DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY

FCD 94-28

STORMWATER MANAGEMENT REPORT VOLUME II

FINAL FEASIBILITY STUDY

MARCH 1997

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
23265
JOHN
SVECHOVSKY
Date Signed 3-21-97
ARIZONA, U.S.A.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Registered Professional Engineer (Civil)
CERTIFICATE NO
22211
WILLIAM S.
SNARR
Date Signed 3-21-97
ARIZONA, U.S.A.

Prepared For:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

2801 West Durango Street

Phoenix, Arizona 85007

602-506-1501

Hook Engineering, Inc.

Hook Engineering, Inc.

March 24, 1997

Flood Control District of Maricopa County
Attn: Bert Miller
Water Resource Planner
2801 West Durango Street
Phoenix, Arizona 85007

Regarding: Doubletree Ranch Road Regional Drainage Study
FCD 94-28

Dear Mr. Miller:

Hook Engineering, Inc. is pleased to submit seven (7) copies of the Final Feasibility Study, four (4) copies of the Appendices, two (2) full sets of plan and profile sheets for the above project, one (1) full size mylar set of plan and profile sheets and one (1) half size mylar set of plan and profile sheets.

This volume summarizes our investigation relating to the hydraulic analysis of the drainage basins for this project.

Should you have any questions concerning the foregoing, please contact our office.

Sincerely,

HOOK ENGINEERING, INC.

William S. Snarr, P.E.
Project Engineer

John Svechovsky, P.E., R.L.S.
Project Manager

Enclosures

FLOOD CONTROL DISTRICT
RECEIVED
MAR 24 1997

	CHENG		P & PM
	DFE		REG
	ADMIN		LMGT
	FINANCE		FILE
	C.N.L.		
	ENGR		

REMARKS

3511 East Indian School Road • Phoenix, Arizona 85018
(602) 956-3200 • FAX (602) 955-5443

Hook Engineering, Inc.

April 2, 1997

Mr. Bert Miller
Water Resource Planner
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Dear Mr. Miller:

Pursuant to our discussions last week, the Executive Summary has been revised to include the method of how the 10-year, 6-hour storm was developed. The U.S. Army Corps of Engineers Design Memorandum No. 2 for the "Gila River Basin, New River and Phoenix City Streams, Arizona", 1982 determined that the 10-year storm was 27 percent of the 100-year storm. These values are reflected in the summary calculations of the discharges for the diversion of Cherokee Wash to the Doubletree Ranch Road Storm Drain System in Volume III.

Sincerely,

HOOK ENGINEERING, INC.

JSvechovsky

John Svechovsky, P.E., R.L.S.
Project Manager

c: Mr. Bill Mead, Town of Paradise Valley
Mr. Mark Pacheco, City of Phoenix

Enclosure: Replacement Executive Summary Sheets

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Doubletree Ranch Road
Volume II
Final Feasibility Study

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Plan and Profile Sheets

Description	Station	Station	Sheet #
Title Sheet			1
Location Map			2
Doubletree Ranch Road (0+00)	5+17	8+00	3
	8+00	20+00	4
	20+00	33+00	5
	33+00	46+00	6
	46+00	59+00	7
	59+00	72+00	8
	72+00	85+00	9
Doubletree Ranch Road (Outlet)	80+00	88+00	10
56th Street (500+00)	504+00	511+00	11
	511+00	523+00	12
52nd Street (300+00)	305+00	310+00	3
(400+00)	310+00	323+00	13
	323+00	336+00	14
	336+00	413+50	15
	413+50	405+00	16
Butler Drive (200+00)	205+65	210+00	17
	210+00	222+00	18
Tatum Boulevard (100+00)	105+65	109+00	19
	109+00	120+00	20

Cherokee Wash (600+00)	605+00	614+00	21
	614+00	640+00	22
	640+00	653+00	23
	653+00	666+00	24
	666+00	679+00	25
	679+00	692+00	26
	692+00	705+00	27
	705+00	718+00	28

Preferred Alternative Appendices - See Volume Iii

Study Progression Information - See Volume Iv

1.0 Executive Summary

In 1994, the Town of Paradise Valley applied to the Flood Control District of Maricopa County (District) for funding to address serious flooding and drainage problems within Town limits. In response to the application, the District initiated the Doubletree Ranch Road Regional Drainage Study. The study boundary is approximately 3,000 acres within the Town of Paradise Valley bound by Mountain View Road, the Indian Bend Wash (IBW), Mummy Mountain and the Phoenix Mountains Preserve (see Figures 1.1 and 1.2).

The study's purpose was to develop hydrology for the project watershed and develop feasible alternatives to control the flooding and drainage problems. Tasks completed for this study consisted of:

- Development of hydrology to determine the 100-year, 6-hour design storm volume and peak flow
- Developed 10-year, 6-hour storm diversion from U.S. Army Corps of Engineer Design Memorandum No.2, 1982
- Development and evaluation of flood control alternatives
- Selection of preferred alternatives
- Development of concept plans, costs and right-of-way for the preferred alternatives

A total of eleven alternatives were investigated for the two drainage corridors of the study area: five for the Doubletree Corridor (Area A of Figure 1.3) and six for the Cherokee Wash Corridor (Area B of Figure 1.3). Project cost constraints, engineering feasibility, public involvement input and input from Town officials eliminated nine of the alternatives from consideration. The main components of the two preferred alternatives are:

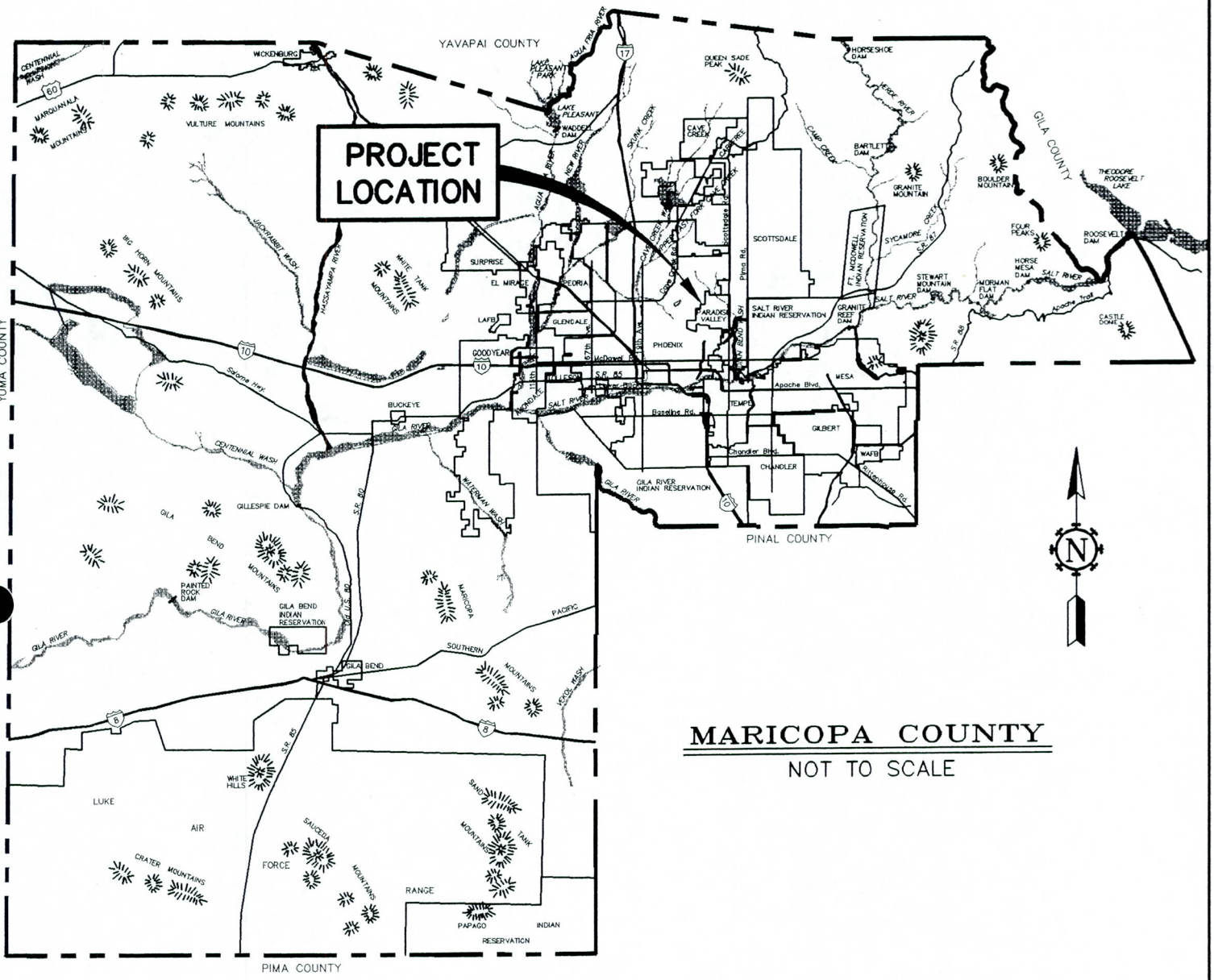
<u>Doubletree Corridor:</u> (See Figure 1.2) ($22,191,666; estimated total cost)

- Box culvert storm drain with 100-year, 6-hour peak discharge capacity from the west side of Tatum Boulevard to the IBW
- Culverts on Tatum Boulevard from Tomahawk Trail to Doubletree Ranch Road and on 52nd Street from Hatcher Road to Doubletree Ranch Road with 100-year, 6-hour peak discharge capacity
- Storm drain diversions from the Cherokee Wash Corridor at 52nd Street and 56th Street with 10-year, 6-hour peak discharge capacity

<u>Cherokee Wash Corridor:</u> (See Figure 1.3) ($ 3,902,555; estimated total cost)

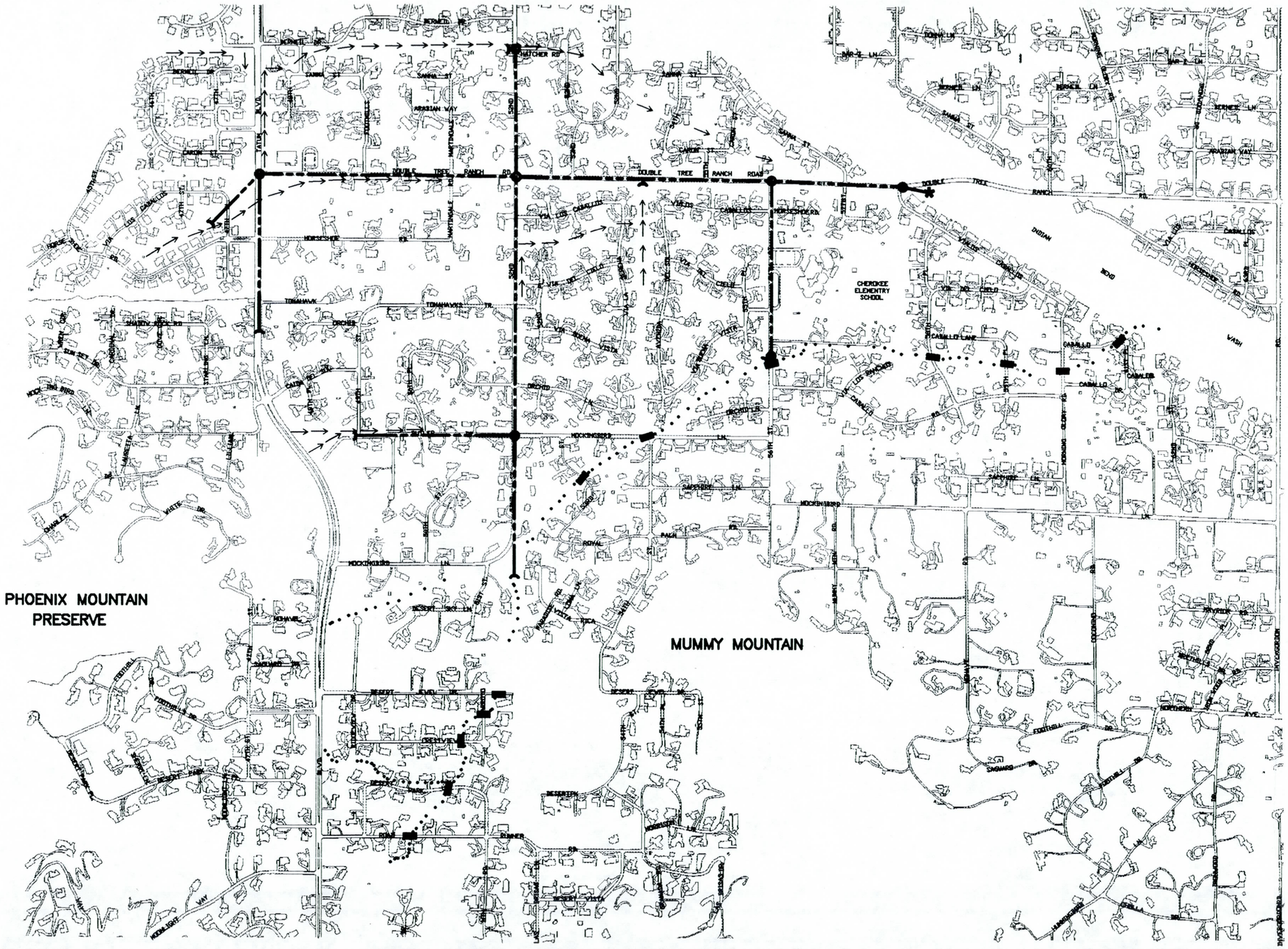
- Upstream, a 40-foot drainage easement corridor between the Paradise Valley Country Club Golf Course and 52nd Street
- Improvements at the street crossings for the upstream corridor
- Downstream, a trapezoidal channel lined with gabion mattresses from 52nd Street to the IBW to enhance the capacity of Cherokee Wash.

The two alternatives are interconnected. As such, they cannot be implemented separately without significant modification to these analysis



LOCATION MAP

FIGURE 1.1



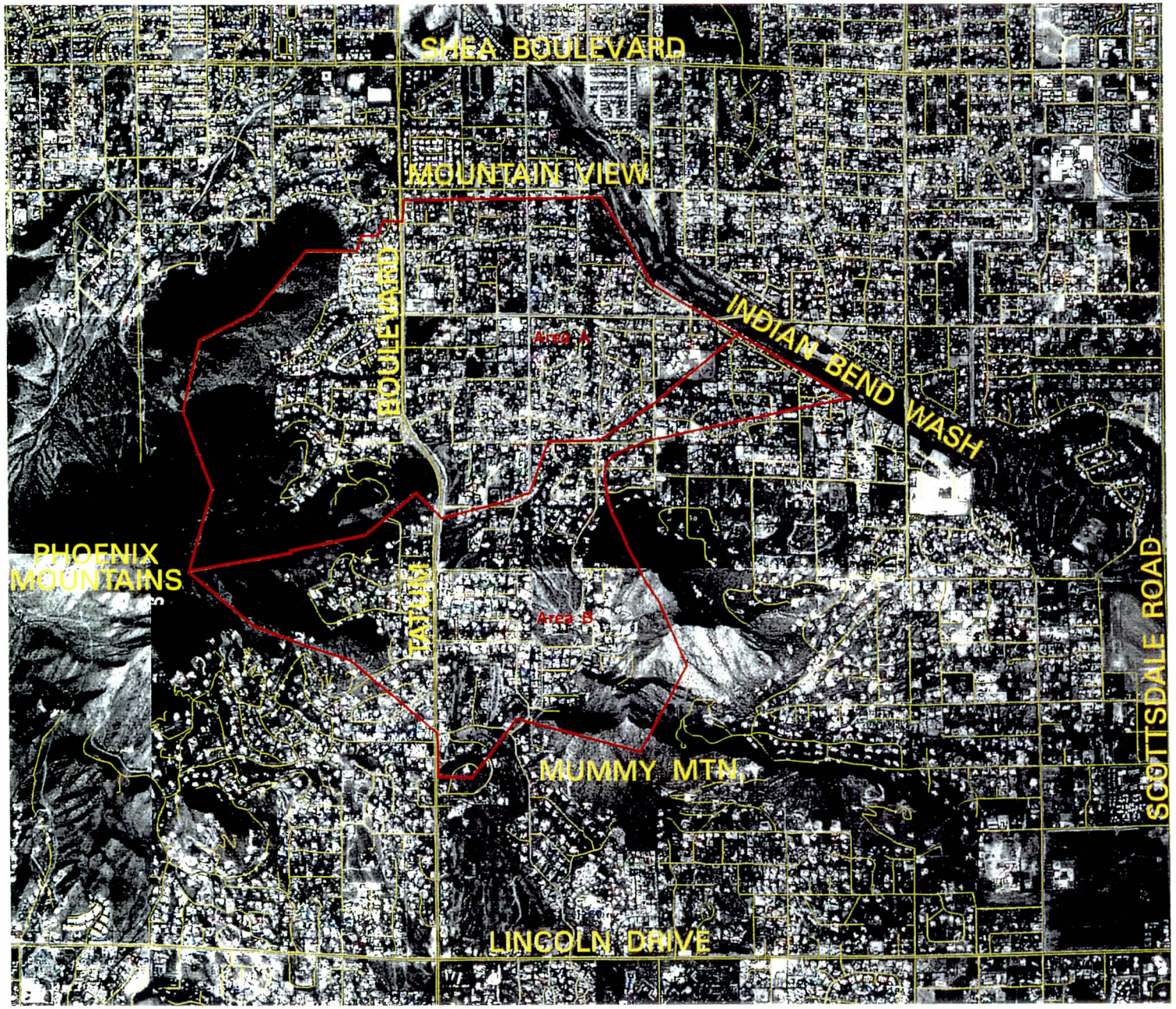
LEGEND

- STORM DRAIN PIPE
- MAJOR STORM DRAIN INLET
- JUNCTION BOX
- ENERGY DISSIPATOR
- CULVERT
- CHEROKEE WASH
- DRAINAGE PATHS

DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY
PREFERRED ALTERNATIVES

FIGURE 1.2

EXHIBIT 1



Area A = Doubletree Ranch Road Drainage Area
Area B = Cherokee Wash Drainage Area
= Street Centerlines

Scale = 1:7200

Doubletree Ranch Road
Regional Drainage System
Drainage Area Boundaries

FIGURE 1.3

Hook Engineering retained Kaminski-Hubbard Engineering, Inc. to develop the hydrology for this project. Those results are detailed in Volume I. Concept plans for the flooding and drainage improvements are attached at the end of Volume II. Cost summaries for the improvement components are tabulated in this volume and detailed in Volume III.

2.0 Introduction

2.1 Study Authorization

The Doubletree Ranch Road Regional Drainage Study is authorized under Contract FCD 94-28. Under the contract, Hook Engineering performed a feasibility study for flooding and drainage problems along Doubletree Ranch Road between Tatum Boulevard and the Indian Bend Wash (IBW), and along Cherokee Wash between the Paradise Valley Country Club Golf Course and the IBW.

2.2 Project Description

This regional drainage study encompasses approximately 3,000 acres and is bound by Mountain View Road on the north, the Indian Bend Wash on the east, Mummy Mountain on the south, and the Phoenix Mountains Preserve on the west (see Figure 1.3). The drainage boundary was divided into two sub-basins: Area 1 for the Doubletree Corridor and Area B for the Cherokee Wash Corridor (see Figures 2.1 and 2.2).

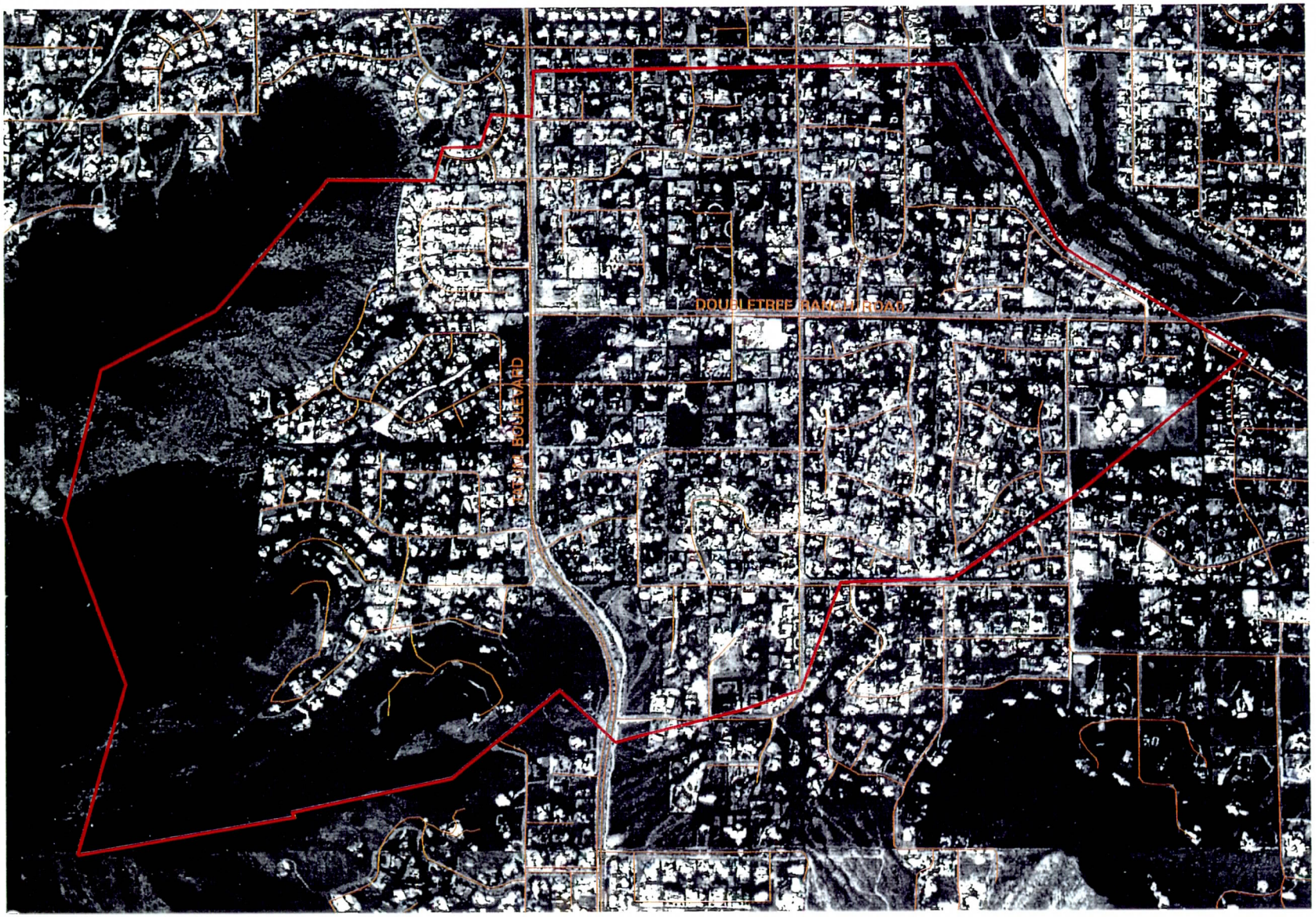
The drainage within the study area originates in the southern and western portions of the watershed along steep mountain sides and flows toward the Indian Bend Wash to the north and east through private development. The watershed is comprised of mountainous and intermediate desert and residential development on predominantly one-acre lots. Lots have minimal or no landscaping with the majority of the lot being natural desert. Existing drainage patterns occur through defined channels identified by drainage easements, along roadside right-of-way, and through residential neighborhoods in the form of sheet flow.

2.3 Scope of Study and Procedure

This study sought to identify and quantify flooding and drainage problems in the 3,000-acre watershed. Through engineering methods, public involvement and District input, Hook Engineering determined feasible alternatives to control the identified problems and selected and developed necessary cost and concept plans for preferred alternative. The study procedure is summarized in the following steps:

- Conduct hydrology to develop stormwater discharges for the existing condition
- Identify existing drainage easements
- Identify existing utility locations
- Describe existing drainage facilities
- Investigate various structural and non-structural alternative concepts
- Conduct a public involvement program to obtain public comment regarding alternative concepts
- Contact public agencies for project input (see Table 2.1).
- Consider public comment, safety, maintenance, cost, aesthetics, access, environmental impacts, engineering feasibility, constructability and other factors in selecting preferred alternatives
- Select preferred alternatives
- Develop concept plans, construction costs and right-of-way costs for the preferred alternatives

EXHIBIT 3



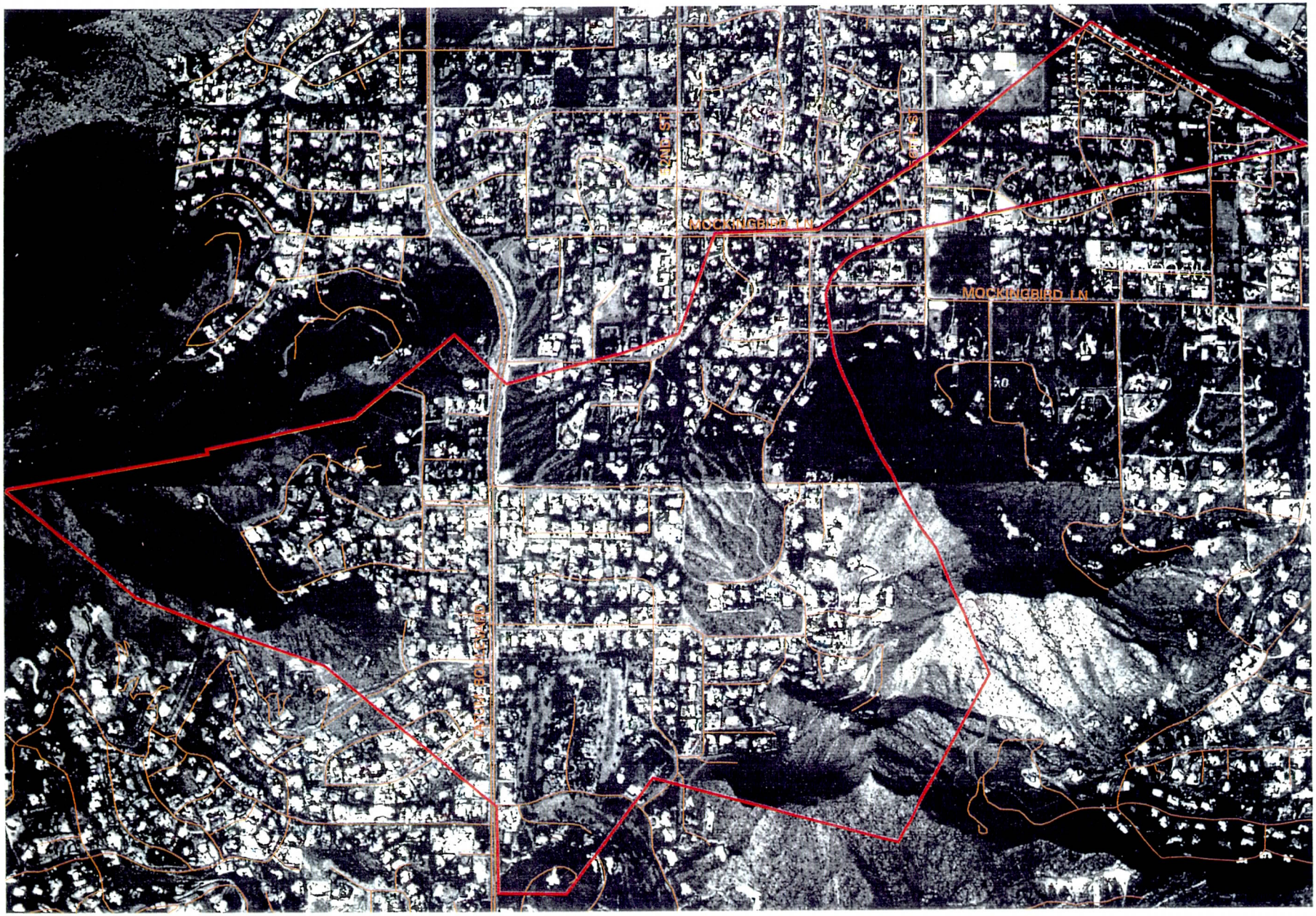
= Doubletree Ranch Road Drainage Area - A
= Street Centerlines

Scale = 1:4000

Doubletree Ranch Road Regional Drainage System Drainage Area A Boundary

FIGURE 2.1

EXHIBIT 3



= Cherokee Wash Drainage Area - B
= Street Centerlines

Scale = 1:4000

Doubletree Ranch Road Regional Drainage System Basin B Boundary

FIGURE 2.2

TABLE 2.1

UTILITY AND AGENCY CONTACTS

Water and Wastewater (Sanitary Sewer)
City of Phoenix
Ralph Mosca
200 West Washington Street, 8th Floor
Phoenix, Arizona 85003
602-495-5601

Sanitary Sewer
City of Scottsdale
Dave Petty
9312 North 94th Street
Scottsdale, Arizona 85258
602-391-5650
602-391-5661

Electrical (Power)
Arizona Public Service
John Rael
Post Office Box 53999, Station 3539
Phoenix, Arizona 85072
602-371-6945

Cable Television
Cox Dimension Cable (Insight)
Carl McKay
115 North 51st Avenue
Phoenix, Arizona 85043
602-352-5860
602-269-1679 Fax

Natural Gas (Heating)
Southwest Gas
Dominique Mitchell
Franchise Department
9 South 43rd Avenue, Mail Station 420-586
Phoenix, Arizona 85009
602-484-5306

Telephone
US West Communications
Helen Sutt
6350 South Maple Avenue, Room 125
Tempe, Arizona 85283
602-831-4771

Utility Line Locations
Blue Stakes
602-263-1100

CITY AND COUNTY GOVERNMENT CONTACTS

Flood Control District Maricopa County
Bert Miller
Water Resource Planner
2801 West Durango Street
Phoenix, Arizona 85009
602-506-1501

Town of Paradise Valley
Bill Mead
Town Engineer
6401 East Lincoln Drive
Paradise Valley, Arizona 85343
602-948-7411

City of Phoenix
Jim Matteson
City Engineer
200 West Washington Street
Phoenix, Arizona 85003
602-262-6136

City of Phoenix
John Bethill
Street Transportation Department
1034 East Madison Street
Phoenix, Arizona 85034-2292
602-495-2050

Recorded Documents
Maricopa County Recorder's Office
111 South 3rd Avenue
Phoenix, Arizona 85003
602-506-3535

Existing View Looking NorthEast Toward Tatum Boulevard

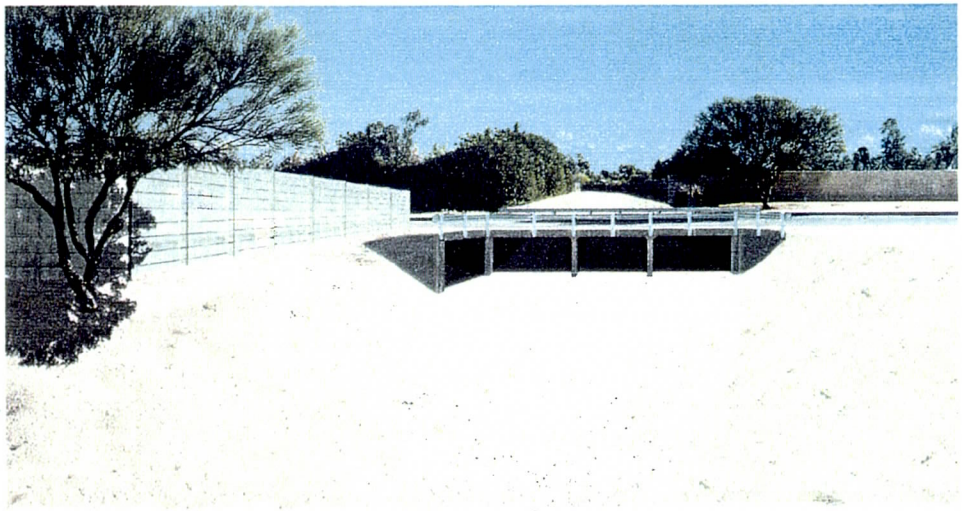
Simulation of Completed Project

Double Tree Ranch Road Wash

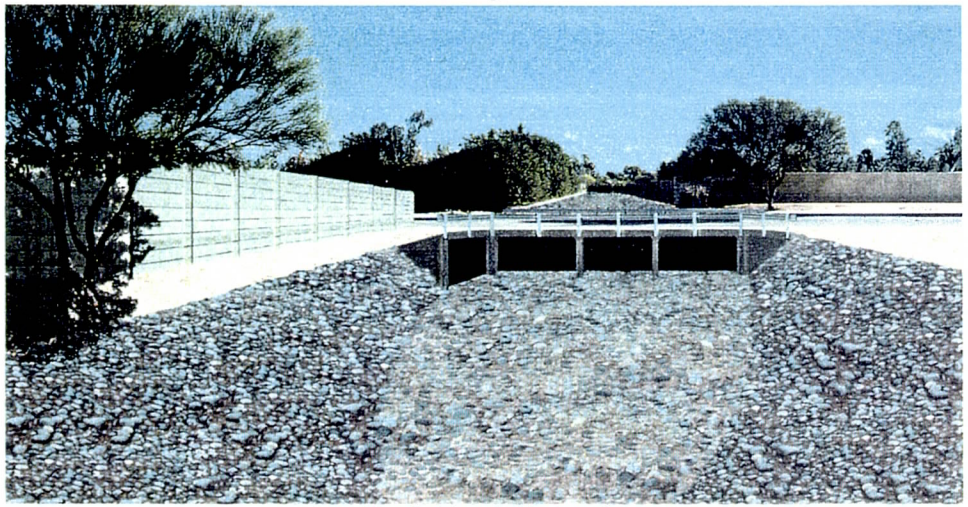
Town of Paradise Valley / Flood Control District

FIGURE 3.2

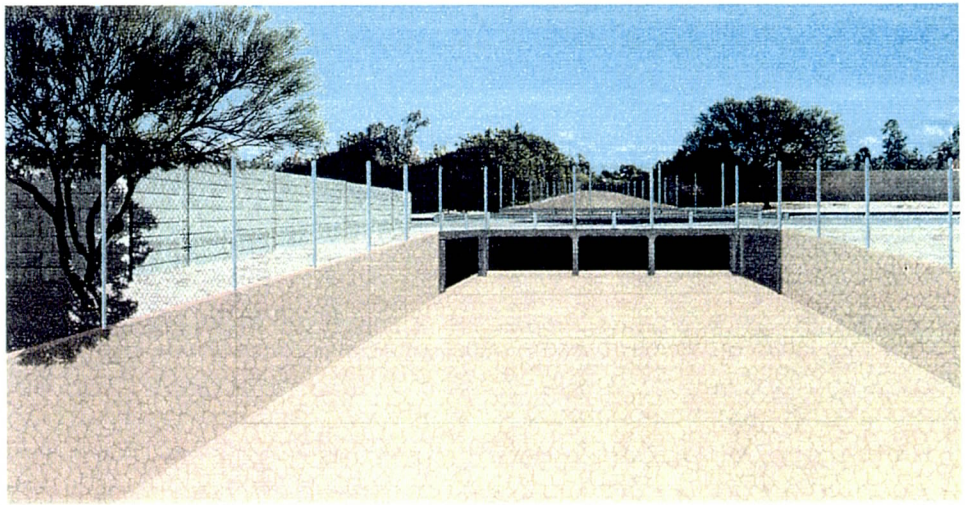
Existing View



Excavated Dirt Channel



Rock Lined Channel



Concrete Channel

Maricopa County
Flood Control District

Proposed Cherokee Wash Alternatives

FIGURE 3.2 CON'T.

