SQUAW PEAK WATER TREATMENT PLANT RELOCATION AT THE ACDC

FCD 88-40

PREDESIGN SERVICES

JUNE 1989

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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TABLE OF CONTENTS

TABLE OF CONTENTS, CONTINUED

TABLES

FIGURES

SECTION 1

SECTION I

INTRODUCTION

The Arizona Canal Diversion Channel (ACDC) is planned to intercept storm water runoff from north of the Arizona Canal to prevent flooding by the Arizona Canal. The ACDC follows the alignment of the Arizona Canal from 51st Avenue to 38th Street. The City of Phoenix Squaw Peak Water Treatment Plant (WTP) is located north of the Arizona Canal near 24th Street and thus is impacted. The ACDC is designed by the Corps of Engineers and is coordinated locally by the Flood Control District of Maricopa County (FCDMC). It is the responsibility of the FCDMC to coordinate the relocation of impacted facilities by the construction of the ACDC.

John Carollo Engineers was retained by the FCDMC to identify the impacts to the Squaw Peak WTP facilities and water mains, and to design and prepare plans and specifications to relocate impacted facilities to accommodate the proposed ACDC. The project is divided into two phases; predesign services and design phase. This report is prepared to summarize the findings of the predesign services. Design phase scope will be finalized and implemented based on accepted predesign recommendations.

The proposed construction of the ACDC affects the existing water treatment plant canal inlet, barscreens and conveyor, premixer, presedimentation basin inlet, various plant drains, a 60-inch water main, and a 66-inch water main. In addition to impacting the water treatment plant facilities, the ACDC may require relocation of a portion of the Arizona Canal in the immediate vicinity of the water treatment plant facilities. The location of these facilities is shown in Figure I-1. This study will

NOTE:

LOCATIONS OF PIPELINES ARE
PER AVAILABLE RECORD DRAWINGS.

EXACT LOCATIONS SHOULD
BE FIELD VERIFIED.

N

SCALE: 1" = 100'

OPEN DITCH
FROM 48" DRAIN
RES. 1 & 2

36" DRAIN
PLANT II

60" WATER MAIN

SRP
SUB STATION

30" DRAIN
PLANT I

RESERVOIR NO.3

W/TP ELECT.

RAW WATER PUMP
STA. NO.2

PRESEDIMENTATION BASIN

RAW WATER PUMP
STA. NO.1

14" PRESED.
DEWATER. LINE

PRESEDIMENTATION
BASIN INLET
& BAR SCREENS

66" WATER MAIN

36" DRAIN
RES. NO.3

SLUDGE PUMPS

6" & 8"
SLUDGE LINES

24TH ST.

FIGURE I - 1

FACILITIES IMPACTED BY
CONSTRUCTION OF ACDC
AT SQUAW PEAK WTP

FIGURE I - 1

address concerns of the facilities' owner and determine the best alternative that will meet the owner's needs at the most economical cost to the FCDMC.

The objectives of this study include the following:

1. Perform soils investigations and prepare a geotechnical report to identify construction constraints and estimate excavation costs.
2. Identify affected agencies' requirements in design of relocated facilities.
3. Develop alternatives for relocation of water treatment plant facilities. Evaluate alternatives with affected agencies and recommend best alternative.
4. Develop alternatives for relocation of water mains. Evaluate alternatives and recommend best alternative.
5. Identify affected utilities in the area from the 66 inch water main by 24th Street along the ACDC to the west side of the SRP substation in the southwest corner of the water treatment plant.
6. Provide field survey and calculations as necessary to tie the Corps of Engineers datum to the City of Phoenix datum.

The results of the analysis to meet each of these objectives is summarized in the following sections.

SECTION II

SECTION II

SOILS REPORT

Geotechnical services were performed to determine subsurface conditions and to develop design recommendations for the pipelines and structures. A brief summary of geotechnical findings is presented. The complete soils report prepared by Thomas Hartig & Associates has been presented to the FCDMC under separate cover.

Soil investigations included test drilling and seismic refraction surveys. Test drilling consisted of nine test borings at locations near the water main relocations and proposed locations of the new water treatment plant facilities. Field resistivity tests were performed and samples taken for lab analysis at each test location. Seismic refraction surveys were used to supplement the test hole information regarding geologic strata. The seismic velocities were used to determine ease of excavation of the material.

The findings of the geotechnical services indicate depth to bedrock and ease of excavation. The typical strata consists of soil, a cemented breccia fanglomerate, and bedrock. The breccia fanglomerate consists of angular gravel or cobble-sized rock with cementation varying from moderate to heavy. The amount of cementation affects the ease of excavation. The ease of excavation for the breccia fanglomerate is defined as moderate or difficult. The moderate classification would require difficult ripping although blasting may be required in narrow pipe trenches or if a hard layer is hit. The difficult classification probably would require blasting. Geotechnical information is grouped as to what facility will or could be located in the area. The table below presents the depth to the geologic layer and the estimated ease of excavation.

Facility	Soil Depth, ft.	Breccia Fanglomerate, ft.	Bedrock ft.
66-inch Water Main	0-5	5-12/moderate 12-22/difficult	22+
East Alt. WTP Inlet	0-5	5-24/moderate	13+
South Alt. WTP Inlet	0-5	5-13/moderate 13+/difficult	13+
60 Inch Water Main	0-7	7-30/moderate	30+

This summary shows that the soil layer is very shallow in the area of the proposed construction. Any excavation below 12 to 24 feet may require blasting. This difficulty of excavation has been factored into the viability of alternatives and the cost of excavation included in the estimated costs presented later in this report.

SECTION III

SECTION III

WATER TREATMENT PLANT FACILITIES

Construction of the proposed ACDC impacts the water treatment plant inlet, bar screens, premixer, presedimentation basin inlet and various plant drains. The impacted water treatment facilities and the various plant drains are discussed in the following.

RELOCATION CRITERIA

Factors governing the location and design of the impacted facilities include affected agency requirements and standard industry design criteria. Each of these is discussed.

Affected agencies include the City of Phoenix, Salt River Project (SRP), and FCDMC. Requirements identified in meetings with these agencies are as follows:

1. The existing treatment capacity of 140 mgd and hydraulic capacity of 160 mgd must be maintained.
2. New facilities must fit in the existing plant hydraulics. The Arizona Canal water surface elevation may vary 1.6 feet. The capacity of the raw water pumps at the west end of the presedimentation basin is decreased by lowered water levels in the presedimentation basin.
3. Maintenance concerns associated with installation of an inverted siphon must be considered.
4. The Squaw Peak WTP is an important facility that must be used most of the year to provide drinking water to the City of Phoenix. Layout of new or modified facilities and construction

scheduling should be such to minimize the impact to plant operation during construction periods.

5. Layout of the new or modified facilities should be coordinated with proposed future improvements to the presedimentation basin and solids handling facilities by the City of Phoenix.
6. A new canal inlet structure should include an obstructionless entry from the Arizona Canal.
7. Flow measurement of the water within 2 percent ± accuracy is required prior to the presedimentation basin. Presedimentation sludge pumped back to the Canal must be metered.
8. Water treatment plant drains back to the Arizona Canal should be of equal diameter or equal flow area if some are combined.
9. The first 20 feet from SRP canal edge must be barren to provide necessary access for maintenance. Fifteen feet must be left between any new structure and the edge of the proposed alignment of the ACDC to provide area for construction.
10. Facilities located between the ACDC and the Arizona Canal should be designed to coordinate with the area's proposed multi-usage recreational classifications and to control access and limit liability of the City of Phoenix.
11. An inverted siphon under the ACDC should have two access points for safe maintenance.
12. Grit from the new grit basins cannot be returned to the Arizona Canal, but must be handled and disposed of by the City of Phoenix.
13. Affected facilities must be replaced with new facilities equal to the existing.

Other factors controlling the development of alternatives are acceptable design criteria of any unit process or operation. Design criteria for the impacted facilities are listed in Table III-1.

RELOCATION ALTERNATIVES - WATER TREATMENT PLANT FACILITIES

The development of relocation alternatives is broken into two parts: Preliminary Investigations and Evaluation of Alternatives.

PRELIMINARY INVESTIGATION. Investigation prior to the development of alternatives raised three important questions:

- Can the new inlet go over the top of the ACDC or must it go under?
- On which side of the ACDC should the bar screens be located if an inverted siphon is used?
- What type of flow measurement device should be used?

UNDER VERSUS OVER ACDC. The new pipes or channels to the water treatment plant must go either over the top of the ACDC or under it since the proposed ACDC location is between the water treatment plant and the Arizona Canal. The elevations of the ACDC and the Arizona Canal are compared to determine the feasibility of going over the top of the ACDC. The ACDC invert by the WTP inlet is approximately 1217.4. The projected depth of flow is 24 feet giving a water surface elevation of 1241.4. The water surface elevation in the Arizona Canal may vary from 1240.5 to 1242.1. (See letter dated April 14, 1989 from SRP in Appendix A.) Comparison of the maximum water surface elevation in the ACDC to the water surface elevation in the Arizona Canal shows it is not possible to go over the top of the ACDC unless the water is pumped. Pumping of the water with low lift pumps is not considered viable due to additional maintenance and operational costs.

TABLE III-1

WATER TREATMENT PLANT DESIGN CRITERIA

	Units	Capacity/No.
Plant Capacity		
Design Capacity	mgd	140
Hydraulic Capacity	mgd	160
Plant Components		
Inlet Structure		
Obstructionless Entry	each	1
Bar Screens		
Mechanically Cleaned Bar Screens	each	3
Design Capacity, each	mgd	70
Hydraulic Capacity, each	mgd	80
Grit Chambers*		
Number	each	2
Design Capacity, each	mgd	70
Hydraulic Capacity, each	mgd	80
Smallest Particle Size to be Removed at Design Capacity	mesh	65
Inverted Siphon*		
Number	each	2
Size	inches	66
Velocity	fps	4.5
Design Capacity	mgd	70
Premixer		
Number of Mixers	each	1
Flowmeter(s)		
Number		-
Type		Magnetic
Preliminary Sedimentation Basins**		
Type - Circular, Center Entry with Collector, Submerged Orifice Outlet Control (with By-pass)		
Number of Basins	each	3
Dimensions, each		
Diameter	feet	160
Depth	feet	12

TABLE III-1, CONTINUED

WATER TREATMENT PLANT DESIGN CRITERIA

	Units	Capacity/No.
Design Flow, each	mgd	47
Surface Loading Rates	gal/day/sf	
@ Design Flow		2,337
@ Hydraulic Flow		2,671

*If required.
**Only if City of Phoenix formulates agreement with FCDMC to participate in costs.

PRETREATMENT LOCATION. The use of an inverted siphon to take water directly from the canal to the water plant without any pretreatment presents serious maintenance concerns. The canal water carries coarse sediment, boards, cans, leaves, long coarse algae or grasses or other debris. The amount of material that collects in an inverted siphon is a function of the velocity and the amount of sediment and debris in the water. A high velocity (6-8 fps) reduces the maintenance by keeping the debris in suspension, but it increases the head loss. This high velocity must be maintained continuously or debris will settle during low flows. High velocities are difficult to maintain due to the variability of flow to the water treatment plant. It is unlikely that high velocities will resuspend the debris once it has settled. Thus, an inverted siphon would require periodic cleaning.

SRP has numerous inverted siphons in their canal system. Cleaning requirements vary from cleaning every 3-4 months to once per year. The length of time to clean an inverted siphon varies from one day to over a week depending on the amount of sediment and debris, and the pipe diameter and length. The cleaning operation for SRP is done by a private company that uses a Vactor truck. Present cost is $175 per hour.

Pretreatment of canal water prior to entering the inverted siphon is necessary to minimize concerns of maintenance and limit hydraulic impact to the existing system. Bar screens are needed to remove the larger debris. Grit basins are necessary to remove coarse sediment. These pretreatment units placed prior to the siphon will greatly reduce required maintenance, but will not eliminate it entirely.

METERING. Three standard flow metering systems were considered; broad crested weir on open channel, sonic flowmeter in pipeline, and

magnetic meter in pipeline. Flow measurement of the water as it leaves the canal is required by SRP for canal operation and water accounting.

A broad crested weir was initially recommended by SRP, but preliminary evaluation showed that it had a major adverse impact on inlet hydraulics and operation of the water treatment plant. The weir must be set at an elevation to allow design flow to occur at minimum canal water surface elevation. This would drop the water surface elevation and would increase pumping costs. A flow control gate is also required with a broad crested weir to control flow into the plant. The balancing of flow into the presedimentation basin with that pumped out would be difficult.

A sonic meter in pipeline was eliminated due to SRP's concern regarding accuracy of the meter with dirty canal water. A magnetic flowmeter is acceptable to SRP. (See letter in Appendix A dated May 24, 1989.) The magnetic flowmeter can be installed to minimize head loss to the water treatment plant, not restrict water treatment plant operation and still achieve accuracy levels. The obstructionless meter allows the presedimentation basin to float on the canal.

EVALUATION OF ALTERNATIVES. The objective of the alternative study is to evaluate location, configuration and cost for relocation of water treatment plant inlet structure on the Arizona Canal, Bar Screen Structure, Grit Chambers, Flowmeter Structure, Premixer and Flow Splitting Structure. Future improvements planned by the City of Phoenix to the Presedimentation Basin are included to show the master plan of the water treatment plant inlet area.

A bridge over the ACDC is necessary for all the alternatives presented to provide access for maintenance and operation of the equipment. The location of the bridge is shown with each alternative.

The cost of the twenty foot wide bridge is estimated at $60,000.

Three alternatives are presented; East Inlet, South Inlet, and North location of the ACDC. Each alternative is described followed by advantages, disadvantages, hydraulics considerations, and estimated costs. A comparison of the alternatives is then presented.

East Inlet Location. The layout of this alternative is shown in Figure III-1. Flow enters through the canal inlet structure into channels to isolation gates and bar screens; to a common channel into a grit chamber; into an inverted syphon consisting of a vertical box culvert, horizontal pipes under the ACDC; and a vertical box culvert; into a pipe to the premixer and flow splitting structure; and through pipelines to the presedimentation basins. Mechanical equipment includes rectangular butterfly valves or slide gates, bar screens and conveyor, grit removal equipment in basins, grit pumps and separation equipment, submersible pumps for dewatering inverted siphons, magnetic flowmeters and a premixer. The location of the grit basin is set prior to the curve in the ACDC to provide maximum space.

The East Inlet alternative requires special design to limit public access to treatment facilities and thereby limit City of Phoenix liability exposure. Fencing or covering of facilities is necessary, some of which must be portable or movable to all for maintenance activities. The advantages and disadvantages are listed below.

Advantages:

1. Good location for canal inlet on straight section of canal to minimize entry of debris.
2. Allows option of either rectangular or circular presedimentation basins.

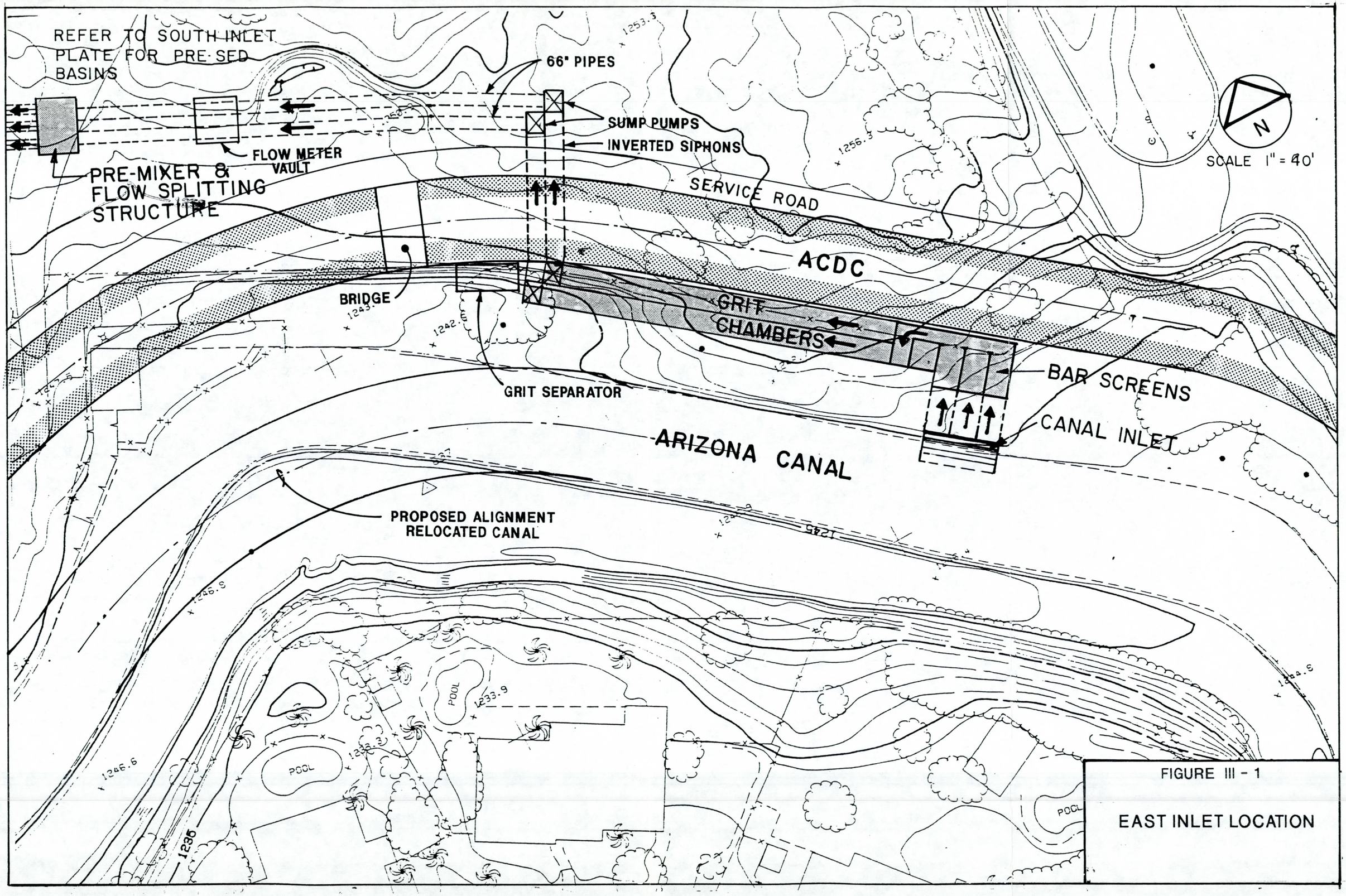


FIGURE III - 1

EAST INLET LOCATION

3. New canal inlet structure is independent of Arizona Canal relocation so no coordination between the construction of the two would be required.
4. Narrow grit basin may be designed without a cross collector.
5. Length of pipe between inverted siphon and premixer and flow splitting structure provides good location for flow meter.

Disadvantages:

1. Location of bar screens could cause an unsightly view for the public due to proximity to 24th Street and proposed City of Phoenix office building. Screenings could attract flies and cause odors.
2. Encroaches on SRP right-of-way and limits access to Arizona Canal to 25 feet.
3. Limits access of recreational usage such as horse trails, bike trails and jogging paths proposed for the area between the Arizona Canal and the ACDC. Also could cause an unsightly view in recreational area.
4. Location of treatment facilities in proposed multi-usage recreational area could increase City of Phoenix liability.
5. Space is very limited for conveyor and access for truck to remove screenings. This alternative would require access from 24th Street to haul screenings.
6. Location of bar screens conflicts with proposed relocation of 66-inch water main discussed in Section IV.
7. Grit basin, grit handling equipment, and inverted siphon are new facilities that require operation and maintenance time and expense.

8. This alternative does not meet requirement to provide 15 feet clear from wall of ACDC. This may require that all of a section, or at least one side of the ACDC be built at the same time as the plant facilities.

Hydraulic Impact: The East inlet location has the greatest impact on the plant hydraulics. This is due to an extra slide gate at the front of the grit chambers and the longer lengths of pipe from the inverted siphon to the premixer and flow splitting structure. Head loss from the canal inlet to the flow splitting structure is estimated at 2.9 feet. This would reduce the capacity of the pumps by about 4 percent and increase pumping costs slightly.

Costs: Costs include construction and future operation and maintenance. The estimated cost to construct the plant facilities of the East Inlet Alternative is $3.0 Million. This includes the facilities shown in Figure III-1 except the circular presedimentation basins. The difficulty of excavation, as discussed in Section II in breccia fanglomerate, is factored into the construction cost.

Economic impact due to operation and maintenance is a function of the equipment. This alternative adds slide gates or rectangular butterfly valves, grit collection equipment, grit pumps, grit separation equipment, inverted siphon sump pumps and magnetic flowmeters. Each of these items require operation and maintenance time and expense. Operational costs are also increased with this alternative due to the hydraulic impact with the slightly lower water level in the presedimentation basin.

South Inlet Location. The layout of this alternative is shown in Figure III-2. The location of the ACDC shown is a preliminary alternative and not the one that was shown in the ACDC Master Plan Report. This

location is used to provide more space between the Arizona Canal and ACDC for the treatment facilities. This allows wider, shallower and shorter grit basins. The wider grit basins still do not encroach on SRP right-of-way and/or the proposed recreational area as much as the East Inlet. This alternative includes the same facilities and equipment as the East Inlet.

This alternative also requires special provisions to restrict public access to treatment facilities and thereby limit City of Phoenix liability exposure. Fencing around or covering of the facilities (with removable portions) will be necessary.

The advantages and disadvantages are listed below.

Advantages:

1. Location provides more space so encroachment on SRP right-of-way is less.
2. Allows better accessibility to handle screenings.
3. Provides less restriction to proposed recreational usage.
4. Locates bar screens more remote from public view.

Disadvantages:

1. Location of grit basins provide flow to existing presedimentation basin at 3/4 point. This limits option to circular sedimentation basins at a future date. Circular sedimentation basins have a slightly higher head loss than rectangular basins and a higher construction costs.
2. Location of treatment facilities in proposed multi-usage recreational areas could increase City of Phoenix liability exposure.

PRE-SED BASIN

PRE-SED BASIN

PRE-SED BASIN

RAW WATER PUMPS PLANT II

RAW WATER PUMPS PLANT I

RAW WATER CHANNEL

PRE-SED BY-PASS LINE

FLOW METER VAULT

PRE-MIXER & FLOW SPLITTING STRUCTURE

SUMP PUMPS

BRIDGE

SERVICE ROAD

66" PIPES

INVERTED SIPHON

ACDC

GRIT CHAMBERS

BAR SCREENS

GRIT SEPARATOR

CANAL INLET

ARIZONA CANAL (RELOCATED)

SCALE 1" = 40'

FIGURE III - 2

SOUTH INLET LOCATION

3. Grit basin, grit handling equipment, and inverted siphon are new facilities that require operation and maintenance time.

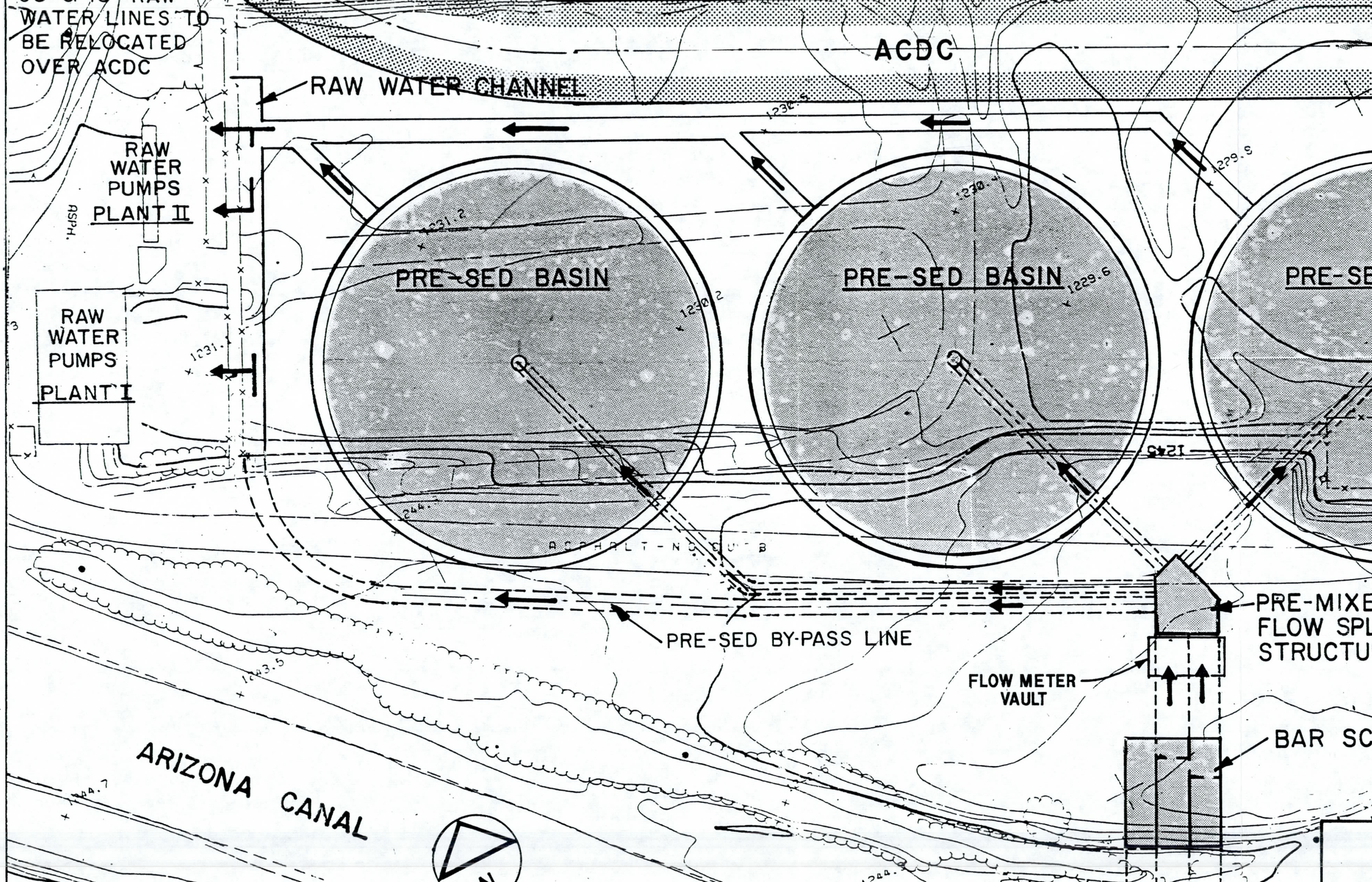
4. This alternative does not meet requirement to maintain 15 feet clear of ACDC. It also may require that all of a section, or at least a part, of the ACDC be built at the same time as these facilities.

