

SPECIFICATIONS 3D-C7471

SALT-GILA AQUEDUCT

**REACH 1A
CENTRAL ARIZONA PROJECT,
ARIZONA**



**UNITED STATES DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE**

2P-S-14

These specifications distributed by
Water and Power Resources Service
Lower Colorado Region
P O Box 427
Nevada Highway and Park Street
Boulder City, Nevada

PHONE INQUIRIES
regarding these specifications should
be made to:

**Contracting Officer,
Boulder City, Nevada**

702-293-8459

1980

SALT-GILA AQUEDUCT-REACH 1A
SALT-GILA DIVISION, ARIZONA
CENTRAL ARIZONA PROJECT

FOREWORD

Reach 1A of the Salt-Gila Aqueduct is located approximately 25 miles east of Phoenix, Arizona, in Maricopa County. The Salt-Gila Aqueduct is a feature of the Central Arizona Project which will convey Colorado River water to the Central Arizona service area in the Gila River Basin which encompasses large agricultural areas as well as the metropolitan areas of Phoenix and Tucson.

The principal features of the work include earthwork for and construction of approximately 5.61 miles of unreinforced concrete-lined aqueduct and approximately 0.37 mile of reinforced concrete-lined aqueduct for Reach 1A of the Salt-Gila Aqueduct, and approximately 0.67 mile of reinforced concrete-lined aqueduct for reach 12 completion of Granite Reef Aqueduct. Structures include bridges, overchute pier, floatwells, and fencing.

Note: Wherever the word "canal" appears hereinafter in these specifications, it means the same as the word "aqueduct."

BIDS UNDER THESE SPECIFICATIONS ARE SUBJECT TO THE AFFIRMATIVE ACTION REQUIREMENTS OF THE SPECIFICATIONS FOR EQUAL EMPLOYMENT OPPORTUNITY.

(Price \$20.00)

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**BID FORM
(Construction Contract)**

REFERENCE

SPECIFICATIONS 3D-C7471

*Read the instructions to Bidders (Standard Form 22).
This form is to be submitted in* **SINGLE**

DATE OF INVITATION
**

NAME AND LOCATION OF PROJECT

Salt-Gila Aqueduct—Reach 1A
Salt-Gila Division, Arizona
Central Arizona Project

BIDDER'S NAME AND ADDRESS (Include ZIP Code) (Type or print)

*

TELEPHONE NUMBER (Include Area Code)

*

DATE

*

TO: U.S. DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE

In compliance with the above-dated invitation for bids, the undersigned hereby proposes to perform all work for

SPECIFICATIONS 3D-C7471

in strict accordance with the General Provisions (Standard Form 23-A), Labor Standards Provisions Applicable to Contracts in Excess of \$2,000 (Standard Form 19-A), specifications, schedules, drawings, and conditions, for the following amount(s) stated in the accompanying Bidding Schedule(s),

* To be filled in by bidder
** Not necessary for bidder to fill in

and agrees that, upon written notice that a preliminary examination of the bids indicates that he will be the successful bidder, he will within 10 calendar days (unless a longer period is allowed) after receipt of the prescribed forms, execute Standard Form 23, Construction Contract, and give performance and payment bonds on Government standard forms, if these forms are required, with good and sufficient sureties: Provided, That contract and bond forms executed by the bidder prior to award of the contract will become effective only if his bid actually is accepted within the time established herein. The undersigned further agrees that, when reinsurance agreements are contemplated, all necessary reinsurance agreements will be on Government forms and will be executed and submitted with the bonds. However, when an additional period of 15 days (not to exceed 45 calendar days) is authorized by the procuring activity, reinsurance agreements may be submitted within such period after the execution of the bond.

The undersigned agrees, if awarded the contract, to commence the work within the specified number of calendar days after the date of receipt of notice to proceed, and to complete the work within the number of calendar days after the date of receipt of notice to proceed as stated in the specifications.

Performance and payment bonds shall be furnished when (1) the contract award resulting from this bid exceeds \$25,000, or (2) bonds are specifically required by the INVITATION FOR BIDS (Standard Form 20).

Each contractor receiving an award over \$10,000 shall identify its principal place of performance and furnish its DUNS number if one has been assigned.

*Bids acceptance period. Bids offering less than 60 days for acceptance by the Government for the date set for opening will be considered nonresponsive and will be rejected. Bid acceptance period is * ___ days (60 days unless indicated otherwise).

RECEIPT OF AMENDMENTS: *The undersigned acknowledges receipt of the following amendments of the invitation for bids, drawings, and/or specifications, etc. (Give number and date of each):*

* AMENDMENT NO.					
* DATE					
* AMENDMENT NO.					
* DATE					

The representations and certifications on the accompanying STANDARD FORM 19-B are made a part of this bid.

ENCLOSED IS BID GUARANTEE, CONSISTING OF		IN THE AMOUNT OF
* NAME OF BIDDER (Type or print)		* _____
* BUSINESS ADDRESS (Type or print) (Include "ZIP Code")		
* BY (Signature in ink. Type or print name under signature)		
* TITLE (Type or print)		
* FULL NAME OF ALL PARTNERS (Type or print)		

DIRECTIONS FOR SUBMITTING BIDS: *Envelopes containing bids, guarantee, etc., must be sealed, marked, and addressed as follows:*

Address to the WATER AND POWER RESOURCES SERVICE indicated in the specifications as the office for receiving bids. The following properly filled out bid identification must be placed on the left side of the envelope containing the bid:

BID for (SPECIFICATIONS 3D-C7471)
 To be opened (Time and date of opening)
 BID of (Name of bidder)

CAUTION—Bids should not be qualified by exceptions to the bidding conditions. **STANDARD FORM 21 Back (Rev. 2-79)**

REPRESENTATIONS AND CERTIFICATIONS**(Construction and Architect-Engineer Contract)****(For use with Standard Forms 19, 21 and 252)**

REFERENCE (Enter same No.(s) as on SF 19, 21 and 252)

NAME AND ADDRESS OF BIDDER (No., Street, City, State, and ZIP Code)

DATE OF BID

In negotiated procurements, "bid" and "bidder" shall be construed to mean "offer" and "offeror."

The bidder makes the following representations and certifications as a part of the bid identified above. (Check appropriate boxes.)

1. SMALL BUSINESS

He is, is not, a small business concern. (A small business concern for the purpose of Government procurement is a concern, including its affiliates, which is independently owned and operated, is not dominant in the field of operations in which it is bidding on Government contracts, and can further qualify under the criteria concerning number of employees, average annual receipts, or other criteria as prescribed by the Small Business Administration. For additional information see governing regulations of the Small Business Administration (13 CFR Part 121)).

2. MINORITY BUSINESS ENTERPRISE

He is, is not a minority business enterprise. A minority business enterprise is defined as a "business, at least 50 percent of which is owned by minority group members or, in case of publicly owned businesses, at least 51 percent of the stock of which is owned by minority group members." For the purpose of this definition, minority group members are Negroes, Spanish-speaking American persons, American-Orientals, American-Indians, American-Eskimos, and American-Aleuts."

3. CONTINGENT FEE

(a) He has, has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract, and (b) he has, has not, paid or agreed to pay any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract; and agrees to furnish information relating to (a) and (b) above as requested by the Contracting Officer. (For interpretation of the representation, including the term "bona fide employee," see Code of Federal Regulations, Title 41, Subpart 1-1.5.)

4. TYPE OF ORGANIZATION

He operates as an individual, partnership, joint venture, corporation, incorporated in State of

5. INDEPENDENT PRICE DETERMINATION

(a) By submission of this bid, each bidder certifies, and in the case of a joint bid each party thereto certifies as to his own organization, that in connection with this procurement:

(1) The prices in this bid have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, in the case of a bid, or prior to award, in the case of a proposal, directly or indirectly to any other bidder or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person or firm to submit or not to submit a bid for the purpose of restricting competition.

(b) Each person signing this bid certifies that:

(1) He is the person in the bidder's organization responsible within that organization for the decision as to the prices being bid herein and that he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above; or

(2) (i) He is not the person in the bidder's organization responsible within that organization for the decision as to the prices being bid herein but that he has been authorized in writing to act as agent for the persons responsible for such decision in certifying that such persons have not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above, and as their agent does hereby so certify; and (ii) he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above.

(c) This certification is not applicable to a foreign bidder submitting a bid for a contract which requires performance or delivery outside the United States, its possessions, and Puerto Rico.

(d) A bid will not be considered for award where (a) (1), (a) (3), or (b) above, has been deleted or modified. Where (a) (2) above, has been deleted or modified, the bid will not be considered for award unless the bidder furnishes with the bid a signed statement which sets forth in detail the circumstances of the disclosure and the head of the agency, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

NOTE.—Bids must set forth full, accurate, and complete information as required by this invitation for bids (including attachments). The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

THE FOLLOWING NEED BE CHECKED ONLY IF BID EXCEEDS \$10,000 IN AMOUNT.

6. EQUAL OPPORTUNITY

He has, has not, participated in a previous contract or subcontract subject to the Equal Opportunity Clause herein, the clause originally contained in Section 301 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114; he has, has not, filed all required compliance reports; and representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards.

(The above representations need not be submitted in connection with contracts or subcontracts which are exempt from the equal opportunity clause.)

7. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER

Each bidder shall furnish the following information by filling in the appropriate blocks:

(a) Is the bidder owned or controlled by a parent company as described below? Yes No. (For the purpose of this bid, a parent company is defined as one which either owns or controls the activities and basic business policies of the bidder. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company, such ownership is not required; if another company is able to formulate, determine, or veto basic business policy decisions of the bidder, such other company is considered the parent company of the bidder. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.)

(b) If the answer to (a) above is "Yes," bidder shall insert in the space below the name and main office address of the parent company.

NAME OF PARENT COMPANY	MAIN OFFICE ADDRESS (No., Street, City, State, and ZIP Code)
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(c) Bidder shall insert in the applicable space below, if he has no parent company, his own Employer's Identification Number (E.I. No.) (Federal Social Security Number used on Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941), or, if he has a parent company, the E.I. No. of his parent company.

EMPLOYER IDENTIFICATION NUMBER OF	▶ PARENT COMPANY	BIDDER
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8. CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to (1) contracts, (2) subcontracts, and (3) agreements with applicants who are themselves performing federally assisted construction contracts, exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause.)

By the submission of this bid, the bidder, offeror, applicant, or subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

9. CLEAN AIR AND WATER

(Applicable if the bid or offer exceeds \$100,000, or the contracting officer has determined that orders under an indefinite quantity contract in any year will exceed \$100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.)

The bidder or offeror certifies as follows:

(a) Any facility to be utilized in the performance of this proposed contract has , has not , been listed on the Environmental Protection Agency List of Violating Facilities.

(b) He will promptly notify the contracting officer, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, Environmental Protection Agency, indicating that any facility which he proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities.

(c) He will include substantially this certification, including this paragraph (c), in every nonexempt subcontract.

SUPPLEMENT SHEET TO STANDARD FORM 19-B

- a. The following is added as item 10 of Standard Form 19-B:

10. REPRESENTATION, AFFIRMATIVE ACTION PROGRAM

The bidder represents that he (check appropriate box):

- (a) has developed and has on file
 has not developed and does not have on file

at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or

- (b) has not previously had contracts subject to the written affirmative action program requirement of the rules and regulations of the Secretary of Labor.

- b. The following is added as item 11 of Standard Form 19-B:

11. WOMAN-OWNED BUSINESS

Concern is is not a woman-owned business.

A woman-owned business is a business which is, at least, 51 percent owned, controlled, and operated by a woman or women. Controlled is defined as exercising the power to make policy decisions. Operated is defined as actively involved in the day-to-day management.

For the purposes of this definition, businesses which are publicly owned, joint stock associations, and business trusts are exempted. Exempted businesses may voluntarily represent that they are, or are not, woman-owned if this information is available.

- c. The following is added as item 13 of Standard Form 19-B:

12. PERCENT OF FOREIGN CONTENT

The bidder/contractor will represent (as an estimate), immediately after the award of a contract, the percent of the foreign content of the item or service being procured expressed as a percent of the contract award price (accuracy within plus or minus 5 percent is acceptable).

SALT-GILA AQUEDUCT-REACH 1A
SALT-GILA DIVISION, ARIZONA
CENTRAL ARIZONA PROJECT

Bids will be considered for award on the following schedule but no bid will be considered for award for only a part of the schedule.

Divided items in the schedule shall be in accordance with paragraph 1.3.4.

SCHEDULE

Item	Work or material	Quantity and unit	Unit price	Amount
1	Mobilization and preparatory work	For the lump sum of		\$ _____ (Not to exceed 5 percent of total for schedule)
2	Clearing and grubbing	For the lump sum of		_____ (Not to exceed \$75,000)
3	Water for dust abatement:			
	a. First 32,000 M (1,000) gallons	32,000 Mgal	\$ <u>6.50</u>	
	b. Over 32,000 M (1,000) gallons	18,000 Mgal	<u>5.00</u>	
4	Prewetting canal prism and adjacent areas	For the lump sum of		_____
5	Furnishing and erecting chain link fence	68,100 lin ft	_____	_____
6	Furnishing and erecting chain link fence on bridges	1,030 lin ft	_____	_____
7	Excavation for canal:			
	a. First 730,000 cubic yards	730,000 yd ³	_____	_____
	b. Over 730,000 cubic yards	390,000 yd ³	_____	_____
8	Excavation for structures	33,000 yd ³	_____	_____
9	Overhaul	165,000 mi yd ³	_____	_____
10	Backfill about structures	30,000 yd ³	_____	_____
11	Compacting backfill about structures	27,500 yd ³	_____	_____

BIDDING SCHEDULE FOR
SPECIFICATIONS 3D-C7471

SCHEDULE-Continued

Item	Work or material	Quantity and unit	Unit price	Amount
12	Compacting embankments:			
	a. First 110,000 cubic yards	110,000 yd ³	\$ _____	\$ _____
	b. Over 110,000 cubic yards	60,000 yd ³	_____	_____
13	Furnishing and erecting beam-type guardrail	750 lin ft	_____	_____
14	Select material	4,500 tons	_____	_____
15	Aggregate base course	4,100 tons	_____	_____
16	Liquid asphalt prime coat, MC-70	8 tons	_____	_____
17	Asphaltic concrete	910 tons	_____	_____
18	Asphalt cement, AR-4000	51 tons	_____	_____
19	Preparing foundations for concrete lining	351,000 yd ²	_____	_____
20	Reinforced concrete in structures	3,370 yd ³	_____	_____
21	Reinforced concrete in bridge decks, diaphragms, parapets, and approach slabs	1,050 yd ³	_____	_____
22	Reinforced concrete in canal lining	3,000 yd ³	_____	_____
23	Unreinforced concrete in canal lining	31,500 yd ³	_____	_____
24	Providing joints in unreinforced concrete canal lining	379,000 lin ft	_____	_____
25	Furnishing and installing safety ladders along canal	92 ladders	_____	_____
26	Furnishing and handling cementitious materials	11,500 tons	_____	_____
27	Furnishing and placing reinforcing bars	1,117,000 lb	_____	_____
28	Furnishing and installing bridge deck joint	156 lin ft	_____	_____
29	Furnishing and placing waterstops	32,800 lin ft	_____	_____

BIDDING SCHEDULE FOR
SPECIFICATIONS 3D-C7471

SCHEDULE-Continued

Item	Work or material	Quantity and unit	Unit price	Amount
	Furnishing and placing the following thicknesses of sponge rubber joint filler:			
30	1/2-inch	920 ft ²	\$ _____	\$ _____
31	1-inch	2,130 ft ²	_____	_____
32	Furnishing and placing 1-inch-thick laminated elastomeric bearing pads	170 ft ²	_____	_____
	Furnishing and erecting the following lengths of AASHTO type IV precast prestressed concrete bridge beams for roadway bridges:			
33	81-foot 1-inch	22 beams	_____	_____
34	81-foot 6-inch	5 beams	_____	_____
35	89-foot 2-inch	9 beams	_____	_____
	Furnishing and erecting the following lengths of AASHTO type VI precast prestressed concrete bridge beams for roadway bridges:			
36	104-foot 2-1/2-inch	9 beams	_____	_____
37	116-foot 8-1/2-inch	9 beams	_____	_____
38	Furnishing and installing miscellaneous metalwork	11,300 lb	_____	_____
39	Furnishing and erecting 36B25 pipe vertically for floatwells	57 lin ft	_____	_____
40	Furnishing and laying 4-inch-diameter pipe horizontally for floatwells	610 lin ft	_____	_____
			TOTAL FOR SCHEDULE \$ _____	

BIDDING SCHEDULE FOR
SPECIFICATIONS 3D-C7471

SCHEDULE-Continued

Bidders furnishing domestic construction material only should disregard this sheet.

List below alternative bid prices based on the use of domestic materials for schedule items under which foreign materials are offered as listed on the enclosed Water and Power (Construction) form 7-1532 entitled "Representations by Bidder Pursuant to 'Buy American Act'" (see paragraph at bottom of front page of form 7-1532).

Item	Work or material	Quantity and unit	Unit price	Amount
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NOTE: Unless bidder intends to furnish NONDOMESTIC construction materials it is unnecessary to complete this form, but it should be returned with the bid.

REPRESENTATIONS BY BIDDER PURSUANT TO "BUY AMERICAN ACT"

Bidder represents that all construction materials to be used, other than those specifically exempt from the requirements of the Buy American Act as listed on the back of this form, will be domestic materials conforming to the clause entitled "Buy American," of the General Provisions (Standard Form 23-A) except as noted below:

<u>Name of each item of nondomestic material</u>	<u>Quantity (weight, feet, no., etc.)</u>	<u>Cost delivered to the job site</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
	Total	\$ _____

The contractor will be limited in the use of nondomestic materials to those listed above and those specifically exempt from the requirements of the Buy American Act as listed on the back of this form.

List below the lowest cost of domestic material comparable to each item of nondomestic material shown above, based upon bidder's canvass of domestic suppliers (as required by Paragraph (b)(2) on the back of this form).

<u>Name of each item of domestic material comparable to offered nondomestic material</u>	<u>Quantity (weight, feet, no., etc.)</u>	<u>Cost delivered to the job site</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
	Total	\$ _____

If nondomestic construction materials are listed above, an alternate bid may be submitted offering comparable domestic materials as described in Paragraph (b)(3) on the reverse hereof. However, unless the bidder specifically states alternate bid prices for specific items of the schedule, based upon use of comparable domestic materials, the bid will be evaluated only on the basis of the foreign materials listed above.

INFORMATION REGARDING BUY AMERICAN ACT

(a) The Buy American Act (41 U.S.C. 10a-10d) generally requires that only domestic construction material be used in the performance of this contract. (See the clause entitled "Buy American" in Standard Form 23-A, General Provisions, Construction contract.) This requirement does not apply to the following construction material or components:

Acetylene black	Graphite, natural
Asbestos, amosite	Mica
Bismuth	Nickel, primary, in ingots, pigs, shot, cathodes, or similar forms; nickel oxide and nickel salts
Books, pamphlets, newspapers, magazines, periodicals, printed briefs, and films which are not printed in the United States and for which domestic editions are not available	Petroleum, crude oil; unfinished oils and finished products
Cadmium, ores and flue dust	Platinum and platinum group metals refined, as sponge, powder, ingots, or cast bars
Calcium cyanamide	Quartz crystals
Chrome ore or chromite	Radium salts
Cobalt, in cathodes, rondelles, or other primary forms	Rubber, crude and latex
Cocoa beans	Sperm oil
Cork, wood or bark and waste	Talc, block steatite
Diamonds, industrial, stones	Tin in bars, blocks and pigs
Fair linen, altar	Wax, carnauba
Fibers of the following types: Abace, agave, coir, jute, and palmyra	Woods of the following species: Angelique, balsa, ekki, greenheart, lignum vitae, mahogany, and teak
Goat and kid skins	

(b)(1) Furthermore, bids or proposals offering use of additional nondomestic construction material may be acceptable for award if the Government determines that use of comparable domestic construction material is impracticable or would unreasonably increase the cost or that domestic construction material (in sufficient and reasonably available commercial quantities and of a satisfactory quality) is unavailable. Reliable evidence shall be furnished justifying such use of additional nondomestic construction material.

(2) Where it is alleged that use of domestic construction material would unreasonably increase the cost:

(i) Data shall be included by the bidder, based on a reasonable canvass of suppliers, demonstrating that the cost of each such domestic construction material would exceed by more than 6 percent the cost of comparable nondomestic construction material. (All costs of delivery to the construction site shall be included, as well as any applicable duty.)

(ii) For evaluation purposes, 6 percent of the cost of all additional nondomestic construction material, which qualifies under Paragraph (i) above, will be added to the bid or proposal.

(3) When offering additional nondomestic construction material, bids or proposals may also offer, at stated prices, any available comparable domestic construction material, so as to avoid the possibility that failure of a nondomestic construction material to be acceptable under (1) above, will cause rejection of the entire bid.

**INCLUSION OF LABOR STANDARDS PROVISIONS
IN SUBCONTRACTS**

The Labor Standards Provisions (Standard Form 19-A) must be inserted physically in all subcontracts for construction work under the specifications. (Incorporation of these provisions by reference is not in compliance with this requirement.)

Within 7 days after the making of each subcontract, the contractor shall provide a copy of the subcontract for review by the contracting officer to determine compliance with this requirement. Such copy need not contain the subcontract prices.

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY**

(EXECUTIVE ORDER 11246)

1. The offeror's or bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Goals and timetables for female utilization

Timetable	Goals (percent)
From April 1, 1978 until March 31, 1979	3.1
From April 1, 1979 until March 31, 1980	5.0
From April 1, 1980 until further notice	6.9

Goals and timetables for minority utilization

Timetable	Trade	Goal (percent)
Until further notice	All	15.8

These goals are applicable to all the contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The contractor's compliance with the Executive Order and the regulations in 41 CFR part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice, and in the contract resulting from this solicitation, the "covered area" for female utilization is nationwide and for minority utilization is Maricopa County, Arizona.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY

CONSTRUCTION CONTRACT SPECIFICATIONS

(EXECUTIVE ORDER 11246)

1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the director delegates authority;
- c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
- d. "Minority" includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The contractor shall implement the specific affirmative action standards provided in subparagraphs 7.a. through p. of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign two or more women to each construction project. The contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the contractor may have taken.

d. Provide immediate written notification to the director when the union or unions with which the contractor has a collective bargaining agreement has not referred to the contractor a minority person or woman sent by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under 7.b. above.

f. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions including specific review of these items with on-site supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any jobsite. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7.a. through p.). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7.a. through p. of these specifications: Provided, That the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female work-force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally, the contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the director shall proceed in accordance with 41 CFR 60-4.8.

14. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

GENERAL PROVISIONS

(Construction Contract)

1. DEFINITIONS

(a) The term "head of the agency" or "Secretary" as used herein means the Secretary, the Under Secretary, any Assistant Secretary, or any other head or assistant head of the executive or military department or other Federal agency; and the term "his duly authorized representative" means any person or persons or board (other than the Contracting Officer) authorized to act for the head of the agency or the Secretary.

(b) The term "Contracting Officer" as used herein means the person executing this contract on behalf of the Government and includes a duly appointed successor or authorized representative.

2. SPECIFICATIONS AND DRAWINGS

The Contractor shall keep on the work a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy either in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at his own risk and expense. The Contracting Officer shall furnish from time to time such detail drawings and other information as he may consider necessary, unless otherwise provided.

3. CHANGES

(a) The Contracting Officer may, at any time, without notice to the sureties, by written order designated or indicated to be a change order, make any change in the work within the general scope of the contract, including but not limited to changes:

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written order or an oral order (which terms as used in this paragraph (b) shall include direction, instruction, interpretation, or determination) from the Contracting Officer, which causes any such change, shall be treated as a change order under this clause, provided that the Contractor gives the Contracting Officer written notice stating the date, circumstances, and source of the order and that the Contractor regards the order as a change order.

(c) Except as herein provided, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment hereunder.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any order, an equitable adjustment shall be made and the contract modified in writing accordingly: *Provided, however,* That except for claims based on defective specifications, no claim for any change under (b) above shall be allowed for any costs incurred more than 20 days before the Contractor gives written notice as therein required: *And provided further,* That in the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with such defective specifications.

(e) If the Contractor intends to assert a claim for an equitable adjustment under this clause, he must, within 30 days after receipt of a written change order under (a) above or the furnishing of a written notice under (b) above, submit to the Contracting Officer a written statement setting forth the general nature and monetary extent of such claim,

unless this period is extended by the Government. The statement of claim hereunder may be included in the notice under (b) above.

(f) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this contract.

4. DIFFERING SITE CONDITIONS

(a) The Contractor shall promptly, and before such conditions are disturbed, notify the Contracting Officer in writing of: (1) Subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in this contract. The Contracting Officer shall promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the contract modified in writing accordingly.

(b) No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in (a) above; provided, however, the time prescribed therefor may be extended by the Government.

(c) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this contract.

5. TERMINATION FOR DEFAULT—DAMAGES FOR DELAY—TIME EXTENSIONS

(a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with such diligence as will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within such time, the Government may, by written notice to the Contractor, terminate his right to proceed with the work or such part of the work as to which there has been delay. In such event the Government may take over the work and prosecute the same to completion, by contract or otherwise, and may take possession of and utilize in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefor. Whether or not the Contractor's right to proceed with the work is terminated, he and his sureties shall be liable for any damage to the Government resulting from his refusal or failure to complete the work within the specified time.

(b) If fixed and agreed liquidated damages are provided in the contract and if the Government so terminates the Contractor's right to proceed, the resulting damage will consist of such liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(c) If fixed and agreed liquidated damages are provided in the contract and if the Government does not so terminate the Contractor's right to proceed, the resulting damage will consist of such liquidated damages until the work is completed or accepted.

(d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

- (1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers; and

- (2) The Contractor, within 10 days from the beginning of any such delay (unless the Contracting Officer grants a further period of time before the date of final payment

under the contract), notifies the Contracting Officer in writing of the causes of delay.

The Contracting Officer shall ascertain the facts and the extent of the delay and extend the time for completing the work when, in his judgment, the findings of fact justify such an extension, and his findings of fact shall be final and conclusive on the parties, subject only to appeal as provided in Clause 6 of these General Provisions.

(e) If, after notice of termination of the Contractor's right to proceed under the provisions of this clause, it is determined for any reason that the Contractor was not in default under the provisions of this clause, or that the delay was excusable under the provisions of this clause, the rights and obligations of the parties shall, if the contract contains a clause providing for termination for convenience of the Government, be the same as if the notice of termination had been issued pursuant to such clause. If, in the foregoing circumstances, this contract does not contain a clause providing for termination for convenience of the Government, the contract shall be equitably adjusted to compensate for such termination and the contract modified accordingly; failure to agree to any such adjustment shall be a dispute concerning a question of fact within the meaning of the clause of this contract entitled "Disputes."

(f) The rights and remedies of the Government provided in this clause are in addition to any other rights and remedies provided by law or under this contract.

(g) As used in Paragraph (d) (1) of this clause, the term "subcontractors or suppliers" means subcontractors or suppliers at any tier.

6. DISPUTES

(a) Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Contracting Officer shall be final and conclusive unless, within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the head of the agency involved. The decision of the head of the agency or his duly authorized representative for the determination of such appeals shall be final and conclusive. This provision shall not be pleaded in any suit involving a question of fact arising under this contract as limiting judicial review of any such decision to cases where fraud by such official or his representative or board is alleged: *Provided, however*, That any such decision shall be final and conclusive unless the same is fraudulent or capricious or arbitrary or so grossly erroneous as necessarily to imply bad faith or is not supported by substantial evidence. In connection with any appeal proceeding under this clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

(b) This Disputes clause does not preclude consideration of questions of law in connection with decisions provided for in paragraph (a) above. Nothing in this contract, however, shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

7. PAYMENTS TO CONTRACTOR

(a) The Government will pay the contract price as herein-after provided.

(b) The Government will make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates approved by the Contracting Officer. If requested by the Contracting Officer, the Contractor shall furnish a breakdown of the total contract price showing the amount included therein for each principal category of the work, in such detail as requested, to provide a basis for determining progress payments. In the preparation of estimates the Contracting Officer, at his discretion, may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site may also be taken into consideration (1) if such consideration is specifically authorized by the contract and (2) if the Contractor furnishes satisfactory evidence that he has acquired title to such material and that it will be utilized on the work covered by this contract.

(c) In making such progress payments, there shall be retained 10 percent of the estimated amount until final com-

pletion and acceptance of the contract work. However, if the Contracting Officer, at any time after 50 percent of the work has been completed, finds that satisfactory progress is being made, he may authorize payment in full of each progress payment for work performed beyond the 50 percent stage of completion. Also, whenever the work is substantially complete, the Contracting Officer, if he considers the amount retained to be in excess of the amount adequate for the protection of the Government, at his discretion, may release to the Contractor all or a portion of such excess amount. Furthermore, on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made therefor without retention of a percentage.

(d) All material and work covered by progress payments made shall thereupon become the sole property of the Government, but this provision shall not be construed as relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work, or as waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(e) Upon completion and acceptance of all work, the amount due the Contractor under this contract shall be paid upon the presentation of a properly executed voucher and after the Contractor shall have furnished the Government with a release of all claims against the Government arising by virtue of this contract, other than claims in stated amounts as may be specifically excepted by the Contractor from the operation of the release. If the Contractor's claim to amounts payable under the contract has been assigned under the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15), a release may also be required of the assignee.

8. ASSIGNMENT OF CLAIMS

(a) Pursuant to the provisions of the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15), if this contract provides for payments aggregating \$1,000 or more, claims for moneys due or to become due the Contractor from the Government under this contract may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency, and may thereafter be further assigned and reassigned to any such institution. Any such assignment or reassignment shall cover all amounts payable under this contract and not already paid, and shall not be made to more than one party, except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing. Unless otherwise provided in this contract, payments to an assignee of any moneys due or to become due under this contract shall not, to the extent provided in said Act, as amended, be subject to reduction or setoff. (The preceding sentence applies only if this contract is made in time of war or national emergency as defined in said Act; and is with the Department of Defense, the General Services Administration, the Energy Research and Development Administration, the National Aeronautics and Space Administration, the Federal Aviation Administration, or any other department or agency of the United States designated by the President pursuant to Clause 4 of the proviso of section 1 of the Assignment of Claims Act of 1940, as amended by the Act of May 15, 1951, 65 Stat. 41.)

(b) In no event shall copies of this contract or of any plans, specifications, or other similar documents relating to work under this contract, if marked "Top Secret," "Secret," or "Confidential," be furnished to any assignee of any claim arising under this contract or to any other person not entitled to receive the same. However, a copy of any part or all of this contract so marked may be furnished, or any information contained therein may be disclosed, to such assignee upon the prior written authorization of the Contracting Officer.

9. MATERIAL AND WORKMANSHIP

(a) Unless otherwise specifically provided in this contract, all equipment, material, and articles incorporated in the work covered by this contract are to be new and of the most suitable grade for the purpose intended. Unless otherwise specifically provided in this contract, reference to any equipment, material, article, or patented process, by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition, and the Contractor may, at his option, use any equipment, material, article, or process, which, in the judgment of the Contracting Officer, is equal to that named. The Contractor shall furnish to the Contracting Officer for his approval the name of the manufacturer, the model number,

and other identifying data and information respecting the performance, capacity, nature, and rating of the machinery and mechanical and other equipment which the Contractor contemplates incorporating in the work. When required by this contract or when called for by the Contracting Officer, the Contractor shall furnish the Contracting Officer for approval full information concerning the material or articles which he contemplates incorporating in the work. When so directed, samples shall be submitted for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles installed or used without required approval shall be at the risk of subsequent rejection.

(b) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may, in writing, require the Contractor to remove from the work any employee the Contracting Officer deems incompetent, careless or otherwise objectionable.

10. INSPECTION AND ACCEPTANCE

(a) All work (which term includes but is not restricted to materials, workmanship, and manufacture and fabrication of components) shall be subject to inspection and test by the Government at all reasonable times and at all places prior to acceptance. Any such inspection and test is for the sole benefit of the Government and shall not relieve the Contractor of the responsibility of providing quality control measures to assure that the work strictly complies with the contract requirements. No inspection or test by the Government shall be construed as constituting or implying acceptance. Inspection or test shall not relieve the Contractor of responsibility for damage to or loss of the material prior to acceptance, nor in any way affect the continuing rights of the Government after acceptance of the completed work under the terms of paragraph (f) of this clause, except as hereinabove provided.

(b) The Contractor shall, without charge, replace any material or correct any workmanship found by the Government not to conform to the contract requirements, unless in the public interest the Government consents to accept such material or workmanship with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(c) If the Contractor does not promptly replace rejected material or correct rejected workmanship, the Government (1) may, by contract or otherwise, replace such material or correct such workmanship and charge the cost thereof to the Contractor, or (2) may terminate the Contractor's right to proceed in accordance with the clause of this contract entitled "Termination for Default—Damages for Delay—Time Extensions."

(d) The Contractor shall furnish promptly, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspection and test as may be required by the Contracting Officer. All inspection and test by the Government shall be performed in such manner as not unnecessarily to delay the work. Special, full size, and performance tests shall be performed as described in this contract. The Government reserves the right to charge to the Contractor any additional cost of inspection or test when material or workmanship is not ready at the time specified by the Contractor for inspection or test or when reinspection or retest is necessitated by prior rejection.

(e) Should it be considered necessary or advisable by the Government at any time before acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the Contractor shall, on request, promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect, due to the fault of the Contractor or his subcontractors, he shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, an equitable adjustment shall be made in the contract price to compensate the Contractor for the additional services involved in such examination and reconstruction and, if completion of the work has been delayed thereby, he shall, in addition, be granted a suitable extension of time.

(f) Unless otherwise provided in this contract, acceptance by the Government shall be made as promptly as practicable after completion and inspection of all work required by this contract, or that portion of the work that the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except as regards latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Government's rights under any warranty or guarantee.

11. SUPERINTENDENCE BY CONTRACTOR

The Contractor, at all times during performance and until the work is completed and accepted, shall give his personal superintendence to the work or have on the work a competent superintendent, satisfactory to the Contracting Officer and with authority to act for the Contractor.

12. PERMITS AND RESPONSIBILITIES

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State, and municipal laws, codes, and regulations, in connection with the prosecution of the work. He shall be similarly responsible for all damages to persons or property that occur as a result of his fault or negligence. He shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. He shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire construction work, except for any completed unit of construction thereof which theretofore may have been accepted.

13. CONDITIONS AFFECTING THE WORK

The Contractor shall be responsible for having taken steps reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work or the cost thereof. Any failure by the Contractor to do so will not relieve him from responsibility for successfully performing the work without additional expense to the Government. The Government assumes no responsibility for any understanding or representations concerning conditions made by any of its officers or agents prior to the execution of this contract, unless such understanding or representations by the Government are expressly stated in the contract.

14. OTHER CONTRACTS

The Government may undertake or award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors and Government employees and carefully fit his own work to such additional work as may be directed by the Contracting Officer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by Government employees.

15. SHOP DRAWINGS

(a) The term "shop drawings" includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract.

(b) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate his approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate his approval or disapproval of the shop drawings and if not approved as submitted shall indicate his reasons therefor. Any work done prior to such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (c) below.

(c) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation(s), he shall issue an appropriate contract modification, except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued.

16. USE AND POSSESSION PRIOR TO COMPLETION

The Government shall have the right to take possession of or use any completed or partially completed part of the work. Prior to such possession or use, the Contracting Officer shall furnish the Contractor an itemized list of work remaining to be performed or corrected on such portions of the project as are to be possessed or used by the Government, provided that failure to list any item of work shall not relieve the Contractor of responsibility for compliance with the terms of the

contract. Such possession or use shall not be deemed an acceptance of any work under the contract. While the Government has such possession or use, the Contractor, notwithstanding the provisions of the clause of this contract entitled "Permits and Responsibilities," shall be relieved of the responsibility for the loss or damage to the work resulting from the Government's possession or use. If such prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment in the contract price or the time of completion will be made and the contract shall be modified in writing accordingly.

17. SUSPENSION OF WORK

(a) The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as he may determine to be appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Contracting Officer in the administration of this contract, or by his failure to act within the time specified in this contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent (1) that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor or (2) for which an equitable adjustment is provided for or excluded under any other provision of this contract.

(c) No claim under this clause shall be allowed (1) for any costs incurred more than 20 days before the Contractor should have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of such suspension, delay, or interruption, but not later than the date of final payment under the contract.

18. TERMINATION FOR CONVENIENCE OF THE GOVERNMENT

If not physically incorporated elsewhere, the clause in Section 1-8.703 of the Federal Procurement Regulations, or paragraph 7-602.29(a) of the Armed Services Procurement Regulation, as applicable, in effect on the date of this contract is hereby incorporated by reference as fully as if set forth at length herein.

19. PAYMENT OF INTEREST ON CONTRACTORS' CLAIMS

(a) If an appeal is filed by the Contractor from a final decision of the Contracting Officer under the Disputes clause of this contract, denying a claim arising under the contract, simple interest on the amount of the claim finally determined owed by the Government shall be payable to the Contractor. Such interest shall be at the rate determined by the Secretary of the Treasury pursuant to Public Law 92-41, 85 Stat. 97, from the date the Contractor furnishes to the Contracting Officer his written appeal under the Disputes clause of this contract, to the date of (1) a final judgment by a court of competent jurisdiction, or (2) mailing to the Contractor of a supplemental agreement for execution either confirming completed negotiations between the parties or carrying out a decision of a board of contract appeals.

(b) Notwithstanding (a) above, (1) interest shall be applied only from the date payment was due, if such date is later than the filing of appeal; and (2) interest shall not be paid for any period of time that the Contracting Officer determines the Contractor has unduly delayed in pursuing his remedies before a board of contract appeals or a court of competent jurisdiction.

20. PRICING OF ADJUSTMENTS

When costs are a factor in any determination of a contract price adjustment pursuant to the Changes clause or any other provision of this contract, such costs shall be in accordance with the contract cost principles and procedures in Part 1-15 of the Federal Procurement Regulations, (41 CFR 1-15) or Section XV of the Armed Services Procurement Regulation, as applicable, which are in effect on the date of this contract.

21. PATENT INDEMNITY

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and em-

ployees against liability, including costs and expenses, for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be, for reasons of national security, ordered by the Government to be kept secret or otherwise withheld from issue) arising out of the performance of this contract or out of the use or disposal by or for the account of the Government of supplies furnished or construction work performed hereunder.

22. ADDITIONAL BOND SECURITY

If any surety upon any bond furnished in connection with this contract becomes unacceptable to the Government, or if any such surety fails to furnish reports as to his financial condition from time to time as requested by the Government, or if the contract price is increased to such an extent that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interests of the Government and of persons supplying labor or materials in the prosecution of the work contemplated by this contract.

23. EXAMINATION OF RECORDS BY COMPTROLLER GENERAL

(a) This clause is applicable if the amount of this contract exceeds \$10,000 and was entered into by means of negotiation, including small business restricted advertising, but is not applicable if this contract was entered into by means of formal advertising.

(b) The contractor agrees that the Comptroller General of the United States or any of his duly authorized representatives shall, until the expiration of 3 years after final payment under this contract or such lesser time specified in either Appendix M of the Armed Services Procurement Regulation or the Federal Procurement Regulations Part 1-20, as appropriate, have access to and the right to examine any directly pertinent books, documents, papers, and records of the contractor involving transactions related to this contract.

(c) The Contractor further agrees to include in all his subcontracts hereunder a provision to the effect that the subcontractor agrees that the Comptroller General of the United States or any of his duly authorized representatives shall, until the expiration of 3 years after final payment under the subcontract or such lesser time specified in either Appendix M of the Armed Services Procurement Regulation or the Federal Procurement Regulations Part 1-20, as appropriate, have access to and the right to examine any directly pertinent books, documents, papers, and records of such subcontractor, involving transactions related to the subcontract. The term "subcontract" as used in this clause excludes (1) purchase orders not exceeding \$10,000 and (2) subcontracts or purchase orders for public utility services at rates established for uniform applicability to the general public.

(d) The periods of access and examination described in (b) and (c), above, for records which relate to (1) appeals under the "Disputes" clause of this contract, (2) litigation or the settlement of claims arising out of the performance of this contract, or (3) costs and expenses of this contract as to which exception has been taken by the Comptroller General or any of his duly authorized representatives, shall continue until such appeals, litigation, claims, or exceptions have been disposed of.

24. BUY AMERICAN

(a) *Agreement.* In accordance with the Buy American Act (41 U.S.C. 10a-10d), and Executive Order 10582, December 17, 1954 (3 CFR, 1954-58 Comp., p. 230), as amended by Executive Order 11051, September 27, 1962 (3 CFR, 1959-63 Comp., p. 635), the Contractor agrees that only domestic construction material will be used (by the Contractor, subcontractors, materialmen, and suppliers) in the performance of this contract, except for nondomestic material listed in the contract.

(b) *Domestic construction material.* "Construction material" means any article, material, or supply brought to the construction site for incorporation in the building or work. An unmanufactured construction material is a "domestic construction material" if it has been mined or produced in the United States. A manufactured construction material is a "domestic construction material" if it has been manufactured in the United States and if the cost of its components which have been mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. "Component" means any article, material, or supply directly incorporated in a construction material.

(c) *Domestic component.* A component shall be considered to have been "mined, produced, or manufactured in the

United States" (regardless of its source in fact) if the article, material, or supply in which it is incorporated was manufactured in the United States and the component is of a class or kind determined by the Government to be not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

25. EQUAL OPPORTUNITY

(The following clause is applicable unless this contract is exempt under the rules, regulations, and relevant orders of the Secretary of Labor (41 CFR, ch. 60).)

During the performance of this contract, the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this Equal Opportunity clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency Contracting Officer, advising the labor union or workers' representative of the contractor's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(f) In the event of the Contractor's noncompliance with the Equal Opportunity clause of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (a) through (f) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended by Executive Order No. 11375 of October 13, 1967, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided, however*, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

26. COVENANT AGAINST CONTINGENT FEES

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

27. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress or resident Commissioner shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

28. CONVICT LABOR

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment at hard labor except as provided by Public Law 89-176, September 10, 1965 (18 U.S.C. 4082(c)(2)) and Executive Order 11755, December 29, 1973.

29. UTILIZATION OF SMALL BUSINESS CONCERNS

(a) It is the policy of the Government as declared by the Congress that a fair proportion of the purchases and contracts for supplies and services for the Government be placed with small business concerns.

(b) The Contractor agrees to accomplish the maximum amount of subcontracting to small business concerns that the Contractor finds to be consistent with the efficient performance of this contract.

30. UTILIZATION OF MINORITY BUSINESS ENTERPRISES

(a) It is the policy of the Government that minority business enterprises shall have the maximum practicable opportunity to participate in the performance of Government contracts.

(b) The Contractor agrees to use his best efforts to carry out this policy in the award of his subcontracts to the fullest extent consistent with the efficient performance of this contract. As used in this contract, the term "minority business enterprise" means a business, at least 50 percent of which is owned by minority group members or, in case of publicly-owned businesses, at least 51 percent of the stock of which is owned by minority group members. For the purposes of this definition, minority group members are Negroes, Spanish-speaking American persons, American-Orientals, American-Indians, American-Eskimos, and American-Aleuts. Contractors may rely on written representations by subcontractors regarding their status as minority business enterprises in lieu of an independent investigation.

31. FEDERAL, STATE, AND LOCAL TAXES

(a) Except as may be otherwise provided in this contract, the contract price includes all applicable Federal, State and local taxes and duties.

(b) Nevertheless, with respect to any Federal excise tax or duty on the transactions or property covered by this contract, if a statute, court decision, written ruling, or regulation takes effect after the contract date, and—

(1) Results in the Contractor being required to pay or bear the burden of any such Federal excise tax or duty or increase in the rate thereof which would not otherwise have been payable on such transactions or property, the contract price shall be increased by the amount of such tax or duty or rate increase: *Provided*, That the Contractor if requested by the Contracting Officer, warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price as a contingency reserve or otherwise; or

(2) Results in the Contractor not being required to pay or bear the burden of, or in his obtaining a refund or drawback of, any such Federal excise tax or duty which would otherwise have been payable on such transactions or property or which was the basis of an increase in the contract price, the contract price shall be decreased by the amount of the relief, refund, or drawback, or that amount shall be paid to the Government, as directed by the Contracting Officer. The contract price shall be similarly decreased if the Contractor, through his fault or negligence or his failure to follow instructions of the Contract-

ing Officer, is required to pay or bear the burden of, or does not obtain a refund or drawback of, any such Federal excise tax or duty.

(c) No adjustment pursuant to paragraph b above will be made under this contract unless the aggregate amount thereof is or may reasonably be expected to be over \$100.00.

(d) As used in paragraph b above, the term "contract date" means the date set for the bid opening, or if this is a negotiated contract, the date of this contract. As to additional supplies or services procured by modification to this contract, the term "contract date" means the date of such modification.

(e) Unless there does not exist any reasonable basis to sustain an exemption, the Government, upon request of the

Contractor, without further liability, agrees, except as otherwise provided in this contract, to furnish evidence appropriate to establish exemption from any tax which the Contractor warrants in writing was excluded from the contract price. In addition, the Contracting Officer may furnish evidence to establish exemption from any tax that may, pursuant to this Clause, give rise to either an increase or decrease in the contract price. Except as otherwise provided in this contract, evidence appropriate to establish exemption from duties will be furnished only at the discretion of the Contracting Officer.

(f) The Contractor shall promptly notify the Contracting Officer of matters which will result in either an increase or decrease in the contract price, and shall take action with respect thereto as directed by the Contracting Officer.

**SUPPLEMENT TO GENERAL PROVISIONS
(Standard Form 23-A, April 1975 Edition)**

a. Clause No. 4A.—The following is added as Clause No. 4A of the General Provisions:

**"4A. ADMINISTRATION OF THE
DIFFERING SITE
CONDITIONS CLAUSE**

"(a) Nature of the clause. The Differing Site Conditions clause provides for an equitable adjustment to the Contractor or the Government which reflects the increases or decreases in a Contractor's cost of and time for performance that result from a differing site condition (as that term is defined in the clause) encountered by the Contractor. However, an equitable adjustment is only available to the Contractor if he gives the Contracting Officer a prompt notice in writing before disturbing the conditions (or secures an extension of the time for giving such notice) and asserts the claim before final payment under the contract.

"(b) Notice of differing site conditions. When a Contractor believes that a differing site condition has been encountered, the clause requires that a prompt written notice be given to the Contracting Officer so that the condition of the site can be investigated, the facts can be ascertained, and a determination can be made regarding the presence or absence of a differing site condition. The prompt notice requirement enables the Government to examine the condition of the site and, if necessary, (1) to modify the contract so that it will reflect the increased or decreased cost of and time for performance or (2) to develop records concerning any increase or decrease in the cost of and time for performance. Cost and time information is essential for an independent Government judgment regarding an equitable adjustment of the contract. A failure to give a timely notice could seriously prejudice the Government's ability to determine the extent to which the Contractor or the Government is entitled to an equitable adjustment. Since the existence of a differing site condition is not always recognizable immediately, the clause provides that the Contracting Officer may extend the time for the submission of the required notice. The purpose of the authority to extend the time for the notice is to ensure that Contractors are not deprived of the remedy provided by the clause because of an inadvertent failure to give the required notice. However, this authority to extend the time for the notice does not entitle a Contractor to a time extension beyond the time when he knew, or reasonably should have known, of the existence of a differing site condition. If the Contractor gives the required notice at the time he knew, or reasonably should have known, of the existence of the differing site condition, he is entitled to an equitable adjustment which reflects the increased costs and time required for performance that result from the differing site condition. If the Contractor fails to submit the required notice to the Contracting Officer by the time he knew, or reasonably should have known, of the existence of a differing site condition, he is not entitled to an equitable adjustment which reflects the increased costs and time required for performance prior to the time when he gave the notice or the time when the Government had actual notice of the existence of a differing site condition.

"(c) Processing of claims.

"(1) Since the time required by the Contractor to ascertain the amount of his claim varies with the circumstances, no specific time for the submission of a claim is specified in the clause or in this section. The clause simply states that no claim will be allowed if asserted after final payment. However, Contractors should not unnecessarily postpone the submission of claims for equitable adjustments.

"(2) To prevent Contractors from unnecessarily postponing the submission of claims, Contracting Officers shall take the following actions.

"(i) When a Contractor gives a prompt written notice of a differing site condition but has not submitted a claim for an equitable adjustment, although there has been a reasonable opportunity to ascertain the amount of the adjustment involved, the Contracting Officer shall send a written request to the Contractor (by registered or certified mail) that he submit within a specified period of time either a written claim or a request for an extension of the time for submission of the claim together with the reasons why the additional time is needed.

"(ii) In the event that the Contractor fails to submit a claim within the time specified in the request, or an approved time extension, the Contracting Officer shall make a unilateral determination of the amount of the equitable adjustment which the Contractor is entitled to and shall notify the Contractor of the determination. Such unilateral determinations may not be appealed under the Disputes clause of the contract."

b. Clause No. 5.—At the end of Paragraph 5(d)(2) the period after the word "delay" is deleted, a colon is substituted therefor, and the following is added:

"Provided, That the Contractor shall be excused for delays of suppliers only if the Contracting Officer shall determine that the materials or supplies to be furnished are not procurable in the open market."

c. Clause No. 7.—Paragraph 7(c) is deleted and the following Paragraph 7(c) is substituted therefor:

"(c) In making such progress payments, there shall be retained 10 percent of the estimated amount until final completion and acceptance of the contract work. However, if the Contracting Officer, finds that satisfactory progress was achieved during any period for which a progress payment is to be made, he may authorize such payment to be made in full without retention of a percentage. Also, whenever the work is substantially complete, the Contracting Officer shall retain an amount he considers adequate for protection of the Government and, at his discretion, may release to the Contractor all or a portion of any excess amount. Furthermore, on completion and acceptance of each separate building, public work, or other

division of the contract, on which the price is stated separately in the contract, payment may be made therefor without retention of a percentage."

d. Clause No. 12.—At the end of Clause No. 12 the following is added:

"Upon completion of the contract, or final acceptance of any completed unit thereof, the work shall be delivered complete and undamaged."

e. Clause No. 21.—At the end of Clause No. 21 the following is added:

"Any patented invention, the use of which by these specifications is required or permitted in the alternative to be used and which the United States has the right to use royalty free, shall be available to the contractor without the payment of the royalty."

f. Clause No. 28.—In the third line of Clause No. 28, the words "at hard labor" are deleted.

g. Clause No. 32.—The following is added as Clause No. 32 of the General Provisions:

**"32. AFFIRMATIVE ACTION FOR
DISABLED VETERANS AND
VETERANS OF THE VIETNAM
ERA**

"(This clause is applicable pursuant to 41 CFR 60-250.)

"(a) The Contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam Era in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam Era without discrimination based upon their disability or veterans status in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

"(b) The Contractor agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract and including those occurring at an establishment of the Contractor other than the one wherein the contract is being performed but excluding those of independently operated corporate affiliates, shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The Contractor further agrees to provide such reports to such local office regarding employment openings and hires as may be required.

"State and local government agencies holding Federal contracts of \$10,000 or more shall also list all their suitable openings with the appropriate office of the State

employment service, but are not required to provide those reports set forth in Paragraphs (d) and (e).

"(c) Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and nonveterans. The listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing herein is intended to relieve the Contractor from any requirements in Executive Orders or regulations regarding nondiscrimination in employment.

"(d) The reports required by Paragraph (b) of this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or, where the Contractor has more than one hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location (1) the number of individuals hired during the reporting period, (2) the number of nondisabled veterans of the Vietnam Era hired, (3) the number of disabled veterans of the Vietnam Era hired, and (4) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 U.S.C. 1787. The Contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made on this contract identifying data for each hiring location. The Contractor shall maintain at each hiring location copies of the reports submitted until the expiration of 1 year after final payment under the contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the Contracting Officer or of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment, and placement.

"(e) Whenever the Contractor becomes contractually bound to the listing provisions of this clause, he shall advise the employment service system in each State where he has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these provisions and has so advised the State system, there is no need to advise the State system of subsequent contracts. The Contractor may advise the State system when he is no longer bound by this contract clause.

"(f) This clause does not apply to the listing of employment openings which occur and are filled outside of the 50 States, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands.

"(g) The provisions of Paragraphs (b), (c), (d), and (e) of this clause do not apply to openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of his

own organization or employer-union arrangement for that opening.

"(h) As used in this clause:

"(1) 'All suitable employment openings' includes, but is not limited to, openings which occur in the following job categories: Production and nonproduction; plant and office; laborers and mechanics; supervisory and nonsupervisory; technical; and executive, administrative, and professional openings as are compensated on a salary basis of less than \$25,000 per year. This term includes full-time employment, temporary employment of more than 3 days duration, and part-time employment. It does not include openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement nor openings in an educational institution which are restricted to students of that institution. Under the most compelling circumstances, an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

"(2) 'Appropriate office of the State employment service system' means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.

"(3) 'Openings which the Contractor proposes to fill from within his own organization' means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and the parent companies), and includes any openings which the Contractor proposes to fill from regularly established 'recall' lists.

"(4) 'Openings which the Contractor proposes to fill pursuant to a customary and traditional employer-union hiring arrangement' means employment openings which the Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Contractor and representatives of his employees.

"(i) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

"(j) In the event of the Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

"(k) The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the Contracting Officer. Such notice shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam Era for employment, and the rights of applicants and employees.

"(l) The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Vietnam Era Veterans Readjustment Assistance Act, and is committed to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam Era.

"(m) The Contractor will include the provisions of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance."

h. Clause No. 33.—The following is added as Clause No. 33 of the General Provisions:

"33. EMPLOYMENT OF THE HANDICAPPED

"(a) The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training including apprenticeship.

"(b) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Rehabilitation Act of 1973, as amended.

"(c) In the event of the Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

"(d) The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, Office of Federal Contract Compliance Programs, Department of

Labor, provided by or through the contracting officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

"(e) The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

"(f) The Contractor will include the provisions of this clause in every subcontract or purchase order of \$2,500 or more unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director, Office of Federal Contract Compliance Programs, may direct to enforce such provisions, including action for noncompliance."

i. Clause No. 34.—The following is added as Clause No. 34 of the General Provisions:

"34. CLEAN AIR AND WATER

"(Applicable only if the contract exceeds \$100,000 or the Contracting Officer has determined that the orders under an indefinite quantity contract in any one year will exceed \$100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or the contract is not otherwise exempt.)

"(a) The Contractor agrees as follows:

"(1) To comply with all the requirements of Section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Public Law 91-604) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq., as amended by Public Law 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in Section 114 and Section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this contract.

"(2) That no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing.

"(3) To use his best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed.

"(4) To insert the substance of the provisions of this clause in any nonexempt subcontract, including this Paragraph (a)(4).

"(b) The terms used in this clause have the following meanings:

"(1) The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Public Law 91-604).

"(2) The term "Water Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Public Law 92-500).

"(3) The term "clean air standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order No. 11738, an applicable implementation plan as described in Section 110(d) of the Clean Air Act (42 U.S.C. 1857c-5(d)), an approved implementation procedure or plan under Section 111(c) or Section 111(d), respectively, of the Air Act (42 U.S.C. 1857c-6(c) or (d)), or an approved implementation procedure under Section 112(d) of the Air Act (42 U.S.C. 1857c-7(d)).

"(4) The term "clean water standards" means any enforceable limitation, control, condition, prohibition, standard, or other requirement which is promulgated pursuant to the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a state under an approved program, as authorized by Section 402 of the Water Act (33 U.S.C. 1342), or by a local government to ensure compliance with pretreatment regulations as required by Section 307 of the Water Act (33 U.S.C. 1317).

"(5) The term "compliance" means compliance with clean air or water standards. Compliance shall also mean compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency, or an air or water pollution control agency in accordance with the requirements of the Air Act or Water Act and regulations issued pursuant thereto.

"(6) The term "facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by a contractor or subcontractor, to be utilized in the performance of a contract or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location or site shall be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area."

ADDITIONAL SUPPLEMENT TO GENERAL PROVISIONS
(Standard Form 23-A, April 1975 Edition)

a. Clause No. 6.—Clause No. 6 of the General Provisions is deleted in its entirety and the following is substituted therefor:

"6. DISPUTES CLAUSE:

"(a) This contract is subject to the Contract Disputes Act of 1978 (Public Law 95-563).

"(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved in accordance with this clause.

"(c)(i) As used herein, 'claim' means a written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of contract terms, or other relief, arising under or relating to this contract.

"(ii) A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim for the purposes of the Act. However, where such submission is subsequently not acted upon in a reasonable time, or disputed either as to liability or amount, it may be converted to a claim pursuant to the Act.

"(iii) A claim by the contractor shall be made in writing and submitted to the contracting officer for decision. A claim by the Government against the contractor shall be subject to a decision by the contracting officer.

"(d) For contractor claims of more than \$50,000, the contractor shall submit with the claim a certification that the claim is made in good faith; the supporting data are accurate and complete to the best of the contractor's knowledge and belief; and the amount requested accurately reflects the contract adjustment for which the contractor believes the Government is liable. The certification shall be executed by the contractor if an individual. When the contractor is not an individual, the certification shall be executed by a senior company official in charge at the contractor's plant or location involved, or by an officer or general partner of the contractor

having overall responsibility for the conduct of the contractor's affairs.

"(e) For contractor claims of \$50,000 or less, the contracting officer must render a decision within 60 days. For contractor claims in excess of \$50,000, the contracting officer must decide the claim within 60 days or notify the contractor of the date when the decision will be made.

"(f) The contracting officer's decision shall be final unless the contractor appeals or files a suit as provided in the Act.

"(g) The authority of the contracting officer under the Act does not extend to claims or disputes which by statute or regulation other agencies are expressly authorized to decide.

"(h) Interest on the amount found due on a contractor claim shall be paid from the date the claim is received by the contracting officer until the date of payment.

"(i) Except as the parties may otherwise agree, pending final resolution of a claim by the contractor arising under the contract, the contractor shall proceed diligently with the performance of the contract in accordance with the contracting officer's decision."

b. Clause No. 7.—Paragraph 7.(e) of the General Provisions is redesignated as paragraph 7.(f) and the following is added as paragraph 7.(e):

"(e) If Miller Act (40 U.S.C. 270a-270e) performance or payment bonds are required under this contract, the Government shall pay to the contractor the total premiums paid by the contractor to obtain the bonds. This payment shall be paid at one time to the contractor together with the first progress payment otherwise due after the contractor has (1) furnished the bonds (including coinsurance and reinsurance agreements, when applicable), (2) furnished evidence of full payment to the surety company, and (3) submitted a request for such payment. The payment by the Government of the bond premiums to the contractor shall not be made as increments of the individual progress

payments and shall not be in addition to the contract price."

c. Clause No. 19.—Clause No. 19 of the General Provisions is deleted in its entirety.

d. Clause No. 25.—Clause No. 25 of the General Provisions is deleted in its entirety and the following is substituted therefor:

"25. EQUAL OPPORTUNITY

"(The following clause is applicable unless this contract is exempt under the rules, regulations, and relevant orders of the Secretary of Labor (41 CFR, ch. 60).)

"During the performance of this contract, the contractor agrees as follows:

"(a) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

"(b) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without discrimination because of race, color, religion, sex, or national origin.

"(c) The contractor will send to each labor union or representative of workers, with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the contracting officer, advising the said labor union or workers' representative

of the contractor's commitments under section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

"(d) The contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

"(e) The contractor will furnish all information and reports required by said amended Executive Order and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the contracting officer and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

"(f) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the such rules, regulations, or orders, this contract may be canceled, terminated, or suspended, in whole or in part, and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in said amended Executive Order, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

"(g) The contractor will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of said amended Executive Order, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to

enter into such litigation to protect the interests of the United States.

"Note: Equal Employment Opportunity provisions are directed by Executive Order No. 11246 of September 24, 1965 (3 CFR page 167, 1965 Supplement), as amended by Executive Order No. 11375 of October 13, 1967 (3 CFR page 320, 1967 Compilation) and Executive Order No. 12086 of October 5, 1978."

e. Clauses No. 29 and 30.—Clauses No. 29 and 30 of the General Provisions are deleted in their entirety and the following clause No. 29 is substituted therefor:

**"29. UTILIZATION OF SMALL
BUSINESS CONCERNS AND
SMALL BUSINESS CONCERNS
OWNED AND CONTROLLED
BY SOCIALLY AND
ECONOMICALLY DISADVAN-
TAGED INDIVIDUALS**

"The following clause is applicable if the contract is over \$10,000 except (1) contracts for services which are personal in nature and (2) contracts which will be performed entirely (including all subcontracts) outside any State, territory, or possession of the United States, the District of Columbia, or the Commonwealth of Puerto Rico: Subcontracting plans are not required of small business concerns.

"(a) It is the policy of the United States that small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals shall have the maximum practicable opportunity to participate in the performance of contracts let by any Federal agency.

"(b) The contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with the efficient performance of this contract. The contractor further agrees to cooperate in any studies or surveys that may be conducted by the Small Business Administration or the contracting agency which may be necessary to determine the extent of the contractor's compliance with this clause.

"(c)(1) As used in this contract, the term 'small business concern' shall mean a small business as defined pursuant to section 3 of the Small Business Act and in relevant regulations promulgated pursuant thereto.

"(2) The term 'small business concern owned and controlled by socially and economically disadvantaged individuals' shall mean a small business concern—

"(i) which is at least 51 per centum owned by one or more socially and economically disadvantaged individuals; or in the case of any publicly owned business, at least 51 per centum of the stock of which is owned by one or more socially and economically disadvantaged individuals; and

"(ii) whose management and daily business operations are controlled by one or more of such individuals.

"The contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, and other minorities, or any other individual found to be disadvantaged by the Small Business Administration pursuant to section 8(a) of the Small Business Act.

"(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern or a small business concern owned and controlled by socially and economically disadvantaged individuals."

f. Clause No. 35.—The following is added as clause No. 35 of the General Provisions:

**"35. UTILIZATION OF WOMEN-
OWNED BUSINESS CONCERNS
(Over \$10,000)**

"The following clause is applicable if the contract is over \$10,000 except (i) contracts which, including all subcontracts thereunder, are to be performed entirely outside the United States, its possessions, Puerto Rico, and the Trust Territory of the Pacific Islands and (ii) contracts for services which are personal in nature.

"(a) It is the policy of the United States Government that women-owned businesses shall have the maximum practicable opportunity to participate in the performance of contracts awarded by any Federal agency.

"(b) The contractor agrees to use his best efforts to carry out this policy in the award of subcontracts to the fullest extent consistent with the efficient performance of this contract. As used in this contract, a 'woman-owned business' concern means a business that is at least 51 percent owned by a woman or women who also control and operate it. 'Control' in this context means exercising the power to make policy decisions. 'Operate' in this context means being actively involved in the day-to-day management. 'Women' mean all women business owners."

LABOR STANDARDS PROVISIONS
Applicable to Contracts in Excess of \$2,000

1. DAVIS-BACON ACT (40 U.S.C. 276a-276a-7)

(a) All mechanics and laborers employed or working directly upon the site of the work shall be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Copeland Regulations, 29 CFR Part 3), the full amounts due at time of payment computed at wage rates not less than the aggregate of the basic hourly rates and the rates of payments, contributions, or costs for any fringe benefits contained in the wage determination decision of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor or subcontractor and such laborers and mechanics. A copy of such wage determination decision shall be kept posted by the Contractor at the site of the work in a prominent place where it can be easily seen by the workers. The term "mechanics and laborers" shall be deemed to include apprentices and trainees not covered by an approved program as provided by the Apprentices and Trainees clause of this contract.

(b) The Contractor may discharge his obligation under this clause to workers in any classification for which the wage determination decision contains:

(1) Only a basic hourly rate of pay, by making payment at not less than such basic hourly rate, except as otherwise provided in the Copeland Regulations (29 CFR Part 3); or

(2) Both a basic hourly rate of pay and fringe benefits payments, by making payment in cash, by irrevocably making contributions pursuant to a fund, plan, or program for, and/or by assuming an enforceable commitment to bear the cost of, bona fide fringe benefits contemplated by the Davis-Bacon Act, or by any combination thereof. Contributions made, or costs assumed, on other than a weekly basis shall be considered as having been constructively made or assumed during a weekly period to the extent that they apply to such period. Where a fringe benefit is expressed in a wage determination in any manner other than as an hourly rate and the Contractor pays a cash equivalent or provides an alternative fringe benefit, he shall furnish information with his payrolls showing how he determined that the cost incurred to make the cash payment or to provide the alternative fringe benefit is equal to the cost of the wage determination fringe benefit. In any case where the Contractor provides a fringe benefit different from any contained in the wage determination, he shall similarly show how he arrived at the hourly rate shown therefor. In the event of disagreement between or among the interested parties as to an equivalent of any fringe benefit, the Contracting Officer shall submit the question, together with his recommendation, to the Secretary of Labor for final determination.

(c) The assumption of an enforceable commitment to bear the cost of fringe benefits, or the provision of any fringe benefits not expressly listed in section 1(b)(2) of the Davis-Bacon Act or in the wage determination decision forming a part of the contract, may be considered as payment of wages only with the approval of the Secretary of Labor pursuant to a written request by the Contractor. The Secretary of Labor may require the Contractor to set aside assets, in a separate account, to meet his obligations under any unfunded plan or program.

(d) The Contracting Officer shall require that any class of laborers or mechanics, including apprentices and trainees, which is not listed in the wage determination decision and which is to be employed under the contract shall be classified or reclassified conformably to the wage determination decision, and shall report the action taken to the Secretary of Labor. If the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers or mechanics, including apprentices and trainees to be used, the Contracting Officer shall submit the question, together with his recommendation, to the Secretary of Labor for final determination. Apprentices and trainees may be added under this clause only where they are employed pursuant to an apprenticeship or trainee program meeting the requirements of the Apprentices and Trainees clause below.

(e) In the event it is found by the Contracting Officer that any laborer or mechanic, including apprentices and trainees, employed by the Contractor or any subcontractor directly on the site of the

work covered by this contract has been or is being paid at a rate of wages less than the rate of wages required by paragraph (a) of this clause, or by the Apprentices and Trainees clause of this contract, the Contracting Officer may (1) by written notice to the Government Prime Contractor terminate his right to proceed with the work, or such part of the work as to which there has been a failure to pay said required wages, and (2) prosecute the work to completion by contract or otherwise, whereupon such Contractor and his sureties shall be liable to the Government for any excess costs occasioned the Government thereby.

(f) Paragraphs (a) through (e) of the clause shall apply to this contract to the extent that it is (1) a prime contract with the Government subject to the Davis-Bacon Act, or (2) a subcontract also subject to the Davis-Bacon Act under such prime contract.

2. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT—OVERTIME COMPENSATION (40 U.S.C. 327-333).

This contract is subject to the Contract Work Hours and Safety Standards Act and to the applicable rules, regulations, and interpretations of the Secretary of Labor.

(a) The Contractor shall not require or permit any laborer or mechanic, including apprentices, trainees, watchmen, and guards, in any workweek in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek on work subject to the provisions of the Contract Work Hours and Safety Standards Act unless such laborer or mechanic, including apprentices, trainees, watchmen, and guards, receives compensation at a rate not less than 1½ times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this clause, shall be the amount paid per hour exclusive of the Contractor's contribution or cost for fringe benefits, and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

(b) In the event of any violation of the provisions of paragraph (a), the Contractor shall be liable to any affected employee for any amounts due, and to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including an apprentice, trainee, watchman, or guard, employed in violation of the provisions of paragraph (a) in the sum of \$10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by paragraph (a).

3. APPRENTICES AND TRAINEES

(a) Apprentices shall be permitted to work at less than the predetermined rate for the work they performed (1) when they are employed and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or (2) if a person is employed in his first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen in any craft classification shall not be greater than the ratio permitted to the contractor as to his entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not a trainee as defined in paragraph (b) of this clause or who is not registered or otherwise employed as stated above, shall be paid the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The Contractor or subcontractor shall furnish to the Contracting Officer written evidence of the registration of his

program and apprentices as well as the appropriate ratios and wage rates (expressed in percentages of the journeymen hourly rates) for the area of construction, prior to using any apprentices on the contract work. The wage rate paid apprentices shall be not less than the appropriate percentage of the journeymen's rate contained in the applicable wage determination.

(b) Trainees shall be permitted to work at less than the predetermined rate for the work performed when they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification, by the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training. The term "trainee" means a person registered and receiving on-the-job training in a construction occupation under a program which has been approved in advance by the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, as meeting its standards for on-the-job training programs and which has been so certified by the Bureau. The ratio of trainees to journeymen on this contract shall not be greater than the ratio permitted under the plan approved by the Bureau of Apprenticeship and Training. Every trainee must be paid at not less than the rate specified in the approved program for his level of progress. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Bureau of Apprenticeship and Training shall be paid not less than the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The Contractor or subcontractor shall furnish the Contracting Officer written evidence of the certification of his program, the registration of the trainees, and the ratios and wage rates prescribed in that program. In the event the Bureau of Apprenticeship and Training withdraws approval of a training program, the Contractor shall no longer utilize trainees at less than the applicable predetermined rate for work performed until an acceptable program is approved.

(c) The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of this contract.

(d) If at any time the Bureau of Apprenticeship and Training determines, after opportunity for a hearing, that the standards of a training program have not been complied with, or that such a program fails to provide adequate training for participants, the Contractor shall not utilize trainees at less than the predetermined rate for the classification of work actually performed until an acceptable program is approved. If the Contractor brings an appeal pursuant to 29 CFR 5.17 within 30 days of his receipt of a certified letter withdrawing the Bureau of Apprenticeship and Training's approval, the effect of the withdrawal of approval of the program will be delayed until a decision is rendered on the appeal pursuant to 29 CFR 5.17.

4. PAYROLLS AND BASIC RECORDS

(a) The Contractor shall maintain payrolls and basic records relating thereto during the course of the work and shall preserve them for a period of 3 years thereafter for all laborers and mechanics, including apprentices, trainees, watchmen, and guards working at the site of the work. Such records shall contain the name and address of each such employee, his correct classification, rate of pay (including rates of contributing for or costs assumed to provide, fringe benefits), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Contractor has obtained approval from the Secretary of Labor as provided in paragraph (c) of the clause entitled "Davis-Bacon Act", he shall maintain records which show the commitment, its approval, written communication of the plan or program to the laborers or mechanics affected, and the costs anticipated or incurred under the plan or program.

(b) The Contractor shall submit weekly a copy of all payrolls to the Contracting Officer. The Government Prime Contractor shall be responsible for the submission of copies of payrolls of all subcontractors. The copy shall be accompanied by a statement signed by the Contractor indicating that the payrolls are correct and complete, that the wage rates contained therein are not less than those determined by the Secretary of Labor, and that the classifications set forth for each laborer or mechanic, including

apprentices and trainees conform with the work he performed. Submission of the "Weekly Statement of Compliance" required under this contract and the Copeland Regulations of the Secretary of Labor (29 CFR Part 3) shall satisfy the requirement for submission of the above statement. The Contractor shall submit also a copy of any approval by the Secretary of Labor with respect to fringe benefits which is required by paragraph (c) of the clause entitled "Davis-Bacon Act". Contractors employing apprentices or trainees under approved programs shall include a notation of the first weekly certified payrolls submitted to the contracting agencies that their employment is pursuant to an approved program and shall identify the program.

(c) The Contractor shall make the records required under this clause available for inspection by authorized representatives of the Contracting Officer and the Department of Labor, and shall permit such representatives to interview employees during working hours on the job.

NOTE: Watchmen and guards appear on payroll records only for purposes of the Contract Work Hours and Safety Standards Act.

5. COMPLIANCE WITH COPELAND REGULATIONS

The Contractor shall comply with the Copeland Regulations of the Secretary of Labor (29 CFR Part 3) which are incorporated herein by reference.

6. WITHHOLDING OF FUNDS

(a) The Contracting Officer may withhold or cause to be withheld from the Government Prime Contractor so much of the accrued payments or advances as may be considered necessary (1) to pay laborers and mechanics, including apprentices, trainees, watchmen, and guards employed by the Contractor or any subcontractor on the work the full amount of wages required by the contract, and (2) to satisfy any liability of the Contractor and any subcontractor for liquidated damages under paragraph (b) of the clause entitled "Contract Work Hours and Safety Standards Act—Overtime Compensation."

(b) If the Contractor or any subcontractor fails to pay any laborer, mechanic, apprentice, trainee, watchman, or guard employed or working on the site of work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Government Prime Contractor, take such action as may be necessary to cause suspension of any further payments or advances until such violations have ceased.

7. SUBCONTRACTS

The Contractor agrees to insert the clauses hereof entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act—Overtime Compensation," "Apprentices and Trainees," "Payrolls and Basic Records," "Compliance with Copeland Regulations," "Withholding of Funds," "Subcontracts," and "Contract Termination—Debarment" in all subcontracts. The term "Contractor" as used in such clauses in any subcontract shall be deemed to refer to the subcontractor except in the phrase "Government Prime Contractor."

8. CONTRACT TERMINATION—DEBARMENT

A breach of the clauses hereof entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act—Overtime Compensation," "Apprentices and Trainees," "Payrolls and Basic Records," "Compliance with Copeland Regulations," "Withholding of Funds," and "Subcontracts" may be grounds for termination of the contract, and for debarment as provided in 29 CFR 5.6.

9. DISPUTES CONCERNING LABOR STANDARDS

Disputes arising out of the labor standards provisions of this contract shall be subject to the Disputes clause except to the extent such disputes involve the meaning of classifications or wage rates contained in the wage determination decisions of the Secretary of Labor or the applicability of the labor provisions of this contract which questions shall be referred to the Secretary of Labor in accordance with the procedures of the Department of Labor.

SPECIFICATIONS

DIVISION 1—GENERAL REQUIREMENTS

SECTION 1.1—GENERAL CONDITIONS

1.1.1 BONDS

a. Bid guarantee.—For bids which exceed \$25,000, the bidder shall furnish guarantee with each bid in an amount not less than 20 percent of the amount of the bid: Provided, That guarantee in excess of \$3,000,000 will not be required. (See Standard Form 22, Instructions to Bidders.)

b. Performance and payment bonds.—For contracts which exceed \$25,000, the contractor shall furnish to the Government bonds as follows:

(1) Performance bond.—Performance bond with a surety or sureties approved by the contracting officer, and with a penal amount equal to 100 percent of the contract price at the time of award.

(2) Payment bond.—Payment bond with a surety or sureties approved by the contracting officer, for the protection of all persons supplying labor and material in the prosecution of the work provided for in the contract, for the use of each such person. Whenever the contract price at the time of award is not more than \$1,000,000, the payment bond shall be in the sum of one-half of the contract price at the time of award. Whenever the total amount of the contract price at the time of award is more than \$1,000,000 and not more than \$5,000,000, the payment bond shall be in the sum of 40 percent of the contract price at the time of award. Whenever the contract price at the time of award is more than \$5,000,000, the payment bond shall be in the sum of \$2,500,000.

(3) Costs.—All costs of furnishing performance and payment bonds shall be included in the lump-sum price bid in the schedule for mobilization and preparatory work.

c. Requirements for execution of surety bonds.—Each surety company bond (bid, performance, payment), which purports to have been executed by an agent or attorney-in-fact for the corporate surety, is required to have submitted with it a power of attorney to the signatory agent or attorney-in-fact, and executed by the corporate surety upon a

date reasonably proximate to the date of the bond, or the power of attorney shall be accompanied by a certification of the surety to the effect that the power of attorney was in full force and effect upon a date reasonably proximate to the date of the bond.

1.1.2 NOTICE TO SUBCONTRACTORS REGARDING PAYMENT BONDS (1980 Dec)

a. The prime contractor's payment bond furnished to the Government pursuant to the Miller Act (40 U.S.C. 270a-f) provision of the prime contract does not cover all persons (as defined in 40 U.S.C. 270d) who supply either labor or material in the prosecution of the work provided for in this contract. Generally, the prime contractor's payment bond covers (1) persons who supply either labor or material directly to the prime contractor, and (2) persons who supply labor or material directly to a subcontractor who has a direct contractual relationship with the prime contractor; provided, however, that proper and sufficient written notice of a claim, in accordance with the provisions of 40 U.S.C. 270b, is furnished by the latter persons to the prime contractor within 90 days from the final date on which the labor was performed or the material was supplied.

b. The prime contractor shall (1) insert the substance of this clause, including this subparagraph b., in each subcontract hereunder, and (2) require all subcontractors at any tier to insert the substance of this clause, including this subparagraph b., in each subcontract thereunder.

1.1.3 RIGHTS-OF-WAY

The Government will provide the right-of-way or the site for permanent works or installations, the site for borrow pits, channels, spoil banks, and ditches, and right-of-way for access thereto over routes established by the contracting officer. The contractor will be permitted to use such land for construction purposes, but any additional right-of-way or land desired by the contractor for construction purposes shall be provided by the contractor without expense to the Government.

1.1.4 SAFETY AND HEALTH

a. The contractor shall not require any laborer or mechanic employed in the performance of the contract to work under conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under construction safety and health standards promulgated by the Secretary of Labor under section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327), as amended, and "Construction Safety Standards," published by WPRS (Water and Power Resources Service).

b. The contractor shall fully comply with the WPRS "Construction Safety Standards" and amendments or revisions thereto in effect on the date bids are received. This handbook will be provided at no charge for use in connection with the specifications. Construction Safety and Health Standards promulgated by the Secretary of Labor may be obtained from any regional or area office of the Occupational Safety and Health Administration of the U.S. Department of Labor.

c. The contractor shall submit in writing a proposed safety program in the form and time intervals prescribed in section 2 of the Construction Safety Standards.

d. The contractor is responsible for being cognizant of and insuring compliance with the requirements set forth in subparagraphs a. and b. above. Such responsibility shall apply to both his operations and those of his subcontractors. When violations of the safety and health requirements contained in these specifications or standards referenced in subparagraph a. are called to his attention by the contracting officer or his authorized representatives, the contractor shall immediately correct the condition to which attention has been directed. Such notice either oral or written, when served on the contractor or his representative(s), shall be deemed sufficient.

e. In the event the contractor fails or refuses to promptly comply with the compliance directive issued under subparagraph d. above, the contracting officer or his authorized representative may issue an order to stop all or any part of the work. When satisfactory corrective action is taken, an order to resume work will be issued. The contractor shall not be entitled to any extension of time, nor to any claim for damage or to additional compensation

by reason of either the directive or the stop order. Failure of the contracting officer or his representative to order discontinuance of any or all of the contractor's operations shall not relieve the contractor of his responsibility for the safety of personnel and property.

f. The contractor shall maintain an accurate record of, and shall report to the contracting officer's authorized representative in the manner prescribed by the contracting officer, all cases of death, occupational diseases, or traumatic injury to employees or the public involved, and property damage in excess of \$2,500 incident to performance of work under this contract.

g. The contractor shall indemnify and hold the Government harmless for any and all losses, damages, or liability on account of personal injury, death, or property damage, or claims for personal injury, death, or property damage of any nature whatsoever and by whomsoever made, arising out of the activities of the contractor, his employees, subcontractor, or agents under the contract. Such indemnity shall include, but shall not be limited to, the failure of the contractor, his employees, subcontractors, or agents to comply with the safety and health provisions contained in these specifications.

h. The rights and remedies of the Government provided in this paragraph are in addition to any other rights and remedies provided by law or under this contract.

i. In the event there is a conflict between the requirements contained in WPRS "Construction Safety Standards," specifications paragraphs, contractor's approved safety program, referenced safety and health codes and standards, or the U.S. Department of Labor construction safety and health standards, promulgated under section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.), as amended, the more stringent requirement will prevail.

1.1.5 DOCUMENTATION OF DISAGREEMENTS

If the contractor disagrees with any direction, instruction, interpretation, or determination of the contracting officer, his authorized representative, or an inspector, he shall immediately ask, in writing, for a written decision from the contracting officer or his

authorized representative. Upon receipt of the decision, the contractor shall proceed without delay to comply therewith. Directions, instructions, interpretations, or determinations of the contracting officer or his authorized representative relating to drawings, samples, and literature shall be subject to the provisions of this paragraph.

1.1.6 INSPECTION AND TESTS
BY GOVERNMENT

In addition to tests specifically outlined in these specifications, the Government reserves the right to inspect and test materials, equipment, and workmanship during the life of the contract in accordance with clause No. 10 of the General Provisions. The contractor shall cooperate with the contracting officer in arrangements for such inspections and tests so that they may be made without unnecessarily delaying the work or endangering personnel.

SECTION 1.2-SPECIAL CONDITIONS**1.2.1 THE REQUIREMENT**

It is required that there be constructed and completed, in accordance with the Construction Contract (Standard Form 23), including the General Provisions (Standard Form 23A), Labor Standards Provisions (Standard Form 19A), these specifications, and the drawings listed in paragraph 9.1.3 hereof, Salt-Gila Aqueduct, Reach 1A, Salt-Gila Division, Arizona; and Granite Reef Aqueduct, Reach 12 Completion, Granite Reef Division, Arizona; Central Arizona Project.

The work is situated in Maricopa County, approximately 25 miles east of Phoenix, Arizona.

1.2.2 DESCRIPTION OF THE WORK

The principal components of the work to be performed under these specifications include the following:

a. Canal.—Earthwork for and construction of about 5.61 miles of unreinforced concrete lining and about 0.37 mile of reinforced concrete lining for Salt-Gila Aqueduct, and about 0.67 mile of reinforced concrete lining for reach 12 completion. The capacity of 0.64 mile of aqueduct is 3,000 cubic feet per second. The capacity of 6.01 miles of aqueduct is 2,750 cubic feet per second. The aqueduct will have a bottom width of 24 feet and the side slopes will be 1-1/2:1. Cuts will vary from 0 to about 38 feet.

b. Structures.—Earthwork and construction of the following structures along the aqueduct:

- (1) Five bridges with precast prestressed concrete beams.
- (2) One overchute pier.
- (3) Two floatwells.

c. Roadwork.—Roadwork as follows:

- (1) Construction of bridge approaches.
- (2) Construction of ramps from the canal O&M roads to the bridge approaches.
- (3) Furnishing and installing guardrails.

d. Furnishing and installing chain link fence including grounding equipment.

1.2.3 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK

a. Completion period.—The contractor shall begin work within 30 calendar days after date of receipt of notice to proceed, and shall complete all of the work within 730 calendar days from the date of receipt of such notice: Provided, That the period allowed for the completion of the work, shall be reduced by 1 calendar day for each calendar day in excess of 10 calendar days, or any extension thereof, elapsing between the contractor's receipt of and return of properly executed contract, and performance and payment bonds as required in the Bid Form (Standard Form 21).

The drawings and data required to be submitted for approval under these specifications are described in paragraphs 5.2.3, 5.3.13, 7.1.2, and 7.1.3. Except as otherwise provided in these specifications for specific submittals, the contracting officer will require 40 calendar days for review of drawings or data submitted by the contractor for approval, and this review time will apply to each separate submittal or resubmittal whether the drawings or data are approved, not approved, or returned for revision. If the contracting officer uses time in excess of the above-stated number of days for review of any submittal or resubmittal, the excess time will be added to the time allowed the contractor for completion of the work affected by such excess time: Provided, That if the review of two or more separate submittals or resubmittals is late and results in concurrent days of excess time, such days will be counted only once in computing an extension of the completion date. The excess time added to the time allowed the contractor for completion of the work affected by such excess time shall be the contractor's sole remedy for any excess time used by the contracting officer for review of drawings and data submittals. The number of calendar days required for review of drawings or data submitted or resubmitted for approval will include the date the drawings or data are received by the contracting officer and will extend through the date of return mailing to the contractor.

b. Prosecution of the work.—The capacity of the contractor's construction plant, sequence of operations, method of operation, and the forces employed shall, at all times during the continuance of the contract, be subject to the

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approval of the contracting officer and shall be such as to insure the completion of the work within the specified period of time.

c. Priorities.—If performance under these specifications is delayed by operations of any United States national priorities or material allocation system, the time for performance will be extended to compensate for such delays.

changes or adjustments of wage rates or fringe benefits. No increase in the contract price will be allowed or authorized on account of the payment of wage rates or fringe benefits in excess of those listed herein.

The classifications, wage rates, and fringe benefits will be furnished by supplemental notice before bids are opened.

1.2.4 LIQUIDATED DAMAGES

In case of failure on the part of the contractor to complete the work within the time fixed in the contract or any extensions thereof, the contractor shall pay to the Government as fixed, agreed, and liquidated damages, pursuant to the clause of this contract entitled "Termination for Default—Damages for Delay—Time Extensions," the sum of \$1,000 for each calendar day of delay in completion of the work.

1.2.5 RATES OF WAGES

Pursuant to the provisions of the Davis-Bacon Act, 40 U.S.C. 276(a), as amended, the Secretary of Labor has determined that rates of wages and fringe benefits listed in this paragraph are those prevailing for the classifications specified in the locality of the work covered by these specifications and said rates of wages and fringe benefits shall be the minimum rates per hour to be paid for the work covered by these specifications.

Fringe benefit payments include contributions, except those required by Federal, State, or local law, which the contractor makes irrevocably to a trustee or a third party pursuant to any fund, plan, or program to provide for medical or hospital care, compensation for injuries or illness resulting from occupational activity, unemployment benefits, life insurance, disability and sickness insurance, accident insurance (all designated as health and welfare), pensions, vacation and holiday pay, apprenticeship, or other similar programs, and other bona fide fringe benefits.

While the wage rates and fringe benefits shown are the minimum rates required by these specifications to be paid during the life of the contract, it is the responsibility of bidders to inform themselves as to local labor conditions such as the length of workday or workweek, overtime compensation, fringe benefit contributions, labor supply, and prospective

1.2.6 CONSTRUCTION PROGRAM

a. General.—Within 45 calendar days after date of receipt of notice to proceed, the contractor shall submit to the Construction Engineer for information a complete and practicable construction program. The construction program shall show in detail his proposed program of operations and shall provide for orderly performance of the work.

The construction program shall be in such form and detail as to show the following:

- (1) Sequence of operations.
- (2) The dates for commencing and completing the work on the several controlling features of the project including erection of construction plant and each item or group of like items involving placement of concrete, if applicable.
- (3) The dates of issuance of orders for procurement of contractor-furnished materials and equipment and their delivery and installation dates.
- (4) The leadtimes required for any Government-furnished construction drawings for each feature detailed by the contractor in (2) above. Leadtimes greater than 75 days shall be justified.
- (5) The dates on which contractor-prepared drawings will be submitted for approval including all shop drawings as required in these specifications.

The construction program shall be in suitable form and show the percentage of work for each line item scheduled for completion each month, and shall include the contractor's estimate of earnings by months.

b. Submittal requirements.—An original or translucent reproducible and three blackline prints of each construction program and each revised program shall be submitted. Originals or reproducibles shall be of such quality as to permit clear, sharp, legible prints to be made by direct-contact methods.

The contractor shall revise the construction program as necessary to keep it current and shall enter on the program the actual progress at the end of each progress payment period or at such other intervals as directed by the contracting officer, and shall submit two such

marked prints of the program to the Construction Engineer.

Timely submittal of the construction program and timely revisions thereto are important. The Government must have the information contained in the construction program for such purposes as scheduling the preparation of additional drawings required for construction and scheduling services of inspectors and survey crews.

If the contractor elects to program the work by the CPM (Critical Path Method), or by a similar type of network analysis system, he shall submit such program and revised programs as required in lieu of the program specified above. Such CPM program shall include all information required above. The contractor shall submit translucent reproducibles of the network diagram and of printout or computation sheets for such construction program. Reproducibles shall be of such quality as to permit clear, sharp, legible prints to be made by direct-contact methods. If requested, the contractor shall also furnish a printout of the computer data.

The construction program shall be submitted to the Construction Engineer, Water and Power Resources Service, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073.

c. Cost.—The cost of all work required by this paragraph shall be included in the prices bid in the schedule for other items of work.

1.2.7 USE OF CONSTRUCTION FACILITIES

Work at or in the vicinity of the worksite may be performed by the Government or by other contractors engaged in work for the Government during the contract period. The contractor shall, without charge, permit the Government and such other contractors to use the roads, bridges, lighting installation, and any other facilities constructed or acquired by the contractor for use in the performance of the work under these specifications as are available without entailing any material increase in cost to the contractor for maintenance or operation of such facilities.

1.2.8 OTHER CONTRACTS

During the progress of the work under these specifications, additional work may be

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performed concurrently by other contractors and the Government in the vicinity of the Salt-Gila Pumping Plant between Granite Reef Aqueduct stations 821+18.17 and 832+25. The Salt-Gila Pumping Plant contractor, under specifications 3D-C7448, is required to perform all canal earthwork for the aqueduct between Granite Reef Aqueduct-reach 12 completion station 787+27.21 Ah. and Salt-Gila Aqueduct station 20+00. The canal earthwork must be finished before the contractor under these specifications can begin preparing foundations for concrete lining and placing reinforced concrete lining between the stations stated above. The contractor under these specifications shall cooperate fully with such other contractors and with Government employees and carefully fit his own work to such other work as may be directed by the contracting officer.

The contractor shall not commit or permit any act to be committed which will interfere with the performance of work by any other contractor or by Government employees. Where working space is limited, use of working space will be subject to the approval of the contracting officer.

1.2.9 STAKING OUT WORK

a. Government.—The Government will establish the primary control for lines and grades required for the work consisting of bench marks and reference points. Reference points will be brass caps set at approximately 1,000-foot intervals and at bearing changes on the right-of-way line along the right side of the canal and near all major structures.

The Government will endeavor to locate the primary control system so that the points will not be subject to damage or destruction during construction operations. However, should it become apparent to the contractor that any primary control point is in the way of his activities, he shall notify the contracting officer immediately in order that the point may be moved. In case of damage to or destruction of any of the Government's primary control points by the contractor's forces, they will be replaced by the Government at the contractor's expense. The actual cost to the Government of replacing primary control points will be deducted from payments due the contractor. Such actual cost will include a reasonable charge for use of Government supplies and equipment plus 15 percent overhead.

Complete information concerning the primary control system will be provided to the contractor immediately following receipt of notice to proceed.

The Government will also make original and final surveys and make computations to determine the final quantities of work and materials.

b. Contractor.—All survey work performed by the contractor shall be subject to field and office review by the contracting officer.

From the primary control points, the contractor shall lay out the work by establishing all lines and grades at the site necessary to control the work and shall be responsible for all measurements that may be required for the execution of the work to the location and limit marks prescribed in these specifications or on the drawings.

The contractor shall place and establish such additional horizontal and vertical control points, stakes, and markers as may be necessary for control and guidance of his construction operations.

The contractor shall furnish all materials, including stakes, spikes, steel pins, templates, platforms, equipment, tools, and other accessories, and perform all work as may be required in laying out any part of the work from the primary control points established by the Government. It shall be the responsibility of the contractor to maintain and preserve all stakes and other marks established by him until authorized to remove them.

All survey data shall be recorded and shall be available at all times during the progress of the work for examination by the contracting officer.

c. Cost.—The cost of all materials furnished by the contractor and all work performed by the contractor for layout of work and related work as herein required shall be included in the prices bid for the items of work for which the surveys are required.

1.2.10 PERFORMANCE AND SUPERVISION OF WORK BY CONTRACTOR

a. Performance of work.—The contractor shall perform on the site and with his own

organization and forces on his payroll, work equivalent to at least 30 percent of the total amount of construction work at the site. The cost of contractor-furnished material and equipment incorporated in the work shall not be included in computing the total amount of construction work at the site.

b. Supervision of work.—If the contractor does not give personal superintendence to the work at all times during its performance and until the work is completed and accepted, he shall provide a competent superintendent fully authorized to act in his behalf, as required under clause No. 11 of the General Provisions. The superintendent shall be an employee of the contractor and on the contractor's payroll. The superintendent shall give personal supervision to the work, including coordinating, directing, and expediting of all subcontracted work, until completion of all work under the contract. All directions given to such superintendent shall be considered as given to the contractor and shall be binding on the contractor.

1.2.11 WOMEN-OWNED BUSINESS CONCERNS SUBCONTRACTING PROGRAM

a. The contractor agrees to establish and conduct a program which will enable women-owned business concerns to be considered fairly as subcontractors and suppliers under this contract. In this connection, the contractor shall:

- (1) Designate a liaison officer who will administer the contractor's "Women-Owned Business Concerns Program."
- (2) Provide adequate and timely consideration of the potentialities of known women-owned business concerns in all "make-or-buy" decisions.
- (3) Develop a list of qualified bidders that are women-owned businesses and assure that known women-owned business concerns have an equitable opportunity to compete for subcontracts, particularly by making information on forthcoming opportunities available, by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation of women-owned business concerns.

(4) Maintain records showing (i) procedures which have been adopted to comply with the policies set forth in this paragraph, including the establishment of a source list of women-owned business concerns; (ii) awards to women-owned businesses on the source list by minority and nonminority women-owned business concerns; and (iii) specific efforts to identify and award contracts to women-owned business concerns.

(5) Include the "Utilization of Women-Owned Business Concerns" clause in subcontracts which offer substantial subcontracting opportunities.

(6) Cooperate in any studies and surveys of the contractor's women-owned business concerns procedures and practices that the contracting officer may from time-to-time conduct.

(7) Submit periodic reports of subcontracting to women-owned business concerns with respect to the records referred to in subparagraph (4) above, in such form and manner and at such time (not more often than quarterly) as the contracting officer may prescribe.

b. The contractor further agrees to insert, in any subcontract hereunder which may exceed \$500,000 for supply, or \$1,000,000 in the case of contracts for the construction of any public facility and which offers substantial subcontracting possibilities, provisions which shall conform substantially to the language of this paragraph, including this subparagraph b., and to notify the contracting officer of the names of such subcontractors.

c. The contractor further agrees to require written certification by its subcontractors that they are bona fide women-owned and controlled business concerns in accordance with the definition of a women-owned business concern as set forth in the Utilization of Women-Owned Business Concerns (Over \$10,000) Clause at the time of submission of bids or proposals.

1.2.12 PREFERENCE FOR UNITED STATES-FLAG AIR CARRIERS

a. Public Law 93-623 requires that all Federal agencies and Government

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contractors and subcontractors will use United States-flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available. It further provides that the Comptroller General of the United States shall disallow any expenditure from appropriated funds for international air transportation on other than a United States-flag air carrier in the absence of satisfactory proof of the necessity therefor.

b. The contractor agrees to utilize United States-flag air carriers for international air transportation of personnel (and their personal effects) or property to the extent service by such carriers is available.

c. In the event that the contractor selects a carrier other than a United States-flag air carrier for international air transportation, he will include a certification on vouchers involving such transportation which is essentially as follows:

Certification of Unavailability
of
United States-Flag Air Carriers

I hereby certify that transportation service for personnel (and their personal effects) or property by certificated air carrier was unavailable for the following reasons:
*(state reasons).

* See Federal Procurement Regulations (41 CFR 1-1.323-3).

d. The terms used in this paragraph have the following meanings:

(1) "International air transportation" means transportation of persons (and their personal effects) or property by air between a place in the United States and a place outside thereof or between two places both of which are outside the United States.

(2) "United States-flag air carrier" means one of a class of air carriers holding a certificate of public convenience and necessity issued by the Civil Aeronautics Board, approved by the President, authorizing operations between the United States and/or its territories and one or more foreign countries.

(3) The term "United States" includes the 50 States, Commonwealth of Puerto Rico, possessions of the United States, and the District of Columbia.

e. The contractor shall include the substance of this paragraph, including this subparagraph e., in each subcontract or purchase hereunder which may involve international air transportation.

1.2.13 USE OF UNITED STATES-FLAG
COMMERCIAL VESSELS

a. The Cargo Preference Act of 1954 (Public Law 664, August 26, 1954, 63 Stat. 832, 46 U.S.C. 1241(b)), requires that Federal departments or agencies shall transport at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) of equipment, materials, or commodities which may be transported on ocean vessels on privately owned United States-flag commercial vessels. Such transportation shall be accomplished whenever:

(1) Any equipment, materials, or commodities, within or outside the United States, which may be transported by ocean vessel, are:

(a) Procured, contracted for, or otherwise obtained for the agency's account; or

(b) Furnished to or for the account of any foreign nation without provision for reimbursement.

(2) Funds or credits are advanced or the convertibility of foreign currencies is guaranteed in connection with furnishing such equipment, materials, or commodities which may be transported by ocean vessel.

Note: This requirement does not apply to small purchases as defined in 41 CFR 1-3.6 or to cargoes carried in the vessels of the Panama Canal Co.

b. The contractor agrees as follows:

(1) To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved

whenever shipping any equipment, material, or commodities under the conditions set forth in subparagraph a. above pursuant to this contract to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.

Note: Guidance regarding fair and reasonable rates for United States-flag vessels may be obtained from the Division of National Cargo, Office of Market Development, Maritime Administration, Washington DC 20230: area code 202, phone 377-3449.

(2) To furnish, within 15 working days following the date of loading for shipments originating within the United States or within 25 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated "on-board" commercial ocean bill of lading in English for each shipment of cargo covered by the provisions in subparagraph a. above to both the contracting officer (through the prime contractor in the case of subcontractor bills of lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington DC 20230.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract, except for small purchases as defined in 41 CFR 1-3.6.

SECTION 1.3-PAYMENTS AND ADJUSTMENTS

1.3.1 FUNDS AVAILABLE FOR EARNINGS

Pursuant to section 12 of the Reclamation Project Act of 1939 (43 U.S.C., sec. 388), funds for earnings under this contract will be made available as provided in this paragraph.

a. The sum of \$1,500,000 has been reserved and is available for payments to the contractor to cover earnings during fiscal year 1981 under the schedule items, materials delivered to the site, and all other earnings which may be due under the contract, or any contract adjustments thereunder, including retained percentages and liquidated damages.

b. In future budgetary requests for funding this contract, it is anticipated that the rate of progress will be as follows:

	Percent of bid
Fiscal Year 1982	60
Fiscal Year 1983	Balance

The above information as to program estimates for future fiscal years is provided solely for informational purposes. The contractor is cautioned that any schedule of operations which contemplates a different rate of funding is his own responsibility. It is expressly understood that the Government does not represent that any or all of the funds covering these estimates will be appropriated by the Congress or will be reserved for earnings under this contract. The contractor hereby releases the Government from any and all liability due to the failure of the Congress to appropriate funds sufficient to cover payment in accordance with the above estimates, including any adjustments under clauses No. 3, "Changes"; 17, "Suspension of Work"; or 18, "Termination for Convenience of the Government," of the General Provisions, or an adjustment under any other provision of the contract. The contractor also releases the Government from any and all liability for damages for breach of contract as a result of the failure of the Congress to appropriate sufficient funds. Annual reservations of funds will be made in writing as provided elsewhere in this paragraph after the Congress acts on the Appropriation Act.

As to any work which may be done in excess of the amount for which funds have been reserved under the provisions of this paragraph, the liability of the United States is contingent upon the necessary appropriations being made therefor by the Congress and an appropriate reservation of funds thereunder. Further, the contractor hereby releases the Government from any and all liability due to the failure of the Congress to appropriate sufficient funds, or for delays in payments due to lack of funds, including any adjustments under clauses No. 3, "Changes"; 17, "Suspension of Work"; or 18, "Termination for Convenience of the Government," of the General Provisions, or an adjustment under any other provision of the contract. The contractor also releases the Government from any and all liability for damages for breach of

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contract as a result of the failure of the Congress to appropriate sufficient funds.

c. If at any time the contracting officer finds that the balance of this reservation is in excess of the estimated amount required to meet all payments due and to become due the contractor because of work performed or to be performed prior to the beginning of the next fiscal year, the right is reserved to reduce said reservation by the amount of such excess. The contractor will be notified in writing of any such reduction.

d. If the rate of progress of the work is such that the contracting officer finds that the balance of the reservation is less than the estimated amount required to meet all payments due and to become due because of work performed prior to the beginning of the next fiscal year, the Government may reserve additional funds for payments under this contract if there are funds available for such purpose. The contractor will be notified in writing of such additional reservation.

e. Should it become apparent to the contractor that existing fund reservations will be exhausted within the next 30 days, the contractor shall at that time give written notice thereof to the contracting officer. If additional funds can be made available, the contracting officer may issue an additional fund reservation as provided for in subparagraph d. hereof. It is expressly understood, however, that the Government has no obligation to provide funds in addition to those reserved in writing. The contractor is also cautioned that the prosecution of the work at a rate that will exhaust the funds reserved before the end of the fiscal year will be at his own risk. If additional funds cannot be made available, the contracting officer will give written notice thereof to the contractor. If at any time funds are being made available by appropriations for interim periods prior to the enactment of an Appropriation Act, the contractor will be so advised in writing in which case the other notice requirements of this subparagraph will not apply.

If the contractor so elects, he may continue work under the conditions and restrictions of the specifications after funds have been exhausted, so long as there are funds for inspection and supervision, concerning which he will be notified in writing. No payment will be made for any work done after funds have

been exhausted unless and until sufficient additional funds have been provided by the Congress. When funds again become available, the contractor will be notified in writing as to the amount thereof reserved for payments under this contract. The amount so reserved shall be subject to decrease or increase in a manner similar to that provided in subparagraphs c. and d. hereof. However, if the contractor so elects, the work may be suspended when the available funds have been exhausted. Should work be thus suspended, additional time for completion will be allowed equal to the period during which the work is necessarily so suspended. Such a suspension of work shall not be considered to be a suspension, delay, or interruption under the terms of clause No. 17, "Suspension of Work," of the General Provisions.

f. The procedure above described in this paragraph shall be repeated as often as necessary on account of exhaustion of available funds and the necessity of awaiting the appropriation of additional funds by Congress.

g. Should Congress fail to provide the expected additional funds during its regular session, the contract may, at the option of the contractor, by written notice, be terminated and considered to be completed without prejudice to him or liability to the Government at any time subsequent to 30 days after payments are discontinued, or subsequent to 30 days after passage of the act which would ordinarily carry an appropriation for continuing the work, or after adjournment of the Congress which failed to make the necessary appropriations. Such a termination shall not be considered to be a termination for convenience of the Government under the terms of clause No. 18, "Termination for Convenience of the Government," of the General Provisions.

1.3.2 PROGRESS PAYMENTS

a. General.—Payments will be made in accordance with clause No. 7 of the General Provisions and will be made within 30 calendar days after receipt by the Government of signed vouchers from the contractor on estimates approved by the contracting officer.

b. Retained percentages.—Pursuant to clause No. 7(c) of the General Provisions, when 25 percent of the work has been completed the

contracting officer will make his initial determination as to satisfactory progress and may then waive retainage from subsequent progress payments and may reduce the retainage to an amount equal to 2.5 percent of the total bid for all schedules of the contract as awarded. After 75 percent of all work originally contemplated has been completed, with satisfactory progress being maintained, the contracting officer may reduce the retainage to an amount equal to 1.5 percent of the total bid for all schedules of the contract as awarded, which amount may be further reduced after substantial completion of all work under the contract.

c. Payment for materials.—Estimates for progress payments, as provided in clause No. 7 of the General Provisions, will include items of materials delivered on the site which will become a part of the finished construction work and for which the contractor presents satisfactory evidence that he has acquired title to such materials. Invoices receipted by the supplier showing that payment in full has been made, or certificates from both the contractor and the supplier warranting that full title to the materials is vested in the contractor and that the materials are free of liens and encumbrances, will be accepted as satisfactory evidence that the contractor has acquired title to the materials. No consideration, however, will be given to individual purchases of less than \$300 for any one item. At the discretion of the contracting officer, progress payments may also include materials delivered to the contractor in whole or in part at locations other than the site, including his supplier's plant or plants, subject to the above provisions. Except as otherwise provided in paragraph 1.3.5, no consideration will be given to any other preparatory work done.

d. Payment for separate contract divisions.—Clause No. 7(c) of the General Provisions provides for payment without retention of a percentage on completion and acceptance of each separate building, public work, or other division of the contract on which the price is separately stated in the contract. Any separate building, public work, or other division of the contract which is intended to come under this provision of clause No. 7(c) will be specifically so identified elsewhere in the contract.

e. Release of claims.—After completion of work, and prior to final payment, the contractor shall furnish to the contracting officer, a release of claims against the United States arising out of the contract, other than claims specifically excepted from the operation of the release.

1.3.3 POSTING SECURITIES IN LIEU OF RETAINED PERCENTAGES

a. At his option the contractor may, subject to procedures prescribed by the contracting officer, deposit approved interest-bearing negotiable securities, with interest accruing to the contractor, in lieu of retained percentages contemplated in clause No. 7 of the General Provisions (Standard Form 23-A).

b. If the contractor elects to exercise his option, he shall notify the contracting officer, who will then provide him with a form of agreement to which he must subscribe and which will set forth the requirements deemed necessary to protect the interest of the Government to the same extent as would be the case if the option to post securities in lieu of retained percentages were not exercised. A copy of the notification letter shall be sent by the contractor to the Construction Engineer, Water and Power Resources Service, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073. The required forms of agreement are available for inspection by bidders at the office of the contracting officer.

c. The securities shall be deposited in escrow with an escrow agent approved by the contracting officer. The escrow agent shall be insured by the Federal Deposit Insurance Corporation.

1.3.4 QUANTITIES AND PRICES

a. General.—The quantities stated in the schedule are estimated quantities for comparison of bids, and except as provided in subparagraph b., no claim shall be made against the Government for excess or deficiency therein. Payment at the unit or lump-sum prices agreed upon will be in full for the completed work and will cover materials, supplies, transportation, labor, tools, machinery, and all expenditures incident to satisfactory compliance with the contract, unless otherwise specifically provided.

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b. Divided items.—Because the quantities of work actually required for schedule items 3, 7, and 12 may vary widely from the quantities listed therefor in the schedule, the total estimated quantities of these items have been divided into two ranges, as shown in the schedule.

Each range has been listed in the schedule as a subitem for payment purposes only and the two ranges together are one item of work. The first range represents approximately 65 percent of the estimated total quantity of work to be performed under each of the items so divided.

This division of quantities into two ranges is provided so that bidders will include, in the unit price bid for the quantity within the first range, that part of the contractor's cost for construction facilities, mobilization and demobilization, plant, fixed overhead, and other fixed costs, properly allocated for the item of work. The first range shall exclude any cost component for which payment is to be made under the provisions of paragraph 1.3.5. Accordingly, the unit price bid for the quantity in excess of the first range shall exclude any part of the contractor's costs for construction facilities, mobilization and demobilization, plant, fixed overhead, and other fixed costs. The unit price bid in the schedule for the quantities in excess of the first range shall not exceed the unit price bid for the quantities in the first range. Should any bidder submit a unit price for the second range that is in excess of the unit price bid for the first range for that item, the bid will not be rejected; however, the bid will be evaluated on the basis of, and payment for all of the work under the item will be made at, the unit price bid in the schedule for the first range.

Should the actual quantity of work performed be less than the quantity listed in the schedule for the first range, such deficient quantity will be considered a deletion for which an adjustment will be made under clause No. 3 of the General Provisions.

As provided above, the quantities of work that will actually be required for the divided items may vary widely from the quantities listed therefor in the schedule. Accordingly, payment will be made in accordance with the provisions of this paragraph regardless of any such variations of quantity actually experienced. The contractor shall be entitled

to no additional allowance above the unit prices bid in the schedule by reason of none or of any amount in excess of the quantity of work in the second range being performed.

1.3.5 MOBILIZATION AND PREPARATORY WORK

a. General.—For the purposes of providing for expenses incident to the initiation of construction and discouraging unbalanced bidding, an item not to exceed 5 percent of total for schedule has been included in the bidding schedule to provide for payment for mobilization and preparatory work. The item for payment for mobilization and preparatory work is intended to compensate the contractor for operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of offices, buildings, plants, and other facilities at the project site; for payment of premiums for bonds and insurance for the project including premiums for performance and payment bonds; for any necessary costs of acquisition of equipment including purchase and mobilization expense; and for any other work and operations which must be performed or costs that must be incurred incident to the initiation of meaningful work at the site and for which payment is not otherwise provided for under the contract.

All facilities, plant, and equipment which are established at or brought to the worksite shall be deemed to be subject to the provisions of this paragraph unless the contracting officer specifically provides otherwise in writing for a particular item or items. The contractor shall be solely responsible for the adequacy, efficiency, use, protection, maintenance, repair, and preservation of all facilities, plant, and equipment. The facilities, plant, and equipment covered by this paragraph shall not be dismantled or removed from the worksite prior to completion of the work under the contract without the written permission of the contracting officer.

All facilities, plant, and equipment on the worksite shall also be subject to the Government's right to take possession of and utilize the same for the purposes of completion of the work as provided by clause No. 5 of the General Provisions should the contractor's right to proceed be terminated thereunder. In addition, any encumbrance,

lien, or other security interest on any such facilities, plant, or equipment shall be subordinated to the Government's rights under said clause No. 5 to utilize all facilities, plant, and equipment to complete the work under the contract, and the contractor agrees to provide evidence of this, acceptable to the contracting officer.

b. Payment.—Payment for mobilization and preparatory work will be made at the lump-sum price bid therefor in the schedule. Progress payments for mobilization and preparatory work will be made as follows:

(1) The total amount of premiums paid by the contractor to obtain performance and payment bonds will be paid at one time together with the first progress payment otherwise due, as provided in clause No. 7(e) of the General Provisions.

(2) When 5 percent of the total original contract amount is earned from other schedule items, 50 percent of the amount bid for mobilization and preparatory work will be paid, exclusive of any amount already paid the contractor for performance and payment bond premiums.

(3) When 10 percent of the total original contract amount is earned from other schedule items, the balance of the amount bid for mobilization and preparatory work will be paid.

Progress payments for mobilization and preparatory work shall be subject to retainage as provided by clause No. 7(c) of the General Provisions. In addition, for the purposes of said clause No. 7(c), the item for mobilization and preparatory work will not be considered to be a separate division of the work, completion of which would permit the payment of the complete item price without retention.

1.3.6 BACKCHARGES TO CONTRACTOR

Where these specifications provide for charges to the contractor for costs incurred by the Government for services, materials, or use of equipment, such charges will include the costs of labor and materials, a reasonable allowance for use of plant and equipment, and other expenditures which can be directly assigned to the services or materials furnished, plus 15

percent of such total costs for Government overhead.

In the event of termination of the contract for default under clause No. 5 of the General Provisions, the increased costs occasioned by the Government thereunder shall include those administrative costs which are necessary for and directly assignable to completing the work following such termination and which would not have been required had termination not been necessary. In addition, the Government shall be entitled to 15 percent of the total of such administrative costs for Government overhead.

1.3.7 CONTRACT ADJUSTMENTS

a. General.—If the contractor requests adjustment under clause No. 3, 4, or 17 of the General Provisions of this contract, the contractor shall submit sufficient data to establish his entitlement to adjustment thereunder. Insofar as possible, prices will be negotiated in advance for adjustments under clauses No. 3, 4, and 17. Such prices may be lump sums, unit prices, or other agreed rates for properly allocated charges which may include such items as labor, material, equipment ownership and operation, rental of equipment not owned by the contractor, and plant, overhead, or other proper indirect expense. Allowable costs in price adjustments shall be made in accordance with the cost principles stated in part 1-15 of the Federal Procurement Regulations (41 CFR 1-15) except that equipment ownership and operation expense shall be computed in accordance with the paragraph included in these specifications entitled "Equipment Ownership and Operation Expense." Where the amount of the adjustment is not agreed upon in advance, the contractor shall keep sufficient records and data to establish the cost of the work in accordance with the requirements of 41 CFR part 1-15.

b. Availability of records.—For the purpose of determining the amount allowable for contract adjustments, pursuant to 41 CFR sec. 1-3.809, the contracting officer, through his authorized agents, shall have access to all payrolls, records of personnel, invoices of materials, records of plant and equipment, and any and all other data relevant to the performance of the contract or necessary to determine its costs. Where it is determined to be necessary for computation of the proper amount of an adjustment, the contractor shall

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furnish any pertinent part of his original bid computations and supporting documents thereto.

c. Indirect cost and profit.—Allowances for indirect cost (overhead) shall be made where appropriate (see 41 CFR sec. 1-3.807-11). There shall be no duplication of direct cost in any allowance for indirect cost. Allowances for profit shall be made where appropriate under these clauses pursuant to the principles stated in 41 CFR sec. 1-3.808. An amount for interest (including any paid for capital investments) may be considered in establishing an allowable amount of profit. Where adjustments are allowed for performance wholly or substantially by subcontractors or suppliers, such adjustments may include an allowance for the prime contractor's indirect cost and profit. However, the total of such allowances for the prime contractor's indirect cost and profit shall not exceed 10 percent of the adjustment allowed for the subcontractor or supplier. Where more than one tier of subcontractors or suppliers are involved in the performance, the total allowance for indirect cost and profit allowed for each tier shall not exceed 10 percent of the adjustment allowed for the subcontractor or supplier who wholly or substantially performs the work.

d. Truth in negotiation.—The provisions of the "Truth in Negotiation" regulations (41 CFR part 1-3) are applicable to any modification of this contract exceeding \$100,000 in amount.

1.3.8 EQUIPMENT OWNERSHIP AND OPERATION EXPENSE

a. General.—Adjustments allowed under clause No. 3 or 4 of the General Provisions of this contract may include allowances for ownership of equipment owned by the contractor or any subcontractor and available at the site of the work. It will be normally anticipated that allowances for equipment ownership will be made as herein provided; however for contract modifications over \$100,000 the contracting officer may, at his option, compute allowances for equipment ownership expense based on actual cost records complying with 41 CFR parts 1-3.8 and 1-15.

It is to be understood that allowances for equipment ownership and operating expense as herein provided are for equipment in good

operating condition only. The contractor shall furnish a complete description of each item of equipment which is involved in any request for adjustment, listing the date of manufacture, date of acquisition, make, model, size, capacity, mounting, type of power, and any and all accessory equipment which is attached thereto for use under the particular work to be performed. The contractor shall furnish acceptable evidence of his acquisition cost of new or used equipment. Acquisition cost is defined as the contractor's original purchase price, including sales tax. The acquisition cost of the unit of equipment shall include all accessories and expendable components required for a specific equipment utilization. As an example, the acquisition cost would include: (1) the ripper attachments purchased with a crawler tractor, and (2) the original tires on a wheeled vehicle. If used equipment is reconditioned and recapitalized, its acquisition cost shall be adjusted to the recapitalized value shown in the contractor's accounting records. If acceptable evidence to determine acquisition cost is not supplied, the contracting officer may determine the same by any means he may deem appropriate, such as use of national publications which list current average equipment values.

b. Equipment ownership allowances.—Allowances for equipment ownership will be determined as follows:

(1) Depreciation.—Allowances for depreciation will be made in accordance with the tables in the "Contractors' Equipment Manual" in effect on the date of the contract, as published by the Associated General Contractors of America, without regard to the provisions and examples included in the text of the manual. The expense per working hour for depreciation will be determined by multiplying the acquisition cost of new or used equipment by the percentage given in the column "Depreciation" and dividing by the number listed in the column "Average Use Hours Per Year." In accordance with the last sentence in the first paragraph of subparagraph a. above, consideration will be given to shorter periods of depreciation writeoff than provided in the AGC Manual if the contractor supplies sufficient data to establish his entitlement thereto, pursuant to 41 CFR sec. 1-15.205-9.

(2) Taxes, insurance, and incidentals.—The expense per working hour for taxes, insurance, and incidentals will be determined by multiplying the acquisition cost by 3 percent and dividing by the average number of hours use per year determined as in (1) above. The amount allowed hereunder shall not be duplicated in any general allowance for overhead.

(3) Interest on investment and replacement cost escalation.—No allowance is made under this paragraph for interest on investment (see 41 CFR sec. 1-15.205-17) or for replacement cost escalation.

The sum of allowances for depreciation, taxes, insurance, and incidentals computed in accordance with the above criteria shall constitute the hourly cost of ownership of equipment. Rates allowed for equipment ownership expense for the use of items of equipment not listed in the AGC tables will be established by agreement or by the contracting officer conformably with items which are listed in the AGC tables.

c. Idle time.—Ownership expense allowance for idle time of equipment allowed under clauses No. 3 and 4 will be made on the basis of 50 percent of the hourly rate. A maximum of 40 hours per week will be allowed. No allowance will be made for Saturdays, Sundays, or holidays, when work is not actually performed. This 50 percent factor shall be applied to ownership rates allowed for working time. Periods of time less than 2 hours on which equipment is down for normal and regular servicing and for minor field repair or field maintenance shall be considered as operating rather than idle time and such periods will not be deducted from use or operating time. No allowance will be made as idle time for equipment which is not in good operating condition. This paragraph shall not apply to adjustments under clause No. 17.

d. Small tools.—Small tools shall mean all items having a replacement value of less than \$400. For modifications in excess of \$100,000, small tool allowances shall be made based on information furnished by the contractor. For contract modifications amounting to \$100,000 or less, at the option of the contracting officer, an allowance for small tools not to exceed 5 percent of direct labor may be made where appropriate.

e. Equipment ownership expense under clause No. 17.—Allowances for equipment ownership under clause No. 17 shall be made on the basis of depreciation only, based on acceptable evidence thereof furnished by the contractor.

f. Equipment operating expense.—Allowances for the cost of operating equipment such as operating crew labor, servicing labor and equipment, labor and parts for all repairs, fuel, oil, grease, and supplies will be made in addition to the amounts allowed for equipment ownership expense. Equipment operating expense allowances shall be based on the contractor's cost records or other sources complying with 41 CFR parts 1-3.8 and 1-15 as approved by the contracting officer. For forward-priced adjustments, operating expense figures developed for use by the contractor in estimating or bidding generally from historical accounting records or actual cost experience under this contract will be accepted if evidence thereof satisfactory to the contracting officer is furnished.

1.3.9 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA

If any price, including profit or fee, negotiated in connection with this contract or any cost reimbursable under this contract was increased by any significant sums because:

a. The contractor furnished cost or pricing data which was not accurate, complete, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data;

b. A subcontractor, pursuant to the clause of this contract entitled "Subcontractor Cost or Pricing Data" or "Subcontractor Cost or Pricing Data—Price Adjustments" or any subcontract clause therein required, furnished cost or pricing data which was not accurate, complete, and current as certified in the subcontractor's Certificate of Current Cost or Pricing Data;

c. A subcontractor or prospective subcontractor furnished cost or pricing data which was required to be accurate, complete, and current, and to be submitted to support a subcontract cost estimate furnished by the contractor but which was not accurate, complete, and current as of the date certified

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in the Contractor's Certificate of Current Cost or Pricing Data; or

d. The contractor or a subcontractor or prospective subcontractor furnished any data, not within subparagraph a., b., or c. above, which was not accurate as submitted; the price or cost shall be reduced accordingly and the contract shall be modified in writing as may be necessary to reflect such reduction. However, any reduction in the contract price due to defective subcontract data of a prospective subcontractor when the subcontract was not subsequently awarded to such subcontractor, will be limited to the amount (plus applicable overhead and profit markup) by which the actual subcontract, or actual cost to the contractor if there was no subcontract was less than the prospective subcontract cost estimate submitted by the contractor: Provided, The actual subcontract price was not affected by defective cost or pricing data.

(Note: Since the contract is subject to reduction under this clause by reason of defective cost or pricing data submitted in connection with certain subcontracts, it is expected that the contractor may wish to include a clause in each such subcontract requiring the subcontractor to appropriately indemnify the contractor. It is also expected that any subcontractor subject to such indemnification will generally require substantially similar indemnification for defective cost or pricing data required to be submitted by his lower tier subcontractors.)

1.3.10 AUDIT

a. General.—The contracting officer or his representatives shall have the audit and inspection rights described in the applicable subparagraphs b., c., and d. below.

b. Examination of costs.—If this is a cost-reimbursement type, incentive, time and materials, labor hour, or price redeterminable contract, or any combination thereof, the contractor shall maintain, and the contracting officer or his representatives shall have the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of this contract. Such right of

examination shall include inspection at all reasonable times of the contractor's plants, or such parts thereof, as may be engaged in the performance of this contract.

c. Cost or pricing data.—If the contractor submitted cost or pricing data in connection with the pricing of this contract or any change or modification thereto, unless such pricing was based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation, the contracting officer or his representatives who are employees of the United States Government shall have the right to examine all books, records, documents, and other data of the contractor related to the negotiation, pricing or performance of such contract, change or modification, for the purpose of evaluating the accuracy, completeness, and currency of the cost or pricing data submitted. Additionally, in the case of pricing any change or modification exceeding \$100,000 to formally advertised contracts, the Comptroller General of the United States or his representatives who are employees of the United States Government shall have such rights. The right of examination shall extend to all documents necessary to permit adequate evaluation of the cost or pricing data submitted, along with the computations and projections used therein.

d. Availability.—The materials described in subparagraphs b. and c. above, shall be made available at the office of the contractor, at all reasonable times, for inspection, audit, or reproduction, until the expiration of 3 years from the date of final payment under this contract or such lesser time specified in Part 1-20 of the Federal Procurement Regulations (41 CFR Part 1-20) and for such longer period, if any, as is required by applicable statute, or by other clauses of this contract, or by (1) and (2) below:

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for a period of 3 years from the date of any resulting final settlement.

(2) Records which relate to appeals under the "Disputes" clause of this contract, or litigation or the settlement of claims arising out of the performance of this contract,

shall be made available until such appeals, litigation, or claims have been disposed of.

e. The contractor shall insert a clause containing all the provisions of this clause, including this subparagraph e., in all subcontracts hereunder except altered as necessary for proper identification of the contracting parties and the contracting officer under the Government prime contract.

1.3.11 SUBCONTRACTOR COST OR PRICING DATA

a. The contractor shall require subcontractors hereunder to submit, actually or by specific identification in writing, cost or pricing data under the following circumstances:

(1) Prior to the award of any subcontract the amount of which is expected to exceed \$100,000 when entered into;

(2) Prior to the pricing of any subcontract modification which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed \$100,000; except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation.

b. The contractor shall require subcontractors to certify, in substantially the same form as that used in the certificate by the prime contractor to the Government, that to the best of their knowledge and belief, the cost and pricing data submitted under subparagraph a. above is accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract change or modification.

c. The contractor shall insert the substance of this clause including this subparagraph c. in each subcontract hereunder which exceeds \$100,000 when entered into except where the price thereof is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation. In each such excepted subcontract hereunder in excess of \$100,000, the contractor shall insert the substance of the following paragraphs:

"SUBCONTRACTOR COST OR PRICING DATA-PRICE ADJUSTMENTS

"a. Subparagraphs b. and c. of this paragraph shall become operative only with respect to any modification made pursuant to one or more provisions of this contract which involves aggregate increases and/or decreases in cost plus applicable profits expected to exceed \$100,000. The requirements of this paragraph shall be limited to such contract modifications.

"b. The contractor shall require subcontractors hereunder to submit, actually or by specific identification in writing, cost or pricing data under the following circumstances:

"(1) Prior to award of any subcontract, the amount of which is expected to exceed \$100,000 when entered into;

"(2) Prior to the pricing of any subcontract modification which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed \$100,000; except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation.

"c. The contractor shall require subcontractors to certify, in substantially the same form as that used in the certificate by the prime contractor to the Government, that to the best of their knowledge and belief the cost and pricing data submitted under subparagraph b. above is accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract change or modification.

"d. The contractor shall insert the substance of this paragraph including this subparagraph d. in each subcontract hereunder which exceeds \$100,000 when entered into."

1.3.12 EXAMINATION OF RECORDS

a. (1) The contractor agrees to maintain books, records, documents, and other evidence pertaining to the costs and expenses of this contract (hereinafter collectively called "records") to the extent and in such detail as will properly reflect all net costs, direct and indirect, of labor,

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materials, equipment, supplies and services, and other costs and expenses of whatever nature for which reimbursement is claimed under the provisions of this contract.

(2) The contractor agrees to make available at the office of the contractor at all reasonable times during the period set forth in subparagraph (4) below any of the records for inspection, audit, or reproduction by any authorized representative of the Comptroller General, Secretary of the Interior, and the contracting officer.

(3) In the event the Comptroller General or any of his duly authorized representatives determine that his audit of the amounts reimbursed under this contract as transportation charges will be made at a place other than the office of the contractor, the contractor agrees to deliver, with the reimbursement voucher covering such charges or as may be otherwise specified within 2 years after reimbursement of charges covered by any such voucher, to such representative as may be designated for that purpose through the contracting officer, such documentary evidence in support of transportation costs as may be required by the Comptroller General or any of his duly authorized representatives.

(4) Except for documentary evidence delivered to the Government pursuant to subparagraph (3) above, the contractor shall preserve and make available his records (i) until expiration of 3 years after final payment under this contract or of the time periods for the particular records specified in part 1-20 of the Federal Procurement Regulations (41 CFR part 1-20), whichever expires earlier, and (ii) for such longer period, if any, as is required by applicable statutes, by any other paragraph of this contract, or by (A) or (B) below:

(A) If this contract is completely or partially terminated, the records relating to the work terminated shall be preserved and made available for a period of 3 years from the date of any resulting settlement.

(B) Records which relate to (i) appeals under the disputes clause of this

contract, (ii) litigation or the settlement of claims arising out of the performance of this contract, or (iii) costs and expenses of this contract as to which exception has been taken by the Comptroller General, Secretary of the Interior, or the contracting officer, or any of their duly authorized representatives, shall be retained by the contractor until such appeals, litigation, claims, or exceptions have been disposed of.

(5) Except for documentary evidence delivered pursuant to subparagraph (3) above, and the records described in subparagraph (4)(B) above, the contractor may in fulfillment of his obligation to retain his records as required by this paragraph substitute photographs, microphotographs, or other authentic reproductions of such records, after the expiration of 2 years following the last day of the month of reimbursement to the contractor of the invoice or voucher to which such records relate, unless a shorter period is authorized by the contracting officer with the concurrence of the Comptroller General or his duly authorized representative.

(6) The provisions of this subparagraph a., including this subparagraph (6), shall be applicable to and included in each subcontract hereunder which is on a cost, cost-plus-a-fixed-fee, time-and-material, or labor-hours basis.

b. The contractor further agrees to include in each of his subcontracts hereunder, other than those set forth in subparagraph a.(6) above, a provision to the effect that the subcontractor agrees that the Comptroller General, the Secretary of the Interior, and the contracting officer, or any of their duly authorized representatives, shall, until the expiration of 3 years after final payment under the subcontract, or of the time periods for the particular records specified in part 1-20 of the Federal Procurement Regulations (41 CFR 1-20), whichever expires earlier, have access to and the right to examine any directly pertinent books, documents, papers, and records of such subcontractor, involving transactions relating to the subcontractor. The term "subcontract," as used in this subparagraph b., only excludes (i) purchase orders not exceeding \$10,000, and (ii) subcontracts or purchase orders for public

utility services at rates established for uniform applicability to the general public.

1.3.13 COST REDUCTION INCENTIVE (Value Engineering)

This paragraph applies to proposals resulting in a total estimated decrease in the contractor's costs of \$10,000 or more which are initiated, developed, and submitted in writing, after award of contract, by the contractor for modifying the drawings, specifications, or other requirements of this contract. This paragraph does not, however, apply to any such proposal unless it is identified by the contractor, at the time of its submission to the contracting officer, as a proposal submitted pursuant to this paragraph. Such proposals shall be submitted after award of contract and prior to initiating work on the proposed modification. Only those proposals will be considered which would not impair essential functions or operating characteristics of the facility being constructed under this contract. Acceptance will be made by issuance of an order for changes or by other written notice. Proposals based solely on reducing contract delivery or completion periods, changing basic engineering designs, or eliminating requirements necessitated by public law will not be considered.

Cost reduction proposals shall contain a description of the difference between the existing contract requirement and the proposed modification, an itemized and detailed estimate of the anticipated reduction in the contractor's costs, the time within which a decision thereon must be made by the Government, and other appropriate information.

The Government will not be liable for any delays in acting upon, or for failure to act upon, any proposal submitted pursuant to this paragraph, and any such delays shall not serve to extend the time of performance under the contract unless authorized by the contracting officer. The decision of the contracting officer on all questions relating to proposals submitted or submitted and accepted under this contract will be final and will not be subject to the "Disputes" clause of this contract. The contractor shall remain obligated to perform in accordance with existing contract terms unless an order for change is issued accepting the proposal or he is otherwise notified in writing of acceptance of the proposal.

If a contractor's cost reduction proposal is accepted, an equitable price adjustment will be made under the "Changes" clause of this contract. The amount of such adjustment will be established by determining the total estimated decrease in the contractor's costs that would result from acceptance of the proposal and reducing the contract price by 50 percent of such total estimated decrease. For example, if it is determined that an accepted proposal will reduce the contractor's costs by \$100,000, the contract price will be reduced \$50,000, thus permitting the contractor to benefit by the remaining \$50,000.

Unless the contractor expressly restricts the Government's right to utilize in whole or in part a cost reduction proposal submitted and accepted under this paragraph by reason of established proprietary rights, e.g., patent or copyright, the Government will have the right to use all or any part of the proposal for work or procurement under other contracts without payment of royalty or further obligation to the contractor.

SECTION 1.4—MATERIALS

1.4.1 MATERIALS TO BE FURNISHED BY THE CONTRACTOR

a. General.—The contractor shall furnish all materials required for completion of the work.

The words "material" or "materials" as used in these specifications to denote items furnished by the contractor shall be construed to mean equipment, machinery, product, component, or any other item required to be incorporated in the work.

When a separate item which includes the furnishing of any material is provided in the schedule, the cost of furnishing, hauling, storing, and handling shall be included in the price bid for that item. When a separate item is not provided in the schedule for furnishing any material required to be furnished by the contractor, the cost of furnishing, hauling, storing, and handling shall be included in the price bid for the work for which the material is required.

Materials furnished by the contractor shall be of the type and quality described in these specifications. The contractor shall make diligent effort to procure the specified materials from any and all sources, but where

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because of Government priorities or other causes, materials required by the specifications become unavailable, substitute materials may be used: Provided, That no substitute materials shall be used without prior written approval of the contracting officer, said written approval to state the amount of the adjustment, if any, to be made in favor of the Government. The contracting officer's determination as to whether substitution shall be permitted and as to what substitute materials may be used shall be final and conclusive. If the substitute materials approved are of less value to the Government or involve less cost to the contractor than the materials specified, an adjustment shall be made in favor of the Government, and where the amount involved or the importance of the substitution warrants, an order for changes will be issued, otherwise the adjustment will be handled by deduction from payments to the contractor on the basis of prices stated in the written approval. No payments in excess of prices bid in the schedule will be made because of substitution of one material for another or because of the use of one alternate material in place of another.

b. Inspection of materials.—Materials furnished by the contractor which will become a part of the completed construction work shall be subject to inspection in accordance with clauses No. 9 and 10 of the General Provisions at any one or more of the following locations, as determined by the contracting officer: at the place of production or manufacture, at the shipping point, or at the site of the work. To allow sufficient time to provide for inspection, the contractor shall submit to the Project Construction Engineer, unless specifically directed otherwise at the time of issuance, copies in triplicate of purchase orders, including drawings and other pertinent information, covering materials on which inspection will be made as advised by the contracting officer, or shall submit other evidence in the event such purchase orders are issued verbally or by letter.

The inspection of materials at any of the locations specified above or the waiving of the inspection thereof shall not be construed as being conclusive as to whether the materials conform to the contract requirements under clause No. 10(a) of the General Provisions, nor shall the contractor be relieved thereby of the responsibility for furnishing materials meeting the requirements of these specifications.

Acceptance of all materials will be made only at the site of the work.

1.4.2 REFERENCE SPECIFICATIONS AND STANDARDS.

a. General.—The materials to be furnished by the contractor which are specified by reference to Federal Specifications, Federal Standards, or other standard specifications or codes shall be in compliance with the latest editions or revisions thereof in effect on the date bids are received, including any amendments or supplements. In the event of conflicting requirements between a referenced specification, standard, or code, and these specifications, these specifications shall govern.

Unless otherwise specified, all materials that will become a part of the completed work shall be new and shall conform to the Federal or other specifications and standards referred to herein. Where reference specifications numbers are designated throughout these specifications, they refer to Federal Specifications unless otherwise noted. In the event that the materials are not covered by Federal or other specifications, the materials furnished shall be of standard commercial quality. Where types, grades, or other options offered in the reference specifications are not specified in these specifications, the material furnished will be acceptable if it is in accordance with any one of the types, grades, or options offered.

The references to materials, wherein manufacturer's products or brands are specified, are made as standards of comparison only as to type, design, character, or quality of the article required, and do not restrict bidders to the manufacturer's products or to the specific brands named. It shall be the responsibility of the contractor to prove equality of materials and products to those referenced and to provide all descriptive information, test results, and other evidence as may be necessary to prove the equality of materials or products which he offers as being equal to those referenced.

Copies of the Federal Specifications may be examined at the office of the Water and Power Resources Service, Engineering and Research Center, building 67, Denver Federal Center, Denver, Colorado; the Regional Office, Water and Power Resources Service,

Nevada Highway and Park Street, Boulder City, Nevada; or the Arizona Projects Office, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix, Arizona. Single copies of Federal Specifications required for bidding purposes may be obtained without charge at Business Service Centers of Regional Offices of the General Services Administration. Specifications, standards, and codes published by associations or other standardizing agencies should be obtained by the contractor, at his expense, directly from those agencies.

b. Addresses for obtaining reference specifications and standards.—Addresses for obtaining some of the referenced specifications, standards, and codes are listed below. Information on other specifications, standards, and codes referred to in these specifications may be obtained from the Water and Power Resources Service, Attn D-1330, P O Box 25007, Denver CO 80225.

Federal Specifications and Standards—Specification Activity, Building 197, Washington Navy Yard, General Services Administration, Washington DC 20407

Water and Power Resources Service Specifications—Water and Power Resources Service, Attn D-1330, P O Box 25007, Denver CO 80225

Military Specifications and Standards—Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia PA 19120

Maritime Administration Specifications—Division of Naval Architecture, Room 4057, Maritime Administration, Department of Commerce Building, 14th and East Street NW., Washington DC 20230

AISC—American Institute of Steel Construction, Inc., 1221 Avenue of the Americas, New York NY 10020

AISI—American Iron and Steel Institute, 1000 16th Street NW., Washington DC 20036

ANSI—American National Standards Institute, 1430 Broadway, New York NY 10018

ASME—American Society of Mechanical Engineers, 345 East 47th Street, New York NY 10017

ASTM—American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103

AWS—American Welding Society, Inc., 2501 NW. Seventh Street, Miami FL 33125

AWWA—American Water Works Association, Inc., 6666 West Quincy Avenue, Denver CO 80235

IEEE—Institute of Electrical and Electronic Engineers, 345 East 47th Street, New York NY 10017

IPCEA—Insulated Power Cable Engineers Association, 192 Washington Street, Belmont MA 02178

JIC—Joint Industrial Council, 7901 Westpark Drive, McLean VA 22101

NEC—National Electrical Code, National Fire Protection Association, 470 Atlantic Avenue, Boston MA 02210

NEMA—National Electrical Manufacturers Association, 2101 L Street NW., Washington DC 20037

SAE—Society of Automotive Engineers, 400 Commonwealth Drive, Pittsburgh PA 15096

UL—Underwriters' Laboratories, 207 East Ohio Street, Chicago IL 60611

WCLB—West Coast Lumbermans Inspection Bureau, 6980 SW. Varns Road, Portland OR 97223

1.4.3 MATERIALS AND WORKMANSHIP

As stated in clause No. 9 of the General Provisions, materials used in the manufacture of equipment to be furnished by the contractor shall be of the most suitable grade for the purpose intended. The contractor shall be responsible for the accurate manufacture and fabrication of the equipment in accordance with the best modern practice and the requirements of these specifications notwithstanding minor errors or omissions therefrom.

Liberal factors of safety and adequate shock-absorbing features shall be used throughout the designs and especially in the design of all parts subject to stresses or shock, including alternating- and vibrating-type stresses and shock. Shock-absorbing features shall include provisions which prevent components from loosening.

Unless otherwise specified, materials used in the manufacture of the equipment shall conform to applicable Federal Specifications or Federal Standards, and if there are no applicable Federal Specifications or Federal Standards, shall conform to the applicable specifications of the American Society for Testing and Materials, the

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Society of Automotive Engineers, or the American National Standards Institute. If the contractor for justifiable cause proposes to deviate from or to use materials not covered by the Federal Specifications or Federal Standards, he shall state the reasons for and exact nature of the deviation and shall submit for the approval of the contracting officer complete specifications for the materials that he proposes to use.

Parts shall be made accurately to standard gage where possible so as to facilitate replacement and repair. Bolts, nuts, screws, taps, pipes, and pipefittings shall be unified screw threads conforming to ANSI B1.1 and B2.1. For internal connections of individual items of equipment only, the contractor will be permitted to deviate from ANSI: Provided, That he furnishes a complete set of all such necessary taps and dies which might be required by the Government to facilitate repair or replacement.

1.4.4 WEIGHTS OF METAL PARTS

The weights of metalwork, metal pipe, reinforcing steel, and other metal parts, the furnishing, installing, handling, or placing of which is to be paid for on the basis of weight, will be determined by the contracting officer. The Government will not provide scales for actually weighing all of the material, but the contracting officer will determine the weight of each part or item involved in the most practicable manner and will use for this purpose railroad shipping weights, manufacturer's weights, catalog weights, and estimated weights, subject to the provisions of clause No. 6 of the General Provisions in case of dispute.

Net weights only will be paid for and the weight of all tare, packing, and blocking will be deducted. Weights of mortar or grout, shims, wedges, lead and other calking materials, gaskets, oil, grease, welds, paint, coating materials other than galvanizing; joint materials other than bolts, nuts, and washers, and similar materials as are required to be applied at the site of construction, will not be included in the weights for which payment is made. Regardless of whether applied at the fabricating plant or at the site of construction, protective wrappings, mortar or concrete coating or lining, and bituminous or coal-tar coating or lining also will not be included in the weights for which payment is made.

SECTION 1.5-LOCAL CONDITIONS

1.5.1 INVESTIGATION OF SITE CONDITIONS

Bidders are urged to visit the site of the work and by their own investigations satisfy themselves as to the existing conditions affecting the work to be done under these specifications. If the bidder chooses not to visit the site or conduct investigations, he will nevertheless be charged with knowledge of conditions which reasonable inspection and investigations would have disclosed.

Bidders are also urged to carefully examine all of the materials and information regarding site conditions made available by the Government and to obtain their own samples and perform tests on the soil and rock materials to determine unit weights, to evaluate shrinkage and swell factors, and to evaluate other properties which the bidder believes to be significant in arriving at a proper bid.

Bidders and the contractor shall assume all responsibility for deductions and conclusions as to the difficulties in performing the work.

1.5.2 ACCESS TO THE WORK AND HAUL ROUTES

a. General.—Rights-of-way for access to the work from existing roads will be provided by the Government in accordance with paragraph 1.1.3. All work on the rights-of-way necessary for access to the site shall be performed by the contractor.

The contractor shall make his own investigation of the condition of available public or private roads and of clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect transportation and ingress and egress at the jobsites. Subject to clause No. 5 "Termination for Default—Damages for Delay—Time Extensions" of the General Provisions, the unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work. It shall be the contractor's responsibility to construct and maintain, at his own expense and at his own risk, any haul roads, access roads, bridges, or drainage structures required for construction operations.

Except as required for constructing fence and as otherwise approved by the contracting officer, access to the area on the uphill side of the canal between the toe of the dike and the right-of-way will not be allowed.

b. Existing roads.—Existing roads are available for the contractor's use subject to existing restrictions. The contractor shall meet all conditions properly imposed upon the use of existing roads by those having jurisdiction thereover, including (without limitation of the generality of the foregoing) seasonal or other limitations or restrictions, the payment of excess size and weight fees, and the posting of bonds conditioned upon repair of road damage caused by the contractor.

c. Haul routes.—The hauling of sand, gravel, earth materials, or other intrajob hauling, over public highways, roads, or bridges shall be in compliance with the applicable local regulations and shall be such as to minimize interference with or congestion of local traffic. Where haul routes cross public highways or roads, the contractor shall provide barricades, flagmen, and other necessary precautions for safety of the public as provided in paragraph 1.5.10.

d. Cost.—The cost of all work described in this paragraph shall be included in the prices bid in the schedule for other items of work.

1.5.3 USE OF LAND FOR CONSTRUCTION PURPOSES

The contractor will be permitted to use Government land, controlled by the Water and Power Resources Service, for field offices, construction plant, storage yards, shops, and other facilities required for construction operations: Provided, That such use shall not interfere with any part of the work or of the work of other contractors or of the Government in the vicinity, or with reservations made by the Government for use of the land. Personnel housing will not be permitted on Government land, except housing for guards or watchmen as approved by the contracting officer.

If private land is used by the contractor for construction facilities or other purposes, the contractor shall make all necessary arrangements with the owner and shall pay all rentals or other costs connected therewith.

The location, construction, maintenance, operation, and removal of the contractor's construction facilities on Government land shall be subject to the approval of the contracting officer.

1.5.4 USE AND MAINTENANCE OF ROADS

a. General.—After their completion, the bridge approach roads and the operation and maintenance road ramps required to be constructed under these specifications will be available for the use of the contractor in his construction operations for the remaining work under the contract. The contractor shall maintain the roadbed, structures, and surfacing of these roads and ramps until completion and acceptance of all the work under this contract. Maintenance is considered to include repair of any of the roads and ramps as required to keep them in good, safe, serviceable condition.

At his option, the contractor may defer, until the latest practicable date within the specified completion period, placement of the surfacing on any of the roads or ramps subject to heavy and deteriorating use by his construction operations or equipment.

b. Cost.—The cost of maintenance of roads and ramps as described in this paragraph shall be included in the prices bid in the schedule for other items of work.

1.5.5 EXISTING FENCES

Fences on the right-of-way shall be removed by the contractor where necessary for the performance of the work, and where required, shall be rebuilt in as good condition as found. Where designated, fences shall be maintained until the work is completed or their removal is authorized. Where the contractor removes existing fences to facilitate the work, temporary fence protection for lands adjacent to the right-of-way shall be provided at all times during the continuation of the contract. Such temporary fence protection shall be adequate to prevent livestock from straying from or onto adjacent lands and shall be constructed complete with gates and/or cattle guards. Temporary fencing constructed on the right-of-way shall be removed by the contractor as part of the cleanup operations prior to final acceptance of the completed work.