Hook Engineering, Inc.

MEMO

Date: January 22, 1996

To: Bert Miller, Flood Control District of Maricopa County

From: Susan McManus

Subject: Summary of Comments Received at the Doubletree Ranch Road Drainage Project Open House, January 17, 1996

Seventy-nine attendees signed the attendance register at the Open House Wednesday evening.

We received 29 comment forms for Area A (Doubletree Ranch Road Drainage Corridor).

25	Preferred the "100-year" storm drain
1	Preferred the "10-year" storm drain
1	Wrote in that a "50-year" storm drain would be ideal
2	Did not express a preference.

We received 13 comment forms for Area B (Cherokee Wash Drainage Corridor).

We asked the respondents to rank the five alternatives in order of preference. By assigning 5 points to each "1st preference" response, 4 points to each "2nd preference" response, 3 points to each "3rd preference" response, 2 points to each "4th preference response, and 1 point to each "5th preference" response, we have come up with the following scores for each alternative.

FIGURE 3.3

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Alternative	Score	# of 1st Rankings
Excavated Dirt Channel with Detention Basins	37	5
Rock Lined Channel with Detention Basins	37	3
Excavated Dirt Channel without Detention Basins	18	1
Rock Lined Channel without Detention Basins	34	3
Concrete Channel without Detention Basins	18	* 0

* The concrete channel also received several emphatic comments like "NO WAY" and "UNACCEPTABLE".

We asked if the respondents favored the use of Detention Basins. The results were:

Yes 6
No 4

We asked which type of channel treatment the respondents favored. The results were:

Dirt/Decomposed Granite 5
Rock 6
Concrete 0

One respondent wrote in "Clean existing channel".

Other written comments included four references to the crossing at 56th Street needing immediate attention and two references to building box culverts where dip sections currently exist.

FIGURE 3.3
CONTINUED

This report discusses the results of the study. Appendices, bound under separate covers, provide additional details regarding the project hydrology, cost considerations and engineering calculations.

2.4 Hydrology

Kaminski-Hubbard Engineering, Inc. (KHE) was retained by Hook Engineering to prepare an existing condition hydrologic analysis for the project. Pursuant to project and District requirements, KHE used the HEC-1 computer model to compute the 2-, 10-, 50- and 100-year return period peak discharges for both the 6-hour and 24-hour duration storm events. The 6-hour duration storm was used for the study for consistency to a February 1995 study performed by District staff. The KHE study (Volume I) was approved by the District on November 29, 1995.

Hook Engineering took the 6-hour peak discharge values prepared by KHE and developed hydrology for 10-year diversions at 52nd Street and 56th Street. The results of these diversions are shown in Table 2.2.

3.0 Alternatives

3.1 Overview

The goals for developing major design features of feasible alternatives for the Doubletree and Cherokee Wash Corridors were:

- Increase the conveyance of the corridors
- Develop conceptual designs for both corridors
- Provide functional continuity between existing and proposed facilities
- Maximize utilization of existing channels in both corridors
- Minimize the acquisition of new right-of-way
- Minimize cost of proposed feasible alternatives
- Consider the specific objectives of public comment, safety, maintenance, cost, aesthetics, access, environmental impacts and disturbance to utilities in assessing the alternatives

3.2 Public Involvement

In January of 1994, Hook Engineering was contracted by the Town of Paradise Valley to do a study entitled "Doubletree Ranch Road Drainage and Street Improvement Project." The initial public involvement phase of this project was intended to listen to residents' concerns and build consensus among them regarding project parameters. The first public meeting was held on January 19, 1994 at the Cherokee Elementary School in the Town of Paradise Valley with approximately 180 people in attendance. Both verbal and written comments were received. After the first public meeting, many citizens indicated their desire to be included in a neighborhood meeting. Four neighborhood meetings were held at Town Hall because of the large anticipated attendance on February 16, 17, 22, 23, 1994. Sixteen residents requested individual meetings and Hook Engineering scheduled these meetings with the residents and representatives from the District. It

TABLE 2.2

DOUBLETREE RANCH ROAD

PROJECT NO. 2878

SUMMARY OF DISCHARGES (cfs)

LOCATION	StormCAD I.D.	100-YEAR, 6-HOUR	REMARKS
DOUBLETREE CORRIDOR			
at 47th Place	I-1	708	Upstream Limit
at Tomahawk Trail & Tatum Boulevard	I-2	29	
CONCENTRATION POINT (at Tatum Boulevard)	J-16	737	
at Berniel Drive & 52nd Street (from North)	I-6	320	
at 52nd Street (from South)	I-9	889	Includes diversion, flows from Butler Dr. and local drainage
CONCENTRATION POINT (at 52nd Street)	J-10	1946	
at West of 56th Street	I-7	2064	
at East of 56th Street	I-5	551	Includes diversion and local drainage
CONCENTRATION POINT (at 56th Street)	I-8	2615	Outfall into Indian Bend Wash
CHEROKEE WASH CORRIDOR			
at West of 52nd Street	I-3	1574	
at East of 52nd Street	I-3	1150	424 cfs diversion to Doubletree Corridor
at West of 56nd Street	I-5	1362	
at East of 56nd Street	I-5	994	368 cfs diversion to Doubletree Corridor

became clear that the project parameters needed to expand to address regional drainage issues, and coordination with the District became more extensive than originally anticipated. On March 23, 1994, a final public meeting was held at Cherokee Elementary School to present the proposed District project schedule and parameters to the citizens. Following these meetings, the District went through the process of selecting a consulting engineering firm to perform a feasibility study of the flooding and drainage problems in the Doubletree Ranch Road Regional Drainage area.

The City of Phoenix and the Town of Paradise Valley were contacted during project development and invited to participate in a project scoping session.

After the Notice to Proceed was given on December 8, 1994 by the District, Hook Engineering set up a meeting with the Town of Paradise Valley on January 4, 1995, to brief them on the public involvement meeting to be held on January 11, 1995. Presented at this briefing was a summary of study activities, review of the public meeting agenda and study schedule, review of aesthetic advisory committee guidelines, and review of overall project status.

At the public involvement meeting held on January 11, 1995 at the Cherokee Elementary School in the Town of Paradise Valley, a formal presentation was given which included a summary of the District's program for completion of the study, design and construction of the project. The study schedule and details of the technical process to be followed during the study were explained. An overview of the public involvement process and responsibilities of the aesthetics advisory committee were also explained.

In August of 1995 a mailing list of approximately 2,000 addresses was created and a questionnaire was mailed out on the 28th of the month. The questionnaire responses were evaluated and presented in an exhibit in the following public involvement meetings (see Figure 3.1).

On Wednesday, September 20, 1995, a progress meeting was held with the Town of Paradise Valley to present and discuss the progress of the Doubletree Ranch Road Regional Drainage Study. The staff was shown where the proposed detention basins would be located. The detention basins would be placed on vacant property, in the path of the existing channel. No pumps or diversions were to be utilized. It was felt that Phoenix Mountains Preserve property should not be used for detention basins due to the District's past experiences with other projects. The Town of Paradise Valley determined that a meeting should take place to discuss this issue from a political point of view with the City of Phoenix.

On Friday, October 20, 1995, Mayor Joan Horne and staff of Town of Paradise Valley met with Mayor Skip Rimsza and staff of City of Phoenix and discussed the possibility of detention basins in the Phoenix Mountains Preserve. It was concluded that the City and Town staffs would work together to evaluate different alternatives and combinations to see if it would be practical for detention basins to be built in the preserve. The study was to address the costs and benefits of having detention basins in the preserve taking into account that the purpose of the preserve is desert wildlife preservation. Approval for any basin sites would need to be obtained from the Phoenix Park Board and citizens near the preserve.

EXHIBIT 2

QUESTIONAIRE RESPONSE SUMMARY

DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY PROJECT NO. FCD 94-28

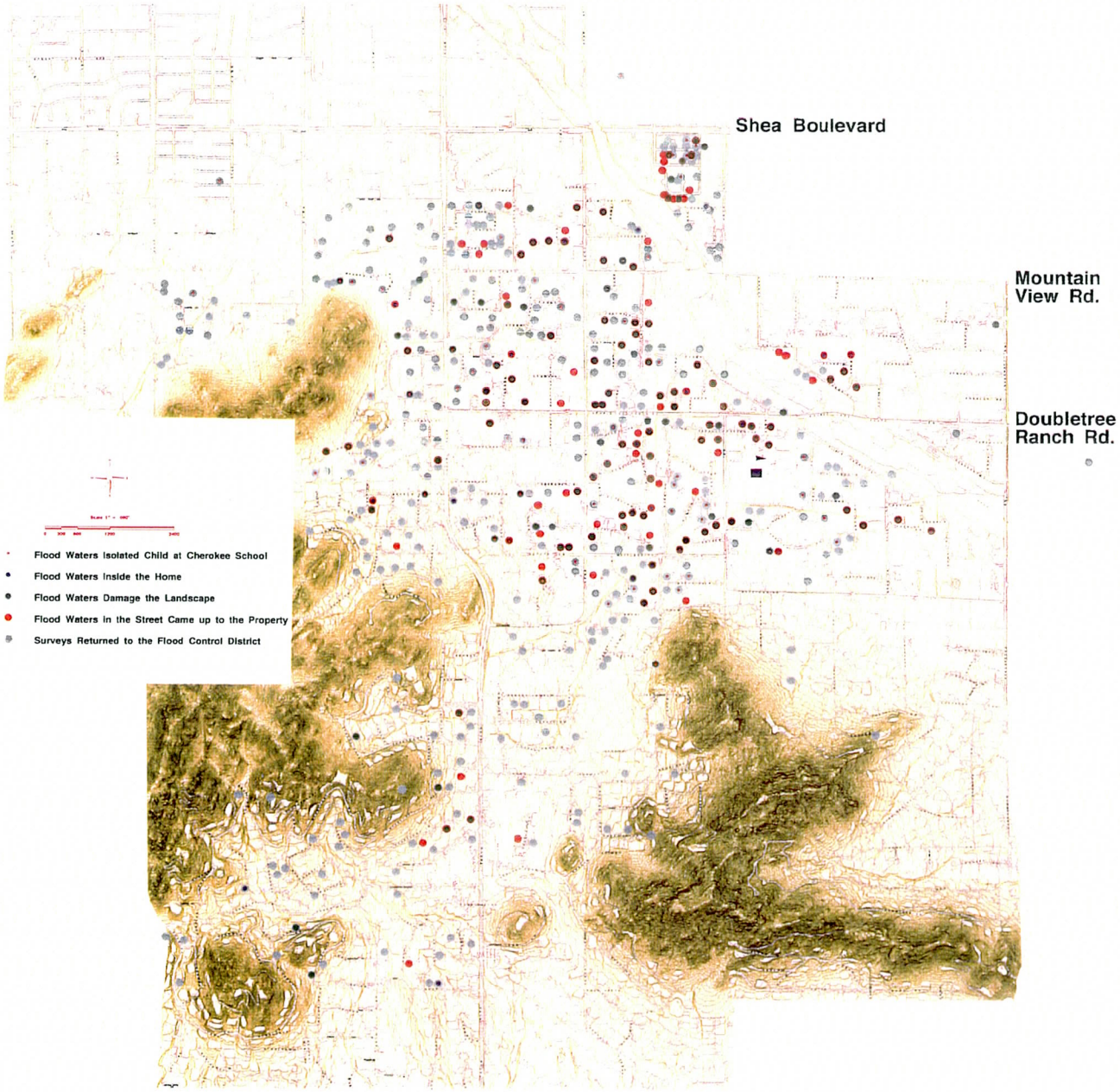


FIGURE 3.1

On November 16, 1995 a progress meeting update was held to discuss the status of the Doubletree drainage study at the Town of Paradise Valley. A summary of the Doubletree Corridor storm drain alternative concepts was presented. It was determined that detention basins along Doubletree Ranch Road would not be cost effective because land costs and construction costs of detention basins would be higher than a 100-year capacity storm drain system down Doubletree Ranch Road. At that time, the Doubletree Drainage System was designed to accept 400 cubic feet per second at 56th Street from Cherokee Wash. The Phoenix Mountains Preserve basins were ruled out because they would not detain enough stormwater to make a significant difference. From the alternative concepts, the town expressed a desire for the project direction to be a 100-year capacity storm drain constructed in Doubletree Ranch Road, and the District directed Hook Engineering to proceed with this preferred alternative.

Another progress meeting was held on December 14, 1995 at the Town of Paradise Valley to present findings on the Cherokee Wash Corridor alternatives solutions and a summary of the costs. The alternatives were reviewed, which included lining the channels with granite, rock or concrete. To increase capacity, detention basins could be added upstream on vacant property. The alternatives were rated from a technical basis on capacity, cost and maintenance. The consensus was that construction should stay within the existing drainage easements, detention basins would not be a part of the project, and that a concrete channel would not be compatible with the neighborhood. Rock or native soil would be the choice for the lining of the channel but it would be necessary to continue a dialog with the residents and the District to determine more specifically what the treatment should be. After this meeting, the District directed Hook Engineering to proceed with the development of a sixth alternative for Cherokee Wash which would include diverting 10-year storm off Cherokee Wash into the Doubletree Corridor storm drain system at 52nd Street and 56th Street. Ultimately, this alternative evolved to limit channel improvements from 52nd Street downstream to Indian Bend Wash.

A public information meeting was to be held on January 9, 1996 at the Cherokee School in the Town of Paradise Valley for the Doubletree Corridor. Due to a delay in the notification mailing, only members of the Town Council attended this meeting.

On January 17, 1996, a public information meeting was held to discuss both the Doubletree and Cherokee Wash Corridors. An open house format was used to inform the public of the most beneficial alternatives to seek input regarding their concerns and requests and ultimately their preference regarding which alternative should be constructed. Computer-enhanced photographs depicting how the area would appear after construction is completed and vegetation established was presented (see Figure 3.2). The photographs enabled residents to visualize the benefits of proposed improvements. The meeting was attended by 79 citizens. Written comments and rankings were received from 42 citizens (see Figure 3.3).

On March 14, 1996 at the Town Council Meeting, Greg Rodzenko of the District, presented the preferred alternatives for the Doubletree Corridor and Cherokee Wash Corridor. After the input from concerned citizens, the Town Council took a vote and passed a resolution authorizing the District to proceed in the development of the preferred alternatives for the two corridors.

3.3 Development of Alternatives

As discussed in Section 2.3, the goal of this project was to develop alternatives that considered public comment, safety, maintenance, cost, aesthetics, access, environmental impacts, engineering feasibility, constructability and other factors. From these developments, one alternative for each corridor was to be selected and concept plans, construction costs and right-of-way costs developed.

In addition to a "No Action" alternatives for the corridors, a number of alternatives were investigated as follows:

Doubletree Corridor Alternatives

1. Open Channel with Detention Basins.
2. Open Channel without Detention Basins.
3. Storm Drain with Detention Basins in the Phoenix Mountains Preserve.
4. Storm Drain with Detention Basins in Residential Areas.
5. Storm Drain without Detention Basins.

Cherokee Wash Corridor Alternatives

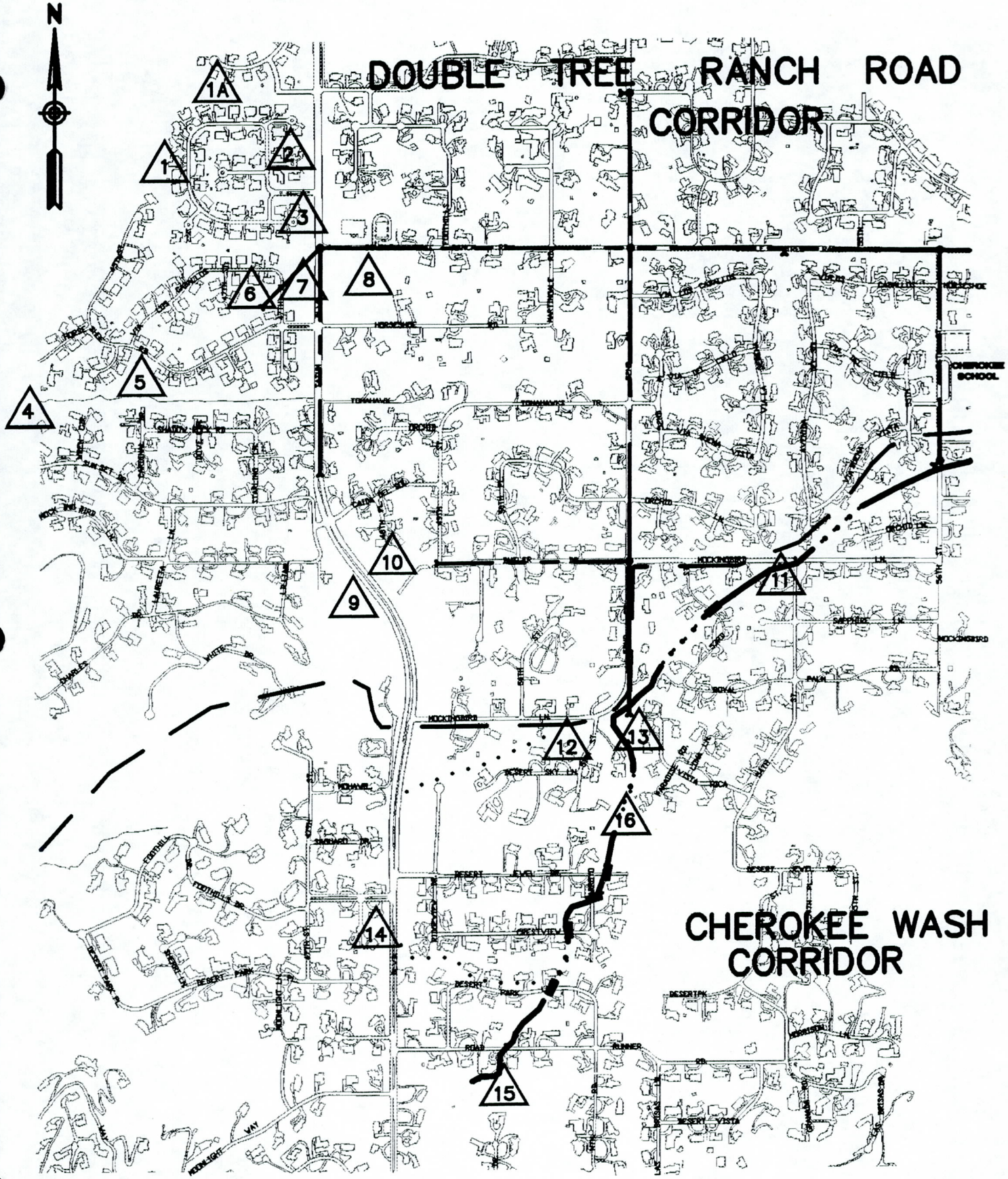
1. Excavated Dirt Channel with Detention Basins.
2. Rock-Lined Channel with Detention Basins.
3. Excavated Dirt Channel without Detention Basins.
4. Rock-Lined Channel without Detention Basins.
5. Concrete Channel without Detention Basins.
6. Gabion-Lined Channel Downstream of 52nd Street with Diversions to the Doubletree Corridor.

Hook Engineering initially set out to reduce peak flows and attenuate flood hydrographs for the two corridors with the use of in-stream detention basins. Seventeen basins were originally developed for the project (see Figure 3.4). Detention basins placed in the Phoenix Mountains Preserve were eliminated from consideration early in the process because of discouraging results that the District had had on recent projects in proposing detention in the Preserve. The high cost of land for the basins throughout the project area resulted in solutions which did not include basins.

The elimination of detention basins as a component to flood control solutions curtailed the further consideration of all of the Doubletree Corridor alternatives save open channel and storm drain solutions. With the Cherokee Wash Corridor, only open channel alternatives were further investigated.

3.4 Open Channel System

An open channel system was considered for the Doubletree Corridor. Design slopes were determined for the corridor reaches and hydraulic calculations were made. A variety of open channel cross sections and channel linings were investigated; however, the use of open channels would require culverts under driveways adding substantially to



DETENTION BASIN LOCATIONS **FIGURE 3.4**

the cost. An open channel was thus eliminated from further development and alternative five approved to be the most reasonable selection for the Doubletree Corridor.

For Cherokee Wash, the selection of an open channel system appeared advantageous because of the existence of a 40-foot drainage easement through much of the corridor. Culverts at roadway crossings were analyzed for the level of protection of a storm the channel could accommodate. Hydraulic calculations revealed that downstream reaches were too flat to convey the 100-year design storm.

To increase the downstream level of protection for the Cherokee Wash Corridor, Hook Engineering, under the direction of the District, proceeded to make diversions off the Cherokee Wash Corridor at 52nd Street and 56th Street to the Doubletree Corridor. With these diversions, the analysis and selection of a gabion-lined channel and the replacement of culverts at roadway crossings, alternative six was selected for the Cherokee Wash Corridor. A full discussion of the selected alternative for each corridor appears in Section 4.

3.5 Culverts

The existing culverts were hydraulically analyzed where the storm drain channel crossed driveways, streets, and dip crossings. Some of the existing culverts were found to be inadequate to convey the 100-year 6-hour storm flow and would need to be replaced. Concrete is the recommended material because of it's service life, structural strength, hydraulic roughness, low cover requirements and high traffic load capacity.

Doubletree Ranch Road has existing three 36" corrugated metal pipes at Sanna Drive, a dip crossing at 56th Street, a double 24" culvert at 52nd Street and various size culverts under driveways. There is an existing double 10' x 2' concrete box culvert at 47th Place. All of these culverts will be replaced by a storm drain using concrete box culverts.

Cherokee Wash has existing dip sections at the following ten locations: Caballo Lane, Morning Glory Road, 59th Place, 58th Place, Mockingbird Lane, 53rd Place, Desert Jewel Drive, Arroyo Lane, Crestview Lane and Desert Park Lane. All of the dip sections will be replaced by culverts which will be the capacity of the channel. Existing four 24" x 36" arch corrugated metal pipes at 56th Street will be replaced with a box culvert and an overflow back to the existing channel. Road Runner Road has existing two 36" coated corrugated metal pipe with mitered ends which will remain.

4.0 Selected Alternative

4.1 Overview

Evaluation of the alternatives consisted of qualitative and quantitative comparisons. Some specific items were given greater consideration in the analysis. Listed below are those items which were primary considerations in the alternatives evaluation, followed by items that were considered secondary.

Primary Considerations:

1. Maximize capacity.
2. Minimize cost.
3. Minimize right-of-way acquisition.
4. Minimize or eliminate need for detention basins.

Secondary Considerations:

1. Minimize maintenance costs.
2. Maximize safety.
3. Minimize channel excavation for Cherokee Wash.
4. Ability to provide access.
5. Ability to enhance visual appeal.

A summary of the alternatives evaluation follows:

The "No Action" Alternative for either corridor involves no planning. There is no advantage to this alternative because it provides no flood relief for citizens or any improvements to the flooding and drainage problems currently present in the project area.

4.1.1 Doubletree Corridor Alternatives

4.1.1.1 Alternative 1

Detention basins along with an open channel down the south side of Doubletree Ranch Road.

Advantages:

- Low channel construction cost.
- Short construction time.
- Aesthetically pleasing, natural looking channel banks.
- Construction outside of roadway.

Disadvantages:

- Difficult to implement detention basins.
- High cost due to land acquisition costs of detention basins.
- Unsafe for vehicular and pedestrian traffic.
- High Maintenance (vegetation growth through bank lining would require maintenance).
- Insufficient capacity in existing right-of-way.
- Requires culverts under driveways and streets.
- Might require grade control structures to lower velocity.
- Requires extensive excavation.

4.1.1.2 Alternative 2

Open channels without detention basins.

Advantages:

- Low channel construction cost.
- Short construction time.
- Aesthetically pleasing, natural looking channel banks.
- Construction outside of roadway.
- Not labor intensive.
- Cost effective.

Disadvantages:

- Unsafe for vehicular and pedestrian traffic.
- High Maintenance (vegetation growth through bank lining would require maintenance).
- Insufficient capacity in existing right-of-way.
- Requires culverts under driveways and streets.
- Might require grade control structures to lower velocity.
- Some bank linings might not be durable.
- Requires extensive excavation.

4.1.1.3 Alternative 3

Detention basins in the Phoenix Mountains Preserve with a storm drain system.

Advantages:

- Vacant government owned property can be utilized for basins.
- Basin locations are in the flow path of the existing channels.

Disadvantages:

- Storage capacity far smaller than needed.
- Difficult to implement detention basins in the Preserve.
- Political considerations used in evaluation.

4.1.1.4 Alternative 4

Detention basins located on vacant parcels within residential areas with the use of a storm drain down Doubletree Ranch Road.

Advantages:

- Safer for vehicular and pedestrian traffic.
- Aesthetically pleasing.
- Low maintenance.

Disadvantages:

- Difficult to implement detention basins.
- High land acquisition cost for detention basins.
- Long construction time.
- Labor intensive.

4.1.1.5 Alternative 5

Storm drain exclusively without the use of detention basins.

Advantages:

- Most cost effective.
- Safest for vehicular and pedestrian traffic.
- Sufficient capacity to convey 100-year storm capacity.
- Least Maintenance.
- Least Visual Impact.

Disadvantages:

- Inconvenience to the community during construction.

4.1.2 Cherokee Wash Corridor Alternatives

4.1.2.1 Alternative 1

Detention basins with excavated natural channel.

Advantages:

- Acceptable to residents.
- Low channel construction cost.
- Short construction time.
- Aesthetically pleasing, natural looking channel banks.

Disadvantages:

- Does not provide desired capacity.
- High Maintenance.
- Difficult to implement detention basins.
- High cost of property for detention basins.
- Requires grade control structures to lower velocity.
- Bank lining not durable.

4.1.2.2 Alternative 2

Detention basins with a rock lined channel.

Advantages:

- Acceptable to residents.
- High channel construction cost.
- Moderately aesthetically pleasing.

Disadvantages:

- Does not provide desired capacity.
- Difficult to implement detention basins.
- High cost of due to land acquisition of detention basins.
- Requires grade control structures to lower velocity.
- Medium maintenance.

4.1.2.3 Alternative 3

Natural channel without detention basins.

Advantages:

- Minimum channel construction cost.
- Short construction time.
- Aesthetically pleasing, natural looking channel banks.
- Cost effective.

Disadvantages:

- High Maintenance (vegetation growth through bank lining will require intense maintenance).
- Does not provide desired capacity.
- Might require grade control structures to lower velocity.
- Some bank linings might not be durable.

4.1.2.4 Alternative 4

Rock-lined channel without detention basins.

Advantages:

- Moderate channel construction cost.
- Moderate construction time.
- Moderately aesthetically pleasing, natural looking channel banks.
- Cost effective.

Disadvantages:

- High Maintenance (vegetation growth through bank lining will require intense maintenance).
- Does not provide desired capacity.
- Might require grade control structures to lower velocity.
- Some bank linings might not be durable.

4.1.2.5 Alternative 5

Concrete-lined channel without detention basins.

Advantages:

- Meets 100-year capacity requirement.
- Minimum maintenance.
- Bank linings are durable.

Disadvantages:

- Least safe.
- Highest construction cost.
- Most negative visual impact.

4.1.2.6 Alternative 6

This alternative was developed after the others were evaluated to provide a hybrid solution. It consists of diverting the 10-year 6-hour stormwater from Cherokee Wash into the Doubletree storm drain system at 52nd Street and 56th Street. From 52nd Street to Indian Bend Wash, a gabion or wire tied rock rip rap will be used to maximize the channel capacity within the existing right-of-way.

Advantages:

- Improved downstream capacity.
- Moderate channel construction cost.
- Moderate maintenance cost.
- Aesthetically pleasing, natural looking channel.

Disadvantages:

- Higher cost and longer construction time for Doubletree Storm Drain.

The preferred alternatives are Alternative 5 for the Doubletree Corridor and Alternative 6 for the Cherokee Wash Corridor. Conceptual plans, cost estimates and right-of-way requirements were developed for the selected alternatives.

4.2 System Components

Doubletree Ranch Road storm drain system was designed to convey the 100-year flows in this drainage basin. The point source inlets are the concrete-lined channel between the subdivision west of Tatum Boulevard on Doubletree Ranch Road, Tomahawk Trail west of Tatum Boulevard, Butler Drive east of Tatum Boulevard, Berneil Wash on 52nd Street, and the wash from Via La Serena from the south. Two 10-year diversions flow from Cherokee Wash at 52nd Street and 56th Street also add to the storm drain system. Local drainage throughout the basin may be picked up in catch basins of culvert headwalls and piped to the main storm drain system that has been sized for all the runoff in the basin. The outlet of the storm drain system will be at the headwall of the existing box culvert in Indian Bend Wash as it crosses Doubletree Ranch Road.

Cherokee Wash Corridor starts at the Paradise Valley Country Club and crosses 12 public roads before outfalling into Indian Bend Wash. Existing culvert at Road Runner Road will remain with the remaining dip section on road crossings to have culverts constructed to the same level of protection of the channel. Diversion of the 10-year flow from Cherokee Wash at 52nd Street and 56th Street will help decrease the amount of flow in the channel below these locations. Cherokee Wash from 52nd Street to Indian Bend Wash will be gabion-lined to improve the existing wash flows at a higher level of protection.

4.3 Cost Estimates

Cost estimates were prepared throughout the development of this project for all channel and storm drain alternatives. Cost estimate summaries for the two selected alternatives are presented in Tables 4.1 and 4.2. Cost estimates include 20% of construction cost for design and construction administration and 12% of construction and land acquisition for contingency. Unit prices were based on recent District and Arizona Department of Transportation bid results with adjustments made to reflect the difficulty of the work anticipated. The costs are intended to provide estimates and are relative subject to design specifications and the scarcity of either material or labor. A complete breakdown of all cost components is included in Volume III.

TABLE 4.1

DOUBLETREE RANCH ROAD

PROJECT NO. 2878

DOUBLETREE RANCH ROAD STORM DRAIN PRELIMINARY COST ESTIMATE SUMMARY

ALTERNATIVE NO. 5

DOUBLETREE STORM DRAIN SYSTEM Including CHEROKEE WASH DIVERSION at 52nd and 56th Streets

ALTERNATIVES	LAND/ EASEMENT ACQUISITION	STORM DRAIN CONST.	DETENTION BASIN CONST.	SUB TOTAL CONST.	UTILITY RELOCATION	ENGINEERING DESIGN	CONSTRUCTION ADMIN.	CONTINGENCY	TOTAL PROJECT COST
						Includes: Civil Geotechnical Landscape Structural Survey 10% of Construction	Includes: Inspection Survey Testing 10% of Construction	12% of Land Acquisition & Construction	
	($)	($)	($)	($)	($)	($)	($)	($)	($)
NO DETENTION BASINS 100-Year	122,030	16,183,316	-0-	16,183,316	693,015	1,618,332	1,618,332	1,956,642	$22,191,666

WSS3-19-97

TABLE 4.2

DOUBLETREE RANCH ROAD

PROJECT NO. 2878

CHEROKEE WASH DRAINAGE CORRIDOR
PRELIMINARY COST ESTIMATE SUMMARY
ALTERNATIVE NO. 6

TRAPEZOIDAL CHANNEL GABIONS from Indian Bend Wash to Mockingbird Lane
CULVERT DESIGN to CHANNEL CAPACITY

ALTERNATIVES	LAND/ EASEMENT ACQUISITION	CHANNEL CONSTRUCTION	CULVERT CONST.	UTILITY RELOCATION	ENGINEERING DESIGN	CONSTRUCTION ADMIN.	CONTINGENCY	TOTAL PROJECT COST
	($)	($)	($)	($)	Includes: Civil Geotechnical Landscape Structural Survey 10% of Construction ($)	Includes: Inspection Survey Testing 10% of Construction ($)	12% of Land Acquisition & Construction ($)	($)
NO DETENTION BASINS	1,149,658	1,031,916	910,734	50,640	194,265	194,265	371,077	$ 3,902,555

WSS 3-21-97

Ckd:

The cost data are most useful in assessing relative cost of different levels of stormwater control practices and providing general guidelines to local governments in the estimation of improvement costs.