Hydraulic Impact: The additional facilities affect the plant hydraulics. The impact of this alternative is less than the East Inlet due to the shorter lengths of pipe. Head loss from the canal inlet to the premixer and flow splitting structure is estimated at 2.5 feet. This is an increase of about 1 foot over the existing head loss. This would only cause a slight decrease in pumping capacity and minimal impact on pumping costs.

Costs: Costs for construction, operation and maintenance are very similar to the East Inlet. The estimated cost of construction is $3.2 Million. Additional costs for operation and maintenance discussed for the East Inlet also apply to this alternative.

North Location of ACDC. This alternative proposes moving the alignment of the ACDC from adjacent to the Arizona Canal to the north side of the existing presedimentation basins as shown in Figure III-3. This proposal requires agreement between the City of Phoenix and FCDMC to provide right-of-way. Two options exist.

1. The construction of a new canal inlet, bar screens, premixer and flow splitting structure and presedimentation basins as shown in Figure III-3 can be used, if an agreement is reached between the City of Phoenix and FCDMC, to share in the additional costs.


WATER LINES TO
BE RELOCATED
OVER ACDC
ACDC
RAW WATER CHANNEL
RAW
WATER
PUMPS
PLANT II
RAW
WATER
PUMPS
PLANT I
PRE-SED BASIN
PRE-SED BASIN
PRE-SE
PRE-SED BY-PASS LINE
PRE-MIXE
FLOW SPL
STRUCTU
FLOW METER
VAULT
BAR SC
ARIZONA CANAL
ASPH.
1231.2
1230.2
1231.1
1230.1
1229.5
1229.6
1245
1244.7
1243.5
1244.7
1244.

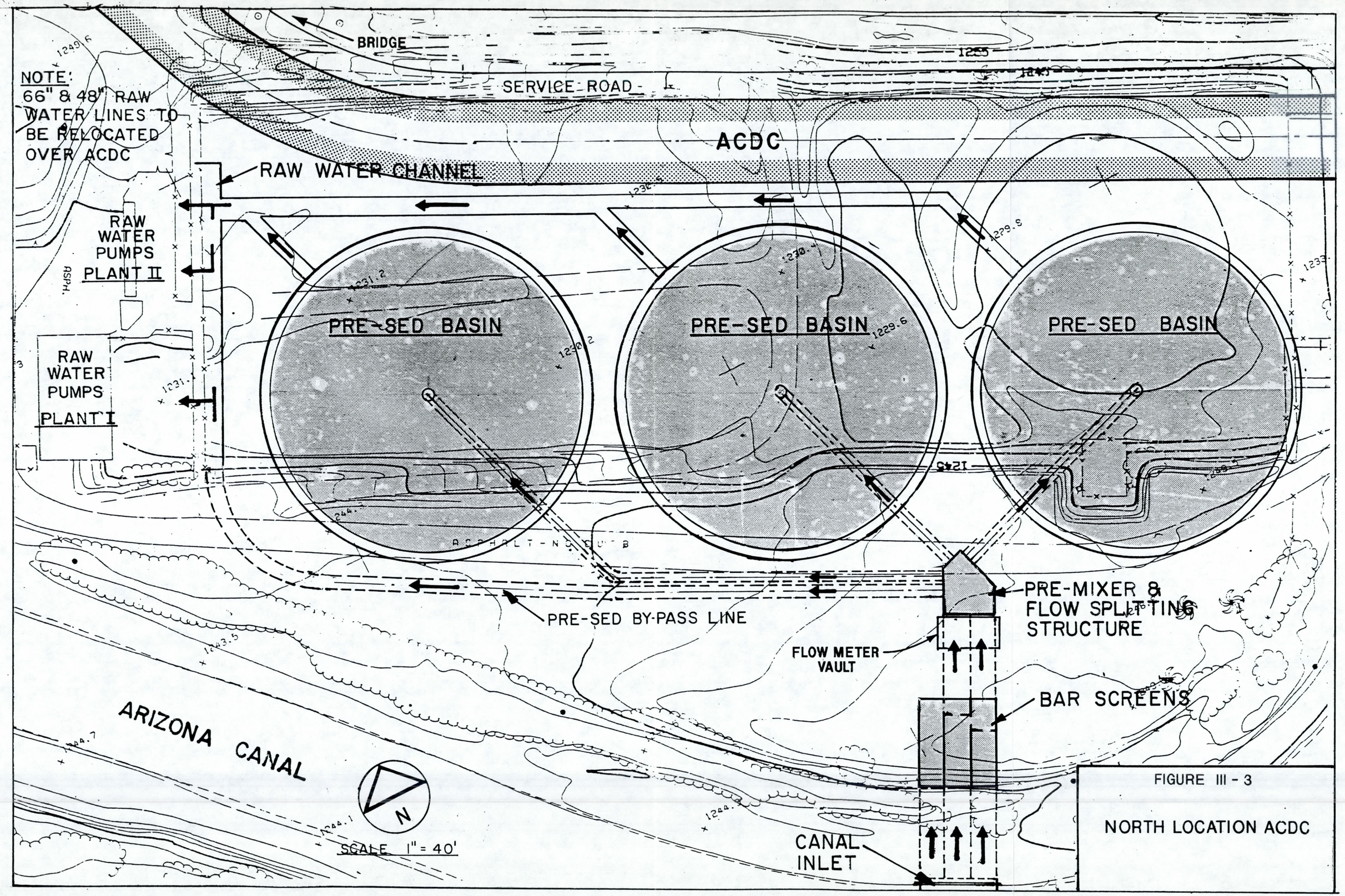


FIGURE III - 3

NORTH LOCATION ACDC

2. The existing canal inlet and bar screens can be used. The existing presedimentation basin can be shifted about 50 feet south. As a minimum, this option would require a new north wall for the presedimentation basin, excavation on the south side of the basin to restore basin to required volume and area, and relocation of the sludge collection mechanism and sludge pump station.

The North ACDC Location alternative provides the capability for the existing plant flow scheme to be maintained. The advantages and disadvantages are listed below.

Advantages:

1. An inverted siphon with its associated maintenance concerns is eliminated.
2. The raw water pumps required minimum modification and still will lift the water out of the modified presedimentation basin(s) and over the top of the ACDC to the water treatment plants.
3. Operation and maintenance costs associated with the grit chambers, grit handling equipment, and inverted siphon sump pumps are eliminated.
4. There is no impact to the present plant hydraulics due to modifications for construction of the ACDC. This eliminates the additional operational cost due to the hydraulic impact of the other alternatives.
5. Construction of the new plant inlet and bar screens eliminates any encroachment on SRP right-of-way and proposed multi-usage

recreational area between the Arizona Canal and the ACDC. The use of existing canal inlet and bar screens does not change present encroachment.

6. Relocation of the Arizona Canal south of the presedimentation basin with its associated cost is not required.

7. Construction scheduling is independent of Arizona Canal relocation, since it is not required in the area of either canal inlet.

Disadvantages:

1. The ACDC may tend to separate pretreatment facilities and raw water pumps from the rest of the plant site.

2. The North ACDC Location impacts more water treatment plant facilities then the other alternatives. Raw water lines from the raw water pumps (66-inch to Plant II and 48-inch to Plant I) must be relocated to go over the top of the ACDC. Electrical conduits to the existing bar screens, and possibly to Plant II, must also be relocated over the top of the ACDC.

3. This alternative may have a bigger impact on plant operations during the construction period if a new canal inlet, bar screens and presedimentation basins is not constructed. Construction of the north presedimentation basin wall, excavation of south basin edge, relocation of sludge collection equipment and pumps would require an extended plant down period.

4. North location of the ACDC requires that FCDMC negotiate right-of-way easement through the water treatment plant and acquire about one acre of land from the property owner west of the water treatment plant.

Hydraulic Impact: This alternative does not impact the present plant hydraulics. The estimated head loss of 1.5 feet from the new canal inlet to the premixer and flow splitting structure is the same as the existing. Head loss from the flow splitting structure to the raw water pumps should be evaluated to determine impact on raw water pumps if circular basins are built.

Costs: Construction costs vary depending on which option is selected. Estimated costs for modifying the existing basin are $1.3 Million. This cost does not include new flowmeters at an estimated price of $0.44 Million since the plant inlet area is not modified. This does not meet one of the requirements, but the existing plant inlet cannot be retrofitted with flowmeters. SRP may require upgraded metering on pump discharge lines and any return flows. Estimated construction costs for the other option are listed below.

1. Construction costs common to the option are $0.4 Million.
2. Construction cost for canal inlet, bar screens, connecting channels and pipes, flowmeters, premixer and flow splitting structure and bypass pipe is $1.8 Million.
3. Estimated cost of the circular presedimentation basins and associated equipment and piping is $4.0 Million.

The total cost of this alternative with the new inlet and presedimentation basins is $6.2 Million. This cost does not include right-of-way acquisition costs through the water treatment plant site or the corner of the property west of the water treatment plant. The allocation of this cost between the FCDMC and the City of Phoenix will have to be negotiated.

This alternative does not add any treatment facilities or equipment so there is no impact on operation and maintenance costs.

Comparison of Alternatives. Each alternative with its advantages and disadvantages is viable. A comparison of the alternatives helps to identify the best alternative. Cost is a consideration. The costs of the alternatives are listed below.

Alternative	Cost $ Million
East Inlet Location	3.0 -
South Inlet Location	3.2 -
North Location ACDC	
Existing Basin Option	1.3
New Inlet Structure (no presedimentation basins)	2.2

The important concerns include impact on the following; SRP right-of-way and proposed multi-recreational usage of right-of-way between Arizona Canal and ACDC, maintenance and operational costs, existing plant hydraulics, coordination of construction, and cost. Each alternative is ranked on each of these concerns.

Impact	East	South	North ACDC
Right-of-way, Recreation	3	2	1
Operation & Maintenance	3	2	1
Hydraulic	3	2	1
Coordination of Construction	1	2	3
Cost	2	3	1*

* Does not include land and/or easement acquisition.

This comparison shows that the North Location of the ACDC alternative has the least impact. This alternative is recommended. A proposed implementation plan is discussed in Section VI.

PLANT DRAINS

The impacted water treatment plant drains are shown on Figure I-1 in Section I. Discussions of each plant drain line consider either possible location of ACDC.

These include the following:

- o 48-inch drain from Reservoirs No. 1 and 2
- o 36-inch drain from Plant II
- o 30-inch drain from Plant I
- o 14-inch dewater line for the presedimentation basin
- o 6- and 8-inch sludge lines
- o 36-inch drain from Reservoir No. 3

The drains must be routed either over or under the ACDC. The alternative of going under the ACDC raises the concern of long-term maintenance costs of the inverted siphon and higher construction costs due to the difficulty of excavation as discussed in Section II. Preliminary investigation of the gravity drains indicate that all of them can go over the top of the ACDC. The relocation of all of these drains over the top of the ACDC is recommended to minimize maintenance and construction costs.

The following coordination is recommended. The 36-inch Plant II drain goes through the SRP substation. Grading of the area north of the SRP substation is recommended to allow rerouting of the 36-inch Plant II drain north of the substation so the contractor does not need to enter the substation. The 48-inch Reservoirs No. 1 and 2 drain should be rerouted to the alignment of the 60-inch water main. This allows the 36-inch drain, the 48-inch drain, and 30-inch drain to cross the ACDC at the same location at the proposed bridge or another location. The 14-inch presedimentation basin dewater line is not impacted due to the proposed location of the ACDC. The 6- and 8-inch sludge lines are not impacted and will be removed or relocated as part of the presedimentation basin modifications. The 36-inch Reservoir No. 3 drain should cross the ACDC in approximately its present location.

A cost estimate to relocate these drains is very difficult due to the lack of specific information on them. Much of the cost will be due to field closures and fittings that may not be readily apparent. The estimated cost to relocate these drains is $0.7 Million.

SECTION IV

SECTION IV

WATER MAINS

INTRODUCTION

Future construction of the ACDC Channel will require the relocation of the existing 66-inch and 60-inch diameter finished water pipelines connecting the Squaw Peak Water Treatment Plant and the City Water Distribution System. The 66-inch water main is located along the west side of 24th Street between the Arizona Canal and 24th Street. The 60-inch water main is located approximately 2,500 lf. west of 24th Street. The location of both water mains and their relocated portions are indicated in Figures IV-1 and IV-2, respectively. This discussion primarily is based on the ACDC Location adjacent to the Arizona Canal; however, if the alternate North Location of the ACDC is selected, the same considerations will apply and thus our recommended approach also will apply.

RELOCATION CRITERIA

Criteria for the relocation of the 66-inch and 60-inch diameter water mains were established through meetings with the Flood Control District, City of Phoenix, and Salt River Project. The following criteria were established:

1. Capacity of relocated water mains should be equal to existing water mains.
2. Existing water mains cannot be out of service during the Canal dry-up.
3. Only one water main can be out of service at any one time.
4. Water main parallel to Arizona Canal shall be located a minimum of 25 feet from edge of top of bank.

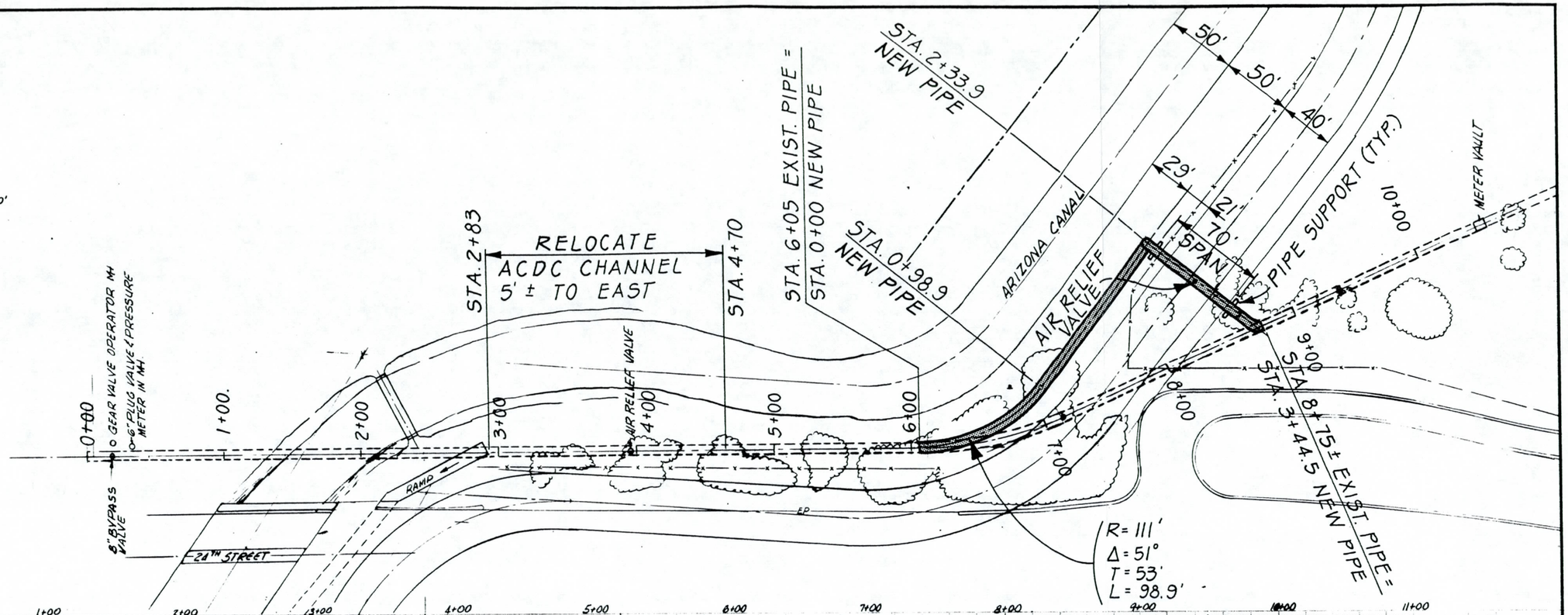
N

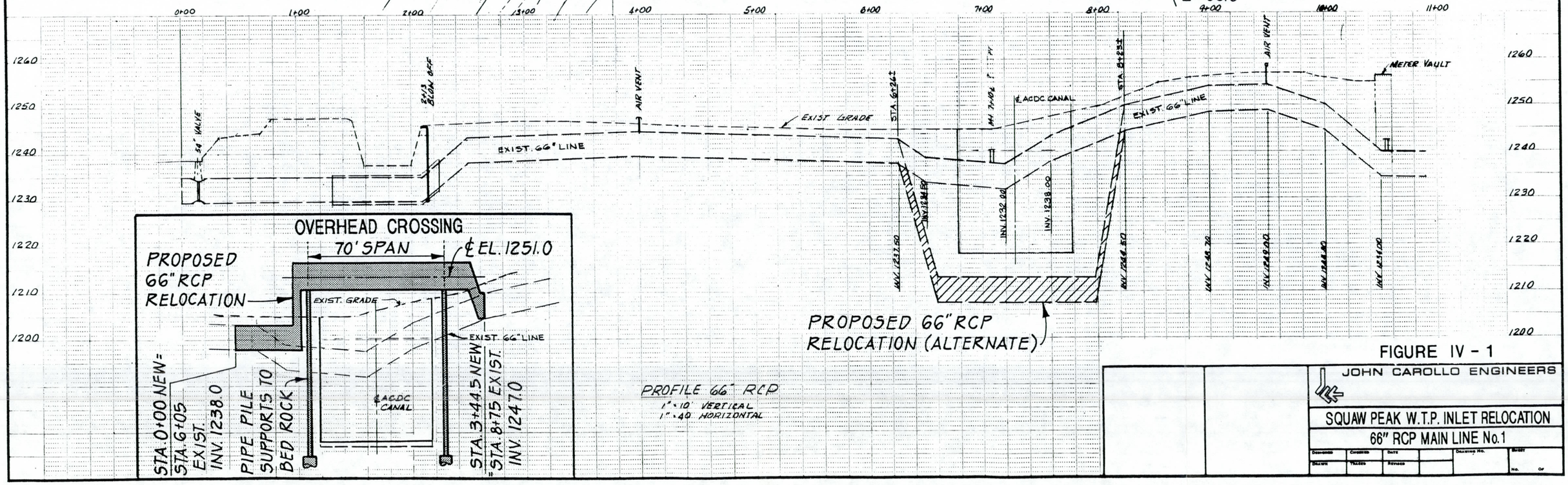
SCALE 1"=40'

NOTE:

LOCATIONS OF PIPELINES ARE PER AVAILABLE RECORD DRAWINGS.

EXACT LOCATIONS SHOULD BE FIELD VERIFIED.





PROFILE 66" RCP
1"=10' VERTICAL
1"=40' HORIZONTAL

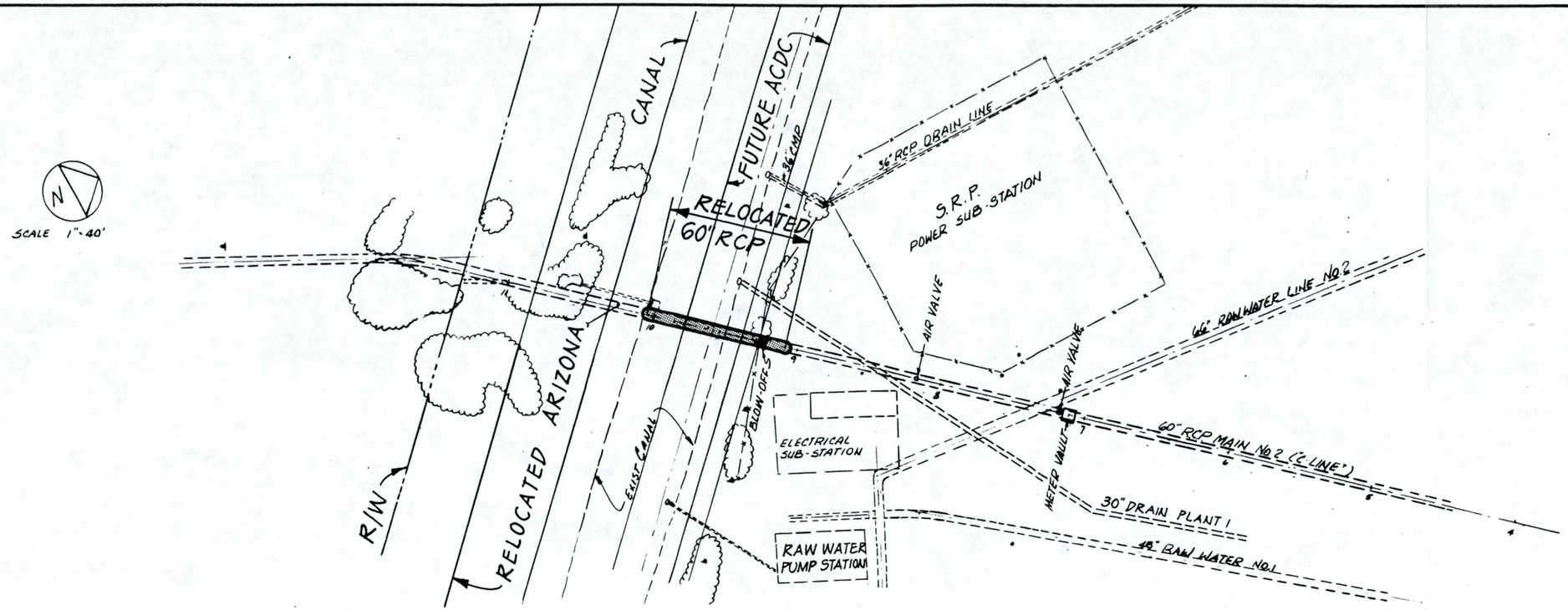
FIGURE IV - 1

JOHN CAROLLO ENGINEERS

SQUAW PEAK W.T.P. INLET RELOCATION

66" RCP MAIN LINE No.1

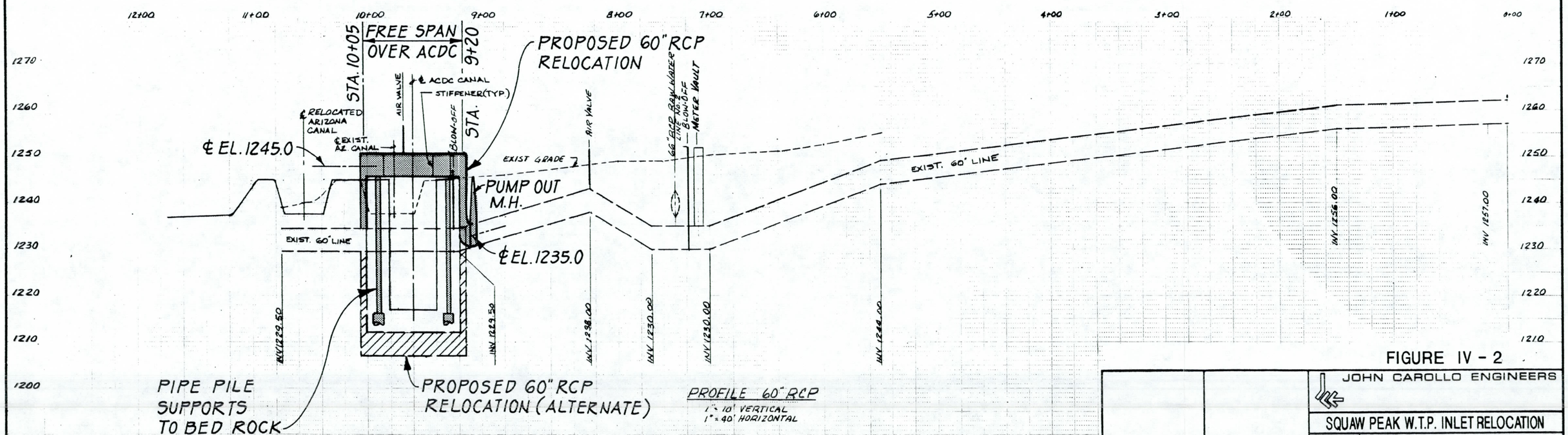
Designed	Checked	Date		Drawing No.	Sheet
Drawn	Traced	Revised			No. Of



NOTE:

LOCATIONS OF PIPELINES ARE PER AVAILABLE RECORD DRAWINGS.

EXACT LOCATIONS SHOULD BE FIELD VERIFIED.



PROFILE 60" RCP
1" = 10' VERTICAL
1" = 40' HORIZONTAL

FIGURE IV - 2

JOHN CAROLLO ENGINEERS

SQUAW PEAK W.T.P. INLET RELOCATION

60" RCP MAIN LINE No.2 ("C-LINE")

Designed	Checked	Date		Drawing No.	Sheet
Drawn	Traced	Revised			No. Of

5. Water main parallel to ACDC channel shall be located a minimum of 15 feet from outside face of channel wall.

RELOCATION ALTERNATIVES

The relocation of the water mains affected by the proposed ACDC Channel was evaluated using the above stated criteria, existing pipe locations determined from available "As-Built" Plans, field surveys, geotechnical investigations, and information furnished by the FCDMC on the ACDC Channel. Two main relocation alignments were considered:

1. Under the ACDC Channel
2. Span over the top of the ACDC Channel

UNDER THE ACDC. The proposed ACDC Channel's dimension are 40 feet wide by 24 feet deep not including the wall and floor slab thicknesses. To provide for protection of the pipe during construction of the ACDC Channel, an additional depth of cover of 5 feet minimum under the bottom of the proposed ACDC Channel would be required. This would require a total excavation depth of 40 feet. Geotechnical data in the vicinity of the 66-inch main indicates that bedrock could be encountered at depths ranging from 19 feet to 33 feet. Therefore, rock excavation at depths of 7 to 21 feet would be required.

