Floodplain and Floodway Delineation
on the
Agua Fria River
from Bell Road to Jomax Road
Maricopa County, Arizona

Yost and Gardner Engineers - Phoenix

A109.014.001

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
3335 W. DURANGO
PHOENIX, ARIZONA 85009

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

REPORT

Floodplain and Floodway Delineation on the Agua Fria River from Bell Road to Jomax Road Maricopa County, Arizona

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

Project No. FCD 79-4
December 21, 1979

Yost and Gardner Engineers
2619 North Third Street
Phoenix, Arizona 85004

Registered Professional Engineer (Civil)
CERTIFICATE NO.
1517
JOHN F.
SCHAEFER
Date Signed 12/20/79
ARIZONA, U.S.A.

Table of Contents

	Page
Transmittal letter	i
Description of study reach	1
Input data and assumptions	3
Results of study	6
References	8
Photographs	Appendix
Survey notes and calculations	Appendix
Input data cards	Separate
Computer printout	Separate
Maps - river topography (4 sheets)	Separate
Maps - floodplain and floodway (4 sheets)	Separate

YOST AND GARDNER ENGINEERS
2619 NORTH THIRD STREET
PHOENIX, ARIZONA 85004

JOHN E. SCHAEFER
F. ROBERT STEVENS
GLENN C. BUSH
WENDELL H. FOLKERTS
T. B. GREER
LAURENCE K. PERRON

Dec. 21, 1979

Mr. Herbert P. Donald, P.E.
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Re: FCD Project No. 79-4

Dear Mr. Donald,

Submitted with this letter is our report on floodway and floodplain delineation in the Agua Fria River valley between Jomax and Bell Roads. The work was done in fulfillment of our contract with the District dated September 4, 1979.

We appreciate having had this opportunity to be of service and would be glad to answer any questions relating to it.

Sincerely,

Yost and Gardner Engineers

By

John E. Schaefer

Registered Professional Engineer (Civil)
CERTIFICATE NO. 1517
JOHN E. SCHAEFER
Date Signed 12/20/79
ARIZONA, U.S.A.

JES/jr

1. Description of Study Reach

The portion of the Agua Fria River covered in this study begins with the Bell Rd. bridge and runs upstream approximately 7 miles to the narrows at Jomax Rd.

In this reach the river is normally dry, any low flows having been intercepted by Waddell Dam, located 8 miles upstream from Jomax Rd. The valley consists of braided channel lying from 1 to 8 feet below a relatively even flood plain varying from 3000 to 6000 feet, in width. At both edges of the flood plain an abrupt escarpment rises 50 feet or more.

The entire area lies in a region of Quaternary alluvium, some of which is cemented to varying degrees. Channel soils consist of sand, gravels, and cobbles up to about 16 inches in size. No outcroppings of bedrock were found in an on-foot reconnaissance of the thalweg. Flood plains have finer superficial soils, mostly silt, but some areas are clay.

The valley is largely in a natural state with vegetation typical of the upper Sonoran life zone. Except for regions with short-lived grasses and forbs, ground cover is probably less than 10 percent. Bank-side trees are mostly blue palo verdes, ironwood, and desert willow (chilopsis). There is a relatively small amount of mesquite. Greasewood is common on the flood plain, especially in the northern parts of the reach. The most common shrub was not identified: it is a leafless bushy plant from 2 to 5 feet high, superfically resembling Mormon tea.* Desert broom is also prevalent in some portions.

Although portions of the eastern flood plain were once under cultivation, none of the area is presently being farmed. Formerly cultivated areas have reverted to a desert-like appearance. The works of man are limited to road crossings, the Bell Rd. bridge, electrical transmission lines, a few minor attempts at diking and channelization,

some fencing, a sand and gravel operation, the Sun City sewage treatment plant currently under construction, and about 40 dwellings concentrated in two separate acreage developments. One well and community water supply system was evident north of Happy Valley Rd. The other housing area near Rose Garden Lane is presumably served by small individual wells.

A series of photographs was taken during the field inspection of the channel. A set of prints is included as an appendix to this report.

EATON'S
CORRASABLE
BOND
USA
BERKSHIRE
25% COTTON FIBRE

---

* See Photo No. 4, second series

2. Input Data and Assumptions

2.1 River discharge values were provided by the Flood Control District as follows:

Table 1 - 100-year discharges - Agua Fria River

Location* (River Mile)	Discharge (Cu. Ft. per sec.)	Ref. Proj No.
19.58	54,000	FD-AF2-75
20.30	54,000	"
20.48	49,250	"
21.26	49,250	"
21.57	44,500	"
22.32	44,500	"
22.72	39,750	"
23.62	39,750	"
24.04	35,000	"
23.35	35,000	FD-AF2-76
23.46	33,960	"
23.85	33,960	"
23.94	32,920	"
24.22	32,920	"
24.31	31,880	"
24.88	31,880	"
24.98	30,840	"
25.37	30,840	"
25.47	29,800	"

2.2 Beginning water surface elevation for a discharge of 54,000 cu. ft. per sec. at River Mile 19.54 was assumed to be 1158.7 based on an extrapolation of the following data from the U.S. Army Corps of Engineers, also furnished by the Flood Control District:

Table 2 - Water surface elevations for a 54,000 cu. ft. per sec. discharge.

River Mile	Water Surface Elevation
19.57	1159.15
19.58	1159.32
19.59	1161.25
19.60	1162.51

* The center of Bell Road is assumed to be at River Mile 19.58

2.3 Horizontal and vertical control for mapping were based on the following:

A brass cap in a handhole marking the common corner of Secs. 35 and 36, T4N, R1W, and Secs. 1 and 2, T3N, R1W, coordinates 960103.93 North, 376004.63 East (Ref. Proj. FD-AF2-75, sheet 13 of 16).

A bearing of N 0°11'48"W for a line from the corner of Secs. 35-36-1-2 to the W¼ Cor. of Sec. 25 T4N, R1W was computed from the given co-ordinates for this stone, 968022.63 North, 375977.45 East, and used as the datum for all bearings (Ref. Proj. FD-AF2-75, sheet 14 of 16).

A brass cap on the top of south rail, west end of Bell Road bridge, elevation 1171.82 (Ref. Plans for Bell Rd. bridge. Proj. 42800, sheet 3 of 14).

2.4 Control surveys were made in August and September, 1979, by Yost and Gardner Engineers (Stuart Addison and party) under the supervision of Glenn C. Bush, Ariz. Reg. C.E. #2453, using a Wild T3 theodolite and a Hewlett Packard model 3805A electronic distance meter.

2.5 Aerial Photogarphy was done on Sept. 7, 1979, (Bell Rd. to Rose Garden Lane) and on Oct. 3, 1979 (Rose Garden Lane to Jomax Rd.) by Kenney Aerial Mapping, Inc.

2.6 Manning's "n" values were assigned to channel and flood plain areas on the basis of field reconnaissance and examination of ground and aerial photographs by John E. Schaefer, Ariz. Reg. C.E. #1546. References 1 and 2 were consulted in the process.

2.7 Bell Rd. bridge geometry was taken from as-built plans for Project S-396(7) (1965) and Project 42800 (1977). Road and riverbed topography from the mapping for this project was also used in preparing input data.

2.8 Channel mapping was done on a Galileo Stereo Simplex G6 plotter by Kenney Aerial Mapping Inc. Cross section data cards were produced

directly from stereo models using a North Star Horizon computer directly coupled to an IBM 026 card punch. Temporary topographic features such as gravel pits and stockpiles were ignored in the cross-sections.

2.9 Water surface elevations were determined using the computer program of Ref. 3. A preliminary run using encroachment method 4 was made to determine approximate floodway limits which were then arbitrarily adjusted to provide a smoother boundary. The adjusted boundaries were used in a final run using encroachment method 1. (See Users Manual for Ref. 3. p. II-1 ff.) In making the computation, the option of containing all flow between stream banks until bank levels are overtopped was used (assigning a value of 10 for variable IEARA, - card X3-1).

2.10 The method used assumes that the river bed is stable. The highly anastomotic nature of the channel and the presence of large amounts of loose sand in the beds indicates, however, that there must be considerable movement of solid material under flood conditions.

3. Results of Calculations

3.1 Presentation

Results of the HEC-2 program calculations are given following the input data in the computer printout submitted with this report. The accompanying maps show floodplain limits under assumed discharges with present channel conditions, determined by plotting water edge stations (output variables SSTA and ENDST) at each appropriate cross-section. Boundaries between cross-sections were drawn freehand approximately parallel to bank indications provided by ground contours. Suggested boundaries for a designated floodway were established in the same manner, using output data from the final encroachment run.

3.2 Possible sources of error.

3.2.1 Divided flows

Instructions for the HEC-2 program caution the user about the possibility of incorrect results where divided flow conditions are indicated in the output data. The computation assumes that water surface elevations do not vary along any cross-sections regardless of the presence of islands, whereas, this is not necessarily true for long islands. The remedy is to assume several trial discharge divisions and compute backwater elevations along each flow path independently, accepting those flow divisions that yield the same water surface elevations for points of confluence. It was not practical to use this approach in this instance because of the complexity of the channel. A plot of the inundated areas obtained from the original natural conditions computer run revealed that there was not a single cross-section that was not interrupted three or more times by islands. Further study revealed that very few of these islands were continuous over three consectuive cross-sections, and where this did occur, the subsidiary channels forming the islands conveyed very little water. We feel that holding to the assumption that water levels are constant along any cross-section, regardless of islands, does not introduce any appreciable error in the results.

3.2.2 Supercritical flows

In certain reaches the computation indicated the possibility of supercritical velocities. A final computation was made proceeding in the downstream direction. The effect is to indicate lower water surface elevations and narrower inundation limits in the critical reaches. Elevation differences were less than 0.8 foot for the worst case (Sec. 22.8) and at the scale of the map, horizontal differences were negligible.

3.2.3 Channel stability assumption

Calculations indicated that erosive velocities (say greater than 8 ft. per sec.) will occur at many locations. High velocities, the loose bed material and the braided nature of the stream all indicate that the river will change continually under major flow conditions, consequently this determination of water surface elevations and inundation limits should not be considered to be permanently definitive. The earthen dike on the right bank between Secs. 22.6 and 22.8 is assumed to remain in place but channel velocities exceed 9 ft. per sec. in this reach, so the assumption is probably invalid. The line of short dashes indicates the floodplain limit without the dike.

3.3.4 Frictional characteristics

Assignments of Manning's "n" values were made on the basis of personal judgments and conditions obtaining in the area at the time of the field reconnaissance. Frictional characteristics are very sensitive to changes in vegetative cover. With weather as variable as ours, there can be profound changes in relatively short periods of time.

References

1. Chow, Ven Te, Open-Channel Hydraulics, McGraw-Hill Book Co., 1959

2. Aldridge, B.N., and Garrett, J.M., Roughness Coefficients for Stream Channels in Arizona, U.S. Geological Survey, open file report, Tucson, Arizona, Feb. 1973.

3. Computer program 723-X6-L202A, HEC-2 Water Surface Profiles, Hydrologic Engineering Center, Corps of Engineers, U.S. Army, Davis, California, August, 1979.

Reconnaisance Notes and Photographs

AGUA FRIA RIVER

Location: River mile 19.6 Photo No. 12 Looking NNE Date 9/5/79

Other Bell Rd. Bridge - upstream side Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				NOTE: River miles based on wheel measurements starting with R.M. 19.6 at Bell Rd. bridge
Alignment	Straight (divided)			
Regularity	Prismatic	Even plain	None	
Gradient	Uniform	Uniform		
Obstructions	None	8'± earth levee		
Silting/Scouring	App. stable (exc. loose bed sand)	Stable		
Surface material				
Kind	Sand, gravel, cobbles	Silty sand		
Size	Up to 12"	<#10 mesh		
Form	rounded low bars	Smooth plain		
Texture				
Vegetation				
% Cover	None	5%		
Dom. Species		Ephedra (?) - 4'		See note on Ephedra (?) on Sheet for R.M. 22.25
Condition		Growing		
Density		10'-20' Spacing		
Sec. Species		Blue Palo Verde		
Condition				
Density		Sparse <1/ac.		
Other		Chilopsis		
		Desert broom		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 19.85 Photo No. 13 Looking N (on "island") Date 9/5/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form			None - comments	
Alignment	Straight (divided)		apply to "island"	levee 8' high
Regularity	uniform prismatic	even - abt. 2000' wide	Even	along left edge
Gradient	uniform	uniform	uniform	of left channel
Obstructions	none	none	None	
Silting/Scouring		–	erosion channels	
			at margins	
Surface material				
Kind	Sand	Sand - cobble bars	Sand	
Size	< 1/4"		fine < #10	
Form	lt. Gran. bulldozed		low dunes	
Texture	loose			
Vegetation				
% Cover	none	5%	5%	
Dom. Species		Ephedra (?)		
Condition		Growing - 3' clumps		
Density		20'-30' Spacing	Like left	
Sec. Species		B. Palo Verde	overbank	
Condition		Good		
Density		< 1/acre		
Other		Ironwood		
		Chilopsis		
High water marks			4'-5' above ground	

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 20.1 Photo No. 14 Looking N. in Lt. Channel Date 9/5/79

Other _____ Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form			"Island"	No Rt. Overbank
Alignment	Straight	Str. abt. 2500' wide		
Regularity	Becoming shallow & wider			
Gradient	Uniform			
Obstructions	None			
Silting/Scouring	Stable (exc. bed load)			
Surface material				
Kind	Sand	Silty sand	Silty sand	
Size	< #10 mesh	< # 10	< #10	
Form	Even	Undulating ± 3'	Undulating ± 2'	
Texture	Loose	Smooth	Smooth	
Vegetation				
% Cover	< 1%	5-10%	5%	
Dom. Species	B. Palo Verde	B. Palo Verde to 20'	Ephedra (?)	
Condition		Good		
Density		15-20 / acre		
Sec. Species		Ephedra (?)	Chilopsis	
Condition			Poor	
Density		20'-30' spacing	< 1 / ac.	
Other		Chilopsis		
High water marks			Debris +4' on island	