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If the contractor does not provide the necessary fences, gates, and cattle guards to adequately protect property adjacent to the right-of-way within a reasonable time after need for such protection arises, the Government will cause the work to be performed and backcharge the contractor for such work.

The cost of all work described in this paragraph shall be included in the prices bid in the schedule for other items of work.

1.5.6 CONSTRUCTION AT TELEPHONE AND POWERLINE CROSSINGS

Telephone and powerlines cross the canal at locations shown on the plan and profile drawings. The utility companies under agreement with the Government will remove these lines and relocate them permanently at other locations which will permit the contractor to proceed with his construction operations without delay.

The contractor shall notify the contracting officer no later than 60 days prior to the time removal and relocation of the utility is required so he can proceed with construction of the canal and roadway relocations at that location in accordance with his sequence of operations. The utility companies under agreement with the Government will perform all work required before, during, and after canal and road construction to remove, relocate, and maintain them in service at all times at no cost to the contractor. The contractor will not be required to perform any work for the crossings, but he shall cooperate with the utility companies thereof so they may perform the required work with as little interference from the contractor's operations as is practicable.

If for his convenience, the contractor wishes a utility company to make temporary relocations or minor alternations at existing utility crossings, it will be the contractor's responsibility to make arrangements with the utility company to perform such work and the costs thereof shall be paid to the utility company by the contractor.

The contractor shall provide for the utility crossings so that no damage will result thereto.

1.5.7 MAINTAINING PUBLIC TRAFFIC

The contractor shall make all necessary provisions for maintaining the flow of public traffic and shall conduct his operations for the

construction of the bridge approaches so as to offer the least possible obstruction and inconvenience to public traffic. Temporary approaches to crossings or intersecting roads shall be provided and kept in good condition. Except during periods of road closure, public traffic shall be permitted to cross over and pass through construction operations at all times with as little inconvenience and delay as possible and the contractor shall, when ordered, provide and station competent flagmen whose sole duties shall consist of directing and controlling the movement of public traffic either through or around the work.

Where public traffic will be required to cross over or pass through the work, construction operations shall be conducted so as to provide a reasonably smooth, even, dustless, and unobstructed passageway for two lines of traffic at all times. Water applied as directed for the abatement of dust in connection with maintaining public traffic, will be measured and paid for as provided in paragraph 2.2.1. At any and all points along the work where the nature of the construction operations in progress and the equipment and machinery in use are of such character as to endanger passing traffic, the contractor shall provide such guards as may be necessary to insure against accidents and avoid damage or injury to passing traffic.

The contractor will be allowed to close the roadways during periods of bridge construction: Provided, That no two adjacent roadways requiring bridge construction shall be closed to traffic at the same time and no roadway except Bush Highway shall be closed for more than 60 days. Bush Highway and McDowell Road shall not be closed for bridge construction at the same time. Bush Highway can only be closed for bridge construction between November 1 and April 1 during which time it can be closed for 90 days.

All plans for road closures must be approved by the contracting officer prior to the actual closure. The contractor's plan shall provide for notification of the Maricopa County sheriff and of the local schools, post office, and emergency services of the road closure date and the date of restoration of service. During road closure periods, the contractor shall erect and maintain durable signs at critical road junctions to warn the public of road construction and closure and to direct traffic to the nearest suitable alternate route of travel.

During construction in the vicinity of Bush Highway Bridge, local residents must be provided with a means of limited access to the area. A portion of the existing plug may be used to cross the canal or a temporary plug may be constructed.

Except for watering for dust abatement as provided in this paragraph, the cost of all work involved in maintaining public traffic, as described in this paragraph, shall be included in the prices bid in the schedule for other items of work.

1.5.8 PROTECTION OF EXISTING STRUCTURES

The contractor shall use care when working near existing structures to avoid damaging them. The existing emergency spillway at station $127+62.3\pm$ shall be protected by a cover of earth during construction of the canal including while lining is placed. Any damages to existing structures caused by operations of the contractor under these specifications shall be repaired by the contractor at his expense.

1.5.9 CONSTRUCTION AT EXISTING WATERCOURSES AND UTILITIES

Where the work to be performed under these specifications crosses or otherwise interferes with water, sewer, gas, or oil pipelines; buried cable; or other public or private utilities, or with artificial or natural watercourses, the contractor shall provide for such utilities and watercourses, and shall perform such construction during the progress of the work so that no damage will result to either public or private interests. The term "watercourses" includes ditches, terraces, furrows, or other features of surface irrigation systems. The Government does not represent that the locations of watercourses and utilities shown on the drawings are exact. It shall be the responsibility of the contractor to determine the actual locations of and make provision for all watercourses and utilities.

In order that waterlines and utilities are not interrupted, the contractor shall provide temporary bypasses as required and as directed by the contracting officer.

Before any watercourse or utility is taken out of service, permission shall be obtained from the owners. The contractor shall be liable for all damage that may result from failure to provide

for watercourses or utilities during the progress of the work and the contractor shall indemnify and hold harmless the Government from claims of whatsoever nature or kind arising out of or connected with damage to watercourses or utilities encountered during construction, damages resulting from disruption of service, and injury to persons or damage to property resulting from the negligent, accidental, or intentional breaching of watercourses or utilities.

If the contractor does not maintain the existing watercourses and utilities in such condition that no damage will result to either public or private interests, the Government will cause the necessary repairs to be made and backcharge the contractor for such work.

Except as otherwise provided below, the cost of all work described in this paragraph shall be included in the prices bid in the schedule for other items of work.

Where construction of new structures or modifications of existing structures are required to render the watercourses or utilities operative beyond the period of the contract, the contractor shall notify the contracting officer so that arrangements can be made with the owners for the construction or modifications required. When it is determined that such work is to be performed by the contractor, and such items of work are not provided for in the schedule, the contractor shall perform the necessary work in accordance with clause No. 3 of the General Provisions.

Where watercourses or utilities are encountered, but are not shown on the drawings or otherwise provided for in these specifications, all additional work required to be performed by the contractor as a result of encountering the watercourses or utilities shall be performed in accordance with clause No. 3 of the General Provisions.

1.5.10 SAFETY OF THE PUBLIC

Roads subject to interference by the work shall be kept open or suitable detours shall be provided and maintained by the contractor. Roadways requiring bridge construction may be closed and traffic rerouted as provided in paragraph 1.5.7. The contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient flasher lights, flagmen, danger signals, and signs, and shall take all necessary precautions for the protection of the work and the safety of the public.

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Roads closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning and detour signs. All barricades and obstructions shall be illuminated at night and all lights shall be kept burning from sunset until sunrise.

Specific signs, barricades, and flagmen requirements are detailed in sections 9 and 19 of the Water and Power Resources Service publication, "Construction Safety Standards" and ANSI "Manual on Uniform Traffic Control Devices" (ANSI D6.1).

The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.5.11 GEOLOGIC INVESTIGATIONS

a. General.—The geologic description, drawings, photographs, logs of subsurface explorations, water-level data, and test data in these specifications include information and records of geologic investigations for the work and are the final geologic data on which design of the work is based. These data supersede any previous versions which may be available for examination by bidders.

Design features shown on the geologic drawings may not reflect more recent revisions which appear in these specifications.

Samples, photographs of the drill core, and cores recovered during the investigations may be inspected by bidders at the Water and Power Resources Service Office in Phoenix, Arizona.

Arrangement for inspection of the samples and cores may be made by telephoning 602-261-3652.

For identification of additional samples which have been shipped to Denver and to arrange for their inspection, contact the Division of General Research, Water and Power Resources Service, P O Box 25007, Denver CO 80225 (telephone 303-234-3780).

Bidders are encouraged to obtain their own samples and perform tests on the soil and rock materials to evaluate properties which the bidder believes to be significant in arriving at a proper bid.

Logs of additional exploration in the vicinity of the work may be examined at the Water and Power Resources Service Office in the Arizona Projects Office in Phoenix, Arizona (telephone 602-261-3652).

Copies of a report entitled "Geologic Investigation Report—Spook Hill Damsite—Buckhorn-Mesa Watershed" may be examined at the Water and Power Resources Service offices in Phoenix, Arizona.

The Government does not represent that the available cores, samples, logs, water-level data, and other available geologic information show the conditions that will be encountered in performing the work, and the Government represents only that such information shows conditions encountered at the particular point from which such information was obtained. The water-level data show only the conditions at the particular time or times the information was obtained and may not indicate variations of such as those caused by periods of drought or increased rainfall, seasonal fluctuations in rainfall, or application of irrigation water. It is expressly understood that the making of deductions, interpretations, and conclusions from all the accessible factual information, including the nature of the materials to be excavated, the difficulties of making and maintaining the required excavations, and the difficulties of doing other work affected by the geology, water-level elevations, and other subsurface conditions at the site of the work, are the contractor's sole responsibility. See also paragraph 1.5.1 and clause No. 13 of the General Provisions.

b. Geologic description.—

(1) Regional geology.—The reach 1 alignment of the Salt-Gila Aqueduct is located within the Basin and Range Physiographic Province of Arizona. This basin and range structure resulted from large-scale crustal faulting during Tertiary time, and is characterized by down-faulted blocks forming the basins, which subsequently have been filled by materials eroded from the adjacent uplifted fault-block mountain ranges. Cores of these mountain ranges are generally comprised of granitic and metamorphic rocks of Precambrian age, and are often intruded by younger igneous rocks and/or are overlain by Early and Middle Tertiary age sedimentary or volcanic rocks. Younger

Tertiary and Quaternary volcanic flows and pyroclastics commonly cap the mountain ranges. Alluvial materials deposited in the basins consist of heterogeneous mixtures of clay, silt, sand, gravel, and locally contain cobbles and boulders. In general, these materials grade from coarser to finer grained with increasing distances from their sources in the surrounding mountains. Locally, along the mountain fronts, irregular bedrock surfaces are covered by relatively thin alluvial deposits, and rock hills and knobs protrude through the alluvial materials. Ground water occurs within the alluvial fan and basin fill deposits.

In general, the ground-water surface slopes gently away from the mountain fronts and occurs at greatest depths adjacent to the mountain ranges. The granitic bedrock in the project area is generally considered a non-water-bearing unit; however, water may occur in, and percolate through, open fractures and joints. Ground water may occur infrequently at shallow depths in both bedrock and surficial deposits during or shortly after periods of heavy precipitation and localized flash flooding.

Withdrawal of ground water from the underground aquifers has resulted in compaction of basin sediments and caused subsidence of the land surface and associated earth-fissuring phenomena in some of the deeper basins. The alignment of the Salt-Gila Aqueduct crosses the periphery of several major subsidence areas. The portion of the aqueduct to be constructed under these specifications has not been subjected to major subsidence or fissuring at the present time.

(2) Seismicity.—The project area is considered to have low historical seismicity. Based on historical seismicity, Algermissen and Perkins (U.S. Geological Survey Open-File Report 76-416, 1976) show that the aqueduct alignment is in an area with a 90-percent probability of not having ground shaking with a horizontal acceleration exceeding 0.04 *g* gravity in a 50-year period. This probability is equivalent to a source earthquake having a return period of 475 years.

(3) Geologic investigations.—Investigations along reach 1 of the Salt-Gila Aqueduct were conducted by the Water and Power

Resources Service and other agencies. Geologic mapping, subsurface exploration for determining foundation conditions, and investigations for construction of flood control structures are presented below as previous investigations and preconstruction investigations.

(a) Previous investigations.—A generalized description of the geology of Arizona covering the area adjacent to reach 1 of the Salt-Gila Aqueduct is included in the Arizona Bureau of Mines Bulletin No. 171, "A Resume of the Geology of Arizona," by E. D. Wilson, 1962, and is shown on the "Geologic Map of Maricopa County, Arizona," 1957, also published by the Arizona Bureau of Mines. A compilation of the county geologic maps, "Geologic Map of Arizona," at a scale of 1:500,000 was published by the U.S. Geological Survey in 1969. These maps are available for inspection at the Arizona Projects Office in Phoenix, Arizona.

Feasibility studies along reach 1, conducted during 1965, included four power auger holes (AP-1-SGC through AP-3-SGC, and AP-13-SGC), and surface geologic mapping at a scale of 1 inch equals 2,000 feet. Logs of feasibility auger holes AP-1-SGC and AP-2-SGC located along the Reach 1A alignment are included in these specifications. Their locations on plan and profile drawings are approximate because they were not located by stationing or coordinate surveys.

Between 1974 and 1975, the Soil Conservation Service, U.S. Department of Agriculture, conducted a geologic investigation for the Spook Hill Flood Retarding Structure and Floodway. Data from this investigation is included in a "Geologic Investigation Report—Spook Hill Damsite—Buckhorn-Mesa Watershed," which was assembled in late 1975 and is available for review at the Water and Power Resources Service, Arizona Project Office, Phoenix, Arizona. The dam, an emergency spillway, and floodway are located upslope adjacent to the left (east) side of Reach 1A. Construction of these structures has been completed.

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(b) Preconstruction geologic investigations.—Preconstruction investigations for the Reach 1A Aqueduct alignment began in March 1975 and continued through August of that same year. Surface geologic mapping of the area adjacent to the alignment, at a scale of 1 inch equals 200 feet, was completed during the summer of 1975. Subsurface investigations consisted of 15 bucket auger holes, AP-99-SG1 through AP-113-SG1, drilled along the lower two-thirds of the alignment using a Calweld bucket auger (24-inch diameter) and 11 Nx-size vertical drill holes, DH-101-SG1 through DH-111-SG1, drilled by a Sprague & Henwood 142C skid rig. Eight of the drill holes were drilled mostly through granitic bedrock. The last three drill holes penetrated variably caliche-cemented alluvial fan deposits consisting of mixtures of silt, sand, and gravel. Two drill holes, DH-110-SG1 and DH-111-SG1, replaced AP-104-SG1 and AP-107-SG1 after the bucket auger could not penetrate layers of strongly caliche-cemented material. In addition, four test pits (TP-1-SG1 through TP-4-SG1) were excavated by a Case 780 backhoe at anticipated bridge sites along the existing alignment. Logs of these auger and drill holes and logs of test pits are included in these specifications.

Between stations 83+60 and 326+70, the excavation of construction materials for the Spook Hill Dam and Floodway, constructed for the U.S. Soil Conservation Service, has changed the natural ground surface which existed in 1975 during the Service preconstruction investigations along the reach 1 alignment. The plan views on drawings 10 (344-D-7167A) through 15 (344-D-7172A) show the topography after construction of Spook Hill Dam and associated structures was essentially completed. The two surface profiles on each of these drawings represent the "original ground surface prior to excavation," shown in red, and a second profile generally below the first, which is marked "Existing ground surface".

Preconstruction investigations were resumed from December 1979 through February 1980. Four additional

exploration holes, drill hole DH-112-SG1, and penetration test holes PR-DH-113-SG1 through PR-DH-115-SG1, were drilled at the four bridge sites. Penetration resistance tests using a split tube sampler were performed in the finer grained subsoils, but were not attempted in materials with a high gravel content. Most standard penetration tests were invalid due to insufficient penetration of the sampler. Logs of these additional drill and standard penetration test holes are included in these specifications.

The borrow of residual soils along the aqueduct alignment right-of-way for construction of the Spook Hill Floodway (constructed by the Soil Conservation Service) necessitated additional exploration along the aqueduct alignment for evaluating sources of impervious materials. Nine test pits, TP-15-SG1 through TP-23-SG1, were excavated with an MF-80 backhoe between stations 80+00 and 160+00. Logs of these test pits, which were completed in 1980, are included in these specifications.

Potential sources of concrete aggregate were explored at two locations, the Queen Creek area aggregate source and the Salt River borrow source. Both are approved aggregate sources for these specifications. Logs of exploration for these sources and summaries of test data are included in these specifications. Locations of exploration are shown on drawings 61 (344-D-7222) and 62 (344-D-7219).

(4) Site geology of the Reach 1A alignment.—The upstream portion of the Reach 1A aqueduct alignment traverses an irregular, southwesterly sloping bedrock surface. Comprised of granitic rock, this surface extends outward an undetermined distance from the Utery Mountains under a series of coalescing alluvial fans that slope gently away from the mountain front. Approximately 75 percent of the alignment excavation and embankment construction will be in alluvial fan deposits (Qaf) while the remainder of the alignment traverses Precambrian granitics (pegr).

(a) Salt-Gila Aqueduct Reach 1A from Granite Reef Aqueduct, reach 12 station

832+25 Bk to Salt-Gila Aqueduct Reach 1 A station 100+00±. Excavation for the Aqueduct from the Salt-Gila Pumping Plant to station 20+00 will be completed by others. From station 20+00 to approximately station 100+00± (a distance of about 1.5 miles), the aqueduct prism will be excavated in, or embankments constructed on, Precambrian granitics (pegr). This portion of the canal alignment was explored by drill holes DH-102-SG1 through DH-108-SG1, and DH-112-SG1, and test pits TP-1-SG1, and TP-21-SG1 through TP-23-SG1. Along this portion of the alignment, outcrops are prevalent, and low ridges and isolated knobs (inselbergs) are located on either side of the aqueduct alignment, see drawing 60 (344-330-7377A).

The bedrock surface is dissected by numerous, normally dry, shallow washes tributary to the Salt River which contain channel deposits (Qal) of loose, clean to silty sand and gravels, see photograph CN344-330-7243NA. Channel deposits were mapped only where they have significant areal extent. Only one interval of channel deposits was delineated along the alignment, and is located near station 44+00.

The granitic rock which will comprise the foundation is gray, coarse grained, and porphyritic, with feldspar phenocrysts to 3-1/2 inches in diameter, see photograph CN344-330-7248NA. Locally, the granite exhibits gneissic texture with distinctive banding. Weathering descriptions are not based solely on oxidation or staining of the rock mass but are categorized on the degree of hydration shattering or disintegration. Weathering is extremely variable but the canal prism will be constructed primarily in highly to moderately weathered rock. Decomposed (disintegrated) granite is present to depths of at least 130 feet in the site vicinity. Where fresh or lightly weathered, the rock is hard and dense; NX-size core breaks with a moderate to sharp hammer blow. Where highly weathered and decomposed, the bedrock is crumbly, and NX-size core and fragments break along fractures or

mineral grains with manual pressure. The granite is intensely to moderately fractured with numerous very intensely fractured zones. Joint spacing in the core from exploratory drill holes varied from 1 to 40 inches apart, but most spacing ranged from 3 to 10 inches apart. Most joint surfaces are moderately to steeply dipping with random strikes. Numerous randomly oriented fractures are also present. Many fractures and joints are partly to totally healed by calcite, quartz, calcareous cementation or less commonly by iron oxides. Many joint surfaces are coated with, or infilled with silt, clay, and fine sand with calcareous cementation. Infillings and calcareous cementation are more prominent near the surface and near the granite-alluvial fan contact. Based on drill hole water losses during percolation testing and surface observations, open joints are present especially near the surface.

Pervasive shearing of the granitics in the site vicinity has resulted in the intense fracturing of the granitics. No shear or fault zones were delineated on surface geology maps and individual shear zones were not delineated in drill hole logs. However, zones of intense fracturing, the presence of slickensided surfaces, and gouge are noted in some drill hole logs. The term "brecciated" on drill hole logs is used to describe these zones. Shear planes were not readily evident in most of the recovered core.

Based on drill hole data and surface observations, surficial deposits overlie the granitics along the alignment to depths ranging from 0 to 19 feet, mostly 3 to 8 feet. These deposits consist of a heterogeneous assemblage of alluvial and colluvial deposits and residual soil, most of which are variably caliche cemented. In situ granular disintegration of the granitics produces a brown to gray, coarse sand to fine gravel-size grus. Coarse gravel- to boulder-size fragments occur where this disintegration is controlled by prominent fractures and joints, see photograph CN344-330-7244NA. These surficial deposits are not delineated on the surface geology maps.

The surface contact between the granite and the alluvial fan deposits near station 100+00± was mapped along the last granite outcrops exposed. Thickness of the alluvium in the vicinity of the alluvial fan/bedrock contact may vary from a few inches to locally several feet. Downstream from this surface contact, the depth to the top of bedrock will increase, but was not discernible in DH-109-SG1, which is approximately 710 feet downstream of the surface contact. However, granitic bedrock may be encountered in the prism excavation to about station 110+00±.

Previously excavated canal prism or constructed embankments between Granite Reef Aqueduct reach 12 station 832+25 Bk and Salt-Gila Aqueduct Reach 1A station 20+00, which will be lined under these specifications, also will be underlain by granitic rock. Logs of exploration and the geologic description for this portion of the alignment and surrounding vicinity are included in a previously issued specification (Salt-Gila Pumping Plant-3D-C7448) which is available at the Arizona Project Office in Phoenix, Arizona. Two of these logs of exploration, DH-101-SG1 and DH-202-SGPD, are included in these Reach 1A specifications.

Thomas Road Bridge site, (centerline station 94+68.97) was explored by drill hole DH-112-SG1. Residual soil and decomposed rock were logged from a depth of 0 to 8.5 feet, and variably weathered, highly to moderately fractured granite below.

(b) Salt-Gila Aqueduct Reach 1A station 100+00 to station 331+00.-From station 100+00 downstream to station 331+00, the end of construction for Reach 1A, the alignment was explored by drill holes DH-109-SG1 through DH-111-SG1, penetration test holes PR-DH-113-SG1, PR-DH-114-SG1, and PR-DH-115-SG1, auger holes AP-99-SG1 through AP-113-SG1, AP-1-SGC and AP-2-SGC, and test pits TP-2-SG1 through TP-4-SG1, and TP-15-SG1 through TP-20-SG1. Logs of all of these subsurface explorations are included in these specifications. This portion of the alignment, a distance of approximately

4.4 miles, will be constructed through a series of coalescing, gently sloping alluvial fans. Most of the canal prism will be excavated in the fan deposits; however, portions of the alignment will require the construction of compacted embankments on top of the fan deposits.

These Quaternary age alluvial fan deposits (Qaf) vary from unconsolidated to strongly caliche-cemented lenticular soils consisting predominantly of silty sand with smaller amounts of clayey sand or clean sand containing minor amounts, generally 15 percent or less, of fine gravel. Caliche cementation varies widely from weak to strong, mostly occurring as strongly cemented lenses interbedded with weakly to moderately cemented materials. Moderately to strongly caliche-cemented material occurs at the surface, but generally the fan deposits are veneered by fine to silty sand with gravel and scattered caliche chips, see photograph No. CN344-330-7245NA. Some very strongly caliche-cemented zones encountered at shallow depths were hard enough to prevent a Case CK780 backhoe equipped with ripper teeth from digging a test pit (TP-3-SG1) more than 10 feet deep. In two auger holes (AP-104-SG1 and AP-107-SG1) near TP-3-SG1, penetration by a Calweld power auger equipped with a 24-inch-diameter bucket was stopped at depths of 6 and 11 feet due to strong caliche cementation. Both sites were subsequently explored using a core drill (DH-110-SG1 and DH-111-SG1). The amount and strength of caliche cementation observed within individual auger holes and test pits differed considerably at various depths.

In this interval, the aqueduct will pass between several steep-sided hills or isolated granite knobs. Spook Hill (Red Mountain), Double Knolls, Signal Butte, and several other unnamed knobs rise about 100 to 300 feet above the alluvial fans that surround them (photograph CN344-330-7247NA). The knob closest to the aqueduct alignment is located about 400 feet right of station 218+00 and about 850 feet south of the McKellips Road Bridge site (photograph CN344-330-7246NA). No granite was encountered in DH-111-SG1

(station 215+80) located about 500 feet north-northeast of the granite outcrops near the base of the knob. The McDowell Road, McKellips Road, and Brown Road bridge foundations will be underlain by the alluvial fan deposits.

(c) Granite Reef Aqueduct Reach 12, station 786+86.32 Bk to station 821+18.17.—With the exception of a small interval of the alignment in the vicinity of the Bush Highway, excavation and construction of embankments for the aqueduct prism will be completed by others under specifications 3D-C7448—Salt-Gila Pumping Plant. Logs of drill holes DH-112-GR12 through DH-124-GR12, and DH-126-GR12 along this portion of the alignment are included in the Reach 1A specifications. Additional excavation to remove the plug between approximately station 815+00± and station 816+75± will be in bedrock comprised of Precambrian granitics (pεgr) and andesite dikes. The Bush Highway bridge also will be founded on this granitic rock. This portion of the canal alignment was explored by drill holes DH-125-GR12 and DH-151-GR12 included in these specifications.

The granite is gray, coarse grained, and porphyritic, with feldspar phenocrysts to 1-1/4 inches in diameter, see photograph CN344-330-4267NA. Outcrops, where present, are generally red-gray to gray and moderately to lightly weathered, see photograph CN344-330-4268NA. Bedrock weathering is highly variable with numerous zones of highly weathered or decomposed granite present to depths of at least 40 feet. Where fresh to lightly weathered, the bedrock is hard and dense, and Nx-size core breaks with a moderate to sharp hammer blow. Where highly weathered or decomposed, the granite is crumbly, Nx-size core segments and fragments break along fractures or mineral grain boundaries with manual pressure. Drill hole core is predominantly intensely fractured. Joint spacing varies from 1 to 24 inches apart but mostly ranges from 3 to 6 inches apart. Numerous randomly oriented fractures spaced from less than 1 inch to 3 inches apart are also present. Joint and fracture surfaces are iron stained, carbonate or

clay coated, and many are slickensided. Some joints are open near the surface and contain clay coatings or locally some sandy clay to one-eighth inch thick. Most joint attitudes are moderately to steeply dipping, but low angle and horizontal joints are also present. Where very intensely fractured, the rock has been weathered to a soft, breccia-like material that can be easily crumbled manually. Photographs CN344-330-4270NA, CN344-330-4269NA, and CN344-330-4271NA, were taken to show conditions of the granitic bedrock in the vicinity of the Bush Highway.

Andesite dikes, though not delineated on surface geologic maps, are also present along this portion of the alignment. Where observed in drill hole core, the dikes are fine grained or porphyritic and very intensely fractured.

(5) Ground water.—The regional ground-water table was not encountered in any of the shallow subsurface investigation drill holes, auger holes, penetration resistance test holes, or test pits completed along the Granite Reef reach 12 and Salt-Gila Reach 1A aqueduct alignments. Granitic bedrock present in the site vicinity is considered nonwater bearing. Ground water is present in the alluvial fan deposits traversed by the alignment. The ground-water table in the vicinity of the Salt-Gila Aqueduct Reach 1A alignment is well below the canal invert. Depths to water in several test wells near the construction area were measured in February 1980, and indicated the water levels were approximately 475 to 500 feet below the ground surface. Locations of these test wells and measured water levels are available in the Water and Power Resources Service Office in Phoenix, Arizona.

Water occurs at or near the ground surface during or shortly after periods of heavy precipitation or flash flooding. The greatest potential for surface flows is in the shallow washes that cross the alignment.

(6) Special consideration, caliche and oversize.—A significant portion of the aqueduct alignment traverses alluvial fan deposits comprised mostly of variably caliche-cemented, silty to clayey sands with gravel and cobbles. Subsurface

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investigations and surface observations indicate that caliche cementation is vertically and laterally variable. Caliche cementation is present throughout the alignment, and seven backhoe test pits, TP-15-SG1 through TP-21-SG1, and auger holes, AP-104-SG1, AP-107-SG1, AP-1-SGC, and AP-2-SGC were unable to reach predetermined depths due to strongly caliche-cemented materials.

(7) Testing and sampling.—A total of four backhoe test pits were excavated along the alignment of Reach 1A to evaluate foundation conditions at representative structure sites. These excavations were also used to evaluate the properties of the canal section foundation materials. In-place density tests were taken at depths of 1 to 2 feet, 5 to 6 feet, and 10 to 11 feet below the ground surface except where strong cementation prevented the backhoe from excavating that deep.

Identification and Proctor compaction or relative density tests were performed on the materials from the in-place density tests. The results of these tests are summarized on table 1-SG1A in these specifications. Permeability tests were also conducted on samples from three of the test pits and are summarized on table 5-SG1A. Materials encountered were mostly silty to clayey sands with gravel. Cementation with calcium carbonate was prevalent.

Samples from six power auger holes also were tested and test result summaries are shown in table 2-SG1A. A summary of laboratory permeability test results is shown in table 4-SG1A for samples from AP-114-SG1.

Samples from nine additional backhoe test pits, TP-15-SG1 through TP-23-SG1, were tested to evaluate the suitability of materials for compacted refill. No in-place density tests were performed, but sample test result summaries are shown on table 3-SG1A.

1.5.12 ELECTRIC POWER FOR CONSTRUCTION PURPOSES

The contractor shall make all necessary arrangements and shall provide all electric power required for his construction purposes. This shall

include providing all necessary transmission lines, distribution circuits, transformers, and other electrical equipment required for distributing the power to the place or places of use by the contractor.

At the termination of the contract under these specifications, the contractor shall dismantle and remove all distribution lines serving his installations, or those of his subcontractors, that are not part of the permanent power installation.

No direct payment will be made to the contractor for providing electric power for construction purposes and the cost thereof shall be included in the prices bid in the schedule for other items of work.

1.5.13 WATER FOR CONSTRUCTION PURPOSES

a. General.—The contractor shall furnish all water required for construction purposes. The contractor shall make all arrangements for obtaining water and provide all means for conveying water to points of use.

Water may be purchased from privately owned wells in the area by making arrangements with the owners.

Water required for use in concrete shall meet the requirements set forth in paragraph 5.3.4.

b. Cost.—The cost of furnishing all water for construction purposes and of providing necessary facilities in conveying water to points of use shall be included in the prices bid in the schedule for other items of work.

SECTION 1.6—ENVIRONMENTAL QUALITY PROTECTION

1.6.1 LANDSCAPE PRESERVATION

a. General.—The contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, approved construction roads, or excavation operations, all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage by the contractor's construction operations and equipment. The edges of

clearings and cuts through trees, shrubbery, and vegetation shall be irregularly shaped to soften the undesirable visual impact of straight lines. Movement of crews and equipment within the right-of-way and over routes provided for access to the work shall be performed in a manner to prevent damage to grazing land, crops, or property.

Special reseeded or replanting will not be required under these specifications; however, on completion of the work, all work areas shall be scarified and left in a condition which will facilitate natural revegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the contractor's operations shall be repaired, replanted, reseeded, or otherwise corrected as directed by the contracting officer and at the contractor's expense.

b. Construction roads.—The location, alignment, and grade of construction roads shall be subject to approval of the contracting officer. When no longer required by the contractor, construction roads shall be restored to the original contour and made impassable to vehicular traffic. The surfaces of such construction roads shall be scarified as needed to provide a condition which will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

c. Construction facilities.—The contractor's shop, office, and yard area shall be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all storage and construction buildings, including concrete footings and slabs, and all construction materials and debris shall be removed from the site. The area shall be regraded, as required, so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

d. Borrow areas and quarry sites.—Borrow pits and quarry sites shall be so excavated that water will not collect and stand therein. Where necessary, as determined by the contracting officer, they shall be drained by open ditches. Before being abandoned, the sides of borrow pits and quarry sites shall be brought to stable slopes, scarified, and left in a condition which will facilitate natural

revegetation. All rubbish, construction equipment, and structures shall be removed from the site. Waste piles shall be shaped to provide a natural appearance.

e. Blasting precautions.—In addition to the requirements of section 24 of Water and Power Resources Service "Construction Safety Standards," the contractor shall adopt precautions when using explosives which will prevent scattering of rocks, stumps, or other debris outside the work area, and prevent damage to surrounding trees, shrubbery, and vegetation.

f. Costs.—The cost of all work required by this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.2 PRESERVATION OF TREES AND SHRUBBERY

a. Preservation.—All trees and shrubbery which are not specifically required to be cleared or removed for construction purposes shall be preserved and shall be protected from any damage that may be caused by the contractor's construction operations and equipment. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage, or other operations; and the contractor shall adequately protect such trees by use of protective barriers or other methods approved by the contracting officer. The removal of trees or shrubs will be permitted only after prior approval by the contracting officer.

The layout of the contractor's construction facilities such as shops, warehouses, storage areas, and parking areas; location of access and haul routes; and operations in borrow and spoil areas shall be planned and conducted in such manner that all trees and shrubbery not approved for removal by the contracting officer shall be preserved and adequately protected from either direct or indirect damage by the contractor's operations.

Except in emergency cases or when otherwise approved by the contracting officer, trees shall not be used for anchorages. Where such use is approved, the trunk shall be wrapped with a sufficient thickness of approved protective material before any rope, cable, or wire is placed.

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b. Repair or treatment of damage.—The contractor shall be responsible for injuries to trees and shrubs caused by his operations. The term "injury" shall include, without limitation, bruising, scarring, tearing, and breaking of roots, trunk, or branches. All injured trees and shrubs shall be repaired or treated without delay, at the contractor's expense. If damage occurs, the contracting officer will determine the method of repair or treatment to be used for injured trees and shrubs as recommended by an experienced horticulturist or a licensed tree surgeon provided by and at the expense of the contractor. All repairs or treatment of injured trees shall be performed under the direction of an experienced horticulturist or a licensed tree surgeon provided by and at the expense of the contractor.

Where tree climbing is necessary, the use of climbing spurs will not be permitted. If climbing is necessary, safety ropes shall be required.

c. Replacement.—Trees or shrubs that, in the opinion of the contracting officer, are beyond saving shall be removed and replaced early in the next planting season. The replacements shall be the same species, or other approved species, and of the maximum size that is practicable to plant and sustain growth in the particular environment. Replacement trees and shrubs shall be guyed, watered, and maintained for a period of 1 year. Any replacement tree or shrub that dies shall be removed and replaced, as directed by the contracting officer, with such replacements being maintained for a period of 1 year from the date of replacement.

d. Cost.—The cost of all work required by this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.3 PROTECTED PLANTS

Certain native plants in the State of Arizona are considered as protected plants in accordance with the provisions of the latest revision of the Arizona Native Plant Law. The contractor shall ascertain which construction areas contain protected plants and, at least 60 days before beginning construction operations in such an area, shall notify the contracting officer. The contracting officer will arrange for removal of the protected plants and the contractor shall cooperate with those performing such removal.

The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.4 PREVENTION OF WATER POLLUTION

a. General.—The contractor's construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, and other objectionable pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

Unwatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or watercourses shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Excavated materials or other construction materials shall not be stockpiled or deposited near or on streambanks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the actual watercourse itself.

Turbidity increases in a stream or other bodies of water that are caused by construction activities shall be limited to the increases above the natural turbidities permitted under the water quality standards prescribed for that stream or body of water. When necessary to perform required construction work in a stream channel, the prescribed turbidity limits may be exceeded, as approved by the contracting officer, for the shortest practicable period required to complete such work. This required construction work may include such work as diversion of a stream, construction or removal of cofferdams, specified earthwork in or adjacent to a stream channel, pile driving, and construction of turbidity control structures. Mechanized equipment shall not be operated in flowing water except as necessary to construct crossings or to perform the required construction.

Wastewaters from aggregate processing, concrete batching, or other construction operations shall not enter streams, watercourses, or other surface waters without the use of such turbidity control methods as settling ponds, gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates, or other approved methods. Any such wastewaters discharged into surface waters shall be essentially free of settleable material. For the purpose of these specifications, settleable material is defined as that material which will settle from the water by gravity during a 1-hour quiescent detention period.

b. Compliance with laws and regulations.—The contractor shall comply with applicable Federal and State laws, orders, and regulations concerning the control and abatement of water pollution.

The contractor shall also comply with the sanitation and potable water requirements of section 7 of Water and Power Resources Service "Construction Safety Standards."

c. Cost.—The cost of complying with this paragraph shall be included in the prices bid in the schedule for the various items of work.

1.6.5 ABATEMENT OF AIR POLLUTION

The contractor shall comply with applicable Federal, State, and local laws and regulations concerning the prevention and control of air pollution. Local authorities may have the responsibility of monitoring air quality and the contractor shall cooperate with the local authorities.

In conduct of construction activities and operation of equipment, the contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants.

The emission of dust into the atmosphere will not be permitted during the manufacture, handling, and storage of concrete aggregates, and the contractor shall use such methods and equipment as are necessary for the collection and disposal, or prevention, of dust during these operations. The contractor's methods of storing and handling cement and pozzolans shall also

include means of eliminating atmospheric discharges of dust.

Equipment and vehicles that show excessive emissions of exhaust gases due to poor engine adjustments, or other inefficient operating conditions, shall not be operated until corrective repairs or adjustments are made.

Burning of materials resulting from clearing of trees and brush, combustible construction materials, and rubbish will be permitted only when atmospheric conditions for burning are considered favorable when authorized by appropriate State or local air pollution or fire authorities. In lieu of burning, such combustible materials may be disposed of by other methods as provided in paragraphs 1.6.11 and 2.1.1. Where open burning is permitted, the burn piles shall be properly constructed to minimize smoke, and in no case shall unapproved materials, such as tires, plastics, rubber products, asphalt products, or other materials that create heavy black smoke or nuisance odors, be burned.

Storage and handling of flammable and combustible materials, provisions for fire prevention, and control of dust resulting from drilling operations shall be in accordance with the applicable provisions of the Water and Power Resources Service "Construction Safety Standards."

Dust nuisance resulting from construction activities shall be prevented in accordance with paragraph 1.6.6.

The cost of complying with this paragraph including the payment of monitoring fees, shall be included in the prices bid in the schedule for other items of work.

1.6.6 DUST ABATEMENT

During the performance of the work required by these specifications or any operations appurtenant thereto, whether on right-of-way provided by the Government or elsewhere, the contractor shall furnish all the labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging crops, orchards, cultivated fields, and dwellings, or causing a nuisance to persons. The contractor will be held liable for any damage resulting from dust originating from his operations under these

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specifications on Government right-of-way or elsewhere.

The cost of procuring and applying water or of other methods of reducing formation of dust shall be included in the prices bid in the schedule for other items of work: Provided, That payment for procuring and applying water for dust abatement applied within the right-of-way lines, will be made in accordance with paragraph 2.2.1.

1.6.7 NOISE ABATEMENT

a. General.—The contractor shall comply with applicable Federal, State, and local laws, orders, and regulations concerning the prevention, control, and abatement of excessive noise.

Nighttime blasting, the use of jackhammers, pile driving, or other operations producing high-intensity impact noise may be performed only upon approval of the contracting officer.

b. Cost.—The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.8 LIGHT ABATEMENT

The contractor shall exercise special care to direct all stationary floodlights to shine downward at an angle less than horizontal. These floodlights shall also be shielded so as not to be a nuisance to surrounding areas. No lighting shall include a residence in its direct beam.

The contractor shall be responsible for correcting lighting problems when they occur as approved by the contracting officer.

The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.9 PRESERVATION OF HISTORICAL AND ARCHEOLOGICAL DATA

a. Federal legislation provides for the protection, preservation, and collection of scientific, prehistorical, historical, and archeological data (including relics and specimens) which might otherwise be lost due to alteration of the terrain as a result of any Federal construction project.

b. The contractor agrees that should he or any of his employees in the performance of this contract discover evidence of possible scientific, prehistorical, historical, or archeological data he will notify the contracting officer immediately giving the location and nature of the findings. Written confirmation shall be forwarded within 2 days. The contractor shall exercise care so as not to damage artifacts or fossils uncovered during excavation operations and shall provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition by the Government.

c. Where appropriate by reason of a discovery, the contracting officer may order delays in the time of performance, or changes in the work, or both. If such delays, or changes, or both, are ordered, the time of performance and contract price shall be adjusted in accordance with the applicable clauses in the General Provisions of this contract.

d. The contractor agrees to insert this paragraph in all subcontracts which involve the performance of work on the terrain of the site.

e. Except as otherwise provided above, the cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.10 PESTICIDES

Pesticides include herbicides, insecticides, fungicides, and rodenticides. Should the contractor find it necessary to use pesticides in work areas of this contract, he shall submit his plan for such use to the contracting officer for written approval. Such plan shall be subject to submittal to and review by the Federal Working Group on Pest Management before the plan is approved.

Pesticides shall only be those registered with the Environmental Protection Agency in compliance with the Federal Environmental Pesticide Control Act of 1972 and other Federal pesticide acts. Pesticides named on the Department of the Interior's "Prohibited List" shall not be used. A copy of the "Prohibited List" can be obtained from regional offices of the Water and Power Resources Service or from the Water and Power Resources Service, Attn D-203, P O Box 25007, Denver CO 80225.

The cost of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.11 CLEANUP AND DISPOSAL OF WASTE MATERIALS

a. Cleanup.—The contractor shall, at all times, keep the construction area, including storage areas used by him, free from accumulations of waste materials or rubbish.

Prior to completion of the work, the contractor shall remove from the vicinity of the work all plant facilities, buildings, rubbish, unused materials, concrete forms, and other like material, belonging to him or used under his direction during construction. All work areas shall be graded and left in a neat manner conforming to the natural appearance of the landscape as provided in paragraph 1.6.1.

In the event of the contractor's failure to perform the above work, the work may be performed by the Government, at the expense of the contractor, and his surety or sureties shall be liable therefor.

b. Disposal of waste materials.—

(1) General.—Waste materials including, but not restricted to, refuse, garbage, sanitary wastes, industrial wastes, and oil and other petroleum products, shall be disposed of by the contractor. Except as otherwise provided in paragraph 2.1.1, disposal of combustible materials shall be by burying, where burial of such materials is approved by the contracting officer; by burning, where burning of approved materials is permitted in accordance with State and local laws; or by removal from the construction area. Except as otherwise provided in paragraph 3.2.6, disposal of noncombustible materials shall be by burying, where burial of such materials is approved by the contracting officer, or by removal from the construction area. Waste materials removed from the construction area shall be dumped at an approved dump.

(2) Disposal of material by burying.—Only materials approved by the contracting officer may be buried. Burial shall be in pits at locations shown on the drawings or as otherwise approved by the contracting officer. The pits shall be covered by at least

2 feet of earth material prior to abandonment.

(3) Disposal of material by burning.—The contractor shall secure the necessary burning permits from the State and local authorities. All burning shall be in accordance with State and local laws.

All materials to be burned shall be piled in designated burning areas in such a manner as will cause the least fire hazards. Burning shall be thorough and complete and all charred pieces remaining after burning, except for scattered small pieces, shall be removed from the construction area and disposed of as otherwise provided in this paragraph.

The contractor shall, at all times, take special precautions to prevent fire from spreading beyond the piles being burned and shall be liable for any damage caused by his burning operations. The contractor shall have available, at all times, suitable equipment and supplies for use in preventing and suppressing fires and shall be subject to all laws and regulations locally applicable for presuppression, suppression, and prevention of fires.

(4) Disposal of material by removal.—Material to be disposed of by removal from the construction area shall be removed from the area prior to the completion of the work under these specifications. All materials removed shall become the property of the contractor.

Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the contractor to make any necessary arrangements with private parties and with county officials pertinent to locations and regulations of such dumping. Any fees or charges required to be paid for dumping of materials shall be paid by the contractor.

c. Cost.—The costs of complying with this paragraph shall be included in the prices bid in the schedule for other items of work.

1.6.12 ENVIRONMENTAL LITIGATION

If construction under these specifications is suspended, delayed, or interrupted through no fault of the contractor by an order of a court of

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competent jurisdiction pursuant to environmental litigation, such suspension, delay, or interruption will be considered to be an unreasonable suspension, delay, or interruption pursuant to the provisions of clause No. 17 of the General Provisions, "Suspension of Work."

DIVISION 2--SITWORK

SECTION 2.1--CLEARING AND GRUBBING

2.1.1 CLEARING AND GRUBBING

a. Clearing.--That portion of the right-of-way where required for access to and for constructing the work under these specifications shall be cleared of all trees, brush, rubbish, and other objectionable matter. Trees designated by the contracting officer shall not be cut and shall be protected from injury as provided in paragraph 1.6.2. Such cleared materials shall be disposed of as provided in subparagraph c. below, or removed from the site of the work before the date of completion of the contract as approved by the contracting officer. If removal of the materials from the site is approved, the materials shall become the property of the contractor upon removal and shall be disposed of by the contractor as he sees fit.

Clearing adjacent to cut-and-fill sections shall be to a minimum distance of 3 feet outside of the slope lines.

b. Grubbing.--The ground surface under all embankments of normal dimensions, as shown on the drawings, and under other embankments where directed by the contracting officer and the surface of all excavation that is to be used for embankments shall be cleared of stumps, roots, and vegetable matter of every kind. The stumps shall be pulled or otherwise removed and the roots shall be grubbed.

c. Disposal of cleared and grubbed materials.--Cleared and grubbed material may be crushed and buried under waste embankments or disposal areas as approved by the contracting officer, burned if the contractor has obtained the proper permits and at locations approved by proper state or local authorities and contracting officer, or reduced to chips of 1/2-inch-maximum thickness. The chips shall be distributed uniformly on the embankment slopes where directed and mixed with underlying earth so that they will not support combustion.

d. Payment.--Payment for clearing and grubbing will be made at the lump-sum price bid therefor in the schedule, which price shall include the cost of all work required by this

paragraph, including disposal of the cleared and grubbed materials.

SECTION 2.2--USE OF WATER

2.2.1 WATER FOR DUST ABATEMENT

a. General.--The contractor shall procure and apply water for dust abatement within the right-of-way lines.

Water applied for dust abatement will be measured for payment: Provided, That payment will only be made for water directed to be applied for dust abatement.

The contractor shall provide, at his expense, all means of conveying the water to the point of use. The amounts of water applied for dust abatement will be subject to the approval of the contracting officer.

b. Measurement and payment.-- Measurement, for payment, of water for dust abatement will be made in tank trucks of predetermined capacity or by means of watermeters of approved types which shall be furnished and installed by the contractor and will include only the quantity of water applied for dust abatement within the right-of-way lines as approved by the contracting officer.

Payment for procuring and applying water for dust abatement within the right-of-way lines will be made at the fixed unit price per M (1,000) gallons bid in the schedule for water for dust abatement and payment will only be made for water used at the direction or approval of the contracting officer. The costs of procuring and applying water elsewhere shall be included in the prices bid in the schedule for the items of work for which the water is used.

No payment will be made for water that has been wasted by carelessness, by excessive application causing runoff, or for water that has been unnecessarily applied due to changes in the contractor's schedule of operations.

2.2.2 PREWETTING CANAL PRISM AND ADJACENT AREAS

a. General.--The contractor shall furnish all labor, materials, and equipment and shall

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procure and apply water required for prewetting the canal prism and adjacent areas under dikes, canal bridge abutments, and roadway embankments between Salt-Gila Aqueduct-Reach 1A stations 20+00 and 331+00 and under bridge abutments on Granite Reef Aqueduct-Reach 12 completion at station 815+66.37 in accordance with the applicable provisions of paragraphs 3.2.3 and 3.4.2.

The waterline for sprinkler irrigation shall be located within the right-of-way on the downhill side of the canal.

The contractor shall provide all means of conveying the water to the point of use. The amounts of water applied on the right-of-way will be subject to the approval of the contracting officer.

b. Payment.—Payment for prewetting canal prism and adjacent areas will be made at the lump-sum price bid therefor in the schedule and shall include all costs of furnishing all labor, equipment, materials, water, moving to the sites, assembling into working condition, disassembling and removing from the site, and all other work required by this paragraph.

Fifty percent of the lump-sum price bid in the schedule for prewetting canal prism and adjacent areas will be included in the monthly estimate for progress payments for the month during which the prewetting operations have commenced. The remaining 50 percent of the lump-sum price will be included in the monthly estimates for progress payments as a percentage of the prewetting operations which have been completed between the stations listed above during the month for which such estimate is prepared.

SECTION 2.3-SITE DRAINAGE

2.3.1 CROSS DRAINAGE

The contractor shall handle all flows from natural drainage channels intercepted by the work under these specifications, perform any additional ditching and grading for drainage as directed, and provide and maintain any temporary construction required to bypass or otherwise cause the flows to be harmless to the work and property. When the temporary construction is no longer needed and prior to acceptance of the work, the contractor shall remove the temporary construction and restore the site to its original

condition as approved by the contracting officer. The cost of all work and materials required by this paragraph shall be included in the prices bid in the schedule for other items of work.

2.3.2 DRAINAGE DITCHES, BERM DRAINAGE, AND WINDROWS

a. Drainage ditches.—In connection with the excavation for the canal and structures, the contractor shall perform excavation for the construction or modification of drain ditches, "V" drain ditches, berm ditches, bathtub-type discharge pools for structures, inlet and outlet channels or ditches and berms for structures, irrigation ditches for irrigation crossings, and other unnamed and dimensioned ditches. Also, the contractor shall construct dikes as may be directed by the contracting officer.

The location, grades, and sections of the ditches and dikes shall be as shown on the drawings and/or as directed.

b. Berm drainage and windrows.—Berm drainage including drainage along the berms and banks of the canal and longitudinal berm ditches shall be constructed where shown on the drawings. The berm ditches shall be constructed to dimensions and grades shown on the drawings or as directed.

The surfaces of berms shall be sloped transversely and earth windrows shall be made along the sides of the banks and berms where shown on the drawings and elsewhere where directed. The windrows may be made by blading of material in place following completion of a canal reach.

c. Measurement and payment.—Measurement, for payment, of excavation for the above ditches and dikes will be made to the lines shown on the drawings or as directed. Payment for excavation for the above ditches, channels, and dikes will be made at the unit price bid in the schedule for excavation for canal, which unit price shall include the costs of placing the material in embankments or otherwise disposing of the excavated materials, and all work necessary to maintain the work in good order during construction.

No direct payment will be made for constructing windrows and sloping berms, and the cost thereof shall be included in the

unit price bid in the schedule for excavation for canal.

SECTION 2.4-FENCING

2.4.1 CHAIN LINK FENCES

a. General.—The items of the schedule for furnishing and erecting chain link fence and furnishing and erecting chain link fence on bridges includes furnishing all materials and performing all work for erecting the 7-foot-high chain link fence along the canal and on the bridges where shown on the drawings except that chain link fence on exterior parapets not adjacent to a walkway or equestrian crossing shall be 3 feet 6 inches high and without barbed wire. The 7-foot-high chain link fence shall consist of 6-foot chain link fabric topped with three strands of barbed wire in a 1-foot height. The chain link fences shall be complete with fabric and barbed wire; posts, gates, and accessories; concrete; anchorage on bridges; and other materials required for complete erection of the fences, except padlocks.

The fences shall be standard chain link fence with gates and a guard of three strands of barbed wire in accordance with the details shown on drawings 56 (40-D-6268) and 47 (344-D-7205), except that no barbed wire is required on the bridges, and the supporting arms for the barbed wire shall be mounted vertically along the canal.

The contractor shall connect the chain link fence to the existing chain link fence in the vicinity of the Granite Reef Aqueduct, reach 12, stations 821+18.17 and 832+25.

b. Materials.—Chain link fencing shall conform to Federal Specification RR-F-191G/GEN and the following detail Federal Specifications.

(1) Chain link fabric.—The chain link fabric shall be one of the following only:

(a) Zinc-coated steel fabric.—Federal Specification RR-F-191/1B, type I, 2-inch mesh, No. 11 gage (0.120-inch nominal wire diameter after coating), and minimum weight of zinc coating of 1.2 ounces per square foot of uncoated wire surface.

(b) Aluminum-coated steel fabric.—Federal Specification RR-F-191/1B, type II, 2-inch mesh, No. 11 gage (0.120-inch nominal wire diameter after coating), and minimum weight of aluminum coating of 0.30 ounce per square foot of uncoated wire surface.

(c) Aluminum alloy fabric.—Federal Specification RR-F-191/1B, type III, 2-inch mesh, No. 9 gage (0.148-inch nominal wire diameter).

The bottom 18 inches minimum to 24 inches maximum of the chain link fabric shall be painted with one coat only of Subox enamel in a dark beige color approved by the contracting officer as manufactured by BASF Wyandotte Corp., Carlstadt, New Jersey; or equal. The method of application may be either by roller, broom, or dipping.

(2) Fenceposts, top rails, and braces.—Except as otherwise provided in this paragraph or shown on the drawings, fenceposts, top rails, and braces shall be zinc-coated steel pipe in accordance with Federal Specification RR-F-191/3B, class 1, grade A. C-section line posts, zinc coated in accordance with ANSI/ASTM A 123, not less than 0.120-inch wall thickness, weighing not less than 2.28 pounds per foot of length, and fabricated from steel conforming to the requirements of ANSI/ASTM A 570, grade E, may be furnished in lieu of steel pipeline posts.

(3) Gates and gate accessories.—Except as otherwise provided in this paragraph or shown on the drawings, gates and gate accessories shall be in accordance with Federal Specification RR-F-191/2B, type I.

Gates shall be swing-type gates with zinc-coated, round tubular frames. The zinc coating shall have an average weight of not less than 1.8 ounces per square foot of surface. The gate fabric shall be the same as the fabric that is furnished for the fence.

Each gate leaf shall be equipped with one pair of heavy hinges that will allow a full gate opening between gate posts. The hinges shall be designed to not twist or turn under gate action and shall allow the gate to swing a full 180° to lie along and parallel to the fenceline. The gates shall have heavy

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latches of an approved type. The latches shall have suitable provisions for padlocking.

Gate hinges, latches, keepers, and other accessories shall be of zinc-coated steel, ductile iron, or malleable iron, except that wire ties and clip bolts and nuts may be of aluminum alloy. The minimum weight of the zinc coating shall be 1.2 ounces per square foot of surface. The barbed wire guard at the top of each gate shall be in accordance with the details shown on the drawings.

(4) Chain link fence accessories.—Except as otherwise provided in this paragraph or shown on the drawings, chain link fence accessories shall be in accordance with Federal Specification RR-F-191/4B.

Post caps, rail ends, and barbed wire support arms shall be of zinc-coated steel, malleable iron, or ductile iron, except that post caps and rail ends may be of cast iron. Rail sleeves, wire ties and clips, brace bands, tension bands, reinforcing wire, and tension or stretcher bars shall be of zinc-coated steel, except that wire ties, clip bolts, and nuts may be of aluminum alloy. Two No. 12-1/2-gage twisted barbless zinc-coated strands may be substituted for the No. 7-gage bottom reinforcing wire.

The barbed wire shall be either zinc-coated steel or aluminum alloy barbed wire to match the type of fence fabric furnished.

(5) Zinc dust-zinc oxide paint.—Federal Specification TT-P-641G, type II.

(6) Nonsettling grout shall be in accordance with paragraph 5.6.1.

c. Erection.—Ground surface irregularities, and other obstacles which would interfere with proper erection of the fence shall be cleared and removed in advance of starting fencing work. Removed material shall be disposed of as provided in paragraph 2.1.1. The contractor shall perform all required excavating, backfilling, and compacting of backfill for posts and gatekeepers. Posts shall be plumb and in alinement. Posts shall be set in concrete as shown. Gatekeepers shall be set in concrete. Where the nature of the material to be excavated is such that the holes for the footings cannot be excavated to the required dimensions and the concrete placed directly

against the surfaces of the excavation, forms shall be used for the concrete.

The cement content of the concrete shall be not less than 5-1/2 bags per cubic yard of concrete.

Gates shall be erected at the location shown, and shall be adjusted to operate in an approved manner.

One tension or stretcher bar shall be provided for each gate and end post and two for each corner and pull post.

Damaged areas of galvanizing shall be cleaned with mineral spirits or xylene, followed by wire brushing. After wire brushing, these areas shall be recleaned with the solvent to remove residue. After cleaning, the damaged areas shall be given two coats of zinc dust-zinc oxide paint. Except for painting damaged areas of galvanizing, no other painting of the fence is required.

Where ground conditions to the fence are required, the cost of such connections and materials for making the connections shall be included in the work for installing the grounding system for the electrical equipment.

d. Measurement and payment.—Measurement, for payment, of chain link fence and chain link fence on bridges will be made along the toprail from centerline to centerline of posts, including gates and overhangs. Payment for furnishing and erecting chain link fence and for furnishing and erecting chain link fence on bridges will be made at the applicable unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials including cement and the fence anchorage at bridges, performing all clearing and earthwork, placing concrete for posts and gatekeepers, furnishing and installing ground rods and grounding fences, and all other work required for complete erection of the fence.

2.4.2 REMOVING EXISTING CHAIN LINK FENCE

The contractor under these specifications shall remove, salvage, and reuse as directed existing chain link fence.

No direct payment will be made to the contractor for labor and equipment required to remove and salvage the existing chain link fence and the cost thereof shall be included in the unit price per linear foot bid in the schedule for furnishing and erecting chain link fence.

2.4.3 FENCE GROUNDING

a. General.—Where 69 kilovolts and above power transmission lines cross chain link fences including gates, the fences shall be grounded as shown on drawing 53 (40-D-6376).

The contractor shall furnish and install all the materials required to complete a low-impedance grounding system for these fences.

The grounding systems indicated on the drawing supplement the requirements in this paragraph. The conductors used for grounding purposes shall be sized as shown on the drawing.

After the connections are made, any metal finishes that have been damaged or removed as a result of the grounding connections being made shall be repaired.

Grounding connections shall be made in accordance with the methods outlined on the drawing and in the "Field Procedures for Electrical Installations, Chapter 2, Electrical Standards for Equipment Installation," of the Bureau of Reclamation.

Ground rods shall be driven vertically the full length of the rod until the top of the rod is at the depth as shown on the drawing below the established elevation of the grade. When solid rock is encountered within 3 feet of the established elevation of the grade, the ground rod shall be grouted into a vertical hole of such depth that the top of the rod will be at the depth as shown on the drawing below the established elevation of the grade. The diameter of the holes shall be at least 1-1/2 times the diameter of the ground rod. When solid rock is encountered more than 3 feet below the established elevation of the grade, drive rod to the refusal at approximately 45° angle, then bend the top of the rod to lie horizontally at the depth as shown on the drawing below the grade elevation.

b. Materials.—

(1) Ground cables.—The copper-clad steel cables for grounding shall be 9/16 inch (seven No. 5 AWG nominal diameter 0.546 inch) or 11/32 inch (seven No. 9 AWG nominal diameter 0.343 inch), dead-soft annealed, 40 percent conductivity as indicated on drawing 53 (40-D-6376). The cables shall be equal to Copperweld annealed stranded as manufactured by Copperweld Bimetals Division, Glassport, Pennsylvania, and in accordance with ASTM designation: B 228 where applicable.

(2) Cable fittings, lugs, and connectors.—All cable fittings other than welded type shall be of the bolted-solderless type and shall have current-carrying capacity equal to that of the cable with which they are used. All cable fittings, lugs, and connectors together with the bolts, nuts, and washers used therewith for copper-clad ground cables shall be of copper alloy containing not more than 4 percent zinc. Aluminum connectors shall be used to connect aluminum to aluminum, and tinned-bronzed connectors shall be used to make aluminum-to-copper connections.

(3) Ground rods.—Each ground rod shall have a layer of copper inseparably bonded to a steel core, 3/4-inch nominal diameter, 10 feet long, and shall meet requirements of UL 467 (ANSI C33.8).

(4) Welding.—Where Cadweld, Thermoweld, or an equivalent process is used, it shall be a heavy-duty type, made of new material from fresh stock, and the installation shall be performed with heavy-duty welding equipment in accordance with the manufacturer's instructions.

One full-size print of each specifications drawing furnished to the contractor for construction purposes as applicable shall be marked to show any changes and additions made during construction and to show the outlines of equipment actually furnished; the marked prints shall be returned to the Construction Engineer who will forward the marked print(s) to the Engineering and Research Center so that the revisions can be transferred to the original drawing.

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c. Cost.—The cost of furnishing and installing ground rods and grounding materials for fences shall be included in the unit price per linear foot bid in the schedule for furnishing and erecting chain link fence, which unit price shall include the cost of furnishing all equipment, materials, and labor required by this paragraph.

DIVISION 3-EARTHWORK**SECTION 3.1-EARTHWORK, GENERAL****3.1.1 EARTHWORK DIAGRAMS AND DATA**

To the extent that they exist, preliminary mass diagrams and earthwork data prepared for the Government's preliminary studies of earthwork for construction of the canal will be available for inspection by bidders in the office of the Construction Engineer. Preliminary mass diagrams include all excavation to pay lines shown on the drawings.

Such preliminary earthwork information is made available solely for the convenience of bidders. The Government does not represent that this information is accurate or complete. Bidders are cautioned that this information is subject to revision and that the Government disclaims responsibility for any interpretations, deductions, or conclusions which may be made therefrom. It is not intended that this preliminary earthwork information will limit or prescribe the excavation and hauling procedures of the contractor, and the Government reserves the right to utilize and distribute earthwork materials during the progress of the work as best serves the interest of the Government.

3.1.2 COMPACTING EARTH MATERIALS

a. General.—Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, voids, laminations, or other imperfections.

b. Compacting clayey and silty materials.—Where compaction of earth materials containing appreciable amounts of clay or silt is required, the materials shall be deposited in horizontal layers. The thickness of each horizontal layer after compaction shall be not more than 6 inches or two-thirds the length of the roller tamping feet whichever is the lesser. Where compaction is performed by hand or power tampers, the compacted layers shall not exceed 6 inches in thickness. The excavating and placing operations shall be such that the materials when compacted will

be blended sufficiently to secure the highest practicable density and best impermeability and stability. If the surface of any compacted layer of earthfill is too dry or smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and/or scarified in an approved manner to provide a satisfactory bonding surface before the next succeeding layer is placed. All rollers used on any one layer of fill shall be of the same type and the same weight per foot of roller.

Prior to and during compaction operations, the materials shall have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, as determined by the contracting officer and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the contracting officer, moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented by sprinkling at the site of compaction, if necessary. If the moisture content is not within the limits described above, the compaction operations shall not proceed, except with the specific approval of the contracting officer, until the material has been wetted or allowed to dry out, as may be required, to obtain optimum moisture content within the tolerances permitted above, and no adjustment in price will be made on account of any operations of the contractor in wetting or drying the materials or on account of any delays occasioned thereby.

When the material has been conditioned as hereinbefore specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density.

The designations hereinafter refer to methods of tests described in the Second Edition of the Water and Power Resources Service Earth Manual.

The dry density of the portion of the soil passing the No. 4 sieve (minus No. 4 fraction) in the compacted material shall not be less than 95 percent of the laboratory maximum dry density as determined by the Water and

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Power Resources Service laboratory compaction test.

(1) Water and Power Resources Service laboratory compaction test.—The compaction tests will be made by the Government or its representative. The maximum dry density of the soil obtained by either of the following Water and Power Resources Service procedures is called the laboratory maximum dry density.

Test	Earth Manual designation
Proctor Compaction Test	E-11
Rapid compaction Control	E-25

The optimum moisture content is the moisture content that corresponds to the laboratory maximum dry density.

When soils contain more than 50 percent gravel, the required percentage of the laboratory maximum dry density can be reduced. The required percent of Proctor maximum dry density can be read directly from the appropriate curve from figure 38-4 in the Earth Manual.

c. Compacting cohesionless materials.—

(1) Compacting cohesionless free-draining materials.—Where compaction of cohesionless free-draining materials, such as sands and gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than 6 inches if compaction is performed by tampers or rollers; not more than 12 inches if compaction is performed by treads of crawler-type tractors, surface vibrators, or

similar equipment; and not more than the penetrating depth of the vibrator if compaction is performed by internal vibrators.

The relative density of the compacted material shall be not less than 70 percent as determined by the Water and Power Resources Service Relative Density of cohesionless soils test. (Designation E-12 of the Earth Manual.)

(a) Relative density test.—The relative density tests will be made by the Government or its representative. The relative density of a cohesionless free-draining soil, expressed as a percentage, is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures described in designation E-12 of the Earth Manual. The relative density is described by or determined by the following formula wherein the maximum density is the highest density of the soil, minimum density is the lowest density of the soil, and in-place density is the density of the minus 3-inch fraction of the soil in place. Tests for moisture content are made on the materials and the densities are expressed in terms of oven-dry weights.

Rel. Den. (%) =

$$\frac{\text{max. den.} \times (\text{in-place den.} - \text{min. den.})}{\text{in-place den.} \times (\text{max. den.} - \text{min. den.})} \times 100$$

(2) Compacting cohesionless materials containing some clay and silt.—This subparagraph applies only to cohesionless materials and not to cohesive materials. Cohesionless materials may not be free draining. When compaction of cohesionless materials containing clay and silt is required, the materials shall be compacted to a dry density in accordance with either subparagraph (a) or (b) below, using whichever test that results in the higher dry density of the compacted material in the placement.

(a) Dry density using the Water and Power Resources Service laboratory compaction test as prescribed in subparagraph b.(1) above.—Prior to and during compaction operations, the materials shall have a moisture content

of not greater than 2 percent wet or less than 4 percent dry of optimum moisture, as determined by the contracting officer, and the moisture content shall be uniform throughout each layer: Provided, That for materials being compacted that have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, the dry density of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory maximum soil dry density, as determined by the Water and Power Resources Service laboratory compaction test and that for materials being compacted that have a moisture content between 2 and 4 percent dry of optimum moisture, the dry density of the soil fraction in the compacted material shall not be less than 98 percent of the laboratory maximum soil dry density, as determined by the Water and Power Resources Service laboratory compaction test.

(b) Dry density using the relative density test as prescribed in subparagraph c.(1)(a) above.—The relative density of the compacted material shall be not less than 70 percent as determined by the Water and Power Resources Service Relative Density of cohesionless soils test. (Designation of E-12 of the Earth Manual.)

Except as otherwise provided for moisture content in subparagraph c.(2)(a) above, when density is determined by the Water and Power Resources Service laboratory compaction test, the materials shall be moistened, placed, and compacted in accordance with subparagraph b. above. When density is determined by the relative density test, the materials shall be moistened, placed, and compacted in accordance with subparagraph c.(1) above.

d. Rollers.—Rollers used for compacting earth materials described in subparagraph b. above shall be tamping rollers meeting the following requirements. Each drum of a roller shall be not more than 6 feet in length. The roller shall have staggered and uniformly spaced tamping feet and be of sufficient weight for proper compaction. The end area of each tamping foot shall be not less than 5 square inches nor more than 10 square inches. The length of each tamping foot measured from the surface

of the drum to the surface of the tamper head shall be not less than 7 inches. The distance measured on the surface of the drum between the center of any two adjacent tamping feet shall be not less than 8 inches. The total end area of the tamping feet shall not comprise more than 9 percent of the total cylindrical area based on the overall diameter and length of the roller at the outer ends of the tamping feet. The tamping heads and cleaner bars shall be properly maintained, and the spaces between the tamping feet shall be kept clear of materials which impair the effectiveness of the tamping roller.

e. Costs.—The costs of compacting earth materials as described in this paragraph shall be included in the prices bid in the schedule for compacting embankments, compacting backfill, and for other items of work where earth materials are required to be compacted under these specifications.

SECTION 3.2-EXCAVATION

3.2.1 CLASSIFICATION OF EXCAVATION

Materials excavated will not be classified for payment. Except as otherwise provided in these specifications, material excavated will be measured in excavation, to the lines shown on the drawings or as provided in these specifications, and all materials so required to be excavated will be paid for at the applicable prices bid in the schedule for excavation. No additional allowance above the price bid in the schedule will be made on account of any of the material being wet. Bidders and the contractor must assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations. The Government does not represent that the excavation can be performed or maintained at the pay lines described in these specifications or shown on the drawings.

3.2.2 EXCAVATION ADJACENT TO CONTRACT BOUNDARIES

Definite stations for the boundaries of the schedule are shown on the drawings, and these definite stations are the contract limits of the work covered by these specifications. It may be necessary to perform a certain amount of excavation, as determined by the contracting officer, beyond the contract limits in order to

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provide space in which to work. Payment for any necessary excavation outside the contract limits will be made at the unit price per cubic yard bid for the adjacent excavation within the contract limits.

3.2.3 EXCAVATION FOR CANAL

a. General.—The canal sections are shown on the drawings. The Government reserves the right, during the progress of the work, to vary the slopes of excavations or the slopes of embankments and the dimensions dependent thereon. Any increase or decrease of quantities excavated as a result of such variations will be included in the estimates. If the contracting officer determines that the contractor's costs of performing the work will be increased or decreased by reason of such variations, an equitable adjustment will be made to cover his increased or decreased costs. Otherwise the work will be paid for at the unit prices bid therefor in the schedule regardless of variations in quantity, except as provided in paragraph 1.3.4. Stones and indurated materials larger than 5 inches shall be removed from materials to be used for compacted embankments as specified in paragraph 3.4.4. Suitable material excavated for the canal and not required for constructing canal embankments shall be used to construct collective dike embankments and O&M road ramp and bridge approach embankments.

Blasting in such a manner as to cause overbreakage which, in the opinion of the contracting officer is excessive, will not be permitted. If runways are cut into canal slopes below the top of canal lining or below the proposed water level in unlined sections, they shall be refilled with selected material and compacted as provided in paragraph 3.4.4. Above the top of canal lining and above the proposed water level in unlined sections, rock will be allowed to stand at its steepest safe angle, and no finishing will be required other than the removal of rock masses that are loose and liable to fall. Insofar as practicable, the finishing operations required on canal sections shall be performed by the contractor simultaneously with the canal excavation.

Where material suitable for selected bedding material in excess of that required to construct adjacent embankments, as determined by the contracting officer, is encountered and cannot be placed as bedding material in one continuous operation, then

such material shall be stockpiled along the right-of-way, where designated by the contracting officer for later use.

The contractor shall excavate the plug existing between stations $815+00 \pm$ and $816+75 \pm$ of Granite Reef Aqueduct reach 12 completion as directed.

Care shall be taken to prevent overbreakage or loosening of material on bottoms and side slopes upon or against which lining is to be placed. Where the original ground surface is below the grade of the canal, the bottom of the canal shall be filled to the underside of the lining as prescribed for constructing and compacting the canal embankments.

Except as provided below, the canal shall be excavated to a subgrade and section as shown on the drawings or as directed to provide for the prescribed thickness of lining, and the foundation for the lining shall be prepared in accordance with paragraph 5.2.1.

In all excavation, the canal shall be excavated so that there will be not less than 3 inches between any point of the excavated surface and the underside of the lining. Surfaces so excavated shall be filled with selected bedding material conforming to paragraph 5.2.1.

Where unsuitable material is encountered in the foundation for the canal, the contracting officer will direct additional excavation to remove the unsuitable material. This additional excavation shall be refilled to the underside of the lining as prescribed for constructing and compacting canal embankments.

b. Moisture.—Except in areas of rock, all areas to be excavated for canal prism and for structures including bridge abutments, shall be kept prewet by sprinkler irrigation to a moisture content of not greater than 2 percent wet nor less than 5 percent dry of optimum at the time of excavation for a depth of 5 feet below the working area, or to impervious cemented material, whichever is less, as determined by the contracting officer: Provided, That in areas of loose (subsidence) material, wetting to optimum plus or minus 1 percent is required. The contractor shall check the progress of the wetting subject to the approval of the contracting officer.

As far as practicable, all material to be excavated in the entire Reach 1A shall have additional moisture applied, if needed, by sprinkler irrigation to condition the materials in place in accordance with the following requirements before any excavation work is begun.

The moisture content of the earthfill materials prior to and during compaction shall be in accordance with paragraph 3.1.2, except that the materials to be placed in embankments not to be compacted shall have a moisture content of not greater than 2 percent wet nor less than 5 percent dry of optimum. Whenever possible, all water added to condition materials shall be added in one application. When moisture is added to the areas to be excavated, care shall be taken to moisten the material uniformly to produce the required moisture content of the material for the purpose of which it is to be used. The contractor is cautioned to control carefully the application of water and to check on the depth and amount of water penetration during application so as to avoid overirrigation.

If at any location to be excavated before or during excavation operations there is excessive moisture, as determined by the contracting officer, steps shall be taken to reduce the moisture by selective excavation to secure the drier materials; by excavating and placing in temporary stockpiles material containing excessive moisture; by excavating drainage ditches; by allowing adequate additional time for drying; or by any other approved means. To minimize operations with overly wet material, the contractor will be permitted to utilize portions of the areas to be excavated which contain dry material to the greatest extent practicable consistent with obtaining suitable material.

In areas of rock where prewetting cannot be performed adequately, the rock must be blasted or ripped; then wetted down immediately before moving or hauling for other required earthwork or for disposal.

The contractor shall be entitled to no additional allowance above the unit prices bid in the schedule on account of the requirement for excavating drainage ditches; for allowing additional time for drying; for stockpiling and rehandling excavated materials which have been deposited temporarily in stockpiles; delays or increased costs due to stockpiling;

poor trafficability on the excavated areas, the haul roads, or the embankment; reduced efficiency of the equipment the contractor elects to use; or on account of any other operations or difficulties caused by overly wet materials. No additional allowance above the unit prices bid in the schedule will be made because of variation in the portion between wet and dry materials which are required to be excavated in order to obtain adequate suitable material.

c. Measurement and payment.—Except as specified herein, measurement, for payment, of excavation for canal will be made to the lines shown on the drawings, as specified herein, or as prescribed by the contracting officer.

Where the contracting officer directs additional excavation to remove unsuitable foundation material, measurement, for payment, of excavation for canal will be made to the outlines of the areas prescribed and between the bottom of the excavation required for the selected bedding material and the depth directed. The cost of refilling such additional excavation shall be included in the unit price per cubic yard bid in the schedule for excavation for canal. Payment for compacting the refill will be made at the unit price per cubic yard bid in the schedule for compacting embankments.

Measurement, for payment, of excavation for canal will not include materials paid for as excavation for structures in accordance with paragraph 3.2.4.

Payment for excavation for canal will be made at the unit price per cubic yard bid therefor in the schedule. The unit prices bid in the schedule for excavation for canal shall include the costs of blasting or ripping, of procuring and applying water to condition earth materials in areas to be excavated, of placing the material in embankment or selected bedding material stockpiles at locations directed, of refilling the additional excavation between the bottom of the excavation required for the selected bedding material and the depth directed, or of otherwise disposing of the excavated materials, of pumping or unwatering, and of all work necessary to maintain the excavations in good order during construction except that required overhaul will be paid for as provided in paragraph 3.2.5.

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No direct payment will be made to the contractor for excavation required below the underside of the concrete lining required for placing selected bedding material and the cost thereof shall be included in the unit price bid in the schedule for preparing foundations for concrete lining.

Payment for prewetting canal prism and adjacent areas will be made in accordance with paragraph 2.2.2.

3.2.4 EXCAVATION FOR STRUCTURES

a. General.—Excavation for the foundation of structures shall be to the elevations shown on the drawings or established by the contracting officer. Insofar as practicable, the material removed in excavation for structures shall be used for backfill and embankments; otherwise, it shall be wasted.

b. Foundations for structures.—The contractor shall prepare the foundations at structure sites, including bridge abutments, by methods which will provide firm foundations for the structures. The bottom and side slopes of excavation, upon or against which the structure is to be placed, shall be finished to the prescribed dimensions, and the surfaces so prepared shall be moistened and tamped with suitable tools to form firm foundations upon or against which to place the structure.

The contractor shall prepare the foundations for the bridge abutments as shown on drawings 21 (344-D-7178), 25 (344-D-7183), 29 (344-D-7187), 33 (344-D-7191), and 37 (344-D-7195). The natural foundation material beneath the required excavation shall be moistened, if required, and compacted in place.

Densities of the compacted foundation materials and the testing thereof shall be in accordance with paragraph 3.1.2.

No separate payment will be made to the contractor for moistening and compacting the foundation for the bridge abutments and the cost thereof shall be included in the prices bid in the schedule for other items of work.

Where unsuitable material is encountered in the foundation for a structure, the contracting officer will direct additional excavation to remove the unsuitable material. This additional excavation shall be refilled with

compacted backfill to provide a firm foundation for the structure. Measurement and payment for excavation, backfill, and compacting backfill will be made to depths and dimensions prescribed by the contracting officer.

c. Overexcavation.—If at any point in excavation the foundation material is excavated beyond the lines required to receive the structure, the overexcavation shall be filled with suitable materials and compacted in accordance with paragraph 3.1.2. If at any point in excavation the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place or, where directed, it shall be removed and replaced with suitable material and compacted in accordance with paragraph 3.1.2. Any and all excess excavation or overexcavation performed by the contractor for any purpose or reason except for additional excavation as may be prescribed by the contracting officer, and whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compacting of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

d. Measurement for payment.—Excavation for structures will be measured for payment to excavation pay lines shown on the drawings, if not shown on the drawings to pay lines in accordance with the provisions of this paragraph or as directed. Regardless of quantities, removed to comply with safety requirements, measurement for payment will be made to the prescribed pay lines. No payment will be made for excavation or removal of material which is outside of the prescribed pay lines.

Measurement of excavation for structures will be in accordance with the following:

(1) Bridge abutments.—Regardless of whether the excavation for and construction of the structure precedes or follows the excavation of the canal at the site of the structure, measurement of excavation for structures will include all excavation below the original ground surface measured to the dimensions and slopes specified below. Measurement of excavation for structures will be made to dimensions 1 foot outside of the outline of the structure foundations and to slopes of

1:1 for common or unclassified excavation and 1/4:1 for rock excavation.

(2) Piers or footings, which cross the canal, floatwells, and other structures lying largely outside of the canal prism.—Regardless of whether the excavation for and construction of the structure precedes or follows the excavation of the canal at the site of the structure, measurement of excavation for structures will include only the required excavation outside of the pay lines for the canal excavation and below the original ground surface, measured to the dimensions and slopes specified below. Measurement of excavation for structures will be made to dimensions 1 foot outside of the outline of the structure foundations and to slopes of 1:1.

(3) Fencepost footings.—Excavation for fencepost footings shall be as prescribed in paragraph 2.4.1.

e. Payment.—Payment for excavation for structures will be made at the unit price per cubic yard bid therefor in the schedule. The unit price bid in the schedule for excavation for structures shall include the cost of all labor and materials for cofferdams and other temporary construction, of all pumping and unwatering, of all other work necessary to maintain the excavations in good order during construction, of removing such temporary construction, where required, and shall include the cost of disposal of the excavated material, except that required overhaul will be paid for as provided in paragraph 3.2.5.

The cost of excavating for fencepost footings shall be included in the unit price per linear foot bid in the schedule for furnishing and erecting chain link fence.

3.2.5 OVERHAUL

a. General.—A mile cubic yard of overhaul is defined as a cubic yard of excavated material hauled 1 mile in excess of the free-haul limit. The free-haul limit will be 1,000 feet. Payment for overhaul will be made only for excavated materials required for canal embankments, temporary and permanent embankments for roadways, road crossings, and for excavated materials directed to be wasted beyond the limit of free haul. The entire cost of hauling the above-described materials any distance up to the free-haul limit from the original position

shall be included in the price bid in the schedule for excavation of the material.

Unless otherwise specifically provided, no overhaul payment will be made for haul of materials paid for as backfill about structures or for selected bedding material used in preparing foundations for concrete canal lining.

b. Measurement and payment.—Measurement and payment for overhaul will be made as specified herein regardless of the methods and the types of equipment used in excavating and hauling.

Where material is taken from canal excavation and deposited in canal embankments, the length of haul will be measured along the centerline of the canal from the center of gravity of the material as found in excavation to the center of gravity of the material as deposited. Regardless of haul routes actually traveled, the above lengths of haul will be the distance measured along the centerline between the center of gravity of the excavation as projected on the centerline and the center of gravity of the deposit as projected on the centerline.

Where material is taken from borrow pits which are located at a distance greater than 150 feet from the centerline of the canal, the length of haul will be measured along the shortest practicable route, as determined by the contracting officer, between the center of gravity of the material as found in excavation and the center of gravity of the materials as deposited in each 100-foot station.

Where material is excavated from the canal and is deposited in embankment other than the embankment of the canal from which excavated, the length of haul will be measured along a straight line distance, as determined by the contracting officer, from the center of gravity of the material as found in excavation to the center of gravity of the material as deposited.

In measuring quantities of overhaul for payment, the volume of overhauled material will be measured in excavation, the length of haul will be measured in station units of 100 feet. Payment for overhaul will be made at the unit price per mile cubic yard bid therefor in the schedule.

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3.2.6 DISPOSAL OF EXCAVATED MATERIALS

a. General.—All suitable materials removed in excavation, or as much thereof as may be needed, as determined by the contracting officer, shall be used in the construction of canal embankments and roadway embankments, for selected bedding material, or for backfill about structures. If there is an excess of material in the excavation, it shall be used to strengthen the embankment on either side of the canal deposited in low areas uphill of the canal to eliminate trapped drainage, or otherwise wasted as directed by the contracting officer.

Material removed in excavation and not suitable or required for embankments, backfill, or other earthwork required under these specifications, shall be deposited in waste areas, in waste banks on right-of-way owned or controlled by the Government, or as directed by the contracting officer and any overhaul necessary shall be in accordance with paragraph 3.2.5.

Unless otherwise directed, no material shall be wasted within 20 feet of the edge of the prescribed or actual canal cut. The waste embankment shall be scarified for future seeding by others. Waste banks shall be left with reasonably even and uniform surfaces as approved by the contracting officer. Unless otherwise directed, the slopes of the waste banks shall be 4:1.

b. Cost.—Except as specifically provided in these specifications for payment for hauling or placing of individual items of excavated materials, the cost of all work described in this paragraph shall be included in the unit price per cubic yard bid in the schedule for excavation for canal.

SECTION 3.3—BACKFILL

3.3.1 BACKFILL ABOUT STRUCTURES

a. General.—The item of the schedule for backfill about structures, including pipe portions of structures, includes all backfill required to be placed under these specifications, except the following:

- (1) Backfill required for erecting fencing.
- (2) Backfill in trenches for buried electrical grounding cables.

The schedule does not include separate pay items for backfill required for erecting fencing; and in trenches for buried electrical grounding cables; however, such backfill shall be placed in accordance with the provisions of this paragraph and the cost shall be included in items of work as specified in subparagraph e. below.

b. Materials.—The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to approval. Backfill material shall be obtained from material moved in required excavations for structures, but when sufficient suitable material is not available from this source or from adjacent canal excavation, additional material shall be obtained from borrow pits to be approved by the contracting officer.

Except as otherwise provided below, backfill material to be compacted shall contain no stones larger than 3 inches in diameter. Backfill material not to be compacted shall contain no stones larger than 5 inches in diameter.

Backfill within 2 inches of buried electrical grounding cables shall be sand or equally fine earth material. Backfill placed below a horizontal line 1 foot above the top of asbestos-cement pressure pipe shall contain no stones larger than 1-1/2 inches in diameter.

c. Placing backfill.—Backfill shall be placed to the lines and grades shown on the drawings, as prescribed in this paragraph, or as directed by the contracting officer.

All backfill shall be placed carefully and spread in uniform layers so that all spaces about rocks and clods will be filled. Backfill shall be placed to about the same elevation on all sides of the pipe portions of structures to prevent unequal loading and displacement of the pipe. The difference in elevation of the backfill on all sides of the pipe portions of the structures shall not exceed 6 inches at any time. The contractor shall be responsible for providing adequate earth cover over pipe to prevent damage from construction equipment loads. Trenches for electrical grounding cables shall be backfilled to the finished lines of adjacent earthwork.

Backfill required to be compacted shall be compacted in accordance with paragraph 3.3.2.

d. Structures on fill.—Where the original ground surface is below the base of a structure or below the bottom of pipe, all fill required for the structure foundation and all fill up to the bottom of the pipe shall be placed as embankment. All fill about the structure above the base of the structure to lateral dimensions 1 foot outside the base of the structure and within slopes of 1:1 to the finished surfaces of adjacent earthwork and fill about pipe above the bottom of the pipe to a bottom width 1 foot wider than the outside diameter of the pipe and within slopes of 1:1 to the finished surfaces of adjacent earthwork shall be placed as backfill. All fill about the structures and pipe portions of structures above the original ground surface and outside of the above-described backfill shall be placed as embankment.

e. Measurement and payment.—No measurement for payment will be made for backfill required for erecting fencing, and in trenches for buried electrical grounding cables. Excavation refill required to be placed about structures that is within the pay-line limits for excavation for the structures will be measured in place for payment as backfill about structures: Provided, That where the contractor elects not to excavate material which is outside the limits of the actual structure or pipe but within the pay-line limits of excavation, all such material will be included in the measurement for payment of backfill. In addition, material placed within the structure excavation pay lines extended to their intersection with the excavated surface of the canal will be measured and paid for as backfill. Except for structures described in subparagraph d., fill about the structures that is above the original ground surface and within the excavation pay lines for such structures extended to intersect the finished surfaces of adjacent earthwork will be measured for payment as backfill about structures: Provided, That above the original ground surface, the excavation pay lines will be extended to intersect the finished surfaces at slopes of 1:1.

Where the original ground surface is below the base of a structure or below the bottom of pipe, measurement, for payment, of backfill will be made above the structure base or the

bottom of the pipe and within the lines prescribed in subparagraph d. for backfill about structures.

Measurement, for payment, of backfill about structures will be made only of the quantities actually placed within limits of the established pay lines.

Payment for backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule, which unit price shall include the cost of all work connected therewith, including the excavation and haul of the necessary material: Provided, That material from required excavation used for backfill about structures will be paid for both as excavation when removed from original position and as backfill when placed. Where additional material is obtained from approved borrow pits and used for backfill about structures, payment will be made for the backfill only, and the costs of excavating and hauling of such material shall be included in the unit price bid in the schedule for backfill about structures: Provided, That if backfill material is not available within 1,000 feet from any point on the structure, overhaul will be paid for in accordance with paragraph 3.2.5.

Refill of excavation performed outside the established pay lines for excavation for structures shall be placed in the same manner as specified for the adjacent backfill, and such refill shall be placed in the same manner as specified for the adjacent backfill, and such refill shall be placed at the expense of the contractor.

The cost of backfill listed in subparagraphs a.(1) and (2) above shall be included in the applicable prices bid in the schedule for items of work for which the backfill is required.

3.3.2 COMPACTING BACKFILL ABOUT STRUCTURES

a. General.—Unless otherwise shown on the drawings, backfill about structures shall be compacted as prescribed in this paragraph or as directed.

To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the contractor to place a sufficient amount of backfill or embankment material over the

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compacted backfill within 72 hours after compacting of the backfill has been completed.

The 1:1 slopes specified below shall extend from the top of the concrete walls to their intersection with the surfaces of the excavation or embankment as the case may be.

b. Location of compacted backfill.-

(1) Backfill about the following structures or portions of structures shall be compacted to slopes of 1:1 from the top of the structure: Provided, That where the structure is located in compacted embankment, the backfill shall be compacted to the elevation prescribed for the adjacent compacted embankment:

(a) Floatwells.

(2) All backfill placed about the overchute pier shall be compacted as shown on drawing 48 (344-D-7206).

(3) At the approach to a bridge structure, all fill or refill about the structure that is within the slopes and limits of the established pay lines for backfill for the structure shall be placed as compacted backfill; and fill placed outside of such pay-line limits in construction of the approach shall be placed as embankment or compacted embankment.

(4) Where additional excavation for a structure is shown on the drawings or directed to provide for a cushion or bedding of compacted material under the structure, the refill within the pay lines for such additional excavation shall be placed as compacted backfill.

(5) All material placed about fencepost footings shall be compacted.

c. Material and compacting.-The material used for backfill to be compacted shall be selected material containing no stones larger than 3 inches in diameter, approved by the contracting officer, and obtained from required excavation or approved borrow pits. To prevent unequal loading and displacement of a pipe, the backfill shall be placed and compacted in layers having essentially the same top elevation on all sides of the barrel.

All materials in backfill to be compacted shall be placed, moistened, and compacted as provided in paragraph 3.1.2.

d. Measurement and payment.- Measurement for payment for compacting backfill about structures will be made in place to the lines shown on the drawings, as prescribed in this paragraph, or as directed by the contracting officer and will be made only for the quantities actually compacted within the limits of the established pay lines for backfill about structures and the compacting of refill outside of excavation pay lines shall be performed at the expense of the contractor. Payment for compacting backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule and will be in addition to the payment made for backfill about structures. The unit price bid in the schedule for compacting backfill about structures shall include the costs of furnishing water and moistening the materials.

The cost of compacting backfill about fencepost footings shall be included in the applicable unit price per linear foot bid in the schedule for furnishing and erecting chain link fence.

3.3.3 REFILL AT TOP OF CONCRETE CANAL LINING

The contractor will be permitted to overexcavate at the top of the concrete canal lining as shown on drawings 3 (344-D-7161) and 4 (344-D-7162) if needed to accommodate lining equipment. Refill shall be placed on the berms at the top of the lining as shown on the drawings as soon after placing the lining as is feasible. The material used for the refill may be obtained from required excavation. The type of material used and the manner of depositing shall be subject to approval. Refill shall be placed, moistened, and compacted in accordance with paragraph 3.1.2. The refill shall be finished uniformly and neatly to the lines shown on the drawings.

The cost of all work described herein shall be included in the prices bid in the schedule for other items of work.

SECTION 3.4-EMBANKMENT**3.4.1 EMBANKMENT ADJACENT TO CONTRACT BOUNDARIES**

Definite stations for the boundaries of the schedule are shown on the drawings and these definite stations are the contract limits of the work covered by these specifications. The contractor shall construct and compact the canal embankments beyond the contract limits as determined by the contracting officer in order to provide a firm foundation for the concrete canal lining. Payment for constructing the necessary embankments outside the contract limits will be made at the unit prices per cubic yard bid in the schedule for the adjacent earthwork within the contract limits.

3.4.2 PREPARATION OF SURFACES UNDER EMBANKMENTS

Except in areas of rock, the areas under the canal embankments for Salt-Gila Aqueduct between stations 20+00 and 331+00 shall be prewet by sprinkler irrigation before clearing, grubbing, or excavation operations or embankment construction begins. The moisture content shall be optimum to a depth of 5 feet below the original ground surface or to impervious cemented material, whichever is less, as determined by the contracting officer. Whenever possible, all water shall be added uniformly in one application.

The contractor is cautioned to control carefully the application of water and to check on the depth and amount of water penetration during application so as to avoid overirrigation, accumulation of water in depressions, or excessive runoff.

If at any location on embankment foundations before or during embankment construction there is excessive moisture, as determined by the contracting officer, steps shall be taken to reduce the moisture by excavating drainage ditches, by allowing adequate drying time, or by any other approved means.

The contractor shall be entitled to no additional allowance above the unit prices bid in the schedule on account of the requirement for excavating drainage ditches, for allowing additional time for drying, delays or increased costs due to poor trafficability on the embankment foundations or on the haul roads, reduced efficiency of the equipment the contractor elects to use, or on account of any

other operations or difficulties caused by overly wet embankment foundations or haul roads.

Where the ground surface under any embankment is not suitable as determined by the contracting officer for a foundation for the embankment, the contractor shall strip the area under the embankment of such unsuitable material to such depth as may be directed. The material so removed shall be disposed of as provided in paragraph 3.2.6. Measurement, for payment, of stripping unsuitable material under embankments will be made only to the lines and to such depths as may be directed, and payment therefor will be made at the unit prices per cubic yard bid in the schedule for excavation for canal.

As soon as feasible after the foundations have been wet to the required moisture content and before any embankment materials are placed, the entire surface of the foundations for all collective dike and canal embankments to be compacted shall be scarified or plowed thoroughly to a depth of 6 inches.

The ground surface under canal embankments not to be compacted and under other embankments where directed shall be scarified with a plow making open furrows not less than 8 inches deep below the natural ground surface or the stripped ground surface, as applicable, at intervals of not more than 3 feet.

The cost of scarifying the foundation surfaces under the collective canal embankments and under other embankments shall be included in the unit prices per cubic yard bid in the schedule for compacting embankments.

Water applied for prewetting areas under the collective dike and canal embankments and under other embankments shall be paid for as specified in paragraph 2.2.2.

3.4.3 CONSTRUCTING CANAL EMBANKMENTS

- a. General.—Canal embankments shall be constructed to top widths and side slopes as shown on the drawings; and where directed to provide an allowance for settlement, the embankment shall be built to heights as directed above those shown on the drawings. The tops of all canal embankments shall be graded to be suitable for a roadway in accordance with subparagraph b. below and the top of other embankments shall be graded or scarified as directed.

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All materials shall be deposited in embankments so that cobbles, gravel, and boulders will be well distributed through the other materials and not nested in any position within or under the embankment except that stones and indurated materials larger than 5 inches shall be removed from materials to be used for compacted embankments as specified in paragraph 3.4.4.

In areas where required excavation does not furnish suitable or adequate material for constructing embankments, material shall be obtained from required excavation only in areas where material in excess of that required to construct the adjacent embankments is available.

Where the original ground surface is below the grade of the canal, and where construction of a fill below the bottom of the canal is prescribed, such fill shall be placed as compacted embankment. Where the original ground surface is below the base of a structure, the fill required to form a suitable foundation for the structure shall be placed as compacted embankments.

b. Roads and ramps.—Except as provided in paragraph 4.1.1 in conjunction with construction of canal embankments, the contractor shall construct operation and maintenance roads and earth ramps adjacent to the canal and structures where shown on the drawings and where directed. Suitable material from required excavation shall be placed as embankments for the roads and ramps. If sufficient material is not available from required excavation, the contracting officer may direct excavation from borrow. Where the width of a road is not shown on the drawings, it shall have a width of not less than 14 feet. The work required for construction of operation and maintenance roads and for earth ramps shall include grading to a uniform surface equal to that obtainable with a motor grader to provide for safe travel with a two-wheel-drive automobile in high gear at moderate speed. Special rolling or compaction will normally not be required: Provided, That if compaction is directed, the embankments shall be compacted in accordance with paragraph 3.4.4.

c. Embankments not to be compacted.—Material for these embankments shall have a moisture content of not greater than 2 percent wet nor less than 5 percent dry of

optimum before equipment is routed over the embankments. Embankments shall be built in approximately horizontal layers carried across the entire width of the embankments to the required slopes. Embankments shall not be widened with loose material dumped from the top. Embankments may be built by excavating and hauling equipment, or by excavating machinery depositing the materials directly from the excavation. Embankments built by excavating and hauling equipment shall be made in horizontal layers and shall be kept as close to level as practicable. The travel over the embankments during construction shall be routed so as to distribute the compacting effect of the equipment to the best practicable advantage.

Embankments built by excavating machinery depositing the material directly from the excavation shall be made in horizontal layers having a thickness of approximately the depth of the material as deposited by the excavating machine. Finer portions of the material excavated shall be placed in that part of the embankment nearest the water, and the coarser materials shall be placed in the outer part of the embankment.

d. Embankments to be compacted.—The requirements for compacted embankments will be as specified in paragraph 3.4.4. All materials in compacted embankments shall be placed, moistened, and compacted as provided in paragraph 3.1.2.

e. Costs.—Except as otherwise provided for compacting of embankments and for overhaul, the costs of all work described in this paragraph shall be included in the unit prices bid in the schedule for excavation for canal.

3.4.3A CONSTRUCTION OF ROCKFILL EMBANKMENTS

a. General.—Much of the canal excavation is expected to be through rock, hard compact material, coarse gravel, cobbles, and boulders. Suitable materials excavated in these reaches shall be used to construct rockfill embankments where directed. Rockfill embankments shall be constructed to top widths and side slopes as shown on the drawings and where directed to provide an allowance for settlement; the embankment shall be built to heights as directed above those shown on the drawings. All materials shall be deposited in embankments so that

cobbles, gravel, and boulders will be well distributed through the other materials and not nested in any position within or under the embankment.

Where the original ground surface is below the bottom of the canal and where construction of a fill below the bottom of the canal is prescribed, such fill shall be placed as compacted rockfill embankment. Where the original ground surface is below the base of a structure, the fill required to form a suitable foundation for the structure shall be placed as compacted rockfill embankment.

b. Rockfill embankments not to be compacted.—Embankments shall be built in approximately horizontal layers carried across the entire width of the embankments to the required slopes. Embankments shall not be widened with loose material dumped from the top. Embankments may be built by excavating and hauling equipment or by excavating machinery depositing the materials directly from the excavation. Embankments built by excavating and hauling equipment shall be made in horizontal layers and shall be kept as close to level as practicable. The travel over the embankments during construction shall be routed so as to distribute the compacting effect of the equipment to the best practicable advantage.

Embankments built by excavating machinery depositing the material directly from the excavation shall be made in horizontal layers having a thickness of approximately the depth of the material as deposited by the excavating machine.

c. Rockfill embankments to be compacted.—The requirements for compacted rockfill embankments will be as specified in paragraph 3.4.4A.

d. Costs.—Except as otherwise provided for compacting rockfill embankments and for overhaul, the costs of all work described in this paragraph shall be included in the unit prices bid in the schedule for excavation for canal.

3.4.4 COMPACTING EMBANKMENTS

a. General.—The materials used for the compacted embankments shall be suitable materials as determined by the contracting officer and shall be obtained from required excavation or from designated borrow pits.

Before the material for the first layer of the embankment is placed, the foundation for the embankment shall be prepared as provided in paragraph 3.4.2 and shall be moistened and compacted in the manner hereinafter specified for each layer of compacted embankment to be placed thereon. The embankments shall be compacted to the elevation and to the top widths and side slopes shown on the drawings or prescribed by the contracting officer: Provided, That where not to be covered with concrete, the density of a 2-foot thickness, horizontal measurement, of compacted embankment parallel and adjacent to the inside slope line may be less than 95 percent of laboratory standard where it is impractical to obtain the 95-percent density with standard rolling equipment. All materials in embankments to be compacted shall be placed, moistened, and compacted as provided in paragraph 3.1.2.

The contractor's operations in the excavation of materials for the compacted embankment shall be such as will result in an acceptable gradation of materials to provide for impermeability and stability when compacted. The maximum dimensions of stones and indurated materials placed in the compacted embankment shall not exceed 5 inches. Stones or indurated materials larger than 5 inches shall be removed by raking or other methods approved by the contracting officer prior to compacting operations.

Where the original ground surface is below the bottom of the canal and where compacted fill below the bottom of the canal is prescribed, such fill shall be placed as compacted embankment. Where the original ground surface is below the base of a structure or where sloping concrete walls or slabs extend above the original ground surface and it is practicable as determined by the contracting officer to construct the walls or slabs directly on earth foundation without the use of intervening forms, compacted embankments shall be constructed to lines and grades as directed to form suitable foundations for the structure or for the sloping walls or slabs.

b. Measurement and payment.—Measurement, for payment, of compacting embankments will be made of the embankments in place including a 6-inch layer of the foundation for the embankment scarified or plowed as provided in paragraph 3.4.2 and will include

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only such portions of the embankments and foundation as have been actually compacted at the direction of the contracting officer and as provided in this paragraph. Payment for compacting embankments will be made at the unit price per cubic yard bid therefor in the schedule, which unit price will be in addition to the unit price bid in the schedule for excavating the material placed in compacted embankments and shall include the cost of placing materials in layers, removing materials larger than 5 inches, furnishing water, moistening, and compacting as provided in this paragraph.

3.4.4A COMPACTING ROCKFILL EMBANKMENTS

a. General.—The materials used for compacted rockfill embankments shall be obtained from required excavation and shall be reasonably well-graded, cohesionless materials selected to meet the requirements in table 3A.

TABLE 3A

Screen size	Percent passing designated screen	
	Minimum	Maximum
12 inches	100	—
6 inches	65	100
3 inches	50	100
3/4 inch	30	70
No. 4	15	55
No. 30	5	30
No. 200	0	15

Before the material for the first layer of the embankment is placed, the foundation for the embankment shall be prepared as provided in paragraph 3.4.2 and shall be moistened and compacted in the manner hereinafter specified for each layer of compacted embankment to be placed thereon. The embankments shall be compacted to the elevation and to the top widths and side slopes shown on the drawings or prescribed by the contracting officer.

The contractor's operations in the excavation of materials for the compacted embankment shall be such as will result in an acceptable gradation of materials to provide the highest practicable unit weight and best stability. The materials shall be deposited and/or spread in horizontal layers across the total width of the

rockfill embankment, and the thickness of the layers before compaction shall not exceed 18 inches. The travel of equipment over the embankments during construction shall be routed so as to distribute the compacting effect of the equipment to the best practicable advantage. Where the embankment material does not have adequate moisture to insure satisfactory compaction as determined by the contracting officer, the contractor shall add water until the material is thoroughly wetted with free moisture visible on all particles. When the material has been properly placed and wetted, each layer shall be compacted with four passes of a track-type tractor weighing not less than 80,000 pounds.

b. Measurement and payment.— Measurement, for payment, of compacting rockfill embankments will be made of the embankments in place, including a 6-inch layer of the foundation for the embankment scarified or plowed as provided in paragraph 3.4.2, and will include only such portions of the embankments and foundation as have been actually compacted at the direction of the contracting officer and as provided in this paragraph. Payment for compacting rockfill embankments will be made at the unit price per cubic yard bid in the schedule for compacting embankments, which unit price will be in addition to the unit price bid in the schedule for excavating the material placed in compacted rockfill embankments and shall include the cost of placing the material in layers, furnishing water, moistening, and compacting as provided in this paragraph.

DIVISION 4-ROADWAY CONSTRUCTION**SECTION 4.1-ROADWAY CONSTRUCTION, GENERAL****4.1.1 ROADWAY CONSTRUCTION, GENERAL**

Paragraphs 4.2.1 through 4.5.9 are applicable to construction of the bridge approaches and the O&M road ramps to these approaches.

Closure of roads during periods of bridge construction shall be allowed in accordance with the provisions set forth in paragraph 1.5.7. Before reopening the closed roadways to public traffic, the roadway and bridge work area shall be thoroughly cleaned and all waste materials shall be disposed of in accordance with paragraph 1.6.11, the guardrail shall be erected, and the pavement painted striping shall be properly reestablished.

The contractor shall remove and stockpile an existing cattleguard as part of the required construction of Thomas Road bridge approaches. The existing cattleguard as shown at approximately station 1+10 on drawing 17 (344-D-7174A) shall be disassembled as necessary to allow for its removal and all salvageable parts, including concrete foundation if possible, shall be transported and stockpiled at a nearby site on the canal right-of-way as designated by the contracting officer. Backfill of the cattleguard site shall be part of the compacted roadway embankment construction. The cost of all work for excavating, removing, hauling, and stockpiling the cattleguard shall be included in the prices bid in the schedule for other items of work.

SECTION 4.2-CLEARING AND GRUBBING FOR ROADWAYS**4.2.1 CLEARING ROAD RIGHT-OF-WAY**

a. General.—The right-of-way for the bridge approach roadways to a width of 3 feet outside the slope lines on each side of the centerline shall be cleared of all vegetation, such as trees, brush, grass, and weeds, and all other objectionable matter as determined by the contracting officer: Provided, That trees designated by the contracting officer shall not be cut and shall be protected from injury as provided in paragraph 1.6.2.

Materials from clearing operations shall be disposed of as provided in subparagraph c. below.

b. Clearing.—The work of clearing shall be kept well in advance of the grading operations. All trees and stumps outside toes of slopes but within the clearing limits shall be cut off as close to the ground as practicable and in no case more than 12 inches above the ground, and all brush and undergrowth shall be cut close to the ground. Where an embankment is to be made more than 2 feet in height, all trees, stumps, and brush shall be cut off within 1 foot of the surface of the ground. Where an embankment is to be made 2 feet or less in height, all stumps and roots shall be grubbed as provided in paragraph 4.2.2.

c. Disposal of cleared materials.—Subject to approval of the contracting officer, material from clearing operations shall be disposed of by burning, reducing to chips and spreading as described below, or removal from the worksite. Disposal of material by burning and by removal from the worksite shall be performed in accordance with the provisions of paragraph 1.6.11.

Material to be disposed of by chipping and spreading shall be reduced to chips of 1/2-inch maximum thickness. The chips shall be distributed uniformly on the ground surface between the slope lines and right-of-way lines as approved. The chips shall be mixed with the underlying earth so that they will not support combustion.

Cleared material may also be crushed and buried under waste embankments or in disposal areas as approved by the contracting officer.

d. Payment.—Payment for clearing road right-of-way will be made at the lump-sum price bid in the schedule for clearing and grubbing, which lump-sum price shall include the cost of disposing of cleared materials.

4.2.2 GRUBBING FOR ROADS

The ground surface under all embankments 2 feet or less in height and the surface of all excavation that is to be used for embankments shall be cleared of all stumps, roots, and

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vegetable matter of every kind. The stumps shall be pulled or otherwise removed, and the roots shall be grubbed. The stumps and roots and any other combustible material removed shall be disposed of in the manner described in paragraph 4.2.1. The work of grubbing shall be kept well in advance of the grading operations. The cost of grubbing and of all work incident thereto, including disposal of the grubbed materials, shall be included in the lump-sum price bid in the schedule for clearing and grubbing.

SECTION 4.3-EARTHWORK

4.3.1 CLASSIFICATION OF EXCAVATION FOR ROADS

Materials excavated will not be classified for payment. Except as otherwise provided in these specifications, material excavated will be measured in excavation, to the lines shown on the drawings or as provided in these specifications, and all materials so required to be excavated will be paid for at the applicable prices bid in the schedule for excavation. No additional allowance above the price bid in the schedule will be made on account of any of the material being wet. Bidders and the contractor must assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations. The Government does not represent that the excavation can be performed or maintained at the pay lines described in these specifications or shown on the drawings.

4.3.2 EXCAVATION FOR ROADWAY

a. Roadway sections.—The roadway sections are shown on the drawings. The Government reserves the right, during the progress of the work, to vary the width of the roadbed or the slopes, alinement, or grades, and the dimensions dependent thereon. Any increase or decrease of quantities excavated as a result of such variations will be included in the estimates. If the contracting officer determines that the contractor's costs will be increased or decreased by reason of such variations, an equitable adjustment will be made to cover his increased or decreased costs. Otherwise, the work will be paid for at the unit prices bid therefor in the schedule

regardless of such variations in quantity, except as provided in paragraph 1.3.4.

The roadway shall be constructed to the full dimensions shown on the drawings or otherwise established, and shall be finished to the prescribed lines and grades. The centerline of the roadbed shall conform strictly to the center stakes. The gradelines shown on the profiles represent finished grade. The term "subgrade" refers to the top of the embankments and the bottom of excavations ready to receive the roadway surfacing.

Areas to be excavated for roadway construction shall be moistened prior to excavation in accordance with paragraph 2.2.2.

b. Excavation.—In material which is unsuitable for a subgrade, the bottom shall in all cases be taken out to 6 inches below subgrade, and all loose rock or boulders and all ridge rock encountered in excavation shall be removed or excavated to a depth of not less than 6 inches below subgrade. Payment for such excavation will be made at the unit prices per cubic yard bid in the schedule for excavation for canal. Such additional excavation and all holes or depressions resulting from removal of rock or boulders from excavation below subgrade shall be refilled to subgrade with material obtained from excavation for the roadway or from canal excavation and the refilled material shall be compacted equivalent to the compaction required for the roadway embankments. Refill of excavation below subgrade will be considered to be part of embankment construction.

Side drains shall be constructed as shown on the drawings or as directed and shall be left clear of obstructions and at the lower ends shall diverge sufficiently to prevent erosion of the adjoining embankments. Excavation around trees, poles, or other objects which are to remain within the right-of-way for the roadway shall be performed and completed in such a manner as to avoid injury or damage to such objects. The items of the schedule for excavation for canal include the removal, where required, of the surfacing on the

existing roadways and the earthwork for construction of road connections.

c. Payment.—Measurement, for payment, of excavation for roadway will be made only to the neatlines as shown on the drawings or established by the contracting officer. Payment for excavation for roadway will be made at the unit price per cubic yard bid in the schedule for excavation for canal.

4.3.3 PREPARATION OF SURFACES UNDER ROADWAY EMBANKMENTS

a. Surface treatment.—Where embankments are to be built on sloping ground, the surface of the ground shall be prepared to provide bond with the embankments and prevent slipping thereof. Where embankments are to be placed on smooth firm surfaces and where shallow embankments are to be placed, the original ground surface shall be thoroughly plowed or stepped as directed to insure proper bonding of the new and existing material. Prior to embankment construction, the area under designated roadway embankments shall be prewet in the manner described in paragraph 2.2.2.

b. Removal of unsuitable material.—Where the ground surface under an embankment is not suitable for a foundation for the embankment, as determined by the contracting officer, the contractor shall strip the area under the embankment of unsuitable material to such depths as directed. Material which is removed shall be disposed of as provided in paragraph 4.3.6.

c. Measurement and payment.—Measurement for payment for stripping unsuitable material under roadway embankments will be made only to the lines and to such depths as may be directed. Payment for stripping unsuitable material under roadway embankments will be made at the applicable unit prices per cubic yard bid in the schedule for excavation for canal, which unit prices shall include the cost of all work described in this paragraph: Provided, That water which is applied to prewet areas under designated roadway embankments shall be paid for in accordance with paragraph 2.2.2.

4.3.4 CONSTRUCTION OF ROADWAY EMBANKMENTS

a. General.—Embankments shall be constructed to the established lines and grades which, in general, will be the lines and grades shown on the drawings, increased by such heights and widths as necessary to allow for settlement. The embankments shall be maintained by the contractor to proper heights, dimensions, and slopes until the final completion and acceptance of all of the work under the contract. Roadway embankment material shall be obtained from required roadway excavation and from excavation for the canal or from borrow locations designated by the contracting officer.

b. Materials.—No brush, roots, sod, or other perishable or unsuitable materials shall be placed in embankments. Material containing sand in such proportion as to prevent it from compacting properly shall not be used, except with prior approval. Clods or hard lumps of earth having maximum dimensions of more than 8 inches shall be broken up before or after being placed on the embankments. Cobbles or rocks more than 6 inches in size shall not be placed in the upper 12 inches of embankments. The contractor may elect to remove the oversize material from the upper 12 inches of embankments by raking or other approved methods. Where there is a choice of materials, the best shall be used on the top of embankments for at least 12 inches in depth.

c. Construction.—All material shall be deposited in embankments so that rock, cobbles, and gravel will be well distributed through the other materials and not nested in any position within or under the embankments. The combined excavation and placing operations shall be such that the materials in the embankment will be blended sufficiently to secure the best practicable degree of compaction and stability, and for this purpose the contracting officer may designate the locations in the embankment where the individual loads shall be deposited.

Embankments shall be placed in continuous, approximately horizontal layers not more than 8 inches in loose thickness prior to being compacted. The layers shall be carried across

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the entire width of the embankments and shall be built to the required slopes and not widened with loose material from the top: Provided, That sidehill fills where the width is too narrow to accommodate hauling equipment may be placed by end dumping until the width of the embankment becomes great enough to permit the use of hauling equipment, after which the remainder of the embankment shall be placed in layers as specified herein. The contractor shall route his hauling equipment over the layers already in place and shall distribute the travel evenly over the entire width of the embankment so as to obtain the most practicable compacting effect of the equipment. The embankments shall be compacted in accordance with paragraph 4.3.5.

The slopes of embankments shall be reasonably true to line and grade: Provided, That where directed the side slopes shall be left rough to facilitate natural revegetation.

d. Costs.—Payment for compacting of embankments will be made as provided in paragraph 4.3.5. Payment for any required overhaul will be made in accordance with paragraph 3.2.5. The costs of all other work described in this paragraph shall be included in the applicable unit prices per cubic yard bid in the schedule for excavation for canal.

4.3.5 MOISTENING AND COMPACTING ROADWAY EMBANKMENTS

a. General.—Where the construction of embankments as provided in paragraph 4.3.4 will not result in compaction of the embankments to 95 percent of laboratory density, embankments or portions thereof will require moistening of the embankment materials and/or compacting with special compacting equipment.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Water and Power Resources Service Proctor Compaction Test for the materials being compacted. If the Water and Power Resources Service standard relative density test is used for compaction control testing, the relative density of the compacted material

shall not be less than 70 percent. The use and description of these tests shall be in accordance with paragraph 3.1.2.

The amount of moistening and/or compacting will depend upon the nature and condition of the materials available for the construction of the embankments.

b. Moistening of embankment materials.—Where embankment materials do not contain sufficient moisture to insure satisfactory compaction, additional moisture shall be provided by sprinkling with water as the layers of materials are placed on the embankments. The materials shall be moistened uniformly and, where directed, shall be harrowed or otherwise worked to produce the required uniformity of moisture content. Material containing an excess of moisture shall be permitted to dry to the extent required before being compacted.

Any additional work required in drying embankment material to the required moisture content shall be considered as work required by the provisions of this paragraph and no payment shall be made for such work.

c. Rolling embankments.—The contractor shall roll each layer of materials as it is placed on the embankments. The amount of rolling which will be required will depend upon the nature of the materials to be compacted. Succeeding layers of embankments shall not be placed until the layer being compacted has been compacted to 95 percent of laboratory density.

d. Measurement and payment.—Measurement for payment for compacting roadway embankments will be made of the embankments in place, including any compaction of the foundation for the embankment which is scarified or plowed as provided in paragraph 4.3.3 and will include only such portions of the embankments and foundations as have been actually compacted at the direction of the contracting officer and as provided in this paragraph.

Payment for compacting roadway embankments will be made at the applicable unit price per cubic yard bid in the schedule for compacting embankments, which unit

price will be in addition to the unit prices bid in the schedule for excavating the material placed in compacted embankments and shall include the cost of placing the materials in layers, removing oversize materials, furnishing water, and moistening as provided in this paragraph.

4.3.6 DISPOSAL OF EXCAVATED ROADWAY MATERIALS

Except as otherwise specified, all suitable materials excavated for the construction of the roadways shall be used in the construction of embankments and for refill of excavation below subgrade, and no such material shall be deposited in waste banks unless such waste is directed.

Materials removed in excavation and not suitable for embankment construction or excavation refills and any other material wasted by direction shall be deposited in approved waste banks at designated points on right-of-way owned by the Government. Waste banks shall be left rough as directed to facilitate natural revegetation.

The cost of all work described in this paragraph shall be included in the applicable unit prices per cubic yard bid in the schedule for excavation for canal.

4.3.7 SUBGRADE

The subgrade for the roadways shall be finished to the lines and grades shown on the drawings or established by the contracting officer and shall be maintained at all times in such condition that it will drain readily and correctly. The finished surface shall be free of loose or extraneous material.

4.3.8 EXCAVATION FOR DRAINAGE CHANNELS

a. General.—In connection with the excavation for the roadway, the contractor shall perform excavation as directed for drainage channels.

All ditches and drains shall be completed to drain the roadways effectively before any other construction will be permitted on that part of the work affected by such ditches and drains. The locations, grades, side slopes, and

bottom widths of drainage channels will be established by the contracting officer to conform to the topographic and hydraulic conditions to be met. All materials excavated in connection with the construction of drainage channels shall be placed in roadway embankments, used to construct dikes, or deposited in waste banks as provided in paragraph 4.3.6.

b. Payment.—Payment for excavation required for drainage channels will be made at the applicable unit prices per cubic yard bid in the schedule for excavation for canal.

SECTION 4.4—GUARDRAIL

4.4.1 BEAM-TYPE GUARDRAIL

a. General.—Steel beam-type guardrail shall be furnished and erected at the ends of bridge parapets in accordance with details shown on the drawings. The installation shall be as shown on drawings 45 (344-D-7203) and 46 (344-D-7204).

b. Materials.—

(1) Rails.—The rail sections shall be in accordance with AASHTO designation: M-180, class A, type 1.

Modified end shoes and type A terminal sections shall be furnished in accordance with the details shown on the drawings and shall have the same splice detail as the rail.

The rail sections, including modified end shoes and terminal sections, shall be galvanized in accordance with ASTM designation: A 525, coating G 210.

(2) Posts.—Posts shall be 6 feet 0 inches long with blocks as shown on the drawings. All posts shall be square and posts and blocks shall be either No. 1 SR timbers and heavy-dimension southern pine conforming to the Standard Grading Rules for Southern Pine Lumber by the Southern Pine Inspection Bureau or Douglas-fir, No. 1 grade, conforming to the Grading Rules for Western Lumber of the Western Wood Products Association.

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Posts and blocks shall be given a preservative pressure treatment in accordance with Federal Specification TT-W-571J, except that for creosote or creosote solutions, the net retention shall be at least 8 pounds of the creosote preservative per cubic foot of post. Posts and blocks shall be cut to length and bored for boltholes before treatment.

(3) Bolts, nuts, and washers.—Bolts, nuts, and washers shall be galvanized in accordance with ASTM designation: A 153 and shall be designed to develop the required joint strength. The post bolt and connection shall develop a 5,000-pound side pull in either direction. The heads of all bolts shall be rounded to provide minimum obstruction.

(4) Reflectors.—Reflectors shall be galvanized in accordance with the details shown on drawing 45 (344-D-7203). Reflectors shall be placed at every other post.

(5) Breakaway cable anchor assembly.—Cable anchor assemblies shall consist of a cable assembly and anchor plate including hardware and concrete footings for two posts.

Anchor plate assemblies and metal plates shall be fabricated of steel conforming to the specifications of ASTM designation: A 36 and shall be galvanized in accordance with ASTM designation: A 123.

Anchor cable shall be 3/4 inch, preformed, 6 by 1-9, wire-strand core or IWRC (independent wire rope core), conforming to AASHTO designation: M-30, class B, type II, and shall be galvanized in accordance with ASTM designation: A 603.

Swaged fittings and stud assemblies shall be galvanized and shall develop the specified breaking strength of the cable.

Cast-in-place concrete footings shall be reinforced with welded-wire fabric. To facilitate future replacement of damaged posts, a 1/4-inch thickness of filler material

shall be placed around the posts before placing concrete footings.

c. Erection.—Posts shall be spaced at 6-foot 3-inch centers and shall be set plumb to the depth shown on the drawings. The postholes shall be backfilled in layers with approved material which shall be compacted thoroughly in such a manner as not to displace the posts from correct alignment. Variation in post or rail alignments, either horizontal or vertical, shall not exceed one-fourth inch from the theoretical alignments: Provided, That the outer ends of the guardrail installed at bridge abutments shall be offset in order to curve the end of the guardrail away from the roadway as shown on the drawings. Care shall be exercised to avoid injuring the surface of treated posts, and the use of hooks or similar tools will not be permitted. The rail sections shall be lapped at posts in the direction of traffic. A terminal section and breakaway cable anchor assembly shall be placed at the outer end of every installation of guardrail and the terminal section shall be lapped on the face of the rail. The center of the rail shall be 21 inches above the top of the finished surfacing.

d. Measurement and payment.—Measurement for payment will be made along the face of the rail from center of the last rail splice at the bridge parapet connections to center of end posts, and no allowance will be made for lap of rails at posts. Payment for furnishing and erecting beam-type guardrail will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of all parts, including reflectors, modified end shoes, terminal sections, and the complete breakaway cable anchor assemblies, and the cost of excavating and backfilling postholes.

SECTION 4.5-SURFACING

4.5.1 ROADWAY SURFACING, GENERAL

The surfacing for the bridge approaches and O&M road ramps will be as described in these paragraphs and as shown on the typical cross sections on the drawings. All materials for the roadway surfacing shall be furnished by the contractor. Equipment not suitable to produce

the quality of work required for the surfacing will not be permitted to operate on the work. The contractor shall furnish all necessary flagmen, signs, lights, and barricades for the protection of traffic or protection of freshly applied liquid asphalt during the drying period.

Discharging unused liquid asphalt into roadway ditches, borrow pits, or gutters will not be permitted. Applying liquid asphalt will not be permitted when the surface to be treated is appreciably damp or when weather conditions are unsuitable. Liquid asphalt shall be heated in a retort or by steam coil in such a manner that steam will not be introduced directly into the liquid asphalt during heating.

All reference to MAG standard specifications in the following paragraphs shall mean Maricopa Association of Governments "Uniform Standard Specifications for Public Works Construction," current edition, and the supplemental revisions thereto.

4.5.2 SAMPLING, CERTIFICATION, AND TESTING OF BITUMINOUS MATERIALS

Only materials conforming to these specifications and where required to MAG standard specifications shall be used in the work. The contractor shall furnish a certified laboratory analysis with each shipment of liquid asphalt prior to incorporating the material into the work. The certification shall include: material identification, quantity represented, and certified test results performed by the manufacturer or other laboratory covering all of the test requirements of the specifications. The accuracy of all laboratory analyses shall be guaranteed by the contractor.

Prior to incorporation of the material in the work, samples may be obtained by the Government at the jobsite for testing purposes. Although use of the asphaltic materials will be permitted upon presentation of the properly certified analysis, such usage shall be at the risk of subsequent rejection should the Government's test results indicate failure of the materials to conform with the specifications requirements. The costs of any delay or damage due to failure of the asphaltic materials to comply with the specifications requirements shall be borne by the contractor.

The Government reserves the right to test any or all materials acceptable on certification when, in the opinion of the Government, such tests are necessary.

4.5.3 WEIGHTS OF ROADWAY MATERIALS

Materials for roadway surfacing which will be paid for by the ton shall be weighed on platform scales furnished at the expense of and by the contractor, unless the materials are shipped by rail or computed by volumetric measurement as specified below: Provided, That weight slips prepared by certified public weighmasters stationed at public scales will be accepted.

Scales furnished by the contractor shall be approved by the contracting officer and shall be tested and sealed, at the expense of the contractor, as often as the contracting officer may deem necessary to insure their accuracy. The contractor shall furnish a weighmaster, certified by the State of Arizona, who shall weigh all materials required to be weighed on contractor-furnished scales as herein provided. If the materials are shipped by rail, the car weights will be accepted: Provided, That actual weights of the materials only will be paid for and not minimum car weights used for assessing freight tariff: Provided further, That car weights will not be acceptable for materials passed through mixing plants.

When the water content of any mineral aggregate for surfacing exceeds 4 percent, by weight, of the oven-dry weight of the material, as determined by the contracting officer, the weight of the material to be paid for shall be determined by deducting from the weight of the material delivered to the job the weight of water in the material in excess of 4 percent of the oven-dry weight of the material.

Volumetric measurements of liquid asphalt at any temperature will be reduced to the volume the material would occupy at 60 °F before converting the volumetric measurements to tons. The following table will be used to convert the volumes from gallons to tons, and the methods specified in "ASTM-IP Petroleum Measurement Tables" (designation: D 1250) of ASTM will be used to convert the volume at any temperature to the volume at 60 °F.

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Grade of liquid asphalt	Gallons per ton at 60 °F
70	253
Asphalt cement, AR-4000	235

4.5.4 AGGREGATES FOR ROADWAY SURFACING

All aggregate materials for the roadway surfacing shall be furnished by the contractor. The contractor will be held responsible for the specified quality of all such materials used in the work. The contractor shall make all necessary arrangements with the owners and shall pay all costs connected therewith.

The source of supply of each of the materials furnished by the contractor shall be subject to approval before the delivery is started. Only approved materials conforming to the requirements of these specifications and, where indicated, of the MAG standard specifications, shall be used in the work. All materials proposed for use may be inspected or tested at any time during their preparation and use. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the contractor shall furnish approved material from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the work.

4.5.5 PREPARATION OF SUBGRADE

a. General.—Before the select material or aggregate base course material is placed, the subgrade shall be made to conform to prescribed grades and cross sections by means of blade graders or motor patrols and shall be compacted so that these materials, when placed, will not mix with the subgrade material. Where directed, water shall be added to the subgrade and the subgrade shall be rolled.

b. Cost.—The cost of performing all work incidental to preparing the subgrade, including watering, shall be included in the unit prices per ton bid in the schedule for other items of surfacing work.

4.5.6 BASE MATERIALS

a. General.—The contractor shall furnish and place select material and aggregate base course material on the roadways as shown on the drawings.

b. Materials.—Mineral aggregate shall be uniform in quality and grading. The aggregate shall be free from adobe, vegetable matter, loam, and other deleterious substances and shall be of such quality that it will compact thoroughly when watered and rolled to form a firm well-bonded base.

The select material, type A, and the aggregate base course shall be crushed aggregate in conformance with gradation table 702 (MAG supplemental specifications) and to the other requirements set forth in section 702 of the MAG standard specifications.

c. Placing.—Preparation of the subgrade for base materials shall conform to paragraph 4.5.5. The select material and aggregate base course when thoroughly compacted shall conform to the grades and dimensions shown on the drawings or otherwise established. Work on each course shall be handled in a similar manner. Depositing and spreading the material shall commence at the point farthest from the point of loading and shall progress continuously without breaks except as otherwise directed. The material shall be spread from the hauling vehicle by hand, from spreading boxes, or from self-spreading vehicles. Dumping in piles on the subgrade or on a preceding course will not be permitted. The material for each course shall be deposited and spread in a layer of uniform thickness and of such depth that after being compacted the course will be of the required thickness. After the material for any course has been spread, it shall be mixed thoroughly by a heavy-blade grader having a wheel base not less than 15 feet long until the material shows a uniform mixture of all sizes of particles. Wetting may be necessary to obtain proper mixing.

d. Compacting.—Rolling of the material shall commence immediately after it has been mixed as described above. Rollers shall weigh from 7 to 12 tons and shall be of the steel, smooth-wheel type. Rolling shall commence at

the outer edges of a course and shall progress toward the center. Under no circumstances shall the center of a course be rolled first. Sufficient water to obtain compaction shall be applied during the rolling operations. Each course shall be rolled until it is compacted thoroughly and is true to grade and cross section.

The select material and aggregate base courses shall be leveled and compacted to the density requirements set forth in section 310 of the MAG standard specifications.

e. Measurement.—The quantity of material for select material and aggregate base course for which payment will be made will be determined as provided in paragraph 4.5.3. The weight of these base materials for which payment will be made will be the total weight of the mineral aggregate and binder.

f. Payment.—Payment for select material and aggregate base course will be made at the applicable unit price per ton bid therefor in the schedule, which unit price shall include the cost of preparing the subgrade; furnishing all materials, including binder and water incorporated with the mineral aggregate and water applied to aid compaction of the base materials after the material has been spread on the roadbed; hauling, placing, blading, mixing, and compacting the materials; and all incidental work connected therewith.

4.5.7 DISTRIBUTOR FOR APPLYING LIQUID ASPHALT

The distributor used in applying all liquid asphalt shall be of the self-propelled type and of sufficient power and capacity to apply the asphalt under pressure uniformly and at the proper rate with not more than 10 percent variation therefrom. The distributor shall be equipped with tachometer and charts, pressure gage, thermometer well, and thermometer; and shall have adjustable-length spray bars of sufficient length to cover one-half of the roadbed at one time. The spray bars shall be adjustable vertically to permit application of the asphalt at the height above the surface approved by the contracting officer and shall be of the full-circulating type with satisfactory cutoff device at each nozzle. The use of trailer-type distributors will not be permitted. A trough shall be located

under the sprays, properly arranged to be swung out of the way after the sprays are operating in a uniform manner at the desired pressure or, in lieu thereof, building paper shall be spread over the treated surface for a sufficient length back so that the sprays are operating properly when the uncovered surface is reached. The building paper shall then be removed and disposed of in accordance with paragraph 1.6.11. If the cutoff is not sufficiently positive, the similar use of paper may be required at the end of the area being covered. The distributor shall be operated in such a manner that liquid asphalt will not be splashed on adjacent guardrails or structures. Any asphalt so splashed shall be removed at the expense of and by the contractor.

4.5.8 LIQUID ASPHALT PRIME COAT

a. General.—The contractor shall furnish and apply a liquid asphalt prime coat to the compacted base course in advance of placing the asphaltic concrete surfacing.

b. Material.—Liquid asphalt, grade MC-70, shall be in accordance with Federal Specification SS-A-671c or section 712 of the MAG standard specifications.

c. Applying.—Liquid asphalt shall be applied to the full width of the area to be surfaced at a temperature of 105 to 175 °F and at the rate of 0.25 gallon per square yard or as determined by the contracting officer. The prime coat shall be allowed to dry prior to placing of asphaltic concrete surfacing. The prime coat shall not be applied during rainy weather or when the atmospheric temperature in the shade is less than 50 °F.

d. Measurement.—The quantity of material for liquid asphalt prime coat for which payment will be made will be determined as provided in paragraph 4.5.3.

e. Payment.—Payment for liquid asphalt prime coat, MC-70, will be made at the unit price per ton bid therefor in the schedule, which unit price shall include the cost of furnishing and applying the liquid asphalt.

4.5.9 ASPHALTIC CONCRETE

a. General.—The contractor shall furnish and place asphaltic concrete material for

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surfacing on the bridge approaches and O&M road ramp turnouts where shown on the drawings or as directed by the contracting officer. Hot plant mix asphaltic concrete may be obtained from commercial sources approved by the contracting officer.

Unless otherwise specified in these paragraphs or otherwise directed by the contracting officer, the asphaltic concrete construction shall conform to the applicable provisions of section 321 of the MAG standard specifications.

A prime coat of liquid asphalt shall be furnished and applied as provided in paragraph 4.5.8.

b. **Materials.**—Mineral aggregate for asphaltic concrete shall meet the quality requirements and the gradation formula for type C-3/4, single course, as established in section 710 of the MAG standard specifications. Paving asphalt, grade AR-4000, conforming to section 711 of the MAG standard specifications shall be used in the mix unless otherwise designated by the contracting officer.

The completed asphaltic pavement shall be acceptable to the contracting officer in both composition and construction quality.

c. **Measurement.**—The weight of asphalt cement and asphaltic concrete mixture for which payment will be made will be determined as provided in paragraph 4.5.3.

The plant-mix material will be measured by the ton after mixing. All trucks used for hauling asphaltic concrete surfacing shall be weighed empty at such times as the contracting officer may direct. Rejected loads or surfacing required to be relaid shall be at the contractor's expense.

d. **Payment.**—Payment for asphaltic concrete will be made at the unit price per ton bid therefor in the schedule, which unit price shall include the cost of furnishing all materials for constructing the surfacing, except asphalt cement, and shall include the cost of furnishing all tools, labor, and equipment required in the preparation, hauling, placing, and compacting of the surfacing.

Although the weight of the asphalt cement is included in the weight of the asphaltic concrete mixture for measurement for payment for the asphaltic concrete, the asphalt cement is also paid for as a separate pay item in the schedule. Payment for asphalt cement, AR-4000, will be made at the unit price per ton bid therefor in the schedule, which unit price shall include the cost of furnishing the asphalt cement and all labor and equipment required in handling and applying the asphalt.

DIVISION 5-CONCRETE**SECTION 5.1-CONCRETE STRUCTURES****5.1.1 CONCRETE IN STRUCTURES**

- a. Concrete in structures shall conform to the requirements of paragraphs 5.3.1 through 5.3.20.
- b. Measurement and payment for concrete in structures will be made as prescribed in paragraphs 5.3.21 and 5.3.22.

5.1.2 CONSTRUCTION OF STRUCTURES

The structures to be constructed include the following:

- a. Roadway bridges including abutments.
- b. Overchute pier.
- c. Floatwells.

The item of the schedule for concrete in structures includes all cast-in-place concrete in the structures listed in a. through c. above.

Cast-in-place concrete for the structures shall conform to the requirements of section 5.3. Pipe and fittings, miscellaneous metalwork, mechanical and electrical equipment, and other items forming a part of the structures are provided for elsewhere in these specifications.

The structures will be located at various points along the canals as shown on the drawings or as otherwise designated. The sequence of construction of the structures shall be subject to approval of the contracting officer.

The structures shall be built to the lines, grades, and dimensions shown on the drawings. The dimensions of each structure as shown on the drawings will be subject to such modifications as may be found necessary by the contracting officer to adapt the structure to the conditions disclosed by the excavation or to meet other conditions. Where the thickness of any portion of a concrete structure is variable, it shall vary uniformly between the dimensions shown.

Where necessary, as determined by the contracting officer, the contractor will be furnished additional detail drawings of the structures to be constructed. The contractor will not be entitled to any additional allowances

above the prices bid in the schedule by reason of the dimensions fixed by the contracting officer or by reasons of any modifications or extensions of a minor character to adapt a structure to a structure site, as determined by the contracting officer.

The contractor shall place and attach to each structure, all timber, metal, and other accessories necessary for its completion, as shown on the drawings.

The cost of furnishing all materials and performing all work for installing timber, metal, and other accessories for which specific prices are not provided in the schedule shall be included in the applicable prices bid in the schedule for the work to which such items are appurtenant.

SECTION 5.2-CONCRETE CANAL LINING**5.2.1 PREPARING FOUNDATIONS FOR CONCRETE LINING**

- a. General.—The provisions of this paragraph apply to the preparation of all foundations upon which concrete lining is to be placed.

The item of the schedule for preparing foundations for concrete lining includes all excavation below the underside of the concrete lining required for placing selected bedding material; wetting the surfaces; furnishing or procuring, excavating from stockpiles, hauling, placing, moistening, and compacting the selected bedding material; and trimming the entire canal. The item also includes placing test sections to verify that the procedures result in acceptable results.

The bottom and side slopes including the surfaces of compacted embankment, compacted selected bedding materials, and compacted backfill, over which concrete lining is to be placed, shall be finished accurately to the dimensions shown on the drawings.

In all excavation, the canal shall be excavated so that there will be not less than 3 inches between any point of the excavated surface and the underside of the concrete lining. All such excavation shall be refilled to the underside of the lining with compacted

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selected bedding material. Embankment over which concrete lining is to be placed shall be constructed so that a layer of compacted selected bedding material can be placed between the embankment and the underside of the concrete lining as shown on drawings 3 (344-D-7161) and 4 (344-D-7162).

Immediately prior to placing the first lift of selected bedding material, the surfaces of the excavation and embankment to receive the material shall be thoroughly wetted to a depth of 6 inches or to impermeable material, whichever is less, as approved by the contracting officer.

If at any point material has been excavated beyond the neatlines required to receive the selected bedding material, the excess excavation shall be refilled in horizontal layers with selected bedding material, moistened if required, and compacted in accordance with paragraph 3.1.2: Provided, That where placing and compacting refill on a sloping foundation, the layers may be placed parallel to the surface of the foundation. If at any point the foundation material is disturbed or loosened during the excavation process or otherwise, it shall be moistened, if required, and thoroughly compacted by tamping, rolling, or other approved methods to form firm foundations upon which to place the concrete lining.

After the canal prism has been shaped to a reasonably true and even surface as described above, selected bedding material shall be placed on thoroughly wetted surfaces in layers of 6-inch-maximum thickness to bring the bedding material to a height where it can be trimmed to form a true and even surface upon which to place the concrete lining. Each layer of bedding material shall be moistened in accordance with paragraph 3.1.2 and thoroughly compacted. Where the bedding material is placed and compacted on a sloping foundation, the layers may be placed parallel to the surface of the foundation. The moisture content of the bedding material at the time of compaction shall be in accordance with paragraph 3.1.2. The compaction procedures used shall be the same as those used in the demonstration sections described below.

The contractor shall be required to place test sections of selected bedding material at times and places designated by the contracting officer to show the adequacy of his

construction procedures for placing and compacting the bedding material. The bedding material shall be placed to sufficient thickness in the test sections to allow practical density testing of the compacted material. The densities of the compacted bedding material in the test sections and the testing thereof shall be in accordance with paragraph 3.1.2. Modifications shall be made to the procedures until it is demonstrated that acceptable densities are being consistently obtained. These procedures shall then be used to compact the selected bedding material on the remainder of the work.

At the end panels of existing lining against which lining is to be placed under these specifications, all loose material shall be removed and all voids beneath the existing lining shall be refilled and thoroughly compacted.

The material used for this bedding shall conform to the following subparagraph b. All materials required for preparing foundations shall be furnished by the contractor.

b. Selected bedding material.—The selected bedding material under concrete lining shall be selected or processed to meet the following requirements of table 5A:

Table 5A

Screen size	Percent passing designated screen	
	Minimum	Maximum
1-1/2 inches	100	-
3/4 inch	70	100
No. 4	45	100
No. 30	15	45
No. 200	5	15

The loading, handling, transporting, and placing of the selected bedding material shall be subject to approval and shall be such as will result in a uniform mixture of the material being placed without separation or segregation. Selected bedding material shall be obtained from required excavation in areas where material in excess of that required to construct the adjacent embankments is available, or from borrow pits approved by the contracting officer.

Where selected bedding material is obtained from borrow pits on Government-owned land

and under the control of the Water and Power Resources Service, no charge will be made to the contractor for such selected bedding material. Where selected bedding material is procured from privately owned lands, the contractor shall make all necessary arrangements with the landowners. Any royalties or other charges required to be paid for materials taken from deposits not owned or controlled by the Government and under the control of the Water and Power Resources Service shall be paid by the contractor. If the deposit is owned or controlled by the Government, the portion of the deposit used shall be located and operated so as not to detract from the usefulness of the deposit or of any other property of the Government and so as to preserve, insofar as practicable, the future usefulness or value of the deposit. Materials, including stripping, removed from Government-controlled deposits and not used in the work shall be disposed of as directed.

c. Measurement and payment. - Measurement, for payment, of preparing foundations for concrete lining will be made of the finished foundation surfaces of the canal over which concrete lining is prescribed and actually prepared for concrete lining as provided in this paragraph. Payment for preparing foundations for concrete lining will be made at the unit price per square yard bid therefor in the schedule, which price shall include the cost of all excavation below the underside of the concrete lining required for placing the selected bedding material; wetting the surfaces; furnishing or procuring, excavating from stockpiles, hauling, placing, moistening, and compacting the selected bedding material; and of all other operations required for the preparation of foundations as herein specified. No separate payment will be made for performing the test sections. No additional allowance above the unit price per square yard bid in the schedule for preparing foundations for concrete lining will be made on account of any amount of overexcavation in canal excavation beyond that required for placing the selected bedding material.

5.2.2 CONCRETE IN CANAL LINING

a. General. - Reinforced and unreinforced concrete canal lining shall be constructed in the canal prism as shown on drawings 3 (344-D-7161) and 4 (344-D-7162). The contractor shall not place concrete in concrete canal

lining between June 1 and September 15 of any year.

Where reinforcement in concrete lining is shown on the drawing as 6x6-D10xD10 welded-wire fabric, the contractor may at his option furnish No. 4 bars at 12 inches in accordance with paragraph 5.3.13: Provided, That the No. 4 bars at 12-inch spacing furnished has the equivalent area to that of the welded-wire fabric, and: Provided further, That there is no additional cost to the Government.

Before placing the concrete in lining, the earthwork shall be completed to subgrade, and the foundations shall be trimmed as specified in paragraph 5.2.1.

Concrete in canal lining shall conform to the requirements of paragraphs 5.3.1 to 5.3.22, inclusive.

When concrete-lining placing operations for unreinforced concrete canal lining are stopped for the day, interrupted because of breakdown, or delayed by other causes, or where the contractor elects to construct a joint, such as would result from constructing one-half of the lining in one pass, the edge of the fresh concrete lining shall be bulkheaded to a surface normal to the lining along transverse or longitudinal lines. Before placing operations are resumed, the surface of the hardened concrete shall be prepared as a construction joint, as provided in subparagraph 5.3.15.c. The fresh concrete shall then be placed against the existing concrete with the full groove for alternative No. 1 contraction joint shown on drawing 5 (344-D-7163) formed against the existing concrete. The completed groove shall be sealed with elastomeric sealant as shown on the above drawing. Contraction joints shall be located as provided in paragraph 5.2.3.

Where concrete lining joins a structure, sponge rubber filler and elastomeric sealant conforming to paragraph 5.4.5 shall be placed as shown on the drawings.

The exposed surfaces of the waterstop shall be thoroughly cleaned. The fresh concrete shall then be placed against the cleaned surfaces with the other one-half of the waterstop embedded therein, thus completing a full contraction joint along the contact surface.

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Contraction joints for reinforced concrete canal lining shall be constructed as shown on drawings 3 (344-D-7161) and 4 (344-D-7162) and in accordance with paragraphs 5.4.1 and 5.4.4.

Where a panel of unreinforced concrete canal lining must be replaced, the old concrete shall be removed to the edges of the adjacent panels. The surfaces of the existing concrete shall be prepared as a construction joint as provided in subparagraph 5.3.15.c. The fresh concrete shall then be placed against the existing concrete with the full groove for alternative No. 1 contraction joint shown on drawing 5 (344-D-7163) formed against the existing concrete. The groove shall be sealed with elastomeric sealant as shown on the above drawing.

Random cracks shall be repaired as approved by the contracting officer.

The pumping plant structure downstream of Granite Reef Aqueduct station 821+18.17 and Upstream of station 832+25 will be built by others.

If the structure has not been constructed at the above stations, the contractor under these specifications shall construct the joint as shown on drawing 4 (344-D-7162) at station 821+18.17 and as shown on drawing 3 (344-D-7161) at station 832+25.

If the pumping plant structure has already been constructed at the above stations, the contractor under these specifications shall remove the existing waterstop protection, clean the existing waterstop, and construct the contraction joint in accordance with paragraph 5.3.16.

The contractor shall cooperate with the contractors under the adjacent contracts so that the work, including the connections, may be performed in an orderly and satisfactory manner.

No direct payment will be made to the contractor for making the connection to existing pumping plant structure and the cost thereof shall be included in the price per cubic yard bid in the schedule for reinforced concrete in canal lining.

b. Measurement and payment.— Measurement and payment for reinforced

concrete and unreinforced concrete in canal lining will be made in accordance with paragraphs 5.3.21 and 5.3.22. Payment will also be made for all cementitious materials in concrete placed within the neatlines of the canal lining. In addition, within the limits prescribed herein, payment will be made for cementitious materials used in concrete placed outside the neatlines of the canal lining. Determination of the amount of additional cementitious materials for which payment will be made will be based on each calendar day's lining placement and in no case exceed 7-1/2 percent of the quantity of cementitious materials required within the neatlines of the lining placed on that calendar day. The cost of cementitious materials used in concrete placed outside of the neatlines in any calendar day which is in excess of the above percentage shall be at the expense of the contractor. The amount of concrete placed outside the neatlines of the canal will be determined by deducting the calculated volume of concrete within the neatlines of the lining from the volume of mixed concrete actually placed in the lining on that calendar day.

Payment for furnishing and handling cementitious materials and for furnishing and placing welded-wire fabric will be made as provided in paragraphs 5.3.2 and 5.3.13.

No payment will be made to the contractor for repairing random cracks in canal lining.

5.2.3 CONTRACTION JOINTS FOR UNREINFORCED CONCRETE CANAL LINING

a. General.— Joints shall be constructed in concrete lining as shown on drawings 3 (344-D-7161), 4 (344-D-7162), and 5 (344-D-7163). Contraction joints for hand-placed lining shall be alternative No. 1 contraction joint shown on drawing 5 (344-D-7163).

The contractor may submit other shapes of the strips for approval in lieu of alternatives No. 2 and 3: Provided, That it is determined by the contracting officer that the strip will accomplish the objective of inducing a contraction joint and providing a satisfactory degree of watertightness. Any royalties required by the use of any patented joint strip shall be paid by the contractor. The joint shall be made along straight lines to the detailed dimensions shown and shall be maintained to

the required shape and dimensions during any subsequent finishing operations until the concrete has hardened.