The existing 60-inch main has 10 feet of cover at the proposed location of the ACDC at an invert of 1229.5. Geotechnical data indicates that at this depth, the pipe is located in breccia fanglomerate. Rock excavation would be extensive if the pipe is realigned under the ACDC.

Due to the additional cost of rock excavation for this alignment alternative and the potentially longer construction time required, this alternative was not considered further.

SPAN OVER THE ACDC.

66-Inch Main. The existing 66-inch main has 2-3 feet of cover in the vicinity of the Arizona Canal. Geotechnical data indicates that the pipeline lies within a zone composed of probable fill, clayey gravelly sand, gravelly sand and gravel and silty sand and moves toward a breccia fanglomerate on the north side of the proposed ACDC. Excavation within this zone should pose no problems, however construction will require proper shoring of trench excavations.

The right of way width between the Arizona Canal and the ACDC is 50 feet. In order to meet the relocation criteria it is proposed that the 66-inch pipe be relocated by keeping the required excavation to a minimum. This can be accomplished by providing a field closure connection at Sta. 6+05 and maintaining an invert of 1237.5 up to Pipe Sta. 233.9, then rise vertically to a center line elevation of 1251.0 and span the ACDC to eventually connect with the existing 66-inch pipe at Sta. 8+75. The center line elevation of the pipe spanning the ACDC was determined on the basis that the bottom of the pipe clear the top of the ACDC using the elevation of 1248 as the top of the right wing wall as determined from the preliminary ACDC Plans. Another constraint for setting the pipe center line elevation is the bottom elevation of the finished water reservoir which is 1258.0.

The span of 70 feet required between pipe supports can be accomplished by use of steel pipe with 1/2 inch wall thickness. The use of stiffeners will be considered during design to reduce wall thickness and their cost against pipe wall savings will be evaluated. The pipe supports will be located at least 15 feet from the outside face of the ACDC and drilled into the bedrock so as not to be disturbed by the ACDC construction.

To minimize the length of realignment required for the 66-inch pipeline, and meet the relocation criteria of 15 feet from the ACDC, it is also recommended that the ACDC alignment be relocated a minimum of 5 feet to the east between Sta. 2+83 and Sta. 4+70.

60-Inch Main. The existing 60-inch pipeline realignment can be accomplished by routing the pipeline over the ACDC. This will minimize the amount of rock excavation and provide an economical realignment. Details of field closure connections will be similar to those for the 66-inch pipeline. The top elevation of the ACDC walls at this location is 1241.5. To maintain the reservoir bottom elevation constraints, it is proposed that the center line elevation of the 60-inch pipeline be at Elevation 1245.0 where it spans the ACDC. Span length will be 70 feet and supported as per the 66-inch pipeline.

We recommend that final design for both 60-inch and 66-inch mains verify existing depth and joint locations by potholing at selected locations.

ACDC NORTH ALIGNMENT IMPACTS

If the ACDC is relocated from its present alignment to the northerly alignment between the presedimentation basins and the reservoir, two additional large diameter pipelines will need to be relocated. These pipelines are the 48-inch and 66-inch raw water pipelines from the raw water pump station. The relocation of these pipelines can be accommodated by also spanning over the top of the ACDC.

The northerly alignment of the ACDC will also facilitate the construction of the 60-inch main as discussed under Construction Schedule below.

CONSTRUCTION SCHEDULE

The proposed realignment of the 66-inch main is not dependent on the realignment of the Arizona Canal nor upon its dry-up. Therefore, construction of this pipeline can begin as soon as design plans are complete and as long as construction is scheduled during the winter months of low water demand. However, scheduling for connections to the existing pipe should consider that the existing pipeline can not be out of service during the Arizona Canal dry-up period. A construction period of 45 days after receipt of pipe and materials is estimated.

The proposed realignment of the 60-inch pipeline is dependent upon the realignment of the Arizona Canal being accomplished first if the current alignment of the ACDC is maintained. However if the ACDC is relocated to the alignment north of the presedimentation basins, then construction of the 60-inch main can be scheduled for the winter months period with the same constraints as of the 66-inch main. A construction period of 45 days should also be considered for the 60-inch pipeline.

COSTS

Estimates for construction costs for the realignments of the 66-inch and 60-inch finished water pipelines were derived from preliminary material costs obtained from Ameron Pipe Co. and by extrapolating costs from previous pipeline jobs obtained from JCE files. Estimates for construction costs for the realignment of the 66-inch and 48-inch raw water pipelines were derived from extrapolating material costs for the 66-inch pipeline furnished by Ameron and from JCE pipeline cost files. Unit costs reflect current construction cost estimates and should be adjusted depending on time of construction. A breakdown of costs for each of the realigned pipelines is attached.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SQUAW PEAK WATER TREATMENT INLET RELOCATION
66-INCH AND 60-INCH PIPELINE REALIGNMENT

ENGINEERS CONSTRUCTION COST ESTIMATE

	Qty.	Unit Cost	Total
66-Inch Main			
1. 66-Inch Prestressed Concrete Pipe	255 lf	$ 480	$122,400
2. 66-Inch Steel Cement Mortar Lined Pipe	80 lf	900	72,000
3. 66-Inch Field Closures	2 ea	4,800	9,600
4. Drilled Pipe Supports	2 ea	2,000	4,000
5. Miscellaneous	1 ls	20,000	20,000
Total			$228,000
60-Inch Main			
1. 60-Inch Prestressed Concrete Pipe	40 lf	$ 400	$ 16,000
2. 60-Inch Steel Cement Mortar Lined Pipe	80 lf	675	54,000
3. 60-Inch Field Closure	2 ea	4,000	8,000
4. Drilled Pipe Supports	2 ea	2,000	4,000
5. Pump Manhole	1 ea	5,000	5,000
6. Miscellaneous	1 ls	10,000	10,000
Total			$ 97,000

SECTION V

SECTION V

FIELD INVESTIGATIONS

Field investigations included collecting and reviewing utility information and right-of-way plans, field survey, and review of traffic and access considerations to the water treatment plant. The area covered in this review extends from the 66-inch water main west of 24th Street to the SRP substation in the southwest corner of the water treatment plant site.

UTILITIES

Utility information from SRP, Southwest Gas, American Cable Television, City of Phoenix, and U.S. West Communications was collected. Maps submitted by these agencies were reviewed to identify utilities in the project area. Utilities in the area include underground and overhead electric, and cable TV. The underground electric is located south of the substation from approximately 300 feet east of the substation continuing west past the substation. Underground electric is also located from the west edge of 24th Street continuing west for about 400 feet. Both are located on the north side of the Arizona Canal in the SRP right-of-way. The underground electric next to 24th Street is the only one that must be relocated with the recommended alignment of the ACDC. The overhead electrical is primarily along the north side of the Arizona Canal in the project area. Cable TV is also strung along the power poles from 24th Street to the area around the present water treatment plant inlet. The north alignment of the ACDC does not require these utilities to be relocated unless they conflict with proposed recreational usage of the area.

RIGHT-OF-WAY

Property ownership and/or right-of-way in the project area is distributed between City of Phoenix and SRP. The recommended plant inlet alternative which locates the ACDC north of the presedimentation basin requires the FCDMC to acquire right-of-way from 24th Street through the water treatment plant site. This alignment also requires the FCDMC to acquire right-of-way through the corner of the adjacent property west of the water treatment plant site.

FIELD SURVEY

The proposed facilities will tie to and become part of the City of Phoenix system. Thus the survey control must be according to their coordinates and datum. The location of these new facilities are also near the proposed ACDC so their location and elevation must be tied to the Corps of Engineers coordinates and datum for the ACDC. The coordinates for several points are listed below.

Point Description	City of Phoenix	Corps of Engineers
Sec. Cor. 24th St. Bethany Home Road	S 2745.2781 E 853.7850	N 918185.8219 E 465644.0844
AC87-140 U.S.C.E.[a]	S 1963.6827 E 3.5248	N 918866.849 E 464761.515
AC87-141 U.S.C.E.[a]	S 1907.6484 E 456.4921 Elev. 1246.16	N 918925.246 E 465214.112 Elev. 1246.1422
AC87-142 U.S.C.E.[a]	S 2643.3951 E 841.8808	N 918191.653 E 465603.286
AC87-137 U.S.C.E.[a]	S 1495.6034 W 479.8547 Elev. 1245.48	N 919332.298 E 464275.720 Elev. 1245.4420

*U.S. Corps of Engineers survey control traverses points along Arizona Canal south of Squaw Peak WTP.

The field survey also included a bench loop to tie the City of Phoenix datum to Corps of Engineers datum. Calculations and survey sketch are included in Appendix B. The previous table also lists the elevations of Corps of Engineers traverse control points and elevations based on City of Phoenix datum. Comparison of elevations show that the equation to go from Corps of Engineers datum to City of Phoenix datum is +0.03.

TRAFFIC AND ACCESS CONSIDERATIONS

Proposed relocation of facilities is not anticipated to impact traffic. The relocation of the 66-inch water main is the closest facility to 24th Street. The minimum distance is 45 feet. This space should provide a contractor adequate room without detours or lane closures on 24th Street.

The construction of the 66-inch is the only facility that affects access to the water treatment plant. The north connection to the existing 66-inch is very close to the proposed plant access. This connection may impact one lane of the water treatment plant access road. This will have to be addressed when the alignment is set during the design phase of the project.

SECTION VI

SECTION VI

IMPLEMENTATION PLAN

The following section presents our suggested approach to implement the recommended plan. The implementation plan consists of three elements: negotiations, construction packaging, and construction scheduling.

NEGOTIATIONS

The recommended alternative of the North Location of the ACDC requires that the FCDMC acquire right-of-way for the proposed alignment. FCDMC should negotiate with the City of Phoenix and the adjacent property owner to acquire right-of-way.

The selection between the option of using the existing presedimentation basins or of constructing new basins needs to be made. This can be accomplished in negotiation between FCDMC and the City of Phoenix to select the option and then define sharing of costs if the new presedimentation basins are to be built.

CONSTRUCTION PACKAGING

Construction packaging is an activity that divides the construction of the proposed facilities by type of contractor and/or time in which specific facilities need to be constructed. The project requires general, mechanical, and electrical contractors. The treatment facilities cannot be broken into independent projects by contractor type. The proposed construction could be divided into water treatment facilities and water mains. This division could cause coordination problems between two contractors that would be working in the same area. Packaging of the

project by the time it must be completed does not seem feasible due to the short time available for construction. It is recommended that all facilities be constructed under one contract.

CONSTRUCTION SCHEDULE

The first step in developing a construction schedule is identifying the constraints. These include the following:

1. Construction of the canal inlet must be during the canal dry-up which normally occurs in the Arizona Canal from mid-October to mid-November.
2. Both the 60-inch water main and the 66-inch water main must be in service during canal dry-up.
3. Only one water main (60-inch or 66-inch) can be out of service at any given time.
4. Minimize impact to water treatment plant operation or distribution system operation - especially during peak demand periods of June, July, and August.
5. Improvements required by the ACDC must be completed by the summer of 1991.

For purposes of this discussion, it is assumed that the new presedimentation basins will be built. The next step is to list improvements as single items or groups that would be done together. These include the following.

1. Coordinate relocation of conflicting utilities.
2. Canal inlet and channels to the bar screens.
3. Raw water channel modifications at west end of presedimentation basin.

4. Bar screens, pipes to premixer and flow splitting structure, meter vault, stubouts to basins, and presedimentation by-pass line.

5. Demolition of old headworks, existing presedimentation basin inlet structure, sludge collection mechanism, and sludge pumping station.

6. Construction of new presedimentation basins and sludge pump station.

7. Construction of bridge over future location of ACDC.

8. Relocation of 60-inch water main.

9. Relocation of 66-inch water main.

10. Relocation of 48-inch raw water line to Plant I and Plant I drain and Reservoir No. 3 drain.

11. Relocation of 66-inch raw water line to Plant II, Plant II drain and Reservoirs No. 1 and 2.

The following criteria are used in establishing the proposed construction schedule.

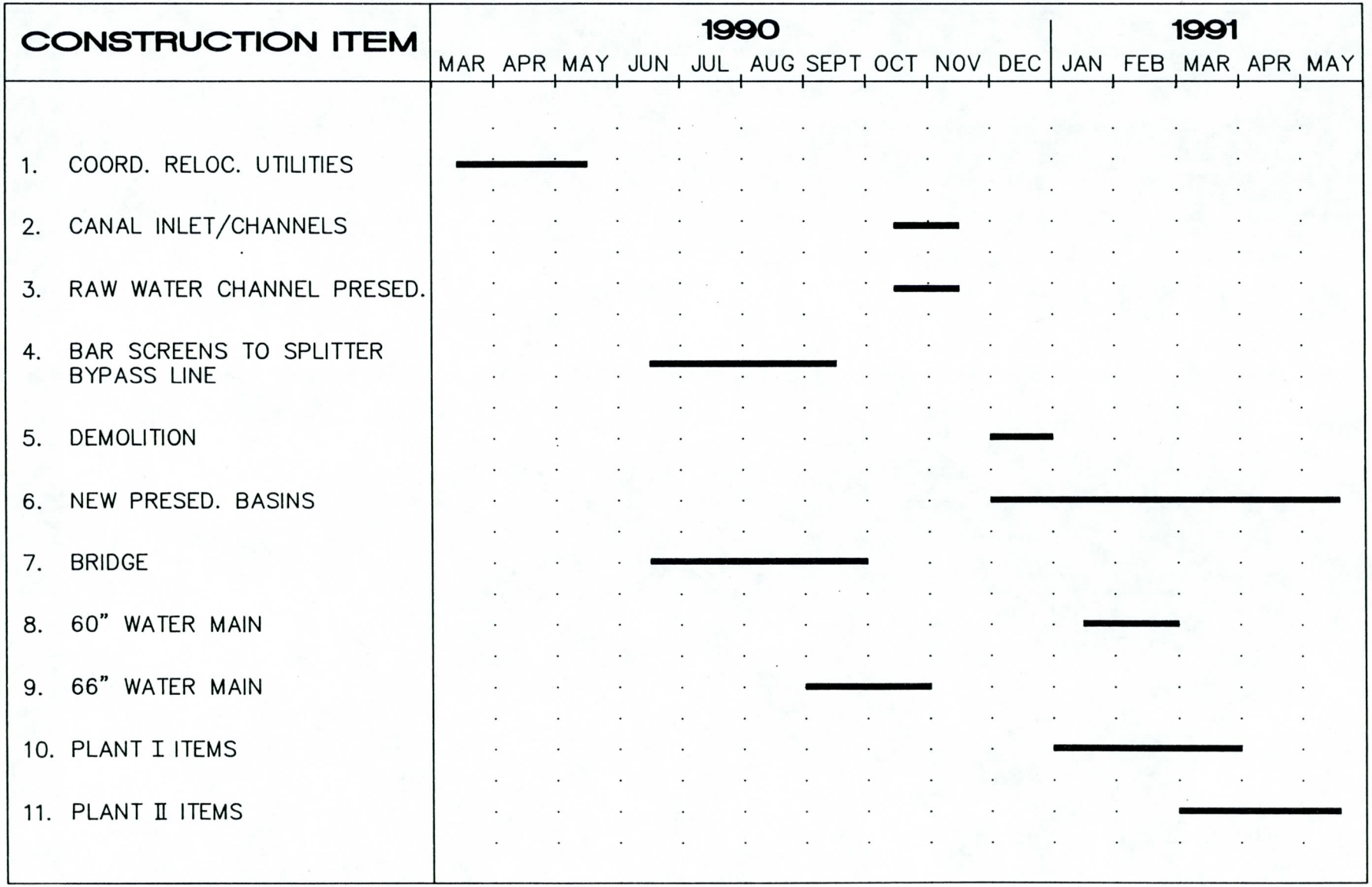
1. The new canal inlet, bar screens, flow splitting structure, and presedimentation by-pass line must be completed prior to starting construction of the presedimentation basins. The new facilities can then be used to take water directly from the canal to the raw water pump stations.

2. Facilities that affect one of the water treatment plants should be done at the same time to allow the operation of at least one of the water treatment plants.

3. Construction of the facilities that are not affected by the constraints or grouping should be scheduled with other construction activities in the area to provide a fairly consistent level of activity during the construction project.

The proposed construction schedule is presented in Figure VI-1.

FIGURE VI - 1
PROPOSED CONSTRUCTION SCHEDULE



APPENDIX

APPENDIX A

PERTINENT CORRESPONDENCE

SALT RIVER PROJECT

POST OFFICE BOX 52025
PHOENIX, ARIZONA
85072-2025
(602) 236-5900

May 24, 1989

Mr. Clyde K. Thompson, P.E.
John Carollo Engineers
3877 N. Seventh Street, Suite 400
Phoenix, Arizona 85014-5005

RE: Squaw Peak Filter Intake Relocation

Dear Clyde:

The purpose of this letter is to respond to your questions regarding the method of flow measurement required by the Salt River Project for the intake structure to the City of Phoenix Squaw Peak Water Filter Plant.

SRP staff has reviewed the three concepts presented by John Carollo Engineers and has identified the North Location ACDC as the preferred alternative. Magnetic Flow meters, with flow accuracy of 2% (+-), located upstream of the pre-mixer and flow splitting structure was determined to be the minimum acceptable measurement facility. It was determined that metering of the raw water pumps did not provide the required real time data and did not adequately address accountability of water in the presedimentation basins due to seepage and evaporation losses.

If you have any specific questions regarding the use of Magnetic metering please feel free to contact Mr. Jim McDade at 236-5508.

For you information I have also enclosed a copy of SRP's Canal Multiple Use Guidelines. If I can be of further assistance please do not hesitate to contact me at 236-2956.

Sincerely,

Timothy S. Phillips
Senior Engineer
Water C&M - Operational Support

TSP:tp
Enclosure:
cc: Terry Riley
Ron Grosch
Jim McDade
Mike Ference
Herb Mattingly

SALT RIVER PROJECT

POST OFFICE BOX 52025
PHOENIX, ARIZONA
85072-2025
(602) 236-5900

April 14, 1989

Mr. Clyde K. Thompson, P.E.
John Carollo Engineers
3877 North Seventh Street
Suite 400
Phoenix, Arizona 85014-5005

RE: Maximum and Minimum Canal Elevations - Arizona Canal

Dear Mr. Thompson:

This letter is to respond to your letter dated March 30, 1989 requesting maximum and minimum water surface elevations in the Arizona Canal in the west of the 24th Street Bridge for the purpose of designing a new inlet structure and drains for the Squaw Peak Water Filter Plant.

As requested the information is as follows:

Canal Capacity	Water Surface Elevation
325 cfs	1240.51'
700 cfs	1242.11'

The canal capacities and water surface elevations defined represent an approximated minimum and maximum and may vary depending on actual downstream water demands.

The datum for the water surface elevation is the Corps of Engineers datum used for the Arizona Canal Diversion Channel. For your reference, a USGS Brass Cap on the southwest corner of the 24th Street Bridge lists an elevation of 1248.20' which is consistent with the COE datum.

As you and I have discussed on the phone, SRP is very interested in the design of the new turnout to the Squaw Peak Filter Treatment Plant to incorporate accurate and real time water delivery measurements. We look forward to coordinating the design of the facilities with you to meet the both needs of the City of Phoenix and the Salt River Project.

If you have any further questions please do not hesitate to contact me at 236-2956.

Sincerely,

Timothy S. Phillips
Water Construction and Maintenance Department

TSP:tp

cc: Terry Riley
Ron Grosch
Bob Larchick

APPENDIX B

FIELD SURVEY

APPENDIX B

FIELD SURVEY

COORDINATE SYSTEM

A field traverse was run to tie City of Phoenix Squaw Peak WTP coordinate system to Corps of Engineers' coordinates.

The following figure shows the traverse that was run to establish the relationship. The upper left-hand corner shows the traverse starting on the northwest and southwest corner of Reservoir No. 2 at the Squaw Peak WTP. The following listing shows the relationship between plant coordinates and Corps of Engineers' coordinates.

Traverse Pt. No.	Corps of Engr. No.	City of Phoenix Coordinates	Corps of Engr. Coordinates
1	-	S 186.30 W 395.00	
2	-	S 380.50 W 395.00	
3	-	S 1360.40 E 13.01	
10	AC 87-140	S 1963.68 E 3.52	N 918,866.85 E 464,761.52
9	AC 87-141	S 1907.65 E 456.49	N 918,925.25 E 465,214.11
6	AC 87-142	S 2643.40 E 841.88	N 918,191.60 E 465,603.26
7	Sect. Corner Bethany Home & 24th	S 2745.28 E 853.79	N 918,089.75 E 465,615.74

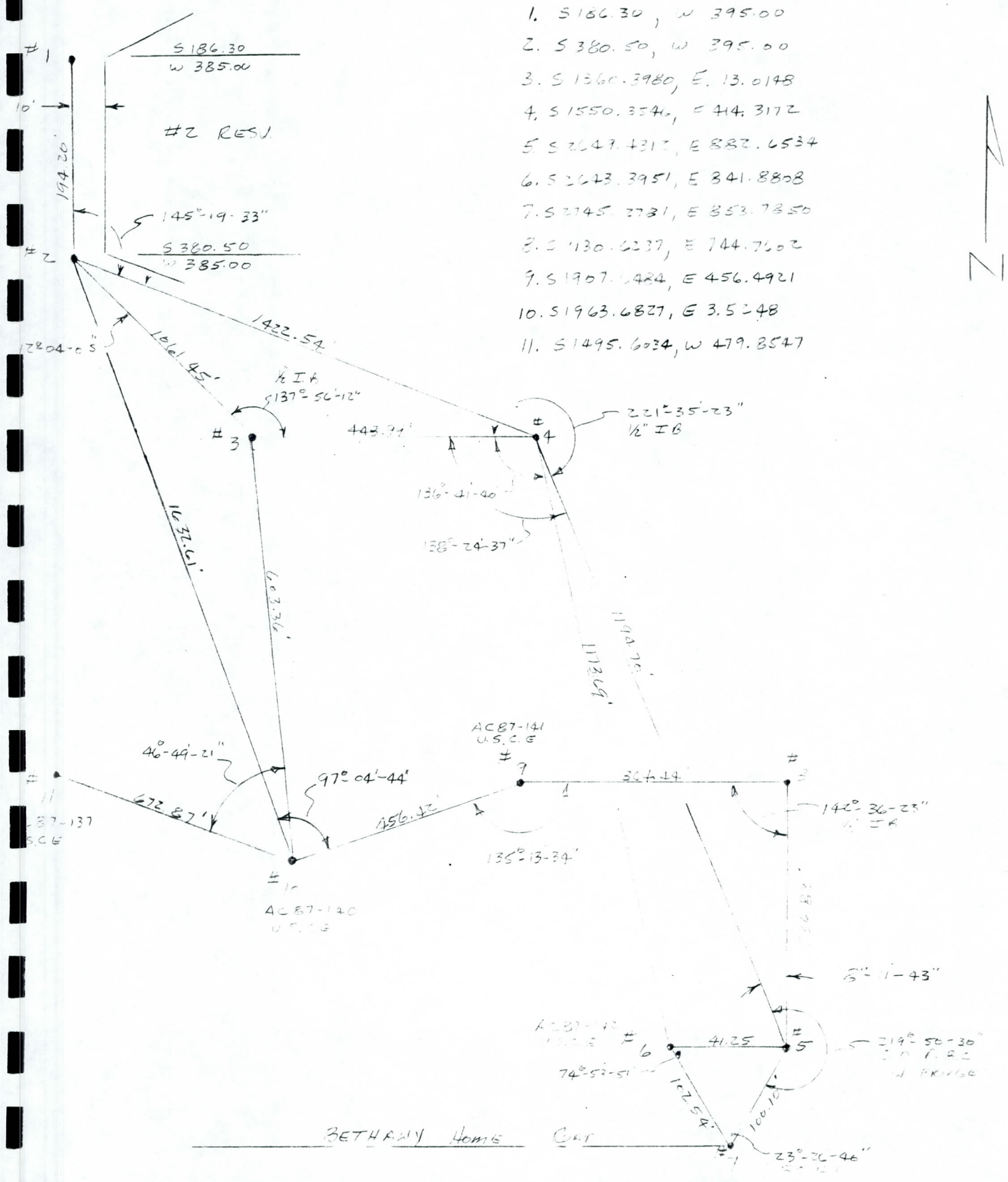
Closure on the traverse is S 0.0436 and E 0.0044.

JOHN CAROLLO ENGINEERS

PHOENIX, AZ • WALNUT CREEK, CA
FOUNTAIN VALLEY, CA • VISALIA, CA
TUCSON, AZ • SAN DIEGO, CA

BY R.E.R. DATE ..... SUBJECT TRUCKEE, SQUAW PEAK W.T.P. SHEET NO. 1 OF 1
CHKD. BY ..... DATE ..... JOB NO. 3249.A.10

1. S 186.30, W 395.00
2. S 380.50, W 395.00
3. S 1360.3980, E 13.0148
4. S 1550.3540, E 414.3172
5. S 2049.4312, E 882.6534
6. S 2043.3951, E 841.8808
7. S 2045.2781, E 853.7850
8. S 1130.6237, E 744.7602
9. S 1907.1484, E 456.4921
10. S 1963.6827, E 3.5248
11. S 1495.6034, W 479.8547



BENCH CIRCUIT

A bench circuit was run from the City of Phoenix 3-inch bronze disk set in the west sidewalk on the 24th Street bridge over the Arizona Canal (stamped elevation 1248.05) and the brass cap on the front step of the water treatment plant Administration Building (elevation 1297.56). The elevation for the City of Phoenix and Corps of Engineers shows the relationship:

	Elevations	
	Phoenix	Corps
Point #9 of Control Traverse of Corps Pt AC 87-141		1246.16

N

1"=40' scale 40 0 40 80 feet

EXISTING ROAD

PUMP STATION ROAD

20' WIDE BRIDGE

PLANT ELECTRICAL STATION

RAW WATER PUMPS PLANT II

RAW WATER PUMPS PLANT I

FUTURE RAW WATER PUMP STATION

100'

50'

TEMPORARY BY-PASS

SLUDGE PUMP STATION (ALTERNATE LOCATION)

ACDC

PRESEDIMENTATION BASIN

SLUDGE COLLECTOR

SLUDGE COLLECTOR 140' TYP.

