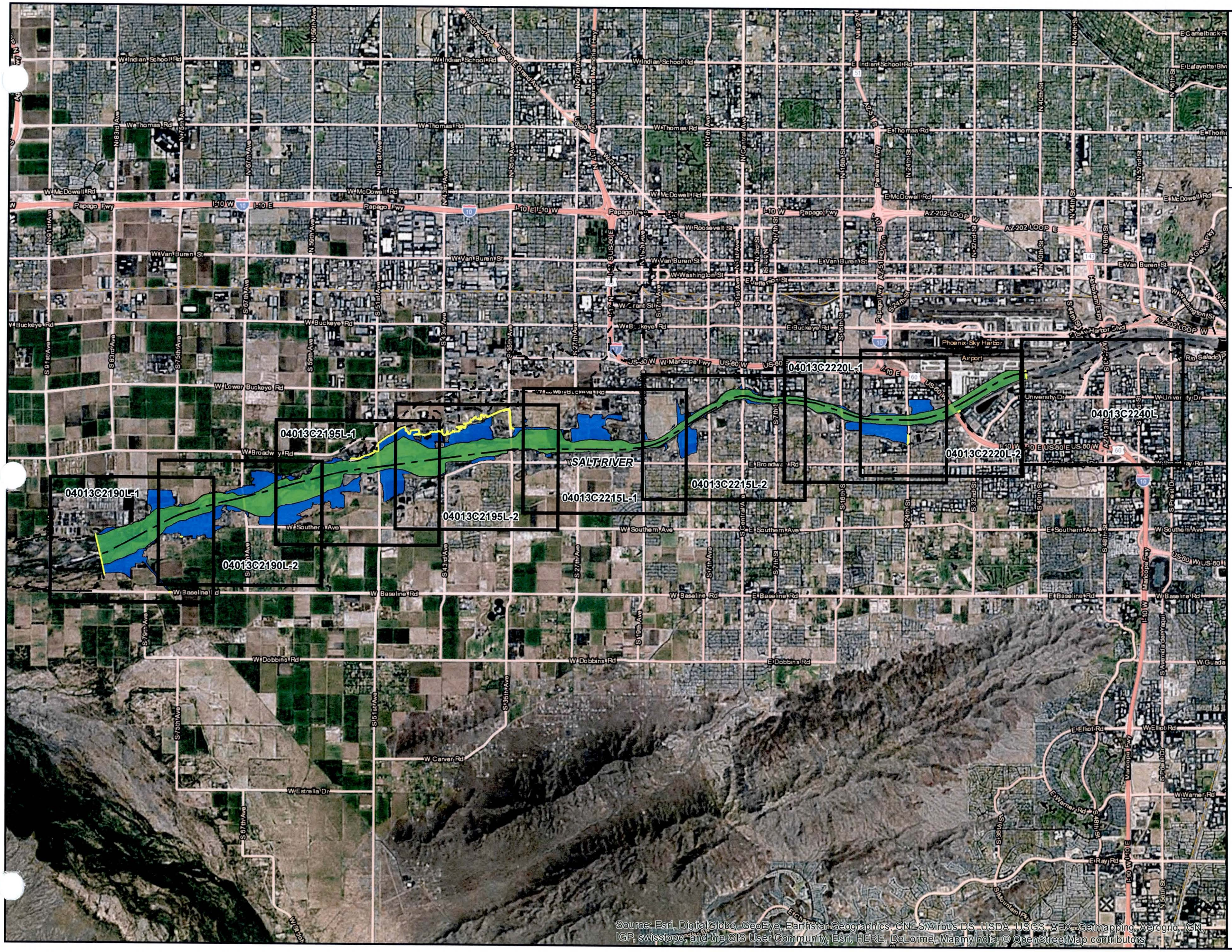
Due to significant length, this appendix is included electronically as a PDF in Exhibit C.

Appendix E – Hydraulic Analysis Supporting Documentation

Due to significant length, this appendix is included electronically as a PDF in Exhibit C.

Appendix F – Erosion, Sediment Transport, and Geomorphic Analysis Documentation

No erosion, sediment transport, or geomorphic analysis was performed for this study.



LEGEND

- PROFILE BASELINE
- EFFECTIVE FLOODPLAIN
- PROPOSED FLOODWAY
- PROPOSED ZONE AE
- PROPOSED ZONE A

N

APPROXIMATE SCALE

8,000 4,000 0 8,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL INDEX

FIRM

FLOOD INSURANCE RATE MAP

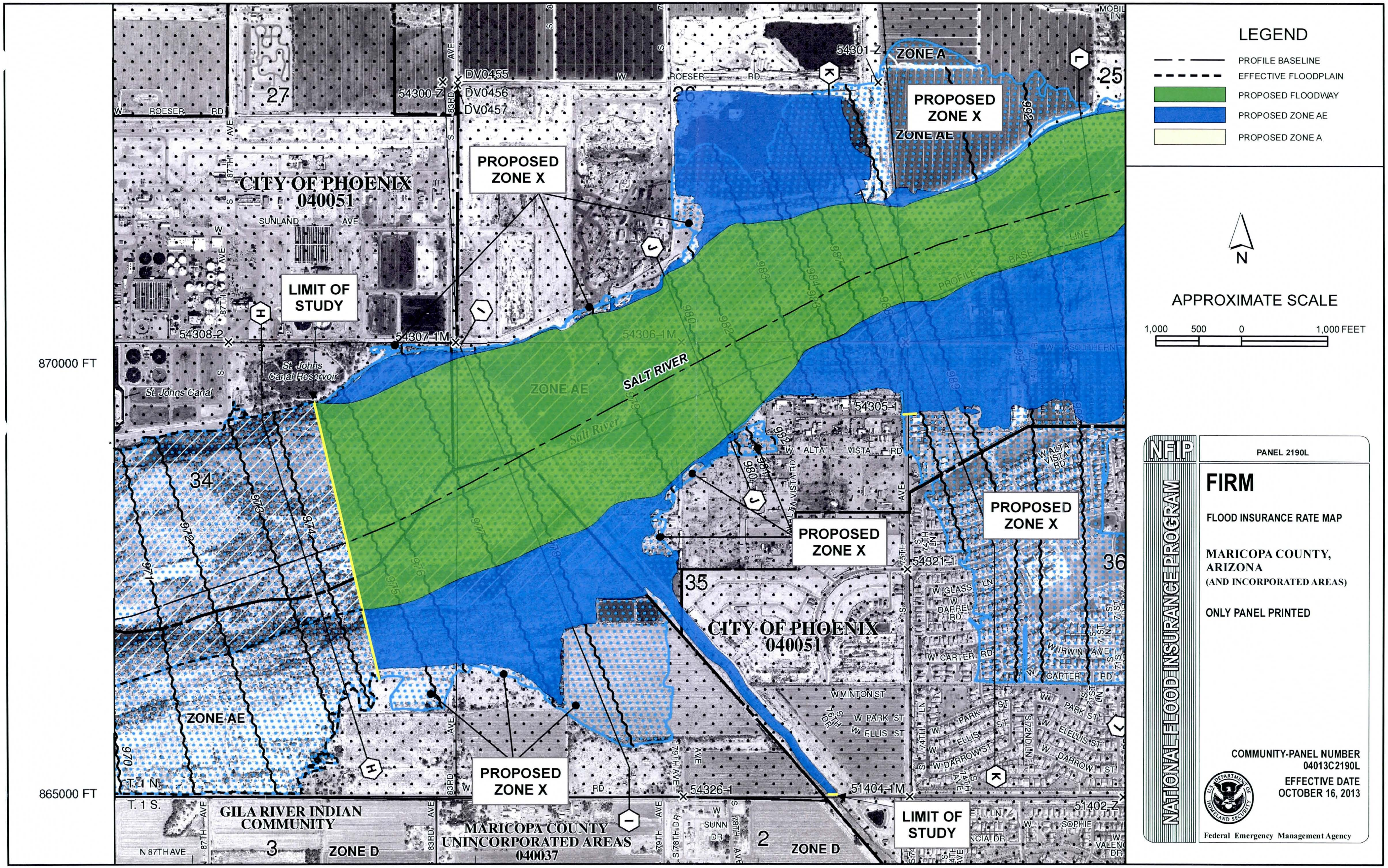
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

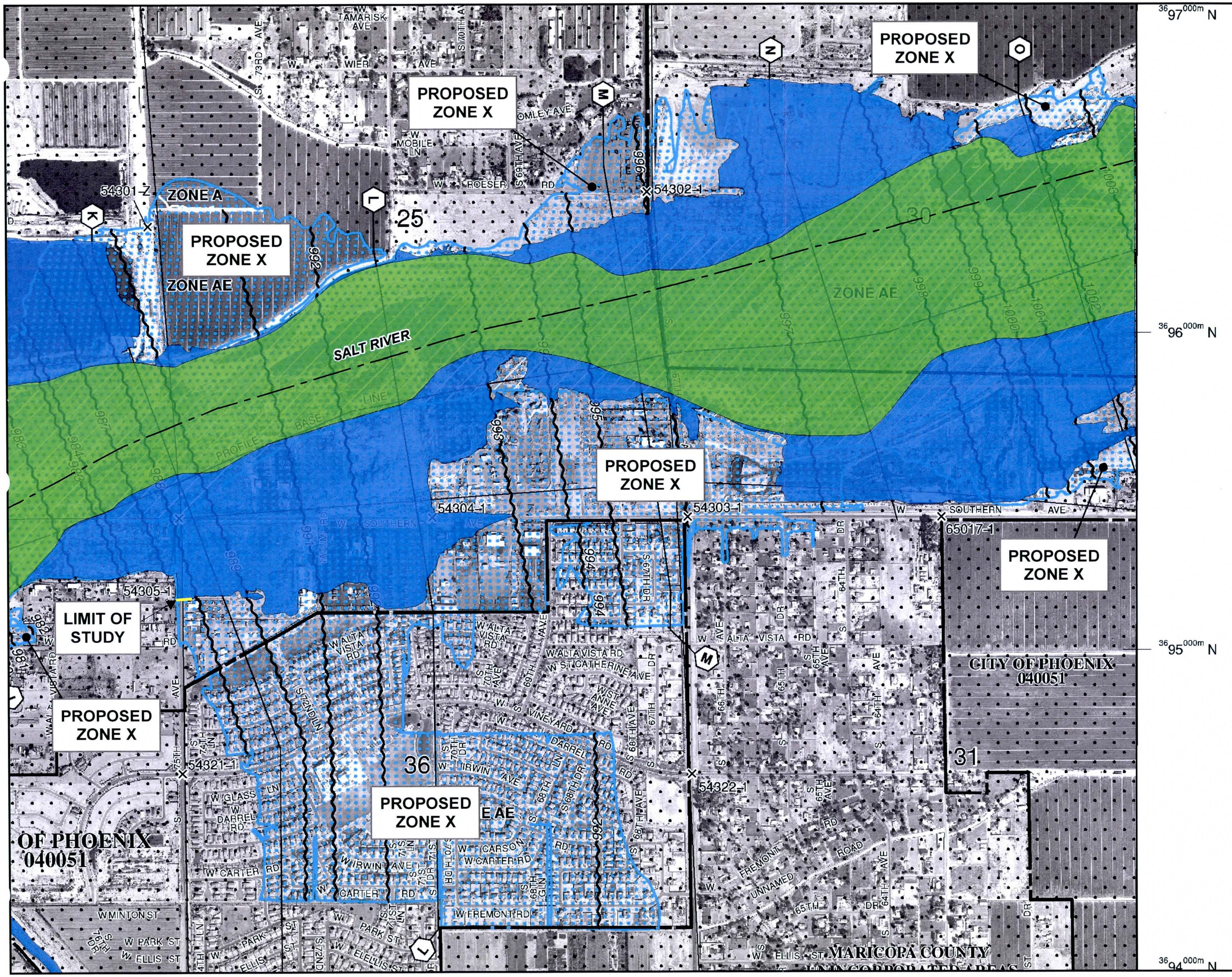
ONLY PANEL PRINTED

COMMUNITY NUMBER
04013C

EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency


LEGEND
PROFILE BASELINE
EFFECTIVE FLOODPLAIN
PROPOSED FLOODWAY
PROPOSED ZONE AE
PROPOSED ZONE A
N
APPROXIMATE SCALE
1,000 500 0 1,000 FEET
NFIP
PANEL 2190L
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)
ONLY PANEL PRINTED
NATIONAL FLOOD INSURANCE PROGRAM
COMMUNITY-PANEL NUMBER
04013C2190L
EFFECTIVE DATE
OCTOBER 16, 2013
Federal Emergency Management Agency
870000 FT
865000 FT
CITY OF PHOENIX
040051
GILA RIVER INDIAN COMMUNITY
MARICOPA COUNTY UNINCORPORATED AREAS
040037
SALT RIVER
LIMIT OF STUDY
LIMIT OF STUDY
PROPOSED ZONE X
PROPOSED ZONE X
PROPOSED ZONE X
PROPOSED ZONE X
PROPOSED ZONE X
ZONE A
ZONE AE
ZONE AE
ZONE AE
ZONE D
ZONE D
St. Johns Canal Reservoir
St. Johns Canal
DV0455
DV0456
DV0457
54300-Z
54301-Z
54308-2
54307-1M
54306-1M
54305-1
54321-1
54326-1
51404-1M
51402-Z
W ROESER RD
W SUNLAND AVE
W ALTA VISTA RD
W SOUTHERN
W CARTER RD
W MINTON ST
W PARK ST
W ELLIS ST
W DARROW ST
W IRWIN AVE
T. 1 N.
T. 1 S.
27
26
25
34
35
36
3
2



LEGEND

— · —	PROFILE BASELINE
- - - -	EFFECTIVE FLOODPLAIN
(green)	PROPOSED FLOODWAY
(blue)	PROPOSED ZONE AE
(pale yellow)	PROPOSED ZONE A