The basis of the quantity estimates and unit prices are as follows:

- Clearing and Grubbing----Construction area quantities were computed based on maximum area needed for development. A price of $1,850/acre was used.
- Channel Excavation----Quantities were provided by using a typical cross section of the channel and projecting down the whole reach. A price of $6.00/cubic yard was used.
- Dumped Rip Rap----Quantities were based on a 24-inch thick rip rap blanket with a two-foot toe down. The unit price includes the rip rap and a non-woven filter fabric. A price of $35.00/cubic yard was used.
- Concrete Construction----Quantities were based on ADOT summaries of box culverts with the cement and reinforcing steel quantified separately. A price of $300/cubic yard for cement poured in place and a price of $.50/pound for steel was used.
- Crushed Granite---Quantities were based on a six inch thick blanket with no filter fabric to protect it. A price of $12.00/cubic yard was used.
- Land Cost----Quantities for detention basin and drainage easement were determined by aerial photographs. From a known piece of property, a price of $125,000/acre was used for drainage and permanent construction easements and $12,500/acre for temporary construction easements.
- Culvert Excavation----Quantities were provided by using ADOT (B-19.50, C-13.15) typical cross section of the trench with 1.5:1 side slopes. A price of $6.00/cubic yard was used.
- Structural Backfill----Quantities were provided by using ADOT (B-19.50) typical cross section of straight walls two feet from the edge of box wall. A price of $18.00/cubic yard was used.
- Road Removal----Quantities were computed based on the area needed for trench excavation. A price of $2.50/square yard was used.
- Road Replacement----Quantities were based on trench width for excavation and a four inch AC and ten inch ABC by City of Phoenix cost estimate. Curb and gutter was not included in this price. A price of $14.00/square yard was used.
- Pipe Culverts----Costs were based on a reinforced concrete pipe, size and linear feet of pipe by using ADOT construction cost.
- End Sections----Costs were based on reinforced concrete end sections, and the size of the pipe culvert from ADOT construction cost.
- Energy Dissipator----No specific type of energy dissipator is identified at this time. Cost for this item was estimated as a lump sum of $195,000 (see Cost Analysis in Volume III).
- Grade Control Structures----No specific type of grade control structure has been identified at this time; cost for this item was estimated as a lump sum of $15,000 each depending on the frequency of the storm design. Four grade control structures were estimated in Cherokee Wash.
- Tatum Crossing----Extra construction costs were estimated due to the complexity of traffic control of Tatum Boulevard and depending on the frequency of the storm design. A price of $100,000 was used.

- Headwalls----Costs were based on ADOT construction cost for pipe culverts over 48 inch diameter and for box culverts the quantities were based on concrete and reinforcing steel quantities (see Concrete).
- Junction Boxes----Costs were based on size and complexity of the box based on ADOT construction cost. A price of $25,000/box was used.
- Manholes----Costs were based on ADOT detail C-18.10-40 construction cost. A price of $5,500/manhole was used.
- Inlets----Costs were based on ADOT catch basin construction cost. A price of $2,000/catch basin was used.
- Grader Ditch Channels----Costs were based on ADOT construction cost. A price of $5.00/linear foot was used.
- Detention Basins
  - Structural Fill----Side slopes of 4:1 was used.
  - Environmental Impact Mitigation---Cost for this work includes erosion control, protection against water/soil contamination, revegetation of channel were necessary and removal of construction waste. Cost for this item was estimated as 2 percent of the construction cost.
  - Fence----Quantities were based on a six foot high chain link fence. A price of $9.00/linear foot was used.
  - Outlet Weir----No specific overflow weir has been designated; cost was estimated as a lump sum. It is anticipated that they will be constructed out of concrete and steel with an energy dissipator at the bottom. Variable prices were used depending upon the size of the basin.
- Utility Relocation----Cost for this item is estimated per utility relocation.
- Engineering Design----Cost for this item is estimated as ten percent of the construction cost. It includes all civil, geotechnical, surveying, landscape, and structural engineering.
- Construction Administration----Cost for this item is estimated as ten percent of construction cost. It includes inspection, survey and testing.
- Contingency----Cost for this item is estimated as 12 percent of both land and construction cost.
- Gabions----Cost for this item was calculated on a one-foot cross-section for Cherokee Wash at $100.00 per linear foot.
- Land Cost----$125,000 per acre.
- Temporary Construction Easement----10% of land cost.

4.4 Right-of-Way

The necessary additional right-of-way for this project consisted of Drainage Easements (DEs), Permanent Construction Easements (PCEs) and Temporary Construction Easements (TCEs) along segments of both corridors. Hook Engineering used a unit cost of $125,000 per acre for both DEs and PCEs and $12,500 for TCEs. These costs were estimated from a recent property sale within the project area. Making DEs and PCEs the same unit cost and TCEs ten percent of the other two was at the District's direction. At the upstream and downstream ends of the Doubletree Corridor and along the Cherokee Wash Corridor, downstream of 52nd Street, PCE costs were included on parcels with existing DEs in place. This was done to conservatively estimate the total project right-of-way requirements because it was unclear whether the Town could construct project facilities within the dedicated DEs without PCEs.

At the upstream portion of the Doubletree Corridor, the project will have the storm drain tie into the end of an existing concrete channel. For conservative estimating purposes, a 35-foot PCE will be located within an existing DE to house the storm drain a ten-foot TCE will run adjacent to both sides of the PCE. The easements will extend from the end of the existing concrete channel to the west right-of-way line of Tatum Boulevard.

At the downstream end of the Doubletree Corridor, the storm drain outfalls into the downstream wingwall of the IBW culverts beneath Doubletree Ranch Road. As the storm drain departs the alignment of the roadway right-of-way, a TCE will be required over a private parcel, a PCE and TCE will be required over an existing DE and a PCE and TCE will be required in the golf course that is a part of the IBW floodway.

Hook Engineering determined that the Cherokee Wash Corridor upstream of 52nd Street does not have any existing DEs. The required easements are to be 40 feet wide the entire length of the upper reach from the Paradise Valley Country Club Golf Course to 52nd Street. No improvements, except at roadway crossings, are proposed. These will occur in existing roadway right-of-way. The DEs are to be kept clear of vegetation and the owner may not construct any structures in the DEs that would obstruct flow.

Downstream of 52nd Street, a 40-foot wide DE exists all the way to the IBW. Hook Engineering has included a 40-foot wide PCE superimposed on the DE. A 5-foot TCE will run adjacent to both sides of the PCE.

The estimated cost of additional required right-of-way for the Doubletree Corridor is $122,030 and the estimated cost for the Cherokee Wash Corridor is $1,149,658. The breakdown costs are shown in detail in Volume III.

4.5 Environmental Considerations

As part of the alternatives development process, potential environmental impacts and general project conditions were identified and are described in the following sections.

Land use: coordination with the City of Phoenix and the Town of Paradise Valley indicate that the vacant privately owned lands are zoned for residential use. The Phoenix Mountains Preserve is in government ownership and will never be developed.

The Doubletree Drainage System for the most part will be within the existing road right-of-way. Additional right-of-way requirements were identified in section 4.4.

The outlet for this project is the Indian Bend Wash (IBW) which, by Town of Paradise Valley Ordinance 124, is designated for flood control and other purposes. Approval from the Marriott Camelback Golf Course will have to be obtained to install the outlet into the IBW.

Hazardous materials: an environmental site assessment of the project area is being conducted under separate contract by the District. There appear to be locations where local dumping has taken place throughout much of the length of both corridors. Other than these locations, there were no observations or evidence to suggest the potential presence of hazardous waste substances within the project area.

Cultural resources: archeological investigations are being conducted under separate contract with the District.

Flood plain considerations: The Federal Emergency Management Agency (F.E.M.A.) has published Flood Insurance Rate Maps (FIRM) for Maricopa County and the City of Phoenix and Town of Paradise Valley (see Figures 4.1 and 4.2).

This project is in Zone "B" Map Number 04013C1690D effective date April 15, 1988 south of Mockingbird Lane and Zone "X" Map Number 04013C1680E map revised September 29, 1989 for area north of Mockingbird Lane. These are areas between the limits of the 100-year flood and 500-year flood; or certain area subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. Indian Bend Wash is classified in Zone "AE" which are areas where the base flood elevation has been determined.

The District completed a delineation of the waters of the United States in May 1994 and the subsequent delineation showed that the U.S. Army Corps of Engineers has no jurisdictional authority over Cherokee Wash and Doubletree Ranch Road Wash. Cherokee Wash and Doubletree Ranch Road Wash are ephemeral streams that flow only when it rains.

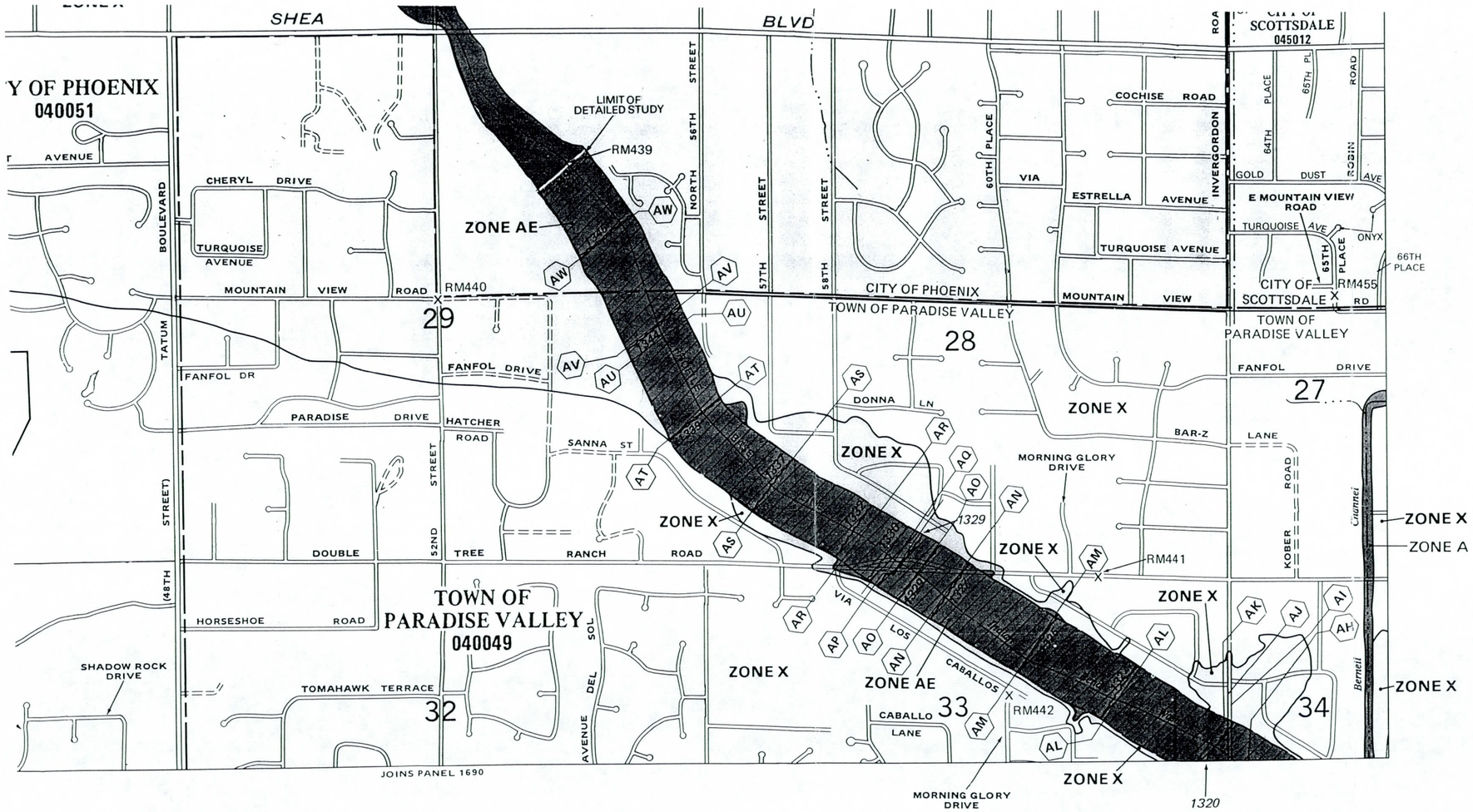
Threatened and endangered species: threatened and endangered species investigations are being conducted under separate contract with the District.

Vegetation: vegetation types will be determined along the banks of the wash and the channel bottom under separate contract with the District. Native species should be utilized for aesthetic treatments and revegetation.

Water quality: improvements within Cherokee Wash will have the potential for temporary effects upon the water quality of the wash. The actual extent of these effects will depend upon the time of year in which construction occurs, as the wash is an intermittent stream that is dry for most of the year. A National Pollutant Discharge Elimination System (NPDES) permit will be required from the Environmental Protection Agency in order to construct any improvements in or adjacent to existing streams and washes. All potential impacts will be minimized by adhering to the District's Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control.

Cherokee Wash and Doubletree Ranch Road Wash are not designated as wild and scenic rivers and do not require special consideration as required by the Wild and Scenic Rivers Act (16 USC 1271-1287).

Construction impacts: temporary air and noise impacts will occur during construction of improvements along Doubletree Corridor and Cherokee Wash. The construction contractor will be required to control fugitive dust with water applications and comply with City, Town, and County regulations to minimize air and noise impacts. To control erosion, areas disturbed by construction will be either revegetated with indigenous plant species or bank protection will be constructed.



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

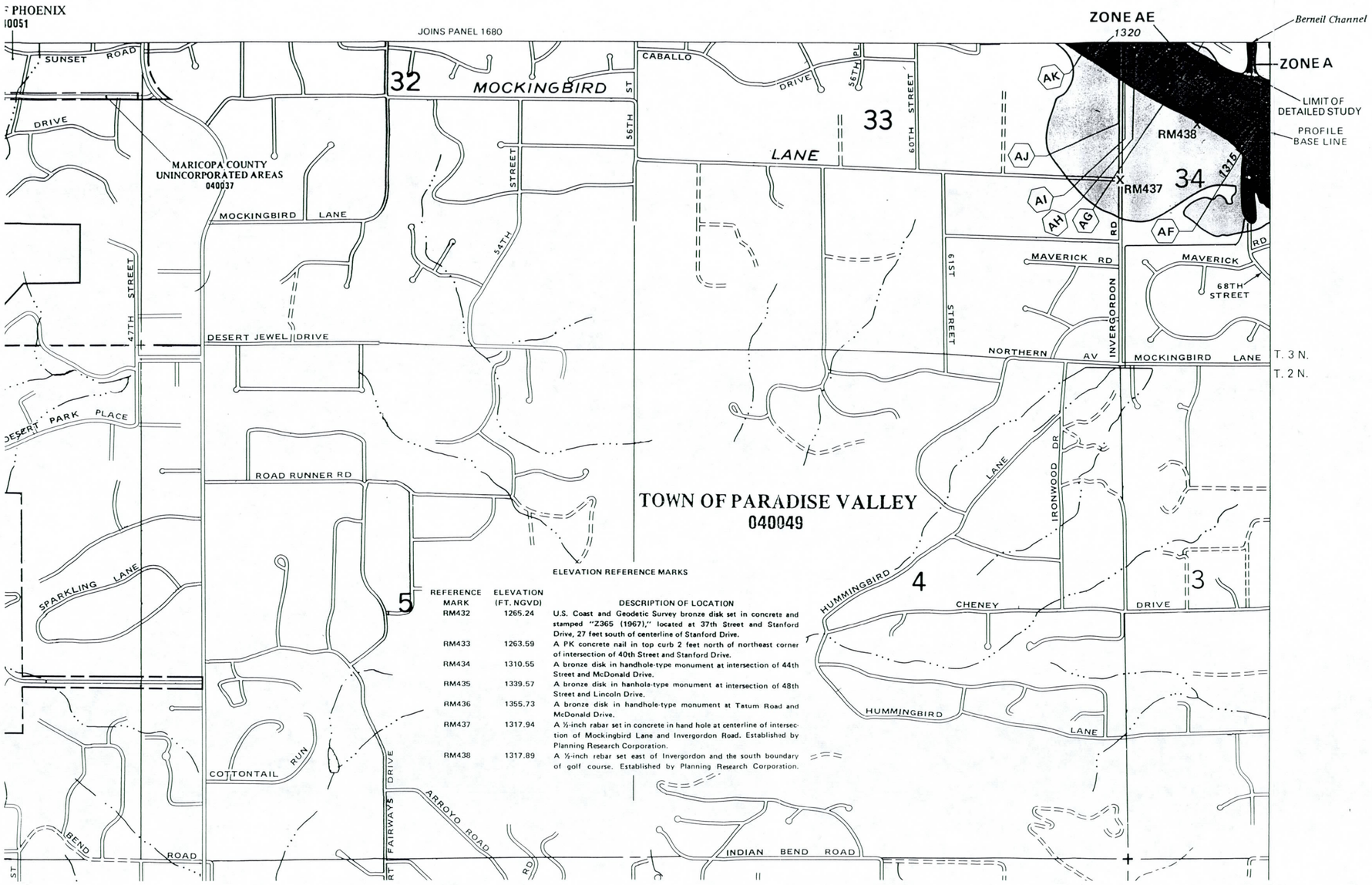
Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

~~~513~~~ Base Flood Elevation Line; Elevation in Feet*

(D)——(D) Cross Section Line

(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 × Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1680 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PARADISE VALLEY, TOWN OF	040049	1680	F
PHOENIX, CITY OF	040051	1680	F
SCOTTSDALE, CITY OF	045012	1680	F

MAP NUMBER
04013C1680 F

MAP REVISED:
SEPTEMBER 30, 1995

Federal Emergency Management Agency

FIGURE 4.1
~~~



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM432	1265.24	U.S. Coast and Geodetic Survey bronze disk set in concrete and stamped "Z365 (1967)," located at 37th Street and Stanford Drive, 27 feet south of centerline of Stanford Drive.
RM433	1263.59	A PK concrete nail in top curb 2 feet north of northeast corner of intersection of 40th Street and Stanford Drive.
RM434	1310.55	A bronze disk in handhole-type monument at intersection of 44th Street and McDonald Drive.
RM435	1339.57	A bronze disk in hanhole-type monument at intersection of 48th Street and Lincoln Drive.
RM436	1355.73	A bronze disk in handhole-type monument at Tatum Road and McDonald Drive.
RM437	1317.94	A ½-inch rabar set in concrete in hand hole at centerline of intersection of Mockingbird Lane and Invergordon Road. Established by Planning Research Corporation.
RM438	1317.89	A ½-inch rebar set east of Invergordon and the south boundary of golf course. Established by Planning Research Corporation.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1690 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY UNINCORPORATED AREAS	040037	1690	E
PARADISE VALLEY, TOWN OF	040049	1690	E
PHOENIX, CITY OF	040051	1690	E
SCOTTSDALE, CITY OF	045012	1690	E

MAP NUMBER
04013C1690 E

MAP REVISED:
SEPTEMBER 30, 1995

Federal Emergency Management Agency

FIGURE 4.2

Traffic control and project phasing will be important aspects to assure safety and reduce inconveniences during construction.

5.0 Conclusion

The objective of this report is to develop a conceptual plan and cost estimates to be used for preparation of construction plans for the storm drain trunk line and channel improvements to control flooding. The District and the Town of Paradise Valley can now use the results of this report to proceed with the preferred alternatives.

In the Doubletree Corridor, detention basins were determined not to be cost effective because of land cost in the Town of Paradise Valley. A storm drain system using concrete box culverts was conceptually designed for the 100-year 6-hour storm event. The storm drain conveyance system was designed to contain flooding with little disruption and inconvenience. Safety for pedestrians and vehicular traffic will be greatly improved. The culverts were designed so the hydraulic gradient would be at least two feet below existing ground. The Doubletree Ranch Road storm drain system was analyzed with both the 100-year and 10-year inlet discharges and tailwater depths at Indian Bend Wash. By the time the hydraulic gradient is to Junction 3 (J3), the water surface elevation is essentially back to normal. None of the lateral trunk lines were affected by the difference in tailwater elevations. Special improved inlets might be needed to increase the hydraulic inlet efficiency. Concrete box culverts are an efficient way to hydraulically transport storm runoff. Right-of-way requirements are kept to a minimum.

The Doubletree storm drain system is designed to pick up six main wash areas: Doubletree Ranch Road Wash west of Tatum Boulevard; Berneil Wash at 52nd Street; Butler Wash at Tatum Boulevard; the wash at approximately 54th Street and Doubletree Ranch Road; and Cherokee Wash at 52nd Street and 56th Street. There is a lateral designed for the west side of Tatum Boulevard to pick up storm runoff from an existing culvert at Tomahawk Drive. The rest of the sub-basin storm runoff will be picked up as local water in catch basins along the storm drain system where local drainage patterns dictate. The 10-year 6-hour storm event of Cherokee Wash will be diverted at 52nd Street and 56th Street because the natural channel cannot handle the 100-year storm capacity within the existing drainage easement banks. Diverting stormwater from Cherokee Wash will provide enhanced flooding protection to the areas down stream of the diversions but it will provide less than the 50-year storm protection.

Indian Bend Wash storm runoff peaks at this location after the stormwater from Doubletree Ranch Road and Cherokee Wash peak. An energy dissipator is required at the outlet in Indian Bend Wash because of the velocities generated in the box culvert. The outlet elevation was set so that there would be a positive slope down Indian Bend Wash and no ponding water in the culvert.

Table 4.1 summarizes the construction cost for the Doubletree storm drain system including extensions to pick up water from Cherokee Wash. Table 4.2 summarizes the construction cost for the Cherokee Wash Corridor.

Drainage easements where not already existing, will be required to stop encroachment upon Cherokee Wash. The acquisition of contiguous easements for the entire Cherokee Wash Corridor will enhance the Town's ability to improve and maintain higher levels of conveyance during storms the presently exist.

The proposed drainage structures have been conceptually designed and will improve control of stormwater in both the Doubletree and Cherokee Wash Corridors. A sediment transport study is under separate contract by the District for Cherokee Wash. Once the sediment report has been completed and accepted, the grades and any structures that have been recommended in this study can be used to further define the frequency protection of the ultimate channel capacity improvement of Cherokee Wash.

Kaminski-Hubbard Engineering's report entitled "Final Drainage Report for Tatum Boulevard, Cadia Del-Sol to Shea Boulevard," dated January 22, 1993 makes a recommendation to address street runoff on Tatum Boulevard for the City of Phoenix. Following the recommendation, the plans have included a 30" line along Tatum Boulevard south of Doubletree Ranch Road to collect runoff from an existing wash and culvert by Tomahawk Trail. Catch basins can be added to this extension during the design phase of this project. Construction of the storm drain system from Hatcher Wash north to approximately Mountain View Road should be postponed until Hatcher Wash between Tatum Boulevard and 52nd Street has been designed and constructed to handle the flows.

During the latter stages of this project, it became evident that the cost for the selected alternatives exceeds the funding limitation budgeted for this project. The Cherokee Wash Corridor has conveyance limitation and the selected alternative does not afford 100-year protection even with diversion to the Doubletree Corridor. Nonetheless, many of the results and analyses presented in this report will be useful if this project is evaluated for flood protection from less severe storm events than the 100-year, 6-hour storm event analyzed in this project.

6.0 References

1. Chow, Ven Te, Open Channel Hydraulics, McGraw-Hill Book Company, Inc., New York, NY, 1959.

2. City of Phoenix, Arizona, The Floodplain Management Section of the Street Transportation Department, The Local Flooding Mitigation Program, Volume I and II, March 1992.

3. Dodson and Associates, Inc., Computer Program, Hydrocalc Hydraulics, 1989.

4. Federal Emergency Management Agency, Flood Insurance Rate Maps, Map No. 04013C1680E, September 29, 1989 and Map No. 04013C1690D, April 15, 1988.

5. Federal Emergency Management Agency, Flood Insurance Study For Maricopa County, Arizona, Arizona And Incorporated Area. Revised September 29, 1992.

6. Flood Control District of Maricopa County, Drainage Design Manual For Maricopa County, Arizona, Volume II, Hydraulics. November, 1991.

7. Flood Control District of Maricopa County, Final Drainage Report for Tatum Boulevard, Cadia Del Sol to Shea Boulevard, Kamiski-Hubbard Engineering, Inc., January 22, 1993.

8. Haestad Methods, Computer Program, StormCAD for Windows, Version 1.0, 1995.

9. King, Horace W. and Brater, Ernest F., Handbook of Hydraulics, Sixth Edition, McGraw-Hill Book Company, 1963.

10. Thomson and Hjalmarson, U.S. Geological Survey, Estimated Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona, 1991.

11. U. S. Army Corps of Engineers, The Hydrologic Engineering Center, Simulation of Flood Control and Conservation Systems, April 1982.

12. U.S. Department of Transportation, Federal Highway Administration, Hydraulic Design of Highway Culverts, HDS No. 5, September 1985.

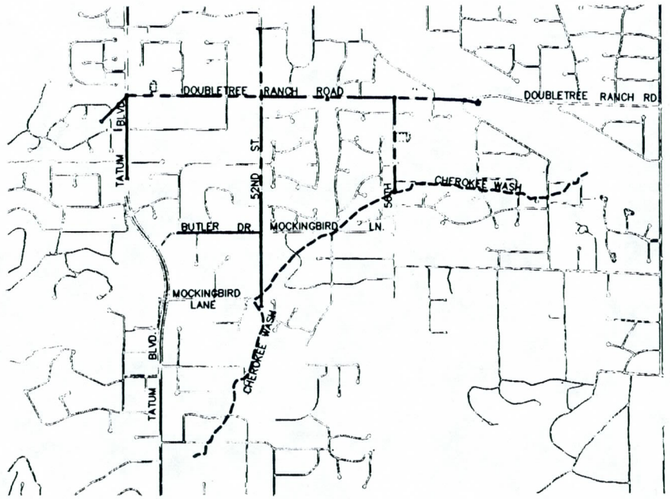
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CONCEPTUAL STORM WATER PLANS
FOR

DOUBLETREE RANCH ROAD
REGIONAL DRAINAGE STUDY

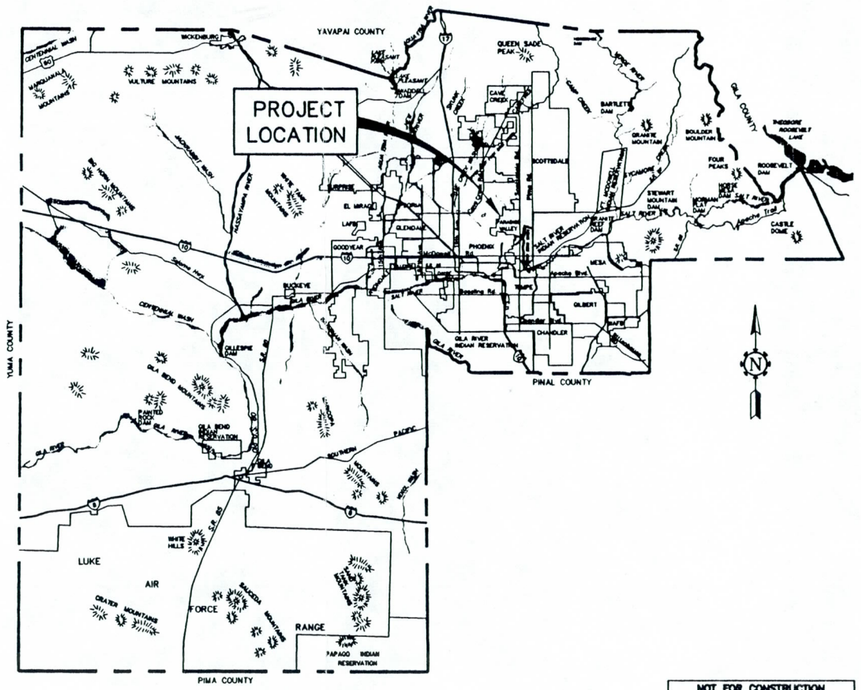
DOUBLETREE RANCH ROAD CORRIDOR
CHEROKEE WASH CORRIDOR

VICINITY MAP
NOT TO SCALE



FLOOD CONTROL DISTRICT of MARICOPA COUNTY

2801 WEST DURANGO
PHOENIX, AZ 85009



MARICOPA COUNTY
NOT TO SCALE

NOT FOR CONSTRUCTION
THESE PLANS ARE CONCEPTUAL. THEY ARE FOR LAYOUT AND COST ESTIMATING PURPOSES ONLY.

F.C.D. CONTRACT NO. 94-28

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM S. SNARR Date Signed 3-3-97 ARIZONA, U.S.A.

HOOK ENGINEERING, INC.
3511 E. INDIAN SCHOOL ROAD PHOENIX, ARIZONA 85018
Tel. (602) 954-3200 Fax (602) 956-5443

	BY	DATE
DESIGN	W.S.S.	12/96
DESIGN CHK.	D.L.S.	12/96
PLANS	W.S.S.	3/97
PLANS CHK.	J.S.	3/97
SUBMITTED BY:		DATE:

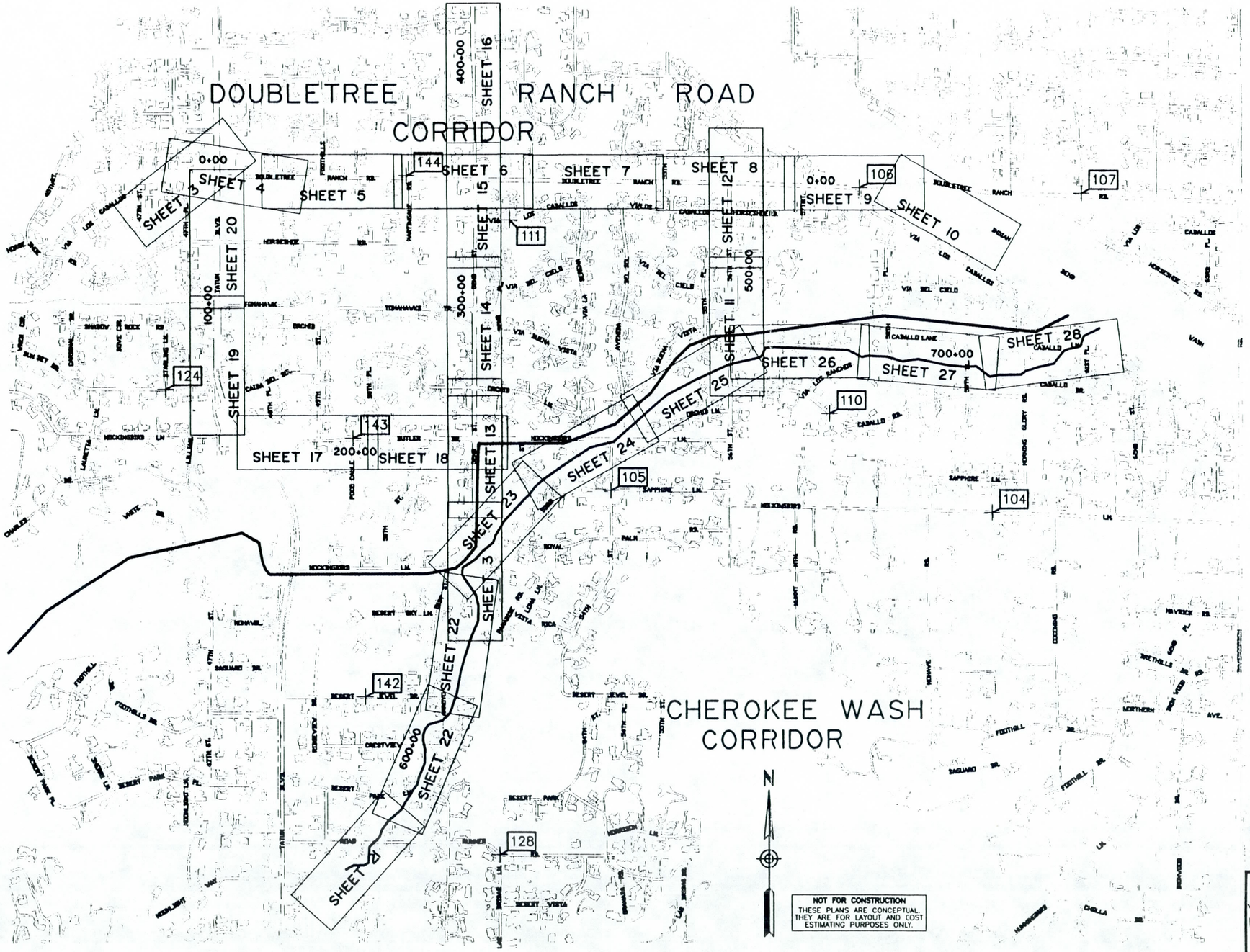
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 OF 28

\2870\DWG\SHEETS\2870CV Fri Mar 21 15:01:44 1997 Plotted by GARRETT

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
LOCATION MAP



F.C.D. CONTRACT NO. 94-28

BENCHMARK CONTROLS

POINT	NORTH	EAST	ELEVATION	DESCRIPTION
104	930848.675	689313.017	1336.31	FOUND ADOT ACP, ON MOCKINGBIRD, +/- 150 FEET WEST OF MORNING GLORY. FOUND MONUMENT MARKED WITH "Y" PANEL.
105	931072.564	685409.934	1364.30	FOUND RR SPIKE AT THE INTERSECTION OF 54TH STREET AND SAPPHIRE. MONUMENT IS 0.2' BELOW PAVEMENT MARKED WITH A "CIRCLE" PANEL.
106	934180.142	687960.855	1330.54	FOUND TOWN OF PARADISE VALLEY BC (FLUSH) AT DOUBLETREE AND VIA LOS CABALLO (WEST SIDE OF INDIAN BEND WASH). MARKED WITH "CIRCLE" PANEL.
107	934127.358	690237.582	1329.86	SET PK NAIL (FLUSH) IN ASPHALT SIDEWALK AT THE NORTHWEST CORNER OF DOUBLETREE ROAD AND MORNING GLORY. MARKED WITH A "CIRCLE" PANEL.
110	931857.140	687646.867	1341.19	FOUND MARICOPA COUNTY HIGHWAY DEPT. BC (FLUSH) AT CABALLO AND AN UN-NAMED CUL-DE-SAC TO THE SOUTH. POINT IS APPROXIMATELY MID-WAY BETWEEN VIA LOS RANCHOS AND 58TH PLACE. MARKED WITH A "CIRCLE" PANEL.
111	933848.352	684374.410	1352.25	FOUND MARICOPA COUNTY HIGHWAY DEPT. BC (FLUSH) AT THE INTERSECTION OF VIA LOS CABALLOS AND 52ND PLACE. MARKED WITH A "CIRCLE" PANEL.
124	932105.449	680869.170	1442.27	FOUND CITY OF PHOENIX BC AT THE INTERSECTION OF SUNSET AND STARLING. MARKED WITH A "CIRCLE" PANEL.
128	927345.784	684258.375	1436.99	FOUND BC (FLUSH) AT THE INTERSECTION OF ROADRUNNER AND LAS BRISAS LANE. MARKED WITH A "CIRCLE" PANEL.
142	928956.139	682893.267	1417.35	SET PK NAIL (FLUSH) ON THE NORTH EDGE OF ASPHALT ON DESERT JEWEL APPROXIMATELY 900' EAST OF TATUM. MARKED WITH "CIRLE" PANEL.
143	931605.340	682775.375	1384.72	FOUND PK NAIL (FLUSH) AT THE INTERSECTION OF OF BUTLER AND POCO CALLE. MARKED WITH A "-" PANEL.
144	934300.954	683323.934	1362.10	SET PK NAIL (FLUSH) ON THE ASPHALT BIKE PATH ON THE NORTH SIDE OF DOUBLETREE AT MARTINGALE. MARKED WITH A "CIRCLE" PANEL.