SLUDGE COLLECTOR

SLUDGE PUMP STATION

R/W

40' RECTANGULAR CHANNEL

20' WIDE BRIDGE

A

CHEM. FEED CHAMBERS

FLOW METERS

BAR SCREEN STRUCTURE

SCREENINGS CONVEYOR

TEMPORARY BY-PASS

ARIZONA CANAL

1200 S

1400 S

1600 S

LEGEND

Temporary Construction

Part of Permanent Presed. Structure

JOHN CAROLLO ENGINEERS

PHOENIX, AZ • WALNUT CREEK, CA
SANTA ANA, CA • VISALIA, CA
SAN BERNARDINO, CA • TUCSON, AZ
SAN DIEGO, CA • BAKERSFIELD, CA
SACRAMENTO, CA • LOS ANGELES, CA
FRESNO, CA • EL PASO, TX

Not used.
Susan F. has already drafted something for this.

INTERNAL AGENDA ITEM ROUTING SLIP

Originator's Name Ed Raleigh/Jan Warriner
Agenda Item No. ~~FCD-90-XX~~ IGA FCD 90005
Topic IGA for Squaw Peak Water Treatment Plant
Date 6-7-90

X	Initial	Date	Reviewers	TARGET BOARD MEETING DATE
___	_____	_____	Branch Chief	7-2-90
X	_____	_____	Division Chief	
X	_____	_____	Other FCD Division (Specify)	
X	_____	_____	Chief, Contracting Branch (All contracts)	
X	_____	_____	Procurement Officer (All contracts)	
X	_____	_____	Controller (For attachment of Financial Sheet)	
X	_____	_____	Deputy Chief Engineer	
X	_____	_____	Chief Engineer and General Manager	

NOTE: Complete the County Routing Form for all external routing.

Remarks:

_____

DRAFT AGENDA INFORMATION FORM

1. BRIEF DESCRIPTION OF PROPOSAL AND REQUESTED BOARD ACTION: It is requested that the Board of Directors approve IGA FCD-90005 with the City of Phoenix for the design of Squaw Peak Water Treatment Plant relocations necessitated by the ACDC (Phase I Design) and the design of future modifications and improvements to the Water Treatment Plant that are desired by Phoenix (Phase II Design).

The IGA provides that the District will perform the Phase I design, construction, and construction management at no cost to the City of Phoenix. The Phase I work includes the relocation of several large diameter water lines, and the construction of two access bridges accross the ACDC. The District will also perform the Phase II design, with the City of Phoenix fully reimbursing the design costs. The Phase II design consists of modification of the existing earthen presedimentation basin to a concrete lined basin, and design of a new canal inlet structure. Phoenix will grant the District a perpetual easement for the ACDC rights-of-way at no cost, partly in consideration for administering the Phase II design contract. The advantage of having one agency contract for both phases of the design with a single design firm is to allow for the coordination of the changes caused by the ACDC with the new treatment plant modifications proposed by Phoenix.

The Phase II design contract is for ~~$280,850.00~~ 288,950.00 which will be fully reimbursed by Phoenix.

Compliance with Maricopa County Procurement Code _____, _____.

(Article) (Paragraph)

4. MOTION: .....approve and authorize the chairman to sign IGA FCD-90005 with the City of Phoenix for the design of both relocations and improvements at the Squaw Peak Water Treatment Plant.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

AGENDA INFORMATION FORM

Contract/Lease for ☒ NEW ☐ RENEWAL ☐ AMENDMENT ☐ CANCELLATION
(for existing, record Encumbrance No. below)

LOW ORG. NO. 6900 DEPARTMENT: Flood Control District CONTROL NUMBER: FCD-1083

ENCUMBRANCE NO. CS905093 AGENCY: Public Works CONTROL NUMBER: PW-1083

1. BRIEF DESCRIPTION OF PROPOSAL AND REQUESTED BOARD ACTION: It is requested that the Board of Directors authorize the advertisement of the Invitation for Bids and award of Contract FCD 90-01, Squaw Peak Water Treatment Plant Relocations at the Arizona Canal Diversion Channel (ACDC).

The work includes: a) relocation of several large diameter water lines, and b) construction of two access bridges.

This work is part of the District's responsibilities by agreement between the United States of America and the Flood Control District, dated July 21, 1977.

2. Compliance with Maricopa County Procurement Code 5 (article), MC1-503 (paragraph). Donald D. Bransky (Procurement Officer)

3. CONTINUED FROM MEETING OF
DISCUSSED IN MEETING OF

4. ☒ **THIS DEPARTMENT WILL CAUSE PUBLICATION**
☐ **CLERK OF THE BOARD TO CAUSE PUBLICATION**

5. MOTION: It is moved that the Flood Control District of Maricopa County Board of Directors . . . authorize the following: 1) advertisement of the Invitation For Bids for Contract FCD 90-01, Squaw Peak Water Treatment Plant Relocations at the Arizona Canal Diversion Channel; 2) award the contract to the lowest responsible bidder if the bid is not more than 10% over the engineer's estimate; 3) authorize the Chairman to sign the contract.

6. FINANCIAL: ☐ Expenditure ☐ Revenue ☐ Budgeted ☐ Contingency ☐ Budget Amendment ☐ Transfer ☐ Grant or other

$ _____ (Total) _____ (Fund) _____ (Financial Officer) _____ (Date)

7. PERSONNEL:

_____ (Personnel Director) _____ (Date)

8. FLOOD CONTROL DISTRICT:

Stanley L. Smith Jr., P.E. (Action Recommended by) DEPUTY CHIEF ENGINEER 1-17-90 (Date)

9. MATERIALS MANAGEMENT:

A. _____ (Materials Management Director) _____ (Date)

B. _____ (W/MBE Representative) _____ (Date)

10. LEGAL: Approved as to form and within the powers and authority granted under the laws of the state of Arizona to the Flood Control District of Maricopa County Board of Directors.

_____ (General Counsel) _____ (Date)

11. INFORMATION SYSTEMS: _____ (FISC)

_____ (Date)

12. APPROVED FOR AGENDA:

_____ (Approving Official) _____ (Date)

13. OTHER: Minority Business Office

_____ (Signature) _____ (Date)

14. BOARD OF DIRECTORS: Action taken:
☐ Approved ☐ Amended ☐ Disapproved ☐ Deleted

Continued to: _____ (Date and type of meeting)

Clerk of the Board FEB 20 1990 (Date)

15. RECOMMENDATION OF COUNTY MANAGER:
☐ Approve ☐ Disapprove

Comments:

_____ (County Manager) _____ (Date)

6900-012 R3-89

JOHN CAROLLO ENGINEERS
PHOENIX, AZ • WALNUT CREEK, CA
FOUNTAIN VALLEY, CA • VISALIA, CA
SAN BERNARDINO, CA • TUCSON, AZ
SAN DIEGO, CA • BAKERSFIELD, CA
SACRAMENTO, CA • LOS ANGELES, CA
FRESNO, CA

June 4, 1990

Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Attention: Mr. Ed Raleigh

Subject: Squaw Peak Water Treatment Plant
Design of Preliminary Treatment Facilities

Dear Ed:

In accordance with your request of May 24, 1990, we have reviewed the Scope of Work for subject project as prepared last January 24, 1990. The purpose of this review was to verify applicability of work tasks and other items that may have changed during evaluation of the project.

We have attached a complete updated proposal with changes as noted.

1. Exhibit A - Scope of Work - Text has been updated to delete references to flow splitter structure and "three presedimentation basins" has changed to "one presedimentation basin". Other minor changes include terminology of "channels" rather than "lines" for bypass or basin feeds. An explanation of planned changes to Raw Water Pumping Station (RWPS) has been added to indicate a requirement for coordination of pretreatment facility design with RWPS design.

   A revised Preliminary Basis of Design Criteria and Site Drawing are included reflecting above changes.

   Design Schedule is still applicable and has not been revised. A composite schedule of activities planned on-site is attached showing relationship of activities between construction of ACDC, Utility Relocation, Plant Bypass and Pretreatment Facility.

2. Exhibit B - Estimate of Effort has been revised to incorporate expected additional effort of Project Management in order to coordinate with RWPS design planning (30 man-hours were estimated for meetings and planning for this interface). We do not foresee additional effort associated with other revisions to Scope of Work.

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Exhibit B - Cost of Engineering Services has been updated to reflect the additional effort needed for RWPS coordination as well as changes to hourly labor rates which have occurred during the estimated 6 month slippage in design period.

We have met with the City of Phoenix Water and Wastewater Department (Mr. Dwayne Williams) to review the proposed changes included herein. It is our belief that the attached items are acceptable to the City and thus are ready for immediate use in preparation of an engineering services agreement for the work.

Please contact us if you have any questions.

Very truly yours,

JOHN CAROLLO ENGINEERS

George E. Shirley

George E. Shirley, P.E.
Partner

GES:jk
Encls.

cc: Mr. Dwayne Williams

EXHIBIT A
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Scope of Work

BACKGROUND

In March 1989, the Flood Control District of Maricopa County (District) contracted with John Carollo Engineers (Engineer) to perform a preliminary study (Phase I Services) of utility relocations required for construction of the Arizona Canal Diversion Channel (ACDC) at the City of Phoenix (City) Squaw Peak Water Treatment Plant (WTP) site. In the June 1989 Predesign Services Report, the recommended alternative was the "north Location of the ACDC". This recommendation, accepted by both the District and the City, required construction of the new ACDC through the existing WTP preliminary sedimentation basin.

Phase II services commenced in September to develop engineering design of utilities to be relocated from the alignment of the ACDC within the WTP site. As part of this service, final design criteria and locations for new preliminary treatment facilities were prepared. In addition, design of new bypass line for pretreatment facilities has been added to the Phase II Scope of Services.

A part of the recommendation for the "north Location of the ACDC" included new pretreatment facilities for the WTP to replace facilities displaced by the ACDC.

New WTP facilities were recommended to include Arizona Canal intake, bar screens, flow metering and premixer structure, presedimentation basin with feed and bypass channels, sludge pump station and miscellaneous electrical, chemical piping and instrumentation.

It has been agreed that the District and the City will enter into an Intergovernmental Agreement wherein the District will administer design and bidding services for the preliminary treatment facilities project, subject to review and approval of the City.

Subsequent professional services and the construction contract for this project will be administered by the City.

In May 1990 it was determined by the City that a revision to the Raw Water Pumping Station (RWPS) will be made, which will probably result in a total replacement of the existing station. Design of the presedimentation basin must be coordinated with planning and design of the new RWPS.

PURPOSE

The purpose of this Scope of Work is to provide design of replacement pretreatment facilities for the City of Phoenix Squaw Peak WTP. Additional services will include: bidding assistance and preparation of a suggested construction schedule, structured to reduce adverse impacts on City of Phoenix water production capability. Construction administration services, including preparation of Operation and Maintenance Manual update, and training of WTP staff in use of new pretreatment facilities, will be subsequent services to the City with Scope, Schedule and Cost of Services to be negotiated at a time prior to start of construction, and when requested by the City.

SCOPE OF WORK

Task I - Plans, Specifications and Cost Estimate. Prepare Plans, Specifications and Estimate of Probable Construction Cost for a new pretreatment facility at the WTP. Site is generally defined as WTP property south of the new ACDC.

New facilities are included as follows:

1. Intake structure at the Arizona Canal.
2. Bar screen structure, with mechanically-cleaned bar screen equipment, conveyor and screenings loading facility.
3. Flowmeter facility.
4. Premixer structure, with chemical feed injection for chlorine, carbon, coagulant and polymer.

5. Preliminary sedimentation basin, with sludge collector mechanism, inlet and outlet piping or channels, connection to bypass channel, and sludge pumping facilities. Features to be included are temporary feed channel to existing RWPS and provisions for permanent feed channel to new RWPS.
6. New chemical feed piping from existing chemical piping system at East ACDC crossing location to new premixer structure for existing chemical systems (alum/carbon line). New lines to feed chlorine and polymer will also be installed in this same location.
7. Electrical system for new facilities and interface to existing electrical system.
8. Process and instrumentation control system for new facilities and interface to existing and proposed control system. All control circuits and alarm signals will be brought to interface panel assumed to be located in existing pump station facility.
9. Site paving, grading, drainage and rerouted westside access road.
10. Demolition of existing pretreatment facilities and removal of temporary portions of bypass.
11. New facilities shall be in accordance with Preliminary Basis of Design Criteria and Site Drawing, as attached.

For the project, the Engineer shall:

- Prepare updated Site Drawing and Basis of Design and submit to District and City for review and comment.
- Prepare Preliminary (50%) Plans and Specifications and a Preliminary Estimate of Construction Cost, and submit to the District and City for review and comment (eight sets).
- Prepare Prefinal (90%) Plans and Specifications and submit to the District and City for review and comment (eight sets).
- Assist the District and City in securing required permits from Maricopa County Health Department and affected utilities and agencies. Submit Plans and Specifications for review and comments (estimate ten sets).

- Prepare Final Plans and Specifications and Estimate of Probable Construction Costs for submittal to the City. Submit full-size and half-size sets (50 each) of Final Plans and 100 sets of Specifications for use in bidding and construction. The Engineer shall retain a reproducible copy of Final Plans and Specifications. Specifications shall be complete to include both Engineer's Technical Specifications and City's Standard Contract Documents.

Geotechnical reports prepared under previous study and design projects shall be supplemented with additional soil borings and investigations as required for specific design task. Location of new facilities shall use existing WTP horizontal and vertical control.

The Engineer shall meet monthly with the District and City to review project status and to coordinate with and define interfaces with other design and construction work planned or underway on WTP site.

Task II - Bidding Assistance. The City will be responsible for bidding of project. The Engineer shall provide bidding assistance to the City, to include: responding to Contractor's requests for clarification; preparation of any required Addenda; attendance at the Prebid Conference; assistance in review of the qualified bids; and preparation of a Bid Review Report with a recommendation on Contract award.

SCHEDULE

Services shall be completed in accordance with the attached Schedule of Services.

EXHIBIT A (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Water Treatment Plant Preliminary Design Criteria

	Units	Capacity/No.
Plant Capacity		
Design Capacity	mgd	140
Hydraulic Capacity	mgd	180
Pretreatment Facility Components		
Intake Structure at Arizona Canal		
Obstructionless Entry	each	1
Bar Screens		
Mechanically Cleaned Bar Screens	each	3
Design Capacity, each	mgd	70
Hydraulic Capacity, each	mgd	80
Flowmeter(s)		
Number		2
Type		Magnetic
Premixer		
Number of Mixers	each	2
Type	-	Radial
Mixing Energy	Sec^{-1}	1,200-1,500
Preliminary Sedimentation Basins		
Type - Rectangular		
Number of Basins	each	1
Dimensions		
Width	feet	140
Length	feet	430
Depth	feet	12
Surface Loading Rates	gal/day/sf	
@ Design Flow		2,325
@ Hydraulic Flow		2,990
Detention Time	min.	
@ Design Flow		56
@ Hydraulic Flow		43
Sludge Pumping Facilities		

EXHIBIT A (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Schedule of Services

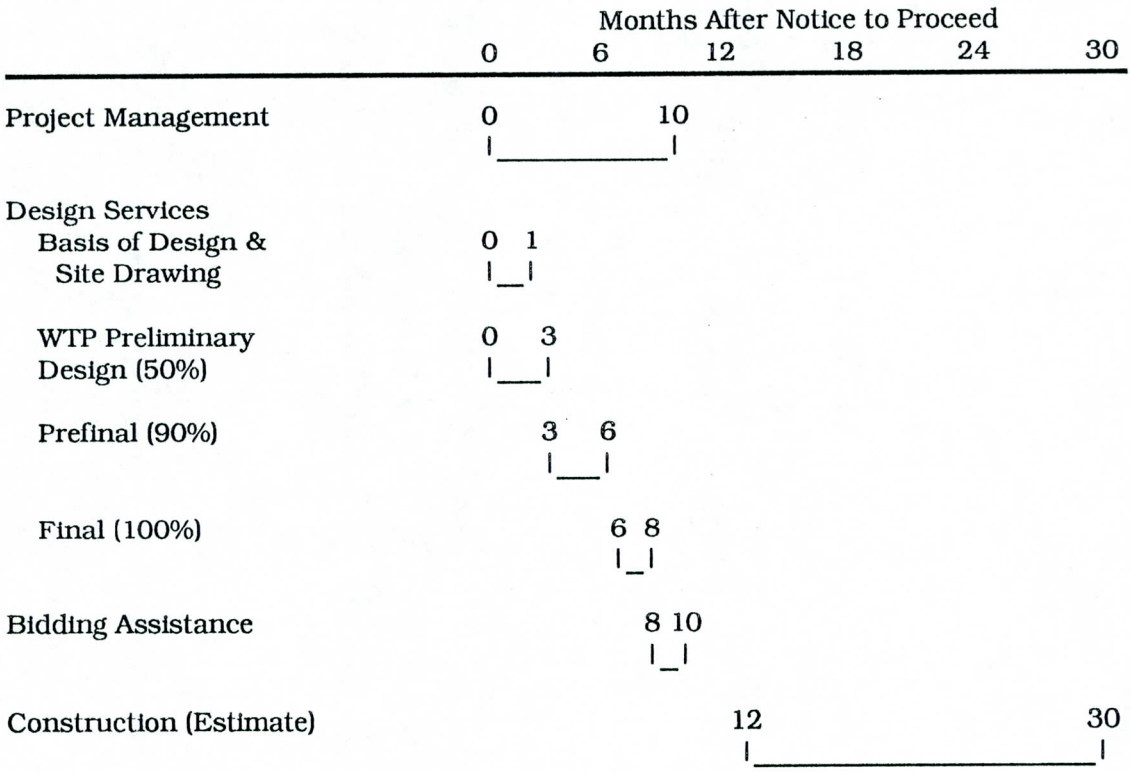


EXHIBIT B
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Estimate of Effort (Man-Hours)

	PIC	PM	PE	DE	Sr. Dsgnr.	Drfts.	Word Proc.	Total
Project Management	30	80					16	126
Design	112	420	680	960	780	870	114	3,936
Bidding Assistance	4	20	40			16	16	96
Total	146	520	720	960	780	886	146	4,158

EXHIBIT B (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Cost of Engineering Services

	Estimated Effort (Man-Hours)	Estimated Rate ($)	Cost ($)
Partner	146	$36.00	$ 5,256
Project Manager (E-VII)	520	32.20	16,744
Project Engineer (E-V)	720	26.30	18,936
Design Engineer (E-III)	960	21.00	20,160
Senior Designer (T-VII)	780	21.60	16,848
Draftsman (T-IV)	886	14.90	13,201
Word Processor	146	12.00	1,752
Total	4,158		$ 92,897
Multiplier*			2.97
Subtotal - Direct Labor, Overhead & Profit			$275,904
Round			$275,900
Subconsultants (no markup)			
Geotechnical Investigation (Thomas-Hartig)			$ 3,050
Other Direct Costs			
Printing Allowance: (actual cost)			
Composite Drawings			$ 4,500
Half-Size Negatives			300
Printing Plan Sets (review) 30(50)($0.42)			630
Printing Plan Sets (final) full size 50(50)($0.42)			1,050
half size 50(50)($0.11)			275
Printing Specifications 100 sets @ 300 pgs. @ $0.10/page			3,000
			$ 9,755
		Use	$ 10,000
Total			$288,950

*Multiplier based on overhead of 158% and profit of 15%.

EXHIBIT B (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
List of Drawings

PRELIMINARY TREATMENT FACILITIES

1. Title Page/Location Map/Index
2. Site Plan/General Notes
3. Hydraulic Profile/Schematics
4.-5. Process and Instrumentation Diagrams
6. Canal Intake - Structural Plan & Details

7. Bar Screens - Structural Plan
8. Bar Screens - Structural Details
9. Bar Screens - Mechanical Plan
10. Bar Screens - Mechanical Details
11. Bar Screens - Mechanical Details

12. Meter Vault - Structural & Mechanical

13. Pre-Mix - Structural Plan
14. Pre-Mix - Structural Details
15. Pre-Mix - Mechanical Plan
16. Pre-Mix - Mechanical Details
17. Pre-Mix - Chemical Feed Piping

18. Presedimentation Basin - Structural Plan
19. Presedimentation Basin - Structural Details
20. Presedimentation Basin - Structural Details
21. Presedimentation Basin - Mechanical Plan
22. Presedimentation Basin - Mechanical Details
23. Presedimentation Basin - Mechanical Isometric
24. Presedimentation Basin - Sludge Pump Station

25. Yard Piping - Piping Plan
26. Yard Piping - Miscellaneous Piping Plan
27. Yard Piping - Piping Details
28. Yard Piping - Piping Profiles

29. Electrical - Site Plan
30. Electrical - Bar Screen/Pre-Mix Plan
31. Electrical - Presedimentation Basin Plan
32. Electrical - Single Line Diagram
33. Electrical - Schematics
34. Electrical - Lighting Plan and Details
35. Electrical - Electrical Demolition/Interfaces
36. Electrical - Electrical Demolition/Interfaces

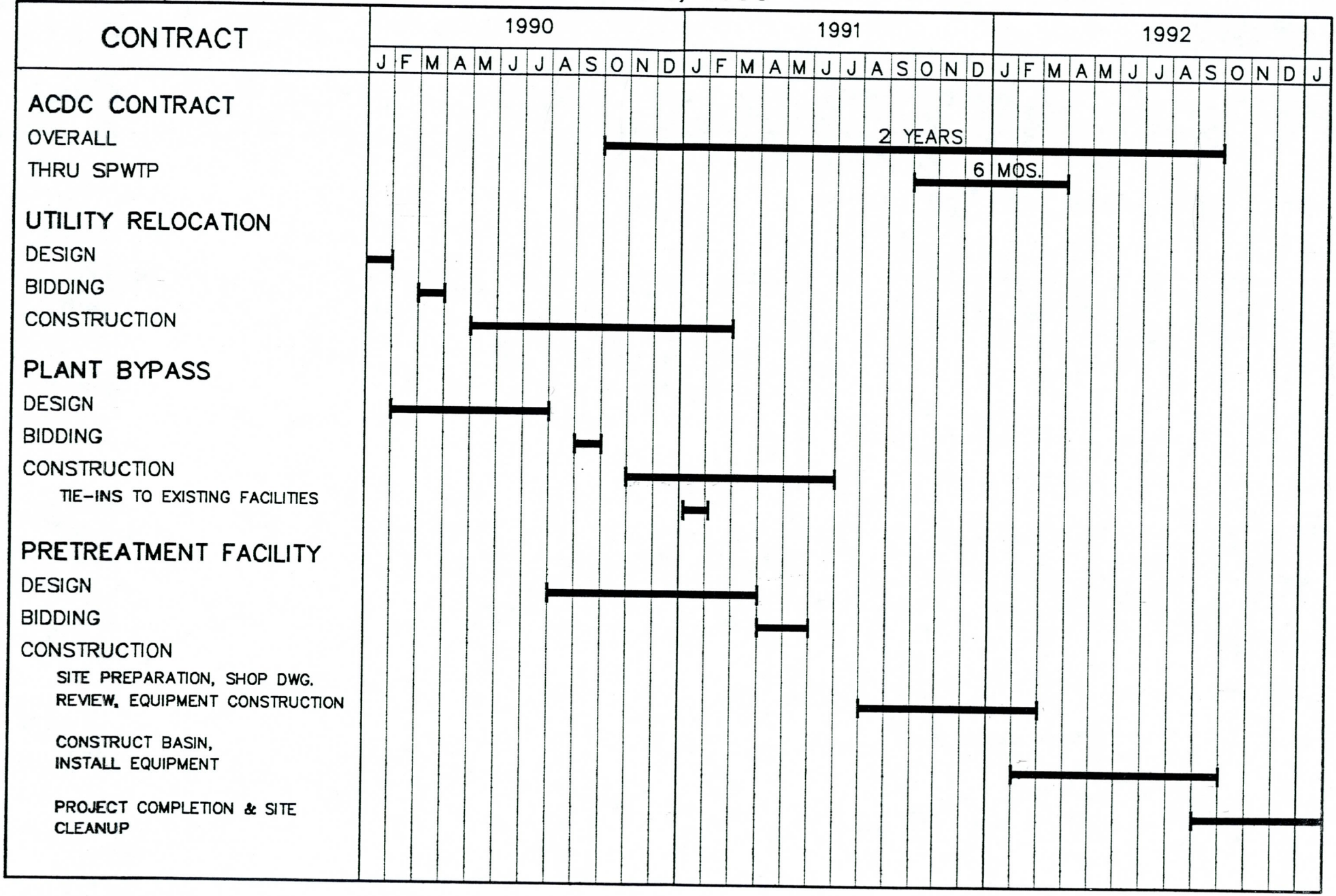
EXHIBIT B (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
List of Drawings (Cont'd)

37. Paving/Grading - Site Plan
38. Paving/Grading - Details
39. Paving/Grading - Sections

40. Demolition - Inlet Structure
41. Demolition - Sedimentation Basins/Sludge Pump Station
42. Demolition - Raw Water Pump Station Modifications
43. Demolition - Miscellaneous Piping Interfaces

44.-49. Typical Details

SQUAW PEAK WTP PROPOSED SCHEDULE
UTILITY RELOCATION, BYPASS & PRETREATMENT FACILITIES
JUNE 1, 1990



N

1"=40' scale 40 0 40 80 feet

EXIST WEST

RECLAMATION ROAD

PUMP STATION ROAD

20' WIDE BRIDGE

PLANT ELECTRICAL STATION

RAW WATER PUMPS PLANT II

FUTURE RAW WATER PUMP STATION

RAW WATER PUMPS PLANT I

SLUDGE PUMP STATION (ALTERNATE LOCATION)

100'

50'

TEMPORARY BY-PASS

ACDC

SLUDGE PUMP STATION

R/W

40' RECTANGULAR CHANNEL

SLUDGE COLLECTOR

SLUDGE COLLECTOR

140' TYP.