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 20.4 Photo No. 15 Looking up channel (NE) Date 9/5/75

Other No. 16 W. across "Island" Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form			"Island"	
Alignment	Slight meander	Straight, 1500' wide		
Regularity	Braided	Even plain		
Gradient	More stepwise	Uniform		
Obstructions	Some trees	None (exc. veg.)		
Silting/Scouring	Intermittent	Stable		
Surface material				
Kind	Cobble ledges	Silty sand	Sand, gravel & cobbles	
Size	< 15"	< #10 mesh	Up to 4"	
Form	Bars & channels	Sl. undulation	Braided	
Texture	Rounded	Smooth	Rough	
Vegetation				
% Cover	< 10%	5-10%	< 5%	
Dom. Species	Chilopsis to 15'	Ephedra (?) 3-4'	Chilopsis	
Condition	Battered		poor	
Density	3 or 4 / acre			
Sec. Species	B. Palo Verde	B. Palo Verde	Ephedra (?) 2-3'	
Condition	Fair			
Density	Sparse		Sparse	
Other	None	Chilopsis		
High water marks			3' on island	

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 20.65 Photo No. 17 Looking N. from tip of "island" Date 9/5/79

Other No. 18 Main channel looking NWly Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				N. End of "Island"
Alignment	Slow meander	Straight		
Regularity	Uniform	Even plain	Very rough ±3'	
Gradient	Even	Uniform	Uneven	
Obstructions	None	None	Vegetation	
Silting/Scouring				
Surface material				
Kind	cobbles	Silty sand	Sand, gravel, & cobbles	
Size	up to 12"	< #10 mesh	up to 16"	
Form	Undulations	Undulating	Bars & channels	
Texture	Rough	Smooth	Rough	
Vegetation				
% Cover	< 1%	5%	5-10%	
Dom. Species	Chilopsis - 12'	Ephedra(?) - 2-3'	Chilopsis - 20'	
Condition	Battered			
Density		20' Spacing		
Sec. Species	B. Palo Verde	B. Palo Verde - 20'	B. Palo Verde	
Condition	Good	Good		
Density	Very Sparse	Abt. 1/ac.	10-12/acre	
Other				
High water marks	8' above thalweg		5' above grd.	

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 20.9 Photo No. 19 Looking NNW Date 9/5/79

Other No. 20 Left overbank looking NNE Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form			Wash enters	
Alignment	Almost straight	straight	from Rt. - not	
Regularity 600'	wide even swale	Even plain ± 1'	much overbank	
Gradient	uniform	uniform		
Obstructions	None	None		
Silting/Scouring				
Surface material				
Kind	Cobbles w/gravel bars	Silty sand	Sand & Gravel	
Size	< 12"	< #10 mesh	< 1 inch	
Form	Wide swale	Hummocky (wind)	Bars & channels	
Texture	Rough	Smooth	Rough	
Vegetation				
% Cover	< 1%	5 - 10%	< 5%	
Dom. Species	Cuilopsis to 8'	Ephedra (?) - 3'	B. Palo Verde - 20'	
Condition	Battered	Fair	Fair	
Density	About 1/ac.		4-5/ac.	
Sec. Species	B. Palo Verde	B. Palo Verde - 15'	Ephedra (?)	
Condition	Poor	Good		
Density		< 1/ac.		
Other				
High water marks	8-10' above thalweg	2' above ground		

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 21.15 Photo No. 21 Looking N. from L. Bank of Channel Date 9/15/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Long curve to NE	Straight	None	
Regularity	Even wide swale	Even plain ± 1'		
Gradient	Uniform	Uniform		
Obstructions	None	None		
Silting/Scouring				
Surface material				
Kind	Gravel w/Cobble Bars	Sand		
Size	< 12"	< #10 mesh		
Form	Even	w/Shallow erosion pits		
Texture	Med. rough	Smooth		
Vegetation				
% Cover	< 1%	20%		
Dom. Species	Chrysopsis	Greasewood - 3'		
Condition		Good		
Density		30'-40' Spacing		
Sec. Species	Greasewood	Grasses		
Condition		Dry		
Density				
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 21.45 Photo No. 22 Looking across channel to NW Date 9/5/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form			None	Small subsidiary
Alignment	Straight-trend NEly	Straight		channel in
Regularity	Wide swale	Even plain		Lt. overbank
Gradient	Uniform	Uniform		
Obstructions	None			
Silting/Scouring				
Surface material				
Kind	Gravel & cobbles	Silty sand		
Size	< 12"	< #10 mesh		
Form	Bars & channels	Hummocky		
Texture	Rough	Smooth		
Vegetation				
% Cover	5%	5%		
Dom. Species	Ephedra (?)	Ephedra (?) - 3'		
Condition				
Density	20-30' spacing	15'-20' spacing		
Sec. Species	Chilopsis	B. Palo Verde (alg.		
Condition		channel bank)		
Density	< 1 /ac.	50' spacing		
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 21.65 Photo No. 23 Looking N in channel Date 9/5/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form			None	
Alignment	Curving NEly	Straight		
Regularity	Widens to N	Even plain		
Gradient	Adverse to N*			* Disturbed by gravel mining?
Obstructions	None			
Silting/Scouring				
Surface material				
Kind	Cobbles	Silty sand &		
Size	< 12"	gravel < 2"		
Form	Bars & channels	Even		
Texture	Rough	Smooth		
Vegetation				
% Cover	None	10%		
Dom. Species		Greasewood - 6'		
Condition		Good		
Density		40' Spacing		
Sec. Species		Ephedra (?)		
Condition		Fair		
Density		20' Spacing		
Other		Grasses (dry)		
		B. Palo Verde <1/ac		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 21.95 Photo No. 24 Looking NE Date 9/5/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	NE ly	Smooth plain		
Regularity	Flat	but disturbed		
Gradient	Even	by gravel pits		
Obstructions		and piles		
Silting/Scouring				
Surface material				
Kind	Sand			
Size	< #10 mesh			
Form	Bars & dunes			
Texture	Smooth			
Vegetation				
% Cover	None			
Dom. Species				
Condition				
Density				
Sec. Species				
Condition				
Density				
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 22.15 Photo No. 25 Looking _____ Date 9/5/79

Other _____ Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Straight - NEly			
Regularity	Uniform			
Gradient	Uniform			
Obstructions	None			
Silting/Scouring				
Surface material				
Kind	Sand, gravel, & cobbles			
Size	< 12"			
Form				
Texture	Smooth			
Vegetation				
% Cover	None			
Dom. Species				
Condition				
Density				
Sec. Species				
Condition				
Density				
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

Corr RM. Here on

AGUA FRIA RIVER

Location: River mile 21.75 Photo No. 1** Looking _____ Date 9/5/79

Other Rose Garden Lane Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form		None		
Alignment	Straight		uniform	Note subdivision
Regularity	Prismatic			w/ houses, fences
Gradient	uniform			etc in ROB
Obstructions	None			upstream from
Silting/Scouring	Stable			this point
Surface material				
Kind	Sand & Gravel		Silt	
Size	< 3"			
Form			Level plain ± 1"	
Texture	Smooth, loose		undulations	
Vegetation				
% Cover	None		100%	
Dom. Species			Greasewood	
Condition			Good	
Density			30' Spacing	
Sec. Species			Grasses	
Condition			Dry	
Density			95% Cover	
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

** Second series - taken 9/25/79

AGUA FRIA RIVER

Location: River mile 22 Photo No. 2 Looking NW in channel Date 9/25/79

Other at Rose Garden Lane Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Straight-NEly			Subsidiary
Regularity			Even plain	channel (recent-
Gradient	Even		Gentle to SE	ly graded)
Obstructions	Few brush piles		Houses, fences	enters from
Silting/Scouring				NNW about
				600' upstream
Surface material				
Kind	S. G. & Boulders		Silty sand	
Size	to 12"		Very fine	
Form	in bars		Hummocky ± 6"	
Texture				
Vegetation				
% Cover	None		50	
Dom. Species			Creosote	
Condition			Good	
Density			15'-20' spacing	
Sec. Species			Grasses, forbs	
Condition			Dry	
Density				
Other			Epha (?)	
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 22.25 Photo No. 3 Looking Upstream in channel Date 9/25

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Straight NNE ly		Right bank	
Regularity			prob. an island	
Gradient	Uniform		at high flows	
Obstructions	None			
Silting/Scouring	Lots of movable		Head cutting to	
	material (loose		12" - rock bottoms	
	sand)			
Surface material		Mostly fine sand		
Kind	S. G. & B	Some rock bars	Sand	
Size	to 12"	< 6"	< #10	
Form	Bars & channels	Undulating	Undulating ±12"	
Texture	Braided	Rough ± 2'		
Vegetation				
% Cover	None	10 - 15	20	
Dom. Species		Eph (?)	Eph (?)	See Photo #4 for
Condition				this very
Density				common (almost
Sec. Species		B. Palo Verde - 12'	B. Palo Verde - 18'	dominant) plant
Condition		Good		I was unable
Density		150 - 200' Spacing	150' Spacing	to identify it.
Other		Iron wood	Ephedra (Mor-	
		Chilopsis	mon tea)	
High water marks		to 5' in ironwood		

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 22.5 Photo No. 5 Looking NWly from Rt edge of channel Date 9/25/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Curving gently			
Regularity				
Gradient	uniform			
Obstructions	Few snags			
Silting/Scouring				
Surface material				
Kind	S & G	S & G	Sand	
Size	to 6"		< #10	
Form	Low serpentine	Gentle undul. ± 6"	Even plain	
Texture	bars - smooth	Smooth	cut through w/low channels	
Vegetation				
% Cover	None	< 5	15	
Dom. Species		Ironwood - 20'	Eplu(?) to 2'	
Condition			Fair	
Density		200'+ spacing	10-15' spacing	
Sec. Species		Eplu(?) - 2'	Ironwood - 12'	
Condition				
Density		40-50' spacing	100'+ spacing	
Other			B. Palo Verde	
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 22.75 Photo No. 6 Looking NEly across channel & L.O/B Date 9/25/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Curving NWly	Part of main		
Regularity		channel (?)	Even plain	
Gradient	Uniform		uniform	
Obstructions		Narrowing		
Silting/Scouring				
Surface material				
Kind	Sand	S&G in bars & chans.	Fine sand	
Size	Mostly < #4	up to 4"	< #10	
Form	Smooth	Uneven ± 18"	Gentle undul.	
Texture	Even		±6" - dunelike	
Vegetation				
% Cover	None	10	30	
Dom. Species		B. Palo Verde - 8'	Greasewood - 8'	
Condition		Good	Good	
Density		60-80' spacing	30-40' spacing	
Sec. Species		Greasewood	Grasses, forbs	
Condition				
Density		50-60' spacing	Dry	
Other		Occ. Ironwood to 20'	B. Palo Verde	
High water marks			Up to 18"	

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 23.0 Photo No. 7 Looking N. from Rt. edge of main channel Date 9/25/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				Subsidiary channel branches to Rt. (head of island?)
Alignment	Curving NW'ly			
Regularity				
Gradient	Uneven to south			
Obstructions	Few brush piles			
Silting/Scouring				
Surface material				NOTE: At river mile 23.12 ± main channel divides going upstream. Taking West br.
Kind	S. G. & Cobbles	Sand	Sand, silt	
Size	to 8"	< #4		
Form	Smooth bars	Hummocky ± 6"		
Texture				
Vegetation				
% Cover	< 1%	20	20	
Dom. Species	B. Palo Verde - 20'	Eplw(?) to 3'	Eplw(?) to 2'	
Condition		Fair	Fair	
Density	100-150' spacing	8' ± spacing	15' spacing	
Sec. Species		B. Palo Verde in clumps along E. edge of O/B	Creasewood - 6'	
Condition				
Density			60-80' spacing	
Other			Ironwood	
High water marks			to 4' in subs. chan @ head of island	

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 23.25 Photo No. 8 Looking NWly across chan. from island Date 9/25/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				NOTE: At Rivermile
Alignment	Divided	(Island)		23.4 ± channel
Regularity	Uniform			splits again
Gradient	Even			Ditching & diking
Obstructions	Occasional trees			(by bulldozer)
Silting/Scouring	& brush piles			done recently
				in N. branch
				See Photo #9 looking NWly at fork
Surface material				
Kind	S.G. & Cobbles	Silt	S & G	Photo #10 looks
Size	to 12"		< 2"	NEly at same
Form	Bars & channels	Hummocks ± 1'	Hummocky	point.
Texture	Mod. rough	Rounded	Rounded	
Vegetation				
% Cover	Negligible	80	20	
Dom. Species		Greasewood - 4'	Eph (?) - 4'	
Condition				
Density		40' Spacing	15-20' Spacing	
Sec. Species		B. Palo Verde	B. Palo Verde	
Condition				
Density		150' Spacing	200'	
Other		Mesquite	Ironwood	
		Grasses		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 23.50 Photo No. 11 Looking NE across L.O/B Date 9/25/79