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2190L

FIRM

FLOOD INSURANCE RATE MAP

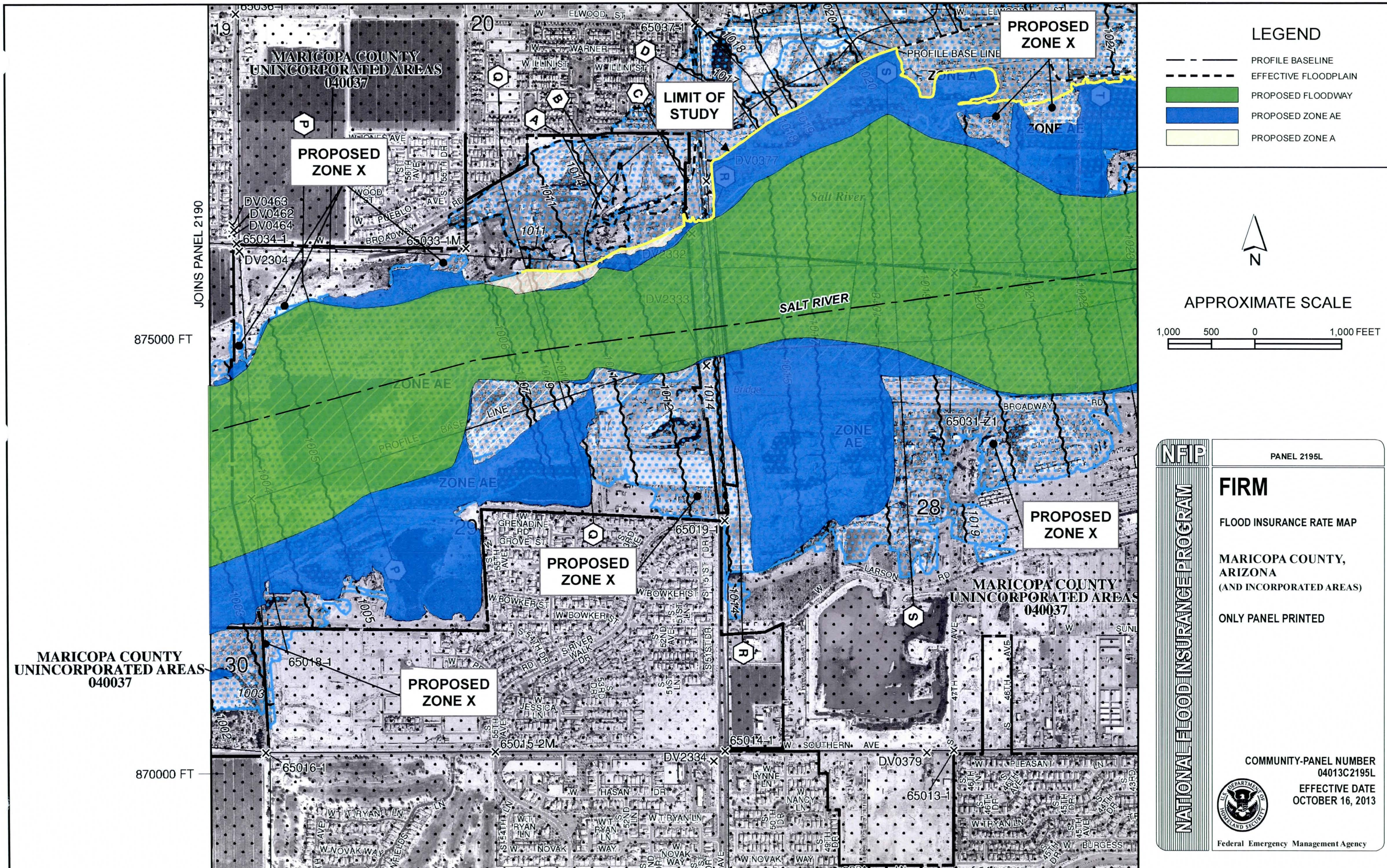
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

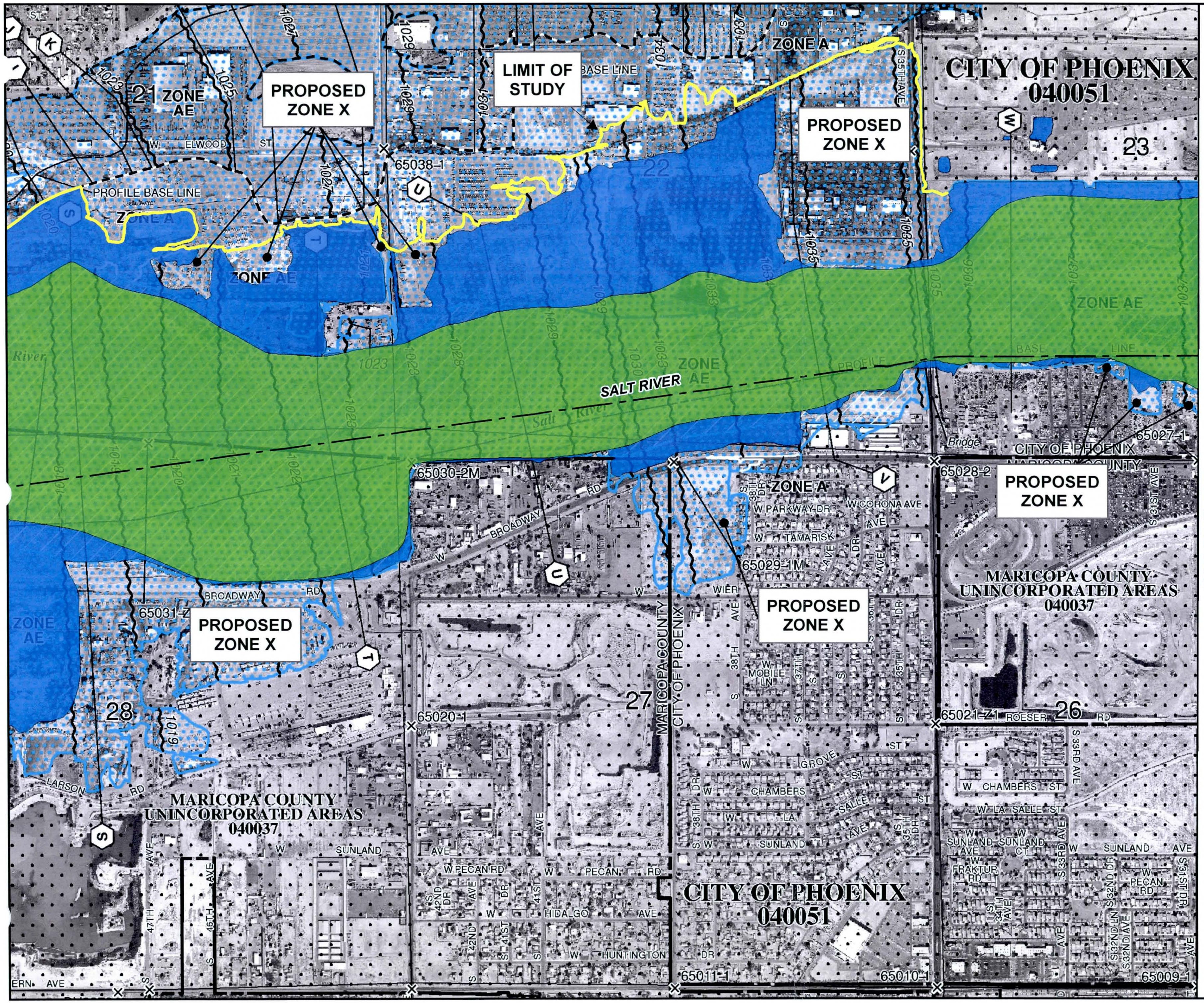
COMMUNITY-PANEL NUMBER
04013C2190L

EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency



LEGEND
PROFILE BASELINE
EFFECTIVE FLOODPLAIN
PROPOSED FLOODWAY
PROPOSED ZONE AE
PROPOSED ZONE A
N
APPROXIMATE SCALE
1,000 500 0 1,000 FEET
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 2195L
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)
ONLY PANEL PRINTED
COMMUNITY-PANEL NUMBER
04013C2195L
EFFECTIVE DATE
OCTOBER 16, 2013
Federal Emergency Management Agency
JOINS PANEL 2190
875000 FT
870000 FT
MARICOPA COUNTY
UNINCORPORATED AREAS
040037
PROPOSED ZONE X
LIMIT OF STUDY
ZONE A
ZONE AE
SALT RIVER
Salt River
PROFILE BASE LINE
W ELWOOD ST
W WARNER
W ILLINI ST
W JONES AVE
W PUEBLO AVE
BROADWAY RD
W GRENADINE RD
GROVE ST
W BOWKER ST
S RIVER WALK DR
W JESSICA LN
LARSON RD
W SOUTHERN AVE
W PLEASANT LN
W HASAN DR
W T RYAN LN
W NOVAK WAY
W BURGESS
W ALTA VISTA RD
DV0463
DV0462
DV0464
DV2304
DV2332
DV2333
DV0377
DV2334
DV0379
65036-1
65037-1
65034-1
65033-1M
65031-Z1
65019-1
65018-1
65015-2M
65014-1
65016-1
65013-1
19
20
28
29
30



LEGEND

- PROFILE BASELINE
- EFFECTIVE FLOODPLAIN
- PROPOSED FLOODWAY
- PROPOSED ZONE AE
- PROPOSED ZONE A

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2195L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
04013C2195L

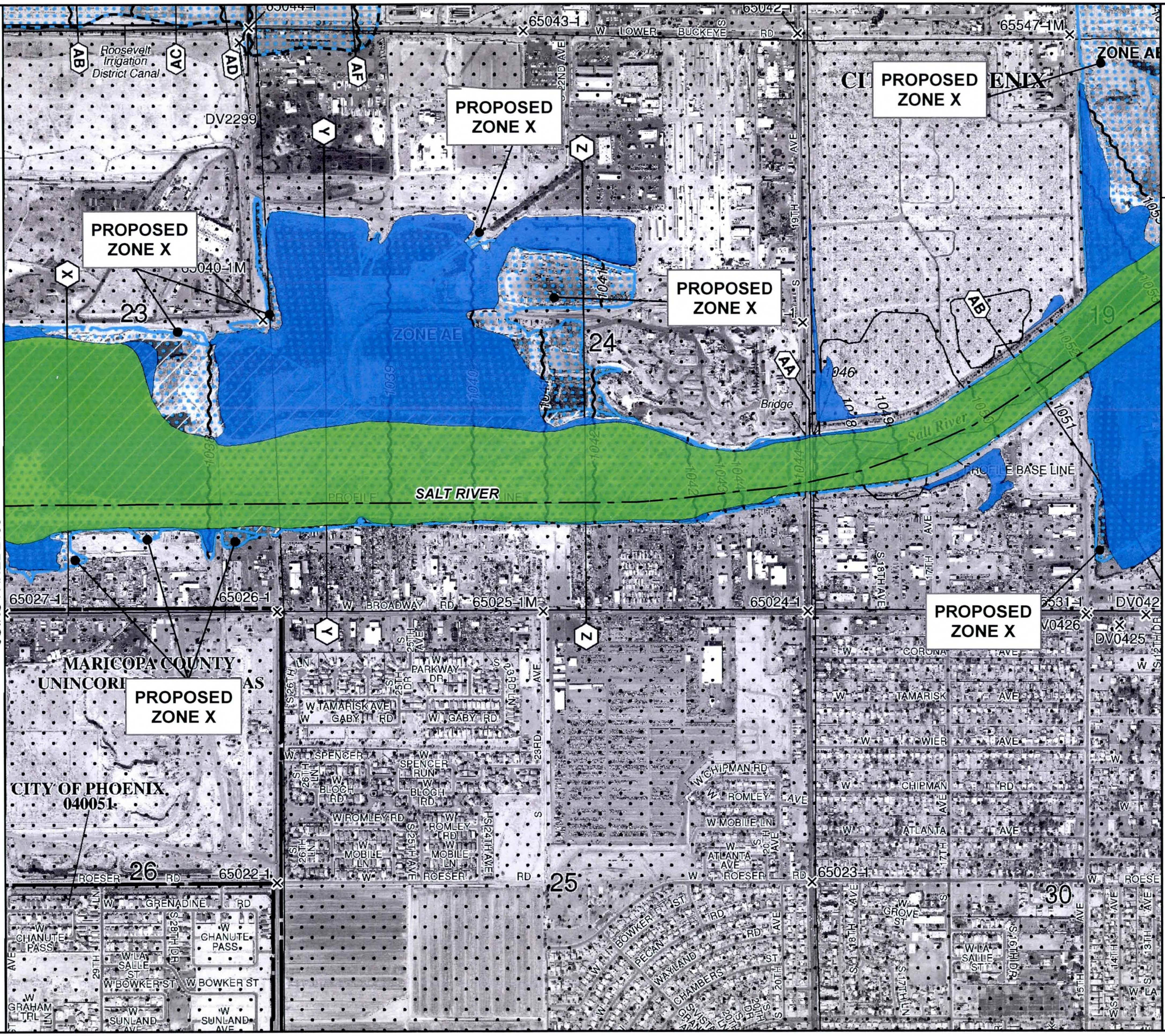
EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency

880000 FT

875000 FT

JOINS PANEL 2195



LEGEND

- PROFILE BASELINE
- EFFECTIVE FLOODPLAIN
- PROPOSED FLOODWAY
- PROPOSED ZONE AE
- PROPOSED ZONE A

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

PANEL 2215L

FIRM

FLOOD INSURANCE RATE MAP

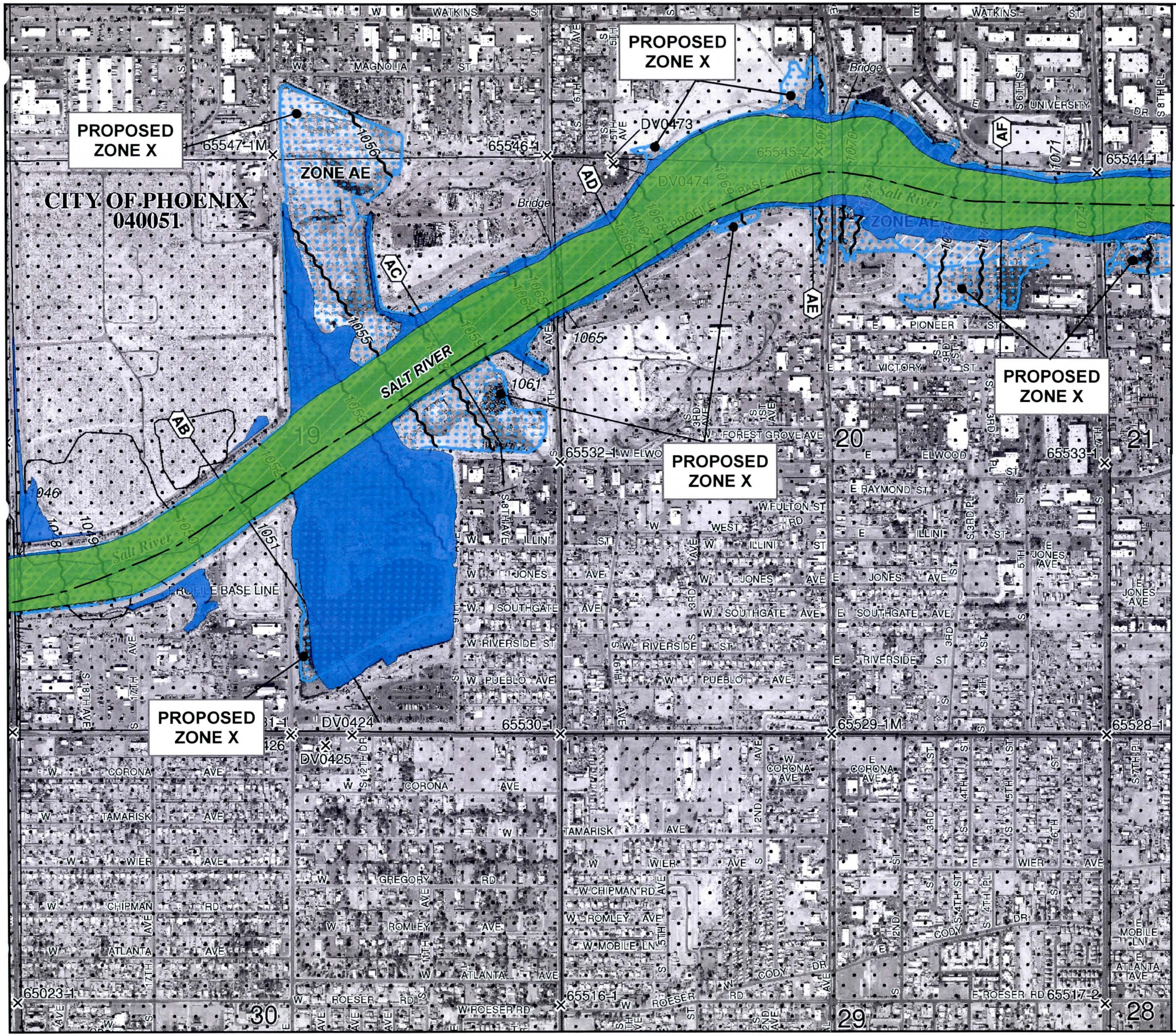
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
04013C2215L

EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency



LEGEND

- PROFILE BASELINE
- EFFECTIVE FLOODPLAIN
- PROPOSED FLOODWAY
- PROPOSED ZONE AE
- PROPOSED ZONE A

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2215L

FIRM

FLOOD INSURANCE RATE MAP

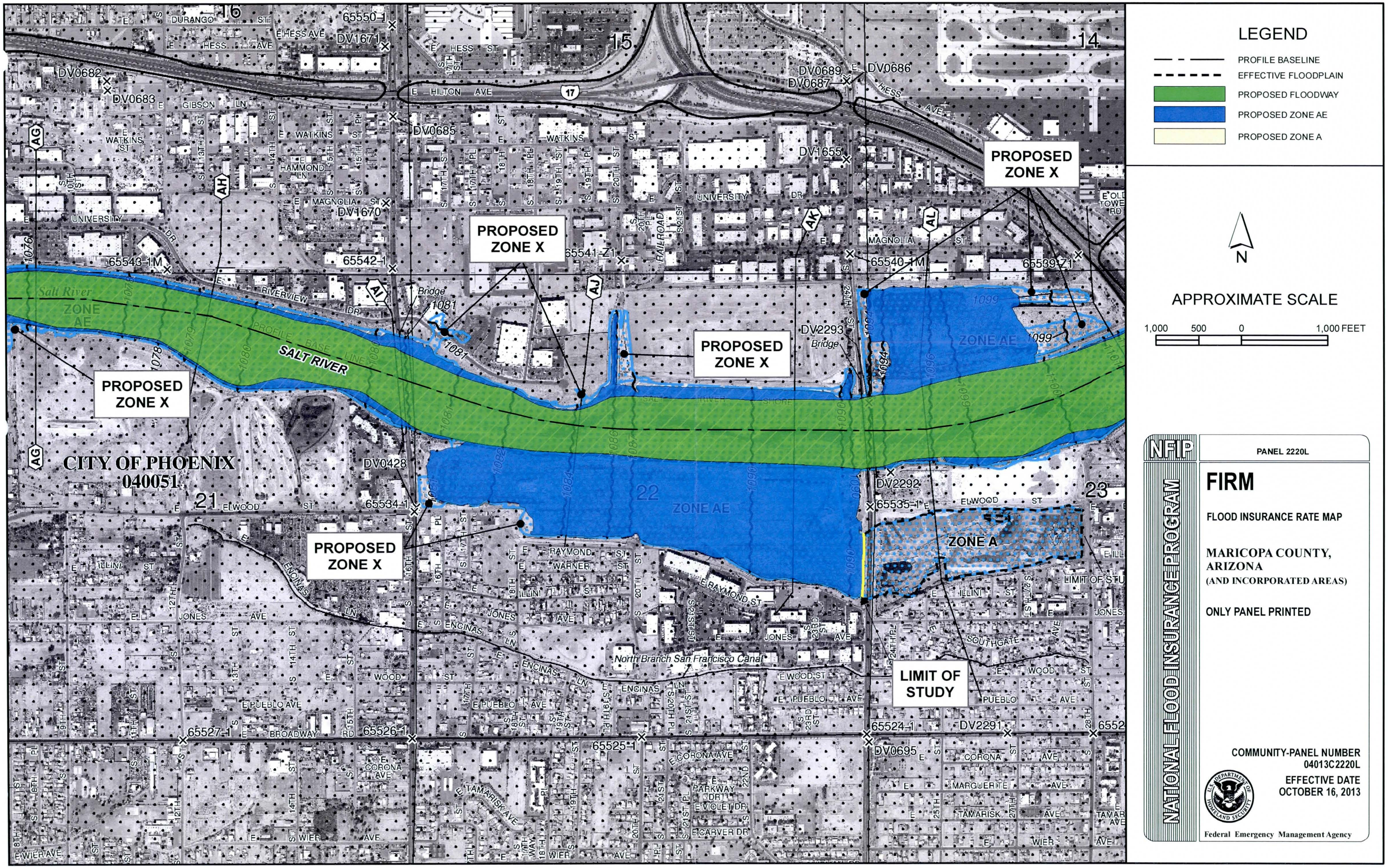
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

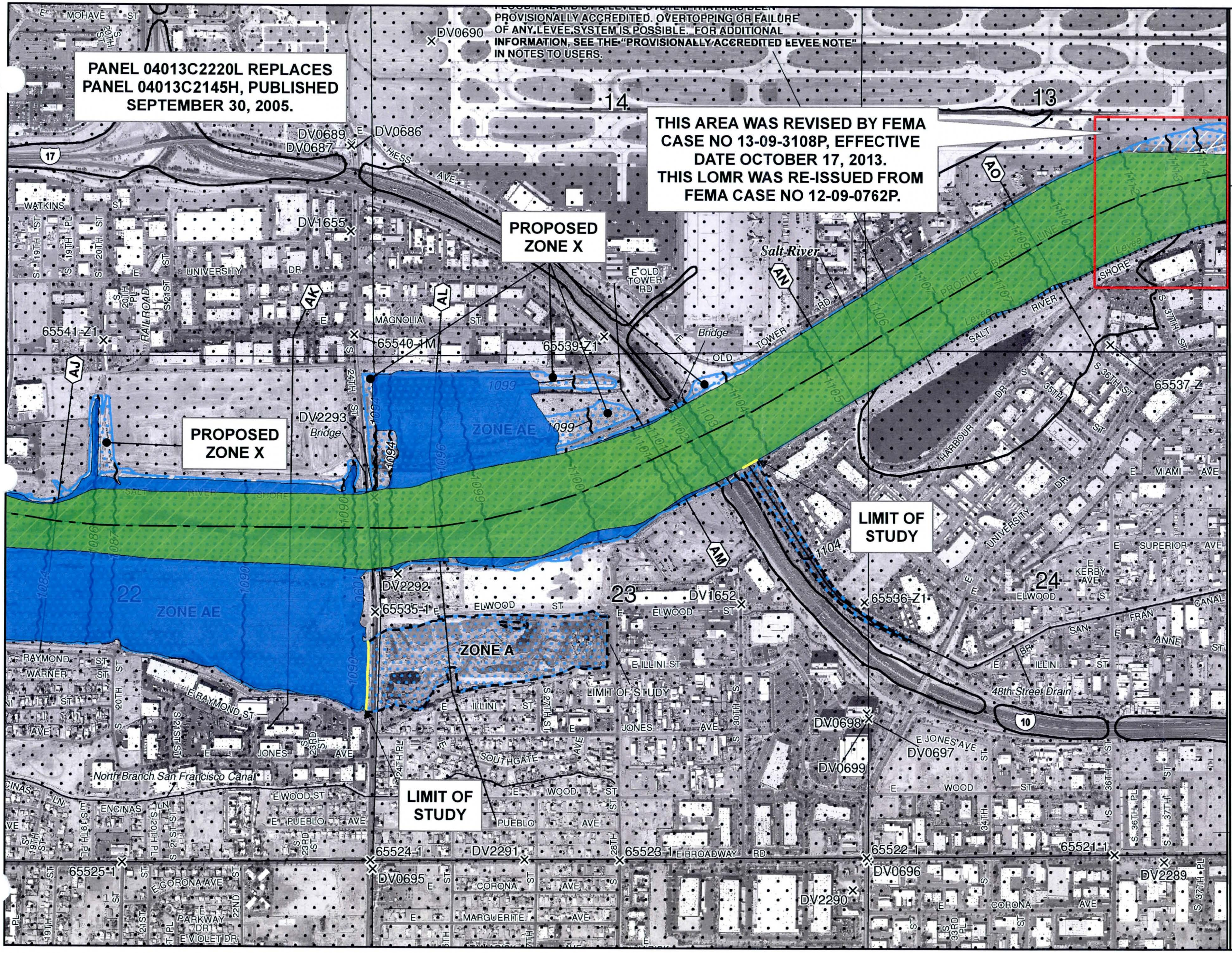
COMMUNITY-PANEL NUMBER
04013C2215L

EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency



LEGEND
PROFILE BASELINE
EFFECTIVE FLOODPLAIN
PROPOSED FLOODWAY
PROPOSED ZONE AE
PROPOSED ZONE A
N
APPROXIMATE SCALE
1,000 500 0 1,000 FEET
NFIP
PANEL 2220L
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)
ONLY PANEL PRINTED
NATIONAL FLOOD INSURANCE PROGRAM
COMMUNITY-PANEL NUMBER
04013C2220L
EFFECTIVE DATE
OCTOBER 16, 2013
Federal Emergency Management Agency
CITY OF PHOENIX
040051
SALT RIVER
Salt River
ZONE AE
ZONE A
PROPOSED ZONE X
LIMIT OF STUDY
North Branch San Francisco Canal
16
15
14
21
22
23
AG
AH
AI
AJ
AK
AL
65550-1
DV1671
DV0682
DV0683
DV0685
DV0689
DV0686
DV0687
DV1655
DV1670
65543-1M
65542-1
65541-Z1
65540-1M
65539-Z1
DV2293
DV0428
DV2292
65534-1
65535-1
65527-1
65526-1
65525-1
65524-1
DV2291
DV0695
E DURANGO ST
E HESS AVE
E HILTON AVE
17
GIBSON LN
E WATKINS ST
HAMMOND LN
E MAGNOLIA ST
E UNIVERSITY DR
RIVERVIEW DR
E ELWOOD ST
E ILLINI ST
JONES AVE
E ENCINAS LN
E WOOD ST
E PUEBLO AVE
BROADWAY RD
E CORONA AVE
E TAMARISK AVE
E WIER AVE
E RAYMOND ST
WARNER
SOUTHGATE
MARGUERITE AVE
PARKWAY DR
E VIOLET DR
E CARVER DR
RAILROAD
Bridge
1081
1099



LEGEND

- PROFILE BASELINE
- EFFECTIVE FLOODPLAIN
- PROPOSED FLOODWAY
- PROPOSED ZONE AE
- PROPOSED ZONE A

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2220L

FIRM

FLOOD INSURANCE RATE MAP

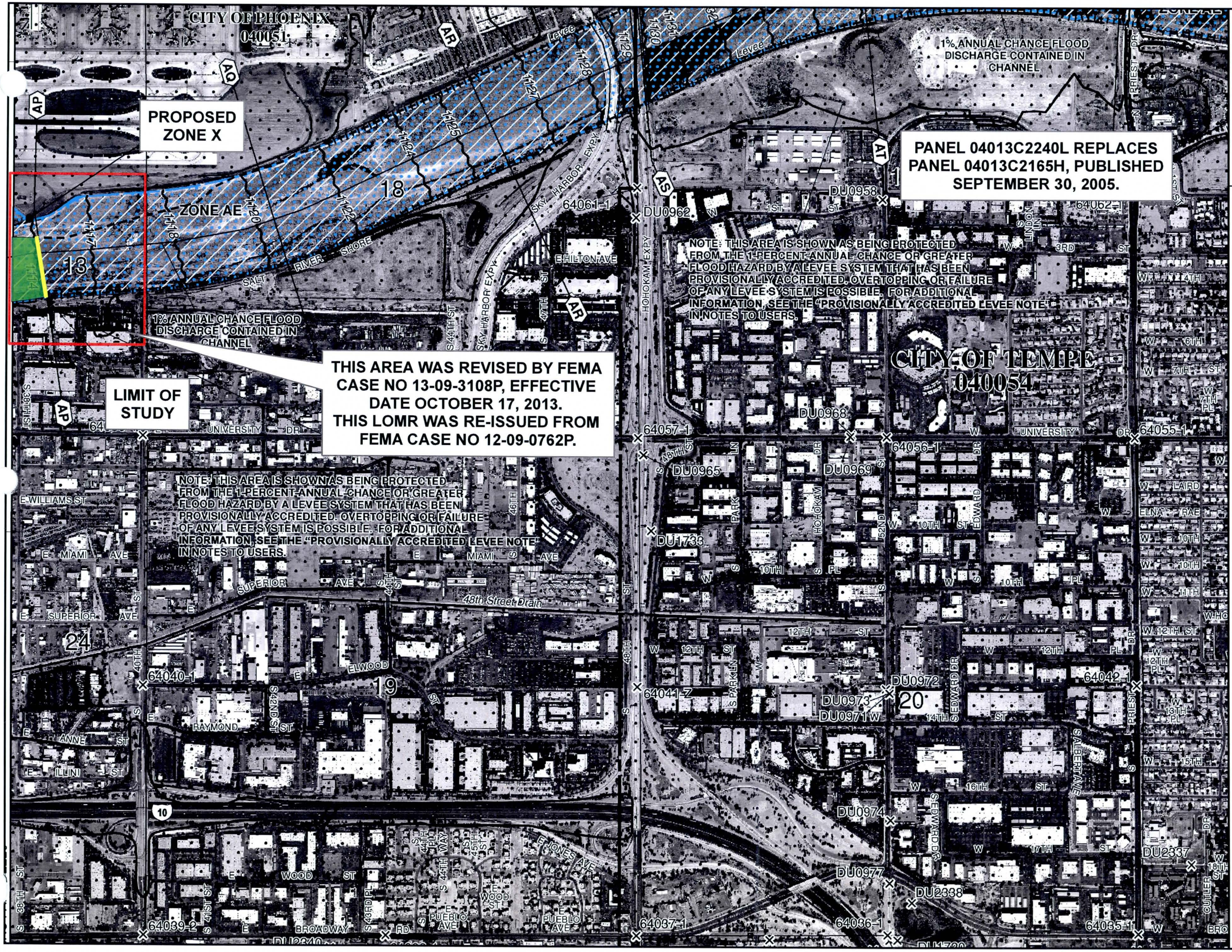
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
04013C2220L

EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency



LEGEND

- PROFILE BASELINE
- EFFECTIVE FLOODPLAIN
- PROPOSED FLOODWAY
- PROPOSED ZONE AE
- PROPOSED ZONE A

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

PANEL 2240L

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY,
ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
04013C2240L

