PRELIMINARY DESIGN REPORT

GILA DRAIN

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

APRIL 1979

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

EXHIBITS

EXHIBITS (continued)

TABLES

APPENDED MATERIALS

GENERAL DESCRIPTION

INTRODUCTION

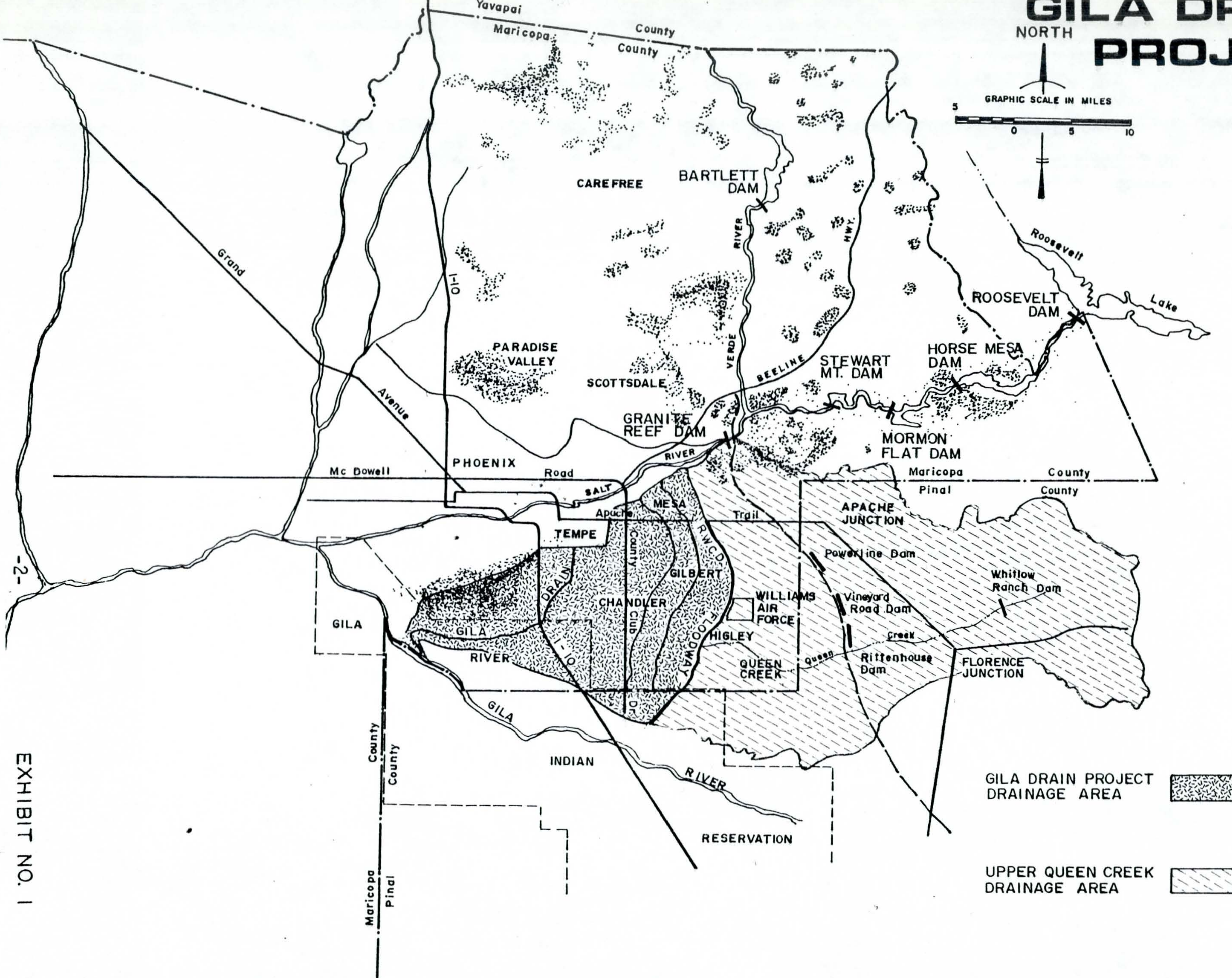
On August 14, 1978 the Board of Directors, Flood Control District of Maricopa County authorized the preparation of preliminary designs and right-of-way determination for the Gila Drain Project. Tentative definition of the Project was based, in general, upon Alternative Plan "B" as identified in the U.S. Army Corps of Engineers September 1977 report entitled "Summary Report for Flood Control - Gila Floodway, Maricopa and Pinal Counties, Arizona". Under this plan a major channel was proposed for the removal of the 100 year storm runoff originating within the Gila River Basin in the vicinities of the cities of Gilbert, Mesa, Tempe and Chandler and from parts of the Gila River Indian Reservation. The drainage area, covering nearly 163,000 acres, is shown on Exhibit No. 1.

The Board recognized the complex pattern of public administration within the drainage area (see Exhibit No. 2) wherein the management of future developments affecting flood runoff falls under the jurisdiction of one county, four city, and one Indian organizations. In addition, storm runoff patterns are strongly influenced by irrigation systems management in over 60 percent of the drainage area. To bring the project to fruition necessitates mutual agreement between responsible agencies. Thusly, the consultant was directed to initiate the preliminary investigation through meetings with selected representatives of the following organizations:

City of Chandler
City of Gilbert
City of Mesa
City of Tempe
Flood Control District of Maricopa County
Gila River Indian Community (GRIC)
Salt River Valley Water Users Association (SRVWUA)

Coordination and development of mutual understanding between communities was achieved through a series of four "Milestone Meetings" in which the consultant reviewed the studies progress in joint session with representatives of the above organizations.

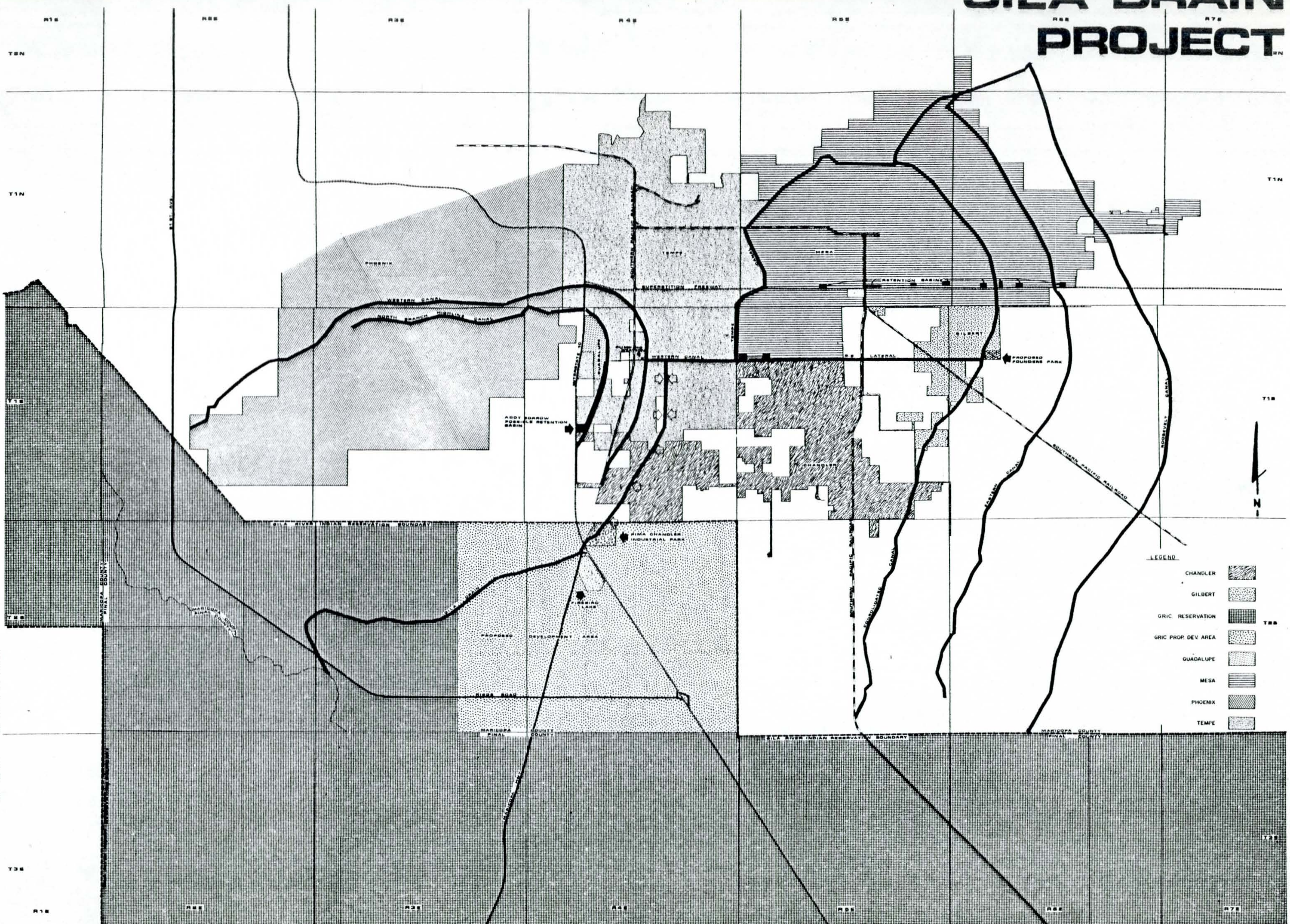
GILA DRAIN PROJECT



LOCATION MAP

EXHIBIT NO. 1

GILA DRAIN PROJECT



JURISDICTIONAL BOUNDARIES

EXHIBIT NO.2

SETTING

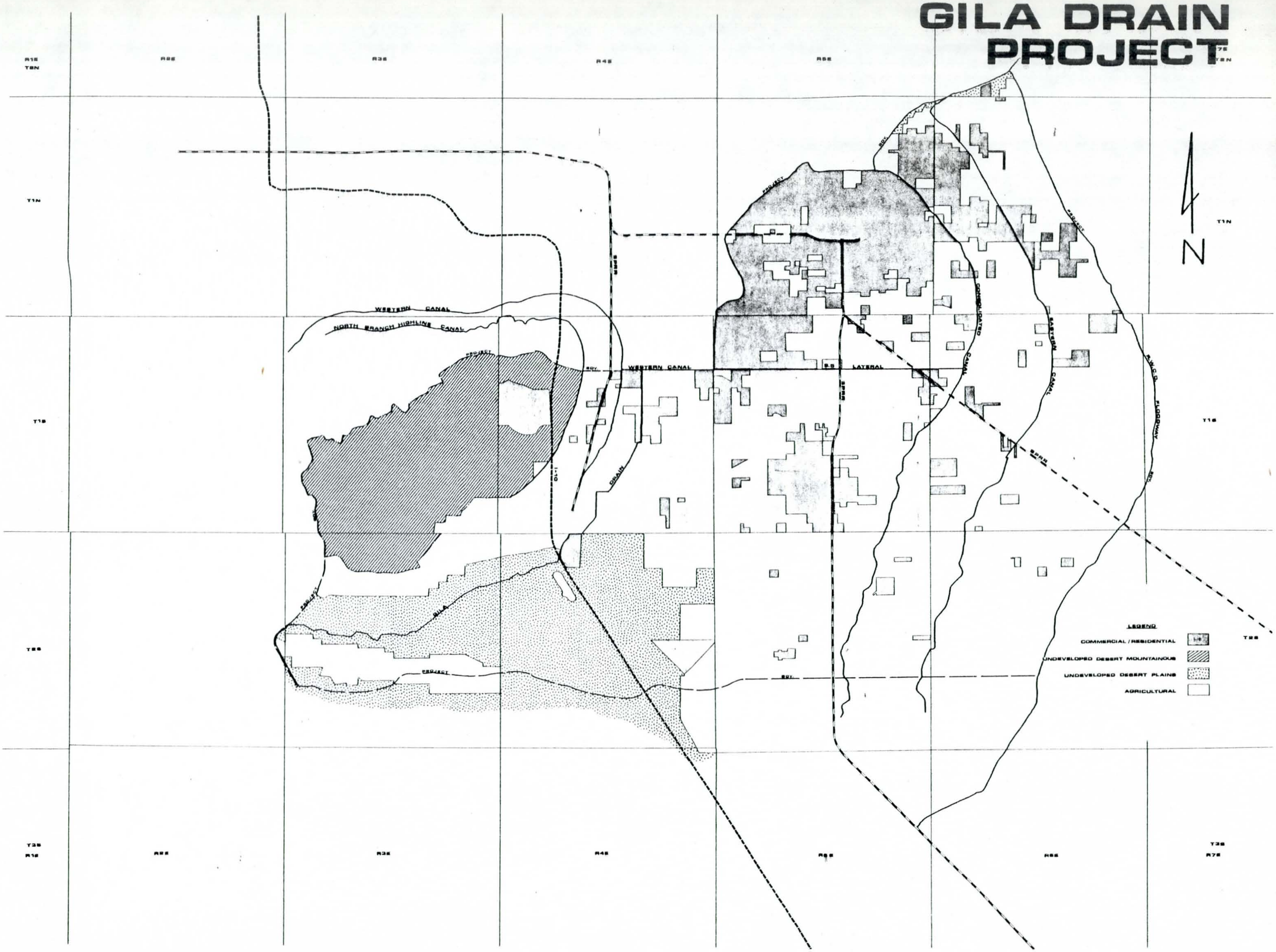
The rich lands and water resources of the Gila and Salt Rivers have been used by man for his welfare for a time span going back 3,000 to 5,000 years or more. Evidence of early use is readily observable throughout these valleys, in the form of canals, sherds and artifacts. Historic mention of irrigated agricultural settlements were first recorded by Spanish missionaries who ventured north from Mexico as early as 1539. First immigration by white men did not occur until the early 1800's. Trappers entered the area in the early 1820's. These were followed by the establishment of military posts and an influx of prospectors who moved into the Arizona Territory in the 1850's, but these were few in number.

Broad scale development of irrigated lands immediately followed the Civil War. The influx was rapid following the construction of the first "Swilling Ditch" in 1867. For example, in 1868 the population of Phoenix was only 100 residents but within the next two decades some 100,000 acres along the Salt River had been brought under irrigated agriculture. By the 1920's surface water resources were more-or-less fully committed and lateral expansion of the agricultural area diminished.

Early urban developments were mostly governed by the demands of the agricultural community itself with some demands coming from the state's mining and cattle industries. Most of the latter demand was satisfied by commercial and residential development in the Phoenix area which was close to the center of the state's government. In general, urbanization within the project area was governed by agricultural demands alone. This held true until the late 1940's.

Acceleration of urban development in the project area has occurred since the 1950's with first growths occurring as a string development eastward along both sides of Apache Boulevard. Recent expansion southward from the cities of Tempe and Mesa as well as spot developments in the Gilbert and Chandler areas give the appearance today of a broad "oasis" of irrigated agriculture upon which is superimposed a rapidly expanding metropolitan development (see Exhibit No. 3).

GILA DRAIN PROJECT



1978 LAND USE PATTERN

EXHIBIT NO. 3

The current status of land use within the project is shown in Table No. 1.

TABLE NO. 1 - 1978 Land Use and Potential Use for Undeveloped Areas (1)

	Public Lands (Acres)	Public Lands (%)	Indian Lands (Acres)	Indian Lands (%)	Total (Acres)	Total (%)
Development						
Agricultural (2)	89,370	54.83	10,370	6.36	99,740	61.19
Commercial/Residential	27,130	16.66	1,100	0.67	28,230	17.33
subtotal	116,500	71.49	11,470	7.03	127,970	78.52
Undeveloped Potential						
Agricultural (2)			18,070	11.09	18,070	11.09
Commercial/Residential	7,910	4.85	1,740	1.07	9,650	5.92
Desert Parklands	7,120	4.37	170	0.10	7,290	4.47
subtotal	15,030	9.22	19,980	12.26	35,010	21.48
TOTALS	131,530	80.71	31,450	19.29	162,980	100.00

(1) Based upon interpretation of 1978 aerial photographs as amended by GRIC's Letter of February 27, 1979.

(2) These agricultural lands are also potentially available for commercial and residential development.

The Drainage Area

The Gila Drain Project area lies within the westerly one-fourth of the Queen Creek subbasin of the Gila River. Before the drainage pattern was altered by man floodwaters from the entire 966 square mile subbasin flowed generally westward until it reached the Gila River through several desert wash stream beds. The confluences were strung out along the Gila River from Gila Butte to Komatke.

Canal and farm ditch construction associated with agricultural development along with the leveling of farmlands obliterated the natural drainage courses. Although dikes were constructed, they were occasionally overtopped damaging main canals, laterals and irrigation structures. Impoundment behind embankments forced floodwater to cross developed lands and to follow constructed floodways, irrigation ditches and roadways. Sediment deposition and water ponding caused some property and crop damage.

Implementation of controlled runoff in the Queen Creek subbasin was initiated in 1960 with the construction of Whitlow Ranch Dam by the U.S. Army Corps of Engineers. Additional control was instituted by the U.S. Soil Conservation

Service in the late 1960's when a series of three earth retention dams (see Table No. 2) were constructed on the upstream side of the Central Arizona Project "Salt-Gila" Aqueduct.

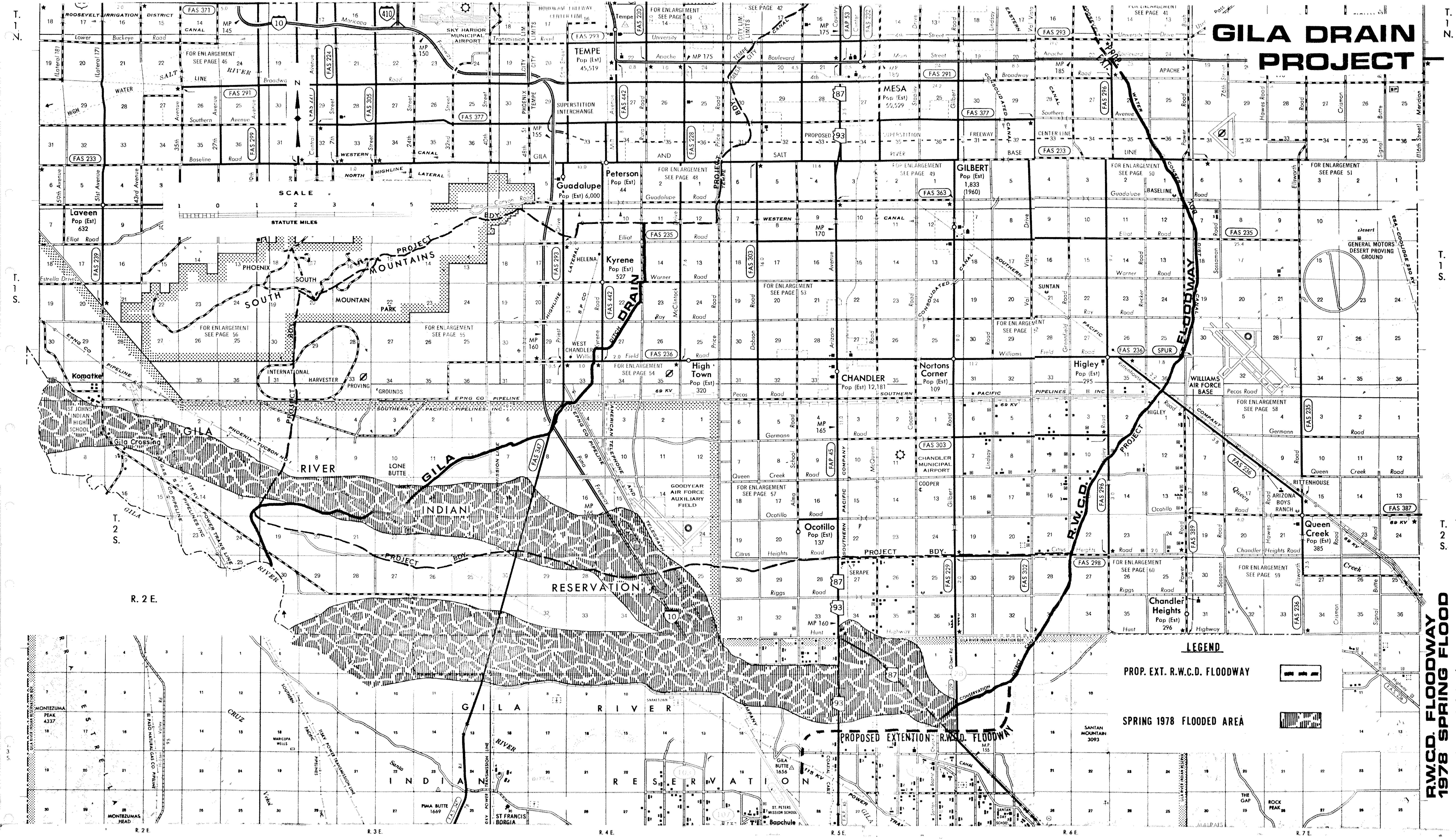
TABLE NO. 2 - Controlled Runoff in the Queen Creek Subbasin of the Gila River

Structure	Year Completed	Controlled Area (Square Miles)
Whitlow Ranch Dam	1960	143
Power Line Dam	1967	50
Vineyard Dam	1968	53
Rittenhouse Dam	1969	50
	TOTAL	296

Control of an additional 43 square miles by construction of the Queen Creek Dam has been authorized for study under the SCS program. Preconstruction foundation investigations have encountered low density soils raising questions as to the technical and economic feasibility of implementation. At the time of publication of this report this problem remains unresolved.

In 1968 the Roosevelt Water Conservation District constructed a channel and dike system along the eastern upstream side of the District's main canal in conjunction with irrigation systems improvements instituted under a U.S. Bureau of Reclamation Small Project Loan. Floodwaters from some 711 square miles (74 percent) of the subbasin is collected by this system and diverted to the south. The existing floodway terminates just upstream of the Southern Pacific Railroad and State Highway 87. No overtopping of these dikes have occurred since their construction.

In the spring of 1978, floodwaters diverted by the RWCD Floodway system inundated large areas of the GRIC Reservation causing considerable damage. The flooded area was well documented by aerial photography and is shown in Exhibit No. 4. Below the SPRR and State Highway floodwaters flow in a westerly direction onto an undeveloped desert area, then overland across the GRIC Reservation to the Gila River. Flows tend to spread over the desert and infiltrate into the ground with only the larger flood flows, such as those occurring in 1978, reaching the Gila River.



ARIZONA HIGHWAY DEPARTMENT
PHOTOGRAMMETRY AND MAPPING DIVISION

EXHIBIT NO. 4

Extension of the RWCD Floodway to the Gila River upstream from Gila Butte has been authorized and construction for the first phase has been funded for 1979.

The SCS project, as authorized, will protect the downstream part of the subbasin against the 100 year storm runoff originating in the upper basin. Without Queen Creek Dam this protection will be reduced to about a 35 year frequency storm. It is assumed, herein, that the Queen Creek Dam problem will be resolved and that the Gila Drain Project can be limited to the 211 square mile (22 percent) part of the subbasin that lies west of the RWCD Floodway as shown in Exhibit No. 1.

History of the Gila Drain

With the introduction of irrigation to the broad expanses of desert lands within the project, groundwater levels were rapidly increased. By the second decade of the 1900's crop production losses from inadequate drainage and salinization became a serious concern. To alleviate this problem the Tempe Irrigation Canal Company dug a ditch along the nadir of the subbasin formed by the steeper slopes of South Mountain on the west and the gently sloping lands on the east. This ditch, called the "Tempe Drain" ran generally south, then southwesterly to the GRIC Reservation.

Legal recognition of this drain appears in the September 20, 1917 Agreement between the "U.S. Government and Drainage District No. 1" (a private association) wherein rights-of-way for the drain through parts of Sections 4 and 5, T2S, R4E, G&SRB&M of the GRIC Reservation were defined. Termination of the drain was described as "the point of intersection of said drainage ditch... with the right-of-way of the Arizona Eastern Railroad,...".

On April 12, 1921 Drainage District No. 1 agreed with the SRVWUA to accept, in the drain, waters collected by the Association. Controversy arose between the U.S. Government and the District because of the increased discharge. As a result, an Agreement directly between the Government and the Association was reached on June 21, 1923 in which the right-of-way for the drain was extended from the Arizona Eastern Railroad to the Gila River. Design restrictions as to capacity (75 cubic feet per second) and a profile of a maximum water surface elevation was imposed in this agreement.

Local reference to the "Tempe Drain" is synonymous with "Gila Drain". The later title is the one commonly used by the SRVWUA. Rights to that part of the drain owned by the Tempe Irrigation Canal Company were purchased by the Association in 1923.

Recent Investigations

In June of 1973 a "Storm Drainage and Flood Control Study for Southeast Maricopa County" was completed by Boyle Engineering Corp. and L.H. Bell and Assoc. The study area conformed more-or-less to that of the Queen Creek subbasin of the Gila River. It described the upper subbasin Soil Conservation Service work plans. A mathematical hydrologic model, similar to the "TR-20 computer program for project formulation hydrology" used by the SCS, was developed for the lower subbasin in support of preliminary plans for an integrated collector system to discharge floodwaters through the Gila Drain. This system developed a 100 year storm peak discharge of 20,130 cubic feet per second at the proposed junction of the Gila Drain and Hunt Highway Floodway, 1973 Construction and rights-of-way costs for implementation of this system were identified.

In September 1977, the U.S. Army Corps of Engineers completed a "Summary Report for Flood Control - Gila Floodway - Maricopa and Pinal Counties, Arizona". In this study the feasibility of constructing measures additional to those under development by the SCS for conveyance of flood flows away from populated areas was studied. It was determined that:

> "Although the aggregate damages resulting from floods greater than the 100 year flood are large, the damages resulting from smaller floods are estimated to be small, thus the average annual flood damages are not large enough to justify structural solutions;...".

In this study the costs associated with the construction of a major channel to the Gila River (Plan "B") was estimated at $8,750,000. The peak 100 year storm discharge from the Gila Drain to the Gila River was estimated at 4,300 cubic feet per second.

Climate

The climate of the Gila Drain Project area is typical of the Sonoran Desert of the southwestern United States. Long, hot summers, short, mild winters, sparse rainfall, low relative humidity and high evaporation rates sustain a vegetal cover of only cacti and other desert plants and precludes dryland agriculture other than range management.

Temperatures show little variation within the project area, such variations resultant from adiabatic differences in elevation within the South Mountain chain. Mean maximum/minimum daily temperatures range from approximately 65/35 degrees Fahrenheit in January to about 105/75 in July. Normal temperatures recorded at the Mesa Experiment Station range from a daily mean of 50.3 degrees in January to 89.2 degrees in July.

Prevailing winds are generally light, but winds can become moderate during the winter and spring, especially during storms.

Rainfall is biseasonal. Winter rainstroms sometimes last for several days, occurring usually as gentle showers over a large area. Summer thunderstorms can be very localized, of high intensity and of short duration. Heavy runoff sometimes produce destructive flash floods. Summer storms can be general. Some individual storms consist of combinations of thunderstorms with summer or winter general storms. The mean annual rainfall varies between 8 inches in the valley to a low of 4 inches in the South Mountains.

Snow is a rarity, melting rapidly when it does occur. Only occasionally do temperatures drop below freezing. Lows of 14°F to 20°F have been recorded in the valley. The annual frost-free season averages 344 days. Sunshine occurs during 85 percent of the daylight hours.

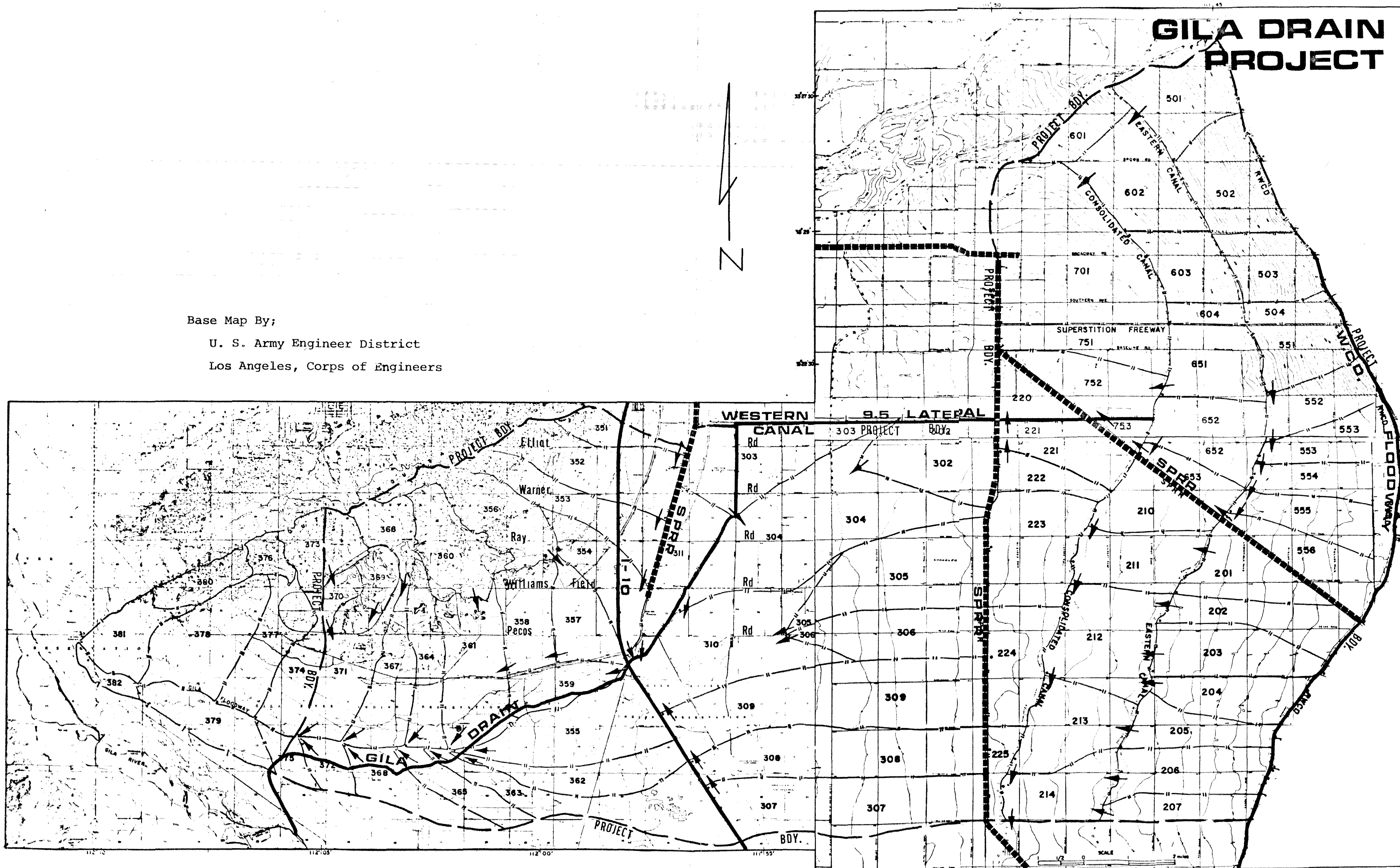
Topography

The Sonoran Desert is characterized by a series of mountain chains separated by broad alluvial valleys. The Gila Drain Project lies within the South Mountain - Superstition Mountain - Santan Mountain triangle. Along the northern boundary the Salt River has cut below the desert floodplain to form an equally flat and broad alluvial plain, leaving a sharp escarpment separating the lower, more recent, river plain from the older, desert alluvial plain. The drainage pattern of the older plain is generally toward the south to the Gila River.

Base Map By;

U. S. Army Engineer District

Los Angeles, Corps of Engineers



PROJECT DRAINAGE PATTERN

EXHIBIT NO. 5

The South Mountains dominate the western slopes of the project area, while the easterly part of the project lies entirely within the alluvial plain. The drainage pattern is shown on Exhibit No. 5.

The Gila Drain originates at the Western Canal of the SRVWUA. At this point wastewaters are released from the irrigation system into an earth channel. The channel runs due south for two miles then cuts to the southwest for about four miles to the Highway I-10 crossing. This channel generally follows the nadir formed by the Queen Creek basin to the east and the South Mountain slopes to the west. Downstream from the highway the drain flows southwesterly to the vicinity of Lone Butte more or less along the basin nadir.

South of Lone Butte, the drain swings to the west following a crooked alignment south of but parallel to the nadir. Four miles west of Lone Butte the drain makes a wide swing to the southeast breaching the natural levee of the Gila River in an upstream direction. The reason for this latter change in alignment appears to have been made in order to discharge drainage waters into the river at a point upstream from the Santa Cruz and Hoover Ditch diversion. These later ditches have long since been abandoned.

The alluvial deposits along the north bank of the Gila River play an important role in turning the drainage pattern westerly toward Komatke. Breaching of this natural levee during the 1978 spring flood was identified at only three locations. Two of these were located within two miles and upstream from the Gila Drain confluence. The third was near Komatke.

Because of its small size, the Gila Drain does not greatly affect major storm runoff. The raised lands at the downstream end formed by the river's natural levee serve as a control, limiting peak discharges from the drain. Further control is effected by the limited size of the culvert crossing at Riggs Road. Erosion at the end of the drain evidences discharges in excess of the 75 cubic feet per second design discharge but represent only a small part of the cross drainage that occurred during the 1978 spring flood.

Geology and Soils

The mountain ranges of the Sonoran Desert compose a variety of igneous, metamorphic and sedimentary rocks ranging in age from Precambrian to Quarternary.

Mountain building was mainly the result of Tertiary block faulting which elevated the subparallel ranges. Intermountain basin filling followed as alluvial materials were eroded from the mountains. The entire Gila - Salt River Plain is underlain by this alluvium. Depositions under the eastern part of the project exceed 1200 feet in thickness, thinning rapidly to the north and west to exposed bedrock in the South Mountain. Isolated peaks are exposed at Lone Butte and Gila Butte. Thickness of the alluvial deposit is shown in Exhibit No. 6.

The soils of the area are composed of sedimentary desert loams representative of parent rock materials. All associations consist of deep, well-drained, nearly level depositions. Sandy and light textured loams predominate with some areas of silty loams and clay loams interspersed.

Within the irrigated areas the desert loams have been modified by agricultural use for a period of half a century or more. All are deep, easily tilled and exhibit good free draining subsurface water movement. The soils are moderately alkaline and have some influence upon the production of more sensitive crops. Cotton, sugar beets, alfalfa, sorghum and small grains predominate. Some citrus is grown along the escarpment where free air drainage reduces frost occurrence.

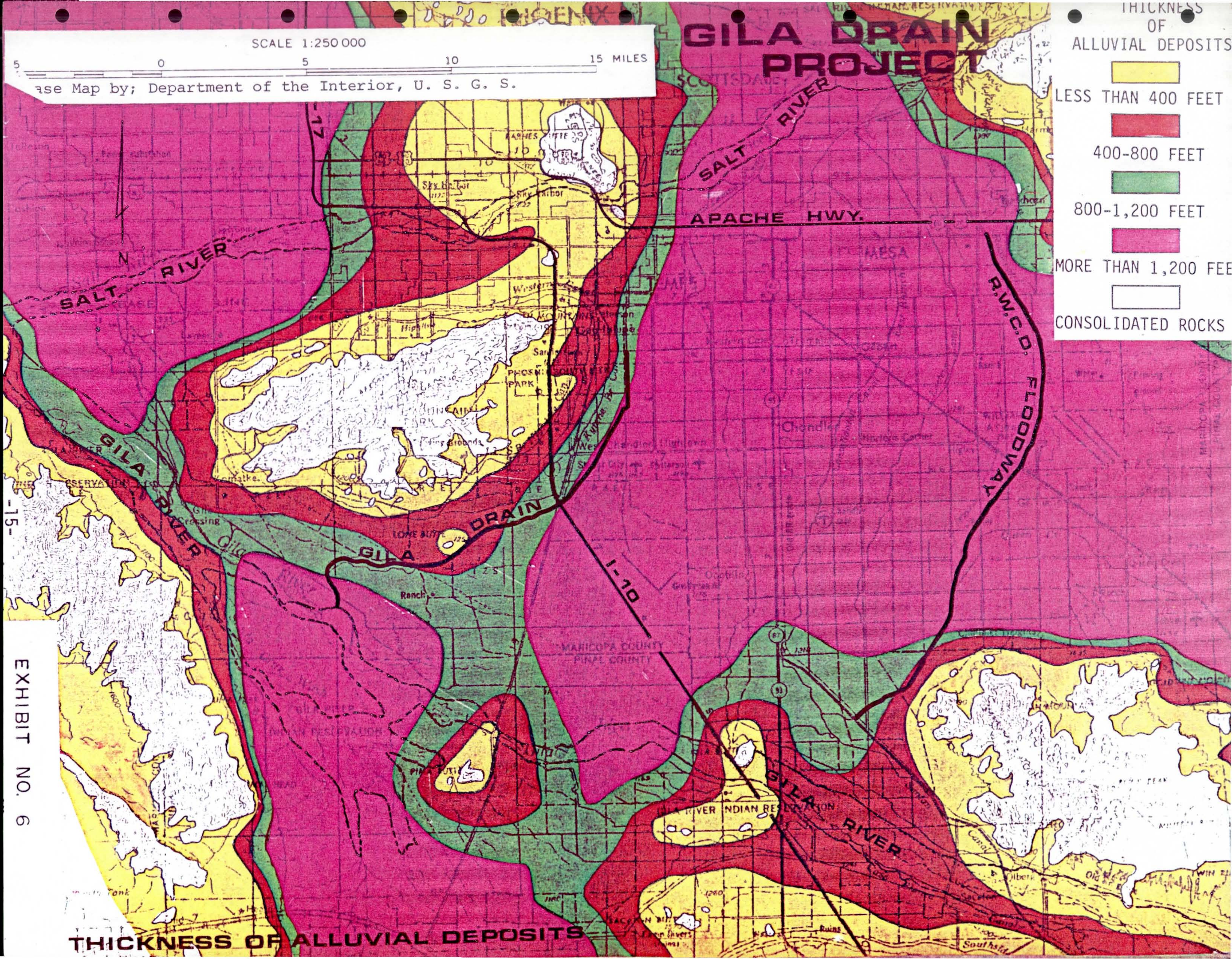
Wind and water erosion are not significant problems within the developed areas but some water erosion is evident along natural streambeds in the undeveloped areas.

Runoff Characteristics

Four distinct drainage patterns are evident in the Gila Drain Project area.

1. Undeveloped mountain slopes
2. Undeveloped desert floodplains
3. Agricultural lands
4. Commercial/Residential

Within these individual areas runoff patterns are quite distinct and separable. However, the entire project is in a flux of urbanized and agricultural development. The former meeting the demands of a rapidly expanding metropolis and the latter serving a developing Indian community. Drainage patterns are shown on Exhibit No. 5.



SCALE 1:250 000
5 0 5 10 15 MILES
ase Map by; Department of the Interior, U. S. G. S.
GILA DRAIN PROJECT
THICKNESS OF ALLUVIAL DEPOSITS
LESS THAN 400 FEET
400-800 FEET
800-1,200 FEET
MORE THAN 1,200 FEE
CONSOLIDATED ROCKS
SALT RIVER
SALT RIVER
APACHE HWY.
R.W.C.D. FLOODWAY
GILA RIVER
GILA DRAIN
I-10
GILA RIVER
MESA
Chandler
MARICOPA COUNTY
PINAL COUNTY
GILA RIVER INDIAN RESERVATION
THICKNESS OF ALLUVIAL DEPOSITS

EXHIBIT NO. 6

Undeveloped Mountain Slopes

The steep slopes of South Mountain compose almost entirely of exposed Precambrian granite/gneiss bedrock with one broad outcropping of tertiary intrusive quartz monzonite separating the east-west sections of the range. Five to 80 percent gradients are highly subject to water erosion during storms. Drainage channels are well defined on the steeper slopes but tend to lose definition upon reaching the valley transition and flows proceed downslope as sheetflow. Drainage patterns encountered with the shallow depths of the sheetflow are radically altered by seemingly insignificant obstructions.

Undeveloped Desert Floodplains

All of these lands lie within the GRIC Reservation along the north bank of the Gila River. In this area, drainage is governed principally by the broad natural levee formed by the river. Sloping to the north and west, the levee forms a broad swale where it meets the toe of the South Mountain slopes. This swale drains westward, generally paralleling the river until it reaches the vicinity of St. John's Mission at which point it cuts through the natural levee to the river. East of Maricopa Highway, channelization is indistinct, streams are interrelated by sheetflow and many shallow catchments are evident. Principal highways crossing the floodplain preserve the sheetflow pattern through the use of multiple pipe and box culverts.

A more distinct channelized flow pattern is evidenced west of Lone Butte by the vegetal growth. Storm runoff is confined between the natural river levee and the foothill slopes as the Gila River approaches the South Mountains. Although the present Gila Drain crosses the floodplain above the defined channel, there is little evidence that any sizable part of the storm runoff is diverted by the Gila Drain.

Agricultural Lands

Within the agricultural sector land leveling and the construction of numerous canals, drains and roadways has altered entirely the normal drainage pattern. The single exception is the Gila Drain which preserves the natural drainage of the area southward to the Gila River. The Eastern and Consolidated Canals serve as barriers to the east-west drainage. Canal embankments normally rise 2 to 3 feet above the farmlands and serve to divert flood runoff southward as sheetflow across the agricultural lands. Road fills at canal crossings act as barriers to the diverted sheetflow causing impoundment and occassional breaching of these canals.

Although the primary purpose of the Lateral 9.5 is as a delivery channel for irrigation water, the Lateral also serves as a waste channel for the Consolidated Canal and receives surface runoff from the streets of Gilbert and from farmlands located immediately to the north and south of the channel. This lateral rises above the surrounding farmlands along its downstream reaches. Storm runoff is impounded behind these raised embankments.

The Tempe Canal serves as a boundary to the project area and separates the drainage system of the City of Mesa from that of the City of Tempe. All storm runoff originating east of the canal is either accepted into the canal or diverted by the Mesa storm drain system.

Downstream from the confluence of the Tempe Canal and Lateral 9.5 the Western Canal serves as a collector of all runoff from the upstream irrigation system, agricultural drainage system and commercial/residential development. Flood discharge from the Western Canal into the Gila Drain is controlled by a single, radial gated wasteway.

Along the eastern slope of South Mountain the Highline and Kyrene Branch Canals cross the natural drainage pattern. Due to the steep cross slopes encountered, these canals were inset at or below the natural ground surface. Thusly, the two canals do not act as barriers to the drainage pattern as described for other canals above. However, sublaterals within this area do extend above natural ground levels and act as barriers to sheetflow.

Throughout the years, some damage to farmlands has occurred either from erosion or from sediment deposition requiring some releveling and find grading. Crop damages have occurred and single crop production losses have been recorded. In general, though, flood depths and time lengths of inundation are too small or short to cause extensive production losses.

Commercial/Residential

Over 68 percent of the commercial/residential development within the project area lies east of the Tempe Canal and north of the Lateral 9.5. Another 10 percent lies within the City of Chandler area. Most of the remaining 22 percent are composed of isolated single tract developments of 160 acres of less. The largest single tract development is the Ahwatukee Parkside Homesite which encompasses nearly 1,200 acres.

Runoff characteristics within and from individual development areas vary widely with dates of development and with jurisdictional requirements. Early residential developments were highly influenced by the agricultural aspects of the community. Individual house lots retained their connections to the irrigation system and lots were bordered to hold the irrigation for watering lawns and foliage. These same borders also served to capture direct precipitation on roofs and yards, thusly, discharges were limited to collection from street and commercial areas only. Some recent developments have retained homesite irrigation systems but these are mostly of farmette or ranchette type developments with lots of 1 to 5 acres in size. The importance of residential irrigation is illustrated by the 1976 Roosevelt Water Conservation District delivery service record when 1,372 acres (4.03 percent of total area served) was irrigated by 565 owners of 5 acres or less.

Later tract developments provided little or no onsite retention and tract discharges onto arterial roadways increased considerable. As long as such tracts were isolated developments, short-frequency storm flooding was absorbed by the surrounding farmlands, generally without increased damage. As development concentrations increased, flood problems also increased dramatically, becoming of increasing concern to public administrators. Recent legislation by city and county have established ordinances throughout the project area whereby developers are required to provide either full onsite retention or show proof that flood discharges from tracts are not increased over predevelopment conditions. As a result, community or tract lakes, lowered recreational park areas and lowered lawns have appeared in tract areas since the mid 1970's.

Factors Affecting Runoff

There are no major or large obstructions to runoff within the undeveloped areas where well defined channelization exists. Obstructions are found within the developed lands where sheetflow predominates. The lands are so flat and topographic relief so minor that embankments 2 to 3 feet in height can cause extensive impoundment. Raised highway, railway and irrigation canal embankments as well as lowered freeway and drainage channel sections, all significantly affect the drainage pattern.

Superstition Freeway

The completed section of the freeway along with its proposed extension will serve to isolate the City of Mesa from the remainder of the project. Storm discharges will be confined entirely to the City of Mesa storm drainage system. This system, designed in accord with the Arizona Department of Transportation criteria for a "50 year" flood can be operated to meet the retention requirements for the 100 year storm used for the Gila Drain Project. There will be two outlets for the Mesa system. One, the Motorola Plant drain, will discharge directly into the Tempe Canal at the Broadway crossing. The second will cross the freeway at Price Road and will discharge into two retention ponds located north of Lateral 9.5 and east of Price Road and Dobson Road respectively.

Western Canal

This principal canal of the SRVWUA system serves as a solid barrier to the natural drainage from that part of the City of Tempe located north of the canal. This approximate 22 square mile portion of the lower Queen Creek subbasin has been or is proposed to be included within the City of Tempe's storm drainage collector system. This system discharges into the Salt River and the area has been excluded from the project.

Lateral 9.5

West of the Southern Pacific Railroad crossing, Chandler spur line, the banks of this lateral stand 2 to 5 feet higher than the adjacent farmland. The natural drainage to the southwest is obstructed and floodwaters are forced westerly towards the Tempe Canal where they are impounded. Two large retention basins at Price and Dobson Roads (see Superstition Freeway above) located north of the lateral will be incorporated into the Mesa storm drainage system.

Railroad Embankments

Three branches of the Southern Pacific Railroad traverse the project area each crossing normal or diagonally to the natural drainage pattern. The railroad bed rises generally 3 to 6 feet above the adjacent lands. Cross drainage structures are few and those that do exist are small and often plugged with debris. The Corps of Engineers study estimated ponding would occur east of the Gilbert and Chandler branches, with a 100 year storm runoff. Flows from the South Mountain slopes would be impounded behind the Pima-Chandler Industrial Park spur line, forcing flows southward to the Highway I-10 culvert crossing.

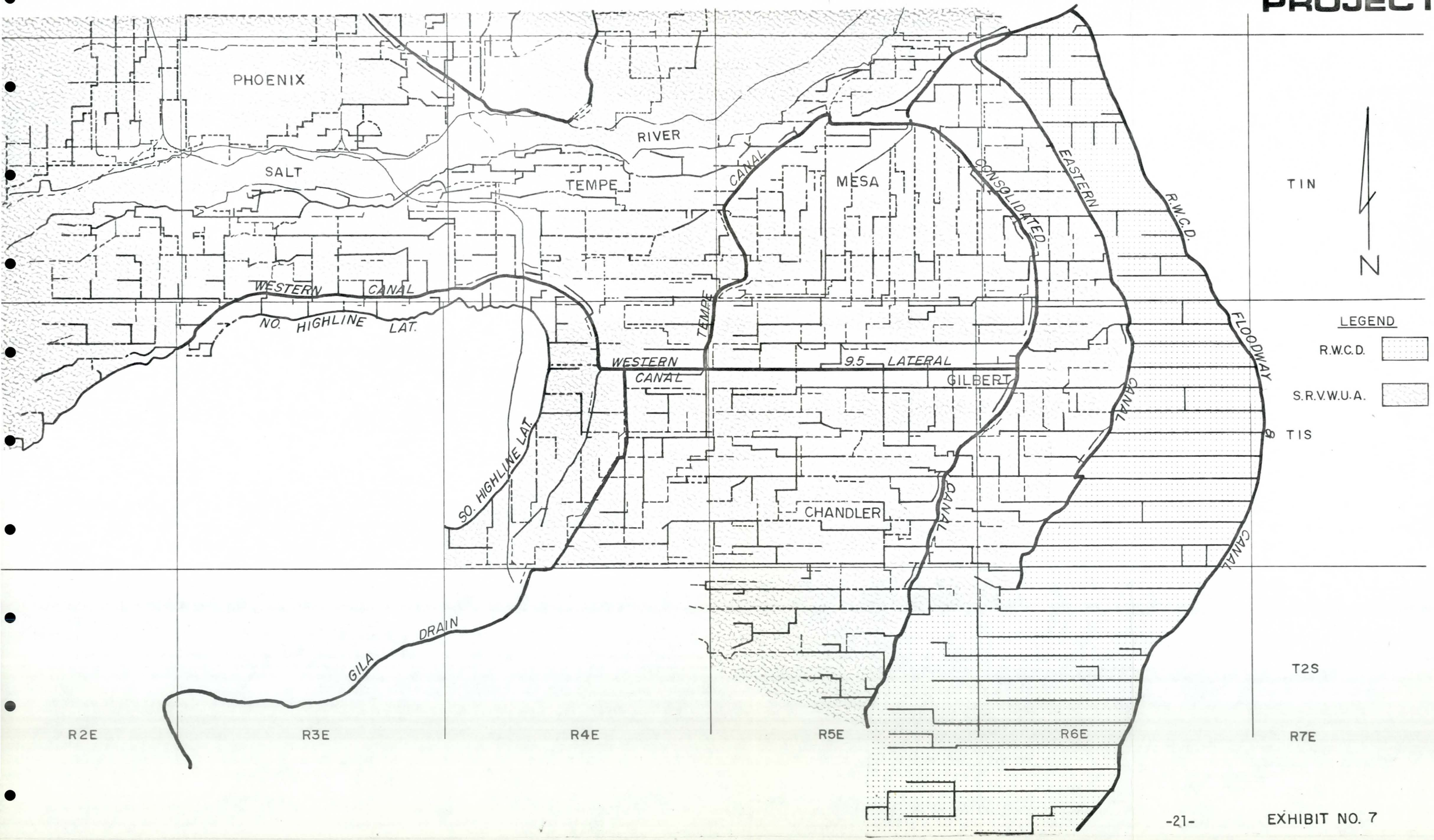
Secondary Irrigation System

The many primary and secondary canals, laterals and drains constructed in the project area act as primary constraints to flood runoff. The complexity of the systems located in the private ownership sector is illustrated on Exhibit No. 7. As with most irrigation systems, principal canals and tertiary laterals run normal to the general land gradient while secondary laterals parallel the natural slope. Many parcels are isolated and without a drainage outlet. The only continuity of drainage within the system depends entirely upon the irrigation tailwater drainage system.

On the GRIC Reservation two development areas have a primary affect upon the drainage pattern (see Exhibit No. 8). The first consists of those lands north of the Gila Drain, presently irrigated by non-Indians as the Broad Acres Lease. There are approximately 3,570 acres of these lands cultivated within the project area. The main irrigation canals run east to west crossing the drainage pattern off South Mountain. Limited impoundment occurs on the upstream side of canal embankments, however, the banks are uncompacted and easily breached by major storms.

There are about 2,680 acres farmed by the Tribal Farm Corporation, cultivated within the project boundaries. These areas have little affect upon the

GILA DRAIN PROJECT



PRIVATE SECTOR IRRIGATION SYSTEMS

EXHIBIT NO. 7

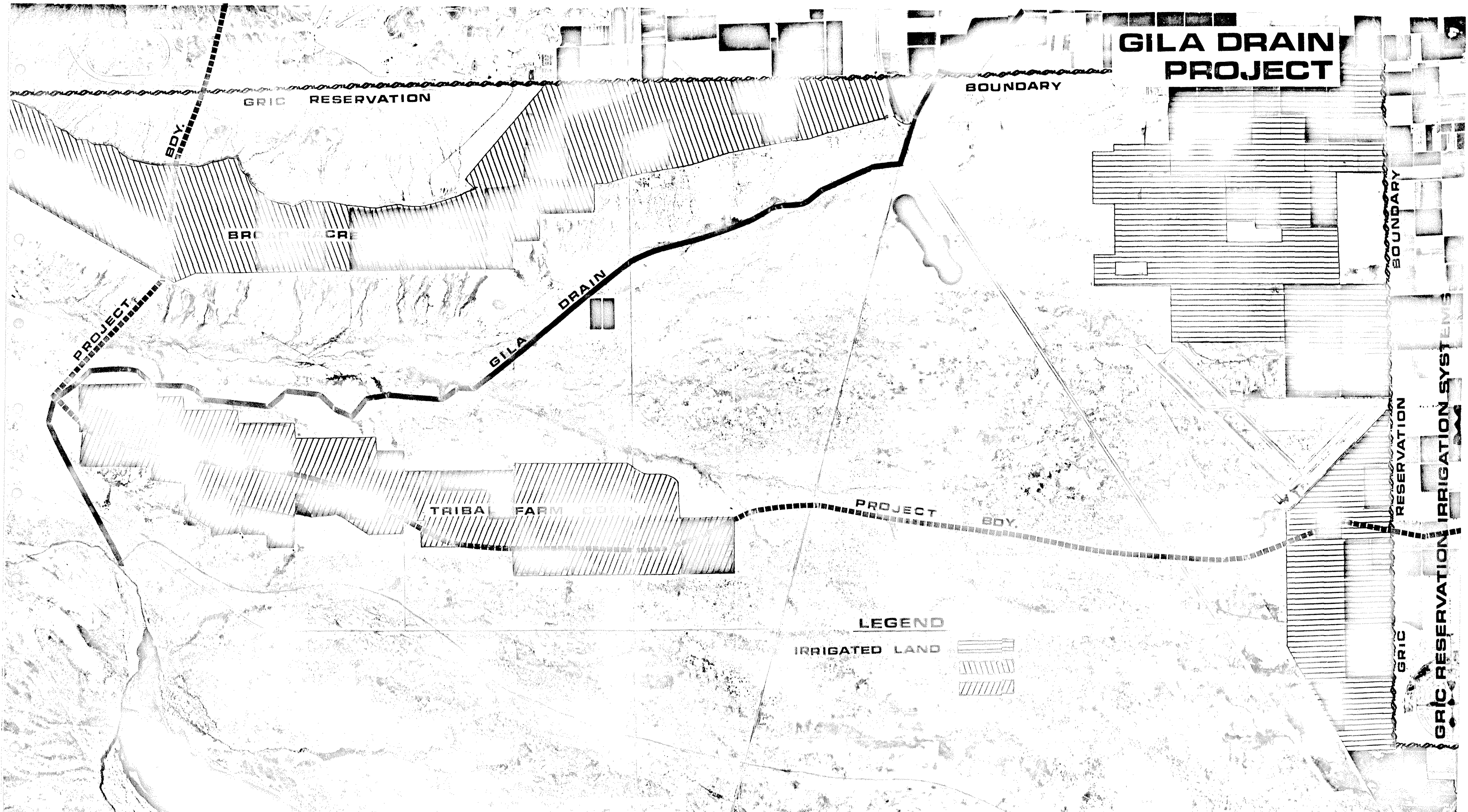

GILA DRAIN PROJECT
GRIC RESERVATION
BOUNDARY
BDY.
PROJECT
GILA DRAIN
TRIBAL FARM
PROJECT BDY.
LEGEND
IRRIGATED LAND
GRIC RESERVATION BOUNDARY
GRIC RESERVATION IRRIGATION

EXHIBIT NO. 8

drainage pattern as the farm lies along an east-west ridge which divides the drainage from the east. The principal drainage pattern can be identified on the aerial photograph by the darker appearance of desert riparian growth.

The remaining 4,120 acres farmed within the project area lie along the eastern boundary in the vicinity of the Goodyear Air Force Auxiliary Airstrip. Precipitation is presently retained on most of these lands.

Urban Expansion

While, as shown in Table No. 1, only 17 percent of the project area has been developed for commercial and residential use, the area is presently entering a period of rapid lateral urban expansion. In 1977, the U.S. Army Corps of Engineers undertook an extensive study of urban expansion in order to develop projections for a base year (1980) and a future year (2030). The results of this study are shown in Exhibit No. 9. These projections were used by the Corps in the computation of future flood discharges, and serves as the basis for hydrologic computations carried out in this current study.

Existing Condition of Facilities

Prior to the initiation of this present study, representatives of the interested communities and organizations arrived at the preliminary concept of the key facilities required to drain the project area when subjected to a 100 year storm.

All communities would provide onsite retention in accordance with ordinances previously adopted.

Principal facilities owned, operated and maintained by the SRVWUA, to be utilized by the project were:

- Lateral 9.5
- Western Canal
- Gila Drain

In addition, consideration would be given to the use of a large borrow pit belonging to the Arizona Department of Transportation (ADOT) and located east of Highway I-10 between Warner and Ray Roads.

URBAN DEVELOPMENT PROJECTIONS

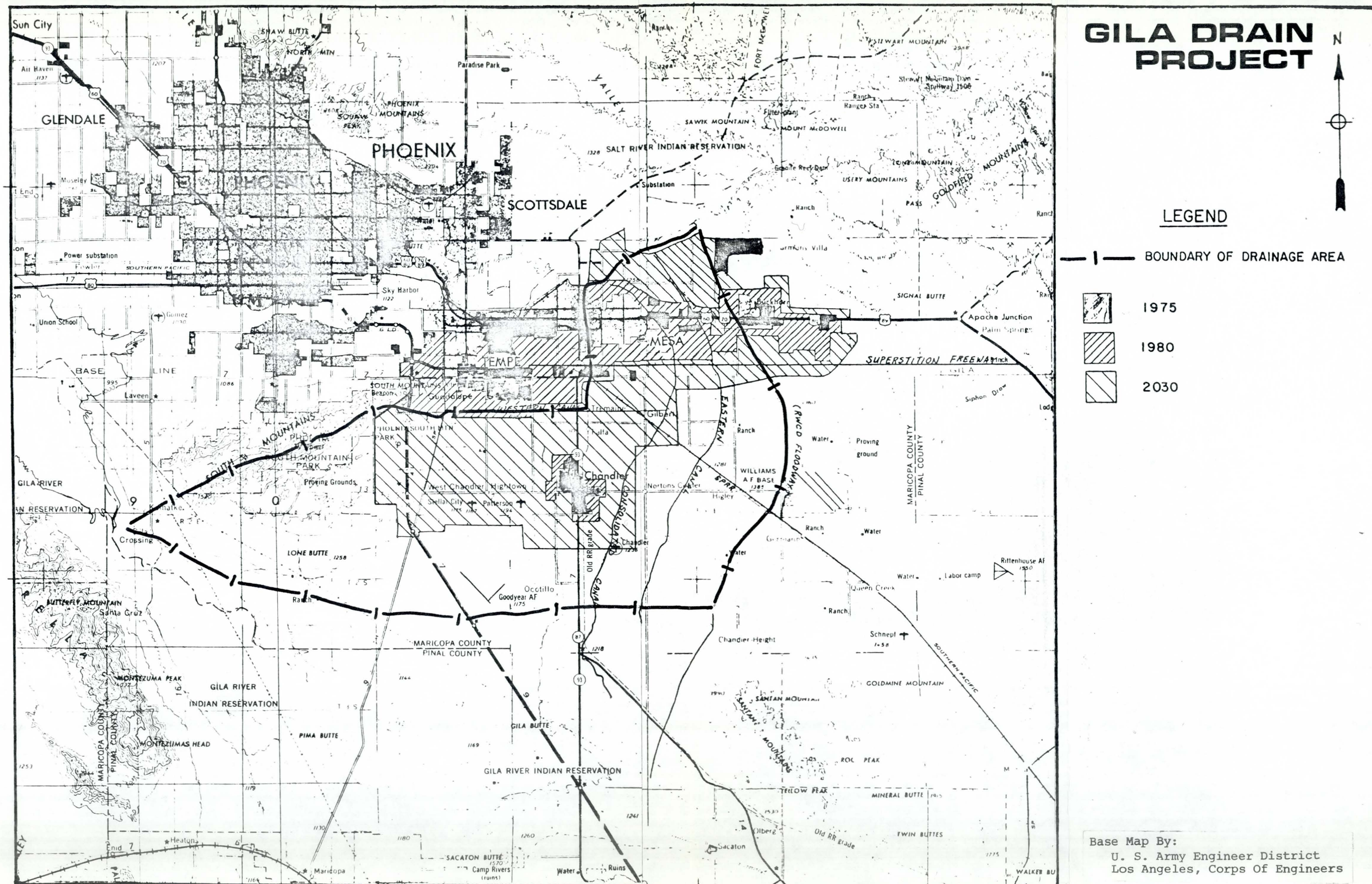


EXHIBIT NO. 9

Lateral 9.5

This dual purpose irrigation/drainage earth canal originates on the Consolidated Canal then flows 7 miles due west to the confluence of the Tempe and Western Canals. Converse to normal irrigation canal design but in compliance with drainage channel design, the canal section capacity increases in the downstream direction.

The diversion structure at the Consolidated Canal has a rated capacity of 7,000 miners inches (140 cubic feet per second). Between the Consolidated Canal and the SPRR crossing (Section 12, T1S,R5E), the lateral's bottom width varies between 4 and 6 feet. The depth averages about 8 feet and the side slopes are about 1 to 1. The channel slope slightly exceeds 0.002 feet per foot.

Flow capacities increase downstream except at structures. The crossing of the Gilbert branch of the SPRR consists of a 4 foot by 6 foot box culvert. A discharge of about 250 cfs could probably pass through this structure without exceeding the minimum 1.5 foot freeboard upstream; however, the channel downstream would need protection along the outlet transition to resist erosion from the high velocity turbulence developed by the increased discharge through the box section.

Most restrictive is the downstream crossing of the Chandler branch of the SPRR. The crossing consists of a single 4 foot by 4 foot box culvert. This structure will carry the present design capacity of 140 cfs without overtopping the upstream embankments but any increase in the flow would cause backwater rises above upstream natural ground surface level. In addition, the small box section is subject to plugging by debris as was the case at the time the structure was inspected.

Irrigation control on the lateral is achieved through ponding above one radial gate check and three twin gated slide gate checks. Overflow and safety bypass of flood flows are inadequate and protection against overtopping of the lateral during storms depends almost entirely upon a prompt opening of the gates by zanjerros.

Western Canal

To be included in the project are the first two miles of the SRVWUA Western Canal. This canal initiates at the confluence of the Lateral 9.5 and the Tempe Canal at a point just east of Price Road and flows westerly along the mid-section line. In operation of the system, the Western Canal is an extension of the larger capacity Tempe Canal while the lateral serves as a secondary channel. Irrigation flow in the Tempe Canal is monitored from the Association's central office by an electronically controlled check structure located immediately upstream from the confluence. The irrigation water level is dropped at the check structure entering the Western Canal through a concrete lined, 90 degree curved section between the check and a bridge serving Price Road. Flow from the Lateral 9.5 enters the Western Canal through a box culvert of the inverted siphon type.

Two miles to the west and immediately east of Rural Road a wasteway of the single, radial gate type serves as the headworks for the Gila Drain. The design capacity for the structure is 75 cubic feet per second. The nearest water level control structure in the Western Canal is located about one-half mile downstream from the Gila Drain wasteway.

Gila Drain

Originating at the Western Canal wasteway this drain runs south parallel to Rural Road for a distance of about 2 miles then southwesterly for an additional 3.4 miles to the GRIC Reservation. Throughout this reach, the drain has a bottom width of 6 feet with 1 to 1 side slopes or steeper. Profile gradients range from a minimum of 0.0003 feet per foot to a maximum 0.0015 feet per foot. The overall fall along this section averages 0.00096 feet per foot. At the design discharge capacity of 75 cfs the depth of flow varies from 2.6 to 4.2 feet. All in-line structures are designed for the 75 cfs capacity and will need to be replaced with an increase in design capacity.

The drain has been recently realigned along the first mile below the GRIC Reservation. A by-pass channel has been constructed around the northern and western boundaries of the Pima-Chandler Industrial Park. The upstream 4,000 feet of this channel consists of an 8 foot bottom width trapazoidal earth section with 1-1/4 to 1 side slope. Profile gradient is 0.0008 feet per foot.

The downstream 1,200 feet has a widened bottom width of 15 feet and the slope is increased to 0.001 feet per foot. This section discharges into a three box culvert under Highway I-10. Concrete pipe culverts are located at the SPRR spur line and at the Allison Road entry way to the park. Design drawings prepared by Henningson, Durham and Richardson Inc., Engineers and Architects show a easement for the drain of 50 feet on each side of the centerline.

Separating the two earth sections crossing the Pima-Chandler Industrial Park is a water level control check and drop structure of the slide gate type. This structure serves as headworks for the "Fowler Ditch" an irrigation canal serving Indian lands west of the I-10 Highway. Requirements for and purposes of this structure are spelled out in Paragraph 1 (c) of the 1923 Agreement between the U.S. Government and the SRVWUA (see Appendix A).

Crossing of the Highway I-10 - Maricopa Highway interchange is achieved through two separate 10 foot by 7 foot three-box culverts. Peak flood capacity of the interchange crossing is governed by the earth channel capacity between the two box culverts. It is extimated that the peak capacity without inundation of the interchange roadway subgrades is about 477 cubic feet per second.

Below the Maricopa Highway the drain has recently been cleaned out to a fairly uniform trapazoidal earth section with a 6 to 8 foot bottom width and 1 to 1 side slopes. Profile gradients appear to parallel that defined by the 1923 Agreement. Cross sections surveyed by the SCS in 1967 indicate some minor subsidence has occurred along the upper reaches (less than 1.0 feet) reducing to no subsidence at survey station 360+00. Profile gradients along this stretch range from a maximum 0.0017 to a minimum 0.00077 feet per foot. The existing channel is adequate for the design capacity of 75 cfs.

Three corrugated, metal arched pipe culverts approximately 36 inches by 54 inches in size and located at approximate Stations 795+00, 840+00 and 871+00 serve as road crossings. No structure has been provided at the downstream end of the Gila Drain and considerable erosion has occurred at the drop into the Gila River.

Existing Rights-of-Way

The widths of the existing rights-of-way for the Gila Drain crossing the private sector are shown on Exhibit No. 10.

Rights-of-way within the GRIC Reservation consist of a 100 foot wide strip of land, 50 feet each side, of the Gila Drain as described in the 1923 U.S. Government - SRVWUA Agreement presented as Appendix "A" of this study. Although the drain's alignment has been changed for the Pima-Chandler Industrial Park development, no amendment of the above agreement reflecting this change has been initiated.

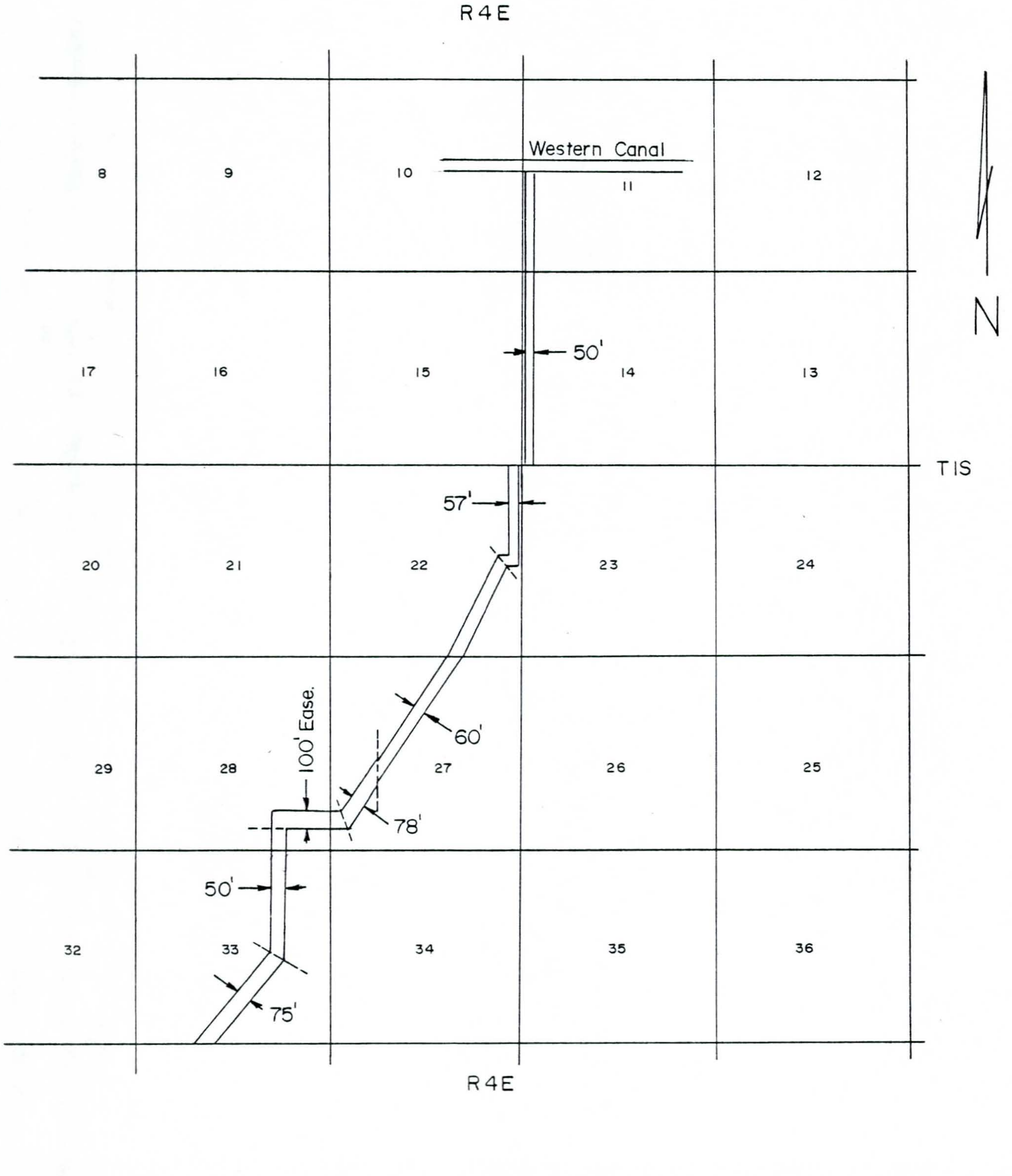
Right-of-way plots, by individual sections, for both the private sector and within the Indian Reservation are presented in Appendix "C".

Water Profile Limitation

Attached to and described in the 1923 Agreement (Appendix "A") between the U.S. Government and the SRVWUA is a profile of the drain which defines the hydraulic properties of a 75 cubic foot per second "Waste Ditch" across the Gila River Indian Reservation. The profile commences at the end of the Tempe Drain and runs about 1,660 feet to the Arizona Eastern Railroad Structure 16A (24' Trestle) then 54,400 feet to the Gila River. A water surface at about Elevation 1147.6 is indicated at the downstream end of the Tempe Drain. A computed water surface can be determined from channel bottom grade elevations as shown on the specified profile.

Provisions are made within the Agreement for the enlargement of the channel by either party (U.S. Government Par. 5, P. A-4) (SRVWUA Par. 4, pp. A-7 & A-8). In each case the enlarged ditch shall "carry the increased flow without raising the water level above the gradient shown on the attached profile".

GILA DRAIN PROJECT



EXISTING RIGHT OF WAY ACROSS PRIVATE SECTOR

EXHIBIT NO. 10

NEED FOR PROPOSED PROJECT

Historically, the Queen Creek subbasin of the Gila River has experienced a number of storms which have caused damage in the project area. Some of these damages resulted from storms within the upper basin. For example, the storm of early 1978, shown in Exhibit No. 4, resulted in a considerable damage on the GRIC Reservation. The project area will be protected against the 100 year frequency storm runoff originating in the upper basin once construction on the RWCD Floodway is completed, provided, Queen Creek Dam foundation problems are resolved (see page 7) and a structure is authorized and constructed.

Damages have also resulted from storms occurring within the lower basin or project area. On October 18th and 19th, a total of 3.42 inches of rain fell on the lower Queen Creek watershed. Impounded floodwaters behind the numerous barriers in the project, rose to depths of 0.5 to 2.5 feet and damages occurred to commercial, residential and agricultural developments. Fortunately, non-agricultural developments were limited and widely spaced and the farmlands absorbed most of the floodwaters. The primary crop at the time was cotton which reportedly suffered yield reductions of 10 to 60 percent. Residential damage was not severe, dollar wise, because most of the flooded homes were on the GRIC Reservation. However, the impact upon this low income community was serious.

Damage risks are escalating rapidly as urban expansion moves into the project. By the year 2020 the project area will be fully urbanized in those areas off the GRIC Reservation and partially developed commercially and industrially within the reservation. Conditions will closely resemble those existent in the June 21st and 22nd, 1972 Phoenix-Scottsdale-Tempe storm area. Centered less than 16 miles northwest of the project's center, that high intensity, short duration storm dropped precipitation in excess of 1 inch over an area of about 258 square miles (Gila Drain Project area equals 254 square miles). Point 6 hour duration measurement exceeded 5 inches with more than 4 inches falling over an area of about 18 square miles. Damages were so extensive that the Governor of Arizona declared a state of emergency. This was followed by a Presidential declaration of the area as a major disaster area. The damage was estimated at $10,558,000. The frequency of the storm was estimated at once in 70 years.

IRRIGATION SYSTEM PROTECTION

The Gila Drain Project lies within a region where water is a precious commodity. SRVWUA and Roosevelt Water Conservation District operational policies give primary emphasis to the conservation and utilization of water for agriculture. Whenever practicable, responses to storm warning forecasts issued by the U.S. Weather Bureau are immediate and pumping from groundwater is stopped. Canals are lowered as rapidly as possible by giving free water to farmers. Releases through the limited wasteway channels are made only as a last resort. The procedure works well during winter storm occurrences when rainfall occurs over broad areas.

Summer storms are a different matter. These storms are associated with deep, very moist, unstable air masses invading the southwestern United States from the Gulf of California or the Pacific Ocean. Precipitation occurs as high intensity thunderstorms affecting small areas over short periods. Forecasts of air mass movements can be and are made. However, the specific identification of precipitation areas and depths of rainfall cannot be accurately foretold.

The SRVWUA irrigation system is probably the most sophisticated operational system in the world. Water levels at principal control points are monitored electronically and controlled from a central office. Radio contact with zanjerros (gate tenders) assures response, at manually controlled gates, within 15 to 30 minutes. Regardless, times of flow between control points place serious constraint upon operational adjustments for expected or unexpected storms. For example, it is estimated that the flow time between: 1) Stewart Mountain Dam and Granite Reef Dam is 6 hours; 2) Bartlett Dam and Granite Reef Dam is 12 hours; and, 3) canal flow from Granite Reef Dam and the Western Canal Gila Drain Wasteway, is in excess of 10 hours.