Joints shall be continuous across and along the canal section. Transverse contraction joints shall be terminated at the top of the side slopes and a 3/4-inch-minimum-depth groove shall be tooled across the concrete curb from the end of each transverse joint. No filler or sealant will be required for these tooled grooves.

To facilitate special conditions at structures and where concrete-lining placing operations are stopped for the day, interrupted because of breakdown, or delayed by other causes, transverse contraction joints may be placed at spacings that vary from the spacing shown on the drawings. The spacings shall not be less than one-half the spacing shown on the drawings.

The contractor shall drill 6-inch-diameter cores at times and locations designated by the contracting officer beginning soon after the first joint installation to enable inspection to determine the effectiveness of the contractor's contraction joint installation procedures. Additional cores shall be drilled by the contractor for any other reason so designated by contracting officer. No direct payment will be made for drilling the first 100 cores and the cost thereof shall be included in the unit prices bid in the schedule for other items of work. Where additional cores are ordered to be drilled by the contracting officer, an equitable adjustment will be made for drilling such cores in accordance with clause No. 3 of the General Provisions. All core holes shall be repaired by and at the expense of the contractor immediately following completion of the inspection of the holes by the contracting officer unless otherwise directed. The method and manner of repair shall be approved by the contracting officer. If inspection reveals that the joint does not meet these specifications, the contractor shall promptly modify equipment and installation procedures to insure compliance with these specifications and, in addition, shall correct the defective work at his expense as required by the contracting officer.

b. Approval of joints.—One print and one reproducible of drawings and data showing the joints the contractor intends to construct, intersection, splice and bend details, and

method of construction shall be submitted by the contractor for approval to the Water and Power Resources Service, Attn D-270, P O Box 25007, Denver CO 80225. The contractor shall also submit one copy of all drawings and data and a copy of the transmittal letter to Construction Engineer, Arizona Projects Office, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073.

c. Materials.—

(1) Elastomeric sealant.—The sealant shall conform to Bureau of Reclamation "Specifications for Elastomeric Canal Joint Sealer," dated August 1, 1977, class R, type II.

(2) PVC strips.—The finished PVC strips shall be manufactured with the shapes conforming to dimensions shown on the drawing and shall be extruded from virgin, pigmented, plasticized PVC. The finished PVC strip shall meet the following requirements of table 5B.

TABLE 5B

Determination	Minimum
Tensile strength, lb/in ²	1,400
Ultimate elongation percent	280
Stiffness in flexure, 1/2-inch span, lb/in ²	400

The above determinations shall be made in accordance with the procedures outlined in "U.S. Army Corps of Engineers Specifications for Polyvinylchloride Waterstops, CRD-C-572-74."

(3) PVC compound.—Test sheets, one-sixth to one-eighth inch thick made from the PVC compound to be used in extruding the finished PVC strip shall meet the requirements shown in table 5C.

TABLE 5C

Determination	Requirement
Tensile strength pounds per square inch, minimum	1,750
Ultimate elongation, percent, minimum	350
Lost temperature brittleness	No chipping or cracking at -35 °F
Stiffness in flexure, 1/2-inch, span pounds per square inch, minimum	400
Accelerated extraction Ultimate elongation after extraction, percent minimum	300
Tensile strength after extraction pounds per square inch, minimum	1,500
Effect of alkalis Change in weight after 7-day immersion, percent	-0.10 to +0.25
Change in Shore "A" hardness after 6-day immersion, maximum	±5

The above determinations shall be made in accordance with the procedures outlined in "U.S. Army Corps of Engineers Specifications for Polyvinylchloride Waterstops, CRD-C-572-74."

d. Sampling, testing, and certification.-

(1) Elastomeric sealant.-The Government will test or require certification of each batch of elastomeric sealant prior to use. However, acceptance of the joint sealant materials under clause No. 10 of the General Provisions will not be made until the materials have been satisfactorily applied at the jobsite.

The contractor shall furnish copies of all purchase orders for elastomeric sealant to the contracting officer. Copies of purchase orders shall be furnished far enough in advance of planned use so that samples if required will be available to the Government to allow a testing period of at least 45 days.

The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required. The Government will act on certifications as to sealant conformance within 16 days after receipt of the certifications by the Government and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Water and Power Resources Service, Attn D-1520, P O Box 25007, Denver CO 80225, shipping costs prepaid and copies of all correspondence shall be sent to the contracting officer at the jobsite.

Samples if required shall be taken by the manufacturer during the canning operation and shall consist of a 2-gallon sample from each 500 gallons or less of each component of each batch or lot. Included with each sample shall be a certification that the sample is from the actual batch to be furnished. Each sample and certification shall be identified with the material, batch, and quantity it represents and the Water and Power Resources Service specifications number.

Certifications if required shall identify the materials as above and shall provide detailed test results of laboratory tests and covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of these specifications.

Joint sealant in storage for more than 6 months after the original tests shall be rejected. Joint sealants shall be subject to resampling and retesting at any time. The costs and delays from additional testing required, as a result of rejection of materials submitted, shall be the responsibility of the contractor.

(2) PVC materials.-The Government will test the finished strips and require certification of the PVC compound used to fabricate the strips prior to installation. However, acceptance of this material under clause No. 10 of the General Provisions will not be made until the material has been satisfactorily installed.

The contractor shall furnish purchase orders for the finished strip and a manufacturer's certification for the PVC compound used for fabricating the strip. The certification shall include material identification, reel number, quantity represented, and certified physical property test results performed by the manufacturer or other laboratory covering all of the test requirements for the PVC compound. The contractor shall be responsible for the accuracy of the manufacturer's certification. In addition, the contractor shall furnish for laboratory tests a representative sample of the contraction joint sealing strip 1 foot long from each reel. Each sample shall be marked with the number of the reel from which the sample was obtained. The reels shall be numbered consecutively for each purchase order. Included with the samples shall be a certification that the samples are taken from the reels to be furnished.

The purchase orders, certifications, and 1-foot-long samples shall be submitted to the Water and Power Resources Service, Attn D-1520, P O Box 25007, Denver CO 80225, shipping costs prepaid.

e. Placing.-

(1) Placing elastomeric sealant.-The canal-lining concrete shall be cured at least 7 days before the two-component elastomeric sealant is placed in the joint grooves. Immediately before placing the sealant in the joint grooves, the joint grooves shall be thoroughly cleaned by approved methods to remove all mortar, laitance, scale, dirt, oil, curing compound, and other foreign materials. Where curing compound has been applied to the surfaces of joint grooves, the surfaces upon and against which the sealant is to be placed shall be sandblasted. The joint grooves that have been sandblasted and other joint grooves, where directed, shall be blown out with high-pressure compressed air to remove all residue. Elastomeric sealant shall not be placed while rain is falling. At the time of placing the joint sealant, the joint groove shall be clean and surface dry and the temperature of the concrete and the ambient temperature shall be not less than 50 °F.

Before use, each component of the elastomeric sealant shall be thoroughly mixed, incorporating the entire contents of the containers and using equipment consistent with the size of the containers. At least once a day the stock tanks on the extrusion equipment shall be drained and scraped down.

The components shall be maintained at a temperature between 80 and 100 °F in the stock tanks on the extrusion machine at the time of mixing and placement. Heating, if required, shall be by indirect means and use of a direct flame will not be permitted.

The extrusion machine for mixing and placing the sealant shall conform to the manufacturer's recommendations and shall deliver two semifluid components in equal volumes to a mixer and nozzle such that the ratio between the quantities of the components shall be 1 plus or minus 10 percent. The extrusion machine shall be equipped with accurate pressure gages with suitable ranges and inspection valves for flow measurements so arranged as to permit convenient monitoring of pressures and proportioning. The proportioning shall be checked at normal operating pump pressures, flow rates, and other operating conditions at least every 2 hours or more frequently as determined by the contracting officer. Proportioning shall be checked by filling containers having a minimum depth of 6-1/2 inches (such as tall-form, cylindrical, 1-quart ice cream container, 3-3/8 inches inside diameter by 6-1/2 inches deep). The throughput rate of the mixing head shall not exceed the maximum specified by the equipment manufacturer.

The method of mixing and placing shall result in a homogeneous material. The sealant shall be extruded at the bottom of the joint groove and shall be tooled as necessary to work the sealant into intimate contact with the bonding surfaces without entrapping air bubbles. The top surface of the sealant shall be tooled to the shape shown on the drawing.

Elastomeric sealant which does not cure to a homogeneous, rubber-like compound, which does not bond to the joint groove faces, or which does not comply with any other requirements of this paragraph shall

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be removed. The joint groove shall then be recleaned and new sealant placed therein by the contractor at no additional cost to the Government.

Sealant pulled out of joints or damaged by the contractor's operations or otherwise damaged during the contract period, shall be replaced in accordance with the applicable provisions of these specifications at no cost to the Government.

(2) Placing PVC strips.—The PVC strips shall be installed in the concrete lining as shown on the drawing. The longitudinal PVC strips shall be installed before the transverse PVC strips are installed. The manner of placement shall include mechanical vibration that produces thorough consolidation of the concrete around the strip and provides a continuous contact between the concrete and all surfaces of the strip.

At intersections between longitudinal and transverse joints containing PVC strips, the top vertical member of the longitudinal strip shall be removed for 3 inches without pulling the strip from the concrete lining and the transverse strip shall be placed within the notch so formed. Depression of the longitudinal strip below the specified positions in the concrete will be permitted at intersections only to the extent necessary to place the transverse strip to the specified depth. However, tolerances and concrete consolidation requirements of the preceding paragraph shall apply at intersections.

The manner of making the intersections shall produce a reasonably close fit between transverse and longitudinal strips and provide a nearly continuous weakened plane normal to the lining surface in both directions through the intersections.

f. Measurement and payment.—Measurement, for payment, of providing joints in unreinforced concrete canal lining will be made along the longitudinal and transverse joints actually provided in the unreinforced concrete canal lining.

Payment for providing joints in unreinforced concrete canal lining will be made at the unit price per linear foot bid therefor in the

schedule, which unit price shall include the cost of all work and materials required to construct the joints in the unreinforced canal lining.

5.2.4 SAFETY LADDERS FOR
CONCRETE-LINED CANALS

a. General.—The contractor shall furnish and install safety ladders along both sides of the canal at 750-foot intervals as directed and in accordance with this paragraph and drawing 55 (40-D-6460).

The canal safety ladders shall be fabricated from carbon steel, aluminum, or corrosion-resisting (stainless) steel.

Carbon steel or aluminum canal safety ladders shall be coated with fusion epoxy in accordance with paragraph 8.1.1.

All canal safety ladders shall be anchored to the canal lining with 3/8-inch-diameter by 3-inch-long, corrosion-resisting (stainless) steel expansion anchors. PVC sleeves shall be placed between expansion anchors and those canal safety ladders which are fabricated of carbon steel or aluminum. PVC washers shall be placed at all expansion anchors on both sides of those canal safety ladders fabricated of carbon steel or aluminum.

PVC sleeves shall be 1/2-inch inside diameter, 3/8 inch long, with 0.06-inch wall thickness.

PVC washers shall be 13/32-inch inside diameter, 1-inch outside diameter, and 1/16 inch thick.

Expansion anchors shall be installed in holes drilled with carbide-tipped drill bits conforming to Federal Specification GGG-D-650B and ANSI B94-12. Minimum installation depth and method of expansion shall be as recommended by the anchor manufacturer. The nuts holding ladders on the anchors shall be tack welded to the anchors as approved by the contracting officer.

Holes drilled in concrete canal lining for expansion anchors which "spall out" shall be repaired with epoxy-bonded epoxy mortar in accordance with the "Bureau of Reclamation Standard Specifications for Repair of Concrete," dated November 15, 1970, and the expansion anchors reset in their original position.

The concrete surfaces at all canal safety ladders shall be painted in accordance with paragraph 8.1.1.

b. Materials.—

(1) Structural shapes, plates, and bars.—Federal Specification QQ-S-741D.

(2) Corrosion-resisting (stainless) steel.—Federal Specification QQ-S-763D, class 304L, condition A.

(3) Aluminum alloy plate and sheet.—Federal Specifications QQ-A-250E/GEN and QQ-A-250/11E, Aluminum Alloy 6061, T6.

(4) Expansion anchors.—Federal Specification FF-S-325, group II, type 3, class 3, or group II, type 4, class 1, and subparagraph b.(2) above. Proof load test will not be required.

(5) Other materials.—All materials not defined herein by detail specifications shall be of good commercial quality approved by the contracting officer.

c. Payment.—Payment for furnishing and installing safety ladders along canal will be made at the unit price per safety ladder bid therefor in the schedule, which unit price shall include the cost of furnishing and installing anchors and tack-welding nuts to anchors.

SECTION 5.3—GENERAL CONCRETE REQUIREMENTS

5.3.1 COMPOSITION

a. General.—Concrete shall be composed of cementitious materials, sand, coarse aggregate, water, and admixtures as specified, all well mixed and brought to the proper consistency.

b. Nominal maximum size of aggregate.—The coarse aggregate to be used in concrete shall be as large as practicable, consistent with required strength, spacing of reinforcement and embedded items, and placement thickness. The size of the coarse aggregate to be used will be determined by the contracting officer, and may vary incrementally according to the conditions encountered in each concrete placement.

c. Mix proportions.—The proportions of various ingredients to be used in the concrete for different parts of the work will be established initially and then adjusted by the Government in accordance with the Eighth Edition of the Water and Power Resources Service Concrete Manual during the progress of the work whenever need for such adjustment is indicated by results of testing of the aggregates and the concrete. Adjustments shall be made as directed to obtain concrete having suitable workability, impermeability, density, strength, and durability without the use of excessive cementitious materials. Suitable strength for structural concrete is that which will assure that 90 percent of all test cylinders will exceed the design strength. Suitable strength for all other concrete is that which will assure that 80 percent of all test cylinders exceed the design strength. Unless shown otherwise on the drawings, the design strength shall be 4,000 pounds per square inch at 28 days.

The mix design and average concrete strength shall be adjusted according to the variability of the cylinder strength test results. The contractor shall be entitled to no additional allowance above the prices bid in the schedule because of such adjustments of the mix proportions.

The net water-cementitious materials ratio, exclusive of water absorbed by the aggregates, shall be sufficiently low to provide adequate durability in concrete. Table 15, page 135, Eighth Edition of the Concrete Manual will be used as a guide for determining the maximum water-cementitious materials ratio to ensure durability of concrete.

Where portland cement plus a pozzolan is used under subparagraph 5.3.2.b.(2), the pozzolan shall constitute 20 percent of the total cementitious materials.

d. Consistency.—The slump of the concrete at the placement shall not exceed 2 inches for concrete in the tops of walls, bridge piers and abutments, and parapets; in slabs that are horizontal or nearly horizontal; and shall not exceed 3 inches for concrete in canal lining and for all other concrete. If the specified slump is exceeded at the placement, the concrete is unacceptable. The Government reserves the right to a lesser slump whenever concrete of such lesser slump can be consolidated readily into place by means

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of the vibration specified in subparagraph 5.3.16.c. The use of buckets, chutes, hoppers, pumps, transit mix trucks, or other equipment which will not readily handle and place concrete of the specified slump will not be permitted.

To maintain concrete at the proper consistency, the amount of water and sand batched for concrete shall be adjusted to compensate for any variation in the moisture content or grading of the aggregates as they enter the mixer. Addition of water to compensate for stiffening of the concrete after mixing but before placing will not be permitted. Uniformity in concrete consistency from batch to batch will be required.

5.3.1A CONCRETE QUALITY CONTROL MEASURES AND CONCRETE QUALITY ASSURANCE TEST PROGRAM

a. Concrete quality control measures.—As stated in clause No. 10 of the General Provisions, the contractor shall be responsible for providing quality control measures to insure compliance of the concrete with the contract requirements.

b. Concrete quality assurance program.—Independently of the contractor's concrete quality control measures, the Government will conduct a concrete quality assurance program incorporating the tests and contractor-furnished sampling equipment, specified below. As a part of its concrete quality assurance program, the Government will conduct tests to the extent and frequency necessary to ascertain that the concrete constituents, as well as fresh and hardened concrete, meet the specified levels of quality.

(1) Tests.—The Government will obtain samples and conduct tests in accordance with the test methods listed below:

(a) Sampling fresh concrete.—ANSI/ASTM C 172.

(b) Density (unit weight) and yield.—ANSI/ASTM C 138 except that a 0.25-cubic-foot container may be used for nominal aggregate sizes up to 1-1/2 inches.

(c) Air content.—ANSI/ASTM C 231.

(d) Slump.—ANSI/ASTM C 143.

(e) Temperature.—Temperature will be determined by placing a thermometer in the concrete at the placement.

(f) Making and curing concrete test specimens in the field.—ANSI/ASTM C 31.

(g) Capping cylindrical concrete specimens.—ANSI/ASTM C 617.

(h) Compressive strength of cylindrical concrete specimens.—ANSI/ASTM C 39.

(2) Test equipment.—The contractor shall provide sampling equipment and testing facilities, including those listed below, for use by the Government:

(a) Mechanical sampling devices for safely procuring and handling representative test samples of aggregates and other concrete materials during batching and for obtaining representative concrete samples from a point in the discharge stream as the concrete is discharged from the mixers.

(b) Ample and protected working space near the placement site and a means for safely procuring and handling representative concrete samples.

(3) Contractor-furnished drawings and data.—Not less than 30 days prior to start of installation of the contractor's plants and equipment for processing, handling, transporting, storing, and proportioning concrete ingredients and for mixing, transporting, and placing concrete, the contractor shall submit drawings and data to the contracting officer, for approval, showing plant arrangement and locations and descriptions of contractor-furnished sampling and testing of concrete and concrete materials. The drawings and data shall provide a description in sufficient detail for an adequate review.

5.3.2 CEMENTITIOUS MATERIALS

a. General.—For purposes of these specifications, cementitious materials shall be interpreted to mean any of the following:

portland cement, or portland cement plus a pozzolan, or blended hydraulic cement.

The provisions of this paragraph apply to cementitious materials for use in cast-in-place concrete required under these specifications. Portland cement required for items such as concrete pipe and other precast concrete products, for grout and mortar, and for other items exclusive of cast-in-place concrete is provided for in the applicable paragraphs of these specifications covering the items for which such portland cement is required.

All cementitious materials shall be furnished by the contractor.

Cementitious materials shall be free from lumps and other deleterious matter and shall be otherwise undamaged when used. Before a concrete placement is started, sufficient cementitious materials shall be in storage at the batch plant to complete the placement.

Transportation from the place of manufacture to the batching plant shall be in weathertight rail cars, trucks, conveyors, and other means which will protect the cementitious materials completely from exposure to moisture. Immediately upon receipt at the jobsite, bulk cementitious materials shall be stored in dry, weathertight, properly ventilated bins until the cementitious materials are batched. The bins shall be emptied and cleaned by the contractor when so directed by the Government; however, the intervals between required cleanings will normally be not less than 6 months. Each shipment of bagged cement shall be stored so that it may readily be distinguished from other shipments and shall be stored in a dry, enclosed area protected from moisture. To prevent undue aging of bagged cement after delivery, the contractor shall use bags of cement in the chronological order in which they were delivered to the jobsite.

All storage facilities shall be subject to approval by the Government and shall be constructed to permit easy access for inspection.

b. Cementitious materials options.—Cementitious materials shall be furnished in accordance with one of the following options:

- (1) Type II portland cement only.

- (2) Type II portland cement plus a class N, F, or C pozzolan.

- (3) Type IP(MS) blended hydraulic cement only.

Concrete shall have a uniform appearance. Different cementitious materials may result in color variations in concrete placements. Therefore, the contractor shall obtain prior written approval to use more than one of the above options for cementitious material in concrete.

c. Materials.—

- (1) Portland cement.—Portland cement shall meet the requirements of ANSI/ASTM C 150 for type II cement, and shall meet the optional false-set limitation specified therein. Portland cement shall also conform to the low-alkali limitation.

- (2) Pozzolan.—Pozzolan used under the options specified in subparagraphs b.(2) and (3) above shall meet the requirements of ANSI/ASTM C 618 for class N, F, or C with the following additional requirements:

- (a) The maximum percent of sulfur trioxide shall be 4.0 percent for classes F and C.

- (b) The maximum percent loss on ignition shall be 8.0 percent for class N and 6.0 percent for class F.

- (c) The pozzolanic activity index with lime shall be determined using 2-inch cubes and the minimum strength at 7 days shall be 900 pounds per square inch.

- (d) Pozzolan used under the option specified in subparagraph b.(2) above shall meet the optional physical requirement of ANSI/ASTM C 618 for mortar expansion at 14 days.

Furthermore, pozzolan used under the options specified in subparagraphs b.(2) and (3) above shall not decrease the sulfate resistance of concrete. The following class N pozzolans have been found not to detract from sulfate resistance; therefore, either of them may be used under options specified in subparagraphs b.(2) and (3) above:

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(a) "Lassenite SR" pozzolan, as marketed by Lassenite Industries, Inc., 1475 Terminal Way, Reno NV 89502, from plant located near Herlong, California.

(b) "Sun" pozzolan, as produced by Oregon Portland Cement Co., 111 SE. Madison, Portland OR 97214, from plant located near Lime, Oregon.

Water and Power Resources Service research on classes F and C pozzolans has correlated sulfate resistance to a resistance factor, "R." "R" is defined as "(C-5)/F" where "C" is the calcium oxide content of the pozzolan in percent and "F" is the ferric oxide content in percent. The higher the "R" factor, the lower the sulfate resistance expected for concrete containing the pozzolan. When a class F or C pozzolan is used with type II cement or type IP(MS) blended cement, the "R" factor shall be less than 2.5. Calcium and ferric oxide contents shall be determined in accordance with ANSI/ASTM C 114.

(3) Blended cement.—Blended cement shall meet the requirements of ANSI/ASTM C 595 for type IP(MS) portland pozzolan cement with the additional requirements.

(a) The optional false-set limitation specified in ANSI/ASTM C 150.

(b) The physical requirement of ANSI/ASTM C 595 for mortar expansion of type P cement at 14 days.

(c) The pozzolan constituent shall be between 15 and 25 weight percent of the portland pozzolan cement.

(d) The amount of pozzolan in the finished cement shall not vary by more than plus or minus 3 weight percent of the finished cement from that stated by the contractor in the information submitted to the contracting officer as required below.

(e) Pozzolan used in blended cement shall meet the applicable requirements in c.(2) above.

The contractor shall inform the contracting officer, in writing, at least 30 days before

first shipments of any cementitious materials are required of the following:

The names and addresses of cement and pozzolan shipping points

The names and addresses of cement and pozzolan suppliers from which the contractor will purchase cementitious materials

The names and addresses of contractors to whom cement and pozzolan will be shipped, if other than the prime contractor

The quantities of cement and pozzolan ordered

Whether cement will be ordered in bulk or in bags

The purchase order number, contract number, or other designation that will identify cement and pozzolan to be used by the contractor

The source and composition of the constituents in blended cement

The weight percent of the pozzolan constituent in blended cement

The contractor shall notify the contracting officer before changes in production or handling of cementitious materials which relate to the data previously submitted are implemented.

d. Acceptance of cement.—The cement will be sampled and tested by the Government in accordance with Department of Army Regulation No. ER 1110-1-2002, Cement and Pozzolan Acceptance Testing.

(1) Prequalified producer.—If the cement is supplied from a producer who is prequalified, as described in appendix C of the above-noted regulation, for the specific cement type to be supplied, cement may be shipped directly from the product bin. Prequalification shall include required optional low-alkali and false-set limitations when specified. A mill test report shall be submitted to the Water and Power Resources Service construction office for each lot of cement from which shipments are supplied.

All cement shipments shall be accompanied by shipping documents containing the following:

- (a) Certification that the cement meets all applicable requirements of these specifications.
- (b) Type of cement shipped, including optional limitations such as "MS," "false set," or "low alkali."
- (c) Manufacturing location and dates.
- (d) Lot (bin) number.
- (e) Date of shipment.
- (f) Quantity of cement shipped.

(2) Testing for non-pre-qualified producer.—If the producer is not prequalified for the cement type to be supplied, the cement shall be sampled and stored in sealed silos at the place of manufacture, and will be tested by the Government for compliance before it is shipped from the sealed silos.

(3) Testing for other categories.—When a producer is removed from the list of qualified producers for the cement type being supplied, or when the contracting officer determines that sealed-silo testing and acceptance are otherwise necessary, cement acceptance will be by successful tests on cement reserved for Government use in sealed silos at the point of manufacture.

(4) Basis for acceptance, removal, and reinstatement.—Acceptance, removal, and reinstatement of a producer as a qualified cement source for a specific cement type are based primarily on project sample tests and statistical evaluations of past mill test results. These criteria are listed in Department of Army Regulation No. ER1110-1-2002.

When so directed by the contracting officer, the producer shall test cement for compliance with the false-set limitation at the latest time, prior to shipment, that the cement is still in possession of the cement company. Testing frequency shall be as directed by the contracting officer and may be as high as one test per truck (about 25 tons) of cement shipped. Cement failing to meet false-set requirements at any time prior to shipment shall not be shipped for Government use.

Cement not meeting specifications requirements may be rejected by the Government at any time prior to its use in concrete, and the contractor shall be entitled to no adjustments in price or completion time by reason of any delays caused by rejection of unacceptable cement, nor for additional expense of handling and replacing rejected cement. Cement may be rejected if it fails to meet false-set tests either at the Government testing laboratory or at the cement plant. Concrete made with cement which is subsequently tested and does not meet specifications requirements may be rejected by the Government and shall, if rejected, be removed and replaced by the contractor at his expense.

The contractor may be charged the cost of testing of all cement which has been ordered in excess of the amount of cement used for the work under these specifications. The charges to be made for the Government expense invested in quality assurance of excess cement will be at the rate of \$ 1.00 per ton and will be deducted from payments due to the contractor.

e. Acceptance of pozzolan.—Pozzolan added to the concrete as an admixture will be sampled and tested by the Government in accordance with Department of the Army Regulation No. ER1110-1-2002, Cement and Pozzolan Acceptance Testing. Acceptance tests will be made on a lot or lots of pozzolan which have been reserved for exclusive Government use in sealed bins at the point of manufacture or other storage site approved by the contracting officer. Untested lots shall not be intermingled or combined with tested and approved lots until such lots have been tested and approved.

Release for shipment and approval for use will be based on compliance with physical, chemical, and uniformity requirements for which tests can be completed within 8 days after tests begin. Release for shipment and approval for use on the above basis will be contingent on continuing compliance with the other requirements of the specifications. No pozzolan shall be shipped until notice has been given that the test results are satisfactory.

Pozzolan not meeting specifications requirements may be rejected by the Government at any time prior to its use in concrete, and the contractor shall be entitled

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to no adjustments in price or completion time by reason of any delays caused by rejection of unacceptable pozzolan, nor for additional expense of handling and replacing rejected pozzolan. Concrete may be rejected by the Government if it has been made with pozzolan from a lot which is subsequently tested and found to not meet specifications requirements. If concrete is rejected by the Government, it shall be removed and replaced by the contractor at his own expense.

The contractor may be charged the cost of testing of all Government-tested pozzolan which has been ordered in excess of the amount of pozzolan needed for the work under these specifications. The charges to be made for the Government expense invested in quality assurance of excess pozzolan will be at the rate of \$ 1.00 per ton and will be deducted from payments due the contractor.

f. Measurement and payment.—No payment will be made for cementitious materials used in wasted concrete, cementitious materials used in replacement of damaged or defective concrete, cementitious materials used in extra concrete required as a result of careless excavation, and cementitious materials use in concrete placed by the contractor in excavations intentionally performed to facilitate the contractor's operations.

No measurement for payment will be made for cementitious materials used in the concrete items specified in subparagraph 5.3.22.a.

Measurement, for payment, of bulk cementitious materials will be on the basis of batch weights and batch counts at the batching plant. Measurement, for payment, of bags of cement will be on the basis of the number of bags of cement used at the mixer.

When determined by the contracting officer, cementitious materials, either bulk or in bags, used for miscellaneous cast-in-place concrete will be measured for payment in the most practicable manner. One bag of cement will be considered as 0.047 ton.

Except as otherwise provided below, payment will be made for cementitious materials used in cast-in-place concrete placed within the pay lines for such concrete. Payment will be made also for cementitious materials used in cast-in-place concrete placed outside the pay lines for such concrete, except that no payment will

be made when the requirement for such concrete is determined by the contracting officer to be the result of careless excavation or excavation intentionally performed by the contractor to facilitate his operations: Provided, That measurement, for payment, of cementitious materials used in cast-in-place concrete placed outside the neatlines for concrete in lining will be limited to the percentage specified in subparagraph 5.2.2.b.

Payment for furnishing and handling cementitious materials will be made at the unit price per ton bid therefor in the schedule, which unit price shall include the cost of purchasing, transporting, handling, and storing cementitious materials. One ton will be considered as 2,000 pounds.

5.3.3 ADMIXTURES

a. General.—The contractor shall furnish air-entraining and chemical admixtures for use in concrete as hereinafter provided. Admixtures shall be of uniform consistency and quality, and shall be maintained at the jobsite at uniform strength of solution. Air-entraining and chemical admixtures shall be batched separately in liquid form in dispensers capable of measuring at one time the full quantity of each admixture required for each batch. Measurement shall be either by weighing or by volumetric-admixture dispensers constructed and located such that the full batch quantity of each admixture can be observed in a visual gage by the plant operator. Each admixture shall be discharged separately into the batched mixing water as the water is being discharged into the mixer.

The contractor shall notify the contracting officer, in writing, of the manufacturers and specific brand names of all admixtures to be used. The contractor will be advised in writing within 16 days after receipt of notification whether admixtures will be tested examined by the Government. Written notification of products to be used shall be furnished far enough in advance of planned use so that samples, if required, can be made available to the Government for a testing period of 45 days after receipt of the samples.

If the Government elects to test an admixture, the contractor shall submit a manufacturer's certification containing the following information:

- (1) Name of admixture.
- (2) ASTM designation under which the admixture is formulated.
- (3) Admixture type.

In addition, the manufacturer shall submit a product description, instructions, recommended dosage, chloride content, and precautions to be considered when using the admixture. If available, independent laboratory test data, confirming that the requirements of the applicable ASTM standard have been met, shall be submitted to the Government; such test results may, as determined by the Government, preclude the need for Government testing of the admixture. If the Government elects to test an admixture, one sample containing approximately 1 liter of the admixture shall also be submitted to the Government. The certification, data, and sample shall be fully identified and furnished, shipping costs prepaid, to: Water and Power Resources Service, Attn D-1511, P O Box 25007, Denver CO 80225.

The contractor will not be entitled to any reimbursement for delays incurred due to Government testing of admixtures or for delays caused by rejection of the proposed admixtures. Final approval of an admixture will not be given until it has performed satisfactorily at the jobsite.

b. Chemical admixtures.—Chemical admixtures which will introduce more than 1/10 of 1 percent chloride, by weight of cementitious materials, shall not be used in concrete in which aluminum, galvanized metalwork, or prestressed steel is to be embedded.

- (1) Accelerator.—Accelerating admixtures shall not be used in cast-in-place concrete.
- (2) Water-reducing, set-controlling admixture.—The contractor shall use a water-reducing, set-controlling admixture, referred to herein as WRA, in all concrete. The admixture shall conform to ANSI/ASTM C 494 for type A or D chemical admixture.

If use of the WRA chosen by the contractor is accompanied by abnormal setting of the fresh concrete, or if the WRA does not perform in accordance with these

specifications, the contractor shall, when directed, furnish and use other brands of WRA until an acceptable admixture is found.

The amount of WRA used shall be that amount necessary to effect the requirements of ANSI/ASTM C 494. The contracting officer reserves the right to adjust the quantities of WRA or eliminate its use, and the contractor shall be entitled to no additional allowances for such adjustments.

c. Air-entraining admixture.—An air-entraining admixture shall be used in all concrete. The admixture shall conform to ANSI/ASTM C 260.

The amount of air-entraining admixture used shall be that amount necessary to effect a total air content in the concrete as shown in table 5D.

Table 5D.— *Total air content*

Nominal maximum size coarse aggregate	Total air, percent by volume of concrete
3/4 inch	6 plus or minus 1
1-1/2 inches	4.5 plus or minus 1

d. Cost.—The cost of furnishing admixtures and all other costs incidental to their use shall be included in the applicable price bid in the schedule for the concrete in which the admixtures are used.

5.3.4 WATER

The water used in making and curing concrete, mortar, and grout shall be free from objectionable quantities of silt, organic matter, salts, and other impurities. The contracting officer will determine whether or not such quantities of impurities are objectionable. Such determination will usually be made by comparison of compressive strength, water requirement, time of set, and other properties of concrete made with distilled or very clean water and concrete made with the water proposed for use. In no case shall mix water contain more than 3000 milligrams per liter soluble sulfate.

If any water to be used in concrete, mortar, or grout is suspected by the contracting officer of exceeding the soluble sulfate limitation, samples

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of the water will be obtained and tested by the Government. The water will be tested for soluble sulfate content in accordance with the Bureau of Reclamation "Method of Test for Determining the Quantity of Soluble Sulfate in Solid (Soil or Rock) and Water Samples," dated May 1, 1973.

5.3.5 SAND

a. General.—The term "sand" is used to designate aggregate in which the maximum size particle will pass a 3/16-inch (No. 4) test sieve. Sand shall be predominantly natural sand which may be supplemented with crushed sand to make up deficiencies in the natural sand gradings.

Sand for concrete will be furnished by the Government in prepurchased stockpiles near the aggregate source in SE1/4NE1/4 sec. 7, T. 1 N., R. 5 E. relative to the Gila and Salt River meridian.

Sand will be loaded on the contractor's trucks by the Salt River Indian Tribe. The contractor shall drive his trucks over scales near the stockpiles so they can be weighed both before and after loading in order to determine the quantity of sand furnished.

Sand, as delivered to the batching plant, shall have a uniform and stable moisture content of less than 6 percent free moisture. Variations of moisture in sand as batched shall not exceed one-half percent, by weight, in 30 minutes.

b. Quality.—The sand shall consist of clean, hard, dense, durable, uncoated rock fragments. Sand may be rejected if it fails to meet any of the following quality requirements. The designations in parentheses hereinafter refer to methods of test described in the Eighth Edition of the Water and Power Resources Service Concrete Manual.

Organic impurities in sand (designation 14).—Color no darker than the specified standard.

Deleterious substances.—As shown in table 5E.

Table 5E.— Allowable percentages of deleterious substance in sand

	Maximum percent by weight, as batched
Material passing No. 200 sieve (designation 16)	3
Lightweight material (designation 17)	2
Friable particles (designation 13)	1
Other deleterious substance (such as mica, coated grains, soft-flaky particles, and loam)	2
Sum of all the above deleterious substances	5

c. Grading.—The sand as batched shall be well graded, and when tested by means of standard sieves (designation 4), shall conform to the limits in table 5F.

Table 5F.— Sand grading requirements

Sieve No.	Individual percent by weight retained on sieve
4	0 to 5
8	5 to 15*
16	10 to 25*
30	10 to 30
50	15 to 35
100	12 to 20
Pan	3 to 7

* If the individual percent retained on the No. 16 sieve is 20 percent or less, the maximum limit for the individual percent retained on the No. 8 sieve may be increased to 20 percent.

The grading of the sand shall be controlled so that the fineness moduli (designation 4) of at least 9 out of any 10 consecutive test samples of finished sand will not vary more than 0.20

from the average fineness modulus of the 10 test samples.

5.3.6 COARSE AGGREGATE

a. General.—For the purposes of these specifications, the term "coarse aggregate" designates clean, well-graded aggregate of particle sizes within the range of 3/16 of an inch to 1-1/2 inches or any size or range of sizes within such limits. Coarse aggregate for concrete shall consist of natural gravel or crushed rock or a mixture of natural gravel and crushed rock.

Coarse aggregate for concrete will be furnished by the Government in prepurchased stockpiles near the aggregate source in SE1/4NE1/4 sec. 7, T. 1 N., R. 5 E. relative to the Gila and Salt River meridian.

Coarse aggregate will be loaded on the contractor's trucks by the Salt River Indian Tribe. The contractor shall drive his trucks over scales near the stockpiles so they can be weighed both before and after loading in order to determine the quantity of coarse aggregate furnished.

Coarse aggregate, as delivered to the batching plant, shall have a uniform and stable moisture content.

b. Quality.—The coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments. Coarse aggregate may be rejected if it fails to meet any of the following quality requirements. The designations in parentheses hereinafter refer to methods of test described in the Eighth Edition of the Water and Power Resources Service Concrete Manual.

Los Angeles abrasion loss (designation 21, using grading A).—Ten percent maximum loss of weight at 100 revolutions or 40 percent maximum loss of weight at 500 revolutions.

Deleterious substances (in any size of coarse aggregate).—As shown in table 5G.

Table 5G.— Allowable percentages of deleterious substances in coarse aggregate

	Maximum percent by weight, as batched
Lightweight material (designation 18)	2
Friable particles (designation 13)	1/2
Other deleterious substances	1/2
Sum of all the above deleterious substances	2

c. Separation.—The coarse aggregate shall be separated into nominal sizes during production of the aggregate. Just prior to batching, the coarse aggregate shall be rewashed by pressure spray and finish screened on multideck vibrating screens capable of simultaneously removing undersized and oversized aggregate from each of the nominal aggregate sizes. If variations in the water content of the aggregates entering the batcher occur during intermittent batching, then a dewatering screen will be required after the finish screens to remove the excess free moisture. Finish screens shall be mounted over the batching plant or on the ground adjacent to the batching plant. The finish screens shall be so mounted that the vibration of the screens will not be transmitted to the batching bins or scales and will not affect the accuracy of the weighing equipment in any other manner.

The method and rate of feed for finish screening shall be such that the screens will not be overloaded and will result in a finished product which meets the grading requirements of these specifications. Coarse aggregate shall be fed to the finish screens in a combination or alteration of nominal sizes which will not cause noticeable accumulation of poorly graded coarse aggregate in any batching bin. The finish-screened aggregates

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shall pass directly to the individual batching bins in such a manner as to minimize breakage. Minus 3/16-inch material passing through the finish screens shall be wasted unless it is routed back through a sand classifier in a manner which causes uniform blending with the natural sand being processed. Water from finish screening shall be drained in such a manner as to prevent aggregate wash water from entering the batching bins and weighing hoppers. Washing and finish screening equipment shall be subject to approval by the contracting officer.

When provided adequate substantiation by the contractor that coarse aggregate, as batched, will consistently meet specified grading requirements without final washing or finish screening, the contracting officer may waive final washing requirements or finish screening requirements or both for structural concrete. If such requirements are waived and grading requirements are not consistently met, the contractor shall implement, within 14 days after notification by the contracting officer, final washing and finish screening as herein specified.

Coarse aggregate for concrete in canal lining to be placed with a lining machine shall be separated into 3/8-, 3/4-, and 1-1/2-inch nominal maximum sizes. Separation of the coarse aggregate into the specified sizes, after finish screening, shall be such that when tested in accordance with designations 5 and 16 in the Concrete Manual, coarse aggregate shall meet the grading requirements in table 5H.

Coarse aggregate for concrete in structures and in canal lining not to be placed with a lining machine may be separated as previously herein specified or may be separated into 3/4- and 1-1/2-inch nominal maximum sizes. Separation of the coarse aggregate into the two sizes shall be such that when tested in accordance with designations 5 and 16 in the Concrete Manual, coarse aggregate shall meet the grading requirements in table 5-I.

Table 5H.—Grading requirements for coarse aggregate for concrete in machine-placed concrete lining

Nominal size	3/8 inch	3/4 inch	1-1/2 inches
Nominal size range	3/16 to 3/8 inch	3/8 to 3/4 inch	3/4 to 1-1/2 inches
Maximum percent retained on (indicated) oversize test sieve*	0% (7/16 inch)	0% (7/8 inch)	0% (1-3/4 inches)
Percent retained on (indicated) test sieve*	Not applicable	25 to 50% (5/8 inch)	25 to 50% (1-1/4 inches)
Maximum percent passing (indicated) undersize test sieve*	2% (No. 5)	2% (5/16 inch)	2% (5/8 inch)
Maximum percent passing the number 200 sieve*	1.0%	0.5%	0.2%

* Sieves used in grading tests will be standard square mesh sieves conforming to ANSI/ASTM E 11 with particular regard for permissible variations in average openings.

Table 5-I.—Grading requirements for coarse aggregate for concrete in structures and nonmachine placed lining

Nominal maximum size	3/4 inch	1-1/2 inches
Nominal size range	3/16 to 3/4 inch	3/4 to 1-1/2 inches
Maximum percent retained on (indicated) oversize test sieve*	0% (7/8 inch)	0% (1-3/4 inches)
Percent retained on (indicated) test sieve*	50 to 75% (3/8 inch)	25 to 50% (1-1/4 inches)
Maximum percent passing (indicated) undersize test sieve*	2% (No. 5)	2% (5/8 inch)
Maximum percent passing the No. 200 sieve*	0.5%	0.2%

* Sieves used in grading tests will be standard square-mesh sieves conforming to ANSI/ASTM E 11, with particular regard for permissible variations in average openings.

5.3.7 DELETED

5.3.8 BATCHING

a. General.—The contractor shall notify the contracting officer 24 hours before batching concrete. Unless inspection is waived in each case, batching shall be performed only in the presence of a duly authorized Government inspector.

The contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the prescribed amounts of the various materials entering the concrete mixers. The amount of bulk cement, pozzolan, sand, and each size of coarse aggregate entering each batch of concrete shall be determined by individual weighing. Sand and coarse aggregate may be weighed with separate scales and hoppers or cumulatively with one scale and hopper. If the batch plant is equipped with automatic interlocking sequential batching controls, the cement and pozzolan may be weighed cumulatively with one scale and hopper so long as weighing is automatically controlled within the specified tolerances and cement is weighed first. If the batch plant is not so equipped, cement and pozzolan shall be weighed separately with individual scales and hoppers. Water and admixtures shall be measured by weight or by volume in accordance with paragraphs 5.3.4 and 5.3.3. Where bagged cement is used, it need not be weighed if the concrete is proportioned on the basis of integral bags of cement.

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When bulk cementitious materials and aggregates are hauled from a central batching plant to the mixers, each batch shall be protected during transit to prevent loss and to limit prehydration of the cementitious materials. Separate compartments with suitable covers shall be provided to protect the cementitious materials or they shall be completely enfolded in and covered by the aggregates to prevent wind loss. If cementitious materials are enfolded in moist aggregate or otherwise exposed to moisture and delays occur between batching and mixing, the contractor shall at his own expense add extra cement to each batch in accordance with the schedule in table 5J.

Table 5J. *Additional cementitious materials requirements*

Hours of contact between dry cementitious materials and moisture*	Additional cementitious materials required
0 to 2	0 percent
2 to 3	5 percent
3 to 4	10 percent
4 to 5	15 percent
5 to 6	20 percent
Over 6	Batch will be rejected.

* The Government reserves the right to require the addition of cementitious materials for shorter periods of contact during periods of hot weather and the contractor shall be entitled to no additional compensation by reason of the shortened period of contact.

b. Equipment.—

(1) All weighing equipment shall be accurate to 0.40 percent over the working range. In addition, the construction and accuracy of the weighing equipment shall conform to the applicable requirements of Federal Specification AAA-S-121D. The contractor shall schedule and perform monthly tests to assure that the operating performance of each scale and measuring device is within the 0.40 percent accuracy and shall provide standard test weights and any other equipment necessary to conduct these tests. The tests shall be made in the presence of a Government inspector and shall be subject to his approval. In addition to monthly tests, the contractor shall

perform additional tests when requested by the Government. The contractor shall make such adjustments, repairs, or replacements as may be necessary to meet the specified requirements for accuracy of measurement.

(2) Each weighing unit shall be springless and shall visibly register the actual weights during the weighing operation and not just indicate when a prescribed weight has been obtained. The clear interval for dial scale graduation shall be not less than 0.03 inch. Each scale graduation shall indicate increments no greater than 2.5 pounds for water and cementitious materials and no more than 10 pounds for aggregate for each cubic yard normally batched. Each batch weight indicator and volumetric dispenser shall be in full view of the operator. Batching controls shall be interlocked so that a new batch cannot be started until the weighing hoppers have been completely emptied of the last batch and the scales register zero weight.

(3) The equipment shall be capable of controlling the delivery of material so that the combined inaccuracies in feeding and measuring during normal operation will not exceed 1 percent for water, 1-1/2 percent for cementitious materials, 3 percent for admixtures, and 2 percent each for sand, 3/4-inch aggregate, and 1-1/2-inch aggregate. The weighing hoppers shall be constructed so as to permit the convenient removal of materials batched in excess of the prescribed mix design and the above tolerances.

(4) Measuring devices for air-entraining and chemical admixtures shall have sufficient capacity to measure at one time the full quantity of the properly diluted solution required for each batch and shall be maintained in a clean and freely operating condition. If admixtures are measured by a method other than direct weighing, equipment shall be designed for confirmation of the accuracy of each batch quantity by use of visual-mechanical gages readily visible from the batch plant operator's station. Admixture batching equipment shall be so constructed that the required batch quantity can only be added once to each batch and so that each admixture is discharged separately into the

batched mixing water as it is being discharged into the mixer.

(5) Equipment for conveying batched materials from weighing hoppers into the mixer shall be constructed, maintained, and operated so as to prevent spillage of the batched materials and overlap of batches.

(6) Equipment for handling cementitious materials in the batching plant shall be constructed and operated so as to prevent noticeable dust during the measuring and discharging of each batch of material.

(7) Aggregate batch bins shall be so constructed as to be self-cleaning during drawdown.

(8) Coarse aggregate shall be deposited in the batch bins directly over the discharge gates.

(9) Convenient facilities shall be provided for readily and safely obtaining representative samples of cementitious materials, admixtures, sand, and each size of coarse aggregate from the discharge stream between batch bins and the weighing hoppers or between the batch hopper and the mixer.

(10) The water batching device shall be constructed so that the water will be discharged quickly and freely into the mixer without objectionable dribble from the end of the discharge pipe and shall be such that leakage will not occur when the valves are closed. In addition, equipment shall be capable of adjusting batch water by as little as 3 pounds per cubic yard. There shall be a means for introducing small increments of water into each mixer after batching for occasional final tempering of the concrete.

(11) The equipment shall be capable of adjustment to compensate for the varying moisture content of the sand and coarse aggregates and to adjust the mix proportions as needed.

(12) The contractor shall inform a Government batch plant inspector prior to and after changes and adjustments in batching equipment and control instrumentation.

5.3.9 MIXING

a. General.—The concrete ingredients shall be thoroughly mixed in mixers designed to positively insure uniform distribution of all the component materials throughout the concrete at the end of the mixing period.

The concrete, as discharged from the mixer, shall be uniform in composition and consistency from batch to batch. Mixers will be examined regularly by the Government for changes in condition due to accumulation of hardened concrete or mortar or to wear of blades. The adequacy of the mixing will be determined by the Government in accordance with the concrete uniformity requirements of ANSI/ASTM C 94, annex A1. Samples of concrete for such tests will be taken from any size batch which is commonly mixed during concrete production. For testing purposes, the contractor shall mix, in the mixers to be tested, the size of batch directed by the Government inspector at the batch plant, and shall assist in collection of required samples from that batch.

Any mixer that at any time produces unsatisfactory results shall not be used until repaired. If repair attempts are unsuccessful, a defective mixer shall be replaced.

Batch size shall be at least 10 percent of, but not in excess of, the rated capacity of the mixer unless otherwise authorized by the contracting officer.

b. Central mixers.—Water shall be admitted prior to and during charging of the mixer with all other concrete ingredients. After all materials are in the mixer, each batch shall be mixed for not less than the time specified by the Government. Expected minimum mixing times are listed in table 5K.

Table 5K.—Mixing time

Capacity of mixer	Time of mixing (minimum)
2 cubic yards or less	90 seconds
3 cubic yards	120 seconds
4 cubic yards	150 seconds

The minimum mixing times specified are based on average mixer performance. The Government will adjust the minimum mixing time required as need is indicated by results of the concrete uniformity tests. Excessive

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overmixing which requires additions of water to maintain the required concrete consistency will not be permitted.

The mixing equipment shall conform to the following additional requirements:

- (1) Plant configuration shall be such that the mixing action of each mixer can be observed from a safe location which can be easily reached from the control station. Provisions shall also be made so that the operator can observe the concrete in the receiving hopper or buckets as it is being dumped from the mixers.
- (2) Each mixer shall be controlled with a timing device which will indicate the mixing period and assure completion of the required mixing period.
- (3) The batch plant shall be equipped with an interlocking mechanism which will prevent concrete batches from entering mixers which are not empty.

c. Truck mixers.—Each truck mixer shall be equipped with an accurate watermeter, located between the supply tank and mixer and having a dial or digital indicator, and a reliable revolution counter, located near the watermeter, which can be readily reset to zero for indicating the total number of revolutions of the drum for each batch. Each mixer shall have affixed thereto a metal plate on which the drum capacities, in terms of volume, for both mixing and agitating and the maximum and minimum speeds of rotation of the drum are plainly marked.

Mixing shall be continued for not less than 50 revolutions nor more than 100 revolutions of the drum after all the ingredients, except approximately 5 percent of the water which may be withheld, are in the drum. The mixing speed shall be not less than 12 revolutions per minute nor more than 22 revolutions per minute. After mixing is completed, additional revolutions, if any, shall be at the agitation speed designated by the manufacturer of the equipment; except that after the addition of withheld water, mixing shall be continued at the specified mixing speed for a minimum of 30 revolutions. In no case shall the design water content be exceeded. After a period of agitation, a few revolutions of the drum at mixing speed will be required just prior to discharging.

Concrete shall be discharged within 1-1/2 hours after the introduction of the mix water and cementitious materials into the mixer. Each batch of concrete, when delivered at the jobsite from commercial ready-mix plants, shall be accompanied by a written certificate of batch weights and time of batching.

5.3.10 TEMPERATURE OF CONCRETE

Fresh structural concrete shall be placed at a temperature between 50 and 90 °F. Fresh canal lining concrete shall be placed at a temperature between 50 and 80 °F. The temperature will be determined by placing a thermometer in the concrete immediately after sampling at the placement site. The temperature of the concrete at the batch plant shall be adjusted to assure that the specified concrete temperature is attained at the placement.

The contractor shall employ effective means, such as precooling of aggregates and mixing water and placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below the specified maximum. The contractor shall be entitled to no additional compensation due to the foregoing requirements.

5.3.11 FORMS

a. General.—Forms shall be used, wherever necessary, to confine the concrete and shape it to the required lines. The contractor shall set and maintain concrete forms so as to insure completed work is within all applicable tolerance limits. If a type of form does not consistently perform in an acceptable manner, as determined by the contracting officer, the type of form shall be changed and the method of erection shall be modified by the contractor, subject to approval by the contracting officer.

Plumb and string lines shall be installed before, and maintained during, concrete placement. Such lines shall be used by contractor's personnel and by Government inspectors and shall be in sufficient number and properly installed as determined by the contracting officer. During concrete placement, the contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

Forms shall have sufficient strength to withstand the pressure resulting from

placement and vibration of the concrete, and shall be maintained rigidly in position. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfer strips shall be placed in the corners of forms and at the tops of wall placements to produce beveled edges on permanently exposed concrete surfaces. Interior angles of intersecting concrete surfaces and edges of construction joints shall not be beveled except where indicated on the drawings.

Forms for concrete surfaces for which finish F3 is specified shall, at the contractor's option, be constructed either with or without groove strips at horizontal construction joints. If groove strips are used, they shall be spaced to form a continuous and uniform pattern of grooves across exposed surfaces of the concrete. If groove strips are not used, the forms shall not be constructed continuously from lift to lift but shall be removed after concrete in a lift has hardened and reset for the next lift. The reset forms shall overlap the hardened concrete in the lift previously placed by not more than 1 inch and shall be tightened snugly against the hardened concrete so that, when concrete placement is resumed, the forms will not spread and allow offsets or loss of mortar at construction joints. Additional bolts or form ties shall be used as necessary to hold the reset forms tight against the hardened concrete.

b. Form sheathing and lining.—Wood sheathing or lining shall be softwood or plywood of such kind and quality, or shall be so treated or coated, that there will be no chemical deterioration or discoloration of the formed concrete surfaces. The type and condition of form sheathing and lining, and the fabrication of forms for finishes F2, and F3, shall be such that the resulting concrete surfaces will have uniform texture and will meet all applicable finish and tolerance requirements. The ability of form sheathing and lining to withstand distortion caused by placement and vibration of concrete shall be such that formed surfaces will conform with specified tolerances. All voids of joints in the plywood form lining or sheathing for finish F3 finishes shall be filled and finished smooth. Where finish F3 is specified, the sheathing or lining shall be placed so that the joint marks on the concrete surfaces will be minimal and will be in alignment both horizontally and vertically. Where used for form sheathing, softwood lumber shall meet applicable

requirements of the latest edition of the Grading Rules of the Western Wood Products Association for dressed lumber or worked lumber of the grade hereinafter specified. All common boards shall be surfaced on both edges (S2E) in accordance with the standard grading rules. Plywood used for form sheathing or lining shall be concrete form, class 1, grade B-B, exterior, mill oiled and edge sealed, in accordance with the latest edition of Product Standard PS1 of the U.S. Department of Commerce. Materials used for form sheathing or lining shall conform with the requirements of table 5L or may be other materials producing equivalent results.

Table 5L.—Form sheathing or lining material requirements

Required finish of formed surface	Wood sheathing or lining	Steel sheathing or lining*
F1	Any grade common board, or plywood.	Steel sheathing permitted. Steel lining permitted
F2	No. 2 common or better shiplap, or plywood.	Steel sheathing permitted. Steel lining permitted if approved
F3	Plywood.	Steel sheathing not permitted. Steel lining not permitted.

* Steel "sheathing" denotes steel sheets not supported by a wood backing. "Lining" denotes thin sheets supported by a wood backing.

c. Uniformity of forming material.—Forms for exposed concrete surfaces to receive finishes F2 and F3 shall be constructed so as to produce a uniform and consistent texture and pattern on the face of the concrete. Metal patches on forms for these surfaces will not be permitted. The form sheathing or lining shall be placed so that all horizontal form marks are continuous across the entire surface. If forms are constructed of plywood form lining or of panels of board lumber, the

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vertical form marks shall be continuous for the entire height of the surface. If forms for concrete surfaces to receive F2 finishes are constructed of board lumber that is not paneled, the boards shall be cut square, and the vertical joints in the boards shall be staggered and shall be made only at studs. The contractor shall use one type of form material for all exposed F2 surfaces and one type of form material for all F3 surfaces. If the contractor elects to use board lumber for forms for F2 surfaces, the lumber shall either be all 6- or all 8-inch lumber.

d. Form ties and form anchors.—Embedded ties for holding forms shall remain embedded and, except where F1 finish is permitted, shall terminate not less than 2 diameters or twice the minimum dimension of the tie, whichever is greater, from the formed surfaces of the concrete. Where F1 finish is permitted, ties may be cut off flush with the formed surfaces. The ties shall be constructed so that removal of the ends or end fasteners can be accomplished without causing appreciable spalling at the faces of the concrete. Unless backfill is to be placed against the concrete, recesses resulting from removal of the ends of form ties shall be filled in accordance with paragraph 5.3.20. Form anchors shall be provided in sufficient number, subject to approval by the contracting officer, to insure that concrete surfaces after stripping forms are within applicable tolerances. Form anchors embedded in concrete which are loosened prior to placement of adjoining concrete shall be replaced by other supports firmly embedded in the hardened concrete.

e. Cleaning and oiling of forms.—At the time the concrete is placed in the forms, the surfaces of the forms shall be free from encrustations of mortar, grout, or other foreign material. Before concrete is placed, the surfaces of the forms, shall be oiled with a commercial form oil that will effectively prevent sticking and will not soften or stain the concrete surfaces, or cause the surfaces to become chalky or dust producing. For wood forms, form oil shall consist of straight, refined, pale, paraffin-base mineral oil. For steel forms, form oil shall consist of refined mineral oil suitably compounded with ingredients which are appropriate for the purpose.

f. Removal of forms.—To facilitate satisfactory progress with the specified curing

and enable earliest practicable repair of surface imperfections, forms shall be removed within 24 hours after the concrete has hardened sufficiently to prevent damage by careful form removal, and specified repair and curing shall be commenced immediately thereafter. The contractor shall be liable for damage and injury caused by removing forms before the concrete has gained sufficient strength.

g. Cost.—The cost of furnishing all materials and performing all work for constructing forms, including any necessary treatment or coating of forms, shall be included in the applicable prices bid in the schedule for the items of concrete for which the forms are used.

5.3.12 TOLERANCES FOR CONCRETE CONSTRUCTION

a. General.—Tolerances are defined as allowable variations from specified lines, grades, and dimensions and as the allowable magnitude of the surface irregularities. Allowable variations from specified lines, grades, and dimensions are listed in table 5M in subparagraph b. below. Allowable magnitudes for concrete surface irregularities are listed in table 5N in subparagraph c. below.

The intent of this paragraph is to establish tolerances that are consistent with modern construction practice, yet are governed by the effect that permissible variations may have upon a structure. The Government reserves the right to diminish the tolerances set forth herein if such tolerances impair the structural action, operational function, or architectural appearance of a structure or portion thereof.

Concrete shall be within all stated tolerances even though more than one tolerance may be specified for a particular concrete structure: Provided, That the specified variation for one element of a structure shall not apply when it will permit another element of the structure to exceed its allowable variation. Where tolerances are not specified or shown on the drawings for a particular structure, tolerances shall be those specified for similar work. As an exception to clause No. 2 of the General Provisions, specific tolerances shown on the drawings in connection with any dimension shall govern. The contractor shall be responsible for finishing the concrete and for

setting and maintaining concrete forms within the limits necessary to insure that the completed work will be within the tolerances specified. Concrete work that exceeds the tolerance limits specified shall be remedied in accordance with subparagraphs d. and e.

b. Variations from specified lines, grades, and dimensions.—Hardened concrete structures shall be checked by the contractor and will be subject to such inspection and measurement as needed to determine that the structures are within the tolerances specified in table 5M.

Variation is defined as the distance between the actual position of the structure or any element of the structure and the specified position in plan for the structure or the particular element. Plus or minus variations shown as (\pm) indicate a permitted actual position up or down and in or out from the specified position in plan. Variations not designated as plus or minus indicate the maximum deviation permitted between designated successive points on the completed element of construction.

Specified position in plan is defined as the lines, grades, and dimensions described in these specifications or shown on the drawings or as otherwise prescribed by the contracting officer.

Table 5M.—Variations from specified lines, grades, and dimensions

A. Tolerances for canal lining.—

1. *Departure from established alinement	± 2 inches on tangents ± 4 inches on curves
2. *Departure from established profile grade	± 1 inch
3. Reduction in thickness of lining	10 percent of specified thickness: Provided, That average thickness is not less than specified thickness.
4. Variation from specified width of section at any height	± 0.25 percent of specified width plus 1 inch
5. Variation from established height of lining	± 0.50 percent of established height plus 1 inch

* Any departure from alinement or grade shall be uniform and no correction in alinement shall be made in less than 100 feet.

B. Tolerances for canal structures.—

1. Floatwells and overchute pier:

(a) Departure from established alinement	± 1 inch
(b) Departure from established grade	± 1 inch
(c) Variation from plumb or specified batter for lines and surfaces of pier:	

(1) When overall length of line or surface is:

10 feet or less	Exposed $\pm 3/8$ inch Buried $\pm 3/4$ inch
More than 10 feet	Exposed $\pm 1/2$ inch Buried ± 1 inch

(2) For any two successive intermediate points on the line or surface separated by:

10 feet	Exposed $3/8$ inch Buried $3/4$ inch
20 feet or more	Exposed $1/2$ inch Buried 1 inch

2. Variation from level for slabs:

(a) When overall length of line or surface is:

10 feet or less	Exposed $\pm 3/8$ inch Buried $\pm 3/4$ inch
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Table 5M.—Variations from specified lines, grades, and dimensions—Continued

(b) For any two successive intermediate points on the line or surface separated by:		
10 feet		Exposed 3/8 inch Buried 3/4 inch
3. Variation in cross-sectional dimensions of columns, pier, and slab parts of the structures in B.1. above from those specified		
		-1/4 inch + 1/2 inch
4. Variation from plumb of pipe erected vertically in any length of 10 feet		
		± 1/2 inch
C. Tolerances for bridges.—		
1. Departure from established alinement		± 1/4 inch
2. Footings:		
(a) Variation in length and width dimensions from those specified		-1/2 inch + 2 inches
(b) Horizontal misplacement or eccentricity:		
(1) 2 percent of the footing width in the direction of misplacement but not more than		2 inches
(c) Reduction in thickness		5 percent of specified thickness
3. Variation from plumb or specified batter for lines and surfaces of piers and walls and for arrises:		
(a) Exposed construction:		
(1) When overall height of line or surface is:		
10 feet or less		± 3/8 inch
More than 10 feet		± 1/2 inch
(2) For any two successive intermediate points on the line or surface separated by:		
10 feet		3/8 inch
20 feet or more		1/2 inch
(b) Buried construction		Twice the amounts listed in C.3.(a) above

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Table 5M.—Variations from specified lines, grades, and dimensions—Continued

4. Variation from level or specified grades for slabs, other than bridge deck; beams; horizontal grooves; railing offsets; and diaphragms:

(a) Exposed construction:

(1) When overall length of line or surface is:

10 feet or less	±3/8 inch
More than 10 feet	±1/2 inch

(2) For any two successive intermediate points on the line or surface separated by:

10 feet	3/8 inch
20 feet or more	1/2 inch

(b) For buried construction Twice the amounts listed in C.4.(a) above

5. Departure of bridge deck and rails from specified grades ±1/4 inch

6. Variation in cross-sectional dimensions from those specified for piers; slabs, other than bridge deck; walls; beams; and similar parts of bridge structures
 -1/4 inch
 +1/2 inch

7. Variation from that specified in the thickness of bridge slabs
 -1/8 inch
 +1/4 inch

c. Concrete surface irregularities.—

(1) General.—Bulges, depressions, and offsets are defined as concrete surface irregularities. Concrete surface irregularities are classified as “abrupt” or “gradual” and are measured relative to the actual concrete surface.

(2) Abrupt surface irregularities.—Abrupt surface irregularities are defined herein as offsets such as those caused by misplaced or loose forms, loose knots in form lumber, or other similar forming faults. Abrupt surface irregularities are measured using a short straightedge at least 6 inches long held firmly against the concrete surface over the irregularity and the magnitude of the offset is determined by direct measurement.

(3) Gradual surface irregularities.—Gradual surface irregularities are defined herein as bulges and depressions resulting in gradual changes on the concrete surface. Gradual surface irregularities are measured using a template conforming to the design profile of the concrete surface being examined. Templates for measuring gradual surface irregularities shall be provided by the contractor. Templates shall be at least 8 feet in length. The magnitude of gradual surface irregularities is defined herein as a measure of the rate of change in slope of the concrete surface. Gradual surface irregularities are measured as shown on figure 1 from a template held firmly against the concrete surface and the magnitude of gradual surface irregularity is computed as shown in figure 1.

The magnitude of gradual surface irregularities on concrete surfaces shall be checked by the contractor to insure that the surfaces are within specified tolerances. The Government will also make such checks of hardened concrete surfaces as determined necessary to insure compliance

with these specifications. Templates for these surfaces shall be furnished by the contractor and shall be available for use by the Government at all times.

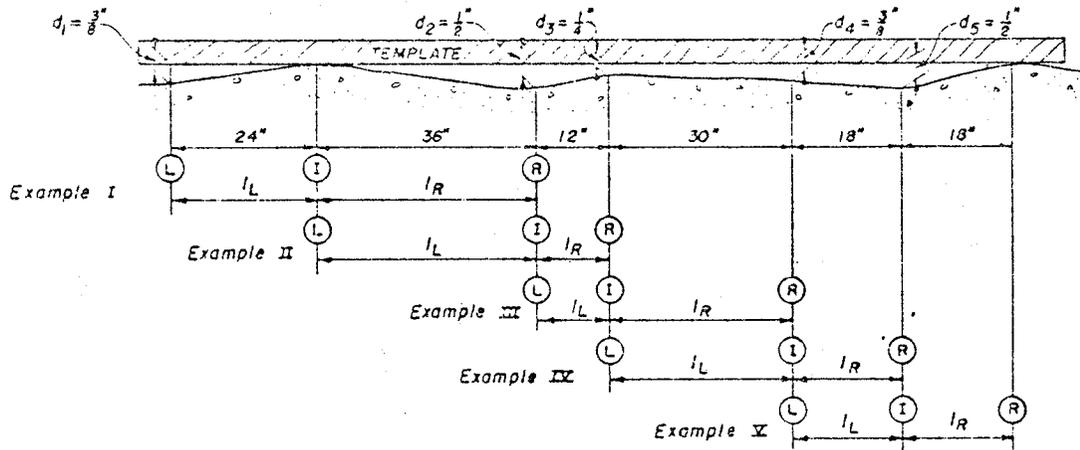
MEASUREMENT OF GRADUAL IRREGULARITIES ON CONCRETE SURFACES

$$\text{Magnitude of Gradual Surface Irregularity (MGS I)} = \left| \frac{d_I - d_L}{l_L} + \frac{d_I - d_R}{l_R} \right|$$

Where:

- d_I = distance from template to concrete surface at an intermediate point, I.
- d_L = distance from template to concrete surface at left end point, L.
- d_R = distance from template to concrete surface at right end point, R.
- l_L = distance along template from left end point L to the intermediate point I.
- l_R = distance along template from right end point R to the intermediate point I.

NOTE: The position of the template and the three points along the template shall be selected and adjusted to obtain the greatest MGS I, except that neither l_L nor l_R shall exceed 3 feet. The MGS I is an absolute value, and should be made positive only after all computations are completed. (See example IX below).



$$\text{Example I MGS I} = \frac{0 - d_1}{l_L} + \frac{0 - d_2}{l_R} = \frac{0 - \frac{3}{8}}{24} + \frac{0 - \frac{1}{2}}{36} = \frac{-\frac{3}{8}}{24} + \frac{-\frac{1}{2}}{36} = 0.0295 \text{ inch / inch}$$

$$\text{Example II MGS I} = \frac{d_2 - 0}{l_L} + \frac{d_2 - d_3}{l_R} = \frac{\frac{1}{2} - 0}{36} + \frac{\frac{1}{2} - \frac{1}{2}}{12} = \frac{\frac{1}{2}}{36} + \frac{\frac{1}{4}}{12} = 0.0347 \text{ inch / inch}$$

$$\text{Example III MGS I} = \frac{d_3 - d_2}{l_L} + \frac{d_3 - d_4}{l_R} = \frac{\frac{1}{2} - \frac{1}{2}}{12} + \frac{\frac{1}{4} - \frac{3}{8}}{30} = \frac{-\frac{1}{4}}{12} + \frac{-\frac{1}{8}}{30} = 0.0250 \text{ inch / inch}$$

$$\text{Example IV MGS I} = \frac{d_4 - d_3}{l_L} + \frac{d_4 - d_5}{l_R} = \frac{\frac{3}{8} - \frac{1}{4}}{30} + \frac{\frac{3}{8} - \frac{1}{2}}{18} = \frac{\frac{1}{8}}{30} + \frac{-\frac{1}{8}}{18} = 0.0028 \text{ inch / inch}$$

$$\text{Example V MGS I} = \frac{d_5 - d_4}{l_L} + \frac{d_5 - 0}{l_R} = \frac{\frac{1}{2} - \frac{3}{8}}{18} + \frac{\frac{1}{2} - 0}{18} = \frac{\frac{1}{8}}{18} + \frac{\frac{1}{2}}{18} = 0.0347 \text{ inch / inch}$$

Table 5N.—Tolerances for concrete surface irregularities

A. Abrupt irregularities.—

1. F1 surfaces, depressions only	1 inch
2. F2 surfaces	1/4 inch
3. F3 surfaces	1/8 inch
4. U1 surfaces	1/4 inch
5. U2 surfaces	1/32 inch
6. U4 surfaces	1/16 inch

B. Gradual irregularities.—

1. F2 surfaces	1/8 inch per inch
2. F3 surfaces	1/16 inch per inch
3. U2 surfaces	1/8 inch per inch

d. Repair of hardened concrete not within specified tolerances.—Hardened concrete which is not within specified tolerances shall be repaired to bring it within those tolerances. Such repair shall be in accordance with paragraph 5.3.20 and shall be accomplished in a manner approved by the contracting officer. Concrete repair to bring concrete within tolerances shall be done only after consultation with a Government inspector regarding the method of repair. The Government shall be notified as to the time when repair will be performed.

for setting screeds, and different finishing techniques, to be implemented by the contractor to avoid repeated failures. The Government reserves the right to delay concrete placements until the contractor implements such preventative actions which are approved by the contracting officer.

Concrete which will be exposed to public view shall be repaired in a manner which will result in a concrete surface with a uniform appearance. Grinding of concrete surfaces exposed to view shall be limited in depth such that no aggregate particles are exposed more than 1/16 inch in cross section at the finished surface. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16 inch in cross section at the finished surface, concrete shall be repaired by excavating and replacing the concrete.

e. Prevention of repeated failure to meet tolerances.—When concrete placements result in hardened concrete that does not meet specified tolerances, the contractor shall upon request submit to the Government an outline of all preventative actions, such as modifications to forms, modified procedure

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5.3.13 REINFORCING BARS AND FABRIC

a. General.—Reinforcing bars and fabric shall be placed in the concrete where shown on the drawings or where directed. The contractor shall furnish all reinforcing bars and fabric required for completion of the work.

b. Materials.—

(1) Reinforcing bars.—Reinforcing bars shall be deformed bars conforming to ANSI/ASTM A 615; grade 60, including supplementary requirements, except reinforcement for the precast prestressed concrete beams shall be in accordance with paragraph 5.5.1.

(2) Fabric.—Fabric shall be electrically welded-wire fabric and shall conform to ASTM designation: A 185 for smooth steel wire or ASTM designation: A 497 for deformed steel wire, except that for wire with a specified yield strength exceeding 60,000 pounds per square inch, the yield strength shall be the stress corresponding to a strain of 0.35 percent.

c. Placing reinforcing bars and fabric.—The reinforcement shall conform to the requirements shown on drawing 52 (40-D-6263) unless otherwise shown on the reinforcement design drawings.

Splices shall be located where shown on the drawings: Provided, That the location of splices may be altered subject to the written approval of the contracting officer. Reinforcing bars in splices located where shown on drawings, or in relocated splices approved by the contracting officer, will be included in the measurement for payment for furnishing and placing reinforcing bars.

Subject to the written approval of the contracting officer, the contractor may splice bars at additional locations other than those shown on the drawings. In order to meet design and space limitations on splicing, some bent bars may exceed usual shipping clearances. Cutting and bending of such bars from stock lengths may be required at the site.

Unless otherwise prescribed, placement dimensions shall be to the centerlines of the bars. Reinforcement will be inspected for compliance with requirements as to size,

shape, length, splicing, position, and amount after it has been placed.

Before reinforcement is embedded in concrete, the surfaces of the bars and fabric and the surfaces of any supports shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances which, in the opinion of the contracting officer, are objectionable. Heavy flaky rust that can be removed by firm rubbing with burlap, or equivalent treatment, is considered objectionable.

Reinforcement shall be accurately placed to meet the following tolerances:

(1) The amount of concrete covering reinforcement in bridge decks shall not deviate from that specified by more than 1/4 inch if the cover specified is more than 2-1/2 inches, nor by more than 1/8 inch if the cover specified is 2-1/2 inches or less.

(2) The amount of concrete cover protecting reinforcement in all other concrete shall not deviate from that specified by more than 1/2 inch if the specified cover is more than 2-1/2 inches, nor by more than 1/4 inch if the cover specified is 2-1/2 inches or less.

(3) The spacing of reinforcing bars shall not deviate from the required spacing by more than 1 inch.

Reinforcement shall be secured in position so that it will not be displaced during the placing of the concrete, and special care shall be exercised to prevent any disturbance of the reinforcement in concrete that has already been placed. Bars shall not be field bent to the extent of permanent set, nor straightened, except as approved by the contracting officer or shown on the drawings. Bars bent without approval shall be replaced in conformance with drawing 52 (40-D-6263). Welding or tack welding of reinforcing bars will not be permitted except at locations shown on the drawings or where approved by the contracting officer. Chairs, hangers, spacers, and other supports for reinforcement shall be of concrete, metal, or other approved material. Where portions of such supports will be exposed on concrete surfaces designated to receive F2 or F3 finish, the exposed portion of the supports shall be galvanized or other corrosion-resistant material, except that

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concrete supports will not be permitted. Unless otherwise shown on the drawings, reinforcement in structures shall be so placed that there will be a clear distance of at least 1 inch between the reinforcement and any anchor bolts, form ties, or other embedded metalwork.

d. Reinforcement drawings to be prepared by the contractor.—The contractor shall prepare and submit to the Government, for approval and for informational purposes, reinforcement detail drawings, including bar-placing drawings, bar-bending diagrams, and bar lists, in accordance with the following provisions.

The contractor's reinforcement detail drawings shall be prepared from reinforcement design drawings included with these specifications.

At least 60 days before scheduled concrete placement, the contractor shall submit to the Construction Engineer, Water and Power Resources Service, 201 North Central Avenue—Suite 2200, Phoenix AZ 85073, for approval, one reproducible and one print of each of his reinforcement detail drawings for the following structures:

- (1) Overchute pier.
- (2) Bridges.

The Government will require 25 calendar days for review of reinforcement detail drawings and this review time will apply to each separate submittal or resubmittal as provided in paragraph 1.2.3.

At least 30 days before scheduled concrete placement, the contractor shall submit to the Construction Engineer at the above address, for informational purposes, one reproducible of each of his reinforcement detail drawings for all structures not listed above.

The contractor's reinforcement detail drawings shall be prepared following the recommendations established by the American Concrete Institute's "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315-74) unless otherwise shown on the reinforcement design drawings. The contractor's drawings shall show necessary details for checking the bars

during placement and for use in establishing payment quantities.

The contractor's reinforcement detail drawings shall be clean, legible, and accurate and checked by the contractor before submittal. If any reinforcement detail drawing or group of drawings requiring approval is not of a quality acceptable to the Government, the entire set or group of drawings will be returned to the contractor, without approval, to be corrected and resubmitted. Acceptable reinforcement detail drawings will be reviewed by the contractin officer for adequacy of general design and controlling dimensions. Errors, omissions, or corrections will be marked on the prints or otherwise relayed to the contractor, and one print of each drawing will be returned to the contractor for correction. The contractor shall make all necessary corrections shown on the returned prints. The corrected drawings need not be resubmitted unless corrections are extensive enough, as determined by the contracting officer, to warrant resubmittal. Such Government review and approval shall not relieve the contractor of his responsibility for the correctness of details or for conformance with the requirements of these specifications.

e. Measurement and payment.—Measurement for payment of reinforcing bars will be based on the weight of the bars placed in the concrete in accordance with the contractor's drawings when conformance with these specifications drawings has been determined at the time of embedment.

Except as otherwise provided below, payment for furnishing and placing reinforcing bars and fabric will be made at the unit price per pound bid in the schedule for furnishing and placing reinforcing bars, which unit price shall include the cost of preparing reinforcement detail drawings, including bar-placing drawings and bar-bending diagrams; of submitting the drawings to the Government; of preparing all necessary bar lists and cutting lists; of furnishing and attaching wire ties or other approved supports; and of cutting, bending, cleaning, and securing and maintaining in position, reinforcing bars and fabric as shown on the drawings.

No direct payment will be made for reinforcement used in the concrete items specified in subparagraph 5.3.22.a.

5.3.14 DOWELS FOR BRIDGES .

The contractor shall furnish all dowels required for completion of the bridges.

The dowels shall be smooth round bars conforming to Federal Specification QQ-S-632C, type I, class 60.

Details for dowels for bridges are shown on the drawings for the bridge abutments.

Dowels shall be placed in the concrete where shown on the drawings or where directed and will be inspected for compliance with requirements as to size, shape, length, position, and amount after they have been placed.

Before the dowels are embedded in concrete, the dowel surfaces shall be cleaned of all dirt, grease, or other foreign substances which in the opinion of the contracting officer are objectionable.

The dowels shall be accurately placed and secured in position so that they will not be displaced during the placing of the concrete.

Measurement, for payment, of dowels will be made only of the weight of the dowels placed in the concrete, in accordance with the drawings, or as directed.

Payment for furnishing and placing dowels will be made at the unit price per pound bid in the schedule for furnishing and placing reinforcing bars, which unit price shall include the costs of furnishing all the materials and placing the dowels and of providing voids in the bridge diaphragm for dowels.

5.3.15 PREPARATIONS FOR PLACING

- a. General.—No concrete shall be placed until all formwork, installation of items to be embedded, and preparation of surfaces involved in the placement have been approved.

The contractor shall supply concrete placement checkout cards satisfactory to the Government, and shall provide a watertight container for such cards at a convenient location near each individual concrete placement site. The cards shall list all the various work items, for example, "Cleanup" and "Embedded items," required prior to placement of concrete. After each work item

for an individual placement has been completed, that item on the card shall be signed by the contractor or his representative signifying completion of the required work. Authorized Government personnel will inspect the work during and after completion of each phase of the preparations, and if the work is satisfactory, will sign the checkout card. Approval of preparations for placement will not be complete until the contractor or his representative and authorized Government personnel have approved, by signature, all applicable items for that placement. The use of placement checkout cards may be waived by the Government where their use is impracticable.

All surfaces of forms and embedded materials shall be free from curing compound, dried mortar from previous placements, and other foreign substances before the adjacent or surrounding concrete placement is begun.

Prior to beginning concrete placement, the contractor shall make ready a sufficient number of properly operating vibrators and operators, and shall have readily available additional vibrators to replace defective ones during the progress of the placement. The Government inspector at the placement may require that the contractor delay the start of the concrete placement until the number of working vibrators available is acceptable.

b. Foundation surfaces.—All surfaces upon or against which concrete is to be placed shall be free from water, mud, and debris.

(1) Rock surfaces shall be free from oil, objectionable coatings, and loose, semidetached and unsound fragments. Immediately prior to placement of concrete, surfaces of rock shall be washed with an air-water jet and shall be brought to a uniform surface-dry condition.

(2) Earth foundations shall be damp when concrete is placed against them. Surfaces shall be wet to a depth of 6 inches or to impermeable material, whichever is less, before concrete is placed.

c. Construction joints.—Construction joints are defined as concrete surfaces upon or against which concrete is to be placed and to which new concrete is to adhere but which have become so rigid that the new concrete cannot be incorporated integrally with that

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previously placed. Construction joints shall be clean, rough, and surface dry when covered with fresh concrete. Cleaning shall consist of the removal of all laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material. Construction joints shall be wet sandblasted, washed thoroughly with air-water jets, and surface dried prior to placement of adjoining concrete. The sandblasting, washing, and surface drying shall be performed at the last opportunity prior to placing of concrete. Drying of the surface shall be uniform and may be accomplished by air jet.

d. Contraction joints.—Contraction joints serve to provide for volumetric shrinkage of monolithic concrete and for movement between monolithic units at established joints, thus preventing formation of objectionable shrinkage cracks elsewhere in the concrete. Prior to application of wax-base curing compound to contraction joints, the surfaces of all joints shall be cleaned thoroughly of accretions of concrete or other foreign material by scraping, chipping, or other means approved by the contracting officer. Curing compound shall not be removed, but shall remain on these joints and be kept intact until adjoining concrete is placed. Waterstops, reinforcing bars, and other embedded items shall be free of curing compound when adjoining concrete is placed.

5.3.16 PLACING

a. General.—The contractor shall notify the contracting officer before batching begins for placement of concrete. Unless inspection is waived for that specific placement, placing shall be performed only in the presence of an authorized Government inspector. Placement shall not begin until after all preparations are complete and the concrete placement check-out card has been signed by the contractor or his representative and the authorized representative of the contracting officer, substantiating completion of all preparations for that placement.

All surfaces upon or against which concrete is to be placed shall be prepared in accordance with paragraph 5.3.15.

Retempering of concrete will not be permitted. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted.

Concrete shall not be placed in standing water except with written permission of the contracting officer, and the method of placing shall be subject to approval. Concrete shall not be placed in running water, and shall not be subjected to running water until after the concrete has hardened.

Concrete shall be deposited as nearly as practical in its final position and shall not be allowed to flow in such a manner that the lateral movement will cause segregation of the coarse aggregate from the concrete mass. Methods and equipment employed in depositing concrete in forms shall minimize clusters of coarse aggregate. Clusters that occur shall be scattered before the concrete is vibrated.

Forms shall be constantly monitored and their position adjusted as necessary during concrete placement in accordance with paragraph 5.3.11.

All concrete shall be placed in approximately horizontal layers. The depths of layers shall not exceed 20 inches. The Government reserves the right to require lesser depths of layers where concrete cannot otherwise be placed and consolidated in accordance with the requirements of these specifications. All construction joints which intersect exposed concrete surfaces shall be made straight and level or plumb except as shown otherwise on the drawings.

Except as shown otherwise on the drawings, construction joints intersecting sloping exposed concrete surfaces shall be inclined near the exposed surface to prevent featheredges. The angle between such inclined surface and the form shall be not less than 50° nor more than 130°, and that surface angle shall extend into the concrete member for at least 3 inches.

To facilitate consolidation at construction joints, structural concrete placements may be started with an oversanded mix containing 3/4-inch-maximum-size aggregate; a maximum net water-cementitious materials ratio of 0.47, by weight; 2 percent additional sand, by weight of total aggregate, based on standard 3/4-inch mix; 6 percent air, by total volume of concrete; and having a maximum slump of 4 inches. The oversanded mix shall be placed 2 to 6 inches deep on the joint at the bottom of the placement.

In placing concrete on unformed slopes so steep as to make internal vibration of the concrete impractical without forming, the concrete shall be placed ahead of nonvibrating slip-form screed extending approximately 2-1/2 feet back from its leading edge. Concrete ahead of the slip-form screed shall be consolidated by internal vibrators so as to insure complete filling under the slip-form.

A cold joint is an unplanned joint resulting when a concrete surface hardens before the next batch is placed against it. Cold joints are undesirable and should be avoided. However, in the event of equipment breakdown or other unavoidable prolonged interruption of continuous placing, cold joints are permitted. If such unavoidable delays in placing occur which make it appear that unconsolidated concrete may harden to the extent that later vibration will not fully consolidate it, the contractor shall immediately consolidate such concrete to a stable and uniform slope. If delay of placement is then short enough to permit penetration of the underlying concrete, placement shall resume with particular care being taken to thoroughly penetrate and revibrate the concrete surface placed before the delay. If concrete cannot be penetrated with a vibrator, the cold joint shall be then treated as a construction joint.

Care shall be taken to prevent cold joints when placing concrete in any part of the work. The concrete-placing rate shall insure concrete is placed while the previously placed, adjacent concrete is plastic so that the concrete can be made monolithic by normal use of the vibrators.

Concrete shall not be placed in rain sufficiently heavy or prolonged to wash mortar from concrete. A cold joint may necessarily result from prolonged heavy rainfall.

The contractor shall be entitled to no additional payment, over the unit prices bid in the schedule for concrete, by reason of any limitations in the placing of concrete required under the provisions of this paragraph.

b. Transportation.—The methods and equipment used for transporting concrete from the batch plant to its final position in the placement and the time that elapses during

transportation shall not cause measurable segregation of coarse aggregate or slump loss during transportation exceeding 2 inches.

Concrete shall be deposited as near as practical to its final position by use of buckets, conveyors, or concrete pumps. The use of aluminum pipe or chutes for delivery of concrete will not be permitted. Concrete buckets shall be capable of promptly discharging concrete of the specified mix design and the dumping mechanism shall be capable of discharging at one location small portions of concrete from a full bucket. Buckets and conveyors shall be designed for attaching drop chutes or tremies which shall be used to deposit concrete whenever the concrete must be dropped more than 10 feet from the bucket to the placing surface.

If used to transport concrete, truck mixers shall meet the applicable requirements of paragraph 5.3.9 for truck mixers. Just prior to discharging, a few revolutions of the drum at mixing speed will be required.

Buckets, chutes, hoppers, pumps, transit mix trucks, and other equipment shall readily handle and place concrete of the specified slump. The contractor shall, when directed, replace inadequate transporting equipment with acceptable equipment.

c. Consolidation.—Concrete shall be consolidated by vibration. The vibration shall be sufficient to remove all undesirable air voids from the concrete, including the air voids trapped against the forms. After consolidation, the concrete shall be free of rock pockets and honey comb areas and shall be closed snugly against all surfaces of forms and embedded materials. All concrete shall be properly consolidated before it hardens.

Except as hereinafter provided, consolidation of all concrete shall be by immersion-type vibrators. Immersion-type vibrators shall be operated in nearly vertical position and the vibrating head shall penetrate and revibrate the concrete in the upper portion of the underlying layer. Care shall be exercised to avoid contact of the vibrating head with embedded items and with formed surfaces which will later be exposed to view. Concrete shall not be placed upon other plastic concrete until the previously placed concrete has been thoroughly consolidated.

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Form vibrators shall be used in conjunction with slip-form lining machines to consolidate concrete in unreinforced canal linings. Such vibrators shall be arranged for effective uniform consolidation of the concrete. The Government may remove samples of the hardened concrete for testing and examination, and the contractor shall repair, at no cost to the Government, concrete from which such samples are removed.

Immersion-type vibrators shall be operated at speeds of at least 7,000 revolutions per minute when immersed in concrete. The contractor shall immediately replace improperly operating vibrators with acceptable vibrators.

5.3.17 FINISHES AND FINISHING

a. General.—The classes of finish and the requirements for finishing of concrete surfaces shall be as specified in this paragraph or as otherwise indicated on the drawings. The contractor shall notify the contracting officer before finishing concrete. Unless inspection is waived in each specific case, finishing of concrete shall be performed only when a Government inspector is present. Concrete surfaces will be tested by the Government in accordance with paragraph 5.3.12 where necessary to determine whether the concrete surface is within the specified tolerances. Finished concrete which is not within the specified tolerances shall be repaired in accordance with paragraph 5.3.20.

b. Formed surfaces.—The classes of finish for formed concrete surfaces are designated by the symbols F1, F2, and F3. Unless otherwise specified or indicated on the drawings, the classes of finish shall apply as follows:

(1) F1.—Finish F1 applies to formed surfaces upon or against which fill material or concrete is to be placed. Holes left by the removal of fasteners from the ends of tie rods shall be filled after form removal as required in paragraph 5.3.20.

(2) F2.—Finish F2 applies to all formed surfaces not permanently concealed by fill material or concrete, or not required to receive finish F3.

(3) F3.—Finish F3 applies to formed surfaces, the appearance of which is

considered by the Government to be of special importance, such as surfaces of structures prominently exposed to public view.

Surfaces to receive finish F3 include:

(a) Formed surfaces of bridges exposed to view, except that surfaces of all bridge parapets shall receive a sack-rubbed surface.

c. Unformed surfaces.—The classes of finish for unformed concrete surfaces are designated by the symbols U1, U2, and U4. Interior surfaces shall be sloped for drainage where shown on the drawings or directed. Surfaces which will be exposed to the weather, and which would normally be level, shall be sloped for drainage. Unless the use of other slopes or level surfaces is indicated on the drawings or directed, narrow surfaces, such as tops of walls and curbs, shall be sloped approximately three-eighths of an inch per foot of width; and broader surfaces, such as walks, roadways, platforms, and decks, shall be sloped approximately one-fourth of an inch per foot. Unless otherwise specified or indicated on the drawings, these classes of finish shall apply as follows:

(1) U1.—Finish U1 (screeded finish) applies to unformed surfaces that will be covered by fill material or by concrete. Finish U1 is also used as the first stage of finishes U2 and U3. Finishing operations shall consist of sufficient leveling and screeding to produce even uniform surfaces.

(2) U2.—Finish U2 (floated finish) applies to unformed surfaces not permanently concealed by fill material or concrete, or not required to receive finish U1 or U4.

Floating may be performed by use of hand- or power-driven equipment. Floating shall be started as soon as the screeded surface has stiffened sufficiently and shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture.

After the surfaces of roadway slabs of concrete bridges have been wood floated, the surfaces shall be given a broom finish. The finish shall be applied when the water sheen has practically disappeared. The broom shall be drawn transversely across

the pavement with adjacent strokes slightly overlapping. The brooming shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operation. The finished surface shall have a uniform appearance and shall be free of corrugations exceeding 1/16 of an inch in depth. Brooms shall be of a quality, size, and construction, and be so operated, as to produce a surface finish satisfactory to the contracting officer.

(3) U4.—Finish U4 applies to canal linings. The finished surface shall be equivalent in evenness, smoothness, and freedom from rock pockets and surface voids to that obtainable by effective use of a long-handled steel trowel. Light surface pitting and light trowel marks will not be considered objectionable. Where the surface produced by a lining machine meets the specified requirements, no further finishing operations will be required.

The top portion of the side slopes of the canal lining extending 5 feet vertically below the top of the lining shall receive a nonskid longitudinal brush finish as approved by the contracting officer.

5.3.18 PROTECTION

The contractor shall protect all concrete against damage until final acceptance by the Government.

Fresh concrete shall be protected from precipitation. The contractor shall provide such protection to prevent erosion of fresh concrete whenever such precipitation, either periodic or sustaining, is imminent or occurring.

When precipitation appears imminent, the contractor shall immediately make ready at the placement site all materials which may be required for protection of fresh concrete. The Government may delay placement of concrete until adequate provisions for protection against weather are made.

All fresh concrete surfaces shall be protected from contamination and from foot traffic until the concrete has hardened. Hardened concrete surfaces which receive U2 finish shall be protected against damage from foot traffic and other construction activity by covering with protective mats, plywood, or by other effective

means. Methods of protection shall be subject to approval by the Government.

Concrete curing membranes shall be kept intact, and other curing materials and processes shall be maintained as necessary to assure continuous curing for the minimum specified curing time. Protection of curing membranes and other curing methods shall be as described in paragraph 5.3.19.

5.3.19 CURING

a. General.—The contractor shall furnish all materials and perform all work required for curing concrete.

Concrete shall be cured either by water curing in accordance with subparagraph d. or by the use of wax-base or water-emulsified, resin-base curing compound, except as otherwise specified below. The curing compound shall be white.

Exposed surfaces of concrete in bridges except top surfaces of bridge decks structure shall be cured by the use of a clear water-emulsified, resin-base curing compound.

Surfaces of construction joints shall be cured by application of type I, class A or type II, class A curing compound in accordance with subparagraph e. and shall immediately, prior to placement of concrete on or against the joints, be prepared in accordance with paragraph 5.3.15.

Contraction joint surfaces shall be cured by application of type I curing compound in accordance with subparagraph e. All extraneous concrete accretions and other foreign materials shall be removed from the surfaces of contraction joints to provide a smooth clean surface prior to application of type I curing compound.

Surfaces of concrete in canal linings shall be cured by application of type I, class A or type II, class A curing compound in accordance with subparagraph e.

The unformed top surfaces of bridge decks shall be cured for 14 days with a damp sand cover or curing mats cover. The sand or curing mats shall not be kept so wet as to allow water to drain from it and stain other concrete. The sand or curing mats shall be removed after the expiration of the curing period.

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All concrete surfaces shall be treated as specified to prevent loss of moisture from the concrete until the required curing period has elapsed or until immediately prior to placement of other concrete or backfill against those surfaces. Only sufficient time to prepare construction joint surfaces and to bring them to a surface-dry condition shall be allowed between discontinuance of curing and placement of adjacent concrete.

As soon as unformed concrete surfaces have been finished as specified and have attained a dull appearance free from bleed water and moist sheen they shall be treated as specified herein.

Forms shall be removed within 24 hours after the concrete has hardened sufficiently to prevent structural collapse or other damage by careful form removal. Where required, repair of all minor surface imperfections shall be made immediately after form removal and prior to curing. Minor surface repair shall be completed within 2 hours after form removal and shall be immediately followed by the initiation of curing by the applicable method specified herein. Concrete surfaces shall be kept continuously moist after form removal until initiation of curing.

b. Materials.—Materials used for curing shall meet the following requirements:

(1) Water.—Water used for curing shall meet the requirements of paragraph 5.3.4 for water used in mixing concrete.

(2) Curing compound.—Type I curing compounds shall conform to the requirements of Water and Power Resources Service "Specifications for Concrete Curing Compound" dated October 1, 1980.

c. Sampling, testing, and certification.—The Government will test or require approved manufacturer's certification of all curing compound prior to use. However, acceptance of the material under clause No. 10 of the General Provisions, "Inspection and Acceptance," will not be made until the material has been satisfactorily applied at the jobsite.

The contractor shall furnish copies of all purchase orders for curing compound to the contracting officer's representative at the

jobsite. Copies of the purchase orders shall be furnished far enough in advance of planned use so that the samples if required will be available to the Government to allow a testing period of at least 45 days. The contractor will then be informed in writing whether materials covered by each purchase order will be tested or whether manufacturer's certification will be required. The Government will act on any required certifications as to conformance to specifications within 16 days after receipt of the certifications by the Government and will notify the contractor.

Manufacturer's certification if required shall be furnished to the contracting officer's representative at the jobsite. The manufacturer shall certify that the material is within 1 percent (by weight of each individual constituent) of the same composition as material which previously has been found to comply with the specifications when completely tested and shall specify identification data including Water and Power Resources Service specifications number, batch number, materials identification, and quantity.

Samples of curing compound if required shall be 1 quart in size and included with each sample shall be a certification that the sample is from the actual batch from which shipments are to be furnished. Samples and accompanying certifications shall be fully identified as previously described and shall be furnished, shipping costs prepaid, by the contractor to: Water and Power Resources Service, Attn D-1521, P O Box 25007, Denver CO 80225. The contractor shall be responsible for the accuracy of all certifications submitted and data contained therein whether submitted by him, a manufacturer, or a subcontractor. The costs and delays that result from rejection of materials or inadequate certifications shall be the responsibility of the contractor.

d. Water curing.—Concrete cured with water shall be kept wet for at least 14 days from the time the concrete has attained sufficient set to prevent detrimental effects to the concrete surfaces. The concrete surfaces to be cured shall be kept wet by covering them with water-saturated material; by using a system of perforated pipes, mechanical sprinklers, or porous hose; or by other methods which will keep all surfaces continuously (not

periodically) wet. All curing methods are subject to approval by the contracting officer.

Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite as determined by the contracting officer is less than 40 °F. If during the prescribed period of water curing ambient temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.

e. Curing with type I or II compound.—Curing by this method shall be by application to designated concrete surfaces to provide a water-retaining film. The curing compound shall be reapplied as necessary to maintain a continuous water-retaining film on the surfaces. The curing compound shall be mixed thoroughly and spray applied to the concrete surfaces in one coat to provide a continuous uniform film over the concrete. The coverage shall not exceed 150 square feet per gallon. On rough surfaces, the coverage rate shall be decreased as necessary to obtain the required continuous film. Special care shall be taken to insure ample coverage with the compound at edges, corners, and rough surfaces; and to keep curing compound off waterstops and reinforcing bars. Equipment for applying curing compound and the method of application shall be in accordance with the provisions of chapter VI of the Eighth Edition of the Bureau of Reclamation Concrete Manual.

In order to assure bond of curing compound the contractor shall, where and as directed by the contracting officer, remove excessive form oil from concrete surfaces by washing with a solution of trisodium phosphate followed by a thorough rinsing of the surfaces with clear water. The trisodium phosphate wash will be required only when it is determined by the contracting officer that the amount of form oil on the concrete will impair the bond of the curing compound.

Where curing compound is to be applied, formed concrete surfaces shall be kept continuously moist by repeated light spraying with water until immediately prior to application of curing compound. Curing compound shall be applied as soon as the surface film of moisture has disappeared but while the concrete still has a damp appearance.

After application of the curing compound has been completed and the coating is dry to touch, all remaining required concrete repairs shall be performed without delay in accordance with paragraph 5.3.20. Completed repairs shall be moistened and coated with curing compound in accordance with the foregoing requirements.

The contractor shall, where and as directed by the contracting officer, remove excessive form oil and other contaminants from concrete surfaces by washing with a solution of trisodium phosphate followed by a thorough rinsing of the surfaces with clear water. The contractor shall prevent exposed concrete surfaces including those below the work area from becoming stained during the washing operations. The trisodium phosphate wash will be required only when it is determined by the contracting officer that the amount of form oil on the concrete will impair the bond of the curing compound or when the surface is unsightly due to other contamination.

Where curing compound is to be applied, formed concrete surfaces shall be kept continuously moist by repeated light spraying with water until immediately prior to application of the curing compound. Curing compound shall be applied as soon as the surface film of moisture has disappeared but while the concrete still has a damp appearance.

After application of the curing compound has been completed and the coating is dry to touch, all remaining required concrete repairs shall be performed without delay in accordance with paragraph 5.3.20. Completed repairs shall be moistened and coated with curing compound in accordance with the foregoing requirements.

f. Protection of curing membranes.—Wax-base compound and resin-base compound shall be maintained to provide a moistureproof membrane for curing concrete for the minimum period specified. Any curing compound that is damaged or that peels from concrete surfaces within 28 days after application, shall be repaired without delay by moistening the concrete and applying additional compound in a manner satisfactory to the contracting officer.

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Where foot traffic and other construction activity is necessary on concrete being cured by wax-base compound or resin-base compound, the curing membrane shall be protected by covering with sand or earth not less than 1 inch thick with plywood or by other effective means approved by the contracting officer. Any protective covering shall not be placed on curing compound until the compound is dry. The contractor shall remove all such protective coverings before final acceptance of the work.

g. Cost.—The cost of furnishing all materials and performing all work for curing concrete shall be included in the price bid in the schedule for the concrete on which the particular curing methods are required.

5.3.20 REPAIR OF CONCRETE

a. General.—Concrete shall be repaired in accordance with this paragraph and Bureau of Reclamation "Standard Specifications for Repair of Concrete," dated November 15, 1970. The following revisions are hereby made in the Standard Specifications:

(1) Delete subparagraph 2a. and substitute therefor the following:

"a. Epoxy resin.—The epoxy resin for epoxy mortar shall meet the requirements of ASTM designation: C 881 for a type III, grade 2, class C epoxy system with the following additional requirements:

"(1) It shall be a 100-percent solids system and no diluent wetting agents or volatile solvents shall be incorporated.

"(2) The curing agent shall be a tertiary amine type, combined with dichloroethyl formal polysulfide polymer as a flexibilizer.

"The epoxy resin for bonding fresh concrete to hardened concrete shall meet the requirements of ASTM designation: C 881 for a type II, grade 2, class C epoxy system. In addition, it shall be a 100-percent solids system and no diluents, wetting agents, or volatile solvents shall be incorporated. Epoxy resin for bonding epoxy mortar repairs

may be the same type as specified for use in the epoxy mortar."

(2) In subparagraph 2e., page 2, delete the sentence beginning in line 5 and substitute therefor the following: "The samples shall be submitted, at least 30 days prior to use in the work, to: Construction Engineer, Water and Power Resources Service, Arizona Projects Office, 201 North Central Avenue—Suite 2200, Phoenix AZ 85073, for subsequent submission, unless otherwise directed by the contracting officer, to: Water and Power Resources Service, Attn D-1510, P O Box 25007, Denver CO 80225."

(3) In paragraph 3, page 2, delete the first sentence and substitute therefor the following: "The contractor shall furnish the contracting officer the manufacturer's certification of conformance with the requirements specified in subparagraph 2.a. for epoxy-resin material."

(4) In paragraph 5, page 2, after line 11, add the following: "In no event shall concrete repairs necessary to produce surfaces conforming to the finishing requirements of these specifications be completed later than 60 days after form removal."

(5) In paragraph 6, page 4, left column, lines 9 and 21 from top of page, and in paragraph 11, page 6, right column, first and seventh lines from bottom of page, change "Seventh" to "Eighth".

(6) In subparagraph 6.e., page 4, delete the sentence beginning with "Epoxy" in the 10th line of the 2nd paragraph and ending with "weight" in the 14th line. Substitute therefor the following: "Epoxy mortar will require approximately 5-1/2 to 6 parts of well-graded sand to 1 part epoxy, by weight."

(7) In paragraph 7, page 5, delete lines 7 and 8 from the top of page and substitute therefor the following: "Where necessary, forms shall be used to form the edge of new concrete to which epoxy mortar is later to be bonded."

Imperfections and irregularities on concrete surfaces shall be corrected in accordance with paragraph 5.3.12 and paragraph 5 of the

Standard Specifications. Minor formed surface repair shall be completed within 2 hours after form removal.

b. Types of repair.—All repairs shall be made with concrete, dry pack, or mortar (portland cement mortar); or with epoxy-bonded concrete or epoxy-bonded epoxy mortar; where and as applicable for the type of repair involved, as provided in the Standard Specifications.

When concrete surfaces are repaired with epoxy-bonded epoxy mortar, as required or permitted, the surfaces of the finished epoxy mortar shall, in areas visible to the public, as determined by the contracting officer, be lightly ground or prepared or treated by other approved methods to eliminate gloss and produce a surface color and texture that closely matches the surrounding concrete surfaces.

c. Cost.—The cost of furnishing all materials and performing all work required in the repair of concrete shall be borne by the contractor.

5.3.21 MEASUREMENT OF CONCRETE

Measurement, for payment, of concrete required to be placed directly upon or against surfaces of excavation will be made to the lines for which payment for excavation is made. Measurement, for payment, of concrete in canal lining will be made to the neatlines shown on the drawings. The volume of concrete in concrete canal lining placed at a curve shall be the product of the cross-sectional area of the canal lining and the centerline length of the curve. Measurement, for payment, of all other concrete will be made to the neatlines of the structures, unless otherwise specifically shown on the drawings or prescribed in these specifications.

In measuring concrete for payment, the volume of all openings, recesses, ducts, embedded pipes, woodwork, and metalwork, each of which is larger than 100 square inches in cross section, will be deducted.

5.3.22 PAYMENT FOR CONCRETE

a. General.—No direct payment will be made to the contractor for the following items of concrete including cement and reinforcing bars, and the cost thereof shall be included in the prices bid in the schedule for work where they are required:

- (1) Concrete in pipe and pipe joints.
- (2) Concrete required for erecting chain link fence.
- (3) Concrete in precast prestressed concrete beams for road bridges.

Payment for all other concrete in the various parts of the work will be made at the applicable unit prices per cubic yard bid therefor in the schedule, which unit prices shall include the cost of furnishing all materials and performing all works required for the concrete construction except that payment for furnishing and handling cementitious materials and payment for furnishing and placing reinforcing bars and reinforcing fabric will be made at the unit prices bid in the schedule for furnishing and handling cementitious materials and furnishing and handling reinforcing bars.

The items of the schedule listed in subparagraph b. below includes all concrete required under these specifications except concrete for the above items.

b. Schedule items of concrete.—

- (1) The item in the schedule for reinforced concrete in structures includes all reinforced concrete and unreinforced concrete required by these specifications except for the items listed below and those listed in subparagraph a. above.
- (2) The item in the schedule for reinforced concrete in bridge decks, diaphragms, parapets, and approach slabs includes all concrete in bridge decks, diaphragms, parapets, and approach slabs.
- (3) The items in the schedule for reinforced concrete in canal lining and for unreinforced concrete in canal lining include all concrete in the canal lining.

SECTION 5.4—SPECIAL CONCRETE REQUIREMENTS

5.4.1 JOINTS IN CONCRETE

a. Construction joints.—Construction joints are joints which are either purposely placed in concrete to facilitate construction or which occur in structures as a result of inadvertent delays in concrete placing operations.

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Construction joints are located to facilitate the contractor's operations, to reduce initial shrinkage stresses and cracks, to allow time for the installation of embedded metalwork, or to allow for the subsequent placing of other concrete. Bond is required at construction joints regardless of whether or not reinforcement is continuous across the joint.

The location of all construction joints in concrete work shall be subject to approval of the contracting officer, and the joints shall be constructed in accordance with paragraphs 5.3.15 and 5.3.16.

b. Contraction joints.—Contraction joints are joints placed in concrete to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units. The joints shall be so constructed that there will be no bond between the concrete surfaces forming the joint. Except as otherwise provided for dowels, reinforcement is never continuous across a contraction joint.

Contraction joints of the types shown on the drawings shall be constructed at the locations shown. The joints shall be made by forming the concrete on one side of the joint and allowing it to set before concrete is placed on the other side of the joint. The surface of the concrete first placed at a contraction joint shall be coated with curing compound before the concrete on the other side of the joint is placed. The curing compound shall conform to Water and Resources Service "Specifications for Concrete Curing Compound," dated October 1, 1980.

At vertical contraction joints in bridge abutments and bridge center pier, as shown on the drawings, wait 72 hours between adjacent concrete placements.

Where elastomeric sealant is specified for contraction joints in concrete, it shall conform to Bureau of Reclamation "Specifications for Elastomeric Canal Joint Sealer," dated August 1, 1977, class R, type II.

c. Edges.—The contractor shall tool or chamfer edges of concrete where shown on the drawings and elsewhere as required. The cost of tooling and chamfering edges of concrete shall be included in the prices bid in the schedule for the concrete in which the tooled and chamfered edges are required.

d. Cost.—Except for furnishing and placing waterstops and for furnishing and placing sponge rubber filler, the cost of furnishing all materials and performing all work for constructing contraction joints shall be included in the applicable prices bid in the schedule for the concrete for which the joints are required.

5.4.2 BRIDGE DECK JOINT

a. General.—The contractor shall furnish and install bridge deck joints in accordance with the provisions of these specifications. The bridge deck joint shall consist of a fabricated or extruded steel shape which provides a mechanical anchor for a preformed elastomeric seal and be capable of a total movement of 2 inches.

b. Materials.—

(1) Elastomer.—The elastomer shall be 100 percent polychloroprene (neoprene). The contractor shall furnish the manufacturer's certification that the material proposed has been pretested and will meet the physical requirements in table 5-0.

TABLE 5-0

Property	Requirements	ASTM method
Tensile strength minimum pounds per square inch	2,000	D 412
Elongation at break, minimum percent	250	D 412
Hardness, type A durometer	55 ± 5	D 2240 (modified)
Compression set, 70 hours at 212 °F, maximum	40 percent	D 395, method B (modified)
Oven aging, 70 hours at 212 °F		
Tensile strength, loss, maximum	20 percent	D 573

TABLE 5-O-Continued

Property	Requirements	ASTM method
Elongation, loss, maximum	20 percent	D 471
Hardness, type A durometer (points change)	0 to plus 10	
Oil swell, ASTM oil 3, 70 hours at 212 °F		
Weight change, maximum	45 percent	D 1149
Ozone resistance		
20 percent strain, 300 pphm in air 70 hours at 104 °F (wiped with toluene to remove contamination)	No cracks	
Low temperature recovery, 72 hours at 14 °F		D-2628-67T
50 percent deflection, minimum	88 percent	
Low temperature recovery, 22 hours at minus 20 °F, minimum		
50 percent deflection	83 percent	D-2628-67T
High temperature recovery, 70 hours at 212 °F minimum		D-2628-67T
50 percent deflection	85 percent	

(2) Structural steel.—Structural steel shall conform to ASTM designation: A 36 or A 242.

(3) Studs.—Studs for anchors shall conform to ASTM designation: A 10B, grades 1015 to 1020.

c. Manufacturing requirements.—The bridge deck joint shall be so constructed as to provide a waterproof seal. The preformed elastomeric seal shall be mechanically anchored to the steel shape.

d. Construction requirements.—The bridge deck joints shall be installed in the position shown on the drawings. The elastomeric seal shall be installed in one continuous length at such time that it will not be damaged by the construction operation. If repairs to the joint are necessary, all repairs shall be made prior to installation of the seal. Metal joint interfaces in contact with the seal shall be free of rust, paint, or other foreign material prior to installation of the seal. The elastomeric seal shall be bonded to the metal with an adhesive recommended by the manufacturer of the seal. Installation procedures shall be as recommended by the manufacturer.

e. Measurement and payment.—Measurement for payment for furnishing and installing bridge deck joint will be made of the number of linear feet of bridge deck joint in place. Payment for furnishing and installing bridge deck joint will be made at the unit price per linear foot bid therefor in the schedule which unit price shall include the cost of furnishing all materials and labor.

5.4.3 RUBBER WATERSTOPS

a. General.—Rubber waterstops shall be placed in joints where shown on the drawings or where directed: Provided, That PVC waterstops conforming to paragraph 5.4.4 may be furnished and placed in lieu of rubber waterstops.

Type "H" rubber waterstops shall be in accordance with the details shown on drawing 54 (40-D-2867).

The contractor shall furnish the waterstops and all materials and equipment for splicing waterstops, for fastening waterstops to the forms and to the supporting reinforcing bars, and for completing the installation of the waterstops. The contractor shall provide suitable support and protection for the waterstops during the progress of the work and shall repair or replace at his expense any

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damaged waterstops which, in the opinion of the contracting officer, have been damaged to such an extent as to affect the serviceability of the waterstops. All waterstops shall be protected from oil, grease, and curing compound.

b. Material.—

(1) Rubber waterstop.—The rubber waterstops shall be fabricated from a high-grade, tread-type compound. The basic polymer shall be natural rubber or a synthetic rubber. The material shall be compounded and cured to have the following physical characteristics as shown in table 5P.

(2) Gum rubber and rubber cement.—Gum rubber and rubber cement shall be suitable for making field connections in rubber waterstops as described in subparagraph f. below.

c. Fabrication.—The rubber waterstops shall be molded or extruded and cured in such a manner that any cross section will be dense, homogeneous, and free from porosity and other imperfections. The following minor surface defects will be acceptable:

(1) Lumps and depressions not exceeding 1/4 inch in longest lateral dimensions and

1/16 inch deep with no limit to the frequency of occurrence.

(2) Lumps and depressions between 1/4 and 1/2 inch in longest lateral dimension and 3/32 inch deep as long as the frequency of occurrence does not exceed six in a 50-foot length, and there is at least 2 inches between any two such defects.

(3) Marks resulting from the tubing operation or handling during manufacture with no limit to width or frequency of occurrence as long as the thickness of material below the mark is not less than the minimum thickness.

(4) Coarse or grainy surface texture.

(5) Suck-back along flash lines of molded goods if not more than 1/16 inch wide, 1/16 inch deep, and not more than 2 feet long.

The tolerances, shown on the drawing, shall govern all cross-sectional dimensions. Any defects which are not within the above limitations either shall be repaired as approved by the contracting officer or shall be removed from the finished product by cutting out a length of waterstop containing such defects and splicing the waterstop at that point. All factory splices shall be molded

TABLE 5P

Type of test	Method of test ASTM designation	Required	
		Natural rubber	Synthetic rubber
Tensile strength, pounds per square inch, minimum	D 412	3,500	*3,000
Tensile strength at 300 percent elongation, pounds per square inch, minimum	D 412	1,450	1,150
Elongation at break, percent, minimum	D 412	500	*450
Shore durometer (type A)	D 2240	60 to 70	60 to 70
Change in weight, water immersion, percent maximum (2 days at 70 °C)	D 471	5	5
Compression set (constant deflection) percent of original deflection, maximum	D 395, method B	30	30
Accelerated aging (96 hours at 70 °C) percent of tensile strength before aging, minimum	D 573	80	80
Percent of elongation before aging, minimum	D 573	80	80
Ozone cracking resistance (7 days at 0.5 p/m at 38 °C) 20 percent elongation	D 1149	No cracks	No cracks

* Polychloroprene shall have a minimum tensile strength of 2,000 pounds per square inch and minimum elongation of 350 percent.

splices. Molded splices shall be made by vulcanizing the splices in a steel mold for a time sufficient to produce maximum strength in the splice. All molded splices shall withstand being bent 180° around a 2-inch-diameter pin without any separation at the splice.

d. Tests.—

(1) General.—Rubber waterstops shall be subject to laboratory tests before shipment. Material for tests shall be furnished by the manufacturer and all tests shall be made at the place of the manufacturer of the rubber waterstops.

Except as otherwise provided below, general sampling procedures shall be in accordance with section 6 of Federal Test Method Standard No. 601.

(2) Sampling for tests.—Samples for laboratory tests to determine physical properties of the compound shall be taken at random to obtain the following number of test units from each separate purchase order as shown in table 5Q:

TABLE 5Q

Size of purchase order	Number of test units
500 lin ft or less	1
501 to 1,000 lin ft	2
1,001 to 5,000 lin ft	4
5,001 to 10,000 lin ft	8
Over 10,000 lin ft	15

At the option of the manufacturer, laboratory tests to determine physical properties of the rubber waterstops required to be furnished under these specifications shall be performed on test specimens cut from (a) test units taken from the finished rubber product or, (b) substitute samples furnished in accordance with paragraph 3.5 of section 6, Federal Test Method Standard No. 601.

(3) Methods of tests.—Tests shall be made in accordance with the methods specified in subparagraph b.(1) above.

(4) Data to be furnished by manufacturer.—One certified copy of all laboratory test reports representing each shipment of

waterstop shall be mailed to the Construction Engineer, Water and Power Resources Service, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073.

e. Shipping and storing.—Rubber waterstops may be shipped in rolls to facilitate handling, but if any roll of waterstop is not to be installed in a structure within 6 months after receipt of the material, the roll shall be loosened. All waterstops shall be stored in as cool a place as practicable, preferably at 70 °F or less. Waterstops shall not be stored in the open or where they will be exposed to the direct rays of the sun.

f. Installation.—

(1) General.—The waterstops shall be installed with approximately one-half of the width of the material embedded in the concrete on each side of the joint. Care shall be exercised in placing and vibrating the concrete about the waterstops to insure complete filling of the concrete forms under and about the waterstops and to obtain a continuous bond between the concrete and the waterstops at all points around the periphery of the waterstops. In the event the waterstop is installed in the concrete on one side of a joint more than 1 month prior to the scheduled date of placing the concrete on the other side of the joint, the exposed waterstop shall be covered or shaded to protect it from the direct rays of the sun during the exposure.

(2) Field splices in type "H" rubber waterstops.—All field splices in type "H" rubber waterstops shall be molded splices. All molded splices shall be made by vulcanizing the splices in a steel mold as follows: The adjoining ends at splices shall be beveled at an angle of 45° or flatter by the use of a saw and miter box so that the ends to be spliced together will be pressed together when the mold is closed. The beveled ends and the sides for at least one-fourth of an inch back from the ends shall be buffed thoroughly to provide clean, rough surfaces. All buffed surfaces shall be given two thin coats of rubber cement and each coat shall be permitted to dry thoroughly. A piece of gum rubber cut to the same dimensions as the beveled face shall then be applied to the end of one strip after removing the cloth backing from the

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gum rubber. The adjoining strip shall then be placed accurately in position, and all edges shall be stitched thoroughly together with a suitable handstitcher. The mold shall be heated to a temperature of 290 °F before the splice is placed in the mold. The prepared splice shall be placed in the mold with the splice in the center of the mold, and the mold shall be closed tightly to prevent slipping during the vulcanizing process. The splice shall remain in the mold 25 minutes after the mold is closed completely, during which time the mold shall be maintained at a temperature of 290 °F.

Each finished splice shall withstand a bend test by bending the waterstop 180° around a 2-inch-diameter pin without showing any separation at the splice.

The contractor shall furnish all materials for splices and all field splicing molds and electrical energy for heating the molds.

g. Measurement and payment.—Measurement, for payment, of the rubber waterstops will be made of the number of linear feet of waterstops in place measured along the centerline of the waterstop, with no allowance for lap at splices and intersections.

Payment for furnishing and placing waterstops will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all material, making field splices and intersections, and installing the waterstops.

5.4.4 PVC WATERSTOPS

a. General.—If PVC waterstops are furnished in lieu of rubber waterstops, they shall conform to the details shown on drawing 54 (40-D-2867).

The contractor shall furnish the waterstops and all materials and equipment for splicing waterstops, for fastening waterstops to the forms and to the supporting reinforcing bars, and for completing the installation of the waterstops. The contractor shall provide suitable support and protection for the waterstops during the progress of the work and shall repair or replace at his expense any damaged waterstops which, in the opinion of the contracting officer, have been damaged to such an extent as to affect the serviceability

of the waterstops. All waterstops shall be protected from oil, grease, and curing compound.

b. Data to be furnished by the contractor.—

(1) At least 60 days prior to placing any waterstop, the contractor shall submit detailed laboratory test reports on the physical properties, listed in subparagraph c., of the compound which will be used in the waterstops to be furnished, together with a copy of the purchase order for the waterstops, and a manufacturer's certificate stating that the waterstops, as furnished, will meet all requirements of these specifications. If the contractor purchases the waterstops under more than one purchase order, the data and samples required by this subparagraph shall be submitted for each separate purchase.

(2) Address for submittals.—The data shall be submitted by the contractor to the Construction Engineer, Water and Power Resources Service, Arizona Projects Office, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073.

c. Material.—PVC waterstops shall be fabricated from a compound, the basic resin of which shall be domestic virgin PVC. No reclaimed PVC or manufacturer's scrap shall be used. The compound shall contain any additional resins, plasticizers, stabilizers, or other materials needed to insure that, when the material is compounded, the finished product will have the following physical characteristics:

Type of test	Method of test	Required
Tensile strength, pounds per square inch, minimum	ASTM designation: D 638, speed D, specimen type IV	2,000
Ultimate elongation, percent minimum	ASTM designation: D 638, speed D, specimen type IV	300
Stiffness in flexure, pounds per square inch, minimum	ASTM designation: D 747	600

Type of test	Method of test	Required
Low temperature brittleness at minus 35 °F	ASTM designation: D 746	No cracking or chipping
Volatile loss, change in weight, percent allowed	ASTM designation: D 1203, method A, 0.08-inch-thick specimen	0.50
Tensile strength after accelerated extraction test, percent of tensile strength before extraction test, minimum	U.S. Army Corps of Engineers Specification CRD-C-572-74	80
Ultimate elongation after accelerated extraction test, percent of ultimate elongation before extraction test, minimum	U.S. Army Corps of Engineers Specification CRD-C-572-74	80
Change in weight after effect of alkalis test, percent allowed	U.S. Army Corps of Engineers Specification CRD-C-572-74	+0.25, -0.10
Change in Shore durometer hardness after effect of alkalis test, percent allowed	U.S. Army Corps of Engineers Specification CRD-C-572-74	±5

d. Fabrication.—All waterstops shall be molded or extruded in such a manner that any cross section will be dense, homogeneous, and free from porosity and other imperfections.

The waterstops shall be fabricated in accordance with detail dimensions and tolerances shown on drawing 54 (40-D-2867); Provided, That longitudinal ribs on the webs between bulbs may be incorporated in

the cross section, at the option of the manufacturer.

e. Inspection and tests.—

(1) General.—All waterstops shall be sampled at the jobsite, tested, and approved by the Government before installation. The contractor shall have the waterstop available at the jobsite in sufficient time to allow 30 days for testing after samples obtained by the Government have been received in the Denver laboratories.

(2) Samples for tests.—A representative sample not less than 12 inches long shall be cut from each 500 feet of each size and type of finished waterstop: Provided, That a minimum of four samples shall be taken for each size and type from each separate purchase order. Each sample shall be marked so that it may be identified with the specific length of waterstop from which it is taken.

(3) Methods of tests.—Test specimens will be prepared from the samples in accordance with the U.S. Army Corps of Engineers Specification CRD-C-572-74, single copies of which may be obtained free of charge from the Director, U.S. Army Engineer Waterways Experiment Station, P O Box 631, Vicksburg MS 39180. Tests will be made in accordance with the methods specified in subparagraph c. above.

f. Installation.—Waterstops shall not be installed until data and field-sampled materials have been approved. The location and embedment of waterstops shall be as shown on the drawings, with approximately one-half of the width of the waterstop embedded in the concrete on each side of the joint. In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken that the waterstops are correctly positioned and secured during installation. All waterstops shall be installed so as to form a continuous watertight diaphragm in the joint unless otherwise shown.

Adequate provision shall be made to completely protect the waterstops during the progress of the work.

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Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement, to assure complete embedment of the waterstops in the concrete. Larger pieces of aggregate near the waterstops shall be removed by hand during embedment to assure complete contact between the waterstop and the surrounding concrete.

Prior to starting installation of the waterstops, the contractor shall furnish to the Construction Engineer, Water and Power Resources Service, Arizona Projects Office, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073, a copy of the manufacturer's recommendations for installing and making splices in the waterstops. Splices of waterstops shall be fabricated only by workmen who have demonstrated, to the satisfaction of the contracting officer, that they are sufficiently skilled to fabricate the required splices. Splices in the continuity or at the intersections of runs of plastic waterstops shall be performed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations. A thermostatically controlled electric heat source shall be used to make all splices. The correct temperature at which splices should be made will differ with the materials compounded but should be sufficient to melt but not char the plastic material. All splices shall be neat with the ends of the joined waterstops in true alignment. A miter-box guide and portable saw shall be provided and used to cut the ends to be joined to insure good alignment and contact between joined surfaces. The spliced area, when cooled and bent by hand to as sharp an angle as possible, shall show no sign of separation.

g. Measurement and payment.— Measurement, for payment, of the PVC waterstops will be made of the number of linear feet of waterstops in place measured along the centerline of the waterstop with no allowance for lap at splices and intersections.

Payment for furnishing and placing waterstops will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials, preparing and submitting data, furnishing required samples of finish waterstops, making field splices and intersections, and installing the waterstops.

5.4.5 SPONGE RUBBER FILLER FOR CONCRETE JOINTS

a. General.—Elastic filler material consisting of sponge rubber shall be furnished and placed in the joints in concrete where shown on the drawings. Elastomeric sealer shall also be furnished and placed in the joints where shown.

b. Materials.—

(1) Sponge rubber.—Sponge rubber shall conform to Federal Specification HH-F-341F, type II, class A, sponge rubber: Provided, That the load required to compress the test specimen to 50 percent of its thickness before test shall be not less than 50 pounds per square inch nor greater than 150 pounds per square inch. Sponge rubber shall be stored in as cool a place as practicable, preferably at 70 °F or less, and in no case shall the rubber be stored in the open exposed to the direct rays of the sun.

(2) Copper nails.—Copper nails shall conform to Federal Specification FF-N-105B for common copper wire nails.

(3) Adhesive.—Adhesive for fastening the sponge rubber in place shall be a nonbituminous adhesive as recommended by the manufacturer of the filler material.

(4) Elastomeric sealant.—Elastomeric sealant shall conform to Bureau of Reclamation "Standard Specifications for Elastomeric Canal Joint Sealer," dated August 1, 1977, class R, type II.

c. Installation.—The sponge rubber filler shall be cut to the size and shape of the joint surface. The filler shall be secured to the concrete in an approved manner, with copper nails embedded in the first-placed concrete in such a manner that the nails will protrude from the joint surface to be covered at approximately 12-inch centers, or by adhesive applied between the filler and the first-placed concrete.

Joints between adjoining portions of the filler material shall be sufficiently tight to prevent concrete from seeping through such joints. Where sealer material is required, the joint filler shall be set back from the edge of the joint to provide the proper recess for installing sealer material. Elsewhere, unless otherwise shown on the drawings or directed, the edges

of the sponge rubber filler shall be placed flush with the finished surface of the concrete or to the bottom edge of chamfers.

d. Measurement and payment.— Measurement, for payment, of sponge rubber joint filler will be made of the area of material in place. Payment for furnishing and placing the various thicknesses of sponge rubber joint filler will be made at the applicable unit price per square foot bid therefor in the schedule, which unit price shall include the cost of furnishing and placing elastomeric sealant.

5.4.6 ELASTOMERIC BEARING PADS

a. General.—The contractor shall furnish and place elastomeric bearing pads at the locations shown on the drawings and in accordance with this paragraph. Elastomeric bearing pads shall be fastened to one concrete surface with rubber cement recommended by the manufacturer of the elastomeric bearing pads.

Elastomeric bearing pads shall be stored in as cool a place as practicable, preferably at 70 °F or less. Elastomeric bearing pads shall not be stored in the open or where they will be exposed to the direct rays of the sun.

Elastomeric bearing pads shall be "laminated" (consisting of alternate layers of elastomer and metal or fabric laminates) as shown on the drawings.

b. Data to be furnished by the contractor.— The contractor shall submit to the Construction Engineer, Water and Power Resources Service, Arizona Projects Office, Valley Center—Suite 2200, 201 North Central Avenue, Phoenix AZ 85073 a manufacturer's certification stating that the elastomer and fabric, if used, in the elastomeric bearing pads as furnished will meet all requirements of these specifications. If the contractor purchases the elastomeric bearing pads under more than one purchase order, the data required by this subparagraph shall be submitted for each separate purchase.

c. Materials.—

(1) Elastomer.—The sole polymer of the elastomeric compound shall be 100 percent virgin polychloroprene (neoprene) and shall be not less than 60 percent by volume of the total compound. The

elastomeric compound shall meet the requirements specified in table 5R.

Table 5R.—Requirements for elastomeric compound

Type of test	Test method	Test limits
(a) Hardness and strength.—		
Hardness	ANSI/ASTM D 2240 or Federal Test Method Standard No. 601, method 3021	Type A durometer reading 55 to 65
Tensile strength	ANSI/ASTM D 412 or Federal Test Method Standard No. 601, method 4111	2,500 lb/in ² , minimum
Ultimate elongation	ANSI/ASTM D 412	350 percent, minimum
(b) Heat resistance.—		
Change in durometer hardness	ANSI/ASTM D 573, 70 hours at 212 °F	Plus 15 maximum points
Change in tensile strength	ANSI/ASTM D 573, 70 hours at 212 °F	Minus 15 percent maximum
Change in ultimate elongation	ANSI/ASTM D 573, 70 hours at 212 °F	Minus 40 percent maximum
(c) Compression set.—		
Compression set	ANSI/ASTM D 395, method B, 22 hours at 212 °F or Federal Test Method Standard No. 601, method 3311	35 percent maximum

Table 5R.—Requirements for elastomeric compound—Continued

Type of test	Test method	Test limits
(d) Ozone.—		
100 ppm ozone in air by volume, 20 percent strain 100 °F plus or minus 2 °F, 100 hours mounting procedure ANSI/ASTM D 518, procedure A	ANSI/ASTM D 1149	No cracks
(e) Adhesion.—		
Bond made during vulcanization	ANSI/ASTM D 429, method B	40 lb/in

(2) Metal laminas.—Metal laminas shall be rolled mild steel sheets not less than No. 20 gage in thickness conforming to ANSI/ASTM A 36 or ANSI/ASTM A 570, grade 36 or 40.

(3) Fabric laminas.—Fabric laminas shall be single ply at the top and bottom surfaces of the pad and either double ply or double strength within the pad. Fabric laminas shall be woven from 100 percent glass fibers of "E" type yarn with continuous fibers. The minimum thread count in either direction shall be 25 threads per inch. The fabric shall have either a crowfoot or an eight-harness satin weave. Each ply of fabric shall have a breaking strength of not less than 800 pounds per inch of width in each thread direction when 3- by 36-inch samples are tested on split drum grips. The bond between double plies shall have a minimum peel strength of 20 pounds per inch.

d. Manufacturing requirements.—Laminated pads shall consist of 1/2-inch layers of elastomer restrained at their interfaces by bonded metal or fabric laminates. The top and bottom layers of metal or fabric laminations shall be uniformly covered with a maximum of

one-eighth inch of elastomer. Edges of metal laminations shall be covered with a minimum of one-eighth inch of elastomer, except at laminate-restraining devices and around holes that will be entirely closed on the finished structure.

Plain pads or pads laminated with fabric laminates may be cut from large sheets. Cutting shall be performed in such a manner as to avoid heating of the material and to produce a smooth edge with no tears or other jagged areas and to cause as little damage to the material as possible.

Pads with metal laminations shall be molded to the dimensions shown on the drawings.

e. Tolerances.—Flash tolerance, finish, and appearance shall meet the requirements of the Third Edition of the RMA Handbook for Molded and Extruded Products, RMA F3 and T.063 for molded bearings and RMA F2 for extruded bearings. The RMA Handbook for Molded and Extruded Products is published by the Rubber Manufacturer's Association, Inc., 1901 Pennsylvania Avenue NW., Washington DC 20006. For both plain and laminated bearings, the permissible variation from the dimensions and configuration required by the drawings and these specifications shall be as listed in table 5S.

Table 5S.—Permissible variations

Dimensions and configurations	Variations
(1) Overall vertical dimensions.—	
Average total thickness 1-1/4 inches or less	-0 + 1/8"
Average total thickness over 1-1/4 inches	-0 + 1/4"
(2) Overall horizontal dimension.—	
36 inches and less	-0 + 1/4"
Over 36 inches	-0 + 1/2"
(3) Thickness of individual layers of elastomer (laminated bearings only)	±1/8"

Table 5S.—Permissible variations—Continued

Dimensions and configurations	Variations
(4) Variation from a plane parallel to the theoretical surface (as determined by measurements at the edges of the bearings)	
Top	1/8"
Sides	1/4"
Individual metal laminates	1/8"
(5) Position of exposed connection members	1/8"
(6) Edges cover of embedded metal laminates or connection members	-0 + 1/8"
(7) Size of holes, slots, or inserts	±1/8"
(8) Position of holes, slots, or inserts	±1/8"

f. Quality assurance.—The Government reserves the right to require the contractor to verify the mechanical properties of the finished bearing pad by laboratory test.

The following values shall be met under laboratory testing conditions of full-size bearing pads:

(1) Compressive strain of any layer of an elastomeric bearing pad shall not exceed 7 percent at 800-pounds-per-square-inch average unit pressure, or at the design dead-load plus live-load pressure if so indicated on the drawings.

(2) The shear resistance of the bearing pad shall not exceed 75 pounds per square inch at 25 percent strain of the total effective thickness after an extended 4-day ambient temperature of minus 20 °F.

g. Measurement and payment.—Measurement of elastomeric bearing pads for payment will be made of the area of the bearing pads in place. Payment for furnishing and placing 1-inch-thick laminated elastomeric bearing pads will be made at the

unit price per square foot bid therefor in the schedule.

SECTION 5.5—PRESTRESSED CONCRETE

5.5.1 PRECAST PRESTRESSED CONCRETE BRIDGE BEAMS

a. General.—The contractor shall furnish and erect precast prestressed concrete I beams for the roadway bridges as shown on the drawings and in accordance with this paragraph. The term "members" as used in this paragraph shall mean "I beams."

b. Approval of precast prestressed concrete members.—Four prints of all checked drawings showing details of the precast prestressed concrete members shall be submitted by the contractor for approval to the Water and Power Resources Service, Attn D-270, P O Box 25007, Denver CO 80225. One copy of each drawing and a copy of the transmittal letter shall be sent to the Construction Engineer, Water and Power Resources Service, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073.

Any fabrication or procurement of materials performed prior to approval of details shall be at the contractor's risk. Approval by the Government of the contractor's details shall not be held to relieve the contractor of any part of the contractor's responsibility to meet all of the requirements of these specifications or of the responsibility for the correctness of the contractor's details.

c. Materials.—

(1) Wire strands.—The wire strands shall conform to ASTM designation: A 416, grade 270.

(2) Reinforcing bars.—Reinforcing bars shall conform to the requirements of paragraph 5.3.13, except the reinforcing bars shall conform to ANSI/ASTM A 615, grade 40 or 60 as specified on the precast prestressed concrete member construction drawings, including supplementary requirements.

Tack welding of reinforcing bars will not be permitted except at locations shown on the drawings or where approved by the contracting officer. Welding will not be

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permitted in the prestressing bed after the prestressing steel is installed.

(3) Concrete for members.—Concrete for precast prestressed members shall conform to the provisions of paragraphs 5.3.1 to 5.3.12, inclusive, except as follows:

(a) The design of the members is based on a concrete compressive strength of 5,000 pounds per square inch at 28 days age. At least 90 percent of the test cylinders shall exceed the design strength.

(b) The cement shall meet the requirements of ANSI/ASTM C150 for type II and shall meet the low alkali and false-set limitations specified therein. The cement for concrete for the members will be accepted on manufacturer's certification. The certification shall show the type of cement to be used and shall be accompanied by a mill test report.

(c) The sand and coarse aggregate shall meet all requirements of ANSI/ASTM C33. Coarse aggregate shall conform to ANSI/ASTM C33 gradings for size No. 67 (3/4 inch to No. 4).

(d) The slump of concrete after the concrete has been deposited but before it has been consolidated shall not exceed 3 inches.

(e) The percentage of air entrained in the concrete as discharged from the mixer shall be 3 to 5 percent, by volume, of concrete. Air-entraining admixture shall be used if necessary to maintain the specified air content.

(4) Embedded bearing and anchor plates.—Steel for bearing and anchor plates embedded in the members shall conform to ASTM designation: A 36. End-welded studs shall conform to ASTM designation: A 108, cold-drawn bars, grade 1015 or 1020, either semi or fully killed. If flux-retaining caps are used, the steel for the caps shall conform to ASTM designation: A 109, temper No. 4 or 5.

(5) Embedded anchorage devices.—Steel bars embedded in the exterior beams for the anchor devices for the intermediate

diaphragms shall conform to ASTM designation: A 36.

Bolts shall conform to ASTM designation: A 307. Couplings shall develop the full strength of the bolts.

Structural-steel tubing embedded in the interior beams for the intermediate diaphragms shall conform to ASTM designation: A 500, grade B.

(6) Anchor bolts.—Anchor bolts shall conform to ASTM designation: A 325.

d. Manufacturing.—

(1) Pretensioned design.—The members shall be precast and prestressed by pretensioning the longitudinal wire strands. No bond shall be transferred to the concrete nor end anchorages released until after the concrete has attained a strength of 4,000 pounds per square inch as determined by the contracting officer. Strands shall be initially tensioned to 70 percent of the minimum ultimate strength of the strands. Strands which are to be deflected shall be subjected to a slightly lower initial tension of a magnitude such that after deflecting they are tensioned to the load specified above.

Prestressing shall be done with approved jacking equipment. If hydraulic jacks are used, they shall be equipped with accurately reading pressure gages. The combination of jack and gage shall be calibrated and a graph or table showing the calibration shall be furnished to the contracting officer. Should other types of jacks be used, calibrated proving rings or other devices shall be furnished so that the jacking forces may be accurately known.

The prestress strands shall be released in such a manner that lateral eccentricity shall be minimized and cracking of the member from the top down shall be prevented.

The minimum transverse spacing of the strands at the ends of the members shall not be less than four times the diameter of the strand. The minimum cover for strands shall be 1-1/2 inches.

Lifting devices shall be provided near each end of the member. The installed lifting

device shall have adequate strength with a reasonable factor of safety to carry all anticipated loads during handling and erection of the member.

The top surface of members to be placed in contact with monolithically placed concrete shall be roughened by scoring "X" to a depth of one fourth inch at approximate 1-foot 6-inch centers.

The upper bearings and other metalwork which is embedded in the member shall be fabricated and installed in a workmanlike manner. Welding shall conform to subparagraph f. below.

(2) Dimensional variations.—Variations in dimensions of precast prestressed concrete beams:

(a) Length	Minus	1/8 inch in 10 feet, maximum of 3/4 inch
	Plus	1/8 inch in 10 feet, maximum of 3/4 inch
(b) Depth	Minus	1/4 inch
	Plus	1/4 inch
(c) Width	Minus	1/4 inch
	Plus	1/4 inch
(d) Out of square	1/8 inch in 12 inches	Maximum of 1/4 inch
(e) Straightness	1/8 inch in 10 feet . .	Maximum of 3/8 inch
(f) Camber	1/8 inch in 10 feet . .	1/2 inch

(3) Testing and curing of concrete.—Specimens used to determine the compressive strength of the concrete shall be 6-by 12-inch cylinders made, cured, and

tested by the contractor in accordance with ANSI/ASTM C192, C617, and C39. At least five laboratory test cylinders shall be made from the mix to be used to assure that the mix design is adequate. Thereafter, additional concrete cylinder tests shall be made whenever there is any change in the mix being used or if uniform or adequate strengths are of field cured cylinders not being obtained.

The members shall be cured by steam curing, radiant heat curing, or water curing as hereinafter provided.

Before detensioning, the members shall be cured until concrete has attained sufficient compressive strength. At the start of manufacture, at least six cylinders shall be made and cured with each member, and tested in pairs at appropriate time intervals during the curing period to establish the duration of curing to produce at least the concrete strength at release shown on the drawings. Cylinders shall be cast, cured, and tested in accordance with ANSI/ASTM C31, C617, and C39. After the curing method and period have been established, two cylinders for each shift shall be made and cured, shall be tested at the end of the curing period, and shall meet the specified minimum curing strength cited above before curing of the members made during the shift concerned is discontinued. If the strength of either cylinder is less than that required, the members concerned shall be cured for an additional time satisfactory to the contracting officer to insure the minimum curing strength requirement is met. All cylinders shall be tested as soon as possible after removal from curing while still in a moist condition. Members cured by water curing and test cylinders cured by any of the specified methods shall be protected from temperatures below 40 °F before and throughout the curing period.

The curing shall be in accordance with the following requirements depending on the method selected:

(a) Steam or radiant heat curing.—Low-pressure steam curing shall be done in a suitable enclosure to maintain the specified curing temperature and prevent loss of moisture from the concrete. The live steam shall not be applied directly to the concrete forms or

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concrete. Radiant heat curing shall be applied by means of pipes circulating steam, hot oil, or hot water or by electric heating elements. Pipes and other heating elements shall not be in contact with concrete, form surfaces, or test cylinders. During the cycle of radiant heat curing, effective means shall be provided to prevent loss of moisture from any part of the concrete member. Moisture shall be applied by a cover of moist burlap or cotton matting and shall be retained by covering the member with plastic sheeting, lapped and sealed at the laps and edges, in combination with an insulating cover or tight enclosure that will promote even application of heat and prevent rapid loss of moisture from the concrete members.

The concrete shall be maintained at a presteaming temperature between 65 and 100 °F for at least 3 hours after the final placement of the concrete to allow the initial set of the concrete to take place. The concrete shall be kept continuously moist during the presteaming period.

During the application of live steam or of radiant heat after presteaming, the ambient temperature within the curing enclosure shall increase at an average rate not less than 20 °F per hour and not more than 35 °F per hour until the curing temperature is reached. The curing temperature within the enclosure shall be not less than 120 °F and not more than 160 °F. The curing temperature shall be maintained until the concrete has reached the desired strength. Additional curing is not required after detensioning.

Following the curing period, the concrete shall be protected from drops in temperature exceeding 35 °F per hour which may damage the concrete.

(b) Water curing.—Concrete in members shall be cured as soon as the concrete has attained sufficient set to prevent detrimental effects to the concrete surfaces. Water curing shall be accomplished by covering the concrete with water-saturated material or by applying moisture using a system of perforated pipes, mechanical sprinklers,

porous hose, or by any other approved method which will keep all exposed surfaces continuously wet during the specified curing period.

e. Handling and placing.—Members shall be lifted by means of the lifting devices provided or others of approved design and shall be maintained in an upright position and supported near the ends only at all times.

Immediately prior to erection, the surfaces of members to be placed in contact with monolithically placed concrete shall be cleaned by wet sandblasting followed by thorough washing to remove all laitance, coatings, and foreign materials.

Extreme care shall be exercised in lifting, handling, and storing the members to prevent cracking or damage. The precast prestressed members shall be placed to the lines and grades specified on the drawings.

The transverse rods shall be tightened prior to grouting the keyway and dowels for fixed bearings.

The top of surface of the members shall be washed thoroughly with air-water jets immediately prior to placement of concrete in the slab. All pools of water shall be removed from the surface of the slab form before the concrete is placed.

f. Welding.—Welding shall be performed only where called for on the drawings. Surfaces to be welded shall be free from loose scale, rust, paint, and other foreign matter.

All welding shall be performed by the electric-arc method by a process which will exclude the atmosphere from the molten metal. Welds shall be made as specified on the drawings and in accordance with the conventional welding symbols of AWS. All welding equipment, processes, workmanship, and techniques shall be in accordance with the latest edition of the American Society Structural Welding Code D1.1.

g. Payment.—Payment for furnishing and erecting the various lengths of AASHTO type IV and VI precast prestressed concrete bridge beams for roadway bridges will be made at the applicable unit price per beam bid therefor in the schedule, which unit price shall include the cost of furnishing all materials including

cement, reinforcing bars, pretensioned wire strands, embedded metalwork, and lifting devices.

SECTION 5.6—GROUTING MORTAR FOR EQUIPMENT AND METALWORK

5.6.1 GROUTING MORTAR FOR EQUIPMENT AND METALWORK

a. General.—Nonsettling grouting mortar shall be furnished and placed as required and shall be in accordance with this paragraph.

b. Nonsettling grouting mortar.—Unless inspection is waived in each specific case, the preblending of the aluminum powder and cement for the nonsettling grouting mortar and the mixing and placing of the nonsettling grouting mortar shall be performed only in the presence of the Government inspector.

Nonsettling grouting mortar shall be composed of cement, water, sand, and aluminum powder. Cement shall be type II portland cement in accordance with ANSI/ASTM C 150, and shall meet the false-set limitation specified therein. Water and sand shall be in accordance with paragraphs 5.3.4 and 5.3.5, respectively, except that sand passing a No. 16 screen shall be used when clearances are such that the specified grading for sand is not suitable. Aluminum powder for use in the mortar shall be ground; shall contain no polishing agents, such as stearates, palmitates, and fatty acids; and shall effectively produce the desired expansion.