LEGEND

- CORRIDOR LINE
- CHEROKEE WASH CENTER LINE
- SHEET NO. — SHEET NUMBERS
- 110 — BENCHMARK CONTROL POINT
- 0+00 — STATIONING

GRAPHIC SCALE

500 250 125 0 250 500

(IN FEET)
1 inch = 500 ft.

HOOK ENGINEERING, INC.
3511 E. INDIAN SCHOOL ROAD PHOENIX, ARIZONA 85018
Tel (602) 956-3200 Fax (602) 955-5443

	BY	DATE
DESIGN	W.S.S.	12/96
DESIGN CHK.	D.L.S.	12/96
PLANS	W.S.S.	12/96
PLANS CHK.	J.S.	3/97
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 2 OF 28

22211 WILLIAM S. SNARR

F:\267RIUMS\SHEETS\SHEET-2 Fri Mar 21 16:07:56 1997 Plotted by Jam

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
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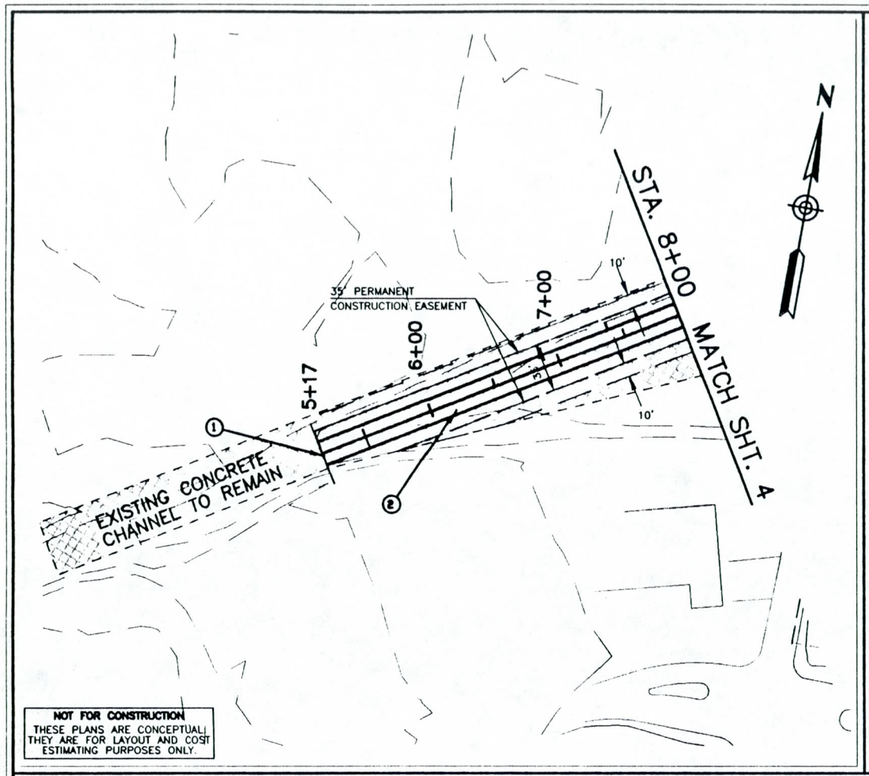
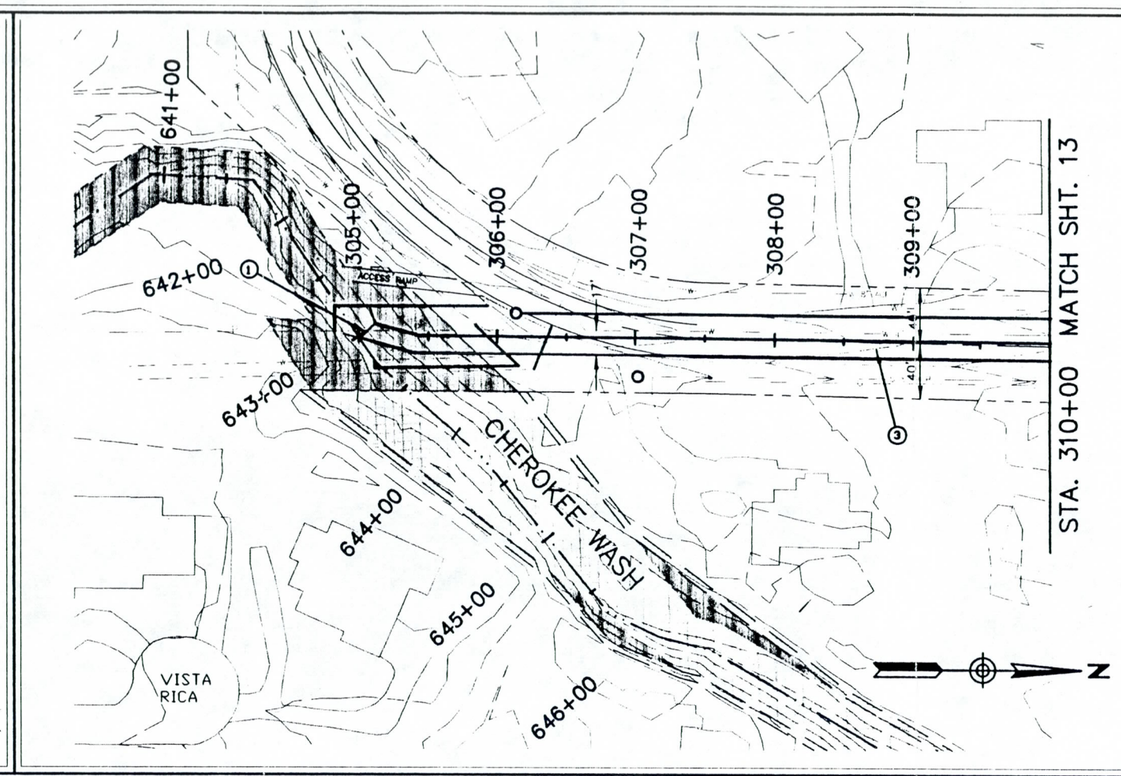
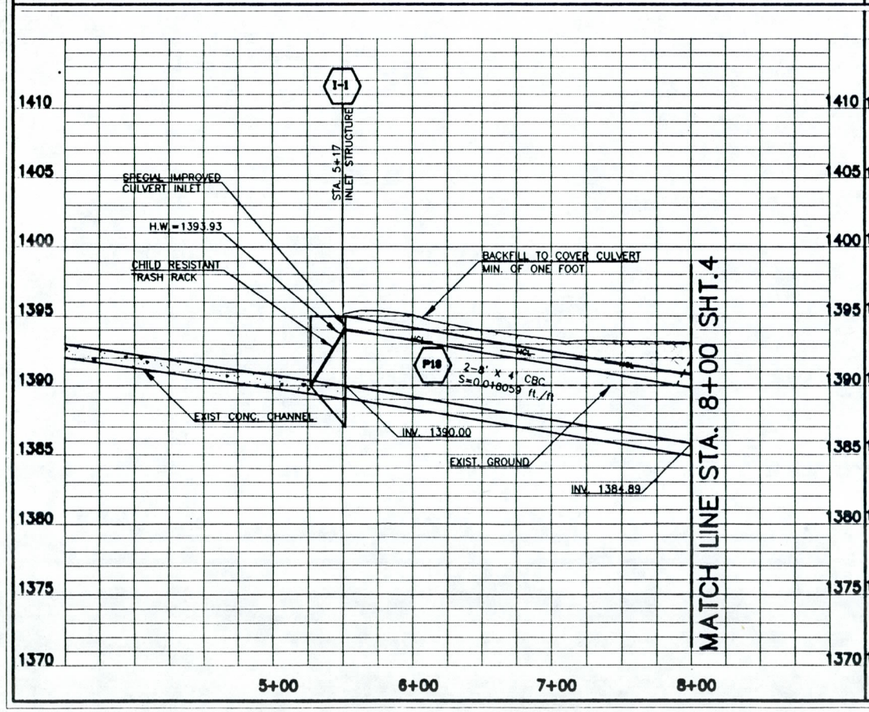
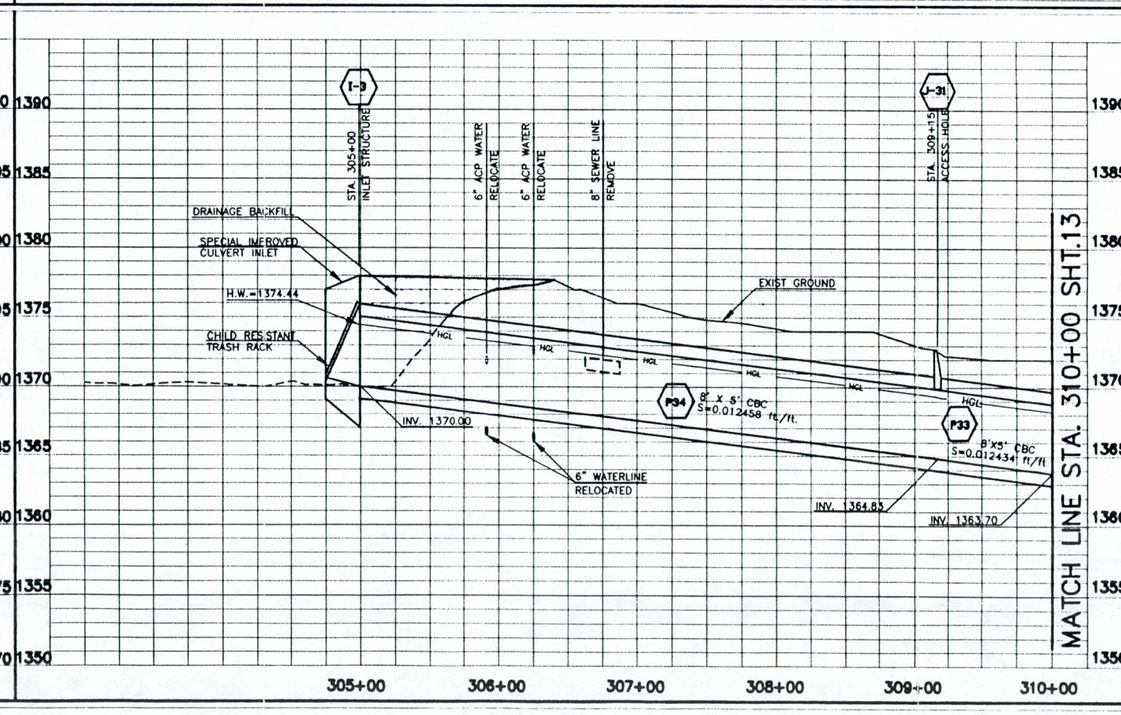


NOT FOR CONSTRUCTION
THESE PLANS ARE CONCEPTUAL; THEY ARE FOR LAYOUT AND COST ESTIMATING PURPOSES ONLY.







① SPECIAL IMPROVED CULVERT INLET W/ CHILD RESISTANT TRASH RACK

② 2-8' x 4' CBC

③ 8' X 5' CBC

LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTURCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- C — CABLE TV
- G — GAS LINE
- TELEPHONE
- OP — OVERHEAD POWER
- S — SANITARY SEWER
- P — UNDERGROUND POWER
- W — WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.
2011 E. HOOK DRIVE, TEMPE, PHOENIX, ARIZONA 85284
Tel (602) 831-8291 Fax (602) 831-8292

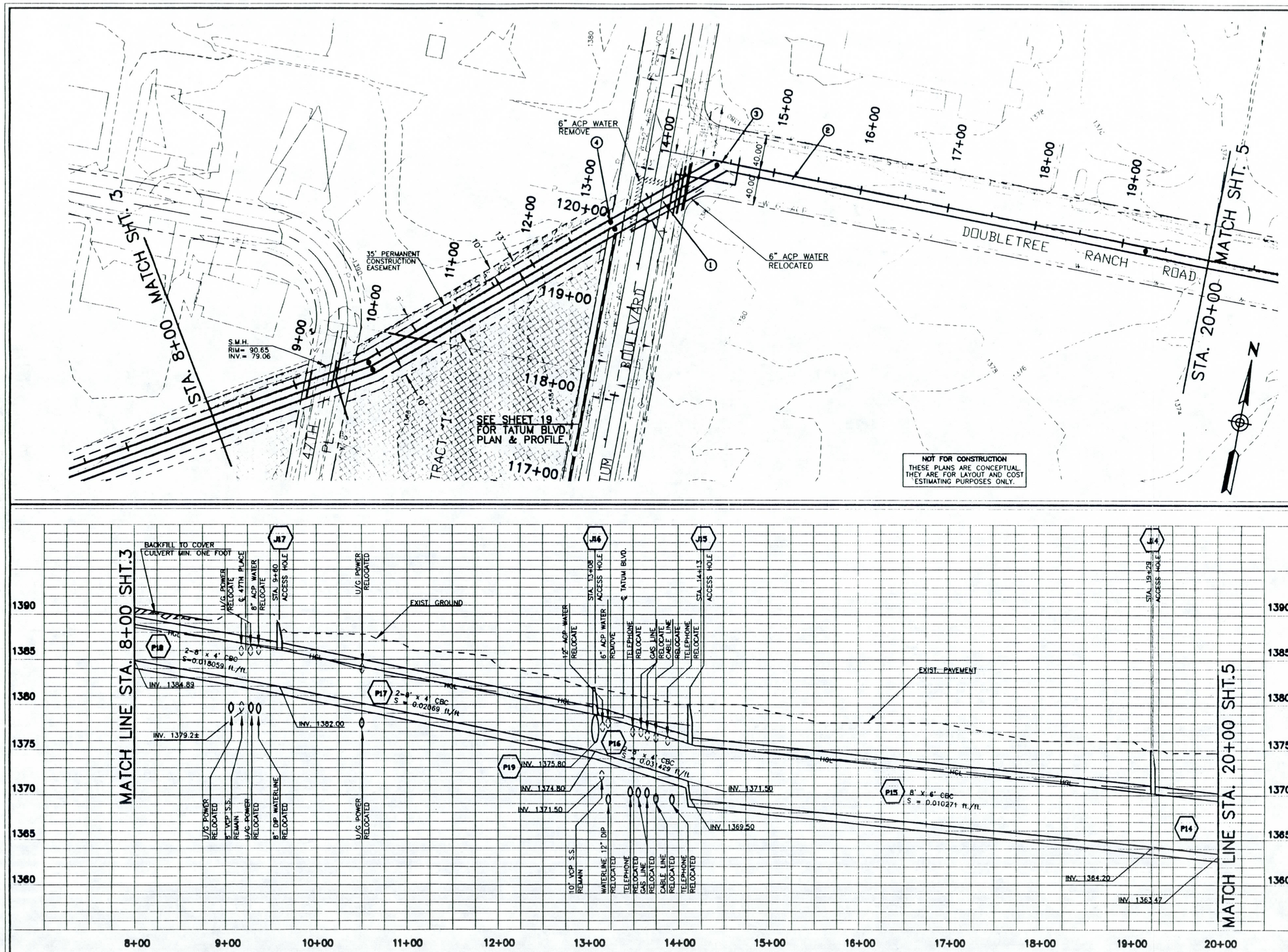
Registered Professional Engineer (Civil)
CERTIFICATE NO. 22211
WILLIAM B. SNARR
Date Signed 3-7-97
ARIZONA, U.S.A.

SHEET 3 OF 28

2878\DWG\SHEETS\SHEET-3 Fri 19:14:50 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	4	28	

1. 2-8' X 4' CBC
2. 8' X 6' CBC
3. TRANSITION STRUCTURE WITH ACCESS HOLE
4. INLET EQUALIZATION PER DETAIL ON SHEET 12



LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- C — CABLE TV
- G — GAS LINE
- T — TELEPHONE
- OE — OVERHEAD POWER
- S — SANITARY SEWER
- P — UNDERGROUND POWER
- W — WATER LINE
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- CENTER LINE
- CENTER LINE OF WASH
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SCALE
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VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.
3111 S. LAKE DRIVE, SUITE 100, CHANDLER, ARIZONA 85248
TEL (602) 963-3087 FAX (602) 963-3097

Registered Professional Engineer (Civil)
CERTIFICATE NO. 22211
WILLIAM B. SHAFER
Date Signed 5-6-97
ARIZONA, U.S.A.

SHEET 4 OF 28

2878\DWG\SHEETS\SHEET-4 Fri 17:04:57 1997 Plotted by GARRETT

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
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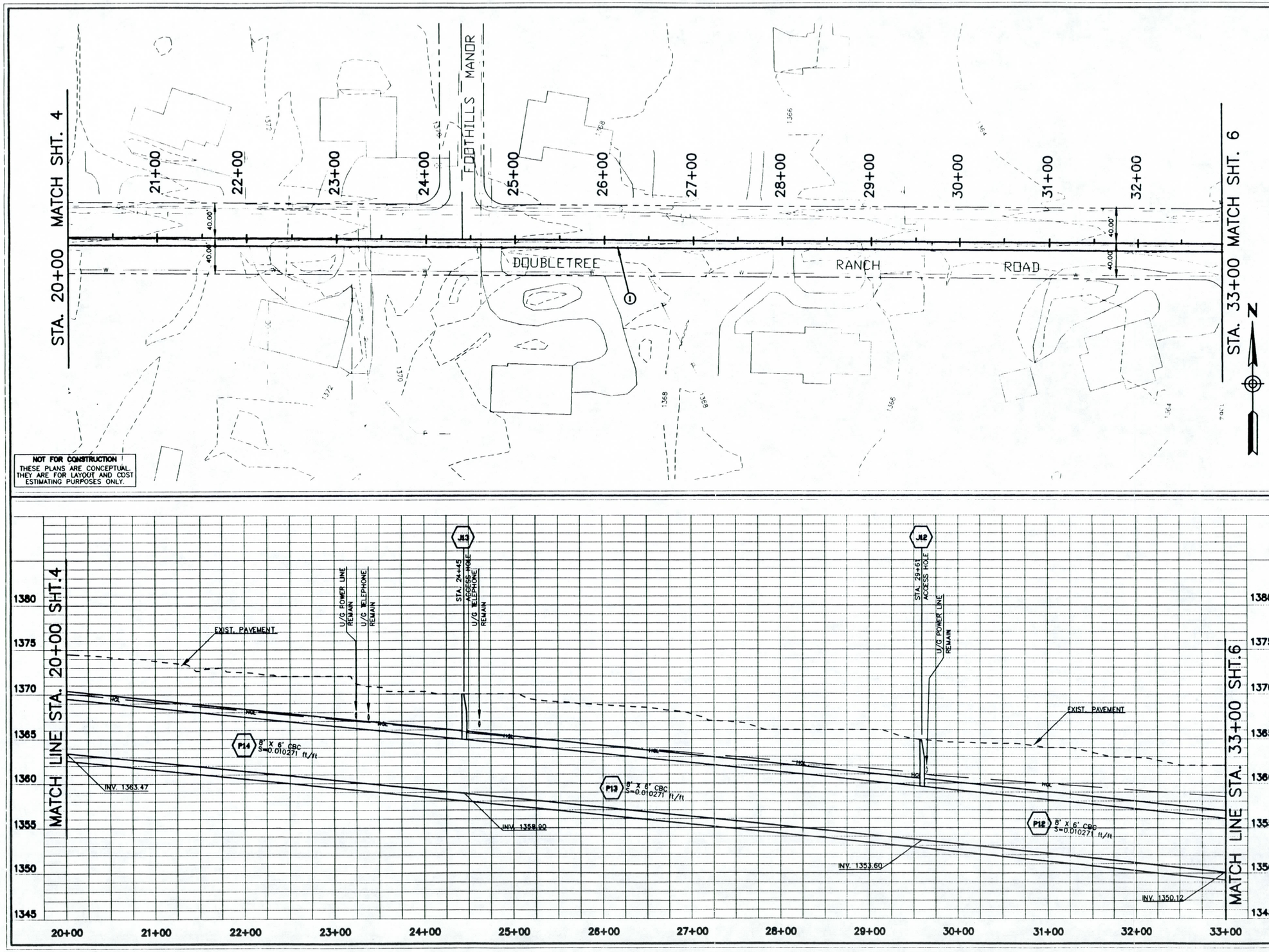

① 8' X 6' CBC

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- C — CABLE TV
- G — GAS LINE
- T — TELEPHONE
- O — OVERHEAD POWER
- S — SANITARY SEWER
- P — UNDERGROUND POWER
- W — WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
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SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

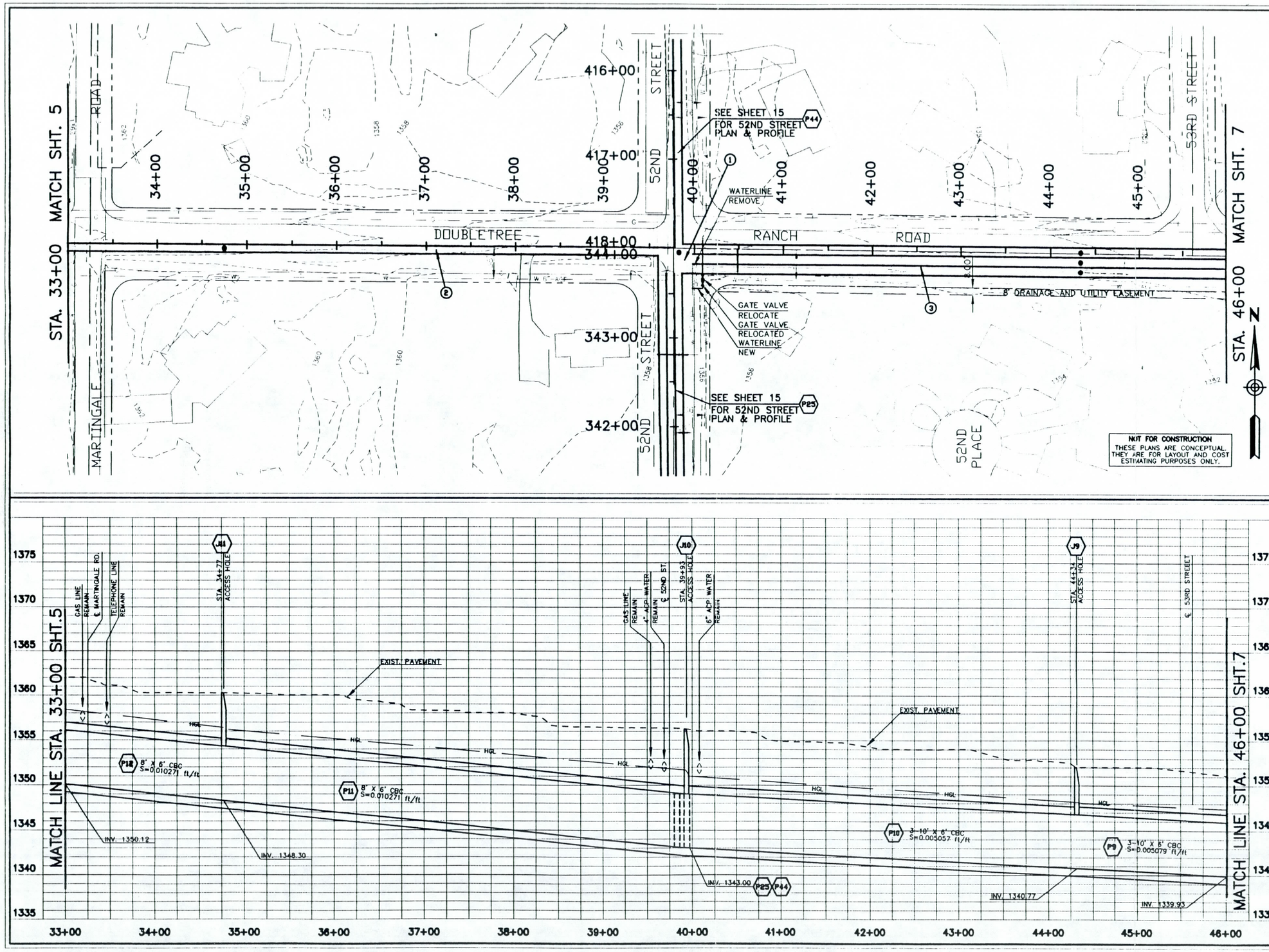
HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM B. SNARR

SHEET 5 OF 28

2878\DWG\SHEETS\SHEET-5 Fri 16:12:30 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	6	28	



1. JUNCTION STRUCTURE
2. 8' X 6' CBC
3. 3-10' X 6' CBC

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
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VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

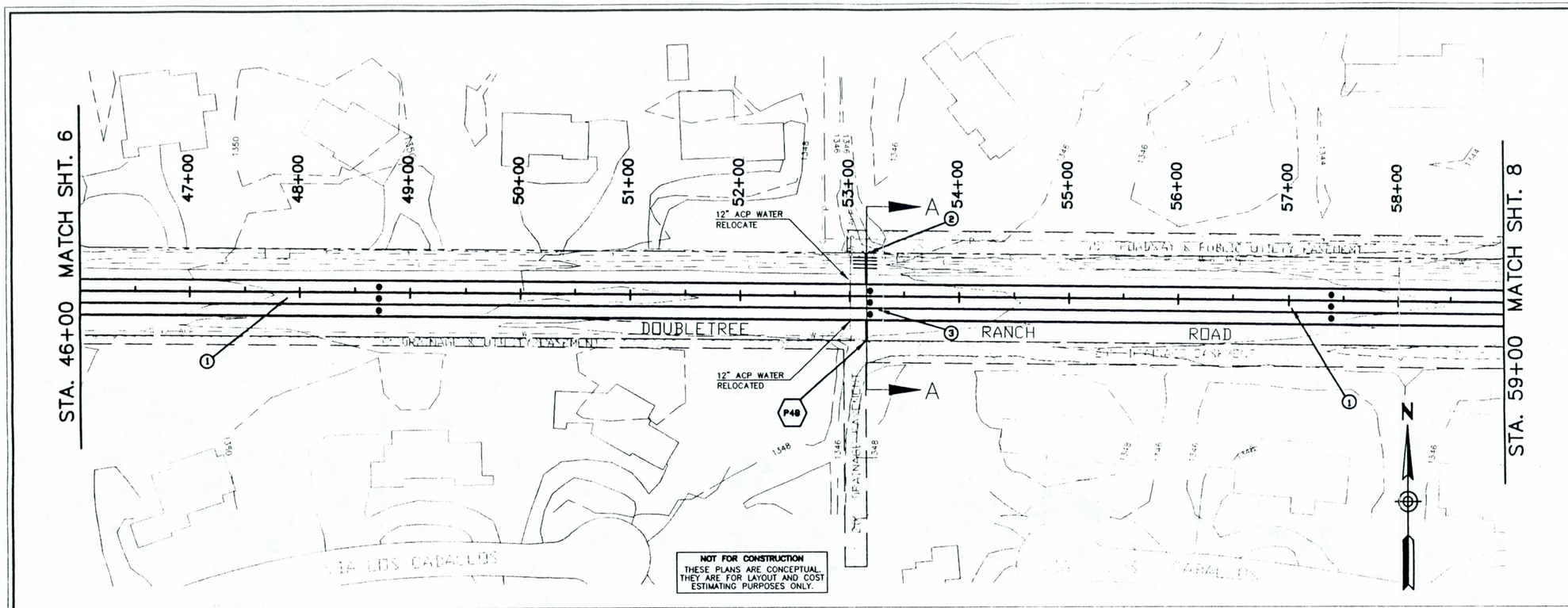
HOOK ENGINEERING, INC.

Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM B. SHAPRI Date Signed 3-27-97 ARIZONA, U.S.A.

SHEET 6 OF 28

\2878\DWG\SHEETS\SHEET-6 Fri 17:38:36 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	7	28	



1. 3-10' X 6' CBC
2. LOCAL RUNOFF WITH INLET STRUCTURES
3. INLET EQUALIZATION PER DETAIL ON SHEET 13

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
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VERT 1"=5'

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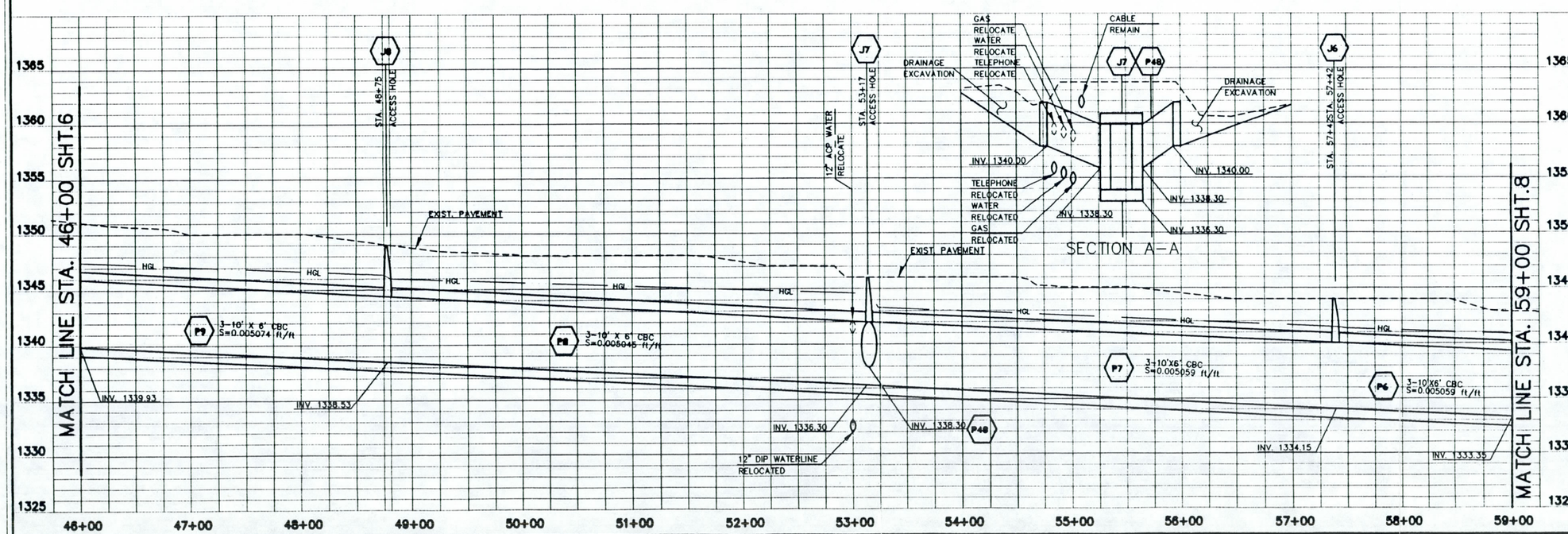
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.



NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

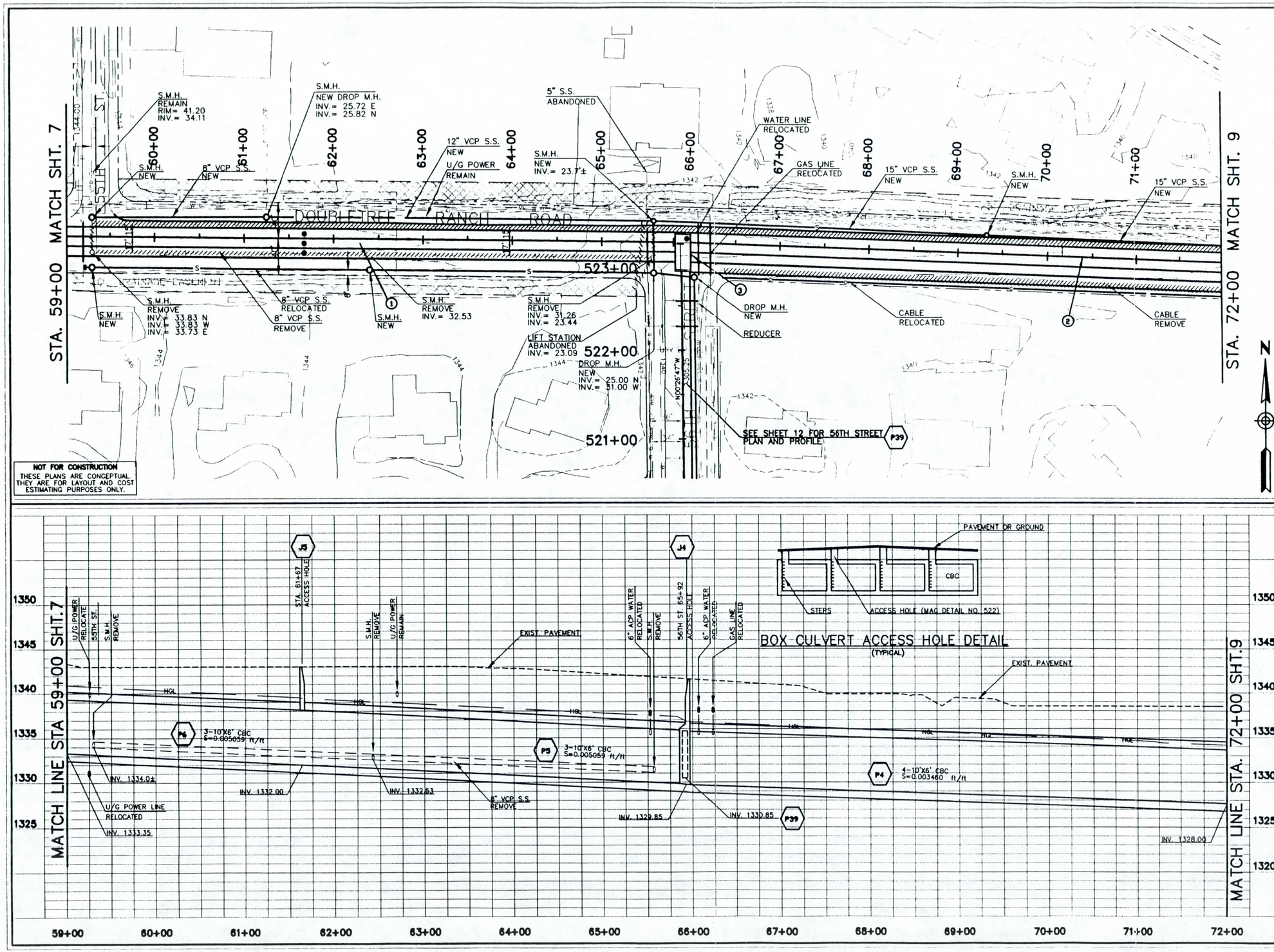
Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM S. SHARP Date Signed 3-31-97 ARIZONA, U.S.A.

SHEET 7 OF 28

2878\DWG\SHEETS\SHEET-7 Fri 19:26:27 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	8	28	

1. 3-10' X 6' CBC
2. 4-10' X 6' CBC
3. JUNCTION STRUCTURE



NOT FOR CONSTRUCTION
THESE PLANS ARE CONCEPTUAL. THEY ARE FOR LAYOUT AND COST ESTIMATING PURPOSES ONLY.

BOX CULVERT ACCESS HOLE DETAIL
(TYPICAL)

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

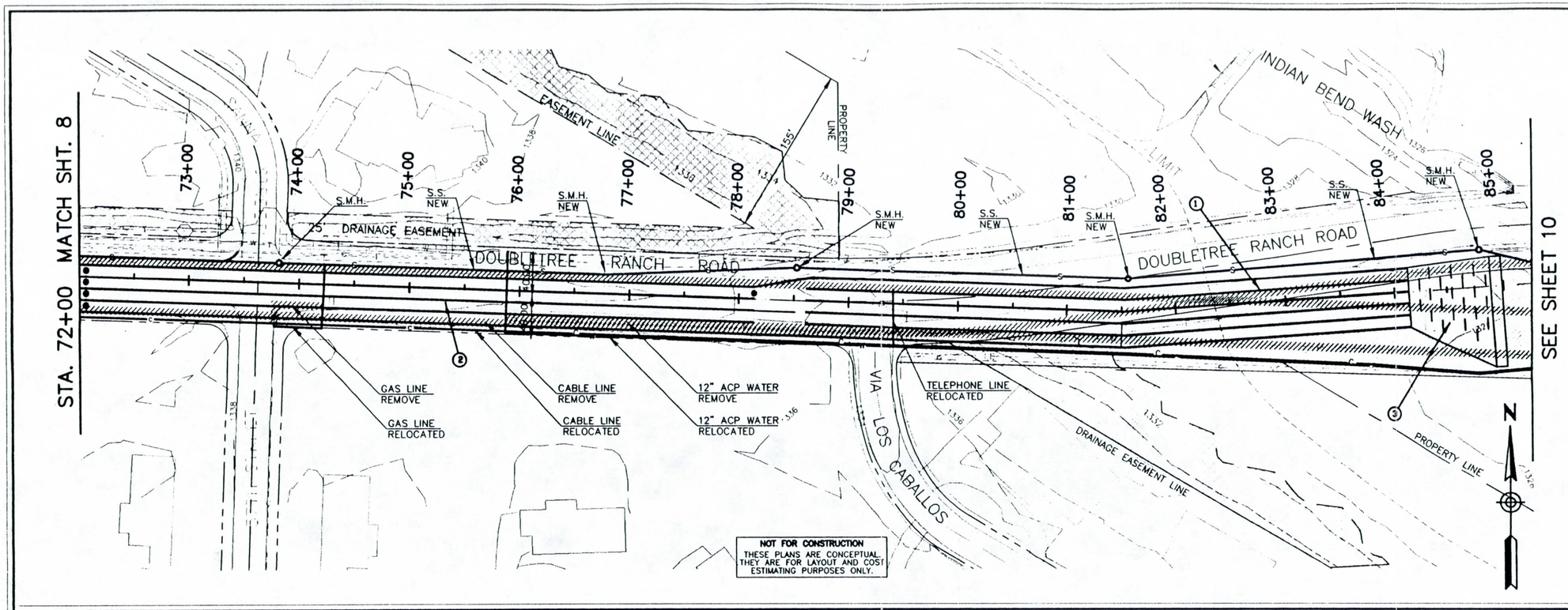
Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM S. SHARP Date Signed 3/7/97 ARIZONA U.S.A.

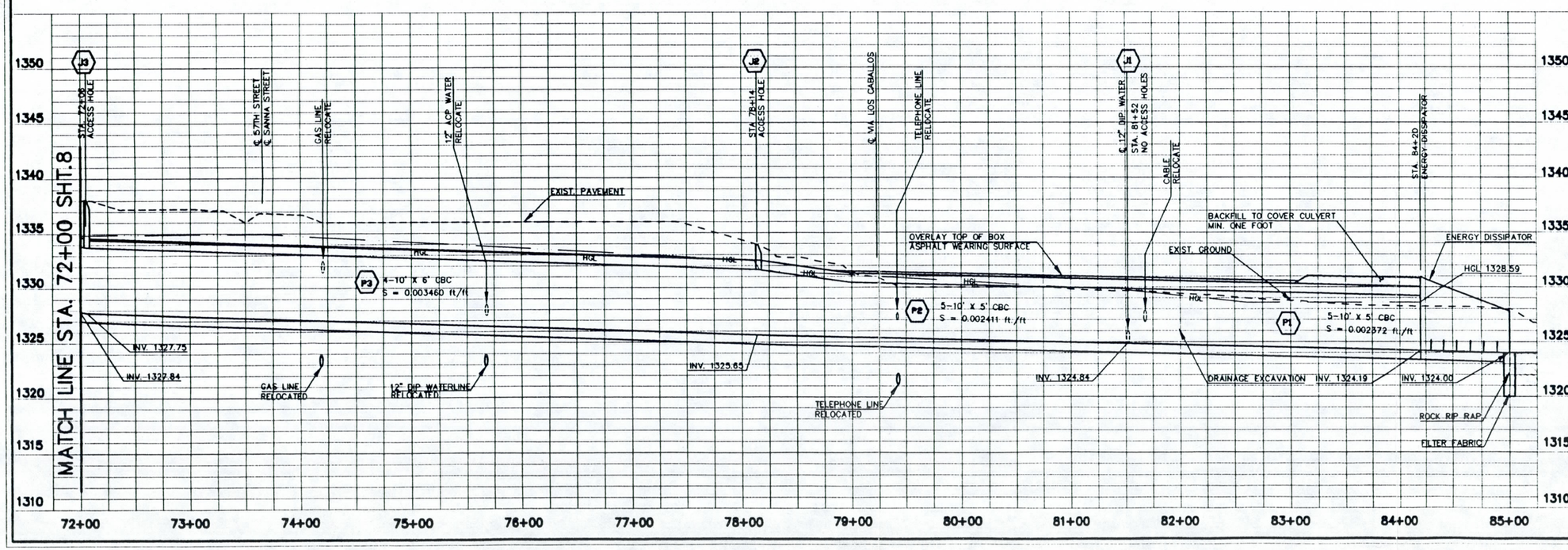
SHEET 8 OF 28

2878\DWG\SHEETS\SHEET-8 Fri 19:34:18 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	9	28	

1. 5-10' X 5' CBC
2. 4-10'x6' CBC
3. ENERGY DISSIPATOR





LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

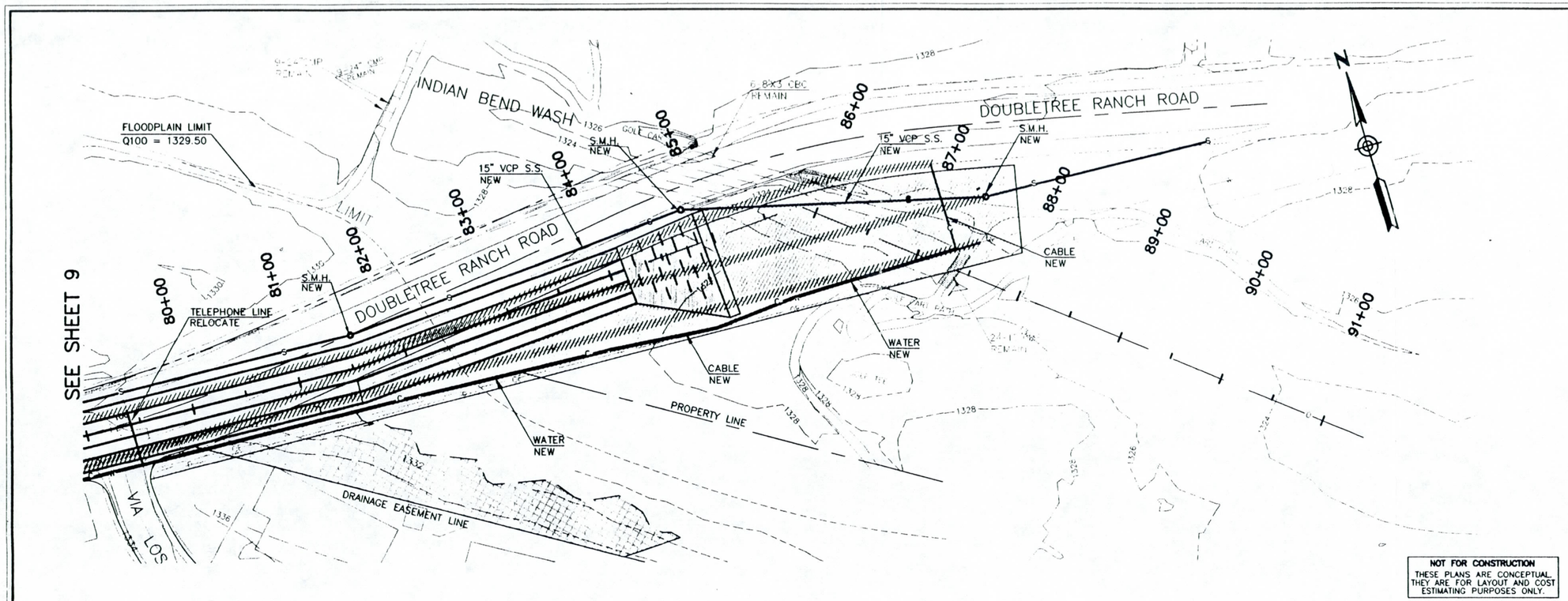
HOOK ENGINEERING, INC.
2411 E. THOMAS ROAD, PHOENIX, ARIZONA 85016
Tel. (602) 955-2881 Fax (602) 955-9442

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 22211
WILLIAM B. SNARR
Date Signed 3-21-97
ARIZONA, U.S.A.

SHEET 9 OF 28

2878\DWG\SHEETS\SHEET-9 Fri 19:40:51 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	10	28	



NOT FOR CONSTRUCTION
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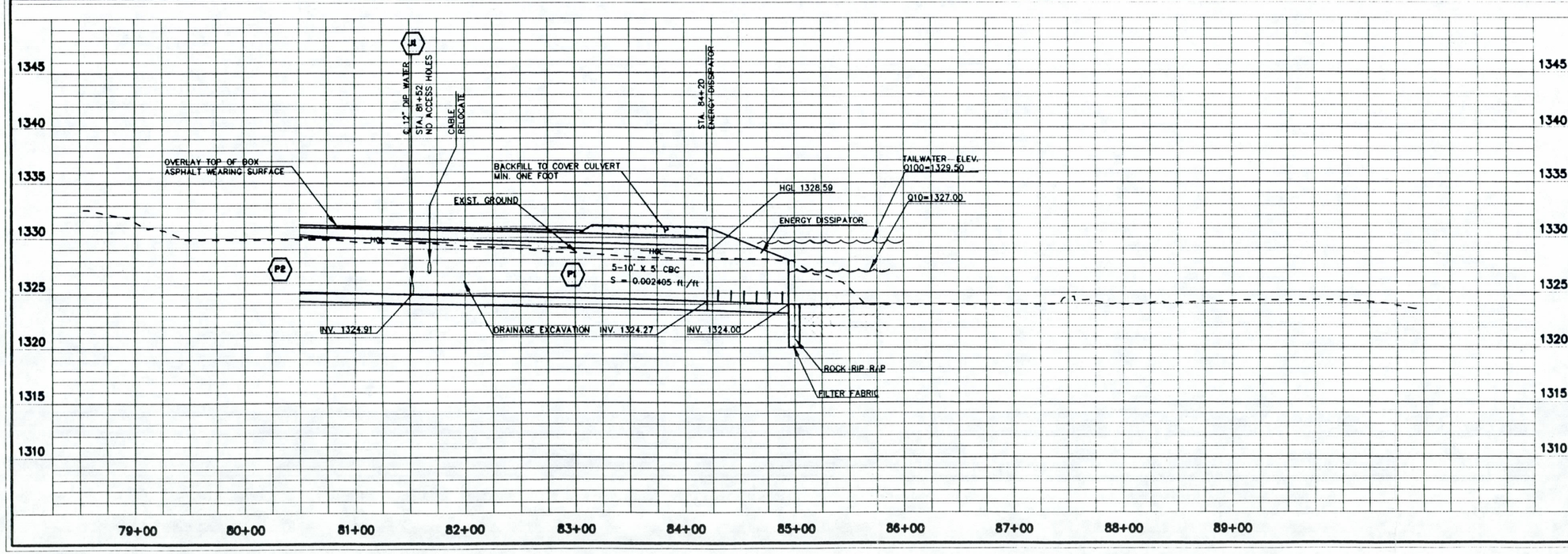


LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- C — CABLE TV
- G — GAS LINE
- T — TELEPHONE
- OP — OVERHEAD POWER
- S — SANITARY SEWER
- P — UNDERGROUND POWER
- W — WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- PS6 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

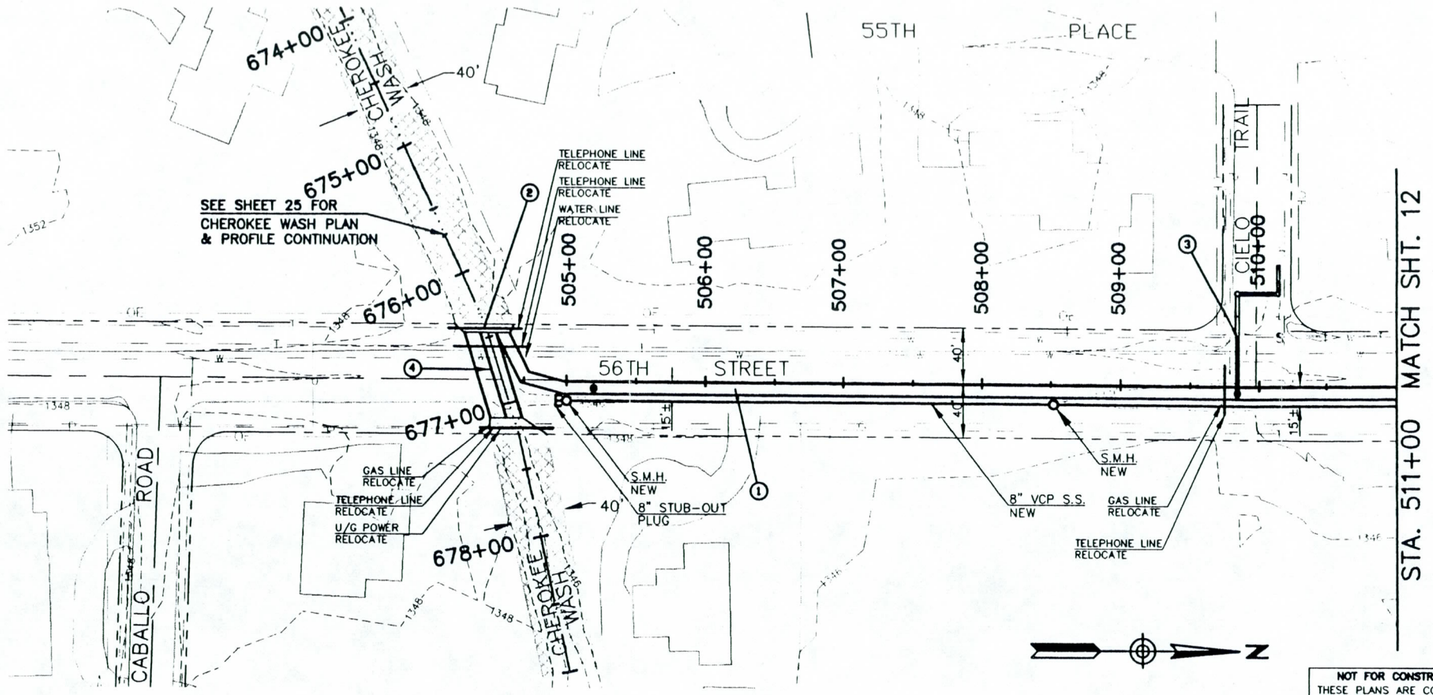
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM B. SNARR Date Signed 3-21-97 ARIZONA, U.S.A.

SHEET 10 OF 28

2878\DWG\SHEETS\SHEET-10 Fri 19:50:24 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	11	28	

1. 8' X 5' CBC
2. SPECIAL IMPROVED CULVERT INLET W/ CHILD RESISTANT TRASH RACK
3. LOCAL RUNOFF
4. 2 - 10' X 5' CBC



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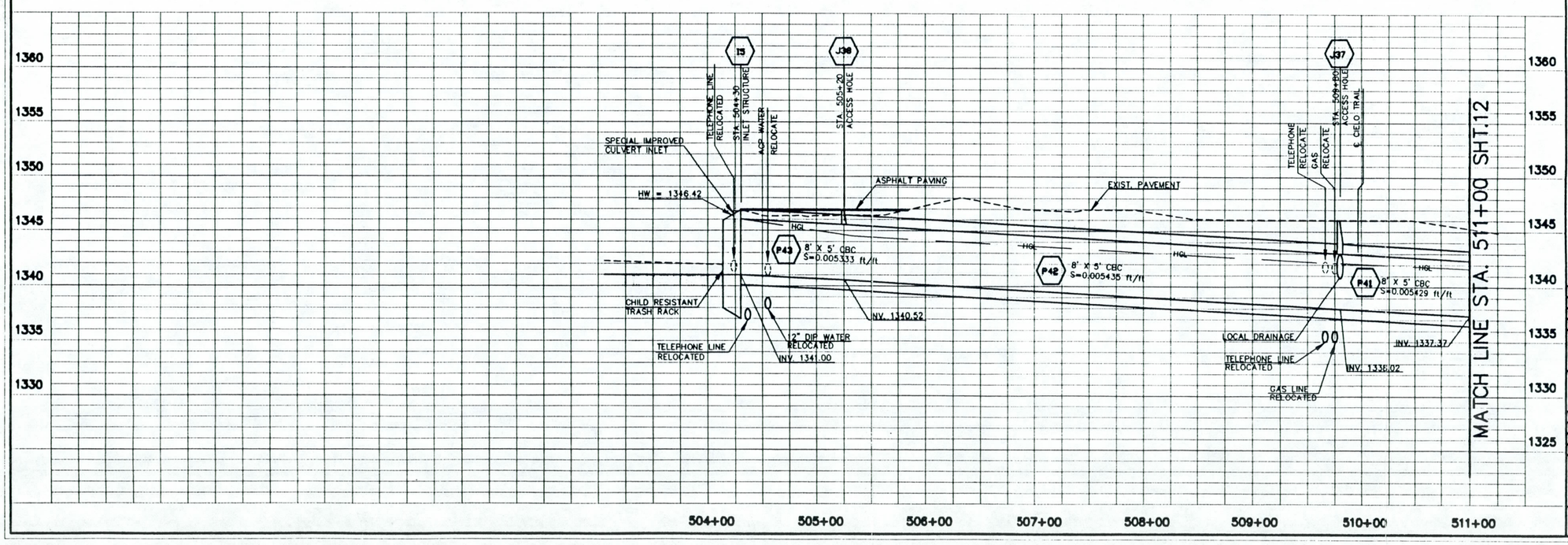


LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

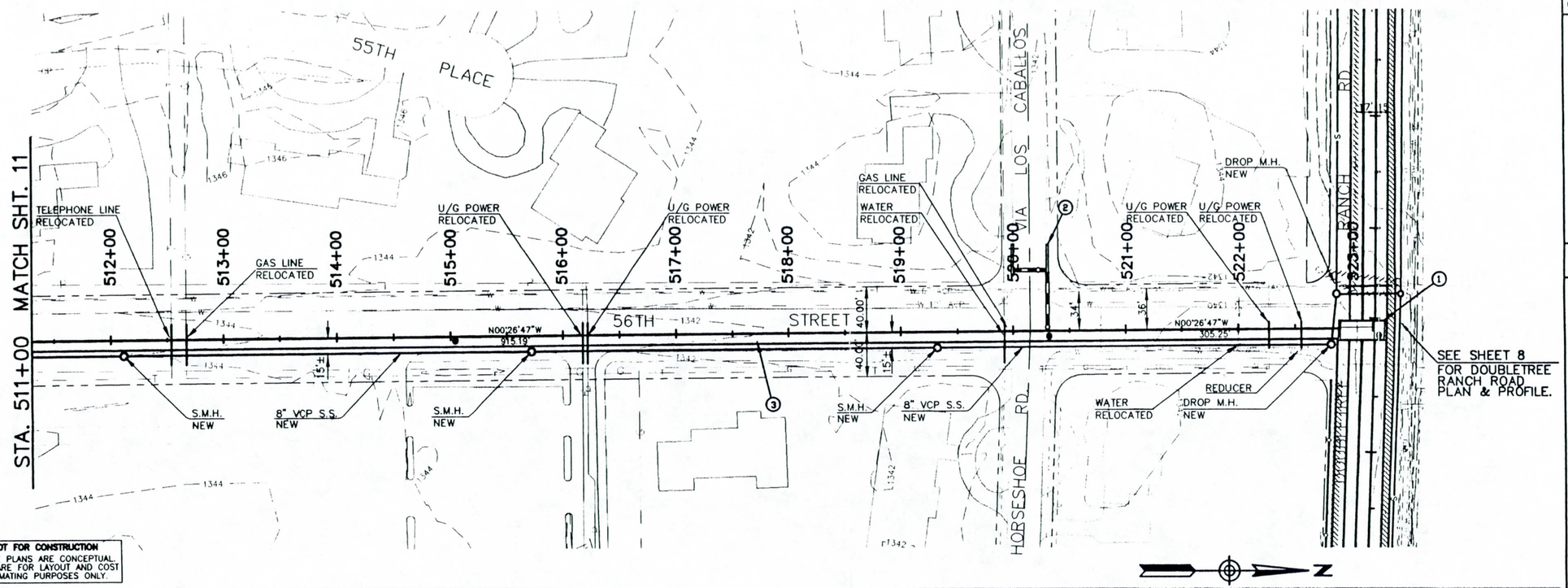
Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM S. SHARP Date Signed 3-3-97 ARIZONA, U.S.A.

SHEET 11 OF 28

\2878\DWG\SHEETS\SHEET-11 Fr 19 53:17 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	12	28	

1. JUNCTION STRUCTURE WITH ACCESS HOLE
2. LOCAL DRAINAGE
3. 8' x 5' CBC



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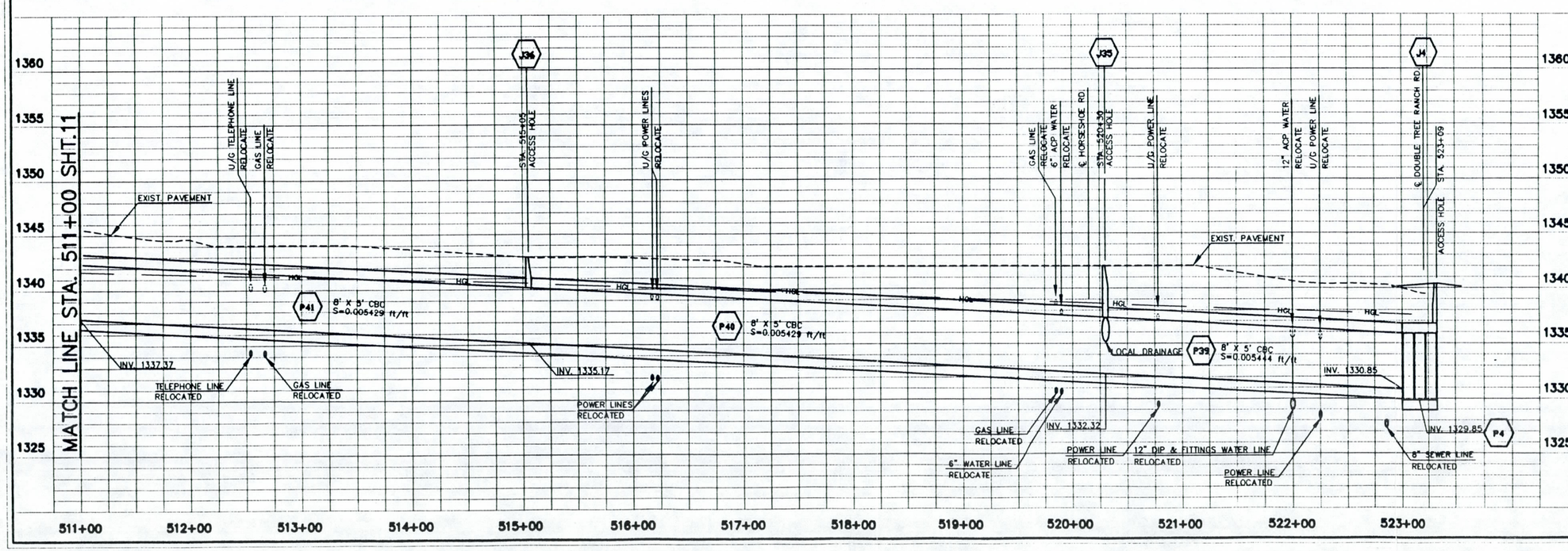


LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P36 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.
2911 E. ROOSEVELT STREET PHOENIX, ARIZONA 85008
Tel (602) 955-2208 Fax (602) 955-5442

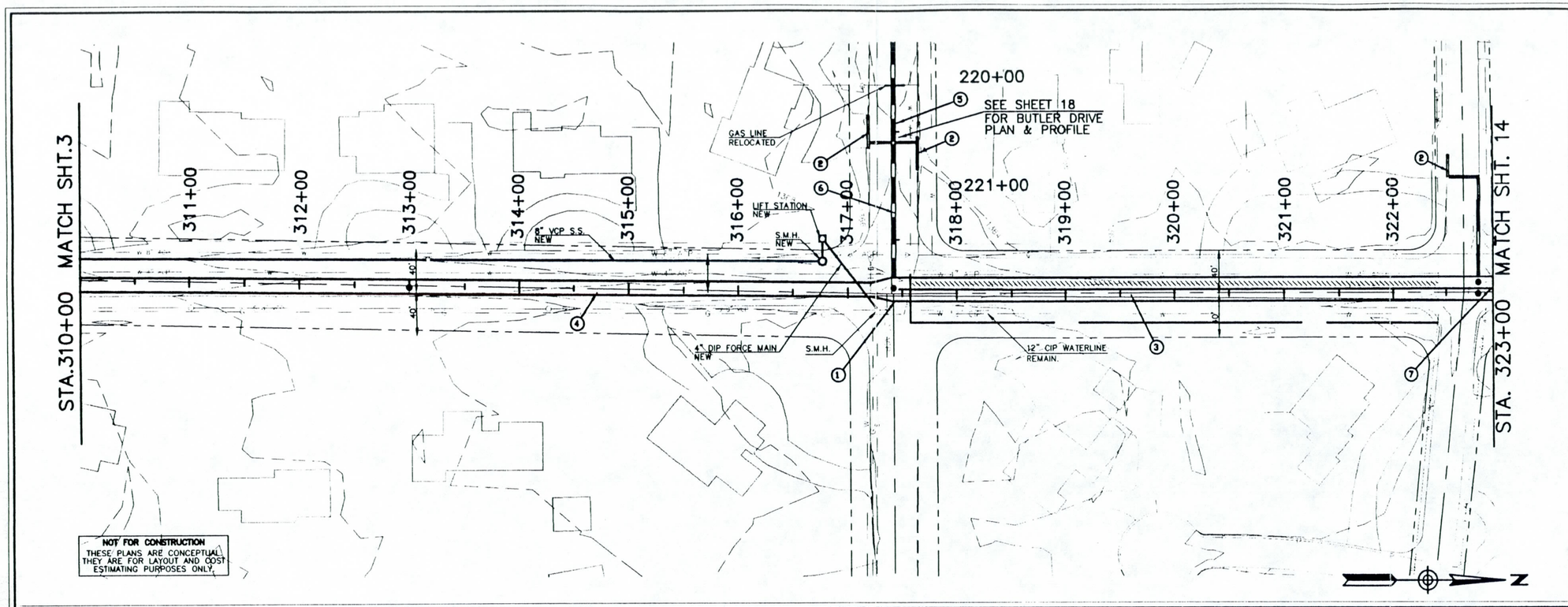
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 22211
WILLIAM S. SNAFR
Date Signed 3-17-97
ARIZONA, U.S.A.