Lowering of irrigation canals can be accelerated through releases from the Hennessy and Tempe Canal Wasteways. Drainage of the Tempe and Western Canals below these wasteways is limited by the present 75 cubic foot per second capacity of the Gila Drain Wasteway. Present needs for safe operation of the system far exceed this limited capacity as indicated in Table No. 3.

TABLE NO. 3 - Estimated Western Canal to Gila Drain Wasteway Discharge Requirements*

Source		Discharge Capacity (cfs)
Tempe Canal		
Irrigation Waste		316
M & I Water Treatment Plant		62
Motorola & Other Drainage		130
	subtotal	508
Lateral 9.5		
Baseline Pump Drain		50
Other Drains		50
	TOTAL	608

* Estimate by SRVWUA to be reviewed in final design.

The above flows are based upon peak irrigation demands, storm drain inflow to the Tempe Canal west of the Motorola Plant (now limited by an 18 inch diameter pipe inlet) and drainage into the Lateral 9.5 from the Baseline Pump Drain and other drains. It is estimated by the SRVWUA operational division that, with increased capacity within the drain emergency releases preceding storms would be made on an average of four to five times a year. These discharges would average about 10 hours for each storm.

URBAN PROTECTION

With urbanization, the effective impervious cover on commercial, industrial and residential properties will be increased from almost zero at present, to 90, 70 and 40 percent, respectively. Runoff from storms will increase several fold. To meet this increase, city, town and county administrators have initiated planning and construction of storm drainage systems on new developments within their jurisdictions, as discussed below.

City of Mesa

The City has underway the development of a storm drainage system for protection of lands within its boundaries against a 50 year, 24 hour storm (3 inch precipitation). The outfall of the system will discharge through a series of retention ponds, located north of the Superstition Freeway, into two interconnected retention ponds located in the southwest corners of the northwest quarters of Sections 7 and 8, Township 1 South, Range 5 East, Gila and Salt River Base and Meridian.

Storage will be provided for full retention of the Corps of Engineers 100 year storm runoff. Discharge from the system will be made directly into the Lateral 9.5 or Western Canal. Tentative discharge capacity is set at 200 cubic feet per second.

New developments are required to provide full retention of 50 year, 24 hour storm (3 inches) runoff. Retention basins shall not pond water greater than 3.5 feet in depth and drainage into existing irrigation or storm drainage facilities within 36 hours, must be provided.

Town of Gilbert

The only storm drainage facility identified in the Town consists of a street inlet located at the western end of Vaughn Street. This inlet discharges through a concrete lined canal, and a 36 inch diameter concrete pipe into the Lateral 9.5 at a point immediately west of the SPRR.

In planning is a proposal for implementation of a combined flood prevention and recreational "Founders Park". No design criteria has been set for this park but a tentative location of an 80 acre site in the south half of the northwest quarter of Section 8, Township 1 South, Range 5 East, Gila and Salt River Base and Meridian, has been selected.

The Town recently adopted an ordinance wherein all future developments are required to provide retention for a 50 year, 24 hour storm similar to that required by the City of Mesa. Drainage of retention must be provided within a 96 hour period by methods approved by the Town Engineer.

City of Tempe

Constructed, under construction or in planning is a storm drainage system serving all lands north of the Western Canal and west of the Tempe Canal. Discharge of this system is northward, to the Salt River. Thusly, this part of the lower Queen Creek basin has been excluded from the Gila Drain Project.

Most of the lands south of the Western Canal are either undeveloped or have been developed in accord with City ordinances providing some type of storm protection. There are less than 80 acres, classed as Zone "A" and developed to provide a 5 year, 1 hour (1.24 inches) retention within this section. All remaining lands are classed as Zone "B" and will be required to provide retention of 100 year, 1 hour (2.4 inches) storm, sufficient in volume to hold the total runoff from the design storm falling on that lot, plot or parcel of land and on adjacent streets and alley rights-of-ways(arterial streets excepted).

City of Chandler

Storm drainage within the centrally developed older sections of the City is provided through an integrated pipe and irrigation waste channel system. The City has experienced annual storm water ponding in the streets at about 12 locations. Water ponding is reported to depths sufficient to impede vehicular traffic, several times each year. Typically these areas drain within sixty to ninety minutes following each storm.

Under design by the Arizona Department of Transportation is a pipe drainage system along Arizona Avenue and Frye Road (Denver St.). This system proposes to discharge into a retention basin located behind the Denver School.

New developments are required to provide retention of 50 year, 24 hour storm runoff from both development and adjacent arterial areas. Depths of ponds shall not exceed 3 feet and they must be drained within 36 hours.

Maricopa County

The County amended its subdivision regulations in September 1975 to require onsite storage for all unincorporated areas within the County. Storage will be such that the peak discharge, computed from 100 year, 2 hour rainfall, leaving the development shall not exceed the predevelopment peak discharge.

Most of the steeper mountainous and desert plains along the western part of the project are unincorporated land. One large development, Ahwatukee, was initiated prior to the amendment, and while some retention has been provided, the discharges, as presently developed, probably exceed predevelopment peaks. This condition also exists within agricultural areas where development plans were approved prior to the amendment.

GRIC Reservation

In June 1978 the GRIC, by Tribal Resolution, adopted the policy whereby all proposals for commercial, industrial and residential land use developments are subject to technical review under which drainage is specifically addressed. These controls are in effect for future developments but do not apply to previously approved land use changes such as the Pima-Chandler Industrial Park and the Firebird Lake developments.

LIMITATION TO STORM RETENTION

City, county and agency planners are acutely aware that the project lies within a water deficient region suffering from a rapid groundwater depletion. The capture and subsequent use of stormwaters for irrigation and groundwater recharge is particularly attractive. This factor has had considerable influence upon the phraseology used in the preparation of development ordinances and the rapid expansion of stormwater retention as the basic fundamental tool for flood control. However, the application of floodwater retention within commercial/residential areas is relatively new to the greater Phoenix metropolitan area and the results of ordinance enforcement are as yet untested. Important limitations to storm retention as a panacea to flooding are discussed here.

Characteristics of the Permeable Medium

The "Arizona General Soils Map (1975)" prepared by the SCS shows the project to contain a wide range in soil permeabilities. Along the slopes of the South Mountains permeabilities range from zero on rock outcropping to moderate in the recent talus slopes, with percolation rates up to 2 incher per hour. Throughout the older valley fill, percolation rates vary widely dependent largely upon the amount of clay content of the soil. Soils are to be found with permeabilities of less than 0.2 inches per hour. More dominant, however, are desert loams of moderately slow to moderate permeabilities ranging from 0.2 to over 2 inches per hour.

Infiltration rates, as indicated by the SCS "General Soils Map of Maricopa County (1969)" run considerably less than percolation rates ranging from zero for bare rock up to 0.3 inches per hour in recent alluvia. In the older alluvia, infiltration ranges from 0.05 to 0.15 inches per hour. In general, individual soil percolation rates exceed their infiltration rates and water movement within the soil is straight down. Few continuous impervious strata exist in the deeper alluvia and horizontal spreading of percolating water is limited.

The above infiltration and permeability rates are based upon relatively undisturbed soil conditions and are not representative of surface soils within intensively developed areas. Earth movement in building foundation levels for structures, lowering street levels and constructing retention ponds has been considerably increased by recent ordinance requirements. Soil structures at the surface and at shallow depths are seriously disturbed and both infiltration and percolation rates are reduced. Infiltration rates can be increased by scarification and subsequent planting to grass. Percolation losses on the other hand occur at greater depth and the rebuilding of soil structure may require years.

Considering present ordinances and construction methods, it can be expected that stormwaters retained at depths of 3.0 to 3.5 feet will not be fully dissipated through deep percolation within permissable time periods in many areas. In other words, deep percolation within retention basins of the longer frequency storm runoff may be the smaller part of the total impondment and disposal of retained waters as surface discharge will predominate.

Available Drainage Outlets

Heavy reliance is presently placed upon the use of the existing irrigation and drainage systems as the means for disposal of surface runoff. Under present conditions when agricultural development predominates, the acceptance of the use of stormwaters for irrigation is decidedly to the advantage of the irrigators. Acceptance of drainage into the SRVWUA system, with outlets into the Gila Drain, is limited to the 75 cubic feet per second authorized under the 1923 Right-of-Way Agreement.

Contractual agreements between the SRVWUA, responsible cities and the county whereby retained stormwaters are pumped into the irrigation system at the convenience of the Association, are presently accepted. In the long term, as more and more lands are urbanized, the demand for irrigation waters will be proportionately reduced and the Association's operational flexibility, permitting such pumping, will be phased out.

Jurisdictional Constraints

As shown in Exhibit No. 2, the incorporation pattern is incomplete within the project area. Each municipality faces future annexations of lands where developments have been regulated under the county's ordinances. Disposal of surface runoff, at least to the extent of present or predevelopment peaking, will need to be accepted under conditions not provided for under present ordinances.

> "It is recommended that the county adopt a special ordinance applicable to those county lands within the Gila Drain Project area, wherein, the 100 year storm runoff within future development areas be completely controlled."

STORM SYNTHESIS

The 100 year frequency storm used in this analysis is based upon the U.S. Army Corps of Engineers hydrographic data presented in the September, 1977 "Summary Report for Flood Control - Gila Floodway". In that study:

- Basic meteorologic and hydrologic characteristics of the study area were defined.
- The runoff process was modeled.
- Storm volume and runoff peaks were determined for selected locations.
    - (a) Under "base year" conditions
    - (b) Under future conditions
- Future discharge frequency values were determined for selected locations under "base year" and future conditions.

For the "base year" the Corps forecast conditions expectant in 1980. Future conditions were forecast to reflect conditions in project year 50 (2030).

The storm synthesis selected is described in detail in the Corps report.

DEVELOPMENT OPPORTUNITIES

Prior to the initiation of this phase of the Gila Drain Project study, a tentative concept of the project had been reached in which the SRVWUA's Western Canal and Gila Drain would be developed to transport flood runoff resultant from a 100 year frequency storm. In addition, a large borrow pit belonging to ADOT and located on the east side of Highway I-10, had been identified as a possible site for stormwater retention. The value of floodwater retention was recognized and it was tentatively agreed that incorporation of a discharge capacity of 200 cubic feet per second per community would be acceptable.

INCORPORATION OF IRRIGATION AND DRAINAGE FACILITIES

This study was limited to the development of a trunk line drainage system into which the sponsoring cities, towns and agencies could discharge floodwaters. No study of the secondary system was made, other than that required to determine flood discharges within the trunk system.

It was found that the development of the Gila Drain as extended by controlled flows through the Western Canal and the Lateral 9.5, would provide a trunk system capable of serving all sponsors. Numerous constraints to increasing design flow were identified as discussed below.

Lateral 9.5

This lateral of the SRVWUA's system was evaluated in terms of its potential use for disposal of 200 cubic feet per second of floodwater discharge from both the Town of Gilbert and the City of Mesa. Inlet for Gilbert was expected to occur at or near the upstream end of the lateral whereas the Mesa inlet would occur at the lateral's downstream end immediately above its confluence with the Western Canal.

The lateral's capacity concurs with standard drainage design requirements, increasing in carrying capacity in the downstream direction. The upper reaches of the lateral channel can carry the proposed 200 cubic feet per second proposed without enlargement. Similarly the confluent structure at the Western Canal should carry the combined discharge of 400 cubic feet per second without enlargement.

Constraints to use the lateral as a storm water floodway exist at the SPRR crossing of the Chandler branch line. At that point the existing 4 foot by 4 foot box culvert if exposed to a 200 cubic foot per second discharge, would backup water to a depth of about 2.5 feet above normal canal depth. Overtopping of the banks and flooding of adjacent lands would result.

Within the lateral, four check structures have been constructed for the diversion of irrigation. None of these structures are provided with overflow protection and they are fully dependent upon the manual opening of gates by zanjerros, for safety against overtopping upstream banks. Additional protection could be provided by either tying these checks to the centrally operated SRVWUA control system, or by the provision of by-pass overpour weirs.

Western Canal

This canal was evaluated for adequacy to conduct the separate flows of the 608 cubic feet per second SRVWUA estimated emergency storm release and the 400 cubic feet per second combined Gilbert - Mesa releases from retention basins. Cross sections and profile information provided in the 1975 survey by Clouse Engineering Co. indicate a safe discharge capacity of about 800 cubic feet per second along the two mile reach from Price to Rural Roads.

The principal constraint is the limited capacity of the Gila Drain Wasteway. This 75 cubic feet per second wasteway (design capacity), is estimated to carry a probable maximum discharge of 130 cubic feet per second.

Gila Drain

The present drain capacity of 75 cubic feet per second was established by the terms of the 1923 Agreement between the U.S. Government and the SRVWUA. Rights-of-Way and drain cross sections were based upon conditions at that time. Enlargement of the drain's carrying capacity will entail the acquisition of additional rights-of-way within the private sector as well as construction expenditures throughout the full reach of the drain.

Available Gradient

The flattest section of the Gila Drain lies along the private ownership sector between the Western Canal and GRIC Reservation. Present channel gradients range from a minimum of 0.0003 to a maximum of 0.0015 feet per foot. The overall gradient along this 5.4 mile reach is 0.00096 feet per foot. Excess head is presently consumed at the numerous culverts encountered at arterial road and farm access crossings.

Within the reservation, legal constraints require that maximum water surface elevations be kept below specified levels identified in the 1923 Agreement. These elevations provide gradients of 0.00077 minimum to 0.0017 maximum feet per foot. In addition several small drops in water surface elevations are provided for in the Agreement. The overall gradient of the Gila Drain, across the 10.2 mile section below the Maricopa Highway crossing, is 0.00121 feet per foot.

Available gradient is not a constraint to the design of economic sections for an increased drainage capacity. In fact, of greater concern is the development of excessive velocities for the dissipation of incumbent energy.

Existing Developments

Structures exist at three locations along the Gila Drain within the private sector that must be considered in the final design. First, a residential development on the east side of Rural Road between Carver and Warner Roads (Canal Stations 52+80 to 80+00) includes two houses which would be seriously affected by a widened channel. In addition, lawns of several additional houses would be reduced by a widened or relocated channel. This development lies within the jurisdiction of the City of Tempe.

Immediately downstream, the drain crosses both Rural and Warner Roads and traverses across the back lots of a low density residential development for the next one-half mile. Widening or relocation of the drain would reduce the lot size and values of these properties. The development lies outside of incorporated areas.

Below the crossing of William Field Road, the drain passes between an electrical substation and an industrial park area. Buildings and parking lots appear to have been constructed up to the existing right-of-way for the drain. Enlargement of the drain would require either a box or rectangular channel through this area or the relocation of the substation and realignment of the drain to the east.

Pima-Chandler Industrial Park

In the realignment of the Gila Drain for this development a 100 foot wide right-of-way was maintained on the development plans. No buildings or structures have been constructed near the drain at this time. Two culvert crossings for the SPRR spur line and for Allison Road will need to be enlarged. The reconstructed drain section consists of an 8 foot bottom width earth channel upstream from the Fowler Ditch check and turnout. Below the check the channel widens to a 15 foot bottom width. Upstream and downstream gradients are 0.0008 and 0.001 feet per foot respectively. A major, automatic/gated, check structure will be required at the Fowler Ditch for diversions from the drain.

Subsidence

Since 1923, when the right-of-way Agreement established a maximum water surface profile for the Gila Drain, widespread subsidence has occurred throughout the subbasin resultant from an extensive drop in the water table. To assess the affect of this subsidence, cross sections of the drain surveyed by the SCS in 1976 were compared with the natural ground surface indicated on the drain profile attached to the agreement. Eleven sections were selected as most representative of undisturbed natural ground conditions. Of these, nine sections showed a general subsidence along the drain alignment ranging from 0.8 foot at the Maricopa Highway crossing to no subsidence along the lower reaches of the drain. It is recommended that the Agreement Profile be adjusted downward to show a 1.0 foot lower elevation at the AERR Trestle (Contract Station 18+00$\pm$) and rake in to no subsidence at Contract Station 360+00. Thusly, contractual maximum water surface levels can be preserved under subsidence conditions.

I-10 and Maricopa Highway Crossing

The crossing of this ADOT interchange is of primary concern to the design of an enlarged capacity for the Gila Drain. First consideration must be given to the maximum water surface levels imposed by the 1923 Agreement. By plotting the approximate locations of the two culverts, their maximum allowable discharge capacities were estimated as follows:

	Highway I-10	Maricopa Highway
Culvert Inlet Station	7+00	16+60
Maximum Water Surface (ft.)	1,144.2	1,142.5
Culvert Inlet Elevation (ft.)	1,140.4	1,137.1
Depth of Flow (ft.)	3.8	5.4
Slope (ft./ft.)	0.002	0.002
Velocity (fps)	6.94	7.97
Maximum Discharge (cfs)	790	1,303

Should a subsidence of 0.8 feet be considered as applicable to the contractual maximum water surfaces permissible at the location of the interchange the Highway I-10 and Maricopa Highway peak capacities would be reduced to 568 and 1,042 cubic feet per second.

As constructed, the earth channel between the two culverts is the principal constraint to present peak discharge. It is estimated that the maximum safe carrying capacity of this channel without encroachment upon the roadway subgrade material would be about 477 cubic feet per second.

The maximum discharge through the interchange could be increased, provided the channel between the culverts was lined with concrete. Better flow conditions would permit use of a reduced frictional coefficient of n=0.014 within the culverts (n=0.016 was used in the above computations). This would result in an increase of peak discharges as follows:

	Highway I-10	Maricopa Highway
Without Subsidence	903	1,489
With Subsidence	649	1,191

No information as to the drainage area served or peak discharges used for the design of the two culverts was available from ADOT. The September 1977 Corps of Engineers study estimated a discharge of 1,853 cubic feet per second at Point 1310 (synonomous with the highway interchange). It is obvious that neither the 1923 Agreement nor the ADOT designs contemplated floods of this magnitude. However, in review of the existing facilities it was determined that a discharge of 2,000 cubic feet per second could be safely conducted through the interchange without encroachment upon the roadway subgrades provided:

1. The channel joining the two culverts is lined for high velocity flows, and
2. The water surface can be raised to levels above those shown on the 1923 U.S. Government and SRVWUA Agreement for that part of the Gila Drain through or upstream from the interchange.

ADOT BORROW PIT

In the construction of Highway I-10, a borrow pit was excavated on the east side of the highway in Section 20, Township 1 South, Range 4 East, Gila and Salt River Base and Meridian, from which over 1,300 acre feet (2,100,000 cubic yards) of material was removed. The approximate dimensions of the pit were paced off and excavated quantities have been estimated (see Exhibit No. 11).

From the Corps study, nodes 351, 352, 353 and 354 were identified as major contributors of floodwaters to that part of the Gila Drain upstream from the drain's crossing of Highway I-10. The highway poses little obstruction to cross drainage. Concentration of flood flows was avoided by the construction of numerous pipe and box culvert crossings. Twenty-three of these culvert crossings were identified between the middle of Section 8, Township 1 South, Range 4 East, Gila and Salt River Base and Meridian, and Ray Road, from which floodwaters could be diverted from their downstream end, to the borrow pit.

Possible locations for diversion channels inspected were:

- Parallel to Highway I-10 and within existing right-of-way
- Parallel to 56th Street and the Highline Canal
- Parallel to the Highline Canal

The first alignment was not recommended because of difficulties encountered at Elliot and Warner Road Crossings. For purposes of deriving cost estimates for this preliminary design the route paralleling 56th Street and the Highline Canal was selected.

All of the runoff originating upstream of the diversion channel in nodes 351 and 352 of the Corps study and most of node 353, could be captured and retained by the borrow pit. Most of the runoff from the remainder of node 353 and all of node 354 could be diverted upstream from the highway but detention would be required to reduce peaks to the carrying capacity of the existing 10 foot by 3 foot culvert crossing the Highway I-10 at Station 738+48 located about 2,350 feet north of the Ray Road overpass.

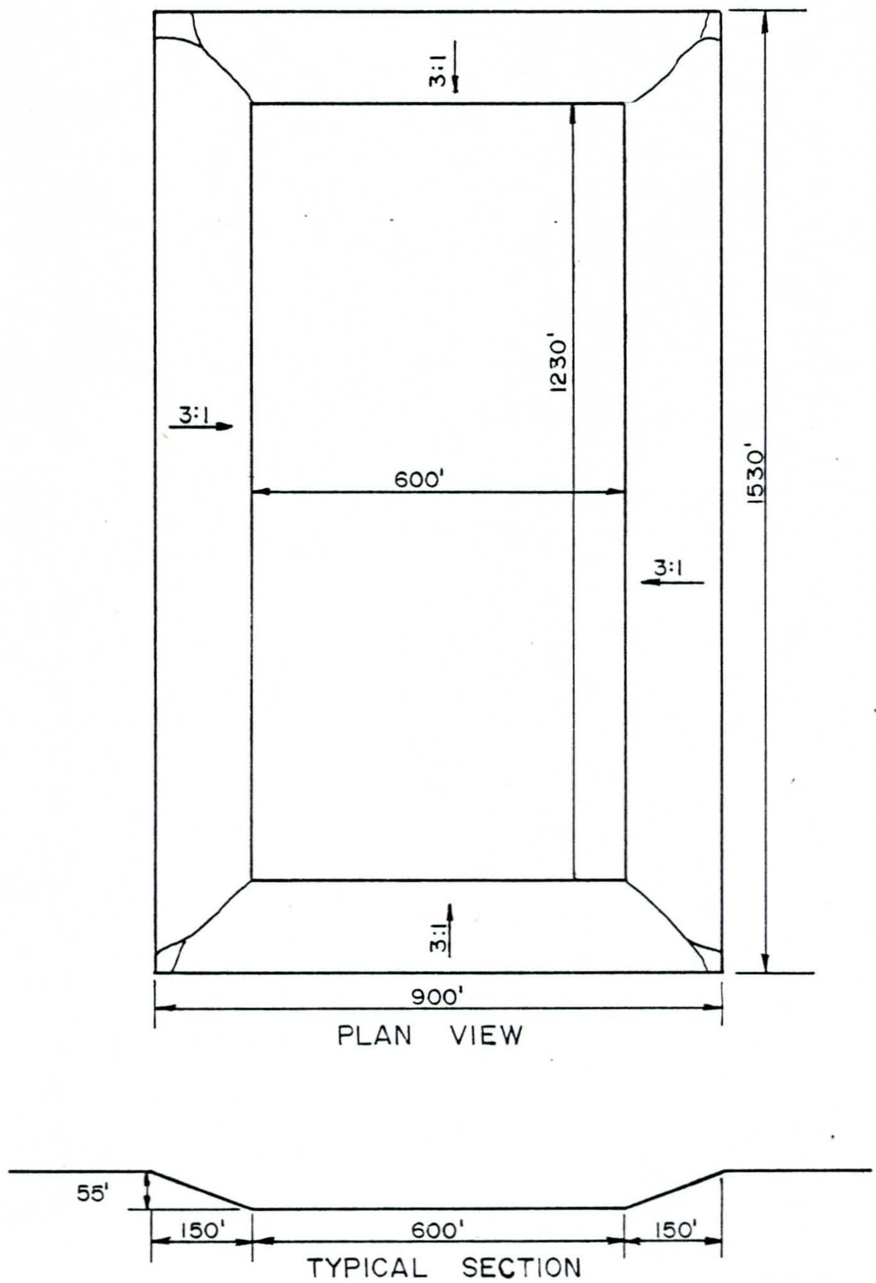
INTERCEPTION OF STORM RUNOFF

In addition to the detention and retention of storm waters required by city and county ordinances and the utilization of the ADOT borrow pit proposed above, numerous opportunities exist for additional interception of storm runoff. These are found primarily on the southeastern slopes of South Mountain and within the undeveloped desert plains on the GRIC Reservation.

Several isolated igneous extrusions project above the recent alluvial slopes leading from the main mountain structure. Numerous intermittent stream beds pass between these foothills. The potential exists for the construction of several low earthened dikes which could be utilized for the protection of downstream developments, through detention or retention.

GILA DRAIN PROJECT

A.D.O.T. BORROW SERIAL No. 7096
Sec. 20–T1S-R4E



NOTE: ALL DISTANCES AND VOLUMES APPROXIMATE.

VOLUME =
H = 10' = 182 ac.ft.
H = 20' = 391 ac.ft.
H = 30' = 628 ac.ft.
H = 40' = 896 ac.ft.
H = 50' = 1,195 ac.ft.
H = 55' = 1,314 ac.ft.

A.D.O.T. BORROW PIT

EXHIBIT NO. 11

Within the desert plain, no natural barriers to the generally westward drainage pattern exists. Runoff originating south and east of the Gila Drain is forced northward across the drain to the natural swale formed along the toe of the slopes of South Mountain. Interception of these floodwaters must be made upstream from the drain otherwise they would be diverted by the enlarged drainage channel proposed.

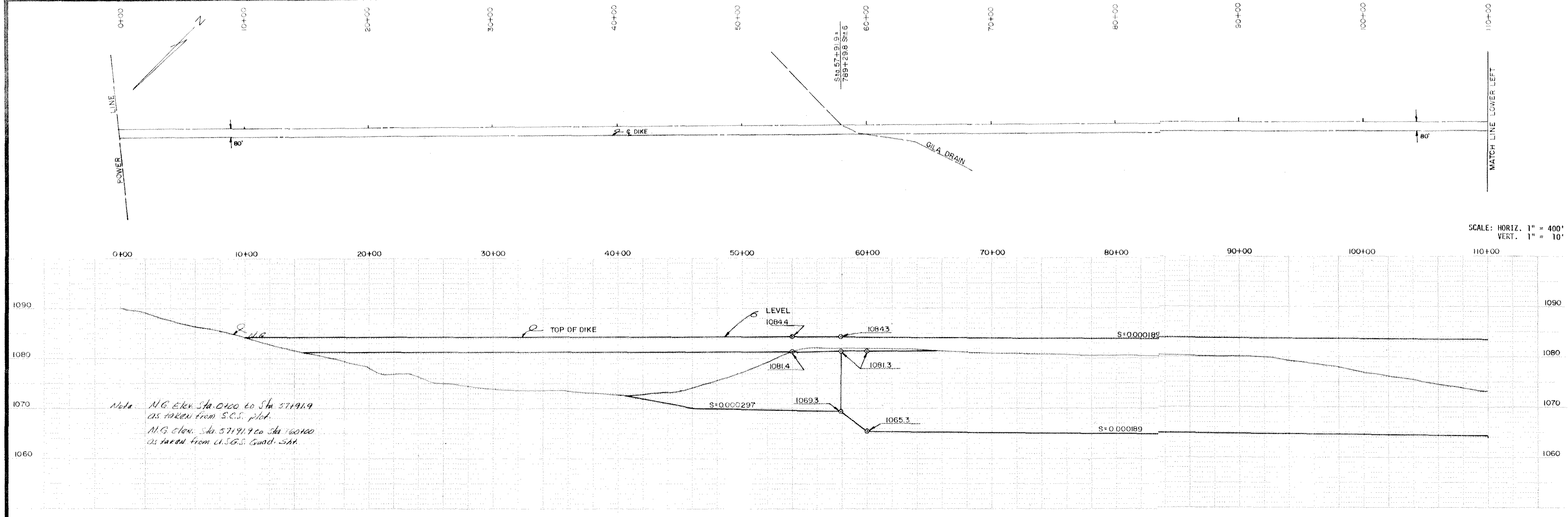
Runoff from the slopes of the South Mountain and west of Highway I-10 generally collect in the natural swale utilized in the Corps study for the location of the Gila Floodway. These flows do not enter the Gila Drain and any retention proposed could be developed either upstream or downstream from the project's boundary as discussed below.

GRIC DIVERSION DIKE AND CHANNEL

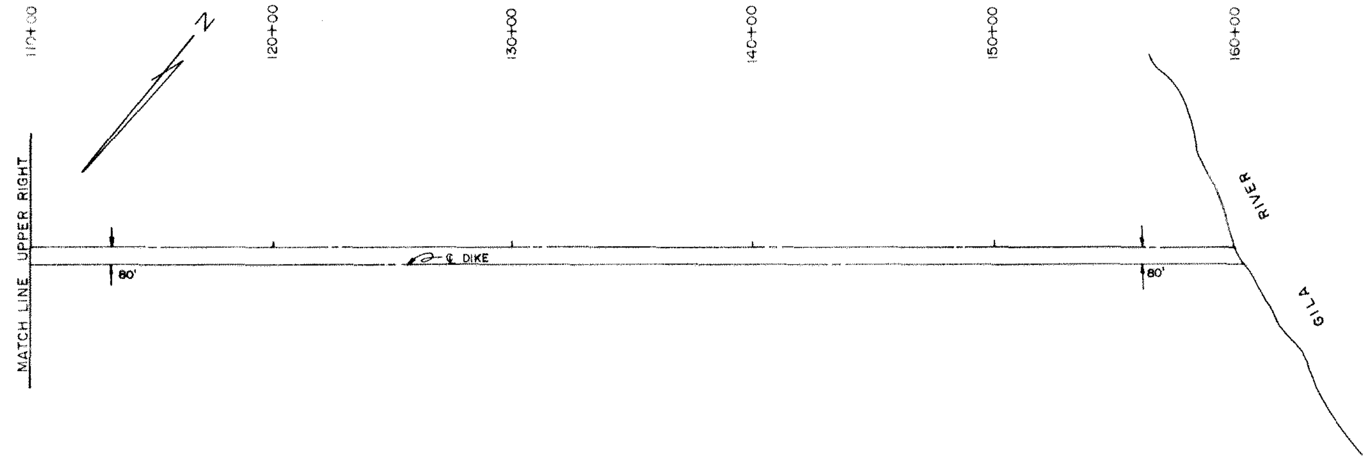
In 1976 the SCS studied the possibility of the interception of the natural floodway flows originating north of the Gila Drain and west of Highway I-10. A survey of a possible dike and diversion channel alignment was made from which all flows, originating within the project as shown on Exhibit No. 1, could be diverted to the Gila River, thus providing greater protection against damage to the Komatke and St. Johns School area resulting from floodwaters originating on the project area. Plan and profile of this diversion dike and channel are shown on Exhibit No. 12. Their location is indicated on Exhibit No. 14. Approximately 81,400 cubic yards of fill material would be required to construct the dike section and an additional 367,000 cubic yards of excavation would be needed for the drainage channel, including the enlarged Gila Drain section. Estimated increase in the costs for construction of this alternative is $563,000.

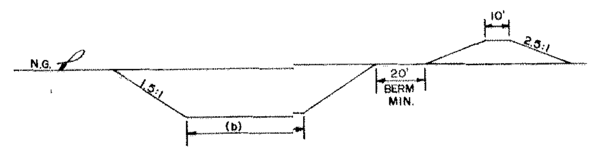
CHANNEL REALIGNMENT

No changes in the general alignment of the drain are proposed within the private sector of the project. However, existing rights-of-way do not meet future requirements for both arterial streets and the Gila Drain along the reach paralleling Rural Road. As shown in Exhibit No. 13, the future roadway section will extend beyond the 33 feet allocated at present and will occupy part of the right-of-way presently assigned to the Gila Drain.



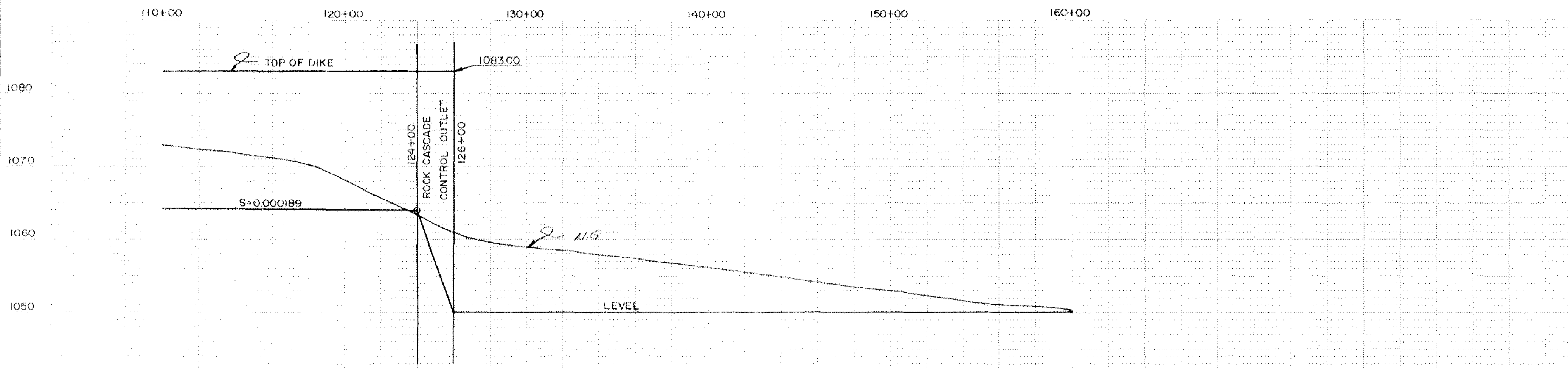
SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'





TYPICAL SECTION

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'



HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec.	SLOPE Ft/Ft
46+00	57+91.9	EARTH	.025	1.5:1	2310	30	12	576	73.27	3.95	4.04	0.000297
CONFLUENT TRANSITION												
60+00	END	EARTH	.025	1.5:1	4817	50	16	1184	107.7	4.94	4.03	0.000189

GILA FLOODWAY DIVERSION CHANNEL AND DIKE

COE & VAN LOO CONSULTING ENGINEERS INC
PHOENIX ARIZONA

PLAN & PROFILE

REVISIONS	DATE	BY

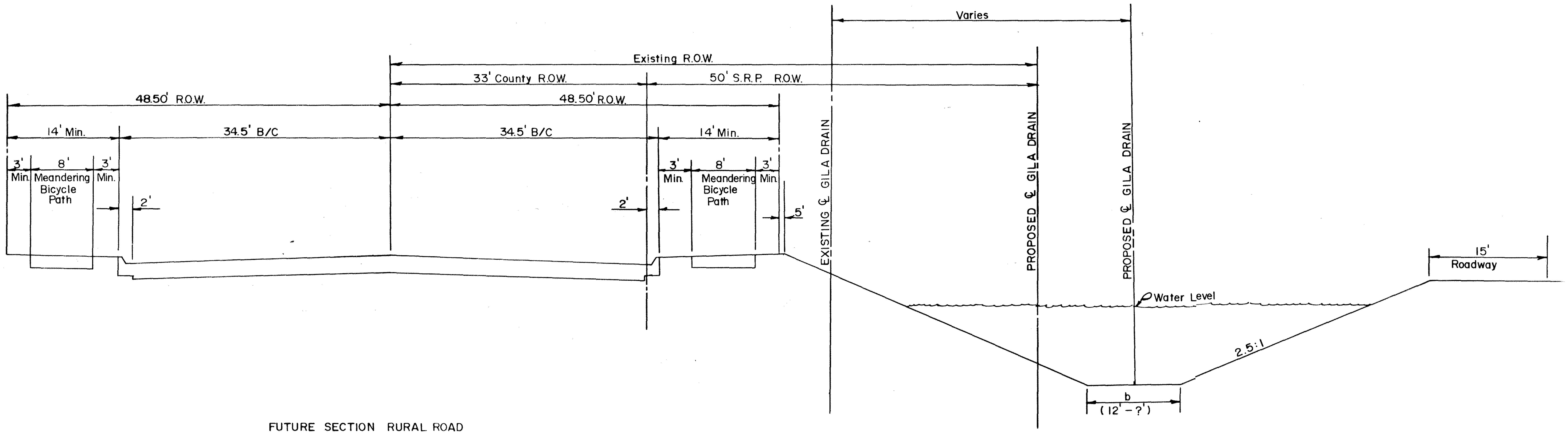
DESIGNED
DRAWN
CHECKED
DATE

1 OF 1

840-01-06

EXHIBIT NO. 12

ALIGNMENT RELOCATION PARALLEL TO RURAL ROAD

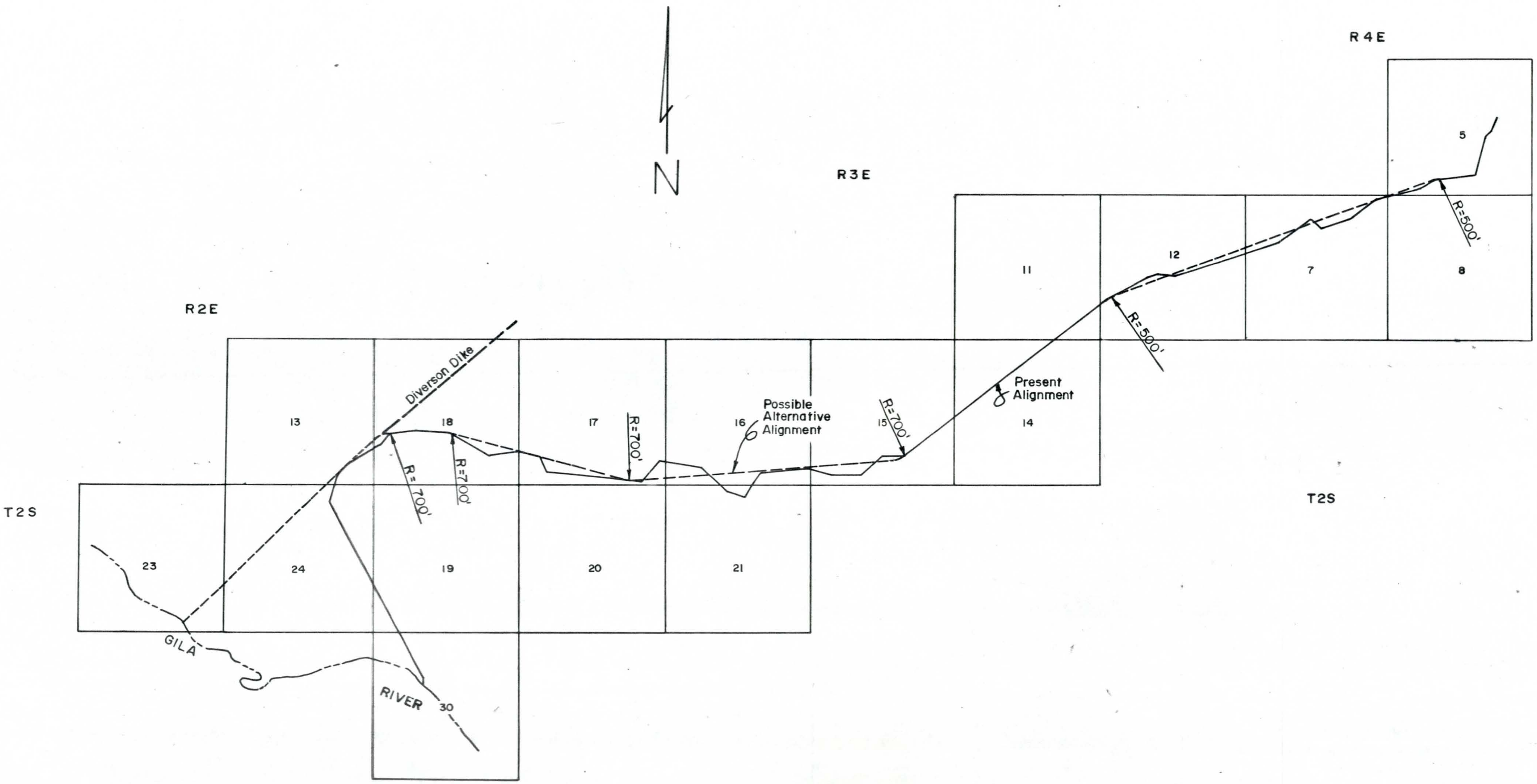


FUTURE SECTION RURAL ROAD

TYPICAL SECTION GILA DRAIN

EXHIBIT NO. 13

GILA DRAIN PROJECT



ALTERNATIVE: ALIGNMENT ACROSS GRIC RESERVATION

EXHIBIT NO. 14

The drain has been moved from the right-of-way alignment as legally defined in the 1923 Agreement for that section of the drain crossing the Pima-Chandler Industrial Park. A revised alignment agreement should honor the alignment established in the park's development plans.

West of the Maricopa Highway crossing the established right-of-way appears to have been selected for reasons other than existing flow patterns. The drain's centerline swings to the south of the natural floodway and contains numerous sharp bends not needed for good drainage design. While the right-of-way alignment posed no serious problems for the construction of the small 75 cubic foot per second channel, enlargement of the channel is significantly affected by the numerous bends.

In the original design the drain was diverted from its general westward flow towards the Gila River as it approached the river's natural levee. It appears that the sharp swing to the southeast along the last 9,000 feet of the drain was made in order to discharge drainage waters into the river at a point upstream from the Santa Cruz and Hoover Ditch Heading. These ditches are no longer in use and the heading has been abandoned.

A possible realignment of the drain within the GRIC Reservation which would serve to reduce construction costs, reduce right-of-way area and at the same time improve channel flow characteristics is presented on Exhibit No. 14.

HYDROLOGY OF ALTERNATIVES

Project formulation was effected through a general consent of sponsoring agents at the "Milestone" meetings. The development opportunities, described above, were reviewed and alternative project concepts discussed. Three overall plans were selected for hydrologic testing to determine channel capacity requirements. Testing was accomplished by step adjustments of the U.S. Corps of Engineers hydrologic data reflecting development alternatives as illustrated in Exhibit No. 15 and as quantified in the computer data presented in Appendix "B".

Alternative "A"

This plan is "a minimum channel capacity" concept needed to service projected urbanization by the year 2030. Principal tenants selected for the plan were:

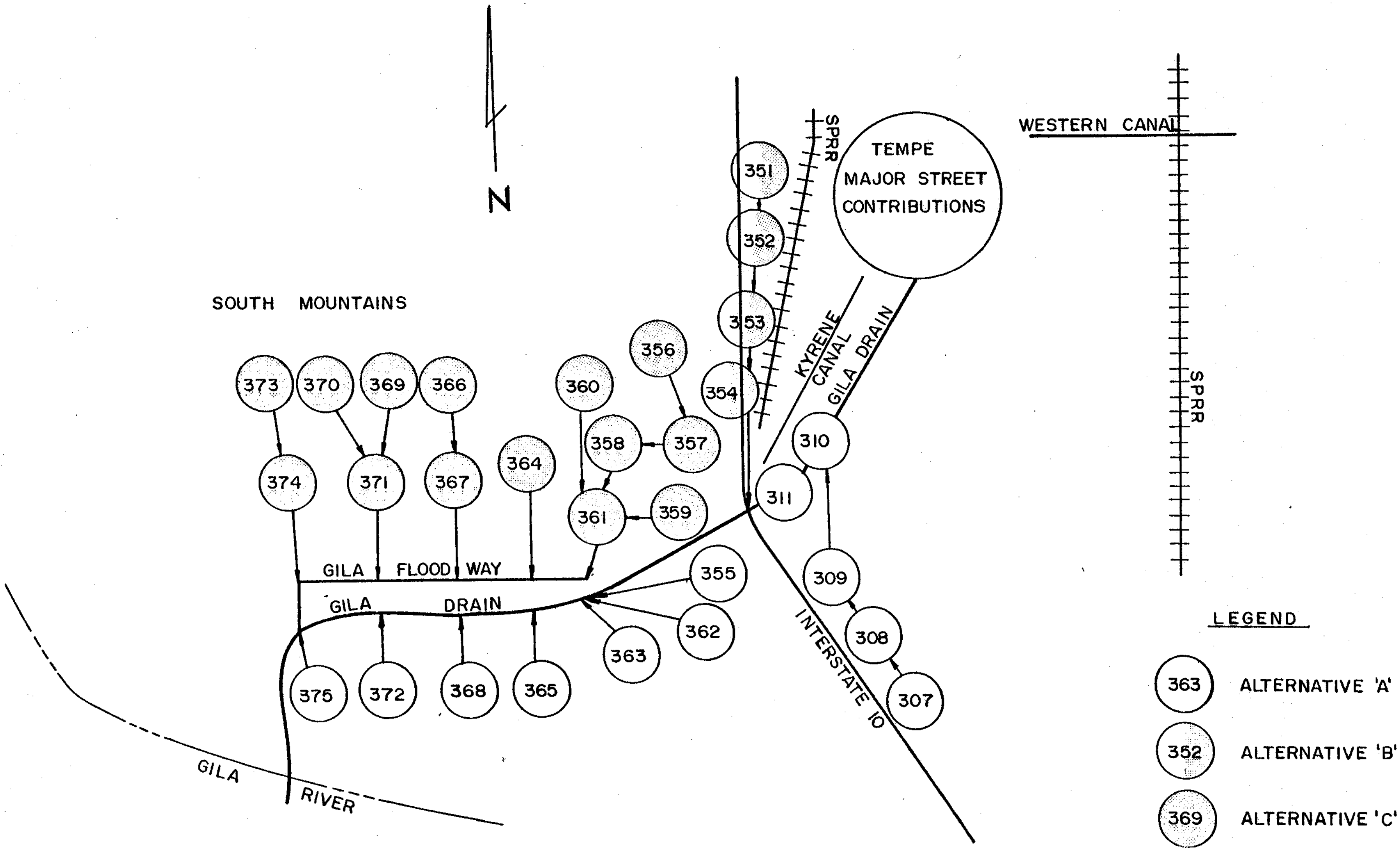
- 100 Year design storms could occur without prior warning
- SRVWUA peak discharge of 608 cfs would be used as the "base flow" during storm occurrence
- City ordinances governing storm retention would be enforced
- County ordinances governing storm retention would be adopted
- Retention would be maintained until after storm peakings had passed
- ADOT borrow pit diversion channel and retention basin would be included in the project
- Storm runoff from project area north of the Gila Drain and west of Highway I-10 would continue to flow westward in the natural channel towards Komatke

Test Runs Nos. 1, 2 and 4 of Appendix "B" define the channel capacity requirements of Alternative "A".

Test Run No. 1

In this test the peak discharge of the upstream section of the Gila Drain was computed. It was assumed that the runoff from arterial streets in the City of Tempe area would occur simultaneous with the base flow release of 608 cubic feet per second from the Western Canal. The arterial street runoff pattern, as illustrated on Exhibit No. 16, assumed that the arterials in this area would be developed in accordance with the City of Tempe standards although portions of the area included lie within the City of Chandler or within Maricopa County. Discharges at critical points were computed as presented in Table No. 4.

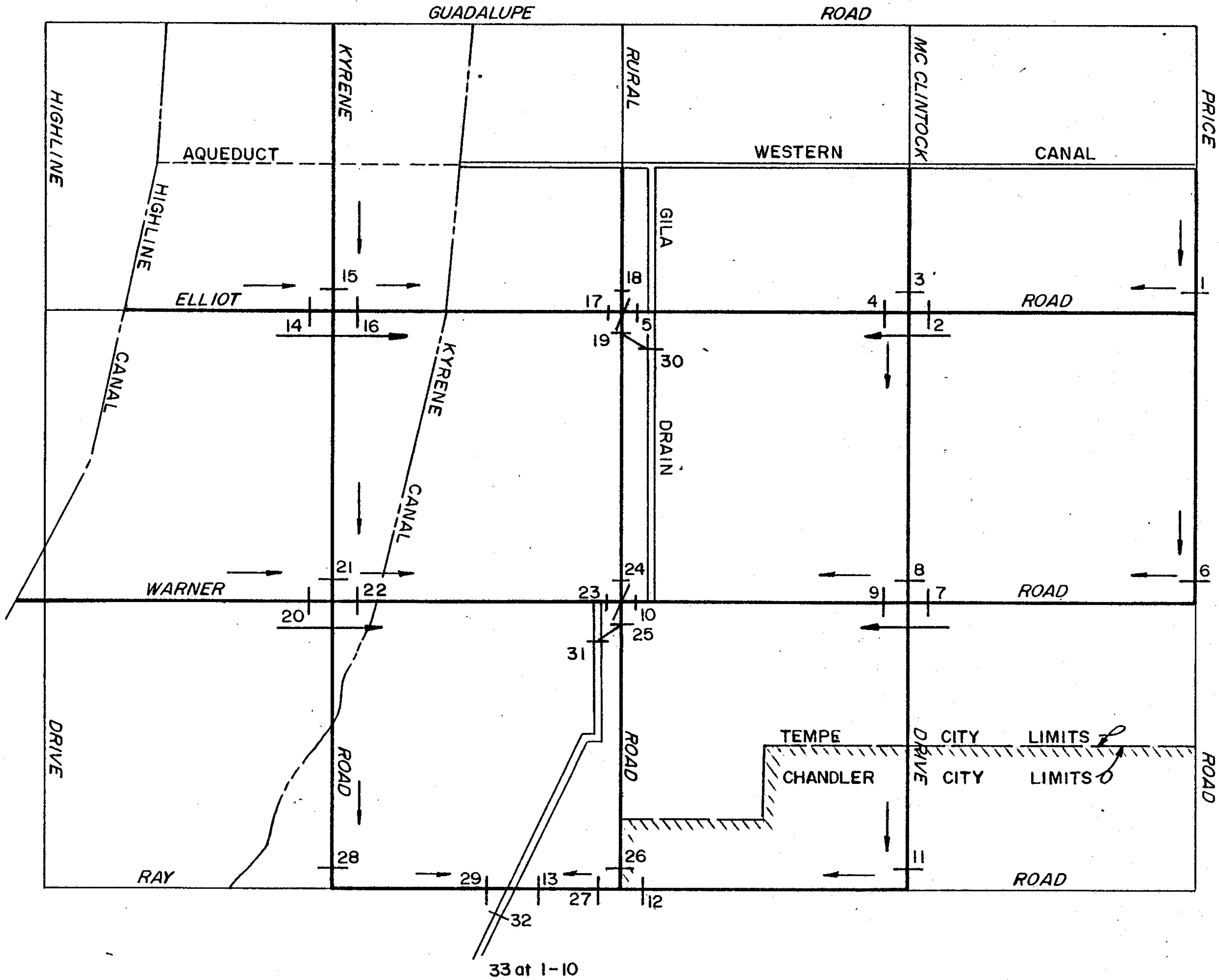
GILA DRAIN PROJECT



SCHEMATIC FLOW DIAGRAM

EXHIBIT NO. 15

GILA DRAIN PROJECT



TEMPE MAJOR STREET CONTRIBUTION

EXHIBIT NO. 16

TABLE NO. 4 - Peak Discharges in the Gila Drain Between the Western Canal and Highway I-10 Crossing

Location	Base Flow (cfs)	Cumulative* Street Contribution (cfs)	Total (cfs)
Western Canal	608		608
Elliot Road	608	95	703
Warner Road	608	211	819
Ray Road	608	269	877
Highway I-10	608	256	864

*These values should be reviewed in the final designs for developed conditions in the Tempe area.

Test Run No. 2

Corps' node numbers 307, 308, 309 and 310 were reevaluated to reflect the implementation of the City of Chandler's ordinance governing storm water retention. These flows originating on the GRIC Reservation, were combined with the hydrograph developed under Test Run No. 1 resulting in an overall peak discharge of 938 cubic feet per second. When added to the base flow of 608 cubic feet per second, the peak discharge through Highway I-10 culvert was increased to 1,546 cubic feet per second.

Field investigation of the onsite runoff pattern on the reservation and east of Highway I-10 showed the Corps' assumption that node numbers 307, 308, 309 and 310 discharge through node point 1310 to be incorrect. A general east to west drainage pattern has been preserved by ADOT in the construction of several pipe and box culverts under Highway I-10 along the section between the Maricopa Highway interchange and Hunts Highway. Overpass structures at Riggs Road and Santan Road further preserve the natural drainage pattern. Thusly, the Corps program is conservative in its evaluation of the discharge through the Gila Drain - Highway I-10 culvert of 1,546 cubic feet per second. However, as no onsite retention has been required for the Pima-Chandler Industrial Park, peak runoff from this park alone when fully developed could amount to as much as 280 cubic feet per second which, when added to the upstream drain discharge of 864 cfs, would yield a peak of 1,144 cfs through the culvert.

Test Run No. 4

To complete the computation of peak discharges under a "minimum channel capacity" alternative, the runoff generated from the Corps' nodes located to the south of the Gila Drain and west of the Highway I-10 were tested. Combined peak discharges and design channel capacities for the downstream section of the drain are presented in Table No. 5.

TABLE NO. 5 - Peak Discharges in the Gila Drain at Points of Inflow Below the Highway I-10 Crossing

Location	Station	Test Run	Point Hydrograph	Combined Peak Discharge	Add Base Flow	Design Flow Selected
Maricopa Highway Culvert Outlet	346+98	#2	1311	938	608	1600
Lone Butte	581+00	#4	1363	2203	608	2800
Mid Section 16	697+00	#4	1365	2289	608	2900

Alternative "B"

In this alternative the importance of the ADOT borrow pit retention basin to Alternative "A" was tested. Corps' node numbers 351, 352, 353 and 354 were isolated from the Corps program (see Test Run No. 3, Appendix "B"). It was determined that under future development by the year 2030 the runoff from these four areas would yield a combined peak discharge to the Gila Drain upstream from the Highway I-10 culvert crossing of 2,752 cubic feet per second. This flow would exceed the capacity of the culvert and overtopping of the highway embankment would occur.

Alternative "C"

Inclusion of the GRIC Diversion Dike and Channel, described above, in the project was tested (see Test Run No. 5). Under this alternative a peak discharge of 2,310 cubic feet per second would be diverted from the Gila Floodway into the Gila Drain at about Station 789+30. The peak combined flow in the Gila Drain below the confluent would be increased from 2,900 to 4,817 cubic feet per second.

MAXIMUM PROJECT PERMISSIBLE UNDER 1923 AGREEMENT CONSTRAINTS

This section addresses the constraints imposed upon the project by the 1923 Agreement between the U.S. Government and the SRVWUA and assesses the feasibility of drain enlargement within the terms of that Agreement. No additional constraints were envisioned because of the Pima-Chandler Industrial Park realignment. It was assumed that the easement indicated on the design engineer's plans for the park would be available to the project.

Right-of-Way Width

The right-of-way described in the 1923 Agreement, as modified by the Industrial Park development, makes available a 100 foot wide strip across the Reservation between Section 33, T1S, R4E, G&SRB&M and the Gila River. As discussed later under "Recommended Project" this limitation in width does not impose a constraint in channel discharge capacity within the limits needed for Hydrologic Alternatives "A" or "B" of the project concept, provided, certain design criteria are accepted.

Maximum Permissible Water Surface

The design profile, attachment to the 1923 Agreement, does not impose any constraint upon channel discharge capacities within the limits needed for Hydrologic Alternatives "A", "B" or "C" of the project concept along that section of the drain downstream from the culvert crossing the Maricopa Highway. However, serious constraint is imposed by the structures of the Highway I-10 - Maricopa Highway interchange upon channel capacities within and upstream from the interchange.

No field survey ties have been made between the alignment defined in the Agreement and the existing highway structures. Approximate ties were estimated by plotting of the channel alignment, as described in the Agreement, upon the site plan of the Pima-Chandler Industrial Park provided by the park's design engineers and architects. Beginning at the 16/14 Corner, Section 5, T2S, R4E, G&SRB&M it was determined that the Agreement alignment passed close to the Highway I-10 culvert at or about Station 7+00. This corresponds to a maximum permissible water surface at Elevation 1144.2 as shown on the "Profile" attachment to the agreement.

Maximum Permissible Discharge

To establish a peak design capacity for the drain, the highway culverts were evaluated for maximization of the discharge within the water surface constraint imposed above. In the interest of conservatism, commensurate with preliminary designs, it was assumed that all subsidence in the land surface had occurred prior to the establishment of the bench mark and structural elevations presented on the ADOT "As Built" drawings dated February 27, 1969 for the Maricopa Highway interchange. The maximum permissible water surface was lowered by 0.8 foot to Elevation 1143.4. Based upon this water surface elevation and the slope constructed in the culvert, a peak discharge of 649 cubic feet per second through the culvert would be permissible.

Paragraph No. 5 (see Appendix "A" p. A-4) of the 1923 Agreement stipulates "that the United States shall have the right to use said drainage ditch at all times for the discharge of 20 sec. ft. of water...". Thusly, the drain crossing the reservation should be sized at 649 cubic feet per second but inflows from the private sector should be limited to 629 cubic feet per second.

Project Concept

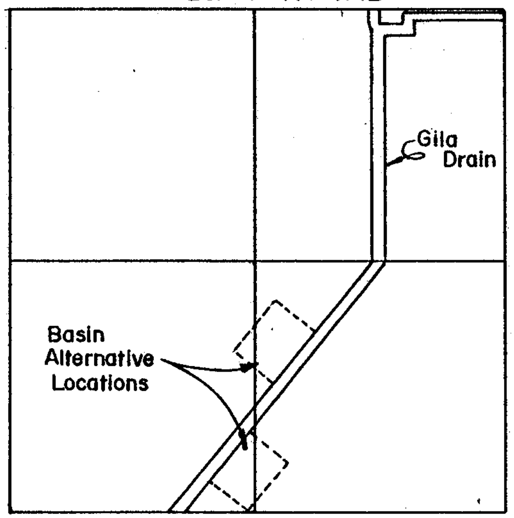
To provide for the 100 year frequency storm discharge from the private sector only as defined under Hydrologic Alternative "A", provisions must be made for the detention of the excess discharges. To accomplish this, a detention basin located immediately upstream from the Indian Reservation on lands within Maricopa County jurisdiction (see Exhibit No. 17) is proposed. Flood discharges in excess of 629 cfs would be routed to the detention basin, as shown in Exhibit No. 18, thusly limiting the peak outflow. Part of the retained floodwaters could be released by gravity into the Gila Drain with the remainder removed by pumping.

As shown in Exhibit No. 33, discussed below, the depth to groundwater throughout the entire reach of the Gila Drain across the Indian Reservation exceeds 200 feet in depth. No provisions for an increased capacity of the drain for "natural underground drainage water" (see Appendix "A", Par. 1(a), p. A-6) will be required.

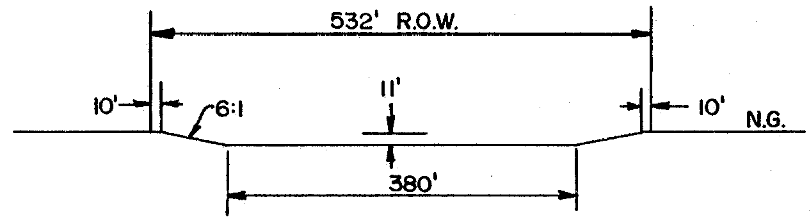
Alternative to the confined detention/retention basin as shown on Exhibit No. 17, are possibilities for an expanded or elongated parkway paralleling the Gila Drain similar to that used for Indian Bend Wash in the Scottsdale area. Such alternatives should be considered in the final design concept.

EXHIBIT NO. 17

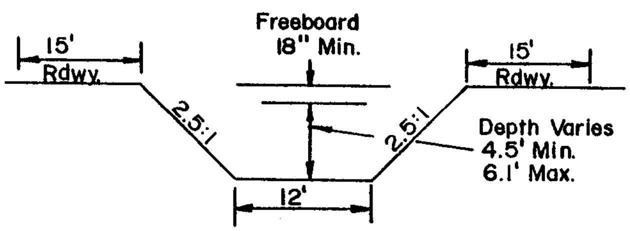
GILA DRAIN PROJECT



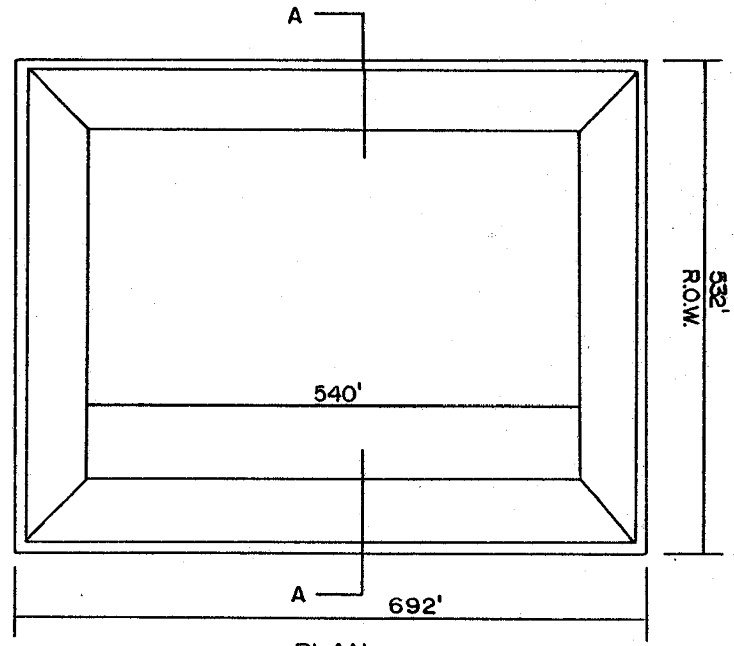
LOCATION



SECTION A-A



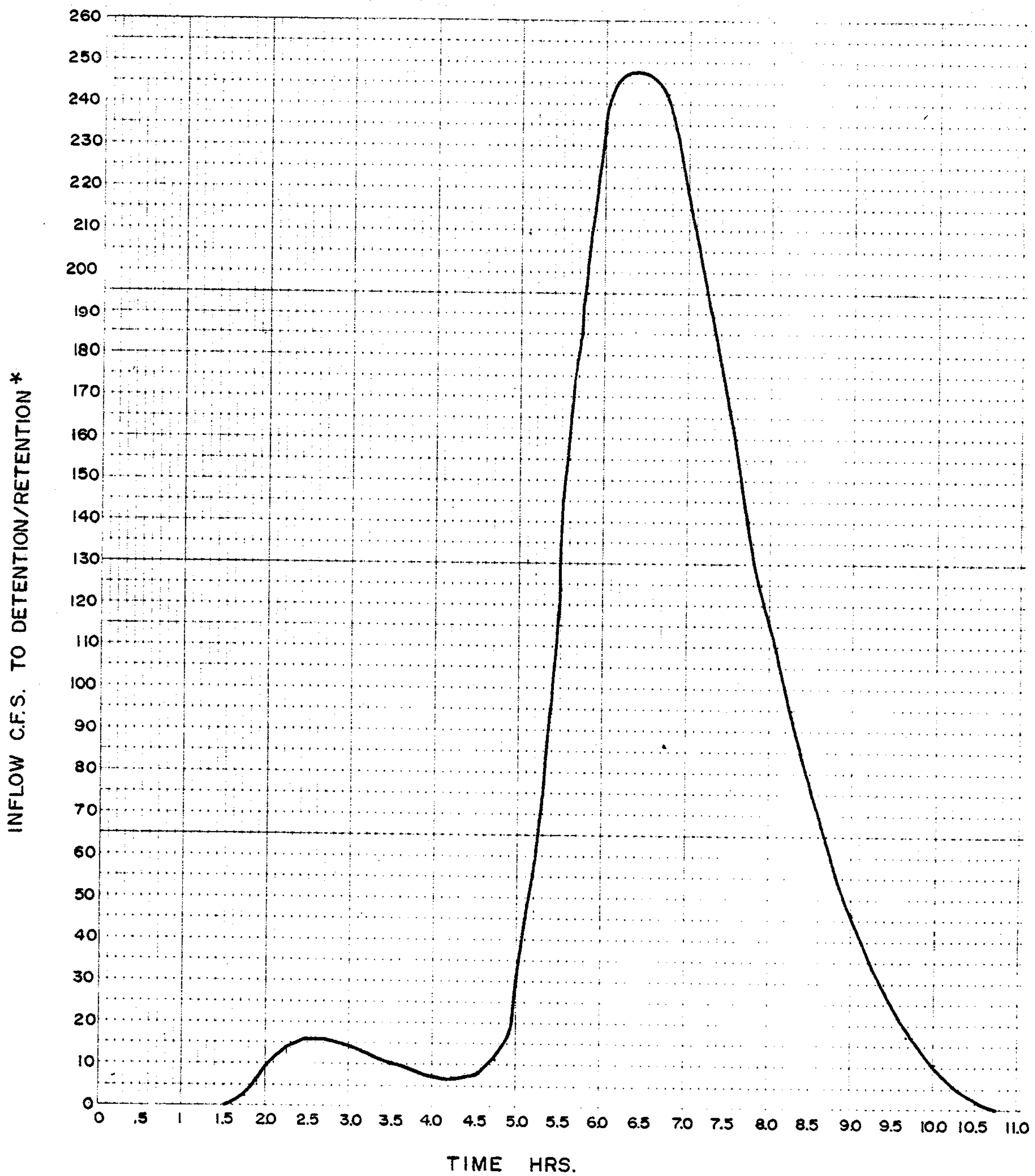
TYPICAL CHANNEL CROSS SECTION
BELOW DET./RET. BASIN



PLAN

GILA DRAIN DETENTION/RETENTION BASIN

GILA DRAIN PROJECT



* Based on Subroutine for Cross Section 32 Test Run No. 1, Appendix "A".

FLOOD ROUTING HYDROGRAPH
GILA DRAIN DETENTION/RETENTION BASIN

EXHIBIT NO. 18

Project Operations

This alternative presumes that 100 year frequency storm runoff will be retained within the sponsors jurisdictional boundaries in accord with existing land development ordinances. Some 6,629 acre feet will be in storage within city basins and the ADOT Retention Basin. An additional 60 acre feet will be retained within the Gila Drain Detention/Retention Basin increasing the total storage to 6,689 acre feet.

As protection against back-to-back occurrence of low frequency storms it is recommended that the retention basins be emptied as soon as practicable following such storms. Suggested allocations of pump discharges following the storm, utilizing the full 629 cubic feet per second discharge capacity available, is presented in Exhibit No. 19.

Cost of Alternative

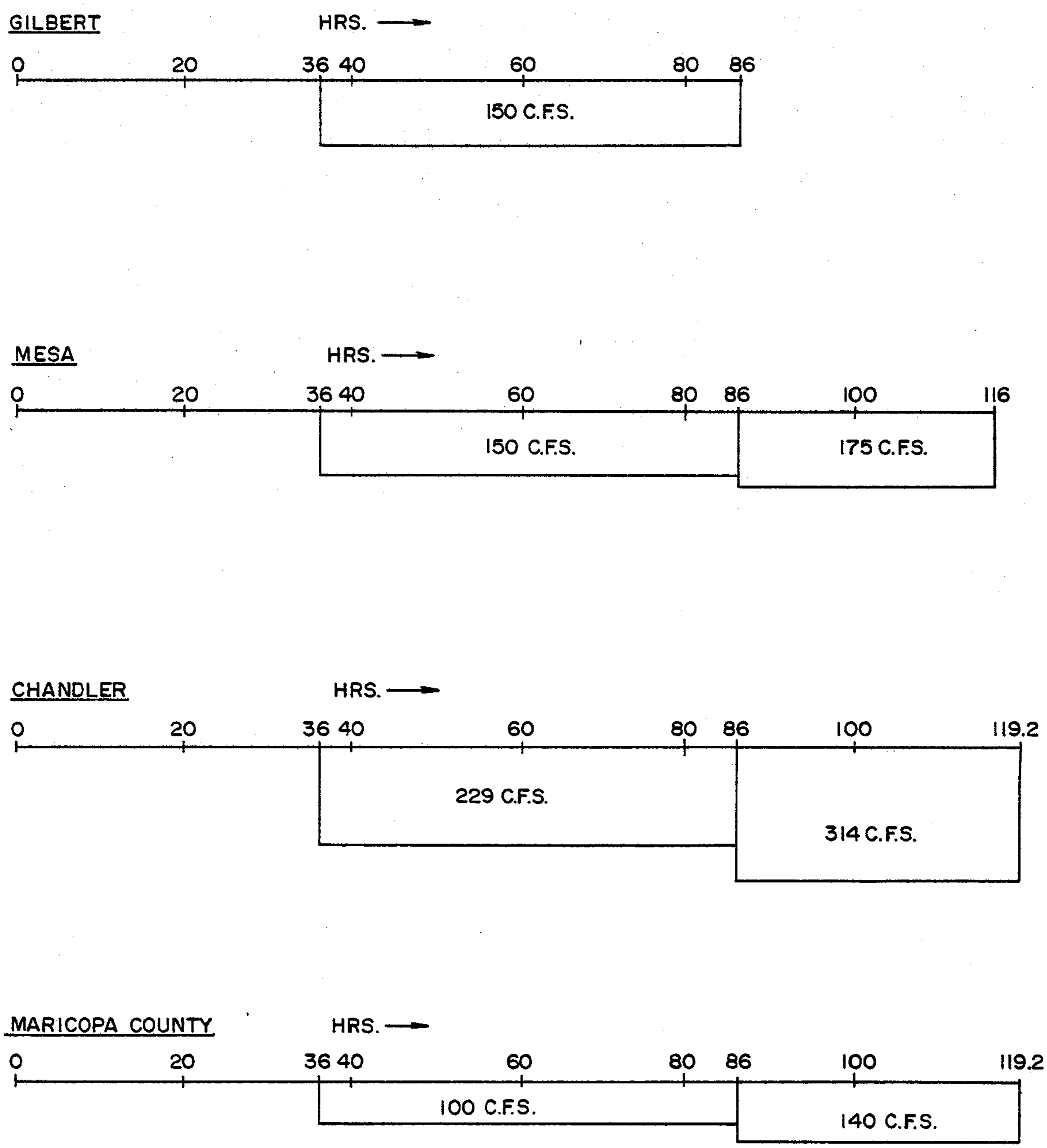
Earthwork construction quantities have been determined by average depth of cut and design channel cross section as determined from the profile attachment to the 1923 Agreement. Structures were identified and typical quantities determined. Structures within the reservation, as stipulated in the Agreement, include four bridges plus a controlled drop outlet at the Gila River. Bridge locations selected were at the Pima-Chandler Industrial Park - Allison Road Entrance, at Station 493+50, at Station 621+00 and at the Beltline Road Crossings.

A 15 percent contingency factor is used in the cost estimate. A three year design and construction period was selected. Engineering costs of 4 percent for design and 5 percent for construction were added to the base cost. Escalation of 9 percent per year was added to the construction costs for each year after 1979. The schedule of expenditures for construction is approximately 25 percent each for years 1980 and 1982 and 50 percent in year 1981. Costs are presented in Table No. 6 .

The total estimated cost of this alternative is $9,866,000.

GILA DRAIN PROJECT

RECOMMENDED PUMPING CAPACITIES WITH GILA DRAIN DETENTION/RETENTION BASIN



SCALE:
1" = 20 HRS. HORIZ.
1" = 400 C.F.S. VERT.

EXHIBIT NO. 19

TABLE NO. 6: Cost of Maximum Project Permissible Under 1923 Agreement Constraints

Item	1979 ($)	1980 ($)	1981 ($)	1982 ($)	Total ($)
CONSTRUCTION (1)					
Lateral 9.5					
Check Protection			48,000		48,000
SRPP Culvert			6,800		6,800
Riprap			12,700		12,700
Subtotal			67,500		67,500
Western Canal					
Wasteway			20,400		20,400
Riprap			5,100		5,100
Subtotal			25,500		25,500
Gila Drain					
Excavation					
Channel		872,000	872,000		1,744,000
Det./Ret. Basin			168,000		168,000
Comp. Embankments			52,000		52,000
Concrete Lining					
Residential Sector			176,000		176,000
Highway Interchange				108,000	108,000
Riprap				7,000	7,000
Gravel Bedding				2,000	2,000
Bridges			1,000,000	1,123,000	2,123,000
Culverts			340,000	330,000	670,000
Det./Ret. Control Struct.				53,000	53,000
Fowler Ditch Control				27,000	27,000
Subtotal		872,000	2,608,000	1,650,000	5,130,000
ADOT Retention Basin					
Excavation				147,000	147,000
Comp. Embankments				52,000	52,000
Bridges				233,000	233,000
Inlet Structure				133,000	133,000
Riprap				10,000	10,000
Subtotal				575,000	575,000

TABLE NO. 6: Cost of Maximum Project Permissible Under 1923 Agreement Constraints (continued)

Item	1979 ($)	1980 ($)	1981 ($)	1982 ($)	Total ($)
(brought forward)		872,000	2,701,000	2,225,000	5,798,000
Contingencies (15%)		131,000	406,000	333,000	870,000
TOTAL CONSTRUCTION COST (1)		1,003,000	3,107,000	2,558,000	6,668,000
RIGHT-OF-WAY					
Gila Drain					
Non-Residential	264,000				246,000
Residential	92,000				92,000
Streets	(54,000) (2)				(54,000) (2)
Det./Ret. Basin	128,000				128,000
ADOT Retention Channel					
Non-Residential	608,000 (2)				608,000 (2)
Streets	(66,000)				(66,000)
TOTAL RIGHT-OF-WAY	1,092,000				1,092,000
ESCALATION		91,000	585,000	754,000	1,430,000
ENGINEERING					
Design	136,000	136,000			272,000
Construction		55,000	185,000	164,000	404,000
TOTAL ENGINEERING	136,000	191,000	185,000	164,000	676,000
TOTAL COST OF PROJECT	1,228,000	1,285,000	3,877,000	3,476,000	9,866,000

(1) Based on 1978 Construction Costs

(2) Not included in cost of project

RECOMMENDED PROJECT

ALTERNATIVE SELECTED

Alternative "A", as defined under "Hydrology of Alternatives" above, was selected as the basis for preliminary designs in accord with a consensus of agreement between sponsoring parties reached at the Milestone No. 2A meeting of December 27, 1978. Under this alternative the constraints imposed by the 1923 Agreement between the U.S. Government and the SRVWUA were recognized to the following extent:

1. Right-of-way widths and relocation as indicated on the engineers and architects plot plans for the Pima-Chandler Industrial Park were presumed to over-ride the 1923 Agreement for that part of the drain crossing the park.

2. Right-of-way width and location within the ADOT Highway I-10 - Maricopa Highway were presumed to over-ride the 1923 Agreement for that part of the drain crossing the interchange.

3. Right-of-way width and location downstream from the highway interchange were presumed to be confined to that provided in the 1923 Agreement.

4. Maximum permissible surface within and upstream from the highway interchange were permitted to exceed that established in the "Profile" attachment to the 1923 Agreement.

5. Maximum permissible water surface as defined in the "Profile" attachment to the 1923 Agreement was recognized as a constraint to preliminary channel designs for that reach of the drain downstream from the highway interchange.

The above concept was based upon the recognition:

1. In fact, if not in definition, of the channel relocation across the Pima-Chandler Industrial Park.

Under this "Recommended Project" provisions are made for the acceptance of flood discharges originating within the Reservation as well as for those originating within the private sector. Floodwaters that would overtop the existing Gila Drain and would flow westerly toward the St. Johns and Komatke area are collected by the enlarged section of the drain and diverted to the Gila River.

FACILITIES REQUIRED

Although the hydrologic aspects of the subbasin compose an integrated drainage system, "project definition" is based upon multi-sponsor service. For example, excluded from the project are facilities serving single sponsors only, such as:

- retention ponds
- secondary drainage channels
- drainage inlet structures
- property access facilities
- city and town utilities

Development, operation and maintenance responsibilities of these (above) facilities remain with the sponsoring agency served.