It is contemplated that the mix portions for the nonsettling grouting mortar will be 1 part cement to 1-1/2 parts sand, by weight, for a fluid mortar; and 1 part cement to 2 parts sand, by weight, for a plastic mortar; each containing a small amount of preblended expansive material. The water-cement ratio of the mortar shall not exceed 0.50, by weight, and the slump of the mortar shall be the lowest practicable for the space to be filled. The exact mix proportions and water-cement ratio for the mortar will be determined by the contracting officer. The quantity of preblended expansive material to be used in the mortar will be governed by the quantity and characteristics of the cement used and will vary as the placing temperature varies, from about 5.5 ounces of preblended material per bag of cement for 70 °F placing

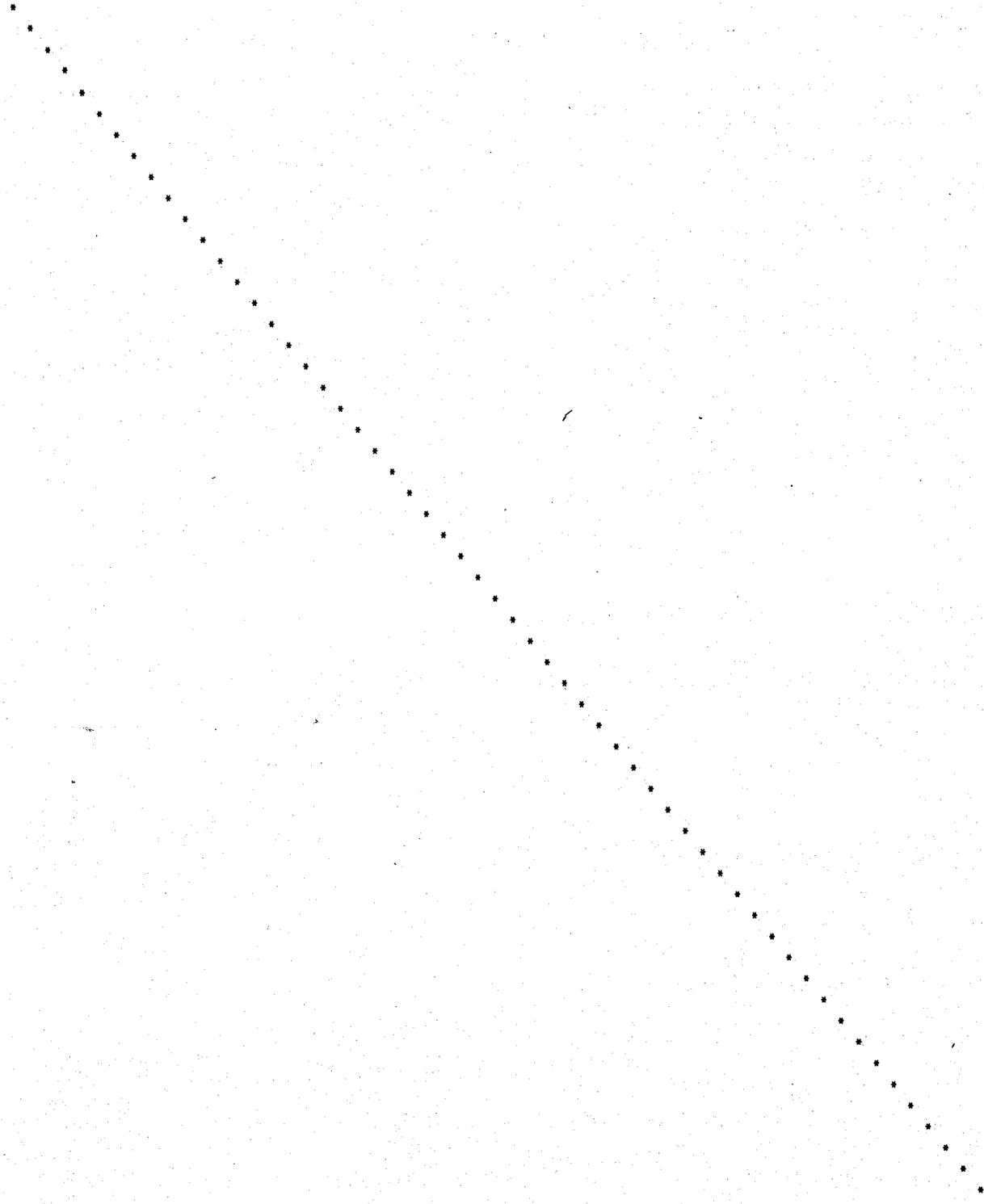
temperature to about 8.5 ounces at 40 °F placing temperature. The preblended expansive material shall be a uniform blend of 1 part aluminum powder to 50 parts cement, by weight. The actual batch of expansive mortar will contain approximately 50 to 100 parts aluminum powder per million parts of cement.

c. Preparation of surfaces and placing mortar.—Before placing mortars, the surfaces of base concrete to which the mortar will be bonded shall be roughened and shall be cleaned of all laitance, loose or defective concrete, curing compound and other coatings, and other foreign material by effective means, followed by thorough washing with water. If any delay occurs between the washing of the concrete and placing of the mortar, the surfaces of the concrete shall be lubricated by washing with water immediately before placing of the mortar. Forms shall be used where required to confine the nonsettling grouting mortar. The mortar shall be placed completely filling spaces adjacent to equipment and metalwork as shown on the drawings.

d. Curing.—The exposed surfaces of mortar shall be cured for 72 hours by keeping them covered with moist burlap, damp sand, or by other effective means approved by the contracting officer.

Loads shall not be applied to the mortar sooner than 72 hours after placement and shall be applied only after the mortar has attained a compressive strength of at least 3,000 pounds per square inch. The time required for the mortars used to attain this strength will be determined by the Government. Care shall be taken when applying loads on the hardened mortar and the contractor shall be responsible for any damage thereto resulting from impact loads when positioning equipment or metalwork.

e. Cost.—The cost of all work in connection with placing nonsettling grouting mortar and the cost of the cement, aluminum powder, water, and sand for mortar shall be included in the prices bid in the schedule for the items of work for which the mortar is required.



DIVISION 6-METALWORK**SECTION 6.1-MISCELLANEOUS METALWORK****6.1.1 MISCELLANEOUS METALWORK**

a. General.—The item of the schedule for furnishing and installing miscellaneous metalwork includes furnishing and installing the following items of metalwork:

- (1) Protective angles on approach slabs or bridges.
- (2) Threaded diaphragm rods for bridges.
- (3) Conduit hanger assemblies for conduits as shown on drawing 30 (344-D-7188).
- (4) Pipe rail on bridge parapets as shown on drawing 23 (344-D-7180).

Embedded metalwork for precast concrete is provided for in paragraph 5.5.1.

Where locations and dimensions of miscellaneous metalwork shown on the drawings are tentative or subject to change in accordance with requirements of equipment furnished, the Government will furnish such information as it becomes available.

The contractor shall confirm such locations and dimensions prior to fabrication of the miscellaneous metalwork.

b. Materials.—

- (1) Structural steel.—ANSI/ASTM A 36.
- (2) Steel pipe.—ANSI/ASTM A 53 or A 120. Except where extra-strong pipe is called for on the drawings, pipe shall be standard-weight pipe. Except where galvanized pipe is called for on the drawings, pipe shall be black pipe. Hydrostatic tests will not be required.
- (3) Bolts.—ANSI/ASTM A 307 except anchor bolts and studbolts. Anchor bolts shall be as shown on the drawings or as required and shall be made from ANSI/ASTM A 36 steel. The length of bolt threads shall be in accordance with ANSI B18.2.1. Threads shall be class 2 free fit, ANSI coarse-thread series.

(4) Nuts.—ANSI/ASTM A 563.

(5) Stud anchors.—Stud anchors and deformed bar anchors shall be of the sizes and shape shown on the drawings and shall be suitable for end welding to steel with automatically timed stud-welding equipment.

(6) Threaded diaphragm rods.—ASTM designation: A 307.

(7) Materials for miscellaneous metalwork not specifically covered herein by detailed specifications shall be of good commercial quality approved by the contracting officer.

c. Fabrication.—All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the type covered by these specifications, notwithstanding any omissions from these specifications or drawings. Fabrication of metalwork shall be in accordance with the applicable provisions of the latest AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and the Aluminum Association's "Specifications for Aluminum Structures" including all supplementary provisions and with the details shown on the drawing. All welding and work related thereto shall be performed in accordance with the latest edition of AWS "Structural Welding Code." Before being laid off or worked, material shall be straight and free from sharp kinks and bends.

Hot-dip galvanizing, where required after fabrication, shall be in accordance with the applicable provisions of ANSI/ASTM A 123, A 385, and A 386.

d. Installation.—All embedded metalwork shall be set accurately in position and shall be supported rigidly to prevent displacement during placing of the concrete.

e. Measurement and payment.—Measurement for payment for furnishing and installing miscellaneous metalwork will be made of the total weights of the metalwork furnished and installed regardless of the materials specified.

Payment for furnishing and installing miscellaneous metalwork will be made at the

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unit price per pound bid therefor in the schedule.

Embedded metal in precast concrete bridge beams is not included in the item for furnishing and installing miscellaneous metalwork.

DIVISION 7-SPECIAL CONSTRUCTION**SECTION 7.1-SPECIAL STRUCTURE REQUIREMENTS****7.1.1 FLOATWELLS**

a. General.—The contractor shall furnish and erect pipe vertically and furnish and lay pipe horizontally for the floatwells as shown on drawing 50 (344-D-7158). The pipe lengths and diameters shall be as shown on the drawings or as directed. Where the wells require pipe of sufficient length, the pipe may be furnished in manufactured lengths; otherwise the pipe shall be cut to lengths shown on the drawings or as directed.

Pipe erected vertically for the floatwells shall be reinforced concrete pressure pipe conforming to paragraph 7.1.2: Provided, That elliptical reinforcement shall not be used.

Pipe erected horizontally for the floatwells shall be 4AC40 asbestos-cement pressure pipe conforming to paragraph 7.1.3 or PVC pipe conforming to ANSI (ASTM D 1785).

Pipe erected vertically shall have type 3 or 4 bell-and-spigot joints with rubber gaskets and shall be erected with the bell end up.

Excavation, backfill, and compacted backfill required for constructing floatwells shall be in accordance with paragraphs 3.2.4, 3.3.1, and 3.3.2.

Backfill or concrete placed about the pipe erected vertically shall be placed carefully so that the pipe will not be moved after erection.

The contractor shall construct concrete bases and furnish and install precast concrete covers for the floatwells as shown on drawing 50 (344-D-7158). Concrete in bases and covers shall conform to paragraphs 5.3.1 through 5.3.20.

b. Measurement and payment.—Measurement for payment for furnishing and erecting pipe vertically will be made along the centerline of the pipe between the ends of the pipe erected vertically as required on the drawings or as directed with no allowance for lap at joints.

Measurement for payment for furnishing and laying 4-inch-diameter pipe horizontally for floatwells will be made along the centerline of

the pipe in place from end to end of pipe with no allowance for lap at joints.

Payment for furnishing and erecting 36B25 pipe vertically for floatwells will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of all work and materials required for manufacturing and erecting the pipe, including cutting pipe if required, to heights shown on the drawing or as directed.

Payment for furnishing and laying 4-inch-diameter pipe horizontally for floatwells will be made at the unit price per linear foot bid therefor in the schedule.

Concrete in the bases and covers for the floatwells will be measured and paid for as specified in paragraphs 5.3.4 and 5.3.22.

7.1.2 REINFORCED CONCRETE PRESSURE PIPE

Reinforced concrete pressure pipe shall be manufactured and tested and data shall be submitted for approval in accordance with Bureau of Reclamation "Standard Specifications for Reinforced Concrete Pressure Pipe," dated January 1974, except that the hydrostatic test requirement shall be waived.

The following revisions are hereby made in the Standard Specifications:

- a. Subparagraph 4.c.(2), page 1, right column, last line at bottom of page, after "Federal" delete "Test Method Standard" and insert "Specification SS-C-1960/3A".
- b. Subparagraph 4.c.(2), page 2, left column, from top of page, delete lines 1 through 6.
- c. Subparagraph 4.d.(1), page 2, left column, line 4 in the subparagraph, change "SS-C-192G" to "SS-C-1960/3A".
- d. Subparagraph 4.d.(3), page 2, delete lines 9 through 12 and substitute therefor the following: "conforms to ANSI/ASTM C 494 for type A or D chemical admixture, except that type E chemical admixture will also be acceptable if it conforms to subparagraph 4.d.(1): Provided".

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e. Subparagraph 4.f.(1)(b), page 3, right column, line 15 from top of page, change "Seventh" to "Eighth".

f. Subparagraph 4.f.(1)(c), page 3, right column, line 2, change "3.1" to "4.1".

g. Subparagraph 4.f.(2)(b), page 4, left column, line 12 from bottom of page, change "Seventh" to "Eighth".

h. Subparagraph 5.a., page 4, right column, line 14 from bottom of page, change "Seventh" to "Eighth".

i. In subparagraph 5.d., page 5, right column, line 18 from top of page, change "SS-C-192G" to "SS-C-1960/3A".

j. Subparagraph 7.c., page 13, line 5, delete the word "either" and the words "or intersection"; and in line 7, after the word "specimens" add the following:

"Reduction in the area of the circumferential reinforcement resulting from welding longitudinal reinforcement to circumferential reinforcement shall be held to a minimum. The circumferential reinforcement at the welded intersection shall develop a tensile strength not less than 90 percent of the specified ultimate strength of the steel furnished."

k. Subparagraph g., figure 3, page 19; figure 4, page 20; figure 5, page 21; figure 6, page 22; the note and dimension for the inside joint opening "Cement mortar required when joint opening averages greater than 3/8 inch" is deleted.

l. Subparagraph 10.c., page 25, after line 13, add the following:

"(6) Top and/or bottom of beveled end pipe."

m. Paragraph 14, page 26, right column, line 3 from top of page, change "220" to "270".

Cement for reinforced concrete pressure pipe shall meet the requirements of Federal Specification SS-C-1960/3A, for type II, portland cement, and shall meet the low-alkali

requirements and false-set limitations specified therein.

Measurement and payment for furnishing reinforced concrete pressure pipe will be made as provided in paragraph 7.1.1.

7.1.3 ASBESTOS-CEMENT PRESSURE PIPE

Asbestos-cement pressure pipe shall be manufactured and tested and data shall be submitted for approval in accordance with Bureau of Reclamation "Standard Specifications for Asbestos-Cement Pressure Pipe," dated October 15, 1971.

The following revisions are hereby made in the Standard Specifications:

a. Subparagraph 1.a., page 1, after line 4, add the following: "Shipping, receiving, handling, assembly, and disassembly of asbestos-cement pressure pipe shall conform to the 'Recommended Work Practices for Asbestos-Cement Pipe,' published by the Asbestos-Cement Pipe Producers Association or AWWA standard M16, 'Work Practices for Asbestos-Cement Pipe,' published by AWWA."

b. Subparagraph 1.b., page 1, lines 13 and 17, after the word "pipe" add the following "and couplings".

c. Subparagraph 1.b., page 1, lines 14 and 18, after the word "pipe" add the following: "or 300 couplings".

d. In the Selection Table, page 3, fourth column, line 13, change the class for symbol 8A275 from "AC25" to "AC35".

e. Subparagraphs 6.a. and 6.b., pages 6 and 7 are deleted entirely and the following subparagraphs 6.a., 6.b., and 6.c. are substituted therefor:

"a. General.—The joint assemblies shall be so formed and accurately manufactured that when the pipe units are drawn together in the trenches, the pipe shall form a continuous watertight conduit with smooth and uniform interior surface, and shall provide for slight movements of any pipe in

the pipeline due to expansion, contraction, settlement, or lateral displacement. The rubber gasket shall be the sole element of the joint depended upon to provide watertightness. The ends of the pipe shall be in planes at right angles to the longitudinal centerline of the pipe. The ends shall be finished to regular smooth surfaces.

"The coupling sleeve shall be fabricated of asbestos cement and shall be equivalent to the class of pipe for which it is to be used. The coupling sleeve shall be accurately manufactured to fit over the ends of the pipe and to compress the rubber gaskets in position between the pipe and the sleeve when assembled. The sleeve shall be centered over the joint when assembled in final position. The shape and dimensions of the joint shall be such as to provide the following minimum requirements.

"(1) The rubber gasket shall be of such size and shape as to provide an adequate compressive force against the pipe end and coupling sleeve after assembly to effect a watertight seal and shall be confined so that movement of the pipe or hydrostatic pressure cannot displace the gasket under all combinations of joint and gasket tolerances.

"(2) The gasket space provided in the engaged joint shall not be less than the volume of the gasket. The tolerances permitted in the construction of the joint shall be those stated in the pipe manufacturer's design as approved.

"(3) The surfaces of the coupling sleeve and spigot in contact with the gasket, and adjacent surfaces that may come in contact with the gasket within the full joint movement range, shall be free from airholes, chipped or spalled surfaces, laitance, or other defects.

"(4) The inside surface of the coupling sleeve adjacent to its ends shall be chamfered or flared, or the end of the spigot shall be tapered, to facilitate joining the pipe sections without damaging or displacing the gasket.

"b. Gasket criteria.—The cross-sectional configuration of the rubber gasket shall be that stated in the pipe manufacturer's design as approved.

"(1) If a rubber gasket of solid circular cross section is provided, the following requirements shall apply:

"The gasket shall be of such size that when the outer surface of the spigot and the inner surface of the coupling sleeve come into contact at some point in their periphery, the deformation in the gasket shall not exceed 50 percent of the gasket diameter at the point of contact; and at any other point in their periphery, the deformation in the gasket shall not be less than 12 percent of the gasket diameter.

"Determination of the percent of gasket deformation in an offcenter joint shall be based on the most unfavorable limits of the contractor's tolerances.

"(2) If a rubber gasket of other-than-circular cross section is provided, the shape, dimensions, and tolerances of the joint shall be such as to meet the following requirements:

"(a) Axial deflection test.—Laboratory hydrostatic pressure tests shall be made on an assembly of two sections of pipe.

"The pipes shall be properly connected in accordance with the joint design and deflection axially in the joint, as shown in figure 1, to the angular deflection values, A, given in table 7A.

"Table 7A.—*Pipe joint deflection values*

Pipe size (inches)	Angular deflection, A (degrees)
4 through 12	2.5
14 through 36	1.5
39 through 42	1.0

"No coatings, fillings, or packing, other than gasket lubricant, shall be placed in or around the joint prior to the tests. After the pipe sections are fitted together with the gaskets in place, the assembly shall withstand a minimum pressure head of 800 feet of water.

"(b) Laterally offset test.—Using a pipe and joint system as described above, the test sections shall be offset laterally within the coupling, as shown in figure 2, to the angular deflection values, A, given in table 7A. While in the offset position, the assembly shall withstand a minimum pressure head of 800 feet of water.

"(c) Eccentric loading test.—Using a pipe and joint system as described above, the coupling and spigot ends of the pipe shall be eccentrically offset as shown in figure 3. The load applied shall be great enough to result in contact between the outside of the spigots and the inside of the coupling. While in the eccentric position, the assembly shall withstand a minimum pressure head of 800 feet of water.

"(d) Vacuum test.—The assembled joint shall be subjected to an internal vacuum or an external pressure, such that the pressure differential between the inside and outside of the joint is at least 3.5 pounds per square inch, while in the deflected, offset, and eccentric positions as in subparagraphs 6b.(2)(a), (b), and (c). The pressure shall be allowed to stabilize for 30 minutes, after which the test assembly shall be sealed off for a minimum of 10 minutes. The

maximum permissible pressure increase during the sealed-off period shall be 0.1 pound per square inch.

"(e) Test results.—The tests outlined in subparagraph 6b.(2) are considered to be qualification tests to establish the adequacy of the manufacturer's joint design as approved by the contracting officer. The contractor shall, in the presence of the authorized representative of the contracting officer, perform the tests outlined in this subparagraph on one set of test specimens from each group of pipe sizes having identical joint clearance dimensions which are to be furnished under these specifications. The test specimens shall be selected to provide maximum coupling diameters and minimum spigot diameters and shall be of the maximum head class that is to be furnished under these specifications.

"The manufacturer may furnish certified copies of the test results and thereby certify that the tests outlined in this subparagraph have been performed on at least one set of test specimens from each group of pipe sizes having identical joint clearance dimensions and selected to provide maximum coupling diameters and minimum spigot diameters; however, acceptance of the manufacturer's certification does not waive the Government's right to witness these tests on any or all of the pipe sizes and head classes to be furnished, if deemed necessary by the contracting officer.

"c. Approval of joints.—Details of the joints, showing exact dimensions of the joints and detailed dimensions of the rubber gaskets, including tolerances, shall be submitted by the contractor to the contracting officer for approval on a contractor's Joint Data Form. One reproducible copy of the completed form and one copy of the pipe manufacturer's certified test results, if applicable, shall be submitted in accordance with paragraph 9. Any fabrication or procurement of

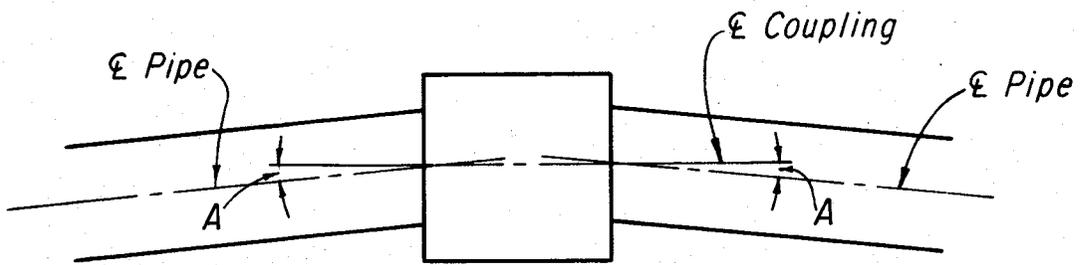


FIGURE 1. AXIALLY DEFLECTED POSITION

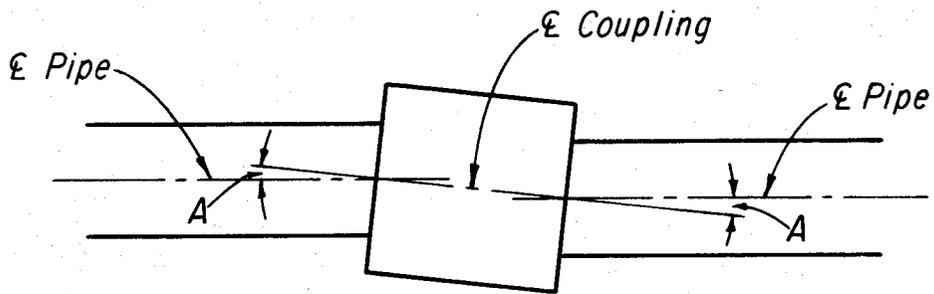


FIGURE 2. LATERALLY OFFSET POSITION

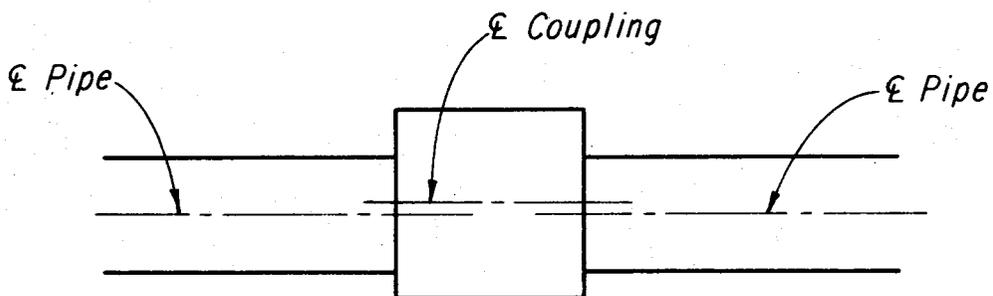


FIGURE 3. ECCENTRIC LOADING POSITION

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materials performed prior to approval of details shall be at the contractor's risk. Approval by the contracting officer of the contractor's details shall not be held to relieve the contractor of any part of the contractor's responsibility to meet all of the requirements of these specifications or of the responsibility for the correctness of the contractor's details."

f. Subparagraph "6.c.", page 7, is changed to "6.d."

g. Subparagraph 6.d., page 7, left column, line 37, delete "After Oven Aging:" and substitute therefor "After Accelerated Aging-Air Oven or Oxygen Bomb:".

h. Subparagraph 6.d., page 7, right column, line 3 from top to page, delete the "period" after the number "1869" and add the following: "and ANSI/ASTM D 572 as applicable".

i. Subparagraph 6.d., page 7, right column, after line 11, from top of page, add the following:

"If a splice is used in the manufacture of the gasket, the strength shall be such that the gasket shall withstand 100 percent elongation over the part of the gasket which includes the splice with no visible separation of the splice. While in the stretched position, the gasket shall be rotated in the spliced area a minimum of 180° in each direction in order to inspect for separation. In addition, any portion of the splice shall be capable of passing a bend test without visible separation. The bend test is defined as wrapping the portion of the gasket containing the splice a minimum of 180° and a maximum of 270° around a rod of a diameter equal to the cross-sectional dimension of the gasket. Only one splice will be allowed per gasket."

j. Subparagraph 7.a., page 7, lines 3 and 11, after the word "standard" add the following: "asbestos-cement".

k. Subparagraph 7.c., page 8, lines 12 and 14, delete the word "strength" and substitute therefor the word "load".

l. Page 9, first line, delete the word "STRENGTH" and substitute therefor the word "LOADS".

m. Subparagraph 8.a.(2), page 10, beginning in the third line, delete the expression "0.08 inch for pipe 15 inches and smaller in diameter and 0.12 inch for pipe 16 inches and larger in diameter." and substitute the following therefor: "the values given in table 7B.

Table 7B.—Allowable wall thickness tolerances at machined portions of the pipe

Pipe size (inches)	Wall thickness tolerance (inches)
4 to 12	-0.080
14 to 18	-0.120
20 to 24	-0.140
27 to 30	-0.170
33 to 36	-0.200
39 to 42	-0.230

n. Subparagraph 8.b.(2), page 10, delete the "period" after the word "manufacture" and add the following: "on pipe units only."

o. Paragraph 9, page 10, left column, line 9, after the word "Form" add the following: "and certified pipe joint test results".

p. Paragraph 9, page 10, left column, line 10, delete "6.b.," and substitute therefor "6.c.,".

q. Paragraph 9, page 10, line 12, delete "Building 67" and substitute "P O Box 25007" therefor.

r. Paragraph 9, page 10, right column, line 1, change "220" to "270".

Measurement and payment for furnishing asbestos-cement pressure pipe will be made as provided in paragraph 7.1.1.

DIVISION 8-PAINING**SECTION 8.1-PAINING****8.1.1 PAINTING, GENERAL**

a. General.—The contractor shall furnish all materials, clean surfaces, and apply the paint and protective coatings in accordance with this paragraph and paragraphs 8.1.2 and 8.1.3.

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. Cleaning and painting operations shall be conducted in such a manner that dust or other contamination will not fall on wet, newly painted surfaces, and newly painted items shall not be moved until the paint is dry through. All contractor-applied coatings exposed to view shall present a uniform texture and color-matched appearance.

Any items or surfaces damaged or contaminated by the contractor's operations shall be returned to their original condition by and at the expense of the contractor. Before topcoating any coated surfaces, the contractor shall reclean any exposed surfaces and apply paint as necessary to restore damaged or defective surfaces to the specified condition. Repair of damaged coatings on manufacturer painted equipment and materials (i.e., panelboards, enclosures, machinery, metal partitions, etc.) shall include masking, sanding, priming, and finish coating by such special methods as are necessary to restore fully the original appearance of the equipment. Painted items shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble machinery, equipment, or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting, and the necessary safety equipment for the protection

of the workmen during painting and coating operations.

b. Materials.—All pigmented paints and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer. Containers shall be labeled with the material specification number and the batch number. Colors of finish paints shall be in accordance with paragraph 8.1.3. All colors and tints shall be prepared by the manufacturer. Tinting at the jobsite will be permitted only with colors-in-oil where specified for slight contrast between coats. Except as provided below for certain small quantities of paint, materials shall be in accordance with the specifications listed below or may be in accordance with subsequent revisions thereto: Provided, That the samples or certifications are identified with the proper specifications revision.

(1) Federal Specifications.—

(a) Rubber paint for concrete surfaces at canal safety ladders.—TT-P-95C, type 1, class 2 or similar proprietary chlorinated rubber base paint recommended for continuous immersion.

(b) Mineral spirits.—TT-T-291E. Selection of type and grade shall be consistent with prevailing pollution regulations.

(c) Xylene.—TT-X-916B, grade A or B.

(2) Miscellaneous specifications.—

(a) Fusion epoxy.—Scotchkote 203 and liquid-applied repair coating Scotchkote 306, as manufactured by 3M Co., 3M Center, St. Paul MN 55101; or approved equal.

(b) Paint and coating materials required to be used on work covered by these specifications and which are not covered by this paragraph shall also be subject to sampling, testing, and certification in accordance with subparagraph c. below.

c. Sampling, testing, and certification of materials.—The Government will test and/or

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require certification of each type, batch, or color of paints or related materials prior to use or application. However, acceptance of the material under the clause of the General Provisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the jobsite.

The contractor shall furnish copies of all purchase orders for paint or related materials to the Government. Copies of purchase orders shall be furnished far enough in advance of planned use so that samples, if required, will be available to the Government to allow a testing period of at least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested and/or whether the manufacturer's certification will be required. The Government will act on certifications within 16 days after receipt of the certifications by the Government, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Water and Power Resources Service, Attn D-1521, P O Box 25007, Denver CO 80225, shipping costs prepaid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the jobsite.

If required, manufacturer's certifications for each type, batch, or color of material shall state that the material is of the same composition as material which previously has been found to comply with the specifications when completely tested. If requested, certifications shall also include the manufacturer's quality control test data. Thinners may be used on the basis of label identification as to the required material specification or manufacturer's specified product. The Government reserves the right to test any materials furnished on certification when, in the opinion of the Government, such tests are necessary. The contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

If required, samples shall consist of 1 quart of each liquid and mastic material. Included with

each sample shall be a certification that the sample is from the actual batch to be furnished.

Each sample, purchase order, and/or certification shall be identified with the material specifications, the batch and quantity represented, and the Water and Power Resources Service specifications number and schedule item numbers under which the material is to be used.

The contractor shall purchase the total quantity of each material that is expected to be used in a reasonable length of time (i.e., 1 year, or the minimum specified storage stability period of the material, whichever is shorter) to avoid repetitive purchases that would impose additional testing expense on the Government. The costs and delays from additional testing required as a result of either unnecessary small purchases or rejection of the material submitted shall be the responsibility of the contractor.

d. Preparation of surfaces.-

(1) Metalwork.-Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surfaces are painted. Cleaning solvent shall be mineral spirits or xylene. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface being cleaned. The coating shall be applied soon after preparation of the surface. If rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed. All surfaces not specifically covered herein shall be prepared by methods common to good practice for the particular surface.

All oil and grease shall be removed from steel surfaces to be painted by the use of clean solvent and clean, lint-free wiping material.

Method C.—Following the solvent cleaning, the surfaces shall be blast cleaned to base metal, using dry, hard, sharp, sand or steel grit, to produce a gray-etched surface free of all foreign substances. The blasting material shall pass a No. 16 United States Standard screen and at least 85 percent shall be retained on a No. 50 United States Standard screen. The surface shall be cleaned to equal or exceed National Association of Corrosion Engineers Standard TM-01-70, NACE No. 2.

(2) Concrete.—Surface preparation shall be in accordance with the following method. The method is indicated in the painting tabulation. Any contaminants to the paint coating, from cleaning or other sources, shall be removed before the surfaces are painted. Any necessary preparation of surfaces not covered by the following subparagraphs shall be prepared by methods common to good practice for the particular surface being prepared. The surfaces shall be kept clean until the final coat is dry. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method T (Concrete and concrete masonry).—All required repair of concrete shall be performed in accordance with paragraph 5.3.20. All protruding surface irregularities shall be removed, and joints in concrete masonry where mortar is loose or missing shall be repointed with a 1:1 (by weight) cement-sand grout. Sand used in the grout shall all pass a No. 50 screen. New concrete and concrete masonry shall be aged at least 3 weeks before application of any paint system.

Surfaces to be painted shall be cleaned until they are free of dirt, excess mortar, loose particles, and any other foreign material. Hosing with clean water may be

employed to remove dirt. Grease and oil stains shall be removed by solvent washing, followed by caustic or detergent cleaning and thorough rinsing with clear water. Wax-base curing compound shall be removed by sandblasting. Glaze, laitance, or efflorescence shall be removed and the surface etched by the application of a 10-percent water solution of hydrochloric or muriatic acid (1 part by volume concentrated hydrochloric acid to 9 parts by volume water) to the affected area. The acid-etching solution shall remain on the surface for at least 5 minutes or until the bubbling stops after which the treated surface shall be washed with freshwater and scrubbed briskly with a stiff bristle brush during the wash. Thereafter, the surface shall be rinsed thoroughly with clear water after scrubbing. In the event that one application of acid does not thoroughly prepare the surface, the process shall be repeated until the surface is properly etched. A properly etched surface will be slightly granular and free from any glaze. Unless otherwise specified, the surfaces shall be allowed to dry thoroughly before application of the paint. The surfaces shall be damp (saturated surface dry) for the first coats of all waterborne (acrylic, emulsion, cementitious, etc.) materials.

e. Application.—Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and, unless otherwise specified, free from moisture at the time of application. Items of metalwork to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80 °F) to drive off any moisture present before paint is applied. Heating, if used, shall be by a method which does not bring products of combustion into contact with surfaces being coated.

Effective means shall be provided for removing free oil and moisture from the air supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently close to the surfaces being painted to avoid excessive evaporation of the volatile constituents and loss of material into the air, or the bridging

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over of crevices and corners. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the substrate or previous coat. Each coat shall be free from runs, pinholes, sags, laps, brush marks, voids, and other defects. Each coat shall be allowed to dry or to harden before the succeeding coat is applied.

The thickness on steel surfaces shall be measured by approved gages and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on specified coverages, or on the specified total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not exceeding 100 °F. Paint shall not be applied when the temperature of the item to be painted or of the surrounding air is under 45 °F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to a smooth uniform coating.

Thinning of paints to facilitate satisfactory application shall be kept to a minimum but in no event shall it exceed 1 pint per gallon of paint, except as otherwise specified; only thinner approved for the type of paint shall be used.

Tinting, where required for color contrast, shall be accomplished by using not more than 3 ounces of tinting color per gallon of paint.

Methods of preparing and applying paints and coatings not included in these specifications shall be in accordance with the manufacturer's instructions and the general requirements of these specifications.

Application of specific materials shall be as follows:

(1) Fusion epoxy.—The fusion epoxy coating shall be applied to sandblasted surfaces, to the specified minimum dry-film thickness, in accordance with the manufacturer's recommended procedures and standards, except as otherwise specified herein. Weld spatter, slag burrs, and other objectionable surface irregularities shall be removed, and sharp corners and edges rounded to a 1/8-inch radius. The fusion-applied coating shall be applied by the fluidized bed process, and redipping will not be permitted.

The repair coating shall be applied in accordance with the manufacturer's instructions and to the thickness specified for the fusion-applied coating. The repair coating shall be used for repair of small defective or damaged areas, but not for coating weld areas or correcting deficient thickness of the fusion-applied coating. Exposed metal to receive the repair coating shall be reblasted, and coated surfaces requiring repair shall be roughened by sanding or light blasting prior to repair.

The applicator of the coating shall provide the equipment and inspect the coating and lining for pinholes, using a dry detector set at about 125 volts per mil of actual coating thickness or a 67-volt wet sponge detector, and shall repair the pinholes. Manufacturer's standards for coating cure and other properties shall apply.

The manufacturer of a coating proposed as equal shall furnish to the contracting officer satisfactory data regarding surface preparation, coating composition, performance record, and an effective repair

All oil and grease shall be removed from steel surfaces to be painted by the use of clean solvent and clean, lint-free wiping material.

Method C.—Following the solvent cleaning, the surfaces shall be blast cleaned to base metal, using dry, hard, sharp, sand or steel grit, to produce a gray-etched surface free of all foreign substances. The blasting material shall pass a No. 16 United States Standard screen and at least 85 percent shall be retained on a No. 50 United States Standard screen. The surface shall be cleaned to equal or exceed National Association of Corrosion Engineers Standard TM-01-70, NACE No. 2.

(2) Concrete.—Surface preparation shall be in accordance with the following method. The method is indicated in the painting tabulation. Any contaminants to the paint coating, from cleaning or other sources, shall be removed before the surfaces are painted. Any necessary preparation of surfaces not covered by the following subparagraphs shall be prepared by methods common to good practice for the particular surface being prepared. The surfaces shall be kept clean until the final coat is dry. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method T (Concrete and concrete masonry).—All required repair of concrete shall be performed in accordance with paragraph 5.3.20. All protruding surface irregularities shall be removed, and joints in concrete masonry where mortar is loose or missing shall be repointed with a 1:1 (by weight) cement-sand grout. Sand used in the grout shall all pass a No. 50 screen. New concrete and concrete masonry shall be aged at least 3 weeks before application of any paint system.

Surfaces to be painted shall be cleaned until they are free of dirt, excess mortar, loose particles, and any other foreign material. Hosing with clean water may be

employed to remove dirt. Grease and oil stains shall be removed by solvent washing, followed by caustic or detergent cleaning and thorough rinsing with clear water. Wax-base curing compound shall be removed by sandblasting. Glaze, laitance, or efflorescence shall be removed and the surface etched by the application of a 10-percent water solution of hydrochloric or muriatic acid (1 part by volume concentrated hydrochloric acid to 9 parts by volume water) to the affected area. The acid-etching solution shall remain on the surface for at least 5 minutes or until the bubbling stops after which the treated surface shall be washed with freshwater and scrubbed briskly with a stiff bristle brush during the wash. Thereafter, the surface shall be rinsed thoroughly with clear water after scrubbing. In the event that one application of acid does not thoroughly prepare the surface, the process shall be repeated until the surface is properly etched. A properly etched surface will be slightly granular and free from any glaze. Unless otherwise specified, the surfaces shall be allowed to dry thoroughly before application of the paint. The surfaces shall be damp (saturated surface dry) for the first coats of all waterborne (acrylic, emulsion, cementitious, etc.) materials.

e. Application.—Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and, unless otherwise specified, free from moisture at the time of application. Items of metalwork to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80 °F) to drive off any moisture present before paint is applied. Heating, if used, shall be by a method which does not bring products of combustion into contact with surfaces being coated.

Effective means shall be provided for removing free oil and moisture from the air supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently close to the surfaces being painted to avoid excessive evaporation of the volatile constituents and loss of material into the air, or the bridging

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over of crevices and corners. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the substrate or previous coat. Each coat shall be free from runs, pinholes, sags, laps, brush marks, voids, and other defects. Each coat shall be allowed to dry or to harden before the succeeding coat is applied.

The thickness on steel surfaces shall be measured by approved gages and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on specified coverages, or on the specified total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not exceeding 100 °F. Paint shall not be applied when the temperature of the item to be painted or of the surrounding air is under 45 °F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to a smooth uniform coating.

Thinning of paints to facilitate satisfactory application shall be kept to a minimum but in no event shall it exceed 1 pint per gallon of paint, except as otherwise specified; only thinner approved for the type of paint shall be used.

Tinting, where required for color contrast, shall be accomplished by using not more than 3 ounces of tinting color per gallon of paint.

Methods of preparing and applying paints and coatings not included in these specifications shall be in accordance with the manufacturer's instructions and the general requirements of these specifications.

Application of specific materials shall be as follows:

(1) Fusion epoxy.—The fusion epoxy coating shall be applied to sandblasted surfaces, to the specified minimum dry-film thickness, in accordance with the manufacturer's recommended procedures and standards, except as otherwise specified herein. Weld spatter, slag burrs, and other objectionable surface irregularities shall be removed, and sharp corners and edges rounded to a 1/8-inch radius. The fusion-applied coating shall be applied by the fluidized bed process, and redipping will not be permitted.

The repair coating shall be applied in accordance with the manufacturer's instructions and to the thickness specified for the fusion-applied coating. The repair coating shall be used for repair of small defective or damaged areas, but not for coating weld areas or correcting deficient thickness of the fusion-applied coating. Exposed metal to receive the repair coating shall be reblasted, and coated surfaces requiring repair shall be roughened by sanding or light blasting prior to repair.

The applicator of the coating shall provide the equipment and inspect the coating and lining for pinholes, using a dry detector set at about 125 volts per mil of actual coating thickness or a 67-volt wet sponge detector, and shall repair the pinholes. Manufacturer's standards for coating cure and other properties shall apply.

The manufacturer of a coating proposed as equal shall furnish to the contracting officer satisfactory data regarding surface preparation, coating composition, performance record, and an effective repair

coating and procedure for repairing damaged areas.

(2) Rubber paint.—Rubber paint for concrete surfaces at canal safety ladder shall be applied in two heavy coats at a maximum coverage of 350 square feet per gallon in accordance with the manufacturer's recommendations.

f. Costs.—The cost of furnishing, preparing, and applying all materials for the cleaning, paint repairing, painting, or coating operations, and of furnishing and submitting purchase orders, certifications, and samples of materials shall be included in the applicable prices bid in the schedule for furnishing and installing or for constructing the items to be painted.

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8.1.2 PAINTING TABULATION

a. General.—Contractor-furnished items shall receive the cleaning, painting, and coating systems shown in the tabulation below. Paint and coatings shall be applied as required under paragraph 8.1.1.

Finish coats of paint shall be of the color and gloss specified in paragraph 8.1.3.

b. Metalwork.—

Tabulation	Item	Surface preparation method	Paint or coating material	Number of coats
1	Carbon steel or aluminum canal safety ladders.	C	Fusion epoxy.	1 (Thickness range: 12-30 mils.)
2	Nonferrous metalwork and galvanized metalwork.		Painting is not required unless specifically listed elsewhere in this tabulation.	

c. Concrete.—

Tabulation	Item	Surface preparation method	Paint or coating material	Number of coats
1	Concrete surfaces at canal safety ladders.	T	Rubber paint. (Color as shown in color schedule.)	2

8.1.3 COLOR SCHEDULE FOR PAINTING

The color and gloss of finish coats of paint shall be in accordance with the schedule below. The numbers in the "Color Number" column of the schedule refer to the Munsell system of color notation as referenced in the "Munsell Book of Color," 1976, published by Macbeth Division of Kollmorgen Corp., Baltimore, MD 21218.

If an item is required to be painted but is not listed in the color schedule, the color or colors to be used will be selected by the contracting officer from the colors listed in the schedule.

It shall be the contractor's responsibility to insure that a true match of color and gloss is obtained for all painted surfaces of items required by these specifications to have the same color and gloss.

Gloss abbreviations:

SG—Semigloss

No.	Item surface	Color	Color number	Gloss
1	Concrete surfaces at safety ladders.	Yellow	2.5Y8/14	SG

DIVISION 9-DRAWINGS**SECTION 9.1-DRAWINGS**

9.1.1 DRAWINGS, GENERAL

a. General.—Some of the drawings included herein show details of fabrication, and other details and specifications not a part of work required under these specifications. Specifications and details shown on these drawings which are not applicable under these specifications shall be disregarded. Reference drawings referred to on specifications drawings, and not included herein, are not considered necessary for bidding purposes but will be furnished to the contractor, where necessary, for construction purposes. Where details shown on standard drawings 40-D-, 103-D-, and 104-D- series differ from those shown on other drawings or the requirements of these specifications, the details shown on other drawings or the requirements of these specifications shall govern. In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings.—Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor shall do no work without proper drawings and instructions. The contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings.—The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work. Full-size contact prints of the original drawings from which the attached reproductions were made, other than standard drawings 40-D-, 103-D-, and 104-D- series, will be furnished to the contractor for construction purposes

upon request. Additional roto prints of the standard drawings 40-D-, 103-D-, and 104-D- series will be furnished upon request. The number of prints of each drawing furnished to the contractor will be limited to 10 contact prints and 1 reproducible.

d. Overprinted drawings.—Some of the drawings included herein have been overprinted in red to show geologic information. These drawings are marked with a red "A" following the number to distinguish them from drawings having the same number without the overprint. Full-size prints of these drawings are available only without the overprint. No full-size prints of drawing 59 (344-D-7156A) are available with or without the overprint.

e. Mailing address.—All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Water and Power Resources Service, Arizona Projects Office, Valley Center, Suite 2200, 201 North Central Avenue, Phoenix AZ 85073.

9.1.2 LIST OF DRAWINGS

The following drawings are made a part of these specifications:

**Central Arizona Project
Salt-Gila Division—Arizona
Salt-Gila Aqueduct
Reach 1A**

General:

1. 344-D-7159—General Map.
2. 344-D-7160—Location Map.
3. 344-D-7161—Typical Sections.
4. 344-D-7162—Granite Reef Aqueduct—Reach 12 Completion—Sta. 787+27.21 To Sta. 821+18.17—Typical Sections.
5. 344-D-7163—Contraction Joints For Unreinforced Concrete Lining.
6. 344-D-5069—Hydrographs—Sheet 1 Of 2.
7. 344-D-5070—Hydrographs—Sheet 2 Of 2.

Par. 9.1.2

Plan and profile:

8. 344-D-7165A-Granite Reef Aqueduct-Reach 12 Completion-Sta. 787+27.21 To Sta. 821+18.17.
9. 344-D-7166A-Sta. 832+25 To Sta. 833+64.79 Bk.=Sta. 14+95.07 AH. To Sta. 60+00-Sheet 1 Of 7.
10. 344-D-7167A-Sta. 60+00 To Sta. 110+00-Sheet 2 Of 7.
11. 344-D-7168A-Sta. 110+00 To Sta. 160+00-Sheet 3 Of 7.
12. 344-D-7169A-Sta. 160+00 To Sta. 210+00-Sheet 4 Of 7.
13. 344-D-7170A-Sta. 210+00 To Sta. 260+00-Sheet 5 Of 7.
14. 344-D-7171A-Sta. 260+00 To Sta. 310+00-Sheet 6 Of 7.
15. 344-D-7172A-Sta. 310+00 To Sta. 331+00-Sheet 7 Of 7.

Roadwork:

16. 344-D-7173A-Reach 12 Completion-Bush Highway-Bridge Approaches At Canal Sta. 875+66.37-Plan And Profile.
17. 344-D-7174A-Thomas Road-Bridge Approaches At Canal Sta. 94+68.97-Plan And Profile.
18. 344-D-7175A-McDowell Road-Bridge Approaches At Canal Sta. 148+39.35-Plan And Profile.
19. 344-D-7176A-McKellips Road-Bridge Approaches At Canal Sta. 209+60.39-Plan And Profile.
20. 344-D-7177A-Brown Road-Bridge Approaches At Canal Sta. 286+21.13-Plan And Profile.

Bridges:

21. 344-D-7178-Granite Reef Aqueduct-Reach 12 Completion-Sta. 815+66.37-Bush Highway Bridge-Plan And Elevation-Sheet 1 Of 4.
22. 344-D-7179-Granite Reef Aqueduct-Reach 12 Completion-Sta. 815+66.37-Bush Highway Bridge-Plan, Sections And Elevations-Sheet 2 Of 4.

23. 344-D-7180-Granite Reef Aqueduct-Reach 12 Completion-Sta. 815+66.37-Bush Highway Bridge-Section And Details-Sheet 3 Of 4.
24. 344-D-7181-Granite Reef Aqueduct-Reach 12 Completion-Sta. 815+66.37-Bush Highway Bridge-Plan, Sections And Elevations-Sheet 4 Of 4.
25. 344-D-7183-Sta. 94+68.97-Thomas Road Bridge-Plans, Elevation, And Section-Sheet 1 Of 3.
26. 344-D-7184-Sta. 94+68.97-Thomas Road Bridge-Plan, Section, And Elevations-Sheet 2 Of 3.
27. 344-D-7185-Sta. 94+68.97-Thomas Road Bridge-Plan And Sections-Sheet 3 Of 3.
28. 344-D-7186-Sta. 94+68.97, Sta. 148+39.35, Sta. 209+60.39 And Sta. 286+18.39-Bridge Details.
29. 344-D-7187-Sta. 148+39.35-McDowell Road Bridge-Plans, Section And Elevation-Sheet 1 Of 4.
30. 344-D-7188-Sta. 148+39.35-McDowell Road Bridge-Plan, Sections, And Details-Sheet 2 Of 4.
31. 344-D-7189-Sta. 148+39.35-McDowell Road Bridge-Plan, Section, Elevation And Details-Sheet 3 Of 4.
32. 344-D-7190-Sta. 148+39.35-McDowell Road Bridge-Plan, Section, Elevation-Sheet 4 Of 4.
33. 344-D-7191-Sta. 209+60.39-McKellips Road Bridge-Plans And Elevations-Sheet 1 Of 4.
34. 344-D-7192-Sta. 209+60.39-McKellips Road Bridge-Plan, Sections And Detail-Sheet 2 Of 4.
35. 344-D-7193-Sta. 209+60.39-McKellips Road Bridge-Plan, Sections, And Elevation-Sheet 3 Of 4.

36. 344-D-7194—Sta. 209+60.39—McKellips Road Bridge—Plan, Section, And Elevation—Sheet 4 Of 4.
37. 344-D-7195—Sta. 286+21.13—Brown Road Bridge—Plan And Elevation—Sheet 1 Of 6.
38. 344-D-7196—Sta. 286+21.13—Brown Road Bridge—Plans, Sections And Details—Sheet 2 Of 6.
39. 344-D-7197—Sta. 286+21.13—Brown Road Bridge—Plan, Section, Details And Elevation—Sheet 3 Of 6.
40. 344-D-7198—Sta. 286+21.13—Brown Road Bridge—Plan Sections, Details, And Elevation—Sheet 4 Of 6.
41. 344-D-7199—Sta. 286+21.13—Brown Road Bridge—Plan, Section, Details And Elevation—Sheet 5 Of 6.
42. 344-D-7200—Sta. 286+21.13—Brown Road Bridge—Section And Details—Sheet 6 Of 6.
43. 344-D-7201—Precast Prestressed Concrete Beams—AASHTO Type IV.
44. 344-D-7202—Precast Prestressed Concrete Beams—AASHTO Type VI.
45. 344-D-7203—Beam-Type Guardrail—Details—Sheet 1 Of 2.
46. 344-D-7204—Beam-Type Guardrail—Details—Sheet 2 Of 2.
47. 344-D-7205—Equestrian And Pedestrian Fencing—Elevation, Sections, And Details.

Structures:

48. 344-D-7206—Station 300+00—Overchute Pier.
49. 344-D-7157—Granite Reef Aqueduct—Reach 12 Completion—Reinforced Lining Modification At Salt River Siphon Outlet.
50. 344-D-7158—Granite Reef Aqueduct—Reach 12 Completion—Flow Wells—Plan, Sections, And Detail.

Standard Drawings

51. 40-D-7006—General Concrete Outline Notes.

52. 40-D-6263—General Notes And Minimum Requirements For Detailing Reinforcement.
53. 40-D-6376—Canal Right-Of-Way Fencing—Grounding Installation.
54. 40-D-2867—Rubber Waterstops—Types "A", "B", "G", And "H".
55. 40-D-6460—Safety Ladder For Concrete Lined Canals.
56. 40-D-6268—School And Urban Safety Fencing.
57. 104-D-252—Termination Of Metal Conduit At Horizontal Surfaces.

Geology

58. 103-D-347—Unified Soil Classification.
59. 344-D-7156A—General Geologic Legend, Explanation And Notes.
60. 344-D-7377A—Location Of Exploration And Surface Geology.
61. 344-D-7222—Salt River Borrow Source—Plan Of Exploration.
62. 344-D-7219—Queen Creek Area—Aggregate Source.

(Also see drawings 8 (344-D-7165A) through 20 (344-D-7177A) which are overprinted in red with geologic information.)

Drill hole logs:

63. DH-202-SGP DL.
64. DH-101-SG1.
65. DH-102-SG1.
66. DH-103-SG1.
67. DH-104-SG1.
68. DH-105-SG1.
69. DH-106-SG1.
70. DH-107-SG1.
71. DH-108-SG1.
72. DH-109-SG1.
73. DH-110-SG1.
74. DH-111-SG1.
75. DH-112-SG1 (page 1 of 2).
76. DH-112-SG1 (page 2 of 2).
77. PR-DH-113-SG1 (page 1 of 2).
78. PR-DH-113-SG1 (page 2 of 2).
79. PR-DH-114-SG1.
80. PR-DH-115-SG1 (page 1 of 2).
81. PR-DH-115-SG1 (page 2 of 2).
82. DH-122-GR12.

Par. 9.1.2

- 83. DH-123-GR12.
- 84. DH-124-GR12.
- 85. DH-125-GR12.
- 86. DH-126-GR12.
- 87. DH 151-GR12 (page 1 of 2).
- 88. DH 151-GR12 (page 2 of 2).

Auger hole logs:

- 89. AP-99-SG1.
- 90. AP-100-SG1.
- 91. AP-101-SG1.
- 92. AP-102-SG1.
- 93. AP-103-SG1.
- 94. AP-104-SG1.
- 95. AP-105-SG1.
- 96. AP-106-SG1.
- 97. AP-107-SG1.
- 98. AP-108-SG1.
- 99. AP-109-SG1.
- 100. AP-110-SG1.
- 101. AP-111-SG1.
- 102. AP-112-SG1.
- 103. AP-113-SG1.
- 104. AP-1-SGC.
- 105. AP-2-SGC.

Test pit logs:

- 106. TP-1-SG1.
- 107. TP-2-SG1.
- 108. TP-3-SG1.
- 109. TP-4-SG1.
- 110. TP-15-SG1.
- 111. TP-16-SG1.
- 112. TP-17-SG1.
- 113. TP-18-SG1.
- 114. TP-19-SG1.
- 115. TP-20-SG1.
- 116. TP-21-SG1.
- 117. TP-22-SG1.
- 118. TP-23-SG1.

Summary of physical properties test results (Proctor Compaction):

- 119. Table 1-SG1A.
- 120. Table 2-SG1A.
- 121. Table 3-SG1A (sheet 1 of 2).
- 122. Table 3-SG1A (sheet 2 of 2).

Summary of permeability test results:

- 123. Table 4-SG1A.

124. Table 5-SG1A.

Photographs:

- 125. CN344-330-7243NA.
- 126. CN344-330-7244NA.
- 127. CN344-330-7245NA.
- 128. CN344-330-7246NA.
- 129. CN344-330-7247NA.
- 130. CN344-330-7248NA.
- 131. CN344-330-4268NA.
- 132. CN344-330-4267NA.
- 133. CN344-330-4270NA.
- 134. CN344-330-4269NA.
- 135. CN344-330-4271NA.

Reach 3, Queen Creek aggregate:

Test pit logs:

- 136. TP-201 MSG3.
- 137. TP-202 MSG3.
- 138. TP-203 MSG3.
- 139. TP-204 MSG3 (sheet 1 of 2).
- 140. TP-204 MSG3 (sheet 2 of 2).
- 141. TP-205 MSG3.
- 142. TP-206 MSG3.
- 143. TP-207 MSG3 (sheet 1 of 2).
- 144. TP-207 MSG3 (sheet 2 of 2).
- 145. TP-208 MSG3 (sheet 1 of 2).
- 146. TP-208 MSG3 (sheet 2 of 2).
- 147. TP-209 MSG3 (sheet 1 of 2).
- 148. TP-209 MSG3 (sheet 2 of 2).
- 149. TP-210 MSG3.
- 150. TP-211 MSG3 (sheet 1 of 2).
- 151. TP-211 MSG3 (sheet 2 of 2).
- 152. TP-212 MSG3 (sheet 1 of 2).
- 153. TP-212 MSG3 (sheet 2 of 2).
- 154. TP-213 MSG3.
- 155. TP-214 MSG3 (sheet 1 of 2).
- 156. TP-214 MSG3 (sheet 2 of 2).
- 157. TP-215 MSG3.
- 158. TP-216 MSG3.
- 159. TP-217 MSG3 (sheet 1 of 2).
- 160. TP-217 MSG3 (sheet 2 of 2).
- 161. TP-218 MSG3 (sheet 1 of 2).
- 162. TP-218 MSG3 (sheet 2 of 2).
- 163. TP-219 MSG3 (sheet 1 of 2).
- 164. TP-219 MSG3 (sheet 2 of 2).
- 165. TP-220 MSG3 (sheet 1 of 2).
- 166. TP-220 MSG3 (sheet 2 of 2).
- 167. TP-221 MSG3.

Summary of physical properties test results (Proctor Compaction):

- 168. Table 2-MSG3 (sheet 1 of 5).
- 169. Table 2-MSG3 (sheet 2 of 5).
- 170. Table 2-MSG3 (sheet 3 of 5).
- 171. Table 2-MSG3 (sheet 4 of 5).
- 172. Table 2-MSG3 (sheet 5 of 5).

Aggregate quality evaluation:

- 173. Aggregate quality evaluation.

Petrographic examination of coarse aggregate:

- 174. Table 1 (sheet 1 of 2).
- 175. Table 1 (sheet 2 of 2).

Summary of quality of coarse aggregate:

- 176. Table 2.

Petrographic examination of coarse sand:

- 177. Table 3.

Photograph:

- 178. CN344-330-4418.

Salt River borrow source:

Auger hole logs:

- 179. AP-23-MSR.
- 180. AP-30-MSR.
- 181. AP-35-MSR.

Salt River borrow and aggregate source:

Test pit logs:

- 182. PIT-61-MSR (shovel pit).
- 183. TP-101-MSR.
- 184. TP-102-MSR (1 of 2).
- 185. TP-102-MSR (2 of 2).
- 186. TP-103-MSR.
- 187. TP-104-MSR.
- 188. TP-105-MSR.
- 189. TP-106-MSR.
- 190. TP-107-MSR.

- 191. TP-108-MSR.
- 192. TP-109-MSR (sheet 1 of 2).
- 193. TP-109-MSR (sheet 2 of 2).
- 194. TP-110-MSR.
- 195. TP-111-MSR.
- 196. TP-112-MSR.
- 197. TP-113-MSR.
- 198. TP-114-MSR.
- 199. TP-115-MSR.
- 200. TP-116-MSR.
- 201. TP-117-MSR.
- 202. TP-118-MSR.
- 203. TP-119-MSR.
- 204. TP-120-MSR.
- 205. TP-121-MSR.

Summary of physical properties test results (Proctor compaction):

- 206. Table 1-MSR (sheet 1 of 2).
- 207. Table 1-MSR (sheet 2 of 2).

9.1.3 DRAWING NUMBERS IN NUMERICAL ORDER

Drawing	Sheet No.
344-D-	
344-D-5069	6
344-D-5070	7
344-D-7156A	59
344-D-7157	49
344-D-7158	50
344-D-7159	1
344-D-7160	2
344-D-7161	3
344-D-7162	4
344-D-7163	5
344-D-7165A	8
344-D-7166A	9
344-D-7167A	10
344-D-7168A	11
344-D-7169A	12
344-D-7170A	13
344-D-7171A	14
344-D-7172A	15
344-D-7173A	16
344-D-7174A	17
344-D-7175A	18
344-D-7176A	19
344-D-7177A	20
344-D-7178	21
344-D-7179	22
344-D-7180	23

Par. 9.1.3

Drawing	Sheet No.
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344-D- (Continued)

344-D-7181	24
344-D-7183	25
344-D-7184	26
344-D-7185	27
344-D-7186	28
344-D-7187	29
344-D-7188	30
344-D-7189	31
344-D-7190	32
344-D-7191	33
344-D-7192	34
344-D-7193	35
344-D-7194	36
344-D-7195	37
344-D-7196	38
344-D-7197	39
344-D-7198	40
344-D-7199	41
344-D-7200	42
344-D-7201	43
344-D-7202	44
344-D-7203	45
344-D-7204	46
344-D-7205	47
344-D-7206	48
344-D-7219	62
344-D-7222	61
344-D-7377A	60

Standard Drawings

40-D-

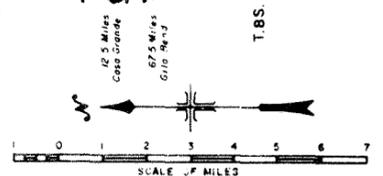
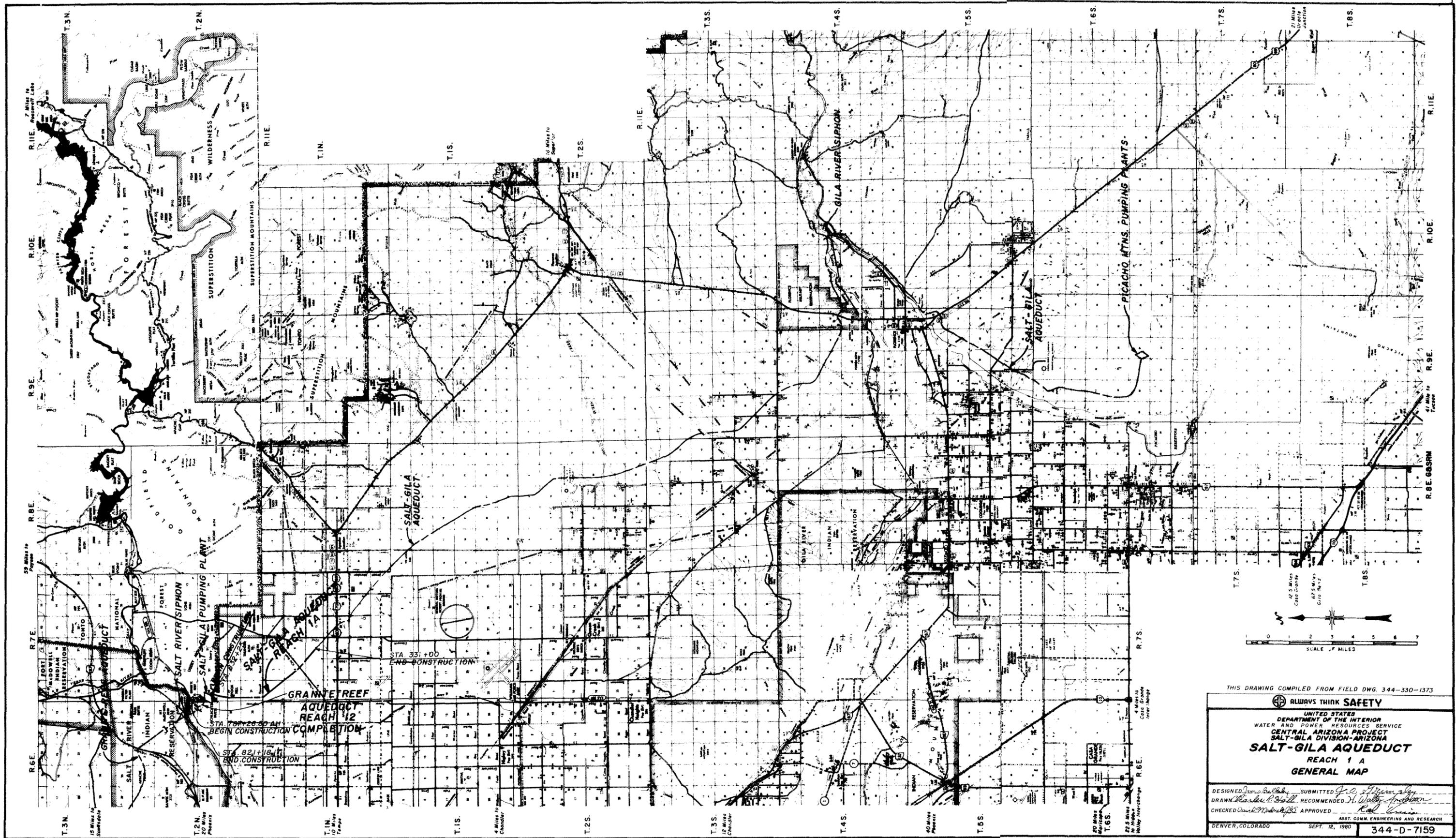
40-D-2867	54
40-D-6263	52
40-D-6268	56
40-D-6376	53
40-D-6460	55
40-D-7006	51

103-D-

103-D-347	58
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104-D-

104-D-252	57
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THIS DRAWING COMPILED FROM FIELD DWG. 344-330-1373

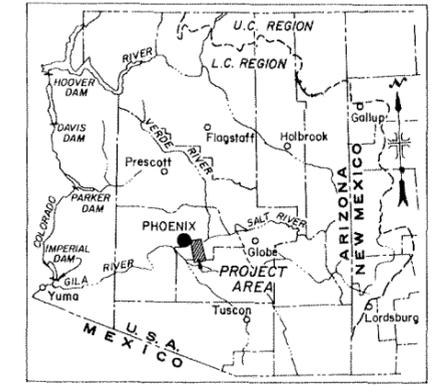
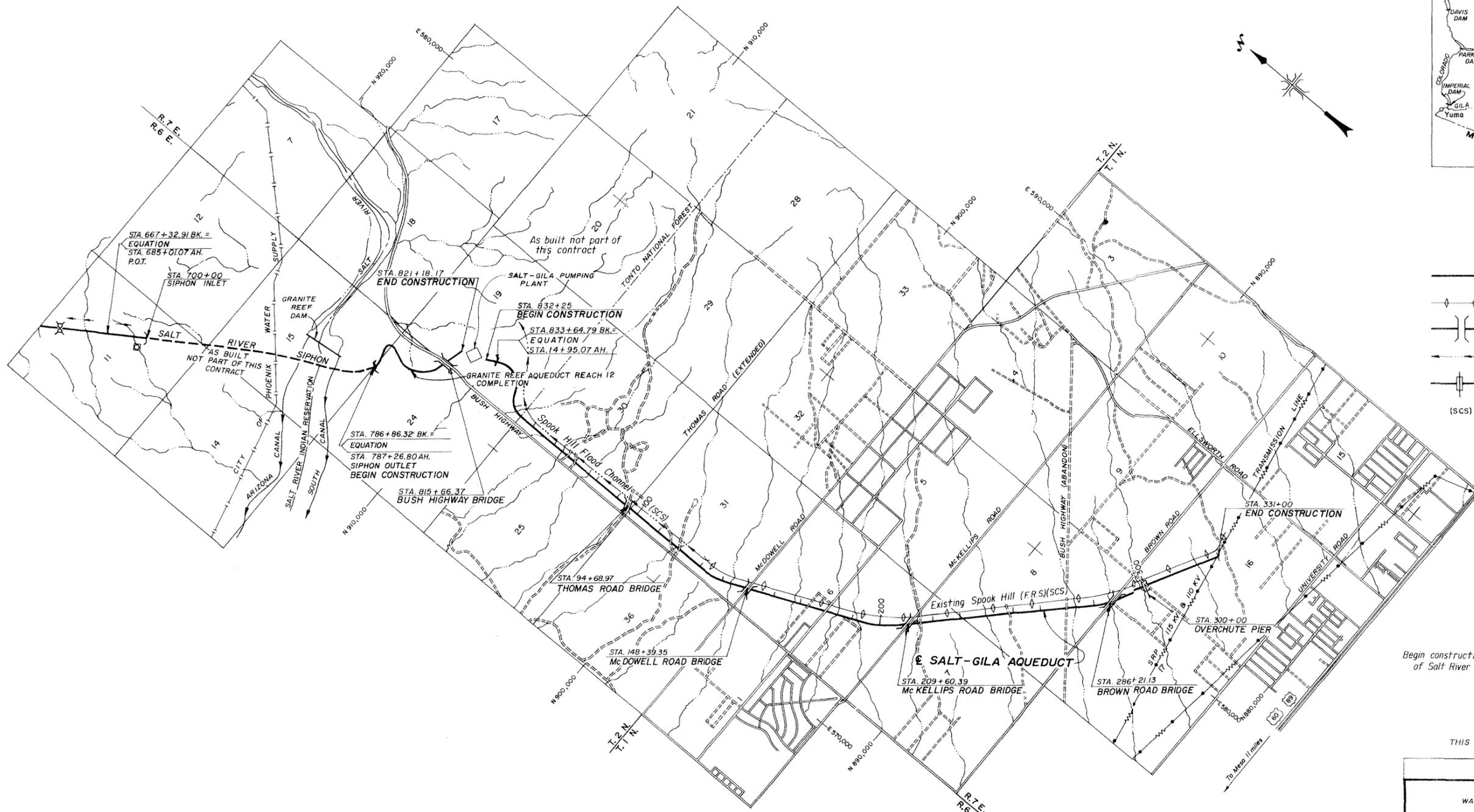
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

**SALT-GILA AQUEDUCT
REACH 1 A
GENERAL MAP**

DESIGNED *James B. Kelly* SUBMITTED *J. C. Sturges*
DRAWN *Charles R. Ball* RECOMMENDED *H. Walter Anderson*
CHECKED *Charles P. Moore* APPROVED *Ed. Lewis*

ASST. COMM. ENGINEERING AND RESEARCH
DENVER, COLORADO SEPT. 12, 1960 344-D-7159



KEY MAP

EXPLANATION

- SALT-GILA AQUEDUCT
- FLOOD AND RETARDING STRUCTURE (FRS)
- BRIDGE
- FLOODWAY
- OVERCHUTE PIER
- U.S. SOIL CONSERVATION SERVICE (SCS)

NOTE
 Begin construction of station 787+27.21 AH. to include modification of Salt River Siphon outlet as shown on 344-D-715B.

THIS DRAWING COMPILED FROM 344-330-803.

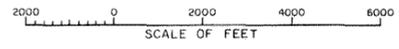
ALWAYS THINK SAFETY

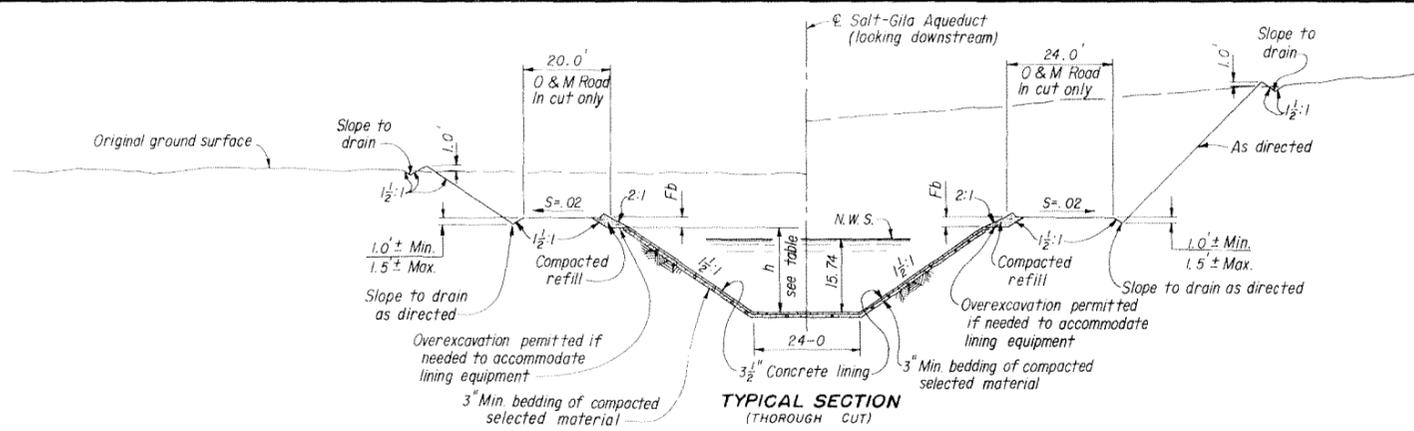
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION - ARIZONA

SALT-GILA AQUEDUCT
 REACH 1A
 LOCATION MAP

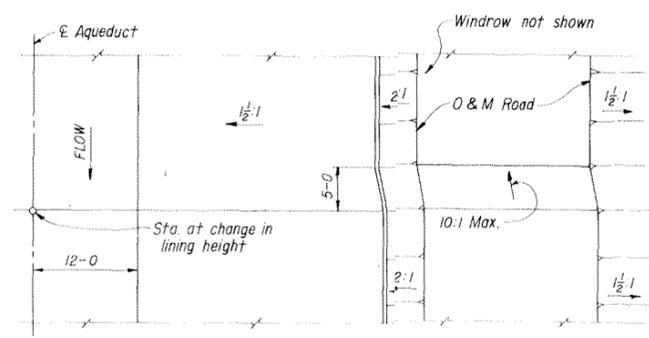
DESIGNED: *James D. ...* SUBMITTED: *S. O. ...*
 DRAWN: *Mark L. ...* RECOMMENDED: *W. ...*
 CHECKED: *...* APPROVED: *...*

ASST. COMM. ENGINEERING AND RESEARCH
 DENVER, COLORADO SEPT. 11, 1980 **344-D-7160**





TYPICAL SECTION (THOROUGH CUT)



TYPICAL PLAN-LINING TRANSITION

LINING HEIGHT TABLE

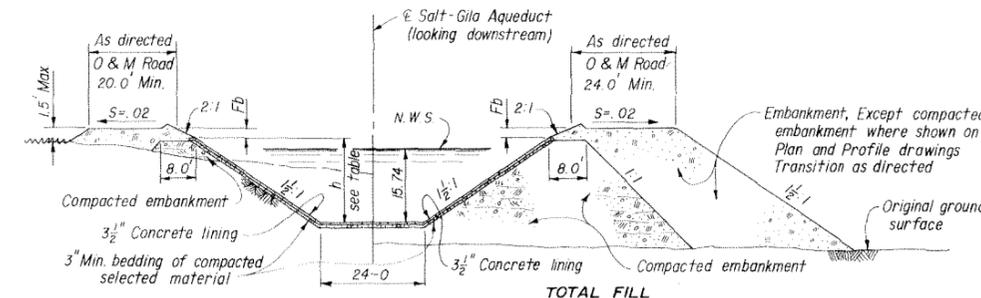
STATION TO STATION	Fb	h
832+25 to 55+00	2.16	17.9
55+00 to 320+00	7.1	17.9
320+00 to 325+50	6.6	18.3
325+50 to 331+00	7.7	18.3

HYDRAULIC PROPERTIES

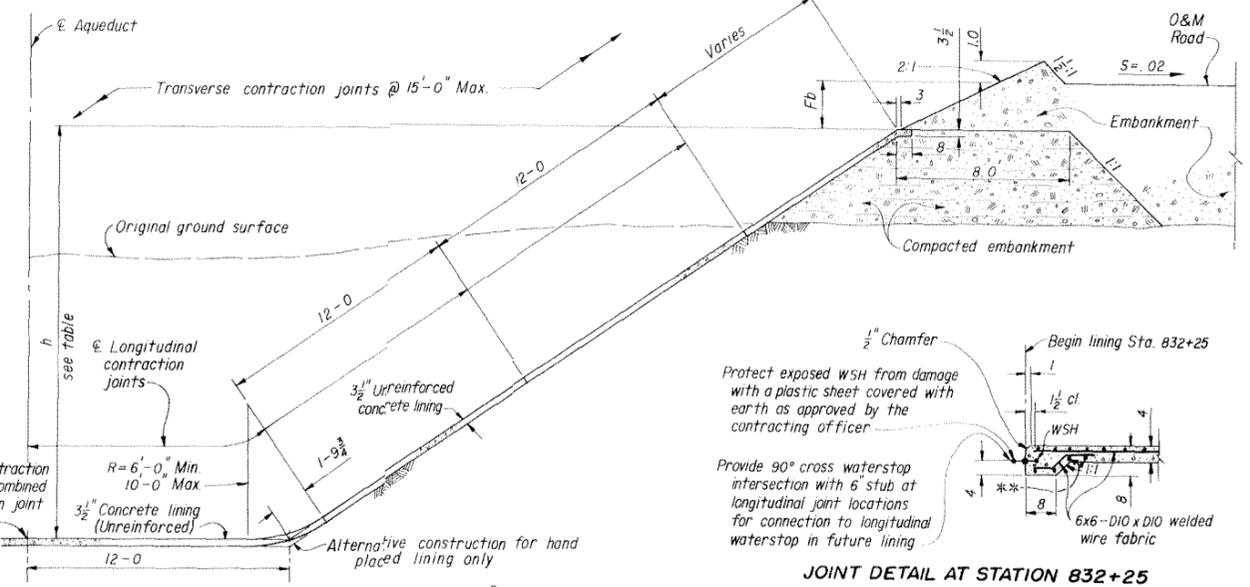
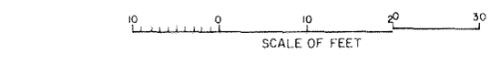
A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74

REINFORCED CONCRETE LINING

STA. 832 + 25	to	STA. 20+00
STA. 93 + 44	to	STA. 95 + 94
STA. 126 + 12	to	STA. 129 + 12
STA. 147 + 00	to	STA. 149 + 75
STA. 208 + 10	to	STA. 211 + 10
STA. 284 + 45	to	STA. 286 + 95

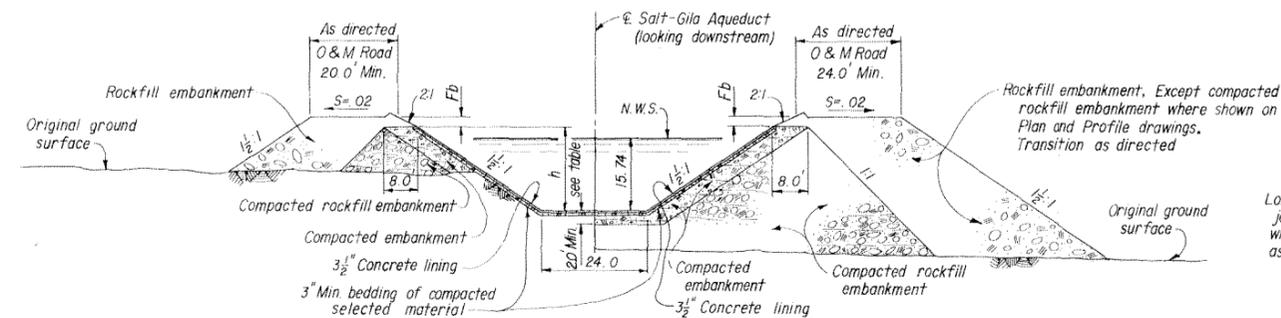


TYPICAL SECTION (EARTH FILL)

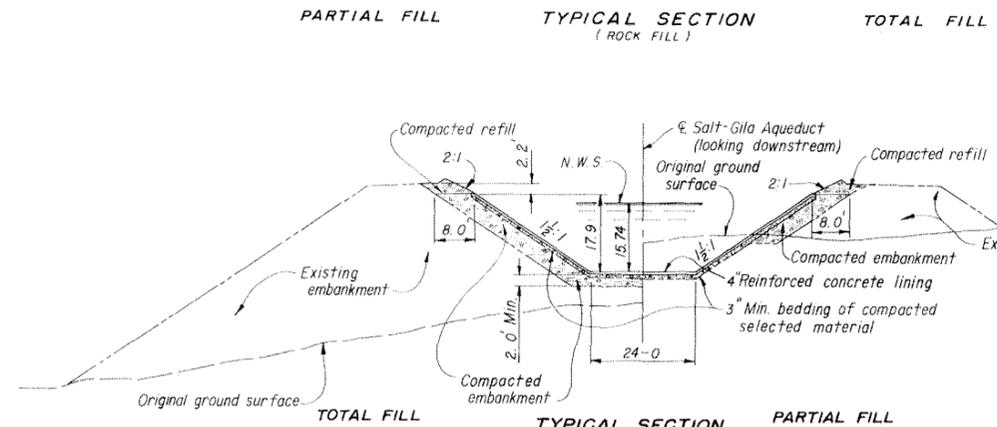


BANK AND LINING DETAILS (UNREINFORCED CONCRETE LINING SHOWN)

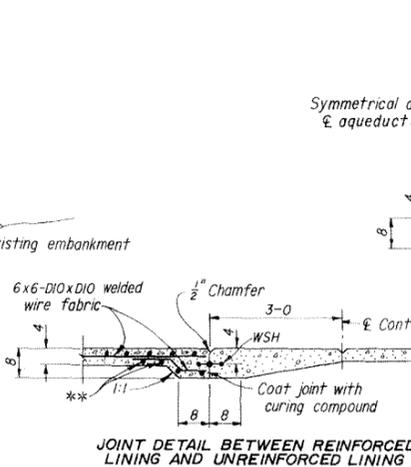
JOINT DETAIL AT STATION 832+25



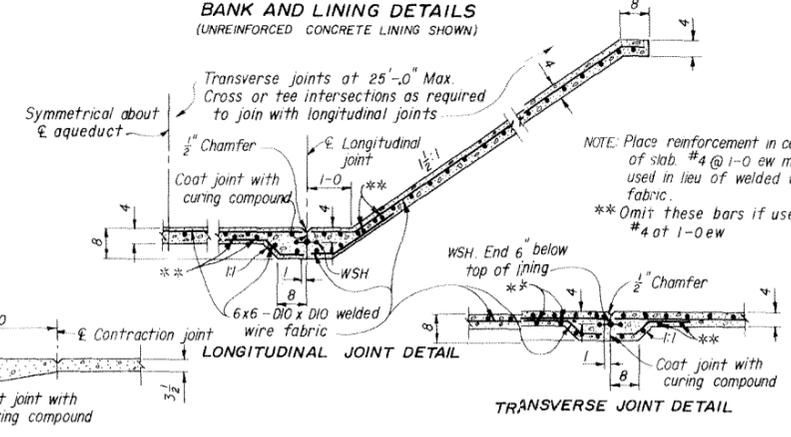
TYPICAL SECTION (ROCK FILL)



TYPICAL SECTION (PARTIAL FILL)



JOINT DETAIL BETWEEN REINFORCED LINING AND UNREINFORCED LINING



REINFORCED CONCRETE LINING DETAILS

NOTES
 Transverse contraction joints around curves to be on radial lines @ 15'-0" centers, spaced along & aqueduct.
 For details of contraction joints, for unreinforced lining, see 344-D-7163.
 For details and spacing of safety ladders, see 40-D-6460.
 Concrete lining design is based on a compressive strength of 3000 p.s.i. @ 28 days.
 For details of waterstop, see 40-D-2867. Waterstop shall be continuous in reinforced lining joints.
 From Sta. 20+00 to Sta. 55+00 strip surficial material to a maximum depth of 4'-0" or as directed.

ALWAYS THINK SAFETY

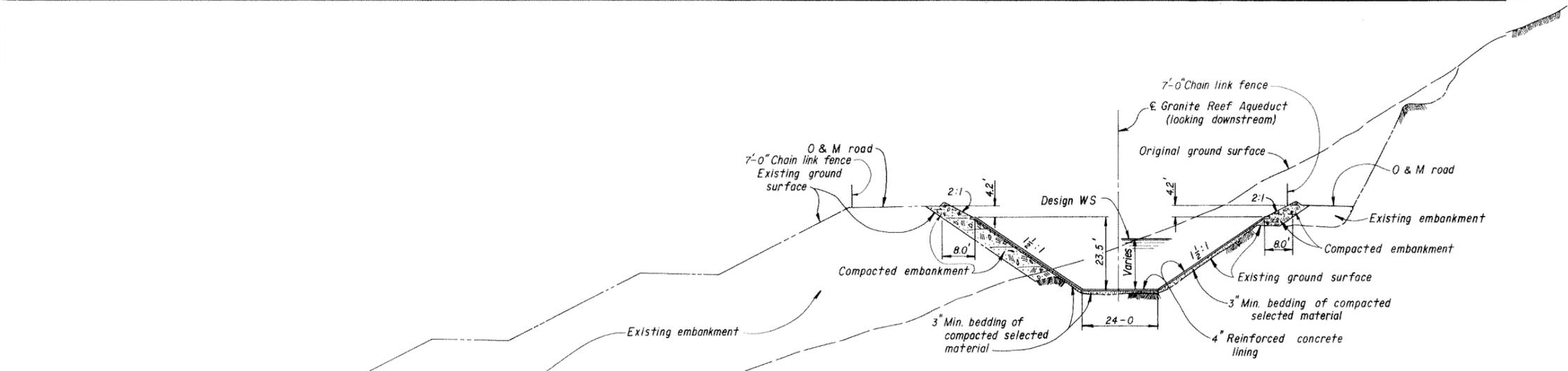
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA
SALT-GILA AQUEDUCT
 REACH 1A

TYPICAL SECTIONS

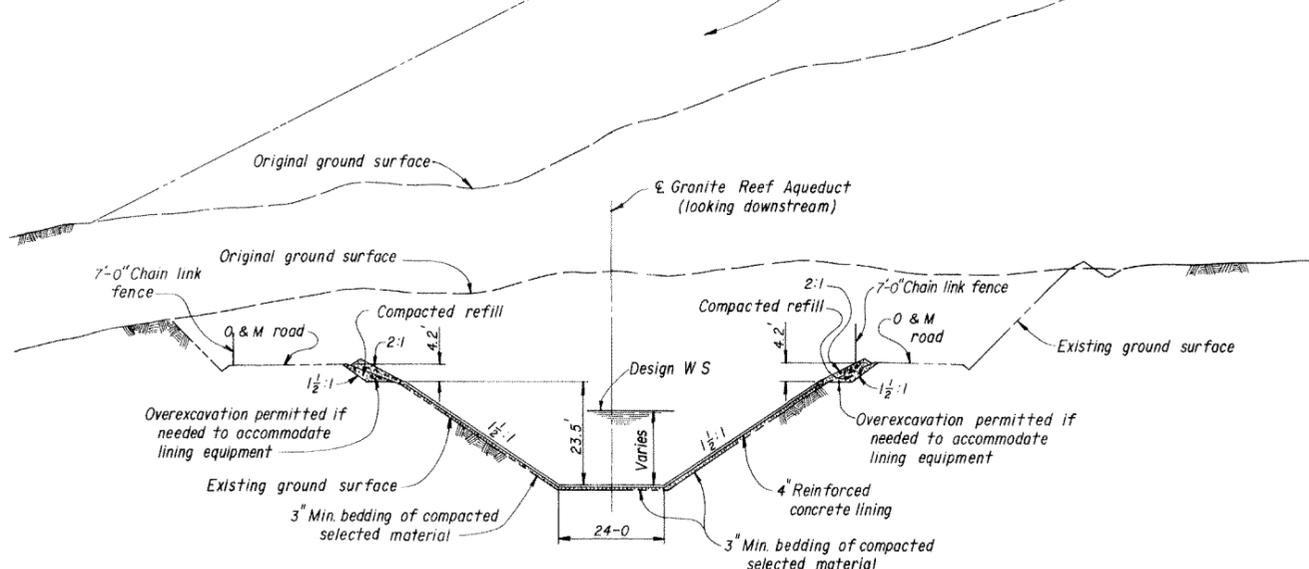
DESIGNED: James D. Bullock, TECHNICAL APPROVAL: John P. Starbuck
 DRAWN: B. E. Brown, SUBMITTED: John P. Starbuck
 CHECKED: [Signature], APPROVED: [Signature]
 CHIEF, WATER CONVEYANCE BRANCH
 DENVER, COLORADO JUNE 13, 1980 344-D-7161

HYDRAULIC PROPERTIES

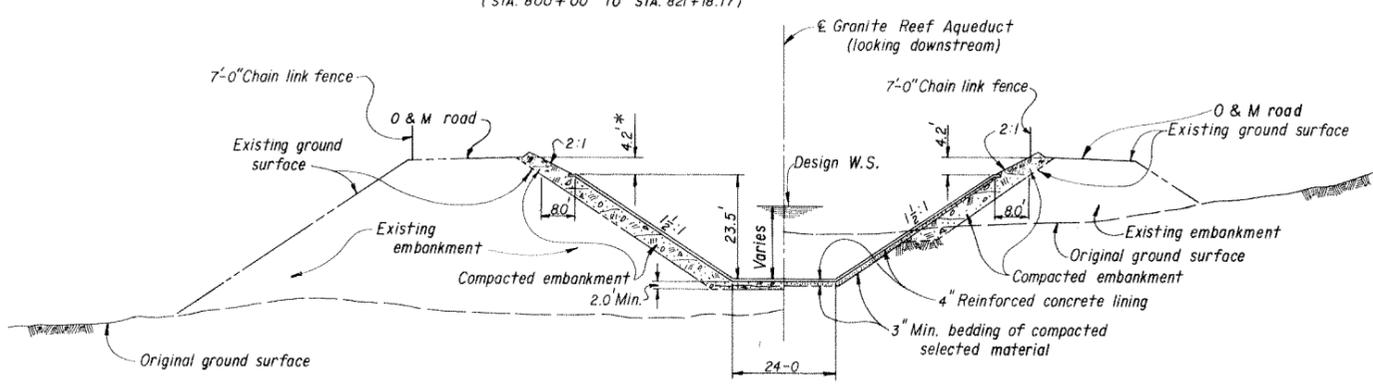
A	V	Q	r	n	s	b	d
Varies	Varies	3000	Varies	.016	.000092	24.0	Varies



TYPICAL SECTION
(STA. 787+27.21 TO STA. 800+00±)

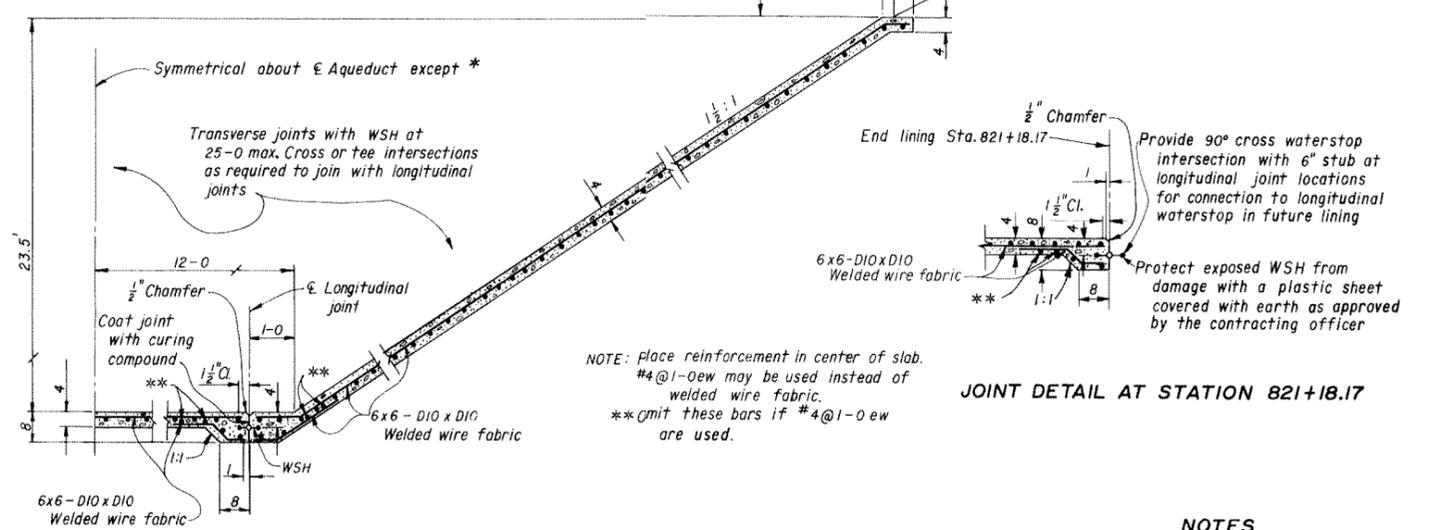
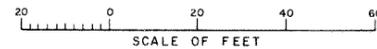


TYPICAL THROUGH CUT SECTION
(STA. 800+00 TO STA. 821+18.17)

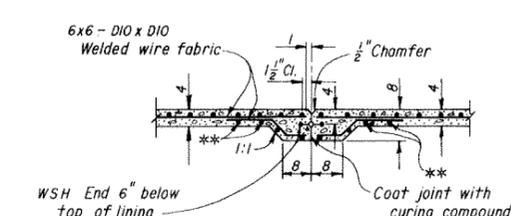


TYPICAL FILL SECTION
(STA. 800+00 TO STA. 821+18.17)

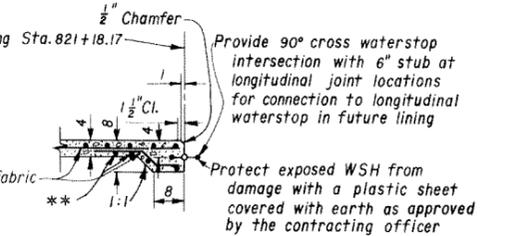
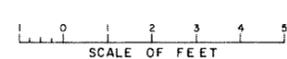
NOTE: *2.2' Sta. 820+00 to Sta. 821+18.17, left side only



REINFORCED LINING, LONGITUDINAL JOINT, AND BANK DETAILS



TRANSVERSE JOINT DETAIL
REINFORCED CONCRETE LINING DETAILS



JOINT DETAIL AT STATION 821+18.17

NOTE: place reinforcement in center of slab.
 #4@1-0ew may be used instead of welded wire fabric.
 **omit these bars if #4@1-0ew are used.

NOTES

Transverse contraction joints around curves to be on radial lines spaced along the aqueduct.
 Concrete lining design is based on a compressive strength of 3,000 psi @ 28 days.
 For details of waterstop, see 40-D-2867. Waterstop shall be continuous in reinforced lining joints.
 Waterstop for aqueduct sections shall be PVC.
 For details and spacing of safety ladders, see 40-D-6460.

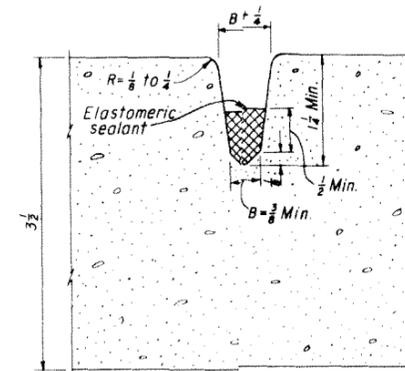


UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 GRANITE REEF DIVISION - ARIZONA

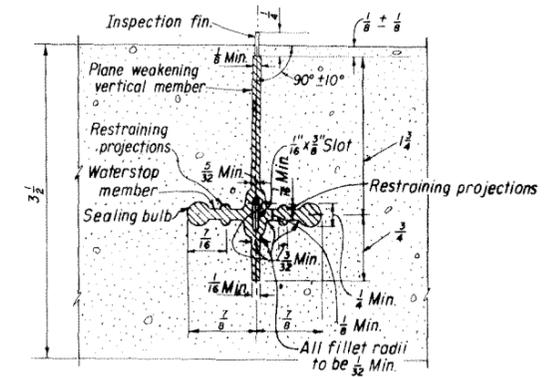
GRANITE REEF AQUEDUCT
 REACH 12 COMPLETION
 STA. 787+27.21 TO STA. 821+18.17
 TYPICAL SECTIONS

DESIGNED: A.S. Wilson TECHNICAL APPROVAL: J.C. Johnson
 DRAWN: R.C. Miska SUBMITTED: W.D. King
 CHECKED: R.C. Miska APPROVED: J.C. Johnson
 CHIEF, WATER CONVEYANCE BRANCH

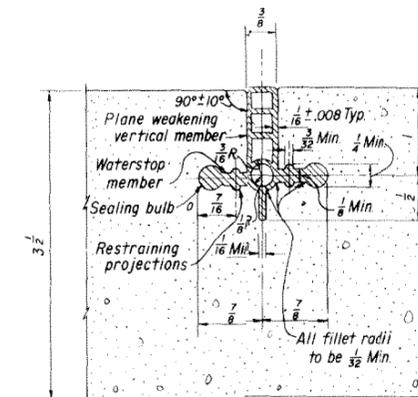
DENVER, COLORADO SEPT. 11, 1980 344-D-7162



LONGITUDINAL OR TRANSVERSE JOINT
ALTERNATIVE No. 1
(ELASTOMERIC SEALANT)



LONGITUDINAL JOINT ONLY
ALTERNATIVE No. 2
(POLYVINYL CHLORIDE STRIP)



TRANSVERSE JOINT ONLY
ALTERNATIVE No. 3
(POLYVINYL CHLORIDE STRIP)

NOTES

A longitudinal joint of one alternative may be used with a transverse joint of another alternative provided a reasonably close fit is obtained at intersections, as approved by the contracting officer.

NOTES: PERTAINING TO ELASTOMERIC ALTERNATIVE
Grooves for alternative No. 1 shall be formed and concrete curing compound in grooves shall be removed by sandblasting.

NOTES: PERTAINING TO POLYVINYL CHLORIDE STRIP ALTERNATIVES
Diameter of the sealing bulb shall be at least twice the thickness of the waterstop member.
Shape of the plane weakening vertical members above and below the center bulb for Alternative No. 2 and below the center bulb for Alternative No. 3 is not defined, except that the members shall conform to the minimum dimensions shown, and shall be sufficiently rigid to insure installation in the specified shape and position.
Weight of the PVC strip shall be a minimum of 460 g/m for the longitudinal strip and a minimum of 420 g/m for the transverse strip.
Where PVC strip is used in the longitudinal direction, cut 3 inches out of the top of the plane weakening vertical member and place the transverse joint through the slot.

ALWAYS THINK SAFETY

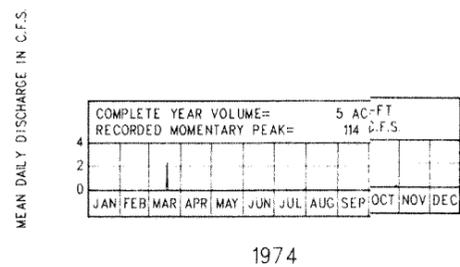
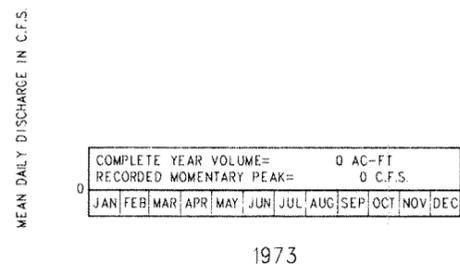
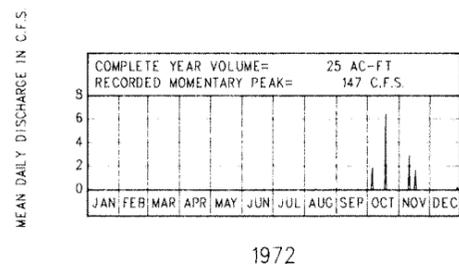
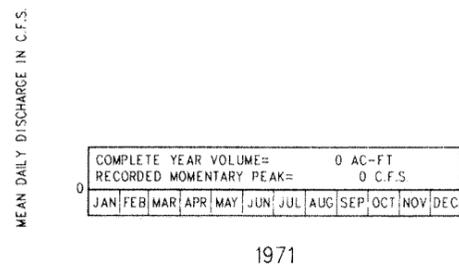
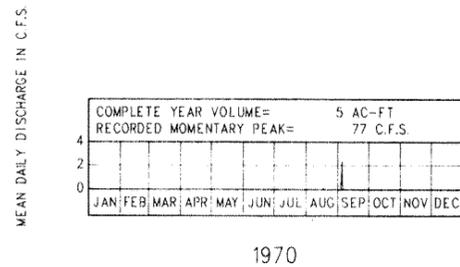
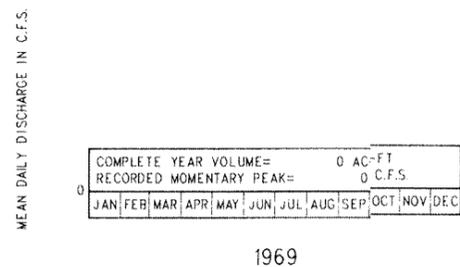
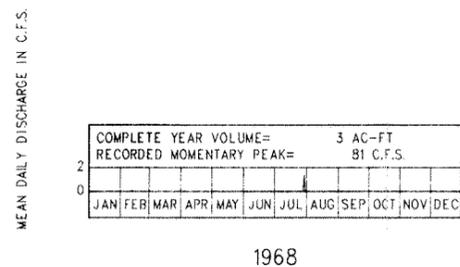
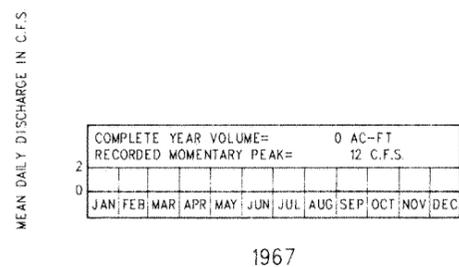
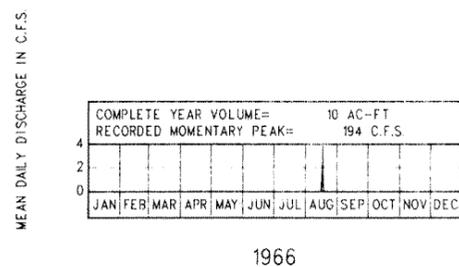
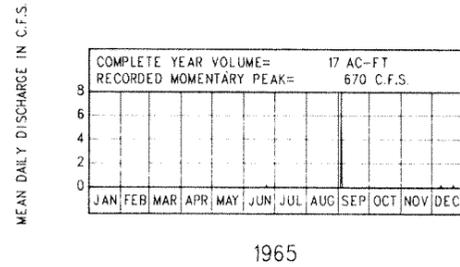
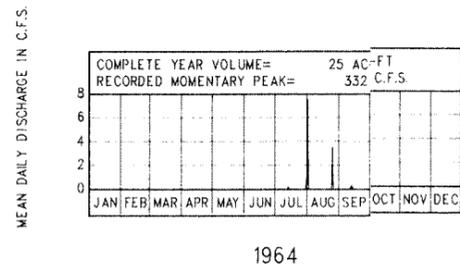
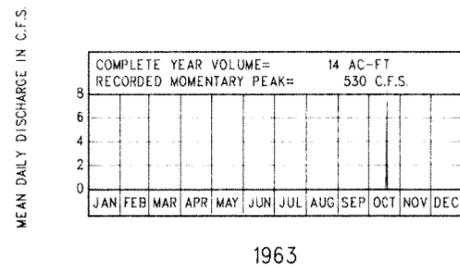
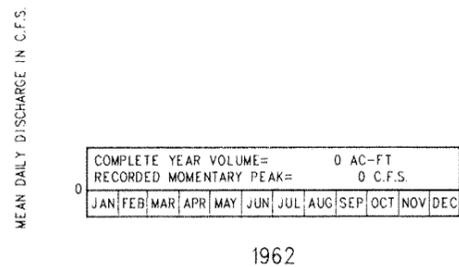
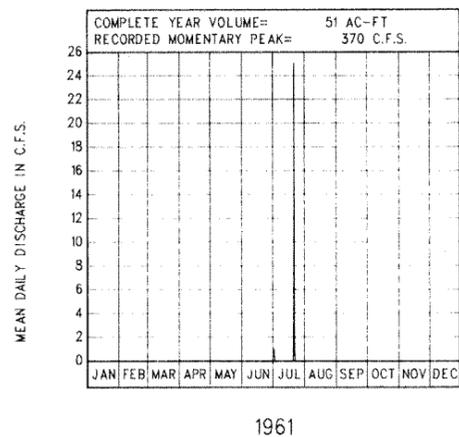
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

**SALT - GILA AQUEDUCT
REACH 1A**

**CONTRACTION JOINTS FOR
UNREINFORCED CONCRETE LINING**

DESIGNED *James R. Kelly* TECHNICAL APPROVAL *T. P. Haider*
DRAWN *WEB* SUBMITTED *T. P. Haider*
CHECKED *David M. Anderson* ADMIN. APPROVAL *G. D. Swinskey*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO AUG. 26, 1980 344-D-7163



HYDROGRAPHS FOR USGS GAGING STATION 095122, SALT RIVER TRIBUTARY AT PHOENIX, ARIZONA

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT

SALT-GILA AQUEDUCT REACH 1A
HYDROGRAPHS

DESIGNED: *D. Barrett* TECHNICAL APPROVAL: *D. Barrett*
DRAWN: *D. Barrett* SUBMITTED: *J. Peterson*
CHECKED: *D. Barrett* APPROVED: *M. J. Hyatt*
CHIEF, HYDROLOGY BRANCH

DENVER, COLORADO MAY 12, 1980
SHEET 1 OF 2

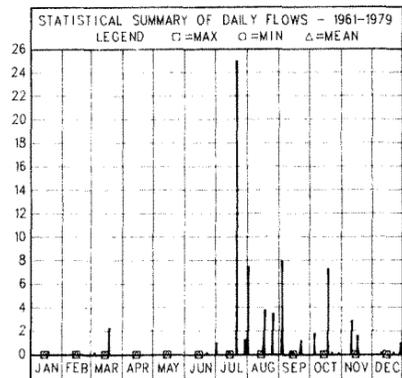
344-D-5069

MEAN DAILY DISCHARGE IN C.F.S.

COMPLETE YEAR VOLUME=	0 AC-FT										
RECORDED MOMENTARY PEAK=	0 C.F.S.										
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

1975

MEAN DAILY DISCHARGE IN C.F.S.

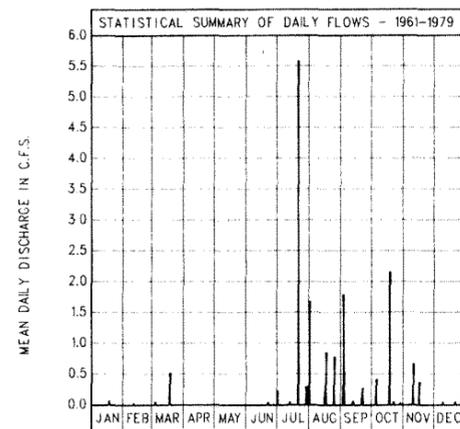


MAX, MIN AND MEAN DAILY FLOWS

MEAN DAILY DISCHARGE IN C.F.S.

COMPLETE YEAR VOLUME=	4 AC-FT										
RECORDED MOMENTARY PEAK=	70 C.F.S.										
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

1976

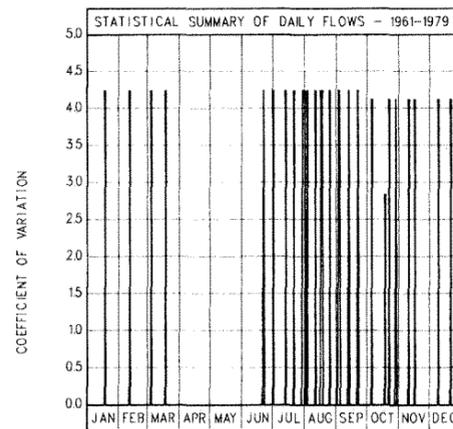


STANDARD DEVIATION FROM MEANS

MEAN DAILY DISCHARGE IN C.F.S.

COMPLETE YEAR VOLUME=	2 AC-FT										
RECORDED MOMENTARY PEAK=	96 C.F.S.										
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

1977



COEFFICIENT OF VARIATION

MEAN DAILY DISCHARGE IN C.F.S.

COMPLETE YEAR VOLUME=	1 AC-FT										
RECORDED MOMENTARY PEAK=	21 C.F.S.										
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

1978

NOTES
The statistical summary shows the maximum, mean and minimum of the mean daily discharges recorded for each day of the year. The standard deviation hydrograph shows the standard deviation of the mean daily values for each day. The standard deviation is a measure of the variability or scatter of the daily values for each day. A higher standard deviation shows larger variability from the mean. The standard deviation is determined by the following formula

$$S = \sqrt{\frac{\sum_{i=1}^n (X_i - M)^2}{n}}$$

where S is the standard deviation, n is the number of observations, X_i is the mean discharge for day i and M is the overall mean of the daily values. The coefficient of variation relates the standard deviation to the mean according to the following formula

$$C = S/M$$

MEAN DAILY DISCHARGE IN C.F.S.

PARTIAL YEAR VOLUME=	NOT AVAILABLE										
RECORDED MOMENTARY PEAK=	NOT AVAILABLE										
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

1979

LOCATION OF STATION
The gaging station Salt River Tributary in South Mountain Park, at Phoenix, Arizona is located in NE 1/4 NE 1/4, Section 18, Township 1 South, Range 3 East in Maricopa County. The station is on the left bank 6.5 miles (10.5km) south of the main Phoenix post office. The gage elevation is 1405.20 feet (428.305m) above mean sea level. The drainage area is 1.75 square miles (4.53 sq km). Although runoff occurs infrequently at this station, major floods have been noted. Despite being somewhat removed from the construction site, the watershed is hydrologically similar and runoff patterns shown should be representative. Since it is not possible to compute the coefficient of variation on days when no runoff has been recorded, the value is available for only a few days of the year. Because most days which have recorded runoff have only one event, the coefficient of variation is constant for most of the days on which it is available and is not a meaningful statistic for this gaging station.

HYDROGRAPHS FOR USGS GAGING STATION 095122, SALT RIVER TRIBUTARY AT PHOENIX, ARIZONA

ALWAYS THINK SAFETY

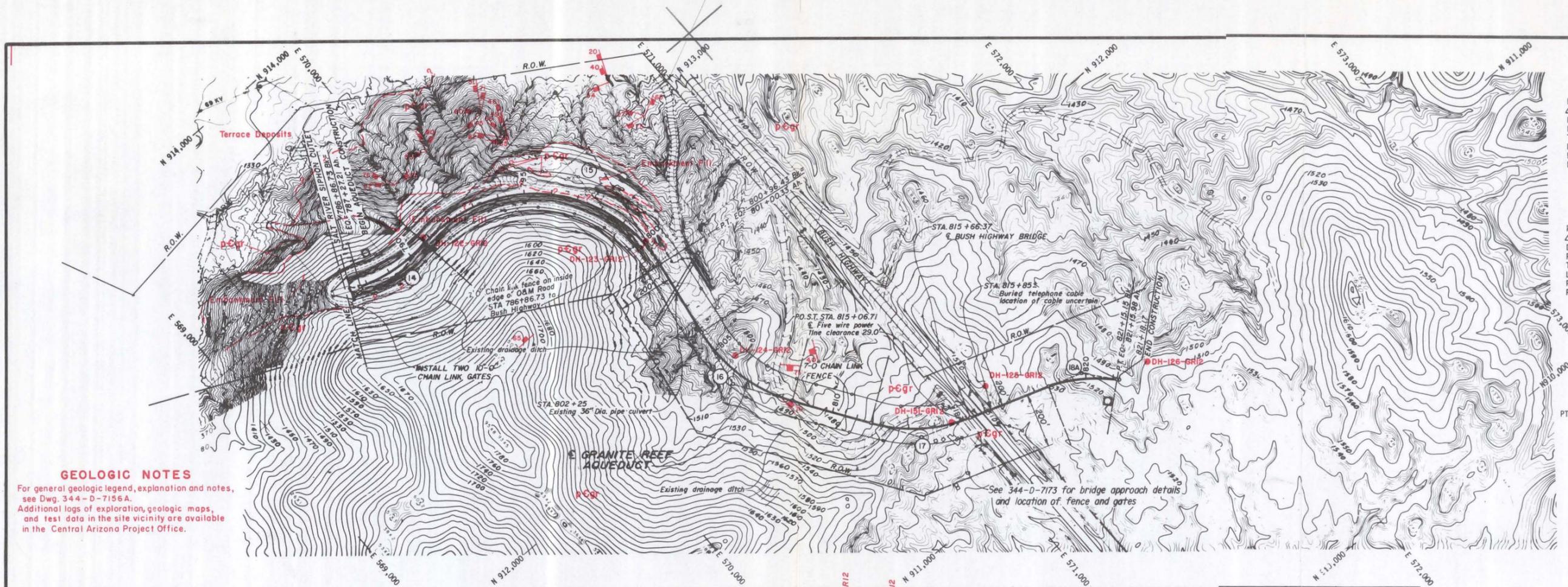
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT

SALT-GILA AQUEDUCT REACH 1A
HYDROGRAPHS

DESIGNED *D. P. Barrett* TECHNICAL APPROVAL *D. P. Barrett*
DRAWN *D. P. Barrett* SUBMITTED *J. K. ...*
CHECKED *D. P. Barrett* APPROVED *J. K. ...*
CHIEF, HYDROLOGY BRANCH

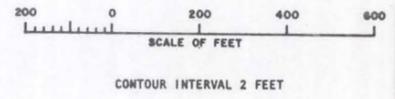
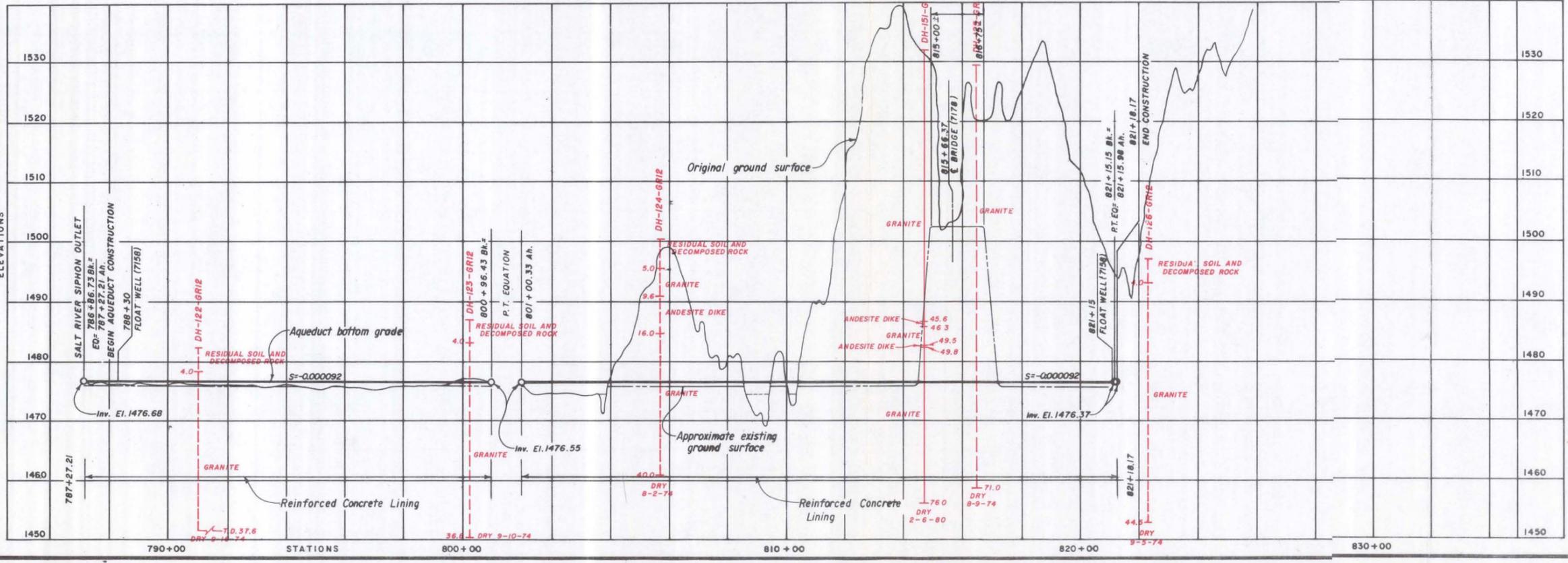
DENVER, COLORADO, MAY 12, 1980
SHEET 2 OF 2

344-D-5070



<p>14</p> <p>P1 789+19.54 $\Delta = 32^{\circ}03' 21''$ Lt D= 549.993 T= 158.00 L= 307.71 PC 787+61.54 PT 790+69.25</p>	<p>15</p> <p>P1 798+12.62 $\Delta = 107^{\circ}00' 20''$ Rt D= 549.9974 T= 743.37 L= 1027.18 PC 790+69.25 PT 800+96.438k=801+00.33Ah</p>
<p>16</p> <p>P1 806+24.92 $\Delta = 42^{\circ}37' 26''$ Lt D= 107 R= 572.961 T= 223.531 L= 426.241 PC 804+01.39 PT 808+27.63</p>	<p>17</p> <p>P1 813+50.70 $\Delta = 37^{\circ}47' 24''$ Lt D= 107 R= 572.961 T= 196.111 L= 377.901 PC 811+54.59 PT 815+32.49</p>
<p>18A</p> <p>P1 819+85.34 $\Delta = 32^{\circ}00' 47''$ Rt D= 127 R= 477.46 T= 136.97 L= 266.78 PC 818+43.37 PT 821+15.158k=821+15.98Ah</p>	

GEOLOGIC NOTES
For general geologic legend, explanation and notes, see Dwg. 344-D-7156A.
Additional logs of exploration, geologic maps, and test data in the site vicinity are available in the Central Arizona Project Office.



NOTES
For Typical Sections, see 344-D-7162.
For other notes and explanation, see 344-D-7160.
This drawing compiled from drawing No. 344-330-2676.
Begin construction at sta. 787+27.21 Ah. to include modification at Salt River Siphon Outlet as shown on drawing No. 344-D-7157.
Notations of existing ground surface and existing facilities refer to conditions after construction under a separate contract.
Chain link fence to be located as shown or as directed. For fence details, see 40-D-6268.

ALWAYS THINK SAFETY

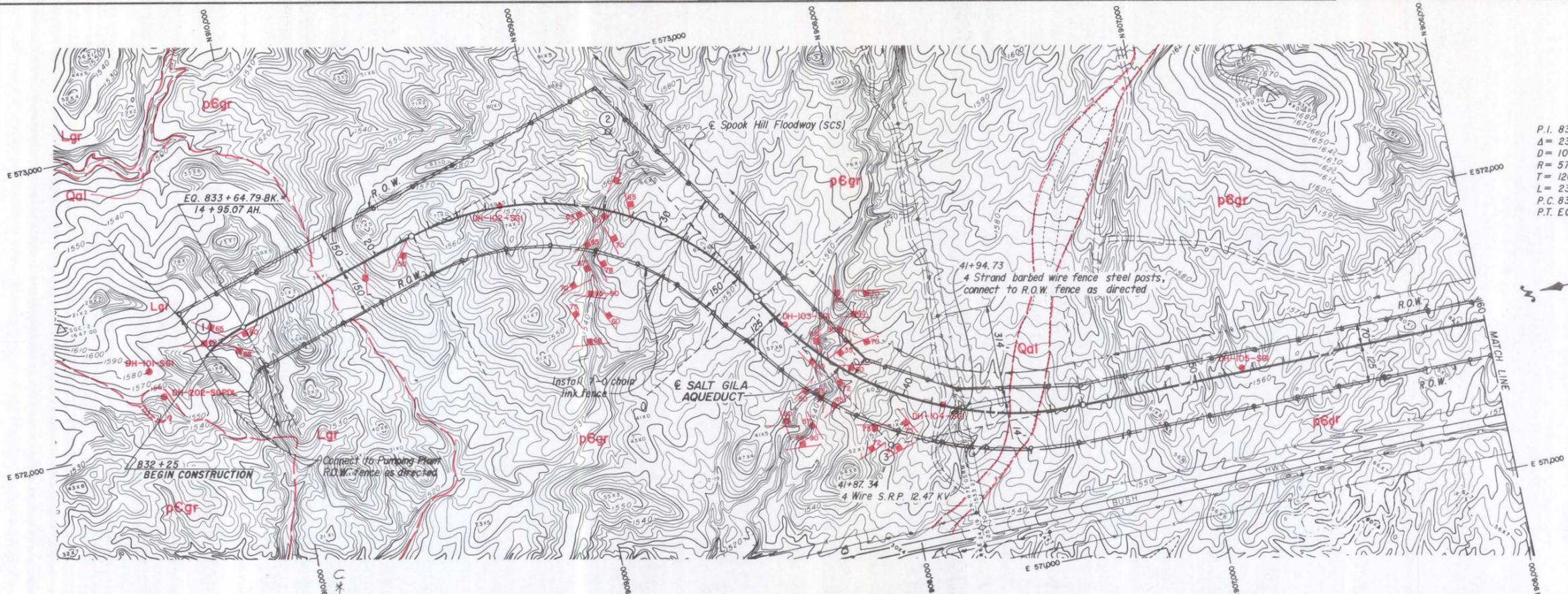
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION-ARIZONA

GRANITE REEF AQUEDUCT
REACH 12 COMPLETION
STA. 787+27.21 TO STA. 821+18.17
PLAN AND PROFILE

DESIGNED BY *[Signature]* SUBMITTED BY *[Signature]*
DRAWN BY *[Signature]* RECOMMENDED BY *[Signature]*
CHECKED BY *[Signature]* APPROVED BY *[Signature]*
DENVER, COLORADO JULY 30, 1980

344-D-7165 A

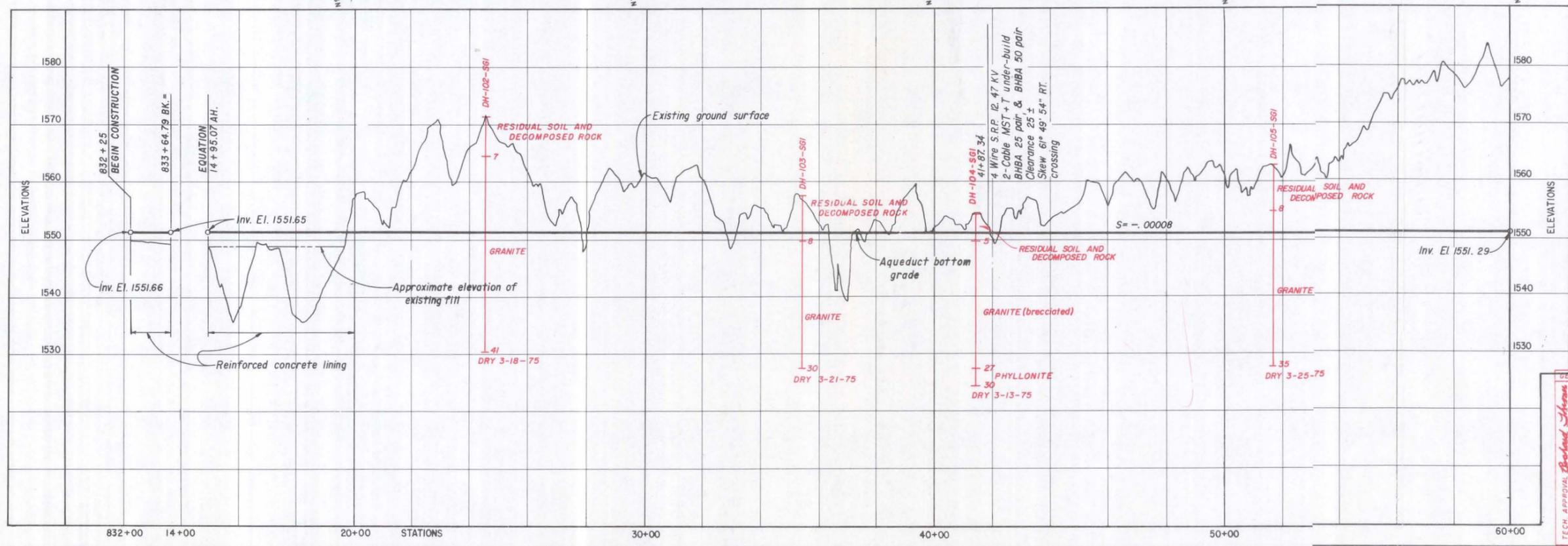
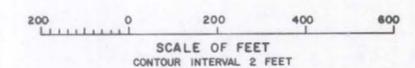
RED-344-D-7165



①	②	③
P.I. 832+48.20	P.I. 28+81.56	P.I. 40+75.15
$\Delta = 23^\circ 39' 39.8''$ Rt.	$\Delta = 76^\circ 02' 50''$	$\Delta = 59^\circ 53' 21''$
$D = 10'$	$D = 6'$	$D = 5'$
$R = 572.96'$	$R = 954.93$	$R = 1145.92$
$T = 120.02'$	$T = 746.71$	$T = 660.12$
$L = 236.61'$	$L = 1267.45$	$L = 1197.78$
P.C. 831+28.18	P.C. 21+34.85	P.C. 34+15.03
P.T. EQ. 833+64.79 BK. = 14+95.07 AH.	P.T. 34+02.30	P.T. 46+12.81

GEOLOGIC NOTES

For General Geologic Legend, Explanation and Notes, see drawing No. 344-D-7156A. Additional logs of exploration, geologic maps, and test data in the site vicinity are available in the Central Arizona Project Office.



HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74

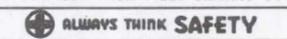
GENERAL NOTES

For 7-0 chain link fence, see 40-D-6268. For typical canal section see (7161).

UTILITY DIRECTORY

- A.P.S. Arizona Public Service Company, Mr. Gary Madden, Station 3278, P.O. Box 1666, Phoenix, Arizona 85036.
- A.W.Co. Arizona Water Company, Mr. Robert Hare, Manager, 185 West Apache Trail, Suite 10, Apache Junction, Arizona 85220 Telephone (602) 982-2201.
- D.S.W.Co. Desert Sage Water Company, Inc. 220 North Crismon Road, Mesa, Arizona 85207.
- C.O.M. City of Mesa, Engineering Division 55 North Center Street, Mesa, Arizona 85201.

THIS DRAWING COMPILED FROM FIELD DRAWING 344-330-503



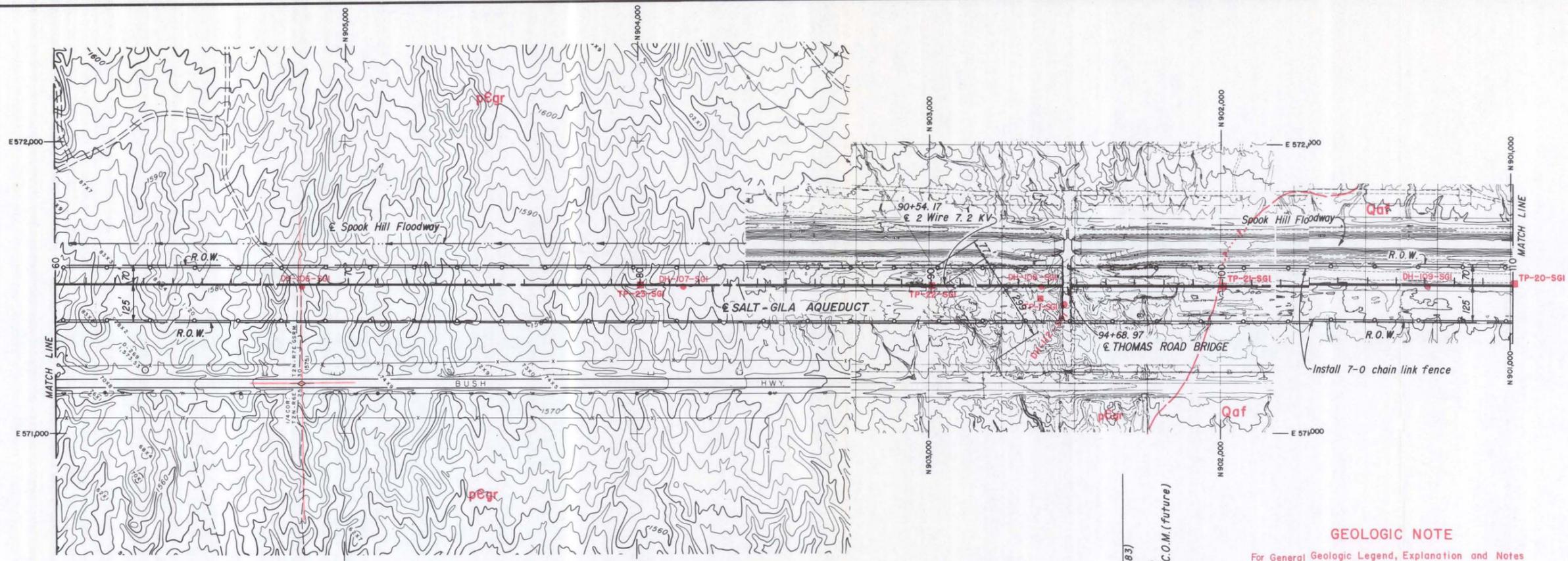
UNITED STATES DEPARTMENT OF THE INTERIOR WATER AND POWER RESOURCES SERVICE CENTRAL ARIZONA PROJECT SALT-GILA DIVISION-ARIZONA **SALT-GILA AQUEDUCT REACH 1A STA. 832+25 TO STA. 833+64.79 BK. = STA. 14+95.07 AH. TO STA. 60+00 PLAN AND PROFILE**

DESIGNED *James Bullock* TECHNICAL APPROVAL *John C. ...*
 DRAWN *David M. ...* SUBMITTED *John S. ...*
 CHECKED *David M. ...* APPROVED *J. O. ...*
 CHIEF, WATER CONVEYANCE BRANCH

TECH. APPROVAL *David M. ...* SUBMITTED *John S. ...*
 APPROVED *John S. ...* CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO MAY 29, 1980 SHEET 1 OF 7 **344-D-7166 A**

BED-344-D-7166

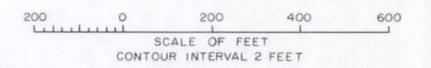


GEOLOGIC NOTE

For General Geologic Legend, Explanation and Notes see Drawing no. 344-D-7156A.

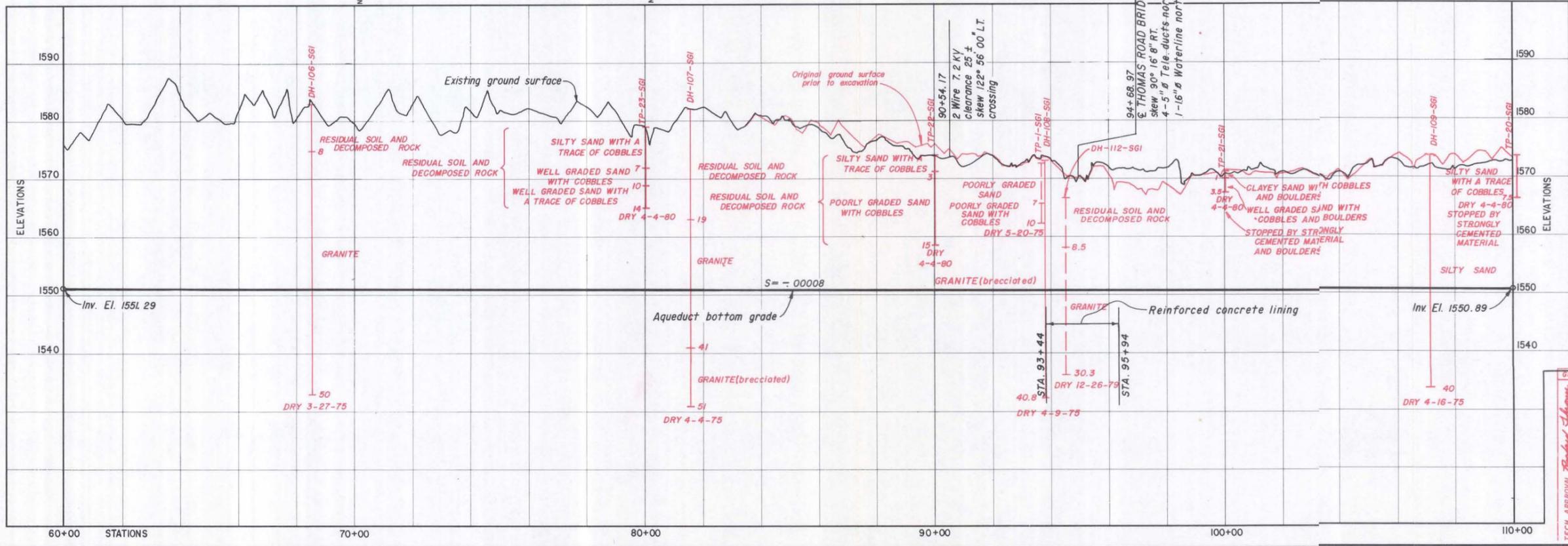
HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74



NOTE

For general notes, see 344-D-7166.



THIS DRAWING COMPILED FROM FIELD DRAWING 344-330-504

ALWAYS THINK SAFETY

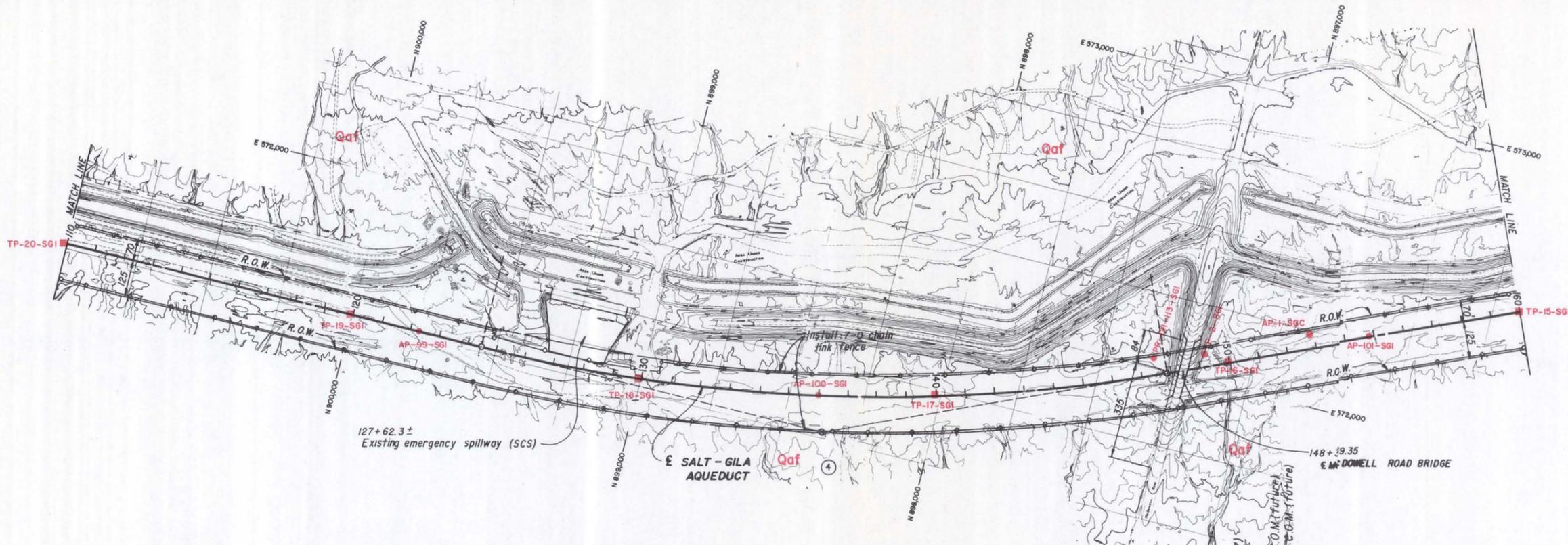
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
 REACH IA
 STA. 60+00 TO STA. 110+00
 PLAN AND PROFILE

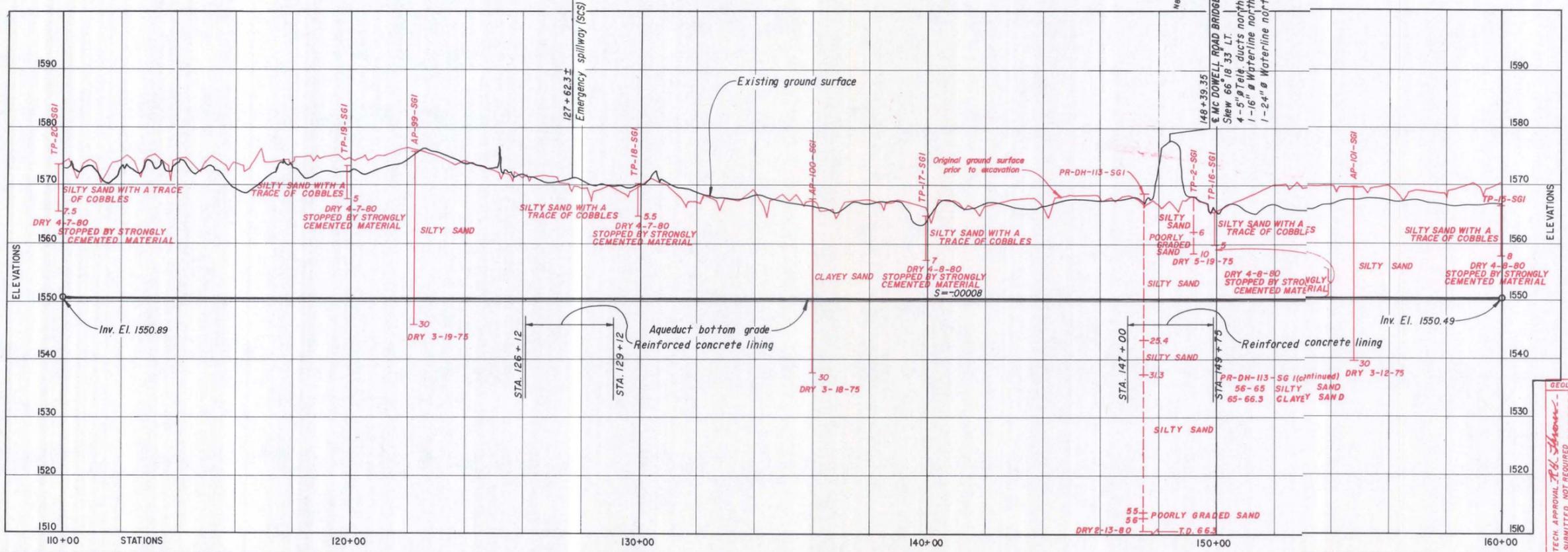
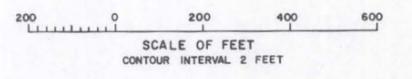
DESIGNED *Samuel B. Bell* TECHNICAL APPROVAL *John C. Strickland*
 DRAWN *Charles R. Bell* SUBMITTED *John C. Strickland*
 CHECKED *David W. Medsker* APPROVED *J. O. Dransky*
WATER CONVEYANCE BRANCH

DENVER, COLORADO MAY 29, 1980 **344-D-7167A**
 SHEET 2 OF 7

RED 344-D-7167



④
 P.I. 136+30.45
 $\Delta = 23^\circ 24' 50''$
 $D = 1''$
 $R = 5729.58$
 $T = 1187.26$
 $L = 2341.39$
 $P.C. 124+43.19$
 $P.T. 147+84.58$



HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74

GEOLOGIC NOTES
 For General Geologic Legend, Explanation and Notes see Drawing No. 344-D-7156A.
 Most standard penetration test results in PR-DH-113-SGI were invalid, most of hole rockbitted; materials classified from wash samples.

NOTE
 For general notes, see 344-D-7166

THIS DRAWING COMPILED FROM FIELD DRAWING 344-330-505

ALWAYS THINK SAFETY

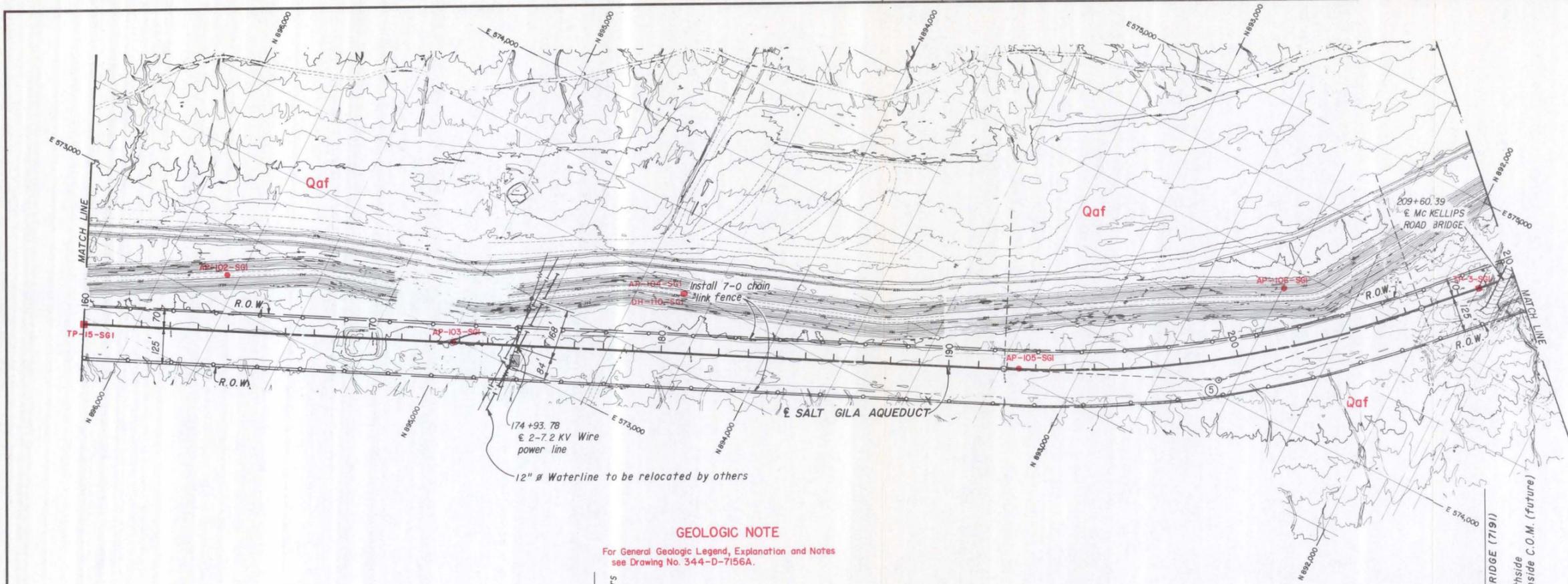
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA

**SALT-GILA AQUEDUCT
 REACH 1A
 STA. 110+00 TO STA. 160+00
 PLAN AND PROFILE**

DESIGNED *James Bullock* TECHNICAL APPROVAL *Robert C. Schuchman*
 DRAWN *David M. Madsen* SUBMITTED *James Bullock*
 CHECKED *David Madsen* APPROVED *J.O. Thomas*
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO MAY 29, 1980
 SHEET 3 OF 7 **344-D-7168 A**

RED 344-D-7168



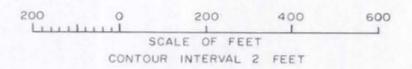
⑤
 P.I. 199+31.57
 $\Delta = 22^\circ 01' 54.3''$ LT.
 D = 1.5°
 R = 3819.72
 T = 743.58
 L = 1468.78
 P.C. 191+87.99
 P.T. 206+56.77

GEOLOGIC NOTE

For General Geologic Legend, Explanation and Notes see Drawing No. 344-D-7156A.

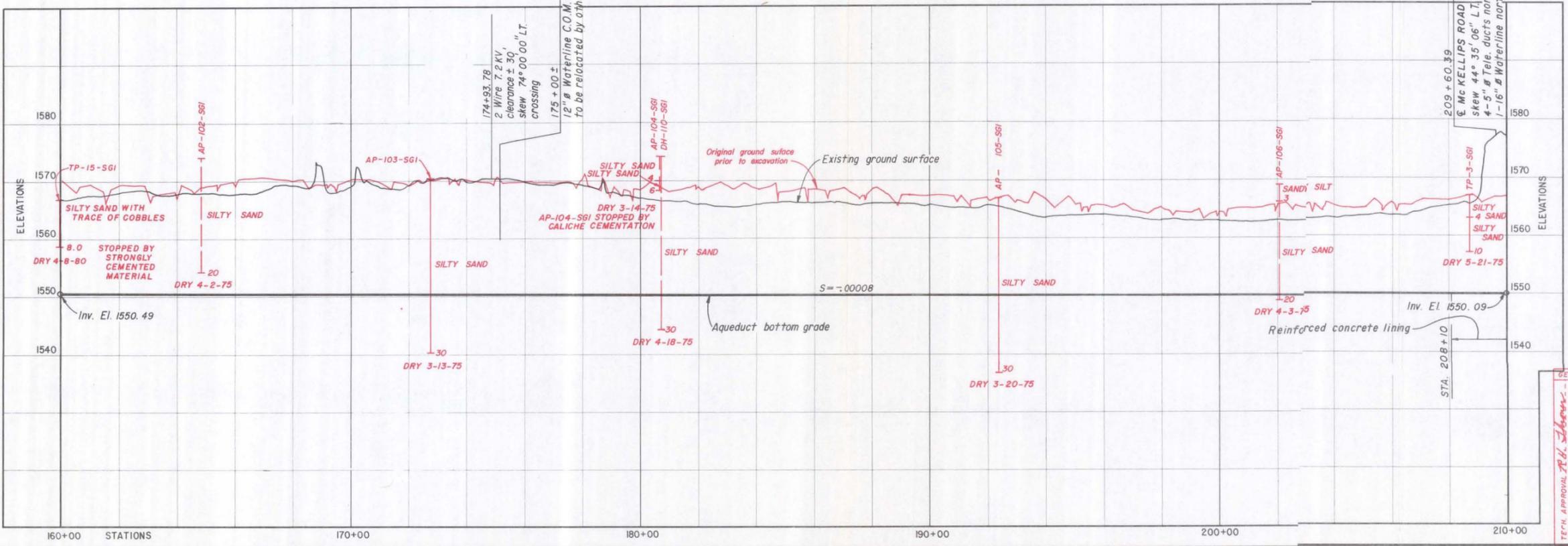
HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74



NOTE

For general notes, see 344-D-7166.