SLUDGE COLLECTOR

20' WIDE BRIDGE

CHEM. FEED CHAMBERS

FLOW METERS

BAR SCREEN STRUCTURE

SCREENINGS CONVEYOR

TEMPORARY BY-PASS

R/W

A

ARIZONA CANAL

1200 S

1400 S

4000 S

420 E

600 E

2000 N

3000 N

LEGEND

Temporary Construction

Part of Permanent Presed. Structure

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JOHN CAROLLO ENGINEERS

ROUTE

CONFERENCE MEMORANDUM

	Squaw Peak Water Treatment Plant - Relocations at the Arizona Canal Diversion Channel	**Conference Date:**	April 19, 1990
	Flood Control District of Maricopa County	**Issue Date:**	April 24, 1990

Conference Location: Flood Control District Office Conference Room

Attendees: See Attachment

Purpose: Preconstruction Conference - Contract 90-01

Distribution: All Attendees
Bob Ardizzone
Perry Johnson
Rod Troyer

File: 3249B.30

**Discussion: The following is our understanding of t
conference. If this differs with your understanding, pl**

SPWTP incoming info

1. All attendees introduced themselves and stat
Attendance roster is attached.

2. Mingus does not have a list of key personnel at th
work.

3.3 Mingus requested a Notice to Proceed date of May

The "dry-up" date for the Arizona Canal has bee
November 10 to the new dates of January 14 thr
must get final SRP board approval. Paul Sherrin
SRP contacts to confirm canal schedule.

Mingus was notified that they could anticipate a Change Order affecting the 36-inch wash water line near the SRP substation. The Change Order will deal with electrical isolation/grounding of the 36-inch wash water line. Salt River Project will remove and relocate the SRP substation fencing that is affected.

3.4 Contract time for this project is 300 calendar days following the Notice to Proceed date.

JOHN CAROLLO ENGINEERS

ROUTE

CONFERENCE MEMORANDUM

Project: Squaw Peak Water Treatment Plant - Relocations at the Arizona Canal Diversion Channel

Conference Date: April 19, 1990

Client: Flood Control District of Maricopa County

Issue Date: April 24, 1990

Conference Location: Flood Control District Office Conference Room

Attendees: See Attachment

Purpose: Preconstruction Conference - Contract 90-01

Distribution: All Attendees
Bob Ardizzone
Perry Johnson
Rod Troyer

File: 3249B.30

Discussion: The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

1. All attendees introduced themselves and stated their position of responsibility. Attendance roster is attached.

2. Mingus does not have a list of key personnel at this time, but will have prior to start of work.

3.3 Mingus requested a Notice to Proceed date of May 1, 1990. FCD agreed with that date.

The "dry-up" date for the Arizona Canal has been changed from October 13 through November 10 to the new dates of January 14 through February 2, 1991. New dates must get final SRP board approval. Paul Sherrington and Tim Philips (236-2956) are SRP contacts to confirm canal schedule.

Mingus was notified that they could anticipate a Change Order affecting the 36-inch wash water line near the SRP substation. The Change Order will deal with electrical isolation/grounding of the 36-inch wash water line. Salt River Project will remove and relocate the SRP substation fencing that is affected.

3.4 Contract time for this project is 300 calendar days following the Notice to Proceed date.

3.5 Construction work must be scheduled to maintain operation of the treatment plant. Any work that will temporarily disrupt existing plant operations will require 60-day, 30-day, and 7-day notifications to the Operations Superintendent through the Engineer.

3.6 Mingus submitted a preliminary construction schedule.

3.7 Failure to complete on time will cause assessment of liquidated damages. Liquidated damages are set at $710 per calendar day, plus actual cost of extended inspection or engineering charges, plus actual cost of lost production of the plant's treatment capacity.

3.8 Salt River Project Right-of-Way License No. 9000055 was given to Mingus. SRP license from the electrical group will be issued as soon as the electrical isolation/grounding problem is resolved (see 3.3 above).

Mingus must get and pay for the Maricopa County earth moving permit.

3.9 Mingus was given copies of the FCD Progress Payment Request Form and the Change Order Form.

No additional work will be authorized without an approved Change Order.

Additional inspection necessitated by overtime work will be paid by the Contractor.

Additional costs for overtime inspection will be waived during the canal dry-up period for two weeks.

4.1 All correspondence from the Contractor will be addressed to the Project Engineer, Billy S. Altman, P.E. All communication from the Contractor to the Owner, or from the Owner to the Contractor, will go through the Project Engineer.

4.2 Mingus was reminded that another contractor will be on-site installing a plant bypass line. Cooperation of all contractors for the benefit of all contractors is expected.

4.3 Construction coordination meetings were scheduled for 9:00 a.m. on Wednesdays.

Tom Martin agreed to schedule the SPWTP Conference Room for that time.

The Contractor will be prepared to give a two-week look-ahead schedule at the weekly conference.

4.4 The Contractor controls the means and methods for his work and is responsible for the safe execution of the work. John Carollo Engineers must be notified immediately of any accidents.

Accident Reports must be submitted to JCE and the FCD.

4.5 The Contractor is responsible for execution and costs associated with traffic control for materials deliveries and other, if required.

4.6 Alcohol or drug use will not be tolerated on this project.

4.7 All work will be guaranteed against materials and workmanship defects for a period of one year after acceptance.

5.1 All testing will be done in accordance with MAG Uniform Standard Specifications and will be performed by JCE or its authorized subconsultant.

5.2 All inspection will be done in accordance with MAG Uniform Standard Specifications and will be performed by JCE.

5.3 Survey baseline and benchmark have been established. The Contractor is responsible for all construction survey.

6.1 The Contractor was reminded that the project is located in a semiresidential area, and that public safety and noise and dust control are very important aspects of the project.

6.3 Mingus will maintain normal working hours of 7:00 a.m. through 3:30 p.m.

6.4 JCE will make a photographic survey of the work area prior to the start of work and at the end of the project. Damage to property will be the responsibility of the Contractor.

OTHER ITEMS

- Mr. Spanulescu requested that a Principal from Mingus and JCE issue a signature authorization letter to the FCD. The letter will indicate authorized signatures for such items as pay requests and change orders.

- The City of Phoenix routinely does in-plant inspection of concrete pipe and puts the City's seal on accepted pipe. Mingus is not required to make any provisions or notification for this in-plant inspection.

- Mr. Hughes said there are three power poles that will require bracing during the project. Mingus should contact Mr. Hughes at SRP and give at least two weeks notice to schedule the bracing.

- Relocation of the SRP duct bank may not take place within the duration of this project.

- There is an APS power pole located at the SRP substation. This APS pole must remain within the confines of the SRP substation fencing. Mingus agreed that deleting a 10-foot triangular area at the southwest corner of the proposed 40' x 40' fence relocation will not affect their work schedule or effort.

CONFERENCE MEMORANDUM

- It was agreed that the fence relocation by SRP must be complete within two weeks of Notice to Proceed.
- SRP will remove the 40' x 40' ground grid from the area of fence relocation, at the same time as the fence relocation.
- Ms. Ortiz distributed executed Contracts to Mingus and to JCE. One copy of the Insurance Agreement was given to JCE.
- All water quality testing to be performed by the SPWTP laboratory will be scheduled through Mr. Brown.

Billy S. Altman, P.E.
Billy S. Altman, P.E.

BSA:cm

Attachments

SQUAW PEAK WATER TREATMENT PLANT
RELOCATIONS AT THE ACDC

PRECONSTRUCTION CONFERENCE
April 19, 1990

AGENDA

Project: Squaw Peak Water Treatment Plant Relocations at the Arizona Canal Diversion Channel

Contract No.: 90-01

Owner: Flood Control District of Maricopa County

Engineer: John Carollo Engineers

Contractor: Mingus Constructors, Inc.

1. Introduction of Attendees
2. Contractors List of Key Personnel
3. Administration
   - 3.1 Purpose of Preconstruction Conference
   - 3.2 Description of Work
   - 3.3 Notice to Proceed
   - 3.4 Contract Time
   - 3.5 Work Involved with Existing Plant
   - 3.6 Construction Schedule
   - 3.7 Liquidated Damages
   - 3.8 Permits
   - 3.9 Project Documents
     - Change Order
     - Progress Payments
     - Overtime Work

4. Control of Work and Coordination

   4.1 Line of Communication
   Contractor - Engineer - Owner

   4.2 Cooperation with Utilities and other Contractors

   4.3 Construction Coordination Meetings

   4.4 Safety

   4.5 Traffic Control

   4.6 Alcohol/Drug Use

   4.7 Guarantee of Work

5. Technical

   5.1 Testing

   5.2 Inspection

   5.3 Survey

6. Public Awareness

   6.1 Safety

   6.2 Noise/Dust Control

   6.3 Work Hours

   6.4 Property Damage

   6.5 Complaints

ATTENDANCE ROSTER

Purpose: Preconstruction Conference

Project: Squaw Peak Water Treatment Plant Relocations at the Arizona Canal Diversion Channel

Contract No.: 90-01

Owner: Flood Control District of Maricopa County

Engineer: John Carollo Engineers

Contractor: Mingus Constructors, Inc.

Date: April 19, 1990

Name	Title	Organization	Telephone
BILL ALTMAN	ENGINEER	JOHN CAROLLO ENGINEERS	263-9500
George Shirley	Partner	John Carollo	263-9500
JAMES DOYLE	INSPECTOR	JOHN CAROLLO ENG.	263-9500
DALE DASHNEY	SUPT	COMMONWEALTH ELECT	437-0354
EARL BLACK	PROJECT MANAGER	MINGUS CONST	634-9556
TOM MARTIN	SUPER	COP / SQUAW PEAK	262-4983
Jan Warriner	Technician	FCD	262-1501
Ed Raleigh	Project Manager	FCD	" "
Bob Payette	Ch. C+O Rev.	"	" "
Andy Brown	Engineer - Const.	City of Phx W; WW	495-7683
Gerald Arakaki	CE	COP WATER	illegible
Laurence Spreulberg	Constr. Inspect.	FCD	262-1501
HELEN ORTIZ	Contracting Er.	FCD	" "
Bill Phillips	Elect. Engr	SRP	236-2732
CHUCK HUGHES	POWER CONSULTANT	SRP	illegible

JOHN CAROLLO ENGINEERS
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SAN DIEGO, CA • BAKERSFIELD, CA
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FRESNO, CA

April 23, 1990
3249C.11

Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Attention: Mr. Ed Raleigh

Subject: Squaw Peak Water Treatment Plant
Relocations at the ACDC - Phase II
Plant Bypass Line
FCD 88-40

Gentlemen:

As a result of our meeting on April 20, 1990 with the City of Phoenix and the Flood Control District of Maricopa County, our firm will prepare alternative bypass line layouts in conjunction with possible rectangular presedimentation basins for the proposed pretreatment facility. This effort is required to determine a possible revised site layout which coordinates with planned modifications to the existing raw water pump station. Since this effort is outside our current scope of services, we will track this effort separately and keep you informed of our progress.

If you have any questions or comments, please do not hesitate to contact us.

Very truly yours,

JOHN CAROLLO ENGINEERS

George E. Shirley

George E. Shirley, P.E.
Partner

GES:cm

3877 North Seventh Street, Suite 400 • Phoenix, Arizona 85014-5005 • (602) 263-9500 • FAX: (602) 265-1422

JOHN CAROLLO ENGINEERS

ROUTE

CONFERENCE MEMORANDUM

Project: Squaw Peak WTP - Relocations at the ACDC, Phase II Plant Bypass Line, FCD 88-40

Conference Date: April 20, 1990

Client: Flood Control District of Maricopa County

Issue Date: April 23, 1990

Conference Location: Squaw Peak Water Treatment Plant

Attendees:

City of Phoenix	FCDMC	JCE	MPI
Tom Martin	Jan Warriner	George Shirley	Dan Baggett
Dwayne Williams		Bob Ardizzone	
Carlos Padilla		Nancy Ash	
K.N. Jagannath			
John Kish			
Randy Smith			

Purpose: Discuss Coordination Between Plant Bypass Line and Raw Water Pump Station

Distribution: Attendees
Mr. Wayne Janis
Mr. Jerry Hayes
Mr. Reggie Swartz

File: 3249C.11

Discussion: The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

DISCUSSION

1. The City of Phoenix (COP) indicated that they arranged the meeting as a follow-up to the meeting that took place on April 16, 1990 between JCE, FCDMC and the COP. At that meeting, the hydraulic considerations for the plant bypass line were discussed. The purpose of the present meeting was to discuss the coordination between JCE's design and the design being performed by Malcolm Pirnie, Inc. (MPI) for the raw water pump station. The COP stated that JCE's minutes of the meeting were transmitted to MPI so they could review the information presented in the earlier meeting.

2. JCE briefly summarized the hydraulic design parameters for the bypass line and new pretreatment facility, and discussed the resultant impacts on the raw water pump station.

3. MPI stated that they have just started work on the preliminary design for the raw water pump station two days ago. The current preliminary concept is to locate a new pump station east of the present pump station (approximately 50 feet by 100 feet). With a new

pump station, a lower hydraulic grade line (HGL) could be easily accommodated. Trying to tolerate a lower HGL with the existing pump station, however, would be difficult due to the existing floor elevation unless several small (i.e., 10 mgd) pumps were installed. Ideally, the new pump station should be constructed in the area of the proposed western circular presedimentation basin, otherwise the plant would have to be shut down for an extended period of time (if constructed in the area of the existing raw water pump station).

4. MPI indicated that their schedule is to have the preliminary design study for the raw water pump station completed in three months. Conceptual design should be completed in about one month.

5. The possibility of utilizing rectangular presedimentation basins to conserve land requirements was discussed. JCE stated that previous meetings with the COP revealed the COP's preference to utilize circular basins due to the increased maintenance requirements associated with rectangular basins. It was acknowledged by the COP that the space limitations at the Squaw Peak Water Treatment Plant may warrant the COP to reconsider its position toward rectangular basins.

6. JCE indicated that the scheduled start of construction for the bypass line was planned for autumn 1990, to coincide with the plant shutdown period. The line itself, however, does not need to be in place until construction of the ACDC and the western-most presedimentation basins are initiated (both planned to occur between October 1991 and March 1992). Since SRP recently indicated that the canal dry-up is now scheduled for January 1991, design and construction for the bypass line could be postponed without affecting the overall schedule.

7. The following plan of action was agreed upon by the COP, FCDMC, JCE and MPI:

   - MPI will study and evaluate further, within the next four weeks, the preliminary design requirements for the raw water pump station.

   - JCE will sketch conceptual layouts for the proposed pretreatment facility utilizing rectangular presedimentation basins.

   - The COP will review and consider the possible use of rectangular versus circular presedimentation basins for the Squaw Peak Water Treatment Plant.

   - In approximately four weeks, another meeting will be held to review the results of MPI, JCE and COP findings.

Robert A. Ardizzone, P.E.

RAA:cm

JOHN CAROLLO ENGINEERS

ROUTE

CONFERENCE MEMORANDUM

Project: Squaw Peak WTP - Relocations at the ACDC, Phase II Plant Bypass Line, FCD 88-40

Conference Date: April 16, 1990

Client: Flood Control District of Maricopa County

Issue Date: April 17, 1990

Conference Location: City of Phoenix Water & Wastewater Department

Attendees:

City of Phoenix	FCDMC	JCE
Tom Martin	Ed Raleigh	George Shirley
Gerald Arakaki		Bob Ardizzone
Dwayne Williams		
Carlos Padilla		
K.N. Jagannath		

Purpose: Discuss Plant Bypass Line Design Criteria

Distribution: Attendees
Mr. Wayne Janis
Mr. Jerry Hayes
Mr. Reggie Swartz
Nancy Ash
Rod Troyer

File: 3249C.10

Discussion: The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

INTRODUCTION

A summary of the various projects were reviewed as follows:

- Utilities Relocation Project - Contract has been awarded to Mingus Constructors. A Preconstruction Conference is scheduled for Thursday, April 19, 1990, at 1:00 p.m. at the offices of the Flood Control District of Maricopa County (FCDMC). The design and construction for this project is being funded by the FCDMC.

- Plant Bypass Line - Design for new bypass around existing and future presedimentation basins and modifications to north end of pump forebay. The design for these facilities were added to JCE's current contract with the FCDMC and is now underway. The design and construction for this project is also being funded by the FCDMC.

- Pretreatment Facilities - Project will include new canal intake, bar screens, flow metering, premixer and flow splitter structure, and three circular presedimentation basins. Before design can commence, need Intergovernmental Agreement (IGA) between FCDMC and City of Phoenix (COP). Currently, IGA is still being processed by COP. Although the design for this project is being administered by the FCDMC, the design service fee, construction cost, and construction administration fee will be funded by the COP.

JCE explained that the purpose of the meeting was to review the design requirements for the new bypass line. The bypass line needs to be in place prior to construction of the ACDC and the new presedimentation basins (both planned to occur between October 1991 and March 1992). An overall schedule of the various projects was reviewed and is attached to this Conference Memorandum.

DESIGN CAPACITY FOR BYPASS LINE AND PRETREATMENT FACILITY

It was agreed that the design capacity for the bypass line and new pretreatment facility should be 140 mgd, with a hydraulic capacity of 180 mgd. The COP stated that the raw water pump stations for Plants I and II are planned to be expanded to have a total pumping capacity of 220 mgd (with all pumps in service) and a firm capacity of 180 mgd (with largest 40 mgd pump out of service).

HYDRAULIC CONSIDERATIONS

JCE reviewed the existing hydraulic design conditions and estimated head loss for the bypass line and new pretreatment facilities (see Attachment No. 1). Currently, the minimum available head is approximately 1.9 feet. With the new facilities, the estimated head loss at 180 mgd will be approximately 3.3 feet. The corresponding water surface elevation in the RWPS for Plant II would be approximately 1237.0±, or about 1.5 feet lower than the original design criteria for the existing pumps. JCE explained that the piping between structures are sized fairly large in order to minimize the head loss. Increasing the size of the piping further would not significantly reduce the head loss and would have the negative effect of having extremely low velocities at low plant flow conditions. The size of the plant bypass line would be an 8' x 8' conduit (or equivalent area) to achieve this head loss.

LIMITATIONS OF EXISTING RAW WATER PUMP STATION

A discussion of the limitations of the existing raw water pump station followed. The COP indicated that any design improvements to the pump station are planned to be included within the design contract with Malcolm Pirnie, Inc. (MPI). The COP suggested that a meeting between the COP, FCDMC, JCE and MPI take place to discuss the necessary coordination between JCE's and MPI's design efforts. The COP will contact MPI and advise JCE and FCDMC of when the meeting will take place.

PROJECT MANAGEMENT ISSUES

JCE stated that if additional head were available, the bypass line would not need to be as large. Based on the assumption that a water surface elevation of 1238.0± in the pump forebay is acceptable for operation of the existing pumps, the interim hydraulic capacity for the bypass

line would be only 140 mgd. Also, assuming that after modifications to the pump station are performed a water surface elevation of 1237.0± in the pump forebay is acceptable in the future, the hydraulic capacity for the bypass line would then be 180 mgd.

It was concluded that resolution of the available head loss and the required size of the bypass line would have to be deferred until after the coordination meeting with MPI.

MISCELLANEOUS DESIGN ISSUES

JCE stated that a survey was performed to locate and stake the Arizona Canal north right-of-way. A site plan showing the right-of-way was reviewed and handed out during the meeting.

JCE indicated that a temporary construction easement from SRP will probably be necessary. FCDMC stated that obtaining the easement from SRP should not be a problem.

Following the meeting, FCDMC stated that JCE should identify the proposed revisions to the north end of the pump forebay within the next two weeks, if possible. This information is required by the Corps of Engineers in order to show on the ACDC design drawings.

ACTION ITEMS

City of Phoenix

Schedule meeting between MPI, JCE and FCDMC to discuss coordination of design for raw water pump station and new pretreatment facility/bypass line.

John Carollo Engineers

1. Following coordination meeting with MPI, finalize sizing requirements for bypass line and continue design.

2. Provide FCDMC with tentative revisions to north end of pump forebay (within next two weeks).

Robert A. Ardizzone, P.E.

RAA:jk

SQUAW PEAK WATER TREATMENT PLANT
RELOCATIONS AT THE ACDC - PHASE II
PLANT BYPASS LINE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Contract FCD 88-40

AGENDA

April 16, 1990
10:00 a.m.

1. Introduction

2. Design Capacity for Bypass Line and New Pretreatment Facility

3. Hydraulic Considerations

   - Existing Hydraulic Design Conditions
   - Estimated Headloss for New Facilities

4. Limitations of Existing Raw Water Pump Station

   - Current Operational Problems
   - Schedule for Anticipated Modifications
   - Coordination of Design With Raw Water Pump Station

5. Project Management Issues

   - Assume Interim Hydraulic Capacity = 140 mgd
     (min. acceptable pump forebay W.S. elev. = 1238.0±)

   - Assume Ultimate Hydraulic Capacity = 180 mgd
     (min. acceptable pump forebay W.S. elev. = 1237.0±)

   - Size of bypass line = 8' x 8' conduit

6. Miscellaneous Design Issues

   - Arizona Canal North Right-of-Way
   - Temporary Construction Easement From SRP
   - Schedule
     - Bypass Line Design/Construction
     - Pretreatment Facility Contract Design

ATTACHMENT NO. 1

HYDRAULIC DESIGN PARAMETERS SUMMARY

1. Proposed Design Capacity for New Bypass Line/Pretreatment Facility per City of Phoenix.

Design Capacity, mgd	140
Hydraulic Capacity, mgd	180

2. Existing Hydraulic Design Conditions

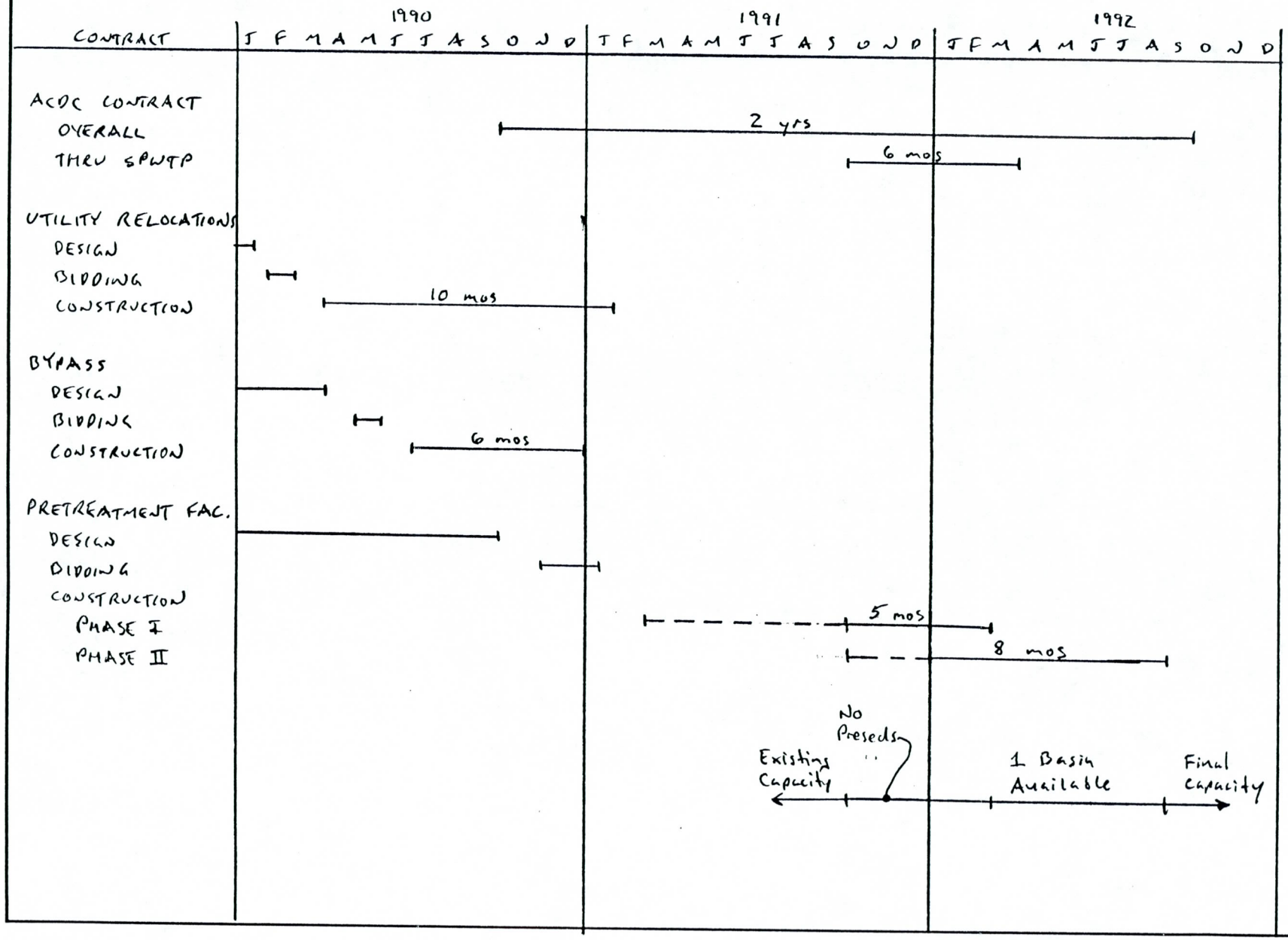
Design Flow, mgd	140
Arizona Canal	
Max. W.S. elev.	1241.96 (1)
Min. W.S. elev.	1240.36 (1)
Design Criteria for Existing Raw Water Pumps	
Pump Station I Min. W.S. elev.	1236.5 (2)
Pump Station II Min. W.S. elev.	1238.5 (2)
Minimum Pump Suction Elevation for Plant II	
Raw Water Pumps to satisfy minimum submergence requirements	
Byron Jackson Pump	1235.9±
Johnston Pump	1237.9±
Minimum available head, ft.	1.9

3. Estimated headloss for new Bypass Line/Pretreatment Facility

	140 mgd	180 mgd
Through Existing Inlet/Bypass		
Estimated headloss, ft.	2.42	3.82
Pump Station II Min. W.S. elev. (3)	1237.94	1236.54
Through New Inlet/Bypass		
Estimated headloss, ft.	2.14	3.30
Pump Station II Min. W.S. elev. (3)	1238.22	1237.06
Through New Inlet/Preseds		
Estimated headloss, ft.	2.22	3.31
Pump Station II Min. W.S. elev. (3)	1238.14	1237.05

(1) Per letter from SRP dated April 14, 1989, adjusted to COP datum.
(2) Per original design notes, adjusted to current COP datum.
(3) Based on Arizona Canal minimum W.S. elev. = 1240.36.