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				Note: At River mile
Alignment	Multiple-Ctr, Br.			23.65 dirt road
Regularity	Wide shallow swale			crosses E. & W.
Gradient	Uniform			
Obstructions	Trees & brush			
Silting/Scouring				
Surface material				
Kind	S.G. & Cobbles	Silty sand	Sand & silt	
Size	up to 12"	Fine		
Form	Bars & channels	Rounded ± 1'		
Texture	Mod. rough	Smooth		
Vegetation				
% Cover	5	20	20	
Dom. Species	B. Palo Verde - 15	Greasewood - 4'	Eph(?) - 2'	
Condition	Good			
Density	100' spacing	20'-30' Spacing	15-30' Spacing	
Sec. Species		B. Palo Verde	B. Palo Verde	
Condition				
Density		100' Spacing	100' Spacing	
Other		Grasses, forbs		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 23.75 Photo No. 12 Looking NWly in main (ctr.) channel Date 9/25/69

Other Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form	Wide & shallow			
Alignment	Trending NWly			
Regularity				
Gradient	Even			
Obstructions	Trees & brush			
Silting/Scouring				
Surface material				
Kind	S. & Gravel < 1"	Sand	Silty sand	
Size	Some cobble bars	< #10		
Form	Shallow bars & ch.	Even plain ± 6"	Even plain ± 6"	
Texture	Smooth	Smooth		
Vegetation				
% Cover		30	40	
Dom. Species	B. Paloverde - 20'	Eptw (?) - 2'	Grass & forbs	
Condition	Good			
Density	80-100' Spacing	15-20' Spacing		
Sec. Species	Eptw (?) - 2'		Greasewood - 4'	
Condition				
Density	30-40' Spacing		100' Spacing	
Other			B. Palo Verde	
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 24.0 Photo No. 13 Looking Ely across channel Date 9/25/79

Other 14 NWly up channel Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form	Very wide & shallow	Very narrow (if any)		
Alignment				
Regularity				
Gradient	Even			
Obstructions	Trees & brush			
Silting/Scouring				
Surface material	Sand, gravel & cobbles in bars		Silty sand	
Kind				
Size	< 6"			
Form	Low smooth		Even plain ± 6"	
Texture	bars & channels		Smooth	
Vegetation				
% Cover	5			
Dom. Species	B. Palo Verde - 20'			
Condition				
Density	60-80' spacing			
Sec. Species	Ironwood - 20'			
Condition				
Density	150' spacing			
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 24.25 Photo No. 15 Looking NNW in Channel Date 9/25/75

Other S. (of 3) steel tower power lines Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form	Very wide & shallow	NOTE: Some horses		NOTE: At River mile
Alignment	trends NWly	& fenced corrals		24.43 a gravel
Regularity		in Left O/B area		road (Happy Valley
Gradient	uniform	above this point		Rd?) crosses E&W
Obstructions	Few trees & brush			
Silting/Scouring				
Surface material				
Kind	Sand			
Size	Scattered rock			
Form	bars < 6"			
Texture	Even			
Vegetation				
% Cover	10		10	
Dom. Species	B. Palo Verde 12'	Greasewood	B. Palo Verde	
Condition				
Density	150' Spacing		80-100' Spacing	
Sec. Species	Eph (?) - 2'	Grasses & forbs		
Condition				
Density	100' Spacing			
Other		B. Palo Verde at		
		E. margin		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 24.5 Photo No. 16 Looking NNWly up channel Date 9/25/79

Other 17 - East across Left O/B Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form	Wide & shallow			
Alignment	NNWly			
Regularity				
Gradient	Even			
Obstructions	None			
Silting/Scouring				
Surface material				
Kind	S.G. & Cobbles	Silty sand		
Size		Fine		
Form	Low flat bars	Undulating ± 6"		
Texture	Smooth	Smooth		
Vegetation	Negligible			
% Cover		60	20	
Dom. Species		Greasewood - 4'	B. Palo Verde	
Condition		Good		
Density		25-30' Spacing	80' Spacing	
Sec. Species		B. Palo Verde - 10'		
Condition				
Density		100' Spacing		
Other		Grasses & forbs		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 24.75 Photo No. 18 Looking NWly across chan. Date 9/25/79

Other 19 Southerly down channel Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				
Alignment	Straight		Like channel	
Regularity	Irreg. & braided			
Gradient	Even			
Obstructions	Some vegetation			
Silting/Scouring				
Surface material				
Kind		Sand		
Size		< #10		
Form		Even plain ± 6"		
Texture		Smooth		
Vegetation				
% Cover	5	20		
Dom. Species	Eptw (?) 2'	Eptw (?)		
Condition				
Density	20-30' Spacing	15-20' Spacing		
Sec. Species	B.P.V. & Ironwood	B. Palo Verde		
Condition				
Density	100-150' Spacing	60-80' Spacing		
Other		Greasewood		
High water marks				

* Looking downstream

Yost and Gardner Engineers

AGUA FRIA RIVER

Location: River mile 25.05 Photo No. See Remarks Looking _____ Date 9/25/79

Other Wood pole power line crosses E&W Obs. JES

	Streambed	Left* Overbank	Right* Overbank	Remarks
Channel form				Photos:
Alignment				#20 NEly across
Regularity	Irreg. & braided			East channel
Gradient	uniform			
Obstructions	Bushes & Trees			#21 NWly across
Silting/Scouring				main channel
				#22 W. across
Surface material				Rt. O/B
Kind	S.G. & Cobbles	Silty sand		
Size	to 4"			
Form	Shallow channels	Rutted (channels)		
Texture	& bars - mod. smooth			
Vegetation				
% Cover	< 5		< 30	
Dom. Species	Eph(?) - 18"	Greasewood	Greasewood	
Condition				
Density	20' spacing			
Sec. Species	B. Palo Verde - 15'		B. Palo Verde	
Condition				
Density	150' spacing			
Other				
High water marks				

* Looking downstream

Yost and Gardner Engineers

Photo No. 12

Photo No. 13

Photo No. 14

Photo No. 15

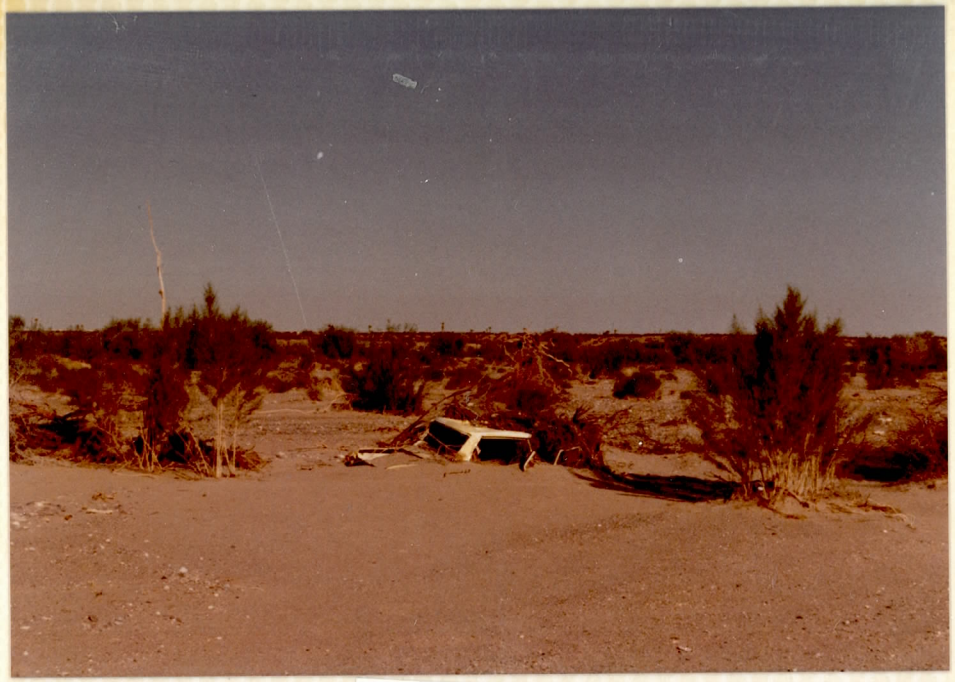


Photo No. 16

Photo No. 17

Photo No. 18

Photo No. 19

Photo No. 24

Photo No. 25

Photo No. 1 (Second Series)

Photo No. 2 (Second Series)

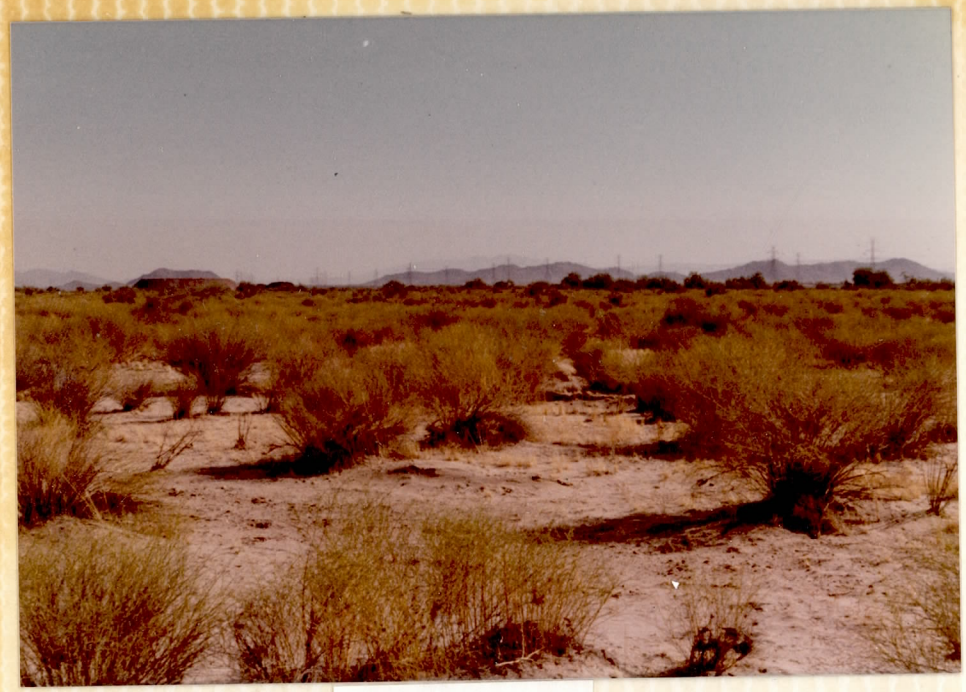


Photo No. 20

Photo No. 21

Photo No.. 22

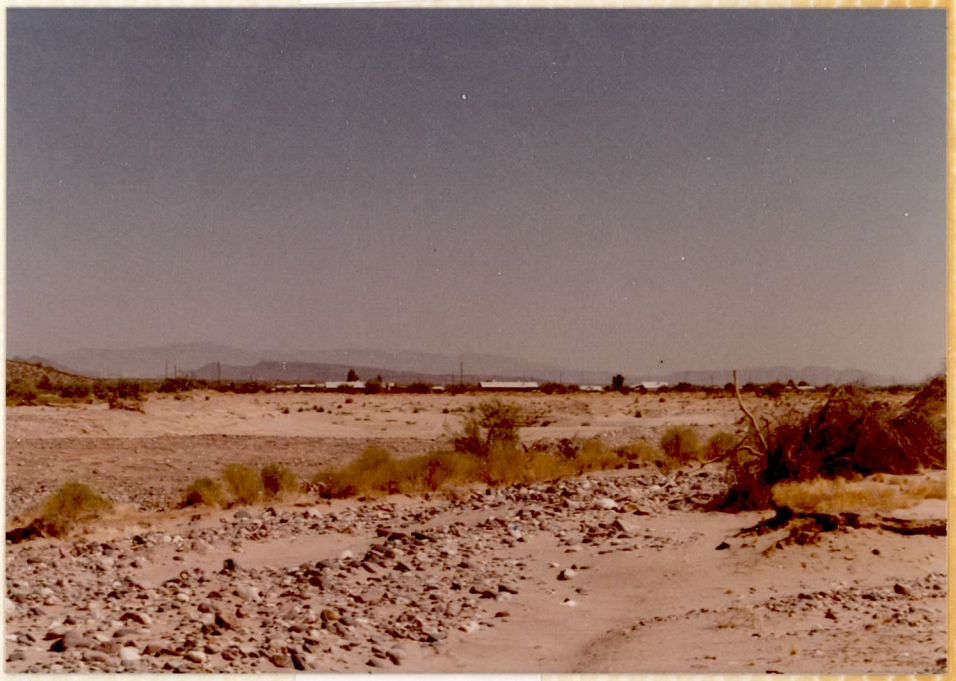


Photo No. 23

Photo No. 7 (Second Series)

Photo No. 8 (Second Series)

Photo No. 9 (Second Series)

Photo No. 10 (Second Series)

Photo No. 3 (Second Series)

Photo No. 4 (Second Series)

Photo No. 5 (Second Series)

Photo No. 6 (Second Series)

Photo No. 15 (Second Series)

Photo No. 16 (Second Series)

Photo No. 17 (Second Series)

Photo No. 18 (Second Series)

Photo No. 12 (Second Series)

Photo No. 13 (Second Series)