SHEET 12 OF 28

2878\DWG\SHEETS\SHEET-12 Fri Mar 20 03:59 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	13	28	

1. JUNCTION STRUCTURE
2. LOCAL DRAINAGE
3. 2-8' X 5' CBC
4. 8' X 5' CBC
5. 48" RCP
6. 60" RCP
7. INLET EQUALIZATION PER DETAIL BELOW



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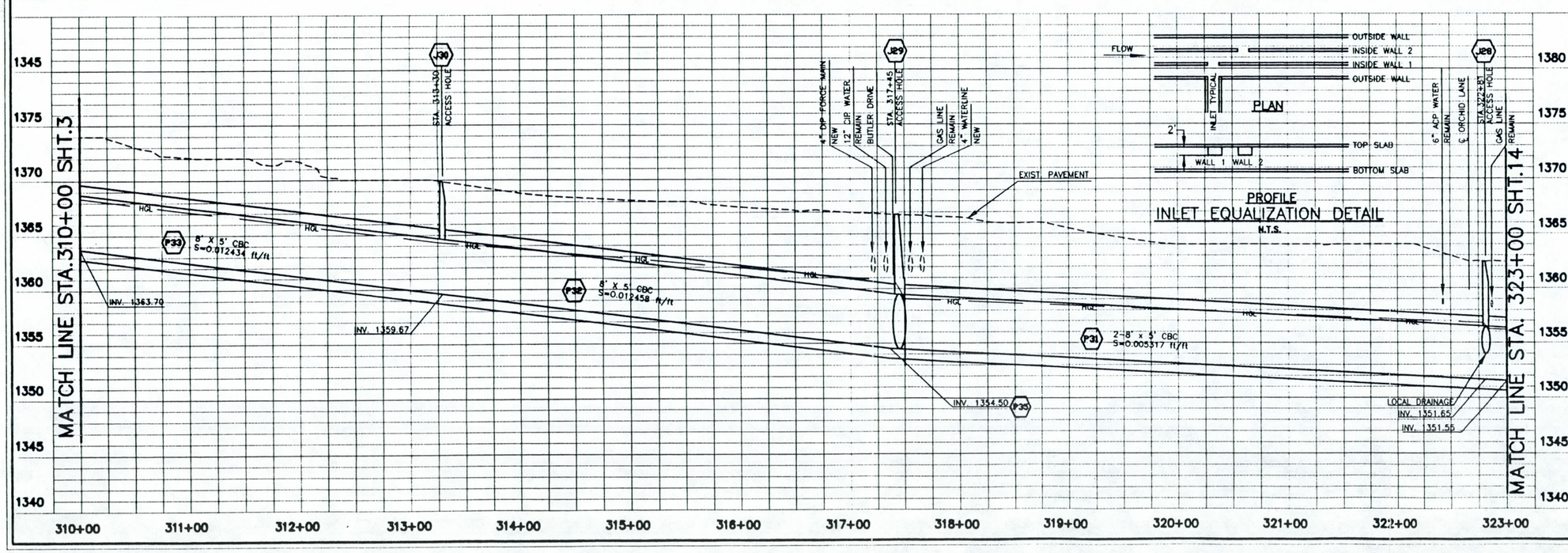


LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P36 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

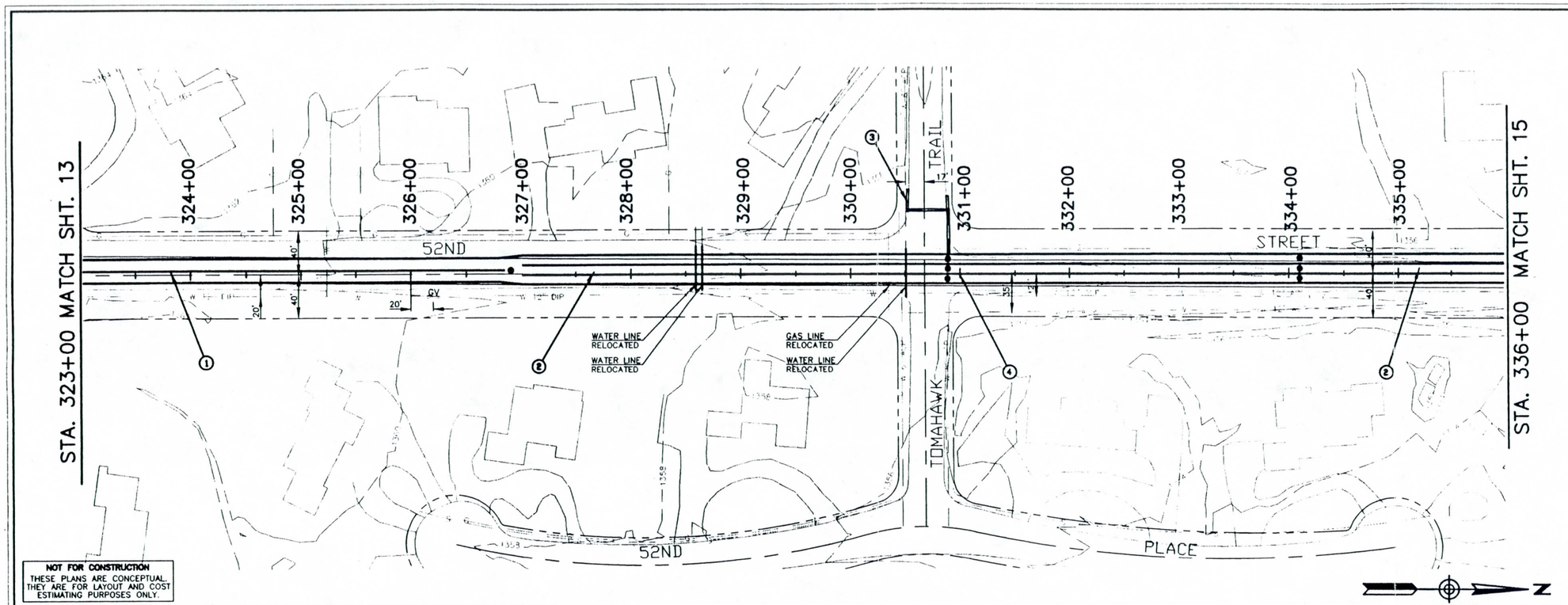
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM R. SNARR Date Signed 3-27-97 ARIZONA, U.S.A.

SHEET 13 OF 28

878\DWG\SHEETS\SHEET-13 Fri Mar 21 22:25:38 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	14	28	

1. 2-8' X 5' CBC
2. 3-8' X 6' CBC
3. LOCAL DRAINAGE
4. INLET EQUALIZATION PER DETAIL ON SHEET 13



NOT FOR CONSTRUCTION
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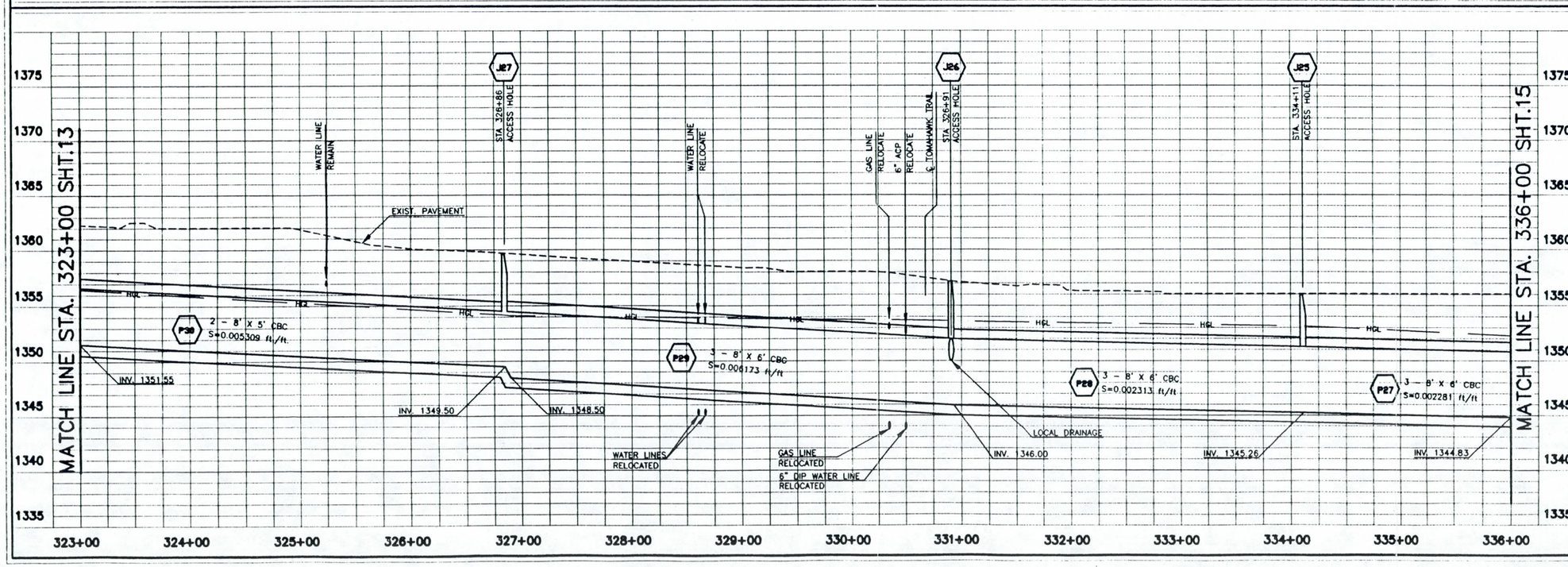


LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

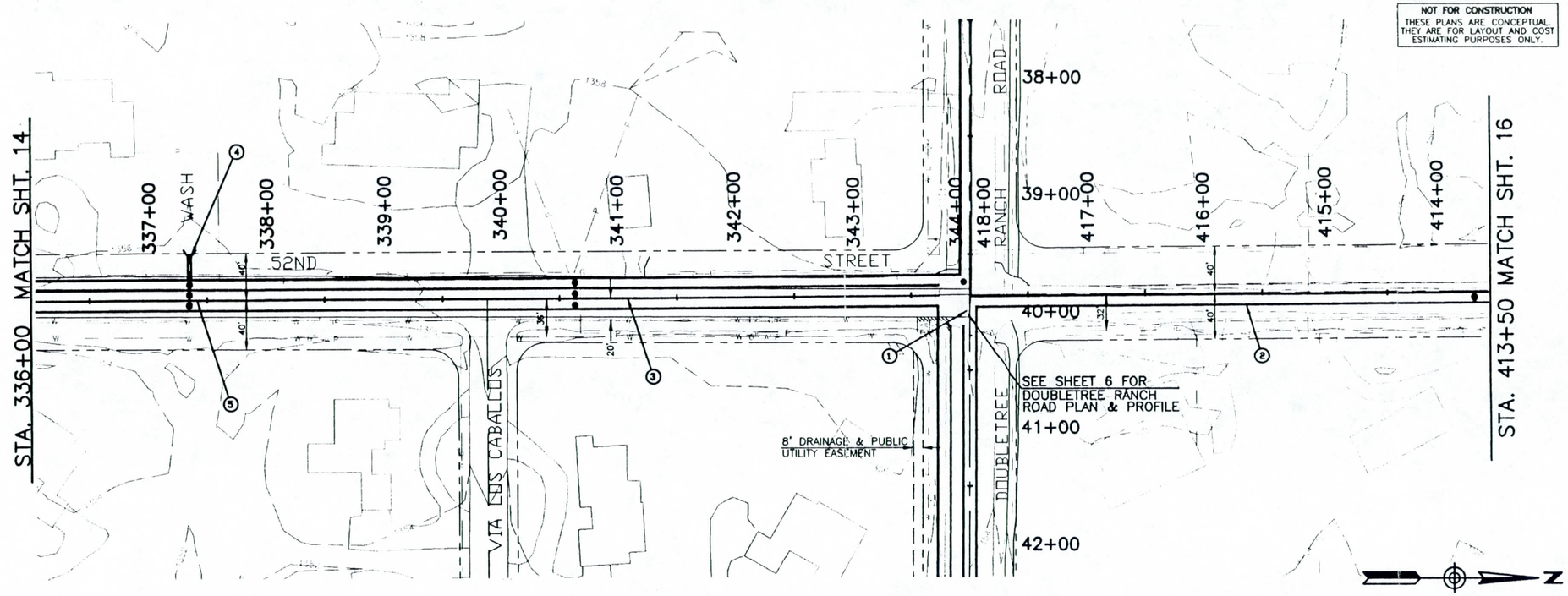
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM B. SNARR Date Signed 3-27-97 ARIZONA, U.S.A.

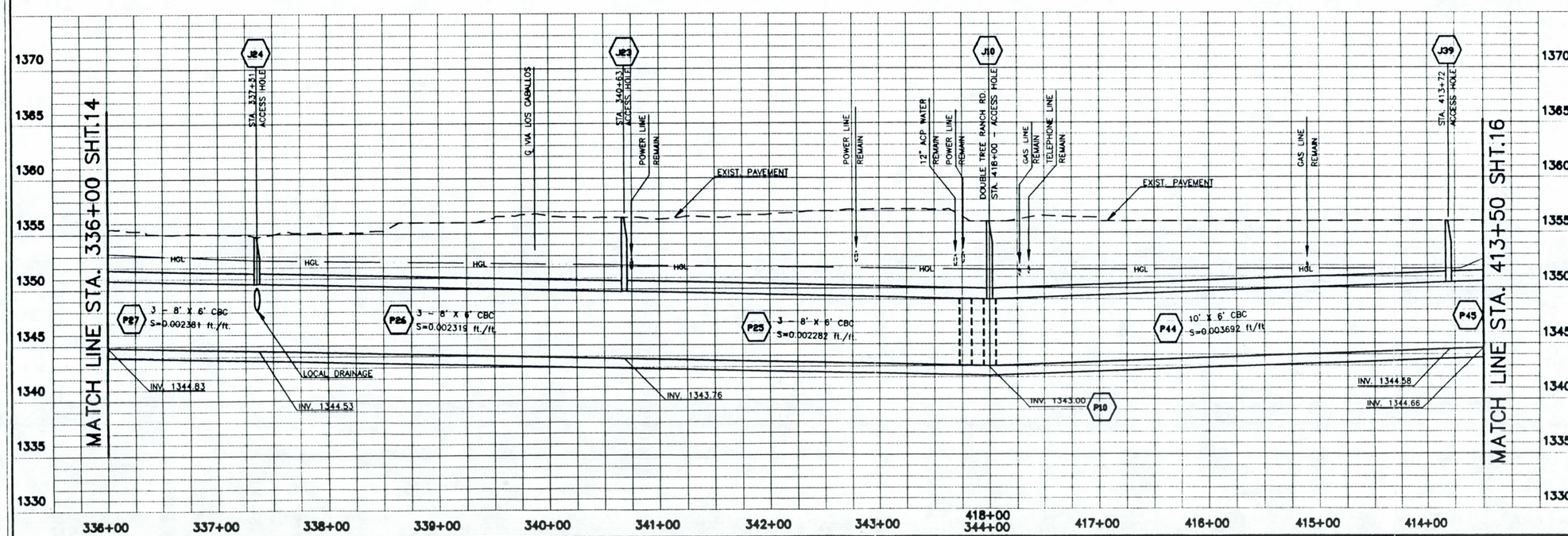
SHEET 14 OF 28

2878\DWG\SHEETS\SHEET-14 Fri 16:21:14 1997 Plotted by JAN

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	15	28	

NOT FOR CONSTRUCTION
THESE PLANS ARE CONCEPTUAL. THEY ARE FOR LAYOUT AND COST ESTIMATING PURPOSES ONLY.





1 JUNCTION STRUCTURE

2 10' X 6' CBC

3 3 - 8' X 6' CBC

4 LOCAL DRAINAGE

5 INLET EQUALIZATION PER DETAIL ON SHEET 13

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.
2011 E. BONITA DRIVE, PHOENIX, ARIZONA 85016
Tel (602) 955-2808 Fax (602) 955-9440

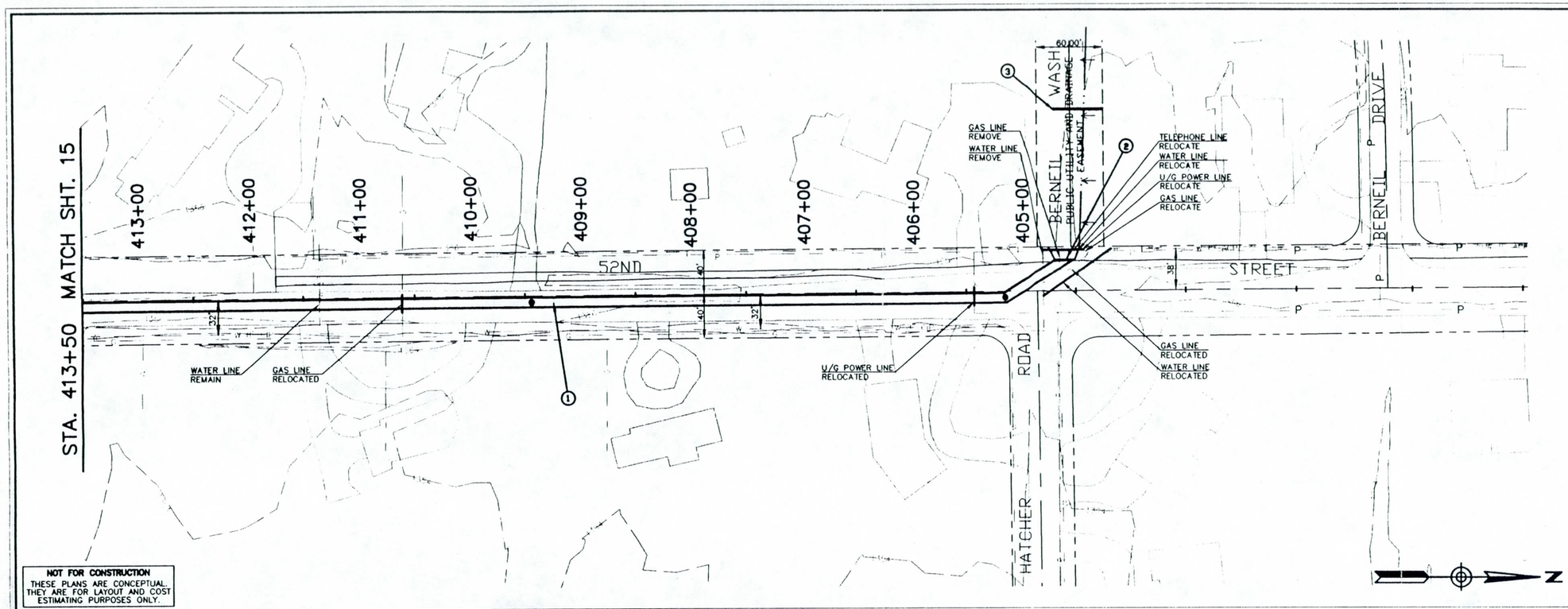
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 22211
WILLIAM S. SNAFR
Date Signed 3-7-97
ARIZONA U.S.A.

SHEET 15 OF 28

2878\DWG\SHEETS\SHEET-15 Fri Mar 7 17:51:28 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	16	28	

1. 10' X 6' CBC
2. SPECIAL IMPROVED CULVERT INLET W/ CHILD RESISTANT TRASH RACK
3. GRADE CONTROL DROP STRUCTURE



NOT FOR CONSTRUCTION
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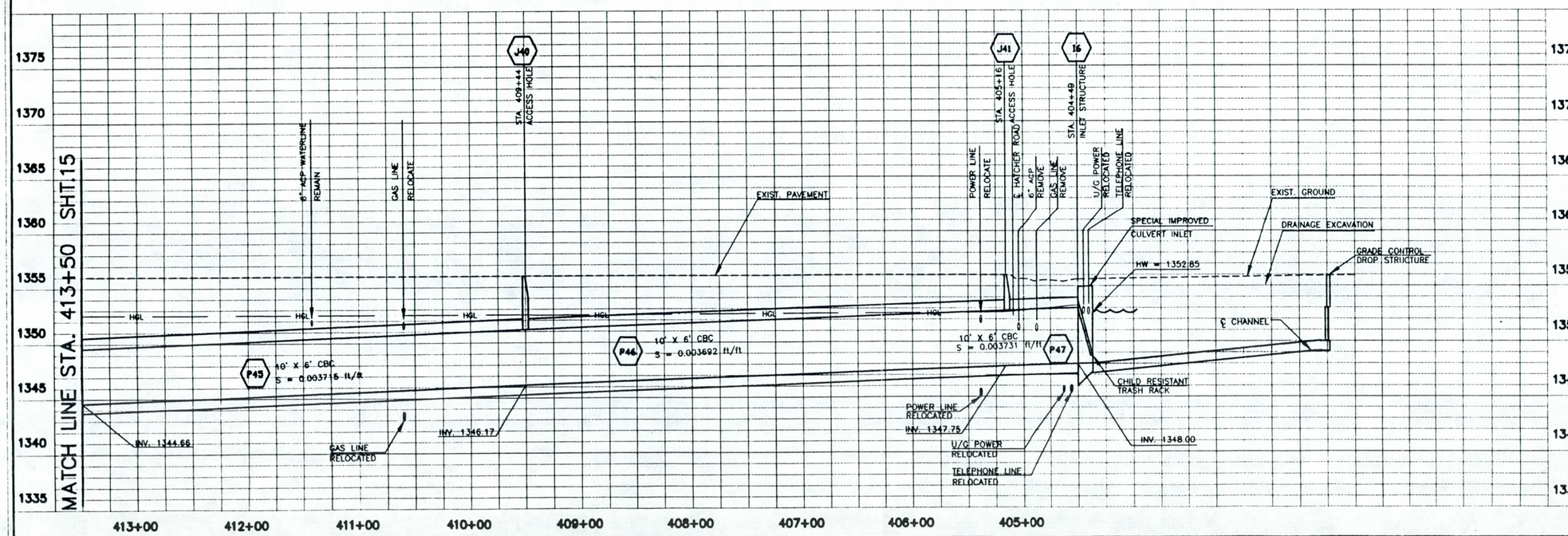


LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

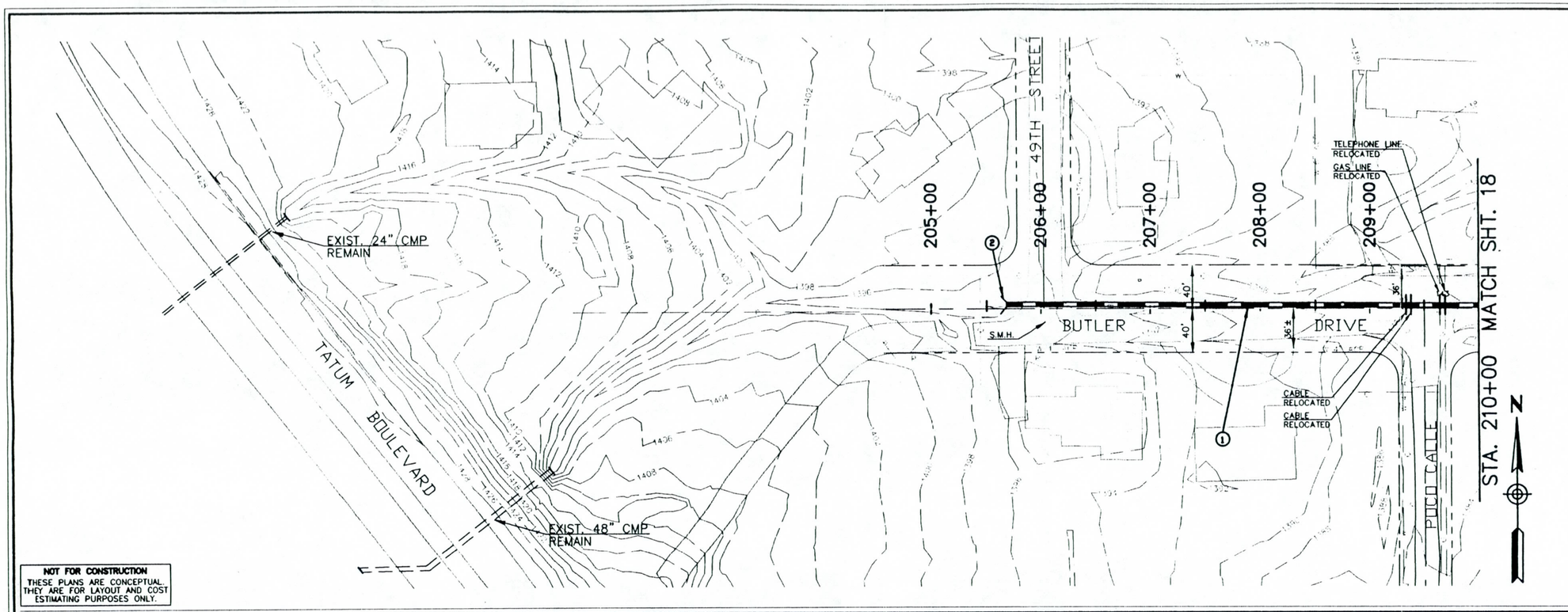
HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM B. SHAFER Date Signed 3-24-97 ARIZONA, U.S.A.

SHEET 16 OF 28

978\DWG\SHEETS\SHEET-16 Fri May 2 20:15:46 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	17	28	



NOT FOR CONSTRUCTION
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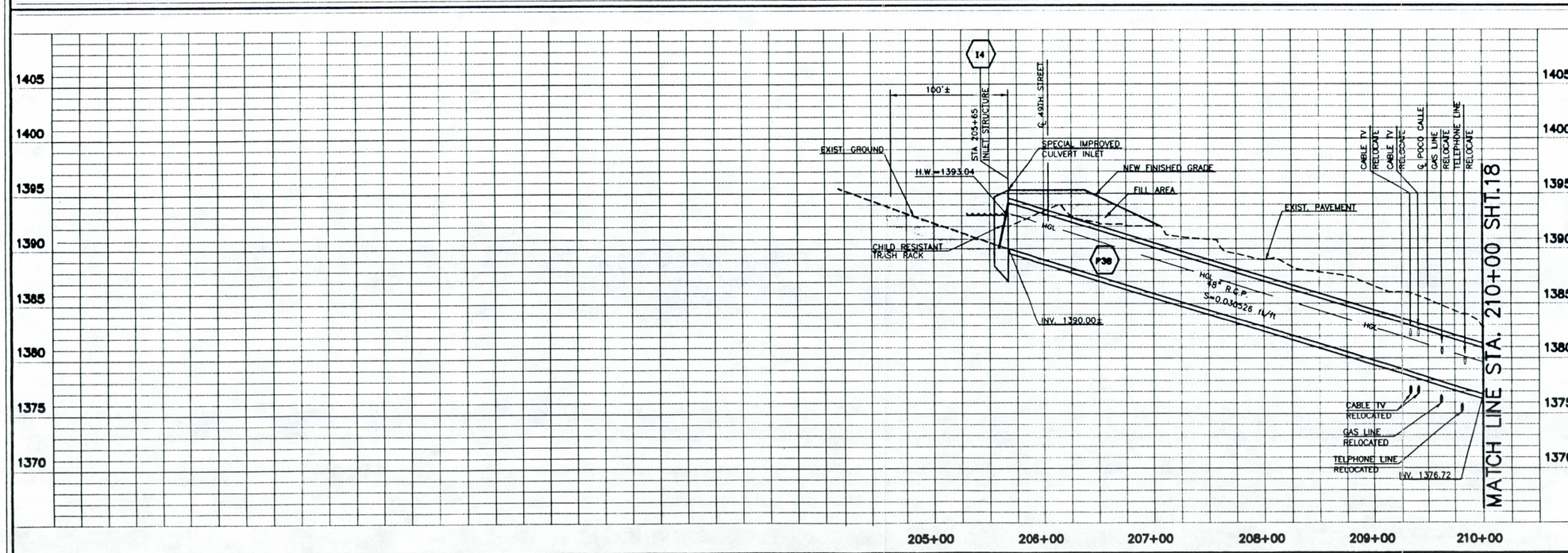


① 48" RCP

② INLET PIPE WITH INLET STRUCTURE

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

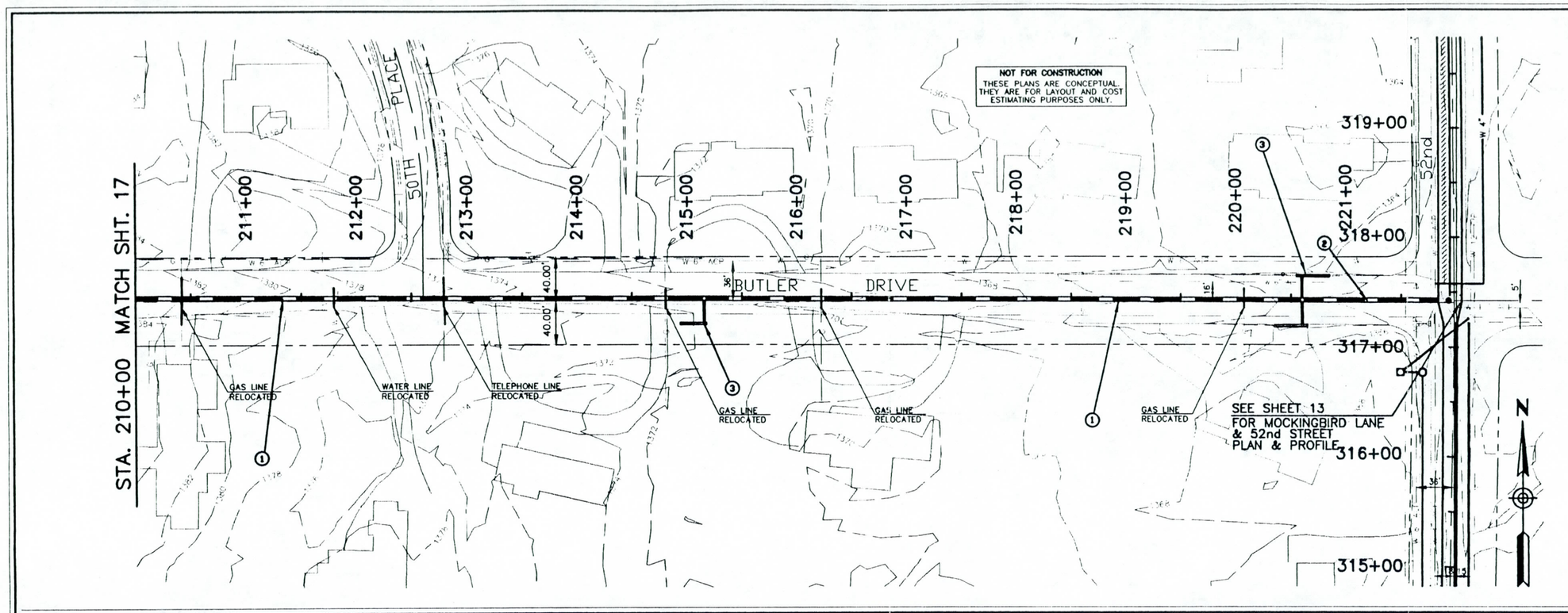
Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM B. SNARR Date Signed 3-21-97 ARIZONA, U.S.A.

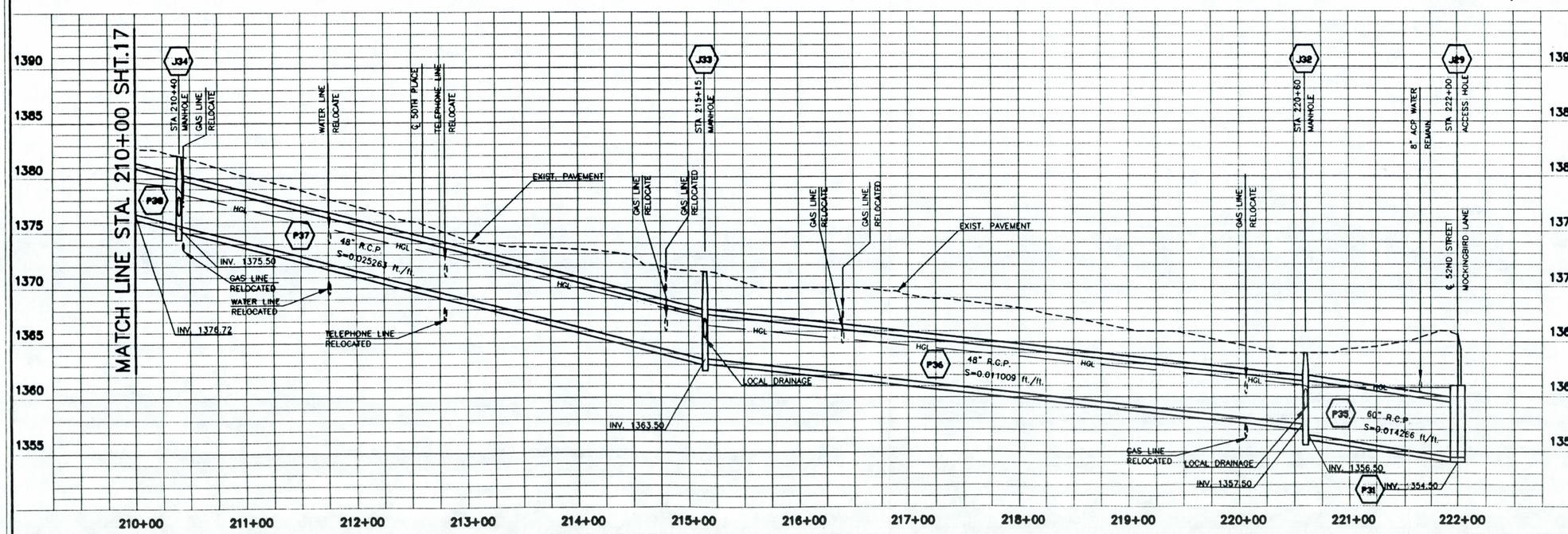
SHEET 17 OF 28

370\DWG\SHEETS\SHEET-17 Fri 0:18:41 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ	2878	18	28	

① 48" RCP
② 60" RCP
③ LOCAL DRAINAGE





LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
- UNDERGROUND POWER
- WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 25 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

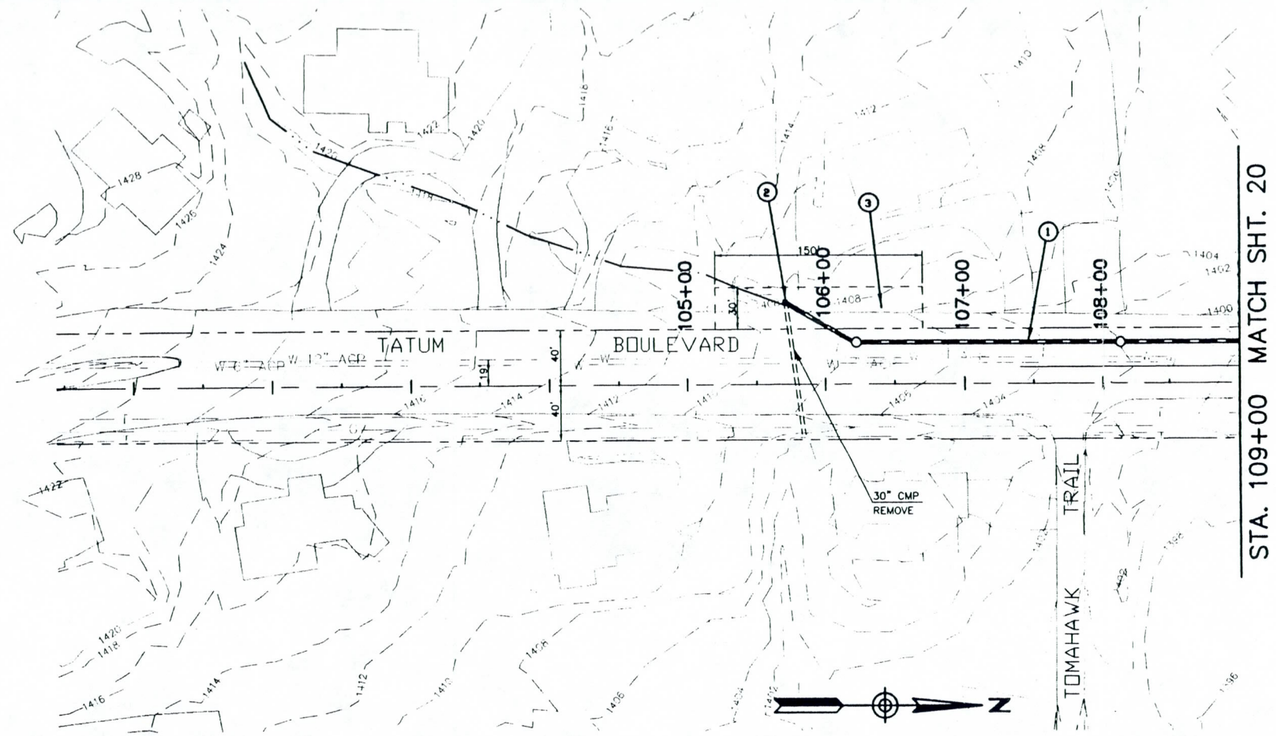
MARICOPA COUNTY, ARIZONA
CERTIFICATE NO. 22211
WILLIAM S. SNARR
Date Expires 3-31-97
ARIZONA, U.S.A.