EFFECTIVE DATE
OCTOBER 16, 2013

Federal Emergency Management Agency

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

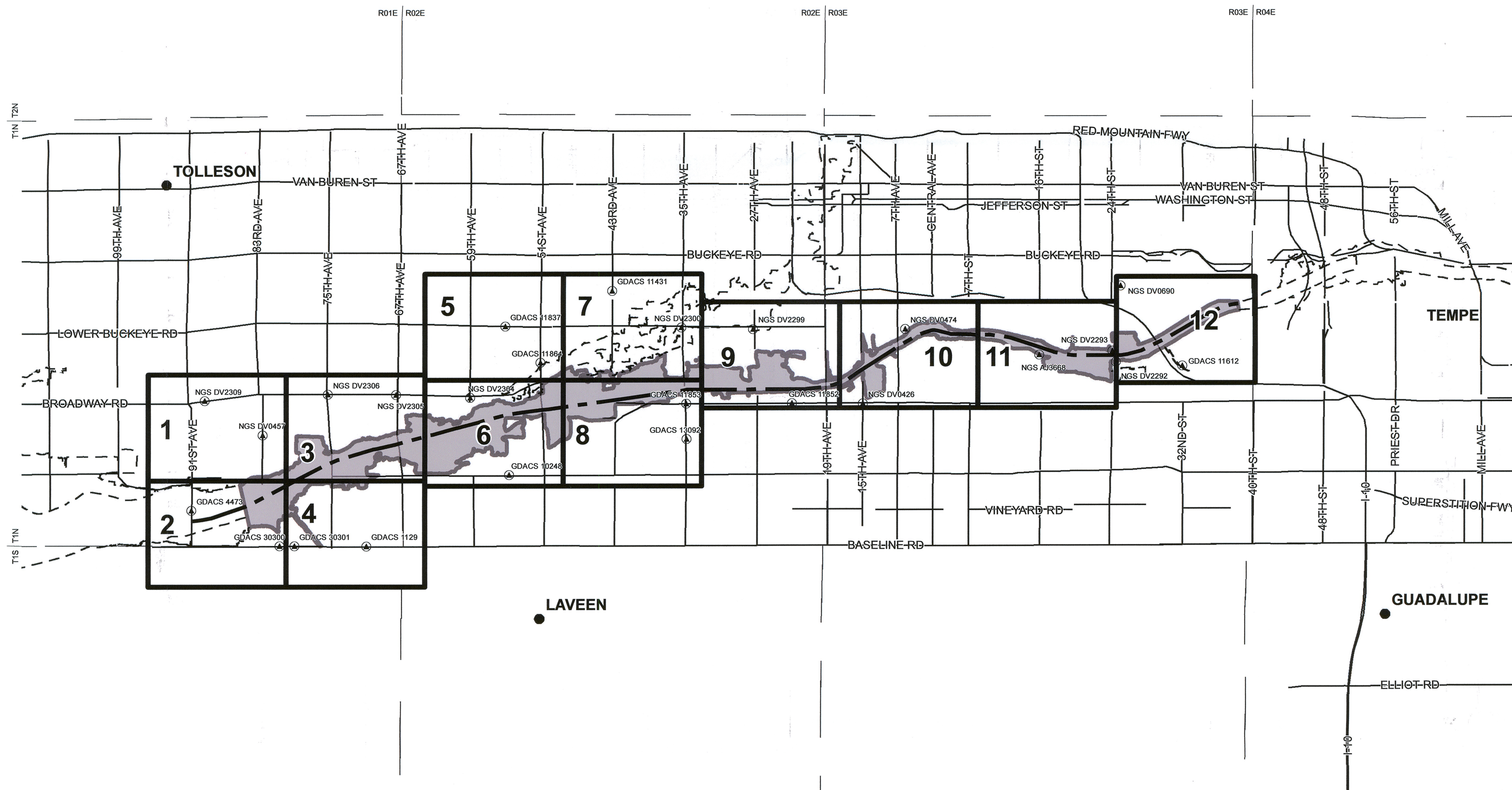
LOWER SALT RIVER
FLOODPLAIN DELINEATION STUDY:
FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

FCD CONTRACT NO. 2013C013
MAY 2015

ELEVATION REFERENCE MARKS

GEODETIC DENSIFICATION CADASTRAL SURVEY
(GDACS)
CONTROL STATIONS

ID Number	Source	NAD 83 Northing (feet)	NAD 83 Easting (feet)	NAVD 88 Elevation (feet)
10248	GDACS	870,238.92	620,596.83	1012.53
1129	GDACS	864,951.01	609,983.40	992.13
11431	GDACS	883,956.73	628,243.58	1040.12
11612	GDACS	878,357.59	670,708.41	1106.81
11819	GDACS	875,559.70	646,954.12	1062.41
11837	GDACS	881,308.78	620,292.65	1026.75
11852	GDACS	875,568.39	641,646.97	1052.93
11853	GDACS	875,550.54	633,775.27	1036.35
11864	GDACS	878,609.20	622,906.94	1018.82
13092	GDACS	872,909.51	633,782.61	1035.04
30300	GDACS	864,958.06	603,524.68	982.87
30301	GDACS	864,957.31	604,620.46	984.08
4473	GDACS	867,609.06	596,944.83	959.02
AJ3668	NGS	879,158.13	660,049.34	1092.36
DV0457	NGS	873,215.73	602,256.29	982.81
DV0474	NGS	881,089.03	650,081.11	1070.51
DV0690	NGS	884,302.08	666,102.69	1106.89
DV2292	NGS	878,642.58	665,757.61	1099.69
DV2293	NGS	879,451.41	665,504.21	1099.89
DV2299	NGS	881,108.92	638,724.33	1050.10
DV2300	NGS	881,220.75	633,385.16	1040.06
DV2304	NGS	876,001.93	617,692.43	1011.84
DV2305	NGS	876,218.83	612,183.20	1008.06
DV2306	NGS	876,233.30	607,097.26	998.98
DV2309	NGS	875,756.06	597,940.95	986.78



LEGEND

PROPOSED 1% ANNUAL CHANCE FLOOD BOUNDARY	
EFFECTIVE FLOODPLAIN BOUNDARY	
HYDRAULIC BASELINE	
COUNTY BOUNDARY	
SHEET WINDOW AND NUMBER	1
ELEV. REFERENCE MARK	
CITY OR TOWN	
TOWNSHIP AND RANGE LINE AND ID	R10W R9W T1N T1S

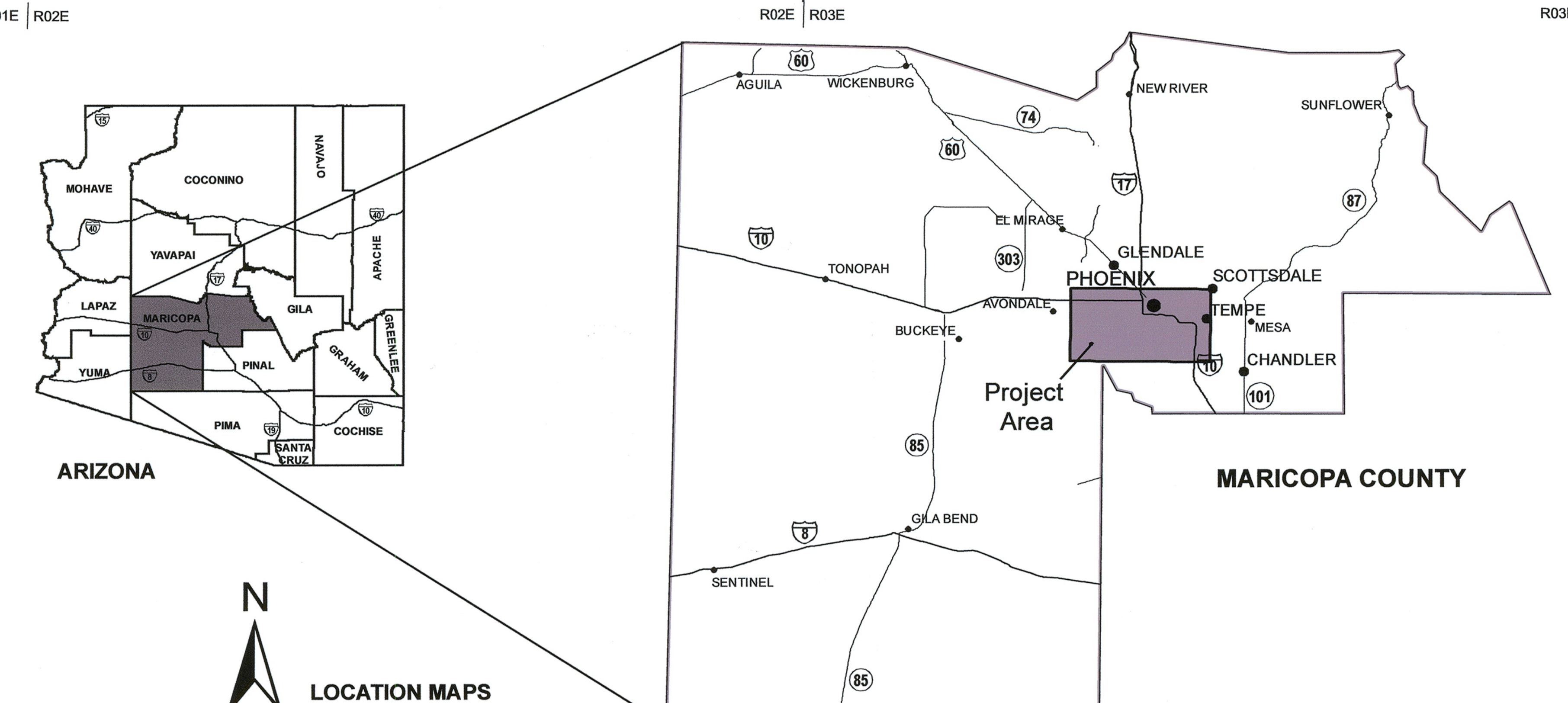
NOTES

ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. ELEVATION CONVERSION FACTOR: NAVD88 ELEV. = NGVD29 ELEV. + 2.1 FT.

N

2 1 0 2 Miles

SCALE: 1" = 1 MILE



LOCATION MAPS
NOT TO SCALE

STATEMENT OF STRUCTURAL SURVEY

I, JOHN R. STOCK, AN ARIZONA REGISTERED LAND SURVEYOR, CERTIFY THAT THE FIELD SURVEYS, DOCUMENTED HEREIN, ALONG WITH ALL FIELD AND OFFICE PROCESS PROCEDURES USED DURING THE COURSE OF THIS SURVEY, WERE PERFORMED UNDER MY DIRECT SUPERVISION, AND THESE SURVEYS ARE RETRACEABLE AND REPEATABLE. FURTHER I CERTIFY THAT THE SURVEY REPORT WAS PREPARED UNDER MY DIRECT SUPERVISION AND THAT THE COORDINATE VALUES AND THEIR ACCURACIES, AS SHOWN IN THE REPORT, ARE CORRECT.

JOHN R. STOCK
AZ RLS #25087

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
25087
JOHN R. STOCK
ARIZONA U.S.A.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

LOWER SALT RIVER
FLOODPLAIN DELINEATION STUDY:
FROM 91ST AVENUE TO UPSTREAM OF
THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

COVER SHEET

MATCH LINE SHEET 2

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATES JANUARY 23, 2014 AND APRIL 1, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station (Feet)
Floodplain Water Surface Elevation
Floodway Water Surface Elevation
100-year Discharge

1000
FP = 2222.3
FW = 2222.3
3333cfs

0+00
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID 5

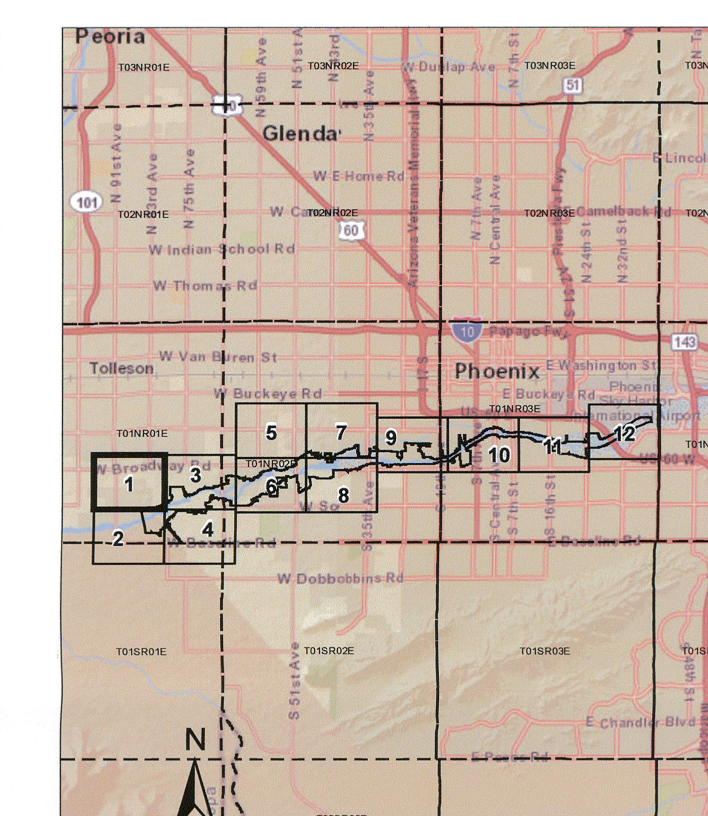
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV2309	986.78	VERTICAL CONTROL DISK SET IN LARGE STRUCTURE WITH DEEP FOUNDATIONS
NGS DV0457	982.81	REFERENCE MARK DISK SET IN TOP OF CONCRETE MONUMENT

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.
2) AREA LOCATED IN TOWNSHIP 1N, RANGE 1E, SECTIONS 21-23, 26-28, AND 33-35.
3) CROSS SECTIONS 202.82-203.08 ARE IN RIVER MILES.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