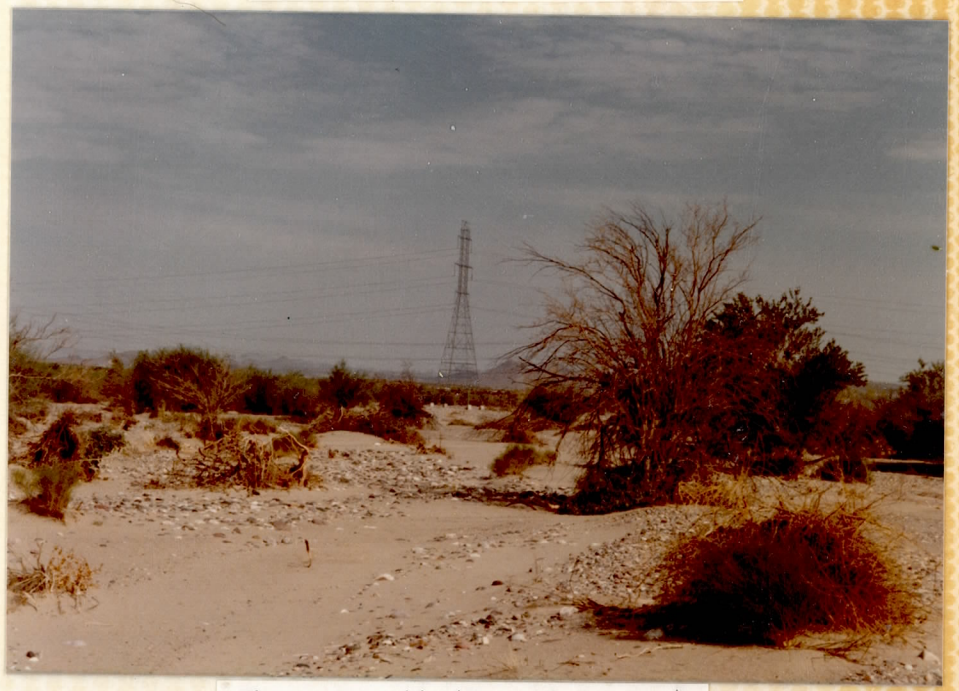


Photo No. 14 (Second Series)

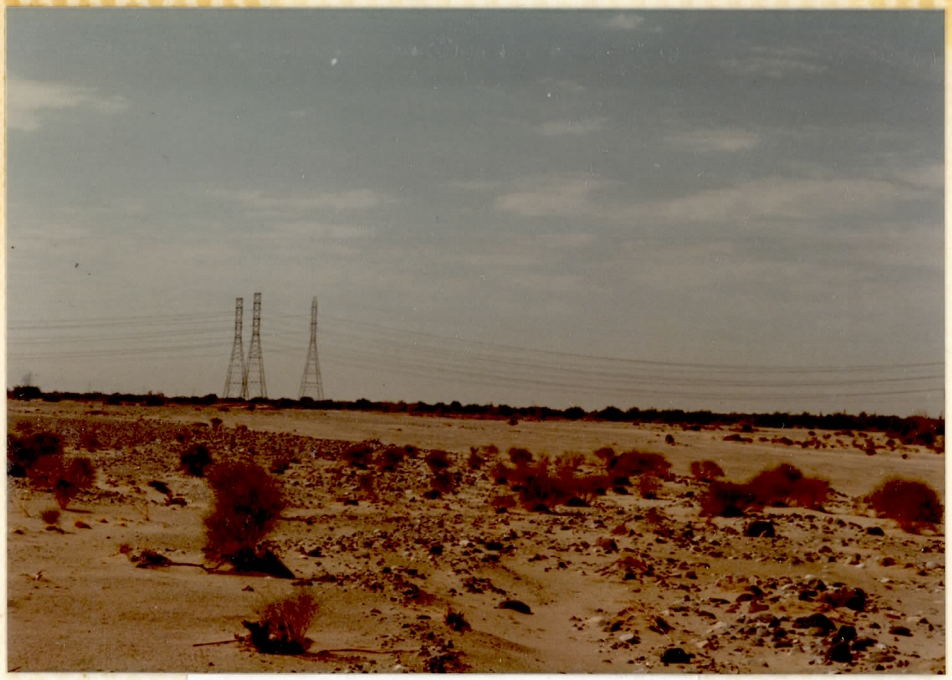


Photo No. 19 (Second Series)

Photo No. 20 (Second Series)

Photo No. 21 (Second Series)

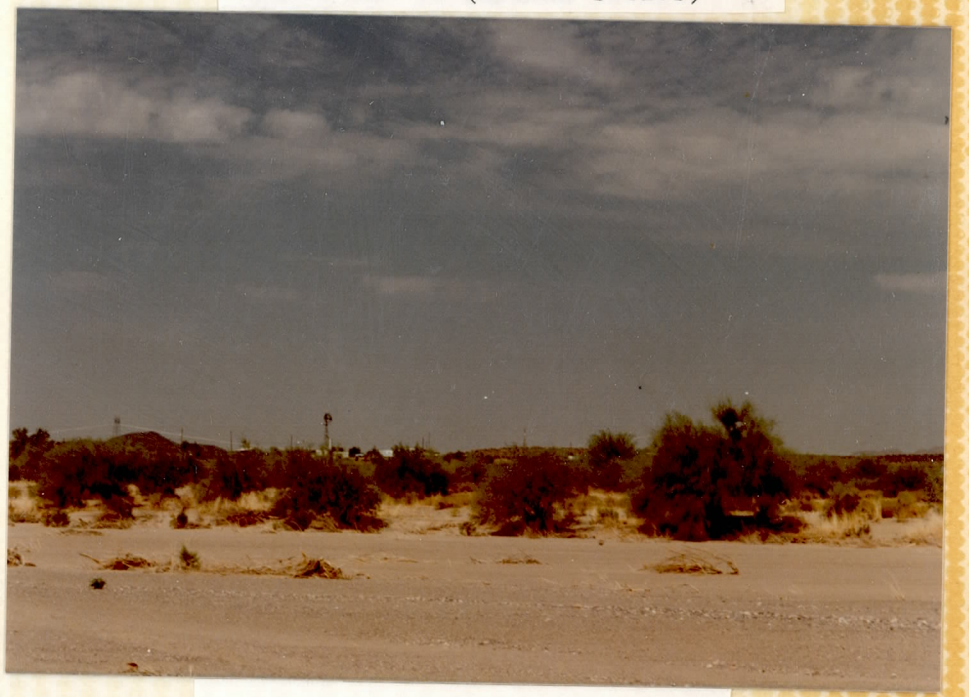


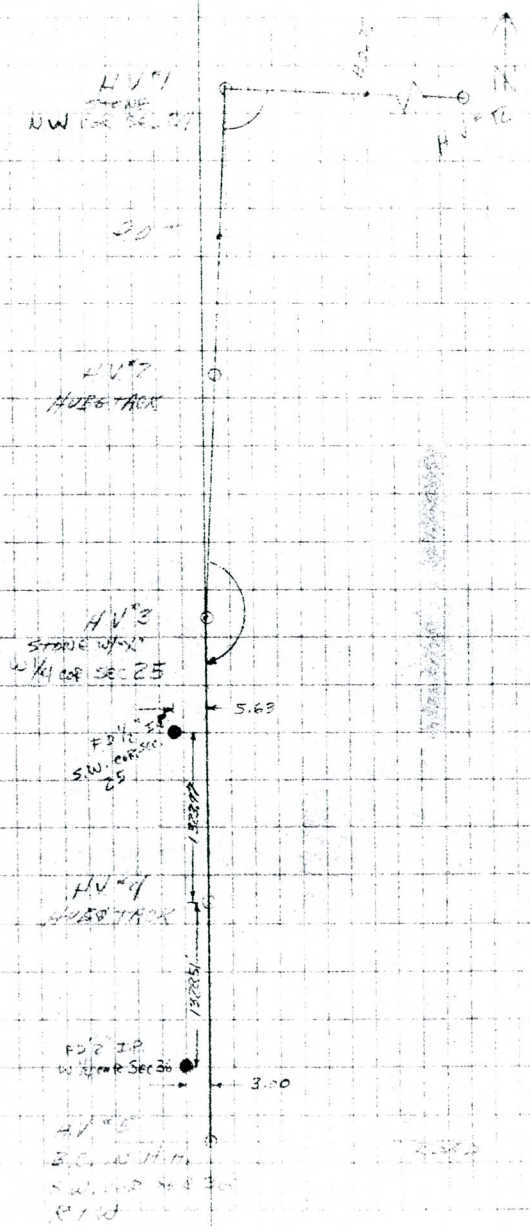
Photo No. 22 (Second Series)

Transcribed Header Down Stream
Job 5483

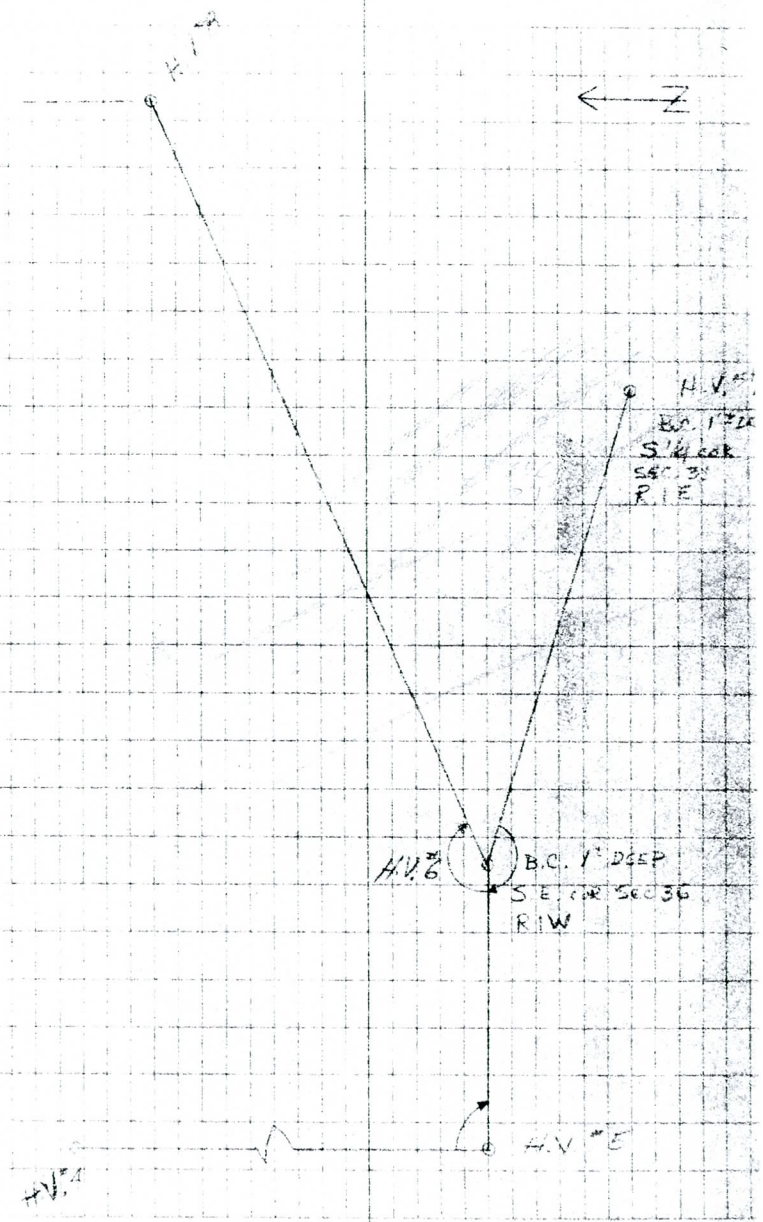
Sept 1999

10 P

HV°2				
	109°56'50"			
	39°52'50"	89°51'00"	3896.65	
	39°43'50"			
HV°3	109°56'57"			
		84°47'30"	3963.99	(3963.4
HV°4				
		40°29'00"	3956.99	(39[illegible]
HV°5				



124°43'10"		
249°26'20"		
138°52'50"		
124°43'10"		
	89°08'00"	2796.06
174°46'05"		
349°32'00"		
339°03'30"		
174°45'52"		
H.V. #6		
90°22'00"	90°02'00"	5227.64
180°45'20"		
01°30'20"		
90°22'35		



H.V. #11

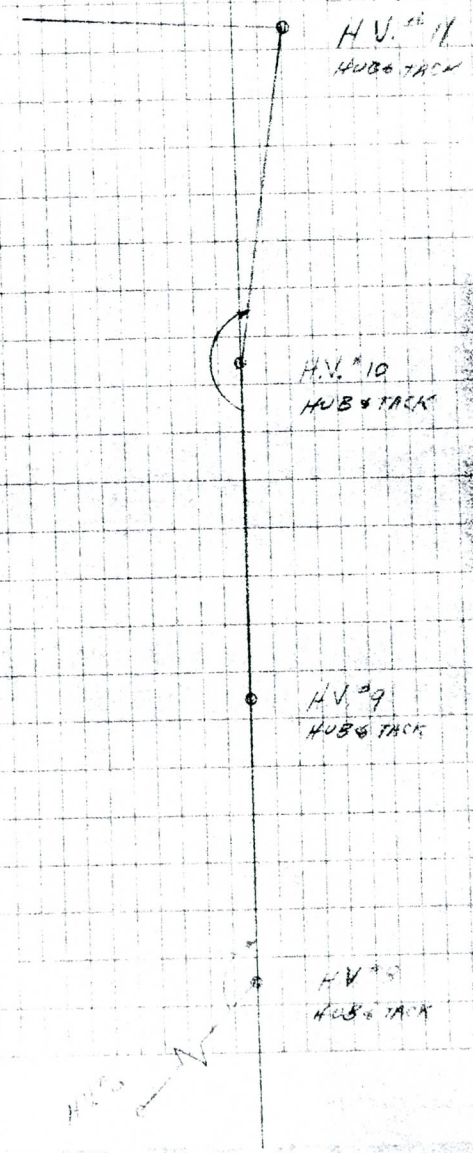
89°55'50" 3881.36

191°10'40"
77°21'15"
44°42'20"
H.V. #10 191°10'50"