Elements serving more that one sponsoring agency are costed in the preliminary design, regardless of the facility's ownership. Included in the project are:

Lateral 9.5

- SPRR (Gilbert Branch) downstream culvert protection
- SPRR (Chandler Branch) replace box culvert
- Check structures (4) overpour weirs

Western Canal

- Controlled outlet enlargement

Gila Drain

- Main channel enlargement from Western Canal to the Gila River
- Arterial road crossings (9)
- Street road crossings (3)
- Channel lining
- Fowler Ditch control structure
- Gila River confluent structure
- Maintenance roads

ADOT Borrow Pit

- Diversion channel
- Borrow pit inlet structure
- Maintenance roads

CHANNEL DESIGN CRITERIA

Insofar as possible, preliminary channel designs presented herein are governed by the County of Maricopa Resolution of December 1, 1975 entitled "Statement of Policy for the Flood Control District of Maricopa County to Assume Ownership and Operation and Maintenance Responsibilities for Flood Control Structures Completed by Others".

Natural gradients along the existing drain alignment are adequate for economic earth lined channel designs of large capacity channels. Enlargement of the existing drain is technically feasible within the terms set forth in the 1975 Resolution, however, in the interest of cost saving and rights-of-way constraints some exceptions are recommended as discussed below.

Design Discharges

Channel capacities for the Gila Drain are based upon point discharges determined under Alternative "A" as presented in Table Nos. 4 and 5 above.

A 500 cubic feet per second design capacity is selected for the ADOT Borrow Pit retention basin diversion channel on the assumption that developers west of the highway will be required to divert floodwaters northward to the box culvert under Highway I-10 located near the southwest corner of the pit and that flow from the culvert will be routed through the diversion channel and inlet structure for the retention basin. Estimated future peak discharge to be diverted from node areas 354 and part of 353 is 1,482 cubic feet per second. Detention/retention required to reduce flows to culvert capacity is about 140 acre feet.

Rights-of-Way

To meet the channel side slope and flow velocity requirements of the County's 1975 Resolution for earth channels would require the acquisition of additional rights-of-way along the full reach of the Gila Drain. Preliminary designs, presented herein, deviate from the County's standards as follows:

Private Sector

Along the two mile reach where the existing drain right-of-way abutts against and parallels that for Rural Road, the centerline of the drain will need to be offset to permit widening of this arterial street.

Between Carver Road (Station 52+80) and Warner Road (Station 80+00) the existing housing development limits the potential widening of the right-of-way. For this reason a reduced, concrete lined, section with 1.5 to 1.0 side slopes was selected for the preliminary design.

Farm buildings and large trees are encountered south of the Gila Drain between Stations 106+72 and 111+28. Preliminary designs assume that additional rights-of-way will be acquired along the northern side of the drain.

South of Williams Field Road the drain's right-of-way is confined between a switchyard station and buildings and paved parking lot of the adjacent industrial park. A reduced, concrete lined, section for the 200 foot reach south of the Williams Field Road bridge was included in the costs for the preliminary designs.

GRIC Reservation

The preliminary designs are based upon the actual realignment and assumption that a 100 foot wide right-of-way strip will be set aside for the drain in the Pima-Chandler Industrial Park design drawings.

Downstream from the Maricopa Highway crossing, channel and maintenance road preliminary design cross sections were selected to conform to the existing 100 foot wide right-of-way provided by the SRVWUA - U.S. Government Agreement of 1923. Exceptions to the County's 1975 Resolution, required to conform to this constraint, are described below.

Channel Sections

In support of the channel designs selected, some 21 test borings were made along the alignment of the Gila Drain as described in Appendix "D". Basis for preliminary designs are as follows:

Safety

At present, urbanization affects only about one and one-half miles of the Gila Drain. Housing development west of Rural Road between Stations 0+00 and 26+40 expose the drain to possible trespass by children. However, a concrete block wall, constructed on the east side of the housing development limits access from the development to the three streets with access to Rural Road. South of

Carver Road (Station 52+80) and north of Warner Road (Station 80+00) housing development containing ranchettes and farmettes, one to three acres in size, have been constructed. Children have been seen playing in the existing drain.

By the year 2030 it is projected that all of the lands north of the GRIC Reservation will be urbanized. Residential developments will probably dominate this area and this entire reach will be subject to trespass by children. Channel side slopes of 2-1/2 to 1 were selected for the earth sections through the private sector to permit ready escape from the drain in times of flooding. It is recommended that safety ladders or steps be provided at 500 foot intervals along concrete lined sections.

Development within the GRIC Reservation at present is limited to industrial parks. Traditional residential areas for the Indian community are located some miles from the drain alignment. Future developments are forecast as industrial and agricultural. Safety to humans is not so critical and side slopes of earth channels can be steepened to 1.5 to 1 at limited risk to grazing cattle on the open range. Safety ladders or steps are recommended for lined sections.

Flow Velocities

The basic tenant used in selection of channel velocities was the design of non-scouring, non-deposition flows during 10 year frequency storms. Siltation will be expected during storm runoffs of less than 10 year frequency and scouring will occur during longer frequency storms.

The natural gradient along the Gila Drain, downstream from the Highway I-10 crossing, yield velocities in excess of five feet per second, thusly, velocity criteria is based upon soils survey data as required in Paragraph 2.2(c) of the County Resolution.

Non-cohesive layers 3 to 5 feet in thickness were encountered at various depths in the soil borings. Three holes representing about 1.5 miles of the channel's length indicate low velocities with flattened side slopes are required. This criteria would require a widened section exceeding the existing 100 foot right-of-way. To maintain the higher velocities and the steeper side slopes used in the adjacent sections, the preliminary designs propose over-excavation of the non-cohesive layers and replacement with compacted select materials.

Velocity criteria used in the preliminary design is based upon criteria established by the U.S. Soil Conservation Service as published in Technical Release No. 25 entitled "Design of Open Channels". The "Allowable Velocity" approach described in that publication was used.

Bends and Curves

The minimum radius of curvature recommended for heavy maintenance equipment including semi-truck and trailer type dump trucks is 100 feet. Eccentricities encountered along the lower reach of the drain for this minimum maintenance roadway curvature are presented in Table No. 7.

The maximum correction factor for changes in alignment recommended by the Soil Conservation Service TR No. 25 is 5 times the water width. Preliminary designs selected range in water width from 42 feet to 60.2 feet or minimum channel radii of 210 feet and 301 feet respectively. Test computations of channel sections resulted in excessive velocities for channels confined to 100 foot rights-of-way. Minimum radii of 8 times the water width for selected designs retained velocities within acceptable limits. A minimum radius of curvature of 500 feet was used for earth channels in the preliminary design. Eccentricities for 500 foot radii curves are shown in Table No. 7. In the selection of the preliminary design it was presumed that the channel would be adjusted within the available right-of-way to the extent that eccentricities could be retained within the right-of-way and still retain a maintenance road on at least one side of the channel. In Table No. 7, the eccentricity requirements that exceed available rights-of-way are underlined. The canal sections at these bends are reduced in size and lined with concrete.

Channel Freeboard

Subcritical velocities will be maintained throughout the channel length except at in-line drop structures. A residual freeboard of 1.5 feet is used in the preliminary designs in accord with the requirements of Paragraph 2.2(f) of the County's 1975 Resolution.

Bank Slope Stability

A maximum depth of excavation of about 15 feet to the bottom of the channel occurs along short sections at the lower end of the Gila Drain. Test borings indicate channel slopes at 1.5 to 1 would remain stable, provided, they are not undercut by erosion, and provided no surcharge is added to the top of the excavation. The preliminary designs provide for a trapazoidal channel section with continuous side slopes between the bottom of the channel and the natural ground surface.

Other Criteria

Maintenance Roads

Paragraph 2.2(e) of the County's 1975 Resolution requires "an access road of 10 foot minimum width for maintenance will be provided along...both banks where the top width exceeds 20 feet".

With urban development, it is expected that fences will be constructed along property lines by residents and that such fences will interfere with the operation of large maintenance equipment. For this reason the operating roads abutting residential and commercial properties within the private sector are widened to 15 feet. Along Rural Road the arterial street is considered to provide adequate access along one side of the channel and no additional maintenance road is required on the street side of the channel.

Within the GRIC Reservation right-of-way constraints will not permit the construction of roadways along both sides of the channel. A single maintenance road, 12 feet in width, is provided in the preliminary design along the southeast bank.

Levees

The levee (dike) section provided along one bank of the ADOT Borrow Pit Diversion Channel will compose of a compacted embankment with 2.5 to 1 side slopes and a 10 foot width in accord with the requirements of Paragraph 3 of the County's 1975 Resolution.

Fencing

No fencing is included in the preliminary designs.

RECOMMENDED DESIGNS

Preliminary designs of recommended facilities for the Gila Drain Project are described below.

TABLE NO. 7: Curve Data of Gila Drain in GRIC Reservation

Station	Bearing (deg)	Distance (ft)	Angle of Curvature (deg)	Eccentricity @ Curves 100' Rad. (ft)	Eccentricity @ Curves 500' Rad. (ft)
358+62					
	S59°58'W	625.4			
364+87			16°44'	1.08	5.40
	S76°42'W	1619.0			
381+06			25°43'	2.57	12.7
	S50°59'W	1118.0			
392+24			21°04	1.71	8.55
	S72°03'W	1160.0			
403+84			57°50'	14.24	71.20
	N50°07'W	500.0			
408+84			75°15'	26.26	131.30
	S54°38'W	1408.0			
422+92			17°25'	1.16	5.80
	S72°03'W	4035.0			
463+27			24°27'	2.31	11.55
	N83°30'W	603.4			
469+30			24°31'	2.33	11.65
	S71°59'W	338.8			
472+69			8°43'	0.29	1.45
	S63°16'W	1625.5			
488+95			11°13'	0.48	2.40
	S52°03'W	9283.0			
581+78			36°58'	5.44	27.20
	S89°01'W	831.0			
590+09			38°35'	5.95	29.80
	S50°26'W	1024.0			
600+32			40°45'	6.67	33.35
	N88°49'W	1065.0			
610+98			13°54'	0.74	3.70
	N74°55'W	920.0			
620+18			21°27'	1.78	8.90
	S83°38'W	1707.0			
637+25			40°22'	6.54	32.70
	S43°16'W	589.0			
643+14			12°53'	0.64	3.20
	S30°23'W	477.0			
648+91			77°37'	28.32	141.60
	N72°00'W	712.0			
656+03			25°15'	2.48	12.40
	N46°45'W	1295.3			
668+98			35°15'	4.93	22.65
	N82°00'W	1571.2			
684+69			56°35'	13.56	67.80
	S41°25'W	990.9			
694+60			53°36'	12.02	60.10
	N84°59'W	3432.7			
728+93			64°38'	18.33	91.65
	N20°21'W	654.3			
735+42					

TABLE NO. 7: Curve Data of Gila Drain in GRIC Reservation (continued)

Station	Bearing (deg)	Distance (ft)	Angle of Curvature (deg)	Eccentricity @ Curves 100' Rad. (ft)	Eccentricity @ Curves 500' Rad. (ft)
735+42			57°45'	14.20	71.00
	N78°06'W	843.5			
743+91			21°08'	1.73	8.65
	S80°36'W	918.4			
753+09			39°29'	6.24	31.20
	N59°45'W	1662.8			
769+71			26°45'	2.79	13.95
	N86°30'W	1151.3			
781+23			9°56'	0.38	1.90
	S83°34'W	939.8			
790+63			42°34'	7.32	36.50
	S40°40'W	514.7			
795+77			17°03'	1.12	5.60
	S57°43'W	1358.0			
809+35			17°07'	1.13	5.65
	S40°36'W	500.0			
841+35			24°33'	2.34	11.70
	S16°03'W	962.4			
823+98			43°28'	7.65	36.25
	S27°25'E	7143.0			
895+41			27°25'	2.93	14.65
	South	257.0			
897+98					

Lateral 9.5

No changes are recommended for the channel section of this irrigation and drainage lateral. Removal of the existing culvert under the SPRR Chandler spur line and replacement with a larger box culvert as shown on Exhibit No. 20 is recommended. Riprapping similar to that shown on this exhibit is also recommended for the existing SPRR Gilbert Main line culvert crossing and for the four control notch drops and four check structures serving this lateral.

To provide full protection of the check structures, the addition of over-pour weir wingwalls similar to those shown on Exhibit No. 21 is recommended. The weir section on each side will be designed to carry a flow of 100 cubic feet per second past the check without overtopping upstream freeboards. This will provide for a safe discharge of 200 cubic feet per second from the Gilbert retention system without causing damage to the existing structures.

Western Canal

The existing wasteway at the Gila Drain will need to be enlarged. A radial gated structure similar to that shown in Exhibit No. 22 is recommended. This structure will provide for the release of 608 cubic feet per second into the Gila Drain without overtopping the Western Canal embankments. Maximum water surface at peak discharge should be based upon the ponded water surface of the nearest downstream control structure.

Gila Drain

Plan and Profile

Preliminary plans and profile designs of the Gila Drain are presented in Exhibit No. 23. The centerline shown on the plans represents the plotting of the June 16, 1976 field survey of the existing drain carried out by the U.S. Soil Conservation Service. This line is not tied to section corners, rights-of-way boundaries or adjacent improvements and should be considered as representative of the channel's general alignment only. Hydraulic properties and descriptions of the channel cross-sections are presented on the profile in tabular form. Concrete lining details are shown in Exhibit No. 24.

Structures

Structural requirements for the Gila Drain are listed in Table No. 8. No special bridge or box culvert structural designs were prepared. Costs were developed from recent per square foot bids received by ADOT for bridges and box culverts of similar sizes. Road crossings were provided for each existing street crossing in the Private Sector. Four bridge locations were selected on the GRIC Reservation as required in the U.S. Government - SRVWUA Agreement of 1923. Two bridges were sited at the existing crossings at Allison Road and the Beltline Road (also called Riggs Road or 51st Avenue). Tentative sites at Stations 493+50 and 621+00 were selected to serve north-south and east-west section lines respectively. These tentative sites are subject to approval by the GRIC prior to final design.

Drop structures will be of the rock cascade type shown in Exhibit No. 25. Because the alignment of the Gila Drain approaches the Gila River in an upstream direction, and, because flows in the drain are minimal in comparison with the river discharges, and because the facilities are to be retained within the existing rights-of-way it is recommended that this structure be inset with the natural river enbankment.

The headworks for the Fowler Ditch should provide for automatic release of flood flows when the water level rises above specified levels. An upstream water level controlled automatically operated radial gated structure of the type shown in Exhibit No. 26 is recommended.

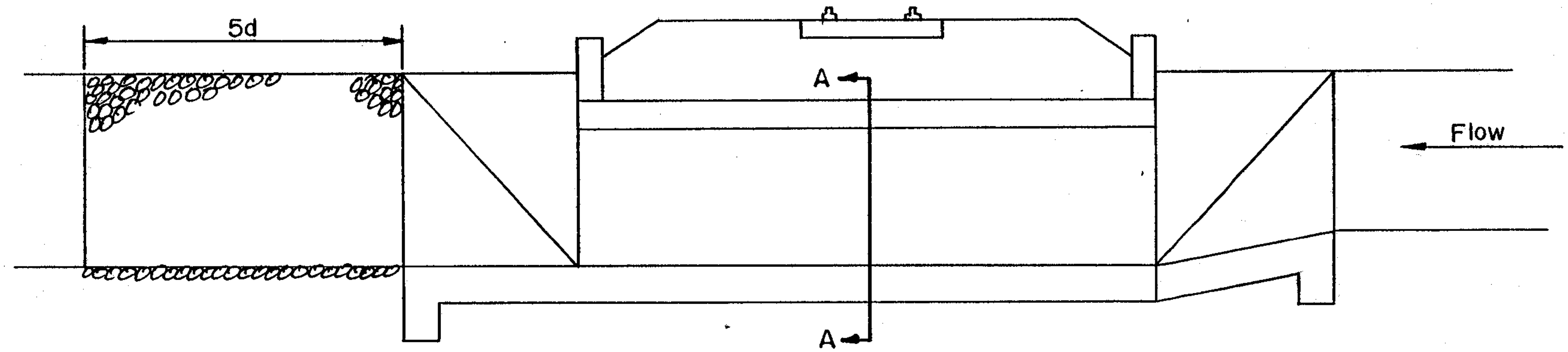
ADOT Borrow Pit Retention Basin

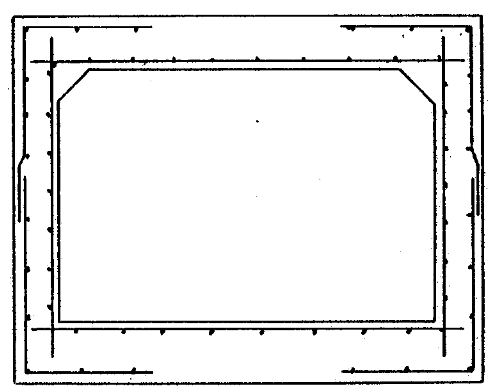
Plan and Profile

The 56th Street alignment was selected for preliminary designs. Plan and profiles for the diversion channel serving the retention basin are presented on Exhibit No. 27. The plan shown is based upon street, highway and Highline Canal locations shown on USGS quadrangle sheets. Ground elevations were selected from SRVWUA profile drawings of the Highline Canal and from the quadrangle sheets.

Structures

Three bridges will be required at crossings at the midsection line of Section 8, T1S, R4E, G&SBM, Elliot Road and Warner Road. No special designs were prepared and cost estimates were developed from recent per square foot bids received by ADOT for bridges of similar size. A drop inlet structure will be needed at the borrow pit. A rectangular chute with "dragon teeth" energy dissipators of the type shown in Exhibit No. 28 is recommended.





SECTION A-A

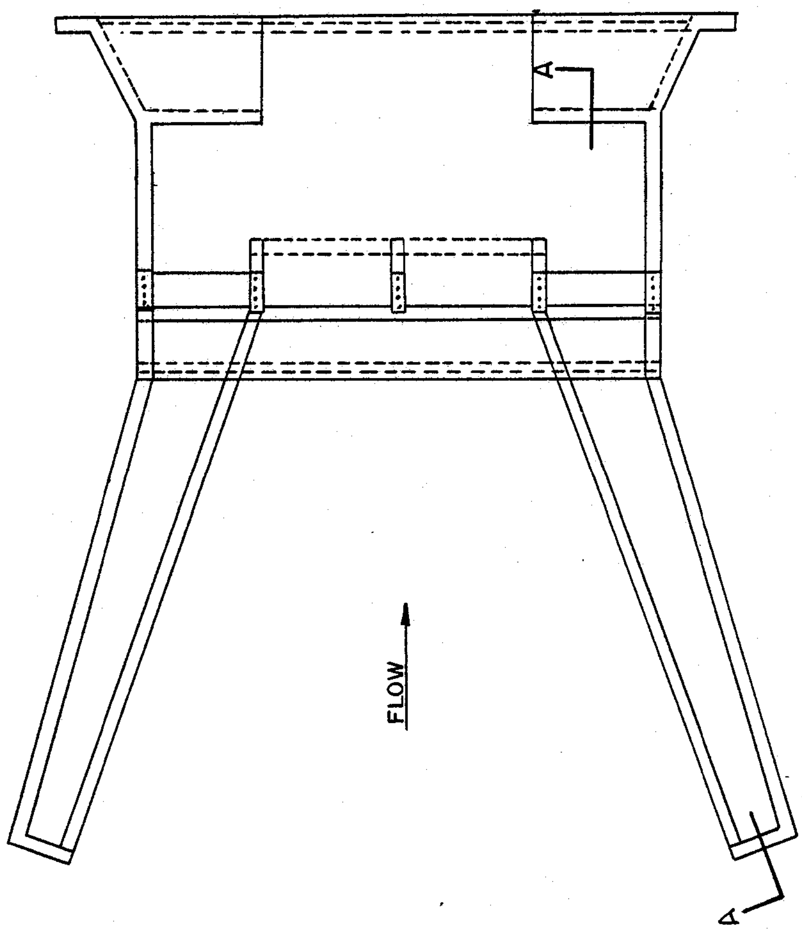
LATERAL 9.5 SPRR BOX CULVERT CROSSING

EXHIBIT NO. 20

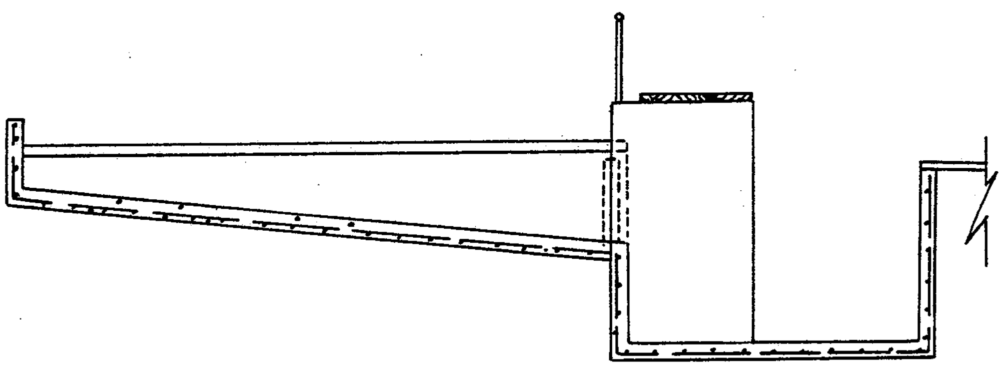
GILA DRAIN PROJECT

GILA DRAIN PROJECT

OVER-POUR WEIR PROTECTION AT CHECK STRUCTURES



PLAN VIEW



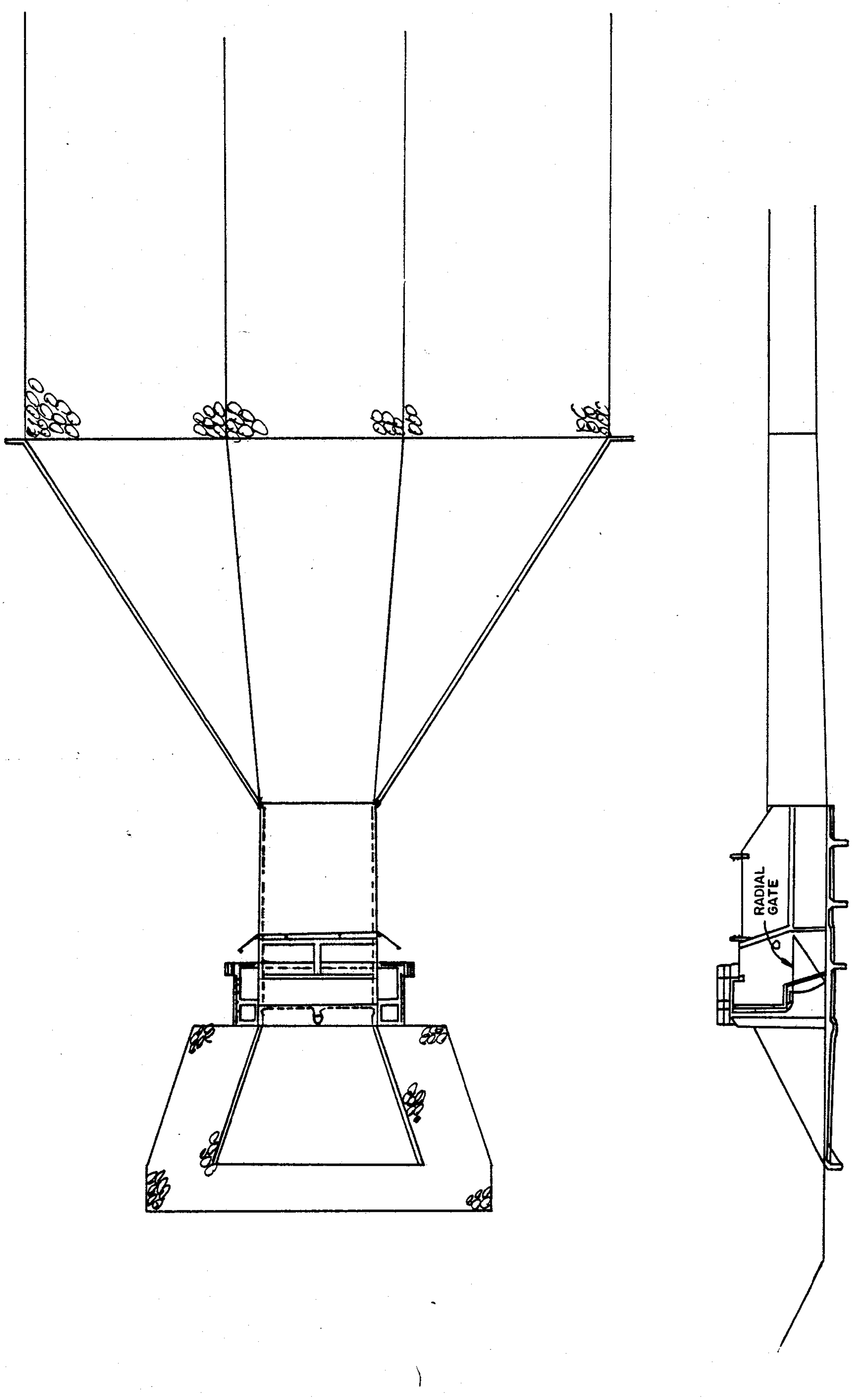
SECTION A-A

EXHIBIT NO. 21

TABLE NO. 8: List of Structures for the Gila Drain

Station	Type of Structure	Remarks
0+00	Wasteway	See Western Canal
26+40	Bridge	Elliot Road
52+80	Bridge	Carver Road
80+00	Box Culvert	Warner & Rural Roads
141+00	Bridge	Ray Road
199+60	Bridge	Kyrene Road
222+02	Bridge	Williams Field Road
280+00	Drop	Rock Cascade
299+24	Bridge	SPRR Spur Line
305+75	Bridge	Allison Road
324+80	Automatic Check	Fowler Ditch Headworks
335+75	Box Culvert	Highway I-10 Existing
346+14	Box Culvert	Maricopa Highway Existing
493+50	Bridge	Tentative Location
516+00	Drop	Rock Cascade
542+00	Drop	Rock Cascade
621+00	Bridge	Tentative Location
871+30	Bridge	Beltline Highway
886+50	Drop & Confluent Structure	Gila River

GILA DRAIN PROJECT



GILA DRAIN WASTEWAY

EXHIBIT NO. 22

HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec.	SLOPE Ft/Ft
0+00	26+40±	EARTH	.025	2.5:1	608	12	5.8	154	43.23	2.33	4.05	0.00085
26+40±	52+80±	EARTH	.025	2.5:1	703	12	6.4	179	46.45	2.45	4.02	0.000756
52+80±	80+00±	CONCRETE	.016	1.5:1	703	8	6.1	105	29.99	2.31	6.77	0.001
80+00±	141+10±	EARTH	.025	2.5:1	820	12	7.3	221	51.31	2.65	4.02	0.000679
141+10±	170+00±	EARTH	.025	2.5:1	880	12	6.2	171	45.39	2.42	5.22	0.00131

PHOENIX ARIZONA

COE & VAN LOO CONSULTING ENGINEERS INC.

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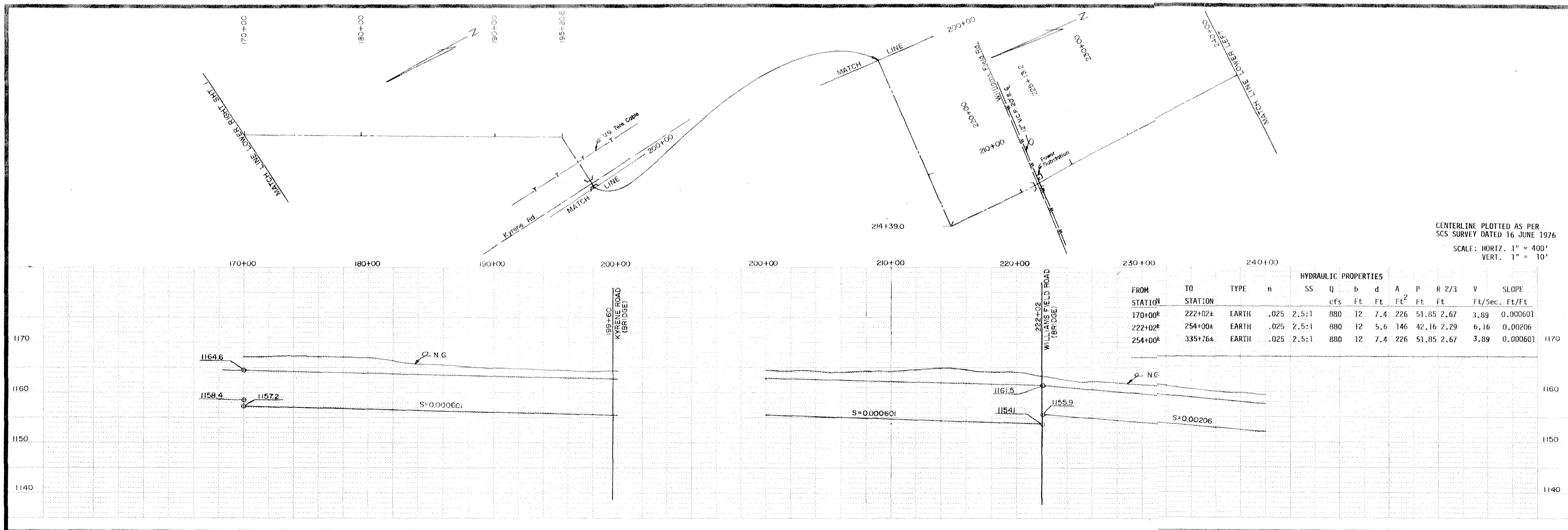
840-01-05

EXHIBIT NO. 23-1

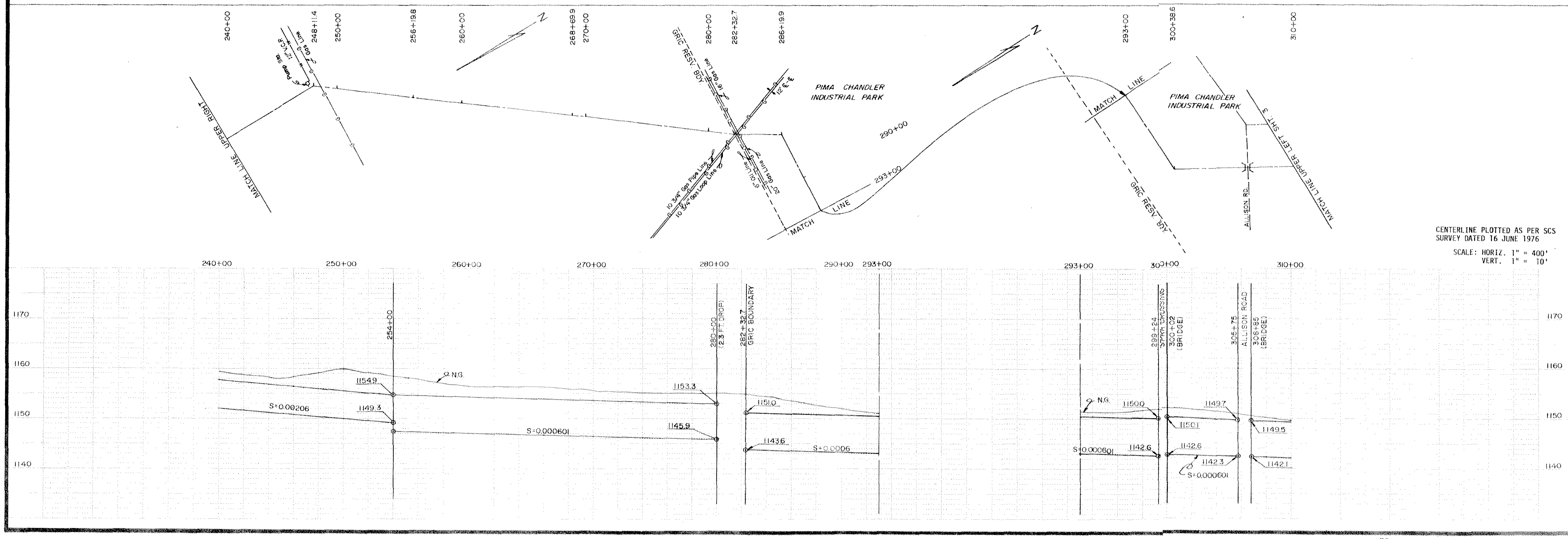


CENTERLINE PLOTTED AS PER SCS SURVEY DATED 16 JUNE 1976

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'

HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec.	SLOPE Ft/Ft
170+00±	222+02±	EARTH	.025	2.5:1	880	12	7.4	226	51.85	2.67	3.89	0.000601
222+02±	254+00±	EARTH	.025	2.5:1	880	12	5.6	146	42.16	2.29	6.16	0.00206
254+00±	335+76±	EARTH	.025	2.5:1	880	12	7.4	226	51.85	2.67	3.89	0.000601



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SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'

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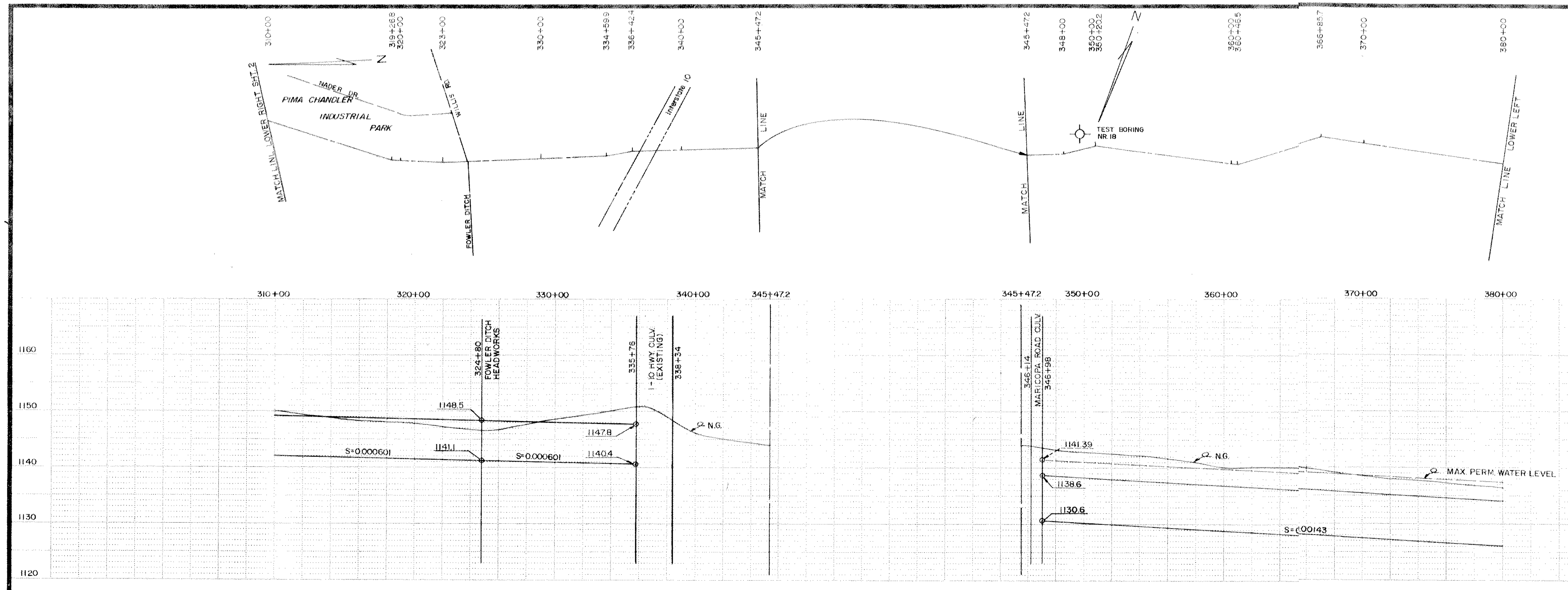
EXHIBIT NO. 23-2



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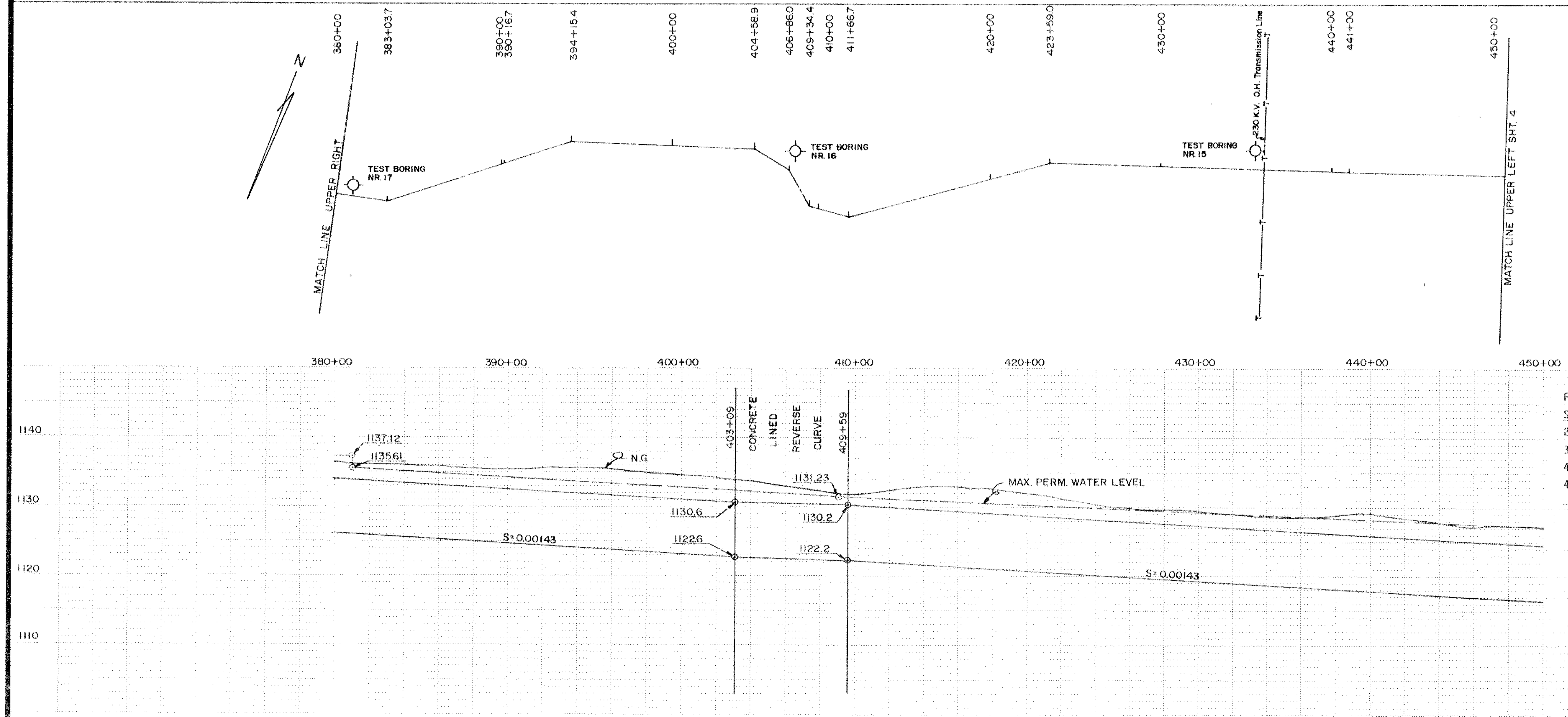
VERT. 1" = 10'



CENTERLINE PLOTTED AS PER SCS SURVEY DATED 16 JUNE 1976

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'

HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec.	SLOPE Ft/Ft
254+00±	335+76±	EARTH	.025	2.5:1	880	12	7.4	226	51.85	2.67	4.00	0.000601
346+98±	403+09±	EARTH	.025	1.5:1	1600	18	8.0	240	46.84	2.97	6.67	0.00143
403+09±	409+59±	CONCRETE	.016	1.5:1	1600	16	8.0	224	44.84	2.92	7.14	0.00069
409+59±	516+00±	EARTH	.025	1.5:1	1600	18	8.0	240	46.84	2.97	6.67	0.00143

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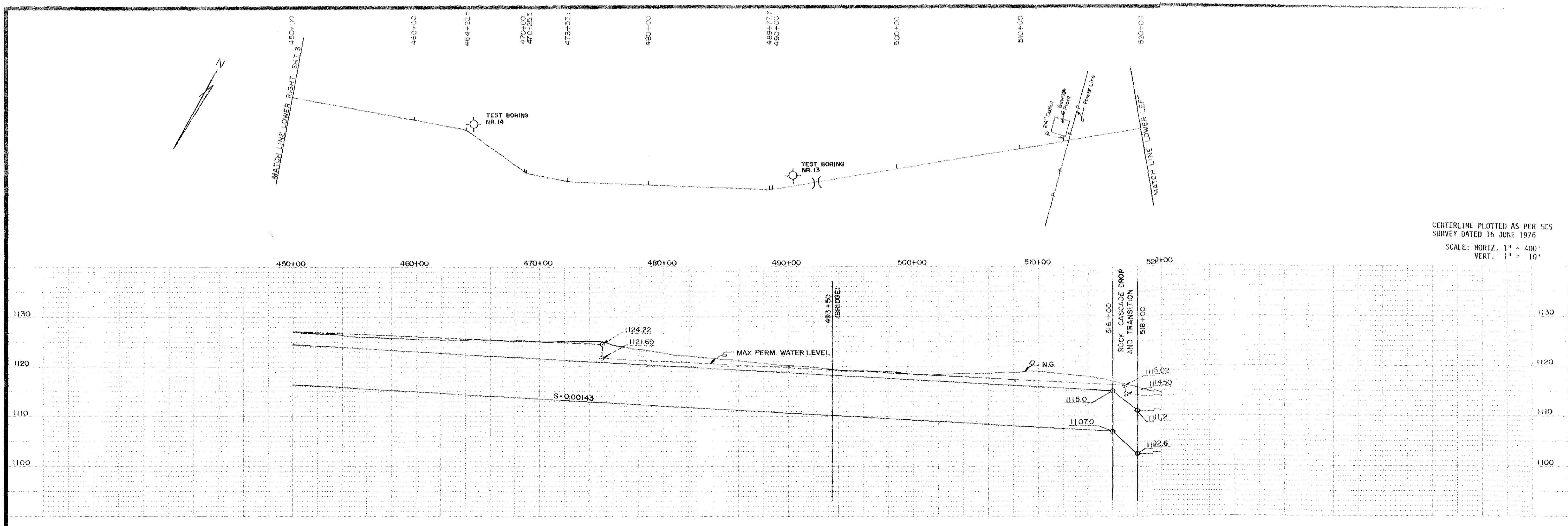

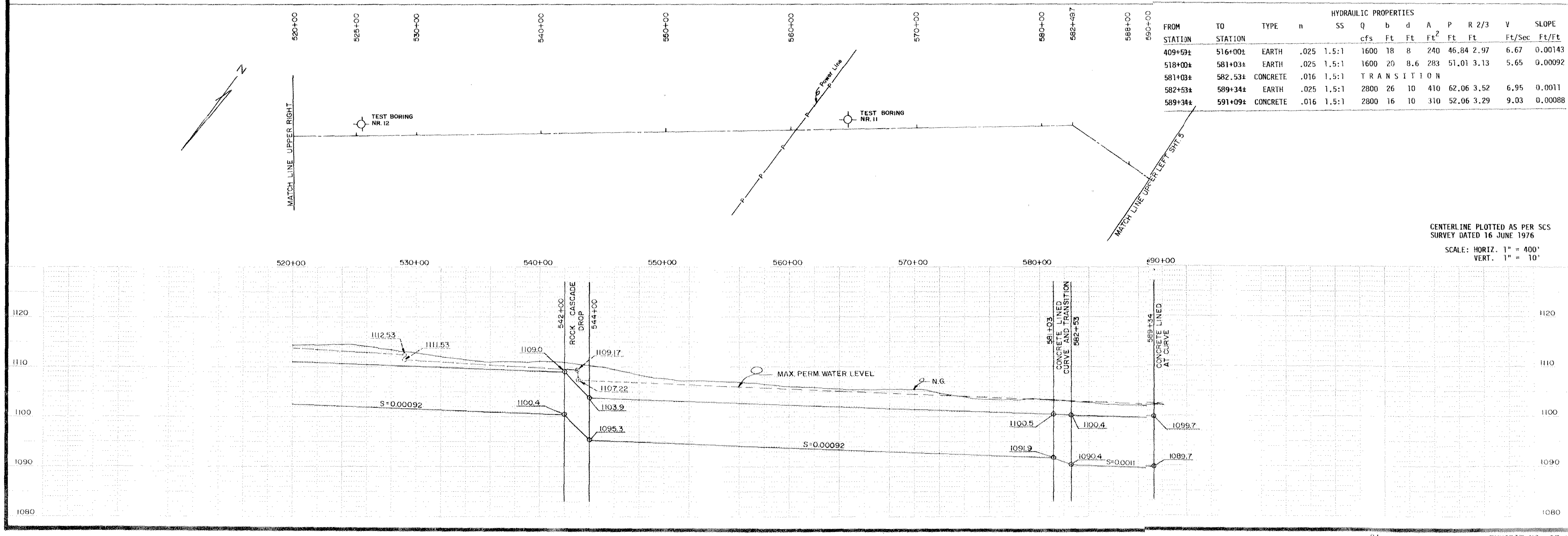

HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec	SLOPE Ft/Ft
409+59±	516+00±	EARTH	.025	1.5:1	1600	18	8	240	46.84	2.97	6.67	0.00143
518+00±	581+03±	EARTH	.025	1.5:1	1600	20	8.6	283	51.01	3.13	5.65	0.00092
581+03±	582.53±	CONCRETE	.016	1.5:1	TRANSITION							
582+53±	589+34±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
589+34±	591+09±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088

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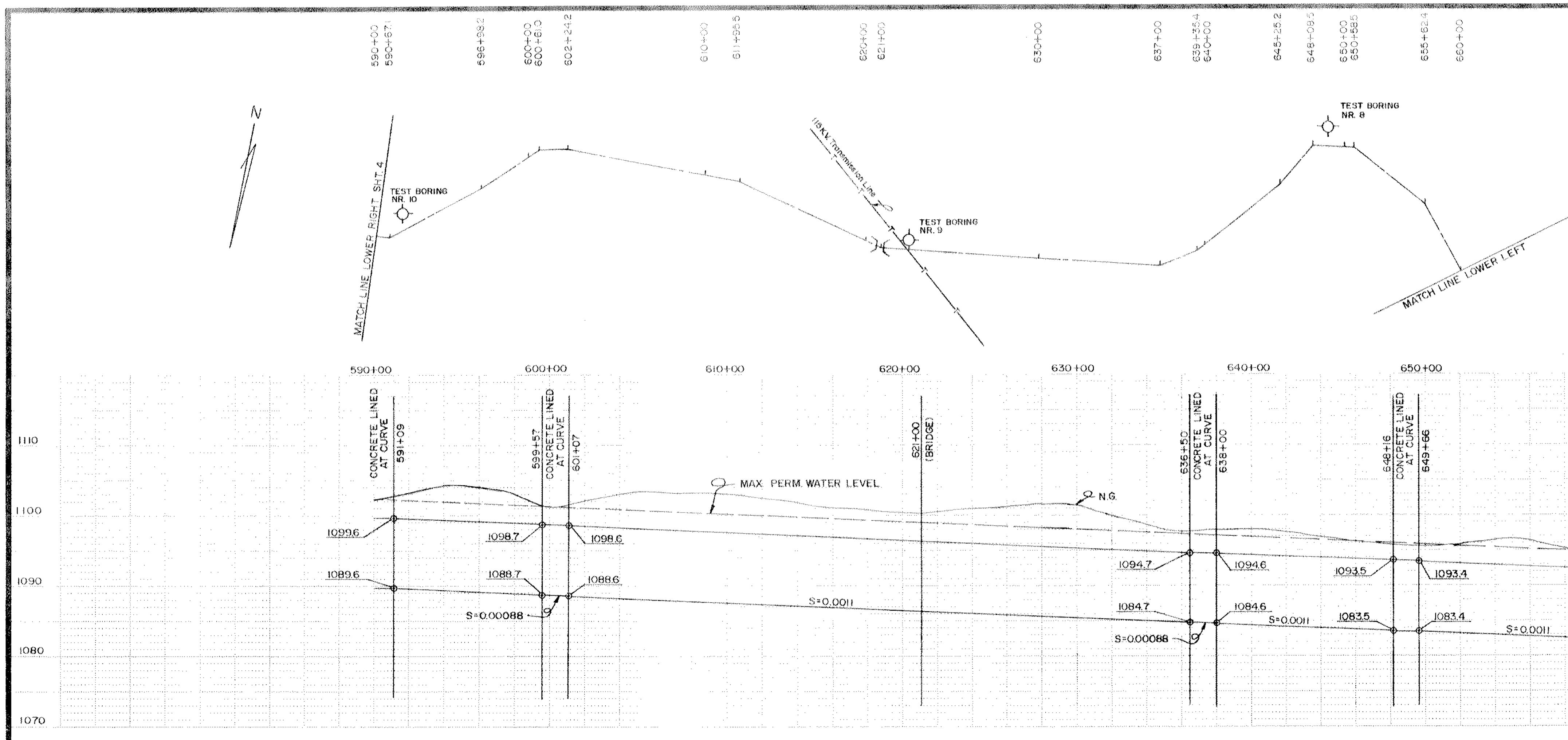
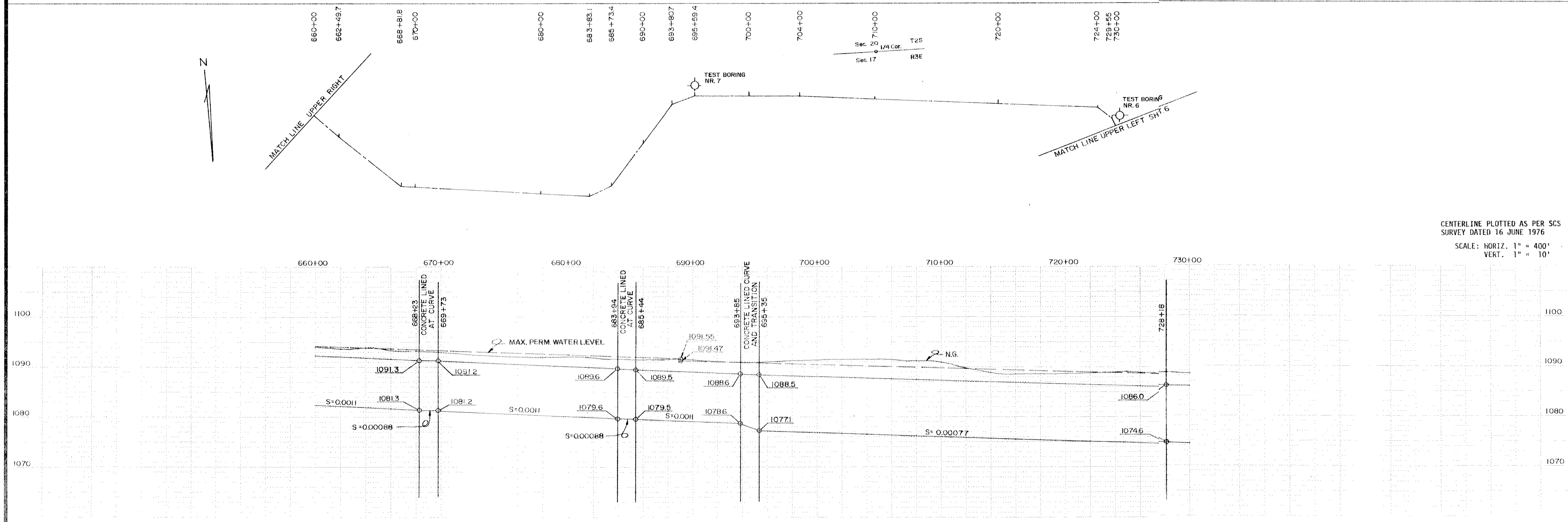


CENTERLINE PLOTTED AS PER SCS
SURVEY DATED 16 JUNE 1976

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'

HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec	SLOPE Ft/Ft
589+34±	591+09±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088
591+09±	599+57±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
599+57±	601+07±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088
601+07±	636+50±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
636+50±	638+00±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088
638+00±	648+16±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
648+16±	649+66±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088
649+66±	668+23±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
668+23±	669+73±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088
669+73±	683+94±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
683+94±	685+44±	CONCRETE	.016	1.5:1	2800	16	10	310	52.06	3.29	9.03	0.00088
685+44±	693+85±	EARTH	.025	1.5:1	2800	26	10	410	62.06	3.52	6.95	0.0011
693+85±	695+35±	CONCRETE	.016	1.5:1	TRANSITION							
695+35±	728+18±	EARTH	.025	1.5:1	2900	26	11.4	486	67.10	3.74	6.16	0.00017
728+18±	736+17±	CONCRETE	.016	1.5:1	2900	16	11.4	377	57.10	3.52	7.69	0.000535



CENTERLINE PLOTTED AS PER SCS
SURVEY DATED 16 JUNE 1976

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'

GILA DRAIN

PLAN & PROFILE

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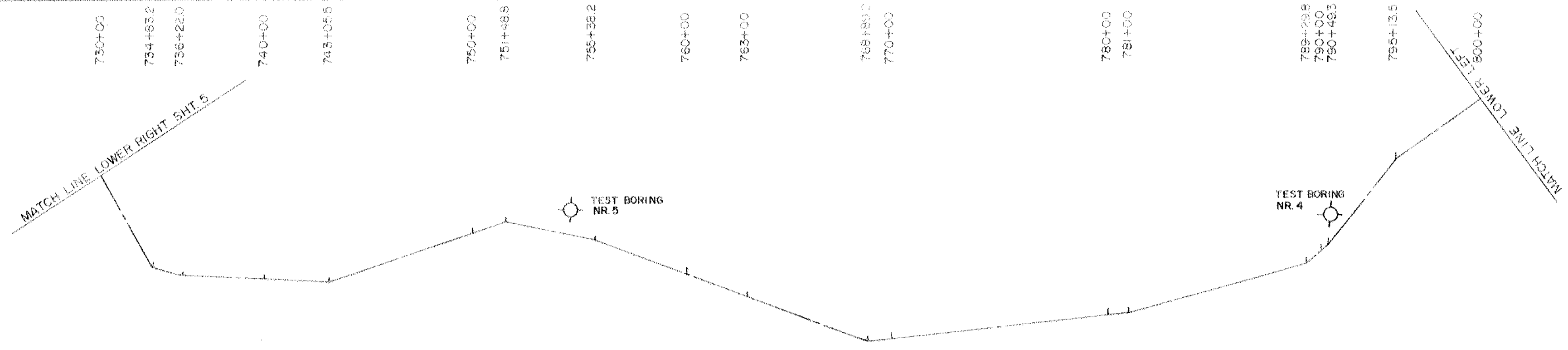
CHECKED
DATE

PHOENIX ARIZONA

5 OF 6

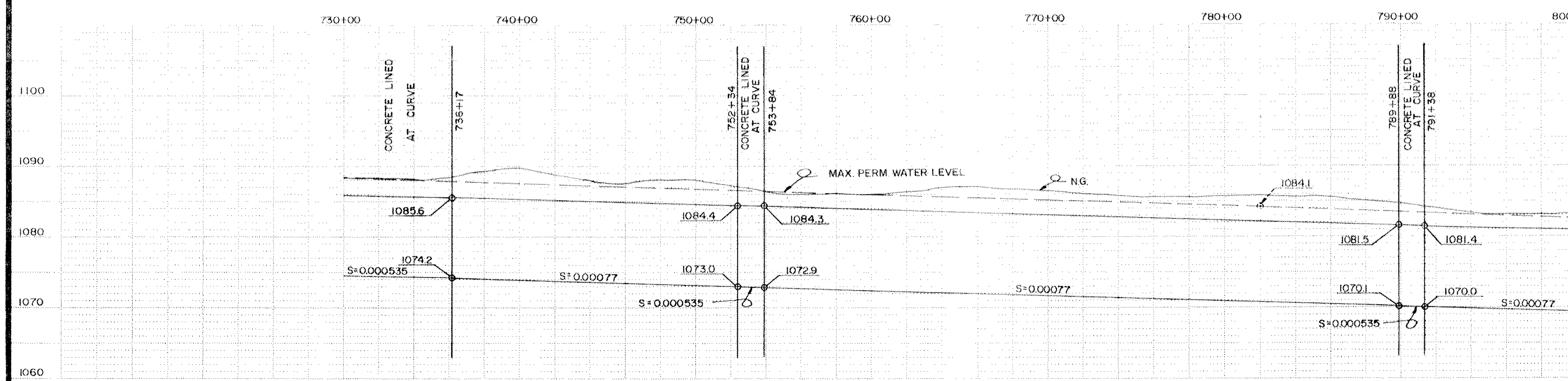
840-01-05

EXHIBIT NO. 23-5



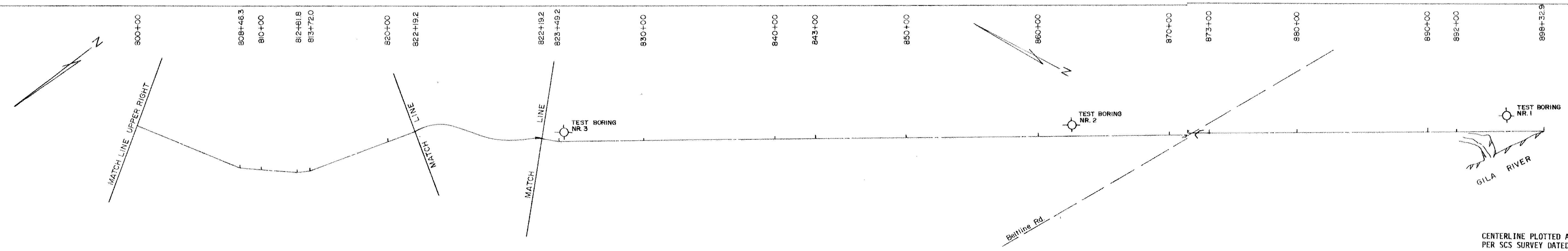
CENTERLINE PLOTTED AS
PER SCS SURVEY DATED 16 JUNE 1976

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'



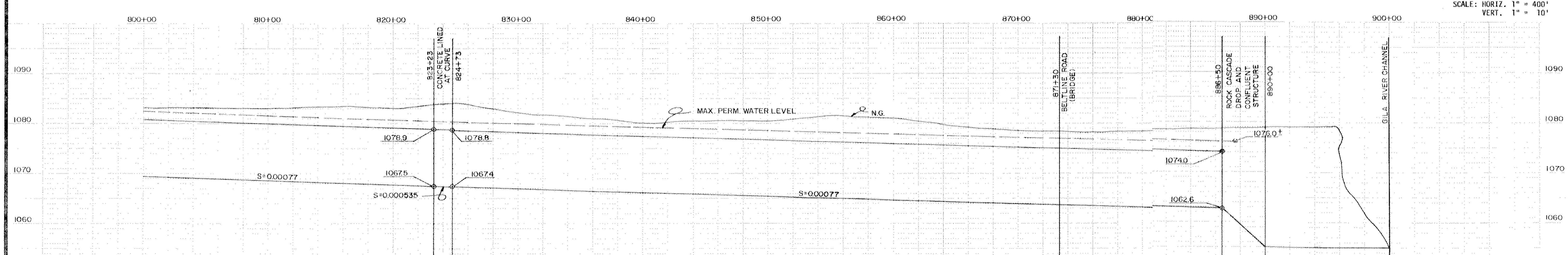
HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R 2/3 Ft	V Ft/Sec	SLOPE Ft/Ft
728+18±	736+17±	CONCRETE	.016	1.5:1	2900	16	11.4	377	57.10	3.52	7.69	0.000535
736+17±	752+34±	EARTH	.025	1.5:1	2900	26	11.4	486	67.10	3.74	6.10	0.00077
752+34±	753+84±	CONCRETE	.016	1.5:1	2900	16	11.4	377	57.10	3.52	7.69	0.000535
753+84±	789+88±	EARTH	.025	1.5:1	2900	26	11.4	486	67.10	3.74	6.10	0.00077
789+88±	791+38±	CONCRETE	.016	1.5:1	2900	16	11.4	377	57.10	3.52	7.69	0.000535
791+38±	823+23±	EARTH	.025	1.5:1	2900	26	11.4	486	67.10	3.74	6.10	0.00077
823+23±	824+73±	CONCRETE	.016	1.5:1	2900	16	11.4	377	57.10	3.52	7.69	0.000535
824+73±	END	EARTH	.025	1.5:1	2900	26	11.4	486	67.10	3.74	6.10	0.00077



CENTERLINE PLOTTED AS
PER SCS SURVEY DATED 16 JUNE 1976

SCALE: HORIZ. 1" = 400'
VERT. 1" = 10'



GILA DRAIN

COE & VAN LOO CONSULTING ENGINEERS INC.

PHOENIX ARIZONA

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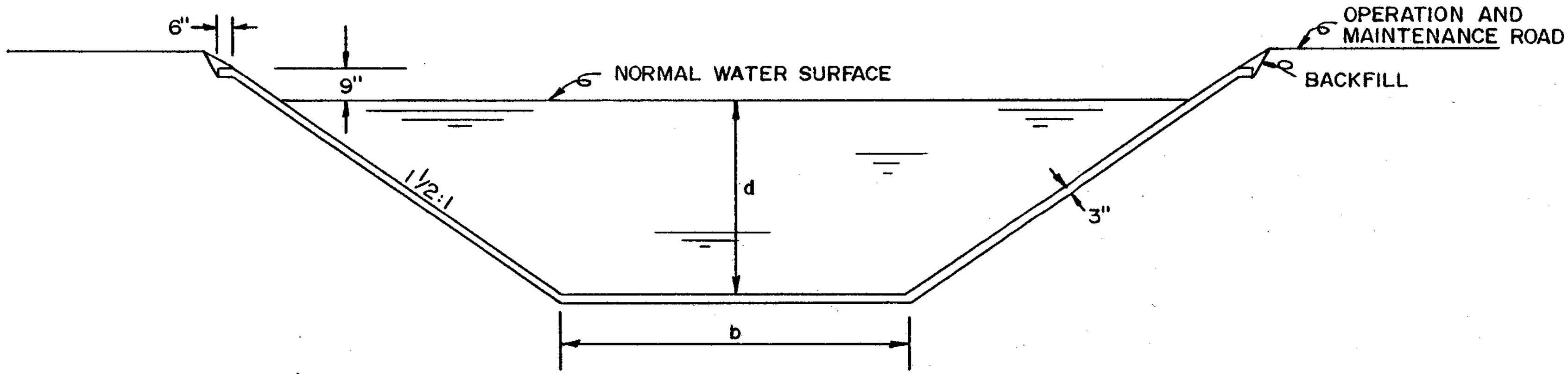
6 OF 6

840-01-05

EXHIBIT NO. 23-6

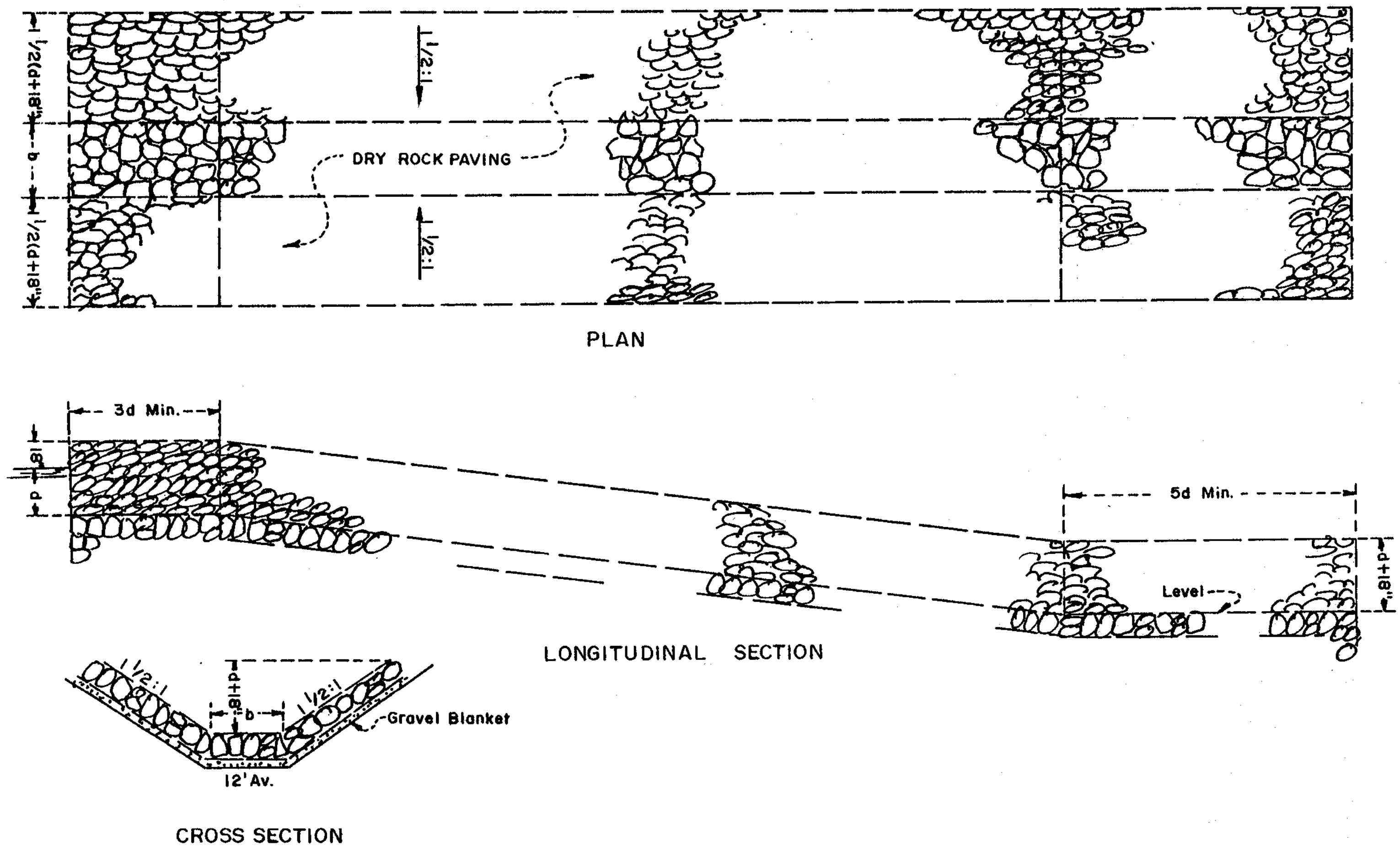


TYPICAL CONCRETE LINED SECTION

GILA DRAIN PROJECT

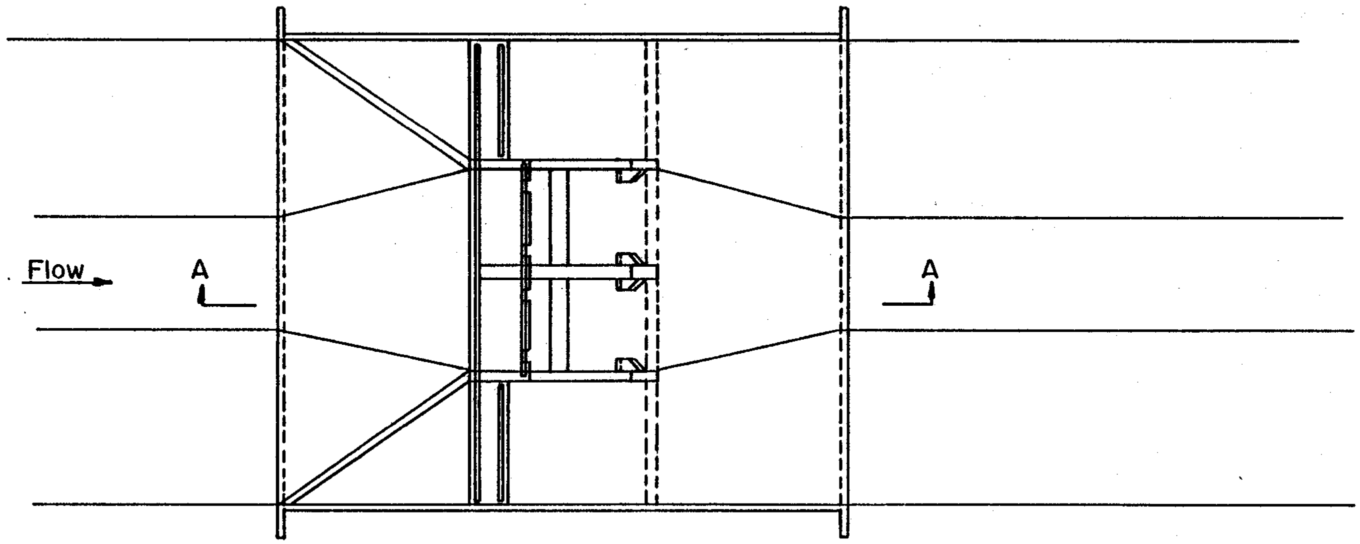
EXHIBIT NO. 24

GILA DRAIN PROJECT

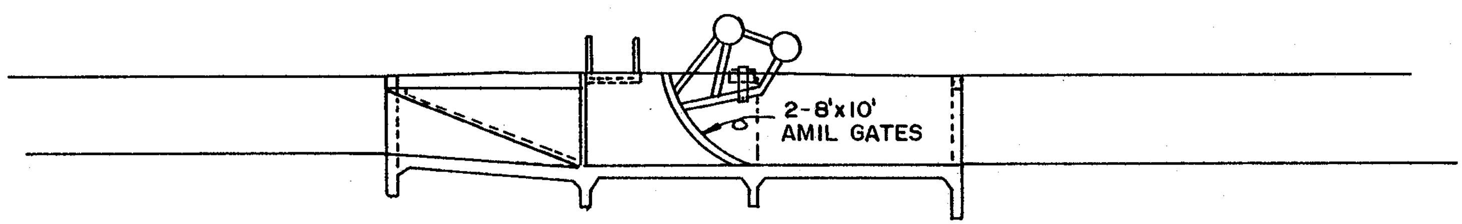


TYPICAL ROCK CASCADE DROP

EXHIBIT NO. 25



PLAN VIEW

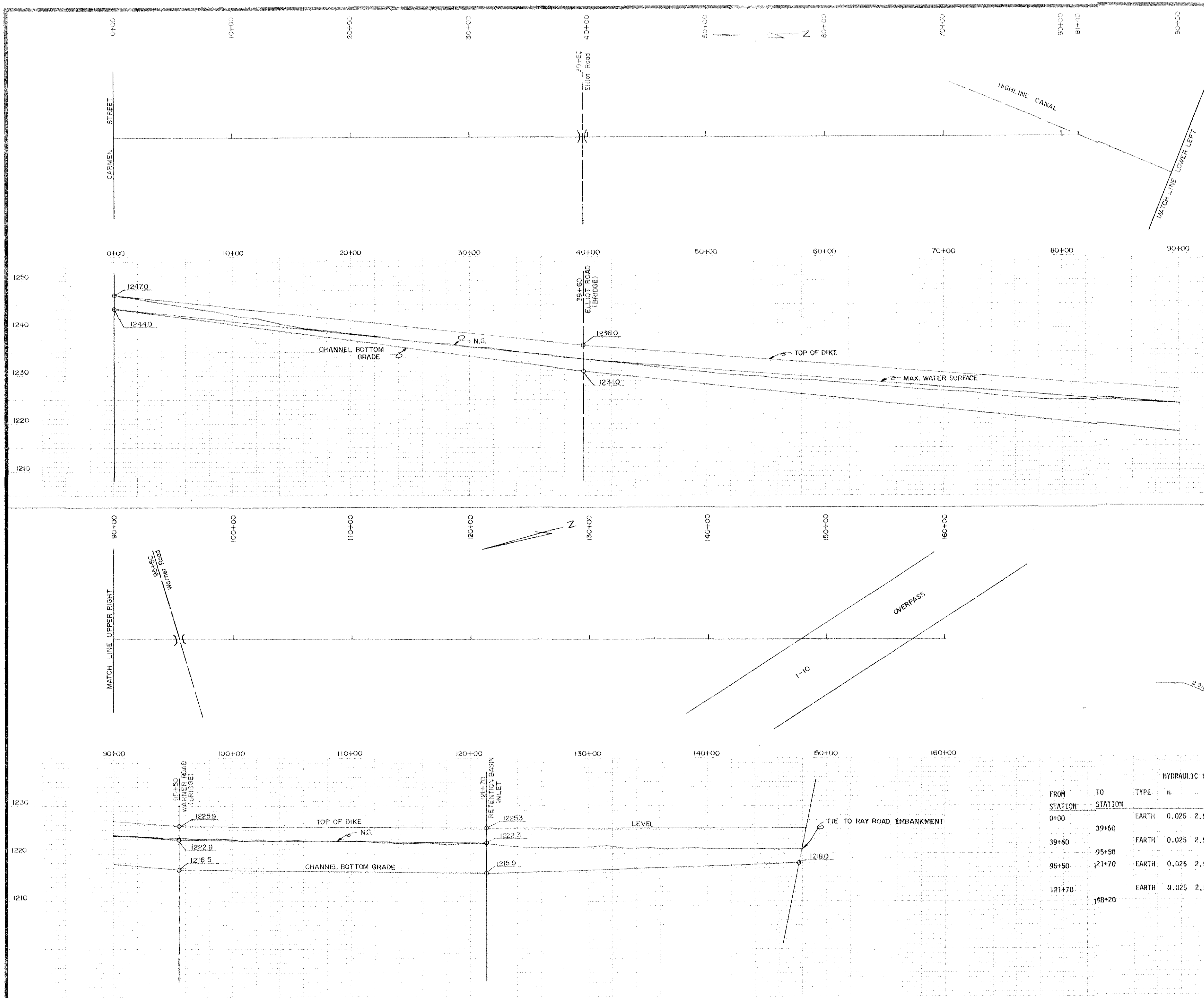


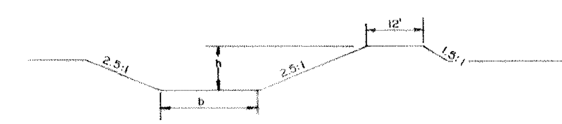
SECTION A-A

FOWLER DITCH CONTROL STRUCTURE

GILA DRAIN PROJECT

EXHIBIT NO. 26





TYPICAL SECTION

HYDRAULIC PROPERTIES

FROM STATION	TO STATION	TYPE	n	SS	Q cfs	b Ft	d Ft	A Ft^2	P Ft	R2/3 Ft	V Ft/Sec.	SLOPE Ft/Ft
0+00		EARTH	0.025	2.5:1	0	20	(NON UNIFORM FLOW)					
	39+60				500							
39+60		EARTH	0.025	2.5:1	500	40	(NON UNIFORM FLOW)					
	95+50				1500							
95+50	121+70	EARTH	0.025	2.5:1		40	8.3	504	84.70	3.28	3.0	0.000237
					1500							
121+70		EARTH	0.025	2.5:1	500	20	(NON UNIFORM FLOW)					
	148+20				0							

ADOT BORROW PIT DIVERSION CHANNEL

PLAN & PROFILE

COE & VAN LOO CONSULTING ENGINEERS INC.