THIS DRAWING COMPILED FROM FIELD DRAWING 344-330-500

ALWAYS THINK SAFETY

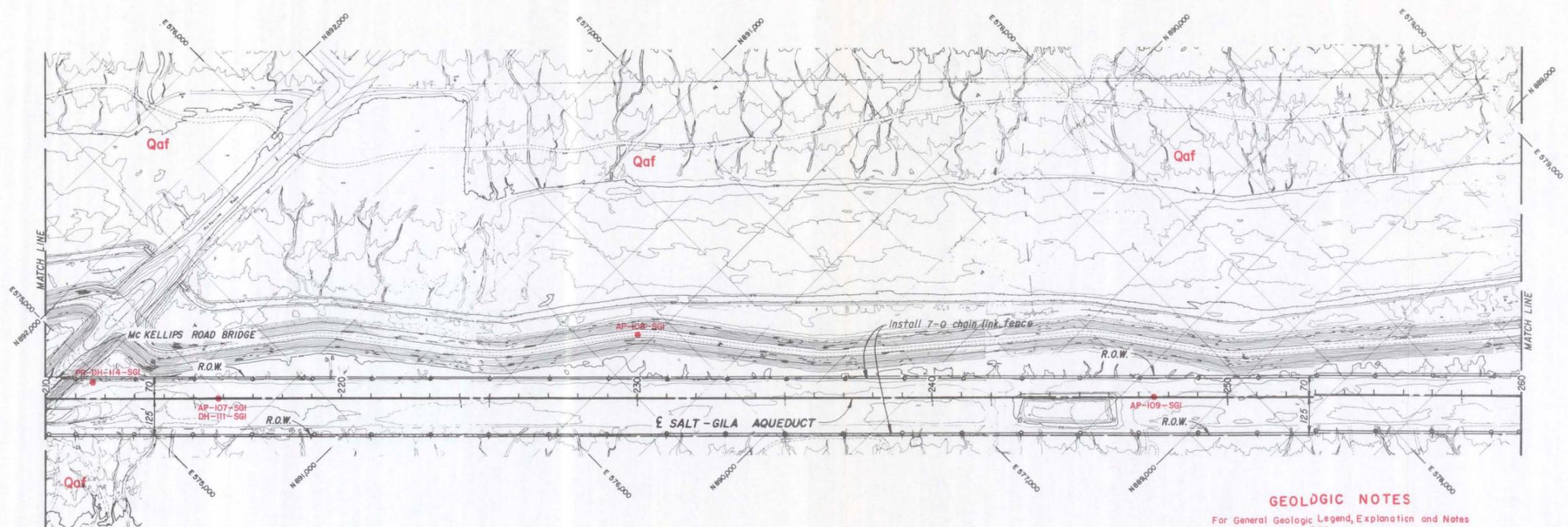
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION - ARIZONA

**SALT-GILA AQUEDUCT
 REACH 'A'
 STA. 160+00 TO STA. 210+00
 PLAN AND PROFILE**

DESIGNED *[Signature]* TECHNICAL APPROVAL *[Signature]*
 DRAWN *[Signature]* SUBMITTED *[Signature]*
 CHECKED *[Signature]* APPROVED *[Signature]*
 (CHIEF, WATER CONVEYANCE BRANCH)

DENVER, COLORADO SHEET 4 OF 7 MAY 29, 1980 **344-D-7169A**

RED 344-D-7169

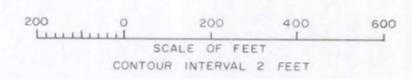


GEOLOGIC NOTES

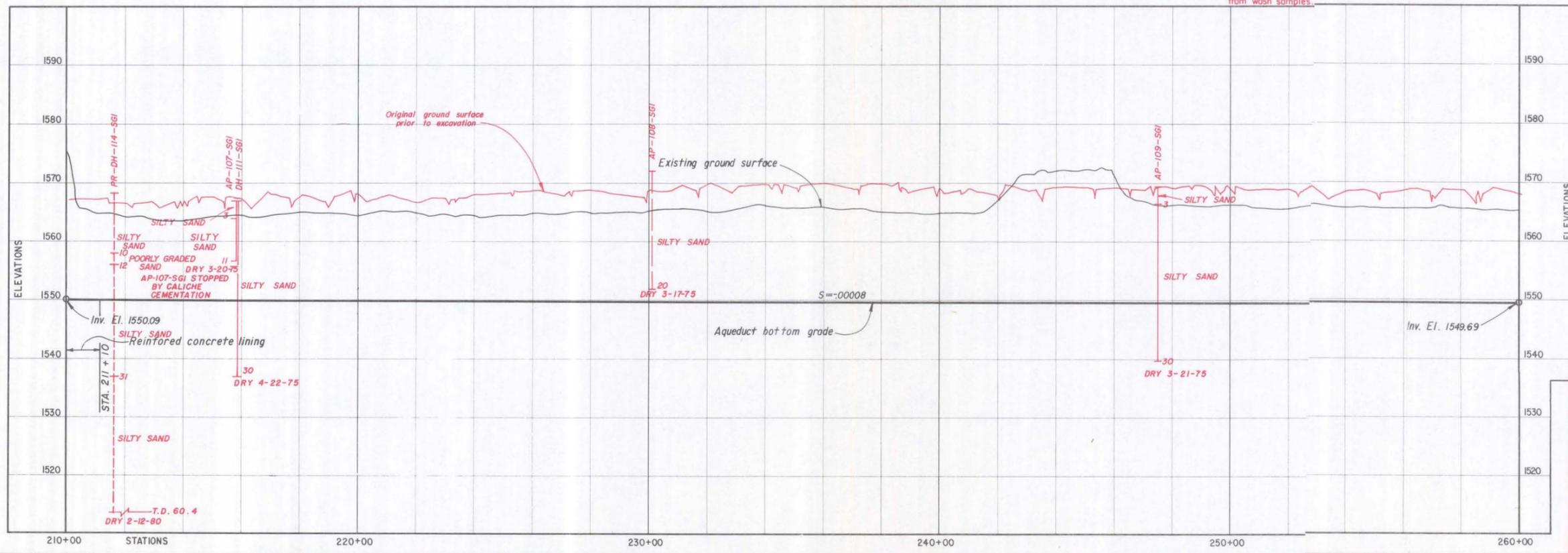
For General Geologic Legend, Explanation and Notes see Dwg 344-D-7156A.
 Most standard penetration test results in PR-DH-114-SGI were invalid; most of hole was rockbitted; materials classified from wash samples.

HYDRAULIC STRUCTURES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74



NOTE
 For general notes, see 344-D-7166



THIS DRAWING COMPILED FROM FIELD DRAWING 344-330-507

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UNITED STATES
 DEPARTMENT OF THE INTERIOR
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 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA

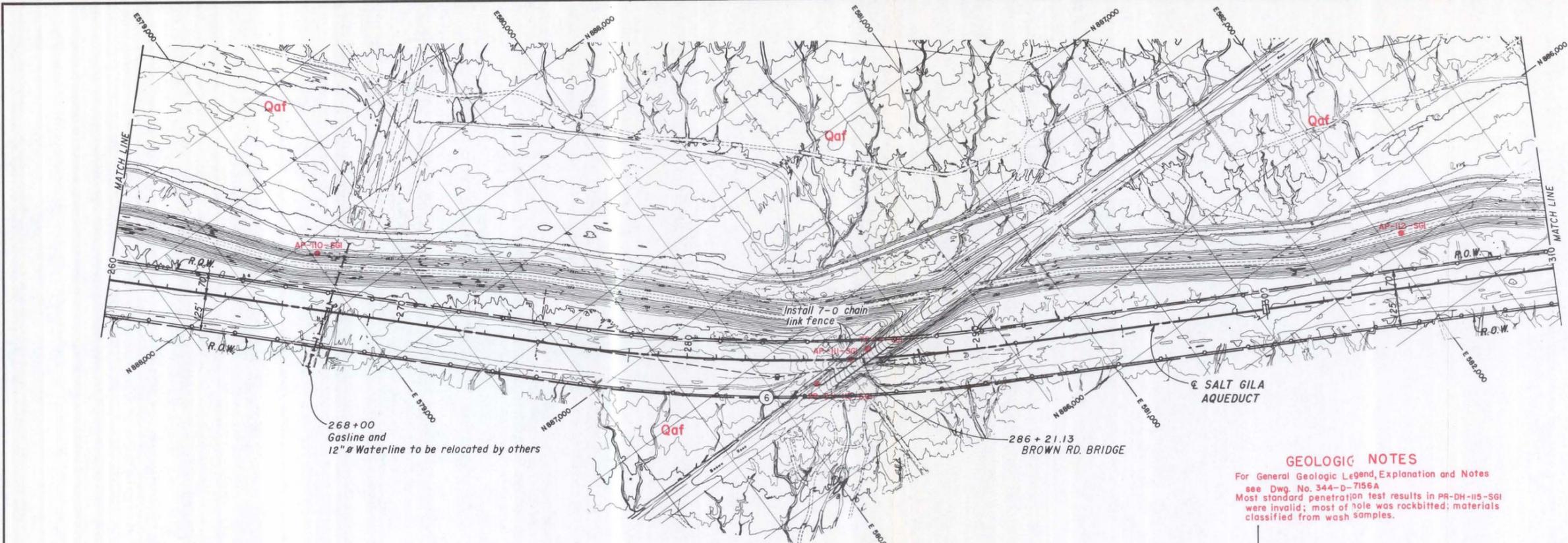
SALT-GILA AQUEDUCT
 REACH IA
 STA. 210+00 TO STA. 260+00
 PLAN AND PROFILE

DESIGNED *James C. Beckley* TECHNICAL APPROVAL *John St. Andrew*
 DRAWN *Richard Hill* SUBMITTED *John St. Andrew*
 CHECKED *Douglas M. Madsen* APPROVED *J. C. Grunsky*
CHIEF, WATER CONVEYANCE BRANCH

TECH. APPROVAL *Richard Hill*
 SUBMITTED *John St. Andrew*
 APPROVED *J. C. Grunsky*

DENVER, COLORADO JUNE 25, 1980 SHEET 3 OF 7 **344-D-7170-A**

RED-344-D-7170



⑥
 P.I. 283 + 14.48
 $\Delta = 16^\circ 26' 47.0''$
 $D = 1^\circ$
 $R = 5729.58$
 $T = 828.01$
 $L = 1544.64$
 $PC = 274 + 86.47$
 $PT = 291 + 31.11$

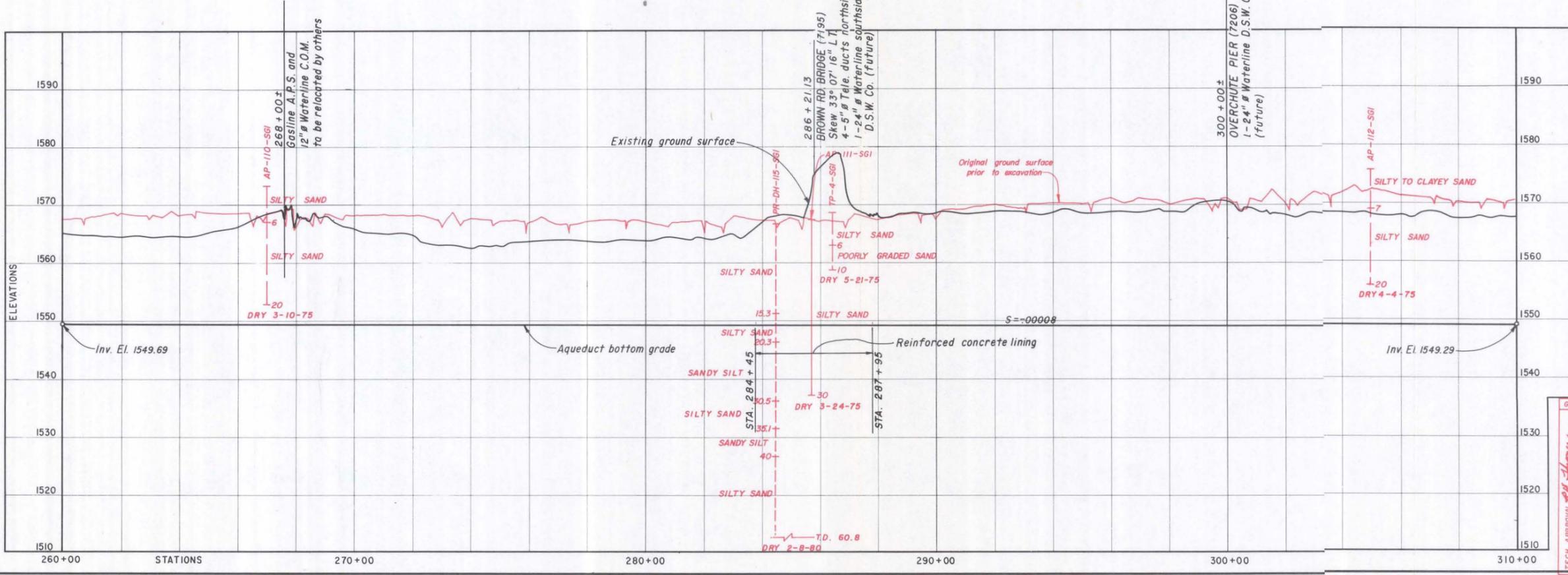
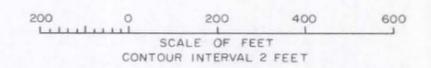
GEOLOGIC NOTES

For General Geologic Legend, Explanation and Notes see Dwg. No. 344-D-7156A
 Most standard penetration test results in PR-DH-115-SGI were invalid; most of hole was rockbitted; materials classified from wash samples.



HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	15.74



NOTE

For general notes, see 344-D-7166.

THIS DRAWING COMPILED FROM FIELD DWG. 344-330-508

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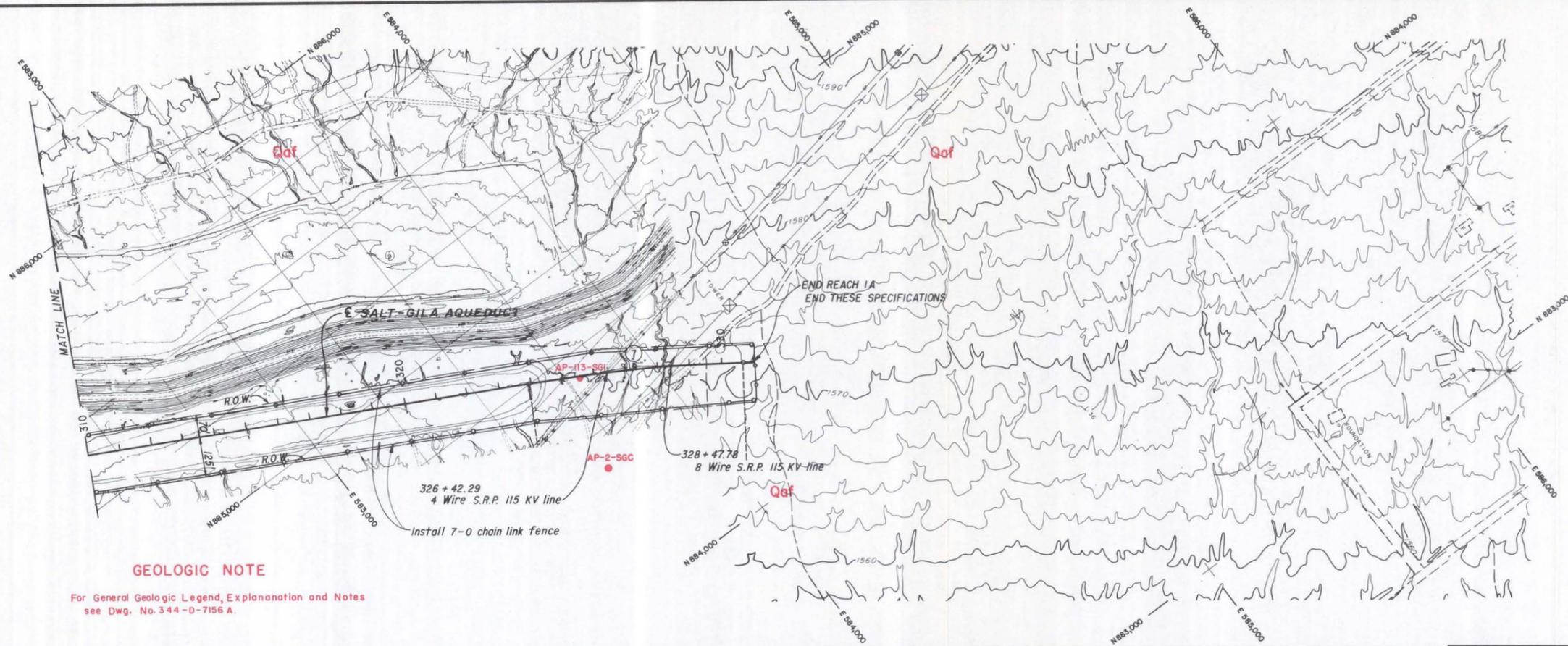
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION - ARIZONA

**SALT-GILA AQUEDUCT
 REACH 1A
 STA. 260+00 TO STA. 310+00
 PLAN AND PROFILE**

DESIGNED *John D. Stuckert* TECHNICAL APPROVAL *John D. Stuckert*
 DRAWN *Charles R. Hull* SUBMITTED *John D. Stuckert*
 CHECKED *David W. Madricks* APPROVED *J. O. Trammell*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO JUNE 25, 1980 **344-D-7171**
 SHEET 6 OF 7

RED-344-D-7171



①
 P.I. 327+25.15
 $\Delta = 6^\circ 40' 48.5''$
 $D = 1''$
 $R = 5729.58$
 $T = 334.39$
 $L = 668.01$
 P.C. 323+90.76
 P.T. 330+58.77

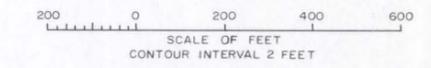


GEOLOGIC NOTE

For General Geologic Legend, Explanation and Notes see Dwg. No. 344-D-7156 A.

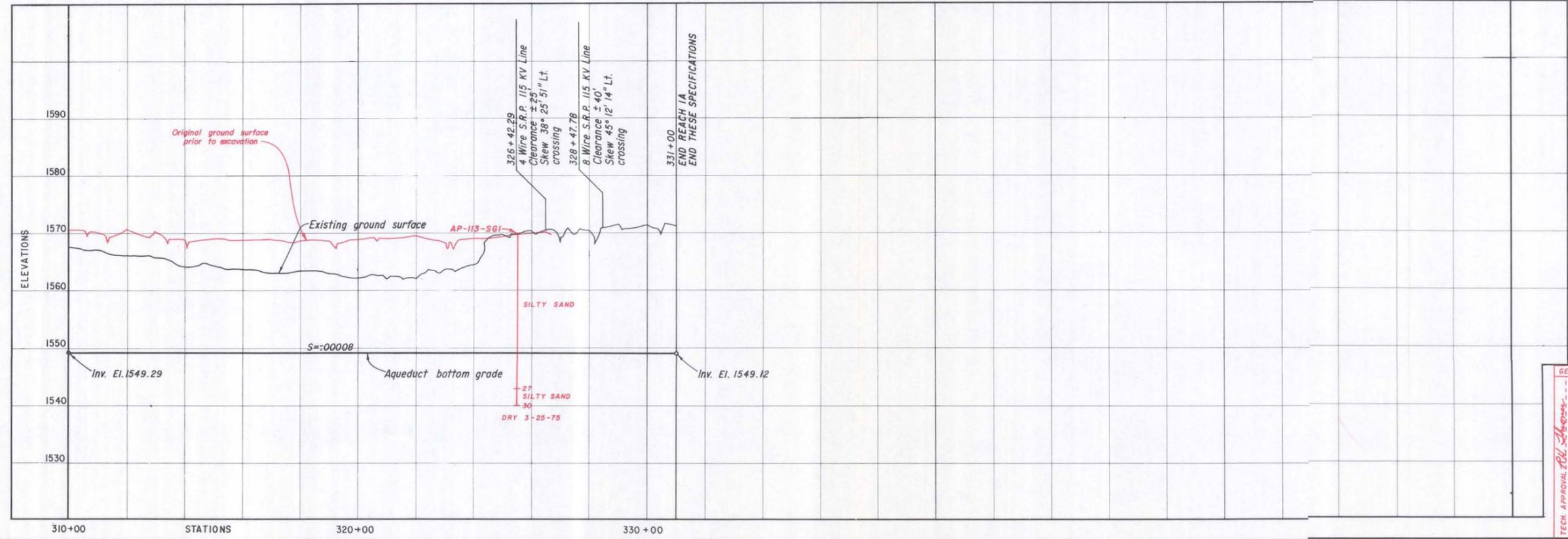
HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
749.38	3.67	2750	9.28	.016	.00008	24	1574



NOTE

For general notes, see 344-D-7166



THIS DRAWING COMPILED FROM FIELD DRAWING 344-330-1520

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 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA

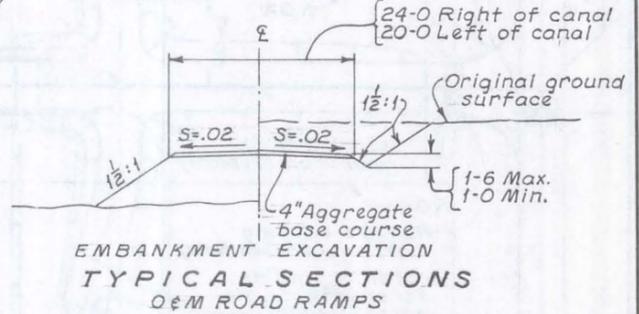
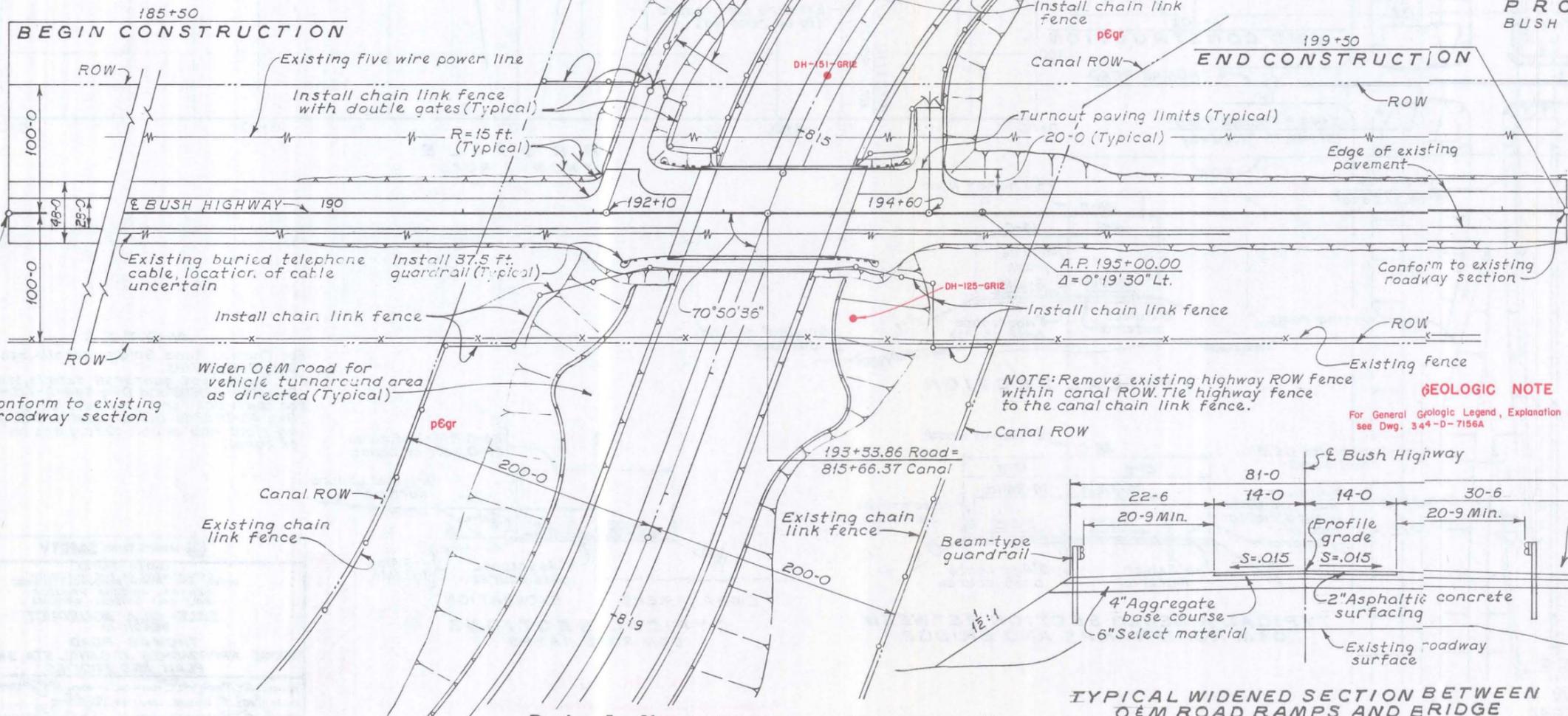
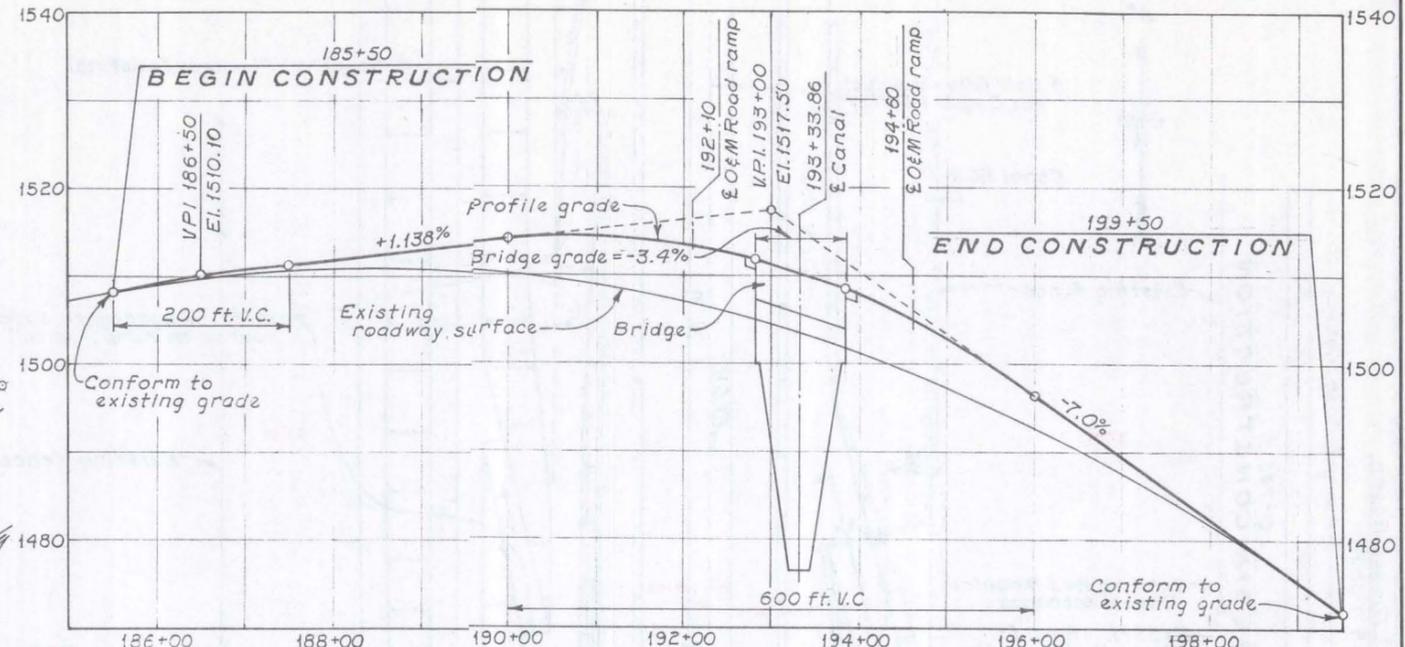
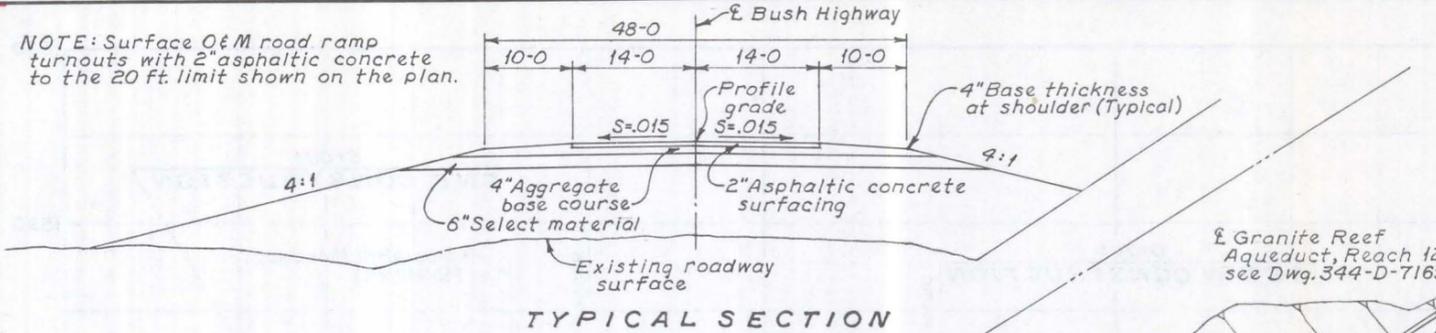
**SALT-GILA AQUEDUCT
 REACH IA
 STA. 310+00 TO STA. 331+00
 PLAN AND PROFILE**

DESIGNED *John E. Bullock* TECHNICAL APPROVAL *John E. Bullock*
 DRAWN *Charles R. Hall* SUBMITTED *John E. Bullock*
 CHECKED *David W. Madsen* APPROVED *John E. Bullock*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO JUNE 2, 1980
 SHEET 7 OF 7 **344-D-7172 A**

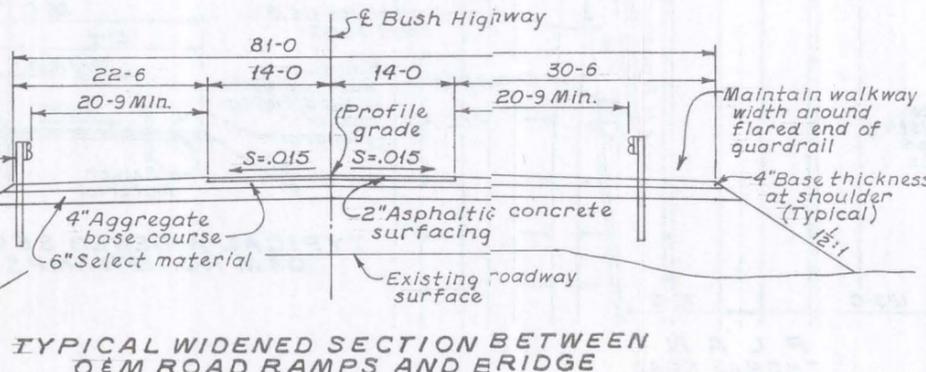
RED-344-D-7172

NOTE: Surface O&M road ramp turnouts with 2" asphaltic concrete to the 20 ft. limit shown on the plan.



NOTES
For Bush Highway bridge details, see Dwg. 344-D-7178.
For beam-type guardrail details, see Dwg. 344-D-7203 and 344-D-7204.
For chain link fence and gate details, see Dwg. 40-D-6268. Install double 12 ft. gates on right and double 10 ft. gates on left of canal.
All powerline and telephone line relocations will be by others.

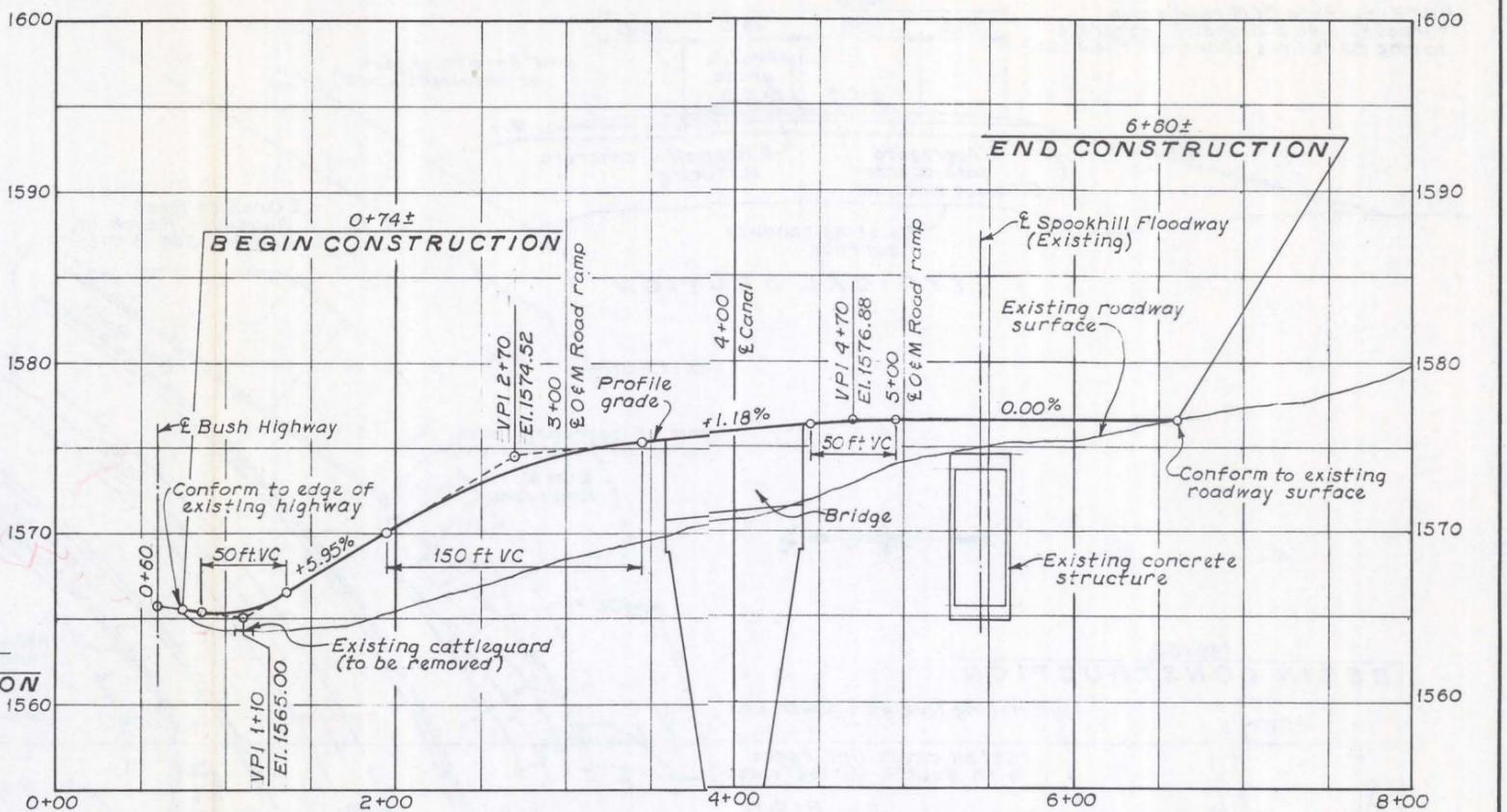
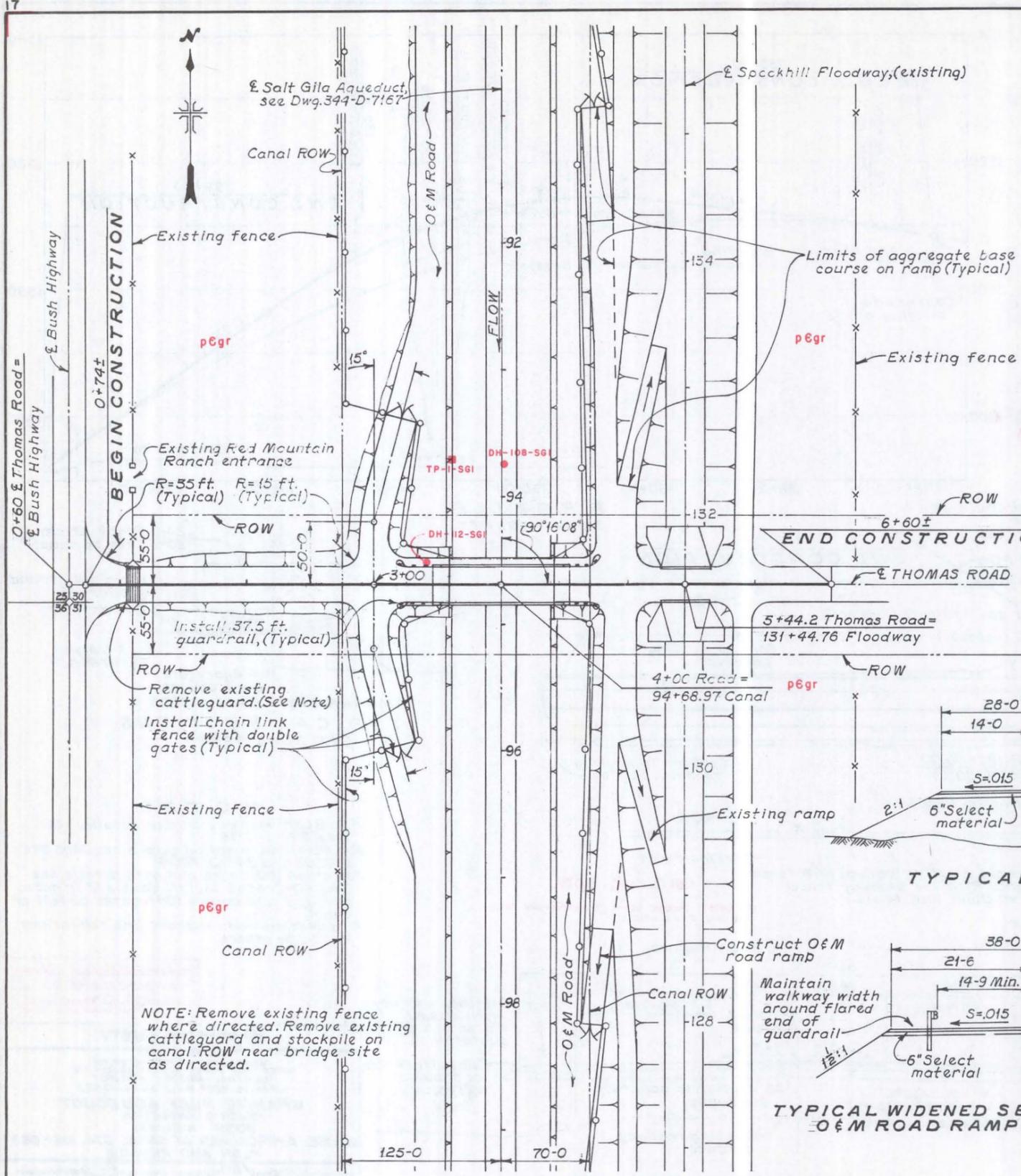
GEOLOGIC NOTE
For General Geologic Legend, Explanation and Notes see Dwg. 344-D-7156A



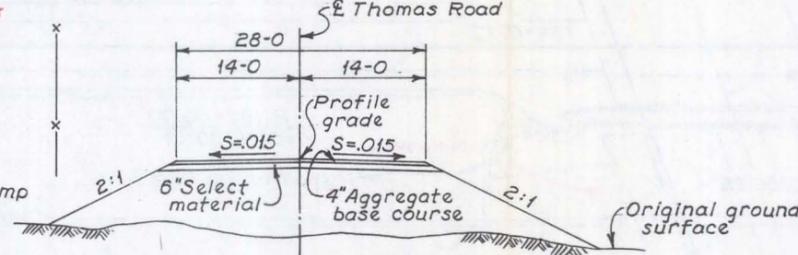
TECH. APPROVAL *Richard Shuman*
SUBMITTED, NOT REQUIRED
APPROVED *Richard Shuman*
CHIEF, WESTERN GEOLOGY BRANCH

ALWAYS THINK SAFETY
UNITED STATES DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA
GRANITE REEF AQUEDUCT
REACH 12 COMPLETION
BUSH HIGHWAY
BRIDGE APPROACHES AT CANAL STA. 815+66.37
PLAN AND PROFILE
DESIGNED BY *Richard Shuman* TECHNICAL APPROVAL *Richard Shuman*
DRAWN *Richard Shuman* SUBMITTED *Richard Shuman*
CHECKED *Richard Shuman* APPROVED *Richard Shuman*
CHIEF, WATER CONVEYANCE BRANCH
DENVER, COLORADO OCT. 1, 1980 **344-D-7173A**

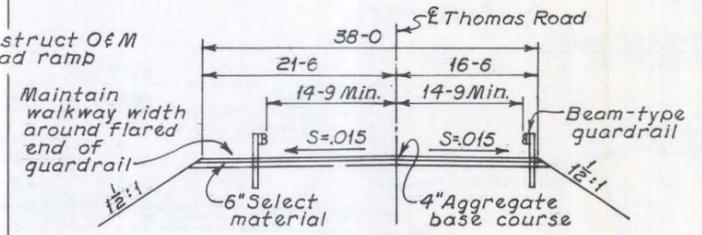
RED 344-D-7173



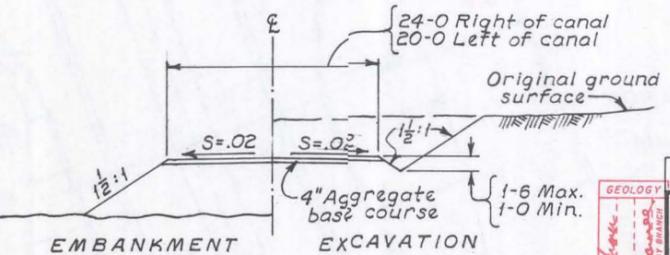
PROFILE THOMAS ROAD



TYPICAL SECTION



TYPICAL WIDENED SECTION BETWEEN O&M ROAD RAMPS AND BRIDGE



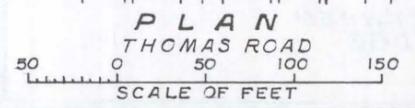
TYPICAL SECTIONS O&M ROAD RAMPS

GEOLOGIC NOTE

For General Geologic Legend, Explanation, and Notes, see Dwg. 344-D-7156A

- NOTES**
- For Thomas Road Bridge details, see Dwg. 344-D-7183.
 - For beam-type guardrail details, see Dwg. 344-D-7203 and Dwg. 344-D-7204.
 - For chain link fence and gate details, see Dwg. 40-D-6268. Install double, 12 ft. gates on right and double 10 ft. gates on left of canal.

NOTE: Remove existing fence where directed. Remove existing cattleguard and stockpile on canal ROW near bridge site as directed.



GEOLOGY
 TECH. APPROVAL: [Signature]
 SUBMITTED: [Signature]
 APPROVED: [Signature]

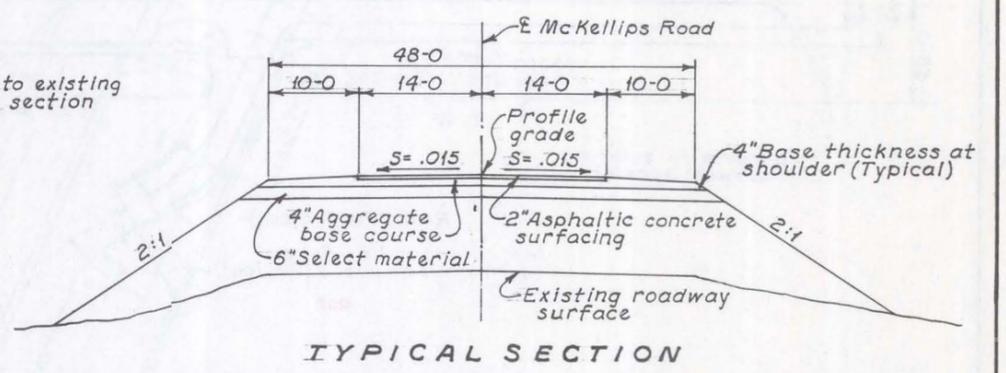
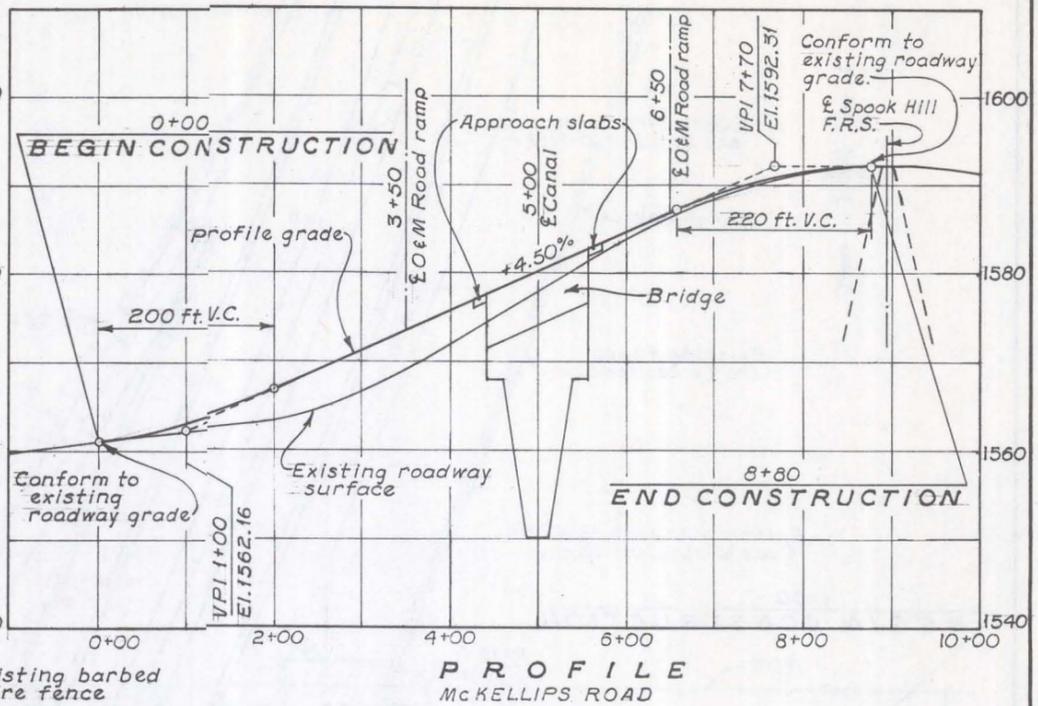
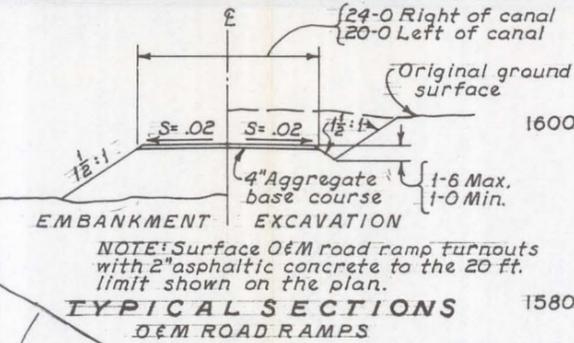
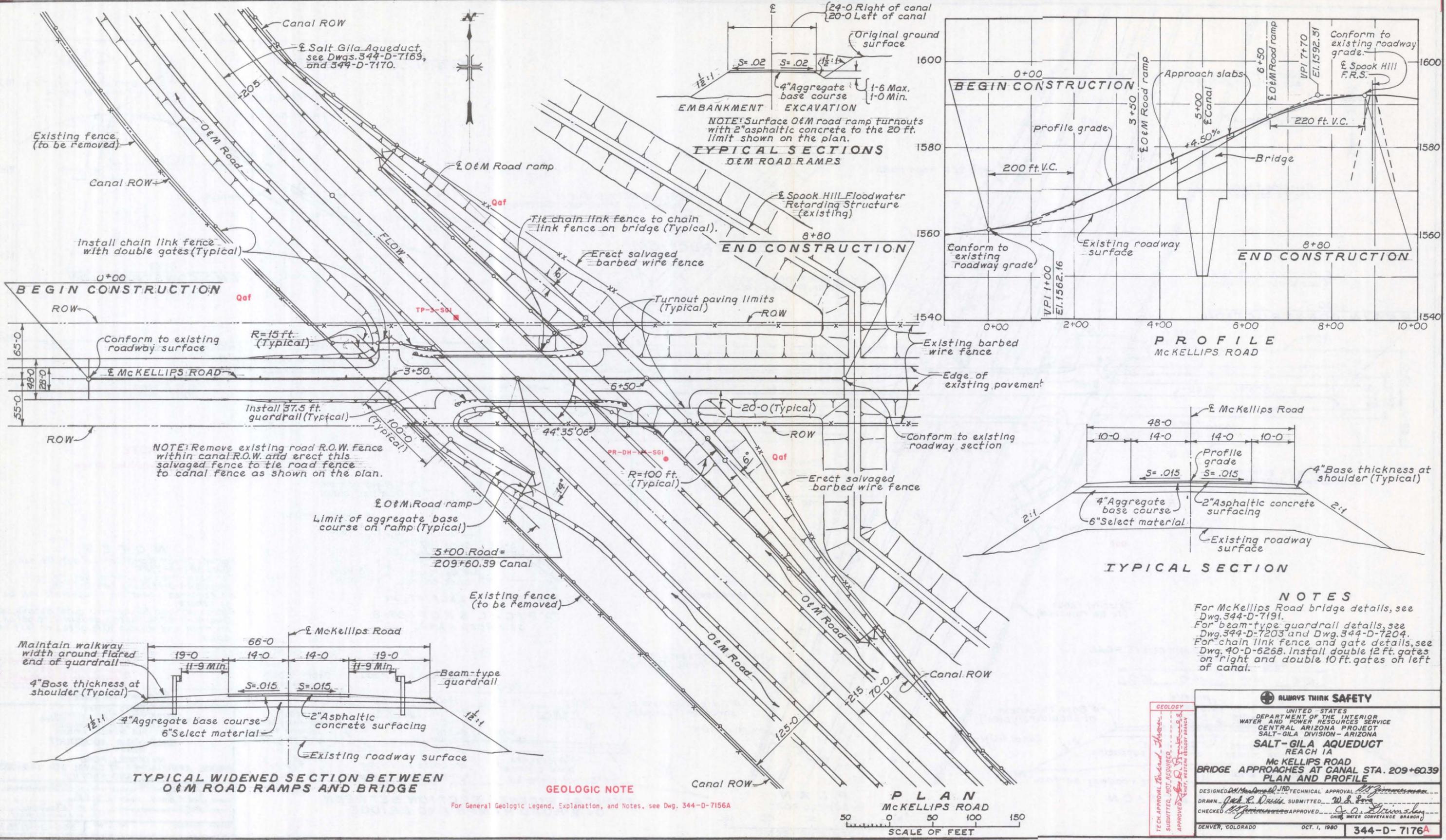
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UNITED STATES
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 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION - ARIZONA
SALT-GILA AQUEDUCT
 REACH 1A
THOMAS ROAD
BRIDGE APPROACHES AT CANAL STA. 94+68.97
PLAN AND PROFILE

DESIGNED: [Signature] TECHNICAL APPROVAL: [Signature]
 DRAWN: [Signature] SUBMITTED: [Signature]
 CHECKED: [Signature] APPROVED: [Signature]
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO OCT. 1, 1980 **344-D-7174 A**

RED-344-D-7174



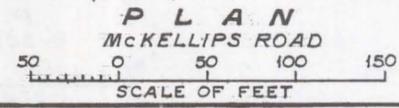
NOTES

For McKellips Road bridge details, see Dwg. 344-D-7191.
 For beam-type guardrail details, see Dwg. 344-D-7203 and Dwg. 344-D-7204.
 For chain link fence and gate details, see Dwg. 40-D-6268. Install double 12 ft. gates on right and double 10 ft. gates on left of canal.

TYPICAL WIDENED SECTION BETWEEN O&M ROAD RAMPS AND BRIDGE

GEOLOGIC NOTE

For General Geologic Legend, Explanation, and Notes, see Dwg. 344-D-7156A

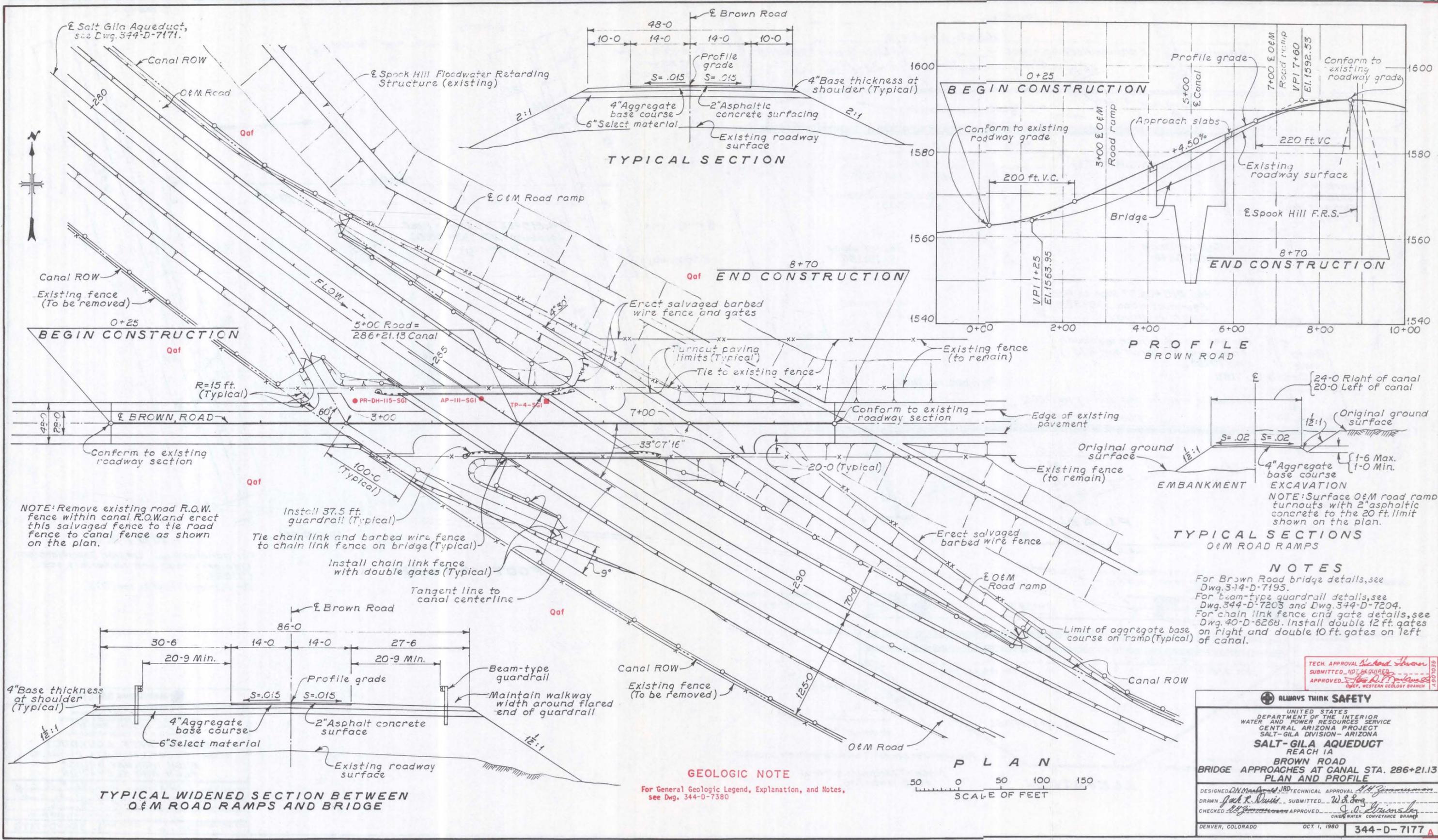


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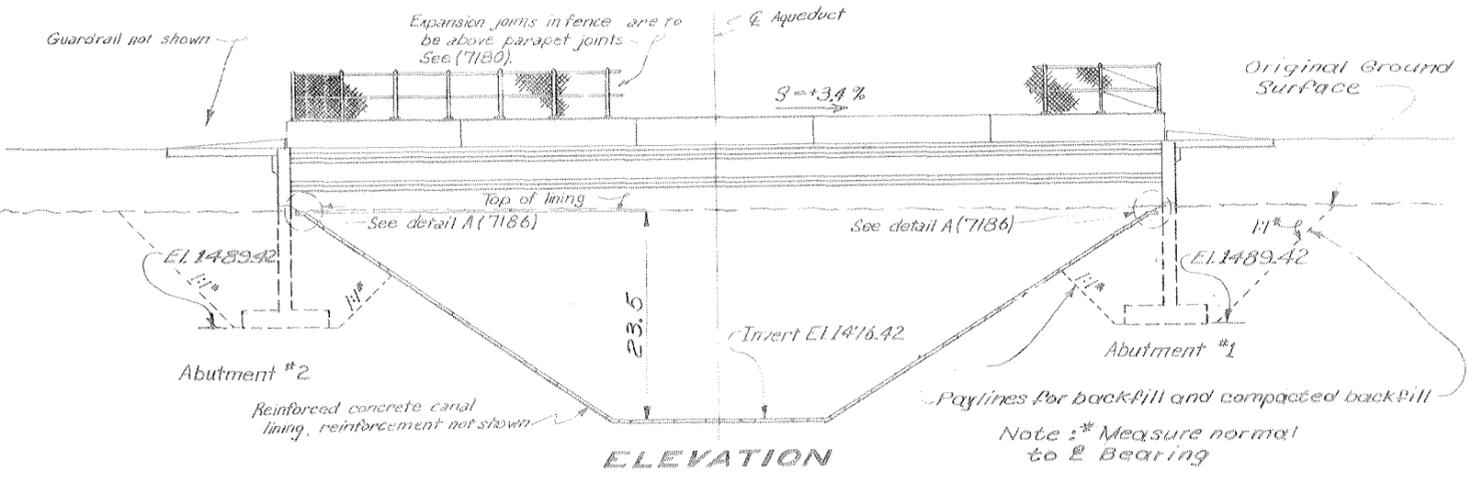
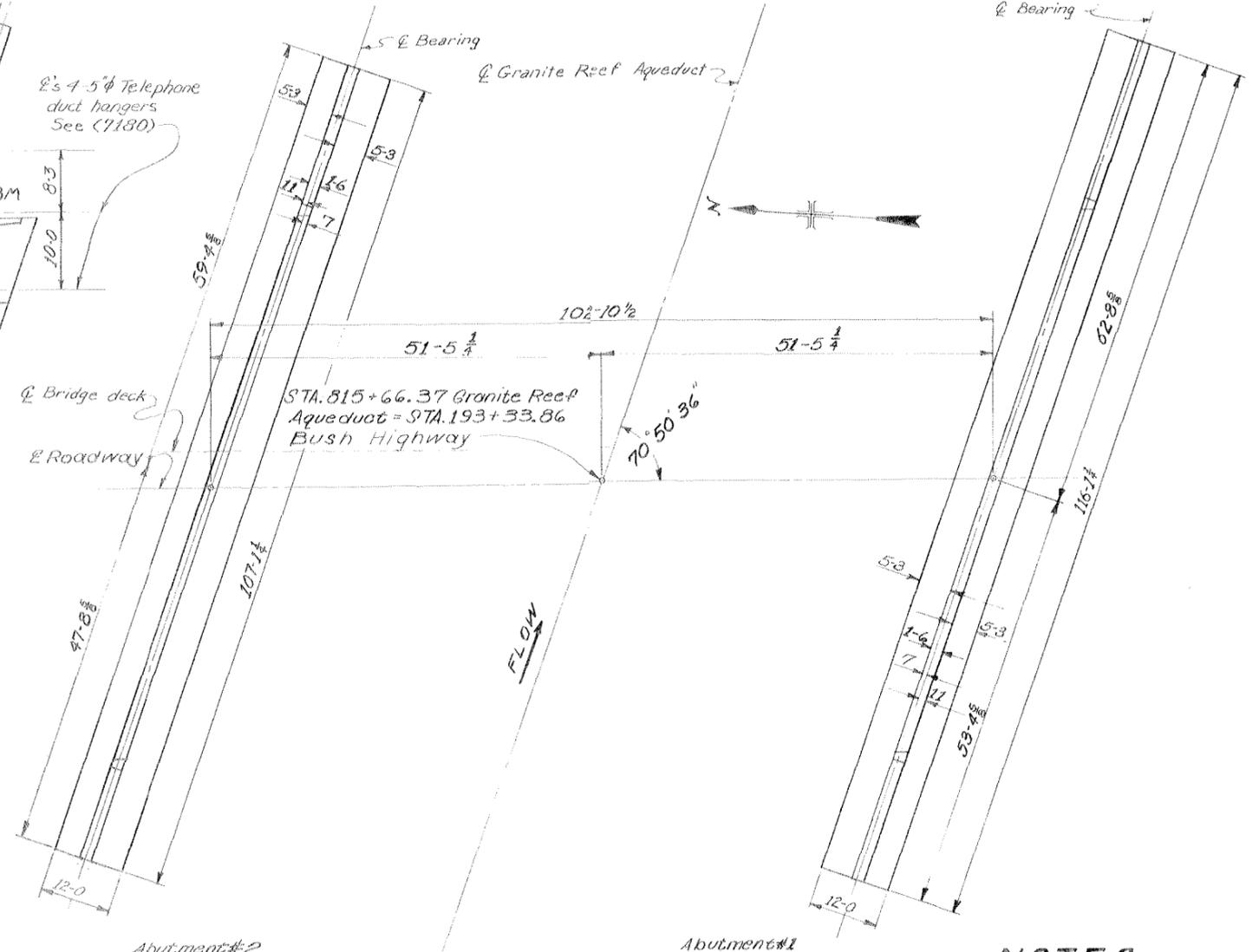
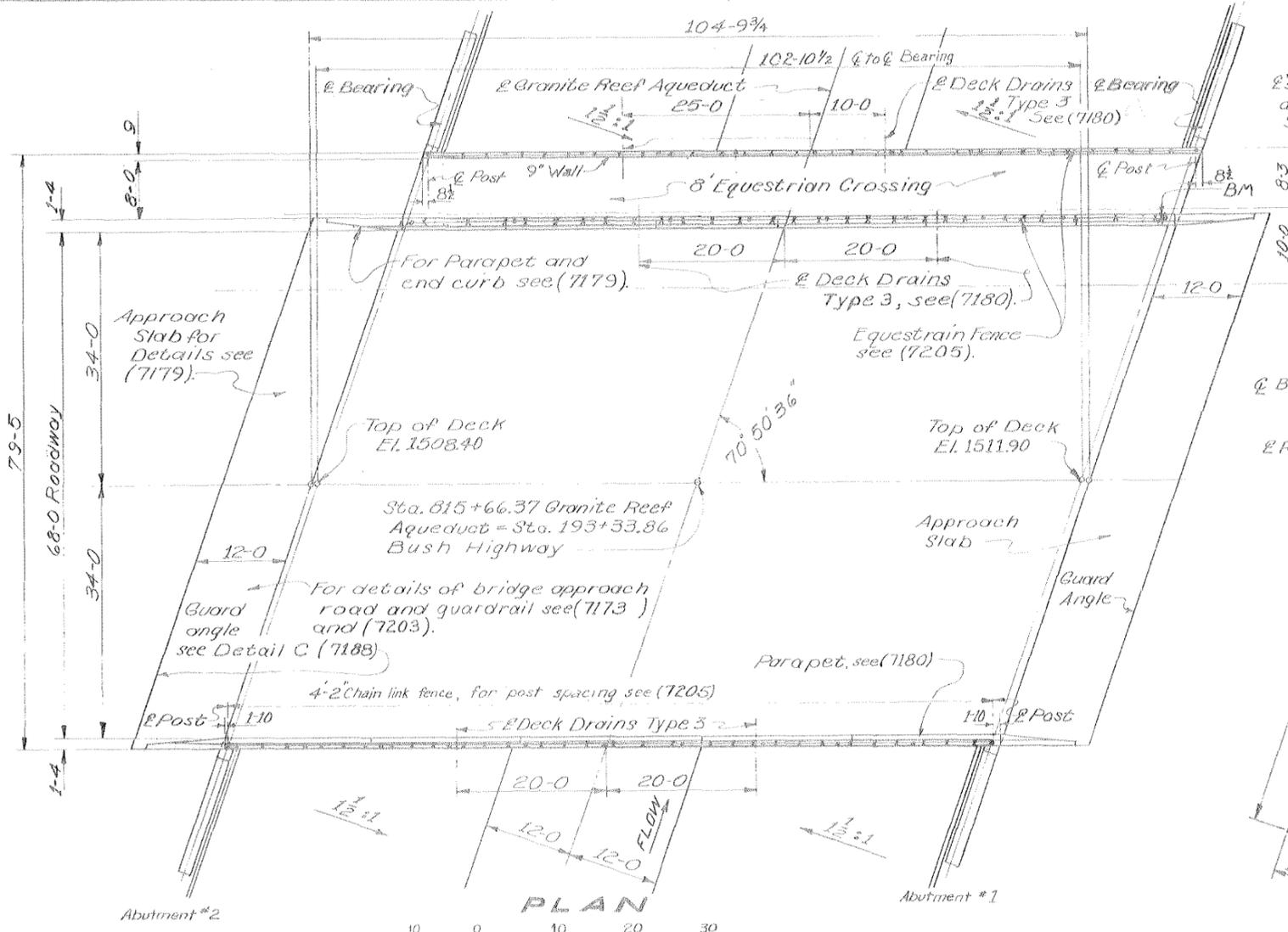
UNITED STATES DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION - ARIZONA
SALT-GILA AQUEDUCT REACH 1A
Mc KELLIPS ROAD BRIDGE APPROACHES AT CANAL STA. 209+60.39 PLAN AND PROFILE

DESIGNED BY: JRD TECHNICAL APPROVAL: [Signature]
 DRAWN BY: [Signature] SUBMITTED: [Signature]
 CHECKED BY: [Signature] APPROVED: [Signature]
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO OCT. 1, 1980 **344-D-7176A**



RED 344-D-7177



NOTES

For General Notes, Design Specifications, Design Loads and Materials, see (7183).
 For Plan and Profile, see (7173).

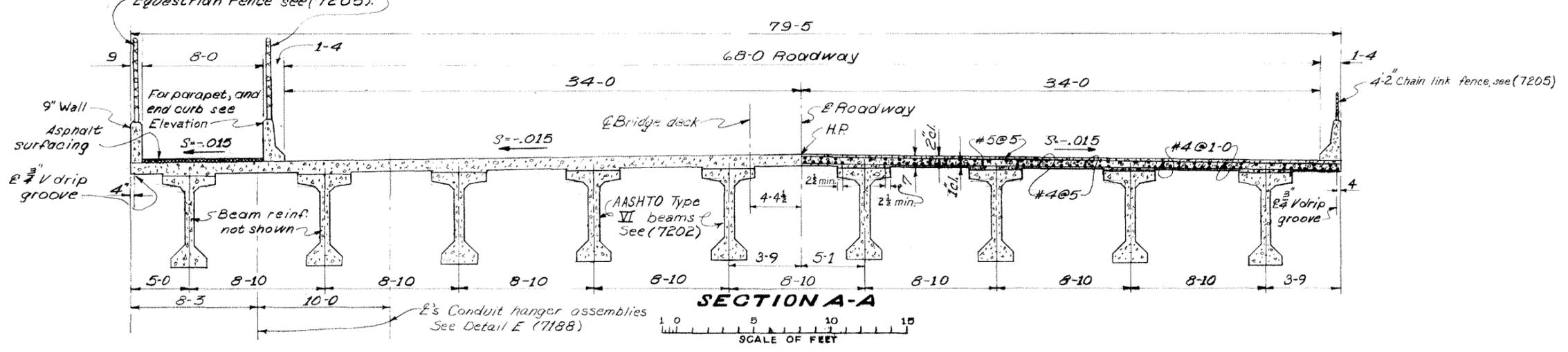
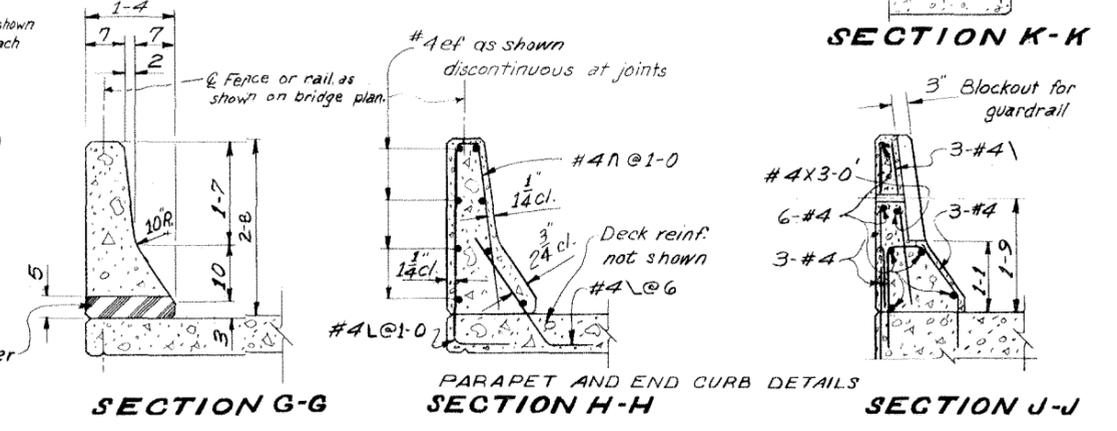
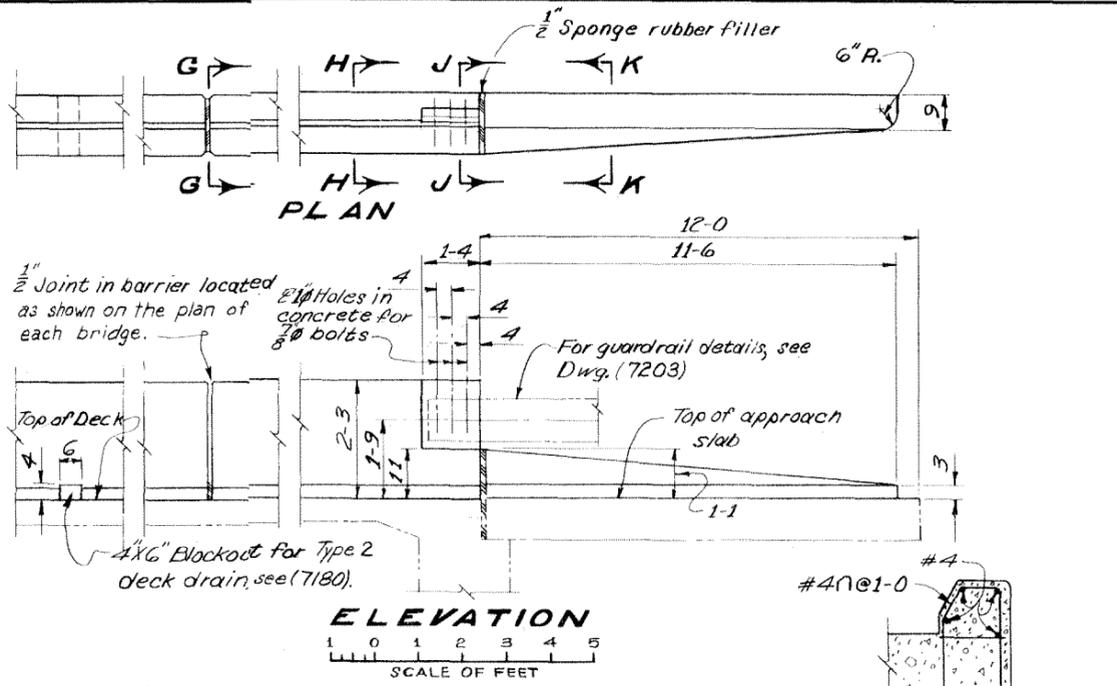
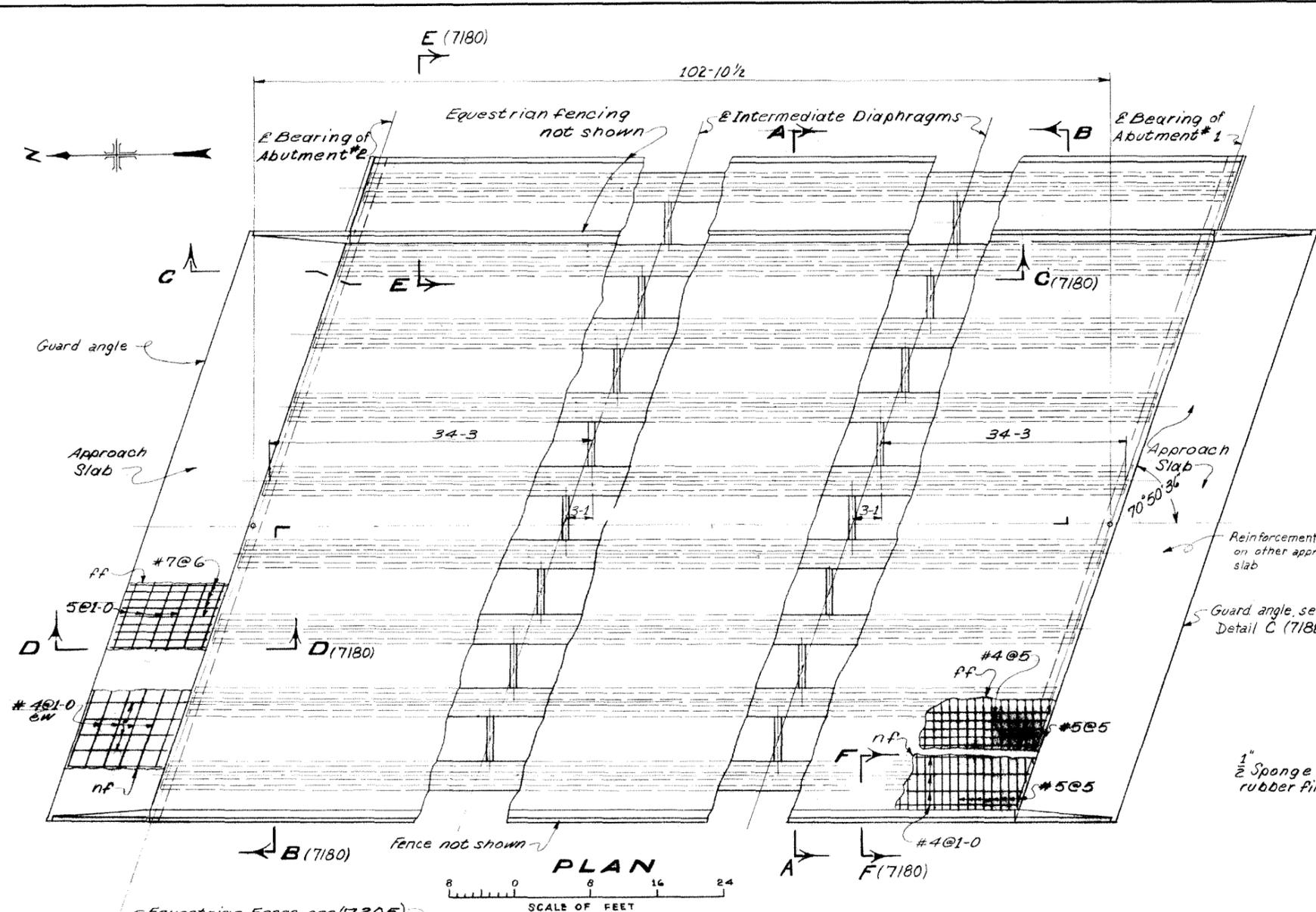
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 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA

GRANITE REEF AQUEDUCT
 REACH 12 COMPLETION-STA. 815+66.37
 BUSH HIGHWAY BRIDGE
 PLAN AND ELEVATION

DESIGNED: *Samuel B. Kelly* TECHNICAL APPROVAL: *John L. Strubbe*
 DRAWN: *Charles R. Hall* SUBMITTED: *John L. Strubbe*
 CHECKED: *David M. ...* APPROVED: *...*
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SHEET 1 OF 4 OCT. 1, 1980 344-D-7178



NOTES

For General Notes, Design Specifications, Design Loads and Materials see (7183).
 For precast, prestressed concrete beams, see (7202).
 Rail Assembly to be galvanized after fabrication.
 Bolts, nuts and washers for Rail Assembly to be galvanized.

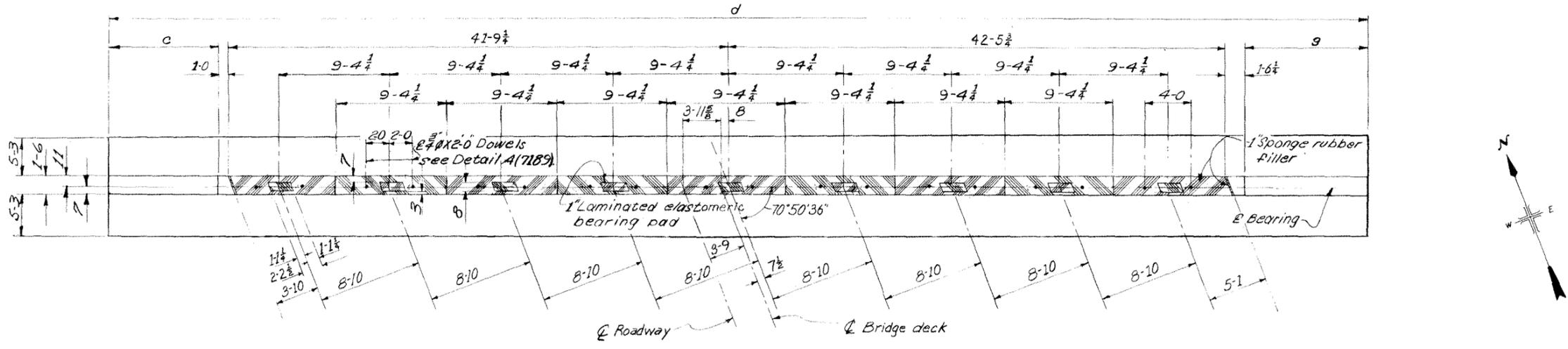
ALWAYS THINK SAFETY

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 GRANITE REEF DIVISION - ARIZONA

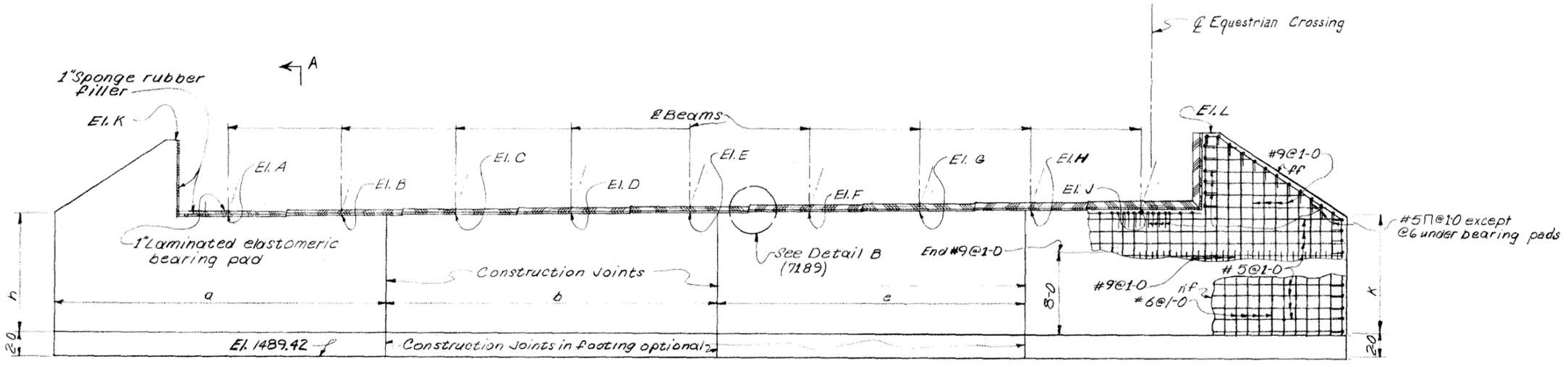
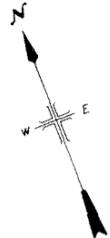
GRANITE REEF AQUEDUCT
 REACH 12 COMPLETION - STA. 815 + 66.37
BUSH HIGHWAY BRIDGE
 PLAN, SECTIONS AND ELEVATIONS

DESIGNED BY *[Signature]* TECHNICAL APPROVAL *[Signature]*
 DRAWN BY *[Signature]* SUBMITTED *[Signature]*
 CHECKED *[Signature]* APPROVED *[Signature]*
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SHEET 2 OF 4 OCT. 1, 1980 344-D-7179



PLAN
ABUTMENT 2 SHOWN ABUTMENT 1 SIMILAR

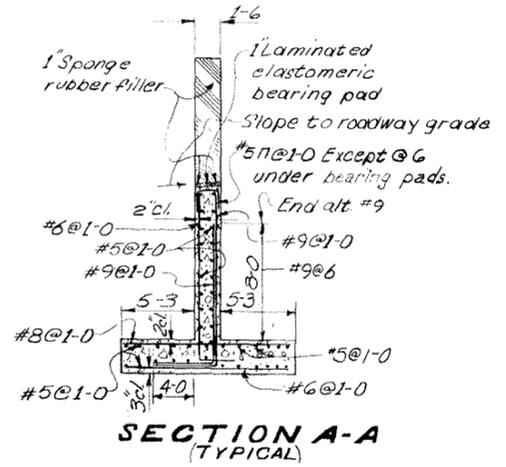


ELEVATION

* Note: Elevations are given at E of bearing, Q of beams.

ABUTMENT	a	b	e	c	g	d	h	k
1	32-0	32-0	25-0	15-3	14-1	116-1 1/4	10-1 1/2	10-1 1/2
2	28-0	28-0	28-0	9-7	10-9	107-1 1/4	10-1 1/2	10-1 1/2

ABUT.	E.I. A*	E.I. B*	E.I. C*	E.I. D*	E.I. E*	E.I. F*	E.I. G*	E.I. H*	E.I. J*	E.I. K	E.I. L
1	1504.14	1504.37	1504.61	1504.85	1504.97	1504.94	1504.92	1504.89	1504.86	1511.41	1512.22
2	1500.63	1500.87	1501.11	1501.35	1501.47	1501.44	1501.41	1501.39	1501.94	1507.91	1508.72



SECTION A-A (TYPICAL)
NOTE
For notes, see (7178).

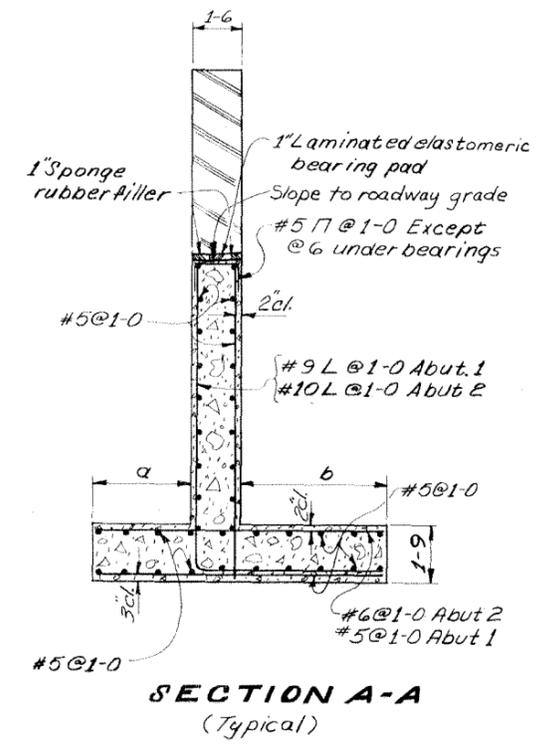
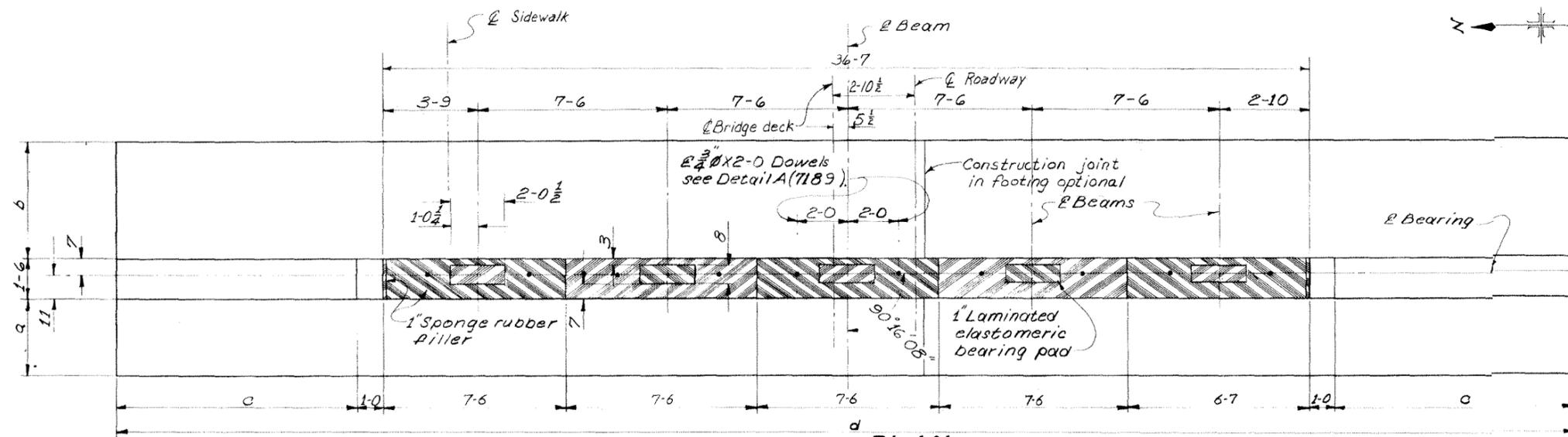
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UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

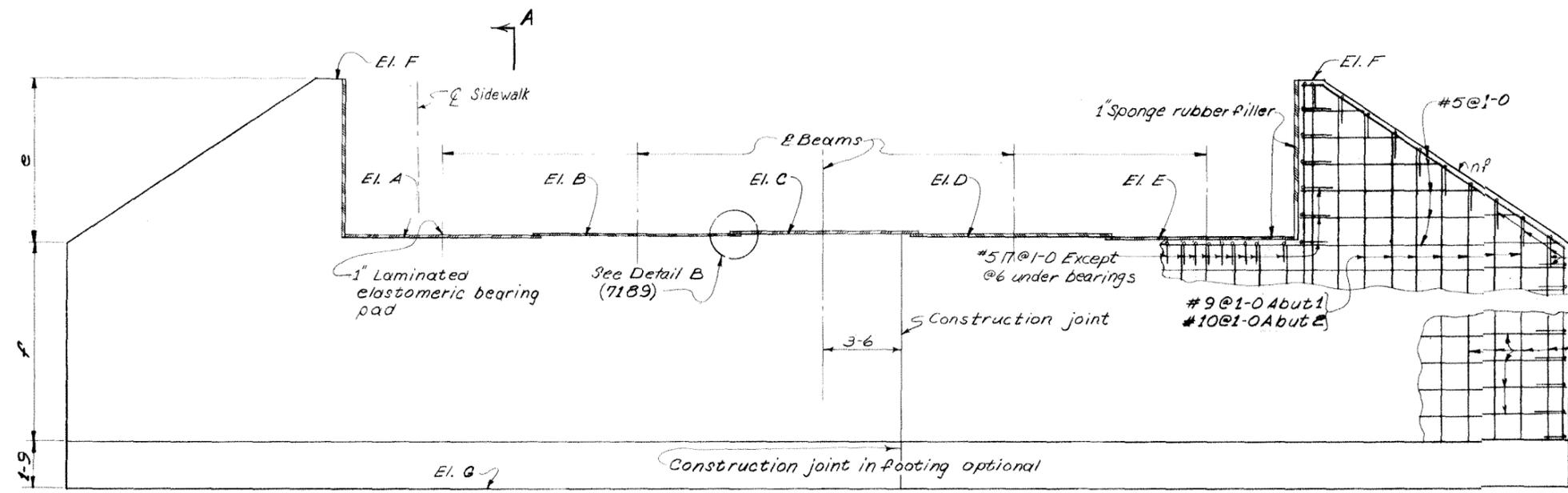
GRANITE REEF AQUEDUCT
REACH 12 COMPLETION - STA. 815+66.37
BUSH HIGHWAY BRIDGE
PLAN, SECTIONS AND ELEVATIONS

DESIGNED: *[Signature]* TECHNICAL APPROVAL: *[Signature]*
DRAWN: *[Signature]* SUBMITTED: *[Signature]*
CHECKED: *[Signature]* APPROVED: *[Signature]*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO OCT. 1, 1980 SHEET 4 OF 4 **344-D-7181**



NOTES
For General Notes, Design Specifications, Design Loads and Materials, see (7183).



ABUTMENT	a	b	c	d	e	f	El. A*	El. B*	El. C*	El. D*	El. E*	El. F	El. G
1	3-0	4-6	9-6	57-7	6-4	7-3 1/2	1569.97	1570.08	1570.19	1570.16	1570.05	1575.76	1560.41
2	4-0	5-0	11-0	60-7	7-4	7-6 1/2	1570.92	1571.03	1571.14	1571.11	1571.00	1576.71	1560.08

* Note: Elevations are given at E bearing

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DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION - ARIZONA

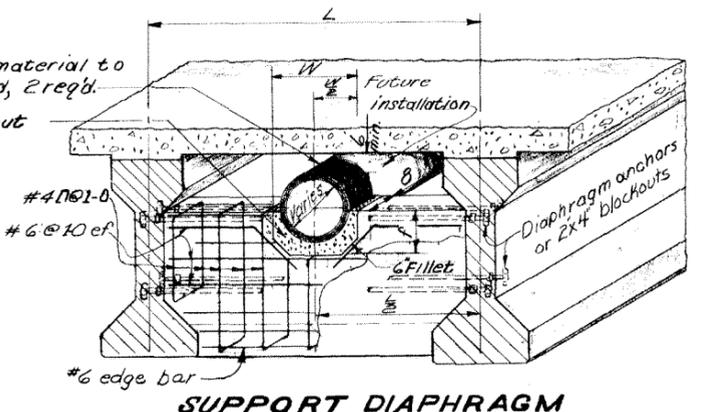
SALT-GILA AQUEDUCT
REACH 1A - STA. 94+68.97
THOMAS ROAD BRIDGE
PLAN, SECTION, AND ELEVATIONS

DESIGNED *David M. ...* TECHNICAL APPROVAL *John P. ...*
DRAWN *Charles R. ...* SUBMITTED *John P. ...*
CHECKED *James B. ...* APPROVED *J. O. ...*
DENVER, COLORADO SHEET 2 OF 3 OCT. 1, 1960 344-D-7184

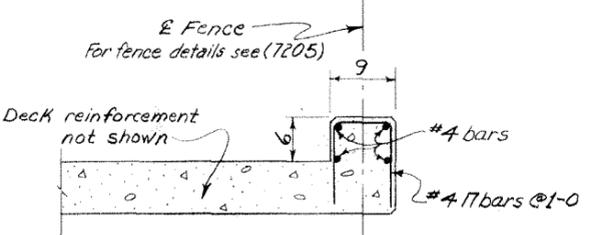
SUPPORT DIAPHRAGM DIMENSIONS

Bridge and Station	PIPE DIA. (INCH)	L	BLOCKOUT DIM.		# OF SUPPORT DIAPHRAGMS REQUIRED	LEN. OF # 8 THREADED RODS
			F	W		
THOMAS ROAD STA. 94+68.97	16	7-6	1-0	2-0	2	2-0
McDOWELL RD. STA. 148+39.35	16	7-3	1-0	2-0	2	2-0
McKELLIPS RD. STA. 209+60.39	16	7-3	1-0	2-0	2	2-0
BROWN ROAD STA. 286+21.13	24	7-10	1-6	2-6	4	2-0

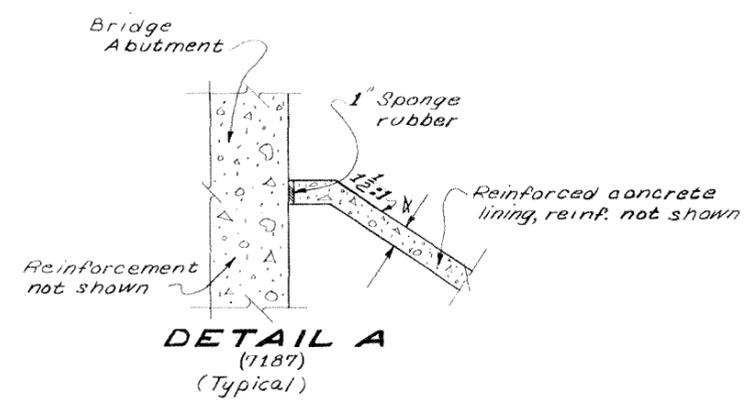
Wrap with 1/2" Asbestos material to prevent bond, 2 req'd.
Non-setting grout



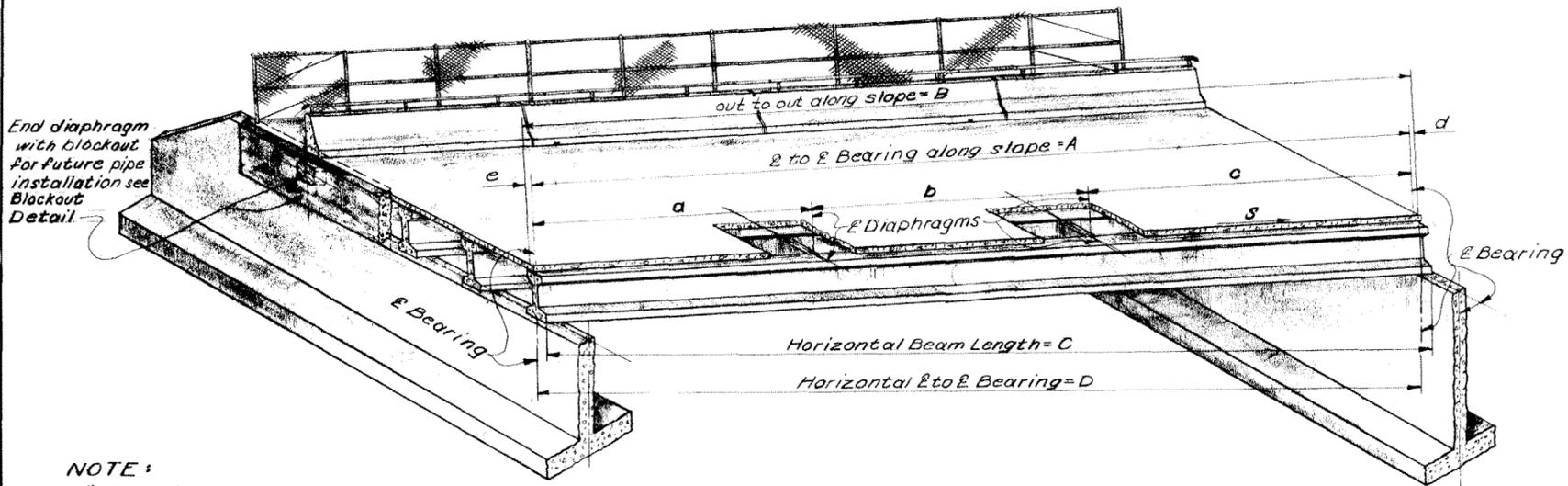
SUPPORT DIAPHRAGM



SECTION B-B (7183)
(Typical 16" Curb Detail)



DETAIL A (7187)
(Typical)



PICTORIAL VIEW

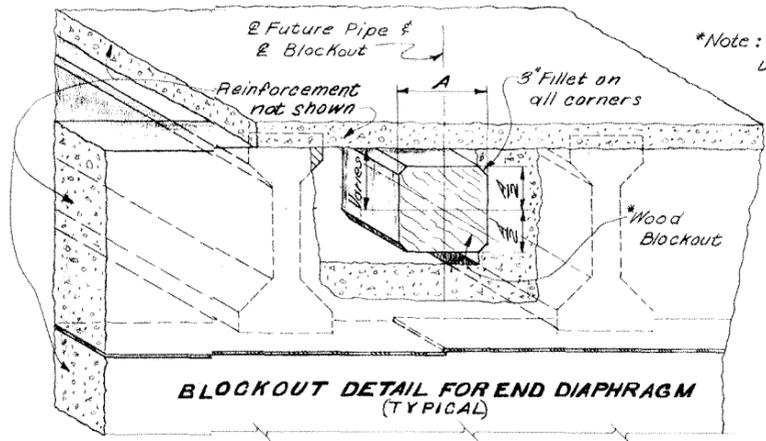
NOTE:
* Span 1 shown, span 2 similar.
** Granite Reef Aqueduct Station.
*** Represents Center Pier for Brown Road Span 1.

Abutment #1

Abutment #2 ***

BRIDGE SPAN DIMENSIONS

BRIDGE	STATION	a	b	c	d	e	A	B	C	D	S
Bush Highway**	815+66.37	34-3	34-5	34-3	7 1/2	7 1/2	102-11	104-2	104-1	102-10 1/2	3.40%
Thomas Road	94+68.97	26-9	26-10	26-9	7	7	80-4	81-6	81-6	80-4	1.18%
McDowell Road	148+39.35	29-4	29-3	29-4	7 1/2	7 1/2	87-11	89-2	87-9	89-0 1/2	6.00%
McKellips Road	209+60.39	38-4	38-4 1/2	38-4	10	10	115-0 1/2	116-8 1/2	116-7	114-11 1/2	4.50%
Brown Road*	286+21.13	26-3	26-5	26-3	1-1	1-1	78-11	81-1	81-0	78-10	4.50%



BLOCKOUT DETAIL FOR END DIAPHRAGM (TYPICAL)

BLOCKOUT DIMENSIONS
Future 16" Pipe A = 2'-0"
Future 24" Pipe A = 2'-6"

*Note: Wood to be left in blockout until installation of pipe.

NOTE
For General Notes, Design Specifications, Design Loads and Materials see Dwg. (7183).

ALWAYS THINK SAFETY

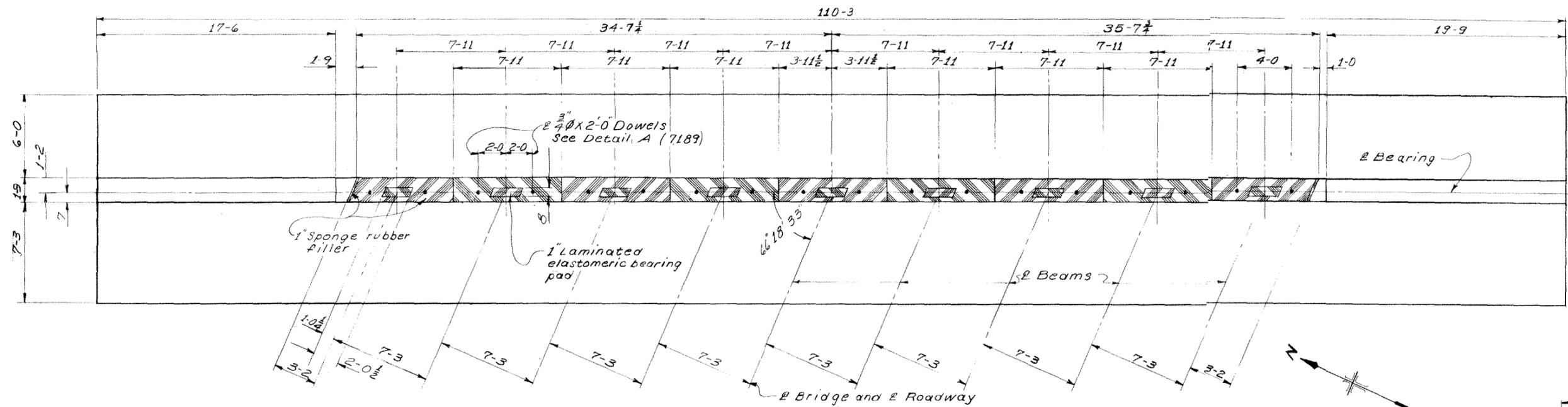
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
REACH 1A - STA. 94+68.97, STA. 148+39.35
STA. 209+60.39 AND STA. 286+21.13

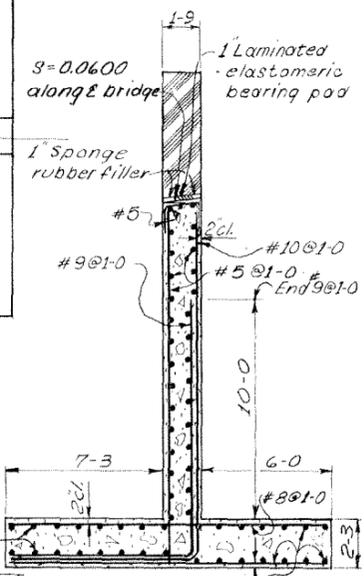
BRIDGE DETAILS

DESIGNED *James B. Bullock* TECHNICAL APPROVAL *John A. Stankovich*
DRAWN *Charles R. Dill* SUBMITTED *John A. Stankovich*
CHECKED *David M. Mink* APPROVED *J. D. Stankovich*
CHIEF, WATER CONVEYANCE BRANCH

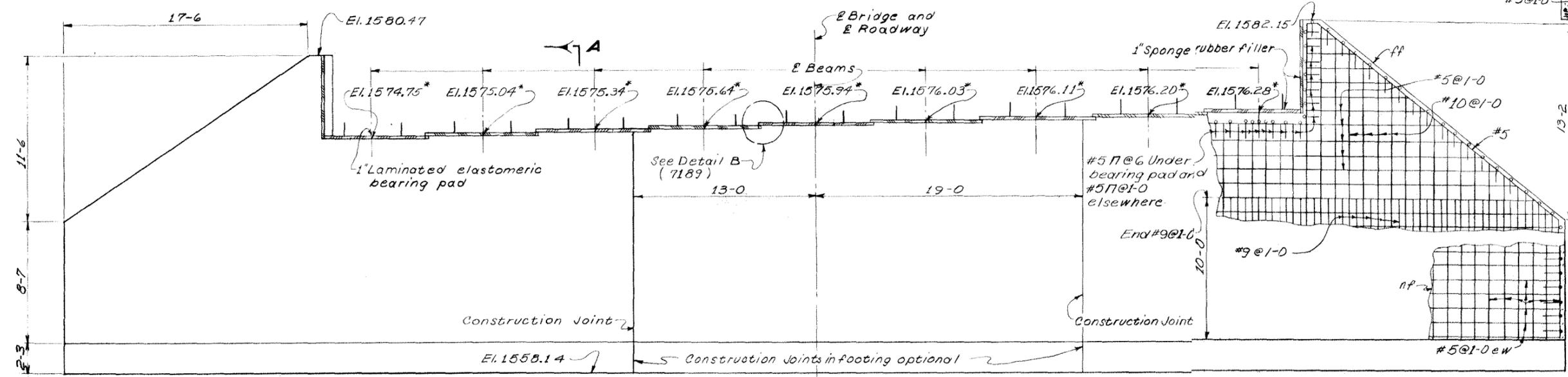
DENVER, COLORADO OCT. 1, 1980 **344-D-7186**



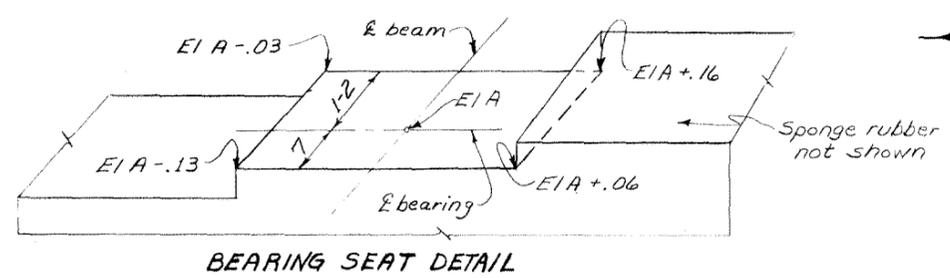
PLAN
ABUTMENT NO. 2



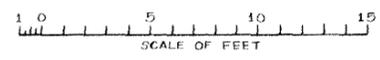
SECTION A-A



ELEVATION
ABUTMENT NO. 2



BEARING SEAT DETAIL



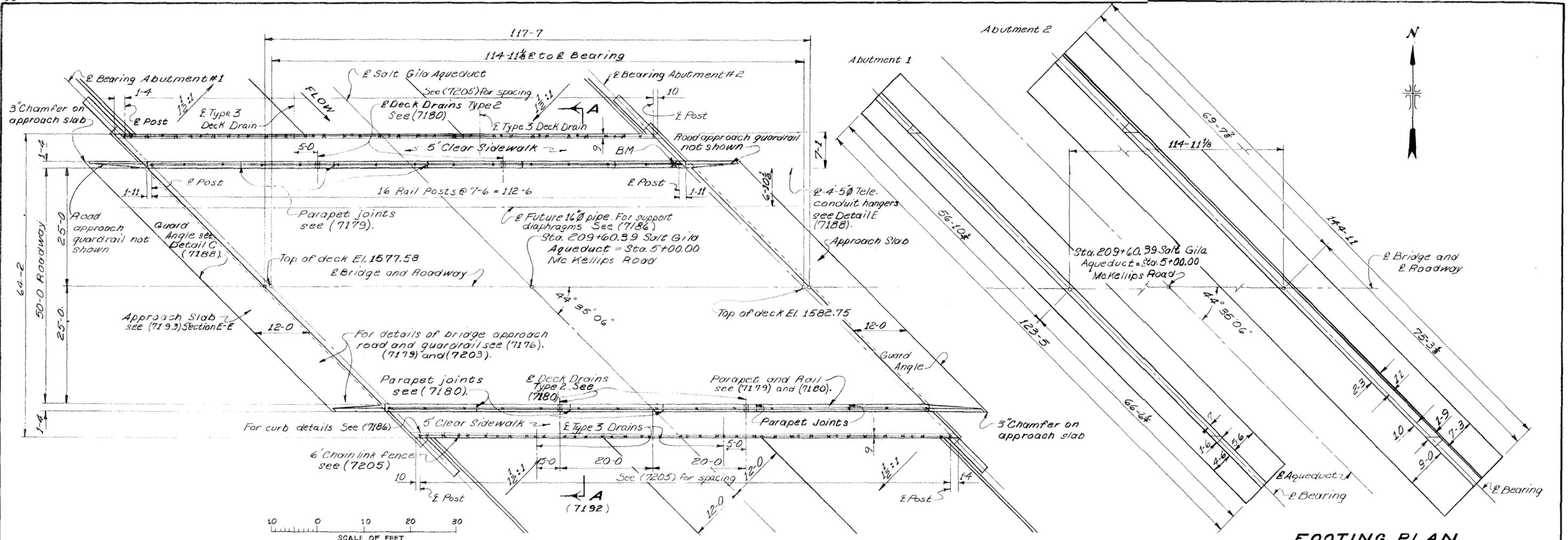
NOTES
 For General Notes, Design Specifications, Design Loads and Materials, see Dwg. (7183)

ALWAYS THINK SAFETY

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA
SALT-GILA AQUEDUCT
 REACH 1A-STA. 148+39.35
Mc DOWELL ROAD BRIDGE
PLAN, SECTION, ELEVATION

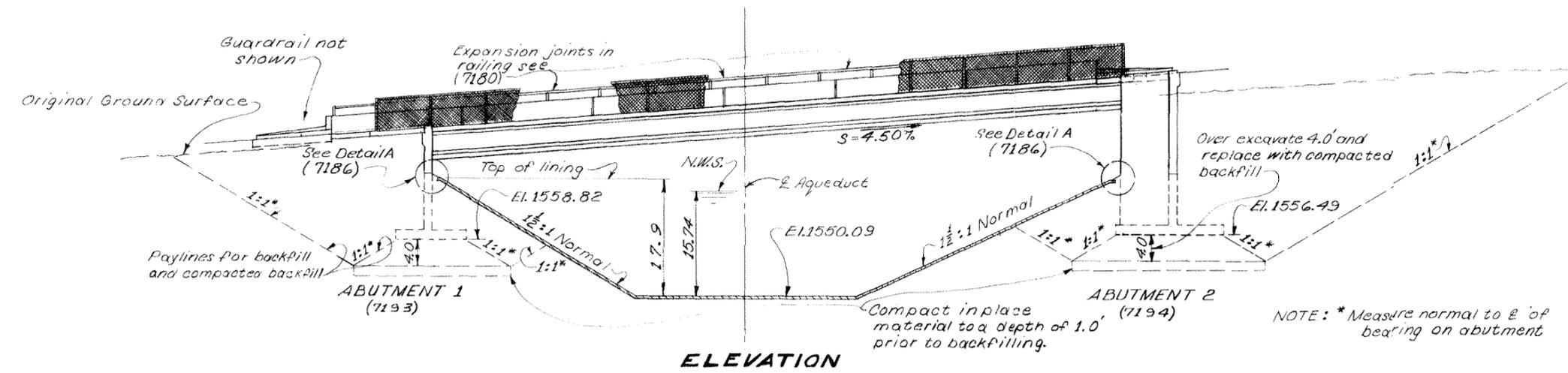
DESIGNED: David M. ... TECHNICAL APPROVAL: ...
 DRAWN: Charles R. ... SUBMITTED: ...
 CHECKED: ... APPROVED: ...
 SUPERVISOR, WATER CONVEYANCE BRANCH

DENVER, COLORADO OCT. 1, 1980
 SHEET 4 OF 4 **344-D-7190**



PLAN

FOOTING PLAN



ELEVATION

NOTES

For General Notes, Design Specifications, Design Loads and Materials see (7183).
 For precast, prestressed concrete beams, see Dwg. 344-D-7202.
 For 6' chain link fence see Dwg. (7205).
 Rail assembly to be galvanized after fabrication.
 Bolts, nuts and washers for rail assembly to be galvanized.

ALWAYS THINK SAFETY

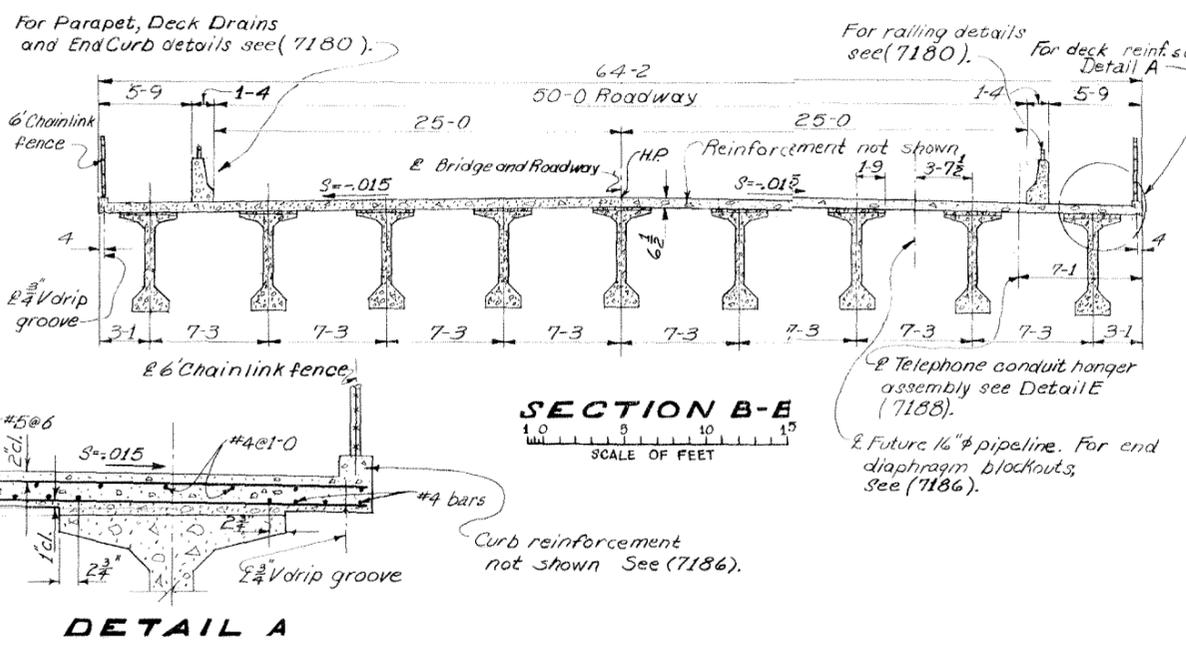
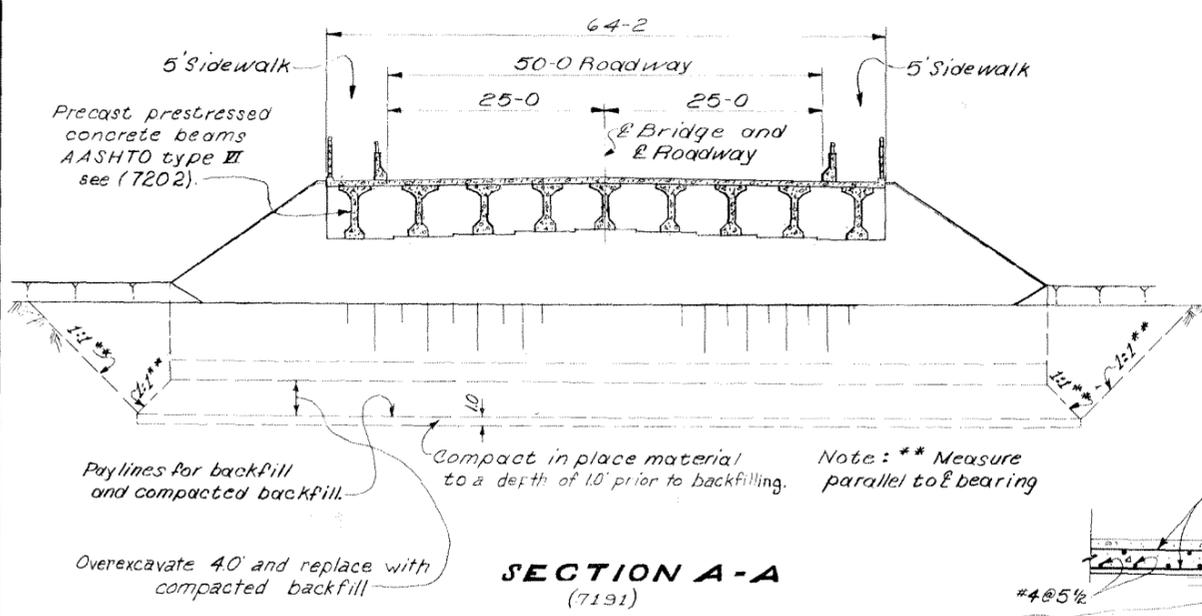
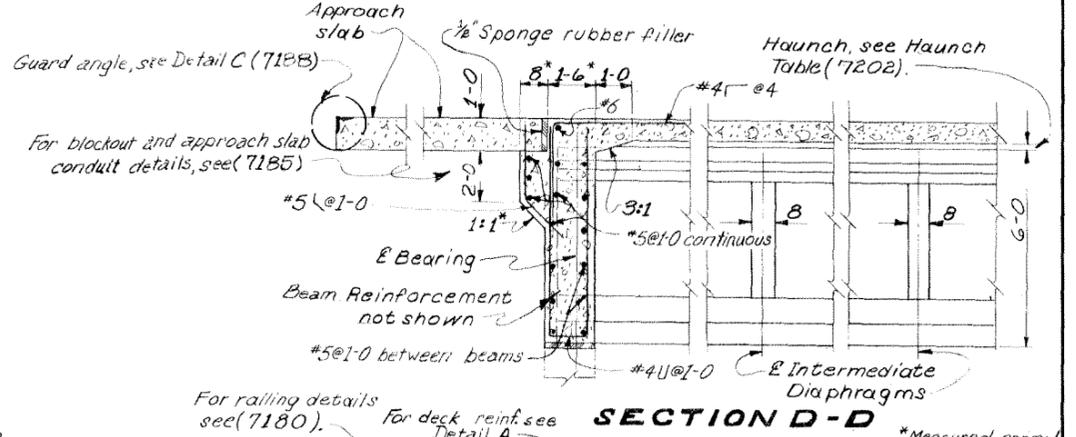
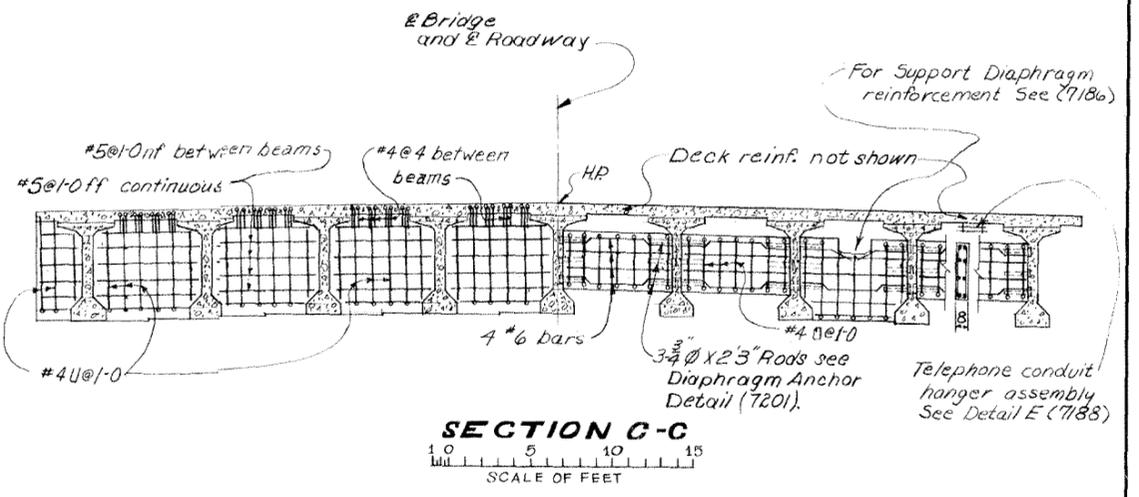
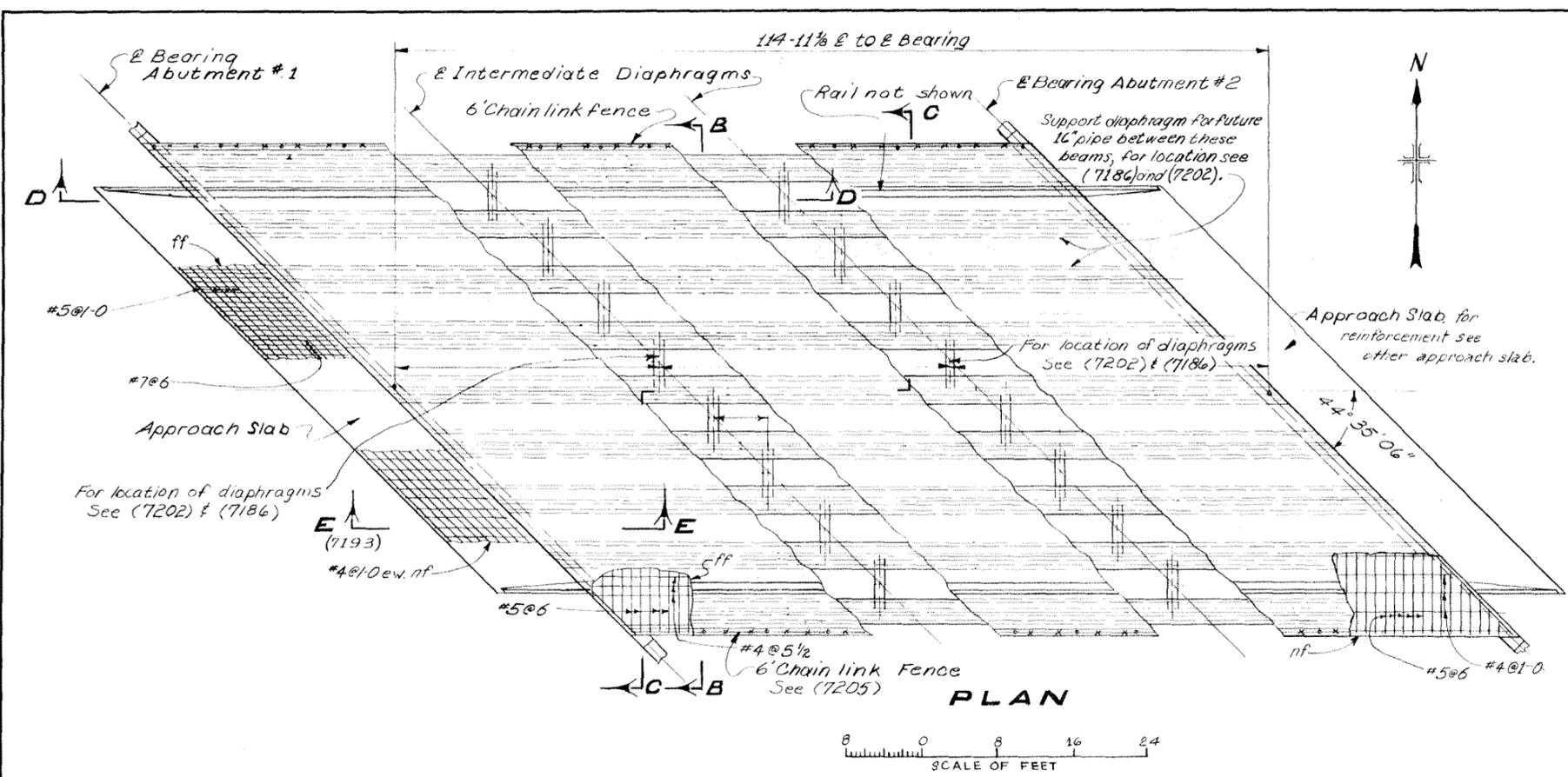
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION - ARIZONA

SALT-GILA AQUEDUCT
 REACH 1A - STA. 209+60.39
MCKELLIPS ROAD BRIDGE
PLANS AND ELEVATIONS

DESIGNED *David M. Murrick* TECHNICAL APPROVAL *John J. Staschuck*
 DRAWN *Charles R. Spall* SUBMITTED *John J. Staschuck*
 CHECKED *James B. Kelly* APPROVED *J. O. Williams*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SHEET 1 OF 4 OCT 1, 1980 **344-D-7191**

NOTE: * Measure normal to ℓ of bearing on abutment



NOTES

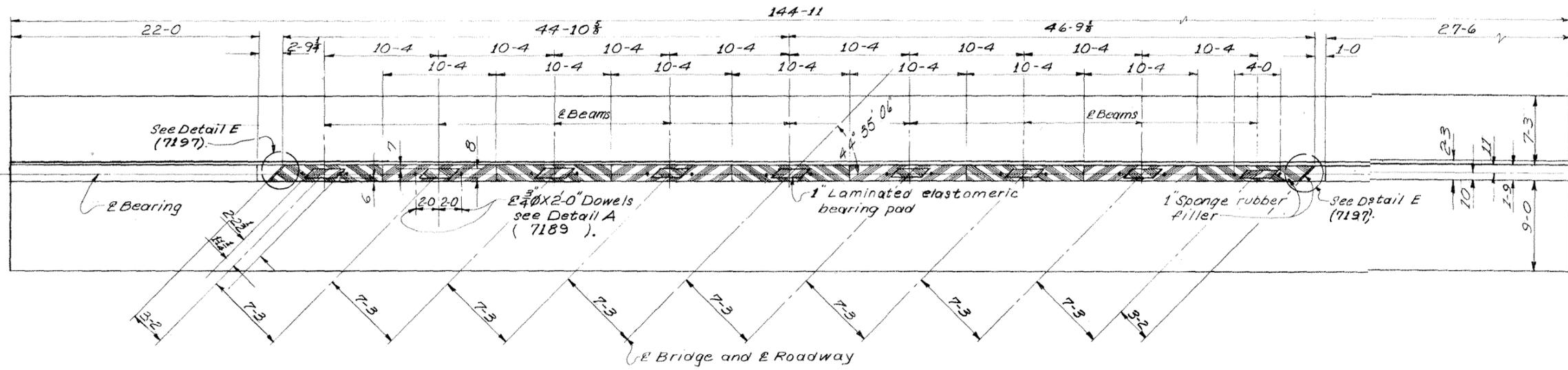
For General Notes, Design Specifications, Design Loads and Materials see Dwg. (7185).

ALWAYS THINK SAFETY

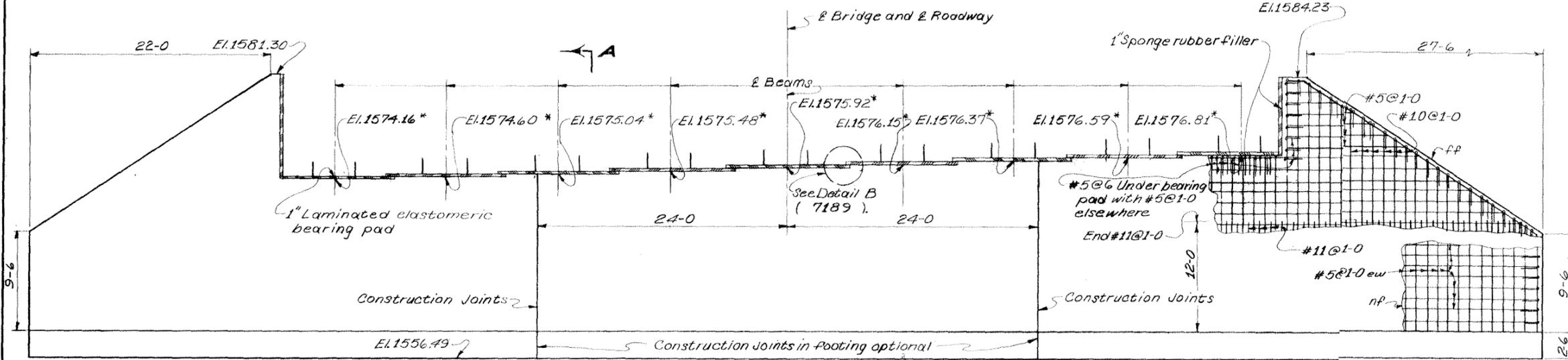
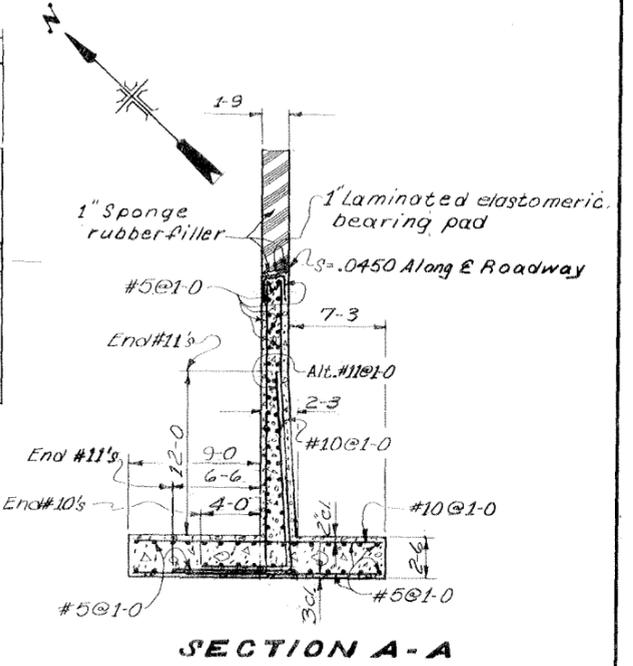
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION - ARIZONA
SALT-GILA AQUEDUCT
REACH 1A - STA 209+60.39
MCKELLIPS ROAD BRIDGE
PLAN, SECTIONS AND DETAIL

DESIGNED *David M. ...* TECHNICAL APPROVAL *John ...*
DRAWN *Charles ...* SUBMITTED *John ...*
CHECKED *James ...* APPROVED *J.P. ...*
CHIEF, WATER CONVEYANCE BRANCH

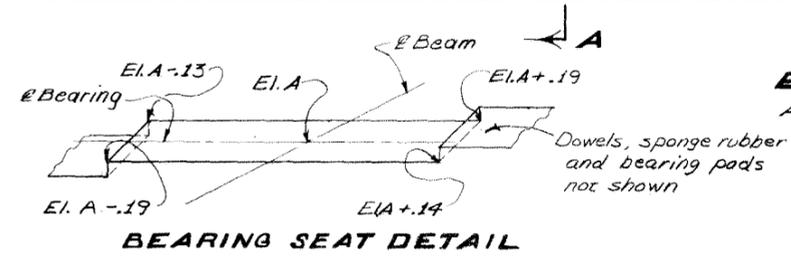
DENVER, COLORADO SHEET 2 OF 4 OCT. 1, 1980 **344-D-7192**



PLAN ABUTMENT NO. 2



ELEVATION ABUTMENT NO. 2



Note: * Concrete elevations given are at E of bearing and E of beams. See Bearing Seat Detail.

NOTES For General Notes, Design Specifications Design Loads and Materials, see Dwg. (7183). For notes see (7191).

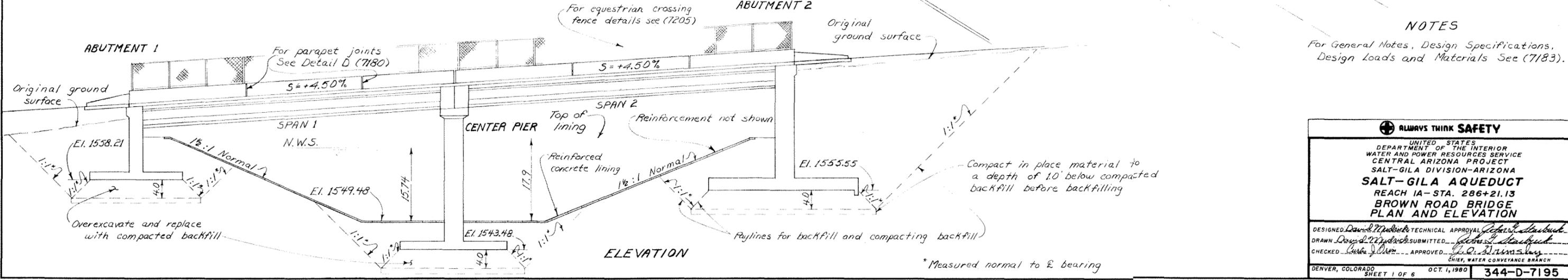
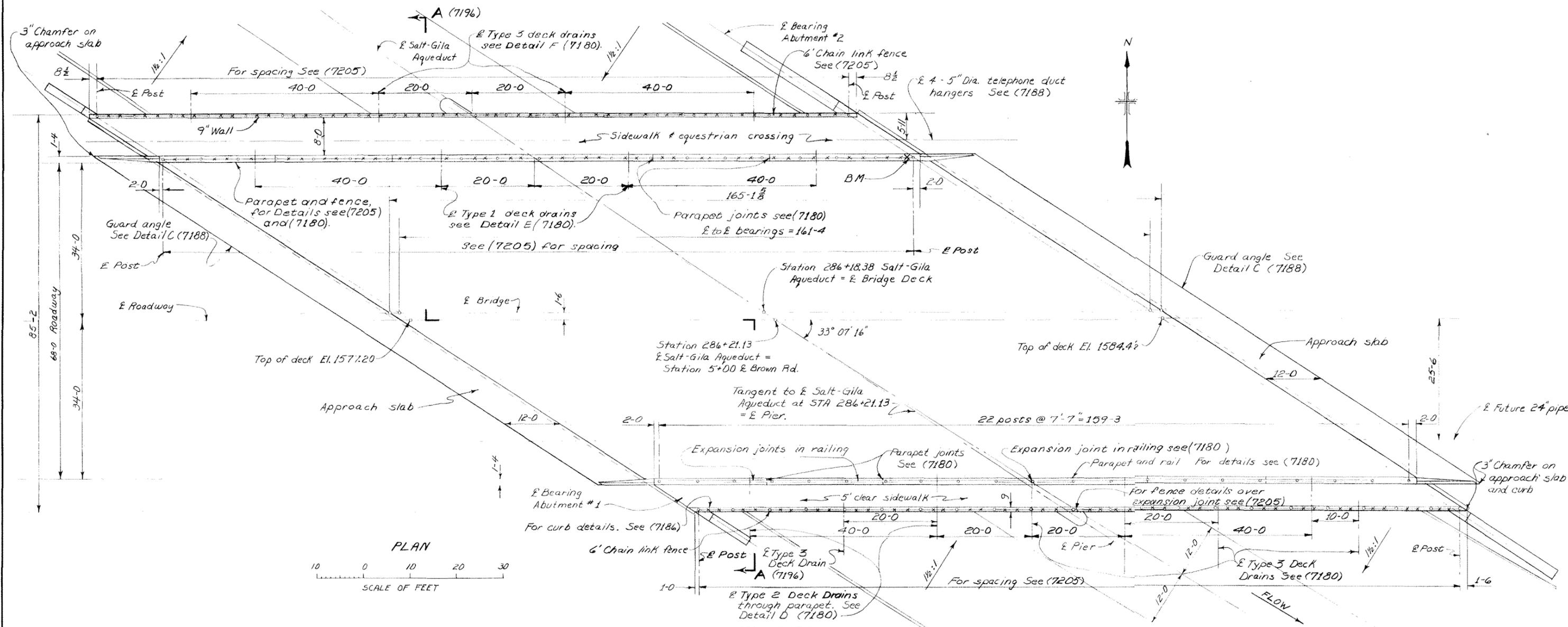
ALWAYS THINK SAFETY

UNITED STATES DEPARTMENT OF THE INTERIOR WATER AND POWER RESOURCES SERVICE CENTRAL ARIZONA PROJECT SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
REACH 1A-STA. 209+60.39
Mc KELLIPS ROAD BRIDGE
PLAN, SECTION, ELEVATION

DESIGNED *David M. Smith* TECHNICAL APPROVAL *John S. Stulquist*
DRAWN *Charles R. Wall* SUBMITTED *John S. Stulquist*
CHECKED *James Bullsey* APPROVED *J. O. Christensen*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SHEET 4 OF 4 OCT. 1, 1980 **344-D-7194**



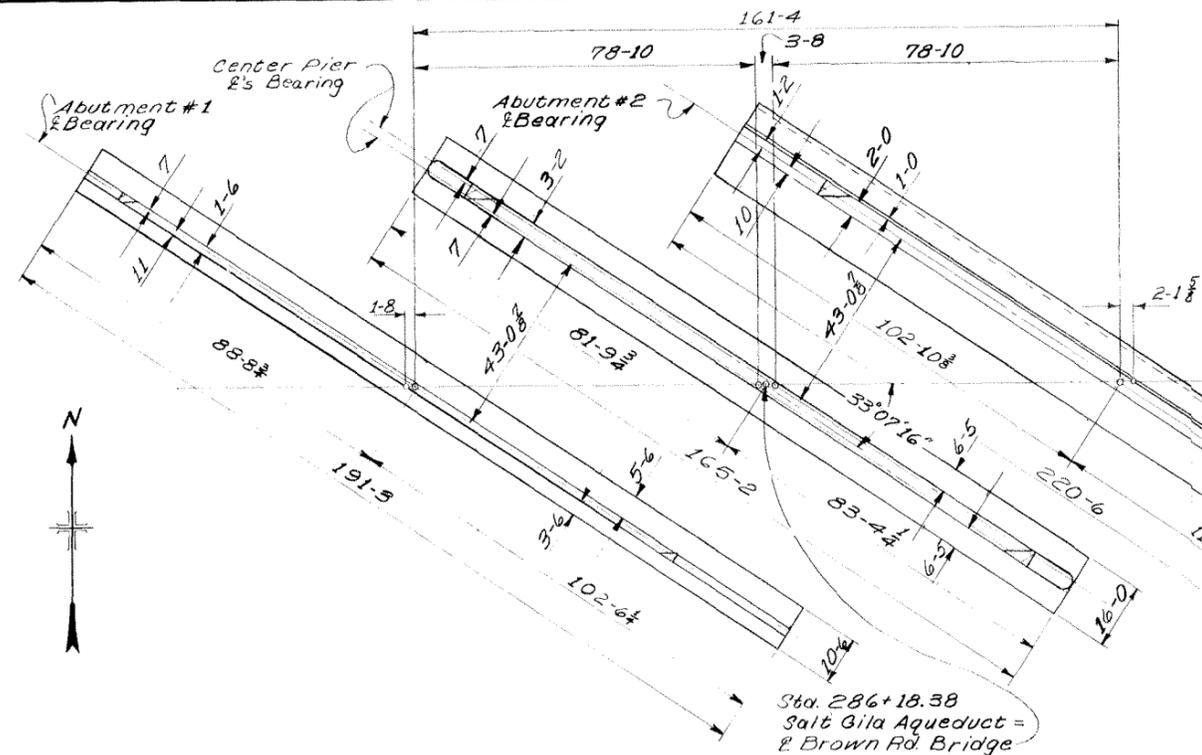
NOTES
 For General Notes, Design Specifications, Design Loads and Materials See (7183).