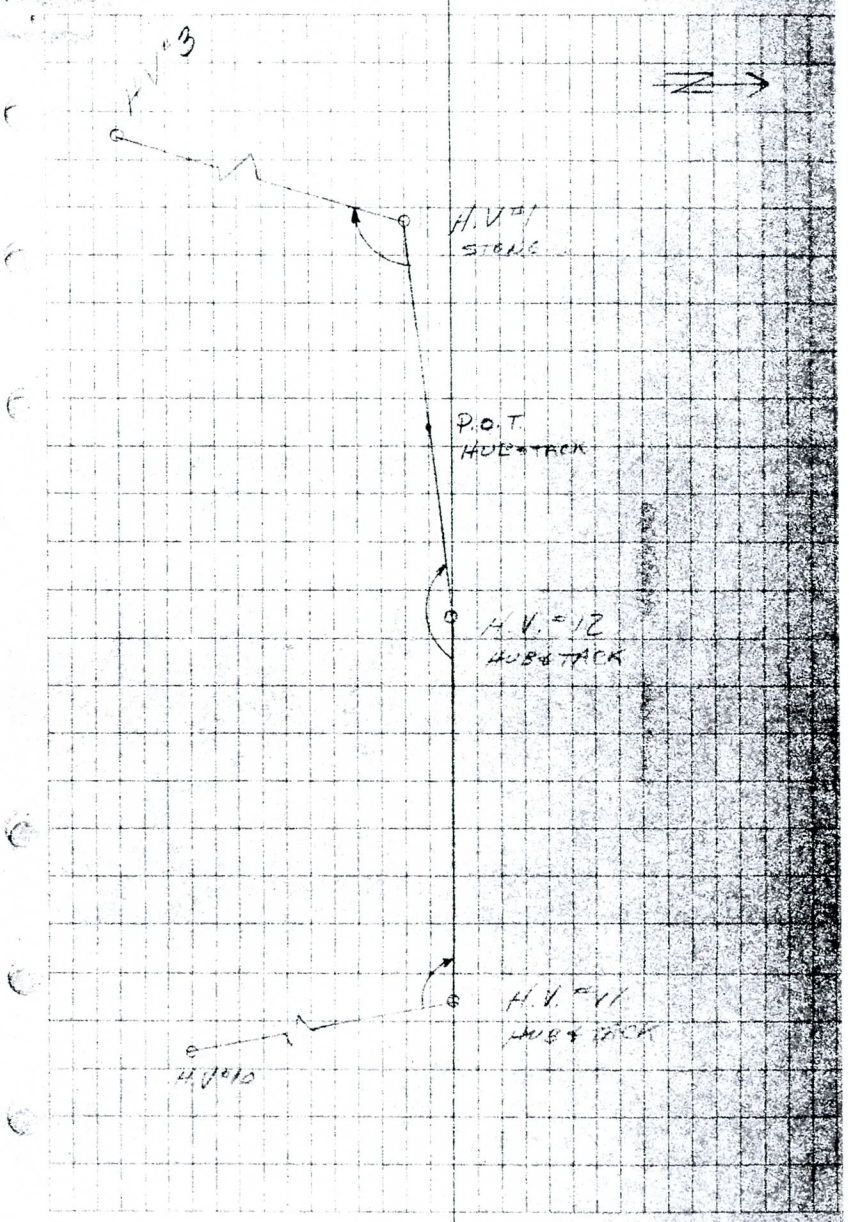
89°56'00" 4356.58

H.V. #9

145°29'10" 90°20'00" 4091.24
270°45'20"
77°37'00"
H.V. #8 145°29'15"



STA	HORZ ∡	VERT ∡	DIST	
	89°53'55"			
	179°48'00"			
	359°35'50"			
H.V. #1	89°53'57"			
		90°30'00"	1866.85	(1866
P.O.T.				
	177°39'50"			
	355°19'25"	91°16'00"	3359.63	(3359
	355°38'40"			
H.V. #12	177°39'40"			
		90°49'00"	3256.12	(3255
	80°49'35"			
	161°39'00"			
	323°17'45"			
H.V. #11	80°49'26"			



[illegible]
Tel: 5485

[illegible] 1979
[illegible]

[illegible]

[illegible]				1177.15	[illegible]
	6.94	1182.09			
T.P. 1			3.99	1178.96	
	[illegible]	1186.43			
T.P. 2			3.52	1182.91	
	6.37	1189.28			
T.P. 3			3.57	1185.71	
	5.91	1191.62			
T.P. 4			3.86	1187.76	T.B.M. [illegible]
	7.81	1195.57			
T.P. 5			2.67	1192.90	
	7.10	1200.00			
T.P. 6			1.06	1198.94	T.B.M. [illegible]
	4.28	1203.22			
T.P. 7			3.68	1199.54	
	6.52	1206.06			
T.P. 8			3.17	1202.89	
	5.43	1208.32			
T.P. 9			4.36	1203.96	T.B.M. [illegible]
	7.15	1211.11			
T.P. 10			2.93	1208.18	
	6.70	1214.88			
T.P. 11			1.12	1213.75	
	6.18	1219.93			
T.P. 12			0.84	1219.09	

HUB 5 [illegible] 0.96 [illegible]
MCHD BRASS CAP @ 51 [illegible]
[illegible] RD MPK.

TOP 1" I.P. WEST ¼ COR. SEC. 36
CIT

USE 1195.95
CONC. NAIL IN FOUNDATION OF FENCE
0.75 MILES NORTH OF BELL RD.

USE 1203.78
N.W. COR. SEC. 36 ¾" I.P.

STA	BS	HI	FS	EL	
				1219.09	
	4.58	1223.67			
T.P.			2.00	1221.67	T.P. 3
	5.02	1226.69			
T.P. #4			6.15	1220.54	
	9.48	1230.02			
T.P. #5			5.77	1224.25	
	1.18	1225.43			
T.P. #6			12.98	1212.45	
	0.24	1212.69			
T.P. #7			11.99	1200.70	
	1.62	1202.32			
T.P. #8			3.06	1199.26	
	6.49	1205.75			
T.P. #9			4.50	1201.25	
	6.43	1207.68			
T.P. #20			4.26	1203.42	T.P. 21
	5.57	1208.99			
T.P. #21			3.91	1205.08	
	6.08	1211.16			
T.P. #22			3.71	1207.45	
	6.30	1213.75			

DATE 17-1-69.
TOP OF STONE WEST ½ COR. SEC 35 HV #3

DATE 12-28-68
E ⊥ 3MI. S.W. COR. SEC. 35

STA	B.S.	H.I.	F.S.	Elev.	
		1213.75			
TP 1			3.40	1207.35	
	6.1	1215.96			
TP 2			.62	1214.34	
	1.42	1224.77			
TP 3			0.65	1224.14	
	12.34	1236.98			
TP 4			3.74	1233.24	
	5.11	1236.35			
TP 5			2.21	1236.14	T.B.M.
	4.17	1240.31			
TP 6			4.11	1236.20	
	6.24	1242.44			
TP 7			3.52	1233.92	
	5.68	1244.60			
TP 8			3.47	1241.13	
	5.39	1246.52			
TP 9			3.45	1243.07	
	5.71	1248.78			
TP 10			1.10	1247.68	
	12.59	1260.27			
T.B. 11			1.46	1258.81	T.B.M.
Finish	1.75	1260.56			

USE 1236.19
2X2 HUB 0.5 MILES NORTH OF N.W. COR.
SEC. 25.

T.B.M. #7 36.19
+ 2.38
HI = 38.57
− 4.52
V#34 = 34.05

USE 1259.57
TOP [illegible]
B.V. #1 [illegible] 0.7 [illegible]
[illegible]

ST	[illegible]	[illegible]	[illegible]	[illegible]
		1260.56		
T.P.			[illegible]	1252.11
	[illegible]	1256.32		
			5.79	1250.53
	3.56	1254.09		
T.P.			5.72	1248.37
	3.31	1251.68		
T.P.			6.01	1245.67
	3.23	1248.90		
T.P.			6.36	1242.54
	2.20	1244.74		
T.P.			10.47	1234.27
	6.99	1241.26		
T.P.			4.55	1236.71
	3.66	1240.37		
T.P.			6.38	1233.99
	1.90	1235.89		
T.P.			8.61	1227.28
	3.39	1229.67		
T.P.			[illegible]	1228.34
	[illegible]	1230.53		
			[illegible]	1224.61
	[illegible]	1229.44		
			[illegible]	1226.07

				1226.57
	[illegible]	1230.19		
[illegible]			[illegible]	1223.55
	[illegible]	1226.76		
[illegible]			[illegible]	1221.61
	[illegible]	1223.88		
[illegible]			[illegible]	1217.95
	[illegible]	1221.24		
[illegible]			[illegible]	1214.75
	[illegible]	1218.13		
[illegible]			[illegible]	1211.62
	[illegible]	1214.56		
[illegible]			[illegible]	1208.02
	[illegible]	1211.34		
[illegible]			[illegible]	1203.95
	[illegible]	1207.97		
[illegible]			[illegible]	1201.65
	[illegible]	1205.83		
[illegible]			[illegible]	1199.56
	[illegible]	1202.73		
[illegible]			[illegible]	1197.24
	[illegible]	1200.82		
[illegible]			[illegible]	1194.52
	[illegible]	1197.18		
[illegible]			[illegible]	1190.22

				1190.22
	4.32	1194.25		
[illegible]			6.41	1187.84
	[illegible]	1191.93		
[illegible]			5.90	1186.03
	4.47	1190.50		
[illegible]			6.74	1183.76
	4.89	1188.05		
[illegible]			6.07	1181.98
	[illegible]	1186.14		
[illegible]			7.31	1178.83
	4.17	1183.00		
[illegible]			4.59	1178.41
	4.41	1182.82		
			5.78	1177.04 [illegible]
			=	1177.15
				.11
				1177.15 [illegible]
	4.57	1181.94		
[illegible]			7.57	1174.37
	4.94	1179.31		
[illegible]			7.37	1171.94
	2.78	1174.72		
[illegible]			2.90	1171.82 [illegible]

PG. 2

M.B. 4 [illegible] with H.H. Earthworks [illegible]

B.M. [illegible] Spike [illegible] Flange [illegible] FRAME [illegible] MARKED 1171.82

STARTING B.M.

		[illegible]				
				1170.67		
	[illegible]	1173.39				
T[illegible]			[illegible]	1174.58		
	[illegible]	1181.37				
			[illegible]	1177.16	[illegible]	
				1171.82	B.M. #5	B.C. WEST END SOUTH SIDE BRIDGE
	1.21	1173.11				
T.P. 1			3.51	1169.60		
	0.48	1170.08				
T.P. 2			5.43	1164.65		
	4.14	1168.79				
T.P. 3			5.80	1162.99		
	5.18	1168.17				
T.P. 4			3.87	1164.30		
	3.76	1168.06				
T.P. 5			5.14	1162.92		
	4.78	1167.70				
T.P. 6			4.42	1163.28		
	5.06	1169.04				
T.P. 7			6.00	1163.04	B.M. #6	B.C. [illegible] SEC 30 T9N R1W APPROX 1 DEAD
						H.V. #6 0.70 HIGHER (SECOND LEVEL)
						[illegible]

STA	B.S.	H.I.	F.S.	EL	
				1163.04	
	6.03	1169.07			
T.P.#8			5.11	1163.96	
	5.51	1169.47			
T.P.#9			2.88	1166.59	
	9.14	1175.73			
T.P.#10			0.15	1175.58	
	8.92	1184.50			
T.P.#11			0.98	1183.52	
	11.10	1194.62			
T.P.#12			0.81	1193.81	
	8.02	1201.83			USE 1197.60
T.P.#13			4.25	1197.58	B.M.#7 X TOP WEST END CONC. HDW. 0.35 MILES EAST B.M.#6
BENCH	4.09	1201.67			NORTH OF BECK RD.
T.P.#14			11.41	1190.26	
	2.45	1192.71			
T.P.#15			8.98	1183.73	
	0.82	1184.55			
T.P.#16			8.67	1175.88	
	0.21	1176.09			
T.P.#17			8.49	1167.60	
	1.92	1169.52			
T.P.#18			5.55	1163.97	
	3.87	1167.84			
T.P.#19			4.78	1163.06	

STA	BS	H.I.	FS	EL.	
				1163.06	
	5.94	1169.00			
T.P. #0			5.03	1163.97	
	5.07	1169.04			
T.P. #1			6.29	1162.75	
	5.02	1167.77			
T.P. #2			4.43	1163.34	
	5.33	1168.67			
T.P. #3			5.42	1163.25	
	5.24	1168.49			
T.P. #4			4.16	1164.33	
	5.65	1169.98			
T.P. #5			4.43	1165.55	
	6.95	1172.50			
			0.72	1171.78	B.M. #5
				= 1171.82	
				(.04)	
				~~1177.60~~	
				1197.58	B.M. #7
	7.05	1204.63			
T.P. #1			6.66	1197.97	
	8.57	1206.54			
T.P. #2			3.60	1202.94	
	6.10	1209.04			
T.P. #3			9.61	1199.43	

"X" TOP WEST END CONC. HDW 0.35 MILES EAST B.M. #6
NORTH BELL RD.