OPTION II - NO PRESEDS FOR 5 MOS



JOHN CAROLLO ENGINEERS

BY RAA DATE 11-16-89 SUBJECT SPWTP SHEET NO. 3 OF 4

CHKD. BY ..... DATE ..... JOB NO. .....

JOHN CAROLLO ENGINEERS
PHOENIX, AZ • WALNUT CREEK, CA
FOUNTAIN VALLEY, CA • VISALIA, CA
SAN BERNARDINO, CA • TUCSON, AZ
SAN DIEGO, CA • BAKERSFIELD, CA
SACRAMENTO, CA • LOS ANGELES, CA
FRESNO, CA

February 21, 1990
3249C.10

Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Attention: Mr. Ed Raleigh

Re: Squaw Peak Water Treatment Plant
Relocations at the ACDC - Phase II
Flood Control District of Maricopa County
FCD 88-40

Gentlemen:

In response to comments received from Mr. Charles Wainwright of your office, enclosed for your review are additional structural calculations regarding the abutment wall sections. Also enclosed is a sketch which shall be issued as an addendum to revise the structural steel requirements for the west access bridge abutment detail.

If you have any questions or comments, please do not hesitate to contact us.

Very truly yours,

JOHN CAROLLO ENGINEERS

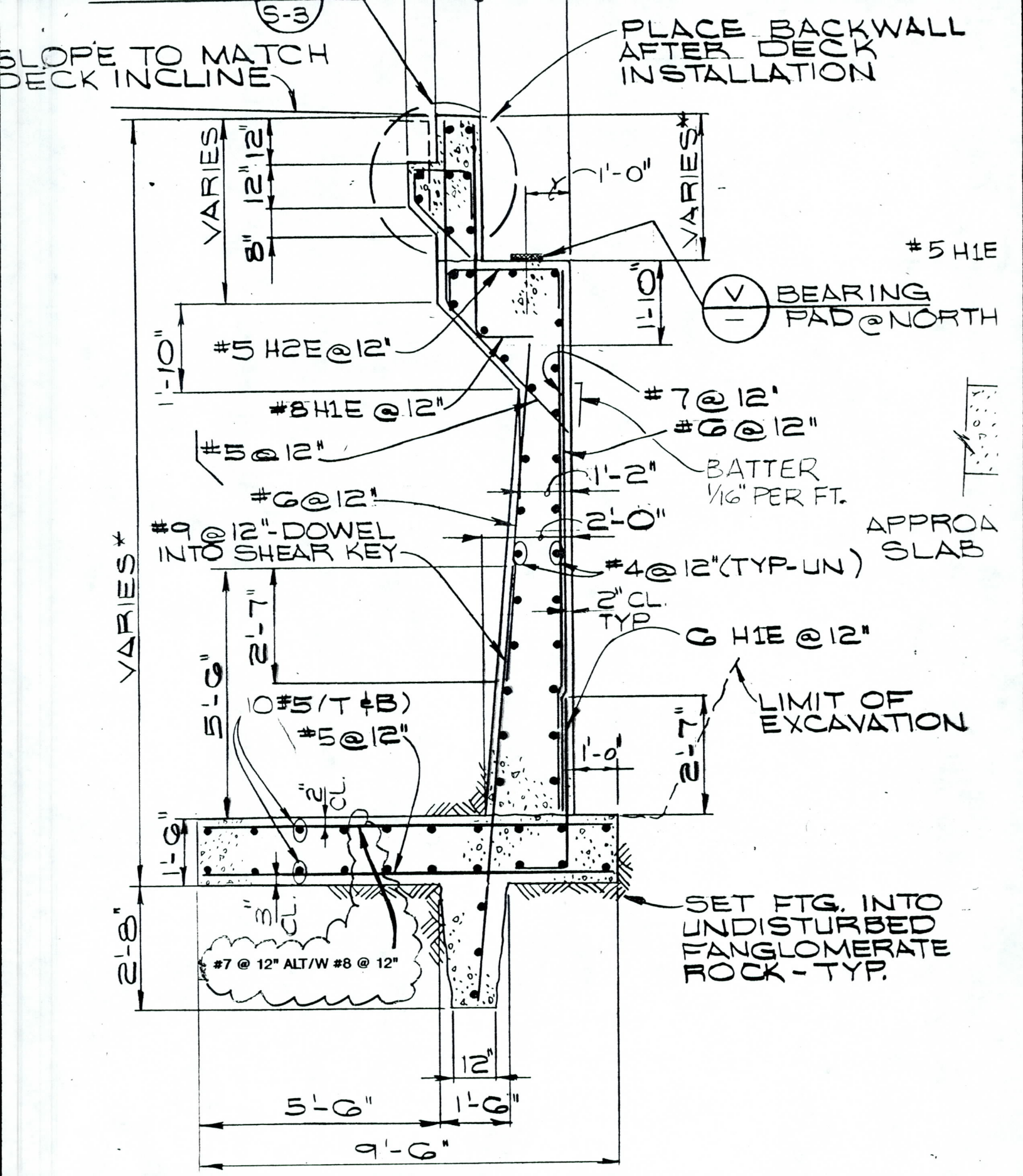
Robert A. Ardizzone

Robert A. Ardizzone, P.E.

RAA:jk

Enclosure

3877 North Seventh Street, Suite 400 • Phoenix, Arizona 85014-5005 • (602) 263-9500 • FAX: (602) 265-1422



T / S-2 ABUTMENT WALL SECTION

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

DRAWING S-4

JOHN CAROLLO ENGINEERS

BY RPT DATE 2/20/90 SUBJECT SQUAW PEAK FCDMC SHEET NO. A-27 OF ___

CHKD. BY ___ DATE ___ JOB NO. 3249B.10

CHECK HEEL OF ABUTMENTS FOR SUPERIMPOSED LOAD WITHOUT ANY UNARD SOIL PRESSURE - AASHTO 5.2

EAST BRIDGE - NORTH ABUT. - SEE SHT A-8, $A_s = 0.79\ in^2/FT$

$M_A = (1.74 + .225)(4.75)^2/2 = 22.2\ K\text{-}FT/FT$

$f_c = 824\ psi$ (< 1400 ✓)

$f_s = 23.68\ ksi$ (< 24 ✓) } SEE SHT. A-28

MOMENT IN CANTILEVER WALL = $30.13\ K\text{-}FT$ (> 22.2 ✓ - Sht. A-7)

EAST BRIDGE - SOUTH ABUT. - SEE SHT A-14, $A_s = 0.31\ in^2/ft$

$M_A = (1.16 + .225)(3.33)^2/2 = 7.69\ K\text{-}FT/FT$

$f_c = 420\ psi$ (< 1400 ✓)

$f_s = 20.3\ ksi$ (< 24.0 ✓) } SEE SHT A-28

MOMENT IN CANTILEVER WALL = $13.50\ K\text{-}FT/FT$ (> 7.69 - Sht. A-14.)

WEST BRIDGE, BOTH ABUTMENTS - SEE SHT. B-19, $A_s = 1.0\ in^2/ft$

$M_A = [(14.38)(0.11) + (1.5)(0.15)](6.5)^2/2 = 38.2\ K\text{-}FT$

$A_s = 1.37\ in^2/ft$ (> 1.0 % MINIMUM REQ'D)

USE # 7@12" ALT/W # 8@12" ($A_p = 1.39\ in^2/FT$)

MOMENT CAPACITY OF CANTILEVER WALL ($A_s = 1.0\ in^2/ft$, $d = 21.5"$)

$= 39.64\ K\text{-}FT/FT$ (> 38.2 ✓ - SEE SHT A-29)

JOHN CAROLLO ENGINEERS
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FOUNTAIN VALLEY, CA • VISALIA, CA
SAN BERNARDINO, CA • TUCSON, AZ
SAN DIEGO, CA • BAKERSFIELD, CA
SACRAMENTO, CA • LOS ANGELES, CA
FRESNO, CA

January 30, 1990
3249B.10

Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Attention: Mr. Ed Raleigh

Re: Squaw Peak Water Treatment Plant
Relocations at the ACDC - Phase II
Flood Control District of Maricopa County
FCD 88-40

Gentlemen:

Responses to the structural design comme in regards to the 90% submittal for the above w.

If you have any questions or comments, plea

All SPWTP info incoming

Very truly yours,

JOHN CAROLLO ENGINEERS

Robert A. Ardizzone

Robert A. Ardizzone, P.E.

RAA:jk
Encl.

3877 North Seventh Street, Suite 400 • Phoenix, Arizona 85014-5005 • (602) 263-9500 • FAX: (602) 265-1422

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FRESNO, CA

January 30, 1990
3249B.10

Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Attention: Mr. Ed Raleigh

Re: Squaw Peak Water Treatment Plant
Relocations at the ACDC - Phase II
Flood Control District of Maricopa County
FCD 88-40

Gentlemen:

Responses to the structural design comments received from the Flood Control District in regards to the 90% submittal for the above referenced project are enclosed for your review.

If you have any questions or comments, please do not hesitate to contact us.

Very truly yours,

JOHN CAROLLO ENGINEERS

Robert A. Ardizzone

Robert A. Ardizzone, P.E.

RAA:jk
Encl.

3877 North Seventh Street, Suite 400 • Phoenix, Arizona 85014-5005 • (602) 263-9500 • FAX: (602) 265-1422

SQUAW PEAK WATER TREATMENT PLANT
RELOCATIONS AT ACDC

Responses to FCDMC Structural Comments

Comments by Laurence Spanulescu:

1. Sheet S-1, comment #10, first part:

   West Bridge is post-tensioned, cast-in-place concrete. There is no option for precast girders at this location.

2. Sheet S-1, comment #10, second part:

   The 1/2:1 slope was used based on COE drawings and soil report recommendations, the geometry of the abutment is such that the toe of the abutment is at least 3 feet back laterally from the face of the future ACDC construction, again per the soils report recommendations.

3. Sheet S-3, comment #11:

   The subject dowels and their spacing is shown on detail P/S-3.

4. Sheet S-3, comment #12:

   Drawing to be changed to indicate "1/2" Bituminous-treated cane fiber expansion board" on detail P/S-3.

5. Sheet S-5, comment #13:

   Drawing to be changed to indicate that "tension in rods may be accomplished by applying a torque of approximately 600 foot-pounds, alternately, contractor may utilize calibrated washers".

Comments by C.G. Wainwright

6. Sheet S-1, comment #1:

   A 3'-0" minimum dimension has been shown from toe of footing to assumed edge of channel excavation.

7. Sheet S-1, comment #2:

   Footing elevations have been shown.

8. Sheet S-1, comment #3:

   Plan (horizontal) dimensions differ from the actual (slope) length of the girders due to the difference in elevation across the bridges.

9. Sheet S-2, comment #1:

   - o Have moved East Bridge note to bottom.
   - o Clear cover note already in notes.
   - o Have added tension lap note.

10. Sheet S-2, comment #2:

    - o Have removed strength reference in quantities table.
    - o Have changed concrete from Class S (ADOT) to Class AA (MAG).

11. Sheet S-3, comment #1:

    Yes, backwall is cast directly against girder, see Sections H & L Bridge is considered propped for SDL + LL.

12. Sheet S-3, comment #2:

    Have added 1'-0" dimension from toe of footing to face to abutment wall.

13. Sheet S-3, comment #3:

    Have corrected Section L to read 6 #5 (T&B).

14. Sheet S-4, comment #4:

    Have added 1'-0" dimension from toe of footing to face to abutment wall.

15. Sheet S-5, comment #1:

    A FCDMC in-house question

16. Sheet S-5, comment #2:

    - o Have noted the 4" fillet dimensions as typical.
    - o Have dimensioned the cantilever as 10" at face of box.
    - o 3'-7" is correct (cross slope was changed from 2% to 1-1/2% late in project).
    - o Have added drip groove call-out.

17. Sheet S-6, comment #1:

    - o Depth in Elevation AJ is correct at 3'-7"
    - o Depth in Section AL will be changed to "varies"

18. Sheet S-6, comment #2:

    Tendon Path Diagram AM, 7-1/2" dimension changed to 7".

19. Sheet S-6, comment #3:

    Prestressing notes have been changed to reflect new jacking force due to superimposed dead load of barriers.

20. Sheet S-6, comment #4:

    "1" and "2" have been reversed

21. Sheet S-6, comment #5:

Detail AP, Bearing plates and bursting reinforcement changed to be perpendicular to tendon path.

22. Design Review, comment #1:

West bridge has been redesigned to include the superimposed dead loads of the traffic barrier. The drawings have been changed to reflect the increase in post-tensioning force. Revised calculation sheets B-4 to B-8 enclosed.

23. Design Review, comment #2:

At-rest earth pressure and temperature growth/stresses were investigated (see enclosed sht. A-26), exterior compression forces are much less than interior prestress. Insufficient thermal growth occurs (for a temperature differential of 80°F) to move abutments far enough to generate passive earth pressure.

24. Design Review, comment #3:

Earthquake restraints have been added

25. Design Review, comment #4:

Cantilevers are 3'-7" wide, which is not unusual. The Post-Tensioning Institute's design manual has several design examples with cantilevers of 4'-4".

26. Design Review, comment #5:

The reason for choosing a post-tensioned concrete bridge at this location (originally for both locations) was economics. Other, subjective factors such as detours and construction duration, do not apply at this site. The parametric costs for a post-tensioned, and a precast girder bridge are tabulated below. Only costs which are significantly different are shown, costs are not shown for sufficiently common items including substructure, barrier walls, wing walls, etc.

Post-tensioned, cast-in-place concrete bridge:

Concrete - 105 CY @ $250.00	$26,250
Reinf. - 12,000 lbs @ 0.56	6,720
Post-tensioning - 5,800 lbs @ 3.25	18,850
TOTAL	$51,820

Precast, prestressed girders (similar to East Bridge):

Girders - 6 ea @ $13,000.00*	$78,000
Asphalt - 27 tons @ 33.00	898
TOTAL	$78,898

*The eighty foot box girders for the east bridge cost approximately $12,000 each in lots of five several years ago, $13,000 for eighty-two foot girders is a reasonable current estimate for comparison purposes.

As can be seen, the precast girder superstructure costs approximately 52% more than the post-tensioned superstructure. Even if a large increase in the cast-in-place concrete unit costs should occur, the post-tensioned bridge is clearly much more economical. A precast, prestressed superstructure would normally be selected where other mitigating factors dictate its usage, such as speed of construction or difficult falsework conditions. There are no reasons for an accelerated construction schedule for this bridge, and the site lends itself to casting the superstructure on grade, eliminating falsework costs. There are now many qualified contractors familiar with this type of construction, so the more economical, post-tensioned box was selected.

CHECK BOX GIRDERS FOR ACTUAL LOADS

REF: HOFFMAN-MILLER CALCULATIONS DATED 6/83

GIRDER DL = 1.112 KLF (REF. p. 2)

BARRIERS (2)(.372)/5GIRDERS
= .149

A/C OVERLAY = .100 (25 PSF)

FWS = .100 (25 PSF)

1.461 KLF

$M_{DL} = (1.461)(78)^2/8 = 1111$ K-FT/GIRDER

LIVE LOAD (HS20)

M_{LL} = 1129 K-FT/LANE (4'/10') = 451.6 K-FT/GIRDER

IMPACT (50)/(78.125) = 0.25

M_{LL+I} = (1.25)(451.6) = 562.8 K-FT

APPLIED M_U:

$M_U = \frac{1.30}{\phi}[D + 5/3(L+I)] = 1.3[1111 + 5/3(562.8)] = 2664$ K-FT

CAPACITY = (40,010,000)/(12000) = 3334 K-FT (> 2664 K-FT)
(REF. p. 6)

APPLIED DESIGN M_U = (40,404,016)/12000 = 3367 K-FT

GIRDERS WERE DESIGN FOR A SPECIAL SCHAFER WHICH OBVIOUSLY EXCEEDS HS20 LOADING

GIRDERS OK

CHECK TEMPERATURE STRESSES IN EAST BRIDGE

IF TOTALLY RESTRAINED ΔT $110^\circ - 30^\circ = 80^\circ$ (CONSERVATIVE)

$\Delta \varepsilon = (3{,}605{,}000)(.00055)(80)/100 = 1586$ psi

$A_{girder} = 1038 in^2$ (HOFFMAN-MILLER CALCS, p. 1 of 13)

$P_T = (1038)(1586)/1000 = 1646^K$

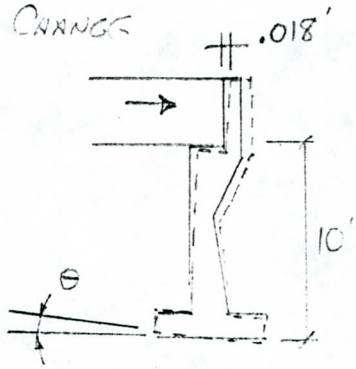
TOTAL RESTRAINT IS IMPOSSIBLE, HOW MUCH DO GIRDERS GROW?

$\Delta L = (.00055)(80)(80)/100 = .035' \ (.422")$

ABOVE IS BETWEEN TWO ABUTMENTS

ROTATION OF SHORTER ABUTMENT DUE TO TEMP. CHANGE

$\theta = .018/(10)(12) = .00015$ RADIANS
$(0^\circ 0' 30")$



THE GENERALLY ACCEPTED RULE OF THUMB FOR WALL ROTATION GENERATING PASSIVE PRESSURE IS .005 H

OR $(.005)(10) = .05' > (.035/2 = .018')$

∴ FULL TEMPERATURE GROWTH WOULD NOT GENERATE PASSIVE PRESSURE

THE ORIGINAL ASSUMPTION OF NON-REST RESTRAINT AT TOP OF WALL IS VALID

MAX $F = (3.54)(4') = 14.16^K$ (SEE SHT. A-6)

$P_f = 794^K$/GIRDER (HOFFMAN-MILLER CALCS, p. 4 of 13)

14.16^K IS ONLY 1.8% OF P_f

SAY OK

AREA = 4574.11 in^2/144 = 31.76 ft^2/ft

Wt = (31.76)(.150) = 4.76 KLF

S_T = 1,161,700/(45 - 25.36)$(12)^3$ = 34.23 ft^3/ft

S_B = 1,161,700/(25.36)$(12)^3$ = 26.51 ft^3/ft

f_T = 1000M/(144)(34.23) = 0.2029 M

f_B = 1000M/(144)(26.51) = 0.2620 M

DESIGN MOMENTS

BARRIERS 2@.372 = 0.74 KLF

DEAD LOAD = 4.76 KLF

DIAPHRAGMS & BARRIERS .74

5.54 KLF

FWS @ 25 PSF

(.025)(20) = .20

5.74 KLF

M_{DL} = (5.74)$(82)^2$/8 = 4828 K-FT

LIVE LOAD DISTRIBUTION

CURB TO CURB = 20' ∴ USE 2 LANES

IMPACT = 50/(82+125) = 0.242

M_{LL} = (2)(1.242)(1201) = 2983 K-FT

$M_{DL} + M_{LL}$ = 4828 + 2983 = 7811 K-FT

P/T REQUIREMENTS AT MIDSPAN DUE TO DL+LL

$f_T = (.2029)(7811) = 1585$ psi (C)

$f_B = (.2620)(7811) = 2046$ psi (T)

ALLOWABLE STRESS FOR $f'_c = 3500$ psi

$C = (.40)(3500) = 1400$ psi

$T = 6\sqrt{f'_c} = 355$ psi → SAY 0

TRY 114 STRANDS ⇒ 3 TENDONS OF 38 EA

$P_f \simeq (114)(.6)(.153)(270)/3 = 942^K$/GIRDER

MIN D = 2.5" 2.5 + 4.5 = 7"

$e = 25.36 - 7 = 18.36"/12 = 1.53'$

$f_b = \frac{P_f}{A} + \frac{P_f e}{S_B} = 2046$

$1000 P_f/4574.11 + P_f(1.53)(.2620) = 2046$

$P_f = 3303^K/3 = 1101^K$/GIRDER

MIN "D" = 2.5" ✓

TOP STRESS @ MIDSPAN

$f_T = P_f/A - \frac{P_f e}{S_T} = \frac{(1101)(1000)}{4574.11} - (1101)(1.53)(.2029)$

$= -101$ psi

FINAL TOP STRESS = 1585 − 101 = 1484 psi (~1400 ✓)

CONCRETE STRENGTH REQ'D = 1484/.40 = 3710

USE $f'_c = 4000$ psi

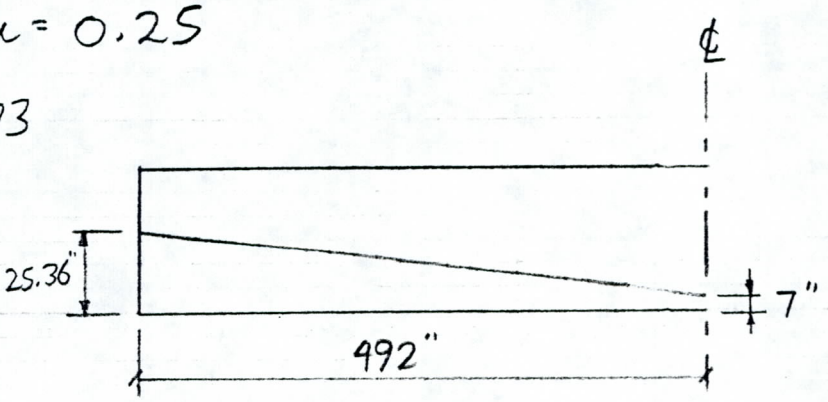
PRESTRESS LOSSES

PRESUMPTIVE LOSS = 32,000 PSI (AASHTO TABLE 9.16.2.2)

FRICTION LOSS $K = .0002$ (GALVANIZED, RIGID)

$\mu = 0.25$

$\alpha = (25.36 - 7)/492 = .0373$



$K\ell + \mu\alpha =$

$(.0002)(82) + (.25)(.0373)$

$= .0257 \quad (< 0.3)$

$P_J = P_x\,(1 + .0257)$

$= 1.0257\,P_x \quad (97.5\%)$ NEGLIBLE FOR DESIGN PURPOSES

ALLOWABLE STRAND STRESS BEFORE LOSSES = .70 × 270 = 189 KSI

$f_e = 189 - 32 = 157$ KSI

STRANDS = $3303/[(3)(157)(.153)] = 45.8$ PER WEB

P_f (BEFORE LOSSES) $= (3)(45.8)(189)(.153) =$ **3976 KIPS** (JACKING FORCE)

REQUIRED CONCRETE STRENGTH AT STRESSING

$3976/((189-10)(.153)) = 145$ STRANDS

DEAD LOAD MOMENT = 4828 K-FT (SEE SHT. A-4)

$f_T = (4828)(.2029) = 980$ psi [C]

$f_B = (4826)(.2620) = 1265$ psi [T]

P/S STRESS AT MIDSPAN BEFORE LOSSES

$f_T = (1000)(3976)/4574.11 - (3976)(1.53)(.2029) = -365$ psi [T]

$f_B =$ " + " $= 2104$ psi [C]

$\Sigma f_T = 980 - 365 = 615$ psi

$\Sigma f_B = -1265 + 2104 = 839$ psi $\quad 839/.55 = 1525$ psi

SET $f'_{ci} = 2000$ psi

CHECK ULTIMATE MOMENT (BONDED TENDONS - WILL BE GROUTED)

$M_U = (1.3)[4828 + (5/3)2983] = 12{,}740$ K-FT

$e^* = (145)(.153)/(278)(36.50) = .00219$

$f^*_{SU} = 270[1 - (0.5)(.00219)(270)/4.0] = 250$ KSI

$(1.4)(36.50)(.00219)(250)/4.0 = 6.99$ " ($< 7\frac{1}{2}$" - N.A. WITHIN FLANGE)

$\therefore$ SECTION CAN BE CONSIDERED RECTANGULAR

$\phi M_N = (.9)(22.19)(250)(36.50/12)[1 - (.6)(.00219)(250)/4.0] = 13{,}936$ K-FT

$> 12{,}740$ K-FT ✓

CHECK MAXIMUM STEEL %

$e^* f^*_{SU}/f'_c = (.00219)(250)/4.0 = .137 < 0.30$ ✓

CHECK MINIMUM STEEL %

$F_r = 7.5\sqrt{4000} = 474$ psi $\qquad P_j = 3923^K$ (SHT. B-6)

$f_{CR} = \frac{(3976)(1000)(0.70)}{4574.11} + (3976(.70)(1.53)(.2620) - M_{CR}(.2620) = -474$

$M_{CR} = 8390$ K-FT

$1.2 M_{CR} = (1.2)(8390) = 10{,}068$ K-FT ($< 13{,}936$ ✓)

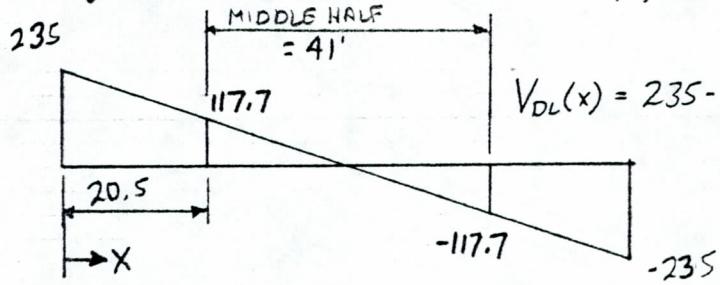
ANCHORAGE STRESSES

$(0.9)(2000) = 1800$ psi

SHEAR - USE 79 INTERIM (FOOTNOTE TO AASHTO 9.20, p. 97)

$$A_V = \frac{(V_U - V_C)s}{2 f_{SY} j d}$$

BUT NOT LESS THAN $A_V = \frac{100 b' s}{f_{SY}}$



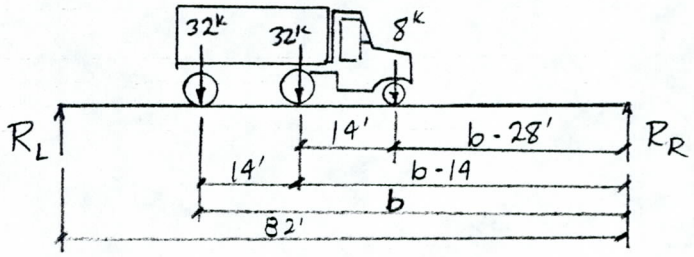
$f_{SY} = 60$ KSI

$V_C = .06 f'_c b' j d \leq 180 b' j d$ ← GOVERNS FOR $f'_c > 3000$ psi

$b' = (3)(12) = 36"$

$d = 18.14 + .4478 X$

LIVE LOAD SHEAR



$$R_L = \left[\frac{32(b+b-14) + 8(b-28)}{82}\right] (2 \text{ LANES})$$

$R_L = (72b - 672)/41$

$3/4 h = (.75)(43.5) = 32.6"$

$V_U = 1.3 [V_{DL} + (1.67)(1.242) V_{LL}]$ ← IMPACT

$e = (134)(.153)/278 d = .0737/d$

$jd = d - a/2 = d - .59 e d \frac{f_v}{f'_c} = d - (.59)(.0737/d)(d)(60)/3.5 = d - .75$

X	d	V_{DL}	V_{LL}	V_U	V_C	A_V/s	USE
20.5	27.32	117.7	91.6	400.0 K	172.2 K	.07	* #5][@12"
22	27.99	109.1	89.0	381.8	176.5	.06	"
26	29.78	86.1	82.0	333.0	188.1	.04	#5 @ 24"
30	31.57	63.1	74.9	284.0	199.7	.02	#5 @ 24"

USE #5][@12" EACH WEB FROM ENDS TO 26'

USE #5][@24" EACH WEB FOR MIDDLE 30'

* ACTUALLY 3 SETS OF][(3 WEBS)

JOHN CAROLLO ENGINEERS
PHOENIX, AZ • WALNUT CREEK, CA
FOUNTAIN VALLEY, CA • VISALIA, CA
SAN BERNARDINO, CA • TUCSON, AZ
SAN DIEGO, CA • BAKERSFIELD, CA
SACRAMENTO, CA • LOS ANGELES, CA
FRESNO, CA

January 25, 1990
3249B.10

City of Phoenix
Water and Wastewater Department
455 North 5th Street
Phoenix, Arizona 85004

Attention: Mr. Gerald Arakaki, P.E.