ALWAYS THINK SAFETY

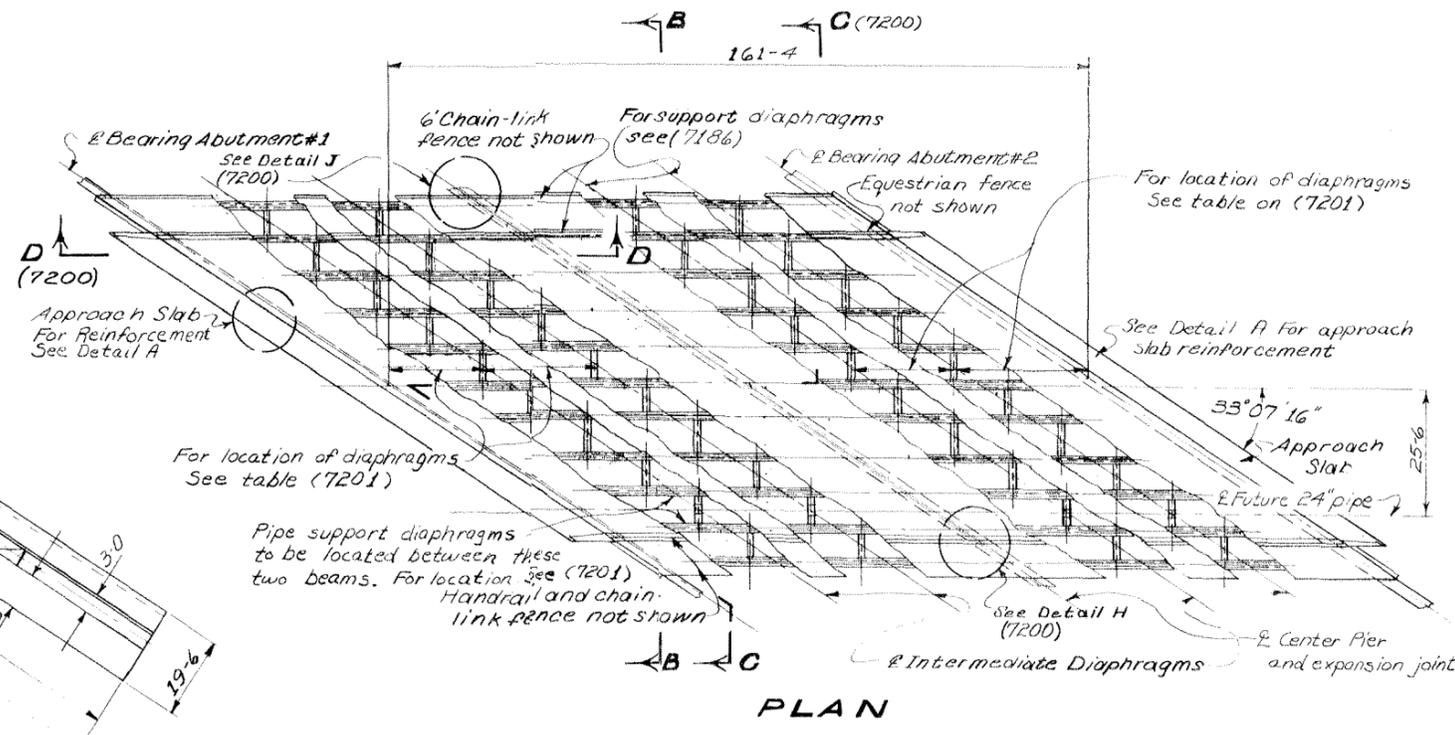
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA
SALT-GILA AQUEDUCT
 REACH 1A- STA. 286+21.13
BROWN ROAD BRIDGE
 PLAN AND ELEVATION

DESIGNED: David M. ... TECHNICAL APPROVAL: Robert ...
 DRAWN: David M. ... SUBMITTED: Robert ...
 CHECKED: ... APPROVED: ...
 CHIEF, WATER CONVEYANCE BRANCH

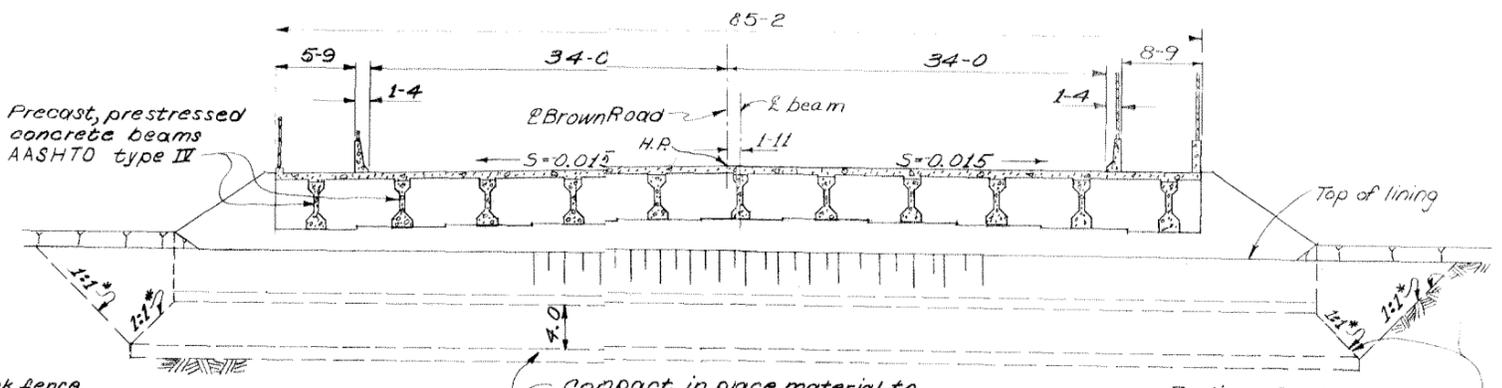
DENVER, COLORADO SHEET 1 OF 6 OCT. 1, 1980 344-D-7195



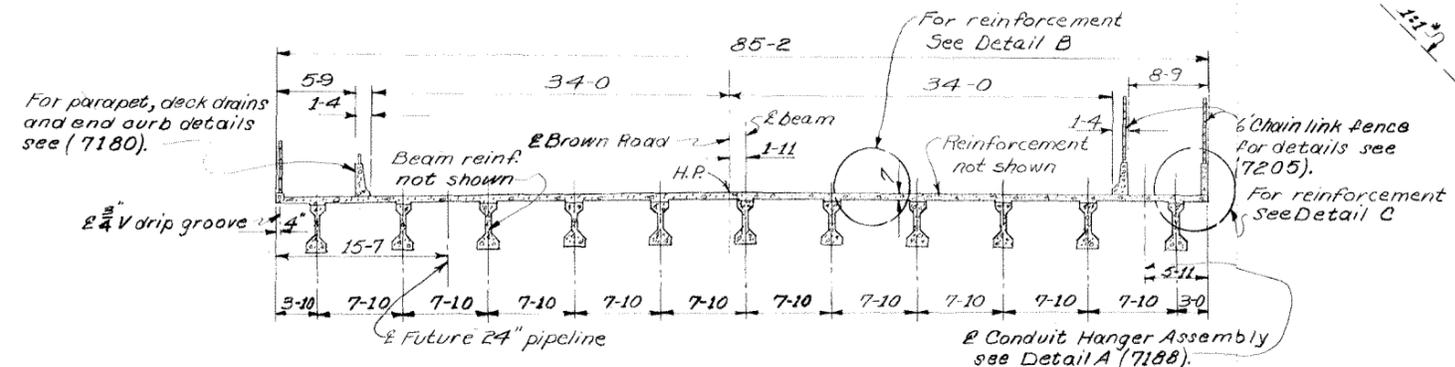
FOOTING PLAN
 SCALE OF FEET
 0 20 40 60



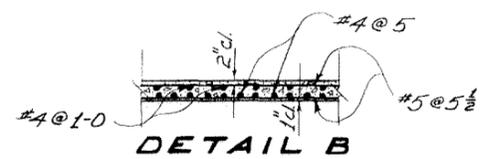
PLAN



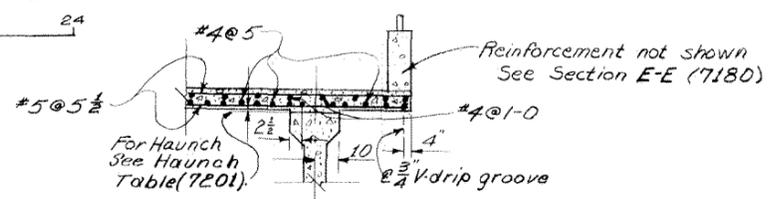
SECTION A-A
(7195)



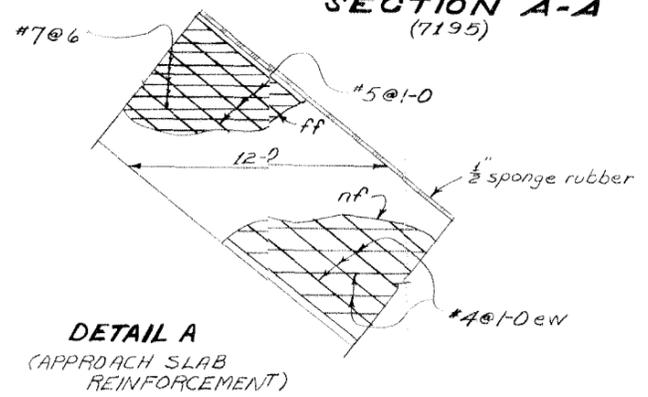
SECTION B-B



DETAIL B



DETAIL C



DETAIL A
(APPROACH SLAB REINFORCEMENT)

NOTES
 For General Notes, Design Specifications, Design Loads and Materials, see (7183).

NOTE: * Measure parallel to bearing

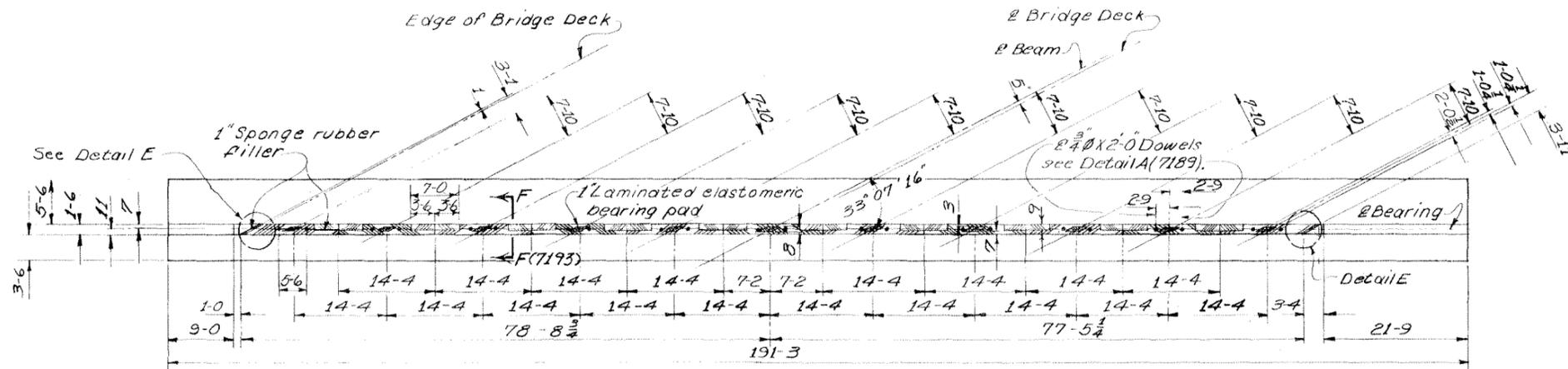
ALWAYS THINK SAFETY

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
 REACH 1A - STA. 286+ 21.13
 BROWN ROAD BRIDGE
 PLANS, SECTIONS AND DETAILS

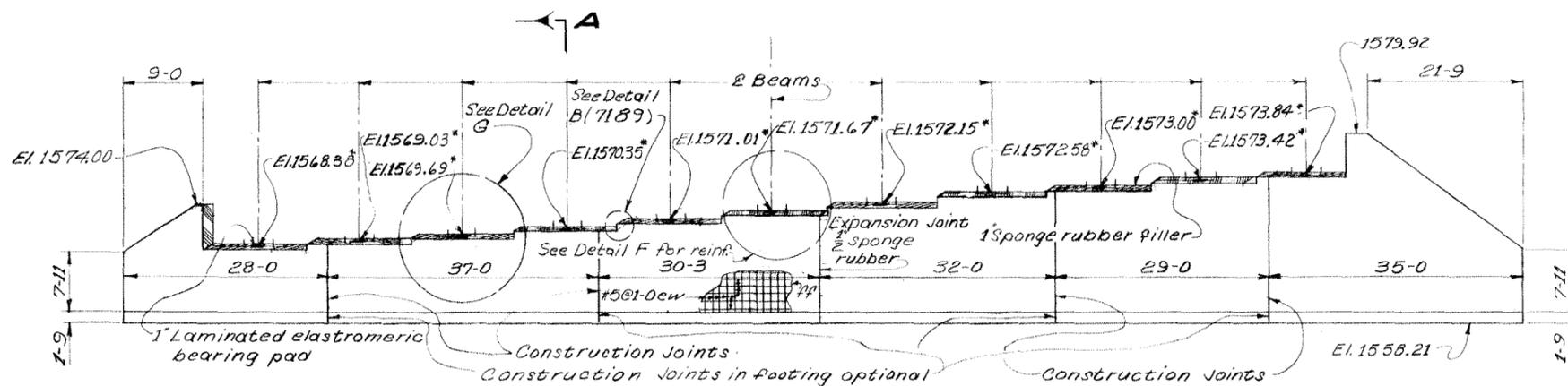
DESIGNED *David M. Marsh* TECHNICAL APPROVAL *John S. Galloway*
 DRAWN *John S. Galloway* SUBMITTED *John S. Galloway*
 CHECKED *John S. Galloway* APPROVED *John S. Galloway*
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SHEET 2 OF 6 OCT. 1, 1980 **344-D-7196**



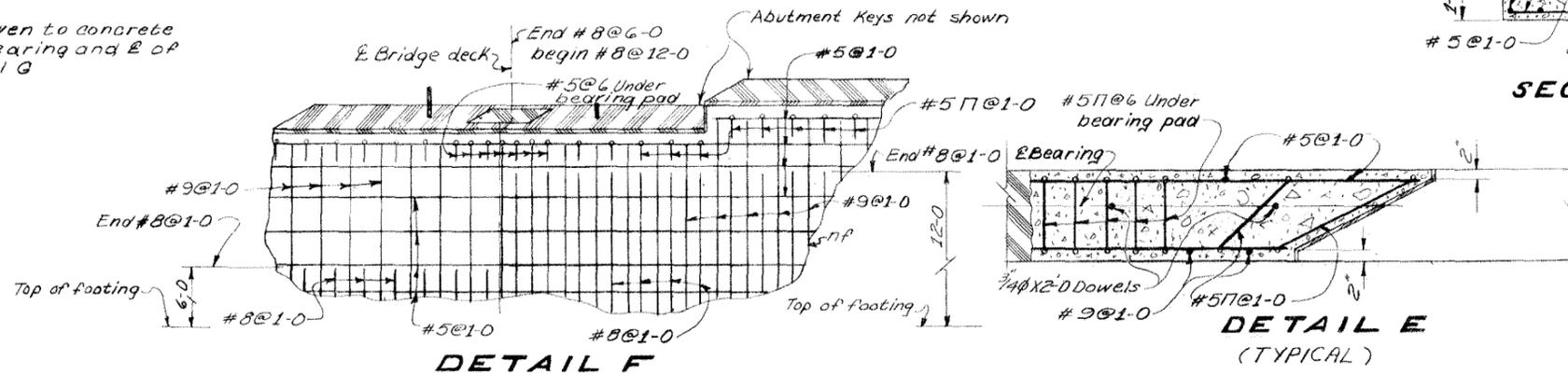
PLAN ABUTMENT NO. 1

SCALE OF FEET



ELEVATION ABUTMENT NO. 1

Note: * Elevations given to concrete surface at E of bearing and E of beams, see Detail G

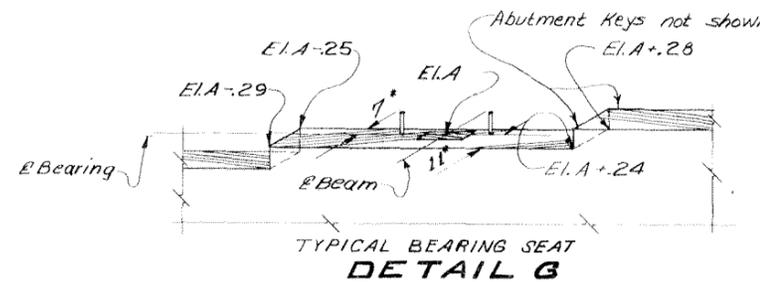


DETAIL F

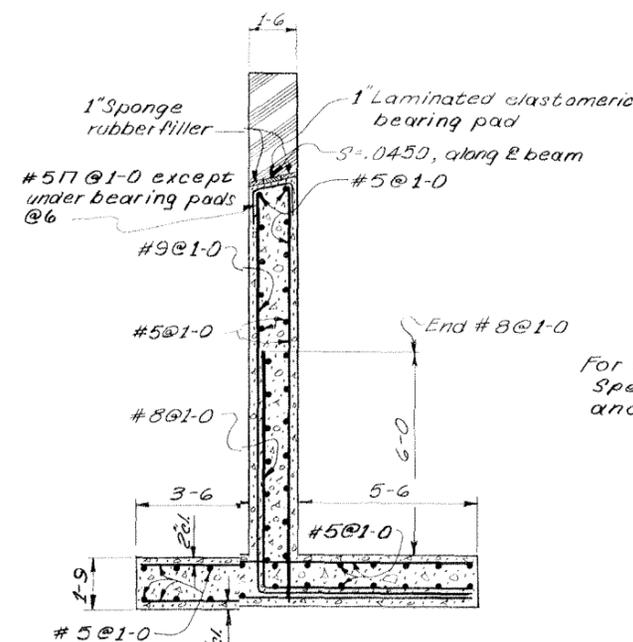
DETAIL E (TYPICAL)



NOTE: Elevations given on concrete surface



* Measured normal



SECTION A-A

NOTES For General Notes, Design Specifications, Design Loads and Materials, See Dwg. (7183).

ALWAYS THINK SAFETY

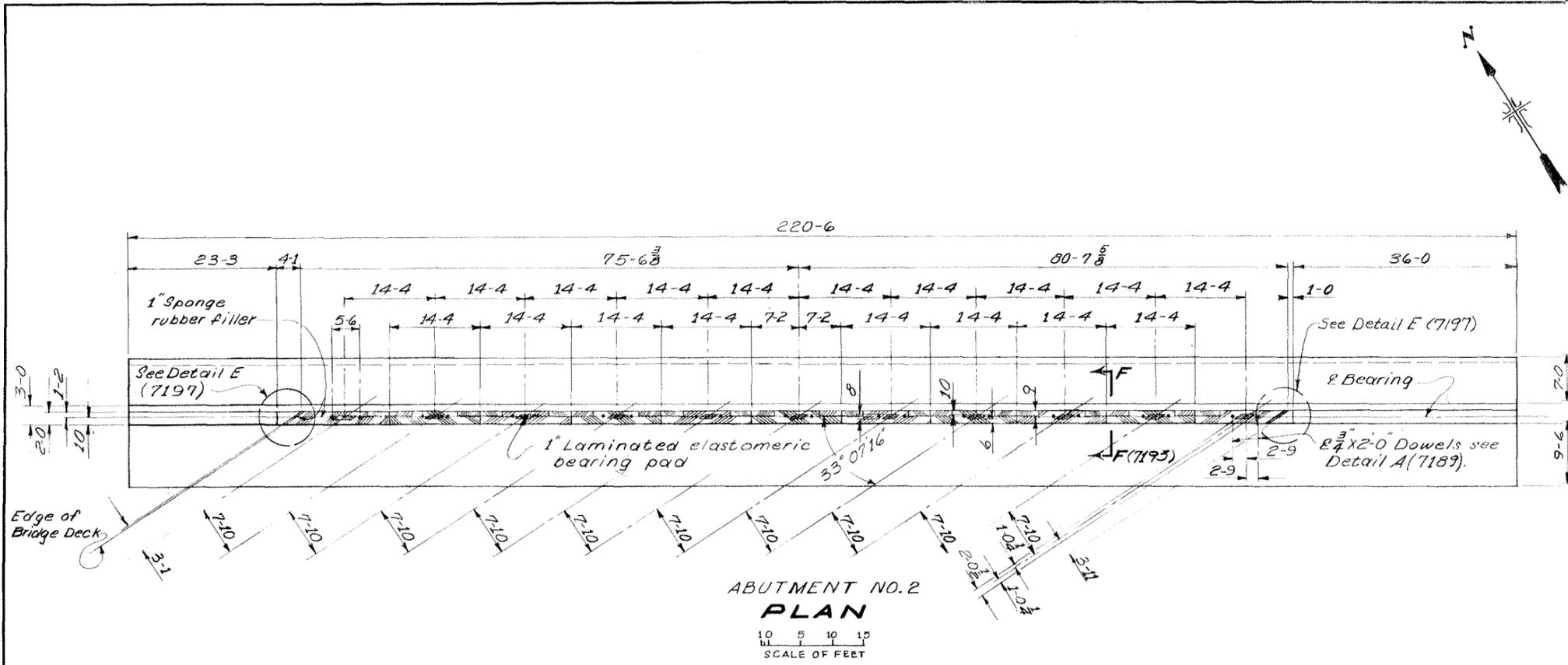
UNITED STATES
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CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
REACH 1A- STA. 286+21.13
BROWN ROAD BRIDGE

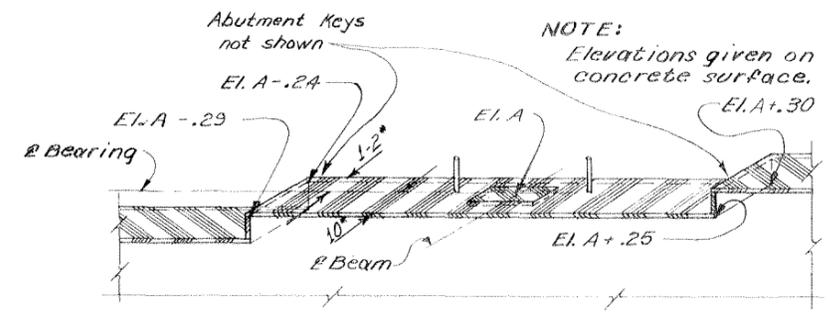
PLAN, SECTION, DETAILS AND ELEVATION

DESIGNED *Charles R. Doolittle* TECHNICAL APPROVAL *Robert L. Stambaugh*
DRAWN *Charles R. Doolittle* SUBMITTED *Robert L. Stambaugh*
CHECKED *Charles R. Doolittle* APPROVED *Robert L. Stambaugh*
CHIEF, WATER CONVEYANCE BRANCH

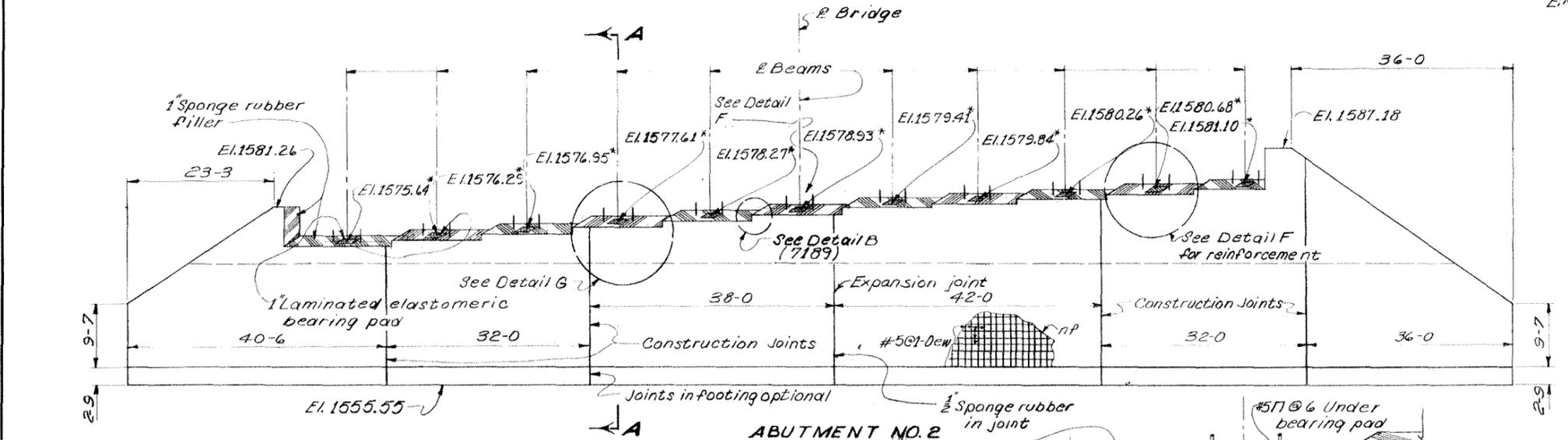
DENVER, COLORADO OCT. 1, 1980 344-D-7197



**ABUTMENT NO. 2
PLAN**
SCALE OF FEET
10 5 10 15

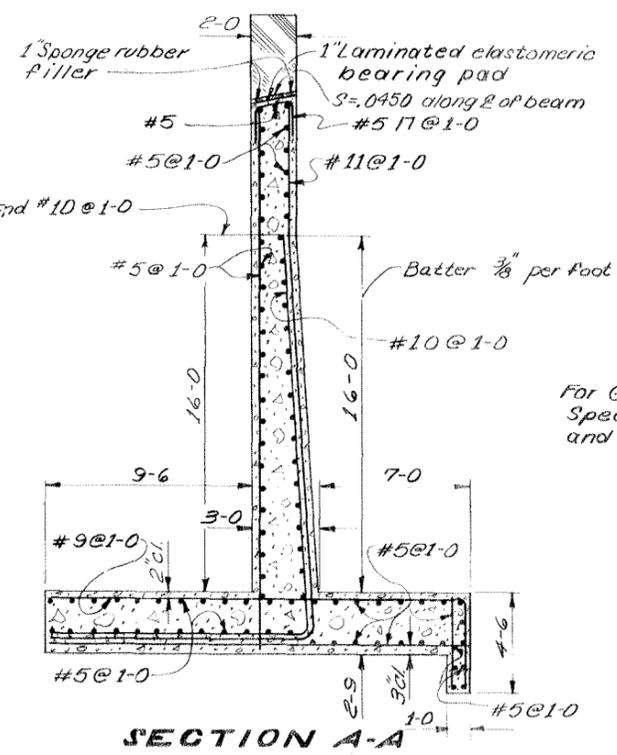


**DETAIL G
(TYPICAL BEARING SEAT)**
*Measured normal



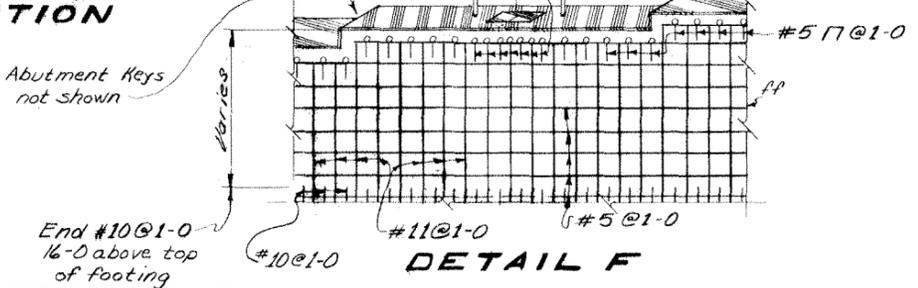
**ABUTMENT NO. 2
ELEVATION**

Note: * Elevations given to concrete surface at E bearing and E beams. See Detail G.



SECTION A-A

NOTES
For General Notes, Design Specifications, Design Loads and Materials, See Dwg. (7183).



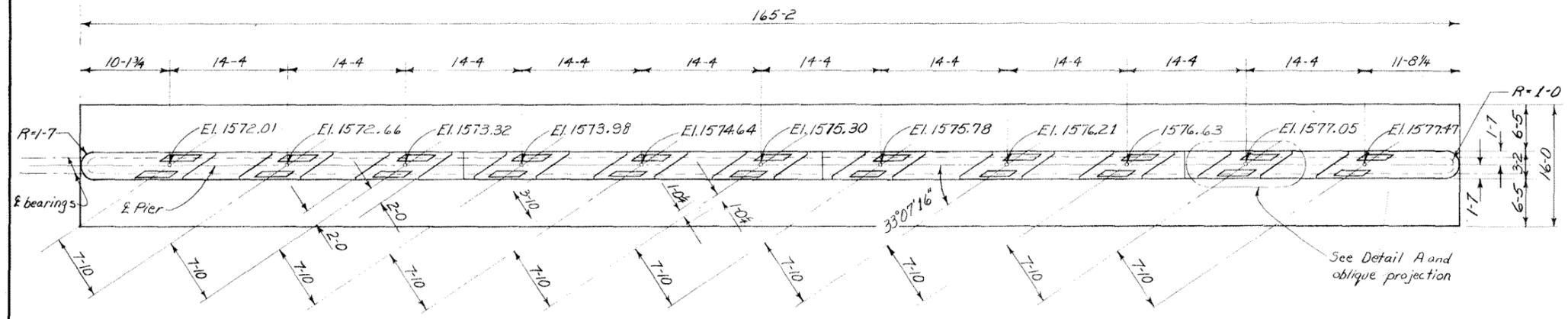
DETAIL F

ALWAYS THINK SAFETY

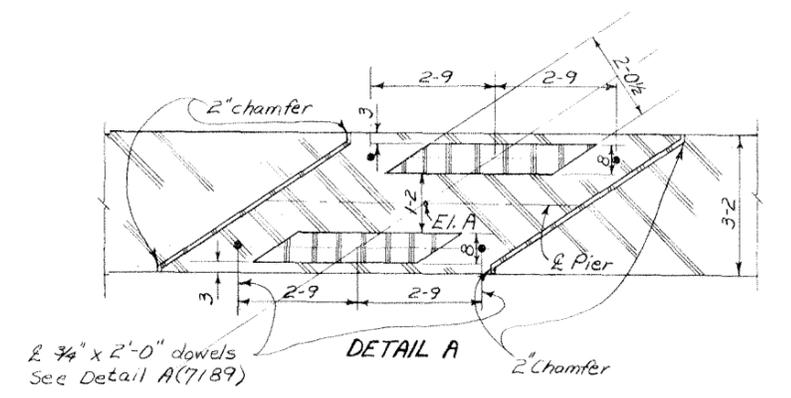
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA
SALT-GILA AQUEDUCT
REACH 1A-STA. 286+21.13
BROWN ROAD BRIDGE
PLAN, SECTIONS, DETAILS, & ELEVATION

DESIGNED *David M. ...* TECHNICAL APPROVAL *John ...*
DRAWN *Charles ...* SUBMITTED *...*
CHECKED *...* APPROVED *...*
CHIEF, WATER CONVEYANCE BRANCH

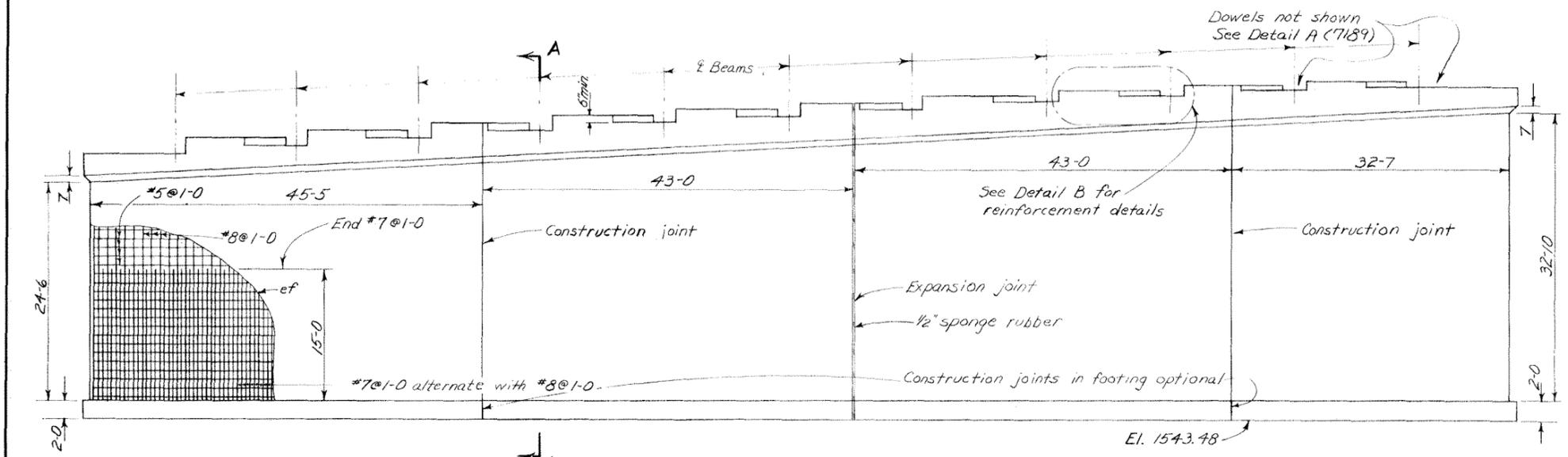
DENVER, COLORADO
SHEET 4 OF 6
OCT. 1, 1980
344-D-7198



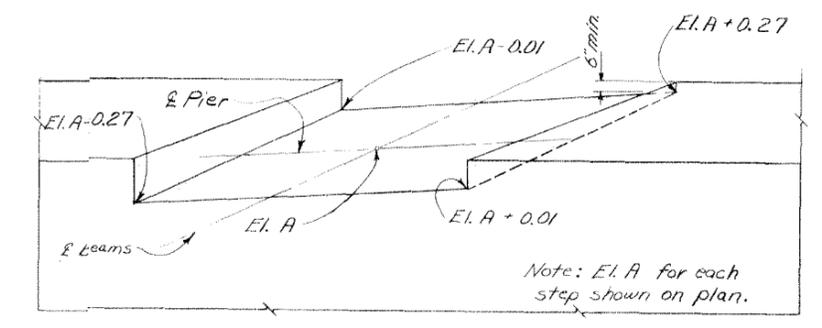
CENTER PIER - PLAN



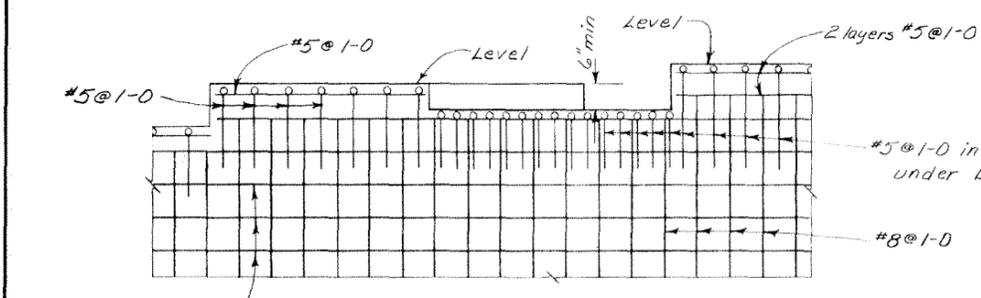
DETAIL A



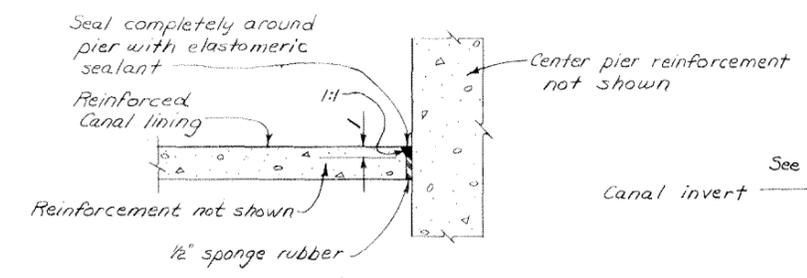
ELEVATION



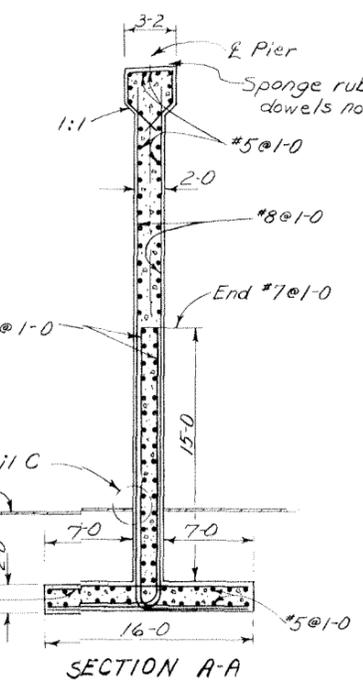
OBLIQUE PROJECTION



DETAIL B



DETAIL C



SECTION A-A

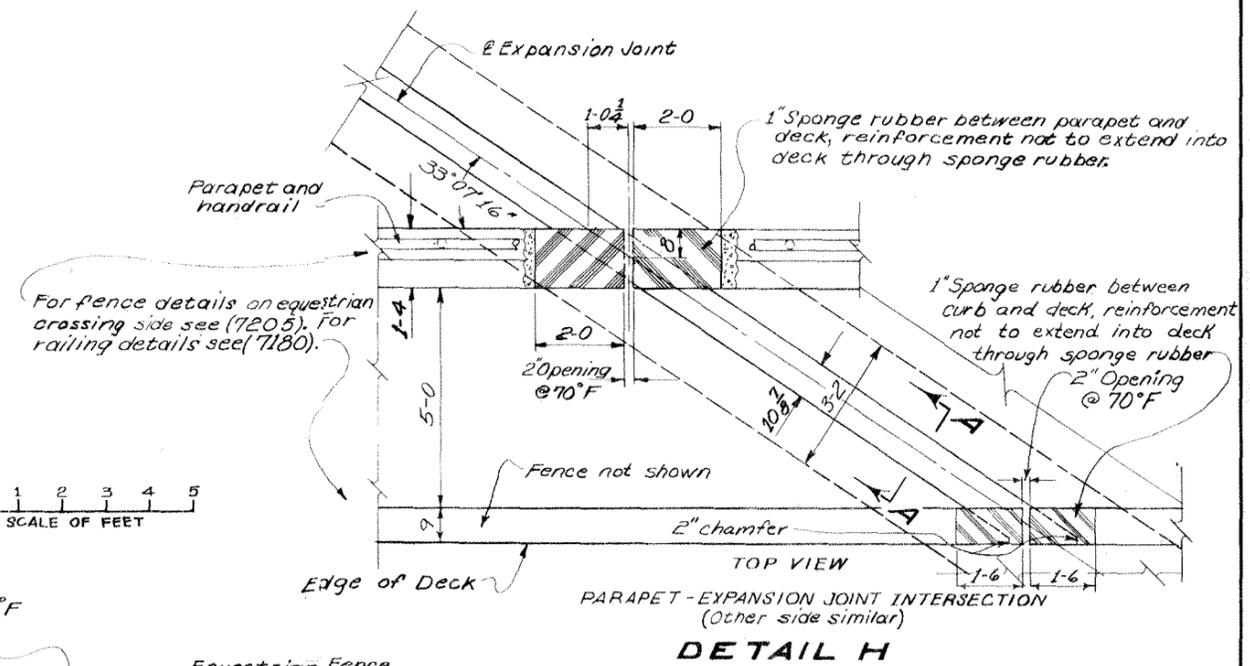
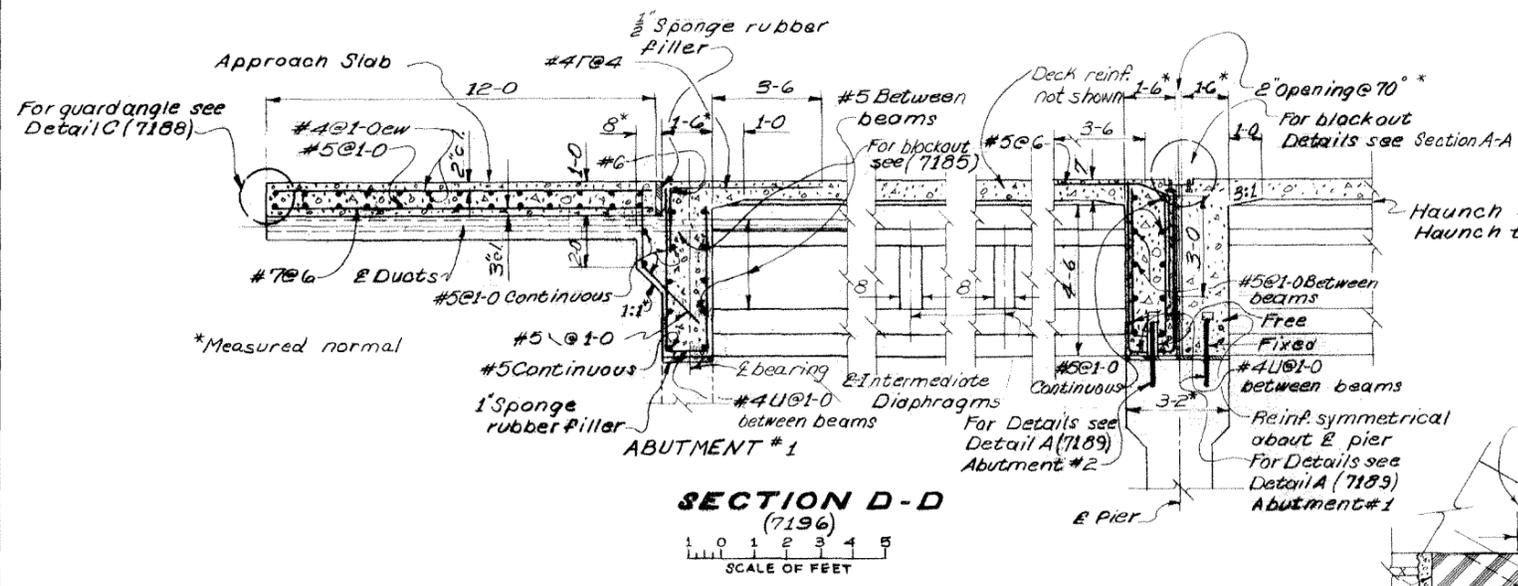
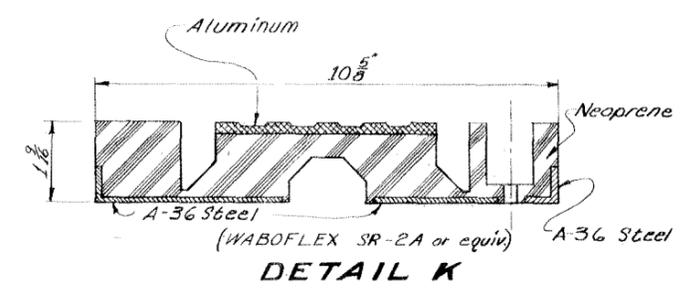
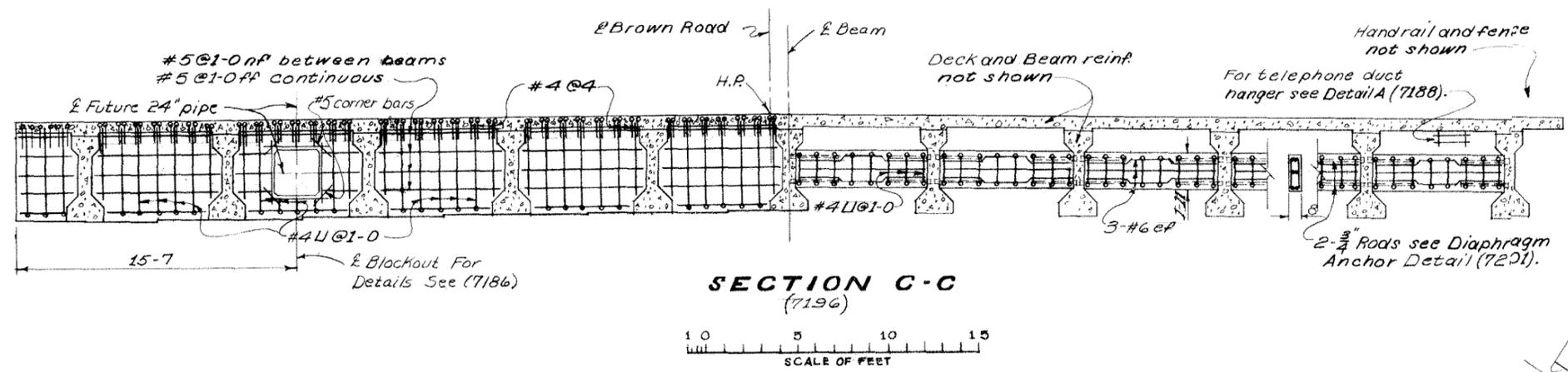
NOTES
 For General Notes, Design Specifications,
 Design Loads and Materials,
 See (7183).

ALWAYS THINK SAFETY

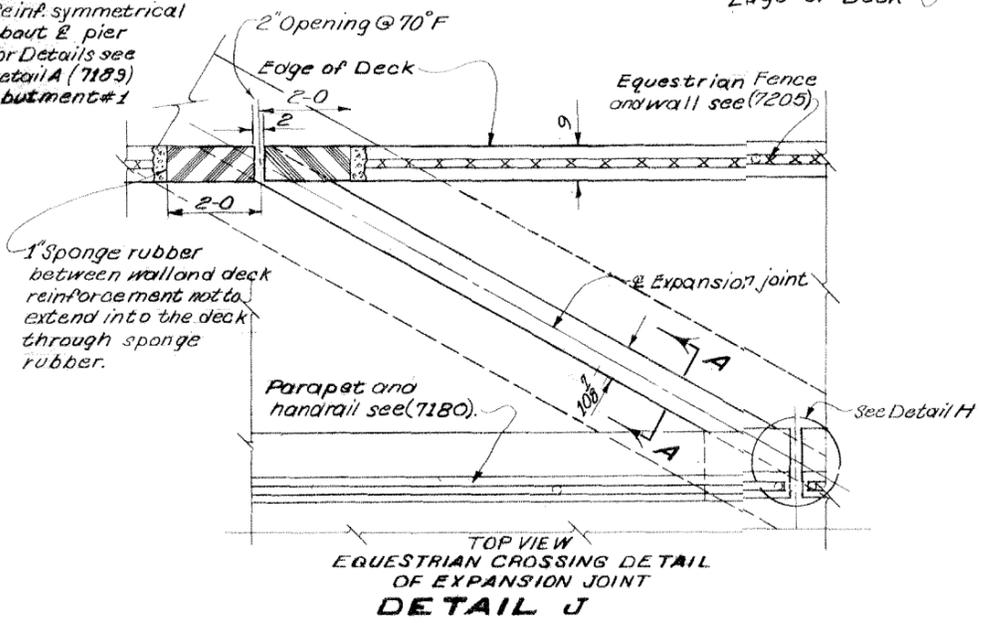
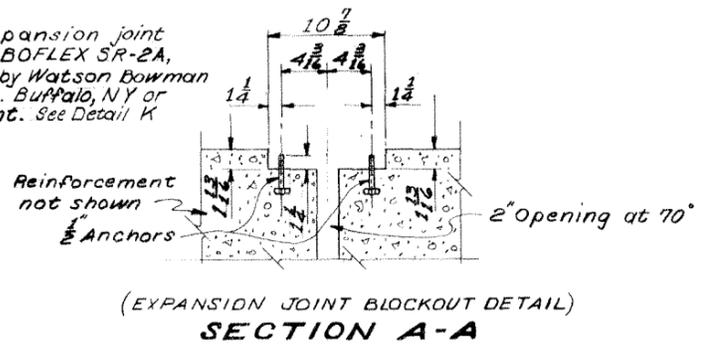
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA AQUEDUCT
 REACH 1A-STA. 286+21.13
 BROWN ROAD BRIDGE
 PLAN, SECTION, DETAILS AND ELEVATION

DESIGNED BY *[Signature]* TECHNICAL APPROVAL *[Signature]*
 DRAWN *[Signature]* SUBMITTED *[Signature]*
 CHECKED *[Signature]* APPROVED *[Signature]*
 CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SHEET 5 OF 6 OCT. 1, 1980 344-D-7199



NOTE: Expansion joint to be WABOFLEX SR-2A, supplied by Watson Bowman Assoc. Inc. Buffalo, NY or equivalent. See Detail K



NOTES
For General Notes, Design Specifications, Design Loads, and Materials see (7183).

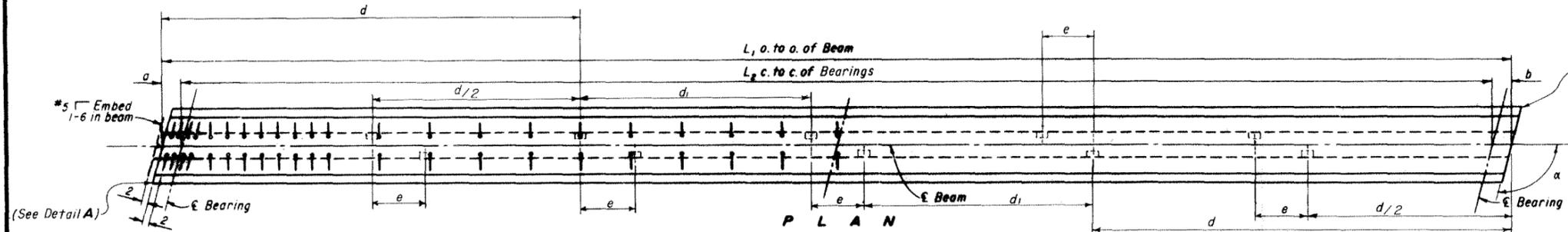
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WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

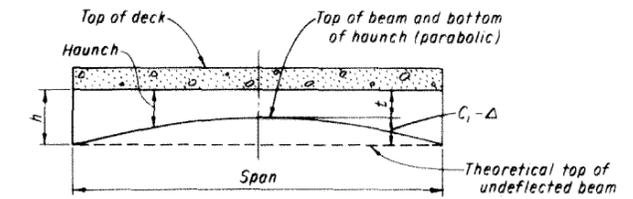
SALT - GILA AQUEDUCT
REACH 1A - STA. 286+21.13
BROWN ROAD BRIDGE
SECTIONS AND DETAILS

DESIGNED: David M. ... TECHNICAL APPROVAL: ...
DRAWN: Charles P. ... SUBMITTED: ...
CHECKED: ... APPROVED: ...
CHIEF, WATER CONVEYANCE BRANCH

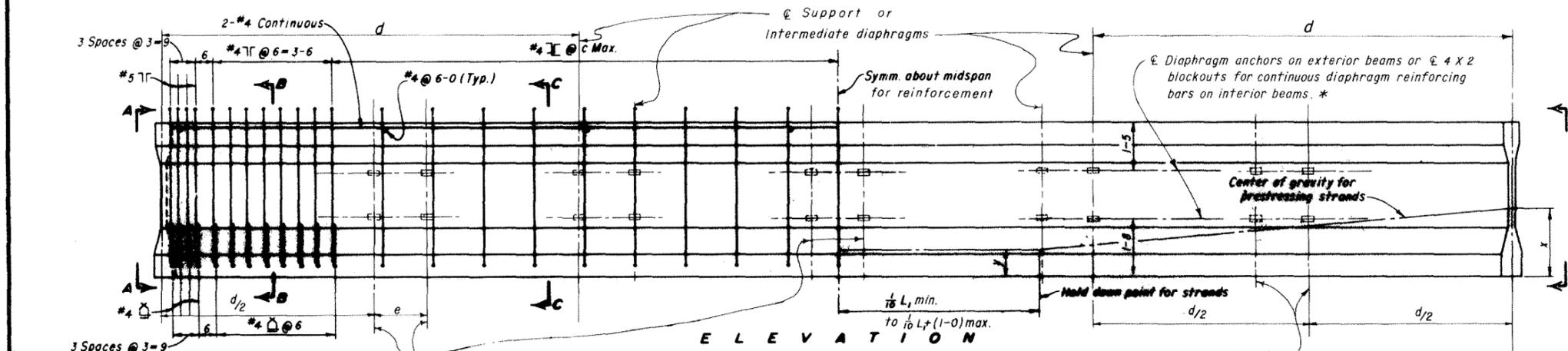
DENVER, COLORADO SHEET 6 OF 6 OCT 1, 1980 344-D-7200



Chamfer acute corners of flanges (See Detail A)



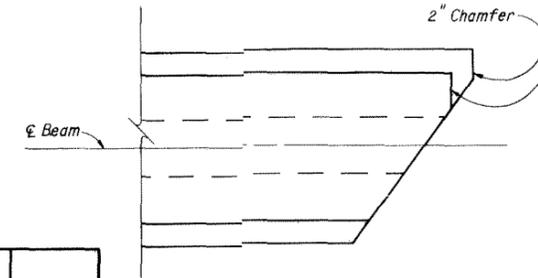
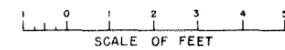
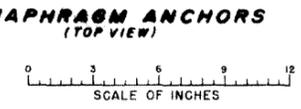
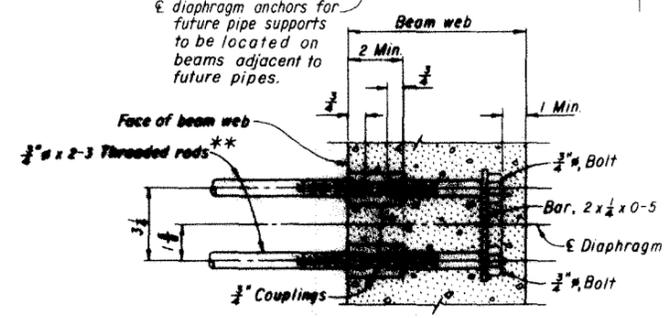
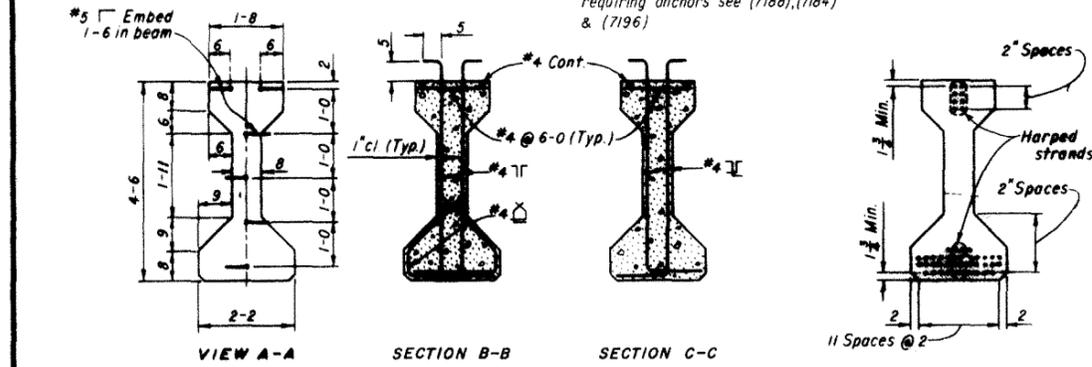
C_1 = Upward camber, measured with beam in place. Elevations are computed on an assumed value for " C_1 ".
 Δ = Downward deflection of the beam at midspan after placing deck, parapets, and intermediate diaphragms.
 $t = \frac{1}{2}$ Minimum haunch thickness at midspan.
 $h = C_1 - \Delta + t$. Minimum haunch thickness at ends of span. If the measured value of " C_1 " is different from the assumed value of " C_1 ", then " h " should be adjusted accordingly.



FOR INTERMEDIATE AND SUPPORT DIAPHRAGMS

* Note Thomas Road Bridge beams to include diaphragm anchors on exterior beams & 4 X 2 blockouts on interior beams. McDowell Road and Brown Rd. Bridges to include diaphragm anchors on all beams.

** See Support diaphragm table on (7186) for rod length exceptions.



NOTES

For general notes, design specifications, design loads and materials, see dwg. (7183).
 All exposed concrete edges to be chamfered $\frac{3}{8}$ " unless otherwise noted.
 Threaded rods are not required at locations of future pipe supports.

BRIDGE	CANAL STATION	a	L ₁	L ₂	a	b	c	# 5 270K PRESTRESSING STRANDS				CONCRETE		NUMBER OF BEAMS	HAUNCH TABLE (INCHES)				d	d ₁	e	
								TOTAL NUMBER	Y-INCHES		Z-INCHES		MIN. COMP. OR DAY STRENGTH f _c (psi)		RELEASE STRENGTH (psi)	t	Δ	C ₁				h
									MIN.	MAX.	MIN.	MAX.										
Thomas Road	94+68.79	90°	81-6	80-4	7	7	1-8	34	3.87	5.31	11.57	12.07	5000	4000	5	1 1/2	3/4	2	2 3/4	27-4	13-5	0
McDowell Road	148+39.35	66° 18' 33"	89-2	87-11	7 1/2	7 1/2	1-8	36	4.08	4.64	11.97	13.97	5000	4000	9	1 1/2	1 1/2	2 1/4	2 3/8	29-11 1/2	13-0 1/2	3-2
Brown Road	286+21.13	33° 07' 16"	81-1	78-11	1-1	1-1	1-8	30	3.62	4.82	11.42	12.92	5000	4000	22	1 1/2	3/4	1 3/8	2 3/8	27-4	7-2 1/2	12-0

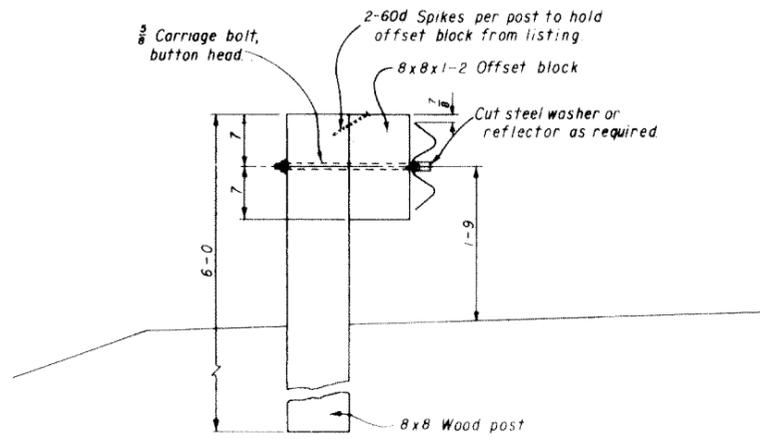
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 CENTRAL ARIZONA PROJECT
 SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
 REACH 1A
 PRECAST PRESTRESSED CONCRETE BEAMS
 AASHTO TYPE IV

DESIGNED *David Mednick* TECHNICAL APPROVAL *Robert Stuebner*
 DRAWN *HEB* SUBMITTED *John E. Schaefer*
 CHECKED *James C. Paul* APPROVAL *John E. Schaefer*
Charles J. Ryan CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO OCTOBER 1, 1978 344-D-7201

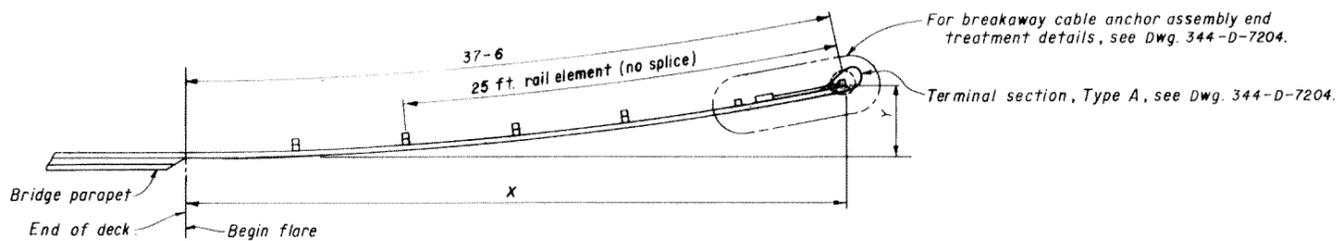


TYPICAL GUARDRAIL POST

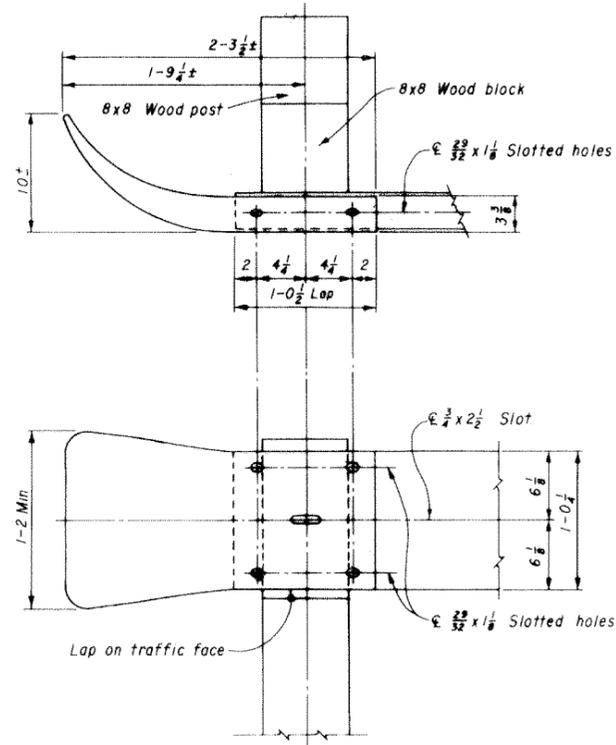
GUARDRAIL FLARE

DIST. ALONG PARABOLIC CURVE	X (FEET)	Y (FEET)
6.25	6.25	0.11
12.50	12.49	0.45
18.75	18.71	1.01
25.00	24.92	1.79
31.25	31.00	2.79
37.50	37.22	4.00

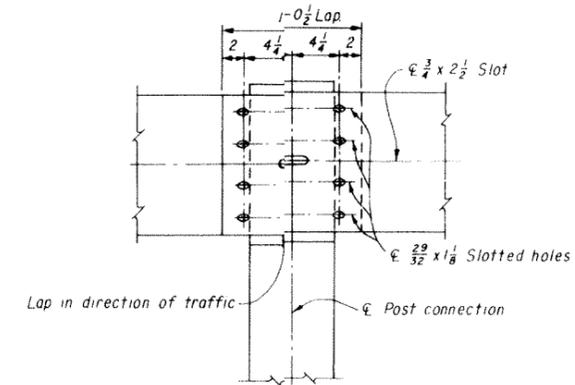
NOTE: The dimensions applicable to flares located on tangent alignment are suitable for use on curves. Offset or Y distance shall be measured from the curved pavement edge.



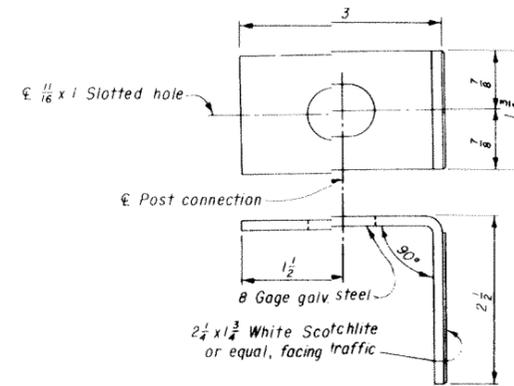
TYPICAL GUARDRAIL INSTALLATION



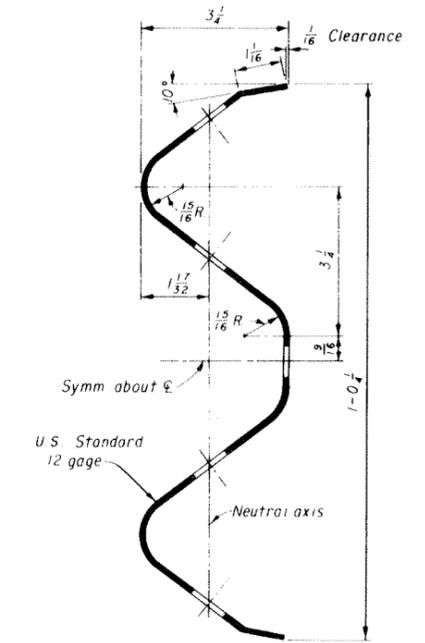
TERMINAL SECTION
Type B



RAIL SPLICE
Rail splice at post only

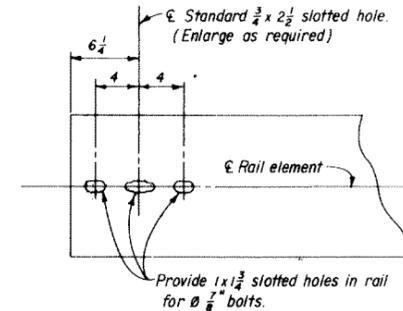


REFLECTOR



SECTION THRU RAIL ELEMENT

NOTE: Length and curvature of rail may vary as shown on the drawings or as directed in the field.



GUARDRAIL-BRIDGE PARAPET
SPECIAL ATTACHMENT HOLES

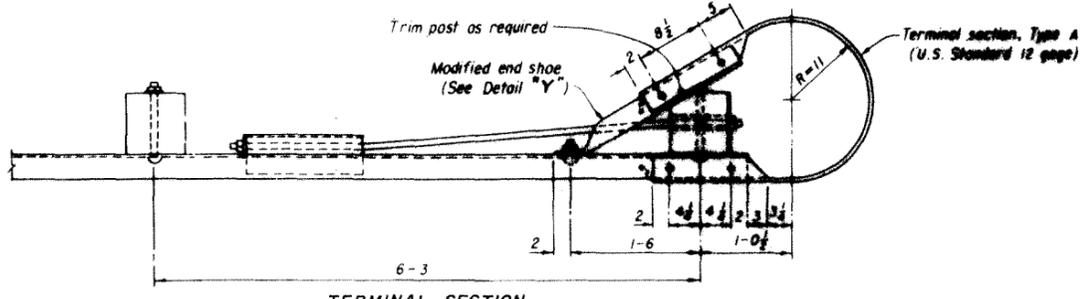
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WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

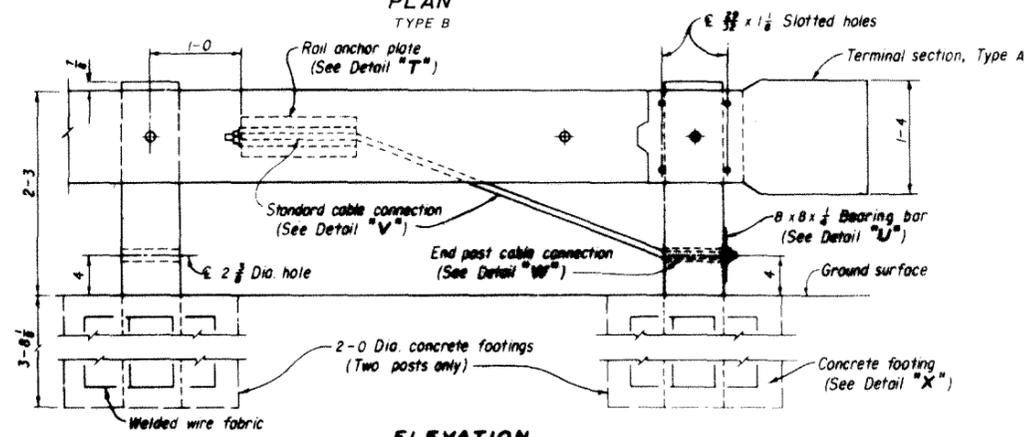
**SALT-GILA AQUEDUCT
REACH 1A
BEAM-TYPE GUARDRAIL
DETAILS**

DESIGNED *James D. Bullock* TECHNICAL APPROVAL *Robert S. Stuebel*
DRAWN *Charles R. Wall* SUBMITTED *John G. Stuebel*
CHECKED *David M. Purvis* APPROVED *P. L. Strimling*
CHIEF, WATER CONVEYANCE BRANCH

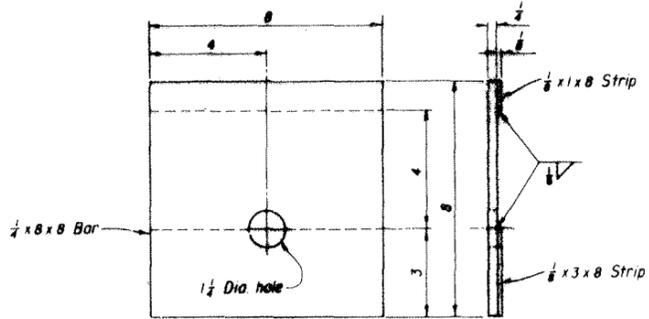
DENVER, COLORADO AUG. 27, 1980 SHEET 1 OF 2 **344-D-7203**



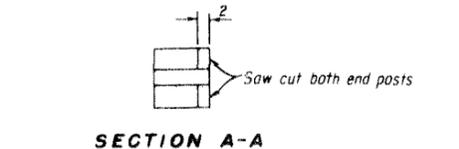
TERMINAL SECTION PLAN TYPE B



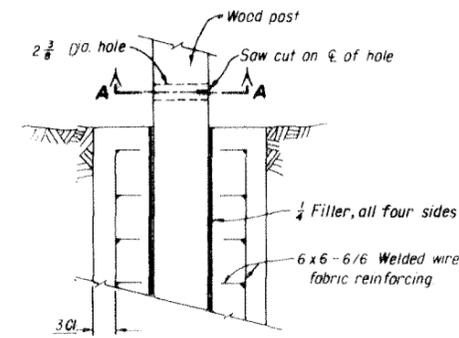
ELEVATION BREAKAWAY CABLE ANCHOR ASSEMBLY



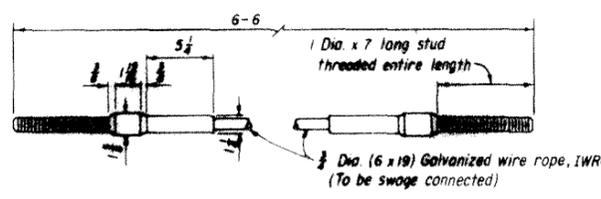
DETAIL "U" BEARING BAR



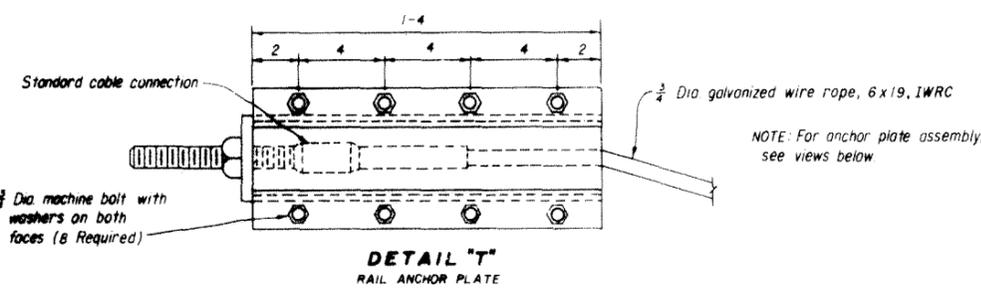
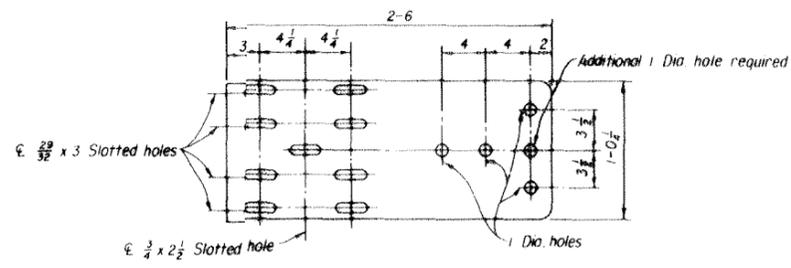
SECTION A-A



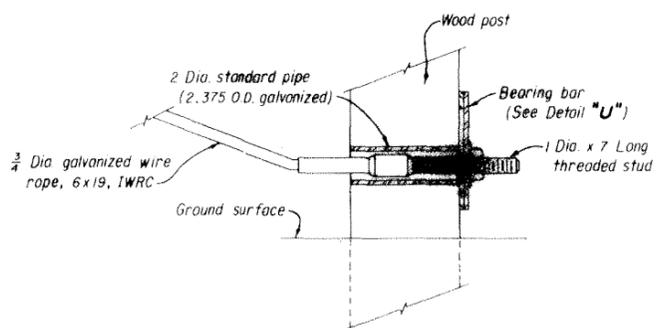
DETAIL "X" POST AND CONCRETE FOOTING



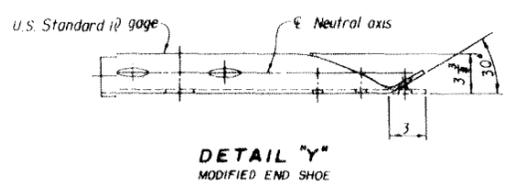
DETAIL "V" STANDARD CABLE CONNECTION



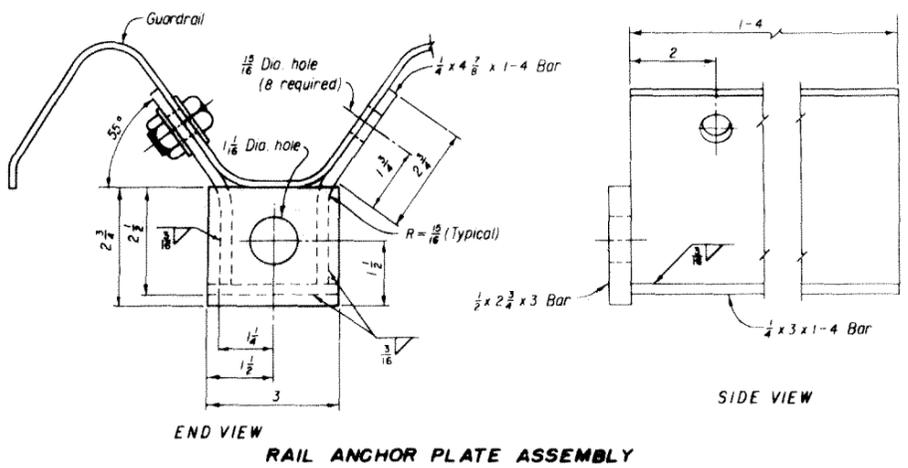
DETAIL "T" RAIL ANCHOR PLATE



DETAIL "W" END POST CABLE CONNECTION



DETAIL "Y" MODIFIED END SHOE



END VIEW RAIL ANCHOR PLATE ASSEMBLY

SIDE VIEW

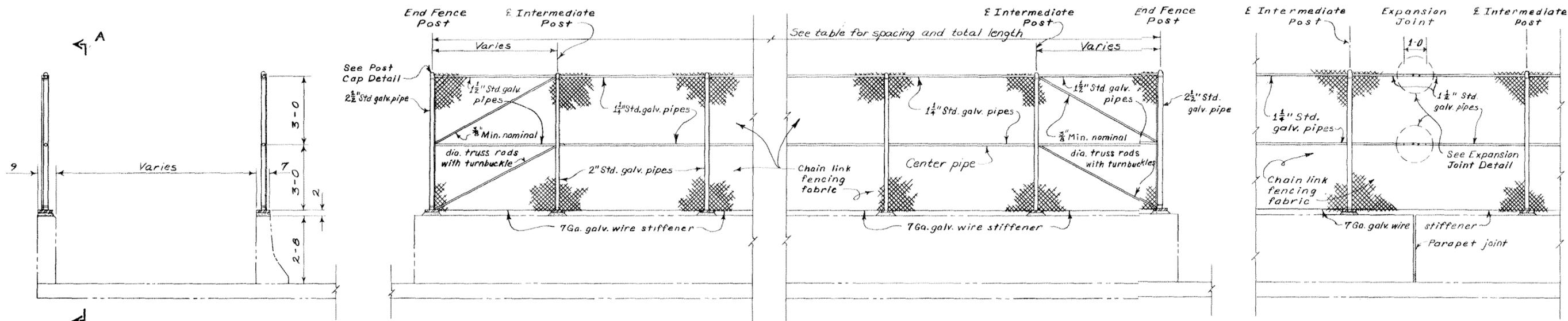
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CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

**SALT-GILA AQUEDUCT
REACH 1A
BEAM-TYPE GUARDRAIL
DETAILS**

DESIGNED: James B. ... TECHNICAL APPROVAL: ...
DRAWN: Charles R. ... SUBMITTED: ...
CHECKED: David M. ... APPROVED: ...
CHIEF, WATER CONVEYANCE BRANCH

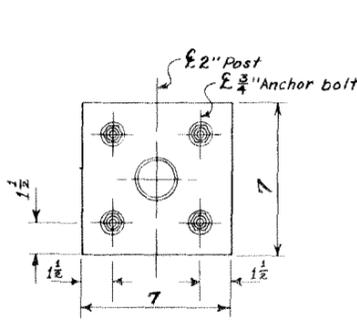
DENVER, COLORADO AUG. 27, 1980
SHEET 2 OF 2 344-D-7204



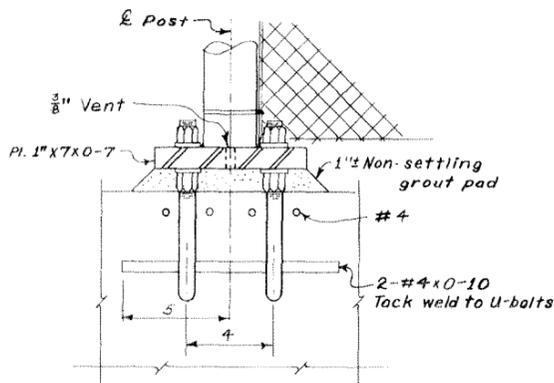
ELEVATION

SECTION A-A (TYPICAL)

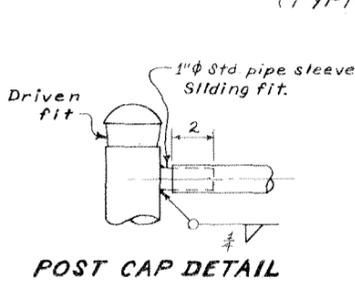
EXPANSION SECTION



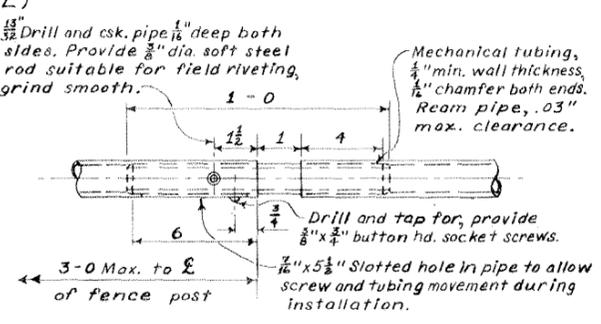
PLAN



SECTION B B



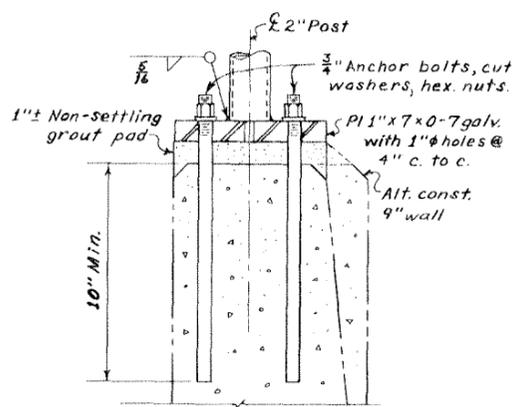
POST CAP DETAIL



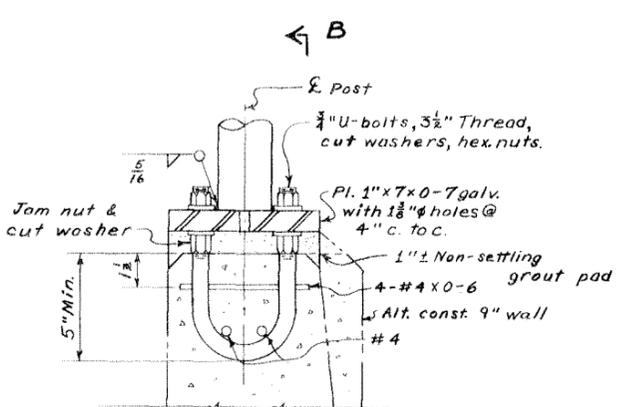
EXPANSION JOINT DETAIL

NOTES

Post spacing and total lengths given in table are measured along the slope. Posts are to be mounted vertically and shall be fixed unless specified removable. Fence post mounted on 6" curb is to be similar to end fence post mounting. 6'-0" fence shown. 3'-6" fence similar, omit the 1 1/2" center pipe. All truss rods, turnbuckles, bolts, and riveting material shall be provided as required for complete installation. Corners and edges of all plates, rods, and pipe ends shall be free of burrs. All plates, bolts, and hardware to be galvanized. Welding symbols apply to the joints of all members of similar identification and welds to be dressed smoothly.



ELEVATION INTERMEDIATE FENCE POST DETAIL



END FENCE POST DETAIL AND ALL FENCE POSTS ON 6" CURB DETAIL

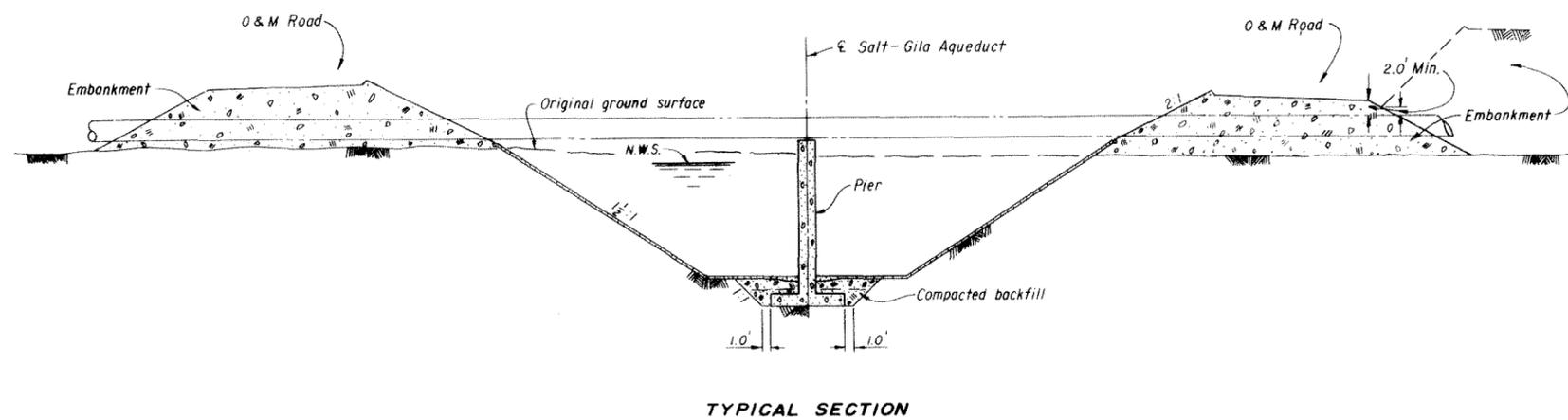
BRIDGE ± Canal Station @ ± Bridge	FENCE LOCATION	MOUNTING SURFACE	FENCE HEIGHT	NUMBER OF POSTS	POST SPACING	TOTAL LENGTH
McDOWELL 148 + 39.35	NORTH (OUTSIDE)	CURB	6-0	12	8-1	88-11
	SOUTH (OUTSIDE)	CURB	6-0	12	8-1	88-11
McKELLIPS 209 + 60.39	NORTH (OUTSIDE)	CURB	6-0	15	8-3	115-6
	SOUTH (OUTSIDE)	CURB	6-0	15	8-3	115-6
THOMAS 94 + 68.97	NORTH (OUTSIDE)	CURB	6-0	11	8-1	80-10
	SOUTH (OUTSIDE)	PARAPET	4-2	11	7-10	78-4
BUSH 815 + 66.37	EAST (OUTSIDE)	9" WALL	6-0	14	7-11 1/2	103-5 1/2
	EAST (INSIDE)	PARAPET	6-0	14	7-9	100-9
	WEST (OUTSIDE)	PARAPET	4-2	14	7-9	100-9
BROWN 286 + 21.13	NORTH (OUTSIDE)	9" WALL	6-0	22	7-9	162-9
	NORTH (INSIDE)	PARAPET	6-0	22	7-7	159-3
	SOUTH (OUTSIDE)	CURB	6-0	22	7-9	162-9

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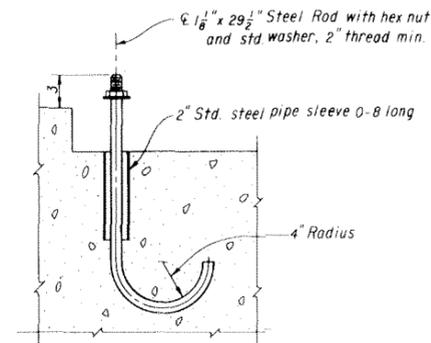
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA
SALT-GILA AQUEDUCT
 REACH 1A
EQUESTRIAN AND PEDESTRIAN FENCING
 ELEVATION, SECTIONS, AND DETAILS

DESIGNED: [Signature] TECHNICAL APPROVAL: [Signature]
 DRAWN: [Signature] SUBMITTED: [Signature]
 CHECKED: [Signature] APPROVED: [Signature]
 CHIEF, WATER CONVEYANCE BRANCH

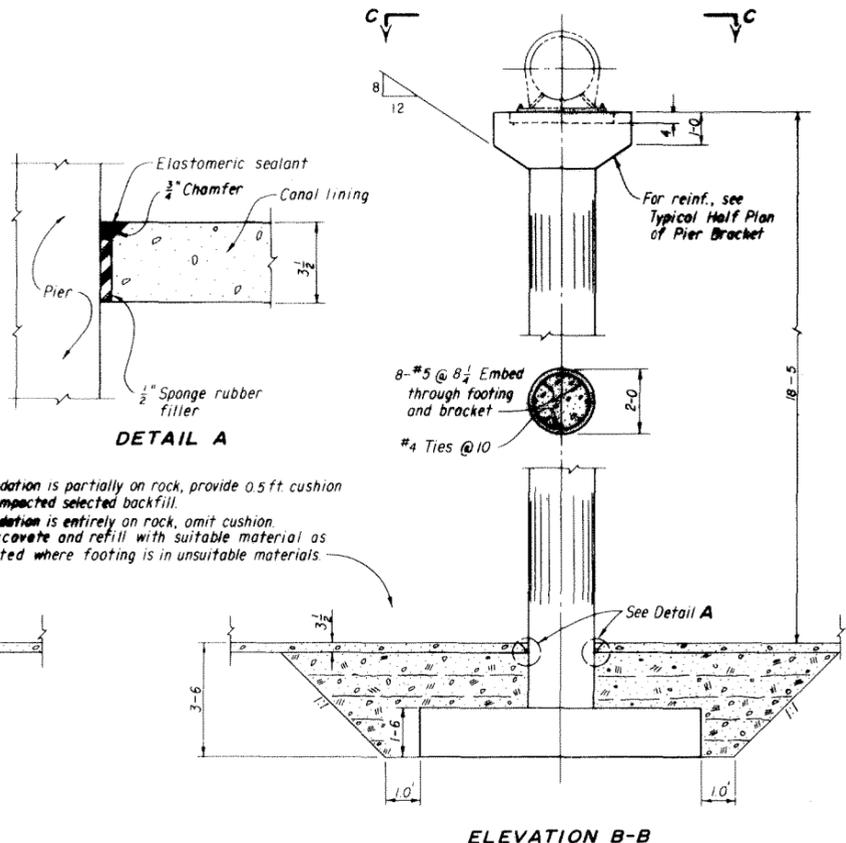
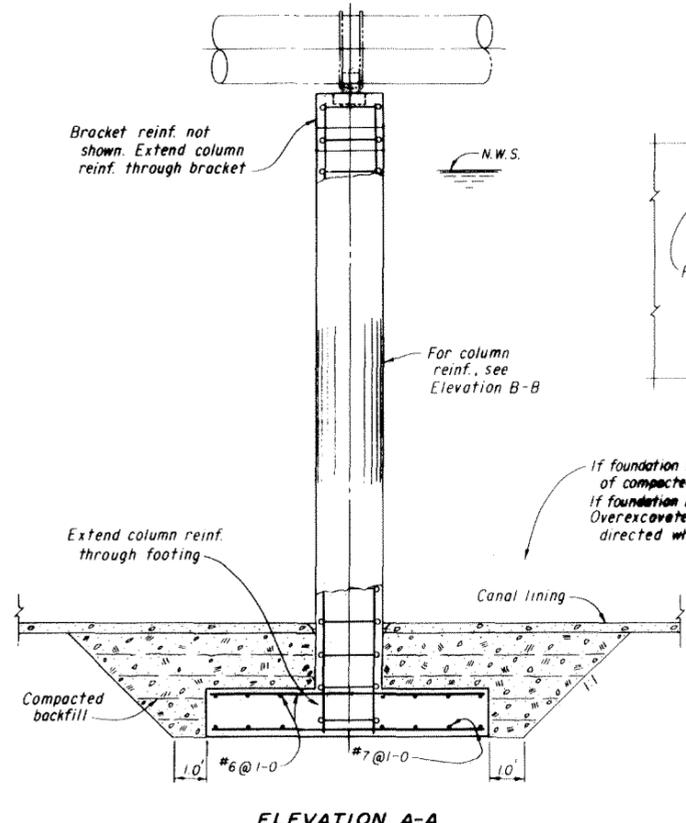
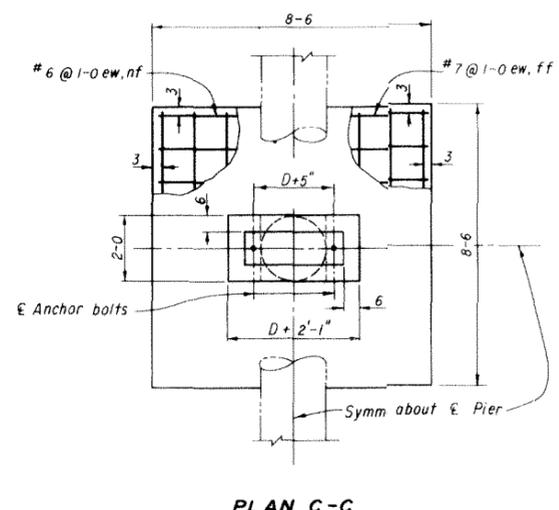
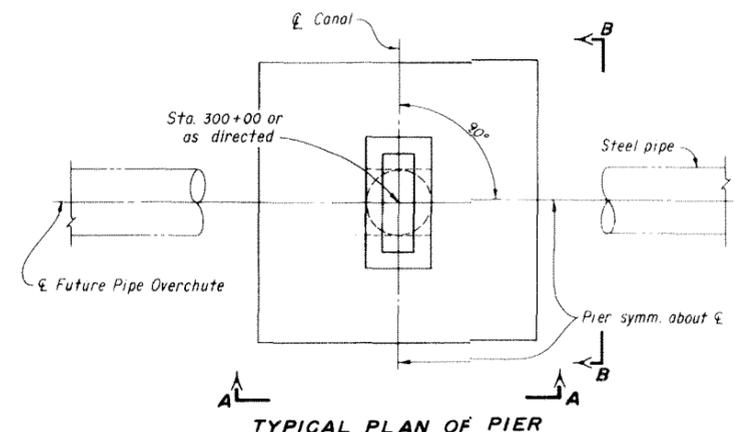
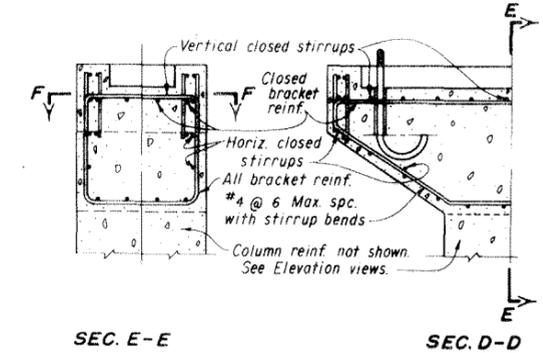
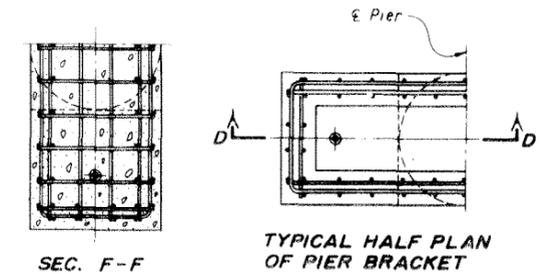
DENVER, COLORADO OCT. 1, 1980 344-D-7205



TYPICAL SECTION



ANCHOR BOLT



If foundation is partially on rock, provide 0.5 ft. cushion of compacted selected backfill.
If foundation is entirely on rock, omit cushion. Overexcavate and refill with suitable material as directed where footing is in unsuitable materials.

NOTES

For general notes, see 344-D-7166 and 344-D-7183.
For plan and profile, see (344-D-7171)
Locate overchute pier at Sta. 300+00 or as directed.
#4 Column Ties to have 12-inch lap length.
Column Tie lap splices shall be staggered 180 degrees.

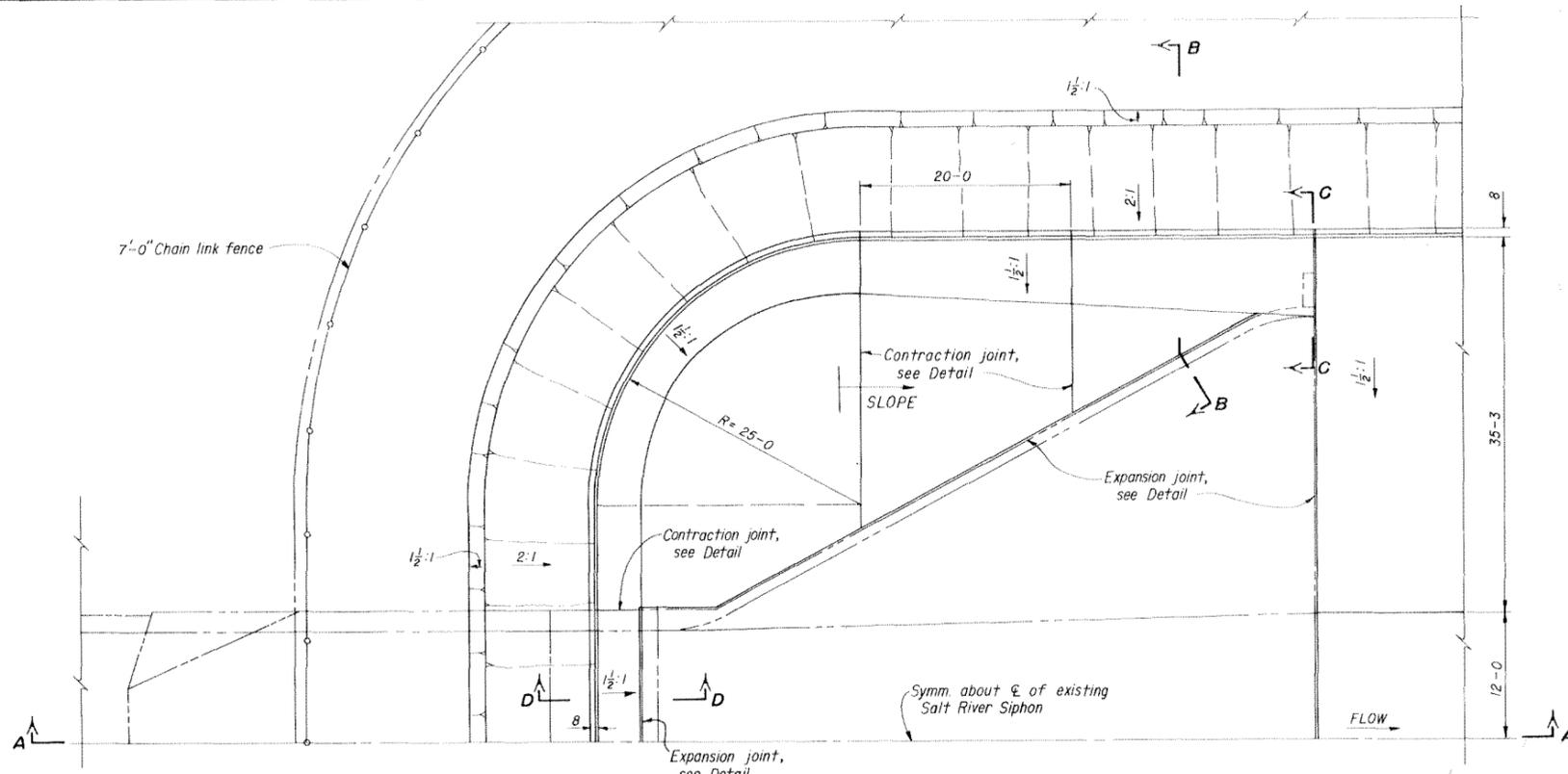
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DEPARTMENT OF THE INTERIOR
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CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION - ARIZONA

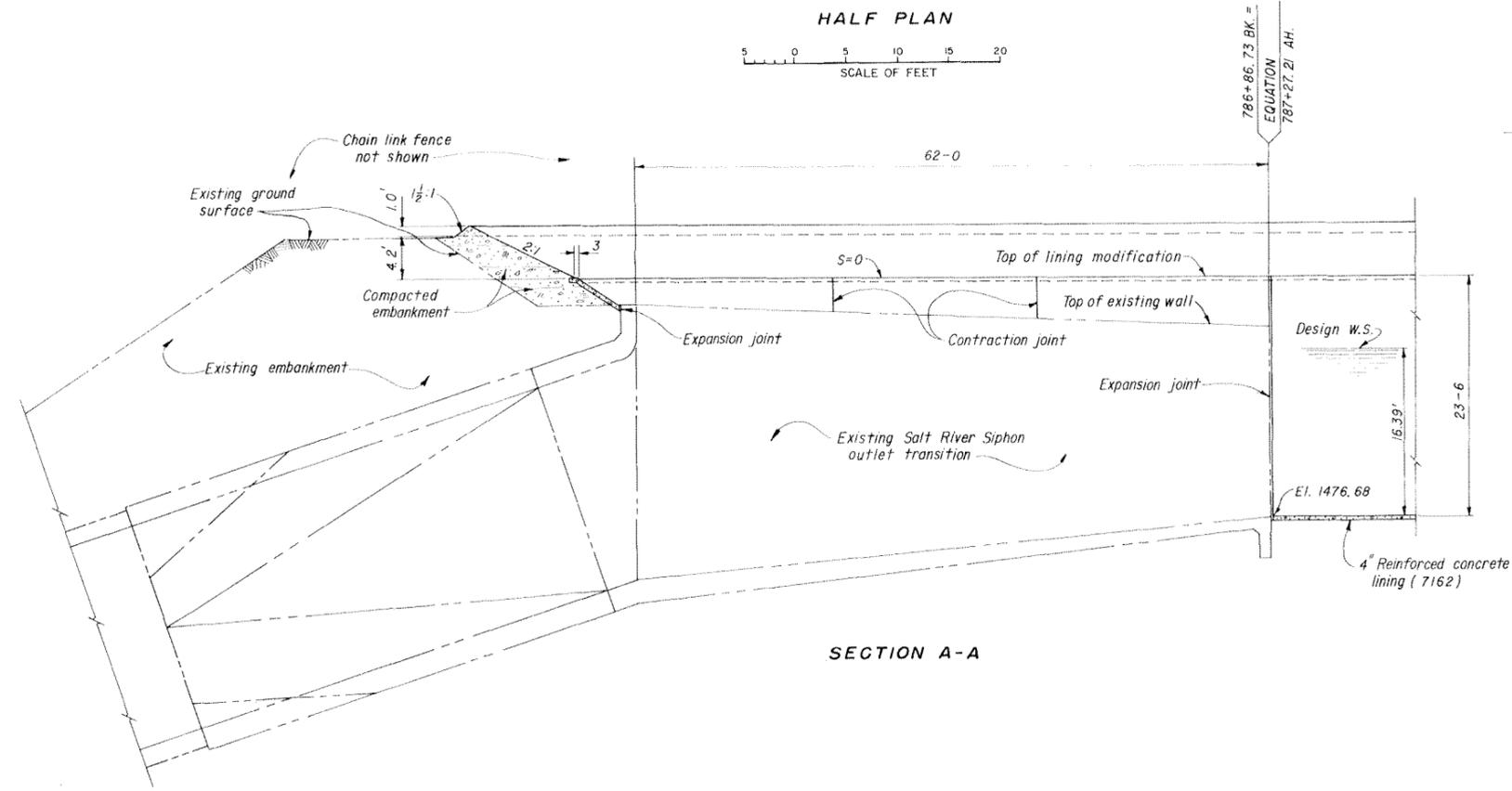
**SALT-GILA AQUEDUCT
REACH 1A
STATION 300+00
OVERCHUTE PIER**

DESIGNED *W.D. Lewis* TECHNICAL APPROVAL *John G. Gledhill*
DRAWN *L.V.E.P.* SUBMITTED *John G. Gledhill*
CHECKED *B. P. ...* APPROVED *John G. Gledhill*
CHIEF, WATER CONVEYANCE BRANCH

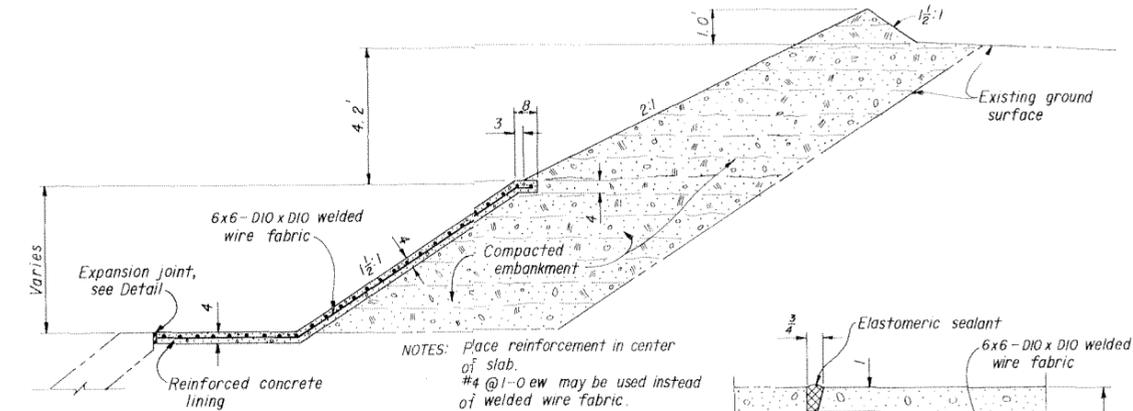
DENVER, COLORADO JUNE 7, 1980 344-D-7206



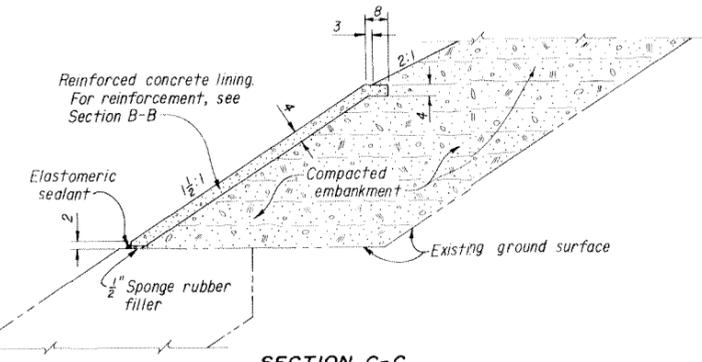
HALF PLAN
SCALE OF FEET



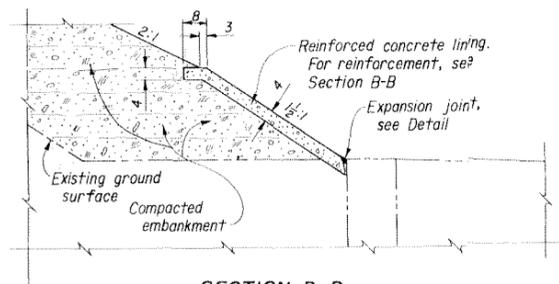
SECTION A-A



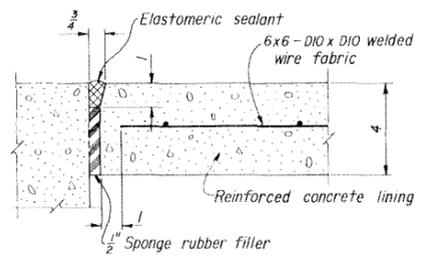
SECTION B-B



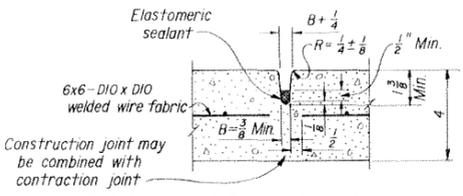
SECTION C-C



SECTION D-D



TYPICAL EXPANSION JOINT



TYPICAL CONTRACTION JOINT

NOTES
Concrete lining design is based on a compressive strength of 3000 p.s.i. @ 28 days.
Remove existing chain link fence around Salt River Siphon outlet transition.

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CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

**GRANITE REEF AQUEDUCT
REACH 12 COMPLETION
REINFORCED LINING MODIFICATION AT
SALT RIVER SIPHON OUTLET**

DESIGNED BY: *[Signature]* TECHNICAL APPROVAL: *[Signature]*
DRAWN BY: *[Signature]* SUBMITTED BY: *[Signature]*
CHECKED BY: *[Signature]* APPROVED BY: *[Signature]*
CHIEF, WATER CONVEYANCE BRANCH

DENVER, COLORADO SEPTEMBER 22, 1980 **344-D-7157**

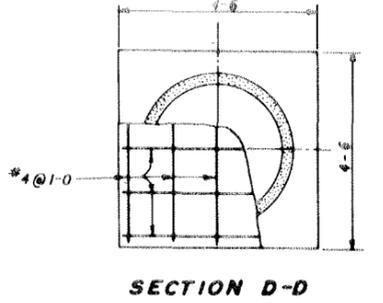
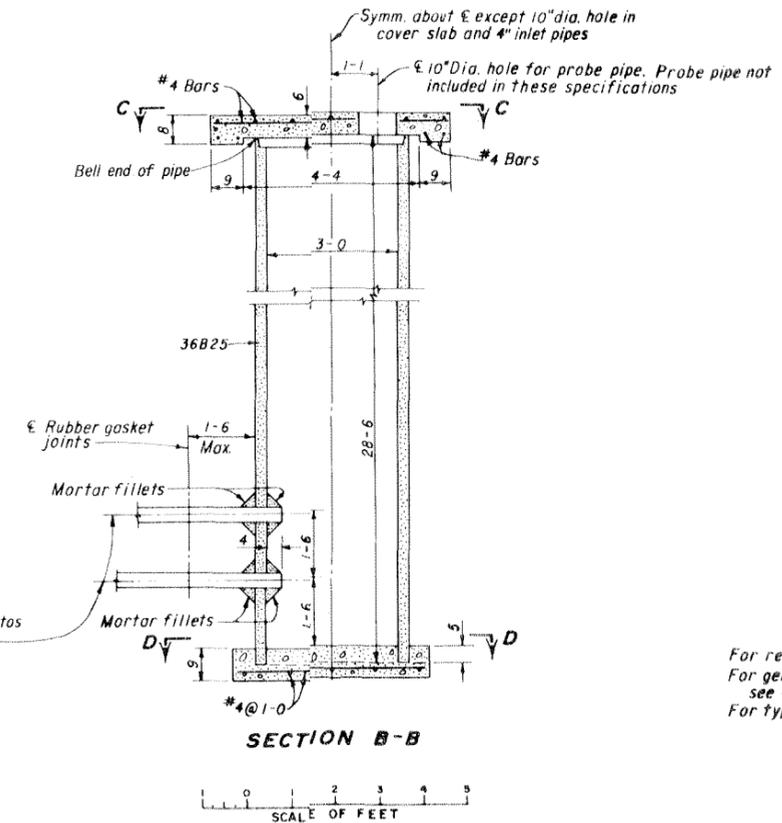
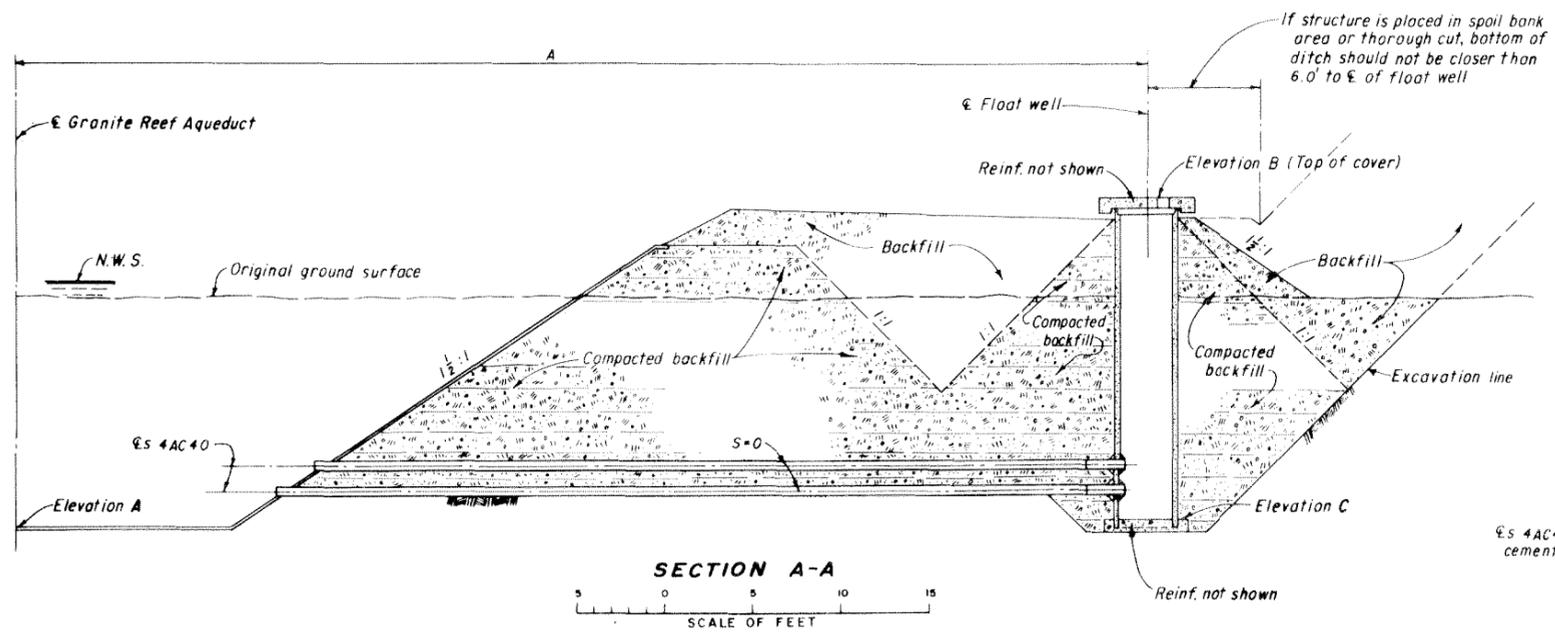
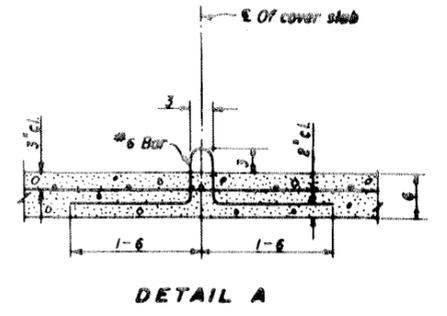
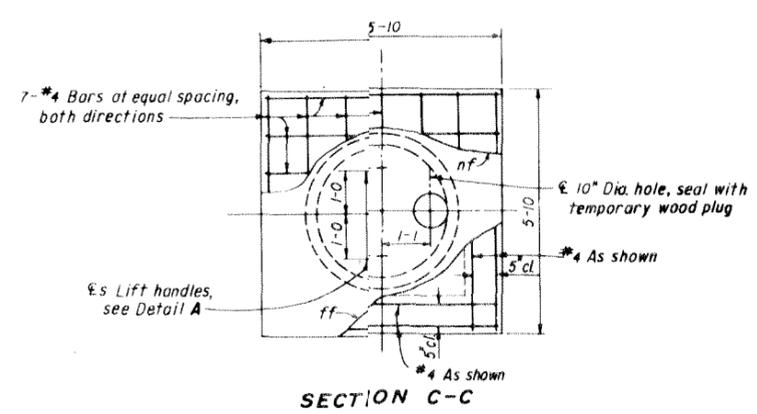
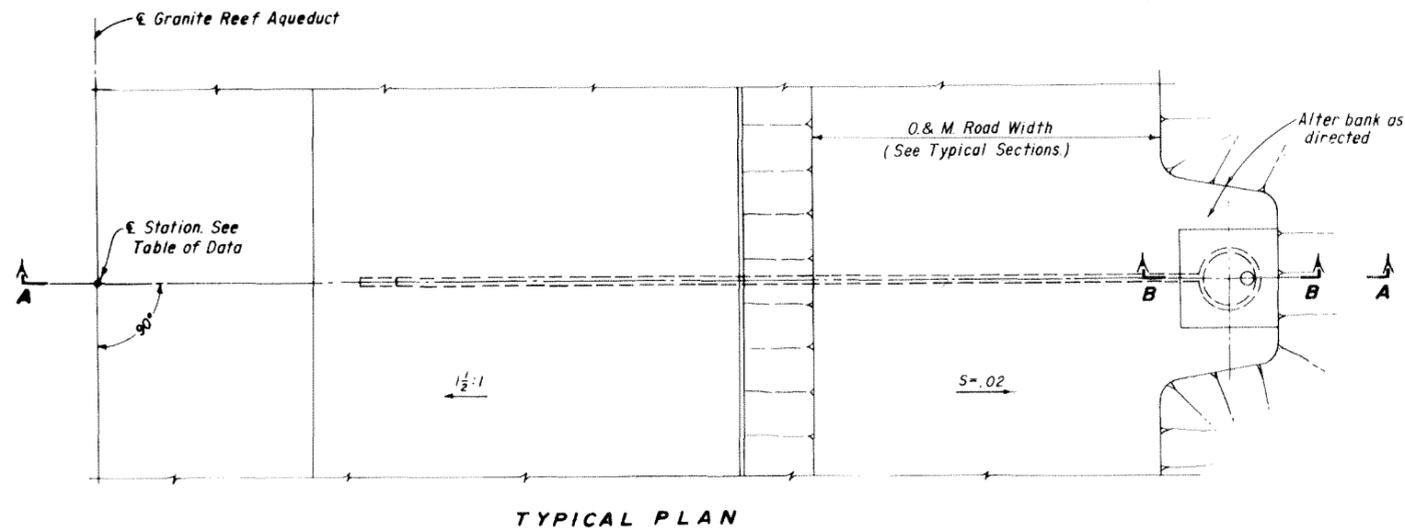


TABLE OF DATA

STATION	A	ELEVATION A	ELEVATION B	ELEVATION C
788 + 30	91' L.T.	1476.67	1505.25	1476.67
821 + 15	85' RT.	1476.37	1504.95	1476.37

NOTES

For reinforcement details, see 40-0-6283.

For general concrete outline notes and abbreviations, see 40-0-7006.

For typical aqueduct sections, see 344-D-7162.

SAVES TIME SAFETY

UNITED STATES
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CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION-ARIZONA

GRANITE REEF AQUEDUCT
REACH 12 COMPLETION
FLOAT WELLS
PLAN, SECTIONS, AND DETAIL

DESIGNED BY: P. J. ... TECHNICAL APPROVAL: J. ...
DRAWN BY: ... SUBMITTED: ...
CHECKED BY: ...

DEPARTMENT OF THE INTERIOR
SEPTEMBER 19, 1960
344-D-7158

GENERAL NOTES

UNLESS OTHERWISE SHOWN, THESE NOTES ARE TYPICAL FOR ALL DRAWINGS THAT REFER TO THIS DRAWING.

ABBREVIATIONS

- | | |
|-----------------------------------|-------------------------------|
| CJ = Construction joint | WSE = Waterstop--Type E |
| OCJ = Optional construction joint | WSF = Waterstop--Type F |
| VCJ = Vertical construction joint | WSG = Waterstop--Type G |
| bf = bottom face | WSH = Waterstop--Type H |
| nf = near face | CrJ = Contraction joint |
| ef = each face | EJ = Expansion joint |
| tf = top face | SP = Sewer pipe |
| ff = far face | HP = High point |
| MSN1 = Metal seal--Type N1 | LP = Low point |
| MSN2 = Metal seal--Type N2 | WP = Working point |
| MSZ = Metal seal--Type Z | El = Elevation |
| WSA = Waterstop--Type A | WS = Water surface, waterstop |
| WSB = Waterstop--Type B | TW = Tailwater |
| WSU = Waterstop--Type D | CrJ = Control joint |

EMBEDDED MATERIALS

Before placing concrete, care shall be taken that all embedded items are in position and securely fastened in place. Anchor bolt location and setting are shown on the structural steel, miscellaneous metal, concrete, and equipment drawings. Conduits and grounding cables are shown on the manufacturer's drawings and the electrical drawings. All projecting waterstops and metal seals shall be supported and protected from damage and exposure.

FINISHES

For location and classes of finishes for formed and unformed concrete surfaces, see the drawings and/or specifications.

CHAMFER

Chamfer edges of permanently exposed concrete surfaces with a 45° bevel, $\frac{1}{2}'' \times \frac{1}{2}''$.

JOINTS

All construction joints, identified CJ, shall be provided where shown on the drawings. All optional construction joints, identified OCJ, are to reduce the volume of placements or to facilitate construction. If optional joints are provided they shall be only at the locations shown. Additional construction joints may be used subject to approval.

REFERENCES

Numerals in parentheses (), following notes and section letters or numbers, indicate the number of the drawing upon which the section or detail is shown; for example, (524) denotes Drawing No. 557-D-524.

CONCRETE SYMBOLS

The different concrete placements are indicated by the following symbols:

- | | |
|--|--|
| | Concrete--First stage |
| | Concrete--Second stage |
| | Concrete--Blockout |
| | Existing concrete or concrete in adjacent structures |
| | Grout |

DIMENSIONS

All dimensions to a joint are to the centerline of the joint. Beams, columns, and walls are centered on reference lines. Dimensions in parentheses () on plans are beam depths. Beam and slab depths shall be measured from the top of the structural slab. Dimensions given for the depth of recesses are from the surface of the structural concrete. Thicknesses shown for walls and slabs adjacent to undisturbed soil or rock are minimum dimensions.

11-5-76 D- XXX	MINOR REVISION
3-30-73 D- SPM	DELETED RUBBER FROM RUBBER WATERSTOP ADDED ABBREVIATION FOR WATERSTOP
11-16-67 D- XXX	ADDED ABBREVIATION
10-4-66 U- XXX	CONCRETE PLACEMENT, EMBEDDED MATERIALS, FINISHES AND JOINTS REVISED.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

GENERAL CONCRETE OUTLINE NOTES

DRAWN C.M. & S. SUBMITTED *Wm. H. Wolf*
 TRACED G.A.M. RECOMMENDED *H. G. ...*
 CHECKED *[Signature]* and APPROVED *[Signature]*
 DENVER, COLORADO APRIL 19, 1966

40-D-7006

GENERAL NOTES

UNLESS OTHERWISE SHOWN ON THE REINFORCEMENT DESIGN DRAWINGS, THE DETAILS AND NOTES SHOWN ARE TYPICAL FOR ALL REINFORCEMENT DRAWINGS THAT REFER TO THIS DRAWING.

ABBREVIATIONS:

bf = bottom face br = bottom row bl = bottom layer
 ff = top face fr = top row fl = top layer
 nf = near face nr = near row ml = middle layer
 ff = far face fr = far row ns = near side
 ef = each face er = each row fs = far side
 if = inside face ir = inside row es = each side
 of = outside face or = outside row ew = each way
 mr = middle row ec = each corner
 spc = space or spaces
 eq. spc = equally spaced, equal spaces
 D = nominal diameter of reinforcing bar
 uv = uniformly varying lengths of bars between lengths shown
 cl = clear
 ctr = center or centers

SYMBOLS:

Bars shown thus $\text{---} \#8 @ 10 \text{---}$ or $\text{---} \#6 @ 7 \frac{1}{2} \text{---}$ indicate a group of the same size bars equally spaced.
 An open circle at the end of a bar indicates a bend with the bar turned away from the observer.
 A closed circle at the end of a bar indicates a bend with the bar turned towards the observer.
 Splices shown thus $\text{---} \text{---}$ indicate a lapped splice, not a bend in the bar.

DIMENSIONS:

Dimensions are to the center lines of the bars unless otherwise shown.
 Clear cover dimensions are marked "cl".

COVER:

Place the reinforcement so that the clear distance between face of concrete and nearest reinforcement is $1 \frac{1}{2}$ " for #5 bars and smaller and 2" for #6 bars and larger; except provide a clear distance from face of concrete placed against earth or rock of 2" where member thickness is 9" or less and 3" where member thickness is greater than 9", the clear distance being to the design dimension line.
 Reinforcement paralleling construction joints shall have a minimum of 2" clear cover.

PLACING:

Reinforcement at small openings (max 1'-6") in walls and slabs may be spread apart not more than $1 \frac{1}{2}$ times the bar spacing.
 Reinforcement may be adjusted laterally to maintain a clear distance of at least 1" between the reinforcement and keys, waterstops, anchor bolts, form ties, conduits, and other embedded material in heavily reinforced areas relocation of the embedded material must be considered.
 In no case should bars be bent to greater than 6 to 1 slope.
 Reinforcement parallel to anchor bolts or other embedded material shall be placed to maintain a clear distance of at least $1 \frac{1}{2}$ times the maximum size aggregate.

SPACING:

The first and last bars in walls and slabs, stirrups in beams, and ties in columns are to start and end at a maximum of one half of the adjacent bar spacing.

STANDARD HOOKS:

Hooks shall have 180° bends and extensions of 4-bar diameters but not less than $2 \frac{1}{2}$ " parallel to the main leg of the bar or 90° bends and extensions of at least 12-bar diameters. Hooks for stirrup and tie anchorage only shall have either a 90° or 135° bend plus an extension of at least 6-bar diameters but not less than $2 \frac{1}{2}$ " at the free end of the bar. Radius of bend to be as specified in the table of pin diameters. A bar (---) with a standard 180° hook on one end is referred to as an "A" bar. A bar (---) with a standard 180° hook on both ends is referred to as a "B" bar.

BENT BARS:

Only billet steel or axle steel shall be used for bars to be bent.
 Unless other radius bends are indicated on the design drawings, all reinforcement requiring bending shall be bent around a pin having the following diameter:

TABLE OF PIN DIAMETERS IN INCHES

BAR NO	3	4	5	6	7	8	9	10	11	14	18
Standard bends	$2 \frac{1}{8}$	$3 \frac{3}{8}$	$3 \frac{1}{2}$	$4 \frac{1}{4}$	$5 \frac{1}{4}$	$6 \frac{1}{4}$	$7 \frac{1}{4}$	$8 \frac{1}{4}$	$10 \frac{1}{4}$	$12 \frac{1}{4}$	$17 \frac{1}{2}$
Stirrup and tie bends	$1 \frac{1}{8}$	$2 \frac{1}{8}$	$2 \frac{3}{8}$	$3 \frac{1}{4}$	$4 \frac{1}{8}$	$5 \frac{1}{8}$	$6 \frac{1}{8}$	$7 \frac{1}{8}$	$8 \frac{1}{8}$	$11 \frac{1}{8}$	$14 \frac{1}{8}$

REINFORCEMENT DOWELS:

Dowels indicated on the drawing, such as #8(d), shall have an embedment equal to L_d and a projection equal to that required for lap splicing a bar of the same diameter.

PLAIN DOWELS:

Plain dowels across contraction joints shall be smooth bars uniformly coated with a film of oil before concrete placement. Viscosity of the oil shall have a SAE rating of not less than 250.

ACCESSORIES:

Bar supports, spacers, and other accessories are not shown on the design drawings. The recommendations of ACI 315 or other approved supporting systems may be used.

REFERENCES:

Numerals in parentheses () following notes and section letters or numbers indicate the number of the drawing upon which the section or detail is shown; for example (524) denotes Drawing No. 557-D-524.
 Unless otherwise shown follow the recommendations established by American Concrete Institute's "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315).

NOTES TO DESIGNERS:

Splice lengths shown in the tables on this drawing are for Class B splices, spaced at least 6 inches on centers, (0.8 x 1.3 L_d) in accordance with ACI 318-71. Splices requiring lap lengths other than those for Class B must be detailed on the reinforcement design drawings.
 Embedment length, L_d , in the above tables is based on "other" bars spaced at least 6 inches or 6 bar diameters.

SPLICES:

Unless otherwise shown, the minimum length of lap for splicing parallel bars shall be as given in the applicable table. Splices shall be staggered, to give 12 inches clear between ends of adjacent splices, if bars are spaced closer than 6 inches or 6 bar diameters.
 Noncontact lap splices shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. When reinforcing bars of different size are to be spliced, the length of lap shall be governed by the smaller diameter bar.
 Splices are to be made so that the given distances to face of concrete will be maintained.

TABLE 3-40

$f'_c = 3000 \text{ psi}$ $f_y = 40,000 \text{ psi}$

BAR SIZE NO.	LENGTH OF LAPPED SPLICE IN INCHES		EMBEDMENT LENGTH L_d
	TOP BARS %	OTHER BARS	
3	12	12	12
4	12	12	12
5	15	12	12
6	19	14	12
7	26	19	14
8	34	24	19
9	43	31	24
10	54	39	30
11	67	48	37

TABLE 3-60

$f'_c = 3000 \text{ psi}$ $f_y = 60,000 \text{ psi}$

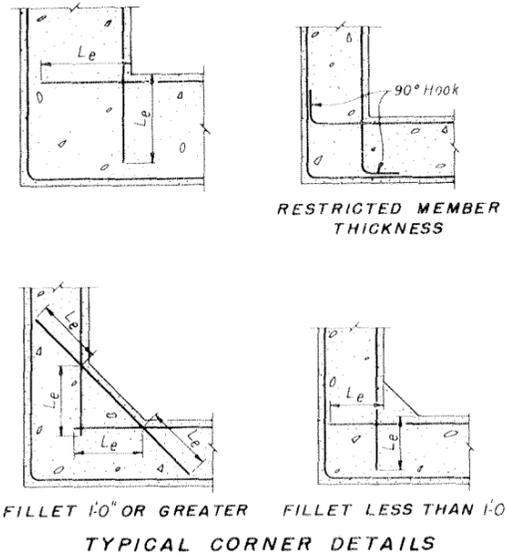
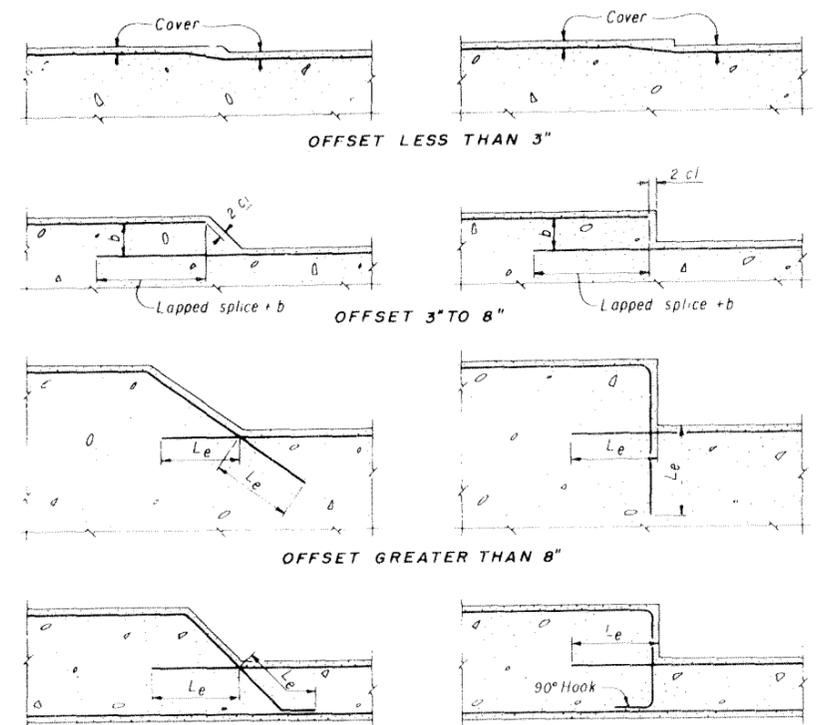
BAR SIZE NO.	LENGTH OF LAPPED SPLICE IN INCHES		EMBEDMENT LENGTH L_d
	TOP BARS %	OTHER BARS	
3	13	12	12
4	18	13	12
5	22	16	12
6	28	20	16
7	39	28	21
8	51	36	28
9	64	46	35
10	81	58	45
11	100	71	55

TABLE 4-60

$f'_c = 4000 \text{ psi}$ $f_y = 60,000 \text{ psi}$

BAR SIZE NO.	LENGTH OF LAPPED SPLICE IN INCHES		EMBEDMENT LENGTH L_d
	TOP BARS %	OTHER BARS	
3	13	12	12
4	13	13	12
5	22	16	12
6	26	19	15
7	33	24	18
8	44	31	24
9	56	40	31
10	70	50	39
11	86	62	47

* Top bars are horizontal bars in beams and slabs so placed that more than 12 inches of concrete is cast in the member below the bar.



OFFSET GREATER THAN 8" RESTRICTED MEMBER THICKNESS TYPICAL OFFSET DETAILS

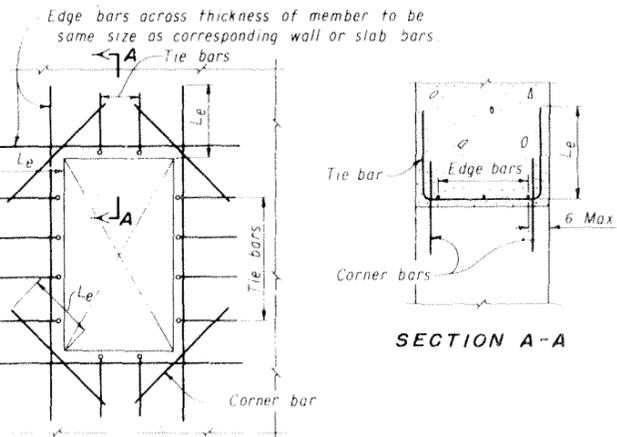
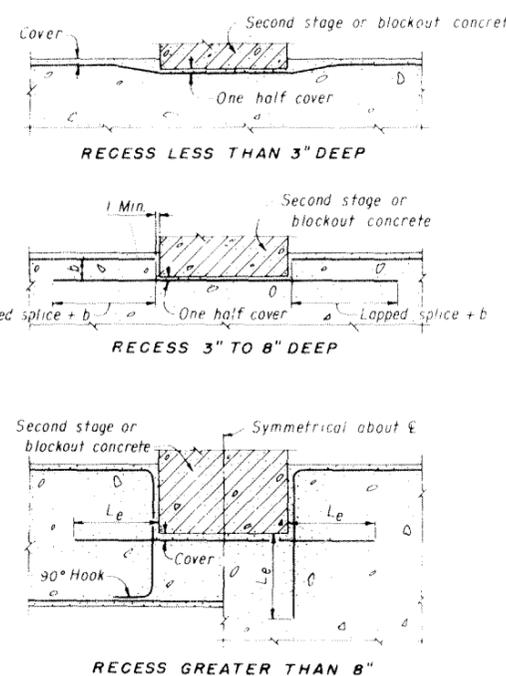


TABLE FOR REINFORCEMENT AROUND OPENINGS

MEMBER THICKNESS	TIE BARS	EDGE BARS	CORNER BARS
Less than 10"	None	1-ctr	1-#4 ctr.
10 thru 1'-6"	None	2-(1-ef)	2-#4 (1 ef)
1'-7" thru 3'-0"	#4 @ 1-0	3-eq spc	2-#6 (1 ef)
Over 3'-0"	#6 @ 1-0	Spc. @ 1-0	2-#8 (1 ef)

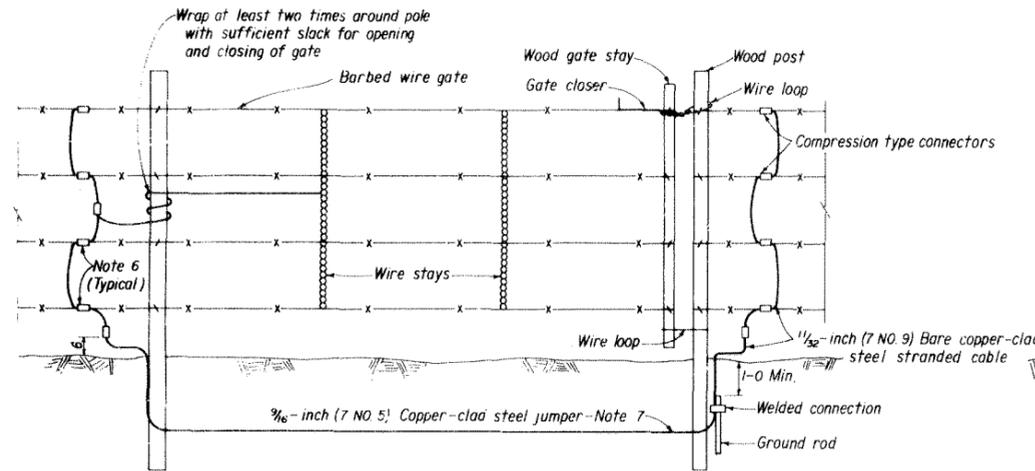
Omit edge and tie bars along sides of openings where dimension is less than 1'-6".
 Omit corner bars at sides of openings adjacent to floors, walls, or beams.
 Corner bars required if either dimension of opening is greater than 1'-6".
 Use corner bars in face of recesses deeper than 4" if either dimension of recess is greater than 1'-6".



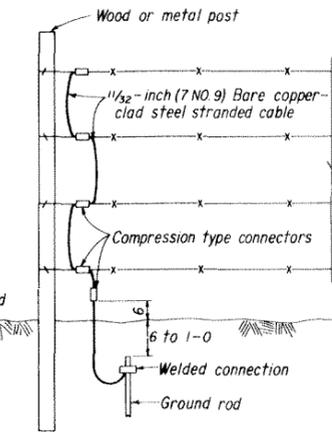
TYPICAL BLOCKOUT RECESS DETAILS
 (Second stage concrete shown)

ADDITIONAL REINFORCEMENT AROUND OPENINGS

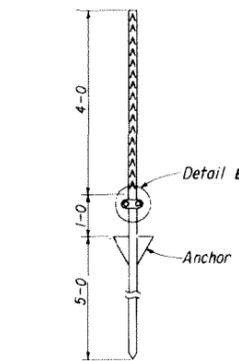
12-B-76 MINOR REVISIONS
 D-R
MINUS THINK SAFETY
 UNITED STATES
 DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 STANDARD DESIGNS
GENERAL NOTES AND MINIMUM REQUIREMENTS FOR DETAILING REINFORCEMENT
 DESIGNED: *M. W. ...* SUBMITTED: *R. D. ...*
 DRAWN: *...* RECOMMENDED: *...*
 CHECKED: *...* APPROVED: *...*
 A.E.S. DIRECTOR, DESIGN AND CONSTRUCTION
 DENVER, COLORADO, JUNE 12, 1972
40-D-6263



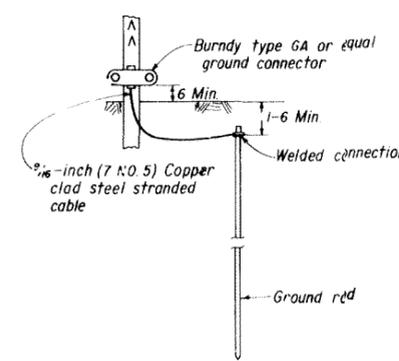
BARBED WIRE FENCING AND GATE (Grounding Detail)



BARBED WIRE FENCING (Grounding Detail)

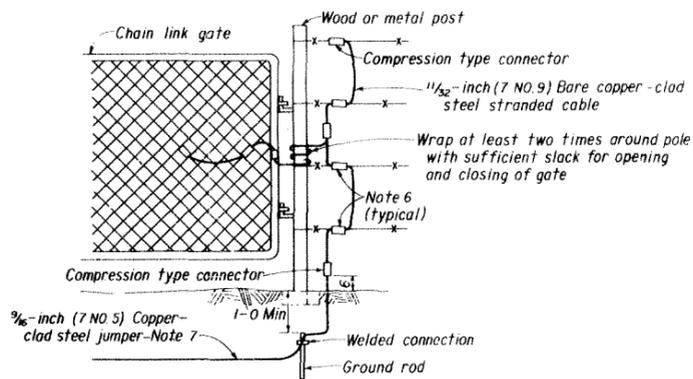


STEEL FENCE POST (Grounding Detail)

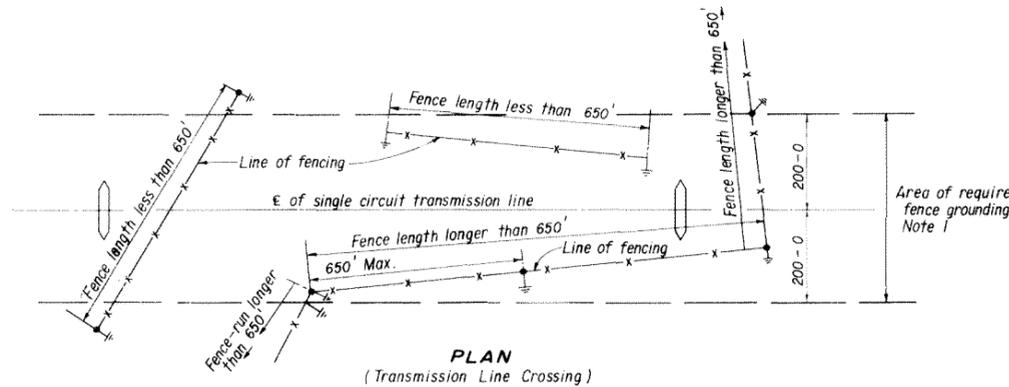


DETAIL B (Grounding Detail)

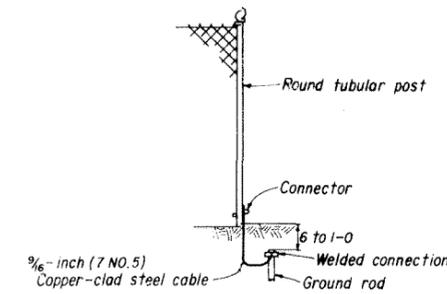
- NOTES**
1. Ground all fencing located within 200 feet of the transmission line center line as shown in plan. If fencing is interrupted by a gate, ground fencing and gate as shown.
 2. For fences less than 650 feet long, provide a ground at each end.
 3. For fences longer than 650 feet, ground each end of fence-run and a fence ground shall be provided where the fence-run crosses the area of required grounding.
 4. The maximum interval between ground connections is 650 feet.
 5. Non-continuous intervals of fence run shall be grounded at each end of the continuous interval. Ground wire jumpers 1/2-inch (7 NO. 9) may be provided.
 6. All grounding shall be as close as possible to a fence post.
 7. Where a ground rod is located near a gate or gate post, the fence shall be grounded around the gate opening to the fence on the opposite side with a 3/16-inch (7 NO. 5) copper-clad steel stranded ground cable.
 8. Fence grounding shall not be connected to the existing transmission line grounding system.
 9. Ground all gates or each half of all double gates to the gate post with flexible braid.
 10. This drawing does not apply to fence grounding for switchyards or substations.
 11. Ground cable sizes listed are minimum allowable.



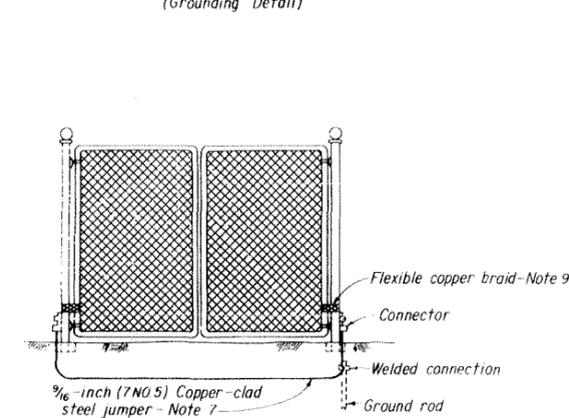
BARBED WIRE FENCING AND CHAIN LINK GATE (Grounding Detail)



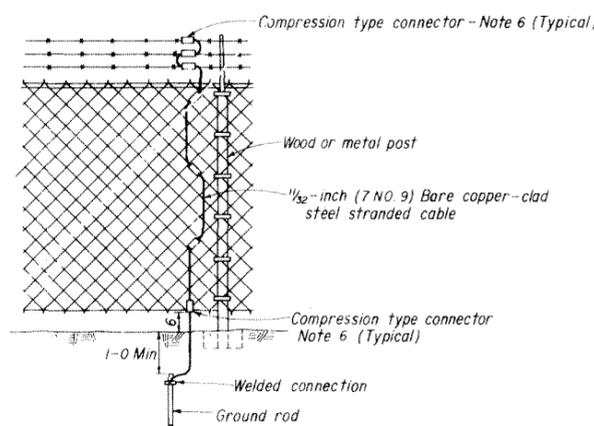
PLAN (Transmission Line Crossing)



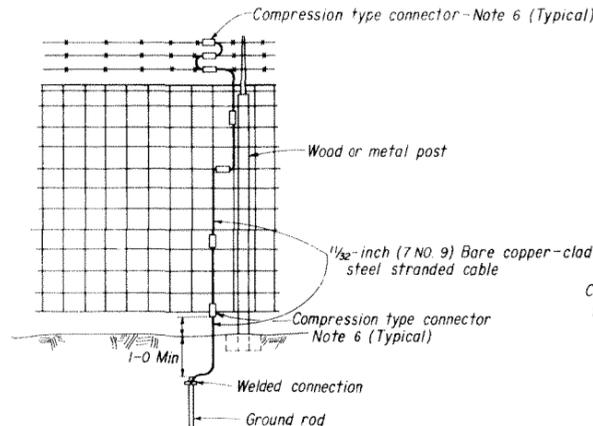
TUBULAR POST FENCING (Grounding Detail)



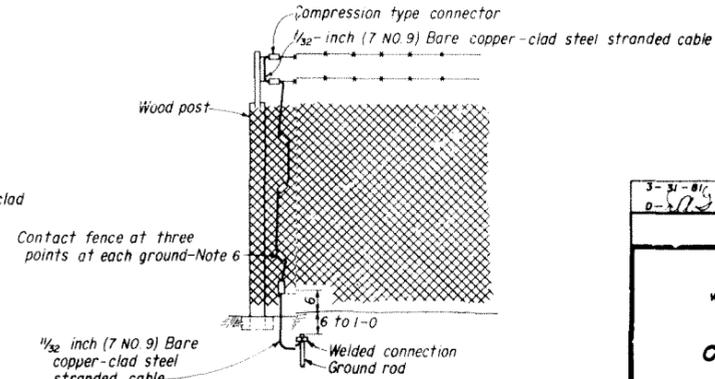
CHAIN LINK FENCE GATE (Grounding Detail)



CHAIN LINK FENCING (Grounding Detail)



WIRE MESH FENCING (Grounding Detail)



WOOD POST CHAIN LINK FENCING (Grounding Detail)

3-31-81
0-57

ADDED NOTE 11.