				1199.43		
	0.27	1200.42				
TP#4			9.47	1190.95		
	0.56	1191.51				
TP#5			6.24	1185.27		
	5.92	1191.19				
TP#6			2.73	1188.46		
	3.26	1191.72				DGE 1191.06
TP#7			0.75	1190.97	B.M.#6	PAINTED DOT ON N.W. CONC. FOOTING OF TRANSMISSION TOWER
	3.48	1194.45				0.65 MILES N. OF B.M.#7
TP#8			3.53	1190.92		
	11.23	1202.15				
TP#9			3.59	1198.56		
	3.96	1201.52				
TP#10			4.65	1196.87		
	6.09	1202.96				
TP#11			2.81	1200.15		
	6.54	1206.69				
TP#12			0.67	1206.02		
	5.68	1211.70				
TP#13			2.54	1208.86		
	5.37	1214.23				
TP#14			3.[illegible]	1211.09		
	[illegible]	1216.28				DGE 1212.60
TP#15			[illegible]	1213.56	B.M.#7	PAINTED DOT ON S.W. CONC. FOOTING OF TRANSMISSION TOWER
						1.[illegible] MILES N. OF B.M.#7

STA	B.S.	H.I.	F.S.	G.L.
				1213.56
	4.99	1218.35		
TP #16			3.20	1215.15
	5.46	1220.61		
TP #17			4.52	1216.09
	5.22	1221.30		
TP #18			7.01	1214.29
	8.80	1223.09		
TP #19			6.18	1216.91
	6.17	1223.08		
TP #20			2.56	1220.52
	5.21	1225.73		
TP #21			6.03	1219.70
	7.08	1226.78		
TP #22			3.37	1223.41
	7.51	1230.92		
TP #23			1.64	1229.28
	4.31	1233.59		
TP #24			3.42	1230.17
	6.53	1236.70		
TP #25			9.18	1227.52
	8.01	1235.53		
TP #26			1.31	1234.33
	3.23	1237.56		
TP #27			1.0	1228.55

USGS 1229.33
Channel Dot on S.W. corner of Tennessee Tower
0.90 miles W. of B.M. #7

SD	B.S.	H.I.	F.S.		
				1228.55	
	8.38	1237.39			
TP 28			6.02	1235.37	
	7.36	1242.57			
TP 29			5.06	1239.51	
	7.29	1246.80			
TP 30			3.39	1243.41	BM #11
	0.56	1243.93			
TP 31			11.32	1232.61	
	0.01	1232.62			
TP 32			9.79	1222.83	
	0.32	1223.15			
TP 33			11.62	1211.53	
	1.85	1213.38			
TP 34			7.59	1205.79	
	5.73	1211.52			
TP 35			5.24	1206.28	
	6.34	1212.62			
TP 36			6.98	1205.64	
	3.79	1209.43			
TP 37			3.30	1206.13	
	3.03	1209.16			
TP 38			4.16	1205.00	
	7.69	1212.69			
TP 39			5.04	1207.65	BM #12

USE 1243.47
Permanent Bar in S.W. Corner of Transmission Tower
0.75 miles N. of 3M #10

USE 1207.82
1.75 miles West of B.M. #11

				1207.65	
	5.10	1212.75			
			5.39	1207.36	
	[illegible]	1211.54			
			5.50	1206.04	
	[illegible]	1210.72			
			[illegible]	1205.51	
	[illegible]	1210.25			
			[illegible]	1205.91	
	11.02	1216.93			
			0.00	1216.53	
	8.33	1224.86			
			5.07	1219.79	
	6.98	1222.77			USE 1220.25
			2.60	1220.17	B.M. #13 B.C. MARKED $\frac{13}{24}$ & ROD APPS. R/W
	6.04	1226.21			
			0.15	1226.06	
	11.37	1237.63			
			0.60	1237.03	
	11.70	1248.73			
			0.64	1248.09	
	11.61	1259.70			
			0.13	1259.57	
	[illegible]	1270.27			USE 1270.23
			0.12	1270.15	B.M. [illegible] PS 0.4 [illegible] OF T.B.M. 18

				1270.15	
	5.32	1275.94			
T.P. 52			5.32	1270.62	
	3.32	1273.84			
T.P. 53			7.78	1266.06	
	2.67	1268.73			
T.P. 54			6.57	1262.16	
	4.45	1266.61			
T.P. 55			7.92	1258.69	
	6.96	1265.65			
			6.91	1258.74	T.B.M. # 8 * 1816
				= 1258.81	
				(.07)	
				1270.28	
				+1270.15 B.M. #1	60 MAIC IN PP 0.4 MILES EAST OF T.B.M. #8
	4.57	1274.72			
T.P. #1			5.88	1268.84	
	1.48	1270.32			
T.P. #2			6.20	1264.12	
	2.97	1267.09			
T.P. #3			6.86	1260.23	
	4.16	1264.39			
T.P. #4			5.47	1258.92	
	3.62	1262.54			
T.P. #5			6.63	1255.91 V #13	4.98 1256.01

5.72	8.5	[illegible]	[illegible]	[illegible]	
				1255.71	
	6.72	1262.63			
TP #6			3.90	1259.23	
	5.35	1264.58			
TP #7			3.22	1261.36	
	7.65	1269.01			
TP #8			3.23	1265.78	
	5.97	1271.75			
TP #9			3.19	1268.56	
	6.27	1274.83			
				1270.20	
			4.71	1270.12	B.M. #14
				= 1270.15 23	
				(.03)	
				1229.27	
				1229.28	B.M. #16
	2.82	1232.10			
TP #1			6.82	1225.28	
	2.33	1227.61			
TP #2			5.36	1222.25	
	7.16	1224.41			
TP #3			4.01	1220.40	
	5.01	1225.41			
TP #4			10.32	1215.09	
	1.17	1216.26			
TP #5			11.28	1204.98	

S.TL	[illegible]	[illegible]	[illegible]	[illegible]	
				1204.98	
	0.32	1205.30			
T.P.#6			7.13	1199.17	
	2.93	1201.10			
T.P.#7			6.90	1194.20	
	3.58	1197.78			
T.P.#8			5.25	1192.53	
	2.47	1195.00			
T.P.#9			4.99	1190.01	
	7.99	1198.00			
T.P.#10			3.97	1194.03	
	3.74	1197.77			
T.P.#11			2.76	1195.01	V.# 14 USE 1195.11
	2.85	1197.86			
T.P.#12			3.59	1194.27	
	3.28	1197.55			
T.P.#13			6.81	1190.74	
	4.61	1195.35			
T.P.#14			1.69	1193.66	
	3.67	1197.33			
T.P.#15			3.20	1194.13	
	3.81	1197.94			
T.P.#16			5.83	1192.11	
	3.95	1196.09			
T.P.#17			4.78	1191.31	

				1191.31			
	3.53	1194.81					
TP#18			6.73	1188.08			
	4.01	1192.09					
TP#19			6.32	1185.77			
	4.10	1189.87					
TP#20			6.73	1183.14	V#15	USE	1183.28
	3.27	1186.41					
TP#21			5.23	1181.18			
	3.94	1185.12					
TP#22			5.43	1179.69			
	3.73	1183.42					
TP#23			5.23	1178.19			
	4.25	1182.44					
TP#24			6.02	1176.42			
	4.26	1180.68					
TP#25			6.56	1174.12			
	4.78	1178.90					
TP#26			5.61	1173.29			
	4.04	1177.33					
TP#27			6.01	1171.32 (.37)	V#16	USE	1171.49
	3.63	1174.95					
TP#28			5.70	1169.25			
	3.02	1172.27					
TP#29			5.55	1166.72			

				1166.72
		1170.65		
			5.60	1165.05
		1169.10		
			5.93	1163.17
	3.52	1166.99		
			5.61	1161.38
	3.79	1165.17		
			5.33	1157.53
	3.20	1163.73		
			5.31	1158.42
	7.71	1166.16		
			3.31	1162.85 BM 6
				= 1163.04 1163.15
				15
				1171.32
	3.51	1175.21		
			5.52	1169.32
	3.71	1173.03		
			5.98	1167.05
	3.91	1170.96		
			5.19	1165.77
	4.17	1169.94		
			5.44	1164.50

				1164.50		
		1168.57				
				1164.45		
		1168.17				
				1164.87		
	1.37	1166.14				
			5.[illegible]	1160.65	[illegible]	1160.87
	5.3[illegible]	1165.99				
			1.67	1164.32		
	4.85	1169.17				
			4.54	1164.63		
	6.53	1170.66				
			3.[illegible]	1166.74		
	5.[illegible]	1172.82				
			[illegible]	1168.61		
	5.[illegible]	1174.32				
			3.[illegible]	1171.28	[illegible]	
				1171.87		
				1213.60	[illegible]	
	3.[illegible]	1216.59				
			4.62	1211.97		
				1191.05	[illegible]	

				1197.60	BM #1
	6.77	1204.37			
RC HX #2			[illegible]	1199.21	
Standard Pt #1			4.1	1200.3	
				1198.78	T.B.M. #2
	3.31	1202.26			
H.V. #1			4.68	1197.58	
				1227.39	BM #10
	2.83	1232.16			
H.V. #10			5.43	1226.73	
				1243.47	B.M. #11
	4.80	1248.27			
H.V. #11			4.54	1243.73	
				1203.45	T.B.M. #6
	5.87	1209.32			
T.P. #1			4.11	1205.21	
	11.37	1216.58			
T.P. #2 - H.V. #2			1.23	1215.35	
	1.95	1217.30			
T.P. #3			12.14	1205.16	
	4.23	1209.39		1203.45	603
			5.76		T.B.M. #6

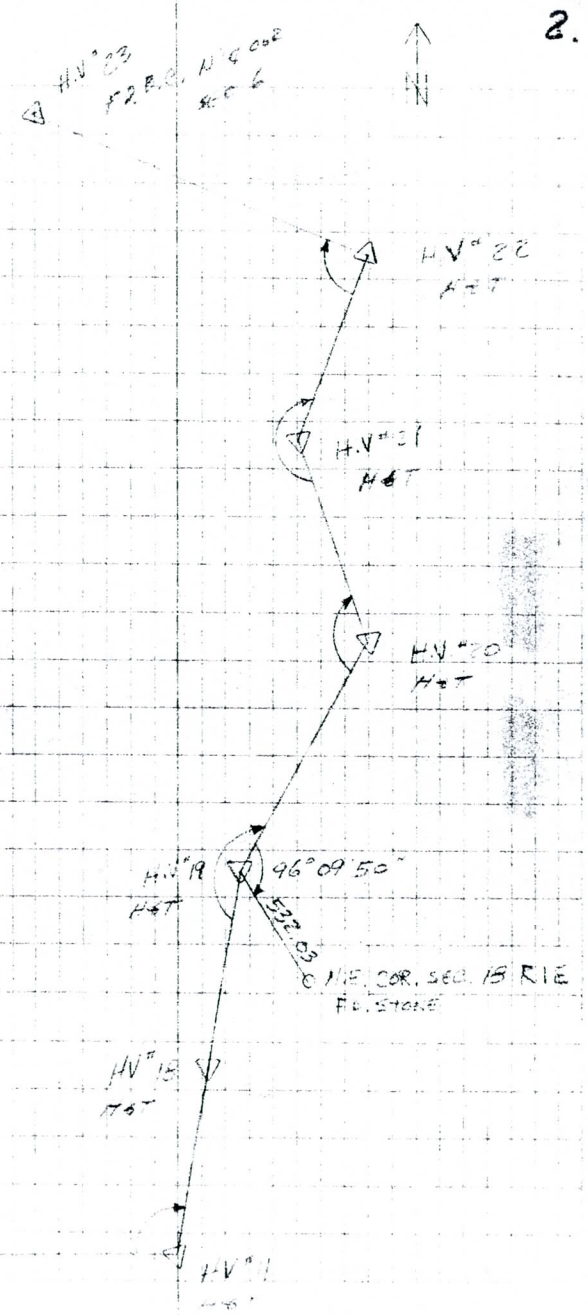
Tape Recorder Upper Hall Beaufrin
Demand Loan Tape # 5483

Sept. 1979

S. Hodson
F. Comire
J. Bussot

ED

STA.	HRZ ∡	VERT ∡	DIST.
H.V. #23	1 69° 0' 20"		
	2 139° 03' 20"		
	3 275° 07' 00"		
	4 16° 01' 45"		
H.V. # 22			
	1 215° 35' 00"		
	2 71° 10' 00"		
	3 142° 20' 00"	88° 51' 30"	2098.22
	4 215° 35' 00"		
H.V. # 21			
	1 194° 56' 15"		
	2 284° 52' 10"		
	3 219° 45' 45"	89° 25'	4380.47
	4 194° 56' 26"		
H.V. # 20			
	1 188° 48' 40"		
	2 17° 37' 20"	89° 27' 30"	3792.74
	3 35° 14' 40"		
	4 188° 48' 40"		
H.V. # 19			
		89° 46'	2562.37
H.V. # 18	1 166° 10' 35"		
	2 212° 21' 15"		
	3 69° 42' 30"	90° 19'	3292.08
	4 106° 10' 32"		
H.V. # 17			



H.V. #27

97°10'25"

2 199°21'30"

4 28°45'10"

H.V. #24 97°10'40"

91°29' 2300.17

170°06'40"