**LOWER SALT RIVER
FLOODPLAIN DELINEATION STUDY:
FROM 91ST AVENUE TO UPSTREAM OF
THE I-10 BRIDGE**

F.C.D. CONTRACT NUMBER 2013C013

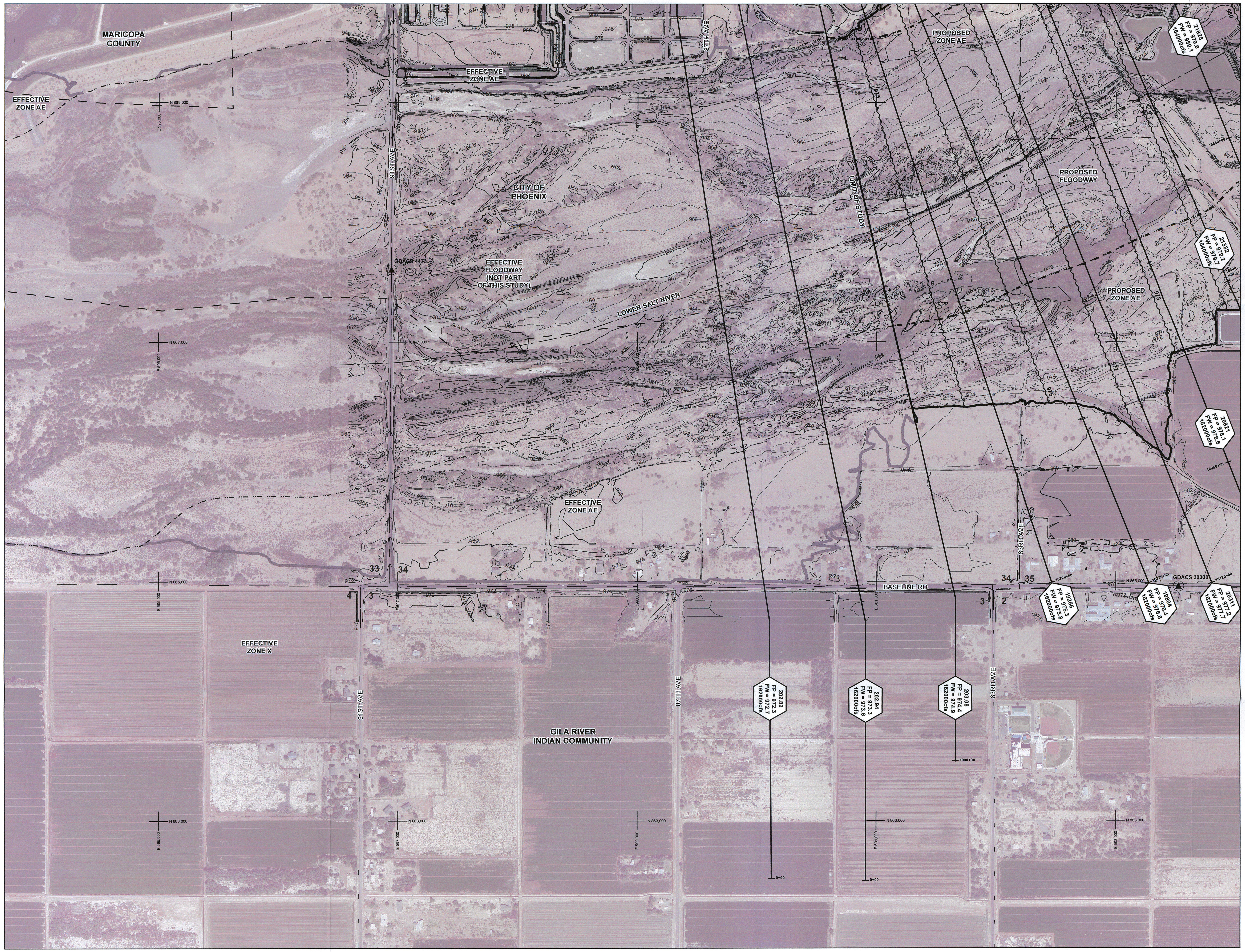
Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 1 OF 12

MATCH LINE SHEET 1



MATCH LINE SHEET 4

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station (Feet) — 1000
Floodplain Water Surface Elevation — FP = 2222.3
Floodway Water Surface Elevation — FW = 2222.3
100-year Discharge — 3333cfs
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID — 5

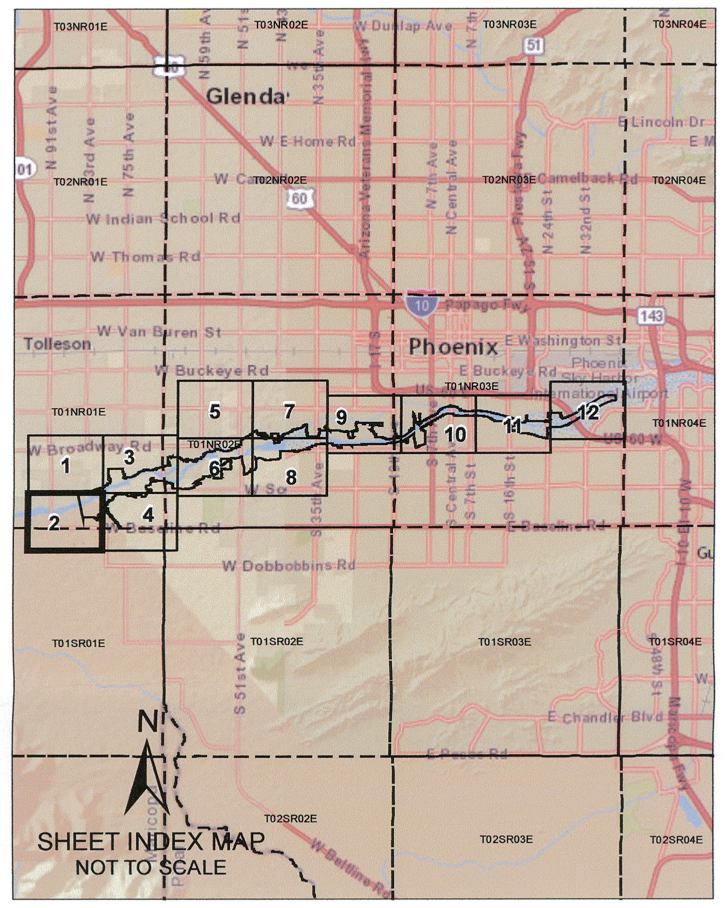
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
GDACS 4473	959.018	SET 3" MCHD BC FL STAMPED "T1NR1E 1/4 S33 S34 2004 37174"
GDACS 30300	982.871	MBCS

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.
2) AREA LOCATED IN TOWNSHIP 1N, RANGE 1E, SECTIONS 33-35, AND TOWNSHIP 1S, RANGE 1E, SECTIONS 2-4.
3) CROSS SECTIONS 202.82-203.08 ARE IN RIVER MILES.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

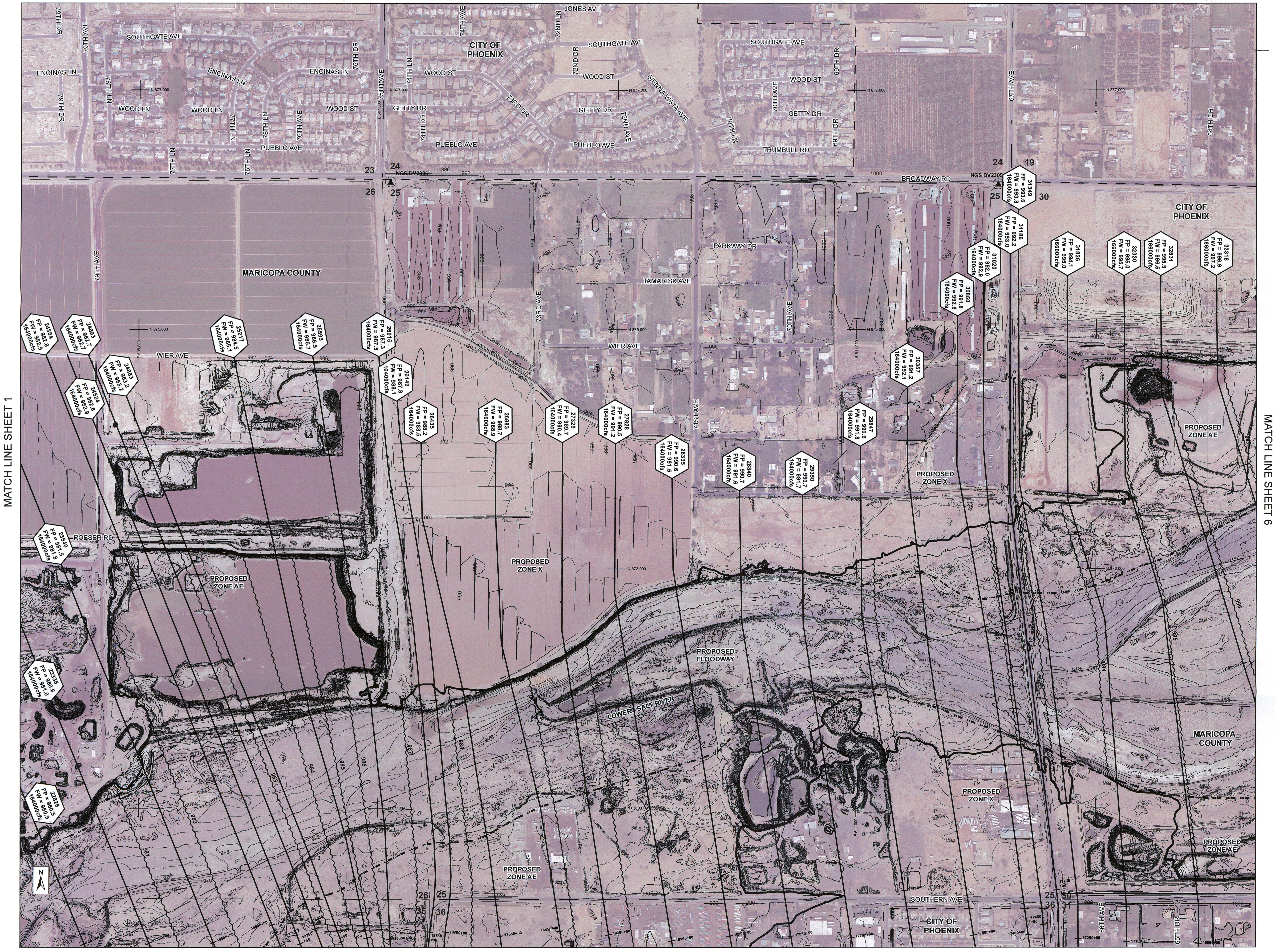
F.C.D. CONTRACT NUMBER 2013C013

41980 BRIAN THOMAS WAHLIN
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 2 OF 12



AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATES JANUARY 23, 2014 AND APRIL 1, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES — Revised / Effective

ZONE A BOUNDARIES — Revised / Effective

FLOODWAY BOUNDARIES — Revised / Effective

ZONE D BOUNDARIES — Effective

BASE FLOOD ELEVATION

HYDRAULIC BASELINE

Cross Section River Station (Feet)
Floodplain Water Surface Elevation
Floodway Water Surface Elevation
100-year Discharge

1000
FP = 2222.3
FW = 2222.3
3333cfs

0+00
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID 5

ELEVATION REFERENCE MARKS

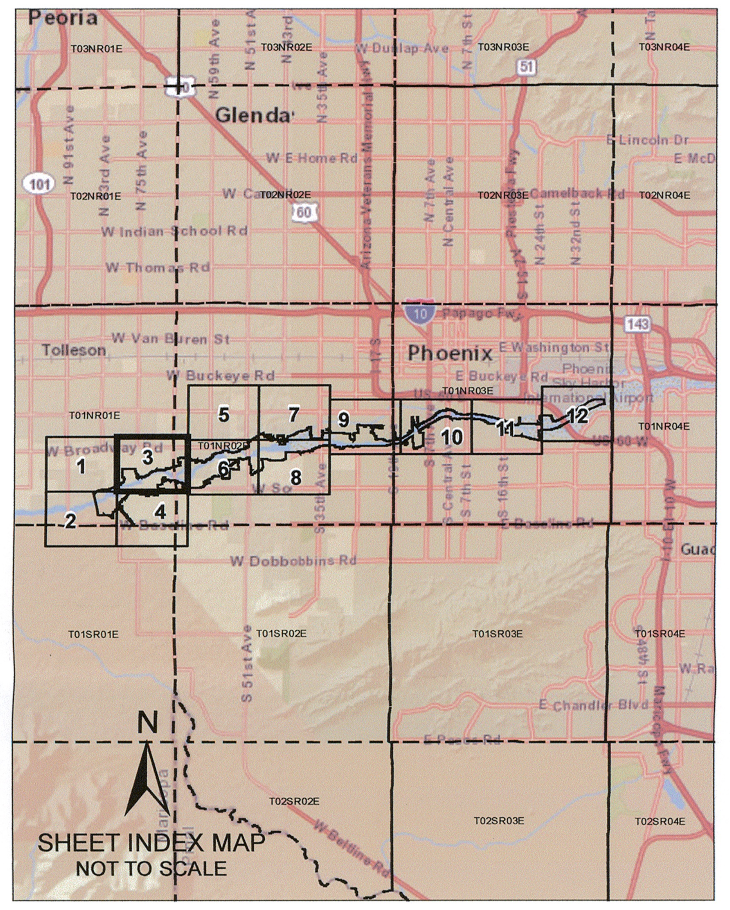
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV2306	998.98	VERTICAL CONTROL DISK SET IN LARGE STRUCTURE WITH DEEP FOUNDATIONS
NGS DV2305	1008.06	VERTICAL CONTROL DISK SET IN LARGE STRUCTURE WITH DEEP FOUNDATIONS

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 1E, SECTIONS 23-26 AND 35-36, AND TOWNSHIP 1N RANGE 2E, SECTIONS 19 AND 30-31.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

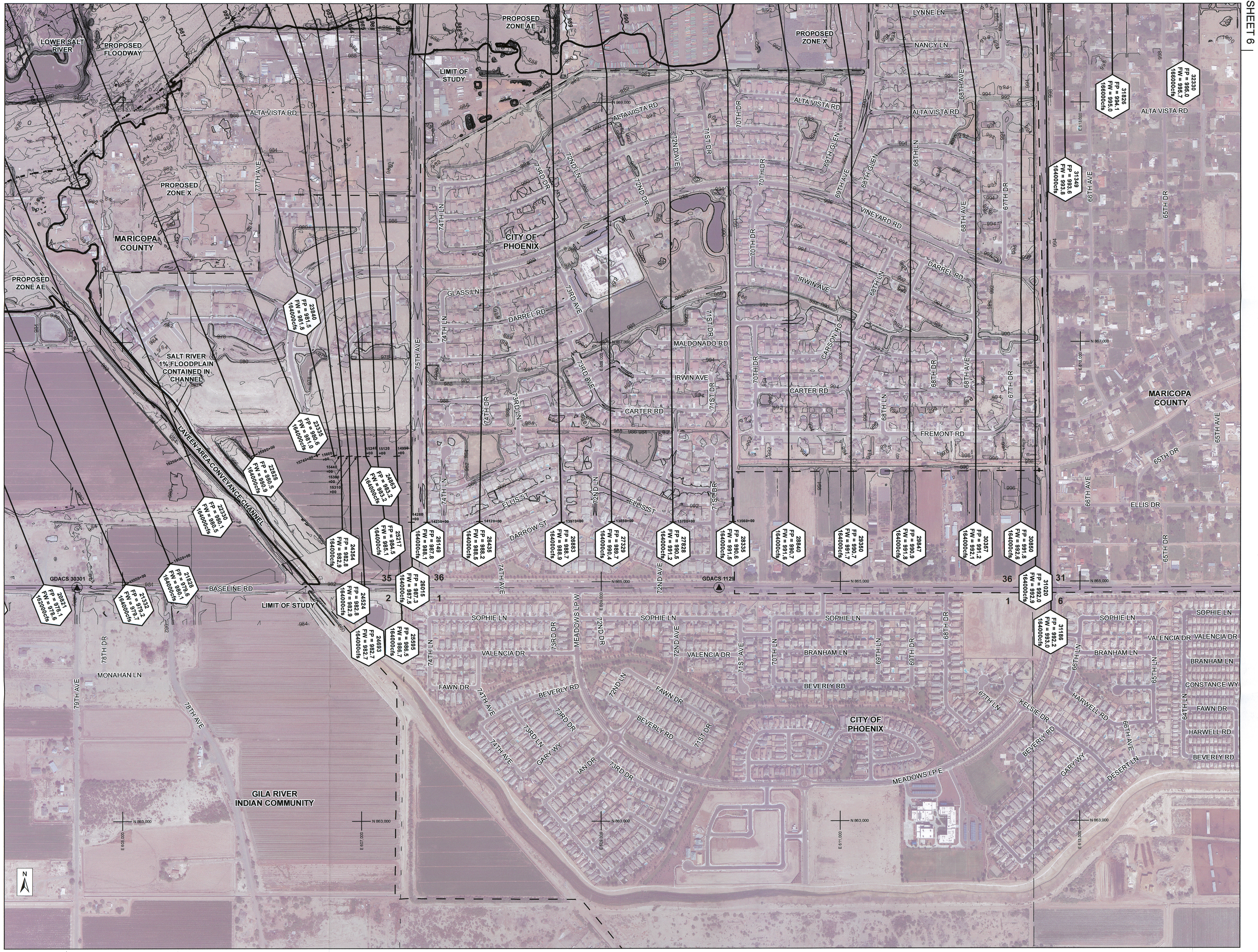
Registered Professional Engineer (Civil)
CERTIFICATE NO. 41980
BRIAN THOMAS WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 3 OF 12