ALWAYS THINK SAFETY

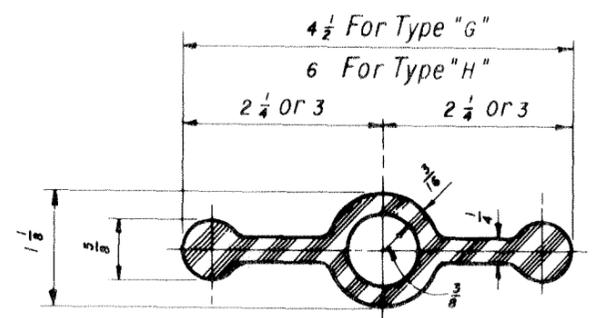
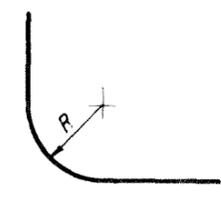
UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
STANDARD DESIGNS

**CANAL RIGHT-OF-WAY FENCING
GROUNDING INSTALLATION**

DESIGNED BY: G. M. M. SUBMITTED BY: L. B. B. B. B.
DRAWN BY: D. W. W. RECOMMENDED BY: E. M. M. M. M.
CHECKED BY: J. J. J. APPROVED BY: W. W. W. W. W.
Acting DIRECTOR OF DESIGN AND CONSTRUCTION

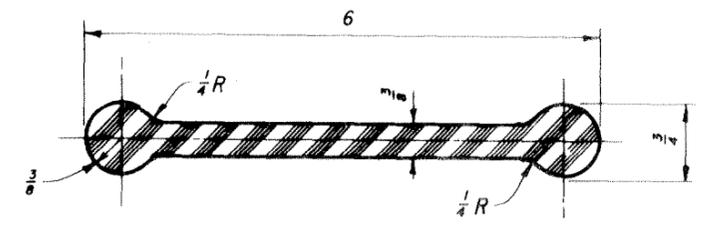
DENVER, COLORADO JULY 10, 1977 40-D-6376

Minimum radius R .
 Type A = 8 inches
 B, G and H = 4 inches

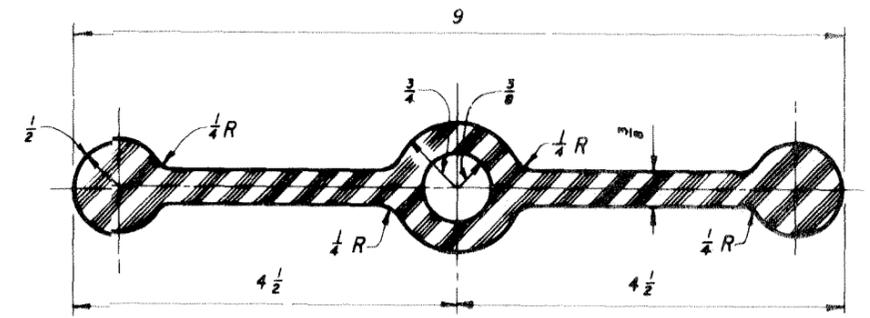


FOR FIELD INSTALLATION

TYPES "G" AND "H"



TYPE "B"



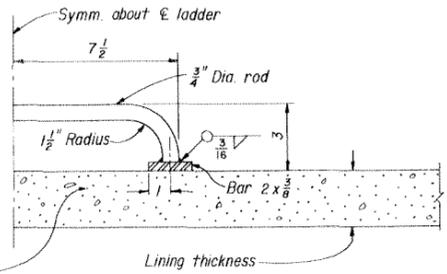
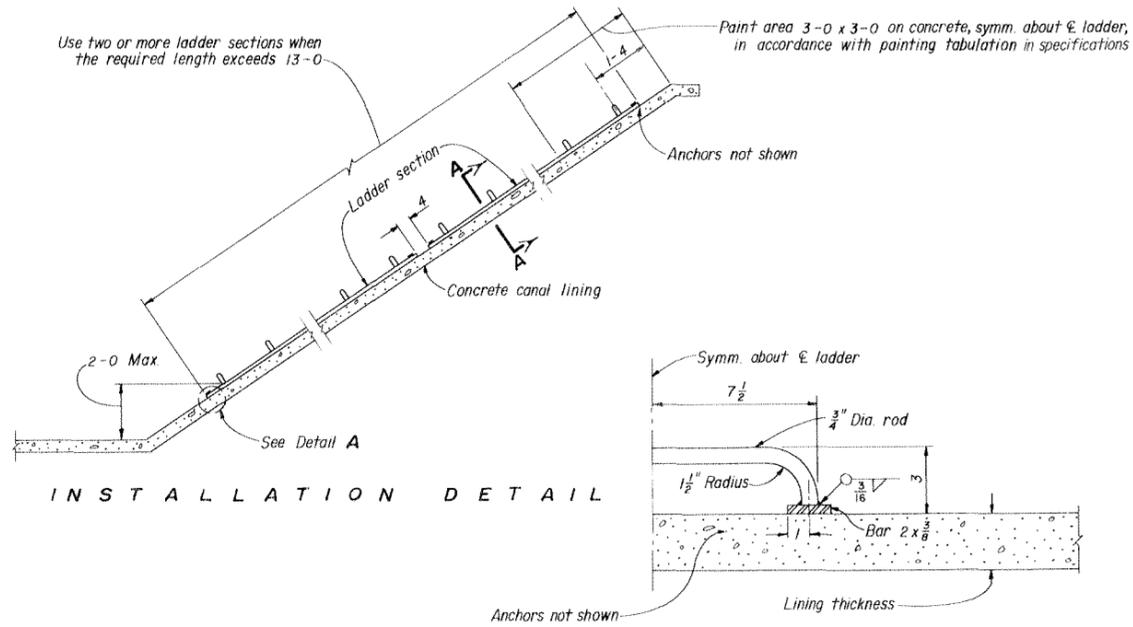
TYPE "A"

TOLERANCES

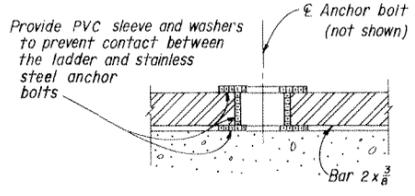
- $\pm \frac{1}{4}$ Width, Type A
- $\pm \frac{1}{8}$ Width, Type B, G, and H.
- $\pm \frac{1}{16} - \frac{1}{32}$ Web thickness, end bulb diameter, and wall thickness on center bulb, all Types.
- $\pm \frac{1}{8}$ Diameter of center bulb, both I.D. and O.D., Types A, G, and H.

ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION STANDARD DESIGNS	
RUBBER WATERSTOPS TYPES "A", "B", "G", and "H"	
DESIGNED <u>H.C.G.</u>	SUBMITTED <u>H.R. McBirney</u>
DRAWN <u>David H. [unclear]</u>	RECOMMENDED <u>K.B. Keener</u>
CHECKED <u>P.W.T.</u>	APPROVED <u>Walker R. Young</u>
DENVER, COLORADO 5-7-41	40-D-2867

B-3-78 TRACED.
 D- [unclear]



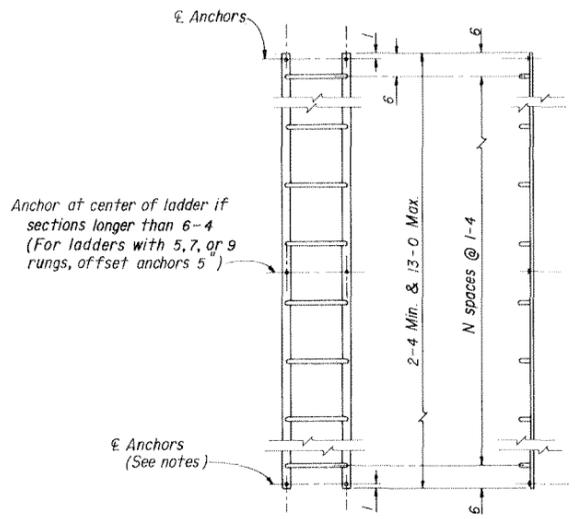
SECTION A-A
LADDER RUNG DETAIL



DETAIL A

NOTES

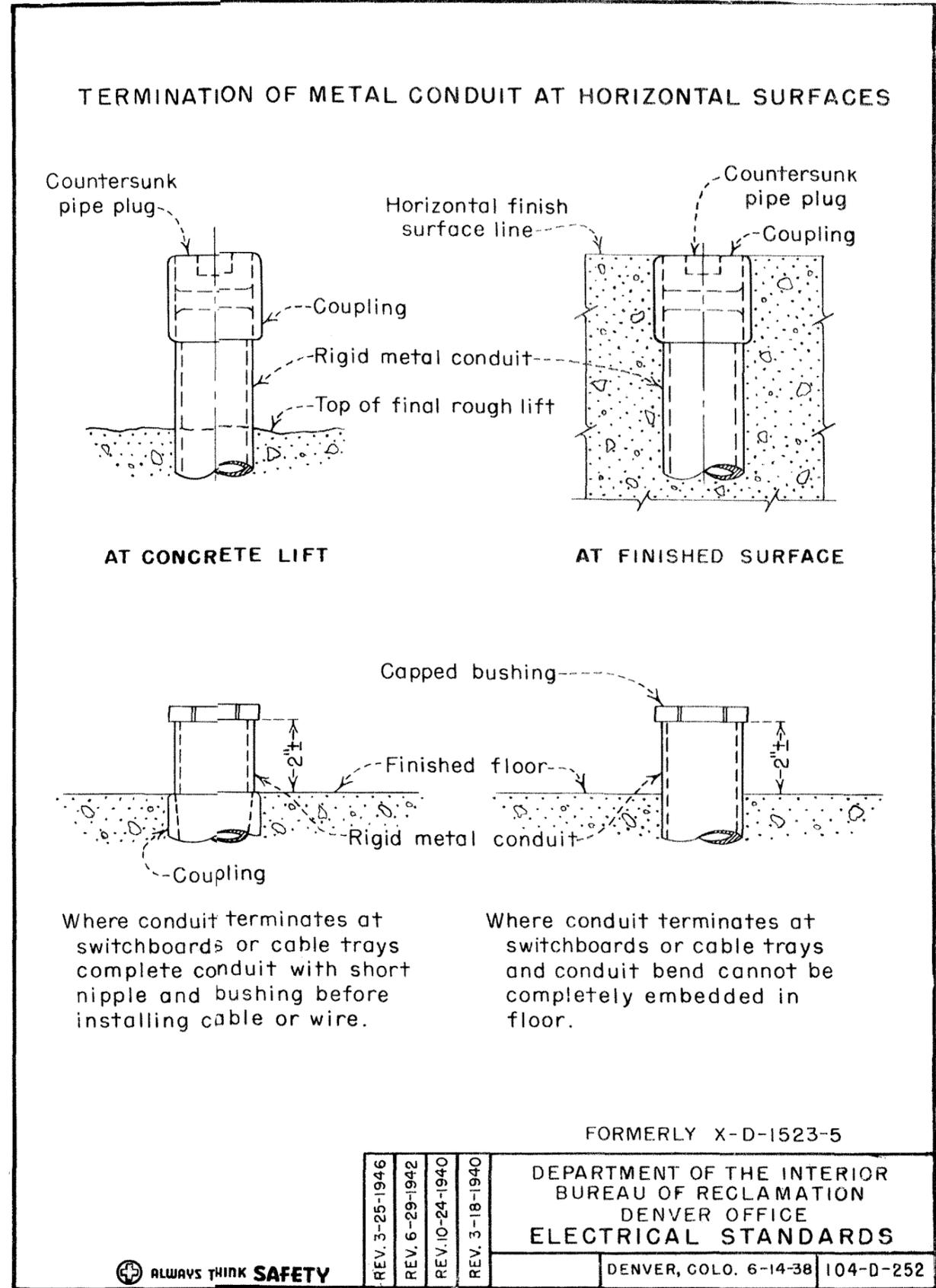
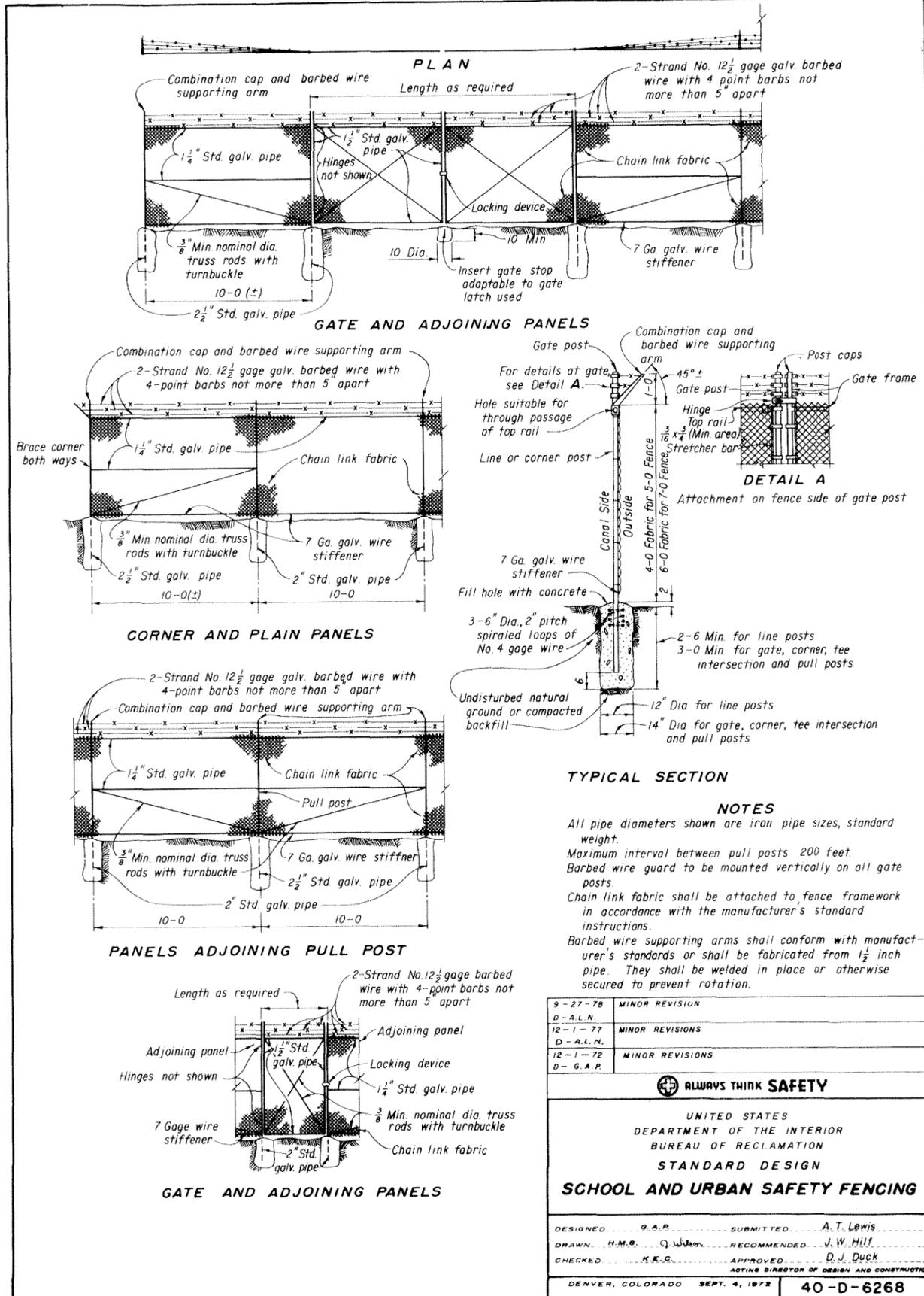
- Ladders shall be installed on sides of canal when the vertical lining height is 2-6 or greater.
- Ladders shall be located opposite each other at 750-foot intervals along the canal and upstream of structures as directed.
- Ladders shall be fabricated from aluminum alloy 6061, T6 unless otherwise specified. See specification paragraphs for protective coating requirements.
- Ladders shall be anchored to the canal lining with corrosion-resisting (stainless) steel expansion anchors. See specifications paragraph for anchor, PVC sleeve, and PVC washer requirements.



LADDER SECTION

THIS DRAWING SUPERSEDES DRAWING 40-D-6112

ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION STANDARD DESIGNS	
SAFETY LADDER FOR CONCRETE LINED CANALS	
DESIGNED <i>Thos. E. Haider</i>	TECHNICAL APPROVAL <i>J. E. Johnson</i>
DRAWN <i>D. C. Engstrom</i>	SUBMITTED <i>W. D. Long</i> <i>R. S. Jensen</i>
CHECKED <i>J. E. Johnson</i>	APPROVED <i>S. G. Mellin</i>
CHIEF, WATER CONVEYANCE BRANCH	
DENVER, COLORADO	JULY 18, 1979
40-D-6460	



**UNIFIED SOIL CLASSIFICATION
INCLUDING IDENTIFICATION AND DESCRIPTION**

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)		GROUP SYMBOLS	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA					
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size.	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Give typical name, indicate approximate percentages of sand and gravel, max size, angularity, surface condition, and hardness of the coarse grains, local or geologic name and other pertinent descriptive information, and symbol in parentheses. For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics. EXAMPLE:- Silty sand, gravelly, about 20% hard, angular gravel particles 1/2-in maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand, (SM)	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3 Not meeting all gradation requirements for GW			
		GRAVELS WITH FINES (Appreciable amount of fines)	Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.			Afterberg limits below "A" line, or FI less than 4	Above "A" line with PI between 4 and 7 are <u>borderline</u> cases requiring use of dual symbols.	
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.					Afterberg limits above "A" line with PI greater than 7
		GRAVELS WITH FINES (Appreciable amount of fines)	Plastic fines (for identification procedures see CL below).	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.			$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3 Not meeting all gradation requirements for SW	Afterberg limits below "A" line or FI less than 4	
		CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	SW	Well graded sands, gravelly sands, little or no fines.					Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse grained soils are classified as follows - GW, GP, SW, SP, Less than 5% GM, GC, SM, SC, More than 5% Borderline cases requiring use of dual symbols.
	CLEAN SANDS (Little or no fines)	Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions. EXAMPLE:- Clayey silt, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place, loess, (ML)	Afterberg limits above "A" line with PI greater than 7	Above "A" line with PI between 4 and 7 are <u>borderline</u> cases requiring use of dual symbols.			
	SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	SM	Silty sands, poorly graded sand-silt mixtures.				Use grain size curve in identifying the fractions as given under field identification.	Use grain size curve in identifying the fractions as given under field identification.	Use grain size curve in identifying the fractions as given under field identification.
	SANDS WITH FINES (Appreciable amount of fines)	Plastic fines (for identification procedures see CL below).	SC	Clayey sands, poorly graded sand-clay mixtures.	Use grain size curve in identifying the fractions as given under field identification.	Use grain size curve in identifying the fractions as given under field identification.	Use grain size curve in identifying the fractions as given under field identification.			
	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE									
	FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size.	SILTS AND CLAYS Liquid limit less than 50	DRY STRENGTH (CRUSHING CHARACTERISTICS)	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.	Give typical name, indicate degree and character of plasticity, amount and maximum size of coarse grains; color in wet condition, odor if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses. For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions. EXAMPLE:- Clayey silt, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place, loess, (ML)	
DILATANCY (REACTION TO SHAKING)			Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.			
TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)			Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.			
SILTS AND CLAYS Liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.				
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays.				
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity.				
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.	Pt	Peat and other highly organic soils.						

† Boundary classifications - Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.
 ‡ All sieve sizes on this chart are U.S. standard.

FIELD IDENTIFICATION PROCEDURES FOR FINE GRAINED SOILS OR FRACTIONS
 These procedures are to be performed on the minus No. 40 sieve size particles, approximately 1/42 in. For field classification purposes, screening is not intended; simply remove by hand the coarse particles that interfere with the tests.

DILATANCY (Reaction to shaking)
 After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky. Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.
 Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

DRY STRENGTH (Crushing characteristics)
 After removing particles larger than No. 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun, or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.
 High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

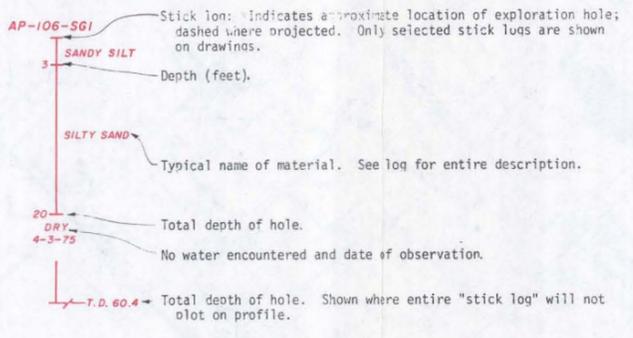
TOUGHNESS (Consistency near plastic limit)
 After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.
 After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles. The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.
 Highly organic clays have a very weak and spongy feel at the plastic limit.

GENERAL GEOLOGIC LEGEND

- Qal** QUATERNARY ALLUVIUM: Channel deposits comprised of unconsolidated to compact, fine to coarse, subangular to subrounded, clean to silty sand. Lenticular; contains lenses of fine to coarse, rounded to subrounded, hard gravel, locally, cobbles and boulders.
- Qaf** ALLUVIAL FAN DEPOSITS: Unconsolidated to variably caliche-cemented, lenticular deposits comprised predominantly of silty sands. Lenses of clayey sands, or clean sands with generally less than 15 percent fine gravel, and some cobbles are also present. Gravels and cobbles occur in established drainages. Caliche cementation varies vertically and laterally; and from weakly to strongly cemented; frequently, strongly cemented lenses are interbedded with weakly or moderately cemented materials. Generally veneered by fine, clean to silty sand, gravel, and caliche chips; locally, exposures are cemented.
- Lgr** YOUNGER GRANITE: (Tertiary to Cretaceous "Laramide Age") Fine- to medium-grained; locally gneissic; light gray granite. Hard and dense where fresh, to soft and crumbly where weathered. Lightly weathered, Nx-size core breaks with strong hammer blow. Variably weathered; intensely fractured; locally pervasively sheared. Fracture and joint spacing 1/2 to 12 inches (mostly 2 to 4 inches) apart, surfaces stained by iron and manganese oxides, and some surfaces slickensided. Occurs as an irregularly shaped intrusive body south of the Salt-Gila Pumping Plant site.
- pEgr** PRECAMBRIAN GRANITE: Medium- to coarse-grained; porphyritic, with feldspar phenocrysts to 3-1/2 inches in diameter; locally gneissic with distinctive banding; gray. Hard and dense where fresh, crumbly where highly weathered. Lightly weathered Nx-size core breaks with moderate to sharp hammer blow; where more weathered or fractured, core breaks along discontinuities or crumbles along mineral grains with manual pressure. Variably weathered, with numerous decomposed (disintegrated) to highly weathered zones; decomposed granite encountered in drill holes to depths of 130 feet; Intensely to moderately fractured; joint spacing in core ranges from 1 to 40 inches apart, mostly 3 to 10 inches. Locally, pervasively sheared. The term "brecciated" is used to describe zones of intense fracturing and the presence of slickensided fragments. Most joint surfaces are iron stained, silt, clay, or carbonate coated; some joint infilling of calcareous-cemented sand and fines. Some joints are open, many are healed with calcite and calcareous cementation (caliche); many are slickensided. Most joints are steeply dipping, most common orientations are 30°, 45°, 60°, and 70-90°, although numerous randomly oriented fractures spaced a fraction of an inch to 3 inches, are also present. Locally intruded by andesite dikes. Phyllonite was also encountered within the granite in one drill hole.

GENERAL GEOLOGIC EXPLANATION

- Approximate contact between geologic units; queried where inferred; dotted where concealed.
- Strike and range of degrees in dip of dominant joints or joint sets.
- Strike of dominant vertical joints or joint sets.
- Strike and dip of multiple dominant joints and joint sets (observations located near points of intersection).
- Approximate location of subsidence earth fissure.
- DH-109-SGI** Location of vertical Nx-size drill hole for Salt-Gila Aqueduct, Reach 1A.
- DH-125-GR12** Location of vertical Nx-size drill hole for Granite Reef Aqueduct, Reach 12.
- PR-DH-113-SGI** Location of vertical drill hole in which penetration resistance tests were conducted.
- AP-101-SGI** Location of power auger hole for Salt-Gila Aqueduct Reach 1A. Suffix SGC denotes feasibility power auger hole.
- AP-23-MSR** Location of power auger hole for Salt River borrow source.
- TP-3-SGI** Location of test pit for Salt-Gila Aqueduct, Reach 1A.
- TP-104-MSR or PIT-61-MSR** Location of test pit for Salt River borrow source.
- TP-202-MSG3** Location of test pit for Queen Creek area aggregate source.



GENERAL GEOLOGIC NOTES

Surface contacts between geologic units are approximate, and are shown as located on the ground surface at time of field examination.

Most rock surfaces are covered by a veneer of surficial deposits, generally 3 to 8 feet thick, that is not delineated on geology drawings. These deposits include siltwash, residual soil, grus, and alluvium, occurring generally as silty, coarse sand to fine gravel with coarse gravel- to boulder-size granitic rock fragments.

Logs of exploration, summaries of test data, and photographs depicting geologic conditions are included in these specifications.

Only selected stick logs of exploration holes or test pits are shown on the profiles. Only the typical name of the material shown on the complete log is indicated on the stick log. The typical name is based on recovered material and may not accurately reflect the in-place condition of the material in all instances. For the entire description of the material, drilling and sampling methods, augering conditions, etc., and exact location of the hole see the complete log.

Ground elevations shown on the geologic logs do not reflect changes due to excavation, grading, and degradation or aggradation, subsequent to the dates of exploration.

Letter classification symbols used in the logs of exploration are group symbols of the Unified Soil Classification System based on field identification; see drawing No. 103-D-347 for explanation.

The graphic classification symbols and typical names shown on the logs represent only the predominant material present; read the entire description for a complete delineation of the materials.

Where used in the exploration hole logs, the terms "weakly," "moderately," and "strongly cemented" refer to materials that could be easily crushed with finger pressure, broken by manual pressure, or required a hammer blow to break, respectively.

Gradation test results listed in the "Particle-Size Fractions in Percent" columns in the summaries of physical properties test results, represent only the gradation of the minus 3-inch material submitted to the laboratory for testing; the plus 3-inch material was removed in the field prior to testing. See the complete log for information on the plus 3-inch material.

The ground-water table was not encountered in any of the exploratory test pits, auger holes, or Nx-size drill holes. The term "Not reached" given on the geologic logs for water level information is shown on the stick logs as "Dry" with the date of measurement.

Penetration resistance tests were performed in three holes drilled at three bridge sites. For test results, see the complete logs for drill holes PR-DH-113-SGI through PR-DH-115-SGI. Classification and description of materials were based on recovered wash samples, and poor recovery of split tube standard penetration samples.

For location of exploration for the Salt-River Borrow Source, see drawing No. 344-D-7222.

For location of exploration for the Queen Creek Area Aggregate Source, see drawing No. 344-D-7219.

Coordinates are based on the Arizona Coordinate System, Central Zone.

For general surface geology and location of exploration, see Drawing No. 344-D-7377A.

For more detailed surface geology and location of exploration, see drawings No. 344-D-7165A through 344-D-7172A.

RED 344-D-7156

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE
CENTRAL ARIZONA PROJECT

**SALT-GILA AQUEDUCT
REACH 1A**

GENERAL GEOLOGIC LEGEND, EXPLANATION AND NOTES

GEOLOGY... PROJECT STAFF... TECHNICAL APPROVAL *Richard Thorne*
DRAWN... SUBMITTED... NOT REQUIRED
CHECKED *David Johnson*... APPROVED *Steve D. Frank*
CHIEF, WESTERN GEOLOGY BRANCH

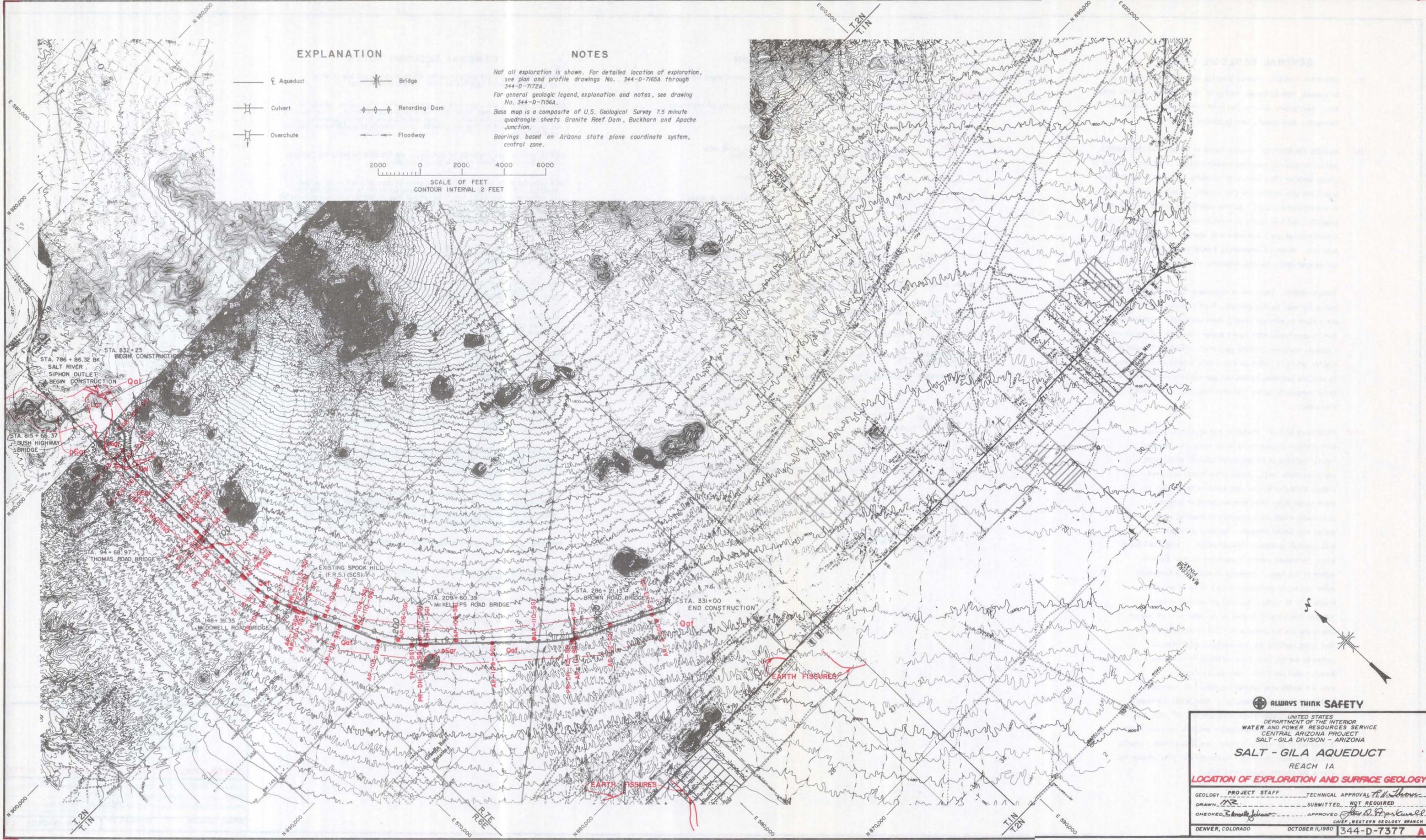
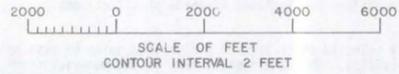
DENVER, COLORADO OCTOBER 1, 1980 344-D-7156 A

EXPLANATION

- Aqueduct
- Culvert
- Overchute
- Bridge
- Retarding Dam
- Floodway

NOTES

Not all exploration is shown. For detailed location of exploration, see plan and profile drawings No. 344-D-7165A through 344-D-7172A.
 For general geologic legend, explanation and notes, see drawing No. 344-D-7156A.
 Base map is a composite of U.S. Geological Survey 7.5 minute quadrangle sheets Granite Reef Dam, Buckhorn and Apache Junction.
 Bearings based on Arizona state plane coordinate system, central zone.



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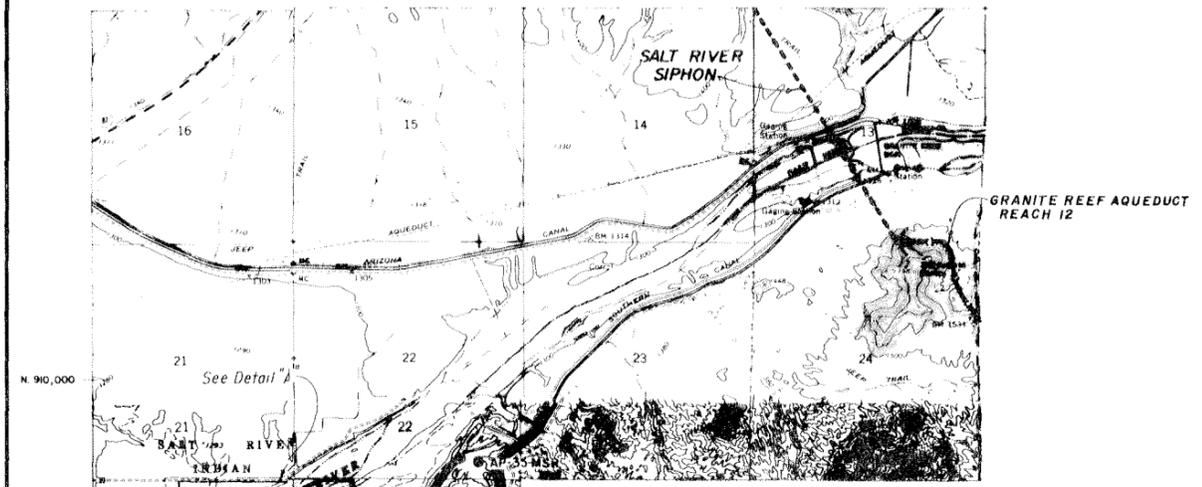
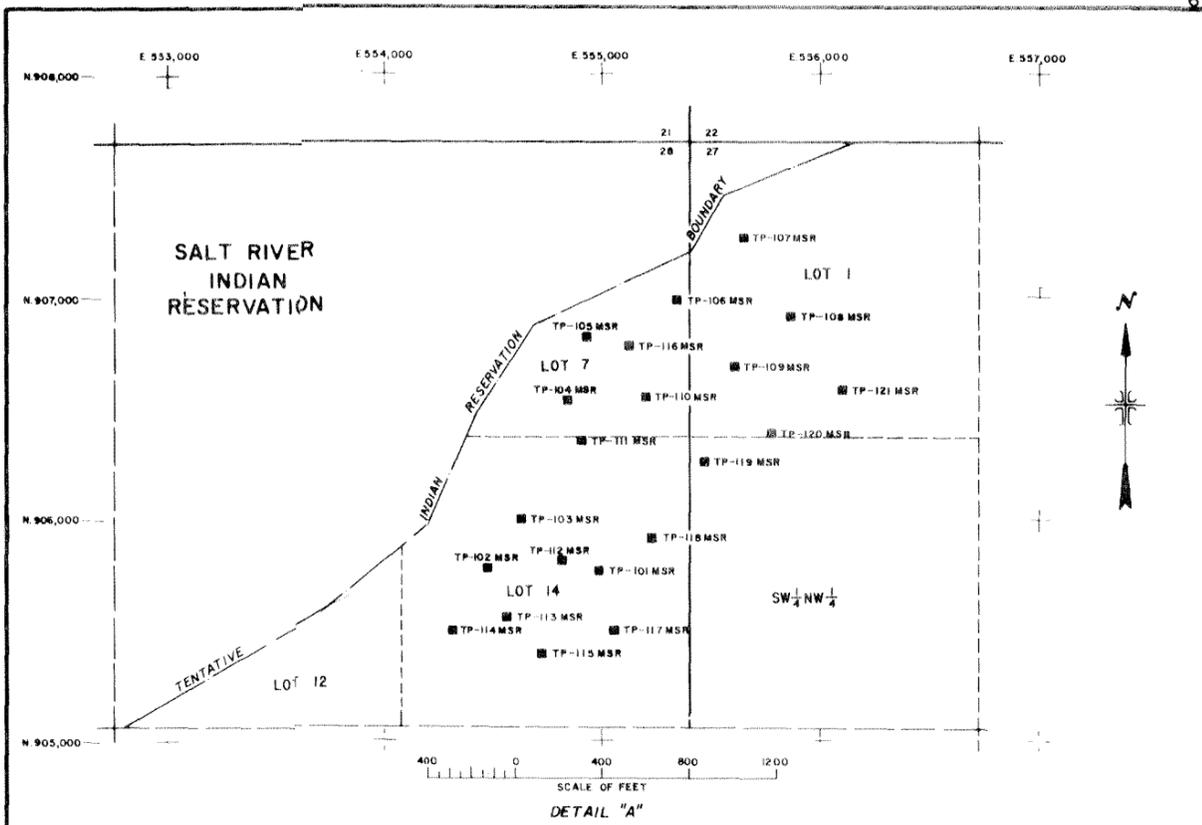
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT
 SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT REACH 1A

LOCATION OF EXPLORATION AND SURFACE GEOLOGY

GEOLOGY	PROJECT STAFF	TECHNICAL APPROVAL	<i>R.H. Thorne</i>
DRAWN	<i>[Signature]</i>	SUBMITTED	NOT REQUIRED
CHECKED	<i>[Signature]</i>	APPROVED	<i>[Signature]</i>
		CHIEF, WESTERN GEOLOGY BRANCH	
DENVER, COLORADO	OCTOBER 11, 1980	344-D-7377	

RED-344-D-7377



NOTES
 For General Geologic Legend, Explanation and Notes see Dwg. 344-D-7156A.
 Topography from U.S. Geological Survey, 7.5 minute quadrangle sheet, Granite Reef Dam and Buckhorn, Arizona.
 Locations of AP-23, 30, and -35-MSR and PIT-61-MSR are approximate.
 Topography and materials present may be different as a result of 1978-1980 flows in the Salt River.

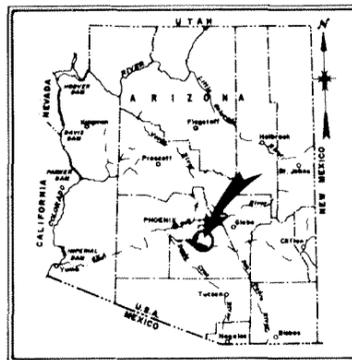
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 WATER AND POWER RESOURCES SERVICE
 CENTRAL ARIZONA PROJECT

SALT RIVER BORROW SOURCE
 SALT-GILA AQUEDUCT-REACH 1A
PLAN OF EXPLORATION

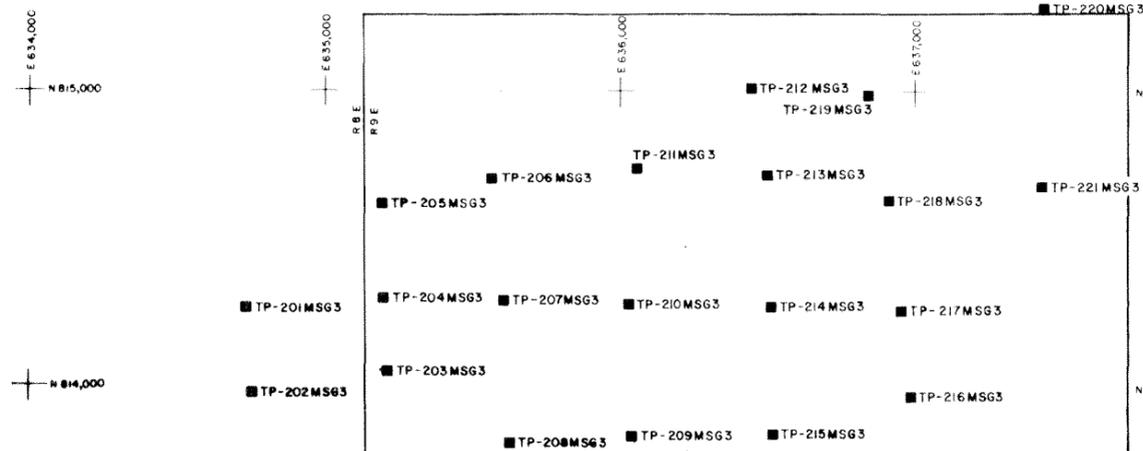
DESIGNED _____ TECHNICAL APPROVAL *Richard Johnson*
 DRAWN *J.R. GILL* SUBMITTED _____ NOT REQUIRED
 CHECKED *F. M. ...* APPROVED *...*
 CHIEF, WESTERN GEOLOGY BRANCH

DENVER, COLORADO JULY 23, 1980 344-D-7222

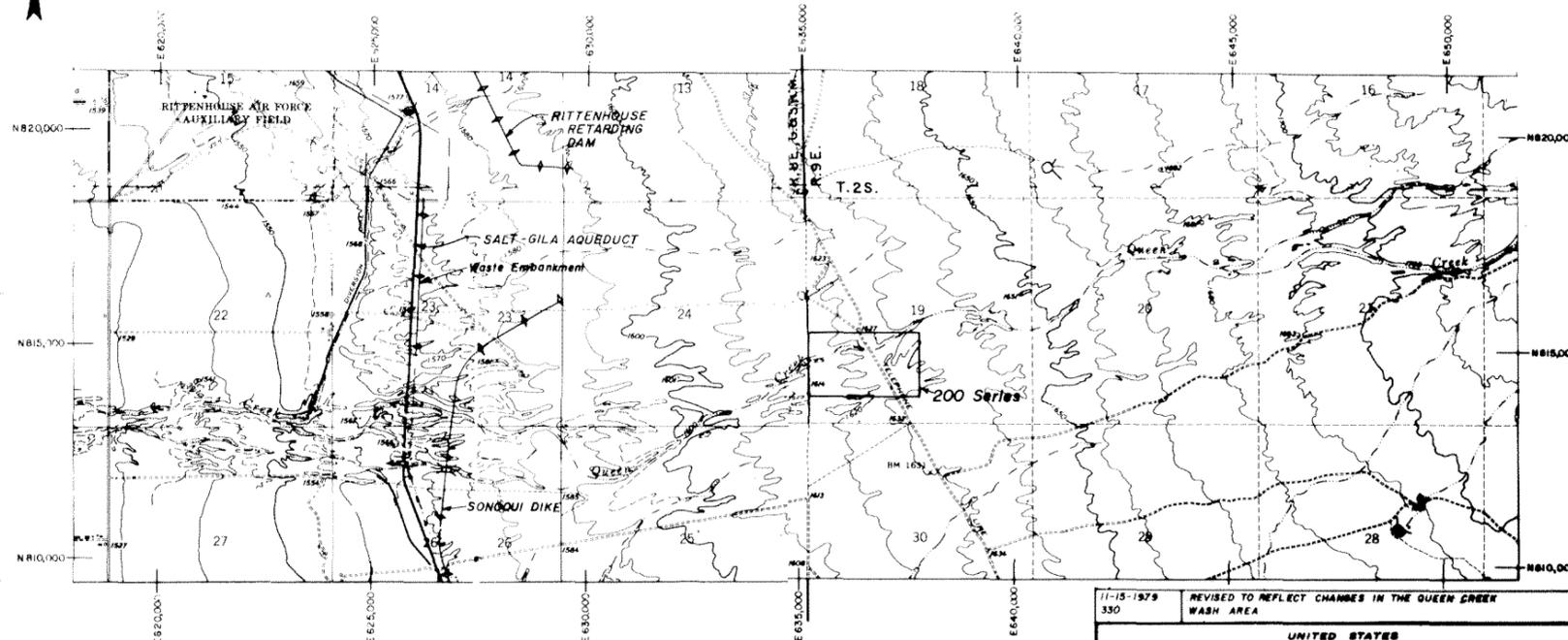
ALWAYS THINK SAFETY



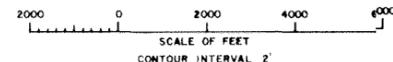
LOCATION MAP



200 SERIES



LOCATION MAP



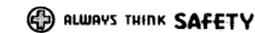
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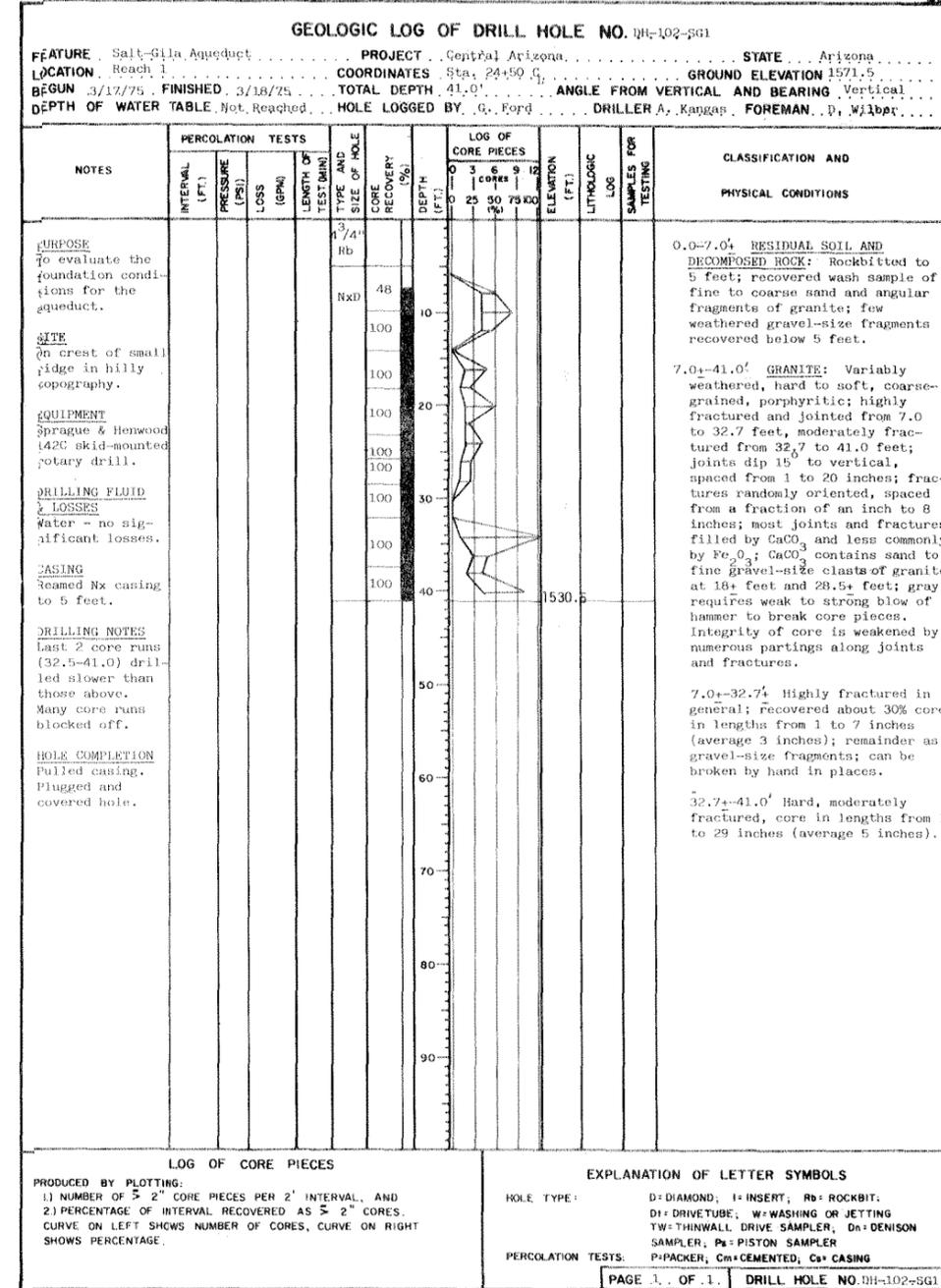
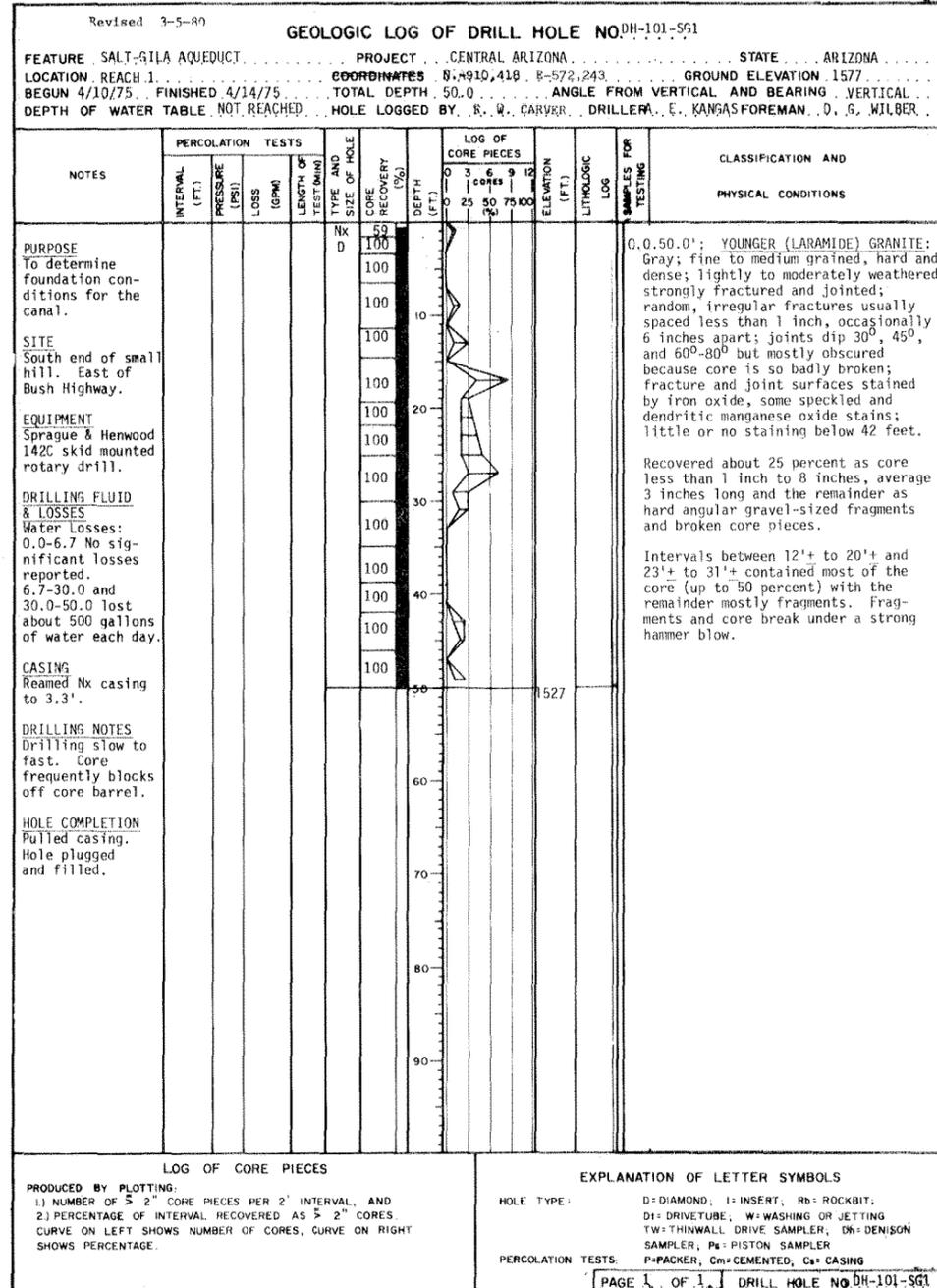
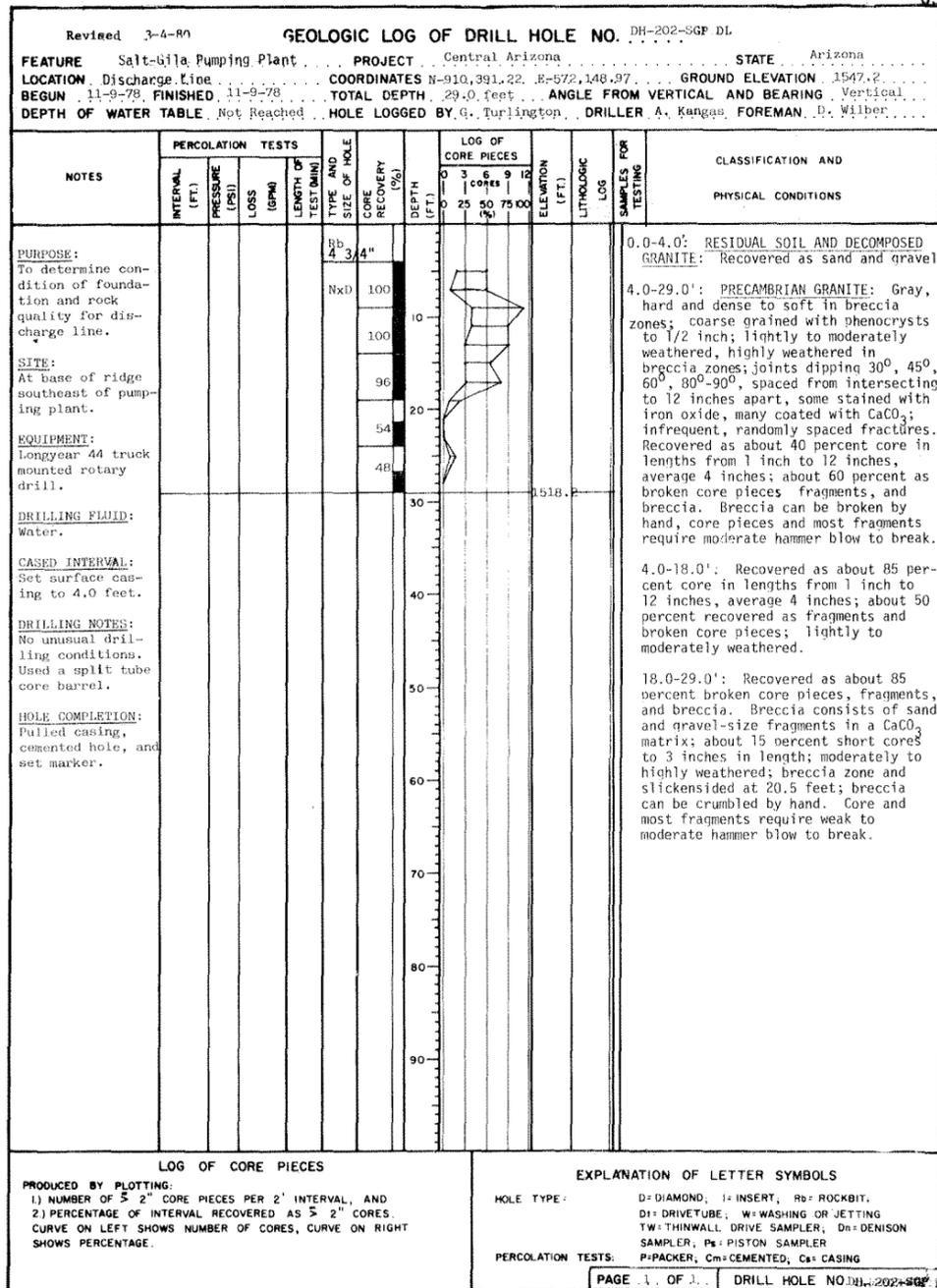
Topography from U.S. Geological Survey 7.5 mi² advance quadrangle sheets, Desert Well, Superstition Mts. S.W., Sacaton N.E., and Magua, Pinal County, Arizona.
 Arizona state plane coordinates system, Central zone.
 For General Geologic Legend, Explanation and Notes, see Drawing No. 344-D-7156A

11-15-1979
 330
 REVISED TO REFLECT CHANGES IN THE QUEEN CREEK WASH AREA

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 CENTRAL ARIZONA PROJECT
 SALT-GILA DIVISION-ARIZONA
SALT-GILA AQUEDUCT
 REACH 1A
 QUEEN CREEK AREA
 AGGREGATE SOURCE

DESIGNED: _____ TECHNICAL APPROVAL: *Richard J. Brown*
 DRAWN: _____ SUBMITTED: NOT ENGINEER
 CHECKED: *E. H. ...* APPROVED: *...*
 DENVER, COLORADO JUNE 5, 1980 344-D-7219





GEOLOGIC LOG OF DRILL HOLE NO. DH-103-SG1

FEATURE Salt-Gila Aqueduct PROJECT Central Arizona STATE Arizona
LOCATION Reach 1 COORDINATES Sta. 35+35.0 GROUND ELEVATION 1557.5
BEGUN 3/19/75 FINISHED 3/21/75 TOTAL DEPTH 30.0' ANGLE FROM VERTICAL AND BEARING Vertical
DEPTH OF WATER TABLE Not Reached HOLE LOGGED BY F. W. Carver DRILLER A. Kangas FOREMAN D. Wilber

Table with columns: NOTES, PERCOLATION TESTS, LOG OF CORE PIECES, CLASSIFICATION AND PHYSICAL CONDITIONS. Includes data for depth, core recovery, and lithologic logs.

LOG OF CORE PIECES
PRODUCED BY PLOTTING:
1) NUMBER OF 2" CORE PIECES PER 2' INTERVAL, AND
2) PERCENTAGE OF INTERVAL RECOVERED AS 2" CORES.
EXPLANATION OF LETTER SYMBOLS
HOLE TYPE: D= DIAMOND, I= INSERT, Rb= ROCKBIT, D1= DRIVETUBE, W= WASHING OR JETTING, TW= THINWALL DRIVE SAMPLER, Dn= DENISON SAMPLER, Pn= PISTON SAMPLER, P= PACKER, Cm= CEMENTED, Cs= CASING

GEOLOGIC LOG OF DRILL HOLE NO. DH-104-SG1

FEATURE Salt-Gila Aqueduct PROJECT Central Arizona STATE Arizona
LOCATION Reach 1 COORDINATES Sta. 41+40.0 GROUND ELEVATION 1554.5
BEGUN 3/13/75 FINISHED 3/13/75 TOTAL DEPTH 30.0' ANGLE FROM VERTICAL AND BEARING Vertical
DEPTH OF WATER TABLE Not Reached HOLE LOGGED BY G. Ford DRILLER A. Kangas FOREMAN D. Wilber

Table with columns: NOTES, PERCOLATION TESTS, LOG OF CORE PIECES, CLASSIFICATION AND PHYSICAL CONDITIONS. Includes data for depth, core recovery, and lithologic logs.

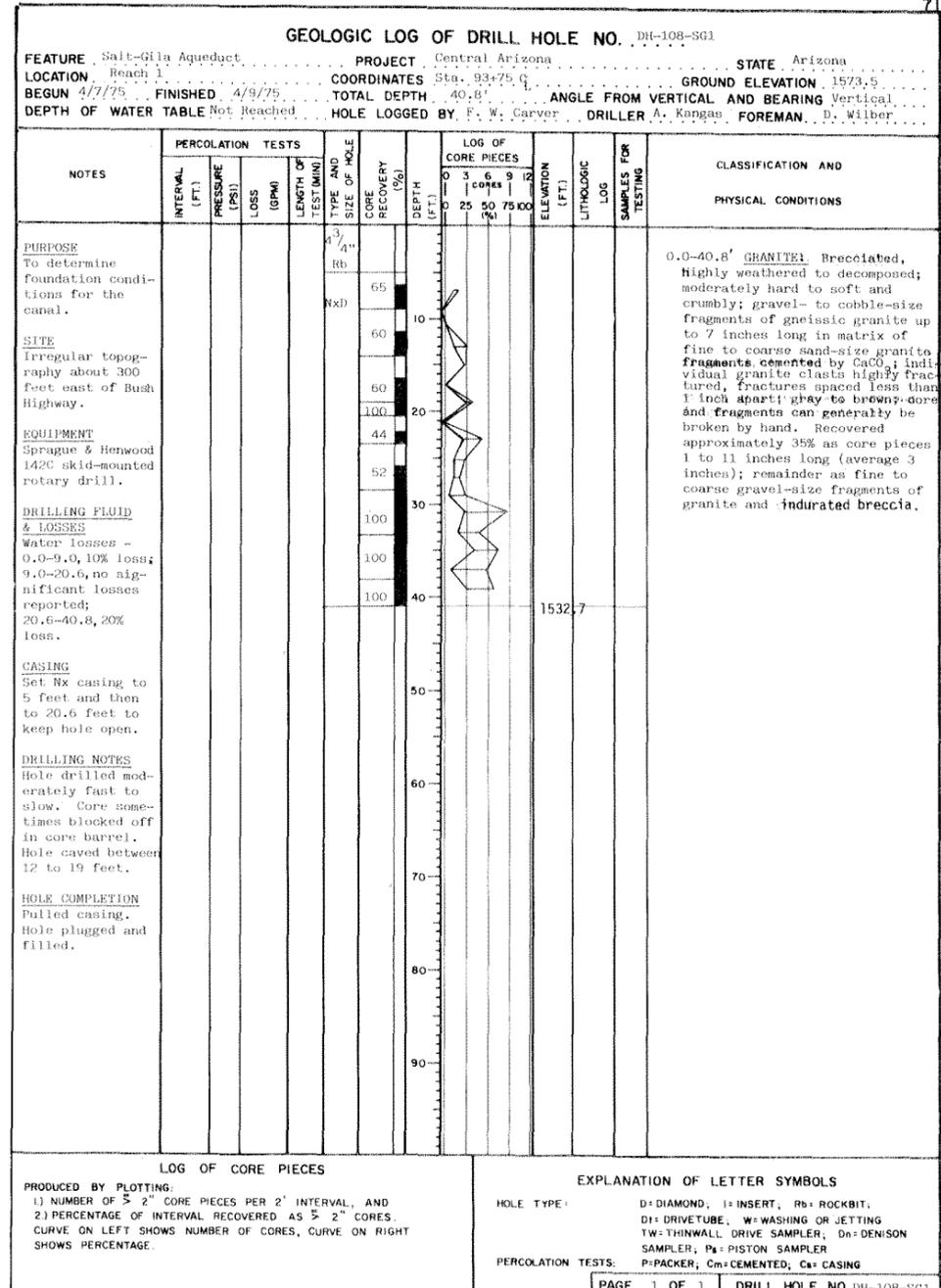
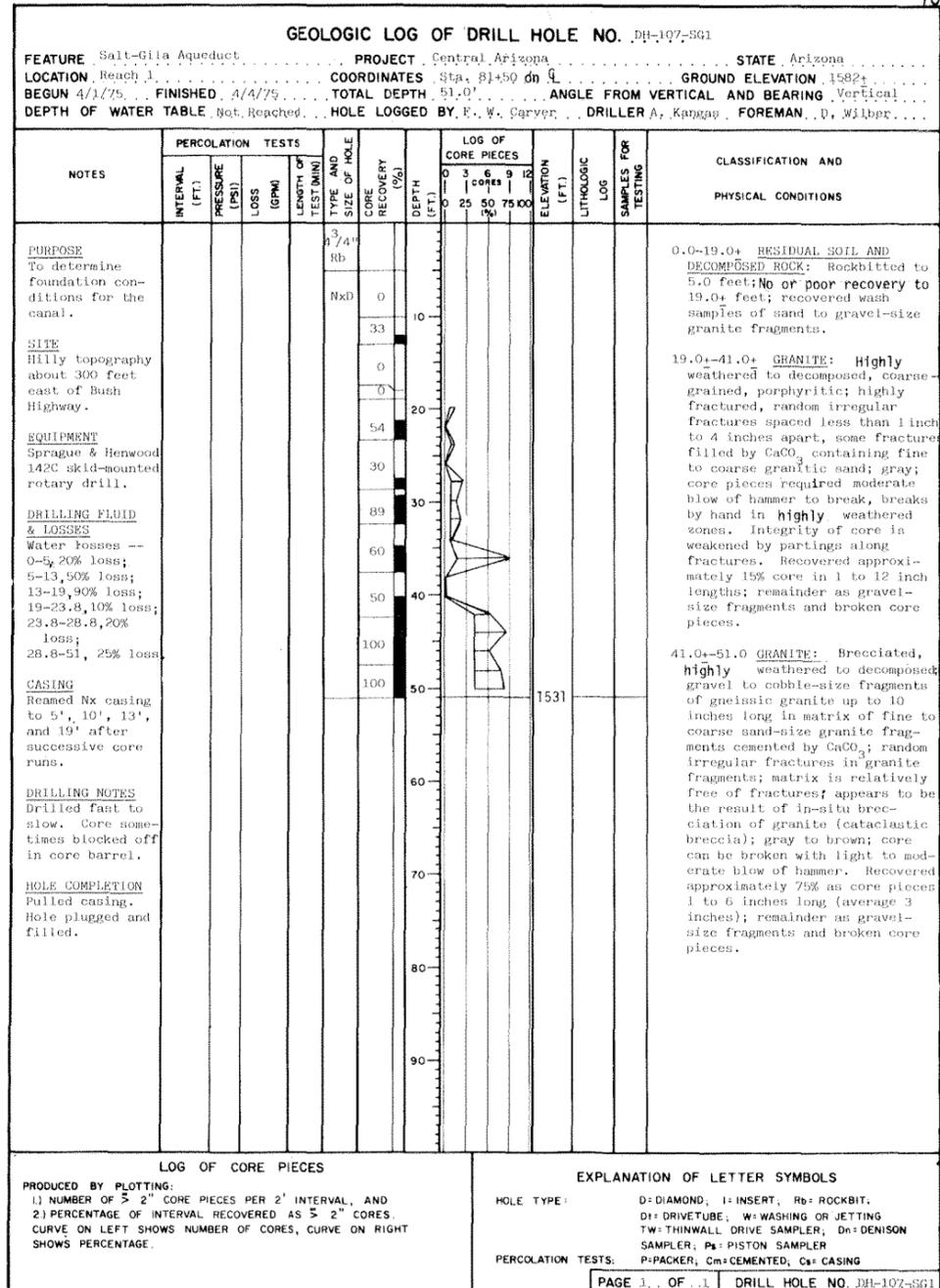
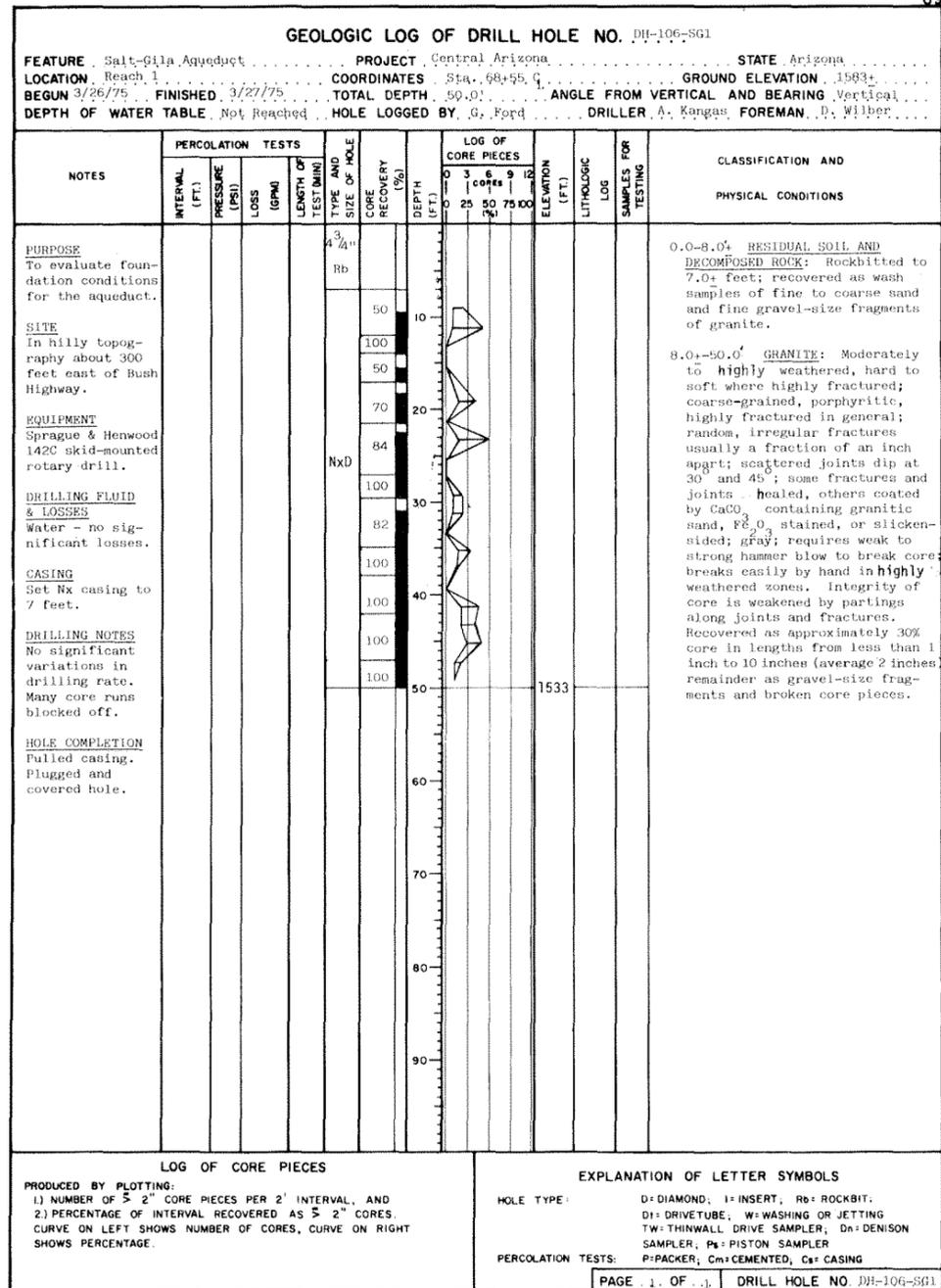
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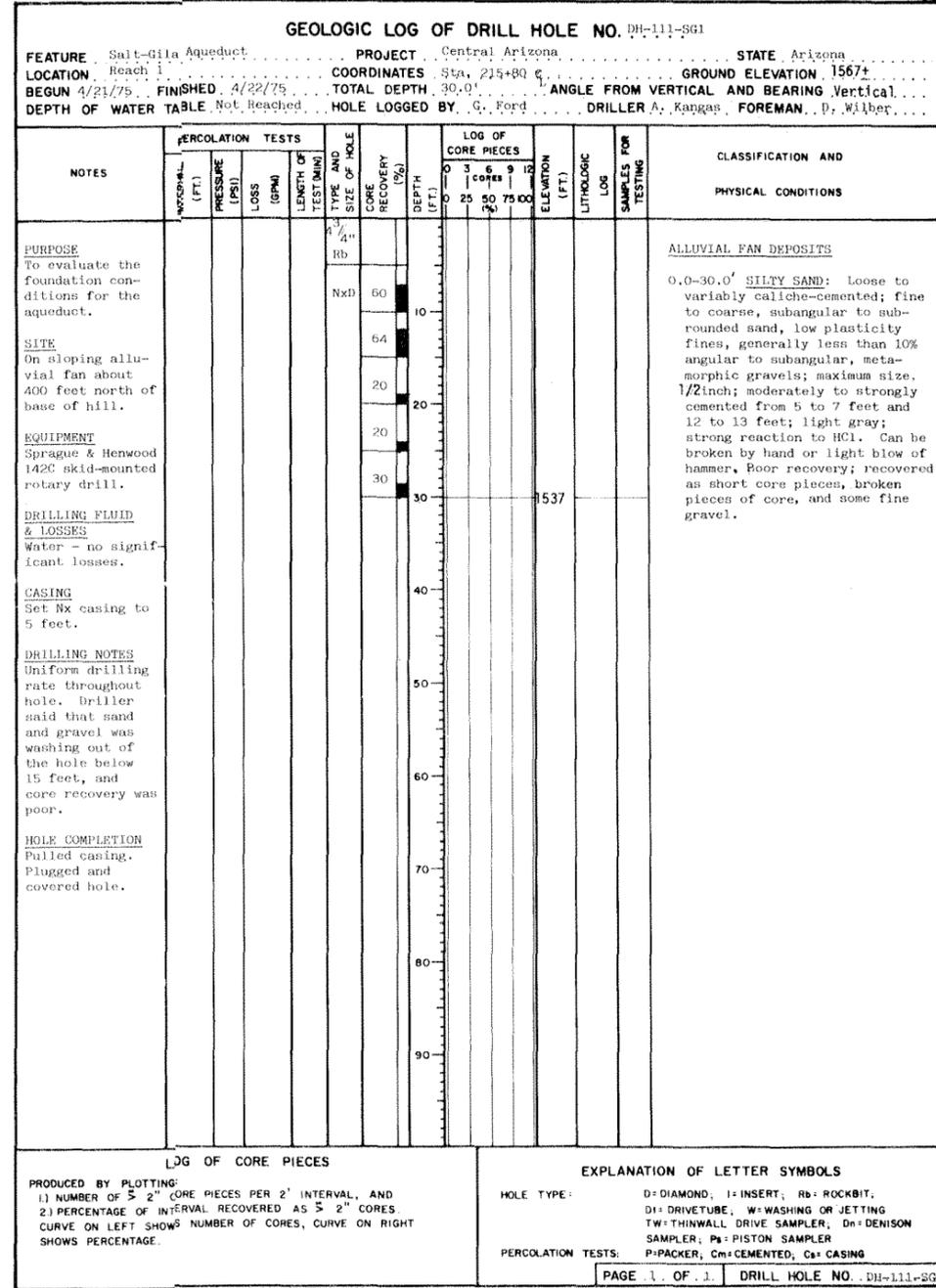
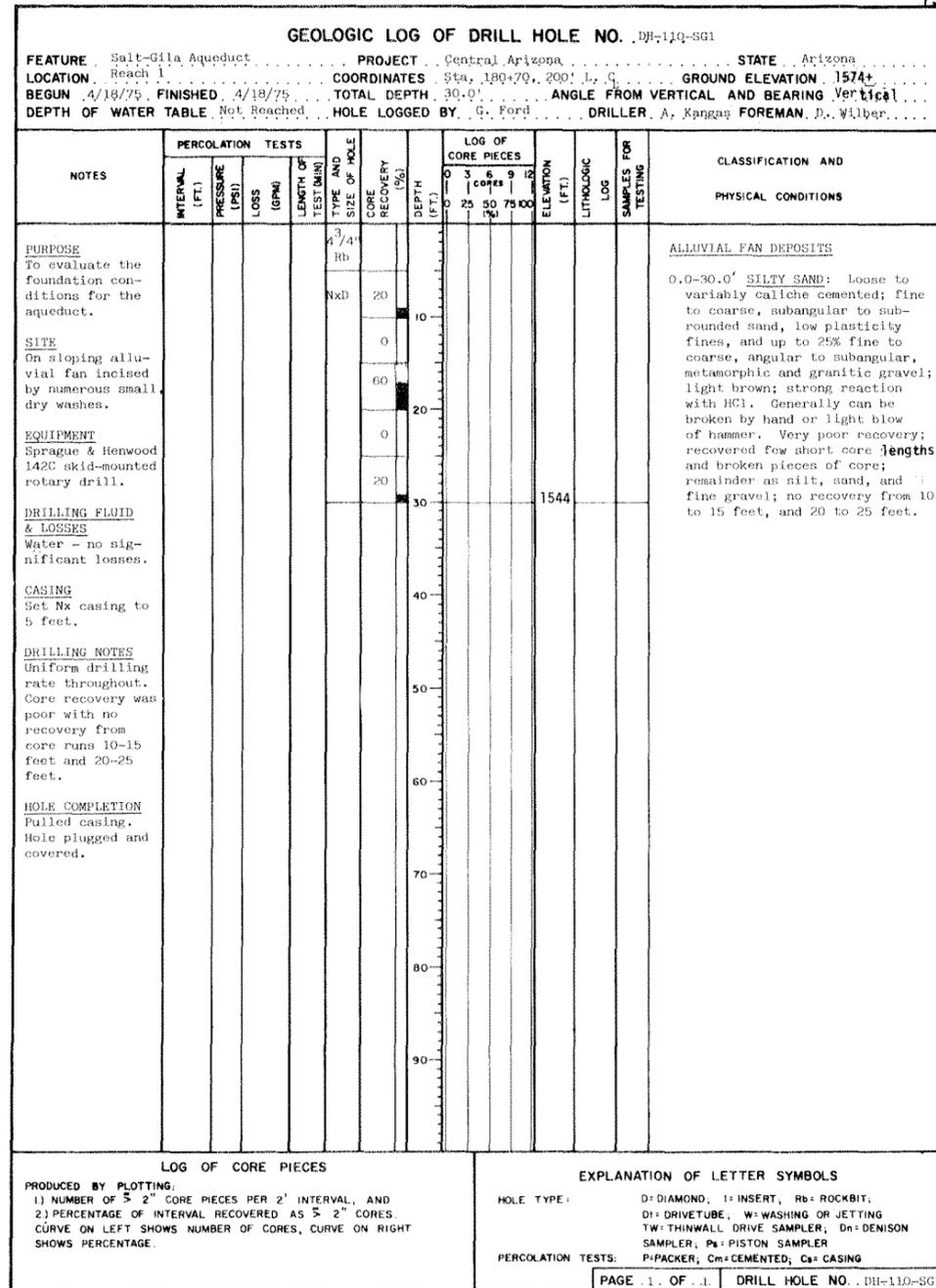
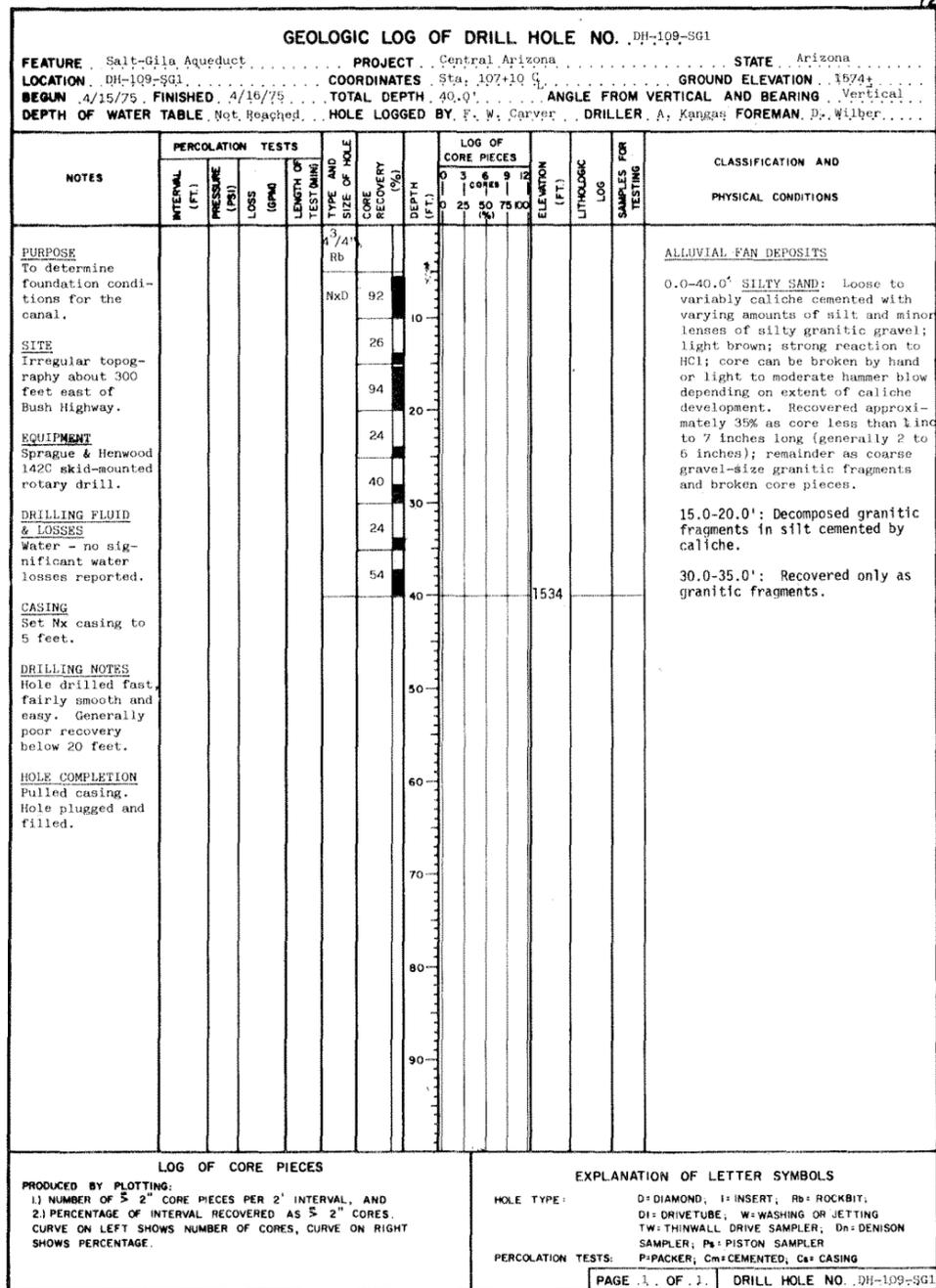
GEOLOGIC LOG OF DRILL HOLE NO. DH-105-SG1

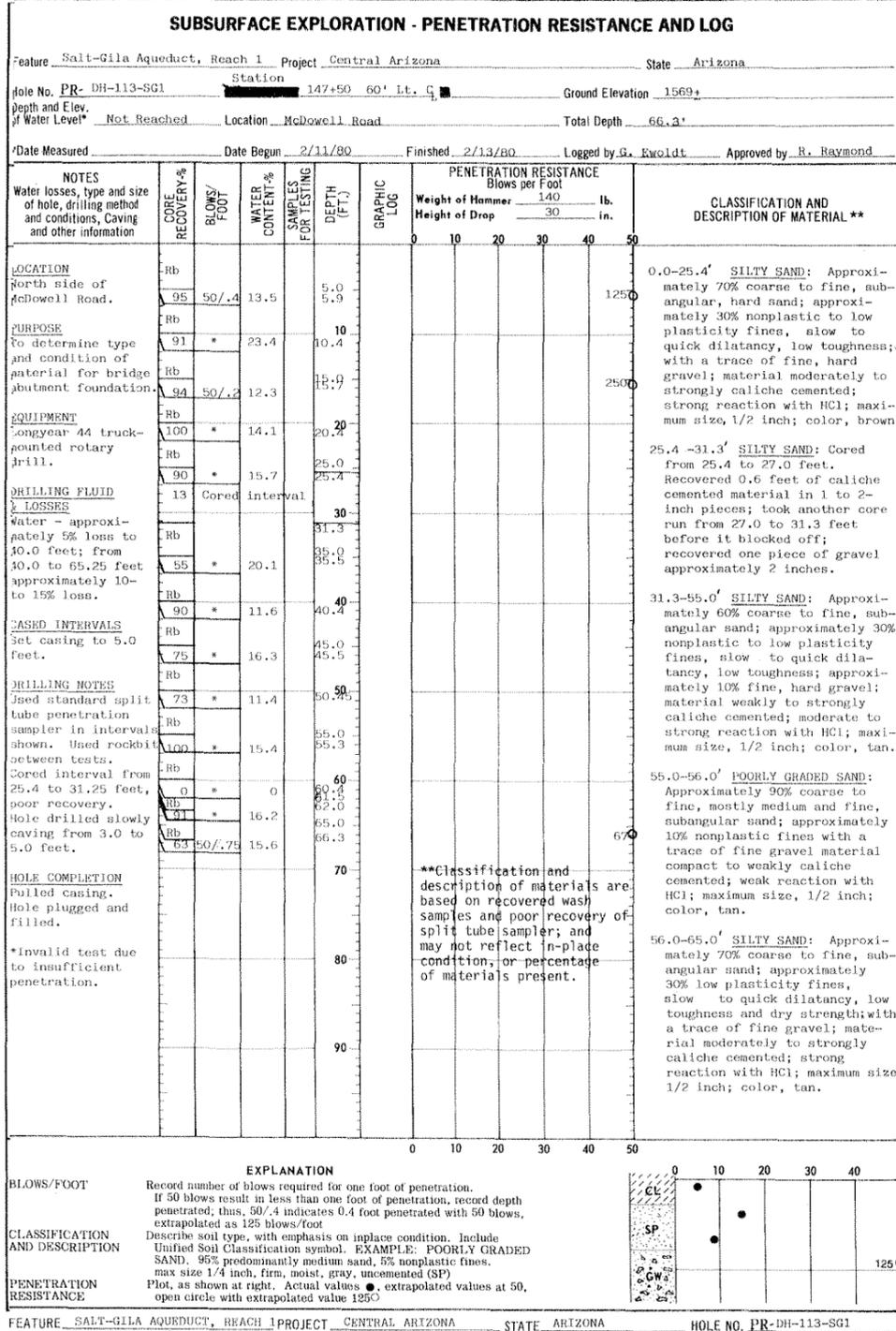
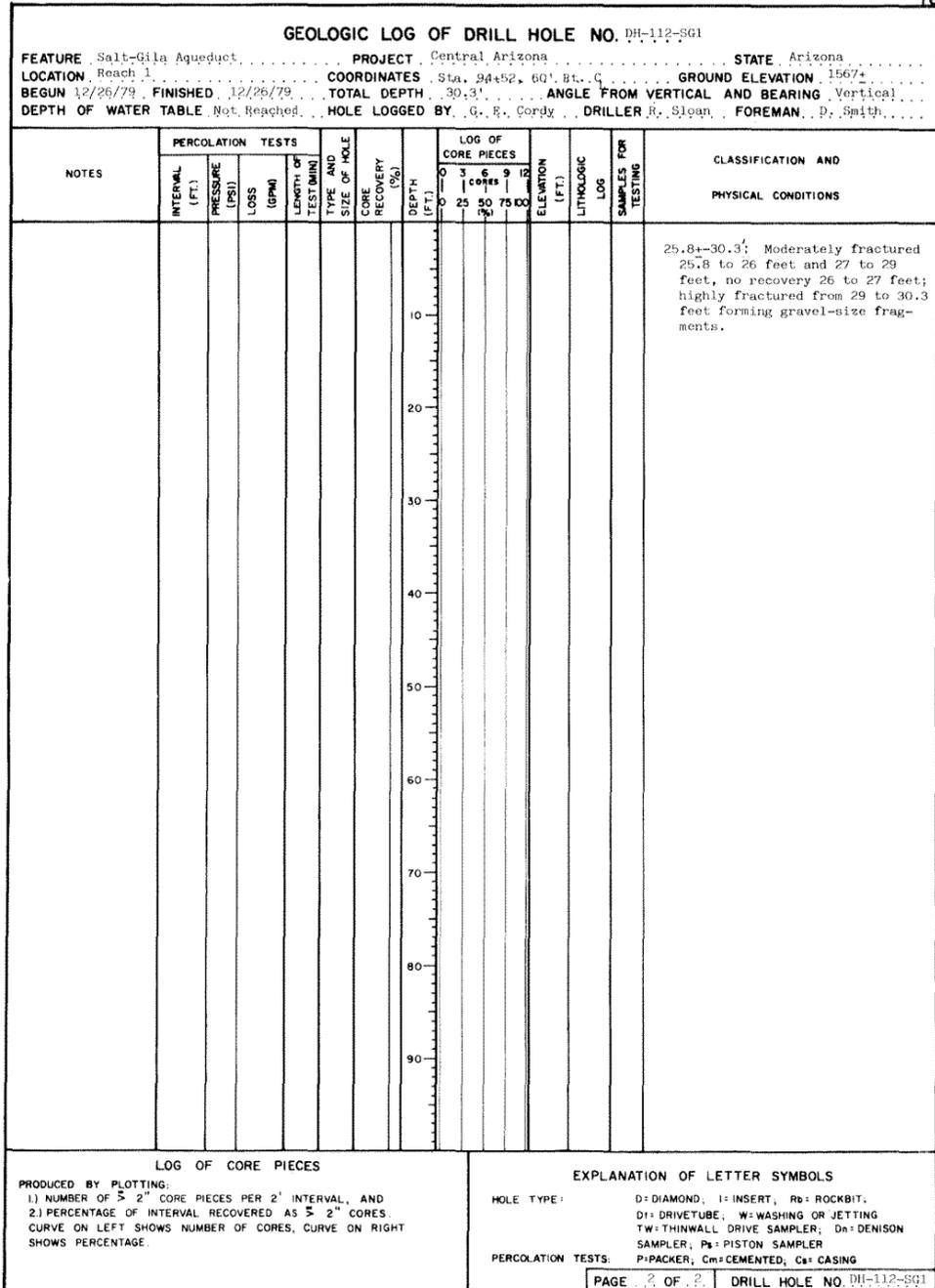
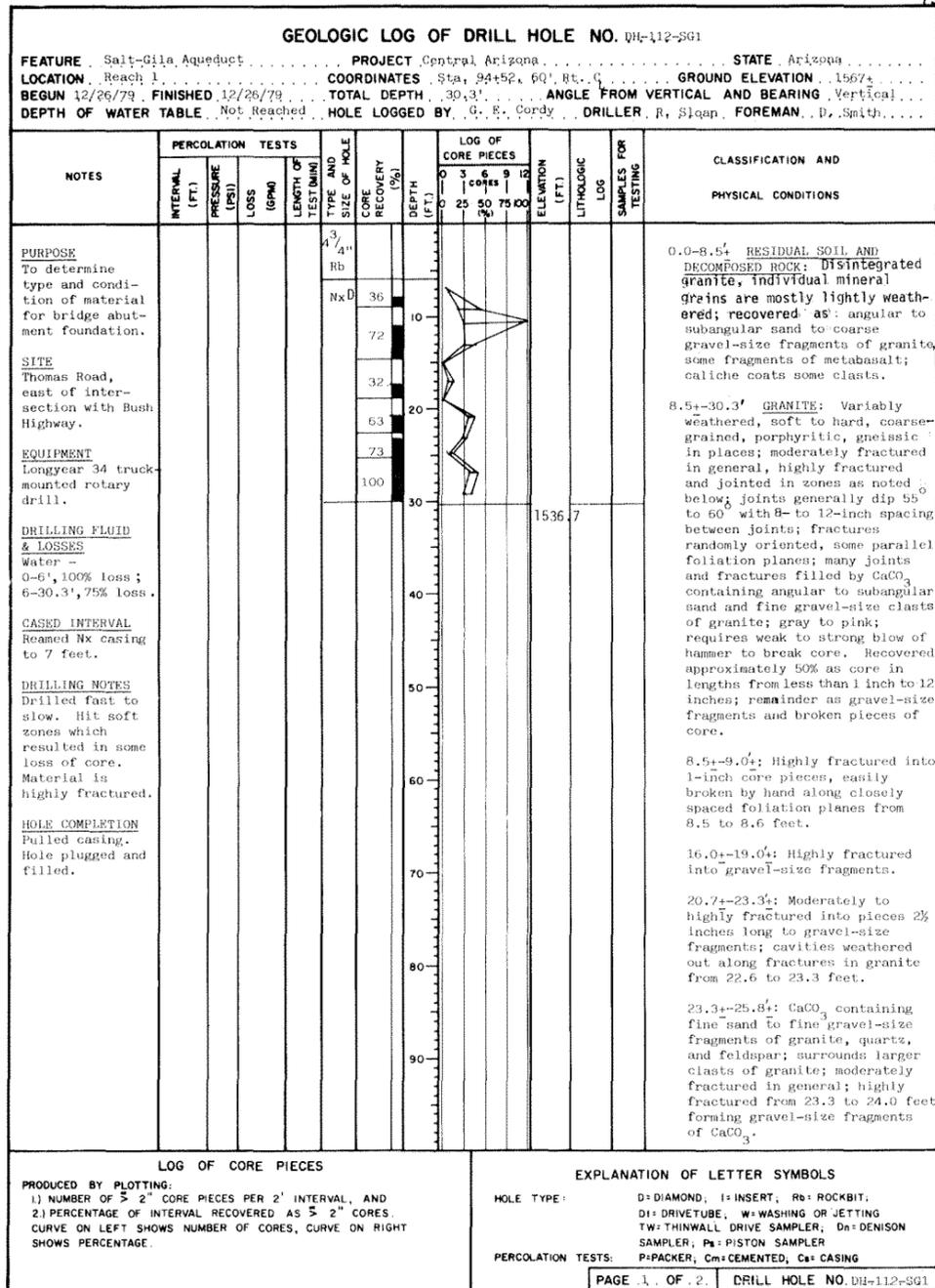
FEATURE Salt-Gila Aqueduct PROJECT Central Arizona STATE Arizona
LOCATION Reach 1 COORDINATES Sta. 51+60.0 GROUND ELEVATION 1563.0
BEGUN 3/24/75 FINISHED 3/25/75 TOTAL DEPTH 35.0' ANGLE FROM VERTICAL AND BEARING Vertical
DEPTH OF WATER TABLE Not Reached HOLE LOGGED BY F. W. Carver DRILLER A. Kangas FOREMAN D. Wilber

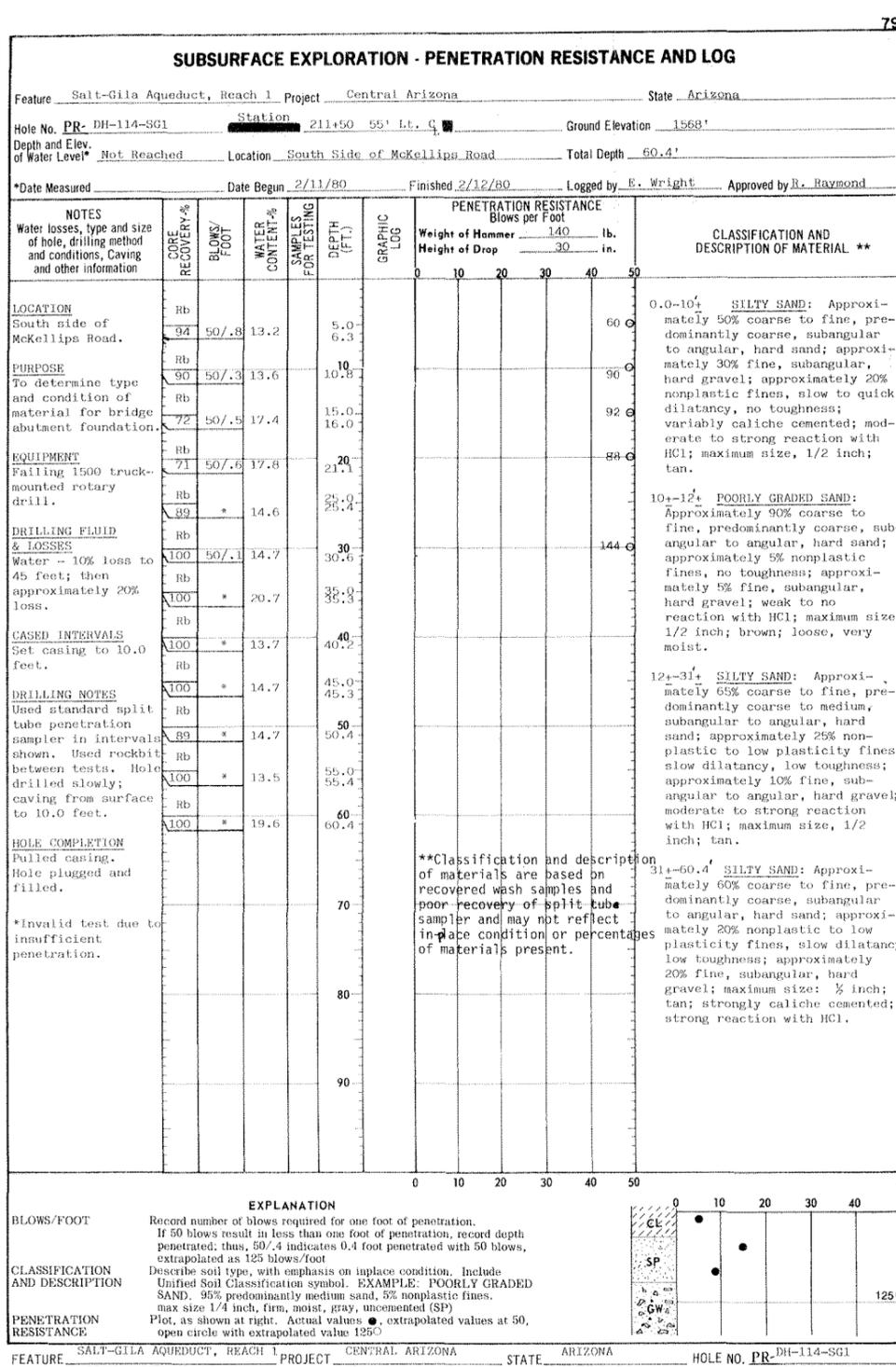
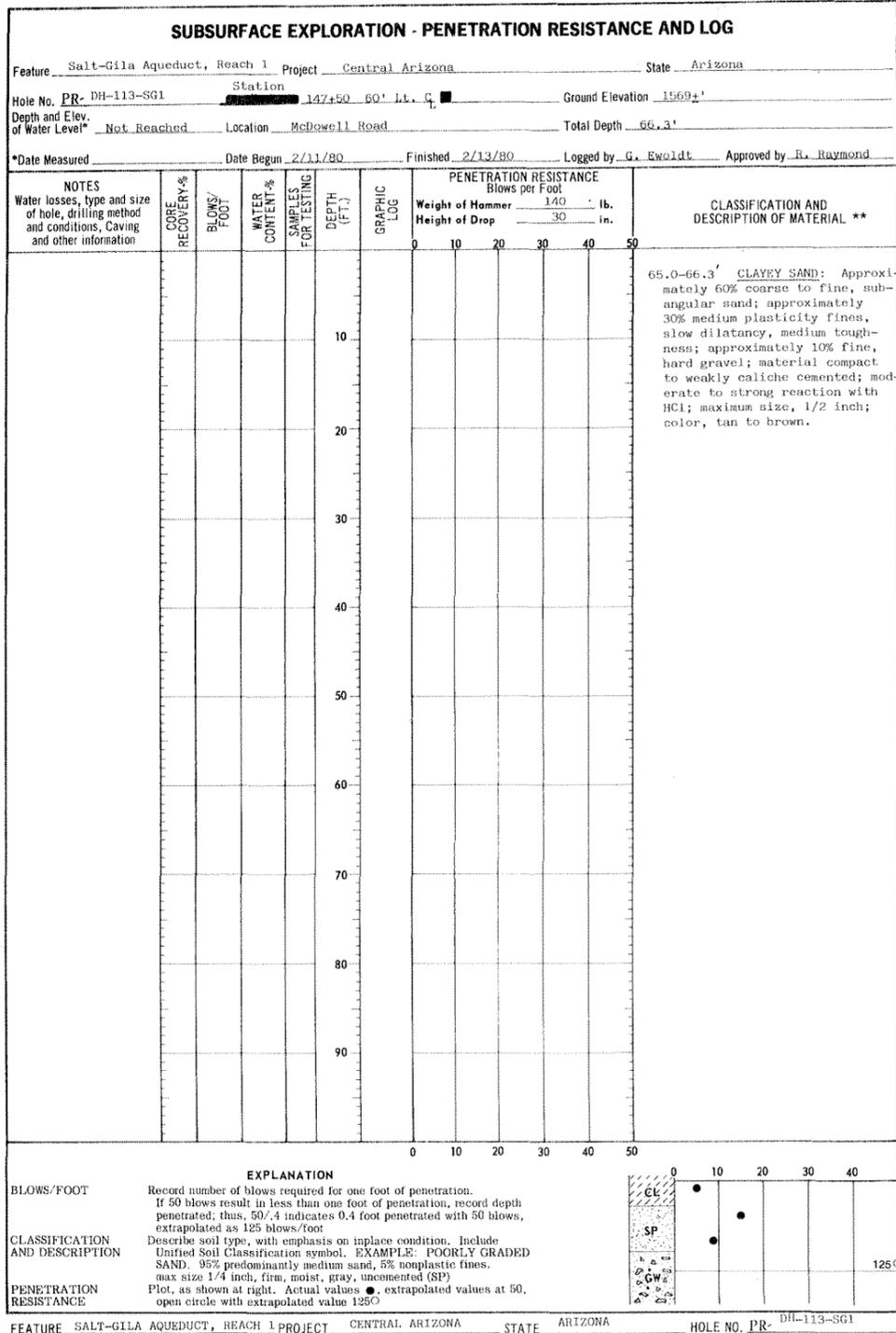
Table with columns: NOTES, PERCOLATION TESTS, LOG OF CORE PIECES, CLASSIFICATION AND PHYSICAL CONDITIONS. Includes data for depth, core recovery, and lithologic logs.

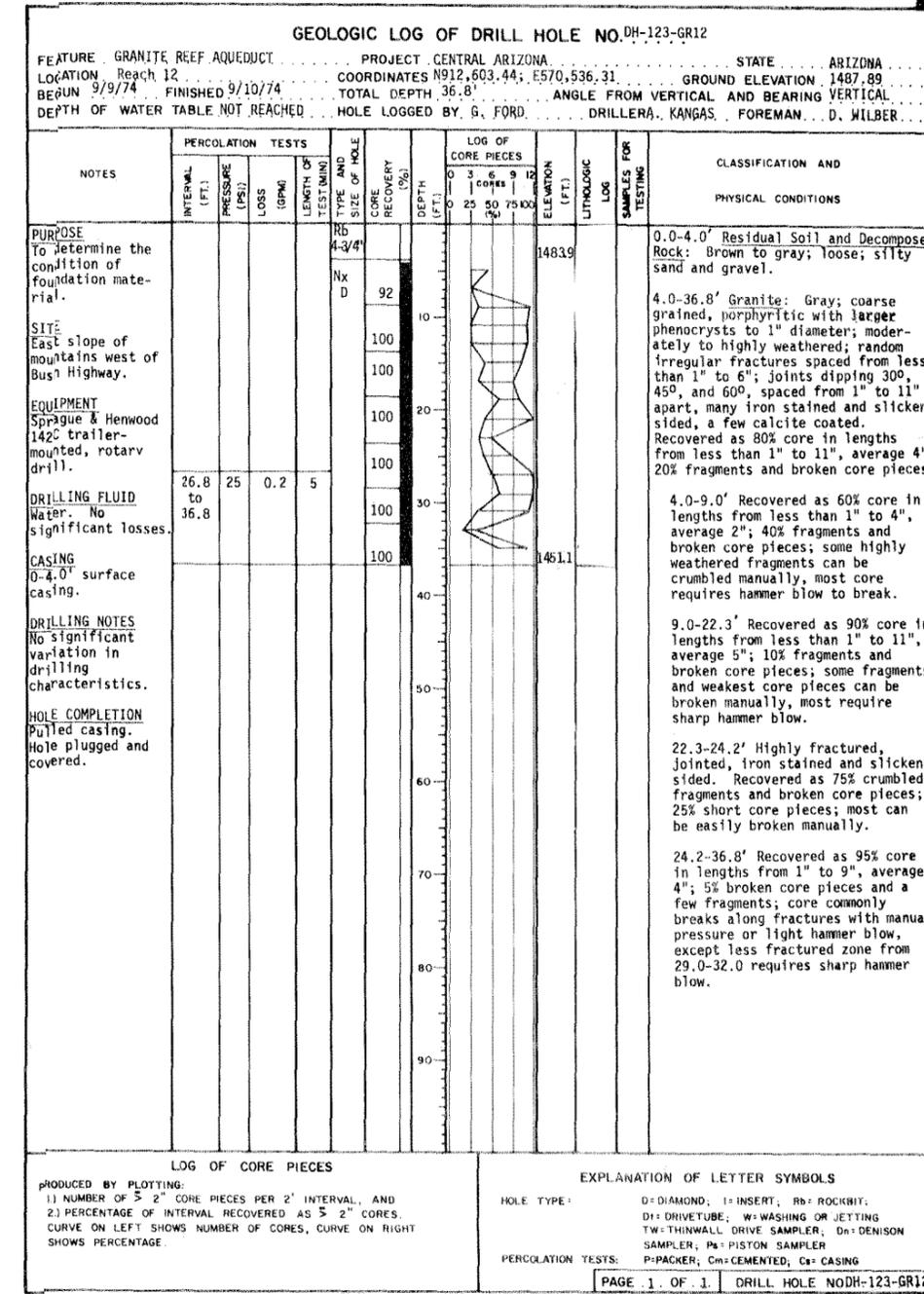
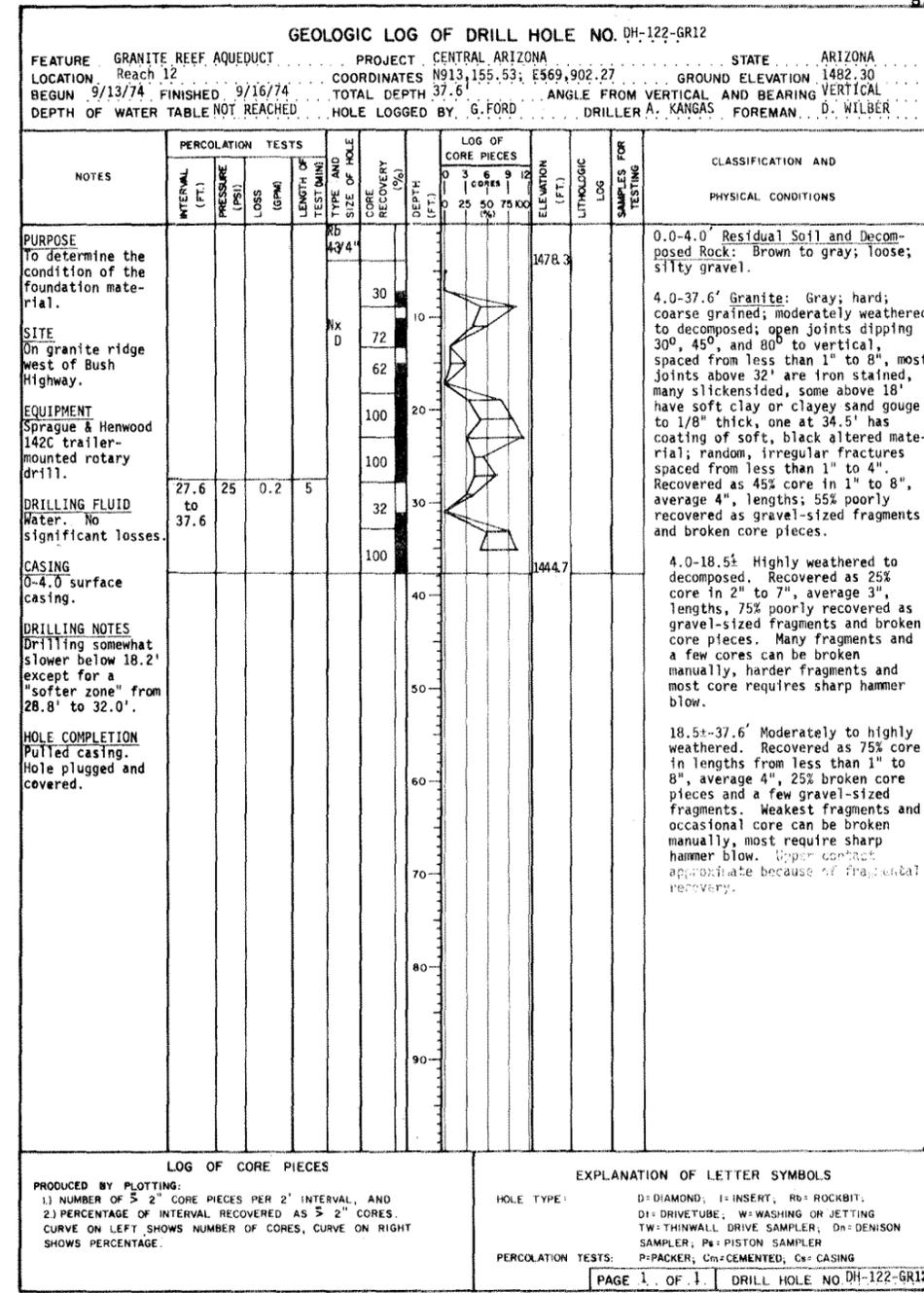
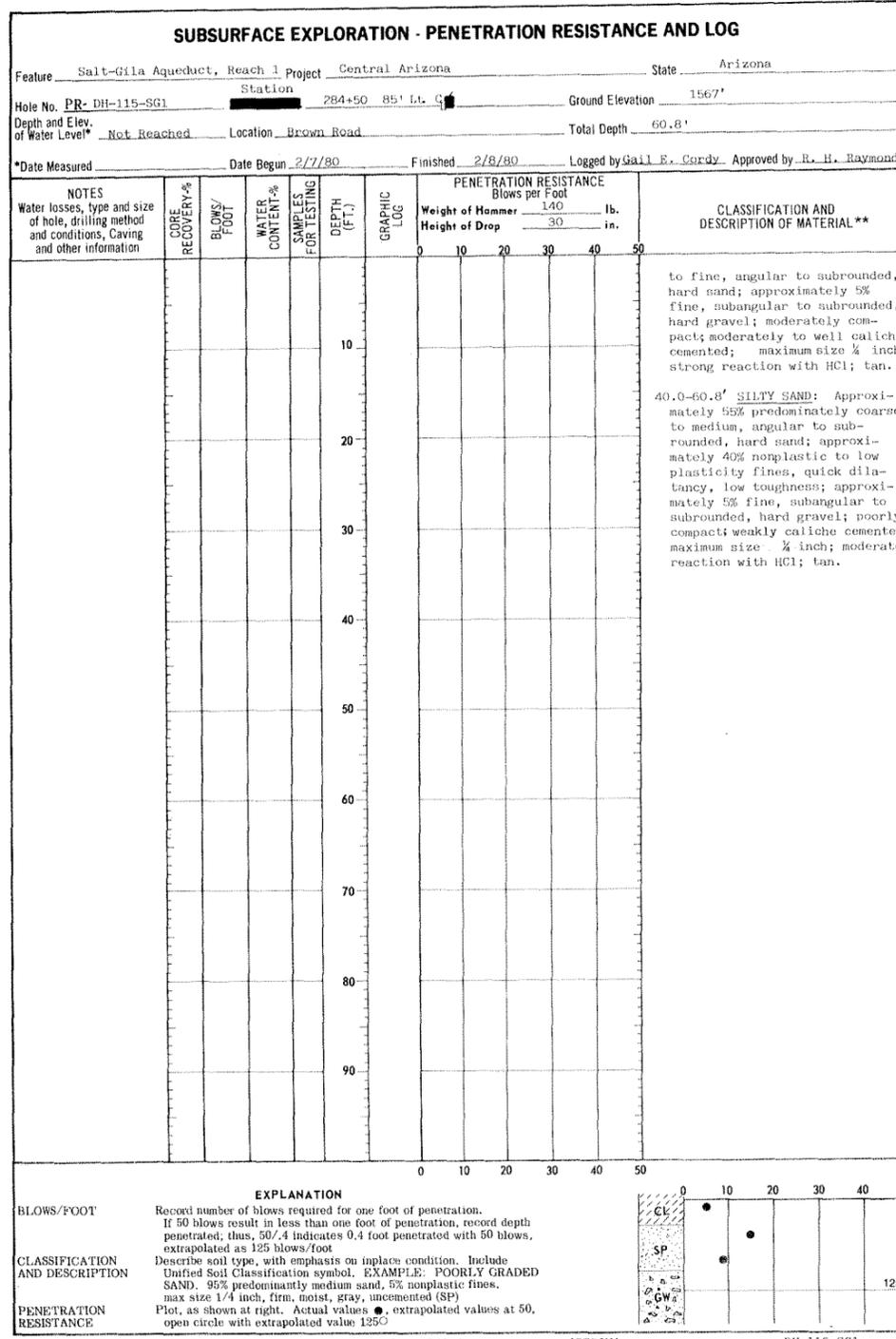
LOG OF CORE PIECES
PRODUCED BY PLOTTING:
1) NUMBER OF 2" CORE PIECES PER 2' INTERVAL, AND
2) PERCENTAGE OF INTERVAL RECOVERED AS 2" CORES.
EXPLANATION OF LETTER SYMBOLS
HOLE TYPE: D= DIAMOND, I= INSERT, Rb= ROCKBIT, D1= DRIVETUBE, W= WASHING OR JETTING, TW= THINWALL DRIVE SAMPLER, Dn= DENISON SAMPLER, Pn= PISTON SAMPLER, P= PACKER, Cm= CEMENTED, Cs= CASING

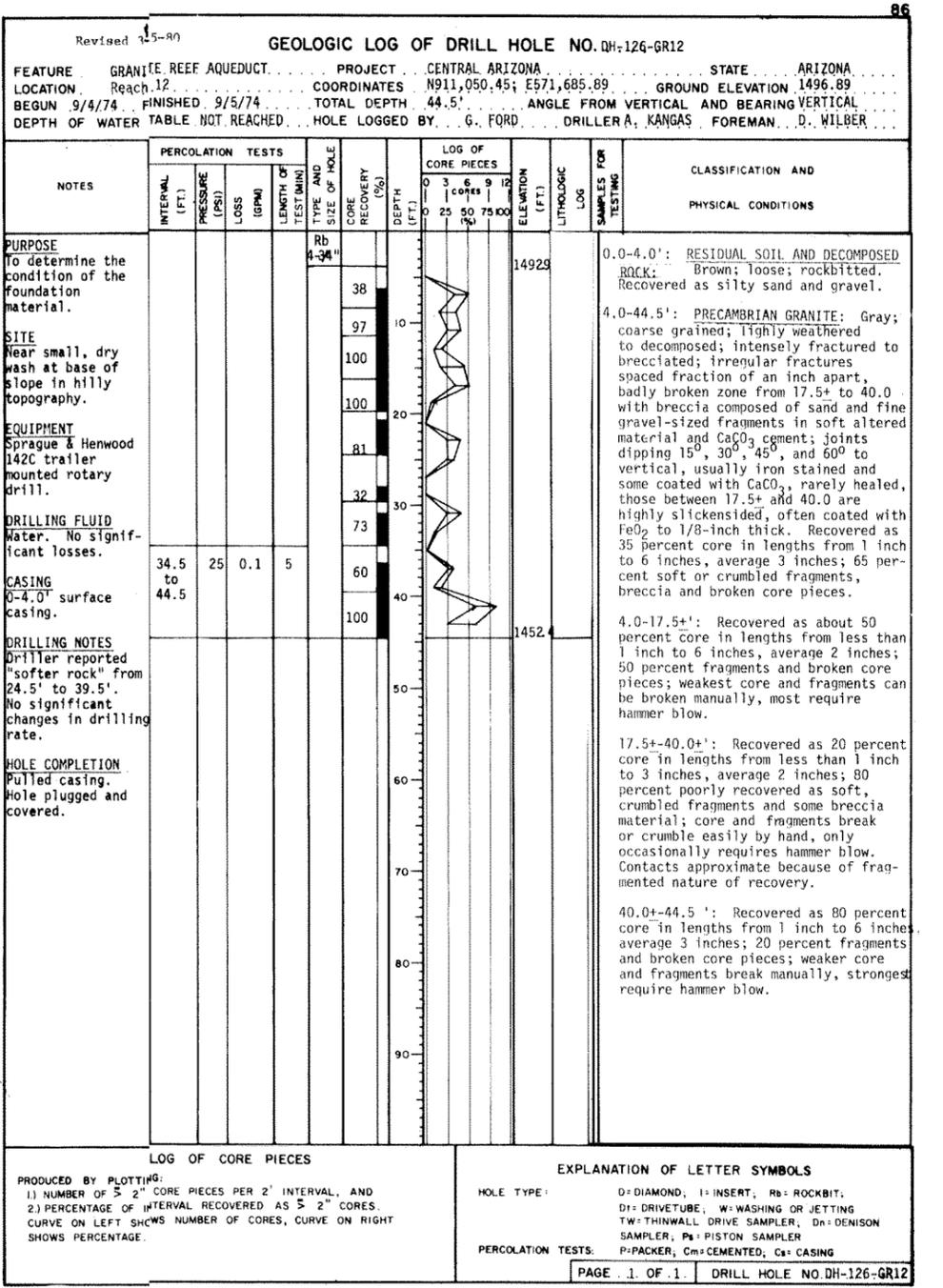
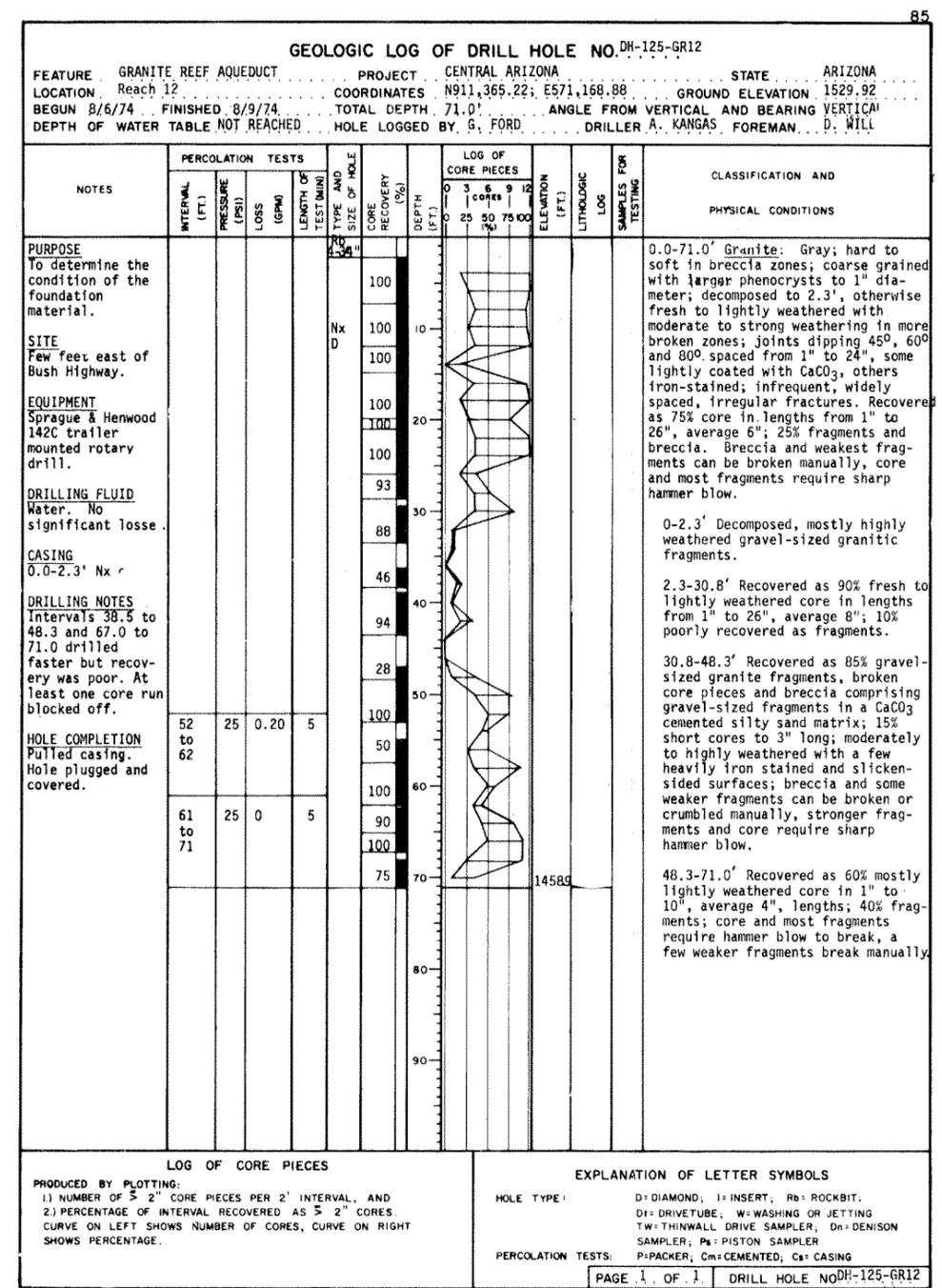
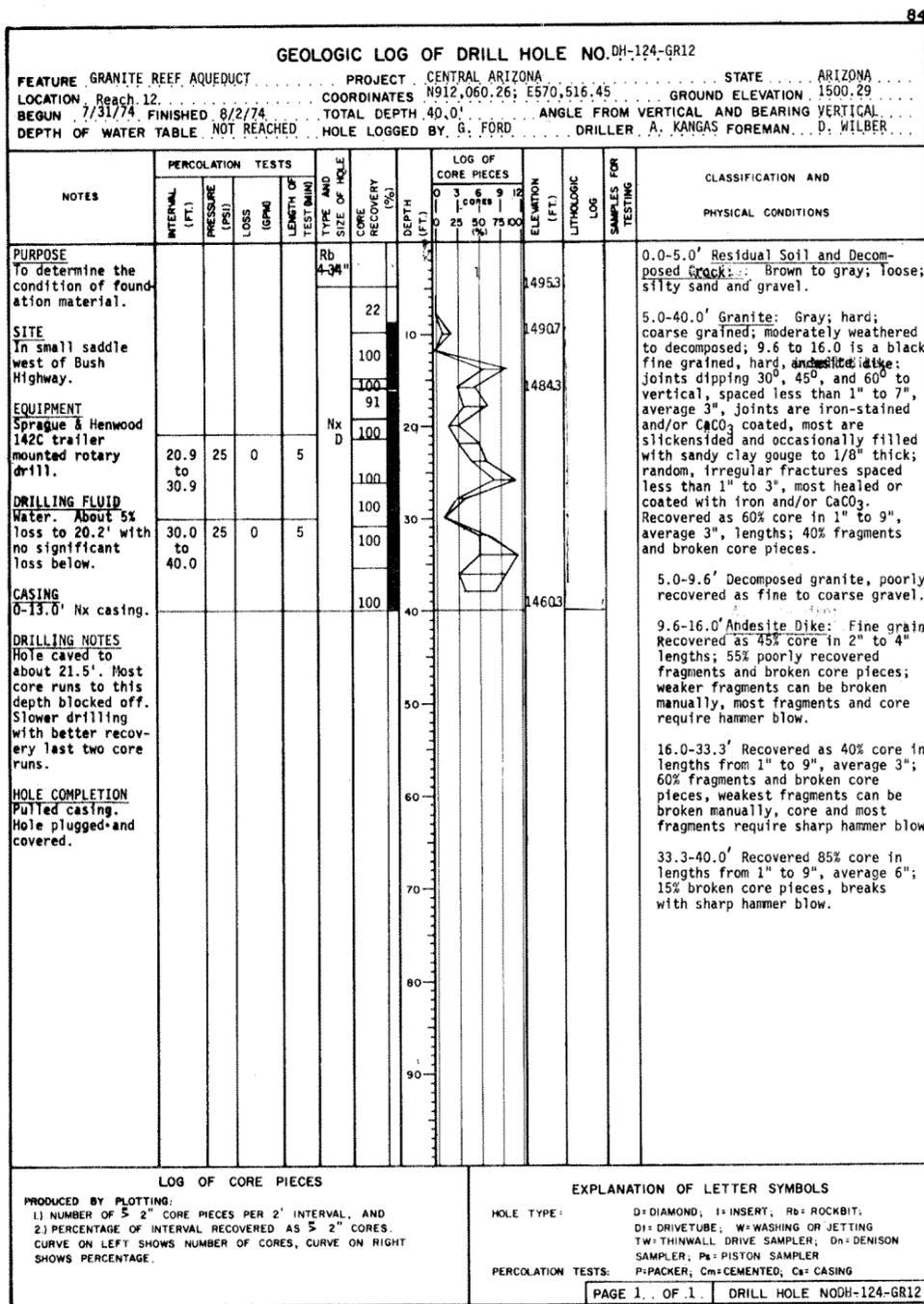












LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-100-SG1		Sta.		136+00 on G		Ground Elevation		1568 ⁺	
Depth to Water Level		Not Reached		Method of Excavation		Calweld Bucket Auger		Date		3-18-75	
CLASSIFICATION SYMBOL		DEPTH (FEET)		SIZE AND TYPE OF SAMPLE TAKEN		CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		PERCENTAGE OF COBBLES AND BOULDERS **		VOLUME OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY HOLE SAMPLED 3 TO 8-INCH VOLUME OF PLUS 8-INCH VOLUME OF (CUBIC FEET) SAMPLED 8 INCH TO 15-INCH SAMPLED 15 INCH TO 24-INCH	
LETTER	GRAPHIC										
SC-CL			1 sack	0.0-30.0 CLAYEY SAND: Approximately 50% coarse to fine, mostly medium and fine, subangular to sub-rounded, sand; approximately 45% low plasticity fines, medium dilatancy, low toughness and dry strength; approximately 5% mostly fine, hard gravel; material variably caliche cemented; strong reaction with HCl. Max. size: 2 inch; Color: gray; Moisture: dry.				0		0	
			30.0								
REMARKS: Material variably caliche cemented. Two very strongly caliche cemented zones from 15.0' to 18.0' and 21.0' to 25.0'. Hole drilled very slow. Hole stopped at the required depth of 30.0'.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-101-SG1		Sta.		154+80 on G		Ground Elevation		1570 ⁺	
Depth to Water Level		Not Reached		Method of Excavation		Calweld Bucket Auger		Date		3-12-75	
CLASSIFICATION SYMBOL		DEPTH (FEET)		SIZE AND TYPE OF SAMPLE TAKEN		CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		PERCENTAGE OF COBBLES AND BOULDERS **		VOLUME OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY HOLE SAMPLED 3 TO 8-INCH VOLUME OF PLUS 8-INCH VOLUME OF (CUBIC FEET) SAMPLED 8 INCH TO 15-INCH SAMPLED 15 INCH TO 24-INCH	
LETTER	GRAPHIC										
SM			1 sack	0.0-30.0 SILTY SAND: Approximately 55% coarse to fine, mostly medium and fine, subangular to sub-rounded, sand; approximately 35% nonplastic to low plasticity fines; approximately 10% fine, hard gravel; material strongly caliche cemented; very strong reaction with HCl. Max. size: 1/2 inch; Color: gray; Moisture: dry.				0		0	
			30.0								
REMARKS: Hole very strongly caliche cemented from the surface to 30.0'. Hole drilled very slow. Hole stopped at the required depth of 30.0'.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-102-SG1		Sta.		164+80 200' Lt. of G		Ground Elevation		1574 ⁺	
Depth to Water Level		Not Reached		Method of Excavation		Calweld Bucket Auger		Date		4-2-75	
CLASSIFICATION SYMBOL		DEPTH (FEET)		SIZE AND TYPE OF SAMPLE TAKEN		CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		PERCENTAGE OF COBBLES AND BOULDERS **		VOLUME OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY HOLE SAMPLED 3 TO 8-INCH VOLUME OF PLUS 8-INCH VOLUME OF (CUBIC FEET) SAMPLED 8 INCH TO 15-INCH SAMPLED 15 INCH TO 24-INCH	
LETTER	GRAPHIC										
SM			1 sack	0.0-20.0 SILTY SAND: Approximately 60% coarse to fine, subangular to subrounded, sand; approximately 35% nonplastic fines, quick dilatancy, low toughness and dry strength; approximately 5% mostly fine, hard gravel; material variably caliche cemented; strong reaction with HCl. Max. size: 3/4 inch; Color: brown to gray; Moisture: dry.				0		0	
			20.0								
PERCOLATION TEST											
Interval Tested		Water to Initially Fill		Water Added		Stabilization Time		Rate		K	
10.0'-20.0'		*		31 gal.		10 min.		1.5 gal/min.		30 min.	
				21 gal.		10 min.					
				19 gal.		10 min.					
				15 gal.		10 min.					
				14 gal.		10 min.					
REMARKS: 0.0' to 2.0' material compact to weakly caliche cemented with some surface caving; from 2.0' to 20.0', hole strongly caliche cemented. Hole drilled slow but smooth. *Sparling meter stopped working during initial filling; stopped test and took apart and cleaned, so no value given for initial filling. Hole stopped at the required depth of 20.0'.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		reach 1 - SGA	
Hole No.		AP-103-SG1		Sta.		172+70 on G		Ground Elevation		1570 ⁺	
Depth to Water Level		Not Reached		Method of Excavation		Calweld Bucket Auger		Date		3-13-75	
CLASSIFICATION SYMBOL		DEPTH (FEET)		SIZE AND TYPE OF SAMPLE TAKEN		CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		PERCENTAGE OF COBBLES AND BOULDERS **		VOLUME OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY HOLE SAMPLED 3 TO 8-INCH VOLUME OF PLUS 8-INCH VOLUME OF (CUBIC FEET) SAMPLED 8 INCH TO 15-INCH SAMPLED 15 INCH TO 24-INCH	
LETTER	GRAPHIC										
SM			1 sack	0.0-30.0 SILTY SAND: Approximately 50% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 40% nonplastic to low plasticity fines, quick dilatancy, low toughness and dry strength; approximately 10% fine, hard gravel; material strongly caliche cemented; very strong reaction with HCl. Max. size: 1/2 inch; Color: gray; Moisture: dry.				0		0	
			30.0								
REMARKS: Hole drilled very slow with strong caliche cementing from 2.0' to 30.0'. Hole stopped at the required depth of 30.0'.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-104-SG1		Sta.		180+70 200' Lt. of C		Ground Elevation		1574'	
Depth to Water Level		Not Reached		Method of Excavation		Caldwell Bucket Auger		Date		3-14-75	
Approx. Dimensions		30" to 4.0'; 24" to 6.0'		Logged by		G. P. Ewoldt					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME				
SM	4.0	1 sack	0.0-4.0 SILTY SAND : Approximately 60% coarse to fine, mostly coarse and medium, subangular to subrounded, sand; approximately 25% nonplastic to low plasticity fines; approximately 15% fine, hard gravel; material loose to weakly caliche cemented; weak to no reaction with HCl. Max. size: 1/2 inch; Color: brown to tan; Moisture: dry.	0	0	0	0				
SM	6.0	None	4.0-6.0 SILTY SAND : Approximately 75% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 15% nonplastic fines; approximately 10% fine, hard gravel; material very strongly caliche cemented; very strong reaction with HCl. Max. size: 1/2 inch; Color: gray; Moisture: dry.	0	0	0	0				
REMARKS: 0.0' to 4.0' loose to weakly caliche cemented, a little caving took place in this interval; 4.0' to 6.0' material became very strongly caliche cemented, bucket auger unable to dig the material beyond 6.0'. DH-110-SG1 drilled to the required depth of 30.0' at this site.											
<small>NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.</small>											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-105-SG1		Sta.		192+35 on C		Ground Elevation		1567'	
Depth to Water Level		Not Reached		Method of Excavation		Caldwell Bucket Auger		Date		3-20-75	
Approx. Dimensions		24" x 30.0'		Logged by		G. P. Ewoldt					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME				
SM	4.0	1 sack	0.0-4.0 SILTY SAND : Approximately 65% coarse to fine, mostly medium to fine, subangular to subrounded, sand; approximately 25% nonplastic fines; approximately 10% coarse to fine, mostly fine, hard gravel; material compact to weakly caliche cemented; no to weak reaction with HCl. Max. size: 2 inch; Color: brown; Moisture: dry.	0	0	0	0				
SM	30.0	1 sack	4.0-30.0 SILTY SAND : Approximately 55% coarse to fine, mostly medium and fine, subangular to subrounded sand; approximately 40% nonplastic to low plasticity fines, quick dilatancy, low toughness and dry strength; approximately 5% mostly fine, hard gravel; material variably caliche cemented; very strong reaction with HCl. Max. size: 3/4 inch; Color: gray to tan; Moisture: dry.	0	0	0	0				
REMARKS: Material from the surface to 4.0' compact to weakly caliche cemented, minor caving took place in this interval. Material from 4.0' to 18.0' very strongly caliche cemented; from 18.0' to 30.0' material moderately to strongly caliche cemented. Hole drilled slow. Hole stopped at the required depth of 30.0'.											
<small>NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.</small>											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-106-SG1		Sta.		202+00 200' Lt. of C		Ground Elevation		1569'	
Depth to Water Level		Not Reached		Method of Excavation		Caldwell Bucket Auger		Date		4-3-75	
Approx. Dimensions		24" to 4.0'; 24" to 20.0'		Logged by		G. P. Ewoldt					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME				
ML	3.0	None	0.0-3.0 SANDY SILT : Approximately 65% nonplastic fines, quick dilatancy, low toughness and dry strength; approximately 30% coarse to fine, subangular to subrounded, sand; approximately 5% fine, hard gravel; material loose to compact, weak reaction with HCl. Max. size: 1/2 inch; Color: brown; Moisture: dry.	0	0	0	0				
SM	20.0	1 sack	3.0-20.0 SILTY SAND : Approximately 55% coarse to fine, subangular to subrounded, sand; approximately 30% nonplastic fines; approximately 15% mostly fine, hard gravel; material variably caliche cemented; moderate to strong reaction with HCl. Max. size: 3/4 inch; Color: gray; Moisture: dry.	0	0	0	0				
PERCOLATION TEST											
Interval Tested		Water Initially Fill		Water Added		Time		Stabilization Rate		Time	
10.0' to 20.0'		397 gal.		93 gal. 73 gal. 58 gal. 51 gal. 49 gal.		10 min. 10 min. 10 min. 10 min. 10 min.		4.9 gal./min.		30 min.	
REMARKS: Material from 0.0' to 3.0' loose to compact with some surface caving, 3.0' to 9.0' material strongly caliche cemented, hole drilled slow in this interval. 9.0' to 17.0' material moderately caliche cemented. 17.0' to 20.0' material weakly caliche cemented. Hole drilled fast and smooth from 9.0' to 20.0'. Hole stopped at the required depth of 20.0'.											
<small>NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.</small>											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		AP-107-SG1		Sta.		215+80 on C		Ground Elevation		1567'	
Depth to Water Level		Not Reached		Method of Excavation		Caldwell Bucket Auger		Date		3-20-75	
Approx. Dimensions		24" x 11.0'		Logged by		G. P. Ewoldt					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME				
SM	3.0	1 sack	0.0-3.0 SILTY SAND : Approximately 60% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 20% mostly fine, subangular to subrounded, hard gravel; approximately 20% nonplastic fines; material weakly caliche cemented; weak to moderate reaction with HCl. Max. size: 3/4 inch; Color: brown; Moisture: dry.	0	0	0	0				
SM-SC	11.0	1 sack	3.0-11.0 SILTY SAND : Approximately 50% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 40% low plasticity fines, quick to medium dilatancy, low toughness and dry strength; approximately 10% fine, hard gravel, material variably caliche cemented; strong reaction with HCl. Max. size: 1/2 inch; Color: gray; Moisture: dry.	0	0	0	0				
REMARKS: 0.0' to 3.0' material weakly caliche cemented; from 3.0' to 7.0' material very strongly caliche cemented; 7.0' to 9.0' material moderately caliche cemented; from 9.0' to 11.0' material very strongly caliche cemented. Auger unable to dig the material beyond 11.0'. DH-111-SG1 was drilled to the desired depth of 30.0' at this site.											
<small>NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.</small>											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 1 - SGA			
Salt-Gila Aqueduct		Central Arizona		Sta. 230+00 200' Lt. of C		Ground Elevation 1572'		Approx. Dimensions 24"x20.0'	
Hole No. AP-108-SG1		Method of Excavation		Date		Logged by		G. P. Ewoldt	
Not Reached		Calweld Bucket Auger		3-17-75					
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF COBBLES TO 5-INCH	PERCENTAGE BY WEIGHT OF COBBLES TO 5-INCH	VOLUME OF BOULDERS TO 5-INCH	PERCENTAGE BY WEIGHT OF BOULDERS TO 5-INCH		
SM	1 sack	1 sack	0.0-20.0 SILTY SAND: Approximately 65% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 30% nonplastic to low plasticity fines; approximately 5% mostly fine, subangular to subrounded, hard gravel; material variably caliche cemented; moderate to strong reaction with HCl. Max. size: 3/4 inch; Color: brown to gray; Moisture: dry.		0		0		
	20.0								

REMARKS: Hole moderately caliche cemented from the surface to 4.0'; from 4.0' to 20.0', material strongly caliche cemented, with some zones from 14.0' to 17.0' very strongly caliche cemented. Hole drilled slow. Hole stopped at the required depth of 20.0'.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 1 - SGA			
Salt-Gila Aqueduct		Central Arizona		Sta. 247+40 on C		Ground Elevation 1569'		Approx. Dimensions 24"x30.0'	
Hole No. AP-109-SG1		Method of Excavation		Date		Logged by		G. P. Ewoldt	
Not Reached		Calweld Bucket Auger		3-21-75					
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF COBBLES TO 5-INCH	PERCENTAGE BY WEIGHT OF COBBLES TO 5-INCH	VOLUME OF BOULDERS TO 5-INCH	PERCENTAGE BY WEIGHT OF BOULDERS TO 5-INCH		
SM	1 sack	1 sack	0.0-3.0 SILTY SAND: Approximately 65% coarse to fine, subangular to subrounded sand; approximately 20% mostly fine, subangular to subrounded, hard gravel; approximately 15% nonplastic fines; material compact to weakly caliche cemented; weak reaction with HCl. Max. size: 1 inch; Color: brown; Moisture: dry.		0		0		
	30.0		3.0-30.0 SILTY SAND: Approximately 55% coarse to fine, subangular to subrounded, sand; approximately 30% nonplastic fines; approximately 15% fine, hard gravel; material variably caliche cemented; strong reaction with HCl. Max. size: 3/4 inch; Color: gray; Moisture: dry.						

REMARKS: Material compact to weakly caliche cemented from the surface to 3.0'; from 3.0' to 9.0' material strongly caliche cemented; from 9.0' to 16.0' material very strongly caliche cemented; hole drilled very slow in this interval; 16.0' to 30.0' material moderately to strongly caliche cemented, this interval drilled relatively smooth and easy. Hole stopped at the required depth of 30.0'.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 1 - SGA			
Salt-Gila Aqueduct		Central Arizona		Sta. 267+00 200' Lt. of C		Ground Elevation 1573'		Approx. Dimensions 30" to 3.0'; 24" to 20.0'	
Hole No. AP-110-SG1		Method of Excavation		Date		Logged by		G. P. Ewoldt	
Not Reached		Calweld Bucket Auger		3-10-75					
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF COBBLES TO 5-INCH	PERCENTAGE BY WEIGHT OF COBBLES TO 5-INCH	VOLUME OF BOULDERS TO 5-INCH	PERCENTAGE BY WEIGHT OF BOULDERS TO 5-INCH		
SM	1 sack	1 sack	0.0-6.0 SILTY SAND: Approximately 70% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 20% nonplastic to low plasticity fines; approximately 10% fine, hard gravel; material loose to compact; with no reaction with HCl. Max. size: 1/2 inch; Color: brown; Moisture: dry.		0		0		
SM	1 sack	1 sack	6.0-20.0 SILTY SAND: About 60% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 35% nonplastic to low plasticity fines; approximately 5% fine, hard gravel; material strongly caliche cemented; very strong reaction with HCl. Max. size: 1/2 inch; Color: gray; Moisture: dry.		0		0		
	20.0								

REMARKS: Material from 0.0' to 6.0' loose to compact, with a little surface caving; from 6.0' to 20.0' hole very strongly caliche cemented, material came out in chunks; no cave in this interval. Hole drilled very slow but smooth. Hole stopped at the required depth of 20.0'.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 1 - SGA			
Salt-Gila Aqueduct		Central Arizona		Sta. 285+70 on C		Ground Elevation 1568'		Approx. Dimensions 24" to 30.0'	
Hole No. AP-111-SG1		Method of Excavation		Date		Logged by		G. P. Ewoldt	
Not Reached		Calweld Bucket Auger		3-24-75					
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF COBBLES TO 5-INCH	PERCENTAGE BY WEIGHT OF COBBLES TO 5-INCH	VOLUME OF BOULDERS TO 5-INCH	PERCENTAGE BY WEIGHT OF BOULDERS TO 5-INCH		
SM	1 sack	1 sack	0.0-30.0 SILTY SAND: Approximately 65% coarse to fine, mostly medium and fine, subangular to subrounded, sand; approximately 25% nonplastic fines; approximately 10% fine, hard gravel; material variably caliche cemented; weak to strong reaction with HCl. Max. size: 1/2 inch; Color: brown to gray; Moisture: dry.		0		0		
	30.0								

REMARKS: Material 0.0' to 5.0' loose to compact with some minor caving in this interval; 5.0' to 11.0' material strongly caliche cemented with no caving, hole drilled slow in this interval; 11.0' to 30.0' material moderately caliche cemented; no caving and material drilled fast and smooth. Hole stopped at the required depth 30.0'.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: Salt-Gila Aqueduct		Project: Central Arizona			Area Designation: Reach 1 - SGA		Hole No.: AP-112-SG1		
Sta.: 304+90		200' Lt. of C.		Ground Elevation: 1570'		Approx. Dimensions: 30" x 5.0" x 24.0"		Date: 4-4-75	
Method of Excavation: Calweid Bucket Auger		Logged by: G. P. Ewooldt							
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF SOIL SAMPLED (CUBIC FEET)	WEIGHT OF SAMPLED SOIL (LBS.)
				VOLUME OF COBBLES (CUBIC FEET)	WEIGHT OF COBBLES (LBS.)	PERCENTAGE BY VOLUME (%)	PERCENTAGE BY WEIGHT (%)		
SM-SC	7.0	1 sack	0.0-7.0 SILTY TO CLAYEY SAND: Approximately 65% coarse to fine, mostly medium and fine, subangular to subrounded sand; approximately 20% low plasticity fines; approximately 15% mostly fine, hard gravel; material loose to compact; weak to no reaction with HCl. Max. size: 3/4 inch; Color: brown; Moisture: dry.			0		0	
SM	20.0	1 sack	7.0-20.0 SILTY SAND: Approximately 55% coarse to fine, subangular to subrounded, sand; approximately 35% nonplastic fines; approximately 10% fine, hard gravel; material variably caliche cemented; strong reaction with HCl. Max. size: 1/2 inch; Color: gray; Moisture: dry.			0		0	
PERCOLATION TEST									
Interval Tested		Water Initially Filled	Water Added	Time	Stabilization Rate	Time	K		
10.0-20.0		395 gal.	31 gal.	10 min.	1.5 gal./min.	30 min.	330 ft./yr.		
REMARKS: Material from the surface to 7.0' loose to compact, with minor caving taking place from 0.0' to 3.0'; from 7.0' to 13.0' material moderately caliche cemented; from 13.0' to 20.0' material strongly caliche cemented. Hole stopped at the required depth of 20.0'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: Salt-Gila Aqueduct		Project: Central Arizona			Area Designation: Reach 1 - SGA		Hole No.: AP-113-SG1		
Sta.: 325+50 on C				Ground Elevation: 1570'		Approx. Dimensions: 24" x 30.0"		Date: 3-25-75	
Method of Excavation: Calweid Bucket Auger		Logged by: G. P. Ewooldt							
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF SOIL SAMPLED (CUBIC FEET)	WEIGHT OF SAMPLED SOIL (LBS.)
				VOLUME OF COBBLES (CUBIC FEET)	WEIGHT OF COBBLES (LBS.)	PERCENTAGE BY VOLUME (%)	PERCENTAGE BY WEIGHT (%)		
			0.0-27.0 SILTY SAND: Approximately 55% coarse to fine, mostly medium to fine, subangular to subrounded, sand; approximately 35% nonplastic to low plasticity fines; approximately 10% mostly fine, hard gravel; material compact to variably caliche cemented; no to strong reaction with HCl. Max. size: 3/4 inch; Color: brown to gray; Moisture: dry.			0		0	
SM	27.0	1 sack	27.0-30.0 SILTY SAND: Approximately 65% coarse to fine, subangular to subrounded, sand; approximately 20% fine, subangular to subrounded, hard gravel; approximately 15% nonplastic fines; material compact, no reaction with HCl. Max. size: 1/2 inch; Color: brown; Moisture: dry.			0		0	
SM	30.0	1 sack							
REMARKS: Material from 0.0-5.0' compact with no caving; from 5.0' to 20.0' material moderately caliche cemented, hole drilled fast and smooth to 20.0'. Material from 20.0' to 24.0' strongly caliche cemented, this material drilled slow; 24.0' to 27.0' material moderately caliche cemented; material from 27.0' to 30.0' compact, hole drilled fast and smooth from 24.0' to 30.0'. Hole stopped at the required depth of 30.0'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: SALT-GILA AQUEDUCT		Project: CENTRAL ARIZONA			Hole No.: AP-1-SGC		Area Designation: Mile 7.1		
Coordinates: NW sec. 6, T1N, R7E		Ground Elevation: APPROX 1560		Depth to Ground Water Level: not reached		Approximate Dimensions of Hole: 30" x 9.0"		Date of Excavation: 2/12/65	
Method of Excavation: Bucket Auger		Hole Logged By: G. D. Burk							
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF SOIL SAMPLED (CUBIC FEET)	WEIGHT OF SAMPLED SOIL (LBS.)
				VOLUME OF COBBLES (CUBIC FEET)	WEIGHT OF COBBLES (LBS.)	PERCENTAGE BY VOLUME (%)	PERCENTAGE BY WEIGHT (%)		
SM	7.0	2 1-pt cartons	0.0-7.0: SILTY SAND: About 55% fine to coarse, hard, angular to subrounded, granitic-source sand; 30% low-plasticity fines; and 15% mostly fine, hard, angular to subrounded, caliche-coated gravel; strong HCl reaction; lenticular. Max. size - 2 1/2"; Moisture - dry; Color - yellowish brown.						
SM-ML	9.0	2 1-pt cartons	7.0-9.0: SILTY SAND: About 45% fine to coarse, hard, angular to subrounded, granitic-source sand; 45% low-plasticity fines; and 10% mostly fine, hard, angular to subrounded gravel; weakly caliche-cemented. Max. size - 2"; Moisture - dry; Color - light brown.						
REMARKS: Drilling stopped by rock or cemented soil.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: SALT-GILA AQUEDUCT		Project: CENTRAL ARIZONA			Hole No.: AP-2-SGC		Area Designation: Mile 10.9		
Coordinates: SE 1/4 sec. 16, T1N, R7E		Ground Elevation: APPROX 1560		Depth to Ground Water Level: not reached		Approximate Dimensions of Hole: 30" x 18.5"		Date of Excavation: 2/12/65	
Method of Excavation: Bucket Auger		Hole Logged By: G. D. Burk							
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF SOIL SAMPLED (CUBIC FEET)	WEIGHT OF SAMPLED SOIL (LBS.)
				VOLUME OF COBBLES (CUBIC FEET)	WEIGHT OF COBBLES (LBS.)	PERCENTAGE BY VOLUME (%)	PERCENTAGE BY WEIGHT (%)		
SM-SC	5.5	2 1-pt cartons	0.0-18.5: SILTY SAND AND CLAYEY SAND: About 60% fine to coarse, hard, angular to subrounded, granitic-source sand; 30% low- to medium-plasticity fines; and 10% mostly fine, hard, angular to subrounded, granitic gravel; in numerous slightly variable lenses; strong HCl reaction; weakly caliche-cemented below 8'. Max. Size - 1"; Moisture - dry; Color - brown.						
SM	8.0	2 1-pt cartons							
SC	16.0	2 1-pint cartons							
SM	18.5	2 1-pint cartons							
REMARKS: Drilling stopped by rock or caliche-cemented soil.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		TP-1-SG1		Sta.		93+70 40' Rt. of C.		Ground Elevation		1573±	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe, Case 780		Date		5-20-75	
								Logged by		G.P. Ewoldt; R. Burger	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **			PERCENTAGE OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY VOLUME OF 3 TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (CUBIC FEET) SAMPLED (LBS) TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (LBS) PLUS 5-INCH				
SP	7.0	1 sack	0.0-7.0 POORLY GRADED SAND: Approximately 60% coarse to fine, subangular to subrounded sand; approximately 35% coarse to fine, angular to subrounded, soft and crumbly gravel; approximately 5% nonplastic fines; material moderately to strongly caliche cemented; weak to moderate reaction with HCl. Max. size: 3 inch; Color: gray; Moisture: dry.		0			0			
SP	10.0	1 sack	7.0-10.0 POORLY GRADED SAND WITH COBBLES: Approximately 60% coarse to fine, subangular to subrounded sand; approximately 35% coarse to fine, angular to subrounded, soft and crumbly gravel; approximately 5% nonplastic fines; material strongly caliche cemented; weak to moderate reaction with HCl. Max. size: 6 inch; Color: gray; Moisture: dry.				5		Trace		

REMARKS: Hit a layer of cobbles from 7.0' to 10.0'. Inplace density tests taken at 1, 5, and 10 feet. Hole stopped at the predetermined depth of 10.0'.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level, give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		TP-3-SG1		Sta.		208+60 on C		Ground Elevation		1567±	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe, Case 780		Date		5-21-75	
								Logged by		G.P. Ewoldt; R. Burger	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **			PERCENTAGE OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY VOLUME OF 3 TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (CUBIC FEET) SAMPLED (LBS) TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (LBS) PLUS 5-INCH				
SM	4.0	1 sack	0.0-4.0 SILTY SAND: Approximately 60% coarse to fine, subangular to subrounded sand; approximately 20% mostly fine, angular to subrounded, hard gravel; approximately 20% nonplastic to low plasticity fines; quick dilatancy, low toughness and dry strength; material weakly to moderately caliche cemented; moderate to strong reaction with HCl. Max. size: 3/4 inch; Color: tan; Moisture: dry.		0			0			
SM	10.0	1 sack	4.0-10.0 SILTY SAND: Approximately 75% coarse to fine, angular to subrounded sand; approximately 15% nonplastic, quick dilatancy fines; approximately 10% fine, hard gravel; strong reaction with HCl. Max. size: 1/2 inch; Color: tan; Moisture: dry.				0		0		

REMARKS: Material from 0.0-4.0' weakly to moderately caliche cemented; 4.0-7.0' material moderately to strongly caliche cemented; 7.0-10.0' material very strongly caliche cemented, material so hard it is almost rocklike. Density tests taken at 1, 5, and 10' depths. Hole stopped at predetermined depth of 10'.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level, give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		TP-2-SG1		Sta.		149+20 40' Lt. of C.		Ground Elevation		1568±	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe, Case 780		Date		5-19-75	
								Logged by		G.P. Ewoldt; R. Burger	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **			PERCENTAGE OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY VOLUME OF 3 TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (CUBIC FEET) SAMPLED (LBS) TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (LBS) PLUS 5-INCH				
SM	1.5	None	0.0-1.5 SILTY SAND: Approximately 65% coarse to fine, subangular to subrounded, sand; approximately 20% nonplastic fines; quick dilatancy, low toughness and dry strength; approximately 15% mostly fine, subangular to subrounded, hard gravel; material moderately caliche cemented; strong reaction with HCl. Max. size: 2 inch; Color: brown to gray; Moisture: dry.					0		0	
SM	6.0	1 sack	1.5-6.0 SILTY SAND: Approximately 70% coarse to fine, subangular to subrounded sand; approximately 25% nonplastic fines, quick dilatancy, low toughness and dry strength; approximately 5% fine, hard gravel; material moderately caliche cemented; strong reaction with HCl. Max. size: 1 inch; Color: gray; Moisture: dry.					0		0	
SP-SM	10.0	1 sack	6.0-10.0 POORLY GRADED SAND: Approximately 70% coarse to fine, subangular to subrounded sand; approximately 20% mostly fine, angular to subrounded, gravel; approximately 10% nonplastic fines; material moderately caliche cemented; strong reaction with HCl. Max. size: 2 1/2 inch; Color: gray; Moisture: dry.								