PHOENIX ARIZONA

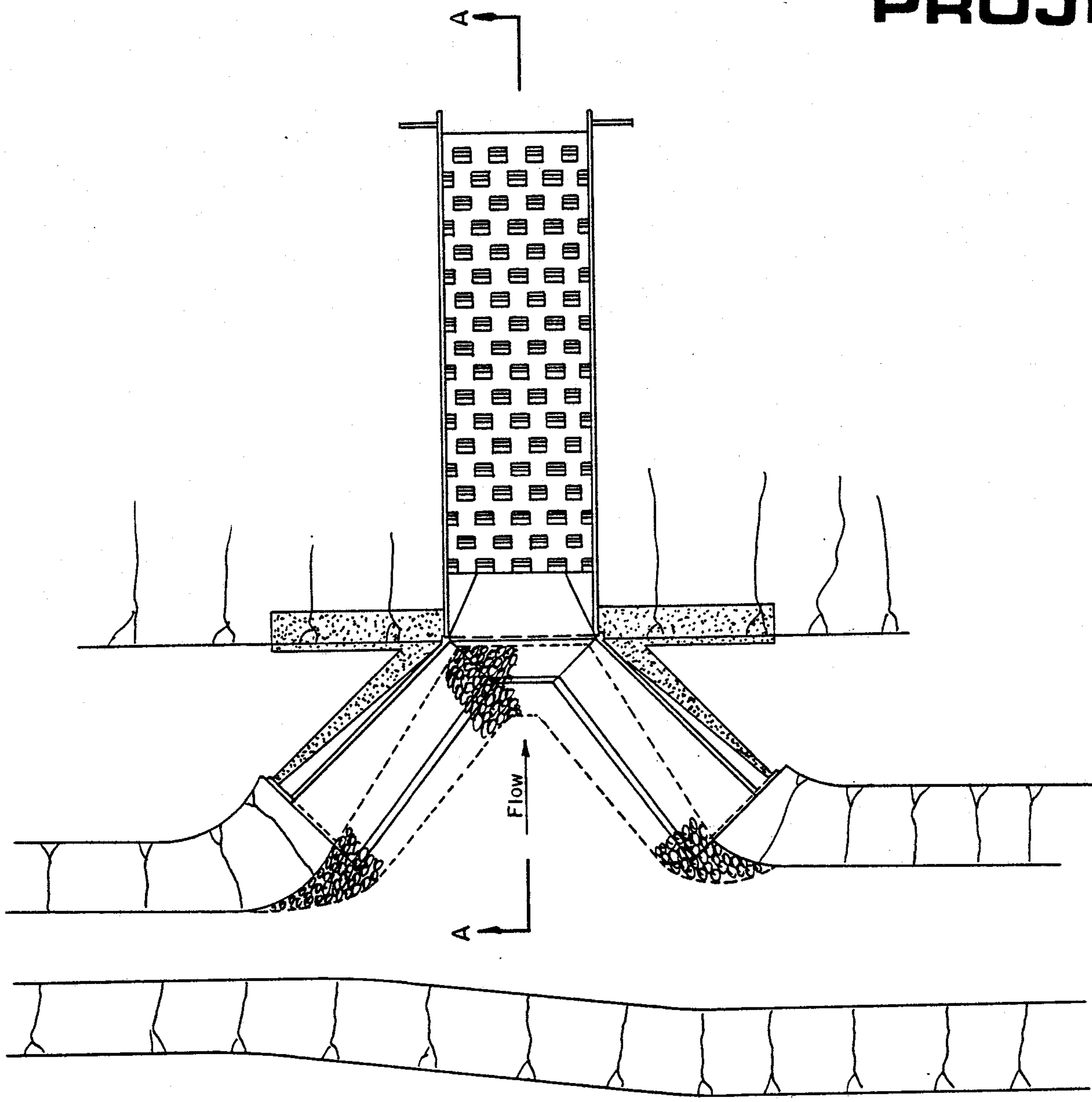
DESIGNED | DRAWN | CHECKED | DATE

REVISIONS | DATE | BY

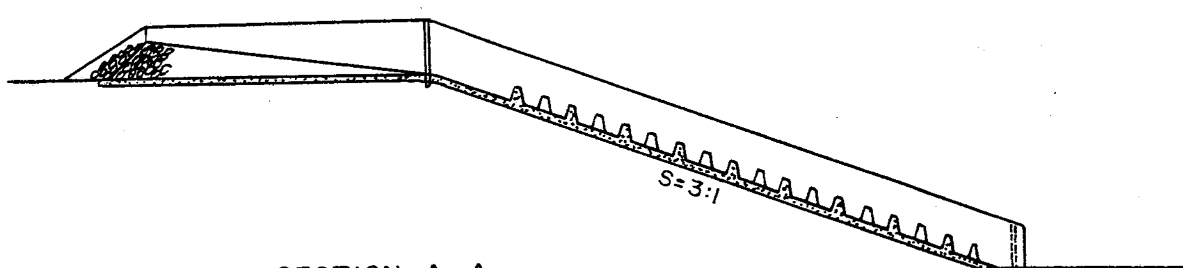
OF

840-01-07

GILA DRAIN PROJECT



PLAN VIEW



SECTION A-A

ADOT BORROW PIT INLET STRUCTURE

EXHIBIT NO. 28

UTILITIES

The typical license granted by the SRVWUA (see Appendix "C") for encroachment on project properties belonging to the United States (the Association) specifies that the licensee shall bear the costs of changes required by the redesign of the Association's facilities. It is presumed that this requirement will extend to the enlargement of the Gila Drain as proposed and that costs for utility relocation need not be included in the project costs.

A list of utilities identified in the field, from available field survey notes and from contacts with utility companies common to the area is presented in Table No. 9. Utility locations are also indicated on the plan presented in Exhibit No. 23.

RIGHTS-OF-WAY

GRIC Reservation

Under the alternative selected for the preliminary designs no additional rights-of-way will be needed for that part of the drain located within the GRIC Reservation. Legal action is required between the U.S. Government, the GRIC Reservation and the SRVWUA for the adjustment of the 1923 Agreement to conform to the realignment through the Pima-Chandler Industrial Park and other related legal questions.

The alignment described in the 1923 Agreement (see Appendix "A") was checked against that presented in the survey of the ditch on July 16, 1924 made by the Association and sworn to by C.C. Cragin, SRVWUA Chief Engineer. A computer plotting of the two descriptions is presented in Exhibit No. 29. The serious discrepancies between the two descriptions need to be resolved. Plots of the right-of-way as described in the Association's survey are presented section by section in Appendix "E".

Private Sector

Additional rights-of-way will be required along the full reach of the Gila Drain crossing of the private sector. Between Stations 0+00 and 106+72, where the existing right-of-way parallels that for Rural Road, an agreement will be needed between the City of Tempe, Maricopa County and the SRVWUA for the transfer of

TABLE NO. 9: List of Utilities - Gila Drain

Station	Facility	Utility Owner
0+00 - 52+80±	14" Force line 12' E. ℄ Rural Road.	City of Tempe
	8" Vitrified clay pipe 14' W. ℄ Rural Road	City of Tempe
	12" Cast iron pipe 19' W. ℄ Rural Road.	City of Tempe
52+80±	12" Cast iron pipe 37' N. ℄ Carver Road.	City of Tempe
	Lift station & 21" vitrified clay pipe N. ℄ Carver Road & E. ℄ Rural Road.	City of Tempe
52+00 - 80+00±	12" Cast iron pipe 22' W. ℄ Rural Road.	City of Tempe
66+15±	8" Asbestos cement pipe 25' N. ℄ El Frede Road.	City of Tempe
79+75±	12" Cast iron pipe 25' N. ℄ Warner Road.	City of Tempe
79+72±	Telephone cable 28' S. ℄ Warner Road.	American Tel & Tel
80+00± - 106+72.7	48" Reinforced concrete pipe 25' E. ℄ Rural Road.	City of Tempe
	12" Cast iron pipe 15' W. ℄ Rural Road.	City of Tempe
141+20±	6.625" O.D. gas pipelane	Western Gas Co.
197+60±	Telephone cable	American Tel & Tel
222+02±	12" Water line	City of Chandler
222+10±	Powerline substation	Arizona Public Service
248+11±	Pumping station & 12" vitrified clay pipeline	William Field Road
248+60±	Gas pipelene	Unknown
282+33±	6" Oil Pipeline	Unknown
	20" Gas pipelein w/reduction to 16"	El Paso Natural Gas
	10-3/4" Gas pipeline	El Paso Natural Gas
	10-3/4" Gas loop pipeline	El Paso Natural Gas
436+00±	230 KV overhead transmission line	Arizona Public Service
513+60±	24" Sewage outfall pipe	City of Chandler
514+00±	Powerline (overhead)	Arizona Public Service
560+00±	Powerline (overhead)	Arizona Public Service
622+40±	115 KV overhead transmission line	U.S. Bureau of Reclamation

GILA DRAIN RIGHT OF WAY ALIGNMENT - 1923 AGREEMENT

1923 CONTRACT

BEARING & DISTANCE TABLE		
NO.	BEARING	DISTANCE
1	S20-34-00W	1643.0000
2	S76-42-00W	3576.0000
3	S50-59-00W	1118.0000
4	S72-03-00W	1160.0000
5	N50-07-00W	500.0000
6	S54-38-00W	1408.0000
7	S72-03-00W	6531.0000
8	S52-03-00W	9283.0000
9	S83-35-00W	837.0000
10	S54-12-00W	998.0000
11	N88-49-00W	3652.0000
12	S34-30-00W	1210.0000
13	N75-50-00W	778.0000
14	N42-16-00W	1270.0000
15	N83-14-00W	1536.0000
16	S61-13-00W	1098.0000
17	N84-26-00W	3533.0000
18	N70-59-00W	4400.0000
19	S82-[illegible]-00W	950.0000
20	S40-[illegible]-00W	[illegible]
21	S27-25-00E	7143.0000
22	S00-00-00W	[illegible]

------- DESCRIPTION ALIGNMENT - LEGAL 1923 AGREEMENT

——— DRAWING ALIGNMENT - 1924 SURVEY

1924 SURVEY

BEARING & DISTANCE TABLE		
NO	BEARING	DISTANCE
1	S42-14-00W	300.00
2	S15-58-00W	1369.20
3	S76-42-00W	69.30
4	S84-39-00W	1301.20
5	S59-58-00W	625.40
6	S76-42-00W	1619.00
7	S50-59-00W	1118.00
8	S72-03-00W	1160.00
9	N50-07-00W	500.00
10	S54-38-00W	1408.00
11	N83-30-00W	603.40
12	S71-59-00W	338.80
13	S63-16-00W	1625.50
14	S89-01-00W	831.00
15	S50-26-00W	1024.00
16	N88-49-00W	1065.00
17	N74-55-00W	920.00
18	S83-38-00W	1707.00
19	S43-16-00W	589.00
20	S30-23-00W	577.00
21	N72-00-00W	712.00
22	N46-45-00W	1295.30
23	N82-00-00W	1571.20
24	S41-25-00W	990.90
25	N20-21-00W	654.30
26	N78-06-00W	843.50
27	S80-36-00W	918.40
28	N59-45-00W	1662.80
29	N86-30-00W	1151.30
30	S83-34-00W	939.80
31	S40-40-00W	514.70
32	S57-43-00W	1358.00
33	S40-36-00W	500.00
34	S16-03-00W	962.40
35	S00-00-00W	257.00
36	N35-43-00E	552.00

5-1-79 - REVISED 1923 CONTRACT ALIGNMENT

EXHIBIT NO. 29

lands required to widen Rural Road (see Exhibit No. 13). Additional rights-of-way requirements presented in Exhibit No. 30 and on the Section Plats of Appendix "E" include those lands required for both the widening of the roadway and for the relocation and enlargement of the drain.

OPERATION AND MAINTENANCE RESPONSIBILITIES

The facilities required to provide integrated control of floodwaters as described above, fall within three distinct categories best served by separate agencies.

Use of Irrigation and Drainage System Facilities

The primary function of the Lateral 9.5 and Western Canal will continue to be service of irrigation waters to Association members. Drainage of agricultural tailwater will continue until such time as the area drained into the lateral is fully developed. Use of this facility for transport of floodwaters will be secondary to irrigation and drainage use. Operation and maintenance of these two facilities will remain the responsibility of the SRVWUA.

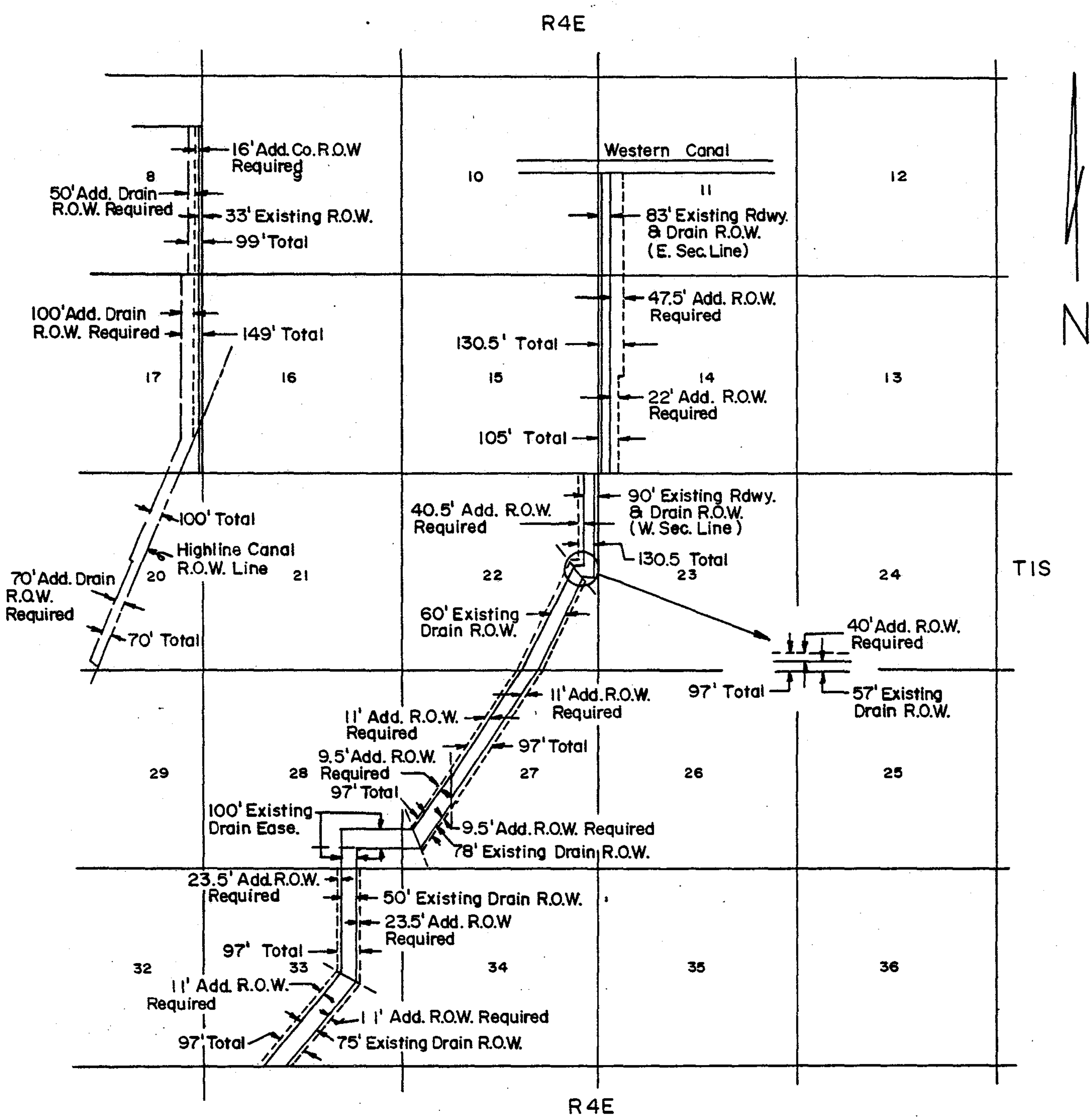
ADOT Borrow Pit and Diversion Channel

The operation and maintenance of diversion channels and retention basins of this type are more generally identified with city responsibility. Although the principal area protected lies within the incorporated area of the City of Tempe the majority of the area contributing floodwater to the retention pond originates on unincorporated county lands. Assignment of operation and maintenance responsibilities for these facilities remains unresolved at this time.

Gila Drain Channel

These facilities will service all sponsoring agencies. They are of the type presently managed by the Flood Control District. Means for the transfer of the maintenance responsibility for the Gila Drain from the SRVWUA to the jurisdiction of the District should be investigated. A major constraint to this transfer of responsibility lies in the 1923 Rights-of-Way Agreement as this agreement pertains to the operation of the Fowler Ditch control structure. Management and maintenance of the Gila Drain may need to be bilateral with the SRVWUA retaining responsibility for that part of the drain upstream above the control structure with a transfer of only the downstream section to the Flood Control District.

GILA DRAIN PROJECT



RIGHT OF WAY REQUIREMENTS ACROSS PRIVATE SECTOR

EXHIBIT NO. 30

PROJECT COSTS

Earthwork construction quantities have been determined by average of end areas planimetered from plots of channel cross-sections on ground line plots of the 1976 SCS survey. Structures have been identified and typical quantities determined as shown on the plans and profile sheets. A 15 percent contingency factor is used in the cost estimates.

A three year design and construction period was selected. Engineering costs of 4 percent for design and 5 percent for construction were added to the base cost estimate. Escalation at 9 percent per year was added to both engineering and construction costs for each year after 1979. Schedule of expenditures for engineering was 50 percent each in 1979 and 1980. Schedule of expenditures for construction was 25 percent in 1980, 50 percent in 1981 and 25 percent in 1982. Costs are presented in Table No. 10.

The total estimated cost of the project is $11,896,000.

TABLE NO. 10: Table of Costs and Expenditures

Item	1979 ($)	1980 ($)	1981 ($)	1982 ($)	Total ($)
CONSTRUCTION[1]					
Lateral 9.5					
Check Protection			48,000		48,000
SPRR Culvert			6,800		6,800
Riprap			12,700		12,700
Subtotal			67,500		67,500
Western Canal					
Wasteway			20,400		20,400
Riprap			5,100		5,100
Subtotal			25,500		25,500
Gila Drain					
Excavation		1,411,000	1,382,000		2,793,000
Compacted Fill		22,000	50,000		72,000
Concrete Lining					
Residential Area			176,000		176,000
Curves			115,000	291,000	406,000
Riprap					
Rock				38,000	38,000
Gravel Bed				10,000	10,000
Bridges			1,300,000	1,086,000	2,386,000
Culverts			340,000	330,000	670,000
Fowler Ditch Control				27,000	27,000
Subtotal		1,433,000	3,363,000	1,782,000	6,578,000
ADOT Retention Basin					
Excavation				147,000	147,000
Comp. Embankments				52,000	52,000
Bridges				233,000	233,000
Inlet Structure				133,000	133,000
Riprap				10,000	10,000
Subtotal				575,000	575,000
Contingencies (15%)		215,000	518,000	354,000	1,087,000
TOTAL CONSTRUCTION COST[1]		1,648,000	3,974,000	2,711,000	8,333,000

TABLE NO. 10: Table of Costs and Expenditures (continued)

Item	1979 ($)	1980 ($)	1981 ($)	1982 ($)	Total ($)
(brought forward)					
TOTAL CONSTURCTION COST (1)		1,648,000	3,974,000	2,711,000	8,333,000
RIGHT-OF-WAY					
Gila Drain					
Non-Residential	264,000				264,000
Residential	92,000				92,000
Streets	(54,000) (2)				(54,000) (2)
ADOT Retention Channel					
Non-Residential	608,000				608,000
Streets	(66,000) (2)				(66,000) (2)
TOTAL RIGHT-OF-WAY	964,000				964,000
ESCALATION		148,000	748,000	800,000	1,696,000
ENGINEERING					
Design	201,000	200,000			400,000
Construction		90,000	236,000	176,000	502,000
TOTAL ENGINEERING	201,000	290,000	236,000	176,000	903,000
TOTAL COST OF PROJECT	1,165,000	2,086,000	4,958,000	3,687,000	11,896,000

(1) Based on 1978 Construction Costs

(2) Not included in cost of project

ENVIRONMENTAL ASSESSMENT

The purpose of this section is the assessment of the environmental impacts of a proposed implementation of an improved drainage system in which storm water rentention/detention is effected to the extent municipal, county and tribal regulations permit. Differences in impacts between alternative project proposals were considered in the selection process. Thusly, the assessment here pertains solely to those impacts resultant from the recommended project.

PHYSICAL ENVIRONMENT

Description of the project's history, climate, topography, geology, and soils is presented in the main body of this report. Of concern here is the description of existing physical aspects upon which the project's implementation may have an impact.

Physiography

The physiographic settings encountered within the project are hereby classified under eleven separately identifiable types:

Type No. 1:	Facility located in undeveloped desert area
Type No. 2:	Facility located in agricultural area with irrigated fields on both sides
Type No. 3:	Facility located in urbanized area with residential development on both sides
Type No. 4:	Facility located within an industrial area
Type No. 1(a):	Facility located within undeveloped area with arterial street bordering one side
Type No. 2(a):	Facility located within agricultural area with arterial street bordering one side
Type No. 3(a):	Facility located within residential area with arterial street bordering one side
Type No. 4(a):	Facility located within industrial park with arterial street bordering one side

Type No. 2(b): Facility located on fringe of agricultural area with canal bordering one side and undeveloped lands on the other

Type No. 2(c): Facility located on fringe of agricultural area with canal bordering one side and commercial development on the other

Type No. 2-4: Facility bordered by irrigated field on one side and industrial area on the other

The relationship of physiographic types to proposed project facilities is presented in Table No. 11.

TABLE NO. 11: Environmental Types

Facility	Station From	Station To	Lenght (ft)	Environmental Type Physical	Environmental Type Vegetational*
Gila Drain					
	0+00	52+80	5,280	2(a)	A
	52+80	106+73	5,393	3(a)	A
	106+73	111+28	455	3	A
	111+28	222+02	11,074	2	A
	222+02	224+00	198	4	A
	224+00	248+11	2,411	2-4	A
	248+11	286+20	3,809	2	A
	286+20	300+39	1,419	2-4	A-B
	300+39	335+76	3,537	4(a)	B-C
	335+76	346+98	1,122	1(a)	B-C
	346+98	End	54,302	1	B-C-D
ADOT Diversion Channel					
	0+00	79+00	7,900	1(a)	E-F
	79+00	End	6,560	2(b)	E-F

* See BIOLOBICAL ENVIRONMENT - Vegetation

Hydrology

The Salt-Gila River Basin agro-metropolitan area has long suffered from water deficits, both in surface water and groundwater consumption. Of primary concern to any water control project are the impacts of that project upon the future water quality and water quantity within the overall area, No records are available of storm discharges from the project area into the Gila River. The Corps of Engineer's study undertook a discharge-frequency analysis in which peak discharges and total storm runoff were estimated under present and future (year 2030) development conditions without the Gila Floodway Project for 25, 50 and 100 year frequency storms. The runoff from the area north and east of the Highway I-10 crossing identified under Node No. 1310B of that analysis is representative of the areas served under the project proposed herein as passing through the Highway I-10 culvert. Estimated discharges are:

TABLE NO. 12 - Peak Discharges and Total Storm Flow Through the Highway I-10 Culvert(1)

	Present Conditions		Future Conditions	
Storm Frequency	Peak Discharge (cfs)	Storm Volume (ac ft)	Peak Discharge (cfs)	Storm Volume (ac ft)
25 Year	700	330	2,300	1,340
50 Year	1,500	800	2,900	1,810
100 Year	2,500	1,770	4,000	2,480

(1) From Tables 1 and 2 of Appendix 1, Summary Report for Flood Control - Gila - Floodway - U.S. Army Corps of Engineers, September 1977

Non-Storm Discharges

The Gila Drain is presently used to conduct three types of surface water flows not attributed to precipitation. These are:

- Irrigation Tailwater Drainage SRVWUA
- Irrigation Routing Broad Acres Farm
- Chandler Sewer Outfall(2)

(2) MAG 208 Water Quality Management Plan - Draft Environmental Impact Statement proposes expansion of these facilities, wastewater treatment for restricted agricultural use and containment of wastewater when not required for cropland irrigation.

During the irrigation season excess flows from the irrigated fields in the Tempe-Chandler area are collected by the SRVWUA drainage system for reuse when possible and for disposal in the Gila Drain when not. In addition.

the Broad Acres Farm Lessee (GRIC) is using the Gila Drain as a means for transporting irrigation waters from a point just downstream from the Pima-Chandler Industrial Park railroad spur crossing. Most of these two flows are diverted from the drain at the Fowler Headworks.

A continuous discharge of sewage effluent into the drain from the Chandler plant flows along the full reach of the drain below Station 513+50. Algae and fine sediment depositions have sealed much of the drain bottom and most of the effluent flows into the Gila River.

Gila River

A study of the magnitude and frequency of flooding on the Gila River was carried out by the U.S. Geological Survey in cooperation with the Arizona Department of Transportation and the Federal Highway Administration. The findings of that study are presented in Exhibit No. 31.

Roosevelt Water Conservation District Floodway

Upon completion of the RWCD Floodway Upper Queen Creek Basin floodwaters will be diverted directly to the Gila River at a point upstream from Gila Butte. According to the final Environmental Impact Statement for this project "the diverted floodwaters, on an average annual basis, is equivalent to a volume of 6,700 acre feet. This volume is compared to an average of 16,600 acre feet that at present flows annually and has been measured at the gaging station on the Gila River at Laveen...".
"The relationship of discharge to frequency of floodwater coming from the project area and by the Gila River is compared in the following table.

Relationship of Discharge to Frequency of Discharge
from Project Area and for Gila River

Frequency Avg. Recurrence Yrs.	Annual Peak Discharge - cfs RWCD Floodway	Gila River
100	8,700	78,400
50	6,100	60,500
10	2,200	24,500
5	1,200	13,900
2	350	5,600

The 100 year annual peak discharge from the project area is equilavent to the 3 year annual peak discharge from the Gila River."

The confluent of the RWCD Floodway and the Gila River is located about 15 miles upstream from the Gila Drain confluent.

Buttes Dam

The United States Congress has authorized the construction of this facility by the U.S. Bureau of Reclamation. A "Plan of Development" Report was completed in 1962 in which a study of the "Benefits from Flood Control, Buttes Reservoir..." is presented. In that analysis the controlled and uncontrolled flow in the Gila River at the dam site were presented as shown in Exhibit No. 32. Reductions in peak discharges are estimated at about 20, 81 and 37 percent for the 100, 50 and 25 year frequency storm respectively.

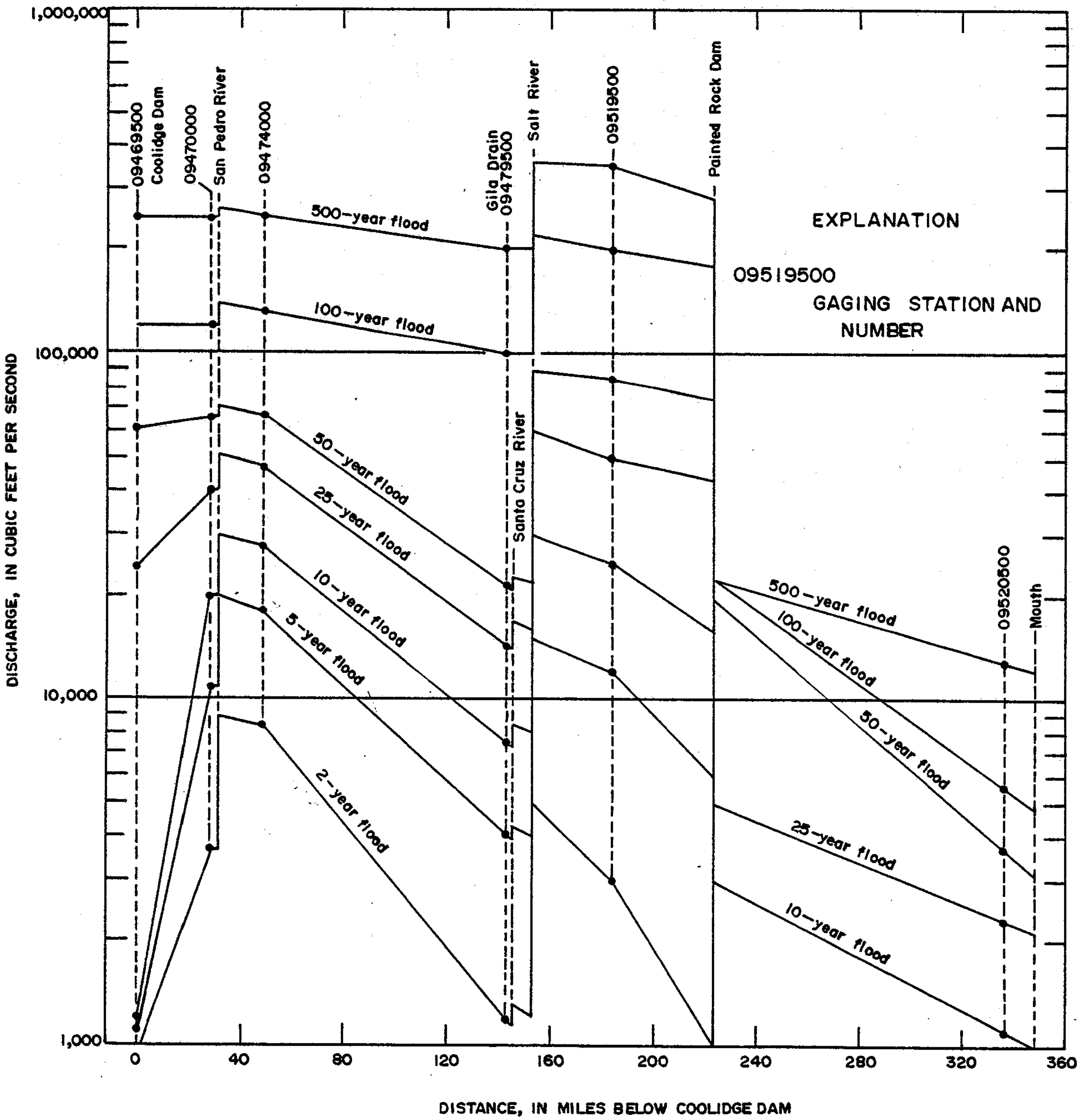
The present status of investigations call for a start of construction in about 1983 and call for a 4 year construction period. No Environmental Impact Study has yet been made and hydrologic studies will be reviewed both for the evaluation of the additional 20-year records now available and for possible changes in design concepts. Final estimates of the impact of this dam upon the flow in the Gila River flow at the Gila Drain confluent will not be available for another three to five years.

Groundwater

As shown in Exhibit No. 13 the depth of alluvial deposit in the project area range from 0 feet to bedrock exposures to depths exceeding 800 to 1200 feet. This alluvial deposit serves as an extensive subterranean resource from which water has been pumped for many years. Historically, the groundwater resource has suffered a rapid drop in elevation throughout the Salt-Gila River valley. At present, depths to groundwater range from under 100 feet along the Gila River to in excess of 400 feet in the northeastern part of the project (see Exhibit No. 33).

The quality of the groundwater, see Exhibit No. 34, varies greatly between wells. Total dissolved solids range from under 1,000 milligrams per liter along the northern and eastern boundaries to over 3,000 milligrams per liter along the Gila River channel. No records are available to show

GILA DRAIN PROJECT



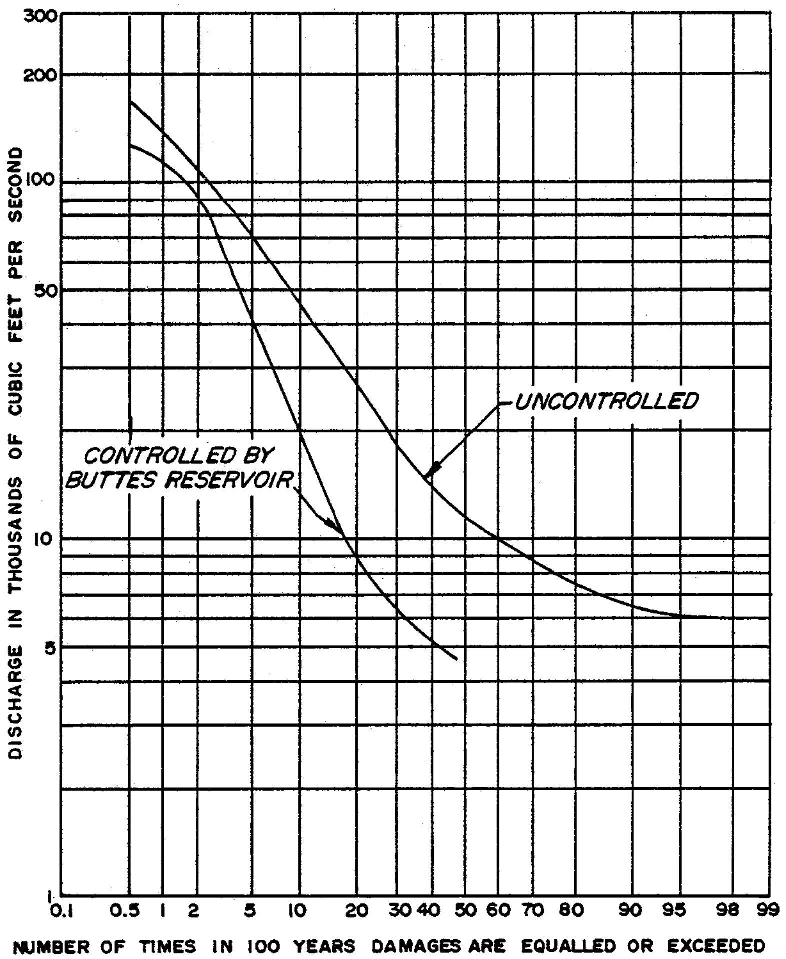
NOTE: 1) Relation of discharge to miles below Coolidge Dam, Gila River main stem, for selected recurrence intervals.

2) Taken from Figure No. 6 ADOT-RS-15(121) Final Report by R. H. Roeske, Sept. 1978

GILA RIVER DISCHARGE FREQUENCY

EXHIBIT NO. 31

GILA DRAIN PROJECT

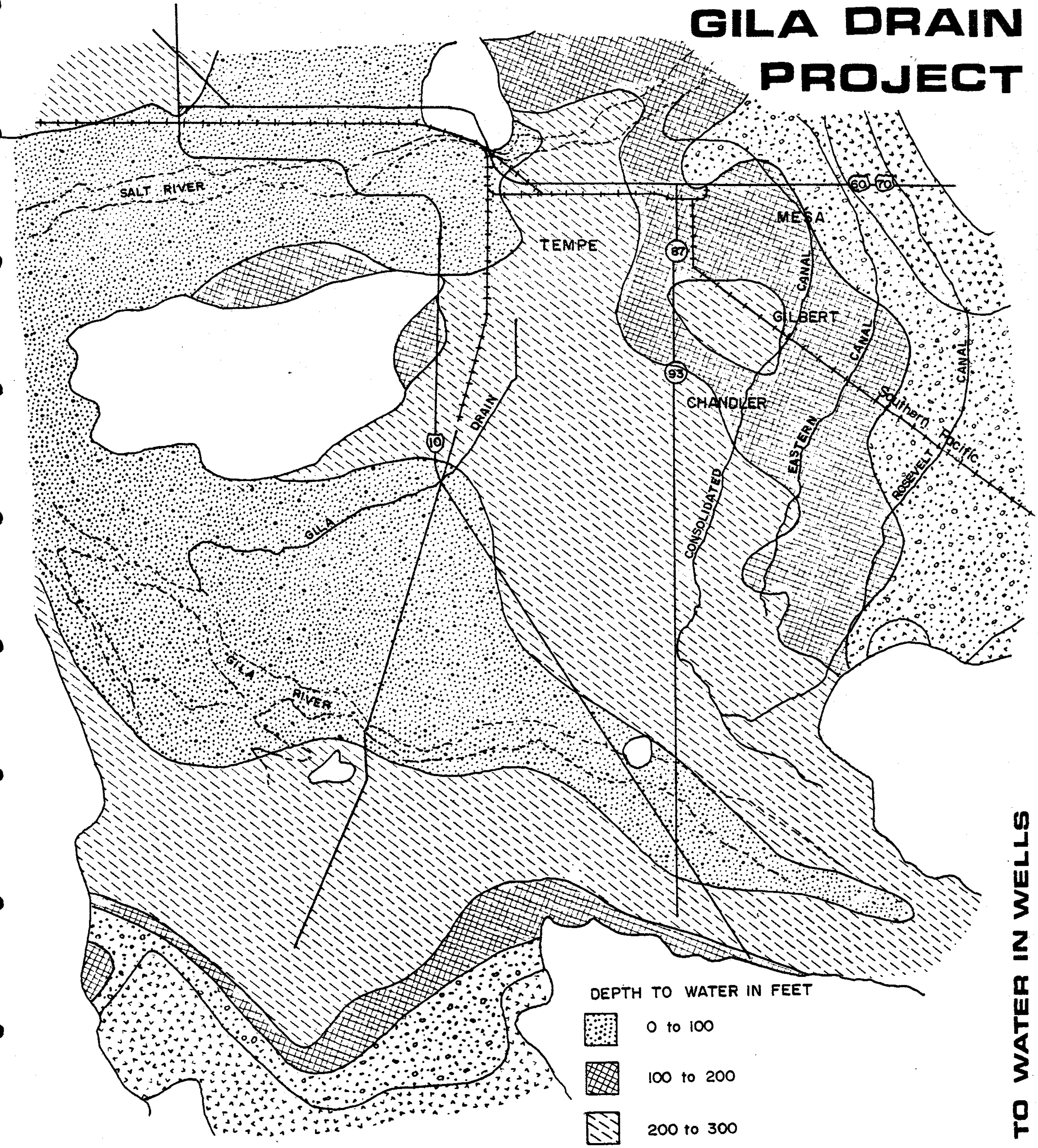


From the Office of the District Engineer
Corps of Engineers, Los Angeles, California
Dated: Aug. 25, 1958

BUTTES DAM DISCHARGE FREQUENCY

EXHIBIT NO. 32

GILA DRAIN PROJECT

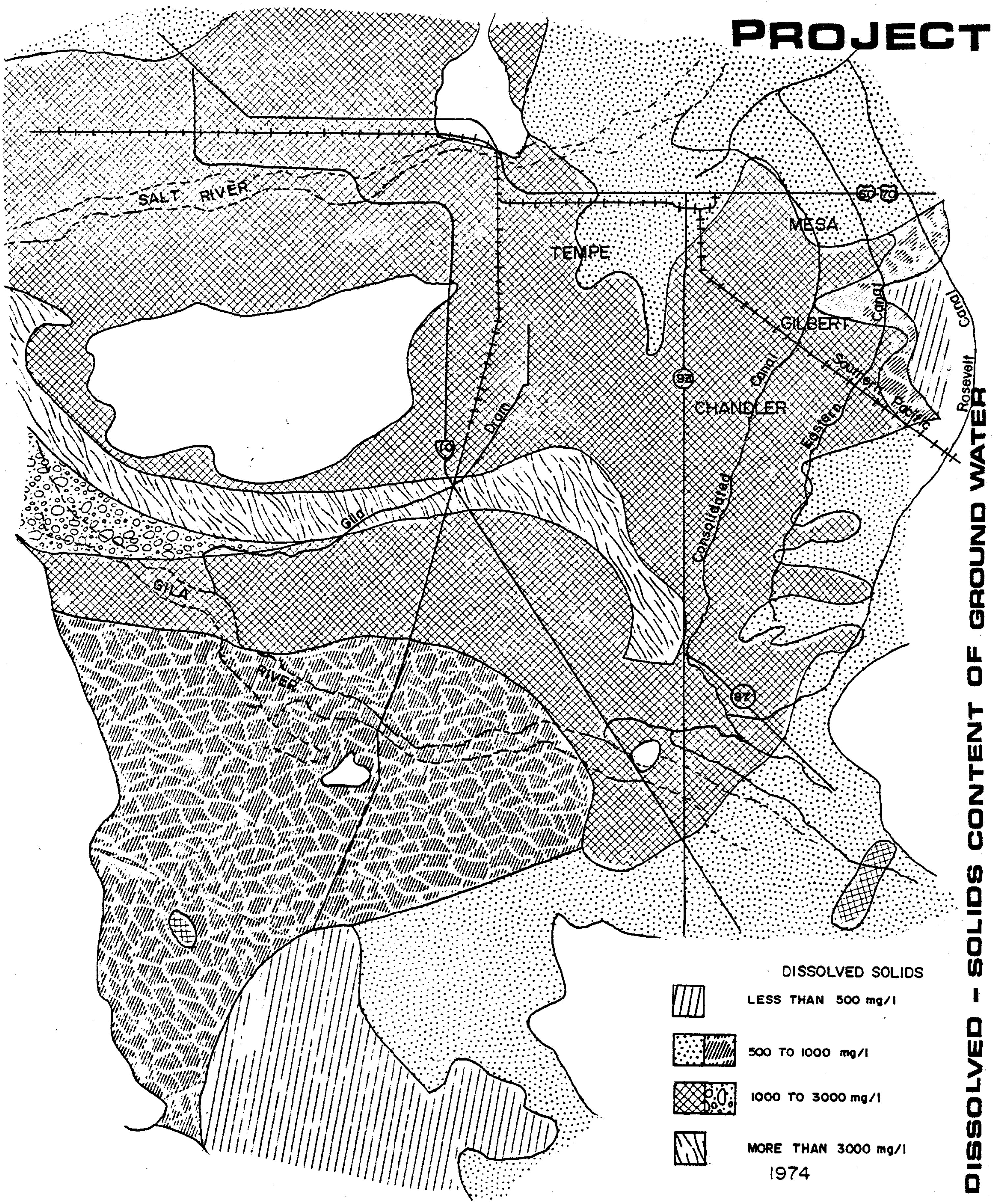


FM U.S.G.S. MAP I-845-D

DEPTH TO WATER IN WELLS

EXHIBIT NO. 33

GILA DRAIN PROJECT



FM U.S.G.S. MAP I-845-G

EXHIBIT NO. 34

changes in water quality with depth of pumping within the project. Information from the unpublished study of Mr. Phillip Ross, U.S. Geological Survey based upon data provided by the SRVWUA indicate that, while there is little change in the chemical composition of the water, concentrations of total dissolved solids decrease with groundwater extraction.

Recharge of the groundwater is derived from:

- canal seepage
- irrigated fields deep percolation loss
- stream channel seepage
- underflow of the Salt and Gila Rivers
- rainfall

The principal source of recharge is from irrigated fields. Deep percolation losses have been estimated at 15 to 20 percent of the water applied to the land. Long term averages of the total dissolved solids (TDS) in the surface irrigation waters range between 600 and 700 milligrams per liter. With effective leaching, salinity concentration in irrigation waters may range from 3,000 to as high as 4,500 milligrams per liter.

BIOLOGICAL ENVIRONMENT

Vegetation

Five types of plant communities were identified along the routes of proposed facilities. These types are described below. Specific plants identified by name are listed in Appendix "F". Locations of specific community types are presented in Table No. 11.

Type "A" - Vegetation found bordering facility access roads in the agricultural area

Type "B" - Native vegetation of the alluvial plain of the Gila River

Type "C" - Native vegetation bordering large washes and drainage areas that periodically have increased water input

Type "D" - Gila River channel vegetation

Type "E" - Creosote bush vegetation

Type "F" - Mesquite Bosque

Fish and Wildlife

The Salt and Verde Rivers provide the only fishery resources of the area. Fish species found in the rivers generally represent those of the warm water fishery. Fish species representing significantly different water conditions may be observed in the colder tailwater released downstream from Bartlett and Stewart Mountain Dams. During the winter season, these cold water fish tend to move downstream and may be occasionally seen in the SRVWUA and RWCD irrigation canals. Fish most commonly seen in the irrigation canals are minnows, catfish, blue gill, carp and suckers. Some fish may reach the Gila Drain through the irrigation system.

The animals associated with the vegetational communities are varied and quite extensive in number. They are often limited to particular habitats depending on moisture or temperature requirements. Animals observed during a brief survey of the area and those most commonly found in the area by type of habitat preferred are listed in Appendix "E".

Threatened and Endangered Species

Plants

It is highly unlikely that there are any endangered plant species in the project area. The few that may occur in the state do not occur in this locale.

Animals

There are two species in the amphibians and reptiles that are listed as threatened (not endangered) species by the Arizona Game and Fish Department that may occur in the project area. These are the desert tortoise (Gopherus agassizi) and the gila monster (Heloderma suspectum). The Sonoran green toad (Bufo retiformis) which may occur in the area, although it is unlikely, may become a threatened species if its habitat is widely disturbed. There are no endangered birds or mammals that occur along the Gila Drain project enlargement right-of-way.

SOCIOCULTURAL ENVIRONMENT

Two distinctly different social communities are encountered in the project area. Largest in number are the agricultural and residential communities found within the private sector of the project. Fewer in number are the Indian communities of the GRIC Reservation. The sociocultural of the former is more closely associated with the backwater ponding effects of stormwater buildup behind manmade embankments such as the SPRR, Highway I-10 and irrigation and drainage canal facilities. Residential developments have started immediately adjacent to the facilities proposed and relief from the threat of long term frequency storm damages are of immediate concern.

The Indian communities associated with the project are, on the other hand, located some miles from the Gila Drain in the St. John's School, Komatke and Gila Crossing area. Many of the homes and other structures of these three communities are located within the floodplains of the Gila Floodway and the Gila River.

Historical and Archaeological Resources

A recent survey of the project area was made by the Office of Cultural Resource Management, Department of Anthropology, Arizona State University in conjunction with the evaluation of archaeological sensitivity zones for major sewer lines (Draft Environmental Impact Assessment - MAG and Draft Environmental Impact Statement - USEPA for the MAG-208 Water Quality Management Plan). The results of that study are presented in Exhibit No. 35. Predictions of site density and average potential site significance were evaluated in accord with their overall archaeological sensitivity, as follows:

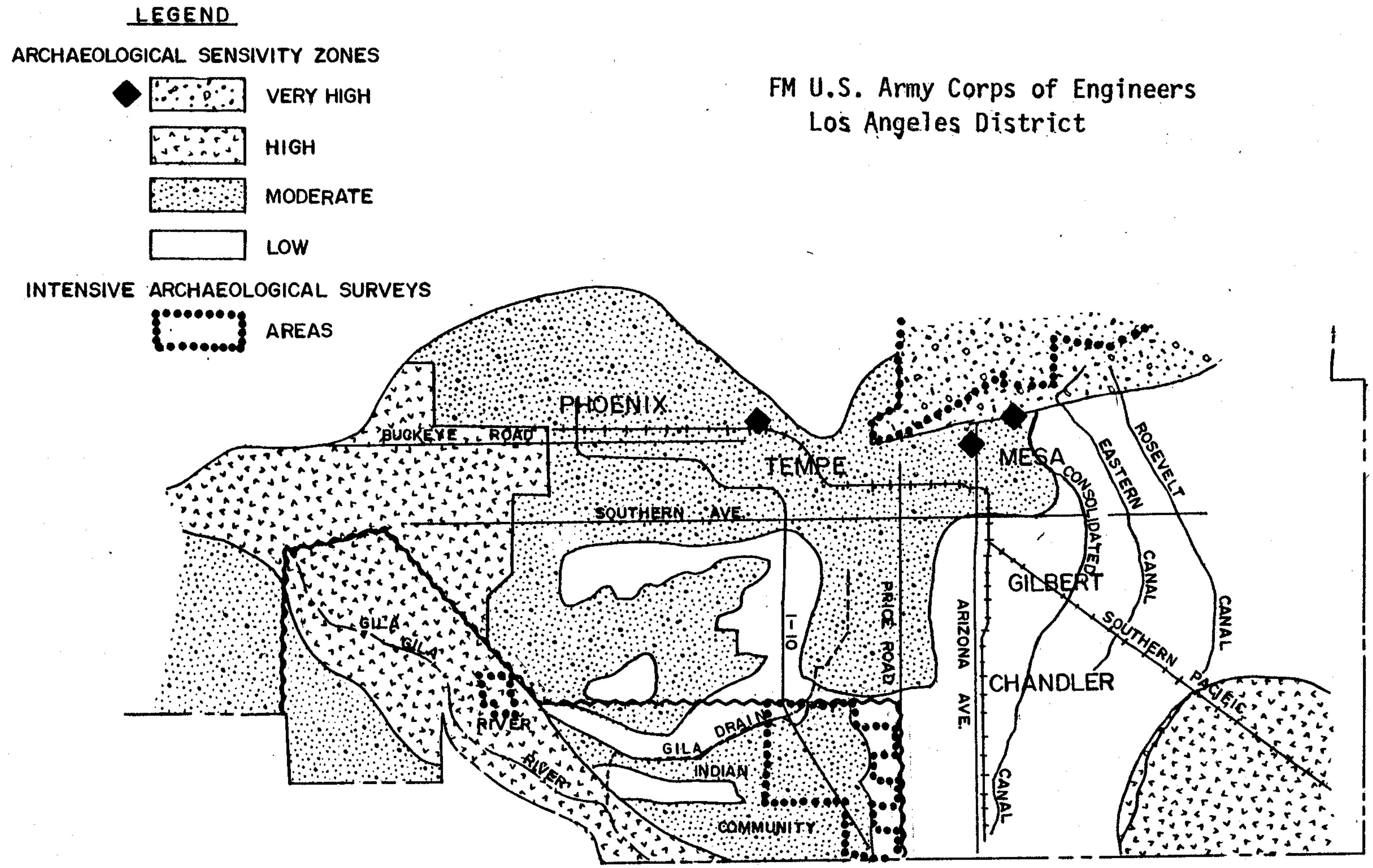
- Very high sensitivity: areas on/or presently under consideration for nomination to the National Register of Historic Places
- High sensitivity: areas expected to contain a high density of very significant archaeological resources
- Moderate sensitivity: areas presumed to have fewer sites and/or less significant archaeological remains
- Low sensitivity: areas expected to have very few sites and/or sites of very little significance.

All facilities proposed for the Gila Drain Project lie within low to moderately sensitive archaeological areas.

Recreational Resources

Hunting and Horseback riding are the principal recreational activities practiced along the drain. Hunting is limited mostly to small game.

FM U.S. Army Corps of Engineers
Los Angeles District



-109-

EXHIBIT NO. 35

GILA DRAIN PROJECT

REGIONAL ARCHAEOLOGICAL SENSITIVITY MAP

Bird hunting is quite popular during quail, dove and white-wing seasons. Cottontail rabbits are also hunted to a limited extent. Most hunting is restricted to residents of the individual communities as Indian lands are posted against hunting except under special license issued by the community. Motorized use of maintenance roads is limited to that section of the Gila Drain between Rural and Williams Field Roads and to the Highline Canal. Barricades and "No Tresspassing" posting of the right-of-way across the reservation discourages traffic along the lower section of the Gila Drain.

Bicycling along the drain's banks is limited due to the unpaved road surface and to the sparsity of housing developments below Station 106+67. No bicycle paths have been constructed along the alignments of proposed facilities.

Horseback riding along canal and drain maintenance roads is encouraged by the SRVWUA. Residential development in the area, particularly along the drain between Carver Road and Station 111+28, is of the ranchette type and many horses are kept for pleasure riding. Extensive use is made of all paths or lanes by riding enthusiasts.

Jogging has recently become a popular sport in the Salt River Valley. Canal and drain embankment roadways offer choice running paths generally free of traffic except at arterial road crossings. Most of the existing maintenance road along the drain lies to the south of the residential area and use of the roadways for jogging is relatively light.

IMPACTS ON THE PHYSICAL ENVIRONMENT

Air Quality

During construction heavy equipment operations will increase dust and machine exhause levels locally. About 1.1 miles (under 6 percent) of the proposed work lies within urbanized areas where the added dust and exhaust fumes may cause irritation and discomfort to individual residents. Hauling of excavated materials would expose residents living adjacent to the drain's maintenance road between Station 106+73 and 111+28.

No impacts upon the quality of air other than those associated with construction is foreseen. Particulates associated with construction activities are subject to State fugitive dust control regulations.

Noise

Due to the use of heavy equipment in the construction activities, there will be an increase in noise level along the channel alignments. This noise level will probably disturb any wildlife feeding, burrowing or roosting immediately adjacent to the channels and some of the wildlife may temporarily leave the area immediate to the construction. This disturbance will affect all non-residential areas or about 95 percent of the project's channels. Disturbed wildlife will find adequate refuge in the adjacent desert and agricultural fields and should return as soon as noise levels decrease.

Construction equipment noise may be bothersome to some residents living adjacent to the channel imporvement operations and additional traffic from hauling operations may be bothersome to residents living on arterial streets. Working hours for construction of the type porposed are normally performed during daytime periods.

Surface Waters

No records are available on measurements of surface water discharges of the Gila Drain to the Gila River. Flows other than those released from the Chandler sewage ponds are believed to be insignificant. With enlargement of the channel capacity, greater use will be made of the drain and increased flows will reach the Gila River. These flows will compose two distinct types. First, will be releases by the SRVWUA of irrigation and municipal waters from the canal system as a protective measure following storm forecast warnings. Quantitatively these releases of about 316 and 62 cubic feet per second, respectively, are estimated to occur four to five times annually for periods up to 10 hours. Maximum probable annual releases would amount to 156 acre feet. Whenever possible these releases will be made to farmers for beneficial use rather than wasted to the drain. Also, part of these releases may be diverted at Fowler Ditch heading for use on the Reservation.

The second type of flow in the drain will compose of storm runoff. Part of this occurs as releases of storm water inflow into the SRVWUA system (230 cubic feet per second). The remainder will compose of either unrestricted and GRIC Reservation surface runoff or controlled releases of retained and detained floodwaters.

Peak Discharges

In the absence of runoff records within the subbasin or from a comparable basin, discharge frequency analysis was made based upon rainfall frequencies. The results of this analysis are presented in Exhibit No. 36 wherein the peak discharge from the Gila Drain into the Gila River is estimated.

Direct comparison of present and future peak discharges without the Gila Drain Project can only be made for the runoff through the Highway I-10 culvert. At that point (see Table No. 12), the 100 year frequency runoff estimated under present conditions at 2,500 cubic feet per second will be increased to 4,000 cubic feet per second by the year 2030.

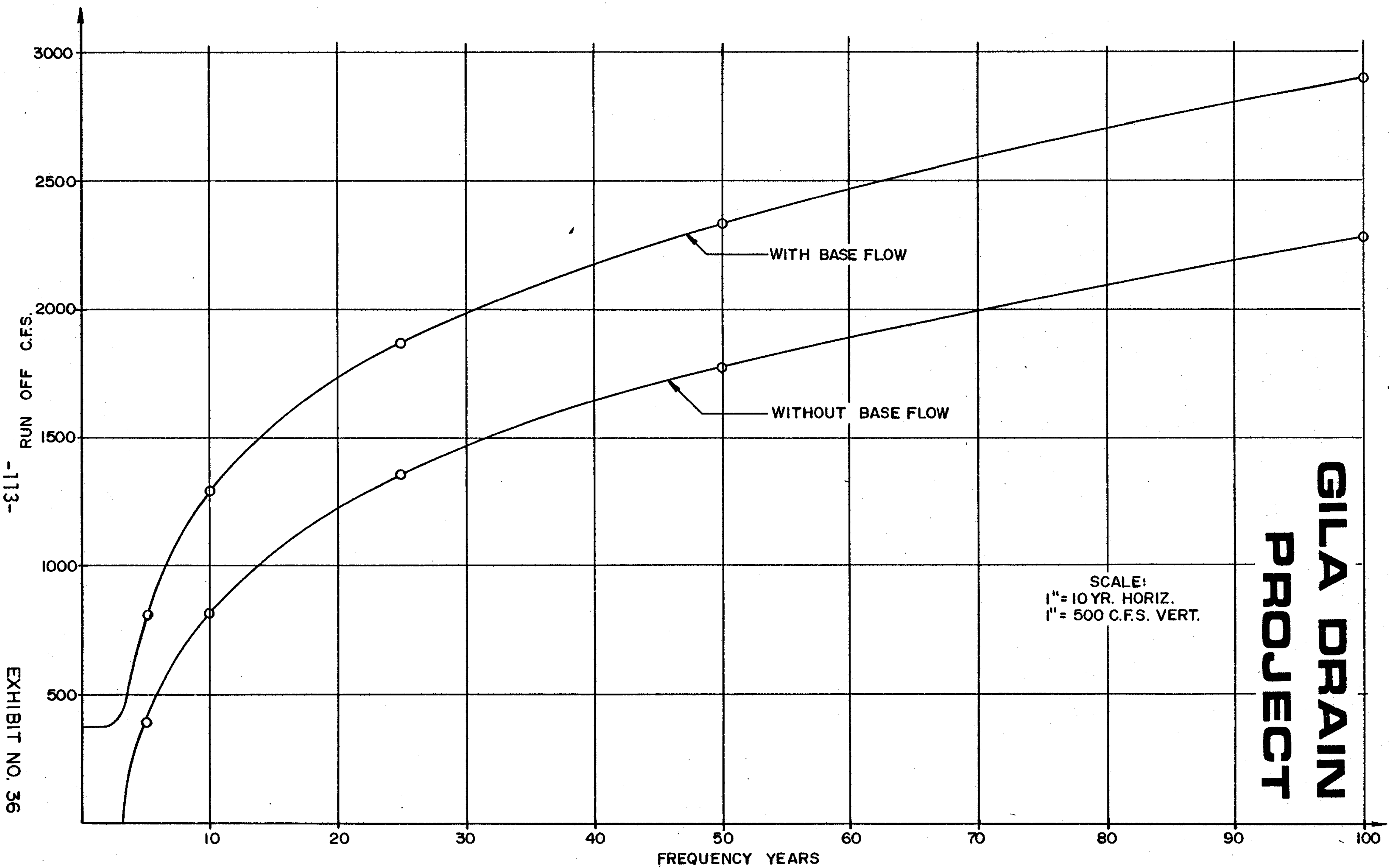
Peak discharges into the Gila River at the Gila Drain confluence will represent the diversion and introduction of large parts of the historic runoff at a point upstream from the natural point of inflow. Essentially most of the 2,900 cubic feet per second flow will be diverted from the natural Gila Floodway channel which will provide an equivalent relief from downstream flooding, particularly in the St. Johns School and Komatke area. Conversely, inflow into the Gila River channel may threaten those structures built within the floodplain of the Gila River at the St. Johns School and Gila Crossing areas.

Total Runoff

The 100 year frequency storm runoff through the Highway I-10 culvert is estimated at 465 acre feet. When added to the SRVWUA base flow release of 156 acre feet, the total discharge of uncontrolled flow through the culvert under future conditions would amount to about 78 percent of the Corps of Engineers estimate of 800 acre feet for present conditions. To this must be added releases of retained/detained flows after the storm.

EXHIBIT NO. 36

GILA DRAIN PROJECT



FREQUENCY RUN-OFF CURVE
AT GILA RIVER AND DRAIN CONFLUENCE

Estimates of storage requirements for individual sponsors were made in accord with projected jurisdictional boundaries as presented in Exhibit No. 37. Required storage is shown in Table No. 13 below:

TABLE NO. 13: Floodwater Storage Requirements by Sponsoring Agencies

Sponsor(1)		Storage (acre feet)
Gilbert		872
Mesa		1,718
Chandler		2,998
Maricopa County(2)		1,041
	Total	6,629

(1) Estimate presumes that storage in the Tempe area will be retained within development areas and fully infiltrated into the soil.

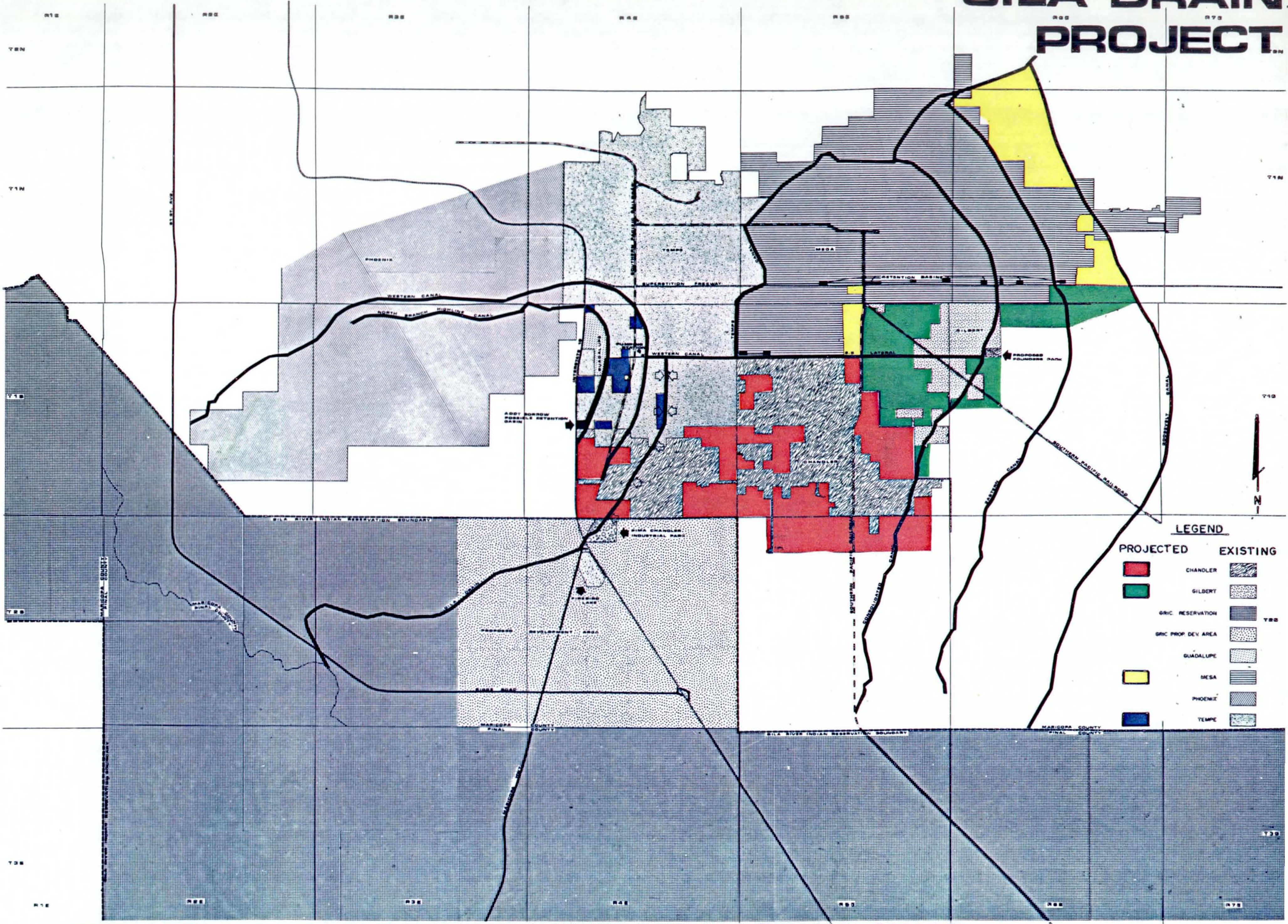
(2) Includes 474 acre feet in the ADOT Borrow Pit Retention Basin

The total 100 year storm runoff that could be discharged into the Gila River is estimated at 7,250 acre feet.

Recommended Pumping Capacities

As protection against back-to-back occurrence of low-frequency storms it is recommended that the retention basins be emptied as soon as practicable following such storms. To evaluate pumping requirements for individual sponsoring agencies the storm runoff was routed into the Gila Drain as soon after storm occurrence as possible. A 36-hour delay between initial releases of SRVWUA pre-storm base flows and start of pumping was assumed. A maximum flow of 400 cubic feet per second through the Lateral 9.5 and Western Canal was permitted. Also, pumping discharge into the Gila Drain was permitted up to the channel design capacity. As shown in Exhibit No. 38, a total of 101.2 hours (4.2 days) would be required to completely drain the system. Pumping capacities for downstream sponsors can be increased to more than 200 cfs once the upstream basins have been emptied.

GILA DRAIN PROJECT



PROJECTED YEAR 2030 JURISDICTIONAL BOUNDARIES

EXHIBIT NO. 37

GILA DRAIN PROJECT

RECOMMENDED PUMPING CAPACITIES FOR RETENTION / DETENTION BASINS

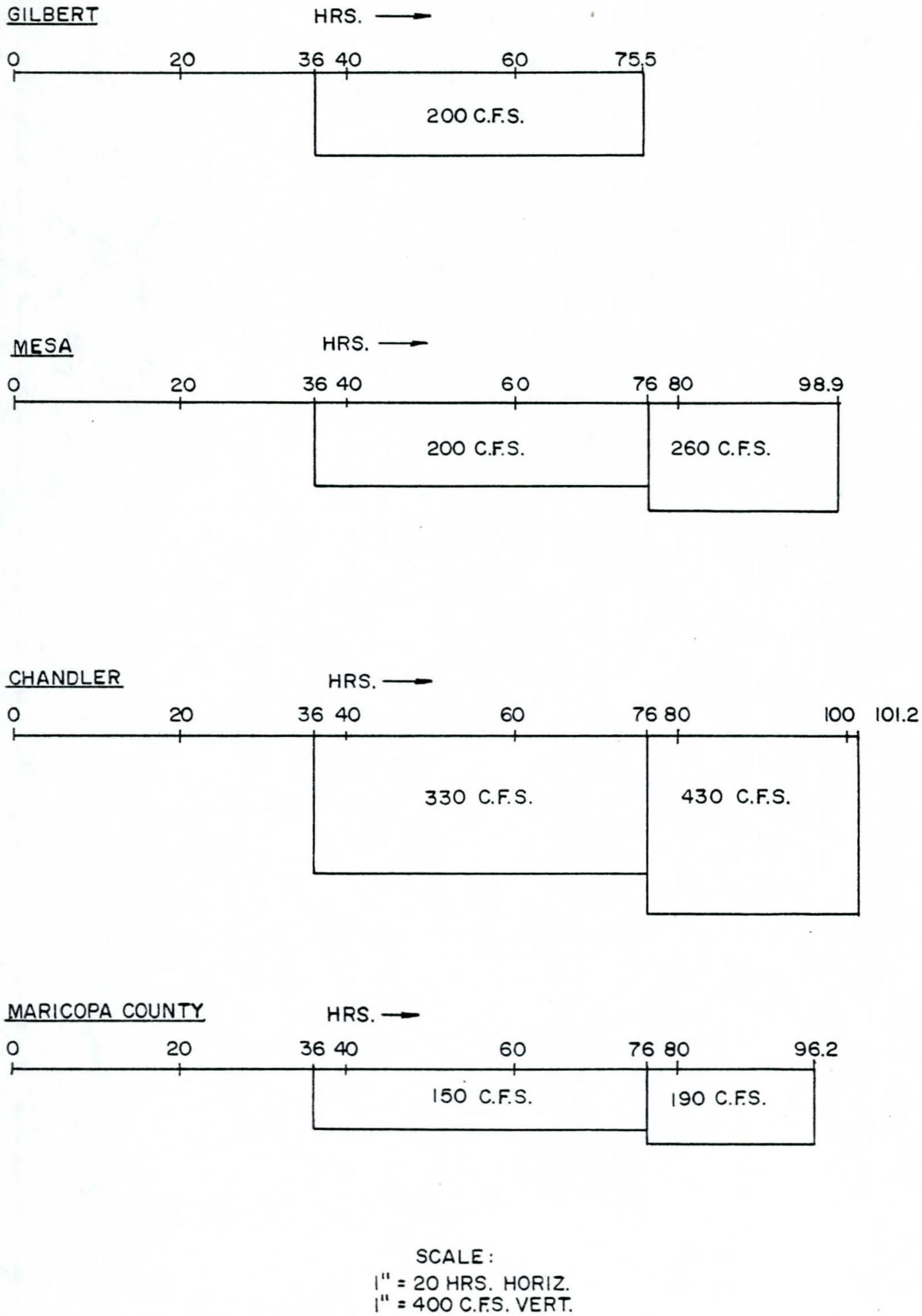


EXHIBIT NO. 38

Pima-Chandler Industrial Park

The design drawings for the Pima-Chandler Industrial Park were reviewed to determine maximum discharge from a fully developed park without retention or detention. It was estimated that the peak flow into the Gila Drain at the Willis Avenue inlet would be equivalent to 280 cubic feet per second. Time of peaking would be 1.34 hours. Corps of Engineers program calls for an inflow of 657 cubic feet per second at the inlet to the Highway I-10 culvert crossing. Recommended designs should adequately remove the projected runoff from this industrial park.

Groundwater

Although all precipitation occurring at greater frequency than the 50 year storm is estimated to be retained on the project area at present, the Corps of Engineers estimates that "rainfall contributes little recharge to the groundwater storage. Most precipitation is lost to the atmosphere as evaporation and as transpiration".

The implementation of storm water retention as a means for groundwater recharge is too recent to the project area for reliable estimates of deep percolation from retention basins as a percentage of total storm precipitation. Collection by storm drain systems will tend to reduce evaporation and transpiration losses and undoubtedly a percentage of the runoff will percolate down to the groundwater table. In part, groundwater recharge will depend upon rule curves developed for the emptying of retention basins. High frequency storms, where the total runoff will percolate into the ground or evaporate in a relatively short time, may be retained entirely without pumping into the drainage outlet system.

Water Quality

Storm runoff from residential and commercial areas will dissolve and pick up solids from the surface during the draining process. Concentrations will vary widely with the type of development drained. However, routings of storm waters are relatively short and dissolved solids are anticipated to remain at low levels in retention basins.

In the process of percolation through the soil beneath retention basins, additional salts will be leached from the soil. At present soil solutions in the agricultural area are quite saline and initial recharges to the groundwater table may equal or be slightly below that from current irrigation practices. Leaching will decrease with time and future recharges to the groundwater will show an improvement in groundwater quality.

IMPACTS UPON THE BIOLOGICAL ENVIRONMENT

Construction operations will extend to the full widths of the proposed rights-of-way. The existing biological environment will be completely altered within these areas.

Vegetation

Areas affected by the proposed facilities are as follows:

Type		Area (acres)
A		14.6
B		32.0
C		3.9
D		-0-
E		23.8
F		12.9
	TOTAL	87.2

Type "A" areas already support a disturbance vegetation subject to annual removal by maintenance or farming operations. No change in the Gila River channel salt cedar community is predicted in terms of density, growth or expansion of the stand as a result of the proposed project. Present day growth is a result of sewage treatment effluent and tailwater releases from upstream irrigation along the Gila River. If the constant flow from the sewage treatment plant is eliminated, there is a likelihood that the salt cedars in the river bottom will be put under periodic moisture stress. Occasional surges of water down the Gila Drain of 600 cubic feet per second or less over short periods of a few days may possibly offset any loss of sewage effluent. It is unlikely that these surges of water will cause the salt cedar riparian community to expand as the surges will be too intermittant or irregular.

Fish and Wildlife

Any fish reaching the Gila Drain must either pass through the SRVWUA irrigation system or have been placed in the drain by residents from their aquariums. Fish life within the SRVWUA canal system is derived almost entirely from downstream migration from the Salt and Verde Rivers. None of the species found in the canals are known to spawn in the canals other than a possible spawning of minnows. Standard maintenance procedures call for an annual dry-up period which results in a total kill of fish. No change in fish life is expected from the project proposed.

The greatest impact on wildlife will occur on the areas where Type B, C, E and F vegetal cover are removed. Over the short term, animals associated with the vegetation types will migrate to adjacent lands. In the long term, however, there will be a loss of about 43.6 acres of cover and food source.

Within the agricultural area, animal life will be more affected by urban development that by the proposed construction. Over the short term, animals associated with 14.6 acres of agricultural lands to be developed may be lost. Over the long term no wild animal life is expected to survive urbanization and the effect of the work proposed will be negligible.

Threatened or Endangered Species

None

IMPACTS ON THE SOCIOCULTURAL ENVIRONMENT

Economics

This study does not assess the flood damages that could be prevented by the works proposed. For this information, refer to the Corps of Engineers Summary Report.

The work to be performed will be carried out under construction bid contracts. The type of work is of a kind normally performed by local contractors using skilled and semi-skilled labor available from the residential population. Access to the work is excellent and no shift in population residency because of the proposed work is expected.

Flood Relief

On December 31, 1977 data was gathered pertaining to the population, number of households and number of dwelling units within the GRIC Reservation. The survey results are presented in Table No. 14.

TABLE NO. 14 - Population, Number of Households and Number of Dwelling Units on the GRIC Reservation that could be Affected by the Gila Drain (1)

	St. John's School	Komatke	Gila Crossing	Total
Enumeration District	#22	#23	#24	
Population	251	166	211	628
Number of Households	53	43	52	148
Number of Dwelling Units	53	53	64	160

(1) Data formally accepted and certified by the U.S. Bureau of Census

These three communities lie within the floodplain of the Gila Floodway, the natural outlet of the Queen Creek subbasin. Historically, these three communities have been subjected to flooding from Queen Creek and its numerous tributaries (see Exhibit No. 4).

Partial control of the 966 square mile subbasin runoff will be effected through the Soil Conservation Services development of the RWCD Floodway system. However, this control affects the runoff from only 711 square miles leaving the remaining 255 square miles uncontrolled. In the September 1977 study by the Corps of Engineers it was estimated that the runoff that would result from a 100 year storm occurrance within the uncontrolled sector would yield, under present development conditions, a flood discharge of 2,500 cfs (1,770 AF) at the Highway I-10 crossing and 4,100 cfs (3,900 AF) at the St. John's School - Gila Crossing - Komatke area. Under future development conditions (Year 2030) it was estimated that these discharges would increase to 4,300 cfs (3,620 AF).

The Gila Drain Project, as recommended herein, will provide 100 year storm frequency protection against flooding from an additional 206 square miles leaving only 49 square miles of the Gila Floodway (Queen Creek Subbasin) drainage area uncontrolled. Flood risks within the Gila Floodway will be reduced considerably by the RWCD Floodway, particularly as they relate to short term frequency storms. In the long term, however, serious flooding within the Gila Floodway can still occur under present conditions. The Recommended Project will greatly reduce the longer term frequency storm risks.

Discussed but not included in the "Recommended Project" is the GRIC Diversion Dike and Channel. This structure, when added to the proposed project would add an additional 35 square miles to the controlled area leaving only 14 square miles uncontrolled. Because these 49 square miles are composed principally of high yield flood discharges from the slopes of the South Mountains it may be to the interest of the Indian Community to provide the additional rights-of-way needed for the incorporation of these facilities in the project.