SHEET 18 OF 28

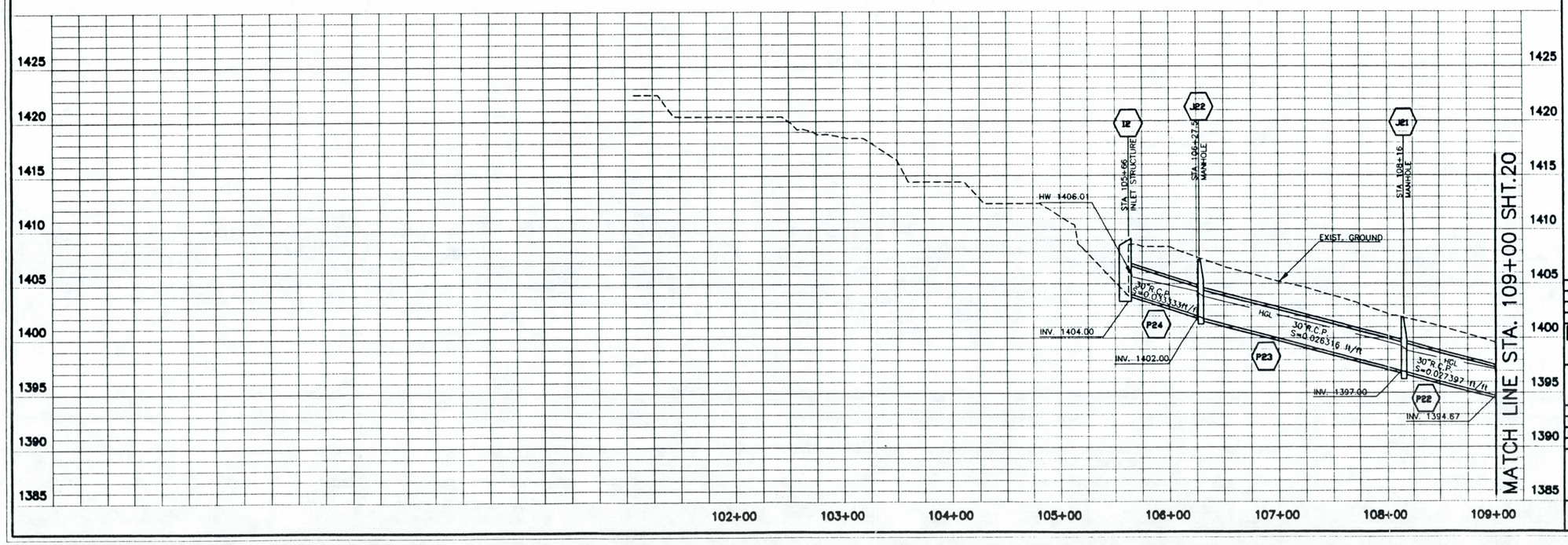
2878\DWG\SHEETS\SHEET-18 Fri 10:18:21 1997 Plotted by Jim

COUNTY	STATE	PROJECT NO	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ	2878	19	28	

1. 30" RCP
2. CULVERT INLET WITH TRASH RACK
3. TEMPORARY CONSTRUCTION EASEMENT



NOT FOR CONSTRUCTION
THESE PLANS ARE CONCEPTUAL. THEY ARE FOR LAYOUT AND COST ESTIMATING PURPOSES ONLY.



LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
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- HGL — HYDRAULIC GRADE LINE
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

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1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

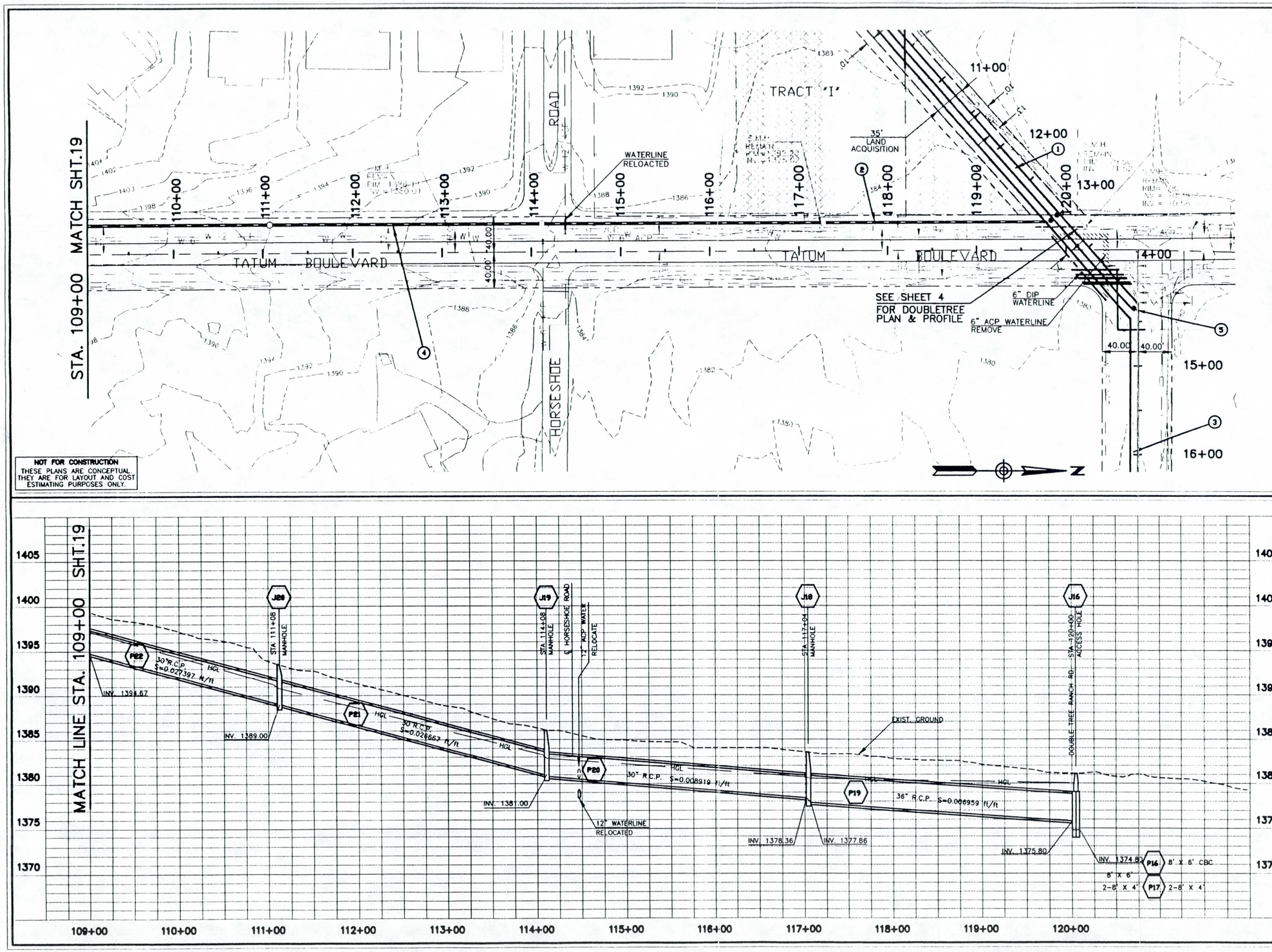
HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 22211
WILLIAM S. SHAFER
Date Signed 3-27-97
ARIZONA, U.S.A.

SHEET 19 OF 28

2878\DWG\SHEETS\SHEET-19 Fri 16:31:56 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	20	28	



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1. 2-8' X 4' CBC
2. 36" RCP
3. 8' X 6' CBC
4. 30" RCP
5. TRANSITION STRUCTURE

LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
- GAS LINE
- TELEPHONE
- OVERHEAD POWER
- SANITARY SEWER
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GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

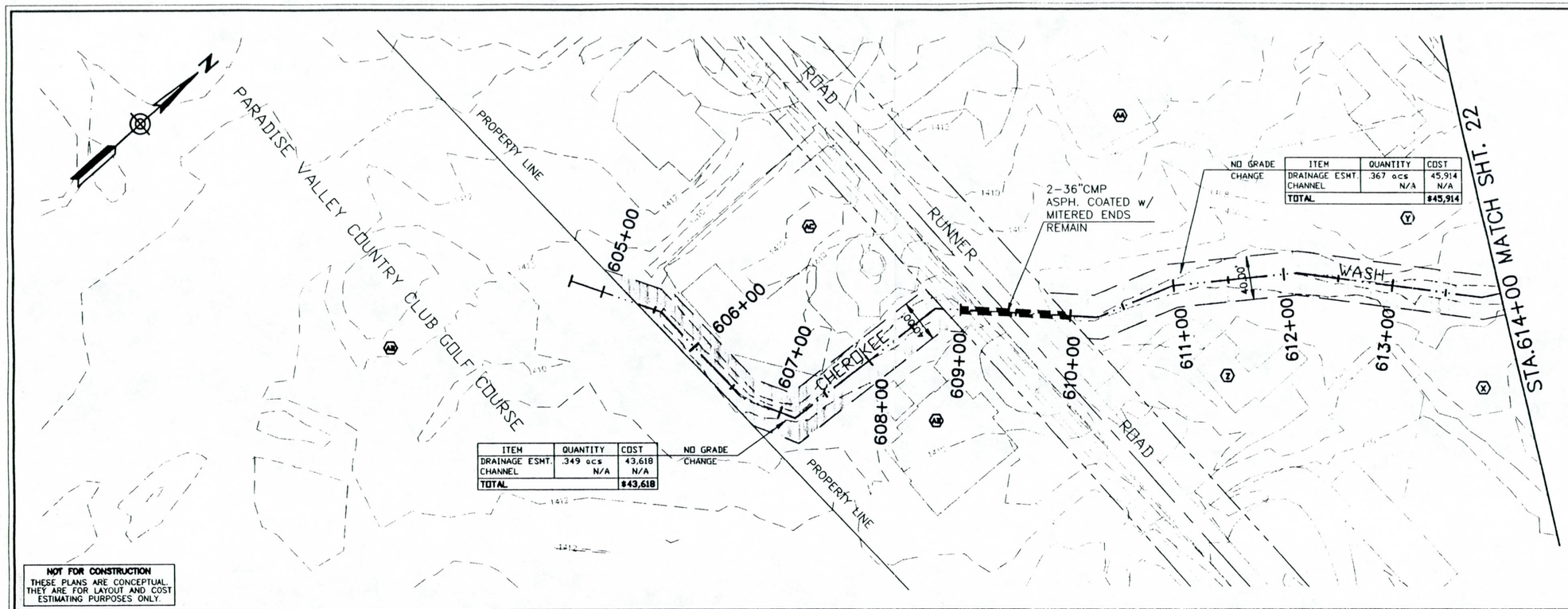
HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER CERTIFICATE NO. 32211 WILLIAM R. SNARR DATE Signed 3-31-97 ARIZONA, U.S.A.

SHEET 20 OF 28

878\DWG\SHEETS\SHEET-20 Fri 16:31:01 1997 Plotted by GARRETT

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	21	28	



ITEM	QUANTITY	COST
DRAINAGE ESMT.	.349 acs	43,618
CHANNEL	N/A	N/A
TOTAL		$43,618

NO GRADE CHANGE

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.367 acs	45,914
CHANNEL	N/A	N/A
TOTAL		$45,914

NOT FOR CONSTRUCTION
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DRAINAGE EASEMENT

- (X) M.C.A.P.N. 169-07-52
- (Y) M.C.A.P.N. 169-07-53
- (Z) M.C.A.P.N. 169-07-5B
- (AA) M.C.A.P.N. 169-07-4A
- (AB) M.C.A.P.N. 169-07-27
- (AC) M.C.A.P.N. 169-07-28
- (AD) M.C.R. BK.70 PG.47

LEGEND

- EXISTING DRAINAGE EASEMENT
- REQUIRED DRAINAGE EASEMENT
- C — CABLE TV
- G — GAS LINE
- TELEPHONE
- OE — OVERHEAD POWER
- S — SANITARY SEWER
- P — UNDERGROUND POWER
- W — WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- L — LEFT TOP OF BANK
- R — RIGHT TOP OF BANK
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

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1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
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(IN FEET)
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NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM S. SHAPIRO Date Signed 3-4-97 ARIZONA, U.S.A.

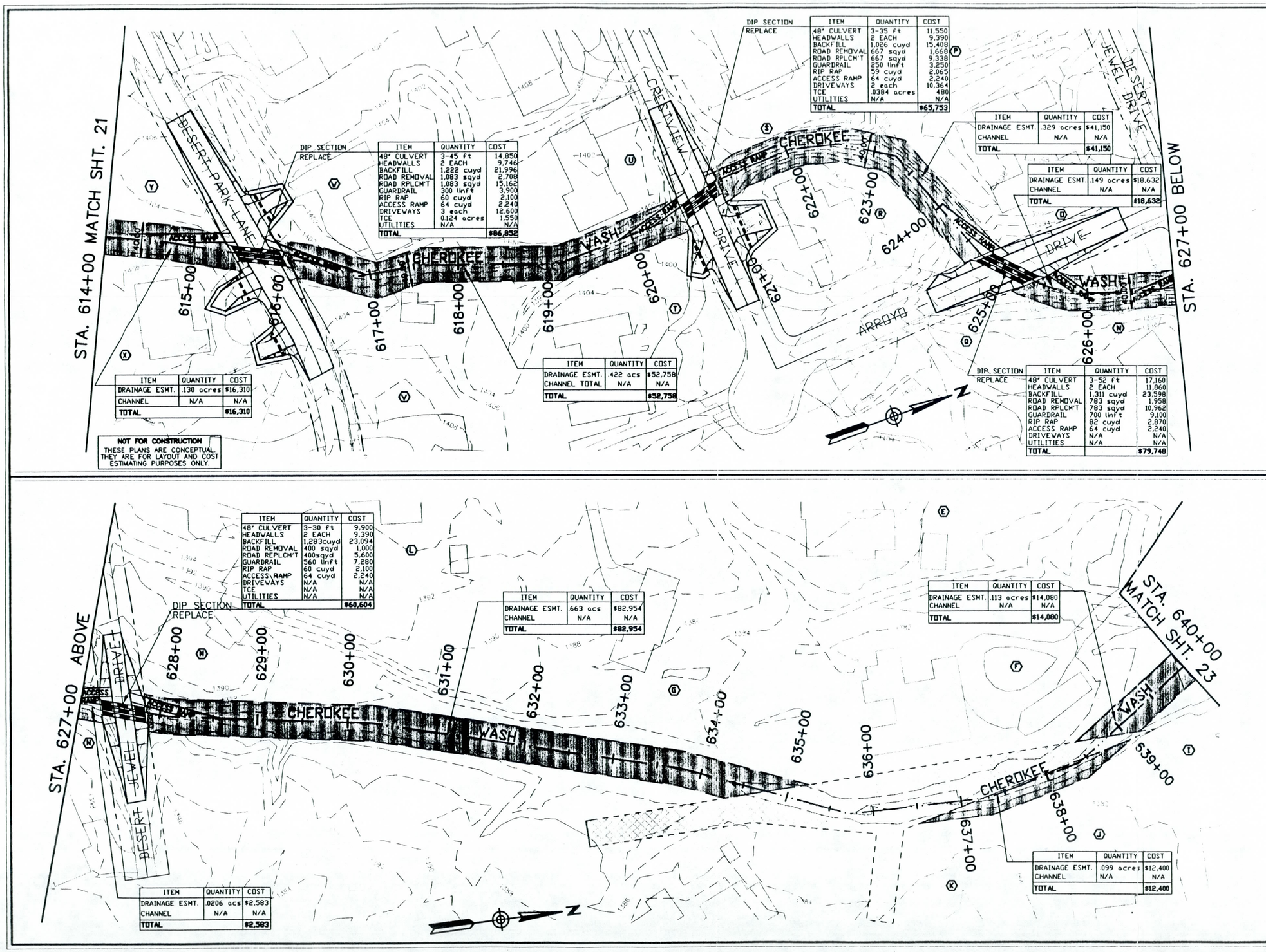
SHEET 21 OF 28

:970\DWG\SHEETS\SHEET-21 Fri 7:37:53 1997 Plotted by JMB

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ	2878	22	28	

DRAINAGE EASEMENT

N	M.C.A.P.N. 169-07-71	U	M.C.A.P.N. 169-07-66
O	M.C.A.P.N. 169-07-72	V	M.C.A.P.N. 169-07-48
P	M.C.A.P.N. 169-07-73	W	M.C.A.P.N. 169-07-47
Q	M.C.A.P.N. 169-07-70	X	M.C.A.P.N. 169-07-52
R	M.C.A.P.N. 169-07-84	Y	M.C.A.P.N. 169-07-53
S	M.C.A.P.N. 169-07-83		
T	M.C.A.P.N. 169-07-67		



ITEM	QUANTITY	COST
DRAINAGE ESMT.	.130 acres	$16,310
CHANNEL	N/A	N/A
TOTAL		$16,310

DIP SECTION REPLACE

ITEM	QUANTITY	COST
48" CULVERT	3-45 ft	14,850
HEADWALLS	2 EACH	9,746
BACKFILL	1,222 cuyd	21,996
ROAD REMOVAL	1,083 sqyd	2,708
ROAD RPLCM'T	1,083 sqyd	15,162
GUARDRAIL	300 linft	3,900
RIP RAP	60 cuyd	2,100
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	3 each	12,600
TCE	0.124 acres	1,550
UTILITIES	N/A	N/A
TOTAL		$86,852

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.422 acs	$52,758
CHANNEL TOTAL	N/A	N/A
TOTAL		$52,758

DIP SECTION REPLACE

ITEM	QUANTITY	COST
48" CULVERT	3-35 ft	11,550
HEADWALLS	2 EACH	9,390
BACKFILL	1,026 cuyd	15,408
ROAD REMOVAL	667 sqyd	1,668
ROAD RPLCM'T	667 sqyd	9,338
GUARDRAIL	250 linft	3,250
RIP RAP	59 cuyd	2,065
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	2 each	10,364
TCE	.0384 acres	480
UTILITIES	N/A	N/A
TOTAL		$65,753

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.329 acres	$41,150
CHANNEL	N/A	N/A
TOTAL		$41,150

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.149 acres	$18,632
CHANNEL	N/A	N/A
TOTAL		$18,632

DIP SECTION REPLACE

ITEM	QUANTITY	COST
48" CULVERT	3-52 ft	17,160
HEADWALLS	2 EACH	11,860
BACKFILL	1,311 cuyd	23,598
ROAD REMOVAL	783 sqyd	1,958
ROAD RPLCM'T	783 sqyd	10,962
GUARDRAIL	700 linft	9,100
RIP RAP	82 cuyd	2,870
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	N/A	N/A
UTILITIES	N/A	N/A
TOTAL		$79,748

DIP SECTION REPLACE

ITEM	QUANTITY	COST
48" CULVERT	3-30 ft	9,900
HEADWALLS	2 EACH	9,390
BACKFILL	1,283cuyd	23,094
ROAD REMOVAL	400 sqyd	1,000
ROAD REPLCM'T	400sqyd	5,600
GUARDRAIL	560 linft	7,280
RIP RAP	60 cuyd	2,100
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	N/A	N/A
TCE	N/A	N/A
UTILITIES	N/A	N/A
TOTAL		$60,604

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.663 acs	$82,954
CHANNEL	N/A	N/A
TOTAL		$82,954

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.113 acres	$14,080
CHANNEL	N/A	N/A
TOTAL		$14,080

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.099 acres	$12,400
CHANNEL	N/A	N/A
TOTAL		$12,400

ITEM	QUANTITY	COST
DRAINAGE ESMT.	.0206 acs	$2,583
CHANNEL	N/A	N/A
TOTAL		$2,583

LEGEND

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- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
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- O — OVERHEAD POWER
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- P — UNDERGROUND POWER
- W — WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- L — LEFT TOP OF BANK
- R — RIGHT TOP OF BANK
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

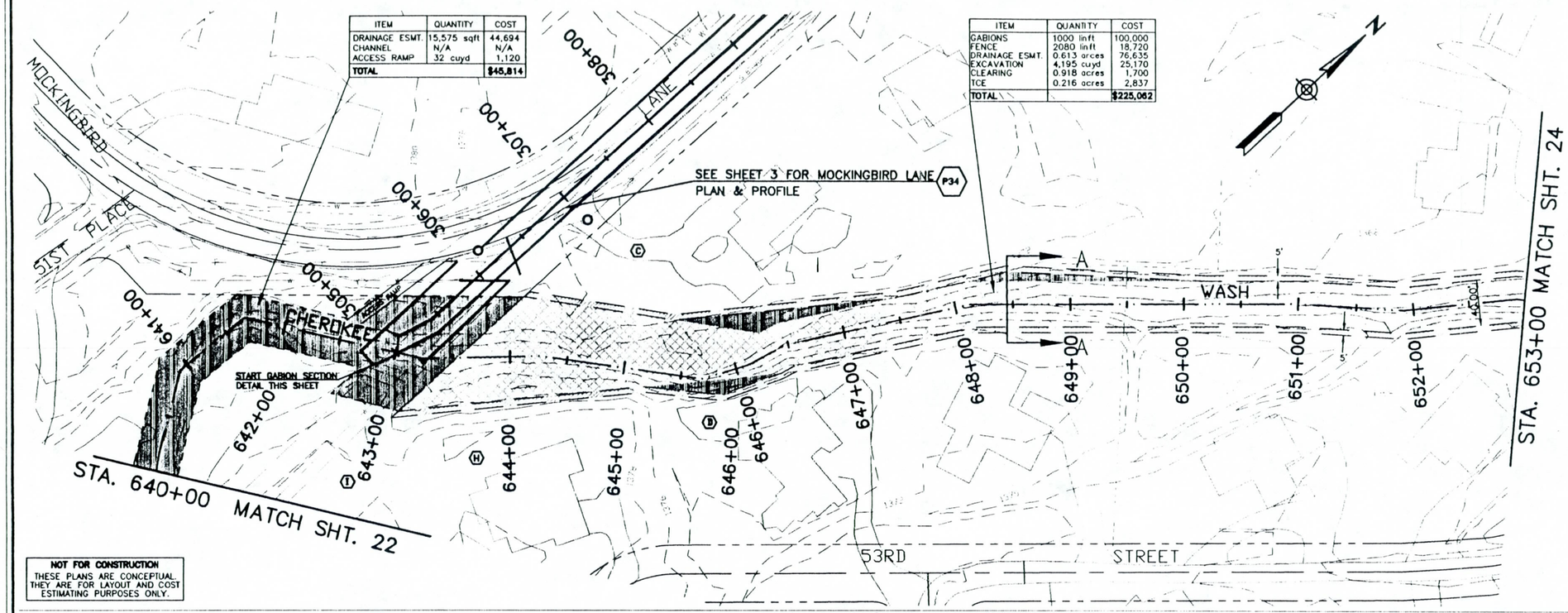
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM S. SHAFER Date Signed 3-31-97 ARIZONA, U.S.A.

SHEET 22 OF 28

8781\DWG\SHEETS\SHEET-22 Fri M 2:26:47 1997 Plotted by Pat

ITEM	QUANTITY	COST
DRAINAGE ESMT.	15,575 sqft	44,694
CHANNEL	N/A	N/A
ACCESS RAMP	32 cuyd	1,120
TOTAL		$45,814

ITEM	QUANTITY	COST
GABIONS	1000 linft	100,000
FENCE	2080 linft	18,720
DRAINAGE ESMT.	0.613 acres	76,635
EXCAVATION	4,195 cuyd	25,170
CLEARING	0.918 acres	1,700
TCE	0.216 acres	2,837
TOTAL		$225,062



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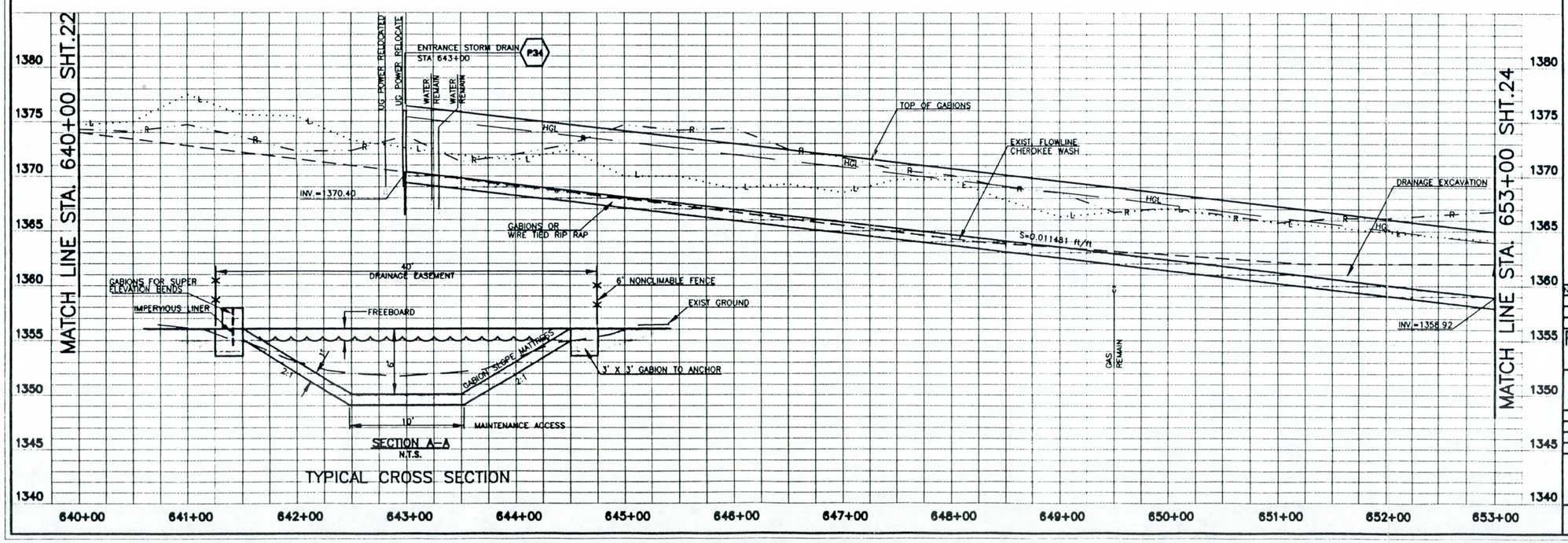

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	23	28	

DRAINAGE EASEMENT

- (C) M.C.A.P.N. 168-66-002
- (D) M.C.A.P.N. 168-74-9A
- (H) M.C.A.P.N. 168-66-14A
- (I) M.C.A.P.N. 168-75-003

LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
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- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- L — LEFT TOP OF BANK
- R — RIGHT TOP OF BANK
- MANHOLE
- ACCESS HOLE
- P36 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B	12/96
CHECKED	J.S	3/97

HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM S. SHAFER Date Signed 3-28-97 ARIZONA, U.S.A.