REMARKS: Inplace density tests taken at 1, 5, and 10' depths. Hole stopped at predetermined depth of 10'.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level, give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1 - SGA	
Hole No.		TP-4-SG1		Sta.		286+35 40' Lt. of C.		Ground Elevation		1569±	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe, Case 780		Date		5-21-75	
								Logged by		G.P. Ewoldt; R. Burger	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **			PERCENTAGE OF WEIGHT OF PERCENTAGE BY WEIGHT OF PERCENTAGE BY VOLUME OF 3 TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (CUBIC FEET) SAMPLED (LBS) TO 5-INCH VOLUME OF PLUS 5-INCH VOLUME OF (LBS) PLUS 5-INCH				
SM	6.0	1 sack	0.0-6.0 SILTY SAND: Approximately 65% coarse to fine, angular to subrounded, sand; approximately 25% nonplastic to low plasticity fines, quick dilatancy, low toughness and dry strength; approximately 10% fine, hard, angular to subrounded, gravel; material weakly to moderately caliche cemented; weak to moderate reaction with HCl. Max. size: 3/4 inch; Color: brown; Moisture: dry.					0		0	
SP-SM	10.0	1 sack	6.0-10.0 POORLY GRADED SAND: Approximately 80% coarse to fine, subangular to subrounded, sand; approximately 10% fine, angular to subrounded, hard gravel; approximately 10% nonplastic fines; material strongly caliche cemented; strong reaction with HCl. Max. size: 3/4 inch; Color: gray; Moisture: dry.								

REMARKS: Inplace density test taken at 1, 5, and 10' depths. Hole stopped at predetermined depth of 10'.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level, give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-15-SG1		Sta.		160+00 C		Ground Elevation		1566.5+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/8/80	
								Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)				
LETTER	GRAPHIC										
SM		1 sack	0.0 to 8.0 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 70% coarse to fine, angular to subangular sand; approximately 30% fines with low plasticity, quick dilatancy, no dry strength; trace of coarse to fine, predominately fine, angular to subangular, hard gravel; max. size, 200 mm; dry, brown; strong reaction with HCl.			Trace		Trace			
	8.0										

REMARKS: Sparse to no ground cover of bushes. Maximum size cobble taken from surface was 200x200x300 mm. Stopped test pit at 8.0 feet due to strongly cemented material.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-16-SG1		Sta.		150+00 C		Ground Elevation		1565.5+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/8/80	
								Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)				
LETTER	GRAPHIC										
SM		1 sack	0.0 to 5.0 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 65% coarse to fine, angular to subangular sand; approximately 20% fines with low plasticity, quick dilatancy, no dry strength; approximately 15% coarse to fine, predominately fine, angular to subangular, friable to hard gravel; max. size, 300 mm; moist, brown; strong reaction with HCl.			Trace		Trace			
	5.0										

REMARKS: Sparse to no ground cover of bushes. Maximum size cobble taken from surface was 300x300x450 mm. Stopped test pit at 5.0 feet due to very strongly cemented material.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-17-SG1		Sta.		140+00 C		Ground Elevation		1564.0+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/8/80	
								Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)				
LETTER	GRAPHIC										
SM		1 sack	0.0 to 7.0 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 70% coarse to fine, angular to subangular sand; approximately 20% nonplastic fines, quick dilatancy, no dry strength; approximately 10% coarse to fine, angular to subangular, friable to hard gravel; max. size, 200 mm; moist, brown; strong reaction with HCl.			Trace		Trace			
	7.0										

REMARKS: Sparse to no ground cover of paloverde trees, bushes and cacti. Maximum size cobble taken from surface was 200x300x550 mm. Stopped test pit at 7.0 feet due to strongly cemented material.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-18-SG1		Sta.		130+00 C		Ground Elevation		1570.0+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/7/80	
								Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)				
LETTER	GRAPHIC										
SM		1 sack	0.0 to 5.5 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 70% coarse to fine, angular to subangular sand; approximately 20% nonplastic fines, quick dilatancy, no dry strength; approximately 10% coarse to fine, predominately fine, angular to subangular, friable to hard gravel; max. size, 250 mm; dry, brown; strong reaction with HCl.			Trace		Trace			
	5.5										

REMARKS: Sparse to no ground cover of paloverde trees, bushes and cacti. Hairline roots to 2.5 foot depth. Maximum size cobble taken from surface was 250x250x300 mm. Stopped test pit at 5.5 feet due to strongly cemented material.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-19-SG1		Sta.		120+00 G		Ground Elevation		1572.5+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/7/80	
				Apprs. Dimensions		18'x8'x5'		Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS.)	PERCENTAGE BY VOLUME OF PLUS 5-INCH (VOLUME OF SAMPLED 3 TO 8-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (WEIGHT OF SAMPLED 3 TO 8-INCH)				
SM	5.0	1 sack	0.0 to 5.0 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 60% coarse to fine, angular to subangular sand; approximately 25% fines with low plasticity, quick dilatancy, no dry strength; approximately 15% coarse to fine, predominately fine, angular to subangular, friable to hard gravel; max. size, 250 mm; moist, tan; strong reaction with HCl.			Trace	Trace				

REMARKS: Sparse to no ground cover of paloverde trees, bushes and cacti. Maximum size cobble taken from excavation was 125x250x300 mm. Stopped test pit at 5.0 feet due to strongly cemented material.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-20-SG1		Sta.		110+00 G		Ground Elevation		1573.0+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/7/80	
				Apprs. Dimensions		19'x4'x7.5'		Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS.)	PERCENTAGE BY VOLUME OF PLUS 5-INCH (VOLUME OF SAMPLED 3 TO 8-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (WEIGHT OF SAMPLED 3 TO 8-INCH)				
SM	7.5	1 sack	0.0 to 7.5 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 60% coarse to fine, angular to subangular sand; approximately 20% coarse to fine, predominately fine, angular to subangular, friable to hard gravel; approximately 20% fines with low plasticity, quick dilatancy, no dry strength; max. size, 350 mm; dry, tan; strong reaction with HCl.			Trace	Trace				

REMARKS: Sparse to no ground cover of bushes and cacti. Small scattering of surface cobbles. Maximum size boulder on surface was 250x350x800 mm. Stopped test pit at 7.5 feet due to strongly cemented material.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-21-SG1		Sta.		100+00 G		Ground Elevation		1571.0+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/4/80	
				Apprs. Dimensions		12'x8'x3.5'		Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS.)	PERCENTAGE BY VOLUME OF PLUS 5-INCH (VOLUME OF SAMPLED 3 TO 8-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (WEIGHT OF SAMPLED 3 TO 8-INCH)				
SC	1.0	1 sack	0.0 to 1.0 ft. CLAYEY SAND WITH COBBLES AND BOULDERS: Approximately 50% coarse to fine, predominately coarse to medium, angular to subangular sand; approximately 30% coarse to fine, angular to subangular, friable to hard gravel; approximately 20% fines with low to medium plasticity, slow dilatancy, low to medium toughness; max. size, 450 mm; moist, brown; strong reaction with HCl.			5	10				
SW-SM	3.5	1 sack		1.0 to 3.5 ft. WELL GRADED SAND WITH COBBLES AND BOULDERS: Approximately 50% coarse to fine, angular to subangular sand; approximately 40% coarse to fine, angular to subangular, friable to hard gravel; approximately 10% fines with low plasticity, quick to slow dilatancy; max. size, 350 mm; dry, brown; strong reaction with HCl.							

REMARKS: Sparse to no ground cover of ironwood trees, bushes and cacti. Moderate scattering of surface cobbles, boulders and decomposed granite. Maximum size boulder on surface was 300x450x700 mm. Predominately decomposed granite throughout test pit. Large granite boulders will be found throughout the excavation. Stopped test pit at 3.5 feet due to strongly cemented material and large granite boulders.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature		Salt-Gila Aqueduct		Project		Central Arizona		Area Designation		Reach 1	
Hole No.		TP-22-SG1		Sta.		90+00 G		Ground Elevation		1574.0+	
Depth to Water Level		Not Reached		Method of Excavation		Backhoe MF-80		Date		4/4/80	
				Apprs. Dimensions		18'x5'x15'		Logged by		J. K. Swapp	
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS.)	PERCENTAGE BY VOLUME OF PLUS 5-INCH (VOLUME OF SAMPLED 3 TO 8-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (WEIGHT OF SAMPLED 3 TO 8-INCH)				
SM	3.0	1 sack	0.0 to 3.0 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 65% coarse to fine, angular to subangular sand; approximately 20% nonplastic fines, quick dilatancy, low toughness; approximately 15% coarse to fine, predominately fine, angular to subrounded, friable to hard gravel; max. size, 200 mm; moist, brown; strong reaction with HCl.			Trace	Trace				
SP-SM	15.0	1 sack		3.0 to 15.0 ft. POORLY GRADED SAND WITH COBBLES: Approximately 60% coarse to fine, predominately coarse to medium, angular to subangular sand; approximately 30% coarse to fine, angular to subangular, friable to hard gravel; approximately 10% nonplastic fines, quick dilatancy; max. size, 250 mm; dry, brown; strong reaction with HCl.			5	5			

REMARKS: Sparse to no ground cover of bushes and cacti. Moderate amount of surface, decomposed granite. Maximum size cobble taken from excavation was 150x300x300 mm. Predominately decomposed granite throughout test pit. Stopped test pit at 15.0 feet, limit of backhoe.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE
FOR BORROW AND FOUNDATION INVESTIGATIONS

Feature: Salt-Gila Aqueduct Project: Central Arizona Area Designation: Reach 1
 Hole No.: TP-23-SG1 Station: Sta. 80+00 Q Ground Elevation: 1579.0+ Approx. Dimensions: 17'x4'x14'
 Depth to Water Level: Not Reached Method of Excavation: Backhoe MF-80 Date: 4/4/80 Logged by: J. K. Swapp

CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS #10	
				VOLUME OF COBBLES > 3 IN. (76.2 mm) TO 5 IN. (127 mm) SAMPLED	WEIGHT OF COBBLES > 3 IN. (76.2 mm) TO 5 IN. (127 mm) SAMPLED
SM	7.0	1 sack	0.0 to 7.0 ft. SILTY SAND WITH TRACE OF COBBLES: Approximately 60% coarse to fine, predominately coarse to medium, angular to subangular sand; approximately 25% coarse to fine, predominately fine, angular to subangular, friable to hard gravel; approximately 15% nonplastic fines, quick dilatancy; max. size, 250 mm; dry, brown; strong reaction with HCl.	Trace	Trace
SW-SM	10.0	1 sack	7.0 to 10.0 ft. WELL GRADED SAND WITH COBBLES: Approximately 55% coarse to fine, predominately coarse to medium, angular to subangular sand; approximately 35% coarse to fine, angular to subangular, friable to hard gravel; approximately 10% nonplastic fines, quick dilatancy; max. size, 300 mm; dry, brown; strong reaction with HCl.	5	5
SW-SM	14.0	1 sack	10.0 to 14.0 ft. WELL GRADED SAND WITH TRACE OF COBBLES: Approximately 70% coarse to fine, predominately coarse to medium, angular to subangular sand; approximately 20% coarse to fine, angular to subangular, friable to hard gravel; approximately 10% nonplastic fines, quick dilatancy; max. size, 150 mm; dry, brown; weak reaction with HCl.	Trace	Trace

REMARKS: Moderate ground cover of ironwood and paloverde trees, greasewood bushes and cacti. Moderate amount of surface decomposed granite. Maximum size cobble taken from excavation was 200x300x450 mm. Predominately decomposed granite throughout test pit. Stopped test pit at 14.0 feet, limit of backhoe.

NOTES: Record water test and density test data, if applicable, under remarks. (lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT: Central Arizona FEATURE: Salt-Gila Aqueduct, Reach 1A

TABLE 1-SG1A SHEET 1 OF 1

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST				
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm	SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO 3 IN. (76.2 mm)	COBBLES 3 IN. (76.2 mm) TO 5 IN. (127 mm)	OVERSIZE LARGER THAN 5 IN. (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	MINUS NO. 4	BULK	APPARENT	ABSORPTION - %	MAXIMUM DRY DENSITY - pcf (gm/cm ³)	OPTIMUM WATER CONTENT - %	In-Place Dry Density (pcf) (kg/cm ³)
TP-1-SG1	Sta. 93+70	1.0-2.0	SC	5	11	67	17			28	14		2.77	2.61		128.0	10.7	120.2	93.9
	40' Rt. C	5.0-6.0	SW-SM	0	9	63	28			--	N/P		2.70	2.59		125.6	96.4	128.5	100+
		0.0-11.0	GM	1	30	31	38			--	N/P		2.72	2.62		129.4	10.0	118.2	91.3
TP-2-SG1	Sta. 149+20	1.0-2.0	SM	7	22	60	11			27	4		2.72	2.55		124.2	11.4	94.1	75.8
	40' Lt. C	5.0-6.0	SM	2	15	78	5			--	N/P		2.67	--		115.3	15.5	104.1	90.3
		0.0-11.0	SM	2	12	77	9			--	N/P		2.71	2.62		122.6	13.3	107.8	87.9
TP-3-SG1	Sta. 208+60	1.0-2.0	SM	7	34	52	7			--	N/P		2.70	2.59		126.1	10.1	99.4	78.8
	C	5.0-6.0	SM-ML	5	44	40	11			39	11		2.65	2.49		111.5	17.0	96.2	86.3
		0.0-11.0	SM	2	13	68	17			--	N/P		2.67	2.41		107.8	17.8	100.8	93.5
TP-4-SG1	Sta. 286+35	1.0-2.0	SM	7	32	50	11			21	4		2.70	2.58		131.4	8.9	102.6	78.1
	40' Lt. C	5.0-6.0	SM-ML	13	36	45	6			31	12		2.71	2.57		116.3	14.8	93.3	80.2
		0.0-11.0	SM	2	12	52	34			--	N/P		2.69	2.32		104.3	19.4	89.2	85.5

NOTE: Numbers in parentheses are metric equivalents of numbers directly above. Note: 1/ Maximum and minimum by relative density test. In-place density is total material. In-place density is minus No. 4 for samples on which Proctor test was run.

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT: Central Arizona FEATURE: Salt-Gila Aqueduct, Reach 1A

TABLE 2-SG1A SHEET 1 OF 1

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST		
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm	SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO 3 IN. (76.2 mm)	COBBLES 3 IN. (76.2 mm) TO 5 IN. (127 mm)	OVERSIZE LARGER THAN 5 IN. (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	MINUS NO. 4	BULK	APPARENT	ABSORPTION - %	MAXIMUM DRY DENSITY - pcf (gm/cm ³)
AP-99-SG1		0.0-30.0	SM	5	21	62	12			--	N/P		2.70	2.51		120.2	12.3
AP-102-SG1		0.0-20.0	SM	7	28	58	7			35	5		2.73	2.39		111.3	14.9
AP-106-SG1		3.0-20.0	SM	10	22	54	14			36	2		2.69	2.49		111.2	16.3
AP-109-SG1		3.0-30.0	SM	7	24	55	14			33	6		2.70	2.48		119.7	13.0
AP-112-SG1		0.0-7.0	SM-SC	5	16	64	15			21	7		2.72	2.57		131.7	8.3
AP-112-SG1		7.0-20.0	SM	9	25	55	11			35	1		2.70	2.44		115.7	13.2

Note: Gradation analysis on minus 8-inch fraction.

NOTE: Numbers in parentheses are metric equivalents of numbers directly above. ©USGPO 1977/777-007/1288 Reg. B

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT: CENTRAL ARIZONA FEATURE: REACH 1, SALT-GILA AQUEDUCT

TABLE 3-SG1A SHEET 1 OF 2

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST		
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm	SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO 3 IN. (76.2 mm)	COBBLES 3 IN. (76.2 mm) TO 5 IN. (127 mm)	OVERSIZE LARGER THAN 5 IN. (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	MINUS NO. 4	BULK	APPARENT	ABSORPTION - %	MAXIMUM DRY DENSITY - pcf (gm/cm ³)
TP-15-SG1	Sta. 160+00	0.0-8.0	SM	5	23	70	2			--	N/P		2.66	--		110.8	16.1
		0.0-5.0	SM	5	13	63	19			--	N/P		2.69	2.38		109.0	17.8
TP-17-SG1	Sta. 140+00	0.0-7.0	SM	5	15	71	9			--	N/P		2.70	2.51		110.2	16.7
		0.0-5.5	SM	5	17	70	8			--	N/P		2.72	2.58		117.1	13.9
TP-19-SG1	Sta. 120+00	0.0-5.0	SM	6	20	58	16			--	N/P		2.71	2.52		113.7	15.1
		0.0-7.5	SM	4	18	56	22			--	N/P		2.71	2.49		112.7	15.6
TP-21-SG1	Sta. 100+00	0.0-1.0	SM	5	14	48	33			20	2		2.73	2.62		131.8	9.1
		1.0-3.5	SW-SM	3	8	50	39			--	N/P		2.74	2.57		122.6	12.1
TP-22-SG1	Sta. 90+00	0.0-3.0	SM	3	19	64	14			--	N/P		2.72	2.54		120.7	11.8
		3.0-15.0	SP-SM	2	6	61	31			--	N/P		2.75	2.61		--	--

NOTE: Numbers in parentheses are metric equivalents of numbers directly above. /1247 REGION NO. 8

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT CENTRAL ARIZONA FEATURE REACH 1, SALT-GILA AQUEDUCT

TABLE 3-SG1A SHEET 2 OF 2

SAMPLE NUMBER	IDENTIFICATION		CLASSIFICATION SYMBOL	PARTICLE SIZE FRACTIONS IN PERCENT				CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST				
	HOLE NUMBER	DEPTH - feet (ft)		FINES	SMALLER THAN 0.075 mm	0.075 TO 0.425 mm	SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO 3 IN. (76.2 mm)	COBBLES 3 IN. (76.2 mm) TO 5 IN. (127 mm)	OVERSIZE LARGER THAN 5 IN. (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	MINUS NO. 4	BULK	APPARENT	ABSORPTION - %	MAXIMUM DRY DENSITY - pcf (gm/cm ³)
TP-23-SG1		0.0-7.0	SM	3	10	58	29					2.71	2.62			124.2	10.7	
Sta. 80+00		7.0-10.0	SW-SM	2	7	55	36					2.74	2.63					
		10.0-14.0	SW-SM	2	6	69	23					2.72	2.63					
		Gradation analysis on minus 3-inch fraction.																

TABLE 3-SG1A SHEET 2 OF 2

SUMMARY OF PERMEABILITY TEST RESULTS

PROJECT Central Arizona FEATURE Salt-Gila Aqueduct, Reach 1A

TABLE 4-SG1A SHEET 1 OF 1

SAMPLE NUMBER	IDENTIFICATION		CLASSIFICATION SYMBOL	PLACEMENT			SETTLEMENT			FINAL		COEFFICIENT OF PERMEABILITY - ft/yr (cm/sec)	HYDRAULIC GRADIENT = HEAD / SPECIMEN LENGTH	
	HOLE NUMBER	DEPTH - feet (ft)		DRY DENSITY - pcf (gm/cm ³)	MOISTURE CONTENT - %	PERCENT PROCTOR DENSITY (P _{roc}) RELATIVE DENSITY (RD)	APPLIED LOAD - psi (kg/cm ²)	LOADED - %	LOADED AND WETTED - %	LOAD RELEASED - %	CONSOLIDATED DRY DENSITY - pcf (gm/cm ³)			PENETRATION RESISTANCE - psi (kg/cm ²)
	AP-99	0.0-30.0	SM	114.2	11.2	95% Proc	20	1.83	2.10	1.74	116.6	--	12.4	5.1
	AP-102	0.0-20.0	SM	105.7	13.6	95% Proc	20	0.68	0.87	0.54	106.6	--	43.6	4.3
	AP-106	3.0-20.0	SM	105.6	15.1	95% Proc	20	0.84	1.33	1.03	107.0	--	144.8	0.9
	AP-109	3.0-30.0	SM	113.7	11.7	95% Proc	20	0.42	0.80	0.54	114.6	--	3.3	5.0
	AP-112	0.0-7.0	SM-SC	125.1	7.1	95% Proc	20	0.70	0.98	0.75	126.3	--	30.6	1.7
	AP-112	7.0-20.0	SM	109.9	12.0	95% Proc	20	0.62	0.88	0.63	110.9	--	14.2	2.1

Reach 1A TABLE 4-SG1A SHEET 1 OF 1

SUMMARY OF PERMEABILITY TEST RESULTS

PROJECT Central Arizona FEATURE Salt-Gila Aqueduct, Reach 1A

TABLE 5-SG1A SHEET 1 OF 1

SAMPLE NUMBER	IDENTIFICATION		CLASSIFICATION SYMBOL	PLACEMENT			SETTLEMENT			FINAL		COEFFICIENT OF PERMEABILITY - ft/yr (cm/sec)	HYDRAULIC GRADIENT = HEAD / SPECIMEN LENGTH
	HOLE NUMBER	DEPTH - feet (ft)		DRY DENSITY - pcf (gm/cm ³)	MOISTURE CONTENT - %	PERCENT PROCTOR DENSITY (P _{roc}) RELATIVE DENSITY (RD)	APPLIED LOAD - psi (kg/cm ²)	LOADED - %	LOADED AND WETTED - %	LOAD RELEASED - %	CONSOLIDATED DRY DENSITY - pcf (gm/cm ³)		
	TP-2-SG1	5.0-6.0	SM	109.5	14.5	95% Proc	20	0.46	0.66	0.35	110.2		1.85
	TP-3-SG1	5.0-6.0	SM-ML	105.9	16.1	95% Proc	20	0.73	1.04	0.55	107.0		1.516.1
	TP-4-SG1	10.0-11.0	SM	99.1	18.4	95% Proc	20	0.93	1.13	0.77	100.2		1.1 9.6

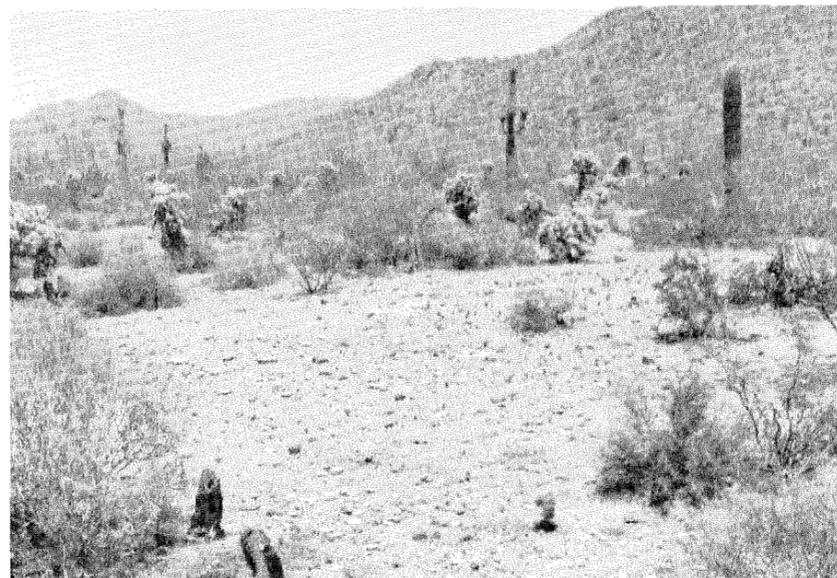
TABLE 5-SG1A SHEET 1 OF 1

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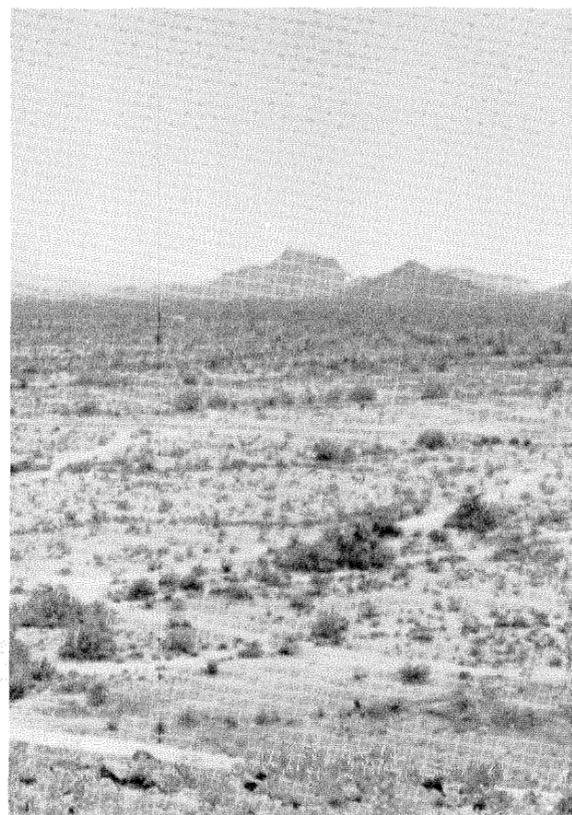
Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. Outcrop of blocky Precambrian granite along south bank of 6- to 8-foot-deep dry wash located about 50 feet upstream from alignment crossing at station 36+75. Photo CN344-330-7243 NA

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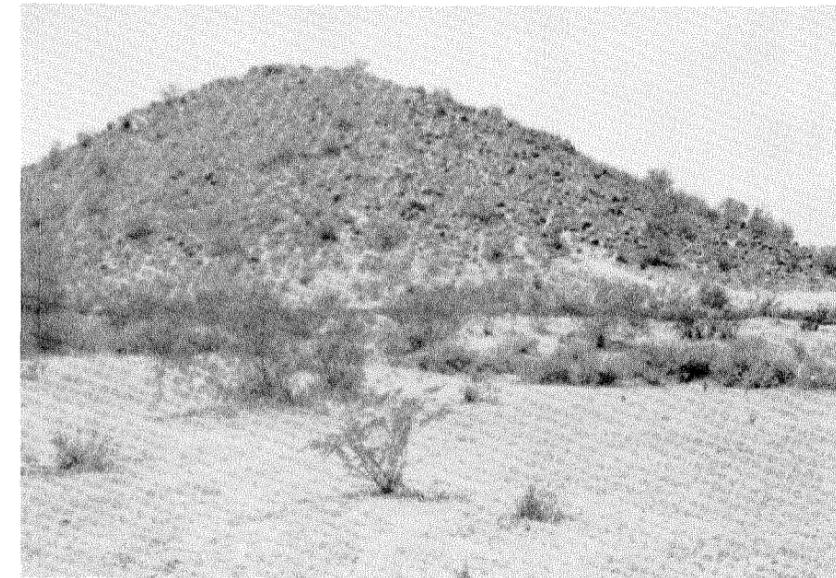
Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. Strongly cemented caliche layers occur at ground surface in alluvial fan deposits in the vicinity of canal station 106+00. Note numerous chips of white caliche scattered about surface. Photo CN344-330-7245 NA

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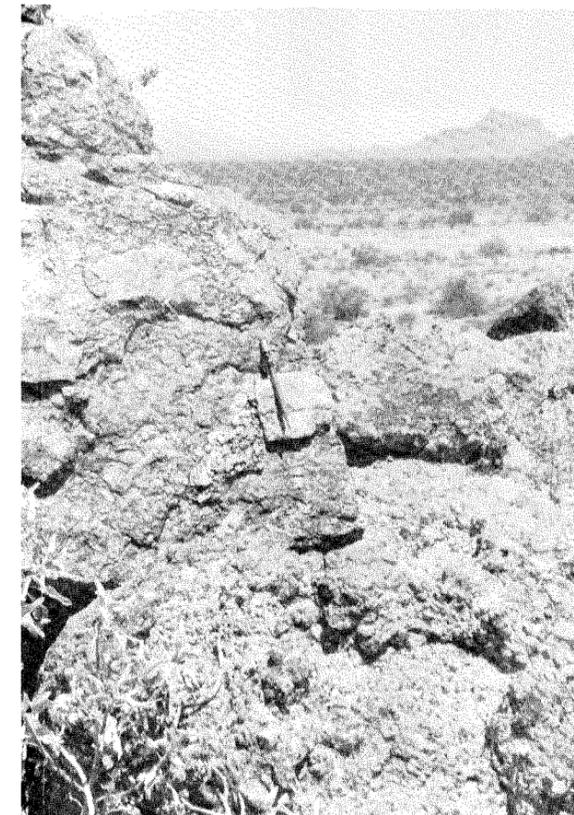
Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. General view looking upstream (vicinity of station 218+00) across gently sloping alluvial fan deposits. McKellips Road crosses center of photo, and Spook Hill and McDowell Mountain on the horizon. Photo CN344-330-7246 NA

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Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. Inselberg of Precambrian granite approximately 130 feet high, surrounded by alluvial fan deposits. Hard granite outcrops at base of hill are about 400 feet right of centerline, station 218+00. Photo CN344-330-7247 NA

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Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. Weathered granite in hillside adjacent to Station 218+00 showing partly weathered out potash feldspars (maximum size 2 1/2" X 3 1/2"). Photo CN344-330-7248 NA

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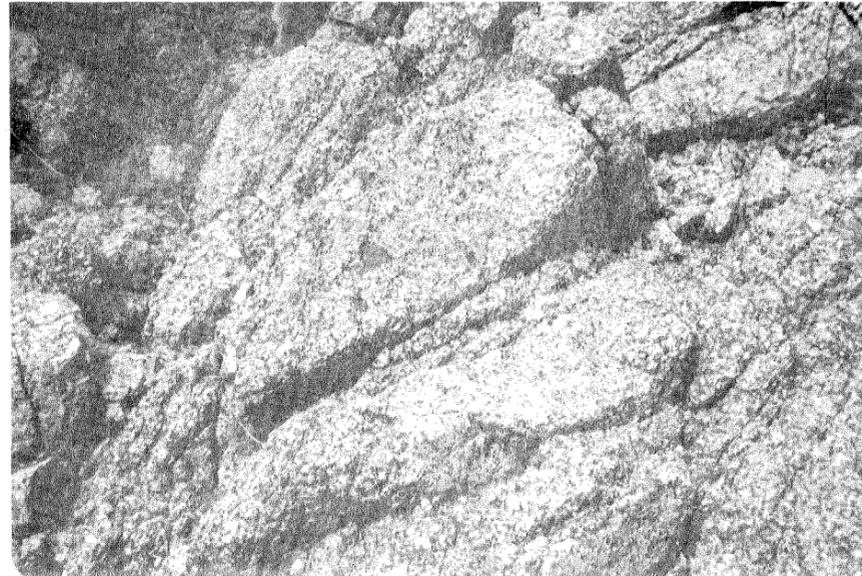


Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. Low ridge of Precambrian granite intersects canal alignment at station 51+75. Note weathering of granite to form rounded blocks and boulders. Photo CN344-330-7244 NA



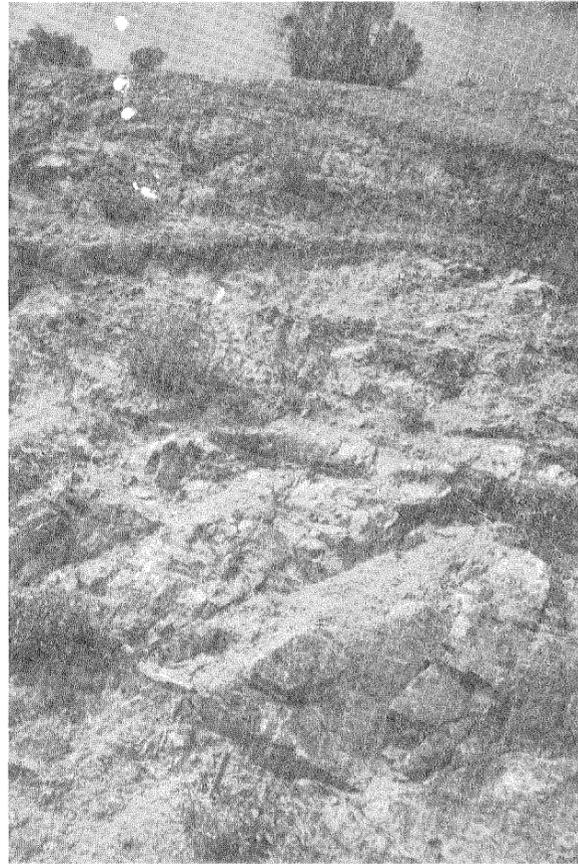
131

Granite Reef Aqueduct, Reach 12—Salt-Gila Pumping Plant—Central Arizona Project—Arizona. Precambrian granite in cut along old jeep trail, approximate station 808+00. Photo CN344-330-4268 NA



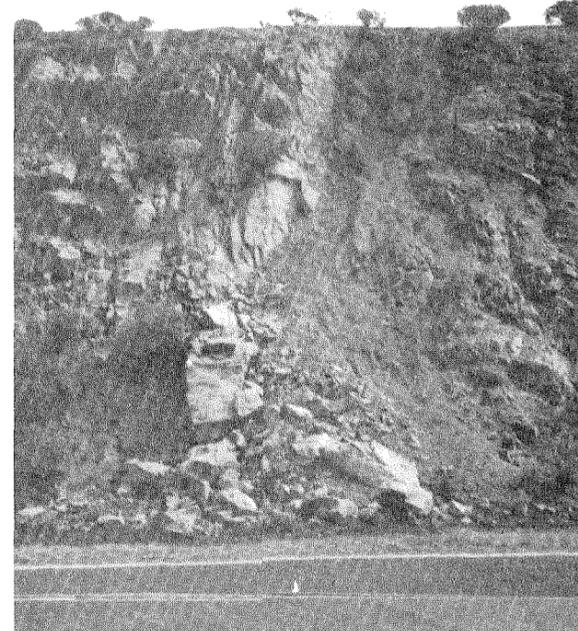
132

Granite Reef Aqueduct, Reach 12—Salt-Gila Pumping Plant—Central Arizona Project—Arizona. Closeup of Precambrian granite right of station 801+00, showing coarse-grained, prophyritic texture. Photo CN344-330-4267 NA



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Granite Reef Aqueduct, Reach 12—Salt-Gila Pumping Plant—Central Arizona Project—Arizona. Roadcut in granite (pégr), west side of Bush Highway near pumping plant site. Photo CN344-330-4270 NA



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Granite Reef Aqueduct, Reach 12—Salt Gila Pumping Plant—Central Arizona Project—Arizona. Roadcut in granite (pégr) on east side of Bush Highway immediately north of Granite Reef Aqueduct, Reach 12. Note small rock slide, intensity of jointing, and variable weathering. Photos CN344-330-4269 NA (top) and CN344-330-4271 NA (lower)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate		Date: 3-29-78			Logged by: J.K. Swapp	
Note No. TP-201 MSG3		Coordinates N. 814,259 E. 634,734		Ground Elevation: 1613.5		Approx. Dimensions: 7'X 13'X 19'		Method of Excavation: Backhoe MF-80			
Depth to Water Level: Not Reached		Method of Excavation: Backhoe MF-80		Date: 3-29-78		Logged by: J.K. Swapp					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS)	PERCENTAGE OF PLUS 5-INCH (PERCENT)					
SP	6.0	4 sacks	0.0-6.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 95% coarse to fine, subangular to sub-rounded, clean sand; Approximately 5% coarse to fine, predominately fine, subangular to subrounded, hard gravel; no reaction with HCl. Max. size: 4 inch; Color: brown; Moisture: moist.		Trace	0					
SP-SM	6.0	4 sacks	6.0-10.5 POORLY GRADED SAND WITH COBBLES: Approximately 50% coarse to fine, subangular to rounded, sand; Approximately 45% coarse to fine, subangular to rounded, hard gravel, with weak surface coating; Approximately 5% nonplastic fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.		5	5					
GW-GC	10.5	1 sack	10.5-13.0 WELL GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, subangular to subrounded, hard gravel, with weak to no surface coating; Approximately 30% coarse to fine, subangular to subrounded, sand; Approximately 10% medium plasticity fines, medium dilatancy; slight reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: wet.		5	5					
REMARKS: Sparse to no ground cover of mesquite and palo verde trees and greasewood bushes. Moderate amount of surface cobbles. Maximum size boulder taken from excavation was 7"X11"X11". Moderate micaceous content throughout. Stopped test pit at 13.0 feet. Material from 10.5' to 13.0' not suitable as aggregate.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate		Date: 3-29-78			Logged by: J.K. Swapp	
Note No. TP-202 MSG3		Coordinates N. 813,970 E. 634,753		Ground Elevation: 1616.0		Approx. Dimensions: 5'X10'X21'		Method of Excavation: Backhoe MF-80			
Depth to Water Level: Not Reached		Method of Excavation: Backhoe MF-80		Date: 3-29-78		Logged by: J.K. Swapp					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS)	PERCENTAGE OF PLUS 5-INCH (PERCENT)					
GP-GM	3.5	4 sacks	0.0-3.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, subangular to subrounded, hard gravel, with moderate to no surface coating; approximately 40% coarse to fine, subangular to sub-rounded sand; approximately 5% non-plastic fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.		5	5					
SP	7.0	4 sacks	3.5-7.0 POORLY GRADED SAND WITH TRACE OF COBBLES AND BOULDERS: Approximately 60% coarse to fine, subangular to subrounded, clean sand; approximately 40% coarse to fine, subangular to subrounded, hard gravel, with weak surface coating; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 13 inch; Color: brown; Moisture: moist.		Trace	Trace					
SM-SC	10.0	1 sack	7.0-10.0 CLAYEY SAND WITH COBBLES: Approximately 50% coarse to fine, subangular to subrounded, sand; approximately 30% coarse to fine, subangular to subrounded, hard gravel; approximately 20% slight to medium plasticity fines, medium to quick dilatancy; slight reaction with HCl. Max. size: 5 inch; Color: brown; Moisture: moist.		5	Trace					
REMARKS: Moderate to sparse ground cover of mesquite and palo verde trees, greasewood and sagebrush. Sparse amount of surface cobbles. Maximum size boulder taken from excavation was 13"X13"X16". Moderate micaceous content throughout. Stopped test pit at 10.0 feet. Material from 7.0' to 10.0' was unsuitable as aggregate.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate		Date: 3-29-78			Logged by: J.K. Swapp	
Note No. TP-203 MSG3		Coordinates N. 814,047 E. 635,216		Ground Elevation: 1616.7		Approx. Dimensions: 10'X17'X20'		Method of Excavation: Backhoe MF-80			
Depth to Water Level: Not Reached		Method of Excavation: Backhoe MF-80		Date: 3-29-78		Logged by: J.K. Swapp					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS)	PERCENTAGE OF PLUS 5-INCH (PERCENT)					
SP	6.0	4 sacks	0.0-6.0 POORLY GRADED SAND WITH COBBLES AND TRACE OF BOULDERS: Approximately 60% coarse to fine subangular to subrounded, clean sand; approximately 40% coarse to fine, angular to subrounded, hard gravel; trace of non-plastic fines; slight to no reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.		5	5					
GP-GM	17.0	4 sacks	6.0-17.0 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 55% coarse to fine, subangular to subrounded, hard gravel, with strong to no surface coating; approximately 35% coarse to fine, subangular to subrounded sand; approximately 10% slight plasticity fines, quick dilatancy; slight to no reaction with HCl. Max. size: 12 inch Color: brown; Moisture: moist.		10	5					
REMARKS: Moderate to sparse ground cover of mesquite and palo verde trees, greasewood and sagebrush. Sparse amount of surface cobbles. Maximum size boulder taken from excavation was 8"X12"X20". Clay seam from 7' to 8' at one end of pit. Moderate micaceous content throughout. Stopped test pit at 17.0 feet, limit of backhoe.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate		Date: 3-30-78			Logged by: J.K. Swapp	
Note No. TP-204 MSG3		Coordinates N. 814,295 E. 635,202		Ground Elevation: 1617.3		Approx. Dimensions: 10'X17'X18'		Method of Excavation: Backhoe MF-80			
Depth to Water Level: Not Reached		Method of Excavation: Backhoe MF-80		Date: 3-30-78		Logged by: J.K. Swapp					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **							
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS)	PERCENTAGE OF PLUS 5-INCH (PERCENT)					
SP	3.0	4 sacks	0.0-3.0 POORLY GRADED SAND WITH COBBLES: Approximately 60% coarse to fine, subangular to rounded, clean sand; approximately 40% coarse to fine, angular to rounded, hard gravel; trace of non-plastic fines; rapid to no reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.		5	Trace					
SP	6.0	4 sacks	3.0-6.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 80% coarse to fine, subangular to sub-rounded, clean sand; approximately 20% coarse to fine, angular to subrounded, hard gravel, with weak surface coating; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 4 inch; Color: brown; Moisture: moist.		Trace	0					
GW	9.0	4 sacks	6.0-9.0 WELL GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 70% coarse to fine, subangular to subrounded, hard gravel; approximately 30% coarse to fine, subangular to subrounded, clean sand; trace of non-plastic fines; slight to no reaction with HCl. Max. size: 13 inch; Color: brown; Moisture: moist.		5	5					
REMARKS: Moderate ground cover of mesquite and palo verde trees, greasewood and sagebrush. Hairline roots from 0.0' to 9.0'. Sparse amount of surface cobbles. Maximum size boulder taken from excavation was 13"X13"X16". Moderate micaceous content throughout. Stopped test pit at 17.0 feet, limit of backhoe.											
NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.											

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS												
Feature			Project			Area Designation			140			
Salt-Gila Aqueduct			Central Arizona			Reach 3, Queen Creek Aggregate						
Hole No. TP-204 MSG3		Coordinates N 814,295 E 635,202		Ground Elevation 1617.3		Approx. Dimensions 10'X17'X18'		Logged by J.K. Swapp				
Depth to Water Level Not Reached		Method of Excavation Backhoe MF-80		Date 3-30-78								
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL				PERCENTAGE OF COBBLES AND BOULDERS **					
			[SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS]				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME
LETTER	GRAPHIC											
			9.0-17.0 WELL GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, subangular to subrounded, hard gravel, with moderate to no surface coating; approximately 45% coarse to fine, subangular to subrounded, clean sand; trace of slight plasticity fines, quick dilatancy; rapid to no reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.									

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. *** (lbs. of rock sampled) 100. Record bulk specific gravity of rock (G_r) (Cubic feet of hole sampled). Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS												
Feature			Project			Area Designation			141			
Salt-Gila Aqueduct			Central Arizona			Reach 3, Queen Creek Aggregate						
Hole No. TP-205 MSG3		Coordinates N 814,614 E 635,196		Ground Elevation 1618.3		Approx. Dimensions 7'X17'X15'		Logged by J.K. Swapp				
Depth to Water Level Not Reached		Method of Excavation Backhoe MF-80		Date 3-30-78								
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL				PERCENTAGE OF COBBLES AND BOULDERS **					
			[SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS]				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME
LETTER	GRAPHIC											
SP-SM		4 sacks	0.0-5.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 65% coarse to fine, angular to subrounded sand; approximately 30% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 5% nonplastic fines; slight to medium reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.						Trace		Trace	
GP-GM		4 sacks	5.0-10.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, subangular to subrounded, hard gravel with strong to no surface coating; approximately 35% coarse to fine, subangular to subrounded, sand; approximately 5% nonplastic fines; slight to rapid reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.						10		5	
GW		1 sack	10.0-17.0 WELL GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 65% coarse to fine, subangular to subrounded, hard gravel, with moderate to weak surface coating; approximately 35% coarse to fine, subangular to subrounded, clean sand; trace of slight plasticity fines; slight to medium reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.						10		5	

REMARKS: Sparse ground cover of mesquite and paloverde trees, greasewood and sagebrush. Hairline roots from 0.0' to 6.0'. Maximum size boulder taken from excavation was 9"X12"X13". Moderate micaceous content throughout. Stopped test pit at 17.0 feet, limit of backhoe.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. *** (lbs. of rock sampled) 100. Record bulk specific gravity of rock (G_r) (Cubic feet of hole sampled). Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS												
Feature			Project			Area Designation			142			
Salt-Gila Aqueduct			Central Arizona			Reach 3, Queen Creek Aggregate						
Hole No. TP-206 MSG3		Coordinates N 814,700 E 635,568		Ground Elevation 1620.8		Approx. Dimensions 5'X9'X17'		Logged by J.K. Swapp				
Depth to Water Level Not Reached		Method of Excavation Backhoe MF-80		Date 4-10-78								
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL				PERCENTAGE OF COBBLES AND BOULDERS **					
			[SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS]				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME
LETTER	GRAPHIC											
SP		4 sacks	0.0-3.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 80% coarse to fine, subangular to subrounded, clean sand; approximately 20% coarse to fine, subangular to subrounded, hard gravel with weak surface coating; trace of non-plastic fines; slight to medium reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.						Trace		Trace	
GP-GM		4 sacks	3.0-6.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, subangular to subrounded, hard gravel, with weak to strong surface coating; approximately 40% coarse to fine, angular to subrounded sand; approximately 5% non-plastic fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 7 inch; Color: brown; Moisture: moist.						5		5	
GP-GM		1 sack	6.0-9.0 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 50% coarse to fine, subangular to subrounded, hard gravel, with weak to strong surface coating; approximately 40% coarse to fine, subangular to subrounded sand; approximately 10% slight plasticity fines, quick to medium dilatancy; slight to rapid reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.						5		5	

REMARKS: Sparse ground cover of mesquite and palo verde trees, greasewood and sage bushes. Moderate amount of surface cobbles. Maximum size boulder taken from excavation was 9"X12"X17". Moderate micaceous content throughout test pit. Stopped test pit at 9.0 feet. Material from 6.0' to 9.0' unsuitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. *** (lbs. of rock sampled) 100. Record bulk specific gravity of rock (G_r) (Cubic feet of hole sampled). Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS												
Feature			Project			Area Designation			143			
Salt-Gila Aqueduct			Central Arizona			Reach 3, Queen Creek Aggregate						
Hole No. TP-207 MSG3		Coordinates N 814,285 E 635,609		Ground Elevation 1619.4		Approx. Dimensions 8'X14'X16'		Logged by J.K. Swapp				
Depth to Water Level Not Reached		Method of Excavation Backhoe MF-80		Date 4-10-78								
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL				PERCENTAGE OF COBBLES AND BOULDERS **					
			[SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS]				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME
LETTER	GRAPHIC											
SP		4 sacks	0.0-2.0 POORLY GRADED SAND WITH COBBLES AND TRACE OF BOULDERS: Approximately 70% coarse to fine, angular to subangular, clean sand; approximately 30% coarse to fine, angular to rounded, hard gravel, with weak surface coating; trace of non-plastic fines; slight to medium reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.						Trace		Trace	
GP		4 sacks	2.0-6.0 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 55% coarse to fine, subangular to subrounded, hard gravel, with weak to strong surface coating; approximately 45% coarse to fine, subangular to subrounded, clean sand; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 14 inch; Color: brown; Moisture: wet.						5		5	
GP		4 sacks	6.0-12.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, subangular to subrounded, hard gravel, with weak to strong surface coating; approximately 40% coarse to fine, angular to subrounded, clean sand; trace of non-plastic fines, quick dilatancy; slight to medium reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: wet.						10		10	
GH-GC		1 sack							10		10	

REMARKS: Slight to Moderate ground cover of mesquite and paloverde trees, greasewood and sagebrush. Moderate to sparse amount of surface cobbles. Maximum size boulder taken from excavation was 12"X14"X24". Moderate micaceous content throughout test pit. Stopped test pit at 14.0 feet. Material 12.0'-14.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. *** (lbs. of rock sampled) 100. Record bulk specific gravity of rock (G_r) (Cubic feet of hole sampled). Record bulk specific gravity in Remarks, stating how obtained (measured or estimated).

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No.: TP-207 MSG3		Coordinates N: 814,285 E: 635,609		Ground Elevation: 1619.4	
Method of Excavation: Backhoe		MF-80		Date: 4-10-78		Approx. Dimensions: 6'X14'X16'		Logged by: J.K. Swapp			
CLASSIFICATION SYMBOL		DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)		PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC					VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	VOLUME OF HOLES SAMPLED 5 TO 9-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)
				12.0-14.0 WELL GRADED GRAVEL WITH COBBLES: Approximately 70% coarse to fine, subangular to subrounded, hard gravel, with weak surface coating; approximately 25% coarse to fine, subangular to subrounded sand; approximately 5% slight to medium plasticity fines, medium dilatancy; slight reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: wet.							

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No.: TP-208 MSG3		Coordinates N: 813,801 E: 635,630		Ground Elevation: 1619.9	
Method of Excavation: Backhoe		MF-80		Date: 4-11-78		Approx. Dimensions: 5'X16'X19'		Logged by: J.K. Swapp			
CLASSIFICATION SYMBOL		DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)		PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC					VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	VOLUME OF HOLES SAMPLED 5 TO 9-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)
SP		2.0	4 sacks	0.0-2.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 55% coarse to fine, angular to subrounded clean sand; approximately 45% coarse to fine, angular to subrounded, hard gravel, with weak surface coating; slight to medium reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.							
SP		6.0	4 sacks					5			5
GP-GM		10.0	4 sacks	2.0-6.5 POORLY GRADED SAND WITH COBBLES: Approximately 50% coarse to fine, angular to subrounded, sand; approximately 45% coarse to fine, angular to subrounded, hard gravel, with weak surface coating; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.				10			5
GP-GM		15.0	4 sacks					5			Trace
GC		16.0	1 sack	6.5-10.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, subangular to rounded, hard gravel, with moderate to strong surface coating; approximately 30% coarse to fine, subangular to subrounded sand; approximately 10% non-plastic fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.				5			5

REMARKS: Sparse ground cover of mesquite and palo verde trees, greasewood and sagebrush. Slight to sparse amount of surface cobbles. Hairline roots to 7 foot depth. Maximum size cobble taken from excavation was 7"X10"X12". Moderate micaceous content throughout. Stopped test pit at 16.0 feet. Material from 15.0' to 16.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No.: TP-208 MSG3		Coordinates N: 813,801 E: 635,630		Ground Elevation: 1619.9	
Method of Excavation: Backhoe		MF-80		Date: 4-11-78		Approx. Dimensions: 5'X16'X19'		Logged by: J.K. Swapp			
CLASSIFICATION SYMBOL		DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)		PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC					VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	VOLUME OF HOLES SAMPLED 5 TO 9-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)
				10.5-15.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 50% coarse to fine, subangular to subrounded, hard gravel, with weak to strong surface coating; approximately 45% coarse to fine, subangular to subrounded sand; approximately 5% non-plastic fines; medium to no reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.							
				15.0-16.0 CLAYEY GRAVEL WITH COBBLES: Approximately 60% coarse to fine, subangular to subrounded, hard gravel, with weak surface coating; approximately 25% coarse to fine, subangular to subrounded sand; approximately 15% medium plasticity fines, medium to slow dilatancy; slight reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.							

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No.: TP-209 MSG3		Coordinates N: 813,822 E: 636,047		Ground Elevation: 1622.9	
Method of Excavation: Backhoe		MF-80		Date: 4-11-78		Approx. Dimensions: 5'X16.5'X17'		Logged by: J.K. Swapp			
CLASSIFICATION SYMBOL		DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)		PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC					VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	VOLUME OF HOLES SAMPLED 5 TO 9-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)
SP-SM		2.5	4 sacks	0.0-2.5 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 80% coarse to fine, angular to subrounded sand; approximately 15% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 5% non-plastic fines; slight to medium reaction with HCl. Max. size: 7 inch; Color: brown; Moisture: moist.							
GP-SP		6.5	4 sacks					5			Trace
SP		8.5	4 sacks	2.5-6.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 50% coarse to fine, angular to rounded, hard gravel, with weak to no surface coating; approximately 50% coarse to fine, angular to subrounded clean sand; trace of non-plastic fines; slight to medium reaction to HCl. Max. size: 11 inch; Color: brown; Moisture: moist.				5			5
GP		13.5	4 sacks					10			5
GP-GC		16.5	1 sack	6.5-8.5 POORLY GRADED SAND WITH COBBLES: Approximately 60% coarse to fine, subangular to subrounded, clean sand; approximately 40% coarse to fine, subangular to rounded, hard gravel, with weak to strong surface coating; trace of non-plastic fines; rapid to no reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.				5			Trace

REMARKS: Medium to sparse ground cover of mesquite and palo verde trees, greasewood bushes. Trace of surface cobbles. Maximum size boulder taken from excavation was 9"X12"X20". Moderate micaceous content throughout test pit. Stopped test pit at 16.5 feet. Material 13.5'-16.5' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No: TP-209 MSG3		Coordinates N: 813,822 E: 636,047		Ground Elevation: 1622.9	
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-11-78		Logged by: J.K. Swapp		Approx. Dimensions: 5'X16.5'X17'	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)
			8.5-13.5 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 60% coarse to fine, subangular to subrounded, hard gravel, with moderate to strong surface coating; approximately 40% coarse to fine, subangular to subrounded sand; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.								
			13.5-16.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, angular to subrounded, hard gravel, with weak to strong surface coating; approximately 35% coarse to fine, subangular to subrounded sand; approximately 5% medium plasticity fines, medium to slow dilatancy; medium to no reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.								

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No: TP-210 MSG3		Coordinates N: 814,279 E: 636,040		Ground Elevation: 1622.3	
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-11-78		Logged by: J.K. Swapp		Approx. Dimensions: 5'X8'X16'	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)
SP		4 sacks	0.0-6.5 POORLY GRADED SAND WITH COBBLES AND TRACE OF BOULDERS: Approximately 65% coarse to fine, subangular to subrounded sand; approximately 30% coarse to fine, subangular to subrounded, hard gravel; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 14 inch; Color: brown; Moisture: moist.							5	Trace
GP-GC		1 sack	6.5-8.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, angular to rounded, hard gravel, with strong to no surface coating; approximately 35% coarse to fine, subangular to subrounded sand; approximately 10% slight to medium plasticity fines, quick to medium dilatancy; slight to medium reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.							5	5

REMARKS: Slight to sparse ground cover of mesquite trees, greasewood and sagebrush. Slight to sparse amount of surface cobbles. Hairline roots to 5 foot depth. Maximum size boulder taken from excavation was 12"X14"X24". Moderate micaceous content throughout test pit. Stopped test pit at 8.0 feet. Material from 6.5' to 8.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No: TP-211 MSG3		Coordinates N: 814,738 E: 636,055		Ground Elevation: 1624.0	
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-12-78		Logged by: J.K. Swapp		Approx. Dimensions: 5'X17'X20'	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)
SM		1 sack	0.0-1.0 SILTY SAND WITH TRACE OF COBBLES: Approximately 55% coarse to fine, angular to subrounded sand; approximately 25% coarse to fine, angular to rounded, hard gravel; approximately 20% non-plastic fines, quick dilatancy; medium to no reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.								
SP		4 sacks									
SP-SM		4 sacks	1.0-5.5 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 55% coarse to fine, angular to subrounded, clean sand; approximately 45% coarse to fine, angular to subrounded, hard gravel; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.							5	Trace
GP-GC		4 sacks								10	10
GP		4 sacks	5.5-8.0 POORLY GRADED SAND WITH COBBLES: Approximately 50% coarse to fine, angular to subrounded sand; approximately 45% coarse to fine, angular to subrounded, hard gravel, with weak to strong surface coating; approximately 5% non-plastic fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.							5	5

REMARKS: Sparse ground cover of mesquite and paloverde trees, greasewood and sagebrush. Moderate to sparse amount of surface cobbles. Hairline roots to 5.0 foot depth. Maximum size cobble taken from excavation was 10"X11"X19". Moderate micaceous content throughout test pit. Stopped test pit at 17.0 feet, limit of backhoe.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Hole No: TP-211 MSG3		Coordinates N: 814,738 E: 636,055		Ground Elevation: 1624.0	
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-12-78		Logged by: J.K. Swapp		Approx. Dimensions: 5'X17'X20'	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	VOLUME OF HOLE SAMPLED 3 TO 8-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 8-INCH (LBS)
			8.0-13.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 50% coarse to fine, angular to rounded, hard gravel, with moderate to no surface coating; approximately 40% coarse to fine, angular to subrounded sand; approximately 10% slight to medium plasticity fines, medium dilatancy; medium to no reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: dry.								
			13.5-17.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, angular to rounded, hard gravel, with strong to no surface coating; approximately 45% coarse to fine, angular to subrounded sand; trace of non-plastic fines; slight reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.								

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		Creek Aggregate					
Hole No. TP-212 MSG3		Coordinates N. 815,006 E. 636,448		Ground Elevation 1626.6		Approx. Dimensions 8'X13'X18'			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-12-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)	VOLUME OF HOLES SAMPLED 5 TO 8-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)		
GM	1.0	1 sack	0.0-1.0 SILTY GRAVEL WITH COBBLES: Approximately 45% coarse to fine, angular to subrounded, hard gravel, with weak to strong surface coating; approximately 40% coarse to fine, angular to subrounded sand; approximately 15% non-plastic fines; quick dilatancy; medium to rapid reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: dry.	5		5			
SP-SM	4	4 sacks		5			Trace		
GP-GM	7.0	4 sacks				Trace	Trace		
GP-GC	9.5	1 sack	1.0-7.0 POORLY GRADED SAND WITH COBBLES: Approximately 75% coarse to fine, angular to subrounded sand; approximately 15% coarse to fine, angular to subrounded, hard gravel, with weak to moderate surface coating; approximately 10% non-plastic fines, quick dilatancy; medium to rapid reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.	10		5			
	13.0		7.0-9.5 POORLY GRADED GRAVEL WITH TRACE OF COBBLES: Approximately 50% coarse to fine, angular to subrounded, hard gravel, with moderate to strong surface coating; approximately 45% coarse to fine, angular to subrounded sand; approximately 5% non-plastic fines; medium to rapid reaction with HCl. Max. size: 6 inch; Color: tan; Moisture: dry.						

REMARKS: Sparse ground cover of mesquite and palo verde trees and greasewood bushes. Moderate amount of surface cobbles. Maximum size cobble taken from excavation was 9"X11"X14". Moderate micaceous content throughout test pit. Stopped test pit at 13.0 feet. Material from 9.5' to 13.0' unsuitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		Creek Aggregate					
Hole No. TP-212 MSG3		Coordinates N. 815,006 E. 636,448		Ground Elevation 1626.6		Approx. Dimensions 8'X13'X18'			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-12-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)	VOLUME OF HOLES SAMPLED 5 TO 8-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)		
			9.5-13.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, angular to subrounded, hard gravel, with moderate to no surface coating; approximately 30% coarse to fine, angular to subrounded sand; approximately 10% slight to medium plasticity fines, quick to medium dilatancy; slight reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		Creek Aggregate					
Hole No. TP-213 MSG3		Coordinates N. 814,715 E. 636,500		Ground Elevation 1627.5		Approx. Dimensions 6'X9'X18'			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-12-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)	VOLUME OF HOLES SAMPLED 5 TO 8-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)		
GP-GM	5.5	4 sacks	0.0-5.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded, hard gravel with weak surface coating; approximately 40% coarse to fine, angular to subrounded sand; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 7 inch; Color: brown; Moisture: moist.	5			Trace		
GP-GM	9.0	1 sack	5.5-9.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 50% coarse to fine, angular to subrounded, hard gravel, with strong to no surface coating; approximately 40% coarse to fine, angular to subrounded sand; approximately 10% slight plasticity fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 4 inch; Color: brown; Moisture: moist.	5			0		

REMARKS: Sparse amount of mesquite and palo verde trees and greasewood bushes. Moderate amount of surface cobbles. Hairline roots to 3.0 foot depth. Maximum size cobble taken from excavation was 6"X7"X10". Stopped test pit at 9.0 feet. Material from 5.5' to 9.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		Creek Aggregate					
Hole No. TP-214 MSG3		Coordinates N. 814,268 E. 636,516		Ground Elevation 1626.3		Approx. Dimensions 10'X15'X19'			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-13-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)	VOLUME OF HOLES SAMPLED 5 TO 8-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS.)		
SM-ML	2.5	1 sack	0.0-2.5 SILTY SAND: Approximately 50% medium to fine, subangular sand; approximately 50% non-plastic fines, quick dilatancy; trace of coarse to fine, predominately fine, subangular gravel; moderate reaction with HCl. Max. size: 1 inch; Color: brown; Moisture: moist.				0	0	
SP-SM	4.5	4 sacks					5	Trace	
SP	7.5	4 sacks	2.5-4.5 POORLY GRADED SAND WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded sand; approximately 35% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 10% non-plastic fines, quick dilatancy; medium to rapid reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.				5	Trace	
GP	11.0	4 sacks					10	5	
GP-GC	15.0	1 sack	4.5-7.5 POORLY GRADED SAND WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded sand; approximately 45% coarse to fine, angular to subrounded, hard gravel, with weak to strong surface coating; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 10 inch; Color: tan; Moisture: dry.				5	5	

REMARKS: Moderate to sparse ground cover of mesquite trees, greasewood and sagebrush. Hairline roots from 0.0' to 4.0'. Maximum size cobble taken from excavation was 10"X11"X18". Moderate micaceous content throughout test pit. Stopped test pit at 15.0 feet. Material from 11.0' to 15.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Coordinates N: 814,268 E: 636,516		Ground Elevation: 1626.3		Approx. Dimensions: 10'X15'X19'	
Hole No.: TP-214 MSG3		Method of Excavation: Backhoe		MF-80		Date: 4-13-78		Logged by: J.K. Swapp		Depth to Water Level: Not Reached	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)
			7.5-11.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, angular to subrounded, hard gravel, with weak to strong surface coating; approximately 40% coarse to fine, angular to subrounded sand; trace of slight plasticity fines, quick dilatancy; rapid to no reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.								
			11.0-15.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 50% coarse to fine, angular to rounded, hard gravel, with weak to strong surface coating; approximately 40% coarse to fine, angular to rounded sand; approximately 10% medium plasticity fines, medium to slow dilatancy; slight to medium reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.								
REMARKS:											

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Lbs. of rock sampled) 100
 **** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ***** Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Coordinates N: 813,831 E: 636,523		Ground Elevation: 1624.0		Approx. Dimensions: 6'X14'X19'	
Hole No.: TP-215 MSG3		Method of Excavation: Backhoe		MF-80		Date: 4-14-78		Logged by: J.K. Swapp		Depth to Water Level: Not Reached	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)
SP-SM		4 sacks	0.0-11.5 POORLY GRADED SAND WITH COBBLES AND TRACE OF BOULDERS: Approximately 55% coarse to fine, angular to subrounded sand; approximately 40% coarse to fine, angular to rounded, hard gravel; approximately 5% non-plastic fines; medium to no reaction with HCl. Max. size: 14 inch; Color: brown; Moisture: moist.							5	5
GC	11.5	1 sack	11.5-14.0 CLAYEY GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 50% coarse to fine, angular to rounded, hard gravel; approximately 35% coarse to fine, angular to subrounded sand; approximately 15% medium plasticity fines, slow dilatancy; slight reaction with HCl. Max. size: 14 inch; Color: brown; Moisture: moist.							5	5
	14.0										
REMARKS: Sparse ground cover of mesquite and palo verde trees, greasewood and sagebrush. Moderate to sparse amount of surface cobbles. Maximum size boulder taken from excavation was 9"X14"X18". Moderate micaceous content throughout test pit. Stopped test pit at 14.0 feet. Material from 11.5' to 14.0' not suitable as aggregate.											

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Lbs. of rock sampled) 100
 **** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ***** Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Coordinates N: 813,964 E: 636,994		Ground Elevation: 1626.4		Approx. Dimensions: 7'X13'X18'	
Hole No.: TP-216 MSG3		Method of Excavation: Backhoe		MF-80		Date: 4-14-78		Logged by: J.K. Swapp		Depth to Water Level: Not Reached	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)
GW-SW		4 sacks	0.0-5.0 WELL GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 50% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 50% coarse to fine, angular to subrounded sand; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 18 inch; Color: brown; Moisture: moist.							5	Trace
GP	5.0	4 sacks									
GP		4 sacks	5.0-10.5 POORLY GRADED GRAVEL WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 45% coarse to fine, angular to subrounded sand; trace of non-plastic fines, slight to no reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: wet.							10	5
GW-GC	10.5	1 sack								10	5
	13.0		10.5-13.0 WELL GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 65% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 25% coarse to fine, angular to subrounded sand; approximately 10% medium plasticity fines, slow dilatancy; slight to no reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: wet.								
REMARKS: Moderate to sparse ground cover of mesquite trees, greasewood and sagebrush. Moderate to sparse amount of surface cobbles. Hairline roots to 10.5 foot depth. Maximum size boulder taken from excavation was 10"X18"X21". Moderate micaceous content throughout test pit. Stopped test pit at 13.0 feet. Material from 10.5' to 13.0' not suitable as aggregate.											

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Lbs. of rock sampled) 100
 **** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ***** Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS											
Feature: Salt-Gila Aqueduct		Project: Central Arizona		Area Designation: Reach 3, Queen Creek Aggregate		Coordinates N: 814,257 E: 636,960		Ground Elevation: 1627.3		Approx. Dimensions: 8'X15'X19'	
Hole No.: TP-217 MSG3		Method of Excavation: Backhoe		MF-80		Date: 4-14-78		Logged by: J.K. Swapp		Depth to Water Level: Not Reached	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				PERCENTAGE OF COBBLES AND BOULDERS **			
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED 3 TO 5-INCH (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF SAMPLED 3 TO 5-INCH (PERCENT)
GP-GM		4 sacks	0.0-4.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 50% coarse to fine, angular to subrounded, hard gravel; approximately 45% coarse to fine, angular to subrounded sand; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.							5	Trace
SM-SC	4.0	1 sack									
GP-GM	7.0	4 sacks	4.0-7.0 SILTY SAND WITH COBBLES: Approximately 40% coarse to fine, angular to subrounded sand; approximately 35% coarse to fine, angular to subrounded, hard gravel, with weak to strong surface coating; approximately 25% slight plasticity fines, quick to medium dilatancy; slight to rapid reaction with HCl. Max. size: 8 inch; Color: brown; Moisture: moist.							10	5
GC	11.0	1 sack								5	5
	15.0		7.0-11.0 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 60% coarse to fine, angular to subrounded, hard gravel, with moderate to strong surface coating; approximately 35% coarse to fine, angular to subrounded sand; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 15 inch; Color: brown; Moisture: moist.								
REMARKS: Moderate ground cover of mesquite trees, greasewood and sagebrush. Hairline roots to 6.0 foot depth. Maximum size boulder taken from excavation was 14"X15"X25". Moderate micaceous content throughout test pit. Stopped test pit at 15.0 feet. Material from 11.0' to 15.0' not suitable as aggregate.											

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 *** (Lbs. of rock sampled) 100
 **** (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled)
 ***** Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		8'X15'X19'					
Note No. TP-217 MSG3		Coordinates N. 814,257 E. 636,960		Ground Elevation 1627.3		Approx. Dimensions			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-14-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF COBBLES AND BOULDERS **	
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME		PERCENTAGE BY WEIGHT
LETTER	GRAPHIC								
			11.0-15.0 CLAYEY GRAVEL WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 30% coarse to fine, angular to subrounded sand; approximately 15% medium plasticity fines, medium dilatancy; slight to no reaction with HCl. Max. size: 7 inch; Color: brown; Moisture: moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic Feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		7'X17'X19'					
Note No. TP-218 MSG3		Coordinates N. 814,629 E. 636,912		Ground Elevation 1628.9		Approx. Dimensions			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-17-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF COBBLES AND BOULDERS **	
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME		PERCENTAGE BY WEIGHT
LETTER	GRAPHIC								
SP-SM	1.0	1 sack	0.0-1.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 55% coarse to fine, angular to subrounded sand; approximately 35% coarse to fine, angular to subrounded, hard gravel; approximately 10% non-plastic fines, quick dilatancy; slight reaction with HCl. Max. size: 7 inch; Color: brown; Moisture: moist.					Trace	Trace
SP-SM	4	4 sacks						5	Trace
SP-SM	5.5	4 sacks						Trace	0
GP-GM	7.0	4 sacks	1.0-5.5 POORLY GRADED SAND WITH COBBLES: Approximately 50% coarse to fine, angular to subrounded sand; approximately 45% coarse to fine, angular to subangular, brittle to hard gravel, with weak to strong surface coating; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.					10	5
GW-GC	15.5	1 sack	5.5-7.0 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 90% coarse to fine, subangular to subrounded sand; approximately 5% coarse to fine, subangular to subrounded, hard gravel; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 4 inch; Color: brown; Moisture: moist.					5	5

REMARKS: Sparse ground cover of mesquite trees and sagebrush. Trace of surface cobbles. Hairline roots to 8.0 foot depth. Maximum size boulder taken from excavation was 8"X12"X16". Moderate micaceous content throughout test pit. Stopped test pit at 17.0 feet. Material from 15.5' to 17.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic Feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		7'X17'X19'					
Note No. TP-218 MSG3		Coordinates N. 814,629 E. 636,912		Ground Elevation 1628.9		Approx. Dimensions			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-17-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF COBBLES AND BOULDERS **	
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME		PERCENTAGE BY WEIGHT
LETTER	GRAPHIC								
			7.0-15.5 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 55% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 40% coarse to fine, angular to subrounded sand; approximately 5% non-plastic fines, quick dilatancy; slight to no reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.						
			15.5-17.0 WELL GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, angular to subrounded, hard gravel, with weak surface coating; approximately 30% coarse to fine, angular to subrounded sand; approximately 10% medium plasticity fines, slow dilatancy; slight reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic Feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature		Project		Area Designation		Reach 3, Queen Creek Aggregate			
Salt-Gila Aqueduct		Central Arizona		8'X15'X18'					
Note No. TP-219 MSG3		Coordinates N. 814,991 E. 636,839		Ground Elevation 1629.9		Approx. Dimensions			
Depth to Water Level Not Reached		Method of Excavation Backhoe		MF-80		Date 4-18-78		Logged by J.K. Swapp	
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **				VOLUME OF COBBLES AND BOULDERS **	
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT	PERCENTAGE BY VOLUME		PERCENTAGE BY WEIGHT
LETTER	GRAPHIC								
SP-SM	2.0	4 sacks	0.0-2.0 POORLY GRADED SAND WITH COBBLES AND TRACE OF BOULDERS: Approximately 50% coarse to fine, angular to subrounded sand; approximately 40% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 10% non-plastic fines, quick dilatancy; slight to rapid reaction with HCl. Max. size: 12 inch; Color: brown; Moisture: moist.					Trace	Trace
GP-GM	6.0	4 sacks						5	Trace
SP	9.5	4 sacks	2.0-6.0 POORLY GRADED GRAVEL WITH COBBLES: Approximately 60% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 35% coarse to fine, angular to subangular sand; approximately 5% non-plastic fines; slight to rapid reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.					Trace	Trace
GP-GM	13.0	4 sacks						5	5
GC	15.0	1 sack	6.0-9.5 POORLY GRADED SAND WITH TRACE OF COBBLES: Approximately 95% coarse to fine, angular to subrounded, clean sand; approximately 5% coarse to fine, subangular to subrounded, hard gravel, with weak to moderate surface coating; trace of non-plastic fines; slight to rapid reaction with HCl. Max. size: 7 inch; Color: brown; Moisture: moist.					5	5

REMARKS: Sparse ground cover of mesquite trees, greasewood and sagebrush. Sparse amount of surface cobbles. Hairline roots to 7.0 foot depth. Maximum size boulder taken from excavation was 10"X13"X13". Moderate micaceous content throughout test pit. Stopped test pit at 15.0 feet. Material from 13.0' to 15.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic Feet of hole sampled)
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: Salt-Gila Aqueduct			Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate			Site No: TP-219 MSG3
Coordinates N: 814,991 E: 636,839			Ground Elevation: 1629.9			Approx. Dimensions: 8'X15'X18'			Logged by: J.K. Swapp
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-18-78			
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SOLE SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE OF VOLUME OF SOLE SAMPLED 3 TO 5-INCH	PERCENTAGE OF WEIGHT OF SOLE SAMPLED 3 TO 5-INCH		
LETTER	GRAPHIC								
			9.5-13.0 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 50% coarse to fine, angular to rounded, hard gravel, with weak to moderate surface coating; approximately 40% coarse to fine, angular to rounded sand; approximately 10% slight plasticity fines, quick dilatancy; slight to medium reaction with HCl. Max. size: 13 inch; Color: brown; Moisture: moist.						
			13.0-15.0 CLAYEY GRAVEL WITH COBBLES: Approximately 50% coarse to fine, angular to rounded, hard gravel, with weak to moderate surface coating; approximately 35% coarse to fine, angular to subrounded sand; approximately 15% slight to medium plasticity fines, quick to medium dilatancy; slight to medium reaction with HCl. Max. size: 10 inch; Color: brown; Moisture: moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: Salt-Gila Aqueduct			Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate			Site No: TP-220 MSG3
Coordinates N: 815,283 E: 637,433			Ground Elevation: 1633.0			Approx. Dimensions: 11'X16'X20'			Logged by: J.K. Swapp
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-18-78			
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SOLE SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE OF VOLUME OF SOLE SAMPLED 3 TO 5-INCH	PERCENTAGE OF WEIGHT OF SOLE SAMPLED 3 TO 5-INCH		
LETTER	GRAPHIC								
SP-SM	4	4 sacks	0.0-5.5 POORLY GRADED SAND WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded sand; approximately 40% coarse to fine, angular to rounded, hard gravel, with weak to no surface coating; approximately 5% non-plastic fines; slight to medium reaction with HCl. Max. size: 11 inch; Color: brown; Moisture: moist.			5			Trace
GP-SP	5.5	4 sacks				5			5
SP-SM	9.0	4 sacks	5.5-9.0 POORLY GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 50% coarse to fine, angular to subrounded, hard gravel, with weak to no surface coating; approximately 50% coarse to fine, angular to subrounded sand; trace of non-plastic fines; slight to medium reaction with HCl. Max. size: 14 inch; Color: brown; Moisture: moist.			5			Trace
GW-GC	14.5	1 sack				10			5
	16.0		9.0-14.5 POORLY GRADED SAND WITH COBBLES: Approximately 50% coarse to fine, angular to subrounded sand; approximately 45% coarse to fine, angular to subrounded, hard gravel, with strong to no surface coating; approximately 5% slight plasticity fines, with quick dilatancy; medium to rapid reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.						

REMARKS: Moderate to sparse ground cover of mesquite trees, greasewood and sagebrush. Moderate to sparse amount of surface cobbles. Hairline roots to 8.0 foot depth. Maximum size boulder taken from excavation was 11"X14"X20". Moderate micaceous content throughout test pit. Stopped test pit at 16.0 feet. Material from 14.5' to 16.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: Salt-Gila Aqueduct			Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate			Site No: TP-220 MSG3
Coordinates N: 815,283 E: 637,433			Ground Elevation: 1633.0			Approx. Dimensions: 11'X16'X20'			Logged by: J.K. Swapp
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-18-78			
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SOLE SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE OF VOLUME OF SOLE SAMPLED 3 TO 5-INCH	PERCENTAGE OF WEIGHT OF SOLE SAMPLED 3 TO 5-INCH		
LETTER	GRAPHIC								
			14.5-16.0 WELL GRADED GRAVEL WITH COBBLES AND TRACE OF BOULDERS: Approximately 60% coarse to fine, angular to subrounded, hard gravel; approximately 30% coarse to fine, angular to subrounded sand; approximately 10% medium plasticity fines, slow dilatancy; no reaction with HCl. Max. size: 15 inch; Color: brown; Moisture: moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: Salt-Gila Aqueduct			Project: Central Arizona			Area Designation: Reach 3, Queen Creek Aggregate			Site No: TP-221 MSG3
Coordinates N: 814,682 E: 637,430			Ground Elevation: 1629.9			Approx. Dimensions: 4'X9'X20'			Logged by: J.K. Swapp
Depth to Water Level: Not Reached		Method of Excavation: Backhoe		MF-80		Date: 4-18-78			
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF SOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SOLE SAMPLED 3 TO 5-INCH (LBS)	PERCENTAGE OF VOLUME OF SOLE SAMPLED 3 TO 5-INCH	PERCENTAGE OF WEIGHT OF SOLE SAMPLED 3 TO 5-INCH		
LETTER	GRAPHIC								
SP-SM	4	4 sacks	0.0-7.5 POORLY GRADED SAND WITH COBBLES: Approximately 55% coarse to fine, angular to subrounded sand; approximately 40% coarse to fine, angular to subrounded, hard gravel, with weak surface coating; approximately 5% non-plastic fines; slight to medium reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.			5			Trace
GM	7.5	1 sack				5			Trace
	9.0		7.5-9.0 SILTY GRAVEL WITH COBBLES: Approximately 45% coarse to fine, angular to subangular, hard gravel, with weak surface coating; approximately 40% coarse to fine, angular to subangular sand; approximately 15% non-plastic fines; slight to rapid reaction with HCl. Max. size: 9 inch; Color: brown; Moisture: moist.						

REMARKS: Moderate to sparse ground cover of mesquite and palo verde trees, greasewood and sagebrush. Slight to moderate amount of surface cobbles. Hairline roots to 4.0 foot depth. Maximum size cobble taken from excavation was 7"X9"X12". Stopped test pit at 9.0 feet. Material from 7.5' to 9.0' not suitable as aggregate.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT Central Arizona FEATURE Salt Gila Aqueduct - Reach 3
Queen Creek Aggregate Investigations

TABLE 2-MSG3 SHEET 1 OF 5

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST			
				FINES		SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO NO. 10 (2.0 mm)	COBBLES 10 (2.0 mm) TO 5 (127 mm)	OVERSIZE LARGER THAN 5 (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	PLUS NO. 4			MAXIMUM DRY DENSITY - pcf (gm/cm ³)	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE - psi (kg/cm ²)
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm								MINUS NO. 4	BULK	APPARENT			
TP-201MSG3		0.0-6.0	SP	1	0	91	8											
		6.0-10.5	SP	2	0	52	46											
		10.5-13.0	GW-GC	6	1	31	62		50	31								
TP-202MSG3		0.0-3.5	GP	1	2	43	54				2.68	2.57	1.9					
		3.5-7.0	SP	1	2	58	39						2.59	2.0				
		7.0-10.0	SM-SC	7	15	48	30		20	7			2.55	2.1				
TP-203MSG3		0.0-6.0	SP	0	1	60	39						2.55	2.0				
		6.0-17.0	GP-GM	3	4	35	58						2.59	1.7				
TP-204MSG3		0.0-3.0	SP	1	1	59	39						2.55	2.0				
		3.0-6.0	SP	1	3	80	16				2.66	2.53	2.3					
		6.0-9.0	GW	2	1	29	68		19	6			2.59	1.5				
		9.0-17.0	GW	3	1	42	54		21	8			2.57	1.6				

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

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TABLE 2-MSG3 SHEET 1 OF 5

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT Central Arizona FEATURE Salt Gila Aqueduct - Reach 3
Queen Creek Aggregate Investigations

TABLE 2-MSG3 SHEET 2 OF 5

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST			
				FINES		SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO NO. 10 (2.0 mm)	COBBLES 10 (2.0 mm) TO 5 (127 mm)	OVERSIZE LARGER THAN 5 (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	PLUS NO. 4			MAXIMUM DRY DENSITY - pcf (gm/cm ³)	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE - psi (kg/cm ²)
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm								MINUS NO. 4	BULK	APPARENT			
TP-205MSG3		0.0-5.0	SP-SM	2	4	63	31											
		5.0-10.0	GP-GM	3	2	35	60		18	6			2.58	1.8				
		10.0-17.0	GW	3	1	31	65		23	9			2.60	1.5				
TP-207MSG3		0.0-2.0	SP	1	2	71	26							2.61	1.6			
		2.0-6.0	GP	1	1	44	54						2.64	1.6				
		6.0-12.0	GP	2	1	39	58					2.65	2.62	1.5				
TP-209MSG3		12.0-14.0	GW-GC	3	2	27	68		22	9			2.62	1.5				
		0.0-2.5	SP-SM	1	5	70	24						2.51	2.3				
		2.5-6.5	GP-SP	1	1	50	48						2.60	1.9				
		6.5-8.5	SP	2	1	57	40						2.62	1.7				
		8.5-13.5	GP	2	1	39	58						2.62	1.9				
		13.5-16.5	GP-GC	6	1	35	58		44	28			2.54	1.9				

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

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TABLE 2-MSG3 SHEET 2 OF 5

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT Central Arizona FEATURE Salt Gila Aqueduct - Reach 3
Queen Creek Aggregate Investigations

TABLE 2-MSG3 SHEET 3 OF 5

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST			
				FINES		SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO NO. 10 (2.0 mm)	COBBLES 10 (2.0 mm) TO 5 (127 mm)	OVERSIZE LARGER THAN 5 (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	PLUS NO. 4			MAXIMUM DRY DENSITY - pcf (gm/cm ³)	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE - psi (kg/cm ²)
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm								MINUS NO. 4	BULK	APPARENT			
TP-211MSG3		0.0-1.0	SM	2	18	56	24											
		1.0-5.5	SP	1	1	55	43							2.63	1.5			
		5.5-8.0	SP	2	2	49	47							2.58	2.0			
		8.0-13.5	GP-GC	3	4	41	52		20	8			2.61	2.57	2.0			
TP-213MSG3		13.5-17.0	GP	2	1	43	54							2.56	1.9			
		0.0-5.5	GP	1	2	41	56							2.58	2.0			
		5.5-9.0	GP-GM	3	5	40	52		18	6			2.53	2.2				
TP-214MSG3		0.0-2.5	SM-ML	4	48	48	0											
		2.5-4.5	SP-SM	3	7	57	33							2.62	1.4			
		4.5-7.5	SP	0	1	52	47							2.60	1.8			
		7.5-11.0	GP	3	1	37	59		19	7			2.62	2.62	1.4			
		11.0-15.0	GP-GC	7	1	42	50		35	20			2.58	1.6				

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

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TABLE 2-MSG3 SHEET 3 OF 5

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

PROJECT Central Arizona FEATURE Salt Gila Aqueduct - Reach 3
Queen Creek Aggregate Investigations

TABLE 2-MSG3 SHEET 4 OF 5

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	PARTICLE-SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST			
				FINES		SAND NO. 200 (0.075 mm) TO NO. 4 (4.75 mm)	GRAVEL NO. 4 (4.75 mm) TO NO. 10 (2.0 mm)	COBBLES 10 (2.0 mm) TO 5 (127 mm)	OVERSIZE LARGER THAN 5 (127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	PLUS NO. 4			MAXIMUM DRY DENSITY - pcf (gm/cm ³)	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE - psi (kg/cm ²)
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm								MINUS NO. 4	BULK	APPARENT			
TP-216MSG3		0.0-5.0	SW	2	1	49	48											
		5.0-10.5	GP	3	1	43	53							2.60	1.7			
		10.5-13.0	GW-GC	4	1	28	67		36	21			2.57	1.5				
TP-218MSG3		0.0-1.0	SP-SM	1	5	59	35								2.59	1.6		
		1.0-5.5	SP	1	1	52	46							2.60	1.7			
		5.5-7.0	SP	2	2	90	6							T	-			
TP-220MSG3		7.0-15.5	GP	2	2	41	55							2.63	2.61	1.9		
		15.5-17.0	GW-GC	7	3	28	62		51	32			2.60	1.7				
		0.0-5.5	SP	1	1	56	42							2.55	2.2			
		5.5-9.0	SP	1	1	51	47							2.60	1.7			
		9.0-14.5	SP-SM	3	2	48	47							2.56	2.0			
		14.5-16.0	GW-GC	5	2	31	62		41	23			2.59	2.0				

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

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TABLE 2-MSG3 SHEET 4 OF 5

Table 2. - Summary of quality of coarse aggregate
Sample No. M-6991

		M-6991	
		Percentage by particle count	
		38 mm to 19 mm	19 mm to 9.5 mm
Physical quality	Satisfactory	88.0	90.1
	Fair	10.1	9.3
	Poor	1.9	0.6
Chemical quality	Alkali-reactive	15.7	14.7

Remarks:

Particle shape: The particles are essentially subrounded with about 11 percent rounded and 11 percent flattened and/or elongated in shape.

Encrustations: About 2.5 percent of the particles are 5 to 25 percent covered with a thin calcium carbonate coating which is well bonded to the particle surface.

The 4.75-mm-size material appears similar lithologically and physically to the 19-mm- to 9.5-mm-size fraction.

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Table 3. - Petrographic examination of coarse sand
Sample No. M-6991

Rock and mineral types	M-6991		
	Percentage by particle count		
	2.36 mm	1.18 mm	600 μm
Quartz grains, quartzose sandstone, and quartzite	36.0	42.0	46.0
Miscellaneous metamorphics - includes quartz-mica schist and granitic gneiss	28.5	29.0	29.0
Altered volcanics - includes rhyolites and rhyodacites	9.0	5.0	4.0
Glassy volcanics - includes rhyolites and rhyodacites	5.5	3.0	3.0
Granitics - includes granite-diorite series rocks	7.0	7.0	3.0
Chert	10.0	4.0	5.5
Feldspar	3.0	8.0	7.0
Carbonates - includes limestone and dolomite	0.5	0.5	-
Basalt	0.5	1.0	0.5
Mica - includes muscovite and biotite	-	0.5	2.0
Percent unsound	1.0	0.5	-
Percent alkali reactive	15.5	7.0	8.5
Percent flat	3.0	*	*
Percent calcium carbonate coated	1.0	*	*

* Not determined.

Remarks: The fine and coarse sands are mostly subangular to subrounded in shape. The fine sands consist of decreasing amounts of the fine-grained rock types found in the coarse sands and increasing amounts of monomineralic grains of quartz, feldspar, chert, hornblende, mica, calcite, magnetite, iron oxides, and clays, as well as minor glass shards and a few miscellaneous detrital minerals.

The fine sands contain no physically unsound material and about 2 percent potentially alkali-reactive chert and glassy volcanics.

The material removed by washing, about 6 percent by weight, consists of the same material found in the fine sand sizes in addition to minor organic debris and traces of opal. No chloride (salt) or sulfate (gypsum) was detected chemically in the samples.

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Salt-Gila Aqueduct, Reach 1A—Central Arizona Project—Arizona. View of representative material excavated from TP-207-MSG3 (Materials Queen Creek). Proposed aggregate source SE¼ sec. 24, T. 2 S., R. 8 E. and SW¼ sec. 19, T. 2 S., R. 9 E. Photo CN344-330-4418

SALT RIVER AGGREGATE SOURCE LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: SALT RIVER		Project: CENTRAL ARIZONA		Hole No. AP-23-MSR					
Area Designation: Salt River		Coordinates: NE 1/4 Sec. 28, T2N, R6E		Ground Elevation: Approx. 1,285		Depth to Ground Water Level: Not reached		Hole Logged By: Winzer	
Method of Excavation: Bucket Auger		Approximate Dimensions of Hole: 4' Dia. x 17' Deep		Dates of Excavation: 4/2-6/70					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)		
SM	0.0-8.0	None	0.0-8.0 SILTY SAND : About 60% fine sand; 40% silt. Max. Size: Sand; Color: Light Brown; Moisture: Dry.			0	0		
	8.0-12.0	None	8.0-12.0 GRAVELLY SAND WITH COBBLES: About 85% fine to coarse sand; 15% fine to coarse hard, rounded gravel. Max. Size: 3"; Color: Light Brown; Moisture: Dry.						
SP	12.0-17.0	None	12.0-17.0 SAND : Mostly fine to medium sand; trace of gravel. Max. Size: Sand; Color: Light Brown; Moisture: Dry.			Trace	Trace		
SP	17.0	None				0	0		

REMARKS: Used water to retard caving. Stopped augering due to excessive caving.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

SALT RIVER AGGREGATE SOURCE LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: SALT RIVER		Project: CENTRAL ARIZONA		Hole No. AP-30-MSR					
Area Designation: Salt River		Coordinates: NW 1/4 Sec. 27, T2N, R6E		Ground Elevation: Approx. 1,300		Depth to Ground Water Level: Not reached		Hole Logged By: Winzer	
Method of Excavation: Bucket Auger		Approximate Dimensions of Hole: 3 1/2' Dia. x 20' Deep		Dates of Excavation: 4/8-10/70					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)		
SM	0.0-1.0	None	0.0-1.0 SILTY SAND : About 70% fine sand; 30% slightly plastic fines. Max. Size: Sand; Color: Light Brown; Moisture: Dry.			0	0		
SW	1.0-18.0	None	1.0-18.0 SAND WITH COBBLES : Mostly fine to coarse sand; trace of slightly plastic fines; trace of hard, rounded gravel. Max. Size: 5"; Color: Light Brown; Moisture: Dry.						
	18.0-18.5	None	18.0-18.5 SANDY SILT : About 70% slightly plastic fines; 30% fine sand. Max. Size: Sand; Color: Light Brown; Moisture: Dry.			Trace	0		
	18.5-20.0	None	18.5-20.0 SILTY GRAVEL WITH BOULDERS : About 50% fine to coarse, hard rounded gravel; 30% slightly plastic fines; 20% fine to coarse sand. Max. Size: 12"; Color: Light Brown; Moisture: Dry.						
ML	18.0	None				0	0		
GM	18.5	None				20	50		

REMARKS: Used 1 1/2-foot casing. Added water to retard caving. Augering stopped due to cobbles and boulders in hole.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

SALT RIVER AGGREGATE SOURCE LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: SALT RIVER		Project: CENTRAL ARIZONA		Hole No. AP-35-MSR					
Area Designation: Salt River		Coordinates: SE 1/4 Sec. 22, T.2N., R6E		Ground Elevation: Approx. 1,300		Depth to Ground Water Level: Not reached		Hole Logged By: Winzer	
Method of Excavation: Bucket Auger		Approximate Dimensions of Hole: 3 1/2' Dia. x 5' Deep		Dates of Excavation: 4/8/70					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)		
GM	0.0-5.0	None	0.0-5.0 SILTY GRAVEL WITH COBBLES : About 70% fine to coarse, hard, rounded gravel; 20% fine to coarse sand; 10% slightly plastic fines. Max. Size: 8"; Color: Light Brown; Moisture: Dry.			40	20		

REMARKS: Added water to retard caving. Stopped augering due to cobbles.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

SALT RIVER AGGREGATE SOURCE LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Feature: SALT RIVER		Project: CENTRAL ARIZONA		Hole No. PIT-61-MSR					
Area Designation: Salt River		Coordinates: NW 1/4 Sec. 27, T2N, R6E		Ground Elevation: Approx. 1,280		Depth to Ground Water Level: Not reached		Hole Logged By: Winzer	
Method of Excavation: SHOVEL		Approximate Dimensions of Hole: 3' wide x 25' deep		Dates of Excavation: 4/7/70					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION" GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (VOLUME OF HOLE SAMPLED 3 TO 5-INCH)		
ML-SM	0.0-5.0	50 lb	0.0-5.0 SANDY SILT-SILTY SAND : About 55% silt; 45% fine sand; trace of gravel; layer of fine sand at 4-5'. Max. Size: Sand; Color: Light Brown; Moisture: 0-4' Dry; 4-5' Damp.			0	0		
GP	5.0-13.0	250 lb	5.0-13.0 SANDY GRAVEL WITH COBBLES : About 75% fine to coarse, hard, rounded gravel; 25% fine to coarse sand. Max. Size: 8"; Color: Light Brown; Moisture: Damp.			25	10		
GP-SP	13.0-25.0	300 lb	13.0-25.0 SANDY GRAVEL-GRAVELLY SAND WITH COBBLES : About 55% fine to coarse, hard, rounded gravel; 45% fine to coarse sand. Max. Size: 8"; Color: Light Brown; Moisture: Damp.			15	15		

REMARKS: Rev. 1-31-75 Addition to Remarks
Site is in gravel pit. Sample taken from channel on side of pit, combined, and transmitted to Denver laboratory for testing. Only lot #1 of this tract (South of midchannel of Salt River, Salt River Indian Reservation Boundary) can be used for aggregate.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE									
FOR BORROW AND FOUNDATION INVESTIGATIONS					Salt River				
Feature		Project			Area Designation		Aggregate Source		
Granite Reef Aqueduct		Salt-Gila Aqueduct			Central Arizona		Central Arizona		
Hole No. TP-101-MSR		Coordinates N 905,764 E 554,992		Ground Elevation 1263.8		Approx. Dimensions 9'x17.5'x20'		Logged by R. Burger	
Depth to Water Level: Not reached		Method of Excavation: Backhoe--Case Model 780			Date: 10/21/75				
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL		PERCENTAGE OF COBBLES AND BOULDERS **				
			GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED LBS. TO 5-INCH	PERCENTAGE OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	WEIGHT OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	PERCENTAGE BY PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH
GP	7.0	2 sacks	0.0-7.0 Poorly Graded Gravel with Cobbles: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, angular to subrounded sand; 5% non-plastic fines. Strata were lensed with varying percentages of sand and gravel. Weak to no surface coating. Slight reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry to moist.				10		5
GP	17.5	2 sacks	7.0-17.5 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, angular to subrounded sand; 5% non-plastic fines. No surface coating. None to slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist to wet.				15		10

REMARKS: Sparse cover of paloverde trees and small bushes. Maximum size of boulder taken from excavation was 9"x12"x16". Hairline roots to 5.0'. Limit of equipment was 17.5'.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE									
FOR BORROW AND FOUNDATION INVESTIGATIONS					Salt River				
Feature		Project			Area Designation		Aggregate Source		
Granite Reef Aqueduct		Salt-Gila Aqueduct			Central Arizona		Central Arizona		
Hole No. TP-102-MSR		Coordinates N 905,770 E 554,478		Ground Elevation 1270.6		Approx. Dimensions 16'x19'x20'		Logged by R. Burger	
Depth to Water Level: Not reached		Method of Excavation: Backhoe--Case Model 780			Date: 10/23/75				
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL		PERCENTAGE OF COBBLES AND BOULDERS **				
			GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED LBS. TO 5-INCH	PERCENTAGE OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	WEIGHT OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	PERCENTAGE BY PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH
			10.0-16.0 Poorly Graded Gravel with Boulders: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, angular to subrounded, clean sand. Weak to no surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: damp to moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE									
FOR BORROW AND FOUNDATION INVESTIGATIONS					Salt River				
Feature		Project			Area Designation		Aggregate Source		
Granite Reef Aqueduct		Salt-Gila Aqueduct			Central Arizona		Central Arizona		
Hole No. TP-102-MSR		Coordinates N 905,770 E 554,478		Ground Elevation 1270.6		Approx. Dimensions 16'x19'x20'		Logged by R. Burger	
Depth to Water Level: Not reached		Method of Excavation: Backhoe--Case Model 780			Date: 10/23/75				
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL		PERCENTAGE OF COBBLES AND BOULDERS **				
			GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED LBS. TO 5-INCH	PERCENTAGE OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	WEIGHT OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	PERCENTAGE BY PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH
SP-GP	3.2	1 sack	0.0-3.2 Poorly Graded Sand with Cobbles: About 50% coarse to fine, predominantly medium to fine, angular to subrounded sand; 45% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. Strata were lensed with varying percentages of sand and gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 8"; Color: multicolored; Moisture: dry.					5	Trace
SP	4.2	No sample						0	0
SP	10.0	2 sacks	3.2-4.2 Poorly Graded Sand: About 95% coarse to fine, predominantly fine, angular to subrounded sand; 5% nonplastic fines; trace of fine, hard gravel. Weak surface coating. Medium reaction to HCl. Max. size: 3/8"; Color: brown; Moisture: dry.					10	5
GP-SP	16.0	2 sacks	4.2-10.0 Poorly Graded Sand with Boulders: About 55% coarse to fine, predominantly medium to fine, angular to subrounded, clean sand; 45% coarse to fine, flat to subrounded, hard gravel. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: dry to damp.					10	10

REMARKS: Moderate cover of small bushes. Few surface cobbles in area. Maximum size of boulder taken from the excavation was 8"x12"x17". Hairline roots to 5.0'. Unable to excavate below 16.0' because hole caved very badly.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE									
FOR BORROW AND FOUNDATION INVESTIGATIONS					Salt River				
Feature		Project			Area Designation		Aggregate Source		
Granite Reef Aqueduct		Salt-Gila Aqueduct			Central Arizona		Central Arizona		
Hole No. TP-103-MSR		Coordinates N 905,998 E 554,634		Ground Elevation 1269.8		Approx. Dimensions 16.5'x20'x25'		Logged by R. Burger	
Depth to Water Level: Not reached		Method of Excavation: Backhoe--Case Model 780			Date: 10/23/75				
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL		PERCENTAGE OF COBBLES AND BOULDERS **				
			GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS		VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED LBS. TO 5-INCH	PERCENTAGE OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	WEIGHT OF PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH	PERCENTAGE BY PLUS 8-INCH VOLUME OF SAMPLED LBS. TO 5-INCH
SP	10.0	2 sacks	0.0-10.0 Poorly Graded Sand with Cobbles: About 65% coarse to fine, angular to subrounded, clean sand; 35% coarse to fine, flat to subrounded, hard gravel. Strata were lensed with varying percentages of sand and gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry to damp.					5	5
GP-SP	16.9	2 sacks	10.0-16.5 Poorly Graded Gravel with Boulders: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, predominantly medium to fine, angular to subrounded, clean sand. Weak surface coating. Slight to medium reaction to HCl. Max. size: 14"; Color: multicolored; Moisture: damp to moist.					10	5

REMARKS: Moderate cover of small bushes. Few surface cobbles and boulders in area. Hole caved very badly, unable to excavate below 16.5'. Maximum size of boulder taken from excavation was 12"x14"x18". Hairline roots to 5.0'.

NOTES: Record water test and density test data, if applicable, under remarks. * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. (Lbs. of rock sampled) 100 (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation		Coordinates N		Ground Elevation	
TP-104-MSR		906,539 E 554,838		1269.9		11'x16'x18'		R. Burger	
Depth to Water Level		Method of Excavation		Date		Logged by			
Not reached		Backhoe--Case Model 780		10/24/75		R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF WEIGHT OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)			
GP-SP	2	2 sacks	0.0-10.0 Poorly Graded Gravel with Cobbles: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, predominantly medium to fine, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 10"; Color: multicolored; Moisture: dry to moist.	5	5				
SP-GP	10.0	2 sacks	10.0-14.0 Poorly Graded Sand with Boulders: About 50% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 45% coarse to fine, flat to subrounded, hard gravel; 5% slightly plastic fines. Weak surface coating. Slight reaction to HCl. Max. size: 16"; Color: multicolored; Moisture: moist to wet.	10	10				
GP	14.0	1 sack	14.0-16.0 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% medium-plasticity fines. Weak clay surface coating. No reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: wet.	10	10				

REMARKS: Sparse to moderate cover of small bushes. Considerable surface cobbles and few boulders in area. Few clay balls were found in the 10.0' to 16.0' strata. Maximum size of boulder taken from excavation was 9'x16'x18". Hairline roots 6.0'. Limit of equipment was 16.0'.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record of water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 *** Bulk specific gravity of rock 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation		Coordinates N		Ground Elevation	
TP-105-MSR		906,821 E 554,929		1271.7		9'x18'x19'		R. Burger	
Depth to Water Level		Method of Excavation		Date		Logged by			
Not reached		Backhoe--Case Model 780		10/10/75		R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF WEIGHT OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)			
GP-SP	2	2 sacks	0.0-13.0 Poorly Graded Gravel with Cobbles: About 50% coarse to fine, predominantly coarse to medium, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded sand; 5% slight-plasticity fines. Weak surface coating. Slight reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry to moist.	20	10				
GP	13.0	2 sacks	13.0-18.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, predominantly coarse to medium, flat to subrounded, hard gravel; 35% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight reaction to HCl. Max. size: 18"; Color: multicolored; Moisture: moist to wet.	20	15				

REMARKS: Sparse cover of small bushes and few surface cobbles and boulders throughout the area. Trace of clay balls in strata from 0' to 13.0'. Maximum size of boulder taken from excavation was 9'x18'x20". Hairline roots to 7.0'. Limit of equipment was 18.0'.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record of water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 *** Bulk specific gravity of rock 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation		Coordinates N		Ground Elevation	
TP-106-MSR		906,986 E 555,338		1271.7		12'x17.5'x19'		R. Burger	
Depth to Water Level		Method of Excavation		Date		Logged by			
Not reached		Backhoe--Case Model 780		10/10/75		R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF WEIGHT OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)			
SP	2.0	No sample	0.0-2.0 Poorly Graded Sand with Boulders: About 65% coarse to fine, angular to subrounded sand; 30% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: dry to moist.	10	5				
GP	2	2 sacks	2.0-11.0 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist.	15	5				
GP	11.0	2 sacks	11.0-17.5 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, angular to subrounded, clean sand; 5% nonplastic fines. No surface coating. No reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist to wet.	15	15				

REMARKS: Sparse cover of paloverde trees and small bushes. Hole caved some while excavating. Maximum size of boulder taken from excavation was 8'x12'x21". Hairline roots to 8.0'. Limit of equipment was 17.5'.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record of water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 *** Bulk specific gravity of rock 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation		Coordinates N		Ground Elevation	
TP-107-MSR		907,256 E 555,650		1269.9		16'x18'x24'		R. Burger	
Depth to Water Level		Method of Excavation		Date		Logged by			
Not reached		Backhoe--Case Model 780		10/9/75		R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF WEIGHT OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS) TO 5-INCH (LBS) PLUS 5-INCH (LBS)			
SP-SM	2.0	No sample	0.0-2.0 Poorly Graded Sand with Boulders: About 50% coarse to fine, predominantly fine, angular to subrounded sand; 40% coarse to fine, flat to subrounded, hard gravel; 10% nonplastic, quick dilatancy, no toughness, no dry strength fines. Weak surface coating. Slight to medium reaction to HCl. Max. size: 18"; Color: multicolored; Moisture: dry to damp.	10	25				
GP	6.5	1 sack	2.0-6.5 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight to no reaction to HCl. Max. size: 16"; Color: multicolored; Moisture: damp to moist.	10	5				
GP-SP	16.0	2 sacks	6.5-16.0 Poorly Graded Sand with Boulders: About 50% coarse to fine, angular to subrounded sand; 45% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. Weak surface coating. Slight to no reaction to HCl. Max. size: 14"; Color: multicolored; Moisture: moist.						

REMARKS: Moderate cover of ironwood trees and greasewood bushes. Considerable surface cobbles and boulders in area. Hole caved quite badly during excavation. Maximum size of boulder taken from excavation was 16'x18'x24". Hairline roots to 4.0'. Limit of equipment was 16.0'.

NOTES: Record water test and density test data, if applicable, under remarks.
 * Record of water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
 ** Applicable only to borrow pits and to foundations which are potential sources of construction materials.
 (Lbs. of rock sampled) 100
 *** Bulk specific gravity of rock 62.4 (Cubic feet of hole sampled)
 Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS										
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Hole No: TP-108-MSR			Project: Central Arizona Coordinates N: 906,916 ; 555,863 Ground Elevation: 1280.4 Method of Excavation: Backhoe--Case Model 780 Date: 10/9/75			Salt River Area Designation: Aggregate Source Approx. Dimensions: 15'x16'x23' Logged by: R. Burger				
DEPTH TO WATER LEVEL	CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
Not reached	LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	VOLUME OF HOLES SAMPLED 5 TO 10-INCH (CUBIC FEET)	WEIGHT OF PLUS 10-INCH (LBS.)	PERCENTAGE BY WEIGHT
	SM		1 sack	0.0-5.0 Silty Sand: About 85% coarse to fine, predominantly fine, angular to subrounded sand; 15% nonplastic, quick dilatancy, no toughness, no dry strength fines. Trace of fine, hard gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 3/8"; Color: brown; Moisture: dry.			0			0
	SP-GP		2 sacks	5.0-11.0 Poorly Graded Sand with Cobbles: About 50% coarse to fine, predominantly fine, angular to subrounded sand; 45% coarse to fine, angular to subrounded, hard gravel; 5% nonplastic fines. Strata were lensed with varying percentages of sand and gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry.			5			Trace
	GP-SP		2 sacks				Trace			Trace
				11.0-15.0 Poorly Graded Gravel with Traces of Cobbles: About 50% coarse to fine, angular to subrounded, hard gravel; 45% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight to medium reaction to HCl. Max. size: 5"; Color: multicolored; Moisture: dry to damp.						

REMARKS: Sparse to moderate cover of paloverde trees and greasewood bushes. Maximum size of cobble taken from excavation was 8"x9"x15". Hairline roots to 11.0'. Unable to excavate below 15.0' with equipment as hole caved badly.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS										
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Hole No: TP-109-MSR			Project: Central Arizona Coordinates N: 906,692 ; 555,609 Ground Elevation: 1277.0 Method of Excavation: Backhoe--Case Model 780 Date: 10/14/75			Salt River Area Designation: Aggregate Source Approx. Dimensions: 15'x15'x24' Logged by: R. Burger				
DEPTH TO WATER LEVEL	CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
Not reached	LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	VOLUME OF HOLES SAMPLED 5 TO 10-INCH (CUBIC FEET)	WEIGHT OF PLUS 10-INCH (LBS.)	PERCENTAGE BY WEIGHT
	SP-SM		No sample	0.0-3.0 Silty Sand: About 90% coarse to fine, predominantly fine, angular to subrounded sand; 10% nonplastic, quick dilatancy, no toughness, no dry strength fines. Trace of angular, hard gravel. Weak to moderate surface coating. Rapid reaction to HCl. Max. size: #4; Color: brown; Moisture: dry.			0			0
	SP		1 sack				5			Trace
	GP		1 sack	3.0-6.5 Poorly Graded Sand with Boulders: About 60% coarse to fine, predominantly fine, angular to subrounded sand; 35% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. Moderate surface coating. Medium to rapid reaction to HCl. Max. size: 17"; Color: multicolored; Moisture: dry to damp.			15			Trace
	SC		No sample				0			0
	GP-SP		1 sack	6.5-10.0 Poorly Graded Gravel with Cobbles: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: damp to moist.						Trace

REMARKS: Moderate cover of paloverde trees, greasewood bushes, and staghorn cacti. Unable to excavate pit below 15.0' because the banks caved badly. Maximum size of boulder taken from pit was 8"x17"x21". Hairline roots to 8.0'.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS										
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Hole No: TP-109-MSR			Project: Central Arizona Coordinates N: 906,692 ; 555,609 Ground Elevation: 1277.0 Method of Excavation: Backhoe--Case Model 780 Date: 10/14/75			Salt River Area Designation: Aggregate Source Approx. Dimensions: 15'x15'x24' Logged by: R. Burger				
DEPTH TO WATER LEVEL	CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
Not reached	LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	VOLUME OF HOLES SAMPLED 5 TO 10-INCH (CUBIC FEET)	WEIGHT OF PLUS 10-INCH (LBS.)	PERCENTAGE BY WEIGHT
				10.0-13.5 Clayey Sand: About 60% coarse to fine, predominantly fine, angular to subrounded sand; 35% medium-plasticity, slow dilatancy, slight to medium toughness, high dry strength fines; 5% fine, hard gravel. Strata were lensed with varying percentages of sand and gravel. Moderate surface coating. Medium to rapid reaction to HCl. Max. size: 3/8"; Color: brown; Moisture: moist.						
				13.5-15.0 Poorly Graded Sand with Cobbles: About 50% coarse to fine, angular to subrounded sand; 45% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. No surface coating. None to slight reaction to HCl. Max. size: 4"; Color: multicolored; Moisture: moist.						

REMARKS:

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS										
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Hole No: TP-110-MSR			Project: Central Arizona Coordinates N: 906,552 ; 555,199 Ground Elevation: 1269.8 Method of Excavation: Backhoe--Case Model 780 Date: 10/10/75			Salt River Area Designation: Aggregate Source Approx. Dimensions: 11'x18'x20' Logged by: R. Burger				
DEPTH TO WATER LEVEL	CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
Not reached	LETTER	GRAPHIC			VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF PLUS 5-INCH (LBS.)	PERCENTAGE BY WEIGHT	VOLUME OF HOLES SAMPLED 5 TO 10-INCH (CUBIC FEET)	WEIGHT OF PLUS 10-INCH (LBS.)	PERCENTAGE BY WEIGHT
	SP		1 sack	0.0-3.5 Poorly Graded Sand with Boulders: About 55% coarse to fine, angular to subrounded, clean sand; 45% coarse to fine, flat to subrounded, hard gravel. Strata were lensed with varying percentages of sand and gravel. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: dry to moist.			10			5
	GP		2 sacks	3.5-18.0 Poorly Graded Gravel with Cobbles: About 55% coarse to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: moist to wet.			20			10

REMARKS: Sparse cover of greasewood bushes. Considerable surface cobbles and few surface boulders in the area. Maximum size of boulder taken from excavation was 7"x12"x24". Hairline roots to 8.0'. 18.0' depth was the limit of the equipment.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Project Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation					
TP-111-MSR		Central Arizona		Aggregate Source					
Coordinates N. 906,353 E. 554,906		Ground Elevation 1265.9		Approx. Dimensions 15'x18'x20'					
Depth to Water Level: Not reached		Method of Excavation Backhoe--Case Model 780		Date 10/14/75		Logged by R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)		
GP	1.2	No sample	0.0-1.2 Poorly Graded Gravel with Boulders: About 65% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: dry to damp.			20	10		
SP-SM	2.5	No sample				0	0		
GP	2	2 sacks	Poorly Graded Sand: 1.2-2.5 A About 85% coarse to fine, angular to subrounded sand; 10% nonplastic, quick dilatancy, no toughness, slight dry strength fines; 5% fine, hard gravel. Weak to moderate surface coating. Medium to rapid reaction to HCl. Max. size: 3/8"; Color: brown; Moisture: moist.			10	5		
GP	10.0	2 sacks	2.5-10.0 Poorly Graded Gravel with Boulders: About 65% coarse to fine, flat to subrounded, hard gravel; 30% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight to no reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist to wet.			15	15		
	18.0		10.0-18.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium sand; 5% slightly plastic fines. Weak surface coating. Slight reaction to HCl. Max. size: 16"; Color: multicolored; Moisture: wet.						

REMARKS: Sparse cover of thistles and small bushes. Hole caved somewhat. Maximum size of boulder taken from excavation was 14"x16"x24". Hairline roots to 6.0'. 18.0' depth was the limit of equipment.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Project Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation					
TP-112-MSR		Central Arizona		Aggregate Source					
Coordinates N. 905,813 E. 554,816		Ground Elevation 1267.9		Approx. Dimensions 11'x17.5'x20'					
Depth to Water Level: Not reached		Method of Excavation Backhoe--Case Model 780		Date 10/23/75		Logged by R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)		
SP	4.5	1 sack	0.0-4.5 Poorly Graded Sand with Trace of Cobbles: About 80% coarse to fine, predominantly medium to fine, angular to subrounded, clean sand; 20% coarse to fine, flat to subrounded, hard gravel. Strata were lensed with varying percentages of sand and gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry.				Trace		
GP-SP	2	2 sacks				10	5		
GP-SP	11.0	2 sacks	4.5-11.0 Poorly Graded Gravel with Cobbles: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, predominantly coarse to medium, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 8"; Color: multicolored; Moisture: dry to moist.				10		
	17.5		11.0-17.5 Poorly Graded Gravel with Boulders: About 50% coarse to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded sand; 5% slight-plasticity fines. No surface coating. Slight to no reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist.				10		

REMARKS: Moderate cover of paloverde trees and small bushes. Few surface cobbles and boulders in area. Maximum size of boulder taken from excavation was 8"x12"x18". Hairline roots to 6.0'. 17.5' depth was the limit of the equipment.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Project Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation					
TP-113-MSR		Central Arizona		Aggregate Source					
Coordinates N. 905,557 E. 554,565		Ground Elevation 1270.0		Approx. Dimensions 10'x17'x19'					
Depth to Water Level: Not reached		Method of Excavation Backhoe--Case Model 780		Date 10/22/75		Logged by R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)		
SP	5.5	1 sack	0.0-5.5 Poorly Graded Sand with Cobbles: About 90% coarse to fine, predominantly medium to fine, angular to subrounded, clean sand; 10% coarse to fine, flat to subrounded, hard gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 1 1/2"; Color: multicolored; Moisture: dry.			5	Trace		
GP-SP	12.0	2 sacks	5.5-12.0 Poorly Graded Gravel with Cobbles: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 8"; Color: multicolored; Moisture: dry to damp.			5	Trace		
GP	17.0	2 sacks	12.0-17.0 Poorly Graded Gravel with Cobbles: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak to no surface coating. Slight to no reaction to HCl. Max. size: 10"; Color: multicolored; Moisture: damp to moist.			10	5		

REMARKS: Moderate cover of small bushes. Top 6' of hole caved badly. Material from 0' to 5.5' strata was lensed. Considerable surface cobbles in area. Maximum size of cobbles taken from the excavation was 8"x11"x17". Hairline roots to 7.0'. Limit of equipment was 17.0'.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct			Project Central Arizona			Salt River Aggregate Source			
Feature		Project		Area Designation					
TP-114-MSR		Central Arizona		Aggregate Source					
Coordinates N. 905,492 E. 554,313		Ground Elevation 1271.2		Approx. Dimensions 14'x20'x25'					
Depth to Water Level: Not reached		Method of Excavation Backhoe--Case Model 780		Date 10/22/75		Logged by R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS!	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED (LBS.)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH (PERCENT)		
GP-SP	3.0	1 sack	0.0-3.0 Poorly Graded Gravel with Cobbles: About 55% coarse to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded, clean sand. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry.			5	Trace		
SP-GP	11.0	2 sacks	3.0-11.0 Poorly Graded Sand with Cobbles: About 55% coarse to fine, angular to subrounded, clean sand; 45% coarse to fine, flat to subrounded, hard gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry.				5		
SP-GP	14.0	2 sacks	11.0-14.0 Poorly Graded Sand with Boulders: About 55% coarse to fine, predominantly coarse to medium, angular to subrounded, clean sand; 45% coarse to fine, flat to subrounded, hard gravel. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: dry to damp.				10		

REMARKS: Moderate cover of small bushes. Few surface cobbles in area. Maximum size of boulder taken from the excavation was 8"x12"x15". Hairline roots to 7.0'. Hole caved badly and could not be excavated below 14.0'. Entire pit was lensed.

NOTES: Record water test and density test data, if applicable, under remarks.
* Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks.
** Applicable only to borrow pits and to foundations which are potential sources of construction materials.

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct				Project Central Arizona		Salt River Aggregate Source			
Feature		Project		Area Designation		Project		Area Designation	
TP-115-MSR		Central Arizona		Aggregate Source		Central Arizona		Aggregate Source	
Hole No.		Coordinates N		Ground Elevation		Approx. Dimensions		Logged by	
TP-115-MSR		905,390 E 554,723		1264.5		11'x17.5'x18'		R. Burger	
Depth to Water Level		Method of Excavation		Date					
Not reached		Backhoe--Case Model 780		10/22/75					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED BOULDERS TO 5-INCHES	PERCENTAGE BY VOLUME OF SAMPLED BOULDERS PLUS 5-INCH	WEIGHT OF SAMPLED BOULDERS PLUS 5-INCHES		
GP-SP	2	sacks	0.0-7.0 Poorly Graded Gravel with Boulders: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, angular to subrounded, clean sand. Strata were lensed badly with varying percentages of sand and gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 13"; Color: multicolored; Moisture: dry to moist.			5	5		
SP	7.0	1 sack				0	0		
GP	11.0	2 sacks	7.0-11.0 Poorly Graded Sand: About 95% coarse to fine, predominantly medium to fine, angular to subrounded, clean sand; 5% fine, flat to subrounded, hard gravel. Weak surface coating. Slight reaction to HCl. Max. size: 3/8"; Color: brown; Moisture: moist.			10	5		
	17.5		11.0-17.5 Poorly Graded Gravel with Cobbles: About 70% coarse to fine, flat to subrounded, hard gravel; 25% coarse to fine, angular to subrounded sand; 5% non-plastic fines. Weak surface coating. Slight to no reaction to HCl. Max. size: 6"; Color: multicolored; Moisture: moist to wet.						
REMARKS: Sparse to moderate cover of paloverde trees and small bushes. Few surface cobbles in the area. Maximum size of boulder taken from excavation was 6"x13"x17". Hairline roots to 5.0'. Limit of equipment was 17.5'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct				Project Central Arizona		Salt River Aggregate Source			
Feature		Project		Area Designation		Project		Area Designation	
TP-116-MSR		Central Arizona		Aggregate Source		Central Arizona		Aggregate Source	
Hole No.		Coordinates N		Ground Elevation		Approx. Dimensions		Logged by	
TP-116-MSR		906,780 E 555,120		1269.2		11'x17'x18'		R. Burger	
Depth to Water Level		Method of Excavation		Date					
Not reached		Backhoe--Case Model 780		10/24/75					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED BOULDERS TO 5-INCHES	PERCENTAGE BY VOLUME OF SAMPLED BOULDERS PLUS 5-INCH	WEIGHT OF SAMPLED BOULDERS PLUS 5-INCHES		
GP	2	sacks	0.0-3.0 Poorly Graded Gravel with Cobbles: About 55% coarse to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: dry to moist.			10	5		
GP-SP	3.0	2 sacks				10	5		
	9.0		3.0-9.0 Poorly Graded Gravel with Boulders: About 50% coarse to fine, flat to subrounded, hard gravel; 50% coarse to fine, predominantly coarse to medium, angular to subrounded, clean sand. Weak surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist to wet.						
GP	17.0	2 sacks	9.0-17.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, angular to subrounded sand; 5% medium-plasticity fines. Weak clay surface coating. Slight reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: wet.			10	10		
REMARKS: Sparse cover of small bushes. Considerable surface cobbles and boulders in area. Few clay balls were found in the 9.0' to 17.0' strata. Maximum size of boulder taken from excavation was 12"x12"x18". Hairline roots to 5.0'. Limit of equipment excavation was 17.0'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct				Project Central Arizona		Salt River Aggregate Source			
Feature		Project		Area Designation		Project		Area Designation	
TP-117-MSR		Central Arizona		Aggregate Source		Central Arizona		Aggregate Source	
Hole No.		Coordinates N		Ground Elevation		Approx. Dimensions		Logged by	
TP-117-MSR		905,493 E 555,055		1270.6		10'x16'x17.5'		R. Burger	
Depth to Water Level		Method of Excavation		Date					
Not reached		Backhoe--Case Model 780		10/21/75					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED BOULDERS TO 5-INCHES	PERCENTAGE BY VOLUME OF SAMPLED BOULDERS PLUS 5-INCH	WEIGHT OF SAMPLED BOULDERS PLUS 5-INCHES		
	0.5	No sample							
	0.0-0.5		Topsoil: Not classified.						
SP	2	sacks	0.5-9.0 Poorly Graded Sand with Cobbles: About 60% coarse to fine, angular to subrounded sand; 35% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. Strata were lensed with varying percentages of sand and gravel. Weak surface coating. Slight to medium reaction to HCl. Max. size: 6"; Color: multicolored; Moisture: dry to moist.			5	Trace		
GP-SP	9.0	2 sacks				5	5		
	12.5		9.0-12.5 Poorly Graded Gravel with Cobbles: About 55% coarse to fine, flat to subrounded, hard gravel; 45% coarse to fine, predominantly coarse to medium, angular to subrounded, clean sand. Weak surface coating. Slight to medium reaction to HCl. Max. size: 9"; Color: multicolored; Moisture: moist.			10	5		
GP	17.5	2 sacks	12.5-17.5 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, angular to subrounded sand; 5% nonplastic fines. No surface coating. Slight to no reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: moist to wet.						
REMARKS: Moderate cover of paloverde trees and greasewood bushes. Maximum size of boulder taken from the excavation was 9"x12"x14". Hairline roots to 4.0'. Limit of equipment excavation was 17.5'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Salt-Gila Aqueduct				Project Central Arizona		Salt River Aggregate Source			
Feature		Project		Area Designation		Project		Area Designation	
TP-118-MSR		Central Arizona		Aggregate Source		Central Arizona		Aggregate Source	
Hole No.		Coordinates N		Ground Elevation		Approx. Dimensions		Logged by	
TP-118-MSR		905,917 E 555,227		1277.6		13'5"x18'x23'		R. Burger	
Depth to Water Level		Method of Excavation		Date					
Not reached		Backhoe--Case Model 780		10/21/75					
CLASSIFICATION SYMBOL	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - "UNIFIED SOIL CLASSIFICATION") GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS)	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLE SAMPLED 3 TO 5-INCH (CUBIC FEET)	WEIGHT OF SAMPLED BOULDERS TO 5-INCHES	PERCENTAGE BY VOLUME OF SAMPLED BOULDERS PLUS 5-INCH	WEIGHT OF SAMPLED BOULDERS PLUS 5-INCHES		
SM	3.0	No sample	0.0-3.0 Silty Sand: About 60% coarse to fine, predominantly fine, angular to subrounded sand; 40% nonplastic, quick dilatancy, no toughness, no dry strength fines; trace of fine, hard gravel. Slight surface coating. Rapid reaction to HCl. Max. size: 3/8"; Color: brown; Moisture: dry.			0	0		
GP	13.5	2 sacks	3.0-13.5 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, angular to subrounded sand; 5% non-plastic fines. Weak surface coating. Medium reaction to HCl. Max. size: 12"; Color: multicolored; Moisture: dry to damp.			15	Trace		
REMARKS: Moderate cover of paloverde trees and greasewood bushes. Hole caved very badly, unable to excavate below 13.5' because of this. Maximum size of boulder taken from excavation was 12"x12"x16". Hairline roots to 6.5'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Site No: TP-119-MSR			Project: Central Arizona Coordinates: 906,253 ; 555,465			Salt River Area Designation: Aggregate Source Approx. Dimensions: 6'x17.5'x20'			Ground Elevation: 1276.4
Depth to Water Level: Not reached		Method of Excavation: Backhoe--Case Model 780		Date: 10/20/75		Logged by: R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF (CUBIC FEET)	VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF (CUBIC FEET)
SM	2.5	No sample	0.0-2.5 Silty Sand: About 60% medium to fine, predominantly fine, angular to subrounded sand; 40% nonplastic, quick dilatancy, no toughness, no dry strength fines; trace of fine, hard gravel. Medium surface coating. Rapid reaction to HCl.		0				
GP-SP	3.0	No sample			Trace				0
SP	7.5	1 sack	2.5-3.0 Poorly Graded Gravel with Trace of Cobbles: About 50% coarse to fine, predominantly medium to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight to medium reaction to HCl.		0				0
	7.5		2.5-3.0 Poorly Graded Gravel with Trace of Cobbles: About 50% coarse to fine, predominantly medium to fine, flat to subrounded, hard gravel; 45% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Weak surface coating. Slight to medium reaction to HCl.		5				Trace
GP	17.5	1 sack	3.0-7.5 Poorly Graded Sand: About 95% coarse to fine, predominantly medium to fine, angular to subrounded sand; 5% nonplastic fines; trace of fine, hard gravel. Weak surface coating. Slight reaction to HCl.						
	17.5		7.5-17.5 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, angular to subrounded sand; 5% nonplastic fines. Strata were lensed with varying percentages of sand and gravel. No surface coating. No to slight reaction to HCl.						
REMARKS:			Max. size: 12"; Color: multicolored; Moisture: dry to moist.						
Moderate cover of paloverde trees and greasewood bushes. Maximum size of boulder taken from excavation was 12"x12"x15". Hairline roots to 8.0'. Limit of equipment excavation was 17.5'.									
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Site No: TP-120-MSR			Project: Central Arizona Coordinates: 906,384 ; 555,775			Salt River Area Designation: Aggregate Source Approx. Dimensions: 11'x16'x20'			Ground Elevation: 1252.5
Depth to Water Level: 12.0'		Method of Excavation: Backhoe--Case Model 780		Date: 10/15/75		Logged by: R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF (CUBIC FEET)	VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF (CUBIC FEET)
SP	0.5	No sample	0.0-0.5 Topsoil: Not classified.						
GP	2.0	2 sacks	0.5-2.0 Poorly Graded Sand with Trace of Cobbles: About 75% coarse to fine, predominantly medium to fine, angular to subrounded sand; 20% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. No surface coating. No reaction to HCl.					Trace	0
	2.0		0.5-2.0 Poorly Graded Sand with Trace of Cobbles: About 75% coarse to fine, predominantly medium to fine, angular to subrounded sand; 20% coarse to fine, flat to subrounded, hard gravel; 5% nonplastic fines. No surface coating. No reaction to HCl.		0			15	5
GP	9.0	2 sacks	2.0-9.0 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% slight-plasticity fines. No surface coating. No reaction to HCl.					15	25
	9.0		2.0-9.0 Poorly Graded Gravel with Boulders: About 55% coarse to fine, flat to subrounded, hard gravel; 40% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% slight-plasticity fines. No surface coating. No reaction to HCl.						
	16.0		9.0-16.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. No surface coating. No reaction to HCl.						
	16.0		9.0-16.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. No surface coating. No reaction to HCl.						
REMARKS:			Sparse grass cover and small bushes throughout area. This pit is located in an area where previous excavation had been done by others. Maximum size of boulder taken from excavation was 16"x17"x27". Hairline roots to 3.0'. Encountered water at 12.3'. After 30 minutes, the water was at 12.0'. Hole caved badly during excavation, unable to excavate below 16.0'.						
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

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LOG OF TEST PIT OR AUGER HOLE FOR BORROW AND FOUNDATION INVESTIGATIONS									
Granite Reef Aqueduct Feature: Salt-Gila Aqueduct Site No: TP-121-MSR			Project: Central Arizona Coordinates: 906,587 ; 556,101			Salt River Area Designation: Aggregate Source Approx. Dimensions: 5'x17.5'x20'			Ground Elevation: 1261.3
Depth to Water Level: 16.4'		Method of Excavation: Backhoe--Case Model 780		Date: 10/15/75		Logged by: R. Burger			
CLASSIFICATION SYMBOL LETTER GRAPHIC	DEPTH (FEET)	SIZE AND TYPE OF SAMPLE TAKEN	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE CHART - UNIFIED SOIL CLASSIFICATION) GIVE GEOLOGIC AND IN-PLACE DESCRIPTION FOR FOUNDATION INVESTIGATIONS	PERCENTAGE OF COBBLES AND BOULDERS **					
				VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF (CUBIC FEET)	VOLUME OF HOLES SAMPLED 3 TO 5-INCH (CUBIC FEET)	PERCENTAGE BY WEIGHT OF SAMPLED (LBS)	PERCENTAGE BY WEIGHT OF PLUS 5-INCH VOLUME OF (CUBIC FEET)
GP	10.0	2 sacks	0.0-10.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. No surface coating. No reaction to HCl.		10				5
	10.0		0.0-10.0 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. No surface coating. No reaction to HCl.						
GP	17.5	2 sacks	10.0-17.5 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. No surface coating. No reaction to HCl.		15				20
	17.5		10.0-17.5 Poorly Graded Gravel with Boulders: About 60% coarse to fine, flat to subrounded, hard gravel; 35% coarse to fine, predominantly coarse to medium, angular to subrounded sand; 5% nonplastic fines. No surface coating. No reaction to HCl.						
REMARKS:			Sparse grass cover and small bushes throughout area. This pit is located in an area where previous excavation had been done by others. Maximum size of boulder taken from pit was 10"x20"x28". Hairline roots to 5.0'. Encountered water at 16.8'. After 30 minutes, the water level was at 16.4'. After 1 hour's time, the water level was still at 16.4'. Limit of equipment excavation was 17.5'.						
NOTES: Record water test and density test data, if applicable, under remarks. (Lbs. of rock sampled) 100 * Record after water has reached its natural level; give date of reading adjacent to graphic symbol or in remarks. (Bulk specific gravity of rock) 62.4 (Cubic feet of hole sampled) ** Applicable only to borrow pits and to foundations which are potential sources of construction materials. Record bulk specific gravity in Remarks, stating how obtained (measured or estimated)									

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SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

Granite Reef Aqueduct

PROJECT Central Arizona--Salt-Gila Aqueduct FEATURE Salt River Aggregate Source

TABLE 1-MSR SHEET 1 OF 2

SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet	CLASSIFICATION SYMBOL	PARTICLE SIZE FRACTIONS IN PERCENT					CONSISTENCY LIMITS			SPECIFIC GRAVITY		COMPACTION TEST			
				SMALLER THAN 0.005 mm	0.005 TO 0.075 mm	SAND NO. 20 (0.075 to 0.425 mm)	GRAVEL NO. 4 (0.425 to 2.0 mm)	GRAVEL NO. 10 (2.0 to 7.5 mm)	COBBLES LARGER THAN 7.5 mm	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	MINUS NO. 4	BULK	APPARENT	ABSORPTION - %	MAXIMUM DRY DENSITY - pcf (gm/cm ³)
1729	TP-101-MSR	0.0-7.0	GP	-	3	39	58	10	5								
1730	101-MSR	7.0-17.5	GP	-	1	40	59	15	10								
1747	103-MSR	0.0-10.0	SP	-	1	62	37	5	5								
1748	103-MSR	10.0-16.5	GP-SP	-	1	51	48	10	5								
1707	107-MSR	2.0-6.5	GP	-	1	43	56	10	10								
1708	107-MSR	6.5-16.0	GP-SP	-	1	51	48	10	5								
1718	111-MSR	2.5-10.0	GP	-	1	31	68	10	5								
1719	111-MSR	10.0-18.0	GP	-	2	32	66	15	15								
1738	114-MSR	0.0-3.0	GP-SP	-	1	46	53	5	T								
1739	114-MSR	3.0-11.0	SP-GP	-	1	53	46	5	T								
1740	114-MSR	11.0-14.0	SP-GP	-	0	54	46	10	5								
1741	115-MSR	0.0-7.0	GP-SP	-	1	51	48	5	5								

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Proctor Compaction)

Granite Reef Aqueduct

PROJECT Central Arizona--Salt-Gila Aqueduct FEATURE Salt River Aggregate Source

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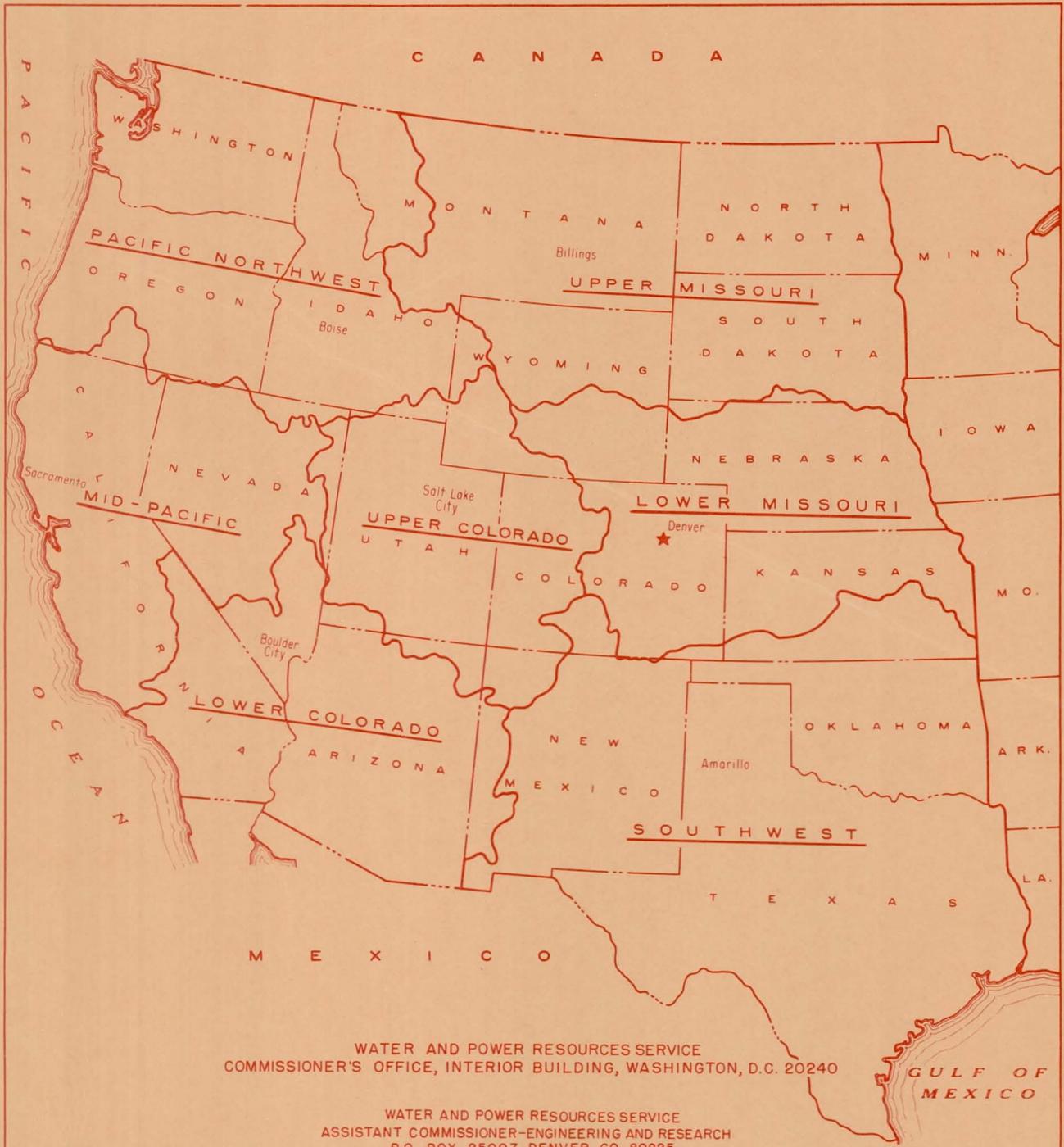
TABLE 1-MSR
SHEET 2 OF 2

IDENTIFICATION				PARTICLE-SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY			COMPACTION TEST			
SAMPLE NUMBER	HOLE NUMBER	DEPTH - feet (m)	CLASSIFICATION SYMBOL	FINES		SAND NO. 200 (0.074 mm) TO NO. 4 (4.76 mm)	GRAVEL NO. 4 (4.76 mm) TO 3 IN. (76.2 mm)	COBBLES 3 IN. (76.2 mm) TO 5 IN. (127 mm) Est.	OVERSIZE LARGER THAN 5 IN. (127 mm) Est.	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	MINUS NO. 4	PLUS NO. 4			MAXIMUM DRY DENSITY - pcf (gm/cm ³)	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE - psi (kg/cm ²)
				SMALLER THAN 0.005 mm	0.005 TO 0.074 mm									BULK	APPARENT	ABSORPTION - %			
1742	TP-115-MSR	7.0-11.0	SP	-	1	97	2	-	-										
1743	115-MSR	11.0-17.5	GP	-	1	27	72	10	5										
1755	116-MSR	0.0-3.0	GP-SP	-	1	46	53	10	5										
1756	116-MSR	3.0-9.0	GP	-	4	41	55	10	5										
1757	116-MSR	9.0-17.0	GP	-	1	37	62	10	10										
1727	121-MSR	0.0-10.0	GP	-	2	34	64	10	5										
1728	121-MSR	10.0-17.5	GP	-	2	37	61	15	20										
				Note: Estimated percentages of cobbles and boulders are visual estimate during test pit excavation. Gradation is on minus 3-inch sample.															

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

TABLE 1-MSR

SHEET 2 OF 2



WATER AND POWER RESOURCES SERVICE
 COMMISSIONER'S OFFICE, INTERIOR BUILDING, WASHINGTON, D.C. 20240

WATER AND POWER RESOURCES SERVICE
 ASSISTANT COMMISSIONER-ENGINEERING AND RESEARCH
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PN REGION, REGIONAL DIRECTOR, FEDERAL BUILDING AND U.S. COURTHOUSE,
 550 WEST FORT STREET, P.O. BOX 043, BOISE ID 83724

UC REGION, REGIONAL DIRECTOR, 125 SOUTH STATE STREET,
 P.O. BOX 11568, SALT LAKE CITY UT 84147

MP REGION, REGIONAL DIRECTOR, 2800 COTTAGE WAY,
 SACRAMENTO CA 95825

SW REGION, REGIONAL DIRECTOR, COMMERCE BUILDING, SUITE 207,
 714 SOUTH TYLER STREET, AMARILLO TX 79101

LC REGION, REGIONAL DIRECTOR, NEVADA HIGHWAY AND PARK STREET,
 P.O. BOX 427, BOULDER CITY, NV 89005

UM REGION, REGIONAL DIRECTOR, FEDERAL BUILDING, 316 NORTH
 26TH STREET, P.O. BOX 2553, BILLINGS MT 59103

LM REGION, REGIONAL DIRECTOR, P.O. BOX 25247, BUILDING 20,
 DENVER FEDERAL CENTER, DENVER CO 80225

**WATER AND POWER RESOURCES SERVICE
 AND REGIONAL BOUNDARIES**

(CONSTRUCTION WORK IS GENERALLY LIMITED
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