Archaeological and Historical

The proposed action can disturb important archaeological or historical sites, mainly by the direct removal of artifacts or historically significant structures, through construction of facility components (see Exhibit No. 35). Prior to construction, an Archaeological Clearance Survey will be carried out under the auspice of the Flood Control District. Sites identified will be flagged under the supervision of a qualified archaeologist/historian and construction will not be initiated at such sites until the sites are mitigated and impacts avoided.

Recreation

Restrictions to public use of the drain maintenance roads for recreational purposes will be limited to the construction site and only during periods of actual construction activity. Excavation and structural operations are limited to short reaches at any one time, and restrictions of public access will rarely exceed one mile of the drain's section.

The impact on recreational use will be limited to joggers, horseback riders, bicyclers and possibly hunters during the quail and dove season. It is expected that these enthusiasts will move to other paths available within short distances and there will be no loss in recreational activities during construction.

Upon completion, the drain's maintenance roads will be available for bike paths, horseback riding, jogging and small game hunters in the private sector.

Transportation

There will be no interruption of access to private residents. Detours will be provided at all existing street crossings.

The proposed offsetting of the Gila Drain between Stations 0+00 to 106+73 will permit the widening of Rural Road for use as an arterial street.

Safety

Construction operations will be regulated in accordance with safety requirements imposed under the Occupational Safety and Health Act program. Most additional risks will be confined to the construction site itself and involve only the working crews. Hauling of removed earth and concrete materials will utilize public thoroughfares.

SUMMARY OF ENVIRONMENTAL IMPACTS

A summary of the environmental impacts of the proposed project is presented in Table No. 15.

TABLE NO. 15: Summary of Environmental Impact

	Impacts	
Environmental Quality	Temporary (During Construction)	Long Term
Air Quality	Individual residents adjacent to a 1.1 mile reach of the Gila Drain may suffer temporary irritation and discomfort from dust and machine exhaust.	Slight reduction in dust along maintenance roadways due to a decrease in maintenance requirements.
Water Quality	None	Groundwater quality will be improved.
Noise	Disturbance of residents along 1.1 miles of the Gila Drain and of wildlife along the remainder of the drain and along the ADOT Diversion Channel. This may cause temporary abandonment of adjacent vegetal refuge. No loss of wildlife should occur.	None
Hydrology	None	There is a one percent chance that an additional 6,450 acre feet of water will be discharged into the Gila River at a peak discharge of 2,900 cubic feet per second.
Waste Disposal	No sites have been selected for the disposal of waste excavation earth materials. Approved pits will be used for the disposal of construction materials removed from the present facilities.	Return to normal land use. Opportunity exists for use of waste materials to improve land surfaces in the Pima-Chandler Industrial Park or other selected sites.
Aesthetics	Construction activities.	Improved appearance of the drainage channel.
Vegetation	Clearing of 14.6 acres of agricultural lands and 43.6 acres of natural desert vegetation.	Loss of 72.6 acres of natural desert vegetation.

TABLE NO. 15: Summary of Environmental Impacts (continued)

	Impacts	
Environmental Quality	Temporary (During Construction)	Long Term
Wildlife	See noise above	Loss of animal life whose habitat is normal to that of the 72.6 acres of natural desert vegetation removed.
Archaeology and Histors	Flagging sites and mitigation activities.	None
Transportation	Increased traffic along arterial roads.	None
Safety	Minor increases of traffic on arterial roads	Reduction of drowning risks to humans, and wildlife due to the flattening of channel side slopes on earth section. Some increase risk to cattle. Increased risks along concrete lined sections due to increased use and channel capacity.
Socioeconomic	Reduction of unemployment in the Greater Phoenix Area.	Improved flood prevention in both the private sector and on the GRIC Reservation.

APPENDIX "A"

AGREEMENT

UNITED STATES GOVERNMENT

AND

SALT RIVER VALLEY WATER USERS ASSOCIATION

for

Construction of Drain Ditch
Across Gila River Indian Reservation

Dated, June 21, 1923

THIS AGREEMENT, made this 21st day of June, 1923, by and between the UNITED STATES OF AMERICA, hereinafter styled the UNITED STATES, acting for this purpose through the Commissioner of Indian Affairs by Herbert V. Clotts, Supervising Engineer, thereunto duly authorized, and the SALT RIVER VALLEY WATER USERS' ASSOCIATION, herein styled the ASSOCIATION, a corporation duly authorized and doing business under the laws of the State of Arizona,

W I T N E S S E T H :

THAT -

1. WHEREAS, the Association, under the terms of an agreement with the United States dated September 6, 1917, is in charge of the care, operation and maintenance of the irrigation works known as the Salt River Project, in the State of Arizona; and,

WHEREAS, the Association has heretofore constructed and has in operation certain drainage pumps and drainage ditches which are being operated or maintained for the purpose of draining the excess ground and surface water from agricultural land within said Salt River Project lying north of the Gila River Indian Reservation and partly within and partly east of Drainage District No. 1, of Marciopa County, Arizona, hereinafter called the DISTRICT; and,

2. WHEREAS, the Association is desirous of constructing and operating additional drainage pumps and ditches for the necessary purpose of draining this land more completely and draining such other land as may be required in the future; and,

3. WHEREAS, there is in full force and effect an agreement dated September 20, 1917, between the District and the United States, whereby the district is granted a right of way 100 feet in width from the north line of the Reservation to the Arizona Eastern Railroad, for a drainage ditch to carry all the water produced by the District, and whereby the United States acquires title to the water; (copy of said agreement being attached hereto and marked "EXHIBIT A") and,

4. WHEREAS, an agreement dated April 12, 1921, between the District and the Association permits the Association to discharge into the District's drainage ditch, water collected by the Association's drainage works, which water so collected materially increases the present flow in the ditch, on account of which a controversy has arisen between the United States and the District over the matter; and,

5. WHEREAS, it is the desire of all parties to adjust the differences in an amicable way; and,

6. WHEREAS, the topography of the vicinity is such that there is a natural fall from the lands now drained and to be drained by the Association, making the route through the Indian Reservation the most feasible location for a drainage ditch; and,

7. WHEREAS, the Association desires to secure from the United States, for the benefit of the lands of the Salt River Project, being all of the lands within the reservoir district as described in the Articles of Incorporation of the Association, the right in perpetuity to construct, maintain and operate a drainage ditch across the Gila River Indian Reservation to the Gila River, for the purpose of providing a satisfactory outlet for the drainage water and other water collected by the canals of the Association; and,

8. WHEREAS, the United States desires to secure an immediate outlet to the Gila River for a part of the water discharged upon the Reservation from the District; and

9. WHEREAS, the United States desires to acquire from the Association the right to the use of all water which it may now or hereafter be able to apply to beneficial use upon the lands in said Indian Reservation that may now or hereafter be discharged upon the Reservation or carried by the ditch to be constructed to the Reservation by the Association as herein provided, the carrying out of which will adjust the differences that may exist.

NOW, THEREFORE, in consideration of these premises, and of the faithful performance by the Association of its covenants hereinafter set forth, the United States:

1. Grants to the Association and its successors in the operation of the Salt River Project, subject to the terms of the Act of March 3, 1891 (36 Stats., 1095), a right of way 100 ft. in width, extending from a point in the drainage ditch of Drainage District No. 1, Maricopa County, the said point being located in Sec. 5, T 2S, R 4 E, G. & S. R. B. & M., through portions of Sections 5, 8, and 7, of said Township; portions of Sections 12, 11, 14, 15, 16, 21, 17, 18, 19 and 30, T 2 S, R 3 E, and through portions of Sections 13 and 24, T 2 S, R 2 E,- the terminal point of the said ditch being a point on the right bank of the Gila River in said Sec. 30, T 2 S, R 3 E. The Center line of said right of way being described as follows, to-wit: -

Beginning at a point 552' South, 35° 43' West from the SW Corner of the SE 1/4 of NE 1/4, Sec. 5, T 2 S, R 4 E; thence S 20° 34' W 1643 ft.; thence S 76° 42' W. 3576 ft.; thence S.50° 59' W. 1118 ft.; thence S.72° 03' W. 1160 ft.; thence N.50° 07' W. 500 ft.; thence S. 54° 38' W. 1408 ft.; thence S.72° 03' W. 6531 ft.; thence S. 52° 03' W. 9283 ft.; thence S.83° 33' W. 837 ft.; thence S. 54° 12' W. 980 ft.; thence N.88° 49' W. 3652 ft.; thence S. 34° 30'W. 1210 ft.; thences N.75° 50' W. 798 ft.; thence N. 42° 16' W. 1270 ft.; thence N.83° 14' W. 1536 ft.; Thence S. 61° 13' W. 1098 ft.; thence N.84° 26' W. 3533 ft.; thence N. 70° 59' W. 4400 ft.; thence S.82° 12' W 950 ft.; thence S. 40° 38' W. 3192 ft.; thence S.27° 25' E. 7143 ft.; thence South 230 ft. to a point on the right bank of the Gila River, whence the SW Cor. of the SE 1/4 of the NE 1/4 of Sec. 30, T 2 S, R 3 E, bears S. 68° 09' East, a distance of 2264 ft.

The location of the said proposed ditch being further shown on the accompanying map, made a part hereof.

2. Release and discharge the Association from all obligations and liabilities for damages sustained or claimed to have been sustained by lands within the Gila River Indian Reservation, from drainage water heretofore discharged upon the Reservation by the Association from the Salt River Project:

3. Agree to refrain at all times from placing any check, diverting dam or other structure in said drainage ditch or in any lateral which may be constructed for the diversion of water therefrom which will cause the natural flow of said drainage ditch to be obstructed in any manner, regardless of the amount of water flowing therein: Provided, however, that should the bottom of said drainage ditch be excavated or eroded below the grade established therefor, as shown on the attached profile, the United States may install such structure as may be necessary to divert the required amount of water therefrom without thereby raising the bottom gradient of the canal above that shown on the profile: Provided, that said structure shall not interfere with the proper functions of said drainage ditch or add to the cost of the maintenance thereof;

4. The United States agrees to interpose no objection to such use by the Association of the drainage ditch of the District through the Reservation above the Railroad Bridge as may be consistent with the terms of the agreement dated September 20, 1917, between the United States and the District;

5. It is understood and agreed that the United States shall have the right to use said drainage ditch at all times for the discharge of 20 sec. ft. of water from the drainage ditch of the District or other source. Whenever the Association and the United States are not discharging 75 sec. ft. of water into or through said ditch and the amount so discharged is insufficient to meet the reasonable needs of the United States or its assigns for the irrigation of lands supplied by said ditch, then and in that event the United States shall have the right to discharge additional water through said ditch up to the full capacity of 75 sec. ft.; and the United States agrees that should it desire to discharge still more water, it will enlarge said drainage ditch and all structures at its own expense, without material interference with the flow of water therein, so as to carry the increased flow without raising the water level above the gradient shown on the attached profile.

6. The United States agrees that in the event that it shall enlarge said drainage ditch in accordance with the provisions of the preceding clause, it will thereafter maintain such proportion of the total length of said drainage ditch, beginning at the lower end, as the share of the normal ditch capacity constructed by the United States bears to the total normal capacity. It shall be maintained in such condition that it will carry the amount of water for which it is designed, without raising the water-line above that shown upon the attached profile. For convenience, it is agreed that maintenance work shall be performed by the Association, and an accurate account of the cost thereof kept, which account shall be subject to inspection by officials of the United States at any time, and a statement of such cost rendered to the United States on January 1st of each year; and that the United States agrees to pay its proportionate part of such cost within sixty days after the rendering of such statement, or as soon thereafter as money is available by Congressional appropriation. It is understood and agreed that the proportionate share of the cost assessed against the United States shall be based on the actual cost of operation, the amount to be paid by the United States to be determined by the difference between the actual capacity of the ditch at the time of the enlargement by the United States and the Capacity of the ditch so enlarged; it being understood that the United States shall under no condition be required to pay any share of the operation of the ditch on account of the 20 second feet or any part thereof that may be discharged through the ditch by the United States.

The Association, in consideration of the premises and of the right of way granted by the United States subject to its compliance with the Act of March 3, 1891, supra, does hereby covenant and agree, in addition to the foregoing, with the United States as follows:

1. The Association will, immediately upon notification of the approval of this Agreement by the Secretary of the Interior, begin the construction of a drainage ditch from the Railroad Bridge aforesaid to the Gila River, in accordance with the map and profile and the plans for intake structures, overhead crossings and bridges, attached hereto; and in accordance with the following conditions:

(a) Said drainage ditch shall be designed and constructed to carry throughout its entire length 75 sec. ft. of drainage water delivered at the Railroad Bridge, plus any other natural underground drainage water which it may collect throughout its course:

(b) It shall be so designed and constructed that the water surface, when carrying the normal capacity of 75 sec. ft., shall not rise substantially above the hydraulic gradient established on the attached profile;

(c) Substantial diversion works shall be constructed immediately above the Railroad Bridge 16-B, at the intake of the new canal, to provide for the division of the water to be taken out of the ditch of the District from that permitted to pass to the channel. This shall be accomplished without interference with the diversion of water into the Fowler Canal which now heads just below the Railroad Bridge;

(d) The outlet of the drainage ditch into the Gila River shall be provided with adequate means of dropping the water from the level of the ditch to the level of the River, or of the natural drainage channel or tributary of said river, into which said drainage ditch may be discharged, which will prevent erosion of the drainage ditch back towards its head to such an extent as to constitute serious damage to adjacent lands. The structure constructed for this purpose must be completed prior to the turning of any water into said drainage ditch, and upon completion thereof maintained in a proper way to prevent overflow thereof of adjacent lands;

(e) Said drainage ditch shall be provided with bridges located on four section line crossings to be indicated by the United States prior to the time of completion of said ditch. At all other section line crossings, whenever demanded by the United States, bridges shall be installed at the expense of the Association, said bridges to be not less than 16 feet wide and suitable for carrying ordinary farm and road machinery and automobiles. All bridges shall be provided with suitable approaches and shall be completed within 30 days of the date demanded by the United States. Temporary crossings, passable for automobiles, shall be provided during the construction work at all used road crossings until the permanent bridges are installed.

(f) The Association agrees to complete all construction work specified herein within six months after the date of notification of the approval of this agreement by the Secretary of the Interior; and for failure to complete same within the specified period, it will immediately shut down all its pumps located outside of the District, the water from which is being discharged on or over the Gila River Reservation; and will not resume operation of the pumps until the construction of the above works shall have been completed in accordance with the terms of this agreement.

2. The Association agrees that of the 75 sec. ft. normal capacity provided in the drainage ditch, 20 sec. ft. thereof is expressly provided and reserved for the use of the United States at all times for the discharge of such water from the drainage ditch of the District or other source, as it may desire to divert to the Gila River; and that when the remaining 55 sec. ft. capacity or any part thereof, is not being used by the Association, it shall be available for the use of the United States as heretofore provided, subject to its use by the Association when again required; Provided, that the Association and the United States shall co-operate in turning as little water into said ditch as possible during the periods when it is necessary to clean or repair said ditch.

3. The Association agrees to make all necessary arrangements with the Arizona Eastern Railroad Company for the conduct of its water under the track and for the construction work upon the Railroad Company's right of way in the vicinity of the bridge; and to hold the United States harmless from all claims for damage due to the operations of the Association, or the construction work of the Association, or the discharge of the water of the Association under the bridge or across the Railroad Company's right of way.

4. The Association agrees that should it ever become necessary for it to discharge more water than the 55 sec. ft. provided for herein, it will enlarge said drainage ditch and all structures therein at its own expense and without interference with the flow of water therein, so as to carry

the increased flow without raising the water level above the gradient shown on attached profile, the increased capacity to be subject to the same use by the United States when not in use by the Association as provided in Paragraph 2 last above. In the event that the United States has already enlarged said ditch the maintenance cost of said ditch shall be re-apportioned in the same manner as that set forth in Paragraph 6 of the covenants of the United States, for the apportionment of such cost, in the event the United States elects to enlarge said ditch.

5. The Association agrees to maintain said drainage ditch at all times in such condition that it will carry the amount of water for which it is designed, without substantially raising the water-line above that shown on the attached profile; and that it will maintain in satisfactory and serviceable condition all structures herein agreed to be constructed by the Association; Provided, that should the United States enlarge said drainage ditch to carry the discharge of additional water, the Association agrees to maintain such proportion of the total length of drainage ditch beginning at the diversion structure in the drainage ditch of the District, as the share of the normal ditch capacity constructed by the Association bears to the total normal ditch capacity; such maintenance work to be performed, and the use of the canal to be subject to the conditions of Paragraph 6 of the covenants of the United States.

IT IS MUTUALLY AGREED between the Association and the United States, as follows: That -

1. WHEREAS, the carrying out of the terms of this agreement will inure to the benefit of the United States and the Association;

That in case of failure of the Association to keep or perform any or all of its covenants herein contained and the United States shall notify the Association in writing of such failure, specifying the particular respect in which such failure exists: and the Association shall not immediately upon receipt of such notification take necessary steps in a diligent way to remedy the failure which shall include payment of any damages resulting therefrom due to such failure, then the right of the Association to use said ditch shall be suspended until such time as it has fully complied with the obligations imposed upon it by the terms of this agreement. However, nothing herein contained shall be construed to in any way modify or change the provisions of the existing agreement between the United States and the District heretofore referred to in paragraph 3, page one hereof, dated September 17, 1917.

2. That this agreement shall not be construed so as to impose on the Association an obligation at any time to cause the discharge of pumped or other waters upon the Reservation or into the said drainage ditch, as herein provided; or to impair or abridge the right of the Association to divert all or any part of the water now intended to be discharged on the Reservation before reaching the boundary thereof, or to use any part or all of said water for the benefit of its shareholders, or for the irrigation of land within the boundaries of the Salt River Project,--- said boundaries being specified in the boundaries of the Reservoir District described in the Articles of Incorporation of the Association, or to dispose of said water in any manner the Association may desire, before reaching said drainage ditch.

3. This agreement shall become effective and binding upon the parties hereto when the same shall have been executed by the President and the Secretary of the Salt River Valley Water Users' Association and the United States acting by and through the Supervising Engineer and approved by the Secretary of the Interior.

4. That the work to be done as provided herein shall conform to and be constructed in accordance with the provisions herein and with the map, profile and plans attached hereto and made a part hereof as follows:

Map showing location of waste ditch (sheet 1)
marked Exhibit B,
Profile of waste ditch (sheet 2) in two parts
marked Exhibit C1, C2
Division gates on Tempe drain ditch, Intake for waste ditch
(sheet 3) marked Exhibit D,
Plan of typical drop in waste ditch (sheet 4)
marked Exhibit E,
Bridges across waste ditch (sheet 5)
marked Exhibit F.

IN WITNESS WHEREOF the Association has caused this agreement to be executed by its President and Secretary pursuant to authority vested in them by its Board of Governors, and its corporate seal hereto affixed; and the same has been signed by the duly authorized agent of the United States and approved by the Secretary of the Interior.

SALT RIVER VALLEY WATER USERS' ASSOCIATION

By (S) F. A. Reid
President

Attest:

(S) F. C. Henshaw
Secretary

UNITED STATES OF AMERICA

By (S) Herbert V. Clotts
Supervising Engineer
U. S. Indian Service

Approved July 23, 1923

(Sgd.) F. M. Goodwin
Assistant Secretary of the Interior

EXHIBIT "A"

THIS AGREEMENT made this 20th day of September, 1917, between Drainage District No. 1, in and for thel dunty of Maricopa, State of Arizona, for convenience hereinafter called the "District," acting for the purpose of this contract by and through J. W. Miller and Alfred H. Oeltjen, the President and Secretary respectively of its Board of Directors, and the United States of America, for convenience hereinafter called the "United States," acting for the purpose of this contract by and through Cato Sells, the Commissioner of Indian Affairs; WITNESSETH, that,

WHEREAS, the District has heretofore constructed and now has in operation a certain drain ditch constructed and now being operated and maintained for the purpose of draining the excess ground water from the agricultural land within the District; and,

WHEREAS, the outfall of said drain ditch is now constructed and is being operated and maintained across the Northwest quarter (NW¼) of Section Four (4) and the Southeast Quarter (SE¼) of the Northeast Quarter (NE¼) and a part of the North Half (N½) of the Southeast Quarter (SE¼) of Section Five (5), all in Township Two (2) South, Range Four East of the Gila and Salt River Meridian, in the County of Maricopa, State of Arizona, which said lands are embraced within and constitute a part of the Gila River Indian Reservation; and,

WHEREAS, the water collected by means of said drain ditch and other drainage works which are now or may hereafter be constructed by the District, is discharged from said drain ditch upon said Indian Reservation at a point in the Northwest Quarter (NW¼) of the Southeast Quarter (SE¼) of said Section Five, (5), said point of discharge being at or near the point of intersection of said drainage ditch as now constructed, with the right of way of the Arizona Eastern Railroad, as now constructed on and across said Northwest Quarter (NW¼) of the Southeast Quarter (SE¼) of said Section Five (5); and,

WHEREAS, the District desires to secure from the United States a right in perpetuity to maintain and operate its said drain ditch, as now constructed across the portions of said Sections Four (4) and Five (5) above mentioned, together with the right in perpetuity to discharge the water collected by said drain ditch and other drainage works of the District as now or hereafter constructed, and to be released and discharged by the United States from all obligations and liabilities of every nature which may now or might hereafter in any way exist or arise by reason of its construction, operation and maintenance of its said drain ditch across the portions of said Gila River Indian Reservation above

EXHIBIT "A"

described and by reason of the discharge of water from said drain ditch upon said Indian Reservation, or by reason of either of said causes; and,

WHEREAS, the United States desires to acquire from the District the control and right to use for irrigation or any other beneficial purpose all water that may now or hereafter be collected by said drain ditch or other drainage works of the District, now or hereafter constructed.

COVENANTS OF THE DISTRICT

The District in consideration of the premises and the rights, privileges and benefits hereinafter granted and conferred and to be granted and conferred to and upon it by the United States, does hereby grant, sell and convey to the United States, its successors and assigns forever, the right to the use of said water collected by means of said drain ditch and drainage works, as now or hereafter constructed by the District. This grant, however, is upon the express condition that the United States and its successors shall never by means of any structures, collection of debris or otherwise, obstruct or retard or permit the obstruction or retarding of the free discharge and outflow of water from the end of said ditch, as now constructed, where the water therefrom is discharged from said ditch, to-wit: at or near the point where said ditch, as now constructed across the Northwest Quarter (NW¼) of the Southeast Quarter (SE¼) of Section Five (5), in Township Two (2) South, Range Four (4) East of the Gila and Salt River Meridian, intersects the right of way of the Arizona Eastern Railroad, and now constructed across said last mentioned tract of land;

COVENANTS OF THE UNITED STATES

The United States, in consideration of the premises and of the rights herein granted to it by the District, does hereby:

First, Grant and convey to the District, and its successors, in perpetuity, a right of way one hundred (100) feet in width across the Northwest Quarter (NW¼) of Section Four (4) and across the Southeast Quarter (SE¼) of the Northeast Quarter (NE¼) and the North Half (N½) of the Southeast Quarter (SE¼) of Section Five (5), all in Township two (2) South, Range Four (4) East of the Gila and Salt River Meridian, on which to maintain and operate its said drain ditch, said right of way being fifty (50) feet on each side of the center line of said drain ditch, as now

EXHIBIT "A"

constructed, and as shown on the accompanying map and field notes, in duplicate, which are hereby referred to for a more detailed description of the location of said right of way, and are made a part hereof;

Second, Release and discharge the District from all obligations and liabilities of every kind and nature which may have been sustained by the United States, or might hereafter accrue or arise in favor of the United States as against the District, by reason of the District having constructed its said drain ditch upon the land above described, within the Gila River Indian Reservation, without having first obtained a permit or other necessary authority therefor, and by reason of the discharge of water from said drain ditch upon the lands within said Indian Reservation, or from either of said causes.

This contract shall become effective and binding upon the parties hereto when the same shall have been executed by the President and Secretary of the Board of Directors of the District and by Cato Sells, as Commissioner of Indian Affairs for the United States, and shall have been approved by the Secretary of the Interior of the United States.

IN WITNESS WHEREOF Drainage District No. 1, in and for the County of Maricopa, State of Arizona, has caused this agreement to be executed by the President and Secretary of its Board of Directors and its corporate seal to be hereto affixed, and the United States has caused the same to be executed by its Commissioner of Indian Affairs and to be approved by the Secretary of the Interior the day and year first above written, all in duplicate.

(Signed) J. W. Miller,
As President of the Board of Directors of Drainage District No. 1, in and for the County of Maricopa, State of Arizona.

WITNESS (SEAL)

(Signed) K. B. Myen

(Signed) Alfred H. Oeltjen
As Secretary of the Board of Directors of Drainage District No. 1, in and for the County of Maricopa, State of Arizona.

(Signed) Cato Sells
Commissioner of Indian Affairs

APPROVED: Dec. 7, 1917.

(Signed) S. G. Hopkins
Assistant Secretary of the Interior.

APPENDIX "B"

TEST RUN NO. 1

TR-2Ø HYDROLOGY

EXECUTIVE CONTROL CARD   OPERATION LIST

LISTING OF DATA IN CORE

0 GILA DRAIN TEMPE CONTRIBUTION

VELOCITY INCREMENT

1 CTABLE		0.2000			
8	0.	0.0800	0.1800	0.2500	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6900	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9300	0.9300
9 ENDTBL					

TIME INCREMENT

4 DIMHYD					
8	0.	0.0300	0.1000	0.1900	0.3100
8	0.4700	0.6600	0.8200	0.9300	0.9900
8	1.0000	0.9900	0.9300	0.8600	0.7800
8	0.6800	0.5600	0.4600	0.3900	0.3300
8	0.2800	0.2410	0.2070	0.1740	0.1470
8	0.1260	0.1070	0.0910	0.0770	0.0660
8	0.0550	0.0470	0.0400	0.0340	0.0290
8	0.0250	0.0210	0.0180	0.0150	0.0130
8	0.0110	0.0090	0.0080	0.0070	0.0060
8	0.0050	0.0040	0.0030	0.0020	0.0010
8	0.	0.	0.	0.	0.
9 ENDTBL					

COMPUTED PEAK K FACTOR = 484.00

TIME INCREMENT

5 RAINFL 1		0.2500			
8	0.	0.0032	0.0064	0.0097	0.0129
8	0.1610	0.0225	0.0290	0.0354	0.0418
8	0.0483	0.0547	0.0611	0.0676	0.0740
8	0.0850	0.0869	0.0998	0.1440	0.2325
8	0.6734	0.8439	0.9163	0.9445	0.9686
8	0.9783	0.9863	0.9936	0.9980	1.0000
9 ENDTBL					

```
6 RUNOFF 1   1       6      0.0104     98.0000      0.73330 0 0 0 0 0
6 REACH  3   2   6   5   5280.0000      0.3700      0.     0 0 0 0 0 0
6 RUNOFF 1   2       6      0.0208     98.0000      0.97780 0 0 0 0 0
6 ADDHYD 4   2   5 6 4                                     0 0 0 0 0 0
6 RUNOFF 1   3       7      0.0104     98.0000      0.66670 0 0 0 0 0
6 ADDHYD 4   4   7 4 6                                     0 0 0 0 0 0
6 REACH  3   5   6   5   5280.0000      0.3700      0.     0 0 0 0 0 0
6 RUNOFF 1   5       6      0.0208     98.0000      1.46670 0 0 0 0 0
6 ADDHYD 4   5   6 5 1                                     1 1 0 1 0 1
6 RUNOFF 1   6       6      0.0208     98.0000      1.33330 0 0 0 0 0
6 REACH  3   7   6   5   5280.0000      0.4100      0.     0 0 0 0 0 0
6 RUNOFF 1   7       7      0.0208     98.0000      1.22220 0 0 0 0 0
6 ADDHYD 4   7   5 7 6                                     0 0 0 0 0 0
6 RUNOFF 1   8       5      0.0208     98.0000      1.46670 0 0 0 0 0
6 ADDHYD 4   9   5 6 7                                     0 0 0 0 0 0
6 REACH  3  10   7   5   5280.0000      0.3900      0.     0 0 0 0 0 0
6 RUNOFF 1  10       6      0.0208     98.0000      1.33330 0 0 0 0 0
6 ADDHYD 4  10   6 5 3                                     1 1 0 1 0 1
6 RUNOFF 1  11       6      0.0208     98.0000      1.33330 0 0 0 0 0
6 REACH  3  12   6   5   5280.0000      0.3700      0.     0 0 0 0 0 0
6 RUNOFF 1  12       7      0.0208     98.0000      1.46670 0 0 0 0 0
6 ADDHYD 4  12   7 5 6                                     0 0 0 0 0 0
6 RUNOFF 1  26       5      0.0208     98.0000      1.46670 0 0 0 0 0
6 ADDHYD 4  27   5 6 7                                     0 0 0 0 0 0
6 REACH  3  13   7   6   2640.0000      0.3700      0.     0 0 0 0 0 0
6 RUNOFF 1  13       5      0.0104     98.0000      0.73330 0 0 0 0 0
6 ADDHYD 4  13   5 6 4                                     1 1 0 1 0 1
6 RUNOFF 1  15       6      0.0208     98.0000      1.33330 0 0 0 0 0
6 RUNOFF 1  14       5      0.0156     98.0000      0.40740 0 0 0 0 0
6 ADDHYD 4  16   5 6 7                                     0 0 0 0 0 0
6 REACH  3  17   7   5   5280.0000      0.5000      0.     0 0 0 0 0 0
6 RUNOFF 1  17       6      0.0208     98.0000      0.86270 0 0 0 0 0
6 ADDHYD 4  17   6 5 7                                     0 0 0 0 0 0
6 RUNOFF 1  18       6      0.0104     98.0000      0.66670 0 0 0 0 0
6 ADDHYD 4  19   6 7 5                                     1 1 0 1 0 1
6 ADDHYD 4  30   5 1 2                                     0 0 0 0 0 0
6 RUNOFF 1  20       6      0.0209     98.0000      0.58670 0 0 0 0 0
6 RUNOFF 1  21       5      0.0208     98.0000      0.97780 0 0 0 0 0
6 ADDHYD 4  22   5 6 7                                     0 0 0 0 0 0
6 REACH  3  23   7   6   5280.0000      0.4900      0.     0 0 0 0 0 0
6 RUNOFF 1  23       7      0.0208     98.0000      0.91670 0 0 0 0 0
6 ADDHYD 4  23   6 7 5                                     0 0 0 0 0 0
6 RUNOFF 1  24       6      0.0208     98.0000      1.33330 0 0 0 0 0
6 ADDHYD 4  25   6 5 7                                     1 1 0 1 0 1
6 ADDHYD 4  31   7 3 1                                     0 0 0 0 0 0
6 REACH  3  31   2   5   5280.0000      0.7200      0.     0 0 0 0 0 0
6 ADDHYD 4  31   5 1 2                                     1 1 0 1 0 1
6 RUNOFF 1  28       6      0.0208     98.0000      0.86270 0 0 0 0 0
6 REACH  3  29   6   5   2640.0000      0.3700      0.     0 0 0 0 0 0
6 RUNOFF 1  29       7      0.0104     98.0000      0.73330 0 0 0 0 0
6 ADDHYD 4  29   7 5 3                                     1 1 0 1 0 1
6 REACH  3  32   2   7   5280.0000      0.7300      0.     0 0 0 0 0 0
6 ADDHYD 4  32   7 3 6                                     0 0 0 0 0 0
6 ADDHYD 4  32   6 4 5                                     1 1 0 1 0 1
6 REACH  3  33   5   7  17160.0000      0.7400      0.     1 1 0 1 0 1
  ENDATA
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END OF LISTING

PASS= 1

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 0.25
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 1/ 0 TO XSECTN/STRUCT 33/ 0
STARTING TIME= 0. RAIN DEPTH= 3.11 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 SOIL CONDITION= 2
ALTERNATE NO.= 1 STORM NO.= 1

SUBROUTINE RUNOFF CROSS SECTION 1
AREA= 0.0104 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.73

SUBROUTINE REACH CROSS SECTION 2
LENGTH= 5280.00 INPUT COEFFICIENT= 0.3700 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 0.998 AVERAGE ROUTING COEFF= 0.3700 NUMBER OF ROUTINGS= 2.17

SUBROUTINE RUNOFF CROSS SECTION 2
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.98

SUBROUTINE ADDHYD CROSS SECTION 2
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 4

SUBROUTINE RUNOFF CROSS SECTION 3
AREA= 0.0104 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.67

SUBROUTINE ADDHYD CROSS SECTION 4
INPUT HYDROGRAPHS= 7,4 OUTPUT HYDROGRAPH= 6

SUBROUTINE REACH CROSS SECTION 5
LENGTH= 5280.00 INPUT COEFFICIENT= 0.3700 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 0.998 AVERAGE ROUTING COEFF= 0.3700 NUMBER OF ROUTINGS= 2.17

SUBROUTINE RUNOFF CROSS SECTION 5
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.47

SUBROUTINE ADDHYD CROSS SECTION 5
INPUT HYDROGRAPHS= 6,5 OUTPUT HYDROGRAPH= 1

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.44	4.688	(NULL)
6.36	41.603	(NULL)

TIME HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.0624

TIME											
0.	DISCHG	0.	0.	0.	0.	0.	0.43	1.41	2.83	3.93	4.56
2.50	DISCHG	4.67	4.35	4.09	3.86	3.64	3.45	3.30	3.21	3.31	4.12
5.00	DISCHG	7.31	13.70	22.67	31.44	38.06	41.29	41.03	38.90	35.74	31.97
7.50	DISCHG	27.96	24.00	20.26	16.83	13.78	11.13	8.88	7.00	5.45	4.19
10.00	DISCHG	3.20	2.43	1.83	1.37	1.01	0.75	0.55	0.40	0.29	0.21
12.50	DISCHG	0.15	0.11	0.07	0.05	0.04	0.02	0.02	0.01	0.01	0.

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1365 CFS-HRS= 126.31 ACRE-FT= 10.44

SUBROUTINE RUNOFF CROSS SECTION 6
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.33

SUBROUTINE REACH CROSS SECTION 7
LENGTH= 5280.00 INPUT COEFFICIENT= 0.4100 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 1.181 AVERAGE ROUTING COEFF= 0.4100 NUMBER OF ROUTINGS= 2.04

SUBROUTINE RUNOFF CROSS SECTION 7
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.22

SUBROUTINE ADDHYD CROSS SECTION 7
INPUT HYDROGRAPHS= 5,7 OUTPUT HYDROGRAPH= 6

SUBROUTINE RUNOFF CROSS SECTION 8
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.47

SUBROUTINE ADDHYD CROSS SECTION 9
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

SUBROUTINE REACH CROSS SECTION 10
LENGTH= 5280.00 INPUT COEFFICIENT= 0.3900 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 1.087 AVERAGE ROUTING COEFF= 0.3900 NUMBER OF ROUTINGS= 2.11

SUBROUTINE RUNOFF CROSS SECTION 10
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.33

SUBROUTINE ADDHYD CROSS SECTION 10
INPUT HYDROGRAPHS= 6,5 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
3.29	5.140	(NULL)
6.92	44.662	(NULL)

TIME HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.0832

TIME											
0.	DISCHG	0.	0.	0.	0.	0.09	0.48	1.14	1.70	2.18	2.88
2.50	DISCHG	3.67	4.47	4.98	5.14	5.05	4.85	4.60	4.38	4.43	5.42
5.00	DISCHG	9.13	16.51	25.67	32.47	37.07	40.28	42.67	44.32	44.59	43.38
7.50	DISCHG	40.96	37.65	33.78	29.66	25.54	21.58	17.91	14.62	11.76	9.33
10.00	DISCHG	7.31	5.66	4.33	3.27	2.45	1.82	1.33	0.97	0.70	0.50
12.50	DISCHG	0.36	0.25	0.18	0.12	0.08	0.06	0.04	0.03	0.02	0.01
15.00	DISCHG	0.01	0.								

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.0905 CFS-HRS= 165.94 ACRE-FT= 13.71

SUBROUTINE RUNOFF CROSS SECTION 11
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.33

SUBROUTINE REACH CROSS SECTION 12
LENGTH= 5280.00 INPUT COEFFICIENT= 0.3700 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 0.998 AVERAGE ROUTING COEFF= 0.3700 NUMBER OF ROUTINGS= 2.17

SUBROUTINE RUNOFF CROSS SECTION 12
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.47

SUBROUTINE ADDHYD CROSS SECTION 12

INPUT HYDROGRAPHS= 7,5 OUTPUT HYDROGRAPH= 6

SUBROUTINE RUNOFF CROSS SECTION 26
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.47

SUBROUTINE ADDHYD CROSS SECTION 27
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

SUBROUTINE REACH CROSS SECTION 13
LENGTH= 2640.00 INPUT COEFFICIENT= 0.3700 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 0.998 AVERAGE ROUTING COEFF= 0.3700 NUMBER OF ROUTINGS= 1.09

SUBROUTINE RUNOFF CROSS SECTION 13
AREA= 0.0104 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.73

SUBROUTINE ADDHYD CROSS SECTION 13
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 4

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.71	5.360	(NULL)
6.55	43.454	(NULL)

HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.0728

TIME											
0.	DISCHG	0.	0.	0.	0.	0.	0.83	3.08	3.67	3.85	4.63
2.50	DISCHG	5.21	5.35	5.06	4.63	4.21	3.88	3.63	3.41	3.69	5.23
5.00	DISCHG	11.27	22.25	28.98	32.81	37.43	41.54	43.40	42.65	40.22	36.84
7.50	DISCHG	32.97	28.92	24.91	21.08	17.54	14.37	11.59	9.23	7.26	5.63
10.00	DISCHG	4.31	3.26	2.44	1.82	1.34	0.98	0.71	0.51	0.37	0.26
12.50	DISCHG	0.18	0.13	0.09	0.06	0.04	0.03	0.02	0.01	0.01	0.

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1282 CFS-HRS= 146.97 ACRE-FT= 12.15

SUBROUTINE RUNOFF CROSS SECTION 15
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.33

SUBROUTINE RUNOFF CROSS SECTION 14
AREA= 0.0156 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.41

SUBROUTINE ADDHYD CROSS SECTION 16
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

SUBROUTINE REACH CROSS SECTION 17
LENGTH= 5280.00 INPUT COEFFICIENT= 0.5000 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 1.700 AVERAGE ROUTING COEFF= 0.5000 NUMBER OF ROUTINGS= 1.73

SUBROUTINE RUNOFF CROSS SECTION 17
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.86

SUBROUTINE ADDHYD CROSS SECTION 17
INPUT HYDROGRAPHS= 6,5 OUTPUT HYDROGRAPH= 7

SUBROUTINE RUNOFF CROSS SECTION 18

AREA= 0.0104 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.67

SUBROUTINE ADDHYD CROSS SECTION 19
INPUT HYDROGRAPHS= 6,7 OUTPUT HYDROGRAPH= 5

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
1.73	7.543	(NULL)
5.60	66.833	(NULL)

TIME HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.0676

TIME											
0.	DISCHG	0.	0.	0.	0.	0.04	2.16	6.75	7.54	6.49	5.30
2.50	DISCHG	4.37	3.64	3.10	2.75	2.56	2.56	2.63	2.69	3.89	8.11
5.00	DISCHG	23.70	50.80	65.47	64.04	56.17	47.99	40.06	32.62	25.77	19.77
7.50	DISCHG	14.73	10.64	7.53	5.27	3.64	2.49	1.68	1.13	0.74	0.48
10.00	DISCHG	0.30	0.19	0.11	0.07	0.04	0.02	0.01	0.		

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.0953 CFS-HRS= 135.04 ACRE-FT= 11.16

SUBROUTINE ADDHYD CROSS SECTION 30
INPUT HYDROGRAPHS= 5,1 OUTPUT HYDROGRAPH= 2

SUBROUTINE RUNOFF CROSS SECTION 20
AREA= 0.0209 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.59

SUBROUTINE RUNOFF CROSS SECTION 21
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.98

SUBROUTINE ADDHYD CROSS SECTION 22
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

SUBROUTINE REACH CROSS SECTION 23
LENGTH= 5280.00 INPUT COEFFICIENT= 0.4900 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 1.633 AVERAGE ROUTING COEFF= 0.4900 NUMBER OF ROUTINGS= 1.76

SUBROUTINE RUNOFF CROSS SECTION 23
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.92

SUBROUTINE ADDHYD CROSS SECTION 23
INPUT HYDROGRAPHS= 6,7 OUTPUT HYDROGRAPH= 5

SUBROUTINE RUNOFF CROSS SECTION 24
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 1.33

SUBROUTINE ADDHYD CROSS SECTION 25
INPUT HYDROGRAPHS= 6,5 OUTPUT HYDROGRAPH= 7

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
1.99	8.414	(NULL)
5.90	83.378	(NULL)

TIME HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.0833

TIME											
0.	DISCHG	0.	0.	0.	0.	0.16	1.60	5.10	7.74	8.41	7.61
2.50	DISCHG	6.43	5.27	4.34	3.69	3.30	3.16	3.18	3.30	4.23	7.77
5.00	DISCHG	19.96	43.64	68.31	81.72	82.62	74.20	60.82	46.98	34.86	25.05
7.50	DISCHG	17.57	12.03	8.03	5.26	3.36	2.10	1.28	0.75	0.43	0.24

10.00	DISCHG	0.14	0.08	0.04	0.02	0.01	0.				

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.0910 CFS-HRS= 166.17 ACRE-FT= 13.73

SUBROUTINE ADDHYD CROSS SECTION 31
INPUT HYDROGRAPHS= 7,3 OUTPUT HYDROGRAPH= 1

SUBROUTINE REACH CROSS SECTION 31
LENGTH= 5280.00 INPUT COEFFICIENT= 0.7200 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 4.371 AVERAGE ROUTING COEFF= 0.7200 NUMBER OF ROUTINGS= 0.97

SUBROUTINE ADDHYD CROSS SECTION 31
INPUT HYDROGRAPHS= 5,1 OUTPUT HYDROGRAPH= 2

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.26	20.609	(NULL)
6.09	211.982	(NULL)

TIME HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.2965

0.	DISCHG	0.	0.	0.	0.	0.25	2.18	8.29	16.00	19.93	20.61
2.50	DISCHG	20.01	18.99	17.63	16.31	15.19	14.37	13.88	13.65	14.61	20.17
5.00	DISCHG	40.35	86.62	148.72	193.44	210.72	207.72	193.64	174.61	153.93	133.22
7.50	DISCHG	113.59	95.54	79.33	65.22	53.11	42.86	34.25	27.10	21.24	16.51
10.00	DISCHG	12.71	9.69	7.33	5.50	4.09	3.02	2.22	1.61	1.16	0.84
12.50	DISCHG	0.60	0.42	0.30	0.21	0.15	0.10	0.07	0.05	0.03	0.01
15.00	DISCHG	0.01	0.								

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1011 CFS-HRS= 593.41 ACRE-FT= 49.04

SUBROUTINE RUNOFF CROSS SECTION 28
AREA= 0.0208 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.86

SUBROUTINE REACH CROSS SECTION 29
LENGTH= 2640.00 INPUT COEFFICIENT= 0.3700 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 0.998 AVERAGE ROUTING COEFF= 0.3700 NUMBER OF ROUTINGS= 1.09

SUBROUTINE RUNOFF CROSS SECTION 29
AREA= 0.0104 INPUT RUNOFF CURVE= 98.0 TIME OF CONCENTRATION= 0.73

SUBROUTINE ADDHYD CROSS SECTION 29
INPUT HYDROGRAPHS= 7,5 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
1.76	3.860	(NULL)
5.75	31.515	(NULL)

TIME HYDROGRAPH, TZERO= 0. DELTA T= 0.25 DRAINAGE AREA= 0.0312

0.	DISCHG	0.	0.	0.	0.	0.	0.84	3.17	3.86	3.28	2.73
2.50	DISCHG	2.18	1.77	1.48	1.31	1.21	1.20	1.23	1.26	1.70	3.43
5.00	DISCHG	9.75	21.55	29.60	31.52	29.53	25.13	19.97	15.17	11.24	8.15
7.50	DISCHG	5.80	4.05	2.76	1.84	1.21	0.78	0.51	0.32	0.21	0.13
10.00	DISCHG	0.08	0.05	0.03	0.02	0.01	0.01	0.			

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1054 CFS-HRS= 62.53 ACRE-FT= 5.17

SUBROUTINE REACH CROSS SECTION 32

LENGTH= 5280.00 INPUT COEFFICIENT= 0.7300 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 4.596 AVERAGE ROUTING COEFF= 0.7300 NUMBER OF ROUTINGS= 0.93

SUBROUTINE ADDHYD CROSS SECTION 32
INPUT HYDROGRAPHS= 7,3 OUTPUT HYDROGRAPH= 6

SUBROUTINE ADDHYD CROSS SECTION 32
INPUT HYDROGRAPHS= 6,4 OUTPUT HYDROGRAPH= 5

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.58	27.532	(NULL)
6.37	272.059	(NULL)

TIME		HYDROGRAPH, TZERO= 0.				DELTA T= 0.25			DRAINAGE AREA= 0.4005		
0.	DISCHG	0.	0.	0.	0.	0.01	1.96	8.26	14.62	21.07	25.80
2.50	DISCHG	27.43	27.09	25.71	23.89	22.09	20.60	19.50	18.73	19.20	23.34
5.00	DISCHG	40.82	81.30	135.92	197.24	245.95	269.21	269.06	253.53	230.36	204.19
7.50	DISCHG	177.57	152.03	128.34	106.94	88.11	71.85	58.02	46.40	36.73	28.80
10.00	DISCHG	22.36	17.20	13.11	9.91	7.43	5.53	4.07	2.99	2.17	1.57
12.50	DISCHG	1.13	0.81	0.57	0.40	0.28	0.20	0.13	0.09	0.06	0.03
15.00	DISCHG	0.02	0.								

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1067 CFS-HRS= 803.00 ACRE-FT= 66.36

SUBROUTINE REACH CROSS SECTION 33
LENGTH= 17160.00 INPUT COEFFICIENT= 0.7400 INPUT ROUTINGS= 0.

AVERAGE WATER VELOCITY= 4.838 AVERAGE ROUTING COEFF= 0.7400 NUMBER OF ROUTINGS= 2.92

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
3.64	26.141	(NULL)
7.40	257.111	(NULL)

TIME		HYDROGRAPH, TZERO= 0.				DELTA T= 0.25			DRAINAGE AREA= 0.4005		
0.	DISCHG	0.	0.	0.	0.	0.	0.	0.	0.07	1.09	4.48
2.50	DISCHG	9.50	15.32	20.68	24.33	25.98	26.04	25.06	23.60	22.07	20.73
5.00	DISCHG	19.70	19.48	21.68	31.46	55.81	95.44	146.12	196.78	235.03	254.57
7.50	DISCHG	256.15	244.46	224.67	200.87	175.84	151.29	128.25	107.31	88.75	72.62
10.00	DISCHG	58.82	47.18	37.47	29.48	22.98	17.74	13.58	10.30	7.76	5.79
12.50	DISCHG	4.29	3.15	2.30	1.67	1.21	0.86	0.62	0.44	0.31	0.21
15.00	DISCHG	0.15	0.10	0.06	0.04	0.02	0.				

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1065 CFS-HRS= 802.93 ACRE-FT= 66.35

ENDCMP

SUMMARY TABLE 1

ALT	STORM	ID	DA SQ-MI.	RAIN TBLE	AMC	DELTA-T HRS.	TZERO HRS.	PRECIP IN.	PRECIP DURATION	PEAK-Q CFS	PEAK-TIME	PEAK-ELEV	RUNOFF IN.	CSM
1	1	5	0.06	1	2	0.25	0.	3.11	7.25	41.60	6.36	0.	3.14	666.71
1	1	10	0.08	1	2	0.25	0.	3.11	7.25	44.66	6.92	0.	3.09	536.80
1	1	13	0.07	1	2	0.25	0.	3.11	7.25	43.45	6.55	0.	3.13	596.89
1	1	19	0.07	1	2	0.25	0.	3.11	7.25	66.83	5.60	0.	3.10	988.65
1	1	25	0.08	1	2	0.25	0.	3.11	7.25	83.38	5.90	0.	3.09	1000.93
1	1	31	0.30	1	2	0.25	0.	3.11	7.25	211.98	6.09	0.	3.10	714.95
1	1	29	0.03	1	2	0.25	0.	3.11	7.25	31.52	5.75	0.	3.11	1010.11
1	1	32	0.40	1	2	0.25	0.	3.11	7.25	272.06	6.37	0.	3.11	679.30
1	1	33	0.40	1	2	0.25	0.	3.11	7.25	257.11	7.40	0.	3.11	641.98

SUMMARY TABLE 3

					DISCHARGE,CFS					
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
XSEC/STRUC NO. 5										
ALTERNATE 1	41.60	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 10										
ALTERNATE 1	44.66	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 13										
ALTERNATE 1	43.45	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 19										
ALTERNATE 1	66.83	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 25										
ALTERNATE 1	83.38	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 29										
ALTERNATE 1	31.52	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 31										
ALTERNATE 1	211.98	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 32										
ALTERNATE 1	272.06	0.	0.	0.	0.	0.	0.	0.	0.	0.
XSEC/STRUC NO. 33										
ALTERNATE 1	257.11	0.	0.	0.	0.	0.	0.	0.	0.	0.

ENDJOB CARD ENCOUNTERED. END OF JOB.

APPENDIX "B"

TEST RUN NO. 2

GILA DRAIN
RDA 95 FUTURE CONDITIONS
307

IUNRG	LOCAL	LNGTH	IMNTH	IDAY	IYR	ITIME	RATIO	IPNCH
0	0	30	7	11	78	1200	0.	0

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1307	100	15	0.46	0	0	0	0.	0	0.

FLOW AT 1307 MULTIPLIED BY 0.460

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	15.
92.	166.	172.	162.	153.	144.	136.	128.	121.	114.
108.	102.	96.	90.	85.	81.	76.	71.	68.	63.
60.	57.	53.	50.	47.	45.	42.	40.	38.	35.
34.	31.	29.	28.	26.	25.	23.	22.	21.	20.
18.	17.	17.	16.	15.	14.	13.	12.	12.	11.
10.	10.	9.	9.	8.	8.	7.	7.	6.	6.
6.	6.	5.	5.	5.	4.	4.	4.	4.	3.
3.	3.	3.	3.	2.	2.	2.	0.	0.	0.

SUM 3258. CFS-PERIOD 67.32 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	2	1308	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1307 ROUTED TO 1308 NO. FLOWS= 120 INTERVAL= 15 MINUTES

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	2.
15.	50.	98.	134.	151.	154.	150.	143.	136.	129.
121.	115.	108.	102.	96.	91.	85.	81.	76.	72.
68.	64.	60.	57.	53.	50.	48.	45.	42.	40.
38.	36.	33.	32.	30.	28.	26.	25.	23.	22.
21.	20.	19.	18.	17.	16.	15.	14.	13.	12.
12.	11.	10.	10.	9.	9.	8.	8.	7.	7.
6.	6.	6.	5.	5.	5.	5.	4.	4.	4.
4.	3.	3.	3.	3.	3.	2.	2.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 3258. CFS-PERIOD 67.32 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1308	100	15	0.70	0	0	2	0.	0	0.

FLOW AT 1308 MULTIPLIED BY 0.700

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
83.	183.	195.	185.	176.	167.	158.	150.	142.	134.
127.	121.	115.	109.	104.	98.	93.	88.	83.	79.
75.	71.	68.	64.	61.	57.	55.	52.	49.	47.
44.	42.	40.	38.	36.	34.	32.	31.	29.	27.
26.	25.	23.	22.	21.	20.	19.	18.	17.	16.
15.	15.	14.	13.	13.	12.	11.	11.	10.	10.
9.	8.	8.	8.	7.	7.	6.	6.	6.	6.
6.	5.	5.	4.	4.	4.	4.	4.	4.	0.

SUM 3984. CFS-PERIOD 82.31 ACRE-FEET

COMBINED HYDROGRAPH

```
AT 1308  NQ= 120    15-MIN INTRVL
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      2.
    98.    234.    293.    319.    327.    320.    308.    293.    278.    263.
   249.    236.    223.    211.    200.    189.    179.    169.    159.    151.
   143.    135.    128.    121.    114.    108.    102.     97.     91.     87.
    82.     78.     73.     69.     65.     62.     59.     56.     52.     49.
    47.     44.     42.     40.     38.     36.     34.     32.     30.     28.
    27.     26.     24.     23.     22.     21.     19.     18.     17.     17.
    16.     14.     14.     13.     12.     12.     11.     11.     10.      9.
     9.      8.      8.      7.      7.      7.      7.      6.      5.      1.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

    SUM      7242. CFS-PERIOD        149.63 ACRE-FEET

   ITQR    ITQO   NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
     15      15       5    1309  0.           0       0       0      0.      0.

  AMSKK       X   QLOSS   CQLOS    NHGT     FIN   KPNCH
  0.250  0.         0.   0.            0      0.       0

HYDROGRAPH  1308   ROUTED TO  1309   NO. FLOWS= 120   INTERVAL=  15 MINUTES
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      4.     16.     44.     88.    142.    196.    241.    272.    289.
   295.    293.    285.    275.    262.    250.    237.    224.    212.    201.
   190.    180.    170.    161.    152.    144.    136.    129.    122.    115.
   109.    103.     97.     92.     87.     83.     78.     74.     70.     66.
    62.     59.     56.     53.     50.     47.     45.     42.     40.     38.
    36.     34.     32.     30.     29.     27.     26.     24.     23.     22.
    21.     20.     19.     18.     17.     16.     15.     14.     13.     12.
    12.     11.     11.     10.      9.      9.      8.      8.      8.      7.
     7.      6.      5.      3.      2.      1.      1.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

    SUM      7242. CFS-PERIOD        149.63 ACRE-FEET

   LOCI     NQI    ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
  13091     100      15    0.23       0       0       0      0.       0      0.

FLOW AT 13091  MULTIPLIED BY   0.230
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.    101.
   251.    304.    296.    275.    255.    236.    219.    203.    189.    175.
   162.    150.    140.    129.    120.    111.    103.     96.     89.     82.
    76.     71.     66.     61.     57.     52.     49.     45.     42.     39.
    36.     33.     31.     29.     27.     25.     23.     21.     20.     18.
    17.     16.     15.     14.     13.     12.     11.     10.      9.      9.
     8.      7.      7.      6.      6.      6.      5.      5.      4.      4.
     4.      3.      3.      3.      3.      3.      2.      2.      2.      2.
     2.      2.      2.      1.      1.      1.      1.      0.      0.      0.

    SUM      4728. CFS-PERIOD         97.68 ACRE-FEET

   ITQR    ITQO   NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
     15      15       1    1309  0.           0       0       3      0.      1.

  AMSKK       X   QLOSS   CQLOS    NHGT     FIN   KPNCH
  0.     0.         0.   0.            0      0.       0

STOR-OUTFLOW TABLE
        0.      0.      194.      0.      194.  10000.

HYDROGRAPH 13091   ROUTED TO  1309   NO. FLOWS= 120   INTERVAL=  15 MINUTES
```

PER	INFLOW	OUTFLOW	STOR
1	0.	0.	1.
2	0.	0.	1.
3	0.	0.	1.
4	0.	0.	1.
5	0.	0.	1.
6	0.	0.	1.
7	0.	0.	1.
8	0.	0.	1.
9	0.	0.	1.
10	0.	0.	1.
11	0.	0.	1.
12	0.	0.	1.
13	0.	0.	1.
14	0.	0.	1.
15	0.	0.	1.
16	0.	0.	1.
17	0.	0.	1.
18	0.	0.	1.
19	0.	0.	1.
20	50.	0.	2.
21	176.	0.	5.
22	277.	0.	11.
23	300.	0.	17.
24	285.	0.	23.
25	265.	0.	28.
26	246.	0.	34.
27	228.	0.	38.
28	211.	0.	43.
29	196.	0.	47.
30	182.	0.	50.
31	169.	0.	54.
32	156.	0.	57.
33	145.	0.	60.
34	135.	0.	63.
35	125.	0.	65.
36	116.	0.	68.
37	107.	0.	70.
38	100.	0.	72.
39	92.	0.	74.
40	86.	0.	76.
41	79.	0.	77.
42	74.	0.	79.
43	68.	0.	80.
44	63.	0.	82.
45	59.	0.	83.
46	55.	0.	84.
47	51.	0.	85.
48	47.	0.	86.
49	43.	0.	87.
50	40.	0.	88.
51	37.	0.	89.
52	35.	0.	89.
53	32.	0.	90.
54	30.	0.	91.
55	28.	0.	91.
56	26.	0.	92.
57	24.	0.	92.
58	22.	0.	93.
59	21.	0.	93.
60	19.	0.	93.
61	18.	0.	94.
62	16.	0.	94.
63	15.	0.	94.
64	14.	0.	95.
65	13.	0.	95.

66	12.	0.	95.
67	11.	0.	96.
68	10.	0.	96.
69	10.	0.	96.
70	9.	0.	96.
71	8.	0.	96.
72	8.	0.	96.
73	7.	0.	97.
74	7.	0.	97.
75	6.	0.	97.
76	6.	0.	97.
77	5.	0.	97.
78	5.	0.	97.
79	5.	0.	97.
80	4.	0.	97.
81	4.	0.	97.
82	4.	0.	98.
83	3.	0.	98.
84	3.	0.	98.
85	3.	0.	98.
86	3.	0.	98.
87	2.	0.	98.
88	2.	0.	98.
89	2.	0.	98.
90	2.	0.	98.
91	2.	0.	98.
92	2.	0.	98.
93	2.	0.	98.
94	1.	0.	98.
95	1.	0.	98.
96	1.	0.	98.
97	1.	0.	98.
98	1.	0.	98.
99	0.	0.	98.
100	0.	0.	98.
101	0.	0.	98.
102	0.	0.	98.
103	0.	0.	98.
104	0.	0.	98.
105	0.	0.	98.
106	0.	0.	98.
107	0.	0.	98.
108	0.	0.	98.
109	0.	0.	98.
110	0.	0.	98.
111	0.	0.	98.
112	0.	0.	98.
113	0.	0.	98.
114	0.	0.	98.
115	0.	0.	98.
116	0.	0.	98.
117	0.	0.	98.
118	0.	0.	98.
119	0.	0.	98.
120	0.	0.	98.

SUM 0. CFS-PERIOD 0. ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
13092	100	15	0.23	0	0	0	0.	0	0.

FLOW AT 13092 MULTIPLIED BY 0.230

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	101.
251.	304.	296.	275.	255.	236.	219.	203.	189.	175.
162.	150.	140.	129.	120.	111.	103.	96.	89.	82.

76.	71.	66.	61.	57.	52.	49.	45.	42.	39.
36.	33.	31.	29.	27.	25.	23.	21.	20.	18.
17.	16.	15.	14.	13.	12.	11.	10.	9.	9.
8.	7.	7.	6.	6.	6.	5.	5.	4.	4.
4.	3.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	1.	1.	1.	1.	0.	0.	0.

SUM 4728. CFS-PERIOD 97.68 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1309	0.	0	0	4	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	3	0.	0

STOR-OUTFLOW TABLE

0.	0.	0.	780.	55.	780.	55.	10000.

HYDROGRAPH 13092 ROUTED TO 1309 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	0.	0.	1.
2	0.	0.	1.
3	0.	0.	1.
4	0.	0.	1.
5	0.	0.	1.
6	0.	0.	1.
7	0.	0.	1.
8	0.	0.	1.
9	0.	0.	1.
10	0.	0.	1.
11	0.	0.	1.
12	0.	0.	1.
13	0.	0.	1.
14	0.	0.	1.
15	0.	0.	1.
16	0.	0.	1.
17	0.	0.	1.
18	0.	0.	1.
19	0.	0.	1.
20	50.	101.	0.
21	176.	251.	1.
22	277.	304.	1.
23	300.	296.	1.
24	285.	275.	1.
25	265.	255.	1.
26	246.	236.	1.
27	228.	219.	1.
28	211.	203.	1.
29	196.	189.	1.
30	182.	175.	1.
31	169.	162.	1.
32	156.	150.	1.
33	145.	140.	1.
34	135.	129.	1.
35	125.	120.	1.
36	116.	111.	1.
37	107.	103.	1.
38	100.	96.	1.
39	92.	89.	1.
40	86.	82.	1.
41	79.	76.	1.
42	74.	71.	1.
43	68.	66.	1.
44	63.	61.	1.
45	59.	57.	0.

46	55.	52.	0.
47	51.	49.	1.
48	47.	45.	1.
49	43.	42.	1.
50	40.	39.	1.
51	37.	36.	1.
52	35.	33.	1.
53	32.	31.	1.
54	30.	29.	1.
55	28.	27.	1.
56	26.	25.	1.
57	24.	23.	1.
58	22.	21.	1.
59	21.	20.	1.
60	19.	18.	1.
61	18.	17.	1.
62	16.	16.	1.
63	15.	15.	1.
64	14.	14.	1.
65	13.	13.	1.
66	12.	12.	1.
67	11.	11.	1.
68	10.	10.	1.
69	10.	9.	1.
70	9.	9.	1.
71	8.	8.	1.
72	8.	7.	1.
73	7.	7.	1.
74	7.	6.	1.
75	6.	6.	1.
76	6.	6.	1.
77	5.	5.	1.
78	5.	5.	1.
79	5.	4.	1.
80	4.	4.	1.
81	4.	4.	1.
82	4.	3.	1.
83	3.	3.	1.
84	3.	3.	1.
85	3.	3.	1.
86	3.	3.	1.
87	2.	2.	1.
88	2.	2.	1.
89	2.	2.	1.
90	2.	2.	1.
91	2.	2.	1.
92	2.	2.	1.
93	2.	2.	1.
94	1.	1.	1.
95	1.	1.	1.
96	1.	1.	1.
97	1.	1.	1.
98	1.	0.	1.
99	0.	0.	0.
100	0.	0.	0.
101	0.	0.	0.
102	0.	0.	0.
103	0.	0.	0.
104	0.	0.	0.
105	0.	0.	0.
106	0.	0.	0.
107	0.	0.	0.
108	0.	0.	0.
109	0.	0.	0.
110	0.	0.	0.
111	0.	0.	0.

```
       112     0.      0.        0.
       113     0.      0.        0.
       114     0.      0.        0.
       115     0.      0.        0.
       116     0.      0.        0.
       117     0.      0.        0.
       118     0.      0.        0.
       119     0.      0.        0.
       120     0.      0.        0.

       SUM     4728. CFS-PERIOD        97.68 ACRE-FEET

   COMBINED HYDROGRAPH
   AT 1309  NQ= 120    15-MIN INTRVL
         0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
         0.      0.      0.      0.      0.      0.      0.      0.      0.    101.
       251.    307.    312.    318.    343.    379.    415.    444.    460.    464.
       457.    443.    425.    404.    382.    361.    340.    320.    301.    283.
       267.    251.    236.    222.    209.    196.    185.    174.    164.    154.
       145.    136.    129.    121.    114.    107.    101.     95.     90.     84.
        79.     75.     71.     66.     63.     59.     55.     52.     49.     47.
        44.     41.     39.     37.     35.     33.     31.     29.     28.     26.
        24.     23.     22.     21.     19.     18.     17.     16.     15.     14.
        14.     13.     12.     11.     11.     10.     10.      8.      8.      7.
         7.      6.      5.      3.      2.      1.      1.      0.      0.      0.
         0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

       SUM    11970. CFS-PERIOD       247.30 ACRE-FEET

      ITQR    ITQO   NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
        15      15       3    1310  0.           0       0       0      0.      0.

     AMSKK       X   QLOSS   CQLOS    NHGT     FIN   KPNCH
    0.250  0.         0.    0.          0      0.       0

   HYDROGRAPH  1309   ROUTED TO  1310   NO. FLOWS= 120   INTERVAL=  15 MINUTES
         0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
         0.      0.      0.      0.      0.      0.      0.      0.      0.      4.
        24.     74.    143.    209.    258.    293.    322.    351.    381.    409.
       431.    445.    449.    445.    435.    419.    401.    381.    361.    341.
       321.    303.    285.    268.    252.    237.    223.    210.    198.    186.
       175.    165.    155.    146.    137.    129.    122.    115.    108.    102.
        96.     90.     85.     80.     75.     71.     67.     63.     59.     56.
        53.     50.     47.     44.     42.     39.     37.     35.     33.     31.
        29.     28.     26.     25.     23.     22.     21.     19.     18.     17.
        16.     15.     14.     14.     13.     12.     11.     11.     10.      9.
         8.      8.      7.      6.      5.      4.      3.      3.      2.      1.
         1.      0.      0.      0.      0.      0.      0.      0.      0.      0.

       SUM    11970. CFS-PERIOD       247.30 ACRE-FEET

      LOCI     NQI    ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
     13101      90      15   0.30        0       0       0      0.       0      0.

   FLOW AT 13101  MULTIPLIED BY   0.300
         1.      3.      5.      7.      8.     10.     12.     14.     16.     17.
        19.     20.     22.     23.     25.     26.     29.     37.     76.    242.
       432.    491.    474.    440.    407.    374.    344.    317.    291.    265.
       241.    219.    199.    181.    165.    150.    136.    124.    113.    103.
        93.     85.     77.     70.     64.     58.     53.     48.     44.     40.
        36.     33.     30.     27.     25.     23.     20.     19.     17.     15.
        14.     13.     12.     11.     10.      9.      8.      7.      7.      6.
         5.      5.      5.      4.      4.      3.      3.      3.      2.      2.
         2.      2.      2.      2.      2.      0.      0.      0.      0.      0.

       SUM     7092. CFS-PERIOD       146.52 ACRE-FEET
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ITQR	ITQQ	NRCHS	LOCO	TATHR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1310	0.	0	0	3	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	0	0.	0

STOR-OUTFLOW TABLE

0.	0.	245.	0.	245.	10000.

HYDROGRAPH 13101 ROUTED TO 1310 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	0.	1.
2	2.	0.	1.
3	4.	0.	1.
4	6.	0.	1.
5	8.	0.	1.
6	9.	0.	1.
7	11.	0.	1.
8	13.	0.	2.
9	15.	0.	2.
10	16.	0.	2.
11	18.	0.	3.
12	20.	0.	3.
13	21.	0.	3.
14	23.	0.	4.
15	24.	0.	4.
16	26.	0.	5.
17	28.	0.	6.
18	33.	0.	6.
19	56.	0.	7.
20	159.	0.	11.
21	337.	0.	18.
22	461.	0.	27.
23	482.	0.	37.
24	457.	0.	47.
25	423.	0.	55.
26	391.	0.	63.
27	359.	0.	71.
28	331.	0.	78.
29	304.	0.	84.
30	278.	0.	90.
31	253.	0.	95.
32	230.	0.	100.
33	209.	0.	104.
34	190.	0.	108.
35	173.	0.	111.
36	157.	0.	115.
37	143.	0.	118.
38	130.	0.	120.
39	118.	0.	123.
40	108.	0.	125.
41	98.	0.	127.
42	89.	0.	129.
43	81.	0.	131.
44	74.	0.	132.
45	67.	0.	133.
46	61.	0.	135.
47	55.	0.	136.
48	50.	0.	137.
49	46.	0.	138.
50	42.	0.	139.
51	38.	0.	139.
52	34.	0.	140.
53	31.	0.	141.

54	29.	0.	141.
55	26.	0.	142.
56	24.	0.	142.
57	21.	0.	143.
58	20.	0.	143.
59	18.	0.	144.
60	16.	0.	144.
61	15.	0.	144.
62	13.	0.	145.
63	12.	0.	145.
64	11.	0.	145.
65	10.	0.	145.
66	9.	0.	145.
67	8.	0.	146.
68	8.	0.	146.
69	7.	0.	146.
70	6.	0.	146.
71	6.	0.	146.
72	5.	0.	146.
73	5.	0.	146.
74	4.	0.	146.
75	4.	0.	147.
76	3.	0.	147.
77	3.	0.	147.
78	3.	0.	147.
79	3.	0.	147.
80	2.	0.	147.
81	2.	0.	147.
82	2.	0.	147.
83	2.	0.	147.
84	2.	0.	147.
85	2.	0.	147.
86	1.	0.	147.
87	0.	0.	147.
88	0.	0.	147.
89	0.	0.	147.
90	0.	0.	147.
91	0.	0.	147.
92	0.	0.	147.
93	0.	0.	147.
94	0.	0.	147.
95	0.	0.	147.
96	0.	0.	147.
97	0.	0.	147.
98	0.	0.	147.
99	0.	0.	147.
100	0.	0.	147.
101	0.	0.	147.
102	0.	0.	147.
103	0.	0.	147.
104	0.	0.	147.
105	0.	0.	147.
106	0.	0.	147.
107	0.	0.	147.
108	0.	0.	147.
109	0.	0.	147.
110	0.	0.	147.
111	0.	0.	147.
112	0.	0.	147.
113	0.	0.	147.
114	0.	0.	147.
115	0.	0.	147.
116	0.	0.	147.
117	0.	0.	147.
118	0.	0.	147.
119	0.	0.	147.

120	0.	0.	147.

SUM 0. CFS-PERIOD 0. ACRE-FEET

LOCI	NQI	ITQI	RTIO	IGAVG	IPRNT	NHGT	FIN	JPNCH	CH
13102	90	15	0.31	0	0	0	0.	0	0.

FLOW AT 13102 MULTIPLIED BY 0.310

1.	3.	5.	7.	9.	10.	12.	14.	16.	18.
20.	21.	23.	24.	26.	27.	30.	38.	78.	250.
447.	507.	489.	454.	420.	387.	356.	328.	301.	274.
249.	226.	206.	187.	170.	155.	141.	128.	117.	106.
96.	88.	80.	73.	66.	60.	55.	50.	45.	41.
37.	34.	31.	28.	25.	23.	21.	19.	17.	16.
15.	13.	12.	11.	10.	9.	8.	7.	7.	6.
6.	5.	5.	4.	4.	3.	3.	3.	2.	2.
2.	2.	2.	2.	2.	0.	0.	0.	0.	0.

SUM 7328. CFS-PERIOD 151.41 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1310	0.	0	0	4	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	3	0.	0

STOR-OUTFLOW TABLE

0.	0.	0.	706.	91.	706.	91.	10000.

HYDROGRAPH 13102 ROUTED TO 1310 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	1.	1.
2	2.	3.	1.
3	4.	5.	1.
4	6.	7.	1.
5	8.	9.	1.
6	9.	10.	1.
7	11.	12.	1.
8	13.	14.	1.
9	15.	16.	1.
10	17.	18.	1.
11	19.	20.	1.
12	20.	21.	1.
13	22.	23.	1.
14	23.	24.	1.
15	25.	26.	1.
16	27.	27.	1.
17	29.	30.	1.
18	34.	38.	1.
19	58.	78.	1.
20	164.	250.	1.
21	348.	447.	1.
22	477.	507.	0.
23	498.	489.	0.
24	472.	454.	1.
25	437.	420.	1.
26	404.	387.	1.
27	371.	356.	1.
28	342.	328.	1.
29	314.	301.	1.
30	287.	274.	1.
31	261.	249.	1.
32	238.	226.	1.
33	216.	206.	0.
34	197.	187.	1.

35	179.	170.	1.
36	163.	155.	1.
37	148.	141.	1.
38	134.	128.	1.
39	122.	117.	1.
40	111.	106.	1.
41	101.	96.	1.
42	92.	88.	1.
43	84.	80.	1.
44	76.	73.	1.
45	69.	66.	1.
46	63.	60.	1.
47	57.	55.	1.
48	52.	50.	1.
49	47.	45.	1.
50	43.	41.	1.
51	39.	37.	1.
52	35.	34.	1.
53	32.	31.	0.
54	30.	28.	1.
55	27.	25.	1.
56	24.	23.	1.
57	22.	21.	1.
58	20.	19.	1.
59	18.	17.	1.
60	17.	16.	1.
61	15.	15.	1.
62	14.	13.	1.
63	13.	12.	1.
64	11.	11.	1.
65	10.	10.	1.
66	9.	9.	1.
67	9.	8.	1.
68	8.	7.	1.
69	7.	7.	1.
70	7.	6.	1.
71	6.	6.	1.
72	5.	5.	1.
73	5.	5.	1.
74	4.	4.	1.
75	4.	4.	1.
76	4.	3.	1.
77	3.	3.	1.
78	3.	3.	1.
79	3.	2.	1.
80	2.	2.	1.
81	2.	2.	1.
82	2.	2.	1.
83	2.	2.	1.
84	2.	2.	1.
85	2.	2.	1.
86	1.	0.	0.
87	0.	0.	0.
88	0.	0.	0.
89	0.	0.	0.
90	0.	0.	0.
91	0.	0.	0.
92	0.	0.	0.
93	0.	0.	0.
94	0.	0.	0.
95	0.	0.	0.
96	0.	0.	0.
97	0.	0.	0.
98	0.	0.	0.
99	0.	0.	0.
100	0.	0.	0.

101	0.	0.	0.
102	0.	0.	0.
103	0.	0.	0.
104	0.	0.	0.
105	0.	0.	0.
106	0.	0.	0.
107	0.	0.	0.
108	0.	0.	0.
109	0.	0.	0.
110	0.	0.	0.
111	0.	0.	0.
112	0.	0.	0.
113	0.	0.	0.
114	0.	0.	0.
115	0.	0.	0.
116	0.	0.	0.
117	0.	0.	0.
118	0.	0.	0.
119	0.	0.	0.
120	0.	0.	0.

SUM 7328. CFS-PERIOD 151.41 ACRE-FEET

COMBINED HYDROGRAPH
AT 1310 NQ= 120 15-MIN INTRVL

1.	3.	5.	7.	9.	10.	12.	14.	16.	18.
20.	21.	23.	24.	26.	27.	30.	38.	78.	253.
471.	580.	632.	664.	679.	680.	678.	679.	682.	683.
680.	671.	655.	633.	605.	574.	542.	509.	478.	447.
418.	390.	365.	341.	318.	297.	278.	260.	243.	227.
212.	198.	186.	174.	163.	152.	143.	134.	125.	117.
110.	103.	97.	91.	85.	80.	75.	70.	66.	62.
58.	55.	51.	48.	45.	43.	40.	38.	35.	34.
32.	30.	28.	26.	25.	22.	21.	19.	18.	17.
16.	15.	14.	14.	13.	12.	11.	11.	10.	9.
8.	8.	7.	6.	5.	4.	3.	3.	2.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 19298. CFS-PERIOD 398.71 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	0	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	0	0.	0

NO ROUTING PERFORMED

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1311	70	15	0.	0	0	0	0.	0	0.

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1311	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	2	1.	0

NO ROUTING PERFORMED

COMBINED HYDROGRAPH
AT 1311 NQ= 120 15-MIN INTRVL

1.	3.	5.	7.	9.	10.	12.	14.	17.	22.
29.	36.	44.	48.	52.	53.	55.	62.	100.	274.
491.	599.	654.	695.	735.	775.	824.	876.	917.	938.
936.	915.	880.	834.	781.	725.	670.	616.	567.	520.
477.	437.	402.	370.	341.	315.	292.	270.	251.	233.