MATCH LINE SHEET 3



MATCH LINE SHEET 2

MATCH LINE SHEET 6

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES	Revised / Effective	ZONE A BOUNDARIES	Revised / Effective
FLOODWAY BOUNDARIES	Revised / Effective	ZONE D BOUNDARIES	Effective
BASE FLOOD ELEVATION		HYDRAULIC BASELINE	

Cross Section River Station (Feet)
Floodplain Water Surface Elevation
Floodway Water Surface Elevation
100-year Discharge

1000
FP = 2222.3
FW = 2222.3
3333cfs

0+00
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID 5

ELEVATION REFERENCE MARKS

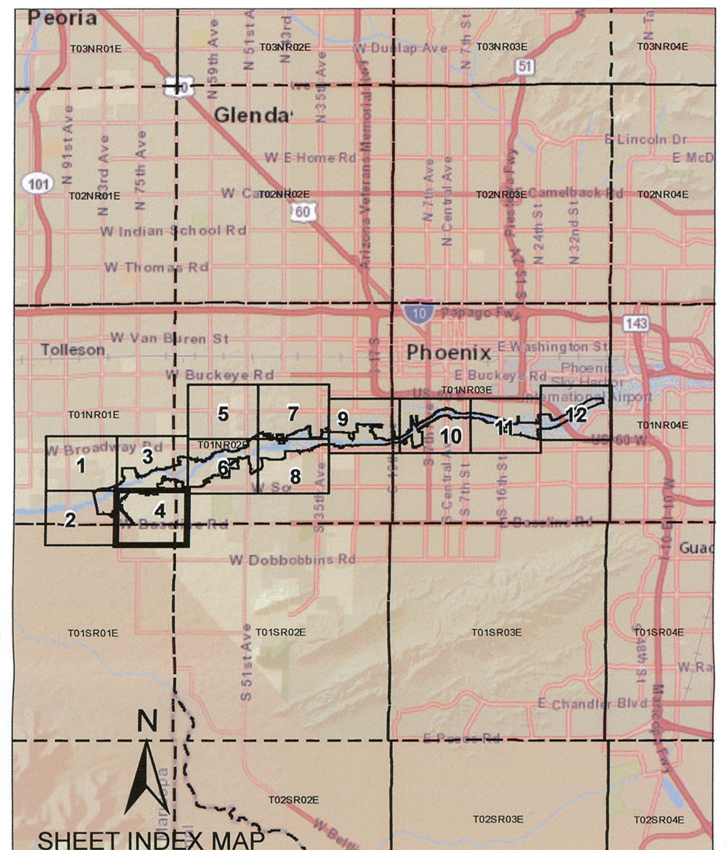
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
GDACS 30301	984.075	MBCS
GDACS 1129	992.129	FD 2 3/4" MCDOT BC IN HH 0.6 DN STAMPED "T1N R1E 6"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 1E, SECTIONS 35-36, TOWNSHIP 1S RANGE 1E, SECTIONS 1-2, TOWNSHIP 1N, RANGE 2E, SECTION 31, AND TOWNSHIP 1S, RANGE 2E, SECTION 6.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

Registered Professional Engineer (Civil)
CERTIFICATE NO. 41980
BRIAN THOMAS WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 4 OF 12

MATCH LINE SHEET 6

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATES JANUARY 23, 2014 AND APRIL 1, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

LEGEND

ZONE AE BOUNDARIES	Revised / Effective	ZONE A BOUNDARIES	Revised / Effective
FLOODWAY BOUNDARIES	Revised / Effective	ZONE D BOUNDARIES	Effective
BASE FLOOD ELEVATION		HYDRAULIC BASELINE	

Cross Section River Station (Feet)
Floodplain Water Surface Elevation
Floodway Water Surface Elevation
100-year Discharge

1000
FP = 2222.3
FW = 2222.3
3333cfs

Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID 5

ELEVATION REFERENCE MARKS

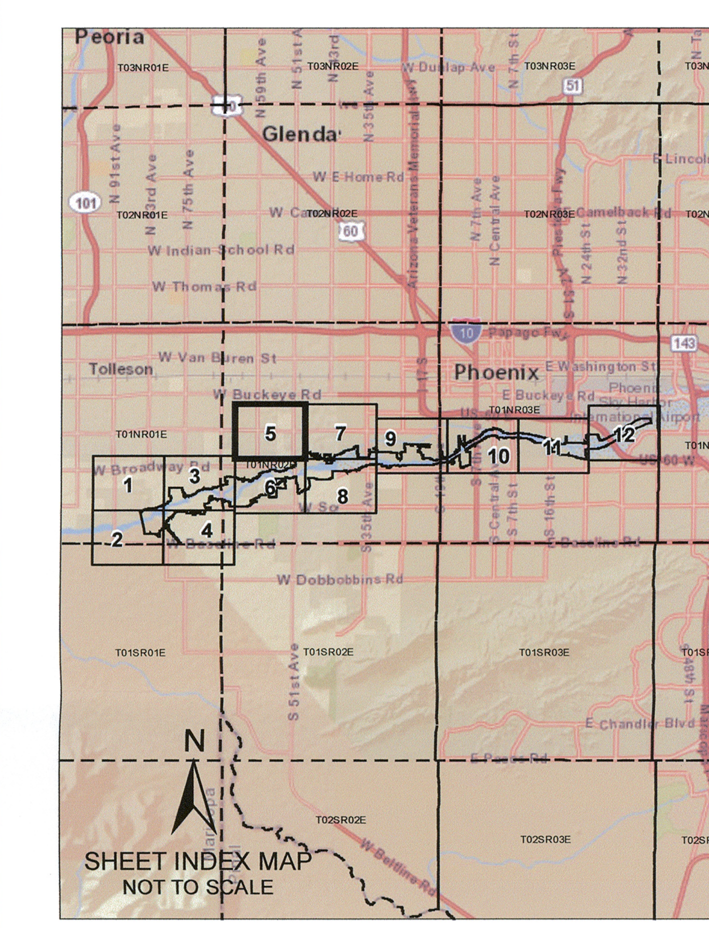
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
GDACS 11837	1026.748	FD 4" MC ENG DEPT BC IN HH 0.5' DN NO STAMPING
GDACS 11864	1018.815	FD 3" AZ HWY DPT BC IN HH 0.8' DN STAMPED "STA 36+83.149 ELEV 1017.14"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 2E, SECTIONS 16-21.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

41980
BRIAN THOMAS WAHLIN
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

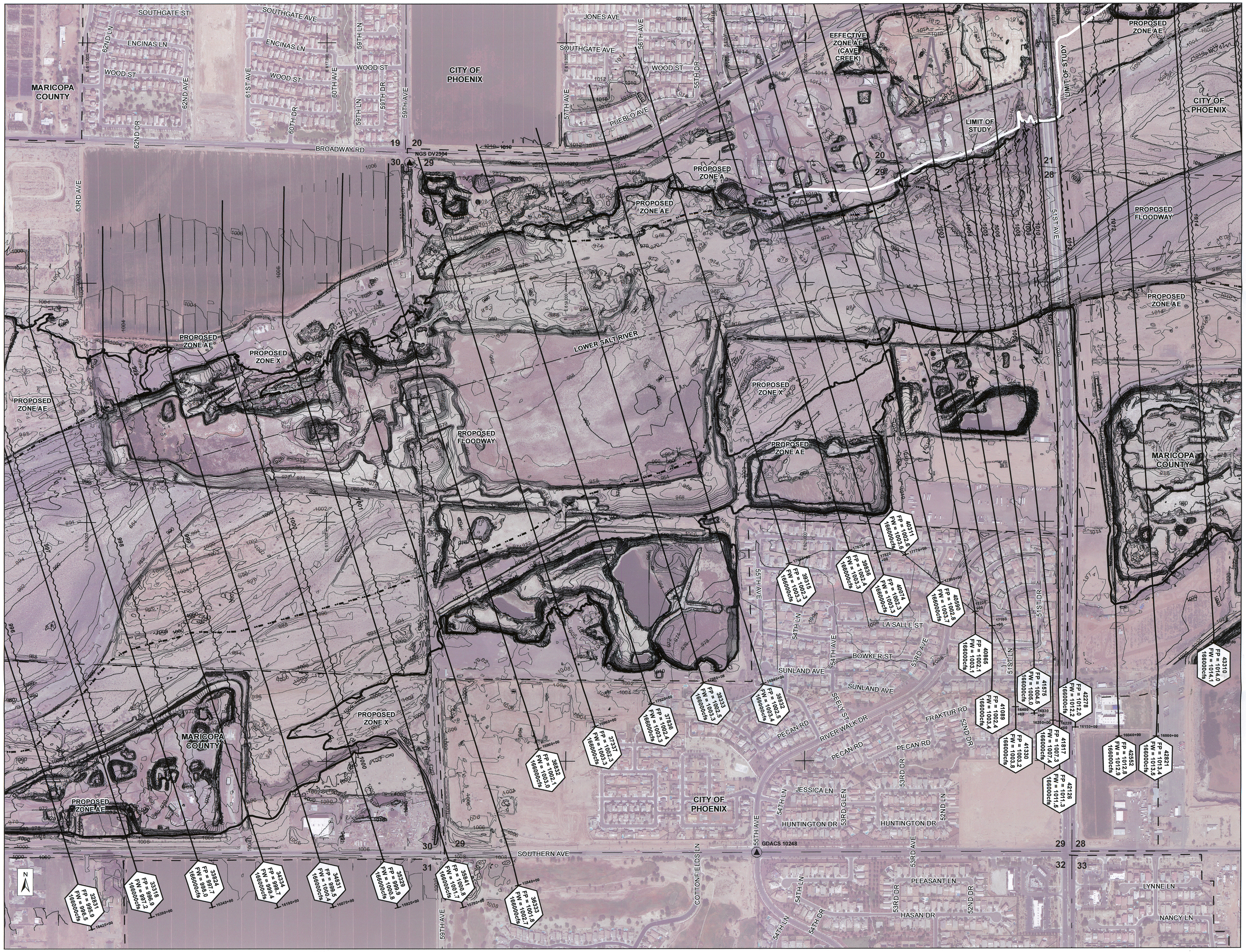
	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 5 OF 12

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MATCH LINE SHEET 5



AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station (Feet) — 1000
Floodplain Water Surface Elevation — FP = 2222.3
Floodway Water Surface Elevation — FW = 2222.3
100-year Discharge — 3333cfs
Cross Section Stationing Tick

ELEV. REFERENCE MARK
SECTION LINE AND ID — 5

ELEVATION REFERENCE MARKS

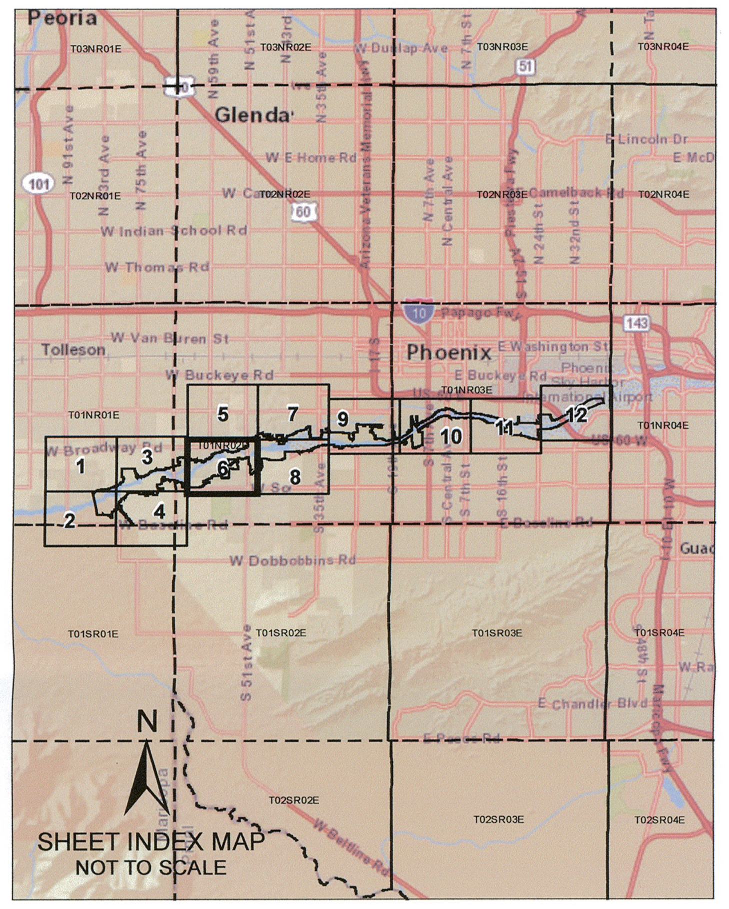
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV2304	1011.84	VERTICAL CONTROL DISK SET IN LARGE STRUCTURE WITH DEEP FOUNDATIONS
GDACS 10248	1012.526	SET 3" MARICOPA CO BC FL STAMPED "T1NR2E 1/4 S29 S32 2006 RLS31610"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 2E, SECTIONS 19-21 AND 28-33.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

BRIAN THOMAS WAHLIN
41980
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 6 OF 12

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MATCH LINE SHEET 5

MATCH LINE SHEET 9

MATCH LINE SHEET 8

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station (Feet)
Floodplain Water Surface Elevation
Floodway Water Surface Elevation
100-year Discharge