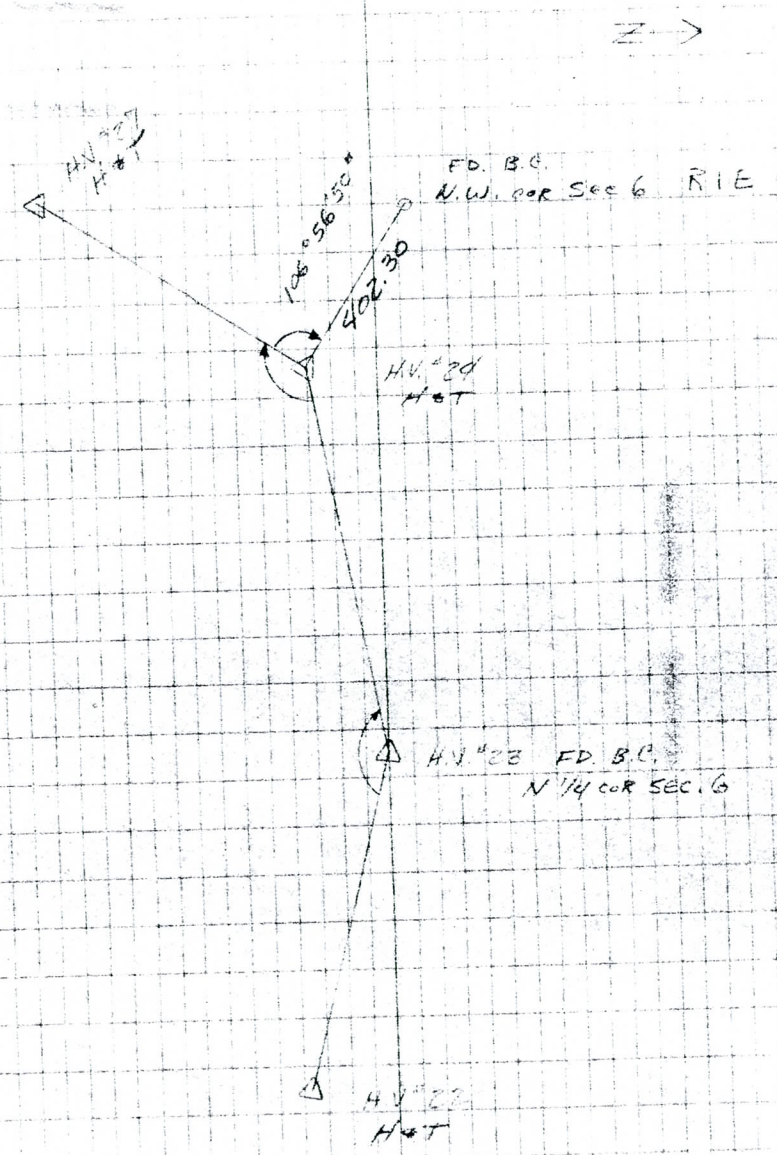
390°13'40"

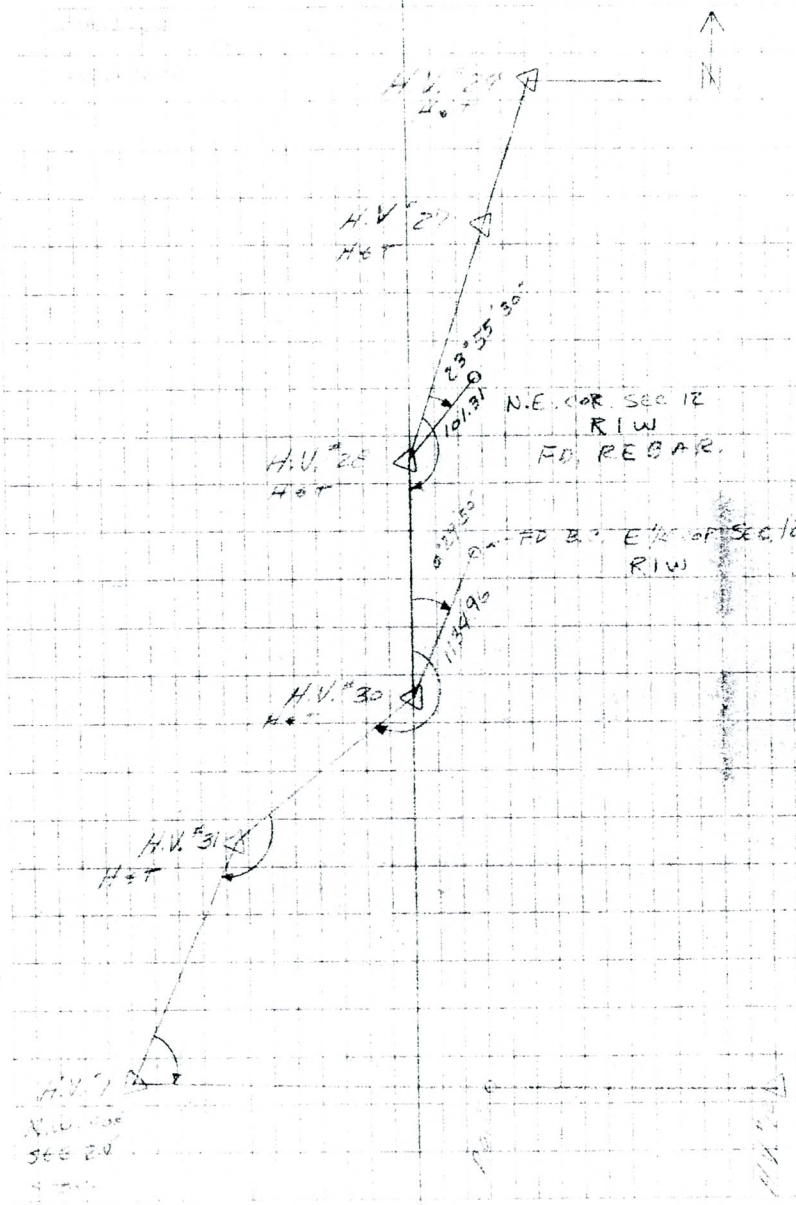
320°26'20"

H.V. #23 170°06'35"

00°00' 4640.15

H.V. #22




N
H.V. #29
H.V. #28
H.T.
23°35'30"
101.31'
N.E. COR. SEC. 12
R/W
FD. REBAR.
H.V. #28
H.T.
FD. B.C. E½ OF SEC. 12
R/W
H.V. #30
H.V. #31
H.T.

Calculations for Open Cycle Heating
Data Sheet Job # 5183

Sept 1979

32 D

Station	F.S.	H.I.	F.S.	Elev.	
				1242.87	BM #11
	5.85	64.32			
TP #1			4.67	95.23	
	6.76	61.79			
TP #2			3.24	98.95	
	5.81	57.46			
TP #3			5.55	53.91	
	6.07	54.48			
TP #4			4.59	49.89	
	3.27	53.16			
TP #5			8.78	44.38	
	9.03	53.41			
TP #6			2.11	51.30	
	9.81	60.11			
TP #7			4.07	56.04	
	5.41	61.45			
TP #8			2.79	1258.66	BM #15
	3.17	61.83			
TP #9			2.13	59.10	
	6.14	65.24			
TP #10			4.57	60.65	
	4.55	65.20			
TP #11			9.04	56.16	
	9.32	65.48			
TP #12			2.57	1262.59	BM #16

USE 1258.67
PAINTED DOT ON N.W. CORN. FOOTING OF TRANS. TOWER
0.70 MILES NORTH B.M. #

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
				126257	
[illegible]	[illegible]	[illegible]			
[illegible]			[illegible]	62.22	
[illegible]	[illegible]	[illegible].93			
[illegible]			[illegible]	[illegible]6.4[illegible]	
	[illegible]	73.11			
[illegible]			[illegible]	70.30	
	[illegible]	[illegible].90			
[illegible]			[illegible].12	73.77	
	7.37	81.14			
[illegible]			1.97	1272.65	[illegible] 17
	[illegible]	83.86			
[illegible]			[illegible]	82.18	
	8.23	91.01			
[illegible]			1.17	89.84	
	11.86	1301.70			
[illegible]			[illegible].82	00.89	
	9.51	10.39			
[illegible]			1.88	1306.51	
	9.14	17.65			
[illegible]			6.25	1311.40	[illegible] 18

1279.68

Printed Dot on S.W. corner footing of Trans. Tower

0.50 Miles N. of N.E. cor. Sec. 18

[illegible] E 1311.44

Printed Dot on S.E. corner footing of Corner Trans. Tower

0.15 Miles N. of N.E. cor. Sec. 18

SIH	[illegible]	[illegible]	[illegible]	[illegible]	
				1258.67	BM [illegible]
	2.88	1261.55			
H.I. #19			5.88	1255.67	
				1262.61	BM #16
	7.11	1269.72			
H.V. #17			3.23	1266.49	
				1311.40	BM #18
	0.10	11.50			
H.V. #20			5.30	13.06.20	
TP #1			10.38	1301.12	
	0.14	01.26			
T.P. #2			11.18	1290.08	
	0.08	90.16			
TP #3			7.44	82.72	
	3.24	85.96			
TP #4			7.07	78.89	
	2.04	80.91			
TP #5			11.20	69.71	
	0.20	69.91			
TP #6			10.94	58.97	
	0.61	59.61			
TP #7			10.43	49.21	
	1.73	50.94			

USE 1311.44

STA	[illegible]	[illegible]	[illegible]	[illegible]	
		37.94			
TP #8			9.05	24.81	[illegible]
	9.03	46.52			
TP #9			5.26	40.64	
	2.57	43.21			
TP #10			6.41	36.80	
	4.49	41.29			
TP #11			3.30	37.99	
	5.33	43.32			
TP #12			4.79	38.53	
	4.13	42.66			
TP #13			5.06	37.60	V #29
	3.67	41.27			
TP #14			7.28	33.99	
	6.54	40.53			
TP #15			5.07	35.46	
	2.93	38.39			
TP #16			2.03	36.36	
	9.54	45.90			
TP #17			0.65	45.25	
	10.96	56.21			
TP #18			0.10	56.11	
	11.23	67.34			
TP #19			3.45	63.89	
	6.47	70.36			

USE 1241.99

Good [illegible] PR = 5.61 cos 10°14'44" = Actual PR

USE 1236.66

STA				
		1270.36		
				67.07
	1.65	72.22		
				69.05
	1.65	71.90		
			5.54	64.36
		66.96		
			5.13	61.83
	3.11	67.82		
			2.55	65.27
	1.60	74.87		
			1.18	73.69
	9.31	83.08		
			0.83	82.25
	10.07	92.32		
			0.68	91.64
	8.20	99.84		
			1.27	98.57
	10.31	105.85		
			3.69	05.24
	5.11	10.35		
			6.70	03.65
	5.00	09.65		
			7.00	01.65
	3.57	05.22		

USE 126-12

Intersection N.E. cor. Footing of Bridge Tower - North Tower S.W. cor. 115th Ave. & [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
		1305.22					
TP #32			6.77	98.45	V #32	[illegible]	1498.54
	3.36	91.8					
TP #33			6.17	95.64			
	3.53	99.17					
TP #34			6.53	92.84			
	3.79	102.63					
TP #35			5.35	90.28			
	3.46	93.79					
TP #36			5.86	87.83			
	4.71	92.59					
TP #37			9.84	82.75			
	5.37	88.12					
TP #38			4.47	83.65			
	4.35	88.00					
TP #39			6.15	81.85			
	4.86	86.11					
TP #40			7.12	1273.99	H.V. #31	[illegible]	1279.09
	5.17	84.16					
TP #41			6.11	78.05			
	5.32	83.37					
TP #42			6.91	76.46			
	3.75	79.81					
TP #43			6.32	72.99			
	3.91	76.70					

		1276.70			
			[illegible]	70.25	
	[illegible]	75.90			
[illegible]			[illegible]	67.14	
	[illegible]	70.34			
[illegible]			[illegible]	63.37	
	[illegible]	66.55			
			[illegible]	58.76	T.B.M. #3
	[illegible]			= 58.87	
			[illegible]	-0.11	
B.M. #12				1207.72	B.M. #12
	[illegible]	13.43			
[illegible]			[illegible]	09.03	
	[illegible]	14.41			
[illegible]			[illegible]	10.28	
	[illegible]	16.55			
[illegible]			[illegible]	12.44	
	[illegible]	18.59			
[illegible]			0.65	17.94	
	[illegible]	29.84			
[illegible]			[illegible]	29.05	
	[illegible]	36.11			
[illegible]			[illegible]	31.67	

TOP STONE @ H.V. #1

				1231.67	
	5.11	37.44			
SET 7			[illegible]	1233.37	O.K.
	3.17	37.62			
			5.98	31.64	
	4.5[illegible]	36.15			
			[illegible]	29.29	
	1.39	31.13			
			7.76	21.37	
	[illegible]	22.86			
			7.[illegible]	13.15	
	9.[illegible]	17.35			
			5.[illegible]	11.95	
	4.34	16.29			
TP[illegible]			6.[illegible]4	10.25	
	4.[illegible]	14.27			
TP[illegible]			5.15	09.12	
	4.28	13.40			
			5.70	1207.70	[illegible]
				= 1207.72	O.K.
				159.74 [illegible]	
	9.72	46.46			
TP[illegible]1			3.[illegible]		
	9.74	[illegible]			

STA					
	1.5	4.7	5.5	[illegible]	
TP#2			1.30		
	10.15	[illegible]			
TP#3			9.95	[illegible]	
	1.50	51.65			
TP#4			4.9	46.50	
	5.40	[illegible]			
TP#5			4.24	[illegible]	
	5.90	53.65			
TP#6			3.24	50.30	
	5.22	50.71			
TP#7			3.82	52.36	
	6.31	53.75			
TP#9			3.33	[illegible]	H.V.#21
	5.72	61.18			
TP#9			5.44	[illegible]	
	5.47	61.7			
TP#10			3.73	52.40	
	5.18	57.62			
TP#11			3.38	51.28	
	5.71	68.45			
TP#12			3.07	61.82	
	9.05	70.93			
TP#13			0.97	1269.96	311.#21
	1.20	71.14			

USE 55.43

USE 1269.96

6" NAIL SOUTHSIDE P.P. N.E. SIR [illegible] AVE. & TOMAS RD.