216.	201.	188.	176.	164.	153.	144.	134.	125.	117.
110.	103.	97.	91.	85.	80.	75.	70.	66.	62.
58.	55.	51.	48.	45.	43.	40.	38.	35.	34.
32.	30.	28.	26.	25.	22.	21.	19.	18.	17.
16.	15.	14.	14.	13.	12.	11.	11.	10.	9.
8.	8.	7.	6.	5.	4.	3.	3.	2.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 22507. CFS-PERIOD 465.01 ACRE-FEET

APPENDIX "B"

TEST RUN NO. 3

GILA DRAIN
SOUTH MTN CONTRIBUTION
BORROW PIT RETENTION

IUNRG	LOCAL	LNGTH	IMNTH	IDAY	IYR	ITIME	RATIO	IPNCH
0	0	30	1	2	79	1200	0.	0

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
13511	40	15	0.50	0	0	0	0.	0	0.

FLOW AT 13511 MULTIPLIED BY 0.500

1.	4.	7.	8.	9.	11.	12.	13.	13.	13.
13.	14.	15.	17.	17.	17.	18.	30.	76.	207.
478.	532.	364.	198.	107.	61.	38.	25.	18.	10.
4.	2.	1.	1.	0.	0.	0.	0.	0.	0.

SUM 2347. CFS-PERIOD 48.49 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1351	0.	0	0	3	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	0	0.	0

STOR-OUTFLOW TABLE

0.	0.	66.	0.	66.	5000.

HYDROGRAPH 13511 ROUTED TO 1351 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	0.	1.
2	2.	0.	1.
3	5.	0.	1.
4	7.	0.	1.
5	8.	0.	1.
6	10.	0.	1.
7	11.	0.	1.
8	12.	0.	2.
9	13.	0.	2.
10	13.	0.	2.
11	13.	0.	2.
12	13.	0.	3.
13	14.	0.	3.
14	16.	0.	3.
15	17.	0.	4.
16	17.	0.	4.
17	18.	0.	4.
18	24.	0.	5.
19	53.	0.	6.
20	141.	0.	9.
21	342.	0.	16.
22	505.	0.	26.
23	448.	0.	36.
24	281.	0.	41.
25	153.	0.	45.
26	84.	0.	46.
27	49.	0.	47.
28	31.	0.	48.
29	21.	0.	48.
30	14.	0.	49.
31	7.	0.	49.
32	3.	0.	49.
33	1.	0.	49.

34	1.	0.	49.
35	0.	0.	49.
36	0.	0.	49.
37	0.	0.	49.
38	0.	0.	49.
39	0.	0.	49.
40	0.	0.	49.
41	0.	0.	49.
42	0.	0.	49.
43	0.	0.	49.
44	0.	0.	49.
45	0.	0.	49.
46	0.	0.	49.
47	0.	0.	49.
48	0.	0.	49.
49	0.	0.	49.
50	0.	0.	49.
51	0.	0.	49.
52	0.	0.	49.
53	0.	0.	49.
54	0.	0.	49.
55	0.	0.	49.
56	0.	0.	49.
57	0.	0.	49.
58	0.	0.	49.
59	0.	0.	49.
60	0.	0.	49.
61	0.	0.	49.
62	0.	0.	49.
63	0.	0.	49.
64	0.	0.	49.
65	0.	0.	49.
66	0.	0.	49.
67	0.	0.	49.
68	0.	0.	49.
69	0.	0.	49.
70	0.	0.	49.
71	0.	0.	49.
72	0.	0.	49.
73	0.	0.	49.
74	0.	0.	49.
75	0.	0.	49.
76	0.	0.	49.
77	0.	0.	49.
78	0.	0.	49.
79	0.	0.	49.
80	0.	0.	49.
81	0.	0.	49.
82	0.	0.	49.
83	0.	0.	49.
84	0.	0.	49.
85	0.	0.	49.
86	0.	0.	49.
87	0.	0.	49.
88	0.	0.	49.
89	0.	0.	49.
90	0.	0.	49.
91	0.	0.	49.
92	0.	0.	49.
93	0.	0.	49.
94	0.	0.	49.
95	0.	0.	49.
96	0.	0.	49.
97	0.	0.	49.
98	0.	0.	49.
99	0.	0.	49.

```
    100      0.      0.      49.
    101      0.      0.      49.
    102      0.      0.      49.
    103      0.      0.      49.
    104      0.      0.      49.
    105      0.      0.      49.
    106      0.      0.      49.
    107      0.      0.      49.
    108      0.      0.      49.
    109      0.      0.      49.
    110      0.      0.      49.
    111      0.      0.      49.
    112      0.      0.      49.
    113      0.      0.      49.
    114      0.      0.      49.
    115      0.      0.      49.
    116      0.      0.      49.
    117      0.      0.      49.
    118      0.      0.      49.
    119      0.      0.      49.
    120      0.      0.      49.

    SUM         0. CFS-PERIOD          0.   ACRE-FEET

    LOCI     NQI    ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
   13512      40      15    0.50       0       0       0      0.       0      0.

FLOW AT 13512  MULTIPLIED BY   0.500
      1.      4.      7.      8.      9.     11.     12.     13.     13.     13.
     13.     14.     15.     17.     17.     17.     18.     30.     76.    207.
    478.    532.    364.    198.    107.     61.     38.     25.     18.     10.
      4.      2.      1.      1.      0.      0.      0.      0.      0.      0.

    SUM      2347. CFS-PERIOD        48.49 ACRE-FEET

    ITQR    ITQO   NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
      15      15       1    1351    0.         0       0       4      0.      1.

   AMSKK       X   QLOSS   CQLOS    NHGT     FIN   KPNCH
   0.      0.         0.   0.          2      0.       0

STOR-OUTFLOW TABLE
        0.      0.         0.    600.       19.    600.       19.   5000.

HYDROGRAPH 13512   ROUTED TO  1351   NO. FLOWS= 120   INTERVAL=  15 MINUTES

     PER  INFLOW OUTFLOW     STOR
       1      1.      1.       1.
       2      2.      4.       1.
       3      5.      7.       1.
       4      7.      8.       1.
       5      8.      9.       1.
       6     10.     11.       1.
       7     11.     12.       1.
       8     12.     13.       1.
       9     13.     13.       1.
      10     13.     13.       1.
      11     13.     13.       1.
      12     13.     14.       1.
      13     14.     15.       1.
      14     16.     17.       1.
      15     17.     17.       1.
      16     17.     17.       1.
      17     18.     18.       1.
      18     24.     30.       1.
      19     53.     76.       1.
```

20	141.	297.	1.
21	342.	478.	1.
22	505.	532.	1.
23	448.	364.	1.
24	281.	198.	1.
25	153.	107.	1.
26	84.	61.	1.
27	49.	38.	1.
28	31.	25.	1.
29	21.	18.	1.
30	14.	10.	1.
31	7.	4.	1.
32	3.	2.	1.
33	1.	1.	1.
34	1.	1.	1.
35	0.	0.	1.
36	0.	0.	1.
37	0.	0.	1.
38	0.	0.	1.
39	0.	0.	1.
40	0.	0.	1.
41	0.	0.	1.
42	0.	0.	1.
43	0.	0.	1.
44	0.	0.	1.
45	0.	0.	1.
46	0.	0.	1.
47	0.	0.	1.
48	0.	0.	1.
49	0.	0.	1.
50	0.	0.	1.
51	0.	0.	1.
52	0.	0.	1.
53	0.	0.	1.
54	0.	0.	1.
55	0.	0.	1.
56	0.	0.	1.
57	0.	0.	1.
58	0.	0.	1.
59	0.	0.	1.
60	0.	0.	1.
61	0.	0.	1.
62	0.	0.	1.
63	0.	0.	1.
64	0.	0.	1.
65	0.	0.	1.
66	0.	0.	1.
67	0.	0.	1.
68	0.	0.	1.
69	0.	0.	1.
70	0.	0.	1.
71	0.	0.	1.
72	0.	0.	1.
73	0.	0.	1.
74	0.	0.	1.
75	0.	0.	1.
76	0.	0.	1.
77	0.	0.	1.
78	0.	0.	1.
79	0.	0.	1.
80	0.	0.	1.
81	0.	0.	1.
82	0.	0.	1.
83	0.	0.	1.
84	0.	0.	1.
85	0.	0.	1.

86	0.	0.	1.
87	0.	0.	1.
88	0.	0.	1.
89	0.	0.	1.
90	0.	0.	1.
91	0.	0.	1.
92	0.	0.	1.
93	0.	0.	1.
94	0.	0.	1.
95	0.	0.	1.
96	0.	0.	1.
97	0.	0.	1.
98	0.	0.	1.
99	0.	0.	1.
100	0.	0.	1.
101	0.	0.	1.
102	0.	0.	1.
103	0.	0.	1.
104	0.	0.	1.
105	0.	0.	1.
106	0.	0.	1.
107	0.	0.	1.
108	0.	0.	1.
109	0.	0.	1.
110	0.	0.	1.
111	0.	0.	1.
112	0.	0.	1.
113	0.	0.	1.
114	0.	0.	1.
115	0.	0.	1.
116	0.	0.	1.
117	0.	0.	1.
118	0.	0.	1.
119	0.	0.	1.
120	0.	0.	1.

SUM 2347. CFS-PERIOD 48.49 ACRE-FEET

COMBINED HYDROGRAPH
AT 1351 NQ= 120 15-MIN INTRVL

1.	4.	7.	8.	9.	11.	12.	13.	13.	13.
13.	14.	15.	17.	17.	17.	18.	30.	76.	207.
478.	532.	364.	198.	107.	61.	38.	25.	18.	10.
4.	2.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 2347. CFS-PERIOD 48.49 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	5	1352	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

EXP UNDERFLO AT LOCATION 035452
EXP UNDERFLO AT LOCATION 035445
EXP UNDERFLO AT LOCATION 035436
EXP UNDERFLO AT LOCATION 035445

HYDROGRAPH 1351 ROUTED TO 1352 NO. FLOWS= 120 INTERVAL= 15 MINUTES

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     1.     1.     1.     1.     2.     3.     4.     6.     7.     9.
    10.    11.    12.    12.    13.    14.    14.    15.    16.    20.
    31.    59.   112.   187.   258.   300.   298.   263.   209.   155.
   109.    73.    48.    31.    19.    12.     7.     4.     2.     1.
     1.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.

     SUM      2350. CFS-PERIOD        48.54 ACRE-FEET

    LOCI    NQI   ITQI   RTIO  IQAVG  IPRNT   NHGT    FIN  JPNCH     CH
   13521     40     15   0.50      0      0      0     0.      0     0.

FLOW AT 13521  MULTIPLIED BY   0.500
     1.     7.    16.    22.    25.    26.    28.    31.    36.    39.
    40.    41.    42.    42.    42.    42.    43.    59.   143.   407.
  1020.  1496.  1298.   868.   537.   333.   208.   134.    96.    64.
    31.    14.     7.     4.     2.     1.     1.     0.     0.     0.

     SUM      7239. CFS-PERIOD       149.56 ACRE-FEET

    ITQR   ITQO  NRCHS   LOCO  TATMR    LAG  NSTRL  NPULS  STORA    RES
      15     15      1   1352  0.         0      0      3     0.     1.

   AMSKK      X  QLOSS  CQLOS   NHGT    FIN  KPNCH
   0.     0.        0.  0.         0     0.      0

STOR-OUTFLOW TABLE
       0.      0.      205.      0.      205.  20000.

HYDROGRAPH 13521   ROUTED TO  1352   NO. FLOWS= 120   INTERVAL=  15 MINUTES

     PER  INFLOW OUTFLOW    STOR
       1      1.      0.      1.
       2      4.      0.      1.
       3     12.      0.      1.
       4     19.      0.      1.
       5     23.      0.      2.
       6     25.      0.      2.
       7     27.      0.      3.
       8     29.      0.      3.
       9     34.      0.      4.
      10     37.      0.      5.
      11     39.      0.      6.
      12     41.      0.      6.
      13     41.      0.      7.
      14     42.      0.      8.
      15     42.      0.      9.
      16     42.      0.     10.
      17     43.      0.     11.
      18     51.      0.     12.
      19    101.      0.     14.
      20    275.      0.     20.
      21    714.      0.     34.
      22   1258.      0.     60.
      23   1397.      0.     89.
      24   1083.      0.    112.
      25    702.      0.    126.
      26    435.      0.    135.
      27    271.      0.    141.
      28    171.      0.    144.
```

29	113.	0.	147.
30	80.	0.	148.
31	47.	0.	149.
32	22.	0.	150.
33	10.	0.	150.
34	5.	0.	150.
35	3.	0.	150.
36	1.	0.	150.
37	1.	0.	150.
38	0.	0.	150.
39	0.	0.	150.
40	0.	0.	150.
41	0.	0.	150.
42	0.	0.	150.
43	0.	0.	150.
44	0.	0.	150.
45	0.	0.	150.
46	0.	0.	150.
47	0.	0.	150.
48	0.	0.	150.
49	0.	0.	150.
50	0.	0.	150.
51	0.	0.	150.
52	0.	0.	150.
53	0.	0.	150.
54	0.	0.	150.
55	0.	0.	150.
56	0.	0.	150.
57	0.	0.	150.
58	0.	0.	150.
59	0.	0.	150.
60	0.	0.	150.
61	0.	0.	150.
62	0.	0.	150.
63	0.	0.	150.
64	0.	0.	150.
65	0.	0.	150.
66	0.	0.	150.
67	0.	0.	150.
68	0.	0.	150.
69	0.	0.	150.
70	0.	0.	150.
71	0.	0.	150.
72	0.	0.	150.
73	0.	0.	150.
74	0.	0.	150.
75	0.	0.	150.
76	0.	0.	150.
77	0.	0.	150.
78	0.	0.	150.
79	0.	0.	150.
80	0.	0.	150.
81	0.	0.	150.
82	0.	0.	150.
83	0.	0.	150.
84	0.	0.	150.
85	0.	0.	150.
86	0.	0.	150.
87	0.	0.	150.
88	0.	0.	150.
89	0.	0.	150.
90	0.	0.	150.
91	0.	0.	150.
92	0.	0.	150.
93	0.	0.	150.
94	0.	0.	150.

95	0.	0.	150.
96	0.	0.	150.
97	0.	0.	150.
98	0.	0.	150.
99	0.	0.	150.
100	0.	0.	150.
101	0.	0.	150.
102	0.	0.	150.
103	0.	0.	150.
104	0.	0.	150.
105	0.	0.	150.
106	0.	0.	150.
107	0.	0.	150.
108	0.	0.	150.
109	0.	0.	150.
110	0.	0.	150.
111	0.	0.	150.
112	0.	0.	150.
113	0.	0.	150.
114	0.	0.	150.
115	0.	0.	150.
116	0.	0.	150.
117	0.	0.	150.
118	0.	0.	150.
119	0.	0.	150.
120	0.	0.	150.

SUM 0. CFS-PERIOD 0. ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHCT	FIN	JPNCH	CH
13522	40	15	0.50	0	0	0	0.	0	0.

FLOW AT 13522 MULTIPLIED BY 0.500

1.	7.	16.	22.	25.	26.	28.	31.	36.	39.
40.	41.	42.	42.	42.	42.	43.	59.	143.	407.
1020.	1496.	1298.	868.	537.	333.	208.	134.	96.	64.
31.	14.	7.	4.	2.	1.	1.	0.	0.	0.

SUM 7239. CFS-PERIOD 149.56 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATHR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1352	0.	0	0	4	0.	1.

AMSKK	X	QLOSS	CQLOS	NHCT	FIN	KPNCH
0.	0.	0.	0.	3	0.	0

STOR-OUTFLOW TABLE

0.	0.	0.	1450.	67.	1450.	67.	10000.

HYDROGRAPH 13522 ROUTED TO 1352 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	1.	1.
2	4.	7.	1.
3	12.	16.	1.
4	19.	22.	1.
5	23.	25.	1.
6	25.	26.	1.
7	27.	28.	1.
8	29.	31.	1.
9	34.	36.	1.
10	37.	39.	1.
11	39.	40.	1.
12	41.	41.	1.
13	41.	42.	1.
14	42.	42.	1.

15	42.	42.	1.
16	42.	42.	1.
17	43.	43.	1.
18	51.	59.	1.
19	101.	143.	1.
20	275.	407.	1.
21	714.	1020.	1.
22	1258.	1450.	1.
23	1397.	1390.	1.
24	1083.	775.	1.
25	702.	629.	1.
26	435.	241.	1.
27	271.	300.	1.
28	171.	41.	1.
29	115.	188.	1.
30	80.	0.	0.
31	47.	66.	1.
32	22.	0.	0.
33	10.	0.	0.
34	5.	8.	1.
35	3.	0.	0.
36	1.	0.	0.
37	1.	1.	1.
38	0.	0.	0.
39	0.	0.	0.
40	0.	0.	0.
41	0.	0.	0.
42	0.	0.	0.
43	0.	0.	0.
44	0.	0.	0.
45	0.	0.	0.
46	0.	0.	0.
47	0.	0.	0.
48	0.	0.	0.
49	0.	0.	0.
50	0.	0.	0.
51	0.	0.	0.
52	0.	0.	0.
53	0.	0.	0.
54	0.	0.	0.
55	0.	0.	0.
56	0.	0.	0.
57	0.	0.	0.
58	0.	0.	0.
59	0.	0.	0.
60	0.	0.	0.
61	0.	0.	0.
62	0.	0.	0.
63	0.	0.	0.
64	0.	0.	0.
65	0.	0.	0.
66	0.	0.	0.
67	0.	0.	0.
68	0.	0.	0.
69	0.	0.	0.
70	0.	0.	0.
71	0.	0.	0.
72	0.	0.	0.
73	0.	0.	0.
74	0.	0.	0.
75	0.	0.	0.
76	0.	0.	0.
77	0.	0.	0.
78	0.	0.	0.
79	0.	0.	0.
80	0.	0.	0.

81	0.	0.	0.
82	0.	0.	0.
83	0.	0.	0.
84	0.	0.	0.
85	0.	0.	0.
86	0.	0.	0.
87	0.	0.	0.
88	0.	0.	0.
89	0.	0.	0.
90	0.	0.	0.
91	0.	0.	0.
92	0.	0.	0.
93	0.	0.	0.
94	0.	0.	0.
95	0.	0.	0.
96	0.	0.	0.
97	0.	0.	0.
98	0.	0.	0.
99	0.	0.	0.
100	0.	0.	0.
101	0.	0.	0.
102	0.	0.	0.
103	0.	0.	0.
104	0.	0.	0.
105	0.	0.	0.
106	0.	0.	0.
107	0.	0.	0.
108	0.	0.	0.
109	0.	0.	0.
110	0.	0.	0.
111	0.	0.	0.
112	0.	0.	0.
113	0.	0.	0.
114	0.	0.	0.
115	0.	0.	0.
116	0.	0.	0.
117	0.	0.	0.
118	0.	0.	0.
119	0.	0.	0.
120	0.	0.	0.

SUM 7239. CFS-PERIOD 149.57 ACRE-FEET

COMBINED HYDROGRAPH
AT 1352 NO= 120 15-MIN INTRVL

2.	8.	17.	22.	26.	29.	32.	37.	43.	47.
50.	52.	53.	54.	55.	56.	57.	74.	159.	427.
1051.	1509.	1502.	962.	887.	541.	598.	304.	397.	155.
175.	73.	48.	38.	19.	12.	8.	4.	2.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 9589. CFS-PERIOD 198.11 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	6	1353	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1352 ROUTED TO 1353 NO FLOWS= 120 INTERVAL= 15 MINUTES

HYDROGRAPH 1352 ROUTED TO 1353 NO. FLOWS= 120 INTERVAL= 15 MINUTES

2.	2.	2.	2.	3.	5.	8.	12.	16.	20.
25.	29.	33.	38.	41.	45.	48.	50.	52.	56.
66.	95.	165.	295.	481.	686.	855.	948.	955.	894.
792.	674.	556.	445.	346.	261.	191.	136.	94.	64.
42.	27.	17.	11.	7.	4.	2.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 9597. CFS-PERIOD 198.30 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
13531	40	15	0.50	0	0	0	0.	0	0.

FLOW AT 13531 MULTIPLIED BY 0.500

1.	2.	6.	8.	10.	12.	16.	19.	20.	21.
22.	22.	22.	22.	22.	23.	23.	32.	81.	247.
641.	1052.	1012.	731.	475.	304.	197.	130.	85.	59.
42.	20.	8.	4.	2.	1.	1.	1.	0.	0.

SUM 5387. CFS-PERIOD 111.29 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1353	0.	0	0	3	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	0	0.	0

STOR-OUTFLOW TABLE

0. 0. 120. 0. 120. 2000.

HYDROGRAPH 13531 ROUTED TO 1353 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	0.	1.
2	1.	0.	1.
3	4.	0.	1.
4	7.	0.	1.
5	9.	0.	1.
6	11.	0.	1.
7	14.	0.	1.
8	17.	0.	2.
9	19.	0.	2.
10	21.	0.	3.
11	21.	0.	3.
12	22.	0.	3.
13	22.	0.	4.
14	22.	0.	4.
15	22.	0.	5.
16	22.	0.	5.
17	23.	0.	6.
18	28.	0.	6.
19	56.	0.	8.
20	164.	0.	11.
21	444.	0.	20.
22	846.	0.	38.
23	1032.	0.	59.
24	871.	0.	77.
25	603.	0.	89.
26	389.	0.	97.
27	250.	0.	103.

28	163.	0.	105.
29	108.	0.	108.
30	72.	0.	110.
31	50.	0.	111.
32	31.	0.	111.
33	14.	0.	112.
34	6.	0.	112.
35	3.	0.	112.
36	2.	0.	112.
37	1.	0.	112.
38	1.	0.	112.
39	0.	0.	112.
40	0.	0.	112.
41	0.	0.	112.
42	0.	0.	112.
43	0.	0.	112.
44	0.	0.	112.
45	0.	0.	112.
46	0.	0.	112.
47	0.	0.	112.
48	0.	0.	112.
49	0.	0.	112.
50	0.	0.	112.
51	0.	0.	112.
52	0.	0.	112.
53	0.	0.	112.
54	0.	0.	112.
55	0.	0.	112.
56	0.	0.	112.
57	0.	0.	112.
58	0.	0.	112.
59	0.	0.	112.
60	0.	0.	112.
61	0.	0.	112.
62	0.	0.	112.
63	0.	0.	112.
64	0.	0.	112.
65	0.	0.	112.
66	0.	0.	112.
67	0.	0.	112.
68	0.	0.	112.
69	0.	0.	112.
70	0.	0.	112.
71	0.	0.	112.
72	0.	0.	112.
73	0.	0.	112.
74	0.	0.	112.
75	0.	0.	112.
76	0.	0.	112.
77	0.	0.	112.
78	0.	0.	112.
79	0.	0.	112.
80	0.	0.	112.
81	0.	0.	112.
82	0.	0.	112.
83	0.	0.	112.
84	0.	0.	112.
85	0.	0.	112.
86	0.	0.	112.
87	0.	0.	112.
88	0.	0.	112.
89	0.	0.	112.
90	0.	0.	112.
91	0.	0.	112.
92	0.	0.	112.
93	0.	0.	112.
94	0.	0.	112.

94	0.	0.	112.
95	0.	0.	112.
96	0.	0.	112.
97	0.	0.	112.
98	0.	0.	112.
99	0.	0.	112.
100	0.	0.	112.
101	0.	0.	112.
102	0.	0.	112.
103	0.	0.	112.
104	0.	0.	112.
105	0.	0.	112.
106	0.	0.	112.
107	0.	0.	112.
108	0.	0.	112.
109	0.	0.	112.
110	0.	0.	112.
111	0.	0.	112.
112	0.	0.	112.
113	0.	0.	112.
114	0.	0.	112.
115	0.	0.	112.
116	0.	0.	112.
117	0.	0.	112.
118	0.	0.	112.
119	0.	0.	112.
120	0.	0.	112.

SUM 0. CFS-PERIOD 0. ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
13532	40	15	0.50	0	0	0	0.	0	0.

FLOW AT 13532 MULTIPLIED BY 0.500

1.	2.	6.	8.	10.	12.	16.	19.	20.	21.
22.	22.	22.	22.	22.	23.	23.	32.	81.	247.
641.	1052.	1012.	731.	475.	304.	197.	130.	85.	59.
42.	20.	8.	4.	2.	1.	1.	1.	0.	0.

SUM 5387. CFS-PERIOD 111.29 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1353	0.	0	0	4	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	3	0.	0

STOR-OUTFLOW TABLE

0.	0.	0.	1450.	25.	1450.
25.	10000.				

HYDROGRAPH 13532 ROUTED TO 1353 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	1.	1.
2	1.	2.	1.
3	4.	6.	1.
4	7.	8.	1.
5	9.	10.	1.
6	11.	12.	1.
7	14.	16.	1.
8	17.	19.	1.
9	19.	20.	1.
10	21.	21.	1.
11	21.	22.	1.
12	22.	22.	1.
13	22.	22.	1.

14	22.	22.	1.
15	22.	22.	1.
16	22.	23.	1.
17	23.	23.	1.
18	28.	32.	1.
19	56.	81.	1.
20	164.	247.	1.
21	444.	641.	1.
22	846.	1052.	1.
23	1032.	1012.	1.
24	871.	731.	1.
25	603.	475.	1.
26	389.	304.	1.
27	250.	197.	1.
28	163.	130.	1.
29	108.	85.	1.
30	72.	59.	1.
31	50.	42.	1.
32	31.	20.	1.
33	14.	8.	1.
34	6.	4.	1.
35	3.	2.	1.
36	2.	1.	1.
37	1.	1.	1.
38	1.	1.	1.
39	0.	0.	1.
40	0.	0.	1.
41	0.	0.	1.
42	0.	0.	1.
43	0.	0.	1.
44	0.	0.	1.
45	0.	0.	1.
46	0.	0.	1.
47	0.	0.	1.
48	0.	0.	1.
49	0.	0.	1.
50	0.	0.	1.
51	0.	0.	1.
52	0.	0.	1.
53	0.	0.	1.
54	0.	0.	1.
55	0.	0.	1.
56	0.	0.	1.
57	0.	0.	1.
58	0.	0.	1.
59	0.	0.	1.
60	0.	0.	1.
61	0.	0.	1.
62	0.	0.	1.
63	0.	0.	1.
64	0.	0.	1.
65	0.	0.	1.
66	0.	0.	1.
67	0.	0.	1.
68	0.	0.	1.
69	0.	0.	1.
70	0.	0.	1.
71	0.	0.	1.
72	0.	0.	1.
73	0.	0.	1.
74	0.	0.	1.
75	0.	0.	1.
76	0.	0.	1.
77	0.	0.	1.
78	0.	0.	1.
79	0.	0.	1.

80	0.	0.	1.
81	0.	0.	1.
82	0.	0.	1.
83	0.	0.	1.
84	0.	0.	1.
85	0.	0.	1.
86	0.	0.	1.
87	0.	0.	1.
88	0.	0.	1.
89	0.	0.	1.
90	0.	0.	1.
91	0.	0.	1.
92	0.	0.	1.
93	0.	0.	1.
94	0.	0.	1.
95	0.	0.	1.
96	0.	0.	1.
97	0.	0.	1.
98	0.	0.	1.
99	0.	0.	1.
100	0.	0.	1.
101	0.	0.	1.
102	0.	0.	1.
103	0.	0.	1.
104	0.	0.	1.
105	0.	0.	1.
106	0.	0.	1.
107	0.	0.	1.
108	0.	0.	1.
109	0.	0.	1.
110	0.	0.	1.
111	0.	0.	1.
112	0.	0.	1.
113	0.	0.	1.
114	0.	0.	1.
115	0.	0.	1.
116	0.	0.	1.
117	0.	0.	1.
118	0.	0.	1.
119	0.	0.	1.
120	0.	0.	1.

SUM 5387. CFS-PERIOD 111.29 ACRE-FEET

COMBINED HYDROGRAPH
AT 1353 NO= 120 15-MIN INTRVL

2.	4.	7.	9.	12.	17.	24.	30.	36.	41.
46.	51.	55.	60.	63.	67.	71.	82.	133.	303.
706.	1146.	1177.	1025.	956.	990.	1052.	1078.	1040.	952.
834.	694.	563.	448.	348.	262.	191.	136.	94.	64.
42.	27.	17.	11.	7.	4.	2.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 14984. CFS-PERIOD 309.59 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	6	1354	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	COLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1353 ROUTED TO 1354 NO. FLOWS= 120 INTERVAL= 15 MINUTES

2.	2.	2.	2.	2.	3.	4.	6.	8.	12.
15.	20.	25.	30.	35.	41.	45.	50.	55.	60.
69.	90.	138.	228.	365.	529.	687.	813.	900.	954.
988.	1006.	1005.	983.	936.	865.	777.	677.	575.	475.
383.	302.	232.	175.	129.	93.	66.	46.	31.	21.
14.	9.	6.	4.	2.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 14996. CFS-PERIOD 309.83 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
13541	60	15	0.50	0	0	0	0.	0	0.

FLOW AT 13541 MULTIPLIED BY 0.500

3.	7.	11.	14.	17.	19.	22.	25.	27.	29.
31.	33.	34.	36.	37.	39.	43.	66.	130.	340.
569.	605.	536.	455.	385.	323.	271.	229.	193.	157.
127.	103.	84.	68.	56.	45.	37.	30.	24.	20.
16.	13.	11.	9.	7.	6.	5.	4.	3.	3.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 5342. CFS-PERIOD 110.37 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1354	0.	0	0	3	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	0	0.	0

STOR-OUTFLOW TABLE

0. 0. 135. 0. 135. 10000.

HYDROGRAPH 13541 ROUTED TO 1354 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	3.	0.	1.
2	5.	0.	1.
3	9.	0.	1.
4	12.	0.	1.
5	15.	0.	1.
6	18.	0.	2.
7	20.	0.	2.
8	23.	0.	3.
9	26.	0.	3.
10	28.	0.	4.
11	30.	0.	4.
12	32.	0.	5.
13	33.	0.	6.
14	35.	0.	6.
15	37.	0.	7.
16	38.	0.	8.
17	41.	0.	9.
18	54.	0.	10.
19	98.	0.	12.
20	235.	0.	17.
21	454.	0.	26.
22	587.	0.	38.
23	570.	0.	50.
24	495.	0.	60.

25	420.	0.	69.
26	354.	0.	76.
27	297.	0.	82.
28	250.	0.	88.
29	211.	0.	92.
30	175.	0.	95.
31	142.	0.	98.
32	115.	0.	101.
33	94.	0.	103.
34	76.	0.	104.
35	62.	0.	106.
36	50.	0.	107.
37	41.	0.	107.
38	33.	0.	108.
39	27.	0.	109.
40	22.	0.	109.
41	18.	0.	110.
42	15.	0.	110.
43	12.	0.	110.
44	10.	0.	110.
45	8.	0.	110.
46	6.	0.	111.
47	5.	0.	111.
48	4.	0.	111.
49	3.	0.	111.
50	3.	0.	111.
51	1.	0.	111.
52	0.	0.	111.
53	0.	0.	111.
54	0.	0.	111.
55	0.	0.	111.
56	0.	0.	111.
57	0.	0.	111.
58	0.	0.	111.
59	0.	0.	111.
60	0.	0.	111.
61	0.	0.	111.
62	0.	0.	111.
63	0.	0.	111.
64	0.	0.	111.
65	0.	0.	111.
66	0.	0.	111.
67	0.	0.	111.
68	0.	0.	111.
69	0.	0.	111.
70	0.	0.	111.
71	0.	0.	111.
72	0.	0.	111.
73	0.	0.	111.
74	0.	0.	111.
75	0.	0.	111.
76	0.	0.	111.
77	0.	0.	111.
78	0.	0.	111.
79	0.	0.	111.
80	0.	0.	111.
81	0.	0.	111.
82	0.	0.	111.
83	0.	0.	111.
84	0.	0.	111.
85	0.	0.	111.
86	0.	0.	111.
87	0.	0.	111.
88	0.	0.	111.
89	0.	0.	111.
90	0.	0.	111.

```
         91       0.       0.       111.
         92       0.       0.       111.
         93       0.       0.       111.
         94       0.       0.       111.
         95       0.       0.       111.
         96       0.       0.       111.
         97       0.       0.       111.
         98       0.       0.       111.
         99       0.       0.       111.
        100       0.       0.       111.
        101       0.       0.       111.
        102       0.       0.       111.
        103       0.       0.       111.
        104       0.       0.       111.
        105       0.       0.       111.
        106       0.       0.       111.
        107       0.       0.       111.
        108       0.       0.       111.
        109       0.       0.       111.
        110       0.       0.       111.
        111       0.       0.       111.
        112       0.       0.       111.
        113       0.       0.       111.
        114       0.       0.       111.
        115       0.       0.       111.
        116       0.       0.       111.
        117       0.       0.       111.
        118       0.       0.       111.
        119       0.       0.       111.
        120       0.       0.       111.

        SUM          0. CFS-PERIOD          0.   ACRE-FEET

      LOCI     NQI    ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
     13542      60      15    0.50       0       0       0      0.       0      0.

   FLOW AT 13542  MULTIPLIED BY   0.500
        3.      7.     11.     14.     17.     19.     22.     25.     27.     29.
       31.     33.     34.     36.     37.     39.     43.     66.    130.    340.
      569.    605.    536.    455.    385.    323.    271.    229.    193.    157.
      127.    103.     84.     68.     56.     45.     37.     30.     24.     20.
       16.     13.     11.      9.      7.      6.      5.      4.      3.      3.
        0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

        SUM       5342. CFS-PERIOD        110.37 ACRE-FEET

      ITQR    ITQO   NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
        15      15       1    1354   0.          0       0       4      0.      1.

     AMSKK       X   QLOSS   CQLOS    NHGT     FIN   KPNCH
     0.      0.         0.   0.          3      1.       0

   STOR-OUTFLOW TABLE
         0.      0.         0.    454.      61.    454.      61.  10000.

   HYDROGRAPH 13542   ROUTED TO  1354   NO. FLOWS= 120   INTERVAL=  15 MINUTES

        PER  INFLOW OUTFLOW     STOR
          1      3.      3.       1.
          2      5.      7.       1.
          3      9.     11.       1.
          4     12.     14.       1.
          5     15.     17.       1.
          6     18.     19.       1.
          7     20.     22.       1.
          8     23.     25.       1.
```

10	28.	29.	1.
11	30.	31.	1.
12	32.	33.	1.
13	33.	34.	1.
14	35.	36.	1.
15	37.	37.	1.
16	38.	39.	1.
17	41.	43.	1.
18	54.	66.	1.
19	98.	130.	1.
20	235.	340.	1.
21	454.	454.	2.
22	587.	454.	4.
23	570.	454.	7.
24	495.	454.	8.
25	420.	454.	7.
26	354.	454.	5.
27	297.	454.	2.
28	250.	156.	1.
29	211.	266.	1.
30	175.	84.	1.
31	142.	200.	1.
32	115.	30.	1.
33	94.	157.	1.
34	76.	0.	0.
35	62.	119.	1.
36	50.	0.	0.
37	41.	64.	1.
38	33.	3.	1.
39	27.	51.	1.
40	22.	0.	0.
41	18.	28.	1.
42	15.	1.	1.
43	12.	23.	1.
44	10.	0.	0.
45	8.	12.	1.
46	6.	1.	1.
47	5.	10.	1.
48	4.	0.	0.
49	3.	5.	1.
50	3.	1.	1.
51	1.	2.	1.
52	0.	0.	0.
53	0.	0.	0.
54	0.	0.	0.
55	0.	0.	0.
56	0.	0.	0.
57	0.	0.	0.
58	0.	0.	0.
59	0.	0.	0.
60	0.	0.	0.
61	0.	0.	0.
62	0.	0.	0.
63	0.	0.	0.
64	0.	0.	0.
65	0.	0.	0.
66	0.	0.	0.
67	0.	0.	0.
68	0.	0.	0.
69	0.	0.	0.
70	0.	0.	0.
71	0.	0.	0.
72	0.	0.	0.
73	0.	0.	0.
74	0.	0.	0.

75	0.	0.	0.
76	0.	0.	0.
77	0.	0.	0.
78	0.	0.	0.
79	0.	0.	0.
80	0.	0.	0.
81	0.	0.	0.
82	0.	0.	0.
83	0.	0.	0.
84	0.	0.	0.
85	0.	0.	0.
86	0.	0.	0.
87	0.	0.	0.
88	0.	0.	0.
89	0.	0.	0.
90	0.	0.	0.
91	0.	0.	0.
92	0.	0.	0.
93	0.	0.	0.
94	0.	0.	0.
95	0.	0.	0.
96	0.	0.	0.
97	0.	0.	0.
98	0.	0.	0.
99	0.	0.	0.
100	0.	0.	0.
101	0.	0.	0.
102	0.	0.	0.
103	0.	0.	0.
104	0.	0.	0.
105	0.	0.	0.
106	0.	0.	0.
107	0.	0.	0.
108	0.	0.	0.
109	0.	0.	0.
110	0.	0.	0.
111	0.	0.	0.
112	0.	0.	0.
113	0.	0.	0.
114	0.	0.	0.
115	0.	0.	0.
116	0.	0.	0.
117	0.	0.	0.
118	0.	0.	0.
119	0.	0.	0.
120	0.	0.	0.

SUM 5343. CFS-PERIOD 110.39 ACRE-FEET

COMBINED HYDROGRAPH
AT 1354 NQ= 120 15-MIN INTRVL

5.	9.	13.	16.	19.	22.	26.	30.	35.	40.
46.	52.	59.	66.	72.	79.	88.	116.	185.	400.
523.	544.	592.	682.	819.	983.	1141.	969.	1165.	1038.
1188.	1036.	1162.	983.	1055.	865.	840.	680.	626.	475.
411.	303.	255.	175.	141.	93.	75.	46.	36.	21.
16.	9.	6.	4.	2.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 20339. CFS-PERIOD 420.23 ACRE-FEET

APPENDIX "B"

TEST RUN NO. 4

```
HHHHGHHHH
U#=NER30500,
PASSWORD
[redacted]

ID:1840017

ENTER PHASE CODE:H

ENTER 1=BILLABLE OR 2=NONBILLABLE: 1

READY
BST N2N9
N2N9 DONE
00015 RETURNED
00006 SUBMITTED
 SUBMITTED/PURGED FILES
HEC1DATA-SUBM'D
 SYSOUT REPORTS
N2N901$$-RET'D
N2N90174-RET'D
N2N90274-RET'D
N2N90206-RET'D
N2N900**-RET'D
```

```
READY
TYP 6
READY
BLI N2N90206;L,W132

BEGIN FILE - N2N90206

    SNUMB = MN2N9, ACTIVITY # = 02, REPORT CODE = 06, RECORD COUNT = 000239
```

GILA DRAIN
RDA 117 FUTURE CONDITIONS
311-372

IUNRG	LOCAL	LNGTH	IMNTH	IDAY	IYR	ITIME	RATIO	IPNCH	
0	0	30	7	11	78	1200	0.	0	

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1311	120	15	0.	0	0	0	0.	0	0.

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	10	1355	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1311 ROUTED TO 1355 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	2.	3.
3.	5.	6.	8.	9.	12.	15.	18.	22.	26.
31.	36.	43.	53.	70.	98.	141.	199.	270.	349.
429.	508.	581.	647.	705.	756.	798.	831.	853.	863.
862.	849.	825.	793.	755.	712.	668.	622.	577.	534.

```
   492.   454.   418.   385.   355.   328.   303.   281.   260.   241.
   224.   208.   194.   181.   169.   158.   147.   138.   129.   120.
   113.   106.    99.    93.    87.    82.    77.    72.    67.    63.
    59.    56.    52.    49.    46.    44.    41.    39.    36.    34.
    32.    30.    28.    26.    25.    23.    21.    20.    19.    18.
    17.    16.    15.    14.    13.    12.    11.    11.    10.     9.
     8.     8.     7.     6.     5.     4.     4.     3.     2.     2.

    SUM      22510. CFS-PERIOD        465.09 ACRE-FEET

   LOCI    NQI   ITQI   RTIO  IQAVG  IPRNT   NHGT    FIN  JPNCH     CH
   1355     80     15  0.         0      0     -1     0.      0     0.

   LOCI    NQI   ITQI   RTIO  IQAVG  IPRNT   NHGT    FIN  JPNCH     CH
   1362     80     15  0.         0      0      3     0.      0     0.

COMBINED HYDROGRAPH
AT 1355  NQ= 120    15-MIN INTRVL
     1.     1.     1.     1.     1.     1.     1.     1.     2.     3.
     3.     5.     6.     8.     9.    12.    15.    56.   206.   766.
  1430.  1629.  1547.  1415.  1302.  1212.  1149.  1111.  1095.  1096.
  1105.  1119.  1134.  1148.  1158.  1166.  1170.  1168.  1158.  1139.
  1111.  1075.  1029.   978.   922.   863.   805.   746.   690.   636.
   585.   538.   493.   454.   417.   385.   355.   328.   302.   279.
   259.   239.   222.   207.   192.   179.   166.   155.   145.   134.
   126.   118.   109.   103.    87.    82.    77.    72.    67.    63.
    59.    56.    52.    49.    46.    44.    41.    39.    36.    34.
    32.    30.    28.    26.    25.    23.    21.    20.    19.    18.
    17.    16.    15.    14.    13.    12.    11.    11.    10.     9.
     8.     8.     7.     6.     5.     4.     4.     3.     2.     2.

    SUM      42214. CFS-PERIOD        872.20 ACRE-FEET

   ITQR   ITQO  NRCHS   LOCO  TATMR    LAG  NSTRL  NPULS  STORA    RES
     15     15      1   1363  0.         0      0      0     0.     0.

  AMSKK      X  QLOSS  CQLOS   NHGT    FIN  KPNCH
  0.250  0.        0.  0.         0     0.      0

HYDROGRAPH  1355   ROUTED TO  1363   NO. FLOWS= 120   INTERVAL=  15 MINUTES
     1.     1.     1.     1.     1.     1.     1.     1.     2.     2.
     3.     4.     5.     6.     8.    10.    12.    27.    96.   356.
   851.  1303.  1493.  1485.  1400.  1305.  1222.  1160.  1122.  1104.
  1102.  1109.  1120.  1134.  1146.  1157.  1164.  1168.  1165.  1154.
  1135.  1107.  1070.  1026.   975.   920.   863.   804.   747.   691.
   637.   587.   539.   496.   456.   420.   387.   357.   329.   303.
   281.   260.   240.   223.   207.   192.   179.   167.   155.   145.
   135.   126.   118.   110.   100.    90.    83.    77.    72.    68.
    63.    60.    56.    53.    49.    46.    44.    41.    39.    36.
    34.    32.    30.    28.    26.    25.    23.    22.    20.    19.
    18.    17.    16.    15.    14.    13.    12.    11.    11.    10.
     9.     8.     8.     7.     6.     5.     4.     4.     3.     2.

    SUM      42213. CFS-PERIOD        872.18 ACRE-FEET

   LOCI    NQI   ITQI   RTIO  IQAVG  IPRNT   NHGT    FIN  JPNCH     CH
   1363     90     15  0.         0      0      2     0.      0     0.

COMBINED HYDROGRAPH
AT 1363  NQ= 120    15-MIN INTRVL
     1.     1.     1.     1.     1.     1.     1.     1.     2.     2.
     3.     4.     5.     6.     8.    10.    12.    44.   178.   689.
  1485.  2038.  2203.  2144.  2011.  1872.  1748.  1648.  1574.  1524.
  1491.  1470.  1455.  1445.  1434.  1424.  1412.  1398.  1378.  1352.
  1318.  1277.  1228.  1172.  1111.  1046.   980.   912.   848.   784.
   724.   667.   613.   565.   520.   479.   442.   408.   376.   347.
```

322.	298.	275.	256.	237.	220.	205.	191.	177.	166.
154.	144.	135.	125.	114.	103.	95.	88.	83.	78.
72.	68.	64.	60.	56.	52.	50.	46.	44.	36.
34.	32.	30.	28.	26.	25.	23.	22.	20.	19.
18.	17.	16.	15.	14.	13.	12.	11.	11.	10.
9.	8.	8.	7.	6.	5.	4.	4.	3.	2.

SUM 53754. CFS-PERIOD 1110.63 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	2	1365	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1363 ROUTED TO 1365 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	3.	4.	5.	6.	8.	13.	39.	146.
431.	904.	1418.	1799.	1986.	2018.	1958.	1861.	1758.	1668.
1596.	1542.	1505.	1479.	1461.	1447.	1435.	1423.	1410.	1394.
1372.	1345.	1311.	1269.	1221.	1166.	1107.	1044.	979.	913.
849.	787.	727.	670.	617.	569.	524.	483.	445.	410.
379.	350.	324.	300.	278.	257.	239.	222.	206.	192.
179.	166.	155.	145.	135.	124.	114.	104.	96.	89.
83.	78.	73.	68.	64.	60.	56.	53.	50.	46.
42.	38.	35.	33.	30.	28.	27.	25.	23.	22.
20.	19.	18.	17.	16.	15.	14.	13.	12.	11.
11.	10.	9.	8.	8.	7.	6.	5.	4.	4.

SUM 53751. CFS-PERIOD 1110.55 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1365	60	15	0.	0	0	2	0.	0	0.

COMBINED HYDROGRAPH
AT 1365 NQ= 120 15-MIN INTRVL

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	3.	4.	5.	6.	8.	23.	87.	341.
797.	1316.	1801.	2140.	2289.	2287.	2197.	2074.	1947.	1836.
1745.	1675.	1623.	1584.	1554.	1530.	1509.	1489.	1468.	1446.
1418.	1386.	1347.	1301.	1250.	1192.	1130.	1064.	997.	929.
863.	800.	738.	680.	626.	577.	531.	489.	451.	415.
379.	350.	324.	300.	278.	257.	239.	222.	206.	192.
179.	166.	155.	145.	135.	124.	114.	104.	96.	89.
83.	78.	73.	68.	64.	60.	56.	53.	50.	46.
42.	38.	35.	33.	30.	28.	27.	25.	23.	22.
20.	19.	18.	17.	16.	15.	14.	13.	12.	11.
11.	10.	9.	8.	8.	7.	6.	5.	4.	4.

SUM 58194. CFS-PERIOD 1202.35 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	3	1368	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1365 ROUTED TO 1368 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	3.	4.	6.	11.	35.
109.	276.	555.	922.	1319.	1675.	1939.	2089.	2136.	2108.
2035.	1943.	1851.	1769.	1699.	1644.	1600.	1566.	1537.	1513.
1490.	1466.	1441.	1412.	1377.	1338.	1292.	1241.	1185.	1124.
1060.	995.	930.	865.	803.	743.	686.	632.	582.	536.
494.	455.	418.	385.	355.	328.	303.	281.	260.	241.
224.	208.	194.	180.	168.	156.	145.	135.	125.	115.

106.	98.	91.	84.	79.	74.	69.	64.	60.	57.
53.	49.	46.	42.	39.	36.	33.	31.	29.	27.
25.	23.	22.	20.	19.	18.	17.	16.	15.	14.
13.	12.	11.	11.	10.	9.	8.	8.	7.	6.

SUM 58182. CFS-PERIOD 1202.11 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1368	70	15	0.	0	0	2	0.	0	0.

COMBINED HYDROGRAPH
AT 1368 NQ= 120 15-MIN INTRVL

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	3.	4.	6.	11.	83.
278.	524.	798.	1143.	1519.	1856.	2103.	2237.	2270.	2230.
2145.	2043.	1941.	1851.	1773.	1711.	1661.	1621.	1587.	1558.
1531.	1503.	1475.	1442.	1405.	1363.	1315.	1261.	1204.	1141.
1075.	1009.	942.	876.	813.	752.	694.	640.	589.	542.
500.	460.	423.	385.	355.	328.	303.	281.	260.	241.
224.	208.	194.	180.	168.	156.	145.	135.	125.	115.
106.	98.	91.	84.	79.	74.	69.	64.	60.	57.
53.	49.	46.	42.	39.	36.	33.	31.	29.	27.
25.	23.	22.	20.	19.	18.	17.	16.	15.	14.
13.	12.	11.	11.	10.	9.	8.	8.	7.	6.

SUM 61184. CFS-PERIOD 1264.14 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	3	1372	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1368 ROUTED TO 1372 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	3.	4.	8.
28.	85.	198.	370.	599.	877.	1186.	1495.	1767.	1974.
2103.	2156.	2148.	2098.	2024.	1943.	1863.	1791.	1728.	1676.
1633.	1595.	1563.	1532.	1502.	1471.	1437.	1398.	1355.	1307.
1254.	1197.	1136.	1073.	1008.	943.	878.	816.	756.	699.
645.	595.	548.	505.	464.	426.	391.	360.	332.	307.
284.	263.	244.	226.	210.	195.	182.	169.	157.	146.
135.	125.	116.	107.	99.	92.	85.	80.	74.	69.
65.	61.	57.	53.	49.	46.	42.	39.	36.	34.
31.	29.	27.	25.	24.	22.	21.	19.	18.	17.
16.	15.	14.	13.	12.	11.	11.	10.	9.	8.

SUM 61166. CFS-PERIOD 1263.76 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1372	50	15	0.	0	0	2	1.	0	0.

COMBINED HYDROGRAPH
AT 1372 NQ= 120 15-MIN INTRVL

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	3.	4.	48.
165.	277.	372.	514.	718.	976.	1268.	1563.	1823.	2020.
2141.	2188.	2174.	2120.	2042.	1958.	1875.	1801.	1736.	1683.
1639.	1600.	1563.	1532.	1502.	1471.	1437.	1398.	1355.	1307.
1254.	1197.	1136.	1073.	1008.	943.	878.	816.	756.	699.
645.	595.	548.	505.	464.	426.	391.	360.	332.	307.
284.	263.	244.	226.	210.	195.	182.	169.	157.	146.
135.	125.	116.	107.	99.	92.	85.	80.	74.	69.
65.	61.	57.	53.	49.	46.	42.	39.	36.	34.
31.	29.	27.	25.	24.	22.	21.	19.	18.	17.
16.	15.	14.	13.	12.	11.	11.	10.	9.	8.

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SUM     62522. CFS-PERIOD        1291.77 ACRE-FEET
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```
READY
BYE
00004.85  CRU    0000.05  TCH    0014.80  KC

OFF AT 13:54MST 12/29/78
```

APPENDIX "B"

Test Run No. 5

```
 HHH
U#=NER30500,
PASSWORD
[redacted]

ID:1840017

ENTER PHASE CODE:H

ENTER 1=BILLABLE OR 2=NONBILLABLE: 1

READY
TYP 6
READY
BST N9X1
N9X1 DONE
00038 RETURNED
00012 SUBMITTED
 SUBMITTED/PURGED FILES
HEC1DATA-SUBM'D
 SYSOUT REPORTS
N9X101$$-RET'D
N9X10174-RET'D
N9X10274-RET'D
N9X10206-RET'D
N9X100**-RET'D

READY
BLI N9X2
READY
BLI N9X10206;L,W132

BEGIN FILE - N9X10206

    SNUMB = MN9X1, ACTIVITY # = 02, REPORT CODE = 06, RECORD COUNT = 000941
```

GILA DRAIN
RDA 117 FUTURE CONDITIONS
311-372

IUNRG	LOCAL	LNGTH	IMNTH	IDAY	IYR	ITIME	RATIO	IPNCH
0	0	30	7	11	78	1200	0.	0

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1311	120	15	0.	0	0	0	0.	0	0.

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	10	1355	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1311 ROUTED TO 1355 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	2.	3.
3.	5.	6.	8.	9.	12.	15.	18.	22.	26.
31.	36.	43.	53.	70.	98.	141.	199.	270.	349.
429.	508.	581.	647.	705.	756.	798.	831.	853.	863.
862.	849.	825.	793.	755.	712.	668.	622.	577.	534.
492.	454.	418.	385.	355.	328.	303.	281.	260.	241.
224.	208.	194.	181.	169.	158.	147.	138.	129.	120.
113.	106.	99.	93.	87.	82.	77.	72.	67.	63.
59.	56.	52.	49.	46.	44.	41.	39.	36.	34.
32.	30.	28.	26.	25.	23.	21.	20.	19.	18.
17.	16.	15.	14.	13.	12.	11.	11.	10.	9.
8.	8.	7.	6.	5.	4.	4.	3.	2.	2.

SUM 22510. CFS-PERIOD 465.09 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1355	80	15	0.	0	0	-1	0.	0	0.

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1362	80	15	0.	0	0	3	0.	0	0.

COMBINED HYDROGRAPH
AT 1355 NQ= 120 15-MIN INTRVL

1.	1.	1.	1.	1.	1.	1.	1.	2.	3.
3.	5.	6.	8.	9.	12.	15.	56.	206.	766.
1430.	1629.	1547.	1415.	1302.	1212.	1149.	1111.	1095.	1096.
1105.	1119.	1134.	1148.	1158.	1166.	1170.	1168.	1158.	1139.
1111.	1075.	1029.	978.	922.	863.	805.	746.	690.	636.
585.	538.	493.	454.	417.	385.	355.	328.	302.	279.
259.	239.	222.	207.	192.	179.	166.	155.	145.	134.
126.	118.	109.	103.	87.	82.	77.	72.	67.	63.
59.	56.	52.	49.	46.	44.	41.	39.	36.	34.
32.	30.	28.	26.	25.	23.	21.	20.	19.	18.
17.	16.	15.	14.	13.	12.	11.	11.	10.	9.
8.	8.	7.	6.	5.	4.	4.	3.	2.	2.

SUM 42214. CFS-PERIOD 872.20 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1363	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1355 ROUTED TO 1363 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
3.	4.	5.	6.	8.	10.	12.	27.	96.	354.

851.	1303.	1493.	1485.	1400.	1305.	1222.	1160.	1122.	1104.
1102.	1109.	1120.	1134.	1146.	1157.	1164.	1168.	1165.	1154.
1135.	1107.	1070.	1026.	975.	920.	863.	804.	747.	691.
637.	587.	539.	496.	456.	420.	387.	357.	329.	303.
281.	260.	240.	223.	207.	192.	179.	167.	155.	145.
135.	126.	118.	110.	100.	90.	83.	77.	72.	68.
63.	60.	56.	53.	49.	46.	44.	41.	39.	36.
34.	32.	30.	28.	26.	25.	23.	22.	20.	19.
18.	17.	16.	15.	14.	13.	12.	11.	11.	10.
9.	8.	8.	7.	6.	5.	4.	4.	3.	2.

SUM 42213. CFS-PERIOD 872.18 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1363	90	15	0.	0	0	2	0.	0	0.

COMBINED HYDROGRAPH
AT 1363 NQ= 120 15-MIN INTRVL

1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
3.	4.	5.	6.	8.	10.	12.	44.	178.	689.
1485.	2038.	2203.	2144.	2011.	1872.	1748.	1648.	1574.	1524.
1491.	1470.	1455.	1445.	1434.	1424.	1412.	1398.	1378.	1352.
1318.	1277.	1228.	1172.	1111.	1046.	980.	912.	848.	784.
724.	667.	613.	565.	520.	479.	442.	408.	376.	347.
322.	298.	275.	256.	.237.	220.	205.	191.	177.	166.
154.	144.	135.	125.	114.	103.	95.	88.	83.	78.
72.	68.	64.	60.	56.	52.	50.	46.	44.	36.
34.	32.	30.	28.	26.	25.	23.	22.	20.	19.
18.	17.	16.	15.	14.	13.	12.	11.	11.	10.
9.	8.	8.	7.	6.	5.	4.	4.	3.	2.

SUM 53754. CFS-PERIOD 1110.63 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	2	1365	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1363 ROUTED TO 1365 NO. FLOWS= 120 INTERVAL= 15 MINUTES

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	3.	4.	5.	6.	8.	13.	39.	146.
431.	904.	1418.	1799.	1986.	2018.	1958.	1861.	1758.	1668.
1596.	1542.	1505.	1479.	1461.	1447.	1435.	1423.	1410.	1394.
1372.	1345.	1311.	1269.	1221.	1166.	1107.	1044.	979.	913.
849.	787.	727.	670.	617.	569.	524.	483.	445.	410.
379.	350.	324.	300.	278.	257.	239.	222.	206.	192.
179.	166.	155.	145.	135.	124.	114.	104.	96.	89.
83.	78.	73.	68.	64.	60.	56.	53.	50.	46.
42.	38.	35.	33.	30.	28.	27.	25.	23.	22.
20.	19.	18.	17.	16.	15.	14.	13.	12.	11.
11.	10.	9.	8.	8.	7.	6.	5.	4.	4.

SUM 53751. CFS-PERIOD 1110.55 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1365	60	15	0.	0	0	2	0.	0	0.

COMBINED HYDROGRAPH
AT 1365 NQ= 120 15-MIN INTRVL

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
2.	2.	3.	4.	5.	6.	8.	23.	87.	341.
797.	1316.	1801.	2140.	2289.	2287.	2197.	2074.	1947.	1836.
1745.	1675.	1623.	1584.	1554.	1530.	1509.	1489.	1468.	1446.
1418.	1386.	1347.	1301.	1250.	1192.	1130.	1064.	997.	929.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	577	[illegible]	[illegible]	[illegible]	[illegible]

```
     379.     350.     324.     300.     278.     257.     239.     222.     206.     192.
     179.     166.     155.     145.     135.     124.     114.     104.      96.      89.
      83.      78.      73.      68.      64.      60.      56.      53.      50.      46.
      42.      38.      35.      33.      30.      28.      27.      25.      23.      22.
      20.      19.      18.      17.      16.      15.      14.      13.      12.      11.
      11.      10.       9.       8.       8.       7.       6.       5.       4.       4.

     SUM      58194. CFS-PERIOD       1202.35 ACRE-FEET

    ITQR     ITQO    NRCHS     LOCO    TATMR      LAG    NSTRL    NPULS    STORA      RES
      15       15        3     1368    0.           0        0        0       0.       0.

   AMSKK        X    QLOSS    CQLOS     NHGT      FIN    KPNCH
   0.250    0.          0.    0.           0       0.        0

HYDROGRAPH  1365   ROUTED TO  1368   NO. FLOWS= 120   INTERVAL=  15 MINUTES
       1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
       1.       1.       2.       2.       2.       3.       4.       6.      11.      35.
     109.     276.     555.     922.    1319.    1675.    1939.    2089.    2136.    2108.
    2035.    1943.    1851.    1769.    1699.    1644.    1600.    1566.    1537.    1513.
    1490.    1466.    1441.    1412.    1377.    1338.    1292.    1241.    1185.    1124.
    1060.     995.     930.     865.     803.     743.     686.     632.     582.     536.
     494.     455.     418.     385.     355.     328.     303.     281.     260.     241.
     224.     208.     194.     180.     168.     156.     145.     135.     125.     115.
     106.      98.      91.      84.      79.      74.      69.      64.      60.      57.
      53.      49.      46.      42.      39.      36.      33.      31.      29.      27.
      25.      23.      22.      20.      19.      18.      17.      16.      15.      14.
      13.      12.      11.      11.      10.       9.       8.       8.       7.       6.

     SUM      58182. CFS-PERIOD       1202.11 ACRE-FEET

    LOCI      NQI     ITQI     RTIO    IQAVG    IPRNT     NHGT      FIN    JPNCH       CH
    1368       70       15    0.           0        0        2       0.        0       0.

COMBINED HYDROGRAPH
AT 1368  NQ= 120     15-MIN INTRVL
       1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
       1.       1.       2.       2.       2.       3.       4.       6.      11.      83.
     278.     524.     798.    1143.    1519.    1856.    2103.    2237.    2270.    2230.
    2145.    2043.    1941.    1851.    1773.    1711.    1661.    1621.    1587.    1558.
    1531.    1503.    1475.    1442.    1405.    1363.    1315.    1261.    1204.    1141.
    1075.    1009.     942.     876.     813.     752.     694.     640.     589.     542.
     500.     460.     423.     385.     355.     328.     303.     281.     260.     241.
     224.     208.     194.     180.     168.     156.     145.     135.     125.     115.
     106.      98.      91.      84.      79.      74.      69.      64.      60.      57.
      53.      49.      46.      42.      39.      36.      33.      31.      29.      27.
      25.      23.      22.      20.      19.      18.      17.      16.      15.      14.
      13.      12.      11.      11.      10.       9.       8.       8.       7.       6.

     SUM      61184. CFS-PERIOD       1264.14 ACRE-FEET

    ITQR     ITQO    NRCHS     LOCO    TATMR      LAG    NSTRL    NPULS    STORA      RES
      15       15        3     1372    0.           0        0        0       0.       0.

   AMSKK        X    QLOSS    CQLOS     NHGT      FIN    KPNCH
   0.250    0.          0.    0.           0       0.        0

HYDROGRAPH  1368   ROUTED TO  1372   NO. FLOWS= 120   INTERVAL=  15 MINUTES
       1.       1.       1.       1.       1.       1.       1.       1.       1.       1.
       1.       1.       1.       1.       1.       2.       2.       3.       4.       8.
      28.      85.     198.     370.     599.     877.    1186.    1495.    1767.    1974.
    2103.    2156.    2148.    2098.    2024.    1943.    1863.    1791.    1728.    1676.
    1633.    1595.    1563.    1532.    1502.    1471.    1437.    1398.    1355.    1307.
    1254.    1197.    1136.    1073.    1008.     943.     878.     816.     756.     699.
     645.     595.     548.     505.     464.     426.     391.     360.     332.     307.
     284      263      244      226      210      195      182      169      157      146
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 135.   125.   116.   107.    99.    92.    85.    80.    74.    69.
  65.    61.    57.    53.    49.    46.    42.    39.    36.    34.
  31.    29.    27.    25.    24.    22.    21.    19.    18.    17.
  16.    15.    14.    13.    12.    11.    11.    10.     9.     8.

  SUM      61166. CFS-PERIOD        1263.76 ACRE-FEET

  LOCI     NQI   ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
  1359      60     15   0.          0       0       0      0.       0      0.

  ITQR    ITQO  NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
    15      15      6    1361   0.          0       0       0      0.      0.

 AMSKK       X  QLOSS   CQLOS    NHGT     FIN   KPNCH
 0.250  0.         0.   0.          0      0.       0

HYDROGRAPH  1359   ROUTED TO  1361   NO. FLOWS= 120   INTERVAL=  15 MINUTES
    0.      0.     0.     0.     0.     0.     1.     1.     1.     2.
    2.      3.     3.     4.     4.     5.     5.     6.     6.     8.
   13.     29.    61.   114.   183.   253.   310.   345.   357.   352.
  333.    308.   280.   251.   224.   199.   176.   156.   138.   122.
  107.     95.    84.    74.    65.    57.    51.    45.    39.    35.
   31.     27.    24.    21.    19.    17.    15.    13.    11.    10.
    9.      7.     6.     5.     4.     3.     2.     1.     1.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.

  SUM       5133. CFS-PERIOD         106.05 ACRE-FEET

  LOCI     NQI   ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
  1356      50     15   0.          0       0       0      0.       0      0.

  ITQR    ITQO  NRCHS    LOCO   TATMR     LAG   NSTRL   NPULS   STORA     RES
    15      15     11    1357   0.          0       0       0      0.      0.

 AMSKK       X  QLOSS   CQLOS    NHGT     FIN   KPNCH
 0.250  0.         0.   0.          0      0.       0

HYDROGRAPH  1356   ROUTED TO  1357   NO. FLOWS= 120   INTERVAL=  15 MINUTES
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     2.     6.    17.    44.    96.   181.   302.   449.
  603.    738.   832.   872.   857.   796.   703.   595.   486.   384.
  295.    222.   164.   119.    85.    60.    41.    28.    18.    12.
    7.      4.     3.     2.     1.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.
    0.      0.     0.     0.     0.     0.     0.     0.     0.     0.

  SUM       9025. CFS-PERIOD         186.47 ACRE-FEET

  LOCI     NQI   ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
 13571      60     15   0.50        0       0       0      0.       0      0.

FLOW AT 13571  MULTIPLIED BY   0.500
    1.      3.     4.     5.     6.     7.     8.     9.    10.    11.
   12.     12.    13.    14.    14.    15.    16.    21.    30.    38.
  103.    172.   168.   150.   132.   116.   102.    90.    79.    67.
   57.     49.    42.    35.    30.    26.    22.    19.    16.    14.
```

3.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 1791. CFS-PERIOD 36.99 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1357	0.	0	0	3	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	0	0.	0

STOR-OUTFLOW TABLE

0.	0.	0.	57.	57.	10000.

HYDROGRAPH 13571 ROUTED TO 1357 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	1.	1.
2	2.	3.	1.
3	3.	4.	1.
4	4.	5.	1.
5	5.	6.	1.
6	6.	7.	1.
7	7.	8.	1.
8	8.	9.	1.
9	9.	10.	1.
10	10.	11.	1.
11	11.	12.	1.
12	12.	12.	1.
13	13.	13.	1.
14	13.	14.	1.
15	14.	14.	1.
16	14.	15.	1.
17	15.	16.	1.
18	19.	21.	1.
19	26.	30.	1.
20	34.	38.	1.
21	70.	87.	1.
22	138.	152.	1.
23	170.	175.	1.
24	159.	154.	1.
25	141.	137.	1.
26	124.	120.	1.
27	109.	105.	1.
28	96.	93.	1.
29	84.	82.	1.
30	73.	70.	1.
31	62.	59.	1.
32	53.	47.	1.
33	45.	43.	1.
34	38.	34.	1.
35	33.	31.	1.
36	28.	24.	1.
37	24.	23.	1.
38	20.	17.	1.
39	17.	17.	1.
40	15.	12.	1.
41	13.	13.	1.
42	11.	9.	1.
43	9.	10.	1.
44	8.	6.	1.
45	7.	7.	1.
46	6.	4.	1.
47	5.	6.	1.
48	4.	3.	1.
49	4.	4.	1.
50	3.	1.	1.

51	3.	4.	1.
52	1.	0.	0.
53	0.	0.	0.
54	0.	0.	0.
55	0.	0.	0.
56	0.	0.	0.
57	0.	0.	0.
58	0.	0.	0.
59	0.	0.	0.
60	0.	0.	0.
61	0.	0.	0.
62	0.	0.	0.
63	0.	0.	0.
64	0.	0.	0.
65	0.	0.	0.
66	0.	0.	0.
67	0.	0.	0.
68	0.	0.	0.
69	0.	0.	0.
70	0.	0.	0.
71	0.	0.	0.
72	0.	0.	0.
73	0.	0.	0.
74	0.	0.	0.
75	0.	0.	0.
76	0.	0.	0.
77	0.	0.	0.
78	0.	0.	0.
79	0.	0.	0.
80	0.	0.	0.
81	0.	0.	0.
82	0.	0.	0.
83	0.	0.	0.
84	0.	0.	0.
85	0.	0.	0.
86	0.	0.	0.
87	0.	0.	0.
88	0.	0.	0.
89	0.	0.	0.
90	0.	0.	0.
91	0.	0.	0.
92	0.	0.	0.
93	0.	0.	0.
94	0.	0.	0.
95	0.	0.	0.
96	0.	0.	0.
97	0.	0.	0.
98	0.	0.	0.
99	0.	0.	0.
100	0.	0.	0.
101	0.	0.	0.
102	0.	0.	0.
103	0.	0.	0.
104	0.	0.	0.
105	0.	0.	0.
106	0.	0.	0.
107	0.	0.	0.
108	0.	0.	0.
109	0.	0.	0.
110	0.	0.	0.
111	0.	0.	0.
112	0.	0.	0.
113	0.	0.	0.
114	0.	0.	0.
115	0.	0.	0.

116	0.	0.	0.
117	0.	0.	0.
118	0.	0.	0.
119	0.	0.	0.
120	0.	0.	0.

SUM 1791. CFS-PERIOD 37.00 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
13572	60	15	0.50	0	0	0	0.	0	0.

FLOW AT 13572 MULTIPLIED BY 0.500

1.	3.	4.	5.	6.	7.	8.	9.	10.	11.
12.	12.	13.	14.	14.	15.	16.	21.	30.	38.
103.	172.	168.	150.	132.	116.	102.	90.	79.	67.
57.	49.	42.	35.	30.	26.	22.	19.	16.	14.
12.	10.	9.	7.	6.	5.	5.	4.	3.	3.
3.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 1791. CFS-PERIOD 36.99 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1357	0.	0	0	4	0.	1.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.	0.	0.	0.	3	0.	0

STOR-OUTFLOW TABLE

0.	0.	0.	219.	19.	219.	19.	10000.

HYDROGRAPH 13572 ROUTED TO 1357 NO. FLOWS= 120 INTERVAL= 15 MINUTES

PER	INFLOW	OUTFLOW	STOR
1	1.	1.	1.
2	2.	3.	1.
3	3.	4.	1.
4	4.	5.	1.
5	5.	6.	1.
6	6.	7.	1.
7	7.	8.	1.
8	8.	9.	1.
9	9.	10.	1.
10	10.	11.	1.
11	11.	12.	1.
12	12.	12.	1.
13	13.	13.	1.
14	13.	14.	1.
15	14.	14.	1.
16	14.	15.	1.
17	15.	16.	1.
18	19.	21.	1.
19	26.	30.	1.
20	34.	38.	1.
21	70.	103.	1.
22	138.	172.	1.
23	170.	168.	1.
24	159.	150.	1.
25	141.	132.	1.
26	124.	116.	1.
27	109.	102.	1.
28	96.	90.	1.
29	84.	79.	1.
30	73.	67.	1.
31	62.	57.	1.
32	53.	49.	1.
33	45.	42.	1.
34	38.	35.	1.

35	33.	30.	1.
36	28.	26.	1.
37	24.	22.	1.
38	20.	19.	1.
39	17.	16.	1.
40	15.	14.	1.
41	13.	12.	1.
42	11.	10.	1.
43	9.	9.	1.
44	8.	7.	1.
45	7.	6.	1.
46	6.	5.	1.
47	5.	5.	1.
48	4.	4.	1.
49	4.	3.	1.
50	3.	3.	1.
51	3.	3.	1.
52	1.	0.	1.
53	0.	0.	1.
54	0.	0.	1.
55	0.	0.	1.
56	0.	0.	1.
57	0.	0.	1.
58	0.	0.	1.
59	0.	0.	1.
60	0.	0.	1.
61	0.	0.	1.
62	0.	0.	1.
63	0.	0.	1.
64	0.	0.	1.
65	0.	0.	1.
66	0.	0.	1.
67	0.	0.	1.
68	0.	0.	1.
69	0.	0.	1.
70	0.	0.	1.
71	0.	0.	1.
72	0.	0.	1.
73	0.	0.	1.
74	0.	0.	1.
75	0.	0.	1.
76	0.	0.	1.
77	0.	0.	1.
78	0.	0.	1.
79	0.	0.	1.
80	0.	0.	1.
81	0.	0.	1.
82	0.	0.	1.
83	0.	0.	1.
84	0.	0.	1.
85	0.	0.	1.
86	0.	0.	1.
87	0.	0.	1.
88	0.	0.	1.
89	0.	0.	1.
90	0.	0.	1.
91	0.	0.	1.
92	0.	0.	1.
93	0.	0.	1.
94	0.	0.	1.
95	0.	0.	1.
96	0.	0.	1.
97	0.	0.	1.
98	0.	0.	1.
99	0.	0.	1.
100	0	0	1

101	0.	0.	1.
102	0.	0.	1.
103	0.	0.	1.
104	0.	0.	1.
105	0.	0.	1.
106	0.	0.	1.
107	0.	0.	1.
108	0.	0.	1.
109	0.	0.	1.
110	0.	0.	1.
111	0.	0.	1.
112	0.	0.	1.
113	0.	0.	1.
114	0.	0.	1.
115	0.	0.	1.
116	0.	0.	1.
117	0.	0.	1.
118	0.	0.	1.
119	0.	0.	1.
120	0.	0.	1.

SUM 1791. CFS-PERIOD 36.99 ACRE-FEET

COMBINED HYDROGRAPH
AT 1357 NQ= 120 15-MIN INTRVL

2.	5.	7.	9.	11.	13.	15.	17.	19.	21.
23.	24.	26.	27.	28.	29.	32.	42.	60.	75.
190.	324.	344.	309.	286.	280.	303.	363.	462.	586.
719.	834.	916.	941.	918.	845.	748.	631.	519.	410.
320.	241.	182.	132.	98.	69.	51.	35.	25.	16.
13.	4.	3.	2.	1.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 12607. CFS-PERIOD 260.47 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	4	1358	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1357 ROUTED TO 1358 NO. FLOWS= 120 INTERVAL= 15 MINUTES

2.	2.	2.	3.	4.	5.	7.	9.	11.	13.
15.	17.	19.	21.	22.	24.	25.	27.	29.	33.
42.	60.	95.	148.	205.	249.	275.	287.	297.	318.
359.	423.	509.	607.	704.	785.	838.	855.	835.	783.
706.	615.	520.	427.	343.	269.	207.	157.	117.	86.
63.	45.	32.	22.	15.	9.	6.	4.	2.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 12615. CFS-PERIOD 260.63 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1358	60	15	0.	0	0	2	0.	0	0.

COMBINED HYDROGRAPH

COMBINED HYDROGRAPH

AT 1358 NQ= 120 15-MIN INTRVL

2.	2.	2.	3.	4.	5.	7.	9.	11.	13.
15.	17.	19.	21.	22.	24.	25.	27.	29.	33.
168.	326.	355.	371.	396.	413.	416.	407.	400.	406.
435.	488.	565.	655.	745.	820.	868.	881.	857.	802.
722.	629.	532.	437.	352.	276.	213.	162.	122.	86.
63.	45.	32.	22.	15.	9.	6.	4.	2.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 14799. CFS-PERIOD 305.75 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	6	1361	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1358 ROUTED TO 1361 NO. FLOWS= 120 INTERVAL= 15 MINUTES

2.	2.	2.	2.	2.	2.	2.	3.	3.	4.
5.	6.	8.	9.	11.	13.	15.	17.	19.	20.
22.	26.	35.	56.	92.	143.	199.	254.	302.	339.
366.	384.	396.	407.	424.	450.	488.	539.	598.	661.
719.	765.	791.	794.	774.	732.	673.	602.	525.	447.
372.	304.	243.	191.	147.	112.	84.	62.	45.	32.
23.	16.	11.	7.	5.	3.	2.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 14811. CFS-PERIOD 306.00 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1360	40	15	0.	0	0	0	0.	0	0.

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	13	1361	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

EXP UNDERFLO AT LOCATION 035452
EXP UNDERFLO AT LOCATION 035445
EXP UNDERFLO AT LOCATION 035436

HYDROGRAPH 1360 ROUTED TO 1361 NO. FLOWS= 120 INTERVAL= 15 MINUTES

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	2.	5.	15.	37.	78.	146.	242.
361.	491.	611.	705.	756.	762.	725.	655.	565.	468.
373.	288.	216.	157.	111.	77.	52.	34.	22.	14.
9.	5.	3.	2.	1.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 7991. CFS-PERIOD 165.10 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1361	60	15	0.	0	0	4	0.	0	0.