1000
FP = 2222.3
FW = 2222.3
3333cfs

0+00
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID 5

ELEVATION REFERENCE MARKS

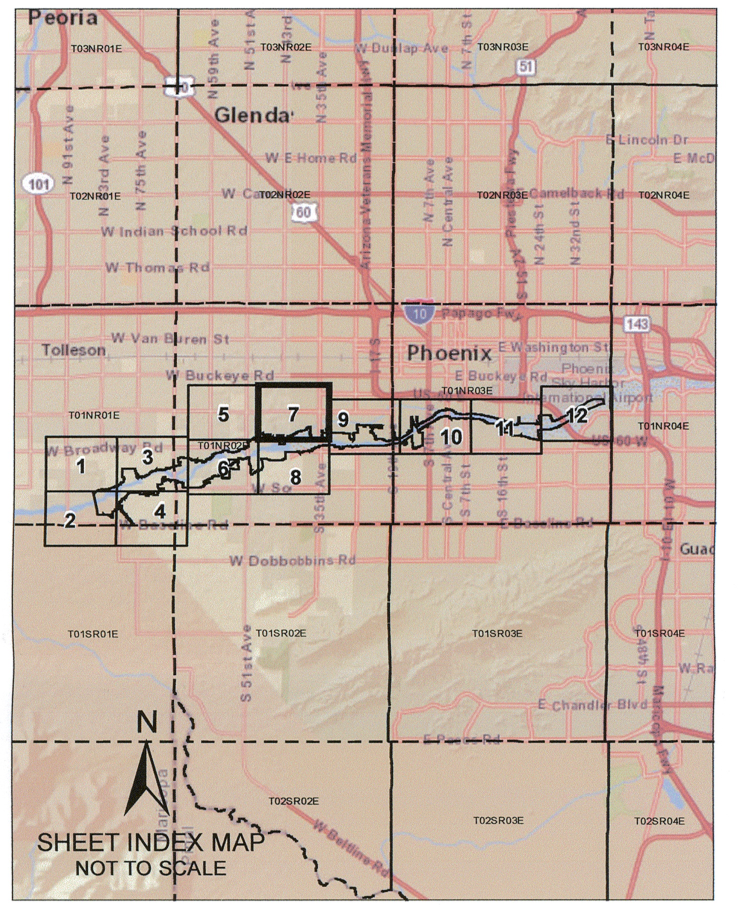
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV2300	1040.056	STAINLESS STEEL ROD W/O SLEEVE (10 FT+)
GDACS 11431	1040.124	SET 3" MARICOPA CO BC IN HAND HOLE 0.3' DOWN STAMPED "T1NR2E 1/4 S16 S15 2005 RLS 31610"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 2E, SECTIONS 14-16 AND 21-23.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

LOWER SALT RIVER
FLOODPLAIN DELINEATION STUDY:
FROM 91ST AVENUE TO UPSTREAM OF
THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

Registered Professional Engineer (Civil)
CERTIFICATE NO. 41980
BRIAN THOMAS WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 7 OF 12

MATCH LINE SHEET 7

MATCH LINE SHEET 6

MATCH LINE SHEET 9

LEGEND

ZONE AE BOUNDARIES	Revised / Effective	ZONE A BOUNDARIES	Revised / Effective
FLOODWAY BOUNDARIES	Revised / Effective	ZONE D BOUNDARIES	Effective
BASE FLOOD ELEVATION		HYDRAULIC BASELINE	

Cross Section River Station (Feet)
Floodplain Water Surface Elevation
Floodway Water Surface Elevation
100-year Discharge

1000
FP = 2222.3
FW = 2222.3
3333cfs

0+00

Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID 5

ELEVATION REFERENCE MARKS

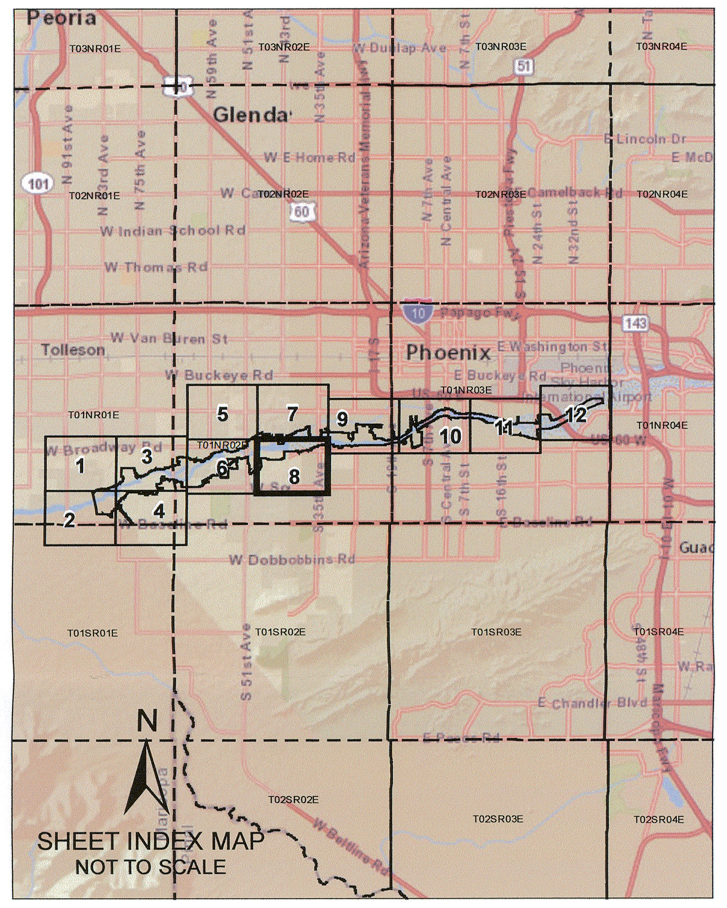
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
GDACS 11853	1036.352	FD 3" PHOENIX BC IN HH 0.5' DN STAMPED "T1N R2E S22 S23 S27 S26 1995 103459"
GDACS 13092	1035.042	SET 3" MARICOPA CO BC FL STAMPED "T1NR2E 1/4 S27 S26 2005 RLS 31610"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 2E, SECTIONS 21-23, 26-28, AND 33-35.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

LOWER SALT RIVER
FLOODPLAIN DELINEATION STUDY:
FROM 91ST AVENUE TO UPSTREAM OF
THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 8 OF 12

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

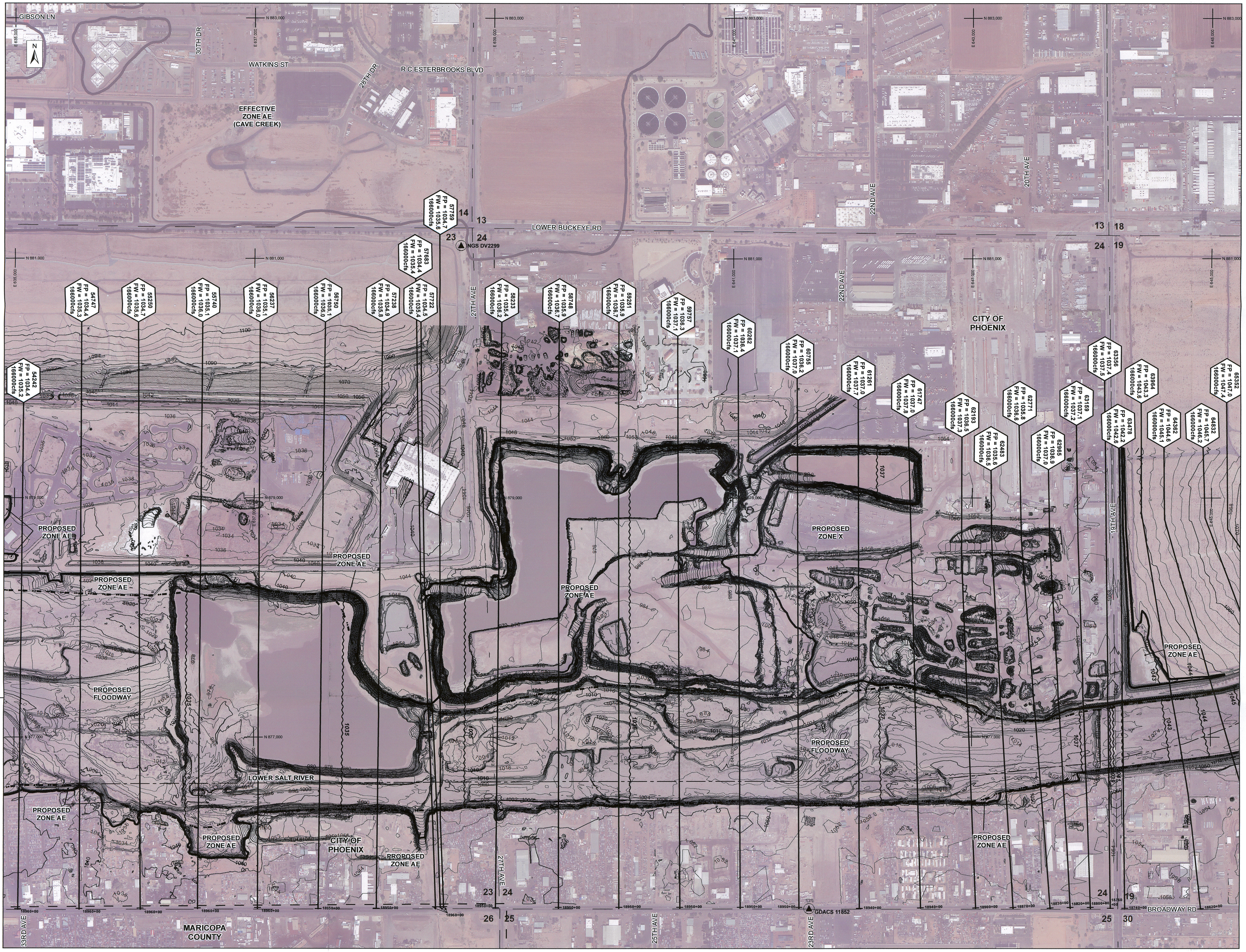
TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station (Feet) — 1000
Floodplain Water Surface Elevation — FP = 2222.3
Floodway Water Surface Elevation — FW = 2222.3
100-year Discharge — 3333cfs
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID — 5

ELEVATION REFERENCE MARKS

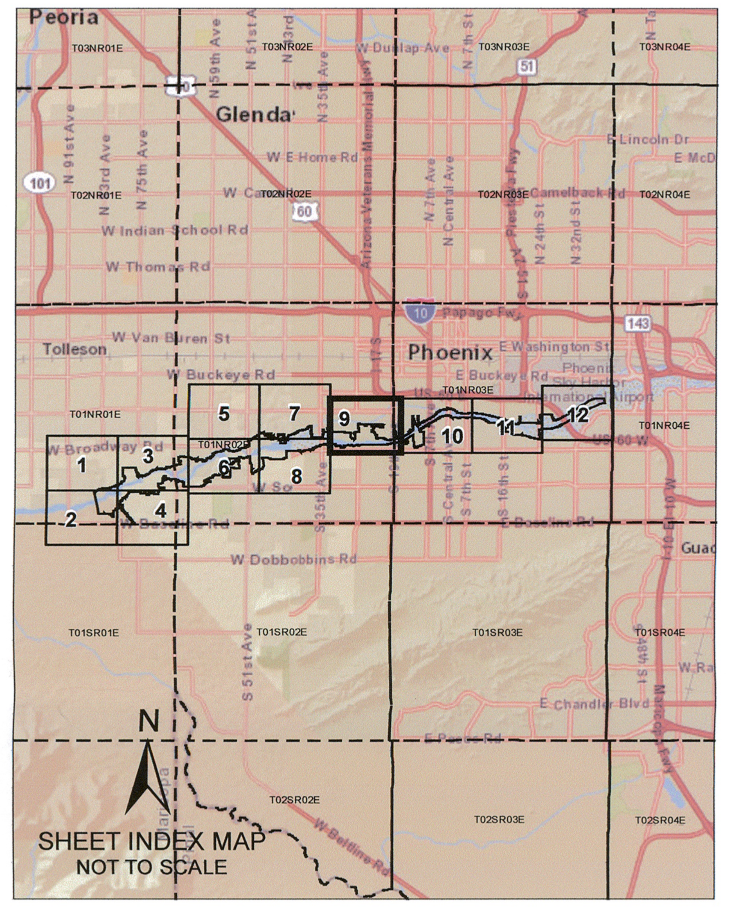
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV2299	1050.1	STAINLESS STEEL ROD W/O SLEEVE (10 FT+)
GDACS 11852	1052.927	SET 3" MARICOPA CO BC FL STAMPED "T1NR2E 1/4 S24 S25 2005 RLS 31610"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 2E, SECTIONS 13-14 AND 23-26, AND TOWNSHIP 1N, RANGE 3E, SECTIONS 18-19 AND 30.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

WEST Consultants, Inc.

41980 BRIAN THOMAS WAHLIN ARIZONA, U.S.A.
Expires 3/31/2017

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 9 OF 12

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station (Feet) — 1000
Floodplain Water Surface Elevation — FP = 2222.3
Floodway Water Surface Elevation — FW = 2222.3
100-year Discharge — 3333cfs
0+00 Cross Section Stationing Tick

ELEV. REFERENCE MARK
SECTION LINE AND ID — 5

ELEVATION REFERENCE MARKS

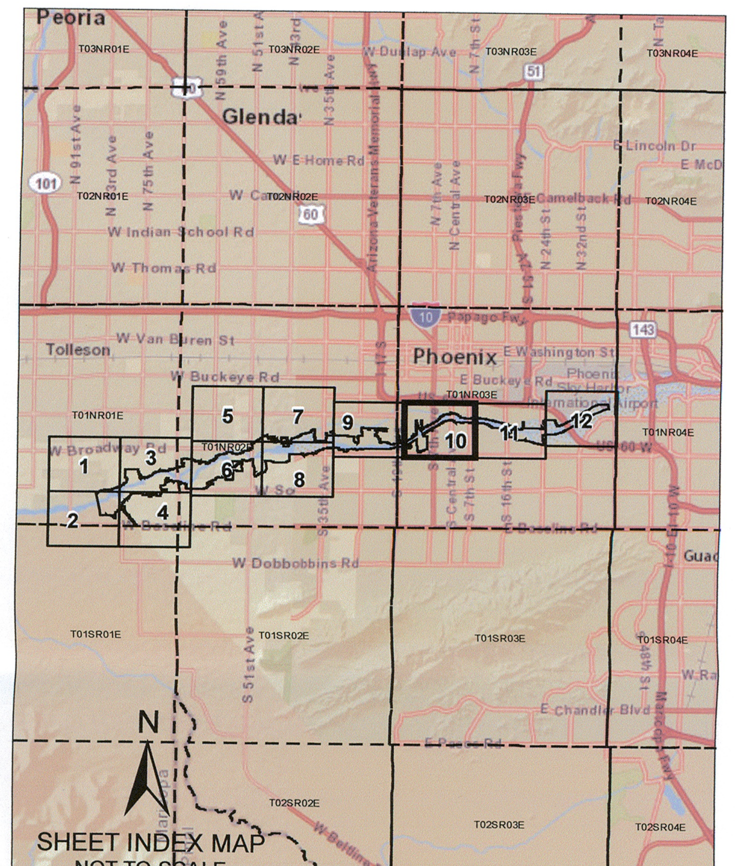
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV0474	1070.5	RM DISK SET IN TOP OF CONCRETE MONUMENT
GDACS 11819	1062.407	FD 3" PHOENIX BC IN HH 0.6' DN NO STAMPING

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 3E, SECTIONS 16-21 AND 28-30.