57		65			
7D			5.62		
	6.21				
7D			6.70		
	1.61				
7D			3.54		
	7.2				
7D			5.32		1.72
	5.23				
7D			2.3		
	4.21				
7D			0.89	78.	
	7.56	85.9			
7D			6.63	79.97	
	5.39	84.36			
7D 21			2.12	77.14	
	5.26	86.53			
7D 22			3.75	90.78	
	1.22	84.20			
7D 23			1.51	76.3	
	4.06	76.19			
7D 24			1.39	74.81	
	1.3	85.91			
5			2.2	88.28	
	2.30	94.41			

4.54 12 5.72

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
		1079.[illegible]			
T[illegible]26			[illegible]	[illegible]	
	[illegible]	98[illegible]			
[illegible]			10.[illegible]	88.[illegible]	
	[illegible]	90.[illegible]			
			[illegible]	93.[illegible]	[illegible]
T[illegible]20			[illegible]	[illegible]	R[illegible]22
	6.18	300.05			
T[illegible]			3.[illegible]	96.[illegible]	
	[illegible]	61.[illegible]			
T[illegible]			7.20	99.[illegible]	
	10.[illegible]	05.[illegible]			
T[illegible]			0.[illegible]	04.61	
	11.06	15.[illegible]			
T[illegible]32			2.12	15.5[illegible]	
	11.13	26.72			
T[illegible]13			0.61	26.[illegible]	
	2.24	28.35			
T[illegible]			[illegible]	18.[illegible]	
	6.05	26.60			
T[illegible]55			0.[illegible]	[illegible]	
	[illegible]12	33.[illegible]			
T[illegible]			0.46	[illegible]	V[illegible]56
	11.[illegible]	44.[illegible]			
T[illegible]37			3.10	[illegible]	

[illegible] Sec [illegible] R[illegible]23
[illegible] MKaCOE SEC 6
[illegible] 1293.61

[illegible] 1253.18

				1341.3	
	4	45.			
TP 38			0.60	45.01	
	10.07	05.36			
TP 39			7.77	47.51	
	5.91	53.42			
TP #40			4.42	49.00	BM #24
	1.25	50.25			
TP #41			11.34	38.91	
	0.02	38.93			
TP #42			9.55	1329.38	B.M. #23
	0.31	29.69			
TP #43			5.58	24.11	
	0.39	23.50			
TP #44			3.39	21.91	
	1.93	23.14			
TP #45			11.41	11.83	
	0.14	11.87			
TP #46			10.19	01.68	
	3.23	03.91			
TP #47			7.30	296.61	H.C. #22
	7.40	04.01			
TP #48			11.19	92.82	
	0.15	92.97			
TP #49			9.68	83.29	

USE 1347.06

USE 1329.45

TP B.C. N.W. cor SEC 6

USE 1296.62

		75.[illegible]			
			[illegible]	61.51	
	4.01	71.[illegible]			
			[illegible]	[illegible]	
	[illegible]	72.[illegible]			
			2.20	61.45	
	5.23	77.20			
			3.[illegible]	74.9	H.U. 28
	0.71	75.40			
			7.47	61.[illegible]	
	4.07	72.78			
			4.67	62.[illegible]	
	4.80	72.46			
			3.83	6[illegible].3	
	4.55	71.51			
			3.18	68.03	D.M. 20
	Deviation	E − 0.09		= 68.12	

USE 12.74.78

				1268.[illegible]	B.M. #30
	3.[illegible]	1271.17			
TP[illegible]			7.22	63.95	
	3.[illegible]	67.03			
TP #2			6.78	60.10	
	4.[illegible]	64.12			
TP #3			7.97	56.25	
	4.18	60.43			
TP #4			7.27	1253.16	B.M. #30
	7.09	60.24			
T.P. #5			2.69	57.55	
	7.04	64.59			
TP #6			3.66	60.93	
	6.38	67.31			
TP #7			3.35	63.96	
	6.71	70.67			
			2.60	1268.07	B.M. #20
			=	1268.12	
				-0.05	

USE 1253.15

B.M. #A				1241.94	B.M. #B
	2.55	1244.49			
TP #1			6.03	38.46	
	3.98	42.24			
TP #2			9.14	33.10	

ST	BS	H	FS	El.	
				1233.10	
	3.7	36.81			
TP#5			6.28	30.53	
	4.48	35.01			
TP#4			6.88	1228.13	V#30
	6.68	34.81			
TP#3			4.19	30.62	
	6.62	37.24			
TP#2			3.00	34.24	
	7.47	41.71			
TP#1			3.21	38.50	
	6.05	44.55			
			2.63	1241.92	B.M.#19
				= 1241.94	
				-0.02	
				1269.96	B.M.#21
	3.57	1273.53			
TP#1			0.29	73.24	
	11.37	84.61			
TP#2			0.03	84.58	
	11.43	96.01			
TP#3			0.51	95.50	
	9.14	1304.64			
TP#4			0.78	1303.86	H.V.#32
	0.29	04.15			

USE 1228.14

USE 1303.87

		1274.15		
T-15			11.63	92.52
	0.12	92.64		
T-16			11.26	81.36
	0.07	81.43		
T-17			10.61	70.82
	2.88	73.70		
			3.77	1269.93 BM#21
			=	1267.96
				-0.03

YOST AND GARDNER ENGINEERS
2619 North Third Street
Phoenix, Arizona 85004

Job No. _____
Sheet 1 of 3
Computed G. C. B.
Checked _____
Date 9/12/79

TRAVERSE COMPUTATION

PROJECT AGUA FRIA RIVER
PRELIM TRAVERSE

STATION	BEARING	(GRID) DISTANCE	CO-ORDINATE NORTH	CO-ORDINATE EAST
H.V. # 6			960,087.3616	381231.2986
	N 89° 49' 16" W	5227.33		
H.V. # 5		HOLD →	960,103.93	376,004.63
HOLD	N 0° 11' 48" W	3956.71	960 103.67 -.26	376 003.99 -.64
H.V. # 4			964,060.6667	375,971.0487
HOLD	N 0° 11' 48" W	3963.19		
H.V. # 3			968023.7833	375,977.4451
	N 0° 08' 12" W	3896.42		
H.V. # 2			971920.1923	375,968.1511
	N 0° 08' 12" W	4006.61		
H.U. # 1	89° 53' 57"		975,926.7909	375958.6942
	N 89° 57' 53" E	1866.81		
P.O.T.			975,927.9403	377825.4038
	N 89° 57' 53" E	3353.37		
H.V. # 12			975,930.0050	381,178.7732
	S 87° 41' 44" E	3285.73		
H.V. # 11			975,797.8891	384,461.8460
	S 11° 28' 53" W	3831.09		
H.V. # 10			971,994.4610	383,687.3165
	S 0° 18' 06" W	4356.30		
H.U. # 9			967,638.2214	383,666.3803
	S 0° 18' 06" W	4090.98		
H.U. # 8			963,547.2981	383,644.8411
	S 34° 53' 54" W	4218.58		
H.U. # 6			960,087.3516	381,231.2986
	N			
H.V. # 5				
H.V. # 6				
		2795.67		
H.V. # 7				

YOST AND GARDNER ENGINEERS
2619 North Third Street
Phoenix, Arizona 85004

Job No.
Sheet 2 of 3
Computed G.C.B
Checked
Date 9/12/79

TRAVERSE COMPUTATION

PROJECT AGUA FRIA RIVER
"FINAL CORRECTED CO-ORD."

STATION	BEARING	DISTANCE	CO-ORDINATE NORTH	CO-ORDINATE EAST
H.V. #6			960,087.58	381,231.87
	N 89° 49'15"W	5227.26		
H.V. #5			960,103.93	376,004.63
	N 0° 11'45"W	3956.73		
H.V. #4			964,060.64	375,991.10
	N 0° 11'45"W	3963.21		
H.V. #3			968,023.83	375,977.56
	N 0° 08'09"W	3896.44		
H.V. #2			971,920.26	375,968.32
	N 0° 08'09"W	4006.63		
H.V. #1			975,926.88	375,958.81
	N 89° 57'52"E	1866.84		
P.O.T.			975,928.04	377,825.65
	N 89° 57'52"E	3353.42		
H.V. #12			975,930.12	381,179.07
	S 87° 41'45"E	3285.77		
H.V. #11			975,798.03	384,462.18
	S 11° 28'50"W	3881.06		
H.V. #10			971,994.62	383,687.71
	S 0° 18'03"W	4356.28		
H.V. #9			967,638.41	383,666.83
	S 0° 18'03"W	4090.96		
H.V. #8			963,547.50	383,645.35
	S 34° 53'52"W	4218.53		
H.V. #6				
H.V. #5				
	S 89° 49'15"E	5227.26		
H.V. #6			960,087.58	381,231.87
	S 84° 35'05"E	2795.67		
H.V. #7			959,823.74	384,015.06

YOST AND GARDNER ENGINEERS
2619 North Third Street
Phoenix, Arizona 85004

Job No. _____
Sheet 3 of 3
Computed _____
Checked _____
Date _____

TRAVERSE COMPUTATION

PROJECT _____

STATION	BEARING	DISTANCE	CO-ORDINATE NORTH	CO-ORDINATE EAST
H.V. # 4			964,060.64	375,991.10
	S 0°11'45" E	1328.51		
3.0' E of W 1/4 COR. SEC 36			962,732.14	375,995.64
	S 89°48'15" W	3.00		
W 1/4 COR. SEC 36			962,732.13	375,992.64
H.V. # 4			964,060.64	375,991.10
	N 0°11'45" W	1323.47		
			965,384.10	375,986.58
	S 89°48'15" W	5.63		
SW COR. SEC 25			965,384.08	375,980.95

YOST AND GARDNER ENGINEERS
2619 North Third Street
Phoenix, Arizona 85004

Job No.
Sheet 1 of 1
Computed G.C.B.
Checked
Date 10/2/79

TRAVERSE COMPUTATION

PROJECT AGUA FRIA RIVER
PRELIM. TRAVERSE (UPPER HALF)

STATION	BEARING	DISTANCE	CO-ORDINATE NORTH	CO-ORDINATE EAST
H.V. 12				
	S 89° 57' 52" W			
H.V. 1			975,926.88	375,958.81
	N 29° 13' 08" E	3313.55		
H.V. 31			978,819.82	377,576.31
	N 43° 00' 17" E	5312.08		
H.V. 30			982,703.53	381,199.46
	N 0° 11' 28" W	3737.64		
H.V. 28			986,441.15	381,186.99
	N 4° 08' 00" E	3330.94		
H.V. 27			989,763.42	381,427.08
	N 4° 08' 00" E	1586.94		
H.V. 24			991,346.24	381,541.46
	N 86° 57' 13" E	2300.17		
H.V. 23			991,468.48	383,838.38
	S 83° 09' 22" E	4640.15		
H.V. 22			990,915.54	388,445.47
	S 27° 48' 53" W	2097.80		
H.V. 21			981,060.11	387,466.61
	S 7° 46' 07" E	4380.24		
H.V. 20			984720.08	388,058.70
	S 27° 17' 27" W	3792.57		
H.V. 19			981,349.65	386,317.77
	S 18° 28' 47" W	2662.35		
H.V. 18			978,919.43	385,507.57
	S 18° 28' 47" W	3292.03		
H.V. 11			975,798.03	384,462.18
	N 87° 41' 45" W		975,797.15	384,464.12
H.V. 12			− 0.88	+ 1.94
		40,346.46		

YOST AND GARDNER ENGINEERS
2619 North Third Street
Phoenix, Arizona 85004

Job No. _____
Sheet 1 of 2
Computed G. C. B.
Checked _____
Date 10/2/79

TRAVERSE COMPUTATION

PROJECT AGUA FRIA RIVER
FINAL TRAVERSE (COPPER HILL)

STATION	BEARING	DISTANCE	CO-ORDINATE NORTH	CO-ORDINATE EAST
H.V. # 12				
	S 89°57'52" W			
H.V. # 1			975,926.88	375,758.81
	N 37°12'57" E	3313.54		
H.V. # 31			978,818.89	377,576.15
	N 43°00'07" E	5311.99		
H.V. 30			982,703.72	381,179.05
	N 0° 11'38" W	3737.72		
H.V. 29			986,441.42	381,186.40
	N 4°07'50" E	3331.00		
H.V. 27			989,763.77	381,426.33
	N 4°07'50" E	1586.97		
H.V. 24			991,346.61	381,540.63
	N 86°57'08" E	2300.06		
H.V. 23 (N¼ COR. SEC 6)			991,468.90	383,837.44
	N 85°09'25" W	4639.92		
H.V. 22			990,916.06	388,444.31
	S 27°49'07" W	2077.81		
H.V. 21			989,060.67	387,465.34
	S 7°45'58" E	4380.12		
H.V. 20			984,720.75	388,057.22
	S 27°17'38" W	3792.58		
H.V. 19			981,350.41	386,318.12
	S 8°28'58" W	2562.34		
H.V. 18			978,720.24	385,505.51
	S 18°28'58" W	3292.01		
H.V. 11			975,798.03	384,462.18
	N 87°41'45" W			
H.V. 12				

YOST AND GARDNER ENGINEERS
2619 North Third Street
Phoenix, Arizona 85004

Job No. _____
Sheet 2 of 2
Computed G.C.G.
Checked _____
Date 10/2/79

TRAVERSE COMPUTATION

PROJECT AGUA FRIA RIVER
FINAL TRAVERSE (UPPER HALF)

STATION	BEARING	DISTANCE	CO-ORDINATE NORTH	CO-ORDINATE EAST
H.V. 20				
	S 27°17'38" W			
H.V. 19			981,350.41	386,318.12
	S 56°32'32" E	532.03		
N.E. COR SEC 18			981,057.09	386,761.97
H.V. 27				
	N 4°07'50" E			
H.V. 24			991,346.61	381,540.63
	N 68°55'20" W	402.30		
N.W. COR SEC 6			991,471.29	381,165.29
H.V. 27				
	S 4°07'50" W			
H.V. 28			986,441.42	381,186.40
	N 28°03'20" E	101.31		
N.E. COR SEC 12			986,530.83	381,234.05
H.V. 28				
	S 0°11'38" E			
H.V. 30			982,703.72	381,177.05
	N 0°18'12" E	1134.76		
E ¼ COR SEC 12			983,838.66	381,205.06