SHEET 23 OF 28

2878\DWG\SHEETS\SHEET-23 Fri 20:26:19 1997 Plotted by Dennis

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	24	28	

DRAINAGE EASEMENT

(A) M.C.A.P.N. 168-65-040

(B) M.C.A.P.N. 168-65-041

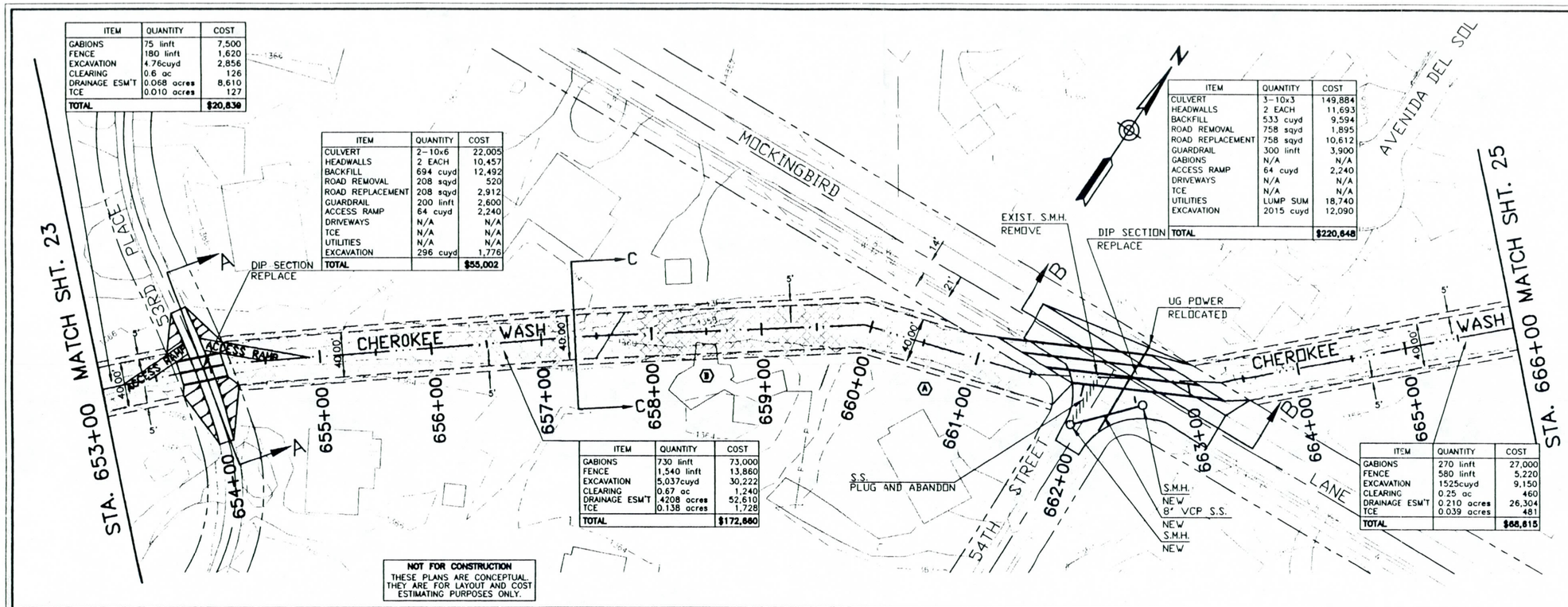
ITEM	QUANTITY	COST
GABIONS	75 linft	7,500
FENCE	180 linft	1,620
EXCAVATION	4.76cuyd	2,856
CLEARING	0.6 ac	126
DRAINAGE ESM'T	0.068 acres	8,610
TCE	0.010 acres	127
TOTAL		$20,839

ITEM	QUANTITY	COST
CULVERT	2-10x6	22,005
HEADWALLS	2 EACH	10,457
BACKFILL	694 cuyd	12,492
ROAD REMOVAL	208 sqyd	520
ROAD REPLACEMENT	208 sqyd	2,912
GUARDRAIL	200 linft	2,600
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	N/A	N/A
TCE	N/A	N/A
UTILITIES	N/A	N/A
EXCAVATION	296 cuyd	1,776
TOTAL		$55,002

ITEM	QUANTITY	COST
CULVERT	3-10x3	149,884
HEADWALLS	2 EACH	11,693
BACKFILL	533 cuyd	9,594
ROAD REMOVAL	758 sqyd	1,895
ROAD REPLACEMENT	758 sqyd	10,612
GUARDRAIL	300 linft	3,900
GABIONS	N/A	N/A
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	N/A	N/A
TCE	N/A	N/A
UTILITIES	LUMP SUM	18,740
EXCAVATION	2015 cuyd	12,090
TOTAL		$220,648

ITEM	QUANTITY	COST
GABIONS	730 linft	73,000
FENCE	1,540 linft	13,860
EXCAVATION	5,037cuyd	30,222
CLEARING	0.67 ac	1,240
DRAINAGE ESM'T	.4208 acres	52,610
TCE	0.138 acres	1,728
TOTAL		$172,660

ITEM	QUANTITY	COST
GABIONS	270 linft	27,000
FENCE	580 linft	5,220
EXCAVATION	1525cuyd	9,150
CLEARING	0.25 ac	460
DRAINAGE ESM'T	0.210 acres	26,304
TCE	0.039 acres	481
TOTAL		$68,615



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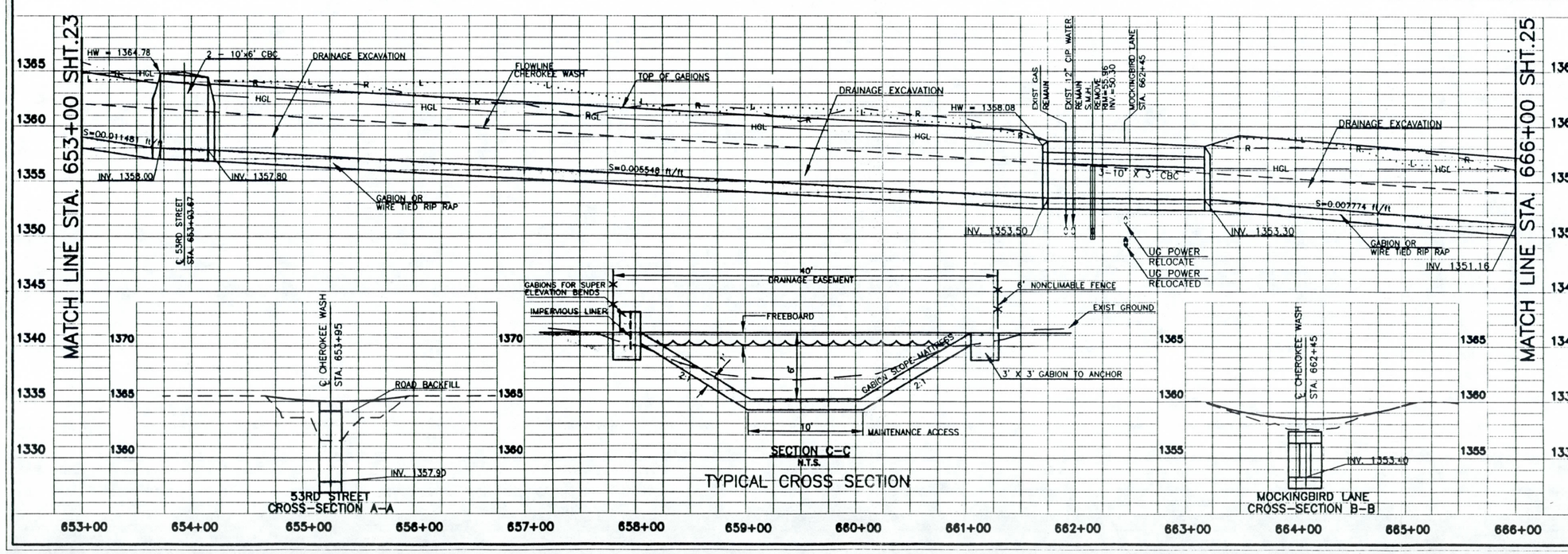

LEGEND

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- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- CABLE TV
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NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

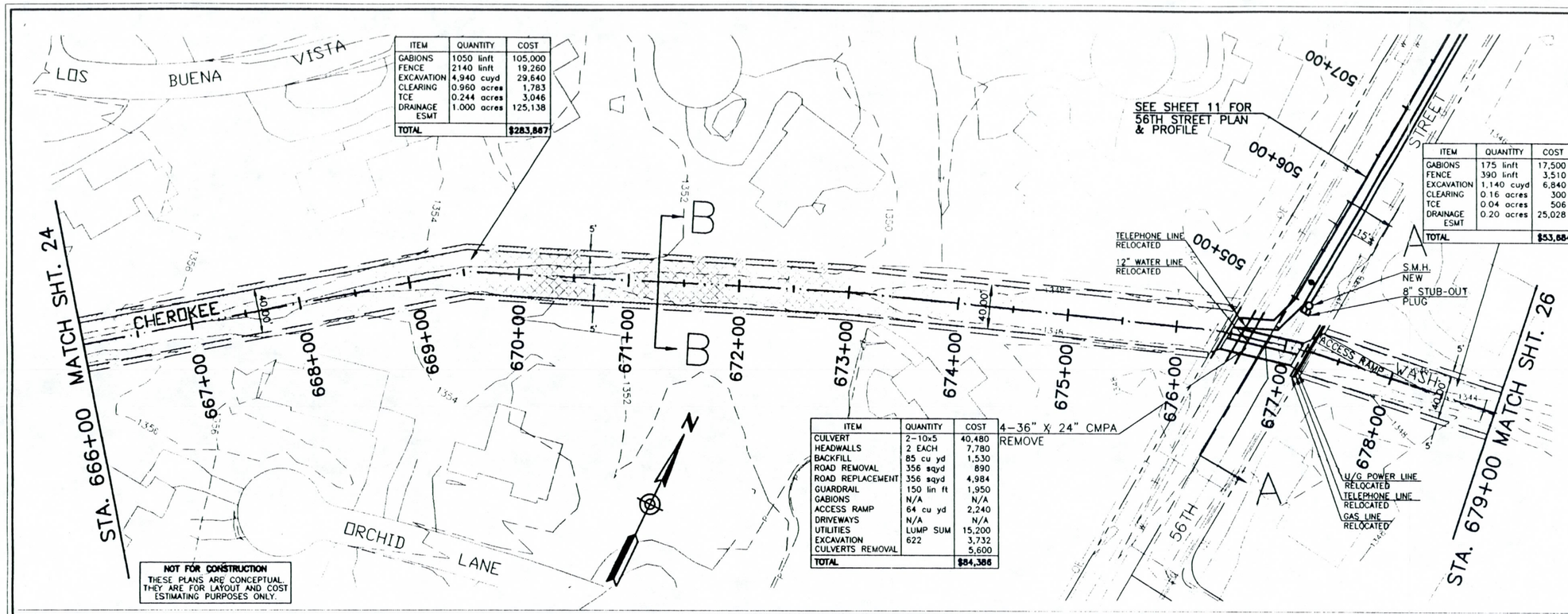
	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM S. SNARR Date Signed 3-21-97 ARIZONA, U.S.A.

:87D\DWG\SHEETS\SHEET-24 Fri Mar 10 05:02 1997 Plotted by Jam

COUNTY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	[illegible]
MARICOPA	AZ.	2878	25	28	



ITEM	QUANTITY	COST
GABIONS	1050 linft	105,000
FENCE	2140 linft	19,260
EXCAVATION	4,940 cuyd	29,640
CLEARING	0.960 acres	1,783
TCE	0.244 acres	3,046
DRAINAGE ESMT	1.000 acres	125,138
TOTAL		$283,867

ITEM	QUANTITY	COST
GABIONS	175 linft	17,500
FENCE	390 linft	3,510
EXCAVATION	1,140 cuyd	6,840
CLEARING	0.16 acres	300
TCE	0.04 acres	506
DRAINAGE ESMT	0.20 acres	25,028
TOTAL		$53,684

ITEM	QUANTITY	COST
CULVERT	2-10x5	40,480
HEADWALLS	2 EACH	7,780
BACKFILL	85 cu yd	1,530
ROAD REMOVAL	356 sqyd	890
ROAD REPLACEMENT	356 sqyd	4,984
GUARDRAIL	150 lin ft	1,950
GABIONS	N/A	N/A
ACCESS RAMP	64 cu yd	2,240
DRIVEWAYS	N/A	N/A
UTILITIES	LUMP SUM	15,200
EXCAVATION	622	3,732
CULVERTS REMOVAL		5,600
TOTAL		$84,386

NOT FOR CONSTRUCTION
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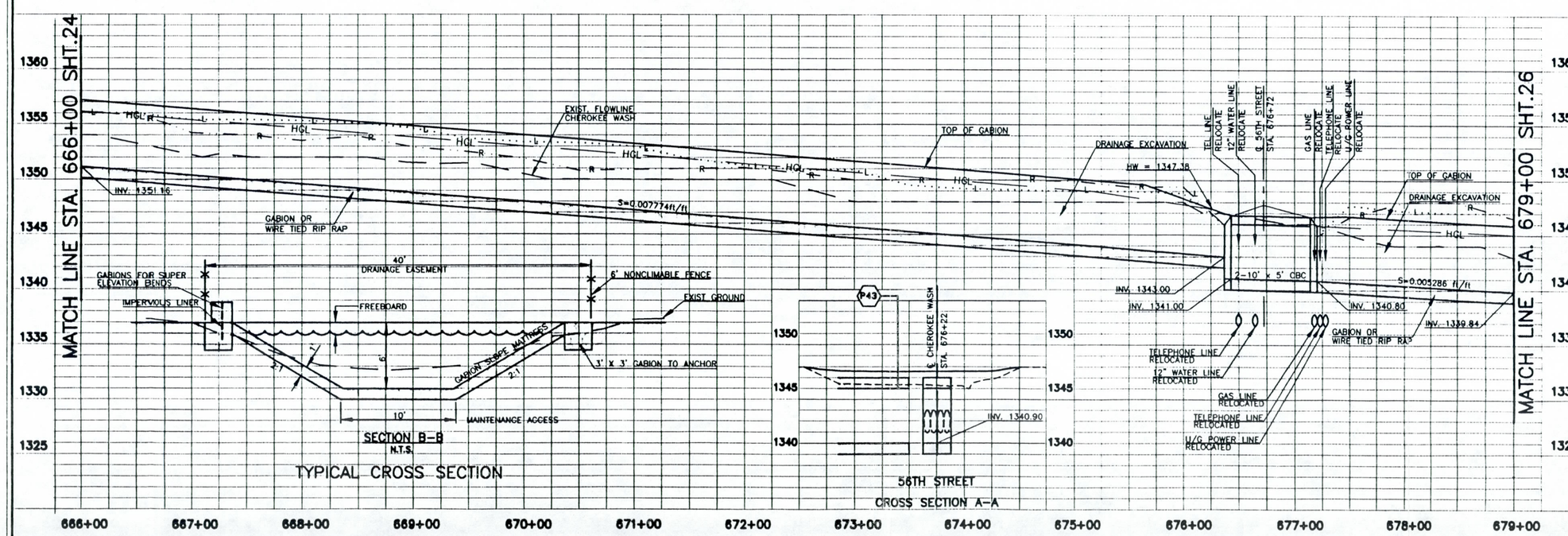


LEGEND

- EXISTING DRAINAGE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- REQUIRED DRAINAGE EASEMENT
- C — CABLE TV
- G — GAS LINE
- T — TELEPHONE
- OL — OVERHEAD POWER
- S — SANITARY SEWER
- UP — UNDERGROUND POWER
- W — WATER LINE
- PROPERTY LINE
- CENTER LINE
- CENTER LINE OF WASH
- HGL — HYDRAULIC GRADE LINE
- L — 20' LEFT TOP OF BANK
- R — 20' RIGHT TOP OF BANK
- MANHOLE
- ACCESS HOLE
- P36 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
100 50 25 0 50 100
(IN FEET)
1 inch = 50 ft.

NO	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

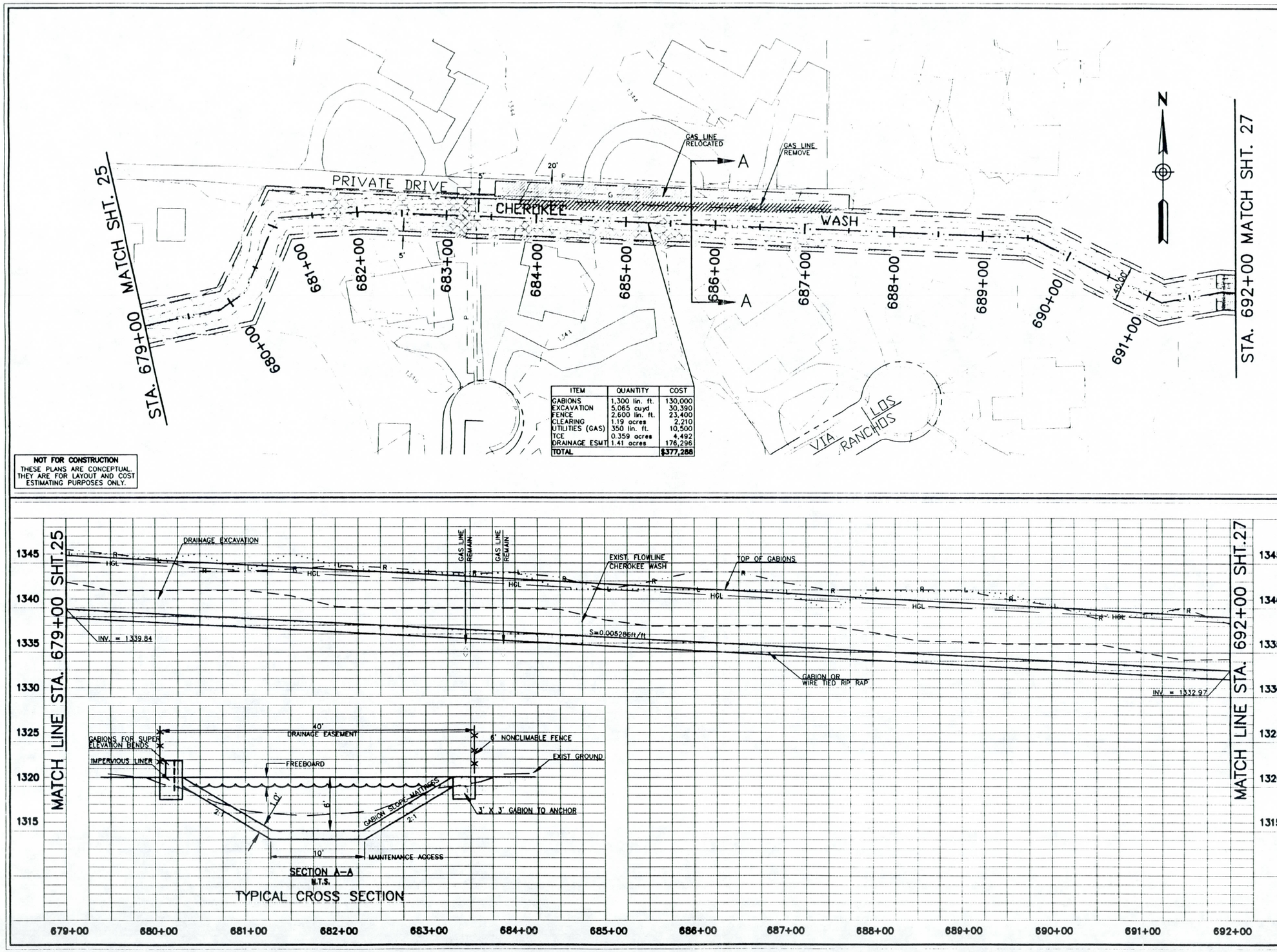
HOOK ENGINEERING, INC.

Registered Professional Engineer (Civil) CERTIFICATE NO. 22211 WILLIAM S. SNAPP Date Signed 3-3-97 ARIZONA, U.S.A.

SHEET 25 OF 28

2878\DWG\SHEETS\SHEET-25 Fri 20:26:50 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	26	28	



ITEM	QUANTITY	COST
GABIONS	1,300 lin. ft.	130,000
EXCAVATION	5,065 cu.yd	30,390
FENCE	2,600 lin. ft.	23,400
CLEARING	1.19 acres	2,210
UTILITIES (GAS)	350 lin. ft.	10,500
TCE	0.359 acres	4,492
DRAINAGE ESMT	1.41 acres	176,296
TOTAL		$377,288

NOT FOR CONSTRUCTION
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LEGEND

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- HGL — HYDRAULIC GRADE LINE
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- R — 20' RIGHT TOP OF BANK
- MANHOLE
- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
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VERT 1"=5'

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263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
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(IN FEET)
1 inch = 50 ft.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.
2911 E. ROSWELL ROAD, PHOENIX, ARIZONA 85016
Tel. (602) 955-3337 Fax (602) 955-3339

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 22211
WILLIAM S. SNAFR
DATE SIGNED 3-14-97
ARIZONA U.S.A.

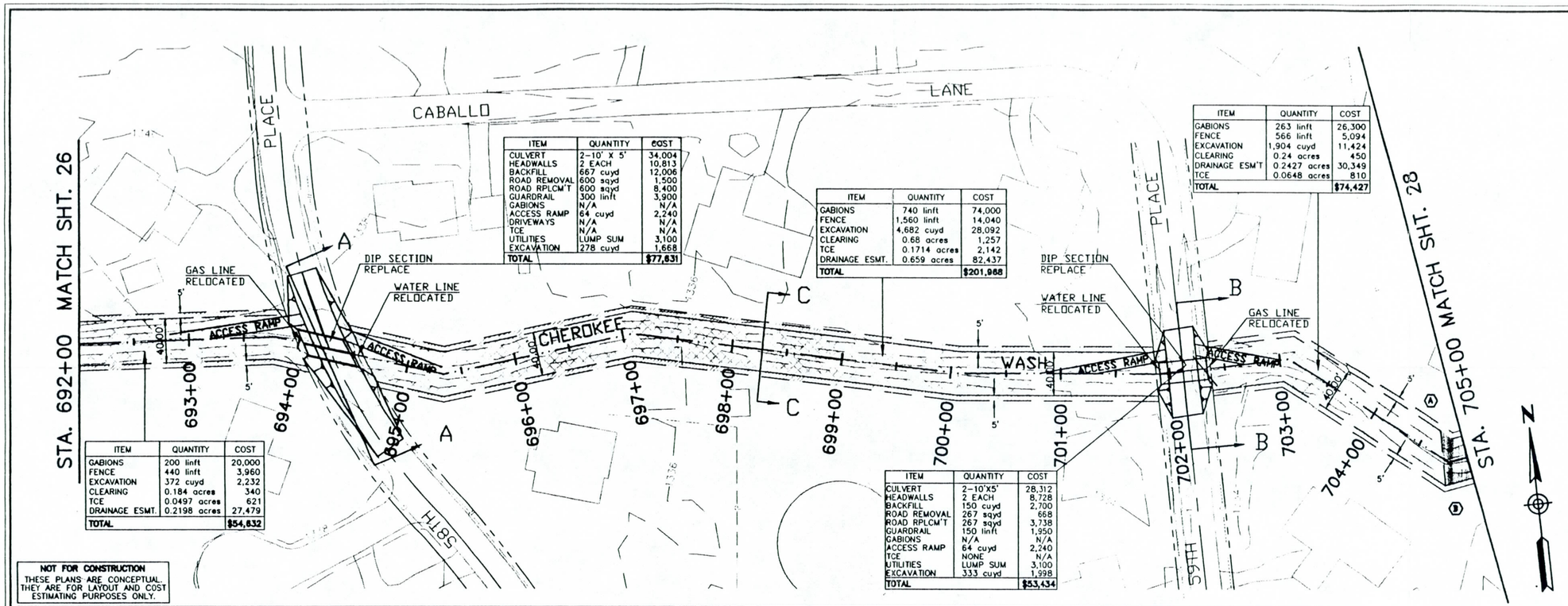
SHEET 26 OF 28

978\DWG\SHEETS\SHEET-26 Fri Mar 28 10:52:36 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	27	28	

DRAINAGE EASEMENT

(A) M.C.A.P.N. 168-59-1E
(B) M.C.A.P.N. 168-59-1G



ITEM	QUANTITY	COST
CULVERT	2-10' X 5'	34,004
HEADWALLS	2 EACH	10,813
BACKFILL	667 cuyd	12,006
ROAD REMOVAL	600 sqyd	1,500
ROAD RPLCM'T	600 sqyd	8,400
GUARDRAIL	300 linft	3,900
GABIONS	N/A	N/A
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	N/A	N/A
TCE	N/A	N/A
UTILITIES	LUMP SUM	3,100
EXCAVATION	278 cuyd	1,668
TOTAL		$77,831

ITEM	QUANTITY	COST
GABIONS	740 linft	74,000
FENCE	1,560 linft	14,040
EXCAVATION	4,682 cuyd	28,092
CLEARING	0.68 acres	1,257
TCE	0.1714 acres	2,142
DRAINAGE ESMT.	0.659 acres	82,437
TOTAL		$201,968

ITEM	QUANTITY	COST
GABIONS	263 linft	26,300
FENCE	566 linft	5,094
EXCAVATION	1,904 cuyd	11,424
CLEARING	0.24 acres	450
DRAINAGE ESM'T	0.2427 acres	30,349
TCE	0.0648 acres	810
TOTAL		$74,427

ITEM	QUANTITY	COST
GABIONS	200 linft	20,000
FENCE	440 linft	3,960
EXCAVATION	372 cuyd	2,232
CLEARING	0.184 acres	340
TCE	0.0497 acres	621
DRAINAGE ESMT.	0.2198 acres	27,479
TOTAL		$54,632

ITEM	QUANTITY	COST
CULVERT	2-10'X5'	28,312
HEADWALLS	2 EACH	8,728
BACKFILL	150 cuyd	2,700
ROAD REMOVAL	267 sqyd	668
ROAD RPLCM'T	267 sqyd	3,738
GUARDRAIL	150 linft	1,950
GABIONS	N/A	N/A
ACCESS RAMP	64 cuyd	2,240
TCE	NONE	N/A
UTILITIES	LUMP SUM	3,100
EXCAVATION	333 cuyd	1,998
TOTAL		$53,434

NOT FOR CONSTRUCTION
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LEGEND

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- CENTER LINE OF WASH
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- ACCESS HOLE
- P56 — REPORT SCHEMATIC NO.

SCALE
HORIZ 1"=50'
VERT 1"=5'

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

GRAPHIC SCALE
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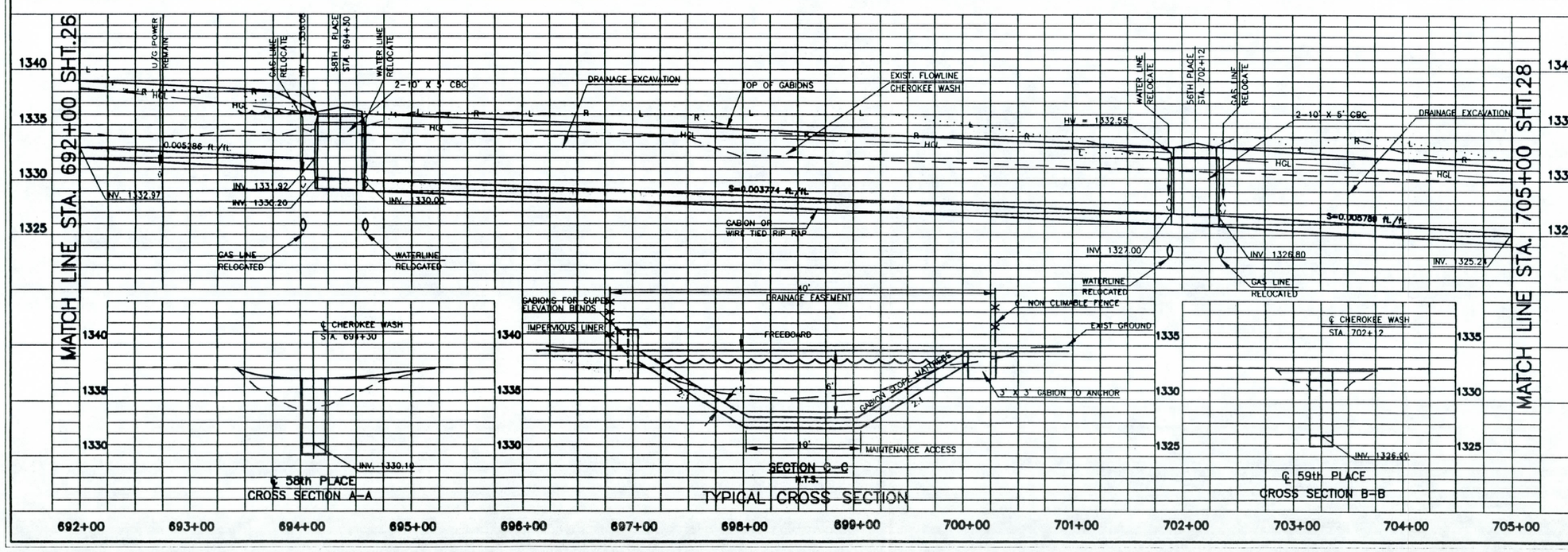


NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 22211 WILLIAM S. SNARR Date Signed 3-4-97 ARIZONA U.S.A.

SHEET 27 OF 28

2878\DWG\SHEETS\SHEET-27 Fri 7:50:40 1997 Plotted by Pat

COUNTY	STATE	PROJECT NO.	SHEET	TOTAL SHEETS	AS BUILT
MARICOPA	AZ.	2878	28	28	

DRAINAGE EASEMENT

(A) M.C.A.P.N. 168-59-1E

(B) M.C.A.P.N. 168-59-1G

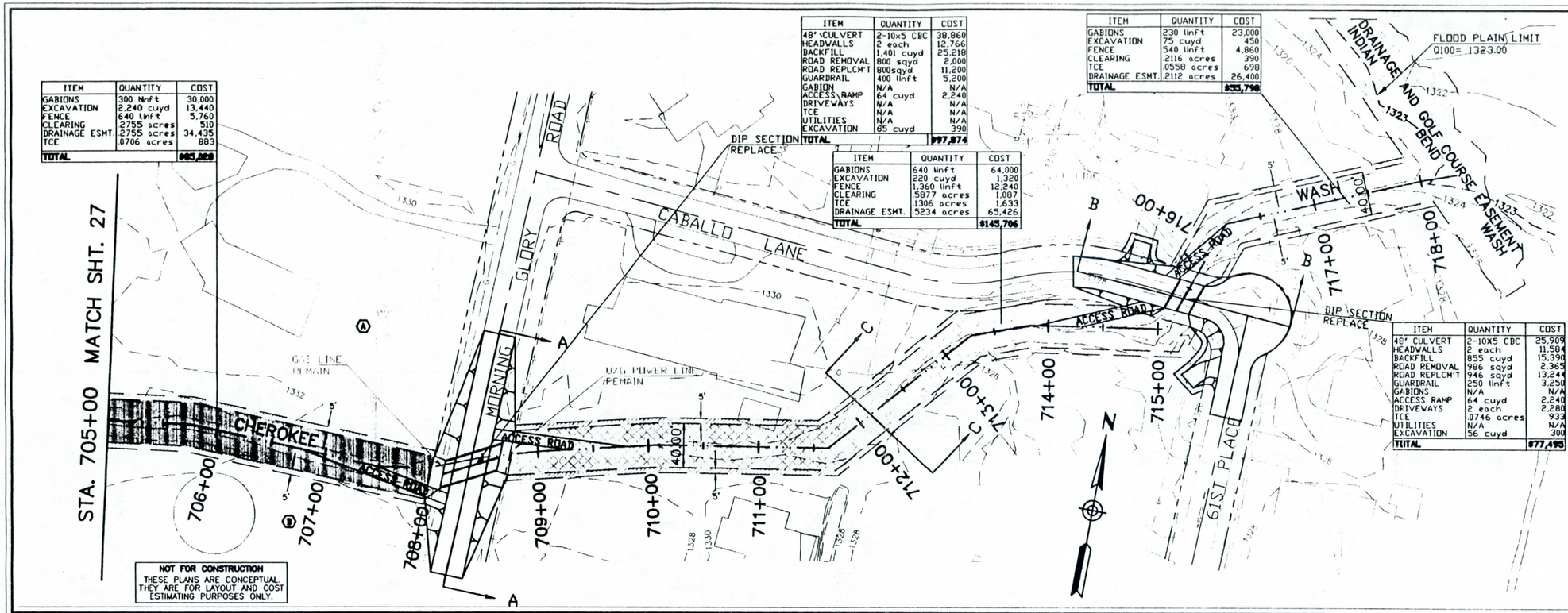
ITEM	QUANTITY	COST
GABIONS	300 linft	30,000
EXCAVATION	2,240 cuyd	13,440
FENCE	640 linft	5,760
CLEARING	.2755 acres	510
DRAINAGE ESMT.	.2755 acres	34,435
TCE	.0706 acres	883
TOTAL		$85,028

ITEM	QUANTITY	COST
48" CULVERT	2-10x5 CBC	38,860
HEADWALLS	2 each	12,766
BACKFILL	1,401 cuyd	25,218
ROAD REMOVAL	800 sqyd	2,000
ROAD REPLCM'T	800sqyd	11,200
GUARDRAIL	400 linft	5,200
GABION	N/A	N/A
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	N/A	N/A
TCE	N/A	N/A
UTILITIES	N/A	N/A
EXCAVATION	65 cuyd	390
TOTAL		$97,874

ITEM	QUANTITY	COST
GABIONS	640 linft	64,000
EXCAVATION	220 cuyd	1,320
FENCE	1,360 linft	12,240
CLEARING	.5877 acres	1,087
TCE	.1306 acres	1,633
DRAINAGE ESMT.	.5234 acres	65,426
TOTAL		$145,706

ITEM	QUANTITY	COST
GABIONS	230 linft	23,000
EXCAVATION	75 cuyd	450
FENCE	540 linft	4,860
CLEARING	.2116 acres	390
TCE	.0558 acres	698
DRAINAGE ESMT.	.2112 acres	26,400
TOTAL		$55,798

ITEM	QUANTITY	COST
48" CULVERT	2-10X5 CBC	25,909
HEADWALLS	2 each	11,584
BACKFILL	855 cuyd	15,390
ROAD REMOVAL	986 sqyd	2,365
ROAD REPLCM'T	946 sqyd	13,244
GUARDRAIL	250 linft	3,250
GABIONS	N/A	N/A
ACCESS RAMP	64 cuyd	2,240
DRIVEWAYS	2 each	2,280
TCE	.0746 acres	933
UTILITIES	N/A	N/A
EXCAVATION	56 cuyd	300
TOTAL		$77,495



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SCALE
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CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

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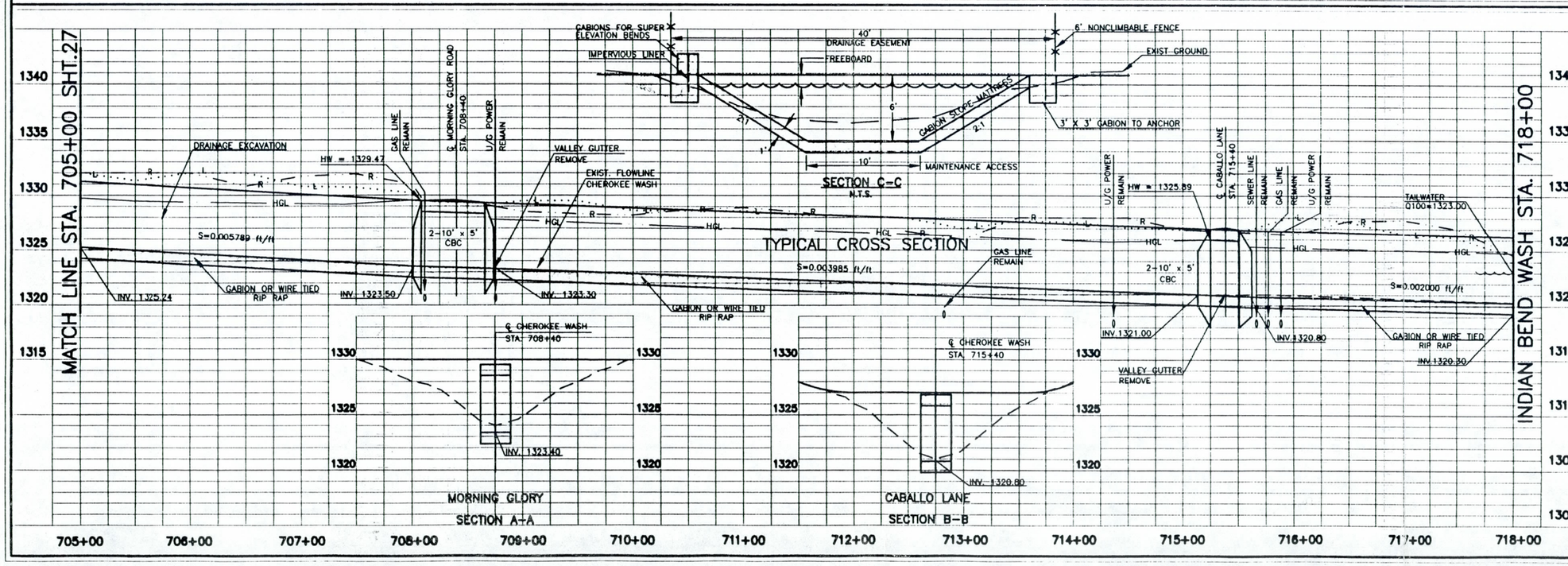

REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL STUDY

	NAME	DATE
DESIGN	W.S.S.	12/96
DRAWN	D.E.B.	12/96
CHECKED	J.S.	3/97

HOOK ENGINEERING, INC.

Registered Professional Engineer CERTIFICATE NO. 22211 WILLIAM S. SHAFER Date Signed 3-6-97 ARIZONA, U.S.A.

SHEET 28 OF 28

2878\DWG\SHEETS\SHEET-28 Fri 17:44:38 1997 Plotted by Pat