SHEET INDEX MAP
NOT TO SCALE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

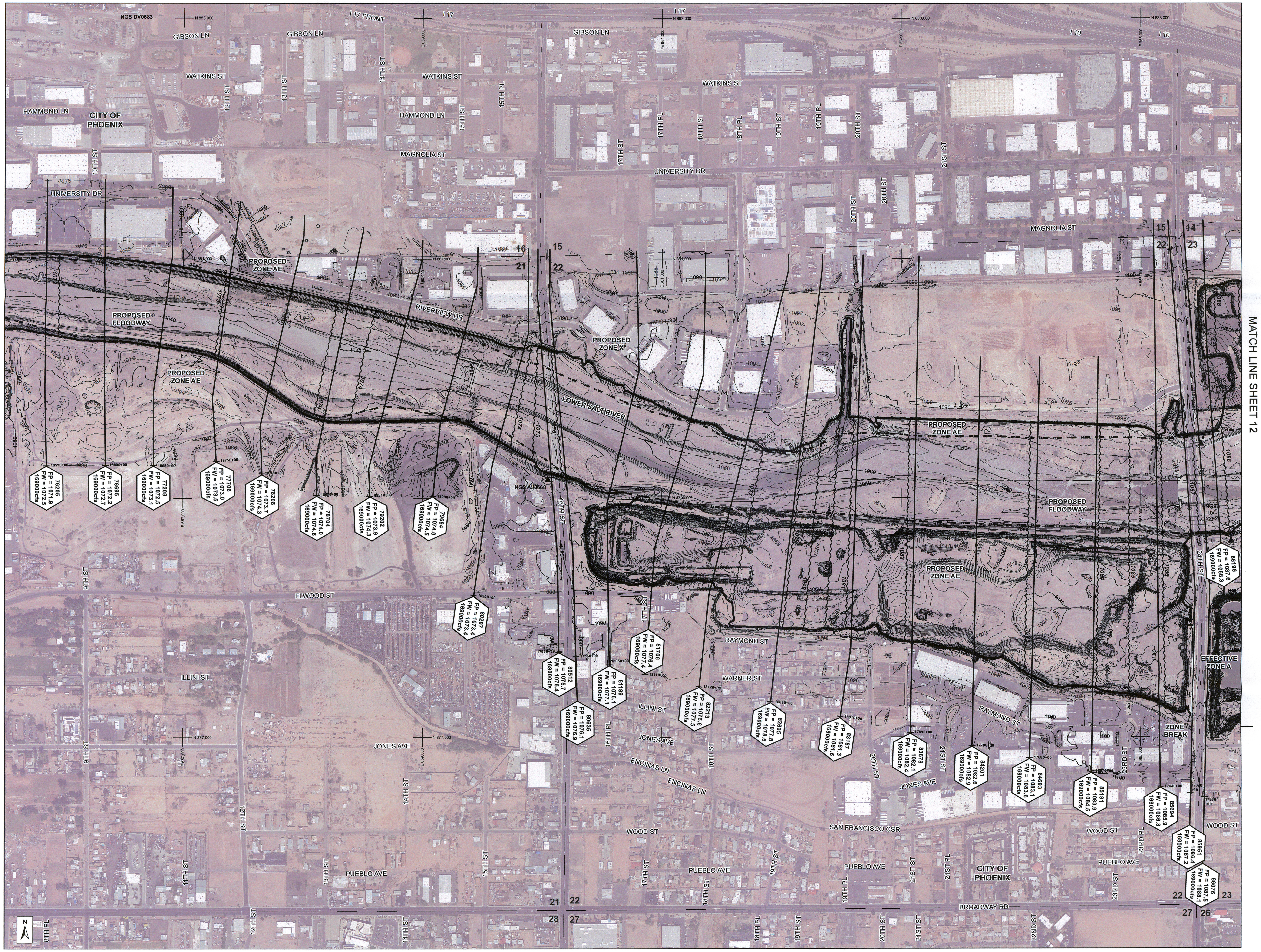
F.C.D. CONTRACT NUMBER 2013C013

Registered Professional Engineer (Civil)
CERTIFICATE NO. 41980
BRIAN THOMAS WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 10 OF 12



LEGEND

ZONE AE BOUNDARIES	Revised / Effective	ZONE A BOUNDARIES	Revised / Effective
FLOODWAY BOUNDARIES	Revised / Effective	ZONE D BOUNDARIES	Effective
BASE FLOOD ELEVATION		HYDRAULIC BASELINE	

Cross Section River Station (Feet): 1000
Floodplain Water Surface Elevation: FP = 2222.3
Floodway Water Surface Elevation: FW = 2222.3
100-year Discharge: 3333cfs
Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID: 5

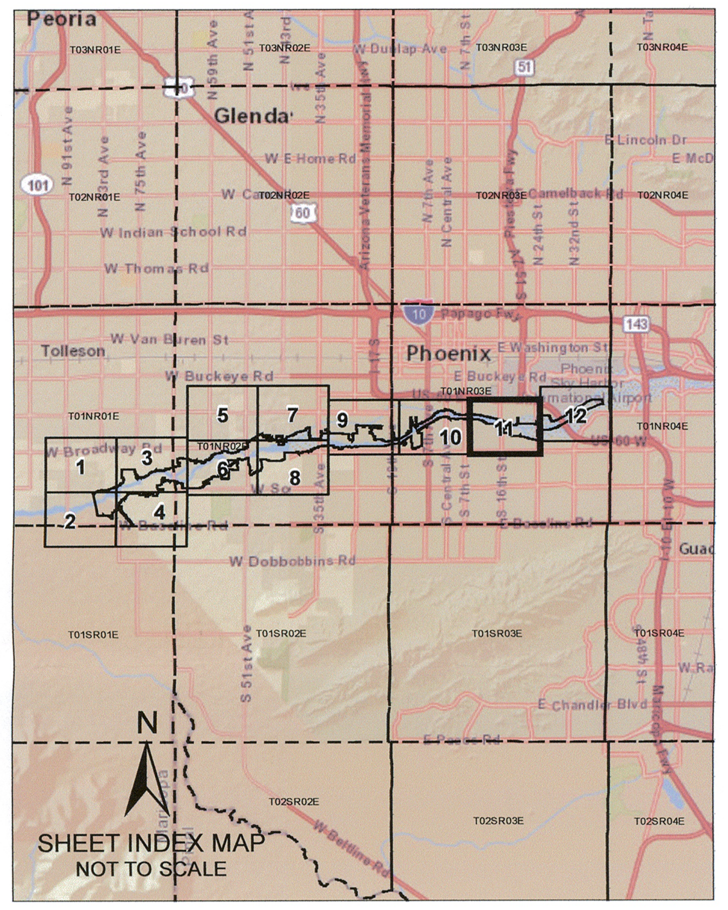
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV2292	1099.69	VERTICAL CONTROL DISK SET IN ABUTMENT OF S 24TH ST BRIDGE
NGS DV2293	1099.89	VERTICAL CONTROL DISK SET IN ABUTMENT OF S 24TH ST BRIDGE
NGS AJ3668	1092.4	BAR MAGNET IMBEDDED IN MONUMENT, METAL ROD DRIVEN INTO GROUND

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.
2) AREA LOCATED IN TOWNSHIP 1N, RANGE 3E, SECTIONS 14-16, 21-23, AND 26-28.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LOWER SALT RIVER FLOODPLAIN DELINEATION STUDY: FROM 91ST AVENUE TO UPSTREAM OF THE I-10 BRIDGE

F.C.D. CONTRACT NUMBER 2013C013

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

41980 BRIAN THOMAS WAHLIN
Expires 3/31/2017

SHEET 11 OF 12

AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE JANUARY 23, 2014.

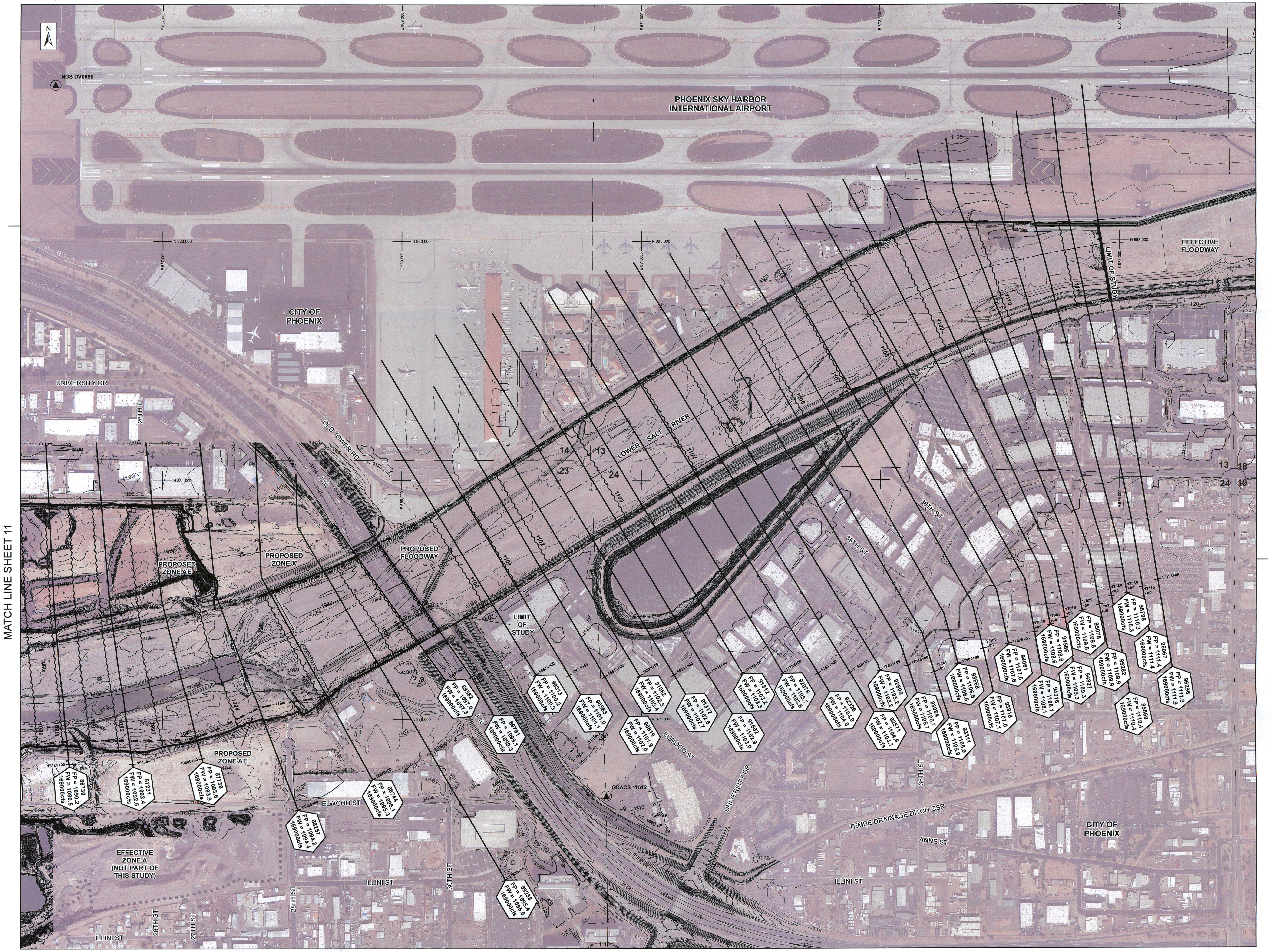
TOPOGRAPHY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



AERIAL IMAGERY PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATES OCTOBER 6, 2013, OCTOBER 8, 2013, AND JANUARY 23, 2014.

TOPOGRAPHY DOWNSTREAM OF THE I-10 BRIDGE PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.
FLIGHT DATE APRIL 13, 2013.

TOPOGRAPHY UPSTREAM OF THE I-10 BRIDGE PROVIDED BY THE CITY OF PHOENIX.
FLIGHT DATES JUNE 12, 2006, AND APRIL 28, 2007.

400 200 0 400 800

SCALE: 1" = 400 FEET
CONTOUR INTERVAL = 2 FEET

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

GROUND CONTROL SURVEY DATA & AERIAL MAPPING DOWNSTREAM OF THE I-10 BRIDGE PROVIDED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

ZONE AE BOUNDARIES — Revised / Effective
ZONE A BOUNDARIES — Revised / Effective
FLOODWAY BOUNDARIES — Revised / Effective
ZONE D BOUNDARIES — Effective
BASE FLOOD ELEVATION
HYDRAULIC BASELINE

Cross Section River Station Designation — 1000
Floodplain Water Surface Elevation — FP = 2222.3
Floodway Water Surface Elevation — FW = 2222.3
100-year Discharge — 3333cfs
0+00 — Cross Section Stationing Tick

ELEV. REFERENCE MARK

SECTION LINE AND ID — 5

ELEVATION REFERENCE MARKS

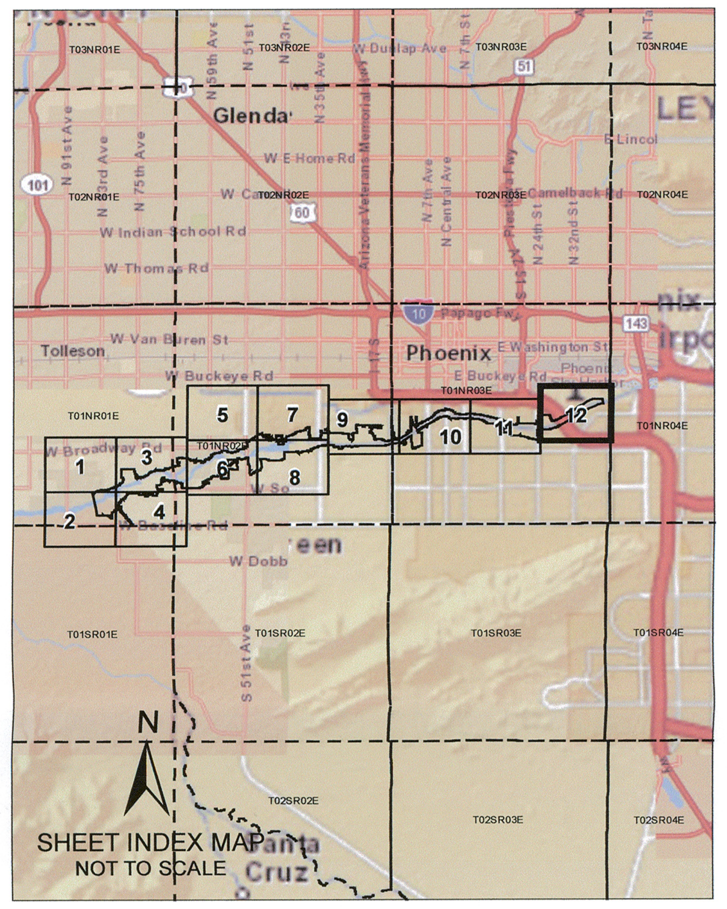
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. SEE MCDOT & NGS ONLINE RESOURCES FOR MORE INFORMATION.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
NGS DV0690	1106.89	TOPOGRAPHIC STATION DISK SET IN TOP OF CONCRETE MONUMENT
GDACS 11612	1106.811	SET 3" MARICOPA CO BC FL STAMPED "T1NR3E 1/4 S23 S24 2005 RLS 31610"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE SHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 3E, SECTIONS 13-14 AND 23-24, AND TOWNSHIP 1N, RANGE 4E, SECTIONS 18-19.



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

**LOWER SALT RIVER
FLOODPLAIN DELINEATION STUDY:
FROM 91ST AVENUE TO UPSTREAM OF
THE I-10 BRIDGE**

F.C.D. CONTRACT NUMBER 2013C013

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 05-04-2015
ARIZONA, U.S.A.
Expires 3/31/2017

WEST Consultants, Inc.

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJB	4/15
PLANS CHECK	BTW	4/15

SHEET 12 OF 12