Re: Squaw Peak Water Treatment Plant
Relocations at the ACDC - Phase II
Flood Control District of Maricopa County
FCD 88-40

Gentlemen:

In response to comments which were received from the City of Phoenix in regards to the 90% submittal for the above referenced project, please find enclosed one copy of the structural design calculations for the pipe spans over the Arizona Canal Diversion Channel (ACDC).

In addition, we have reviewed the construction plans for the new access road from 24th Street to see if there is a conflict with the relocated 66-inch water main. As discussed on the telephone with you, the contract for the new access road shows locating a new fence which would be installed adjacent to the relocated pipeline near station 0+00. This fence would need to be temporarily removed and replaced during construction of the relocated pipeline. The location of the new access road and fence will be shown on the utilities relocation contract.

If you have any questions or comments, please do not hesitate to contact us.

Very truly yours,

JOHN CAROLLO ENGINEERS

Robert A. Ardizzone, P.E.

RAA:fb

Enclosures

cc: Mr. Ed Raleigh, FCDMC
Mr. Tom Martin, City of Phoenix
Mr. Dwayne Williams, City of Phoenix
Mr. Wayne Janis, City of Phoenix
Mr. Jerry Hayes, City of Phoenix
Mr. Reggie Swartz, City of Phoenix
Mr. Tom Wasbotten, City of Phoenix

3877 North Seventh Street, Suite 400 • Phoenix, Arizona 85014-5005 • (602) 263-9500 • FAX: (602) 265-1422

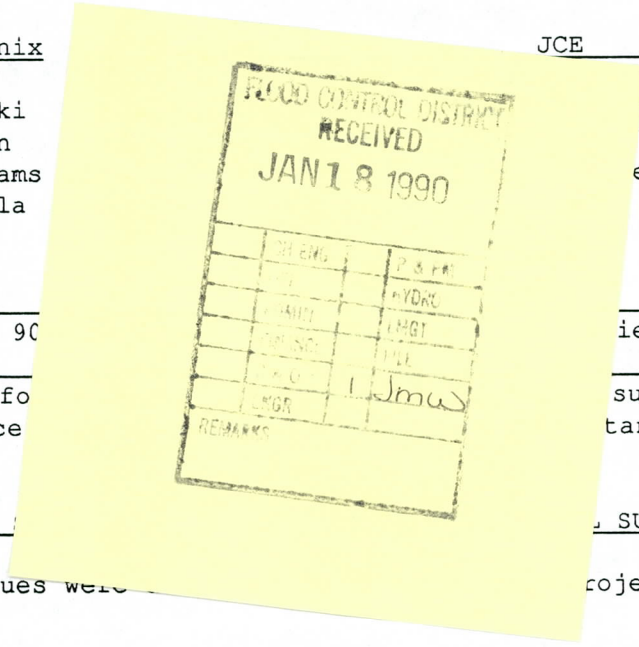
JOHN CAROLLO ENGINEERS

CONFERENCE MEMORANDUM

[Squaw Peak WTP - Relocations at the ACDC, Phase II, FCD 88-40] (Project)	[January 12, 1990] (Conference Date)
[Flood Control District of Maricopa County] (Client)	[January 16, 1990] (Issue Date)
[John Carollo Engineers] (Conference Location)	[3249B.10] (Job #)

ATTENDANTS:

		Route	
City of Phoenix	JCE	PAJ	[ ]
Tom Martin	...ey	LG	[ ]
Gerald Arakaki	...ne	GAB	[ ]
Tom Wasbotten		HWP	[ ]
Dwayne Williams	...ell	_____	[ ]
Carlos Padilla		_____	[ ]
		FILE	[ ]



PURPOSE: Discuss 90 ...ies

DISCUSSION: (The fo... subject matter covered in this conference ...tanding, please notify us.)

COORDINATION WITH ... SUPPORT)

The following issues wer... roject Water Operational Support:

- SRP indicated that the location of the relocated 66-inch water main is acceptable.
- In response to SRP's concern over providing fill material over the 66-inch water main (in order to have 3 feet minimum cover), JCE stated that the relocated pipeline could be designed to be approximately 2 feet deeper and that no fill material would therefore be required.
- JCE noted that the existing 66-inch water main along the ACDC and Arizona Canal which is not being relocated has only approximately 1 foot of cover at some locations. FCDMC indicated that they will caution the ACDC Contractor to protect the existing waterline during construction (by not undercutting nor driving heavy equipment across the top of the pipeline).

JOHN CAROLLO ENGINEERS

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Tom Wasbotten	Charles Wainwright	Rod Troyer	GAB	[ ]
Dwayne Williams		Robin Paulsell	HWP	[ ]
Carlos Padilla	Salt River Project			[ ]
	Tim Phillips			[ ]
			FILE	[ ]

PURPOSE: Discuss 90% Submittal for Relocation of Utilities

DISCUSSION: (The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.)

COORDINATION WITH SALT RIVER PROJECT (WATER OPERATIONAL SUPPORT)

The following issues were discussed with Salt River Project Water Operational Support:

- SRP indicated that the location of the relocated 66-inch water main is acceptable.
- In response to SRP's concern over providing fill material over the 66-inch water main (in order to have 3 feet minimum cover), JCE stated that the relocated pipeline could be designed to be approximately 2 feet deeper and that no fill material would therefore be required.
- JCE noted that the existing 66-inch water main along the ACDC and Arizona Canal which is not being relocated has only approximately 1 foot of cover at some locations. FCDMC indicated that they will caution the ACDC Contractor to protect the existing waterline during construction (by not undercutting nor driving heavy equipment across the top of the pipeline).

- The location of the fence around the relocated 66-inch water main was discussed. The fence would be located approximately 1 foot south of the waterline, or approximately 24 feet north of the Arizona Canal. SRP indicated that the location of the fence is acceptable, provided it is as close to the relocated pipeline as possible.

- SRP will issue a construction license after receipt of 100% complete Plans.

FCDMC COMMENTS ON 90% SUBMITTAL

FCDMC offered the following comments in regards to the 90% submittal:

- Include weight of barriers for dead load moment for west access bridge.

- Include calculations for precast box girders for east access bridge.

- Provide written justification to FCDMC for post-tensioned box bridge (per telephone conversation with Ed Raleigh following the meeting).

- Removal of existing abandoned pipelines should be performed only in the areas outside of the ACDC right-of-way. The ACDC Contractor will be required to perform removals within the right-of-way.

- FCDMC questioned if the City of Phoenix wants to retain the salvaged pipelines. The City responded that they do not.

- Miscellaneous comments in regards to the Plans were expressed. A copy of the Plans, with FCDMC comments, were given to JCE for review.

- FCDMC noted that the COE shows the connection to existing storm drains and plant drains within their draft set of Plans for construction of the ACDC. A copy of the partial Plans were given to JCE for review. JCE requested that FCDMC also provide them with copies of the connection details.

- FCDMC indicated that they will meet with Chuck Hughes of SRP Electric to further discuss access requirements to the SRP substation. FCDMC indicated there probably will be no need to secure right-of-way from the City of Phoenix.

- Written comments from FCDMC Construction Department were also given to JCE for review.

CITY OF PHOENIX COMMENTS ON 90% SUBMITTAL

Comments from the City of Phoenix were expressed as follows:

- Check to confirm if there is a conflict between the 66-inch water main and the new access road from 24th Street. The Preconstruction Conference for this project was just recently held. The City indicated they will provide JCE and FCDMC with the latest Construction Plans.

- Provide structural design calculations to the City of Phoenix for pipe spans over the ACDC.

- The City had no comments on the access bridges.

- The City requested that JCE provide more details for the sequence of construction for the pipe crossings. Some of the concerns were expressed as follows:

  - Want to minimize downtime for existing lines.

  - Consider use of flexible coupling on both ends of the pipeline.

  - Require the Contractor to submit details of construction sequencing.

  - Add statement that relocated pipeline should be in place, tested, and disinfected prior to removing the existing line from service for final connection to the relocated pipeline.

- The City of Phoenix questioned how storm water from the treatment plant would be collected. JCE responded that although a drainage study was not included in their present Scope of Work, all storm drains or open ditches will be intercepted by the ACDC Contractor. These locations have been noted to the COE. FCDMC added that any additional storm inflows could be by spillway over the ACDC wall, since the proposed ACDC is at a lower elevation than surrounding grade.

- The City requested that JCE and FCDMC review the Utility Conflict Report prepared by Morrison-Knudsen Engineers for identification of any other known utilities.

- The future separation of sludge from the two drain lines which are currently designed to discharge to the Arizona Canal was discussed. JCE indicated that in the future, after the sludge is separated, these drains could then be tied into the ACDC, if required. The possibility of providing stub-outs to the ACDC was raised. FCDMC commented that these lines could also discharge to a spillway over the ACDC wall, if required in the future.

- In the Specifications, refer to the Arizona Canal north side as the Arizona Canal, and the Arizona Canal south side as the Southern Canal. The Contractor should verify dates of canal dry-ups.

- Removal of surplus excavation from the plant site.

PROJECT SCHEDULE

FCDMC indicated that approval from their Board of Directors for bid advertisement will take approximately 5 to 6 weeks. FCDMC stated that they will initiate the notification process following the meeting.

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January 31, 1990 - Construction Complete

ACTION ITEMS

John Carollo Engineers

1. Incorporate comments received from FCDMC and the City of Phoenix in regards to the 90% submittal.

2. Lower relocated 66-inch water main by approximately 2 feet.

3. Include weight of barriers for dead load moment for west access bridge.

4. Include calculations for precast box girders for east access bridge.

5. Provide written justification to FCDMC for post-tensioned box bridge.

6. Remove existing abandoned pipelines only in the areas outside of the ACDC right-of-way.

7. Review COE Plans for coordination of storm drains and plant drains being intercepted by ACDC Contractor.

8. Check possible conflict between 66-inch water main and new access road from 24th Street.

9. Provide structural design calculations to the City for pipe spans over the ACDC.

10. Provide additional details in Specifications for sequence of construction for pipe crossings.

11. Review Utility Conflict Report prepared by Morrison-Knudsen Engineers for identification of any other known utilities.

City of Phoenix

1. Provide JCE with latest Construction Plans showing the location of the new access road from 24th Street.

Flood Control District of Maricopa County

1. Caution ACDC Contractor to protect existing 66-inch water main during construction (by not undercutting nor driving heavy equipment across the top of the pipeline).

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ALL ATTENDANTS
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Mr. Reggie Swartz

PREPARED BY:

Bob Ardizzone, P.E.

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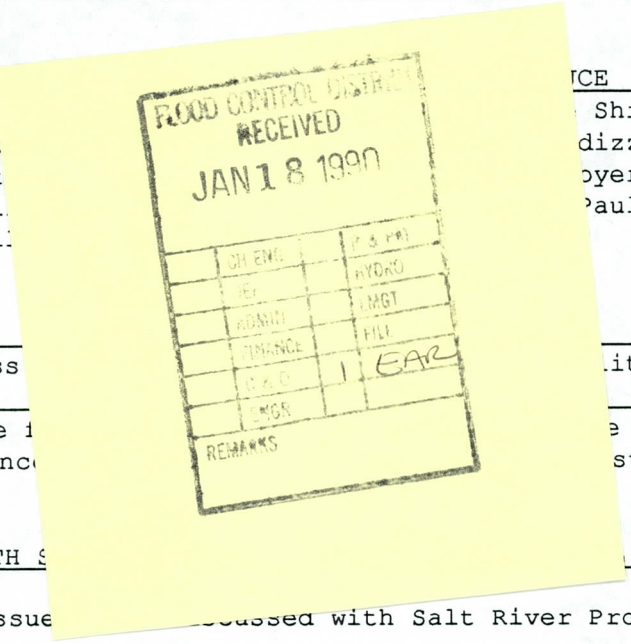

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DISTRIBUTION:
ALL ATTENDANTS
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Mr. Jerry Hayes
Mr. Reggie Swartz

PREPARED BY:

Bob Ardizzone

Bob Ardizzone, P.E.

EXHIBIT A
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Scope of Work

BACKGROUND

In March 1989, the Flood Control District of Maricopa County (District) contracted with John Carollo Engineers (Engineer) to perform a preliminary study (Phase I Services) of utility relocations required for construction of the Arizona Canal Diversion Channel (ACDC) at the City of Phoenix (City) Squaw Peak Water Treatment Plant (WTP) site. In the June 1989 Predesign Services Report, the recommended alternative was the "north Location of the ACDC". This recommendation, accepted by both the District and the City, required construction of the new ACDC through the existing WTP preliminary sedimentation basin.

Phase II services commenced in September to develop engineering design of utilities to be relocated from the alignment of the ACDC within the WTP site. As part of this service, final design criteria and locations for new preliminary treatment facilities were prepared. In addition, design of new bypass line for pretreatment facilities has been added to the Phase II Scope of Services.

A part of the recommendation for the "north Location of the ACDC" included new pretreatment facilities for the WTP to replace facilities displaced by the ACDC.

New WTP facilities were recommended to include Arizona Canal intake, bar screens, metering, premixer and flow splitter structure, three presedimentation basins with channels, piping and bypass lines, sludge pump stations and miscellaneous electrical, chemical piping and instrumentation.

It has been agreed that the District and the City will enter into an Intergovernmental Agreement wherein the District will administer design and bidding services for the preliminary treatment facilities project, subject to review and approval of the City.

Subsequent professional services and the construction contract for this project will be administered by the City.

PURPOSE

The purpose of this Scope of Work is to provide design of replacement pretreatment facilities for the City of Phoenix Squaw Peak WTP. Additional services will include: bidding assistance and preparation of a suggested construction schedule, structured to reduce adverse impacts on City of Phoenix water production capability. Construction administration services including preparation of Operation and Maintenance Manual update, and training of WTP staff in use of new pretreatment facilities will be subsequent services to the City with Scope, Schedule and Cost of Services to be negotiated at a time prior to start of construction, when requested by the City.

SCOPE OF WORK

Task I - Plans, Specifications and Cost Estimate. Prepare Plans, Specifications and Estimate of Probable Construction Cost for a new pretreatment facility at the WTP. Site is generally defined as WTP property south of the new ACDC.

New facilities are included as follows:

1. Intake structure at the Arizona Canal.
2. Bar screen structure, with mechanically-cleaned bar screen equipment, conveyor and screenings loading facility.
3. Flowmeter facility.
4. Premixer splitter structure, with chemical feed injection for chlorine, carbon, coagulant and polymer, and flow distribution splitter to feed presedimentation basins.
5. Preliminary sedimentation basins, with sludge collector mechanisms, inlet and outlet piping or channels, connection to bypass line, and sludge pumping facilities.

6. Interconnecting piping and channels.
7. New chemical feed piping from existing chemical piping system at East ACDC crossing location to new premixer splitter structure for existing chemical systems (alum/carbon line). New lines to feed chlorine and polymer will also be installed in this same location.
8. Electrical system for new facilities and interface to existing electrical system.
9. Process and instrumentation control system for new facilities and interface to existing control system. All control circuits and alarm signals will be brought to interface panel assumed to be located in existing pump station facility.
10. Site paving, grading, drainage and rerouted westside access road.
11. Demolition of existing pretreatment facilities and removal of temporary bypass line.
12. New facilities shall be in accordance with Preliminary Basis of Design criteria and Site Drawing, as attached.

For the project, the Engineer shall:

- Prepare updated Site Drawing and Basis of Design and submit to District and City for review and comment.
- Prepare Preliminary (50%) Plans and Specifications and a Preliminary Estimate of Construction Cost, and submit to the District and City for review and comment (eight sets).
- Prepare Prefinal (90%) Plans and Specifications and submit to the District and City for review and comment (eight sets).
- Assist the District and City in securing required permits from Maricopa County Health Department and affected utilities and agencies. Submit Plans and Specifications for review and comments (estimate ten sets).
- Prepare Final Plans and Specifications and Estimate of Probable Construction Costs for submittal to the City. Submit full-size and half-size sets (50 each) of Final Plans and 100 sets of Specifications for use in bidding and construction. The Engineer shall retain a reproducible copy of Final Plans and Specifications. Specifications shall be complete to include both Engineer's Technical Specifications and City's Standard Contract Documents.

Geotechnical reports prepared under previous study and design projects shall be supplemented with additional soil borings and investigations as required for specific design task. Location of new facilities shall use existing WTP horizontal and vertical control.

The Engineer shall meet monthly with the District and City to review project status and to coordinate with and define interfaces with other design and construction work planned or underway on WTP site.

Task II - Bidding Assistance. The City will be responsible for bidding of project. The Engineer shall provide bidding assistance to the City, to include: responding to Contractor's requests for clarification; preparation of any required Addenda; attendance at the Prebid Conference; assistance in review of the qualified bids; and preparation of a Bid Review Report with a recommendation on Contract award.

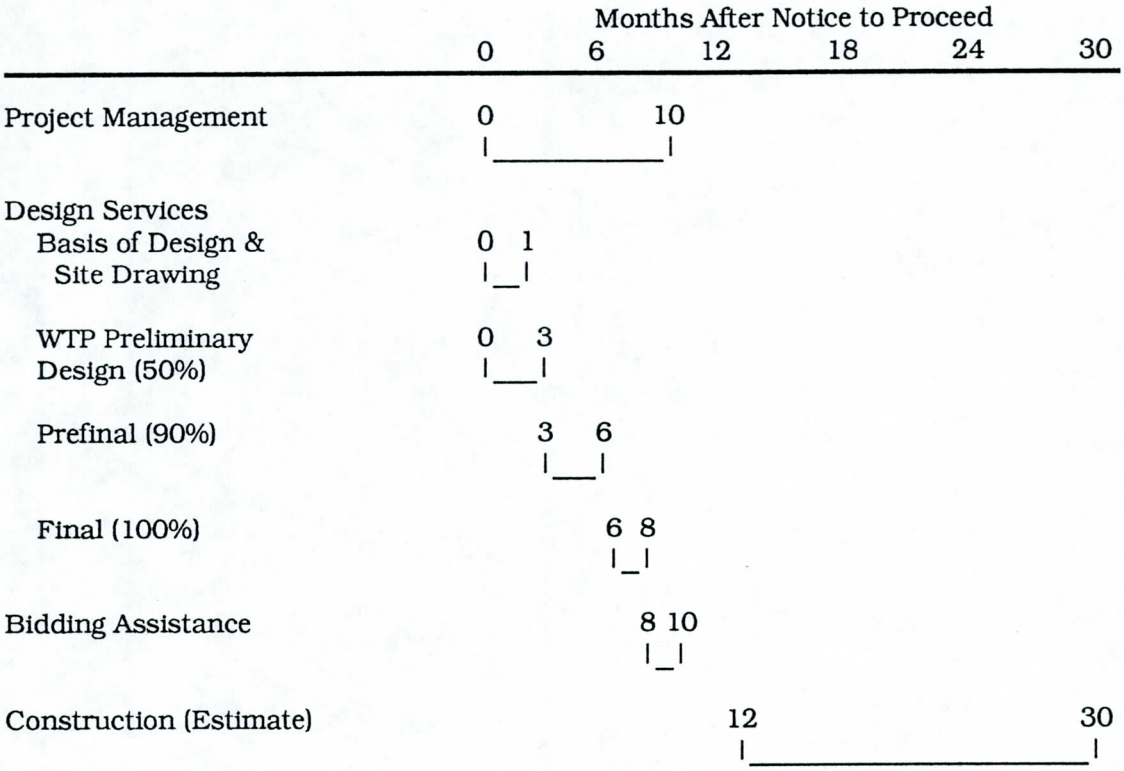
SCHEDULE

Services shall be completed in accordance with the attached Schedule of Services.

EXHIBIT A (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Water Treatment Plant Preliminary Design Criteria

	Units	Capacity/No.
Plant Capacity		
Design Capacity	mgd	140
Hydraulic Capacity	mgd	180
Pretreatment Facility Components		
Intake Structure at Arizona Canal		
Obstructionless Entry	each	1
Bar Screens		
Mechanically Cleaned Bar Screens	each	3
Design Capacity, each	mgd	70
Hydraulic Capacity, each	mgd	80
Flowmeter(s)		
Number		-
Type		Magnetic
Premixer		
Number of Mixers	each	1
Type	-	Radial
Mixing Energy	Sec^{-1}	1,200-1,500
Preliminary Sedimentation Basins		
Type - Circular, Center Entry with Collector, Submerged Orifice Outlet Control (with By-Pass)		
Number of Basins	each	3
Dimensions, each		
Diameter	feet	160
Depth	feet	12
Design Flow, each	mgd	47
Surface Loading Rates	gal/day/sf	
@ Design Flow		2,337
@ Hydraulic Flow		2,671
Sludge Pumping Facilities		
Number of Pumps	each	
Capacity of Pumps	gpm	

EXHIBIT A (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Schedule of Services



20' WIDE BRIDGE

MATCH TO SHEET 14

20' WIDE BRIDGE

ACDC

40'

15'

CLEARANCE FOR CHANNEL CONSTRUCTION

RAW WATER PUMPS PLANT II

RAW WATER CHANNEL

PRE-SED BASIN

PRE-SED BASIN

PRE-SED BASIN

RAW WATER PUMPS PLANT III

BUILDING?