COMBINED HYDROGRAPH
AT 1361 NQ= 120 15-MIN INTRVL

2.	2.	2.	2.	2.	2.	3.	4.	4.	6.
7.	9.	11.	13.	16.	18.	20.	22.	25.	197.
546.	737.	734.	728.	764.	830.	910.	995.	1080.	1171.
1268.	1363.	1444.	1499.	1523.	1514.	1478.	1428.	1369.	1310.
1251.	1191.	1129.	1058.	980.	892.	798.	700.	603.	510.
424.	347.	279.	222.	174.	135.	104.	80.	56.	42.
31.	23.	17.	12.	9.	6.	4.	2.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 34141. CFS-PERIOD 705.38 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1364	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1361 ROUTED TO 1364 NO. FLOWS= 120 INTERVAL= 15 MINUTES

2.	2.	2.	2.	2.	2.	2.	3.	4.	5.
6.	7.	9.	11.	13.	16.	18.	20.	23.	82.
275.	519.	663.	709.	733.	776.	838.	914.	996.	1082.
1174.	1268.	1358.	1434.	1485.	1507.	1500.	1469.	1422.	1367.
1309.	1250.	1190.	1126.	1055.	975.	888.	795.	700.	604.
513.	428.	351.	284.	227.	179.	139.	108.	81.	60.
44.	33.	24.	18.	13.	9.	6.	4.	3.	2.
1.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 34143. CFS-PERIOD 705.42 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1364	50	15	0.	0	0	2	0.	0	0.

COMBINED HYDROGRAPH
AT 1364 NQ= 120 15-MIN INTRVL

2.	2.	2.	2.	2.	2.	2.	3.	4.	5.
6.	7.	9.	11.	13.	16.	18.	20.	81.	459.
1014.	1324.	1367.	1294.	1218.	1178.	1171.	1190.	1225.	1272.
1331.	1399.	1466.	1524.	1559.	1569.	1551.	1511.	1457.	1396.
1333.	1270.	1207.	1140.	1066.	984.	896.	802.	705.	608.
513.	428.	351.	284.	227.	179.	139.	108.	81.	60.
44.	33.	24.	18.	13.	9.	6.	4.	3.	2.
1.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 40224. CFS-PERIOD 831.06 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	2	1367	0.	0	0	0	0.	0.