SLUDGE PUMPS

SLUDGE PUMP

PRE-MIXER & FLOW SPLITTING STRUCTURE

PRE-SED BY PASS LINE

BAR SCREENS

FLOW METER VAULT

25'

CANAL INLET

PRELIMINARY

OCT

EXHIBIT B
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Estimate of Effort (Man-Hours)

	PIC	PM	PE	DE	Sr. Dsgnr.	Drfts.	Word Proc.	Total
Project Management	24	60					12	96
Design	112	420	680	960	780	870	114	3,936
Bidding Assistance	4	20	40			16	16	96
Total	140	500	720	960	780	886	142	4,128

EXHIBIT B (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
Cost of Engineering Services

	Estimated Effort (Man-Hours)	Estimated Rate ($)	Cost ($)
Partner	140	$35.00	$ 4,900
Project Manager (E-VII)	500	31.55	15,775
Project Engineer (E-V)	720	25.80	18,576
Design Engineer (E-III)	960	20.60	19,776
Senior Designer (T-VII)	780	21.20	16,536
Draftsman (T-IV)	886	14.60	12,936
Word Processor	142	11.80	1,676
Total	4,128		$ 90,175
Multiplier			2.97
Subtotal - Direct Labor, Overhead & Profit			$267,820
Round			$267,800
Subconsultants (no markup)			
Geotechnical Investigation (Thomas-Hartig)			$ 3,050
Other Direct Costs			
Printing Allowance: (actual cost)			
Composite Drawings			$ 4,500
Half-Size Negatives			300
Printing Plan Sets (review) 30(50)($0.42)			630
Printing Plan Sets (final) full size 50(50)($0.42)			1,050
half size 50(50)($0.11)			275
Printing Specifications 100 sets @ 300 pgs. @ $0.10/page			3,000
			$ 9,755
		Use	$ 10,000
Total			$280,850

EXHIBIT B (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
List of Drawings

PRELIMINARY TREATMENT FACILITIES

1. Title Page/Location Map/Index
2. Site Plan/General Notes
3. Hydraulic Profile/Schematics
4.-5. Process and Instrumentation Diagrams
6. Canal Intake - Structural Plan & Details

7. Bar Screens - Structural Plan
8. Bar Screens - Structural Details
9. Bar Screens - Mechanical Plan
10. Bar Screens - Mechanical Details
11. Bar Screens - Mechanical Details

12. Meter Vault - Structural & Mechanical

13. Pre-Mix/Splitter - Structural Plan
14. Pre-Mix/Splitter - Structural Details
15. Pre-Mix/Splitter - Mechanical Plan
16. Pre-Mix/Splitter - Mechanical Details
17. Pre-Mix/Splitter - Chemical Feed Piping

18. Presedimentation Basins - Structural Plan
19. Presedimentation Basins - Structural Details
20. Presedimentation Basins - Structural Details
21. Presedimentation Basins - Mechanical Plan
22. Presedimentation Basins - Mechanical Details
23. Presedimentation Basins - Mechanical Isometric
24. Presedimentation Basins - Sludge Pump Station

25. Yard Piping - Piping Plan
26. Yard Piping - Miscellaneous Piping Plan
27. Yard Piping - Piping Details
28. Yard Piping - Piping Profiles

29. Electrical - Site Plan
30. Electrical - Pre-Mix/Splitter Plan
31. Electrical - Presedimentation Basin Plan
32. Electrical - Single Line Diagram
33. Electrical - Schematics
34. Electrical - Lighting Plan and Details
35. Electrical - Electrical Demolition/Interfaces
36. Electrical - Electrical Demolition/Interfaces

EXHIBIT B (CONTINUED)
SQUAW PEAK WATER TREATMENT PLANT
DESIGN SERVICES - PRELIMINARY TREATMENT FACILITIES
List of Drawings (Cont'd)

37. Paving/Grading - Site Plan
38. Paving/Grading - Details
39. Paving/Grading - Sections

40. Demolition - Inlet Structure
41. Demolition - Sedimentation Basins/Sludge Pump Station
42. Demolition - Raw Water Pump Station Modifications
43. Demolition - Miscellaneous Piping Interfaces

44.-49. Typical Details

THOMAS-HARTIG & ASSOCIATES, INC.

TOM W. THOMAS, P.E. • HARRY E. HARTIG, P.E.
Geotechnical, Materials Testing, and Environmental Consultants
7031 West Oakland Street • Chandler, Arizona 85226

James R. Morrow
John P. Boyd, P.E.
Charles H. Atkinson, P.E.

Glen K. Copeland, P.E.
James. M. Willson, P.E.

Frank M. Guerra, P.E.
Steven A. Haire, P.E.
Kenneth L. Ricker, P.E.

John Carollo Engineers
3877 North 7th Street, Suite 400
Phoenix, Arizona 85014

22 January 1990

Attention: Robert Ardizzone, P.E.

Reference: Geotechnical Investigation for
New Pre-Sed Basins and New Canal
Inlet Structure
Squaw Peak WTP
Phoenix, Arizona

DESCRIPTION OF PROJECT

Three new pre-sed basin structures and a new canal inlet structure are proposed. The pre-sed basin structures will be reinforced concrete. The bottom of the pre-sed basin excavation will be about Elevation 1220.

SCOPE OF SERVICES

1. Test drilling to determine subsurface conditions and obtain representative samples for laboratory analyses. Four (4) test borings are proposed. Three of the borings will be drilled to about Elevation 1220 feet, or auger refusal, whichever occurs first. Rock coring and/or rotary gear bit drilling will be utilized if necessary at the remaining boring location to achieve the required depth. As you know, the site is currently developed and contains underground utilities. While we will take all reasonable precaution to avoid damaging these utilities, we will not assume responsibility for damage to a utility which was either inaccurately located by the City of Phoenix, or not located at all.

2. Laboratory analyses of representative samples to include: Moisture content and dry density; pH, Chlorides, and Sulfates.

3. Engineer's report presenting the results of the field and laboratory testing and recommendations for foundation systems (types, footing depths, allowable bearing pressures, and estimated settlements), site grading and subfloor preparation procedures, and lateral earth pressures.

COMPLETION TIME

Final report approximately three to four weeks after authorized to proceed.

P90-083

FEE

$3050.00

We propose to perform this work in accordance with the scope of services and fee noted above and our attached General Conditions for Technical Services.

If this proposal meets with your approval, we ask that a copy be signed by the authorized agent and returned to this office.

We welcome the opportunity to review any portion of this proposal and discuss the fee with all concerned.

Respectfully submitted,

THOMAS-HARTIG & ASSOCIATES, INC.

Steven A. Haire, P.E.

/bc
Copies to: Addressee (2)

Accepted by:

Client:_____

By:_____

Title:_____

Date:_____

THOMAS-HARTIG & ASSOCIATES, INC.

General Conditions for Technical Services

1. **Client**

   Client as used herein is the entity who authorizes performance of services by Thomas-Hartig & Associates, Inc. and accepts responsibility for payment under the conditions stated herein.

2. **On-site Responsibilities and Risks**

   2.1 **Right-of-Entry.** Unless otherwise agreed, Client will furnish right-of-entry and obtain permits as required for us to perform the field work.

   2.2 **Damage to Property.** We will take reasonable precautions to minimize damage to land and other property caused by our operations, and we have not included in our fee any cost of repairing such damage. If Client desires us to repair and/or pay for damages, we will undertake the repairs and add the cost to our fee.

   2.3 **Utilities and Pipelines.** While performing our field work, we will take reasonable precautions to avoid damage to underground structures, pipelines, and utilities. Client agrees to hold Thomas-Hartig & Associates, Inc. and its officers, agents, employees, and subcontractors harmless for any damages to such structures, pipelines and utilities which are not called to our attention, which are incorrectly shown on plans furnished, or inaccurately located by the utility companies.

3. **Warranty**

   3.1 Services performed by Thomas-Hartig & Associates, Inc. will be conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty, either expressed or implied, is made or intended by our proposal, contract, or reports.

   3.2 The data presented by Thomas-Hartig & Associates, Inc. represents conditions only at the specified locations and at the time designated. Client acknowledges that this data may not represent conditions at other locations and times. We will be responsible for our data, interpretations, and recommendations, but shall not be responsible for the interpretation by others.

4. **Insurance**

   Thomas-Hartig & Associates, Inc. maintains General Liability, Automobile Liability, and Professional Liability Insurance. Certificates of coverage will be supplied upon request.

5. **Invoices and Payment**

   Invoices will be submitted every four weeks for services rendered. Payment is due upon presentation of our invoice and is past due thirty (30) days from invoice date. A finance charge of 1 percent per month shall be added to any balance unpaid after the 30 days. If any proceeding or action shall be brought to recover any amount due under this agreement, or for or on account of any breach of this agreement, the prevailing party shall be entitled to recover from the other party reasonable attorney's fees, the amount of which shall be determined by the Court.

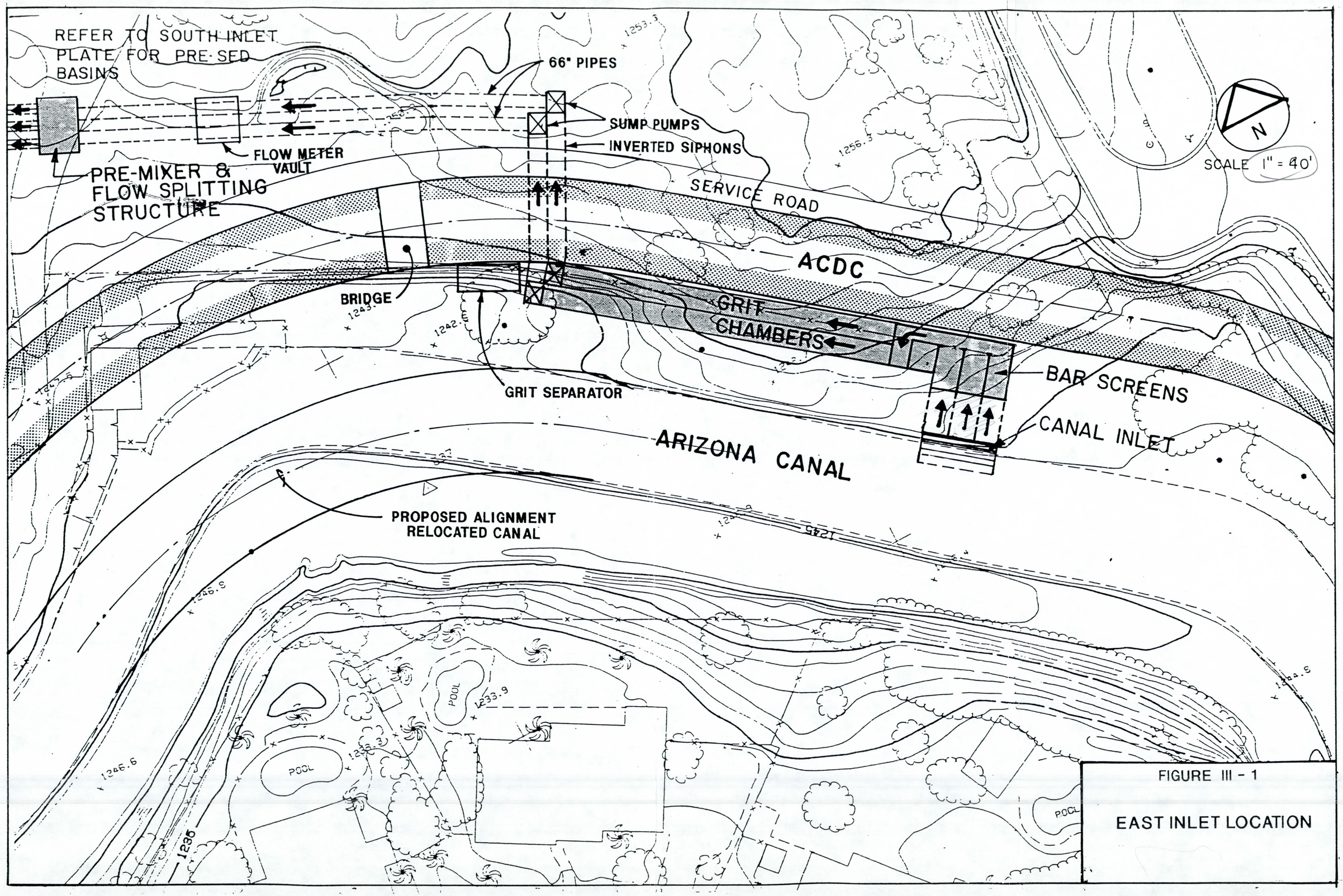


FIGURE III - 1

EAST INLET LOCATION

PRE-SED BASIN

PRE-SED BASIN

PRE-SED BASIN

RAW WATER PUMPS PLANT II

RAW WATER PUMPS PLANT I

RAW WATER CHANNEL

PRE-SED BY-PASS LINE

FLOW METER VAULT

PRE-MIXER & FLOW SPLITTING STRUCTURE

SUMP PUMPS

BRIDGE

SERVICE ROAD

66" PIPES

INVERTED SIPHON

ACDC

GRIT CHAMBERS

BAR SCREENS

GRIT SEPARATOR

CANAL INLET

ARIZONA CANAL (RELOCATED)

N

SCALE 1" = 40'

FIGURE III - 2

SOUTH INLET LOCATION

TO

- FCDMC
- 3335 WEST DURANGO ST
- PHOENIX AZ 85009

FROM

JCE
3877 N 7TH
PHOENIX AZ

SUBJECT HYDRAULIC CALCS AND COST EST - SQUAW PEAK

DATE MAY / 22 / 89

MESSAGE SQUAW PEAK WTP ACDC - FCD 88-40

ENCLOSED ARE OUR HYDRAULIC CALCULATIONS FOR THE PLANT INLET FOR YOUR REVIEW. PAGE 6 CONTAINS THE COMPARISON THAT WAS MENTIONED IN THE MEETING.

PRELIMINARY COST ESTIMATES THAT YOU REQUESTED ARE AS FOLLOWS

3-160 ft DIA PRESED BASINS	4.0
BYPASS LINE	0.35
METER / SPLITTER STRUCTURE	0.15
TOTAL	$ 4.5 MILLION

IF YOU HAVE ANY QUESTION REGARDING THE INFORMATION PROVIDED FEEL FREE TO CALL US

SIGNED Clyde K. Thompson

REDIFORM 4S 468
POLY PAK (50 SETS) 4P468

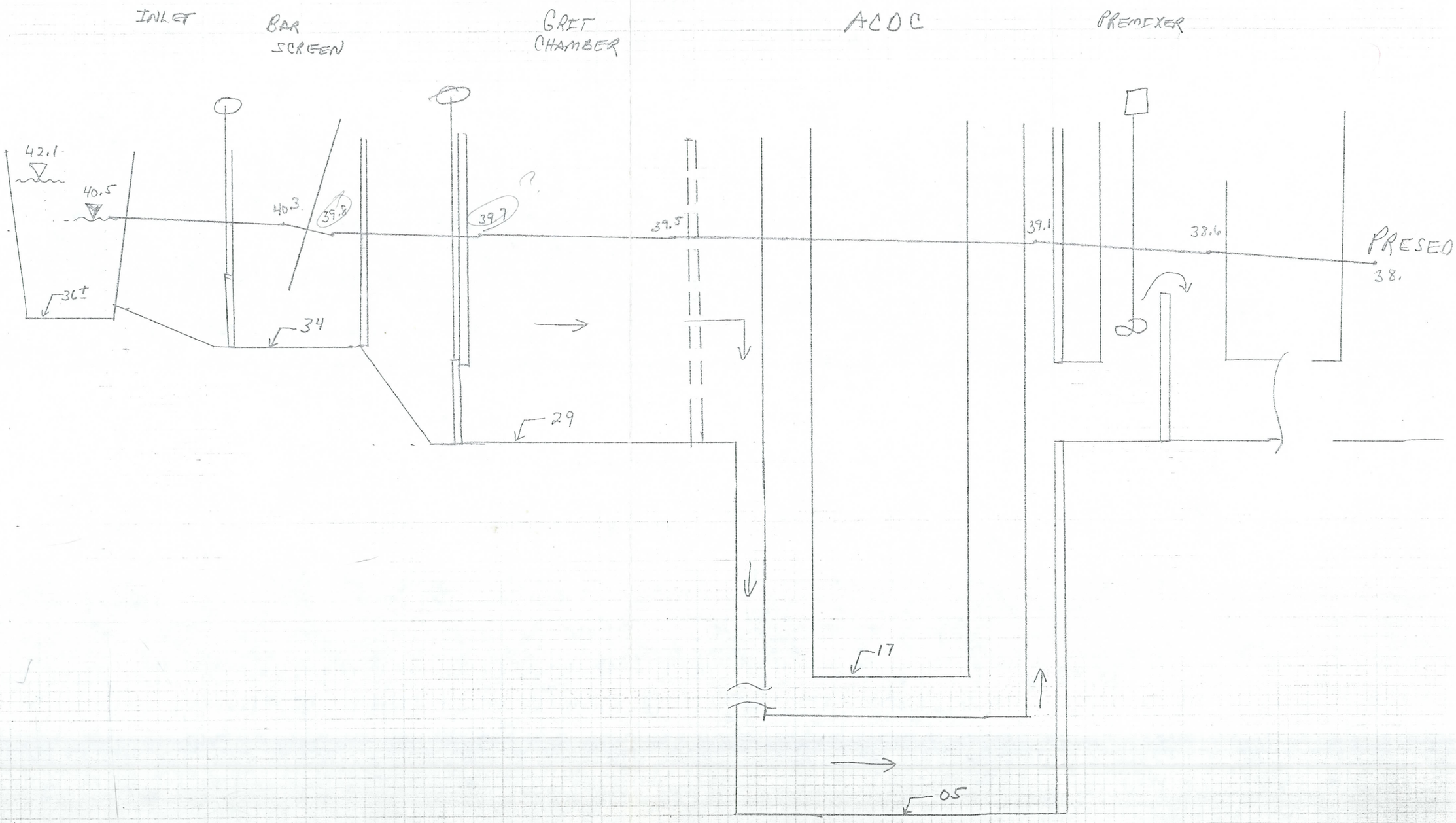
[X] NO REPLY NECESSARY

[ ] REPLY REQUESTED - USE REVERSE SIDE

carbonless

HYDRAULIC PROFILE

5/2/89



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT _____ PAGE ___ OF _____

DETAIL _____ COMPUTED _____ DATE _____

_____ CHECKED BY _____ DATE _____

	E	S	N
INLET LOSSES TO BAR SCREENS	0.04	0.04	0.04
CHANNEL LOSSES	0.01	0.01	0.01
ISOLATION GATES	0.5 (2m.2)	0.5	0.5 ←
BAR SCREENS	0.5	0.5	0.5
CHANNEL BENDS	0.22 (3)	0.11 (2)	—
CHANNEL LOSSES	0.02	001	—
① INLET GATE TO GRIT BASIN	0.25	—	—
GRIT CHAMBER CHANNEL LOSSES	0.003	—	—
BAFFLE WALL	0.25	0.25	—
SIPHON	0.34	0.24	—
BEND	0.31	0.31	—
EXIT	0.31	0.31	0.31
	2.75	2.28	1.36

1 gallon = 0.1337 ft3

JOHN CAROLLO ENGINEERS

BY CKT DATE 5/19/09 SUBJECT HYDRAULIC CALCS. SHEET NO. 1 OF .....
CHKD. BY ..... DATE ..... SQUAW PEAK WTP JOB NO. 3249.A.10
..... FCDMC .....

HEAD LOSS, ft

EAST INLET LOCATIONS

CANAL INLET LOSSES TO BAR SCREENS

1 MGD = 1.54745 cfs

Q DESIGN = 140 MGD → 70 MGD PER CHANNEL
70 MGD = 108.31 cfs
ASSUME CHANNELS 10 ft WIDE x 5 ft DEEP

VEL = 2.17 fps $\frac{v^2}{2g} = 0.073$

ASSUME K = 0.5

$H_L = 0.5\ (0.073) = 0.04$ — 0.04

CHANNEL LOSSES
MANNING EQ $Q = \frac{1.49}{n} A R^{2/3} S^{\frac{1}{2}}$

Q = 108.31 cfs
n = 0.015 (Roughness)
A = AREA = 10 x 5 = 50 ft²
R = Hyd RADIUS = $\frac{50\ ft^2}{20} = 2.5$
S = SLOPE

OR $S^{\frac{1}{2}} = \frac{Vn}{1.49\ (R^{2/3})} = \frac{2.17\ (0.015)}{1.49\ (2.5^{2/3})} = 0.0119$

S = 0.0001

H_L = Length x S = 40 ft x 0.0001 = 0.006 — 0.01

LOSSES DUE TO ISOLATION SLIDE GATES (2) ?

ASSUME VEL = 4 fps
K = 1.0

$H_L = 2 \times \frac{v^2}{2g} = 2 \times \frac{4^2}{64.4} = 0.50$ — 0.50 ?

H_L FOR BAR SCREENS 6" = 0.5 — 0.50
(COMMON VALUE FOR INDUSTRY)

JOHN CAROLLO ENGINEERS

BY CKT DATE 5/19/89 SUBJECT Hydraulic Calcs SHEET NO. 2 OF .....
CHKD. BY ..... DATE ..... Squaw Peak WTP JOB NO. 324.9A.10
..... FCDMC .....

EAST INLET LOCATION (CONT.)

HEAD LOSS, ft

H_L FOR 3 CHANNEL BENDS (INCLUDING INTO BASIN)

CHANNEL 7 ft WIDE 10 ft DEEP

AREA = 70 ft FLOW = 140 MGD = 216.7 cfs

VEL = 216.7 ÷ 70 = 3.1 fps

K = 0.5

1 channel

$H_L = 3 \times 0.5 \times \frac{3.1^2}{2g} = 0.22$ — 0.22

CHANNEL LOSSES

$R = \frac{70}{27} = 2.6$

$S^{\frac{1}{2}} = \frac{Vn}{1.49(R^{2/3})} = \frac{3.1(0.015)}{1.49(2.6^{2/3})} = 0.017$

$S = 0.0003$

LENGTH = 70 ft

$H_L = L \times S = 70\text{ft} \times 0.0003 = 0.02$ — 0.02

INLET GATE TO GRIT BASINS

ASSUME VEL = 4 fps — ? WHY ASSUME ?

K = 1.0

$H_L = 1.0 \times \frac{4^2}{2g} = 0.25$ — 0.25

GRIT CHAMBERS

10 ft WIDE LENGTH = 170 ft DEPTH = 11 ft

Q PER BASIN = 70 MGD = 108.31 cfs

Vel = 1 fps $R = \frac{110}{32} = 3.44$

$S^{\frac{1}{2}} = \frac{Vn}{1.49(R^{2/3})} = \frac{1(0.015)}{1.49(3.44^{2/3})} = 0.0044$

$S = 0.00002$

$H_L = 170\text{ ft} \times 0.00002 = 0.003$ — 0.003

? Sett[ling] velocity 0.065 ft/sec ~2 cm/sec ? to see 0.2 mm

→ 0.2 mm removed settled

JOHN CAROLLO ENGINEERS

BY C.K.T. DATE 5/19/89 SUBJECT HYDRAULIC CALCS SHEET NO. 3 OF .....
CHKD. BY ..... DATE ..... SQUAW PEAK W.T.P. JOB NO. 3249.A.10
..... F.C.O.M.C .....

HEAD LOSS, ft

EAST INLET LOCATION (CONT)

BAFFLE WALL GRIT CHAMBER

ASSUME VEL = 4 fps
K = 1.0

$H_L = 1.0 \times \frac{4^2}{2g} = 0.25$ — 0.25

SIPHON UNDER ALOC TO SPLIT STRUCTURE
DIA = 66" C = 120 23.75 ft²
Q = 70 MGD PER PIPE 108.5 cfs
LENGTH = 340 ft (50 ft VERTICAL)

OK. $H_L = 1.0$ ft / 1,000 $H_L = 340$ ft $\times$ 0.001 = 0.34 — 0.34

BENDS
NO. = 2
VEL = 4.5 fps OK $\frac{V^2}{2g} = 0.31$
0.2 ~ 0.4 High ← K = 0.5
f(Δ/D)

$H_L = 2 \times 0.5 \times \frac{4.5^2}{2g} = 0.31$ — 0.31

EXIT LOSS TO FLOW SPLIT STRUCTURE ?
K = 1.0 VEL = 4.5 fps

$H_L = 1.0 \times \frac{V^2}{2g} = 1.0 \times \frac{4.5^2}{2g} = 0.31$ — 0.31

SUB TOTAL — 2.75

$h_f = f \frac{L}{D} \frac{V^2}{2g}$

$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$

$S = \frac{V^2 \cdot n^2}{2.21 \, R^{\frac{4}{3}}} = 0.00134$

V = 4.5
n = 0.015
R = D/4 = 1.375

JOHN CAROLLO ENGINEERS

BY CKT DATE 5/19/89 SUBJECT HYDRAULIC CALCS. SHEET NO. 4 OF .....
CHKD. BY ..... DATE ..... SQUAW PEAK WTP JOB NO. .....
..... FCOMC .....

SOUTH INLET LOCATION

INLET LOSSES THROUGH BAR SCREENS

THE FOLLOWING VALUES ARE IDENTICAL TO EAST INLET LOCATION

INLET	0.04
CHANNEL (LENGTH OF 60 ft DOES NOT CHANGE H_L THAT MUCH	0.01
ISOLATION GATES	0.5
H_L FOR BAR SCREENS	0.5

CHANNEL LOSSES TO GRIT CHAMBER

#2

CHANNEL ~~7 ft~~ WIDE ~~6 ft~~ DEEP ← WHY DIFFERENT SIZE

AREA = 42 ft FLOW = 70 MGD = 108.31 cfs

VEL = 2.6 fps

2 - channels

$R = \frac{42}{19} = 2.2$

$S^{\frac{1}{2}} = \frac{V n}{1.49 R^{2/3}} = \frac{2.6 (0.015)}{1.49 (2.2^{2/3})} = 0.016$

$S = 0.0002$

LENGTH = 50 ft

$H_L = L \times S = 50 ft \times 0.0002 = 0.012$ — 0.01

H_L FOR 2 BENDS
$K = 0.5$

$H_L = 2 \times 0.5 \times \frac{2.6^2}{2g} = 0.11$ — 0.11

SOUTH INLET LOCATION (CONT)

NOTE: NO INLET GATE TO GRIT BASIN IS REQUIRED DUE TO CHANNEL SEPARATION FROM INLET

GRIT CHAMBER LOSSES ARE NEGLEGIBLE

BAFFLE WALL FROM Pg 3 EAST INLET	0.25
SIPHON UNDER ACDC TO SPLIT STRUCTURE	
DIA = 66" C = 120	
Q = 70 MGD PER PIPE	
LENGTH = 240 ft	
H_L = 1.0 ft / 1,000 H_L = 240 ft X 0.001 = 0.24	0.24
BENDS FROM Pg 3 EAST INLET	0.31
EXIT LOSS TO FLOW STRUCTURE see Pg 3	0.31
SUBTOTAL	2.28

NORTH LOCATION OF ACOC

NOTE HEADLOSS IS THE SAME AS CALCULATED ON Pg 1 EAST LOCATION

INLET	0.04
CHANNEL 120 ft X 0.0001 = 0.012 →	0.01
ISOLATION GATES	0.5
H_L FOR BAR SCREENS	0.5
EXIT LOSS TO FLOW STRUCTURE	0.31
SUBTOTAL	1.36

COMPARISON OF ALTERNATIVES

SET NORTH LOCATION ACOC TO 0

ADDIT. H_L FOR SOUTH LOCATION
2.28 ft − 1.36 = 0.92
USE 0.95 ft

ADD. H_L DUE TO EAST LOCATION
2.75 ft − 1.36 = 1.39 ft

ORIGINAL CALCS SHOWED A DIF OF 1.15 BECAUSE THE INLET GATE TO THE GRIT BASIN WAS OVERLOOKED.