AMSKK X QLOSS CQLOS NHGT FIN KPNCH

```
 0.250  0.        0.    0.          0       0.        0

HYDROGRAPH  1364   ROUTED TO  1367   NO. FLOWS= 120   INTERVAL=  15 MINUTES
     2.      2.      2.      2.      2.      2.      2.      2.      3.      3.
     4.      5.      6.      8.      9.     11.     13.     16.     24.     86.
   278.    599.    927.   1146.   1236.   1242.   1218.   1197.   1194.   1209.
  1240.   1285.   1341.   1402.   1460.   1508.   1537.   1544.   1529.   1494.
  1447.   1391.   1331.   1269.   1204.   1134.   1059.    978.    890.    798.
   704.    610.    519.    436.    360.    293.    236.    187.    147.    114.
    87.     65.     49.     36.     27.     20.     14.     10.      7.      5.
     3.      2.      1.      1.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

     SUM      40228. CFS-PERIOD        831.15 ACRE-FEET

    LOCI     NQI    ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
    1366      40      15    0.         0       0       0      0.       0      0.

    ITQR    ITQO   NRCHS    LOCO   TATMR     LAG   NSTRL  NPULS   STORA     RES
      15      15      16    1367  0.           0       0       0     0.      0.

   AMSKK       X   QLOSS   CQLOS    NHGT     FIN   KPNCH
   0.250  0.       0.    0.          0      0.       0
      EXP UNDERFLO  AT LOCATION     035452
      EXP UNDERFLO  AT LOCATION     035445
      EXP UNDERFLO  AT LOCATION     035436
      EXP UNDERFLO  AT LOCATION     035452
      EXP UNDERFLO  AT LOCATION     035445
      EXP UNDERFLO  AT LOCATION     035436

HYDROGRAPH  1366   ROUTED TO  1367   NO. FLOWS= 120   INTERVAL=  15 MINUTES
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      1.      4.     10.     21.     41.
    71.    114.    166.    224.    280.    326.    357.    368.    360.    336.
   299.    255.    209.    166.    127.     94.     68.     48.     32.     22.
    14.      9.      6.      3.      2.      1.      1.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

     SUM       4036. CFS-PERIOD         83.39 ACRE-FEET

    LOCI     NQI    ITQI    RTIO   IQAVG   IPRNT    NHGT     FIN   JPNCH      CH
    1367      60      15    0.         0       0       3      0.       0      0.

COMBINED HYDROGRAPH
AT 1367  NQ= 120    15-MIN INTRVL
     2.      2.      2.      2.      2.      2.      2.      2.      3.      3.
     4.      5.      6.      8.      9.     11.     13.     16.     41.    360.
   895.   1302.   1564.   1696.   1708.   1649.   1571.   1508.   1474.   1471.
  1502.   1564.   1649.   1748.   1845.   1924.   1972.   1980.   1946.   1879.
  1788.   1683.   1571.   1462.   1354.   1249.   1144.   1040.    936.    831.
   727.    627.    532.    445.    367.    299.    237.    188.    147.    114.
    87.     65.     49.     36.     27.     20.     14.     10.      7.      5.
     3.      2.      1.      1.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```

SUM 50412. CFS-PERIOD 1041.56 ACRE-FEET

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	1	1371	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

HYDROGRAPH 1367 ROUTED TO 1371 NO. FLOWS= 120 INTERVAL= 15 MINUTES

2.	2.	2.	2.	2.	2.	2.	2.	2.	3.
3.	4.	5.	6.	8.	10.	11.	13.	23.	141.
465.	887.	1251.	1504.	1636.	1665.	1628.	1569.	1517.	1487.
1487.	1518.	1577.	1658.	1750.	1840.	1912.	1955.	1960.	1928.
1865.	1779.	1678.	1570.	1462.	1355.	1249.	1145.	1040.	936.
831.	728.	629.	535.	449.	372.	302.	242.	192.	151.
117.	90.	68.	51.	38.	28.	21.	15.	11.	8.
5.	4.	2.	1.	1.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 50414. CFS-PERIOD 1041.60 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1369	40	15	0.	0	0	0	0.	0	0.

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	14	1371	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

EXP UNDERFLO AT LOCATION 035452
EXP UNDERFLO AT LOCATION 035445
EXP UNDERFLO AT LOCATION 035436
EXP UNDERFLO AT LOCATION 035452
EXP UNDERFLO AT LOCATION 035445
EXP UNDERFLO AT LOCATION 035436

HYDROGRAPH 1369 ROUTED TO 1371 NO. FLOWS= 120 INTERVAL= 15 MINUTES

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	4.	9.	19.	37.	63.
97.	136.	175.	208.	229.	236.	229.	210.	184.	154.
123.	95.	70.	51.	35.	24.	16.	10.	6.	4.
2.	1.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUM 2431. CFS-PERIOD 50.23 ACRE-FEET

LOCI	NQI	ITQI	RTIO	IQAVG	IPRNT	NHGT	FIN	JPNCH	CH
1370	40	15	0.	0	0	0	0.	0	0.

ITQR	ITQO	NRCHS	LOCO	TATMR	LAG	NSTRL	NPULS	STORA	RES
15	15	10	1371	0.	0	0	0	0.	0.

AMSKK	X	QLOSS	CQLOS	NHGT	FIN	KPNCH
0.250	0.	0.	0.	0	0.	0

EXP UNDERFLO AT LOCATION 035452
EXP UNDERFLO AT LOCATION 035445

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          EXP UNDERFLO  AT LOCATION     035436
          EXP UNDERFLO  AT LOCATION     035452
          EXP UNDERFLO  AT LOCATION     035445
          EXP UNDERFLO  AT LOCATION     035436

HYDROGRAPH  1370   ROUTED TO  1371   NO. FLOWS= 120   INTERVAL=  15 MINUTES
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       2.       6.      15.      33.      60.      95.     132.     164.
     183.     187.     176.     155.     128.      99.      74.      52.      36.      23.
      15.       9.       5.       3.       2.       1.       1.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

     SUM        1655. CFS-PERIOD          34.19 ACRE-FEET

     LOCI      NQI     ITQI     RTIO    IQAVG    IPRNT     NHGT      FIN    JPNCH       CH
     1371       60       15    0.           0        0        4       0.        0       0.

COMBINED HYDROGRAPH
AT 1371  NQ= 120    15-MIN INTRVL
       2.       2.       2.       2.       2.       2.       2.       2.       2.       3.
       3.       4.       5.       6.       8.      10.      11.      13.      23.     452.
    1222.    1759.    2044.    2191.    2237.    2204.    2130.    2055.    2006.    1989.
    2003.    2044.    2103.    2170.    2235.    2286.    2310.    2299.    2251.    2166.
    2055.    1927.    1792.    1657.    1527.    1404.    1286.    1173.    1063.     955.
     844.     740.     638.     543.     455.     377.     307.     242.     192.     151.
     117.      90.      68.      51.      38.      28.      21.      15.      11.       8.
       5.       4.       2.       1.       1.       1.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

     SUM       62055. CFS-PERIOD        1282.12 ACRE-FEET

     ITQR     ITQO    NRCHS     LOCO    TATMR      LAG    NSTRL    NPULS    STORA      RES
       15       15        1     1372    0.           0        0        0       0.       0.

    AMSKK        X    QLOSS    CQLOS     NHGT      FIN    KPNCH
    0.      0.           0.   0.            0       0.        0

NO ROUTING PERFORMED

     LOCI      NQI     ITQI     RTIO    IQAVG    IPRNT     NHGT      FIN    JPNCH       CH
     1372       50       15    0.           0        0        3       1.        0       0.

COMBINED HYDROGRAPH
AT 1372  NQ= 120    15-MIN INTRVL
       3.       3.       3.       3.       3.       3.       3.       3.       3.       4.
       4.       5.       6.       7.       9.      11.      14.      16.      27.     500.
    1387.    2036.    2416.    2705.    2955.    3180.    3398.    3618.    3829.    4009.
    4144.    4232.    4277.    4290.    4278.    4244.    4185.    4100.    3987.    3849.
    3693.    3528.    3355.    3189.    3029.    2874.    2723.    2571.    2418.    2262.
    2099.    1937.    1774.    1615.    1463.    1320.    1186.    1058.     948.     850.
     762.     685.     616.     556.     502.     454.     412.     375.     343.     315.
     289.     266.     246.     228.     211.     196.     182.     169.     158.     146.
     135.     125.     116.     107.      99.      92.      85.      80.      74.      69.
      65.      61.      57.      53.      49.      46.      42.      39.      36.      34.
      31.      29.      27.      25.      24.      22.      21.      19.      18.      17.
      16.      15.      14.      13.      12.      11.      11.      10.       9.       8.
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SUM 124576. CFS-PERIOD 2573.89 ACRE-FEET

APPENDIX "C"

TYPICAL LICENSE FOR CONSTRUCTION OF UTILITY ON SRVWUA RIGHT-OF-WAY

LICENSE FOR CONSTRUCTION AND
OPERATION OF PIPE LINE

1. The SALT RIVER VALLEY WATER USERS' ASSOCIATION hereby grants to ______________________________ and the ______________________________ hereby accepts, a license to construct, operate and maintain a 10-3/4 in. pipe line for the ______________________________.

2. across the Salt River Project operated by the Salt River Valley Water Users' Association, said pipe line to be constructed and to cross the project of said Association at the points shown on the Map of said proposed pipe line attached hereto, marked "Exhibit A" and made a part hereof, upon the terms and conditions hereinafter set forth.

3. The licensee shall be liable for any and all damages to the property of the United States, or of any third party or parties, by reason of the exercise of the privileges conferred by this license.

4. If the Manager of said Project, or other proper officer, shall so direct, the licensee shall, upon sixty (60) days' written notice, at its own cost, either lower or raise the grade of its said pipe line, at any point where the same crosses the project of the Association, to a depth or height to be designated by the proper officer of the Association, so that said pipe line will not interfere with the construction, operation and maintenance of the Project. The licensee does hereby release the Association from all claims for damages that might arise by changing the grade of said pipe line as contemplated by this paragraph.

5. In case of the failure of the licensee to change the grade of said pipe line, as herein provided, within sixty (60) days after the receipt of written notice, the Association, or its assigns, may cause the grade of the same changed, and the expense so incurred shall be charged to and payable by the said licensee.

6. The said pipe line shall be so constructed as not to obstruct in any manner the flow of water in the canals, laterals or drain ditches of the United States, or to interfere in any manner whatsoever with the construction, operation and maintenance of any part of the Project.

7. In the erection of the aforesaid structure or structures the following specifications and conditions must be followed:

   All undercrossings not less than 18 inches below bottom grade of canal, lateral, or waste ditch.

   All overcrossings not less than 6 inches above maximum high water mark as indicated by stake set by Association. Overcrossings on bridges shall have some clearance as the bridge.

   Backfill at all undercrossings shall be puddled and tamped with 8 inch layers, for not less than 10 feet each side of centerline of canal, lateral, or waste ditch and in a manner satisfactory to Water Users' Association Engineer.

Except as otherwise provided herein, the terms and conditions of this agreement shall inure to the benefit of and be binding upon the heirs, executors, administrators, successors and assigns of the parties hereto; Provided, that Licensee shall not assign or transfer this agreement in whole or in part or permit any other person to use the right or privilege hereby given without the written consent of Licensor.

DATED at Phoenix, Arizona this _____ day of ____________________, 19___.

SALT RIVER VALLEY WATER USERS' ASSOCIATION

By ________________________________

General Superintendent

__________________________, Licensee

By ________________________________

APPENDIX "D"

SOILS INVESTIGATIONS

ENGINEERS TESTING LABORATORIES, INC.
3737 East Broadway Road
P. O. Box 21387
Phoenix, Arizona 85036
(602) 268-1381

Coe & Van Loo
4550 N. 12th Street
Phoenix, Arizona

5 March 1979

Attention: Mr. Bert Cutler, P. E.

Project: Gila Drain Improvements
Maricopa County, Arizona

Job No. 812-888
Inv. No. 112-1133

In accordance with your request, this firm has conducted soil engineering services at the above referenced project. The purpose of these services is to develop information relative to subsoil scour potential at sides and base of channel together with types, extent and apparent condition of subsoils.

It is understood that the channel improvements will result in a base width varying from 16 to 34 feet; the channel will be excavated as much as 13 feet below existing grade; will have a water depth of 10 feet when flowing full; and will probably have velocities of 3 to 6 feet per second when flowing full.

The existing drain is a rough graded unlined channel approximately 3 to 5 feet wide at the bottom, has side-slopes on the order of 1.5 to 1 (horizontal to vertical), and is 4 to 6 feet deep over most of the alignment except for the most southerly portion where depths may approach 12 to 15 feet. The ditch currently has an access road along each side.

Twenty one (21) test borings were drilled at the locations designated by Mr. Cutler and to depths of 15 feet (the maximum anticipated depth of channel cut). As evidenced by test borings and presented on the attached "Soil Boring Data" sheets, the subsoil types and stratification are somewhat variable across the length of the channel. The following is a generalization of subsoil types for various reaches of the channel.

Station From	Station To	Boring Logs	Material Depth Interval Range and Description
0+00	to 141+00±	#14 thru #21	0 - 5 to 8': Clay-sand mixed soils with predominant soil type of clayey sand. Occasional silty sand zones and sandy clay zones. Trace to light cementation generally occurring below depths of 2 to 4 feet.
0+00	to 141+00±	#14 thru #21	5 to 8' to bottom of boring: Predominantly sandy clay with occasional clayey sand zones. Light to moderate cementation generally occurring with occasional interbedded hardpan lenses.
141+00±	to 465+00±	#4 thru #13	0 - 5 to 7': Predominantly clayey sands of low plasticity. Some zones of sandy clay of low to medium plasticity. Non to very light cementation.
141+00±	to 465+00±	#4 thru #13	5 to 7' to bottom of boring: Predominantly clayey to silty sands of non to low plasticity. Occasional zones of silt-clay soils of low plasticity. Variable, light to moderate cementation with occasional lenses of hardpan.
465+00±	to 570+00±	#1 thru #4	0 - 5 to 6': Predominantly silty sands with occasional sandy silt-sandy clay zones.
465+00±	to 570+00±	#1 thru #4	5 to 6' to bottom of boring: Predominantly clayey to silty sands of non to low plasticity. Some zones of low to medium plasticity sandy clays. Occasional zones of clean sands. Variable cementation and some intermittent thin lenses of hardpan.

Gila Drain Improvements
Job No. 812-888

SCOUR POTENTIAL

The following allowable velocities are presented based upon the gradation and Atterberg limits testing accomplished and using design parameters of a 10 foot depth of water, 1.5 to 1 channel slopes and the assumption that flood flow will be sediment-laden. These velocities were determined using Figure 6-2 of the U. S. Department of Agricultural Soil Conservation Service "Design of Open Channels" October 1977 Technical Release No. 25 and assumes straight reaches. Where curves in the channel are developed the scour velocities would increase (i.e. allowable velocities would decrease).

Test Boring (depth)	Material	Allowable Velocity* (Sediment-Laden Flow)
1 (11-13')	Silty Sand (SM)	2.5 fps (2.5:1 side slopes)
2 (6-10')	Sandy Clay (CL)	7.2 fps (1.5:1 side slopes)
3 (7-10')	Clayey Sand (SC)	8.4 fps (1.5:1 side slopes)
7 (4-6')	Clayey Sand (SC)	7.9 fps (1.5:1 side slopes)
7 (8-10')	Silty Sand (SM)	2.5 fps (2.5:1 side slopes)
11 (3-5')	Sandy Silty Clay (CL)	5.7 fps (1.5:1 side slopes)
11 (13-15')	Silty Sand (SM)	2.5 fps (2.5:1 side slopes)
15 (6-8')	Clayey Sand (SC)	8.9 fps (1.5:1 side slopes)
15 (11-13')	Clayey Sand (SC)	9.7 fps (1.5:1 side slopes)
18 (3-5')	Silty Clay (ML-CL)	5.4 fps (1.5:1 side slopes)
18 (13-14')	Sandy Clay (CL)	9.8 fps (1.5:1 side slopes)
21 (8-10')	Sandy Clay-Clayey Sand (SC-CL)	9.8 fps (1.5:1 side slopes)
21 (13-15')	Clayey Sand (SC)	8.2 fps (1.5:1 side slopes)

*Lower allowable velocities would result where curved portions of the channel exist.

CHANNEL SLOPES

Channel slopes, excavated in the clayey sands, silty clays or sandy clays should remain stable under full flow at slopes of 1.5 to 1.0 (horizontal to vertical) provided that these materials are not underlain by erodable sands or that added surcharge loads do not develop at top of channel. Where the silty sands to clean sands are encountered, it is recommended that the slopes be flattened to 2:5 to 1 (horizontal to vertical).

Since the excavated slopes will be exposed to long periods of prolonged drying, some desiccation cracking and/or minor surface slumping may occur. Subsequent wetting, such as by adjacent surface flow runoff, would result in development of rivulets or rills (small erosion features). These features would be exaggerated where surface flow from washes intersects the channel. Therefore, the top of channel should be graded to direct small surface flows away from the slopes. Where major drainage swales, washes, etc. intersect the channel, some provision of erosion control in the form of rip-rap, slope planting, artificial liners (ditches, flumes, channels, etc.) should be considered.

EXCAVATION

Excavation to full channel depth can probably be accomplished with conventional earthmoving equipment. However, isolated zones of hardpan, "caliche", were encountered and may be difficult to excavate. Such zones could require the use of track-mounted and drawn single tooth rippers to aid in the breakup of caliche. Where these zones become massive, the use of pneumatic drills and/or blasting may also be required.

If we may be of further service to you or should you have any questions regarding the contents of this report please do not hesitate to contact the undersigned.

Respectfully submitted,
ENGINEERS TESTING LABORATORIES, INC.
Geotechnical Services

By: Glen K. Copeland
Glen K. Copeland, P.E.

Reviewed by: Kenneth L. Ricker
Kenneth L. Ricker, P.E.

/jm
3579
copies to: Addressee (3)

DEFINITION OF TERMINOLOGY

ALLOWABLE SOIL BEARING CAPACITY ALLOWABLE FOUNDATION PRESSURE	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
BACKFILL	A specified material placed and compacted in a confined area.
BASE COURSE	A layer of specified material placed on a subgrade or subbase.
BASE COURSE GRADE	Top of base course.
BENCH	A horizontal surface in a sloped deposit.
CAISSON	A concrete foundation element cast in a circular excavation which may have an enlarged base. Sometimes referred to as a cast-in-place pier.
CONCRETE SLABS-ON-GRADE	A concrete surface layer cast directly upon a base, subbase or subgrade.
CRUSHED ROCK BASE COURSE	A base course composed of crushed rock of a specified gradation.
DIFFERENTIAL SETTLEMENT	Unequal settlement between or within foundation elements of a structure.
ENGINEERED FILL	Specified material placed and compacted to specified density and/or moisture conditions under observation of a representative of a soil engineer.
EXISTING FILL	Materials deposited through the action of man prior to exploration of the site.
EXISTING GRADE	The ground surface at the time of field exploration.
EXPANSIVE POTENTIAL	The potential of a soil to expand (increase in volume) due to the absorption of moisture.
FILL	Materials deposited by the action of man.
FINISHED GRADE	The final grade created as a part of the project.
GRAVEL BASE COURSE	A base course composed of naturally occurring gravel with a specified gradation.
HEAVE	Upward movement.
NATIVE GRADE	The naturally occurring ground surface.
NATIVE SOIL	Naturally occurring on-site soil.
ROCK	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
SAND AND GRAVEL BASE	A base course of sand and gravel of a specified gradation.
SAND BASE COURSE	A base course composed primarily of sand of a specified gradation.
SCARIFY	To mechanically loosen soil or break down existing soil structure.
SETTLEMENT	Downward movement.
SOIL	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
STRIP	To remove from present location.

Continued on Reverse Side

Type of Material See Below Job No. 812-888

Source of Material --

Test Procedure Tested/Calc. By Date

Reviewed By Date

Hole No.	Location	Depth	Classification AASHTO	Classification Unified	LL	PI	Sieve Analysis - Accum % Passing 200	100	40	16	10	4	¼	⅜	¾	1	1½	2	3	Lab No./I.D.
1	see Site Plan	11-13'		SM	19	NP	18	22	44	70	79	91	93	95	97	100				
2	"	6-10'		CL	32	13	67	74	86	90	92	94	95	98	100					
3	"	7-10'		SC	37	16	31	39	62	68	70	74	77	86	100					
7	"	4-6'		SC	29	12	48	56	75	90	93	97	98	100						
7	"	8-10'		SM	19	NP	16	19	40	72	81	90	93	97	100					
11	"	3-5'		CL	25	8	80	88	96	99	Tr	100								
11	"	13-15'		SM	15	NP	20	25	50	82	88	93	95	97	100					
15	"	6-8'		SC	33	15	44	53	69	75	80	90	93	97	100					
15	"	11-13'		SC	34	17	40	46	57	66	72	84	88	94	100					
18	"	3-5'		ML-CL	24	6	56	68	85	89	90	92	94	95	98	100				
18	"	13-14'		CL	44	22	56	56	60	64	68	80	85	93	100					
21	"	8-10'		SC-CL	43	19	50	56	67	78	85	93	95	97	100					
21	"	13-15'		SC	35	13	40	46	57	70	80	92	94	97	100					

TABULATION OF TEST RESULTS

SOIL CLASSIFICATION AND LEGEND

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size.
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	

NOTE — Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols

FINE-GRAINED SOIL

MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

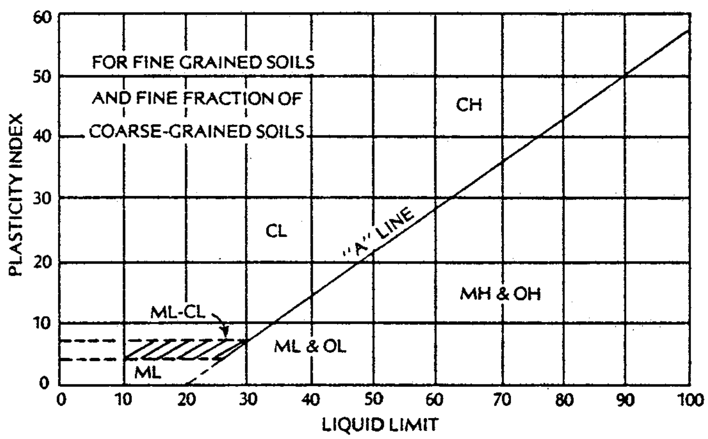
SOIL FRACTIONS

Component	Size Range
Boulders	Above 12 in.
Cobbles	3 in to 12 in.
Gravel	3 in. to No. 4 sieve
Coarse Gravel	3 in. to ¾ in.
Fine Gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

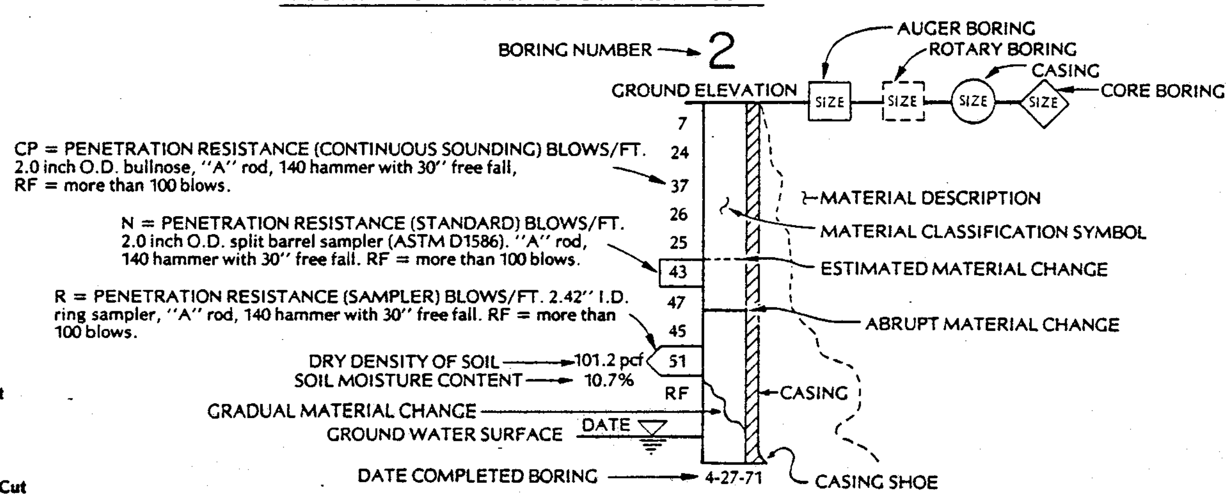
Soil Classification: ASTM D2487

Classification is visual unless accompanied by mechanical analysis and Atterberg limits. Percentage shown on log denotes visual approximation ± 5%.

PLASTICITY CHART



LEGEND OF BORING OPERATIONS



Sample Type

- **R** Ring
- **T** Shelby Tube
- **S** Standard Split Barrel
- **B** Block
- **G** Grab
- **C** Cutting
- **V** Vertical Face Cut

E

SOIL BORING DATA

Location of Boring Gila Drain No. 1 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By PT Date 2-23-79

Type/Size of Boring 6" Date 2-23-79 Driller JDH Reviewed By GKC Date 3-1-79

D-8

Depth Ft.	Penetration Resistance Blows/Ft.		Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Particle Size Distribution %					Gradation			Grain Shape				Relative Density			Dry Strength						Plasticity				Consistency					Cementation			
	C	N								Boulders	Cobbles	Gravel	Sand	Silt & Clay	Well	Med.	Poor	Angular	Subangular	Rounded	Subrounded	Low	Med	High	None	Very Low	Low	Medium	High	Very High	None	Low	Medium	High	Soft	Firm	Stiff	Very Stiff	Hard	None	Light	Moderate	Heavy
1					sli.		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5			X	X	X			X	X		X						X					–				X			
2					damp		very fine sand.						95	15																													
3																																											
4		5	S																																								
5																																											
6																																											
7					sli.		CLAYEY SAND-SILTY SAND; Tan	SM-SC	½"			Tr	70	10			X	X	X				X			X						X				–					X		
8					damp							20	90	30																													
9		13	S																																								
10																																											
1																																											
2																																											
3					sli.		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5			X	X	X			X	X		X						X					–				X			
4		28	S		damp		very fine sand.						95	15																													
5																																											
6																																											
7																																											
8																																											
9																																											
20							Stopped @ 15'																																				
1							No groundwater encountered																																				
2																																											
3																																											
4																																											
5																																											
6																																											
7																																											
8																																											
9																																											
30																																											

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring Gila Drain No. 2 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By PT Date 2-23-79

Type/Size of Boring 6" Date 2-23-79 Driller JDH Reviewed By GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					sli. damp		SILTY SAND-SANDY SILT; Light Brown-	SM-ML	#10				40	40
2							Tan						60	60
3														
4														
5														
6														
7														
8					nr. PL		SANDY SILTY CLAY; Brown	CL	#4				10	80
9													20	90
10														
1														
2					sli. damp		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5
3							very fine sand.						95	15
4					sli. damp		SAND; Light Brown; Fine to medium	SP	½"			Tr	90	Tr
5							sand.					5	95	5
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation Well	Med.	Poor	Grain Shape Angular	Subangular	Rounded	Subrounded	Relative Density Low	Med	High	Dry Strength None	Very Low	Low	Medium	High	Very High	Plasticity None	Low	Medium	High	Consistency Soft	Firm	Stiff	Very Stiff	Hard	Cementation None	Light	Moderate	Heavy
1			X	X	X			X				X					X	X								X			
2																													
3																													
4																													
5																													
6																													
7																										X			
8			X		X				–				X					X				X					X		
9																													
10																													
1																													
2			X	X	X			X	X		X						X						–			X			
3																													
4			X	X	X			X			X						X						–			X			
5																													
6																													
7																													
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9																													
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D-9

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No. 3 Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: PT Date: 2-23-79

Type/Size of Boring: 6" Date: 2-23-79 Driller: JDH Reviewed By: GKC Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					damp		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5
2							very fine sand.						95	15
3														
4														
5														
6														
7														
8														
9					damp		CLAYEY SAND-SILTY SAND; Tan	SM-SC	½"			Tr	70	10
10												20	90	30
1														
2														
3														
4					sli. damp		SILTY GRAVELLY SAND; Brown	SM	3/4"			5	85	Tr
5												15	90	10
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation: Well	Med.	Poor	Grain Shape: Angular	Subangular	Rounded	Subrounded	Relative Density: Low	Med	High	Dry Strength: None	Very Low	Low	Medium	High	Very High	Plasticity: None	Low	Medium	High	Consistency: Soft	Firm	Stiff	Very Stiff	Hard	Cementation: None	Light	Moderate	Heavy
1			X	X	X			X	X		X						X					–				X			
9			X	X	X				X			X						X				–					X		
4	X	X		X	X				X			X					X					–				X			

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain — No.: 4 — Job No.: 812-888

Elev. Top of Hole: — Datum: — Prepared By: PT — Date: 2-23-79

Type/Size of Boring: 6" — Date: 2-23-79 — Driller: JDH — Reviewed By: GKC — Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well, Med., Poor)	Grain Shape (Angular, Subangular, Rounded, Subrounded)	Relative Density (Low, Med, High)	Dry Strength (None, Very Low, Low, Medium, High, Very High)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate, Heavy)
1							CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40	X	X X	X	XX	XX	–	X
2					damp								60	60							X
3																					
4																					
5																					
6																					
7																					
8					damp		CLAYEY SAND-SILTY SAND; Tan	SM-SC	1/2"			Tr	70	10	X	XX	X	X	X	–	X
9												20	30	90							
10																					
1					well below		SANDY SILT-SANDY CLAY; Reddish	ML-CL	1"			Tr	25	60	X	X X	–	X	X	X	X
2					PL		Brown to Tan;					5	35	75							X
3							Hardpan lense @ 11' & 13'														
4							Hardpan lense @ 14.5' (very hard)														
5																					
6																					
7																					
8																					
9																					
20							Refusal @ 14.5'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-11

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No. 5 Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: PT Date: 2-23-79

Type/Size of Boring: 6" Date: 2-23-79 Driller: JDH Reviewed By: GKC Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					near PL		SANDY SILTY CLAY; Brown	CL	#4				10	80
2													20	90
3														
4							Thin hardpan lense @ 4½'±							
5														
6					sli. damp		CLAYEY SAND-SILTY SAND; Tan	SM-SC	½"			Tr	70	10
7					to damp							20	90	30
8														
9														
10														
1														
2														
3					sli. damp		SILTY GRAVELLY SAND; Brown	SM	3/4"			5	85	Tr
4												15	90	10
5														
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation Well	Gradation Med.	Gradation Poor	Grain Shape Angular	Grain Shape Subangular	Grain Shape Rounded	Grain Shape Subrounded	Relative Density Low	Relative Density Med	Relative Density High	Dry Strength None	Dry Strength Very Low	Dry Strength Low	Dry Strength Medium	Dry Strength High	Dry Strength Very High	Plasticity None	Plasticity Low	Plasticity Medium	Plasticity High	Consistency Soft	Consistency Firm	Consistency Stiff	Consistency Very Stiff	Consistency Hard	Cementation None	Cementation Light	Cementation Moderate	Cementation Heavy
1			X		X				–				X					X				X				X			
2																											X		
3																													
4																													
5																													
6			X	X	X				X			X						X				–					X		
7																													
8																													
9																													
10																													
1																													
2																													
3	X	X		X	X				X			X					X					–				X			
4																													
5																													
6																													
7																													
8																													
9																													
20																													
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
30																													

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No.: 6 Job No.: 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: PT Date: 2-23-79

Type/Size of Boring: 6" Date: 2-23-79 Driller: JDH Reviewed By: GKC Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well / Med. / Poor)	Grain Shape (Angular / Subangular / Rounded / Subrounded)	Relative Density (Low / Med / High)	Dry Strength (None / Very Low / Low / Medium / High / Very High)	Plasticity (None / Low / Medium / High)	Consistency (Soft / Firm / Stiff / Very Stiff / Hard)	Cementation (None / Light / Moderate / Heavy)
1					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40	X	X X	X	XX	XX	–	X
2													60	60							X
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10					very		GRAVELLY CLAYEY SAND; Light Brown	SM-SC	3"			Tr	50	20	X	X X	X	XX	XX	–	X
1					damp							20	70	40							
2							SANDY SILT-SANDY CLAY; Reddish	ML-CL	1"			Tr	25	60	X	X X	–	X	X	X	X
3				well	above	PL	Brown to Tan					5	35	75							X
4					very		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5							
5					damp		very fine sand.						95	15	XXX		XX	X	X	–	X
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-13

D-14

SOIL BORING DATA

E

Location of Boring: Gila Drain | No. 7 | Job No. 812-888

Elev. Top of Hole: ____ | Datum: ____ | Prepared By: PT | Date: 2-23-79

Type/Size of Boring: 6" | Date: 2-23-79 | Driller: JDH | Reviewed By: GKC | Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well / Med. / Poor)	Grain Shape (Angular / Subangular / Rounded / Subrounded)	Relative Density (Low / Med / High)	Dry Strength (None / Very Low / Low / Medium / High / Very High)	Plasticity (None / Low / Medium / High)	Consistency (Soft / Firm / Stiff / Very Stiff / Hard)	Cementation (None / Light / Moderate / Heavy)
1					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40	X	X X	X	XX	XX	-	X
2													60	60							X
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10					damp to		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5	X	XX	XX	X	X	-	X
1					very		very fine sand.						95	15							
2					damp																
3																					
4																					
5																					
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain — No. 8 — Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: PT — Date: 2-23-79

Type/Size of Boring: 6" — Date: 2-23-79 — Driller: JDH — Reviewed By: GKC — Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, in.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Grada-tion (Well / Med. / Poor)	Grain Shape (Angular / Subangular / Rounded / Subrounded)	Relative Density (Low / Med / High)	Dry Strength (None / Very Low / Low / Medium / High / Very High)	Plas-ticity (None / Low / Medium / High)	Consis-tency (Soft / Firm / Stiff / Very Stiff / Hard)	Cemen-tation (None / Light / Moderate / Heavy)
1					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40	X	X X	X	XX	XX	–	X
2													60	60							X
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10					damp		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5	X	XX	XX	X	X	–	X
1							very fine sand.						95	15							
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-15

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring Gila Drain No. 9 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By PT Date 2-23-79

Type/Size of Boring 6" Date 2-23-79 Driller JDH Reviewed By GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well, Med., Poor)	Grain Shape (Angular, Subangular, Rounded, Subrounded)	Relative Density (Low, Med, High)	Dry Strength (None, Very Low, Low, Medium, High, Very High)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate, Heavy)
1					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40	X	X X	X	XX	XX	⊢	X
2													60	60							X
3																					
4		22	S																		
5																					
6																					
7																					
8																					
9		30	S																		
10																					
1					damp to		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5	X	XX	XX	X	X	→	X
2					very damp		very fine sand. Trace cementation						95	15							
3							between 7-9'.														
4		15	S																		
5																					
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain   No.: 10   Job No.: 812-888

Elev. Top of Hole: ______   Datum: ______   Prepared By: PT   Date: 2-23-79

Type/Size of Boring: 6"   Date: 2-23-79   Driller: JDH   Reviewed By: GKC   Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation Well	Med.	Poor	Grain Shape Angular	Subangular	Rounded	Subrounded	Relative Density Low	Med	High	Dry Strength None	Very Low	Low	Medium	High	Very High	Plasticity None	Low	Medium	High	Consistency Soft	Firm	Stiff	Very Stiff	Hard	Cementation None	Light	Moderate	Heavy
1					damp	to	CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40			X		X		X		X				X	X				X	X				-			X			
2					sli.	damp							60	60																											X		
3																																											
4																																											
5																																											
6																																											
7																																											
8																																											
9					damp		SILTY SAND; Light Brown; Fine to	SM-SP	#4				85	5			X	X	X			X	X		X						X						-			X			
10							very fine sand.						95	15																													
1																																											
2																																											
3																																											
4																																											
5																																											
6																																											
7																																											
8																																											
9																																											
20							Stopped @ 15'																																				
1							No groundwater encountered																																				
2																																											
3																																											
4																																											
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9																																											
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D-17

E

SOIL BORING DATA

Location of Boring: Gila Drain — No. 11 — Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: JD — Date: 2-5-79

Type/Size of Boring: 6" — Date: 2-5-79 — Driller: Pete — Reviewed By: GKC — Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well / Med. / Poor)	Grain Shape (Angular / Subangular / Rounded / Subrounded)	Relative Density (Low / Med / High)	Dry Strength (None / Very Low / Low / Medium / High / Very High)	Plasticity (None / Low / Medium / High)	Consistency (Soft / Firm / Stiff / Very Stiff / Hard)	Cementation (None / Light / Moderate / Heavy)
1					near PL		SANDY SILTY CLAY; Brown	CL	#4				10	80	X	X	–	X	X	X	–
2													20	90							
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
1																					
2																					
3					damp		GRAVELLY CLAYEY SAND; Light Brown	SM-SC	3"			Tr	50	20	X	X X	X	XX	XX	–	X
4												20	70	40							
5																					
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-18

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No. 12 Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: JD Date: 2-5-79

Type/Size of Boring: 6" Date: 2-5-79 Driller: Rick Reviewed By: GKC Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft.		Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Particle Size Distribution %					Grada-tion			Grain Shape				Relative Density			Dry Strength						Plas-ticity				Consis-tency					Cemen-tation			
	C	N								Boulders	Cobbles	Gravel	Sand	Silt & Clay	Well	Med.	Poor	Angular	Subangular	Rounded	Subrounded	Low	Med	High	None	Very Low	Low	Medium	High	Very High	None	Low	Medium	High	Soft	Firm	Stiff	Very Stiff	Hard	None	Light	Moderate	Heavy
1					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4'				40	40			X		X		X		X				X	X				X	X			–				X			
2													60	60																											X		
3																																											
4																																											
5																																											
6																																											
7																																											
8																																											
9																																											
10					damp		GRAVELLY CLAYEY SAND; Light Brown	SM-SC	3"			Tr	50	20			X		X		X		X		X	X					X	X			–					X			
1												20	70	90																													
2																																											
3																																											
4																																											
5																																											
6																																											
7																																											
8																																											
9																																											
20							Stopped @ 15'																																				
1							No groundwater encountered																																				
2																																											
3																																											
4																																											
5																																											
6																																											
7																																											
8																																											
9																																											
30																																											

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain　No.: 13　Job No.: 812-888

Elev. Top of Hole: ______　Datum: ______　Prepared By: JD　Date: 2-5-79

Type/Size of Boring: 6"　Date: 2-5-79　Driller: Rick　Reviewed By: GKC　Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. in.	Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					near PL		SANDY SILT-SANDY CLAY; Reddish	ML-CL	1"			Tr	25	60
2							Brown to Tan					5	35	75
3														
4														
5														
6														
7														
8					damp		GRAVELLY CLAYEY SAND; Light Brown	SM-SC	3"			Tr	50	20
9												20	70	40
10														
1														
2														
3														
4														
5														
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation: Well	Med.	Poor	Grain Shape: Angular	Subangular	Rounded	Subrounded	Relative Density: Low	Med	High	Dry Strength: None	Very Low	Low	Medium	High	Very High	Plasticity: None	Low	Medium	High	Consistency: Soft	Firm	Stiff	Very Stiff	Hard	Cementation: None	Light	Moderate	Heavy
1			X		X		X		–				X					X				X				X			
2																											X		
8			X		X		X		X		X	X					X	X					–			X			

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No. 14 Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: JD Date: 2-5-79

Type/Size of Boring: 6" Date: 2-5-79 Driller: Rick Reviewed By: GKC Date: 3-1-79

D-21

Depth Ft.	Penetration Resistance Blows/Ft.		Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Particle Size Distribution %				
	C	N								Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL					40	40
2													60	60
3														
4														
5														
6														
7														
8														
9														
10					damp		SANDY CLAY; Light to Reddish Brown;							
1							Occasional thin gravel lenses,	CL	1"			Tr	30	50
2							variable calcite cementation.					10	40	65
3														
4														
5														
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation			Grain Shape				Relative Density			Dry Strength						Plasticity				Consistency					Cementation			
	Well	Med.	Poor	Angular	Subangular	Rounded	Subrounded	Low	Med	High	None	Very Low	Low	Medium	High	Very High	None	Low	Medium	High	Soft	Firm	Stiff	Very Stiff	Hard	None	Light	Moderate	Heavy
1			X		X		X		X				X	X				X	X							X			
2																													
3																													
4																													
5																											X		
6																													
7																													
8																													
9																													
10																													
1			X		X		X		–					X					X			X	X				X	X	
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
20																													
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5																													
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9																													
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NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring Gila Drain No. 15 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By PT Date 2-23-79

Type/Size of Boring 6" Date 2-23-79 Driller JDH Reviewed By GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well, Med., Poor)	Grain Shape (Angular, Subangular, Rounded, Subrounded)	Relative Density (Low, Med, High)	Dry Strength (None, Very Low, Low, Medium, High, Very High)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate, Heavy)
1					below PL		SANDY SILTY CLAY; Brown	CL	#4				10	80	X	X	–	X	X	X	X
2													20	90							X
3																					
4		19	S																		
5																					
6																					
7					sli. damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3.4"				40	40	X	X X	X	XX	XX	–	X
8													60	60							X
9		36	S																		
10																					
1																					
2																					
3					below PL		SANDY CLAY; Light to Reddish Brown;														
4		82	S				Occasional thin gravel lenses,	CL	1"			Tr	30	50	X	X X	–	X	X	XX	XX
5							variable calcite cementation.					10	40	65							
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-22

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No.: 16 Job No.: 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: JD Date: 2-5-79

Type/Size of Boring: 6" Date: 2-5-79 Driller: Rick Reviewed By: GKC Date: 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well, Med., Poor)	Grain Shape (Angular, Subangular, Rounded, Subrounded)	Relative Density (Low, Med, High)	Dry Strength (None, Very Low, Low, Medium, High, Very High)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate, Heavy)
1					damp to		CLAYEY SAND; Brown	SC	3/4"			Tr	70	20	X	X X	X	X	XX	-	X
2					sli. damp								80	30							
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10					well below		SANDY CLAY; Light To Reddish Brown	CL	1"			Tr	30	50	x	X x	-	X	x	XX	XX
1					PL		Occasional thin gravel lenses,					10	40	65							
2							variable calcite cementation.														
3																					
4																					
5																					
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-23

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring Gila Drain No. 17 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By JD Date 1-17-79

Type/Size of Boring 6" Date 1-17-79 Driller Pete Reviewed By GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					sli. damp		CLAYEY SAND; Brown	SC	3/4"			Tr	70	20
2													80	30
3					well below									
4					PL		SANDY SILT-SANDY CLAY; Reddish	ML-CL	1"			Tr	25	60
5							Brown to Tan					5	35	75
6														
7														
8					well below		SANDY CLAY; Light to Reddish Brown;	CL	1"			Tr	30	50
9					PL		Occasional thin gravel lenses,					10	40	65
10							variable calcite cementation.							
1														
2														
3														
4														
5														
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation Well	Med.	Poor	Grain Shape Angular	Subangular	Rounded	Subrounded	Relative Density Low	Med	High	Dry Strength None	Very Low	Low	Medium	High	Very High	Plasticity None	Low	Medium	High	Consistency Soft	Firm	Stiff	Very Stiff	Hard	Cementation None	Light	Moderate	Heavy
1			X		X		X		X				X					X	X				–			X			
2																													
3																													
4			X		X		X		–				X					X				X				X			
5																											X		
6																													
7																													
8			X		X		X		–					X					X			X	X				X	X	
9																													
10																													

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring Gila Drain No. 18 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By PT Date 2-23-79

Type/Size of Boring 6" Date 2-23-79 Driller JDH Reviewed By GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					damp		SAND; Light Brown; Fine to medium	SP	1/2"			Tr	90	Tr
2							sand.					5	95	5
3				well	above	PL	SANDY SILT-SANDY CLAY; Reddish Brown to Tan							
4		17	S				Gravel lense @ 5'	ML-CL	1"			Tr	25	60
5							Moderate cementation below 5'					5	35	75
6														
7				below PL			SANDY CLAY; Light to Reddish	CL	1"			Tr	30	50
8							Brown; Occasional thin gravel					10	40	65
9							lenses, variable calcite cemen-							
10		45	S				tation.							
1														
2							Hardpan lense @ 12'±							
3														
4		36	S	near	to	above								
5					PL									
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation Well	Gradation Med	Gradation Poor	Grain Shape Angular	Grain Shape Subangular	Grain Shape Rounded	Grain Shape Subrounded	Relative Density Low	Relative Density Med	Relative Density High	Dry Strength None	Dry Strength Very Low	Dry Strength Low	Dry Strength Medium	Dry Strength High	Dry Strength Very High	Plasticity None	Plasticity Low	Plasticity Medium	Plasticity High	Consistency Soft	Consistency Firm	Consistency Stiff	Consistency Very Stiff	Consistency Hard	Cementation None	Cementation Light	Cementation Moderate	Cementation Heavy
1			X	X	X			X			X						X						–			X			
2																													
3																													
4			X		X		X		–				X					X				X				X			
5																											X		
6																													
7			X		X		X		–					X					X			X	X				X	X	

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring Gila Drain No. 19 Job No. 812-888

Elev. Top of Hole ______ Datum ______ Prepared By JD Date 1-17-79

Type/Size of Boring 6" Date 1-17-79 Driller Pete Reviewed By GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well, Med., Poor)	Grain Shape (Angular, Subangular, Rounded, Subrounded)	Relative Density (Low, Med, High)	Dry Strength (None, Very Low, Low, Medium, High, Very High)	Plasticity (None, Low, Medium, High)	Consistency (Soft, Firm, Stiff, Very Stiff, Hard)	Cementation (None, Light, Moderate, Heavy)
1					near PL		SANDY SILTY CLAY; Brown	CL	#4				10	80	x	x	–	x	x	x	x
2													20	90							x
3																					
4																					
5					sli. damp		CLAYEY SAND; Brown	SC	3/4"			Tr	70	20	x	x x	x	x	xx	–	x
6													80	30							
7																					
8																					
9																					
10																					
1																					
2					well below		SANDY CLAY; Light to Reddish Brown														
3					PL		Occasional thin gravel lenses,	CL	1"			Tr	30	50	x	x x	–	x	x	xx	xx
4							variable calcite cementation.					10	40	65							
5																					
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Gila Drain No. 20 Job No. 812-888

Elev. Top of Hole: ____ Datum: ____ Prepared By: JD Date 1-17-79

Type/Size of Boring: 6" Date: 1-17-79 Driller: Pete Reviewed By: GKC Date 3-1-79

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay
1					near PL		SANDY SILTY CLAY; Brown	CL	#4				10	80
2													20	90
3														
4														
5					sli. damp		CLAYEY SAND; Brown	SC	3/4"			Tr	70	20
6													80	30
7														
8														
9														
10					well below		SANDY CLAY; Light to Reddish Brown;							
1					PL		Occasional thin gravel lenses,	CL	1"			Tr	30	50
2							variable calcite cementation.					10	40	65
3														
4														
5														
6														
7														
8														
9														
20							Stopped @ 15'							
1							No groundwater encountered							
2														
3														
4														
5														
6														
7														
8														
9														
30														

Depth Ft.	Gradation			Grain Shape				Relative Density			Dry Strength						Plasticity				Consistency					Cementation			
	Well	Med.	Poor	Angular	Subangular	Rounded	Subrounded	Low	Med	High	None	Very Low	Low	Medium	High	Very High	None	Low	Medium	High	Soft	Firm	Stiff	Very Stiff	Hard	None	Light	Moderate	Heavy
1			X		X				–				X					X				X				X			
2																											X		
3																													
4																													
5			X		X		X		X				X					X	X			–				X			
6																													
7																													
8																													
9																													
10																													
1			X		X		X		–					X				X				X	X				X	X	
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
20																													
1																													
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3																													
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5																													
6																													
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9																													
30																													

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E

SOIL BORING DATA

Location of Boring: Gila Drain No. 21 Job No. 812-888

Elev. Top of Hole: ______ Datum: ______ Prepared By: JD Date: 1-17-79

Type/Size of Boring: 6" Date: 1-17-79 Driller: Pete Reviewed By: GKC Date: 3-1-79

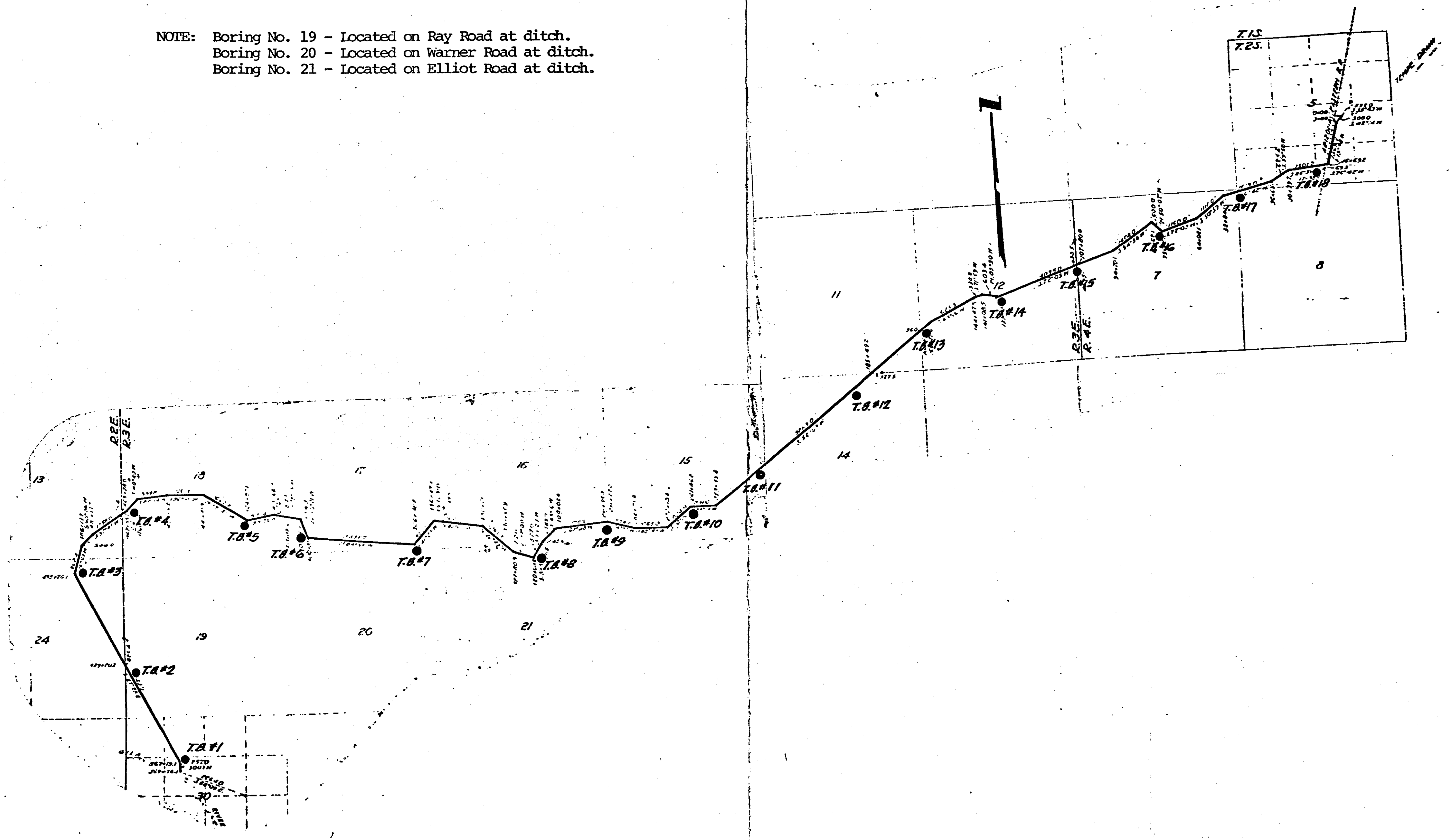
Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation (Well / Med. / Poor)	Grain Shape (Angular / Subangular / Rounded / Subrounded)	Relative Density (Low / Med / High)	Dry Strength (None / Very Low / Low / Medium / High / Very High)	Plasticity (None / Low / Medium / High)	Consistency (Soft / Firm / Stiff / Very Stiff / Hard)	Cementation (None / Light / Moderate / Heavy)
1					damp		CLAYEY SAND; Brown	SC	3/4"			Tr	70	20	X	X X	X	X	XX	–	X
2					to sli.								80	30							
3					damp																
4																					
5																					
6																					
7																					
8																					
9																					
10					damp		CLAYEY SAND-SANDY CLAY; Brown	SC-CL	3/4"				40	40	X	X X	X	XX	XX	–	X
1													60	60							X
2																					
3																					
4				sli.	damp		SAND; Light Brown; Fine to medium	SP	1/2"			Tr	90	Tr	X	XX	X	X	X	–	X
5							sand.					5	95	5							
6																					
7																					
8																					
9																					
20							Stopped @ 15'														
1							No groundwater encountered														
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

D-28

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

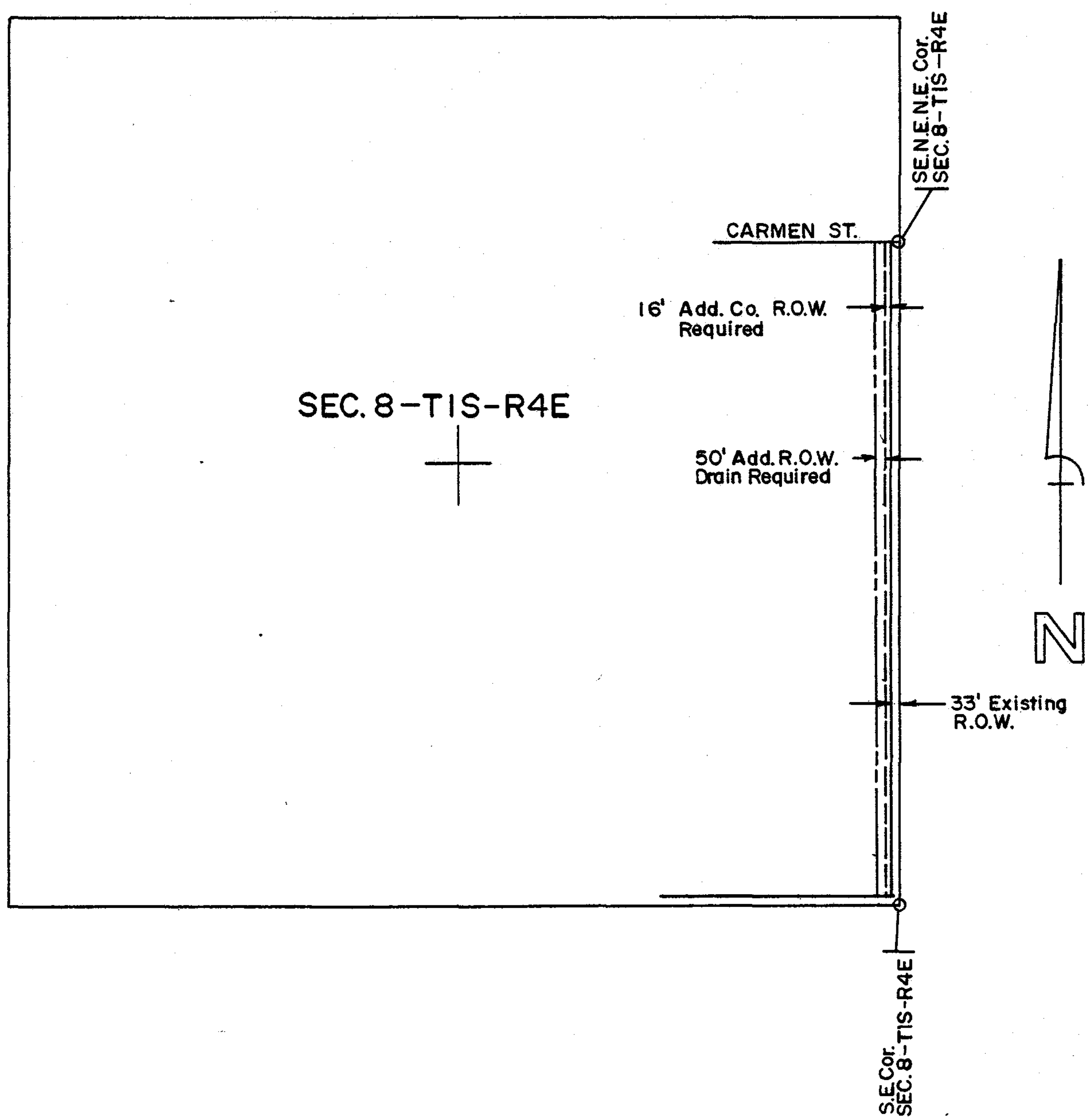
Job No. 812-888

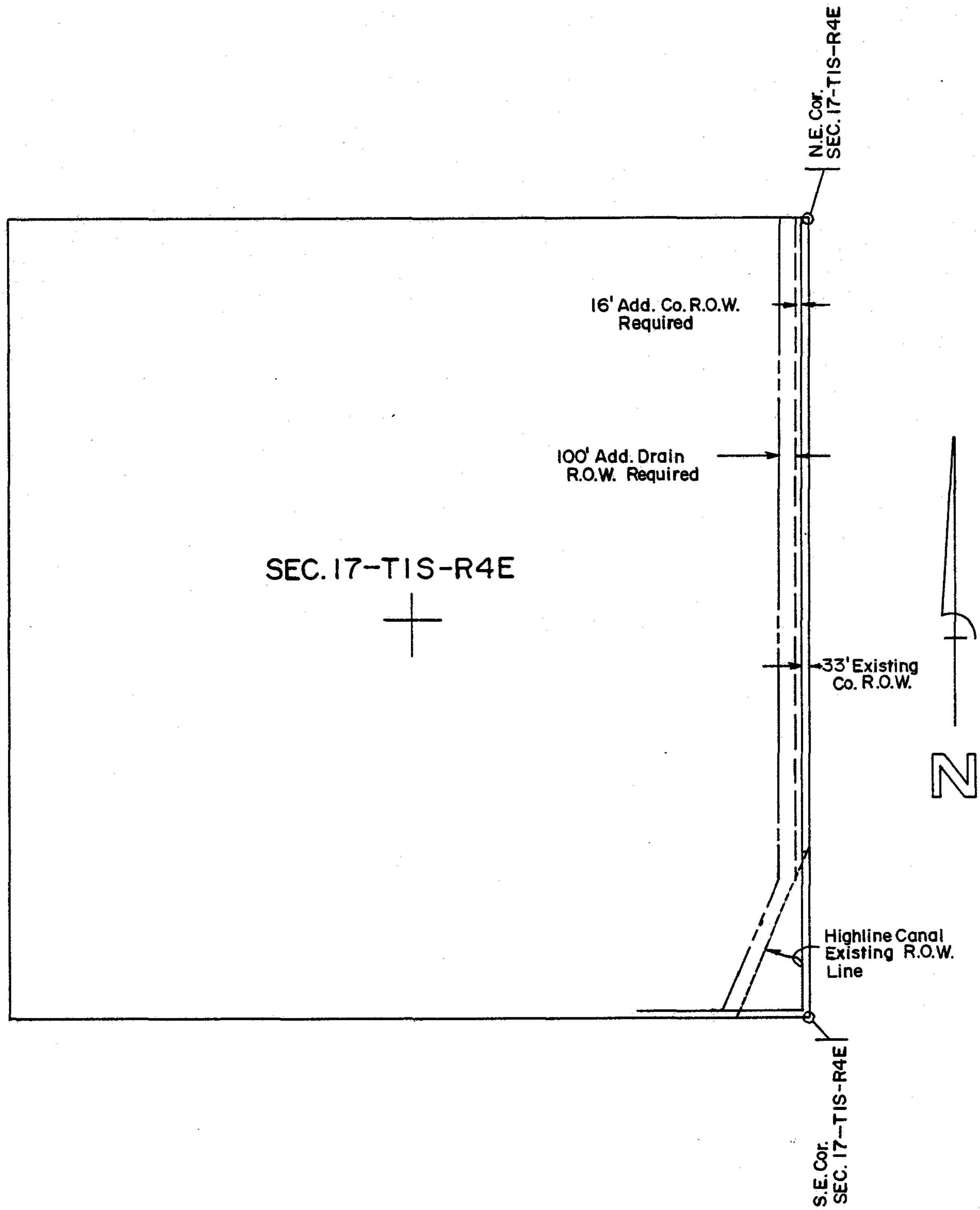
NOTE: Boring No. 19 - Located on Ray Road at ditch.
Boring No. 20 - Located on Warner Road at ditch.
Boring No. 21 - Located on Elliot Road at ditch.

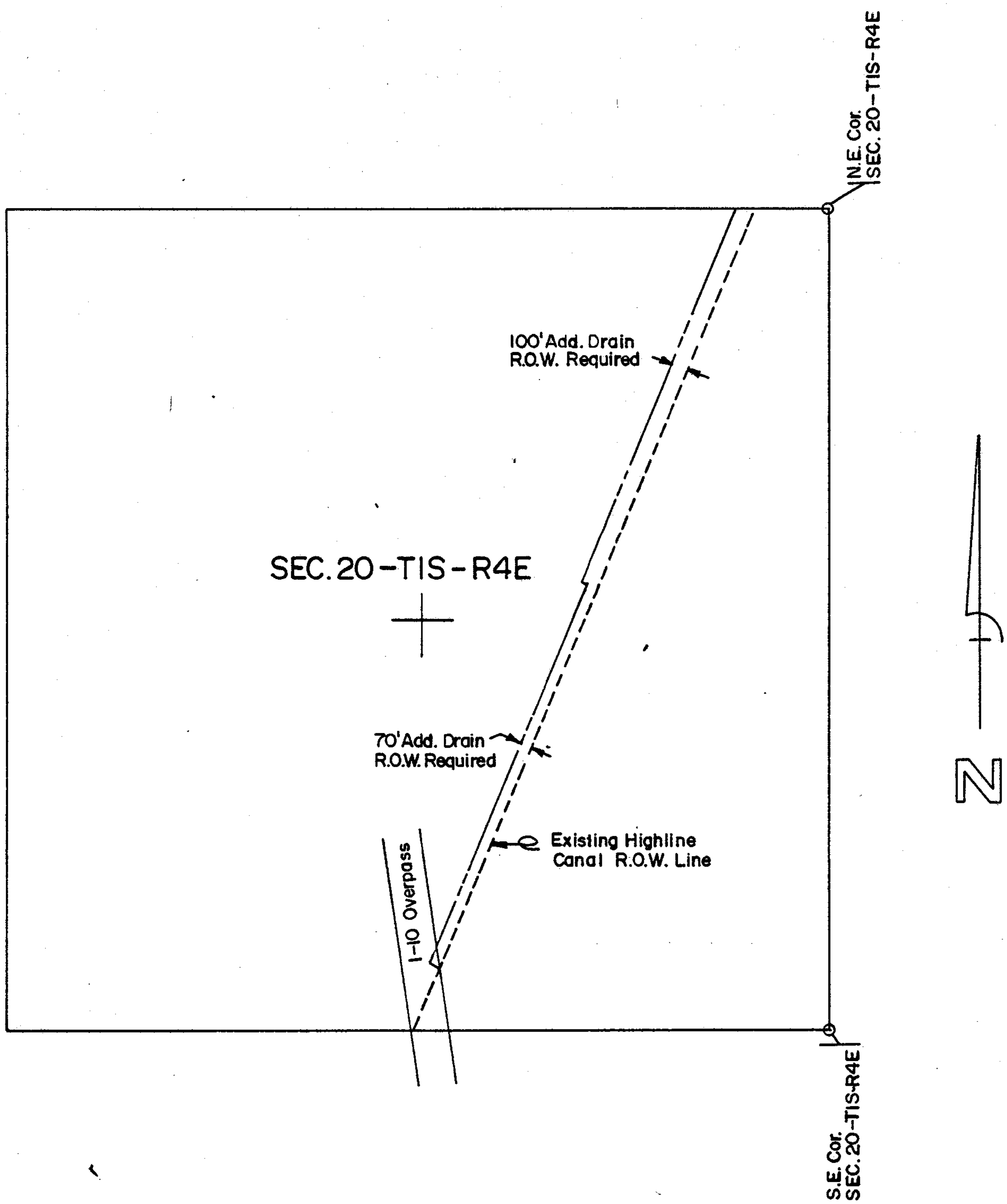


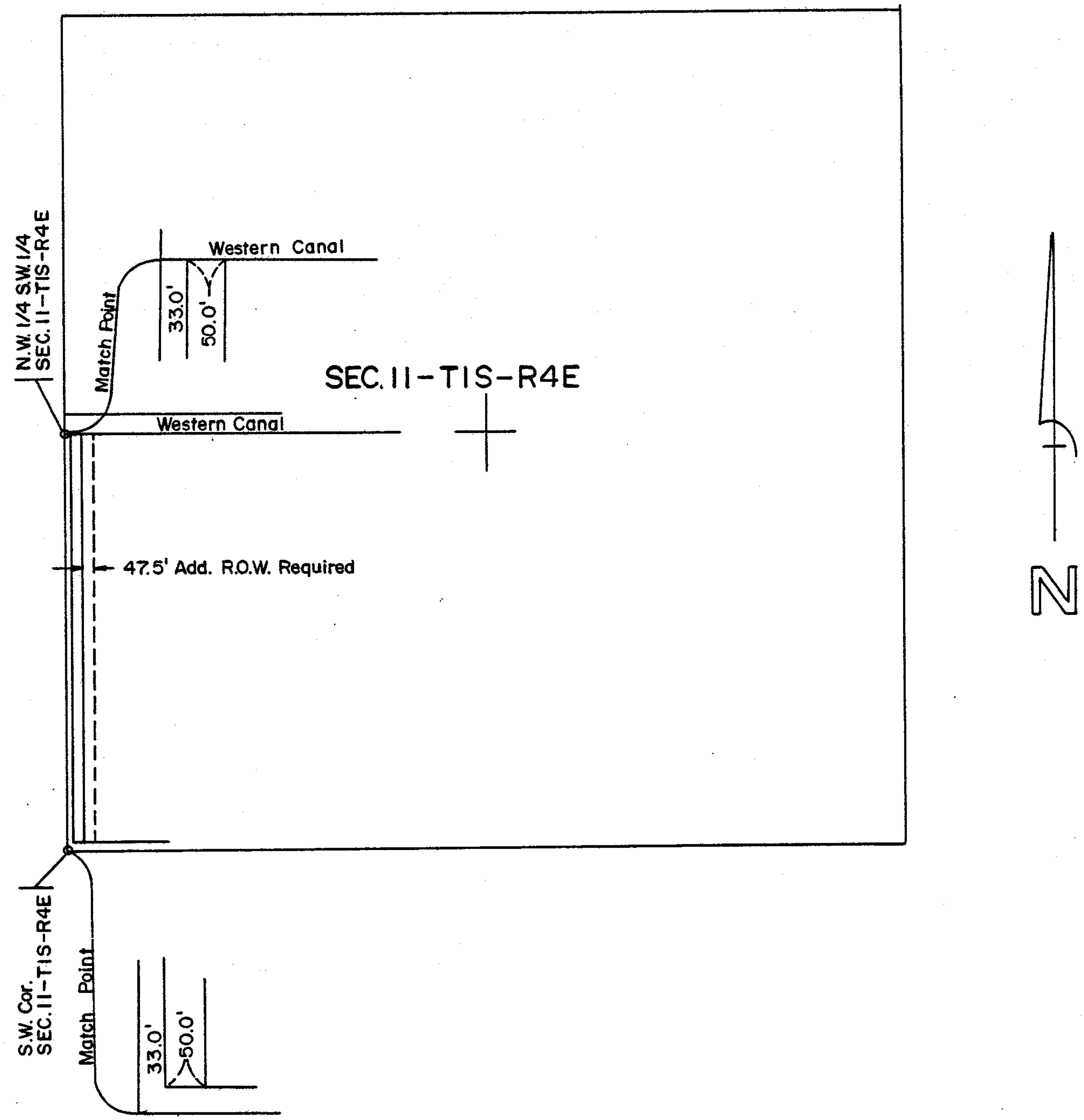
APPENDIX "E"

RIGHT-OF-WAY PLATS

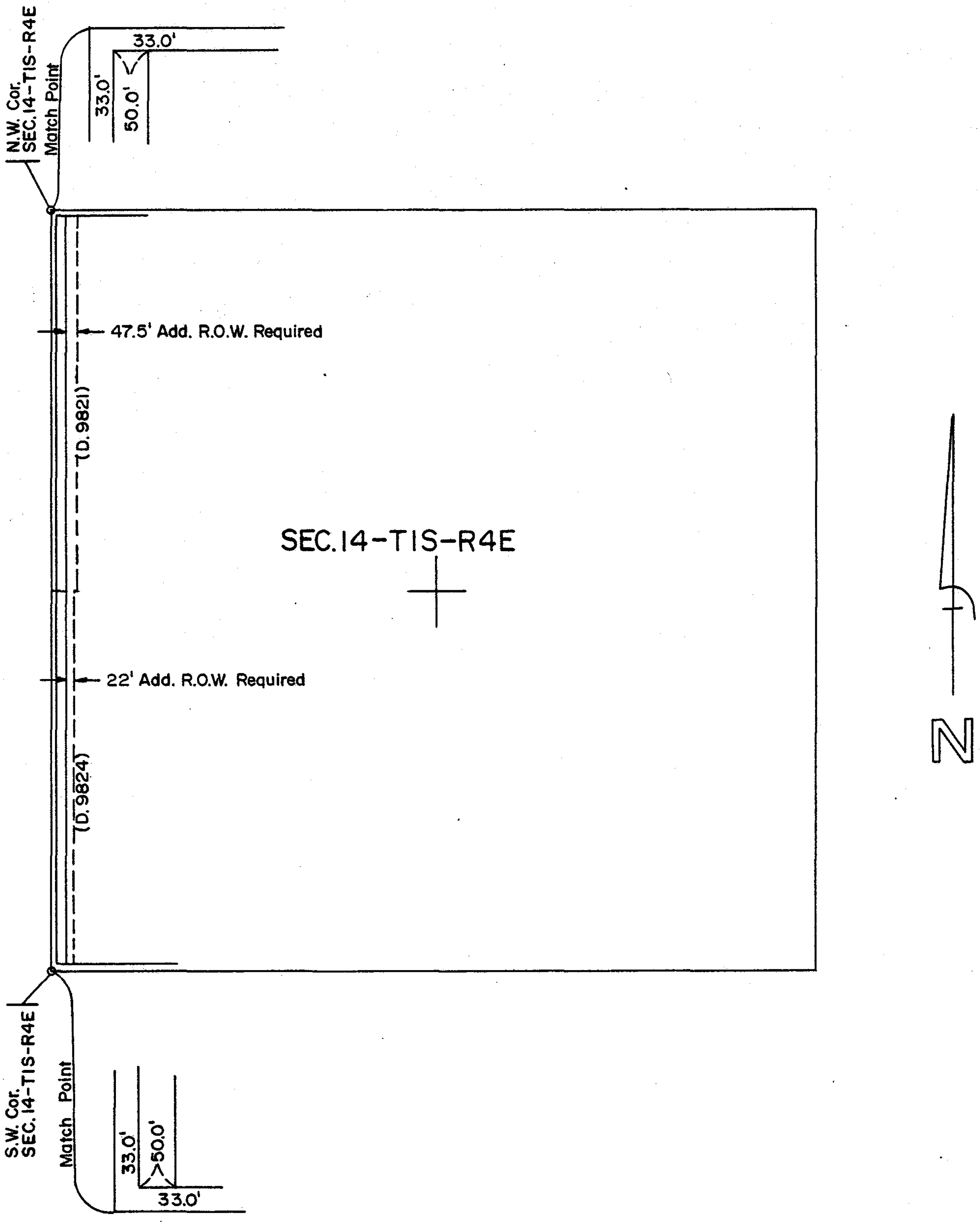

SE.N.E.N.E. Cor.
SEC.8-TIS-R4E
CARMEN ST.
16' Add. Co. R.O.W.
Required
SEC. 8-TIS-R4E
50' Add. R.O.W.
Drain Required
N
33' Existing
R.O.W.
S.E.Cor.
SEC.8-TIS-R4E


N.E. Cor.
SEC. 17-T1S-R4E
16' Add. Co. R.O.W.
Required
100' Add. Drain
R.O.W. Required
SEC. 17-T1S-R4E
33' Existing
Co. R.O.W.
N
Highline Canal
Existing R.O.W.
Line
S.E. Cor.
SEC. 17-T1S-R4E


N.E. Cor.
SEC. 20-TIS-R4E
100' Add. Drain
R.O.W. Required
SEC. 20-TIS-R4E
70' Add. Drain
R.O.W. Required
Existing Highline
Canal R.O.W. Line
I-10 Overpass
S.E. Cor.
SEC. 20-TIS-R4E
N



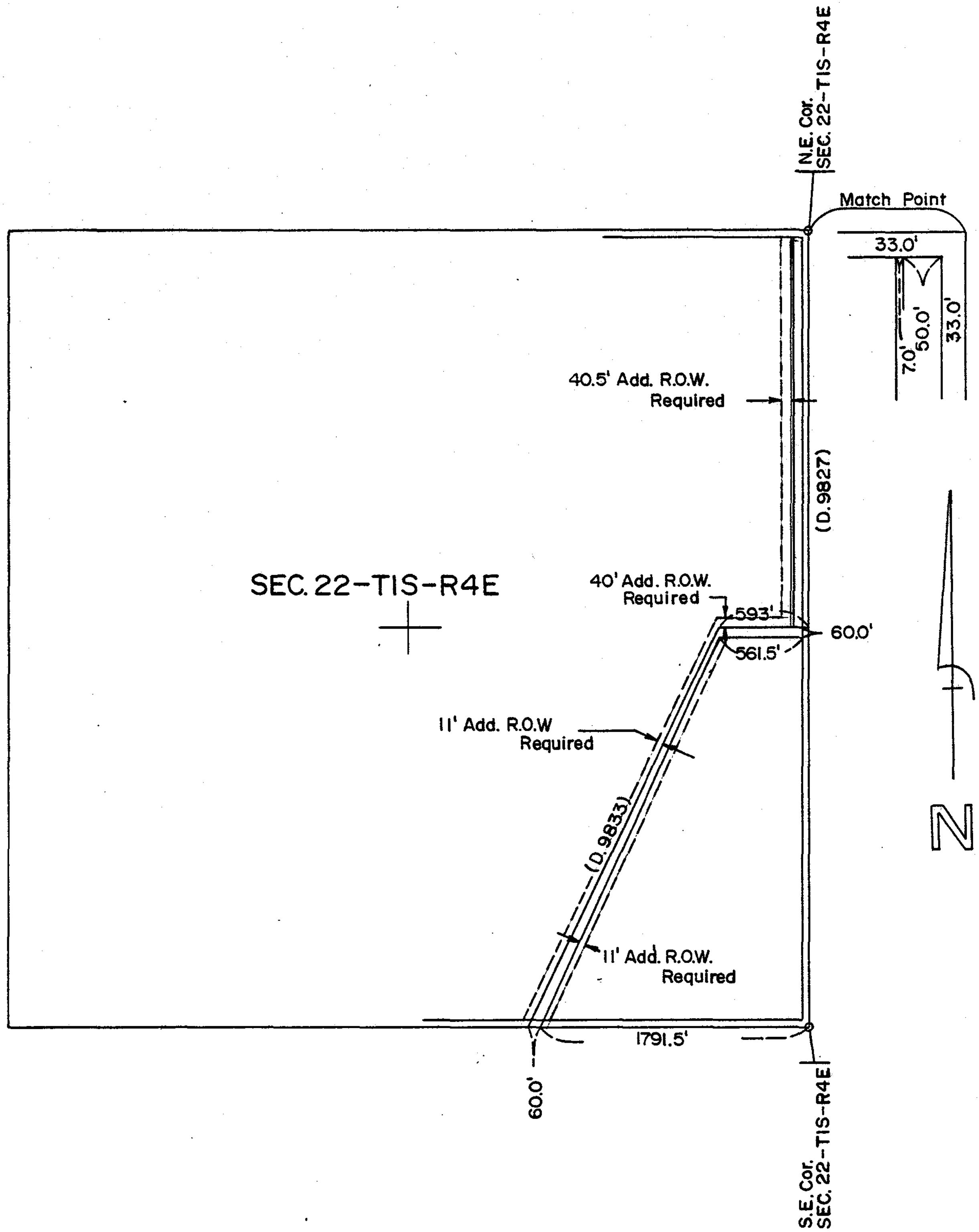
NOTE: DESCRIPTION PLOTTED AS PER DEEDS FURNISHED BY S.R.P.
CANAL (50'R.O.W.) LYING EAST OF 33' COUNTY ROAD R.O.W.



NOTE: DESCRIPTION PLOTTED AS PER DEEDS FURNISHED BY S.R.P.
CANAL (50'R.O.W) LYING EAST OF 33' COUNTY ROAD R.O.W.

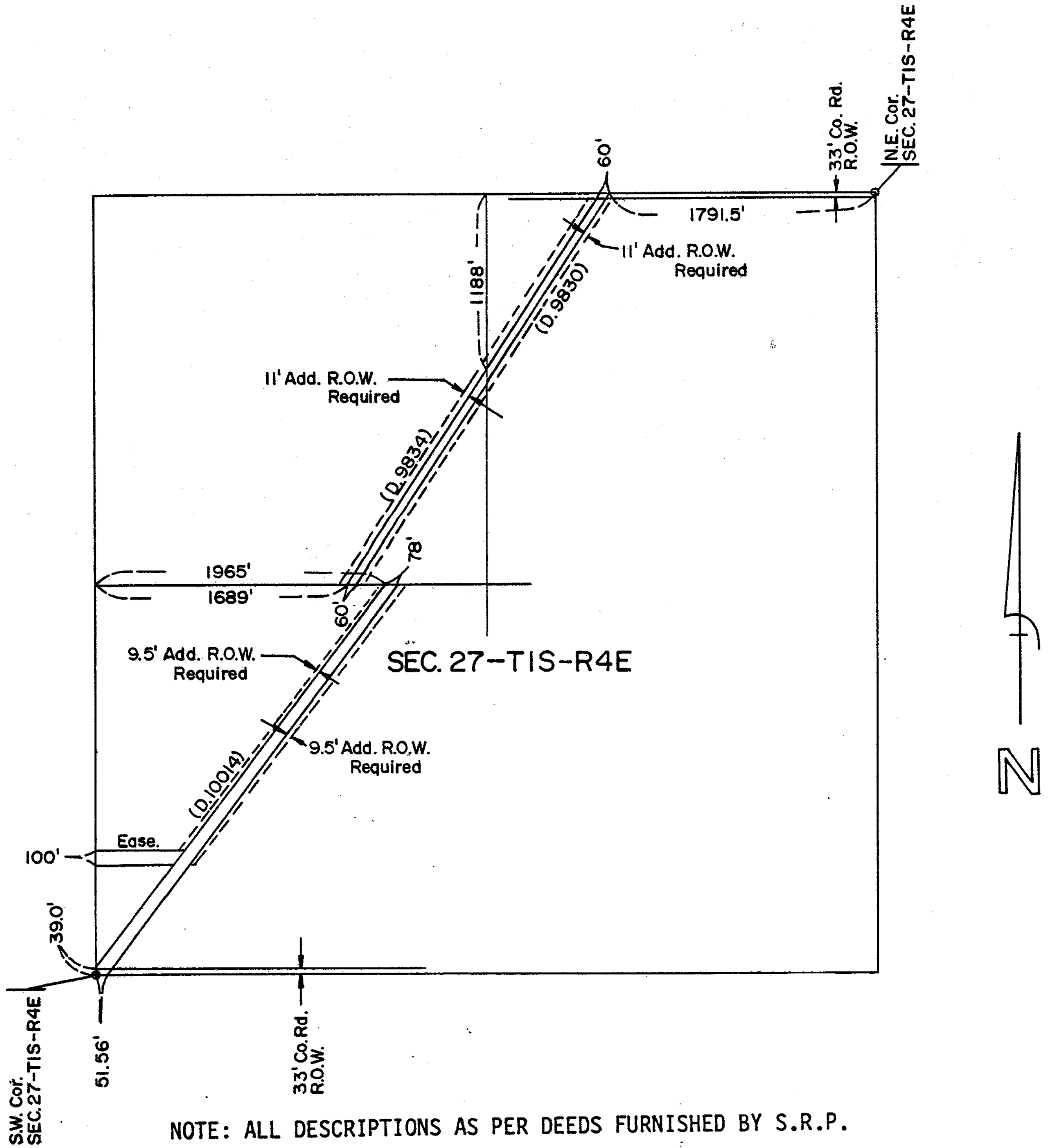
NW-1/4, DEED 9821, RECORDED 29TH SEPTEMBER 1916
BOOK 118 of DEEDS PAGE 517

SW-1/4, DEED 9824, RECORDED 29TH SEPTEMBER 1916
BOOK 118 OF DEEDS PAGE 518



NOTE: DESCRIPTIONS PLOTTED AS PER DEEDS FURNISHED BY S.R.P. CANAL (57' R.O.W.) LYING WEST OF 33' COUNTY ROAD R.O.W.

NE-1/4, DEED 9827, RECORDED 29TH SEPTEMBER 1916
BOOK 118 OF DEEDS, PAGE 518-19
QUIT CLAIM RECORDED 23RD OCTOBER 1964
DOCKET 5274 PAGE 611
SE-1/4, DEED 9833, RECORDED 29TH SEPTEMBER 1916 BOOK 118 of DEEDS PAGE 520-21



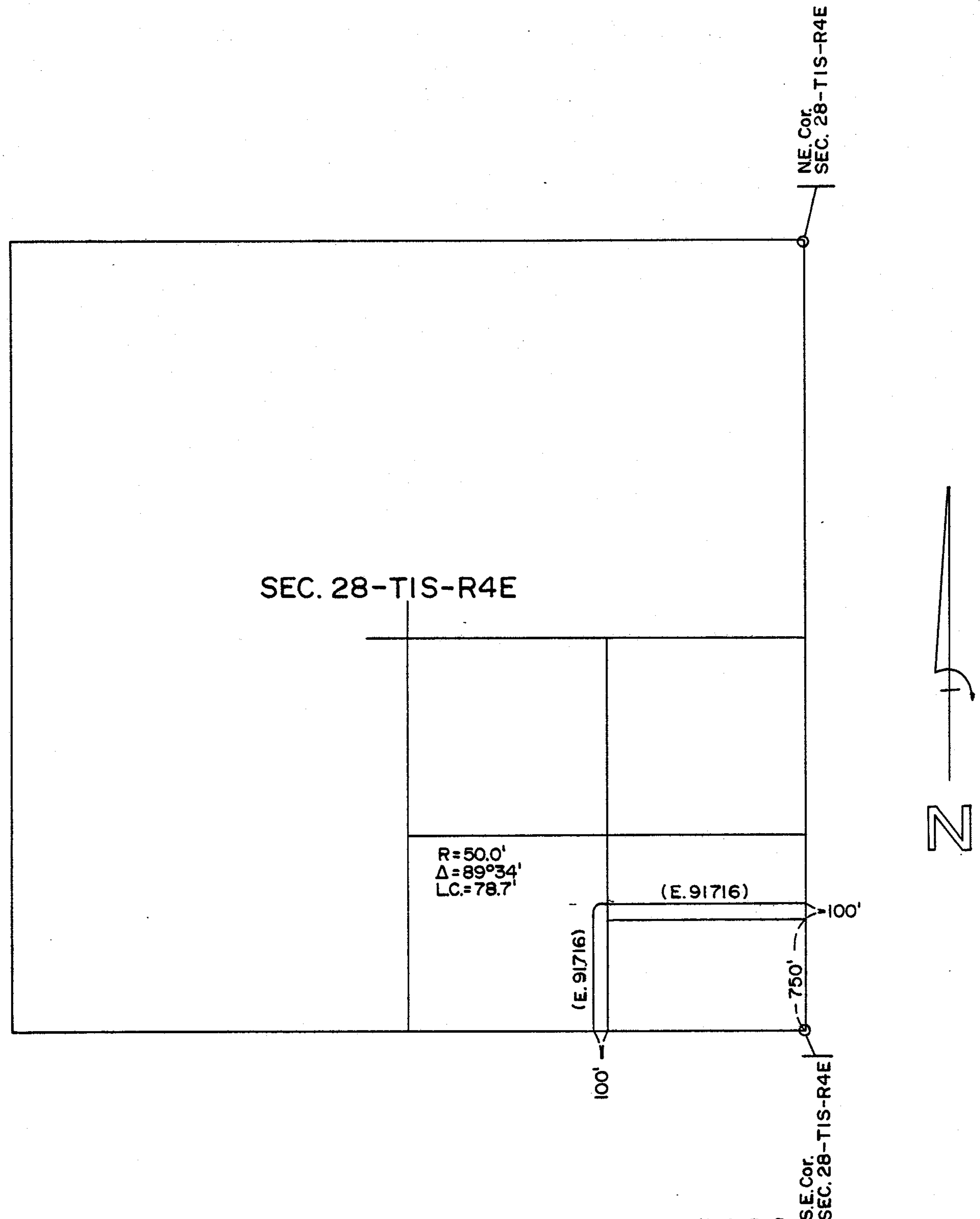
NOTE: ALL DESCRIPTIONS AS PER DEEDS FURNISHED BY S.R.P.

NE-1/4, DEED 9830, RECORDED 29TH SEPTEMBER 1916
BOOK 118 of DEEDS
PAGE 519

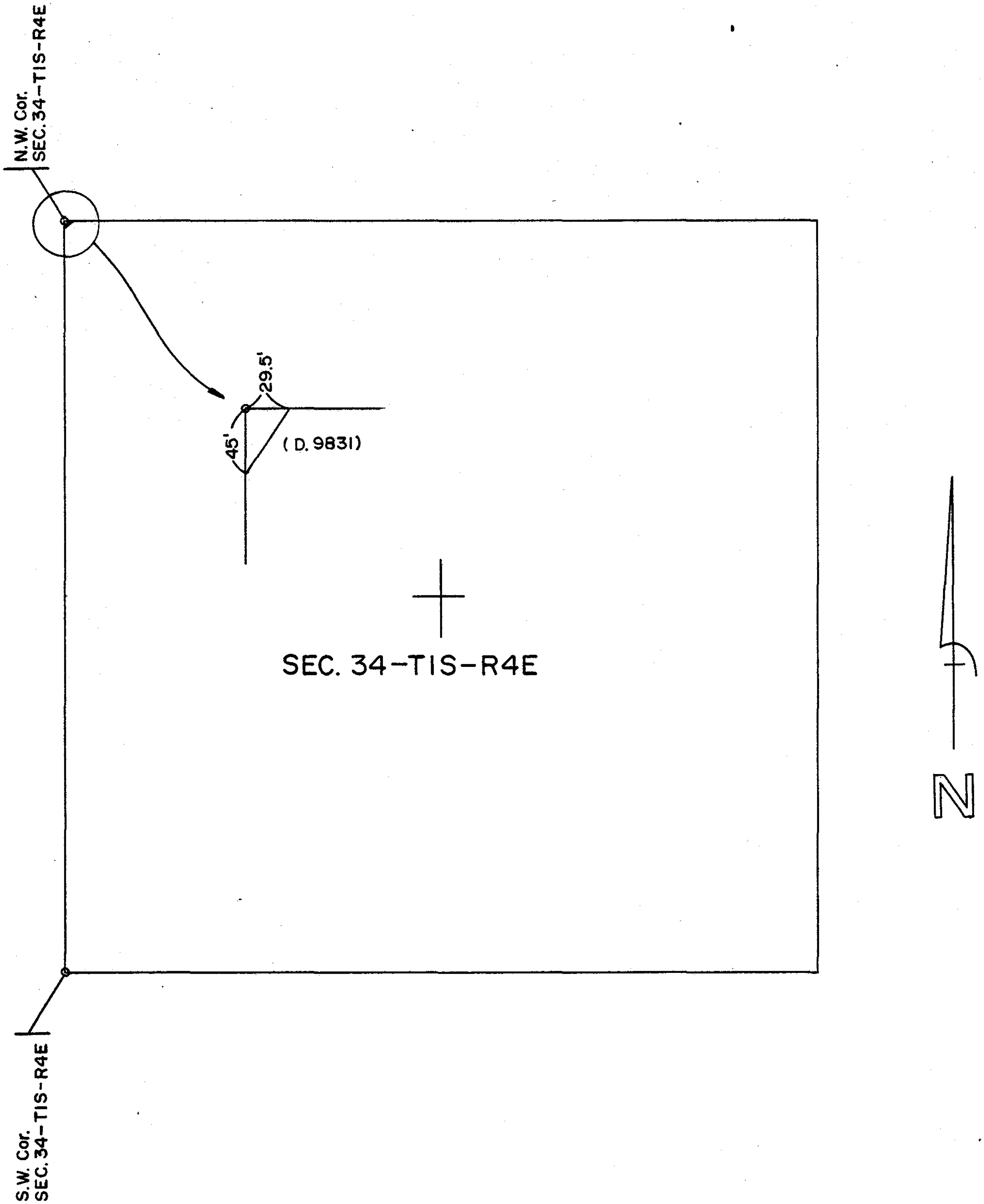
NW-1/4, DEED 9834, RECORDED 29TH SEPTEMBER 1916
BOOK 118 OF DEEDS
PAGE 521

SW-1/4, DEED 10014, RECORDED 25TH JUNE 1917
BOOK 122 OF DEEDS
PAGE 320-21

SW-1/4, EASEMENT, RECORDED 3RD JUNE 1968
DOCKET 7119
PAGE 805-10

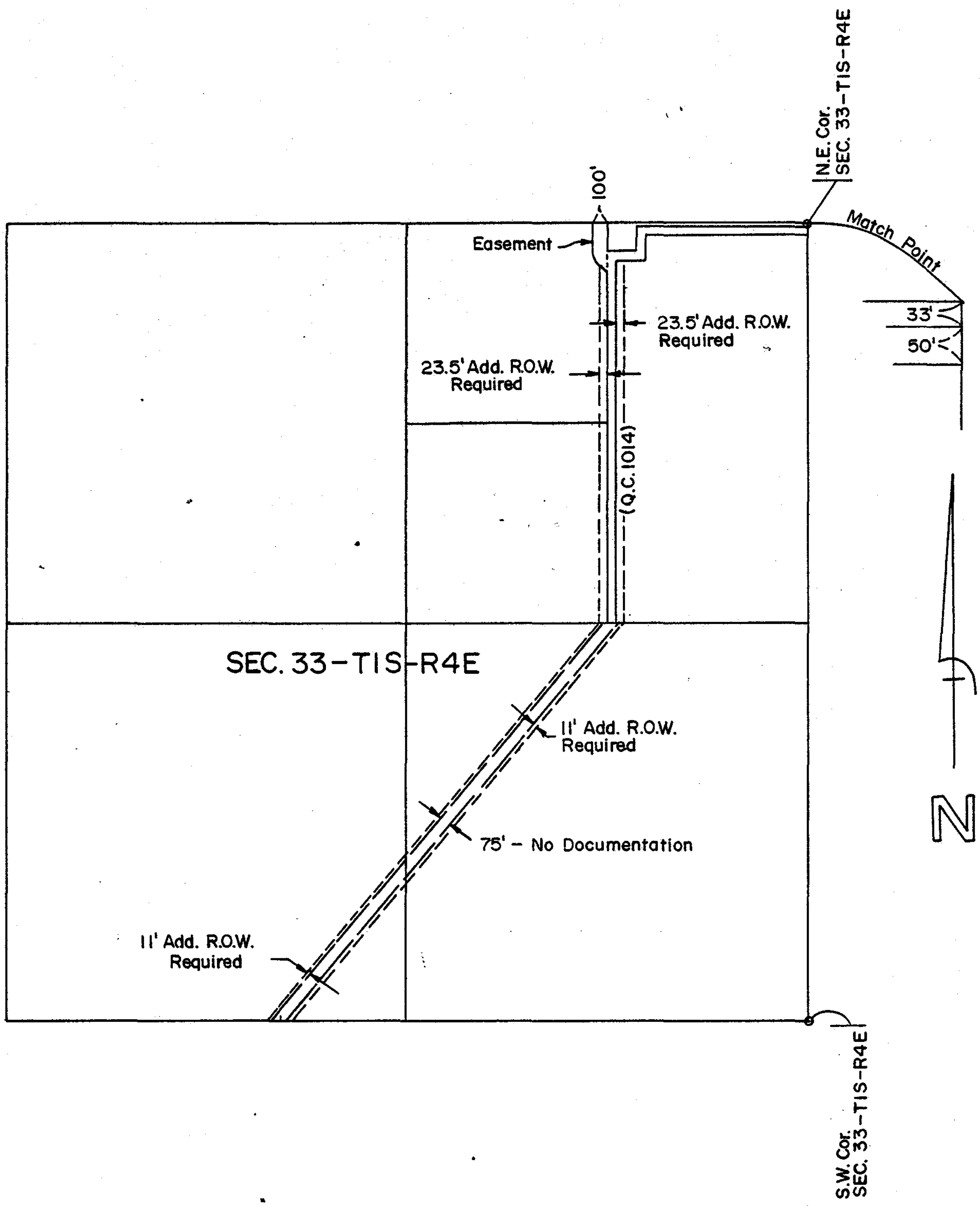


NOTE: DESCRIPTION PLOTTED AS PER EASEMENT FURNISHED BY S.R.P.
CANAL (100' EASEMENT)
Sec. 28, EASEMENT 91716
RECORDED 3RD JANUARY 1968
DOCKET 7119 PAGE 805-810



NOTE: DESCRIPTION AS PER DEED FURNISHED BY S.R.P.

NW¼, DEED 9831, RECORDED 29th SEPTEMBER 1916
BOOK 118 of DEEDS PAGE 520

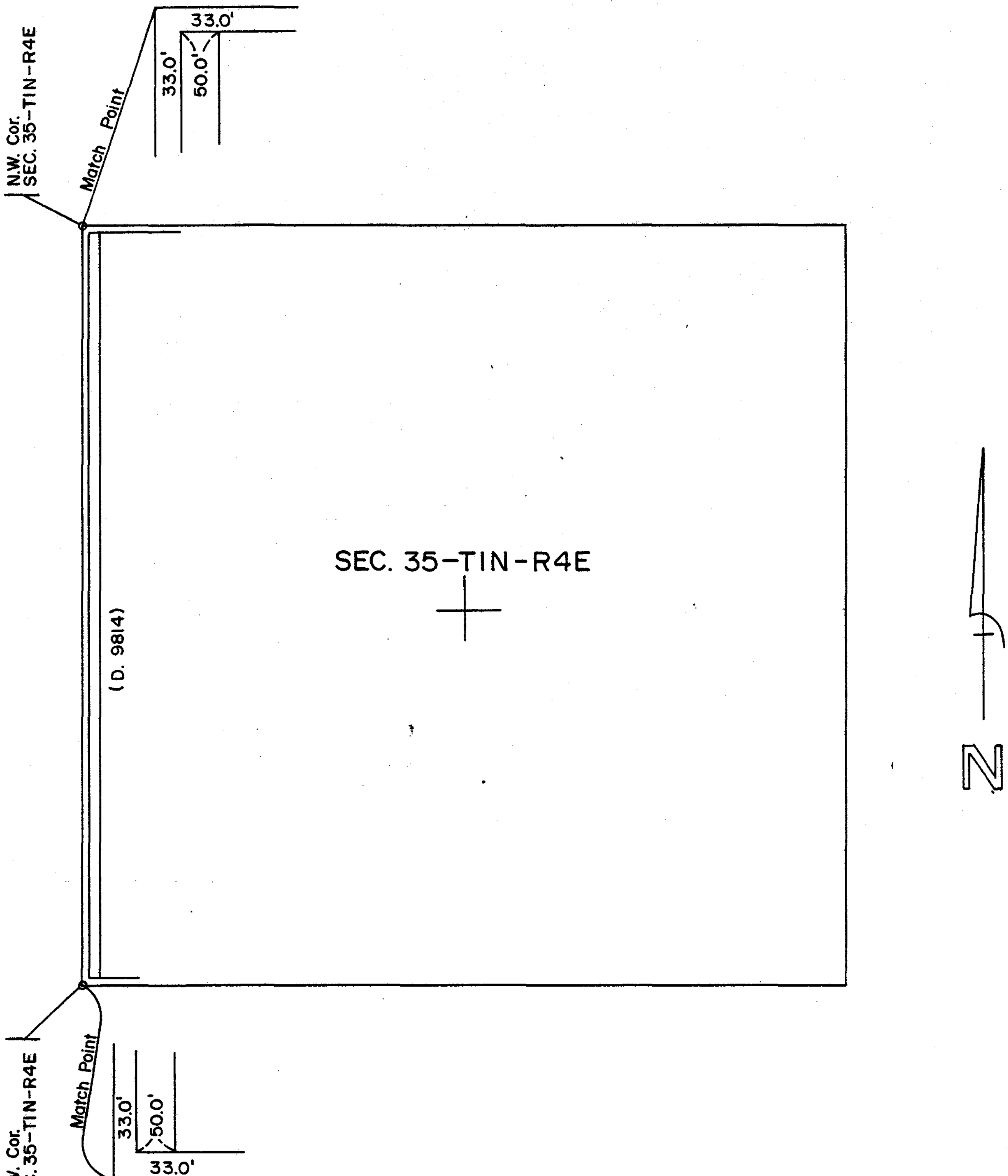


NOTE: DESCRIPTION PLOTTED AS PER DEED & EASEMENT FURNISHED BY S.R.P.

E-1/2NE-1/4, QUIT CLAIM DEED 1014, RECORDED 18TH MARCH, 1954
DOCKET 1316 PAGE 11

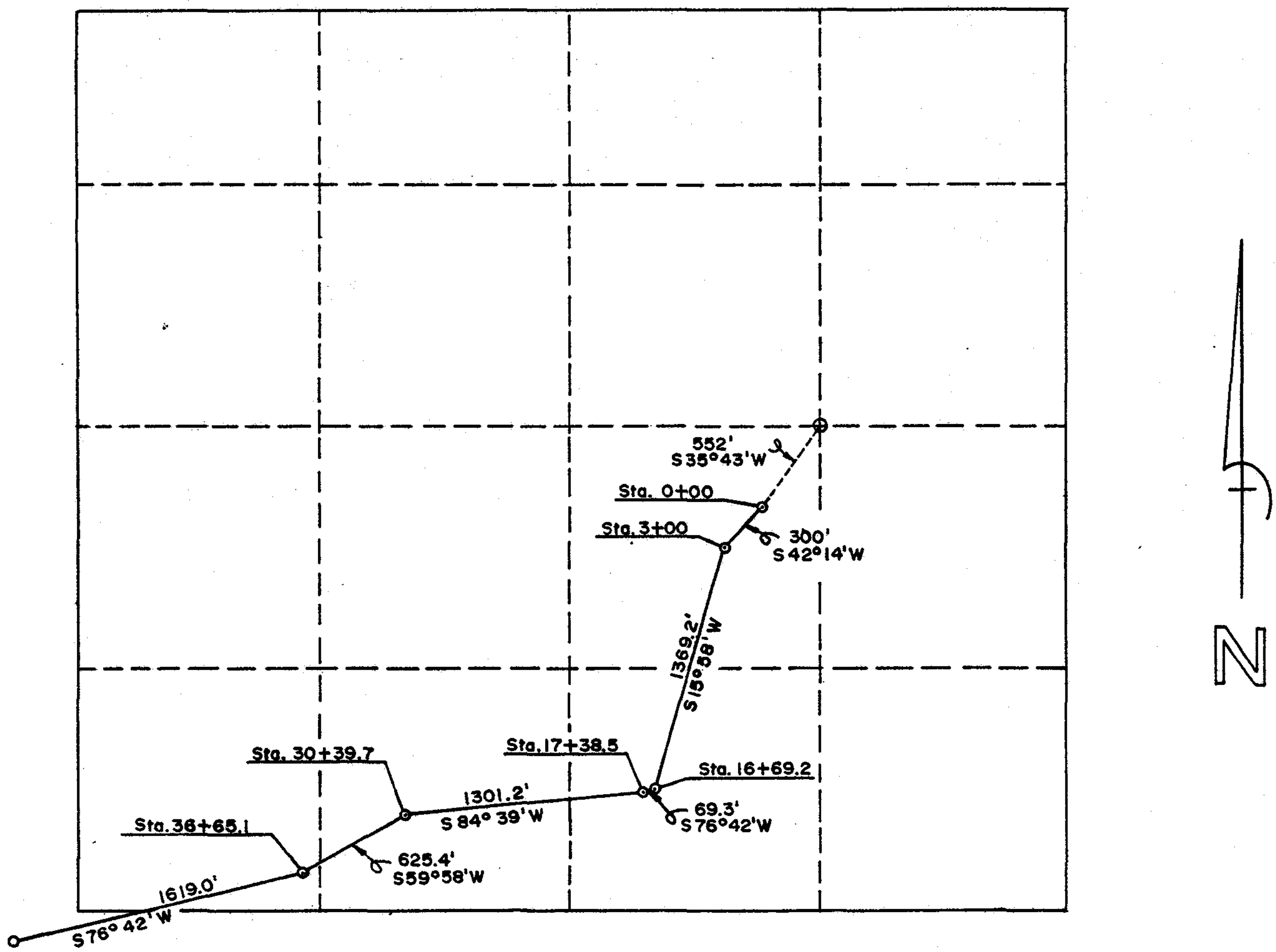
NE-1/4NW-1/4NE-1/4, EASEMENT, RECORDED 3RD JANUARY 1958
DOCKET 7119 PAGE 805-10

S-1/2 NO DOCUMENTATION AT THIS TIME,S.R.P. OBTAINING EASEMENT DOCUMENTATION



NOTE: DESCRIPTION PLOTTED AS PER DEED FURNISHED BY S.R.P.
CANAL (50' R.O.W.) LYING EAST OF 33' COUNTY ROAD R.O.W..

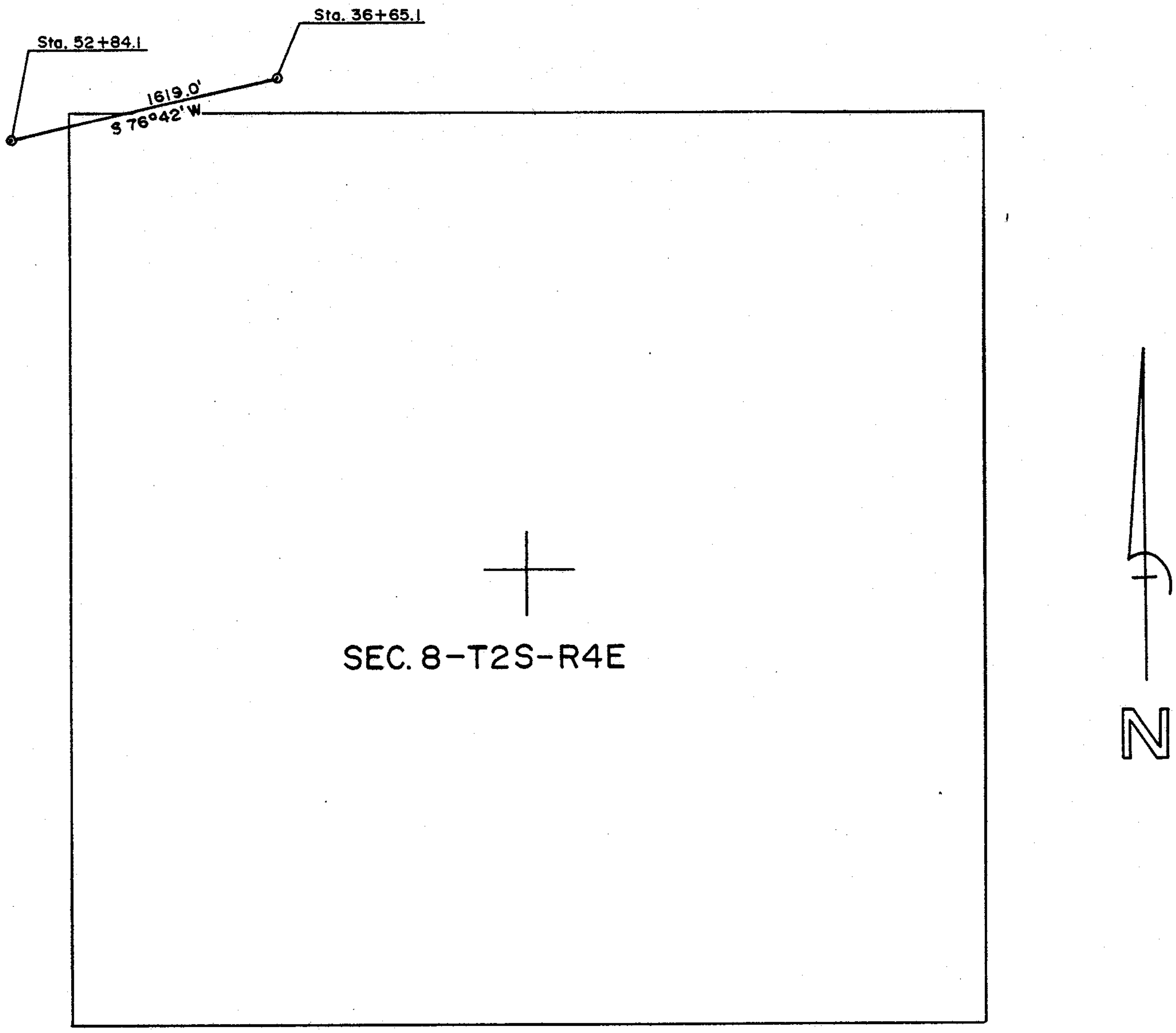
SEC. 35, DEED 9814, RECORDED 29th SEPTEMBER 1916
BOOK 118 of DEEDS PAGE 514



SEC. 5-T2S-R4E

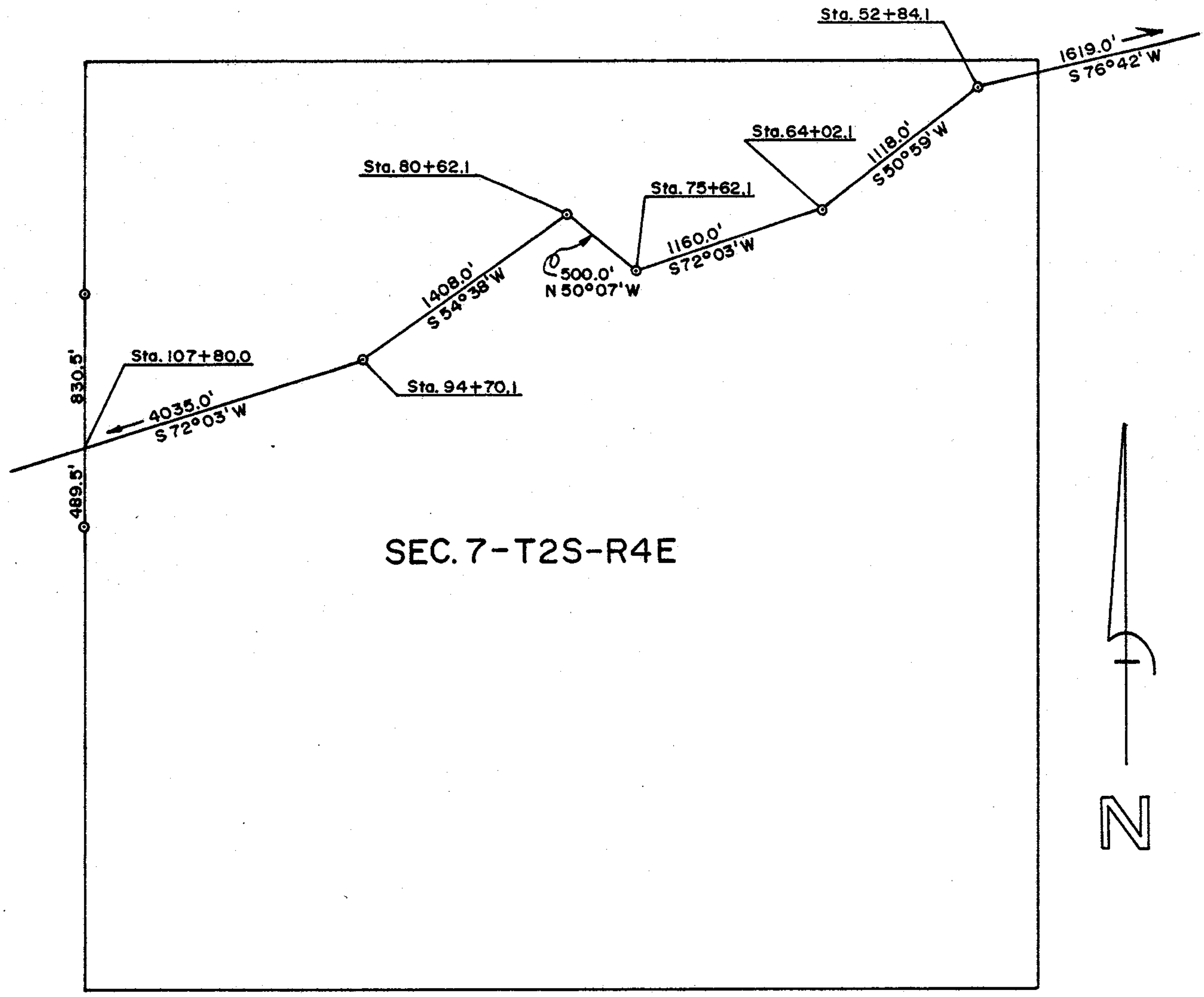
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



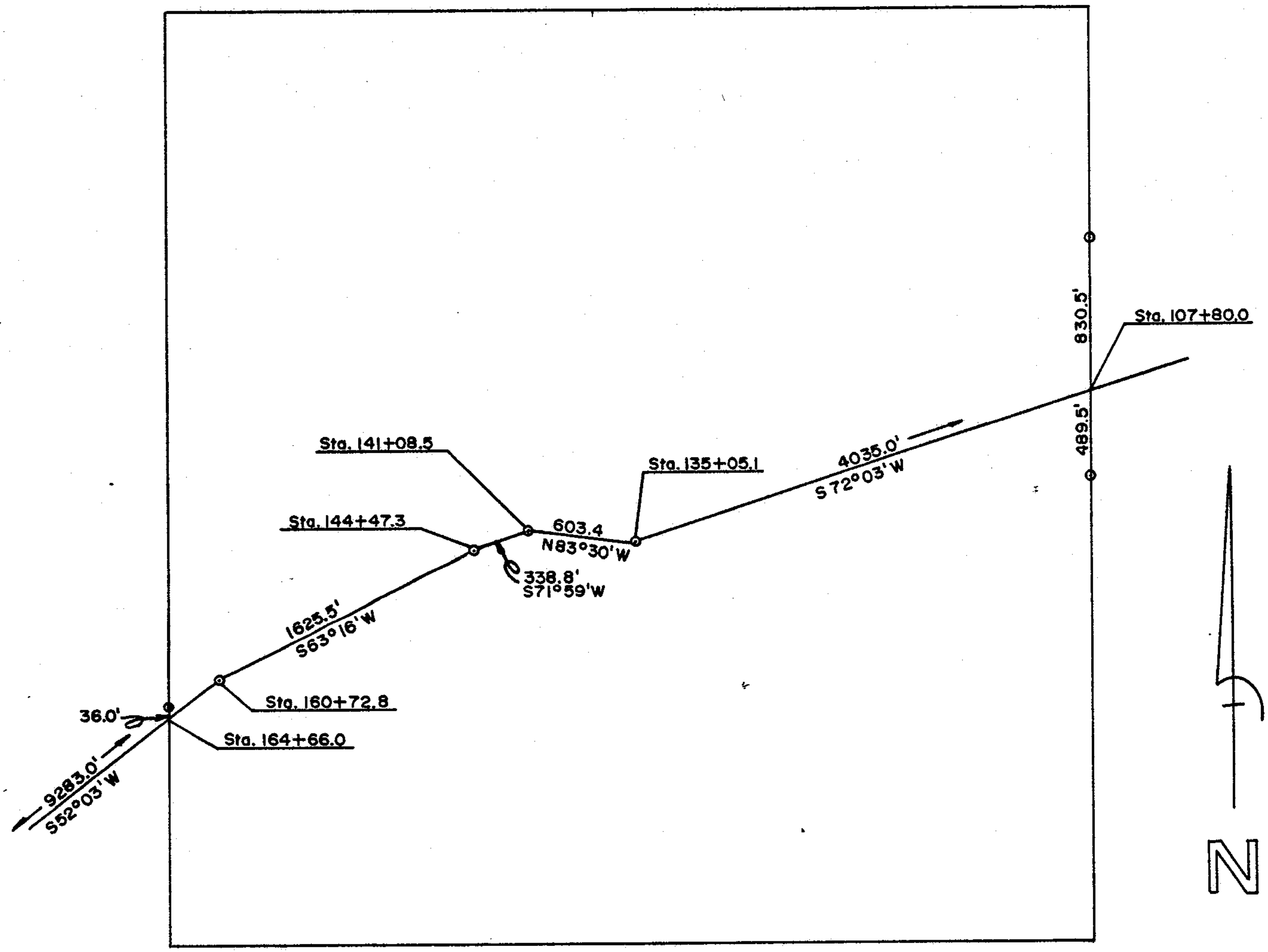
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

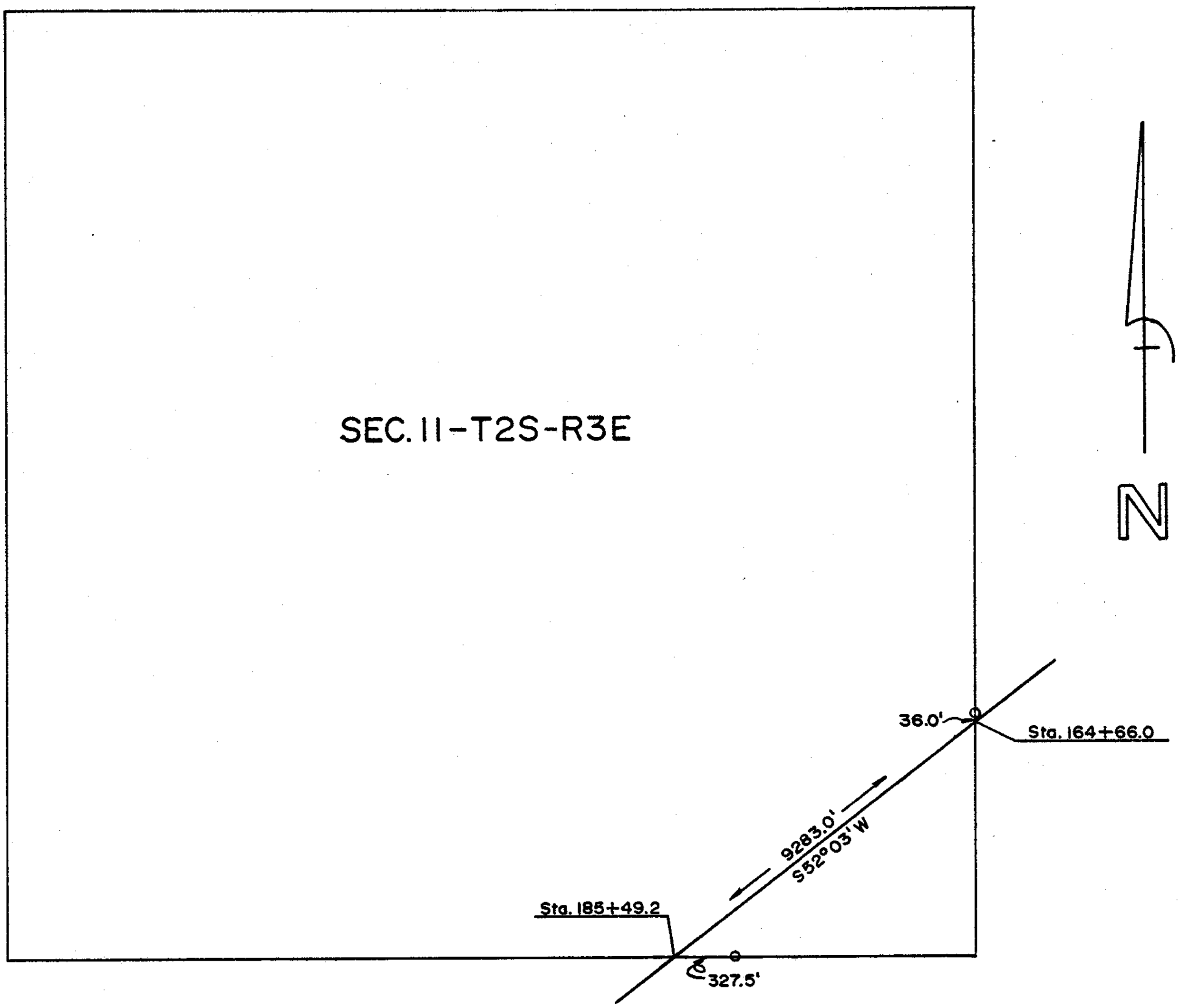
Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



SEC. 12-T2S-R3E

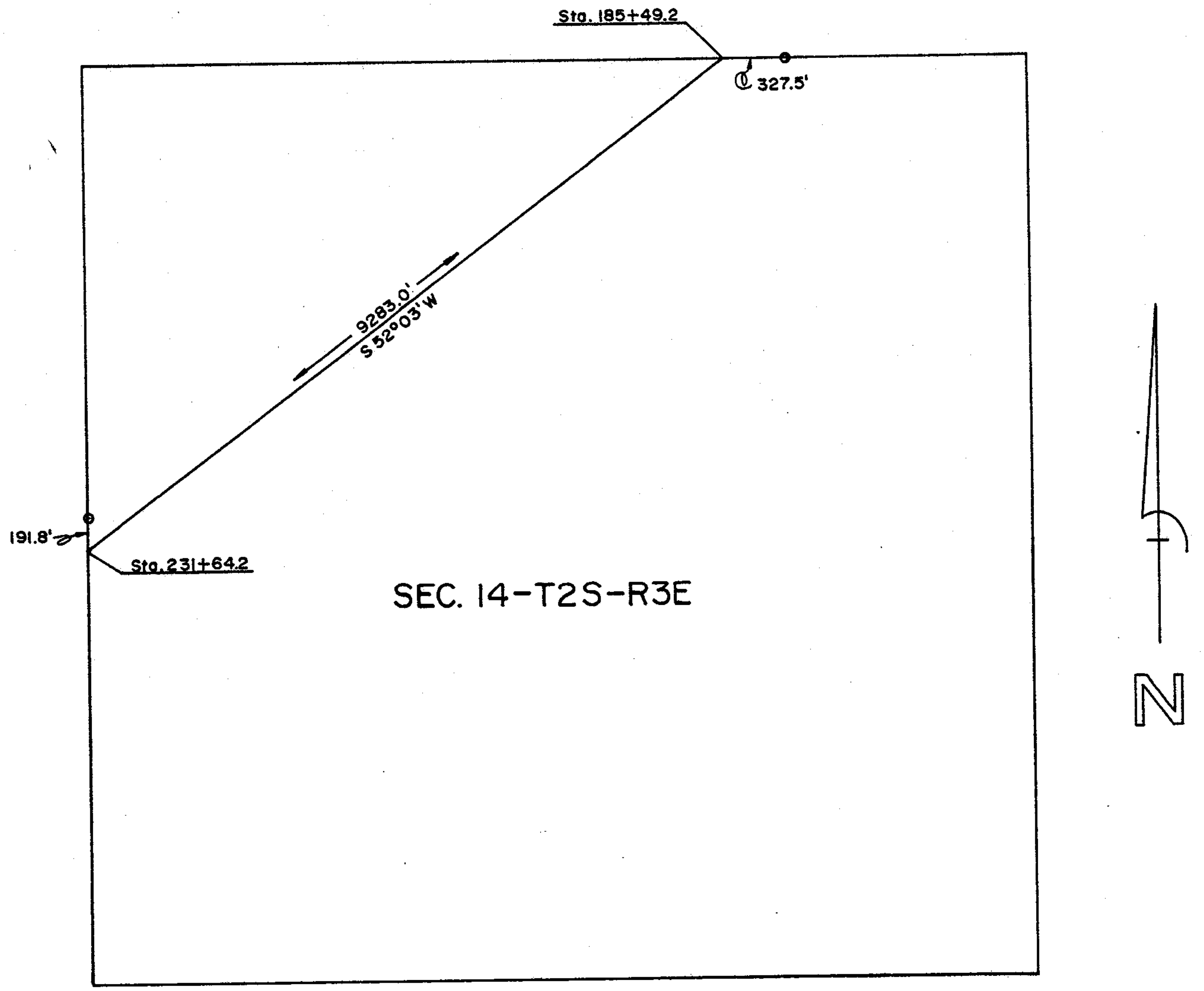
Plotted as per Plat dated July 23, 1924,
Furnished by S,R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



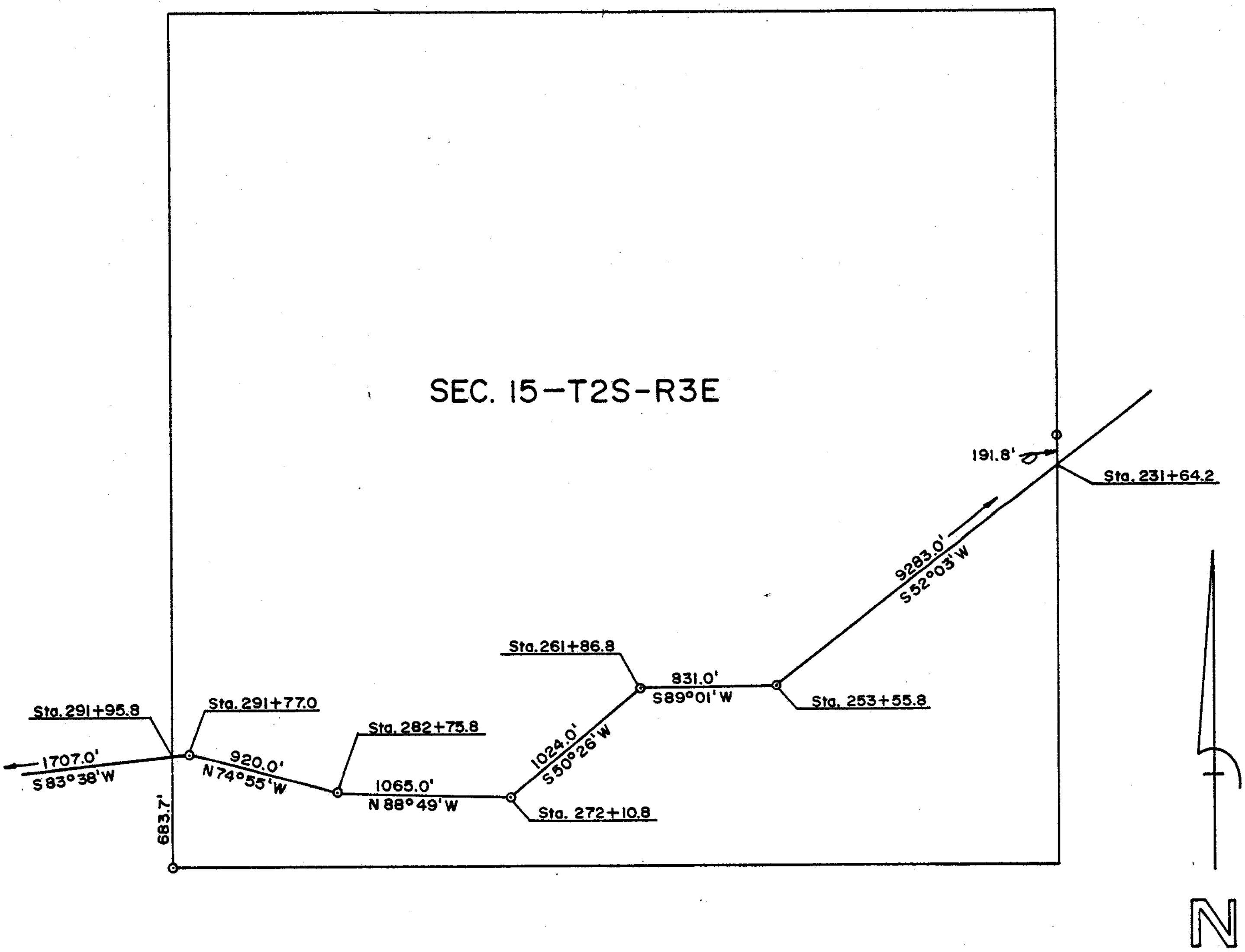
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



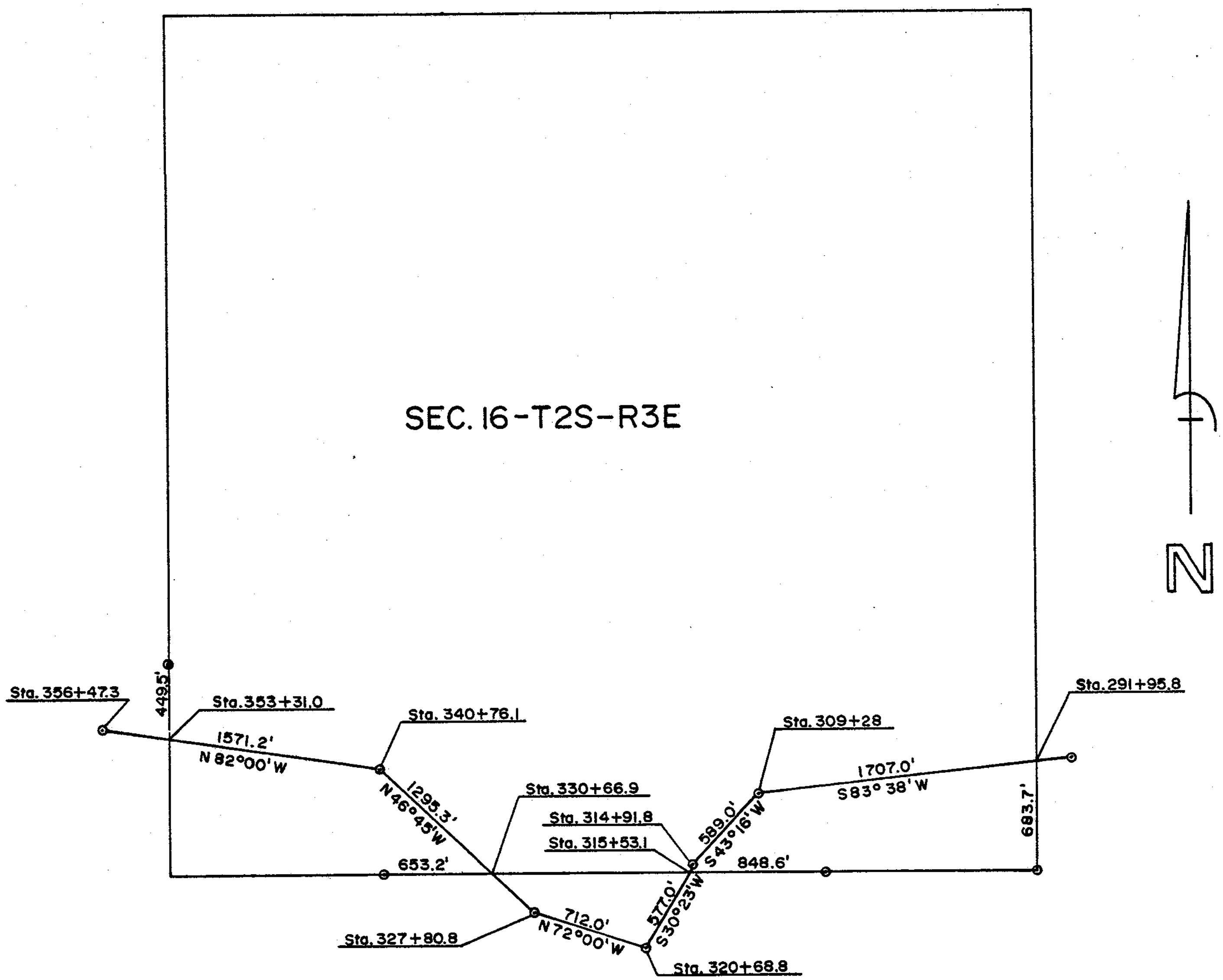
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



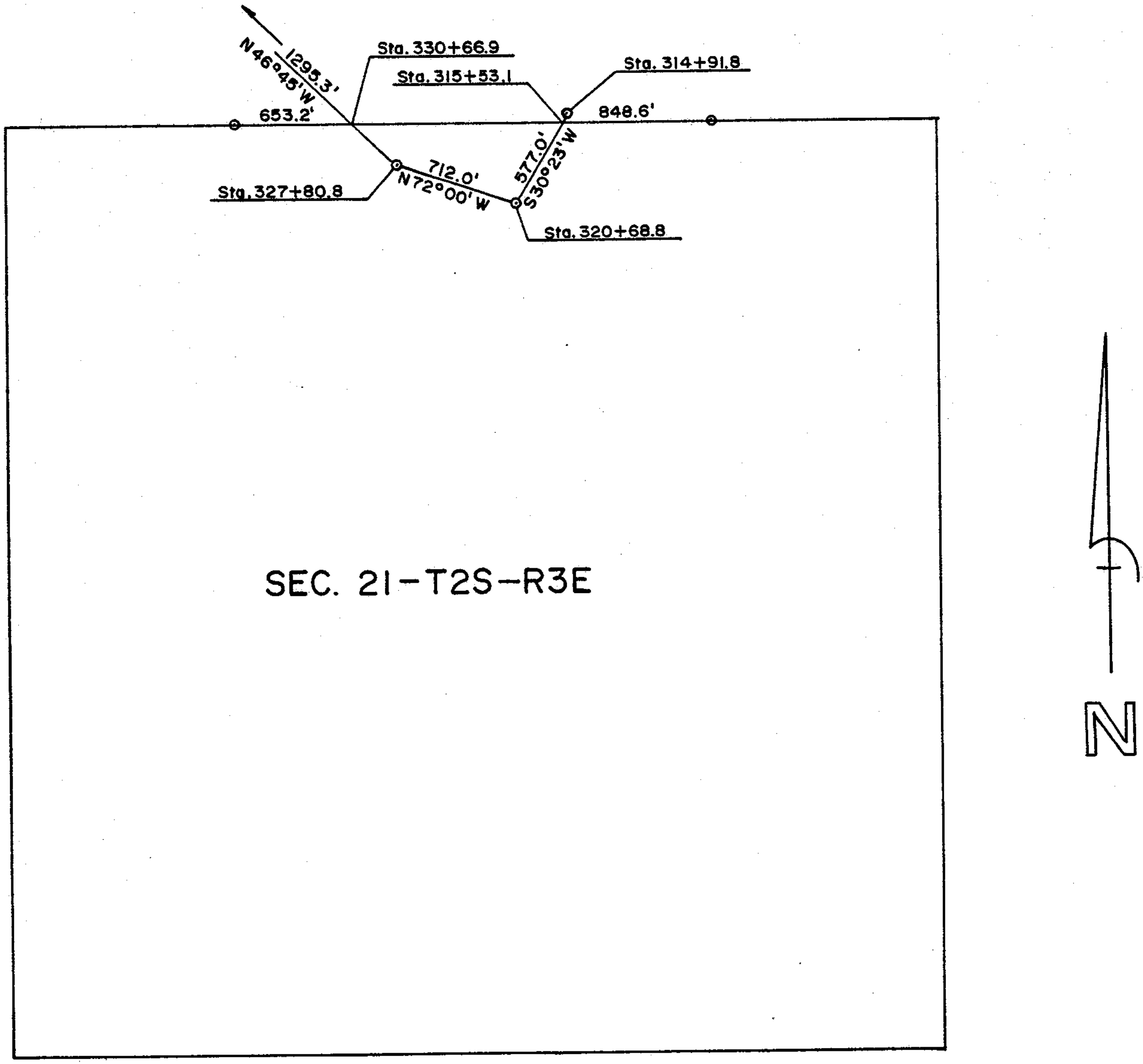
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



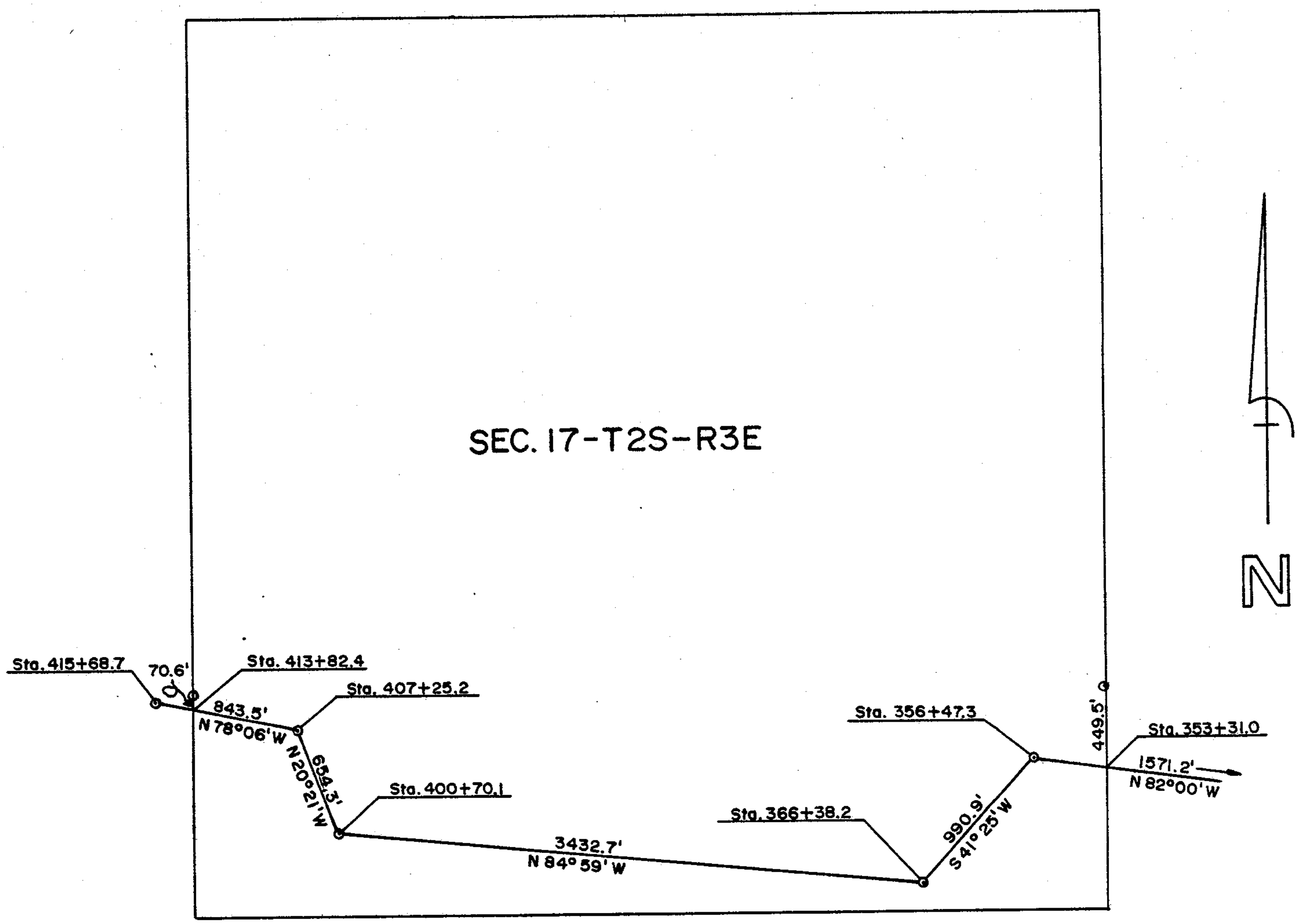
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

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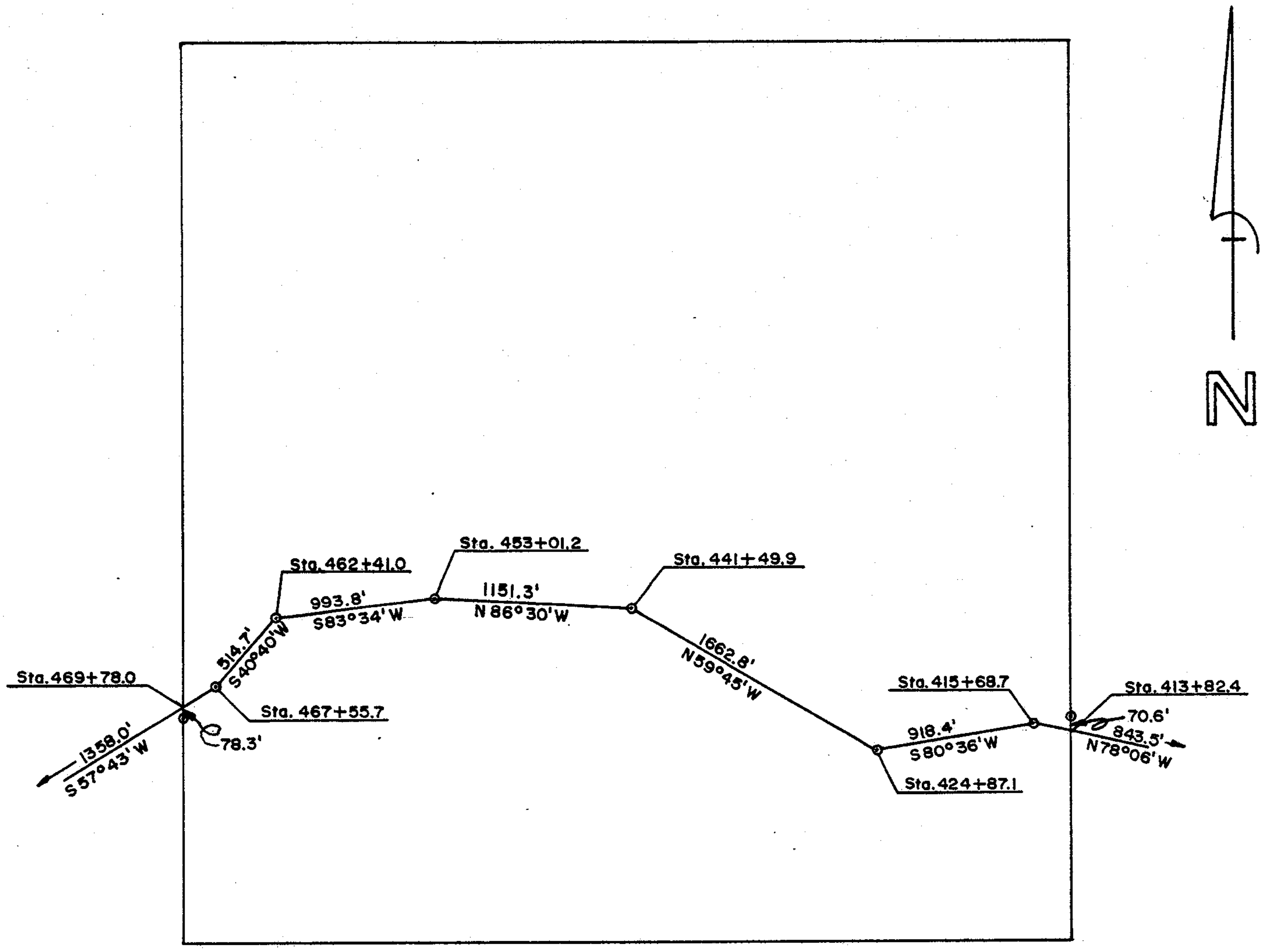
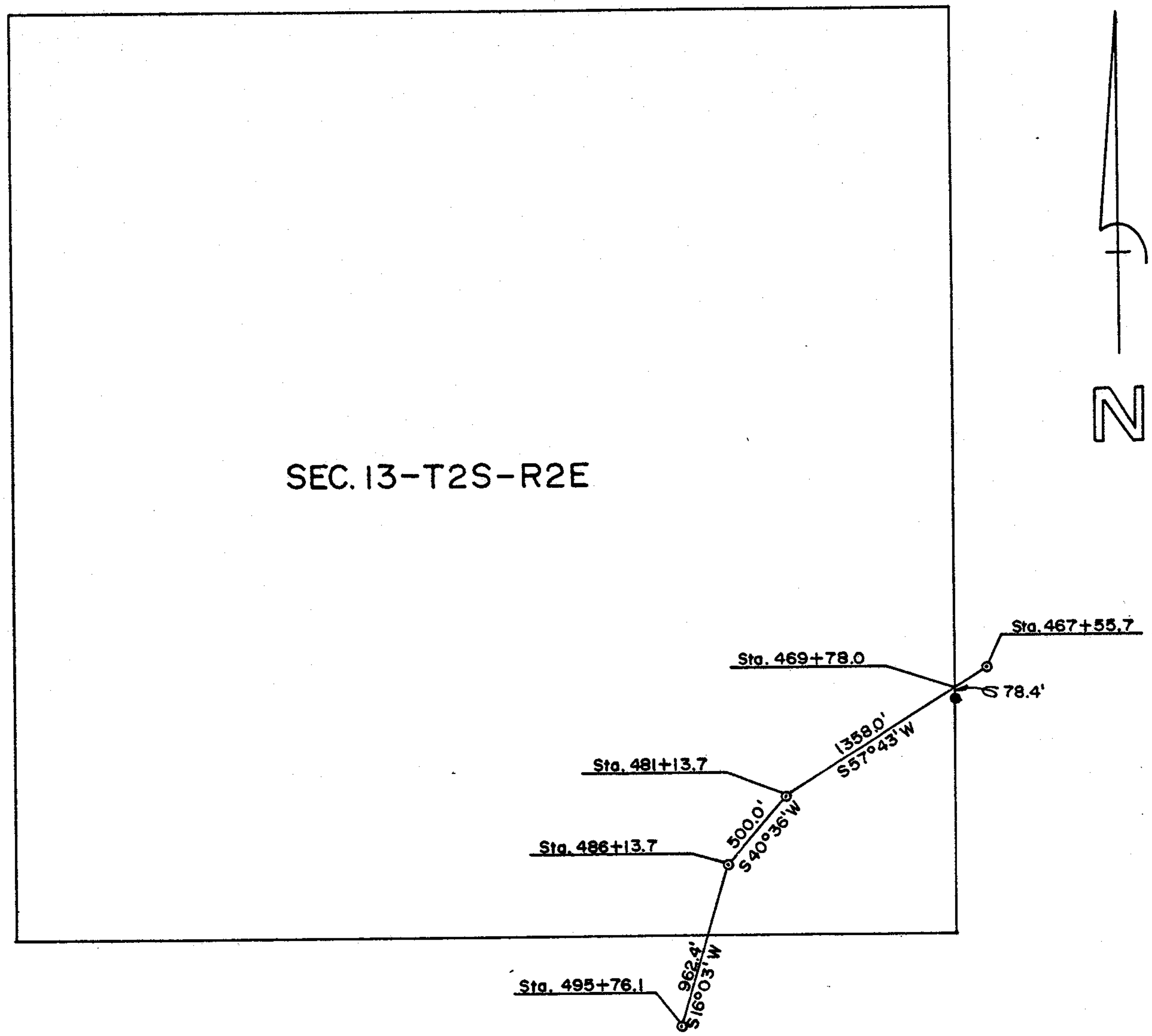


SEC. 18-T2S-R3E

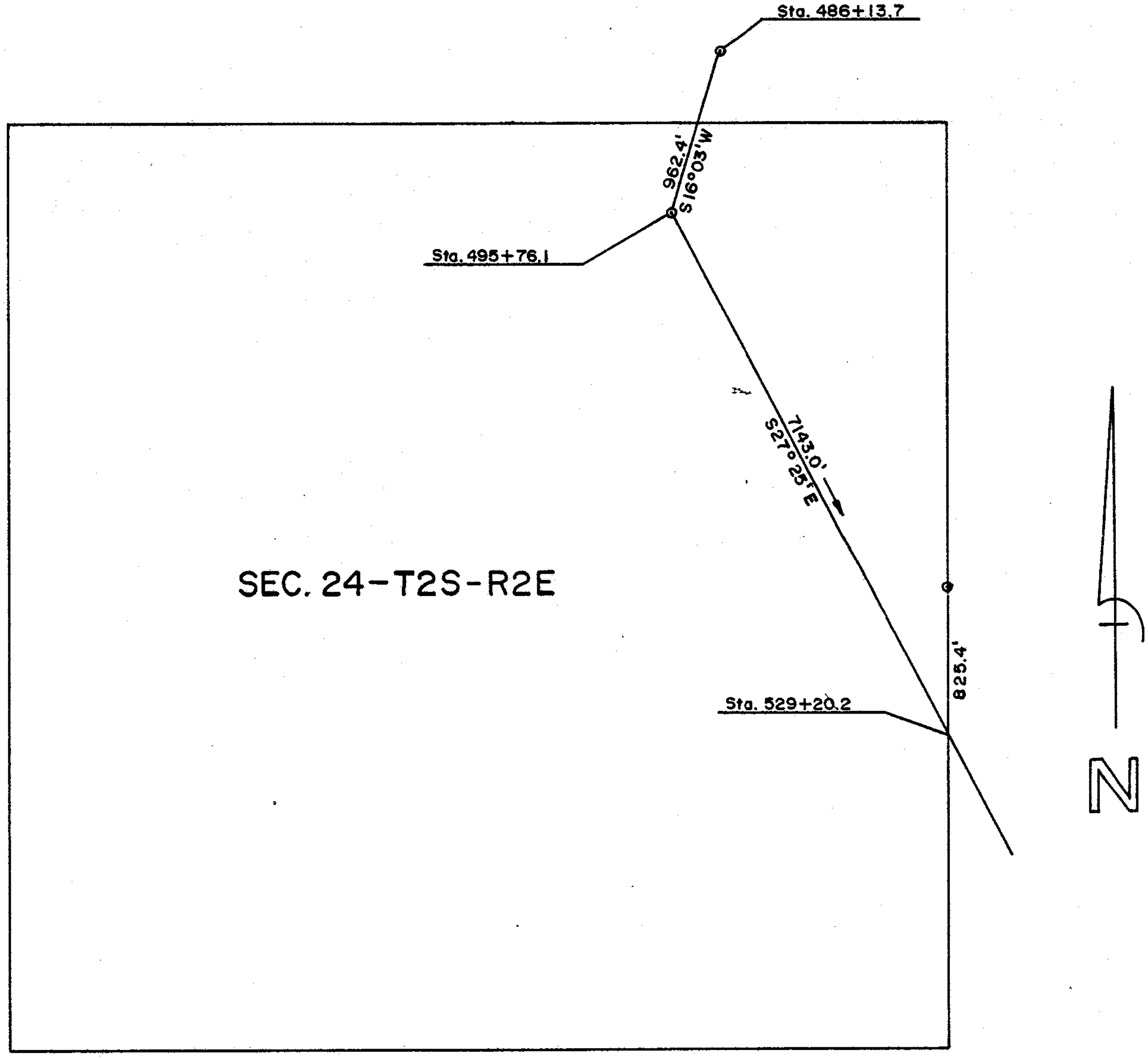
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



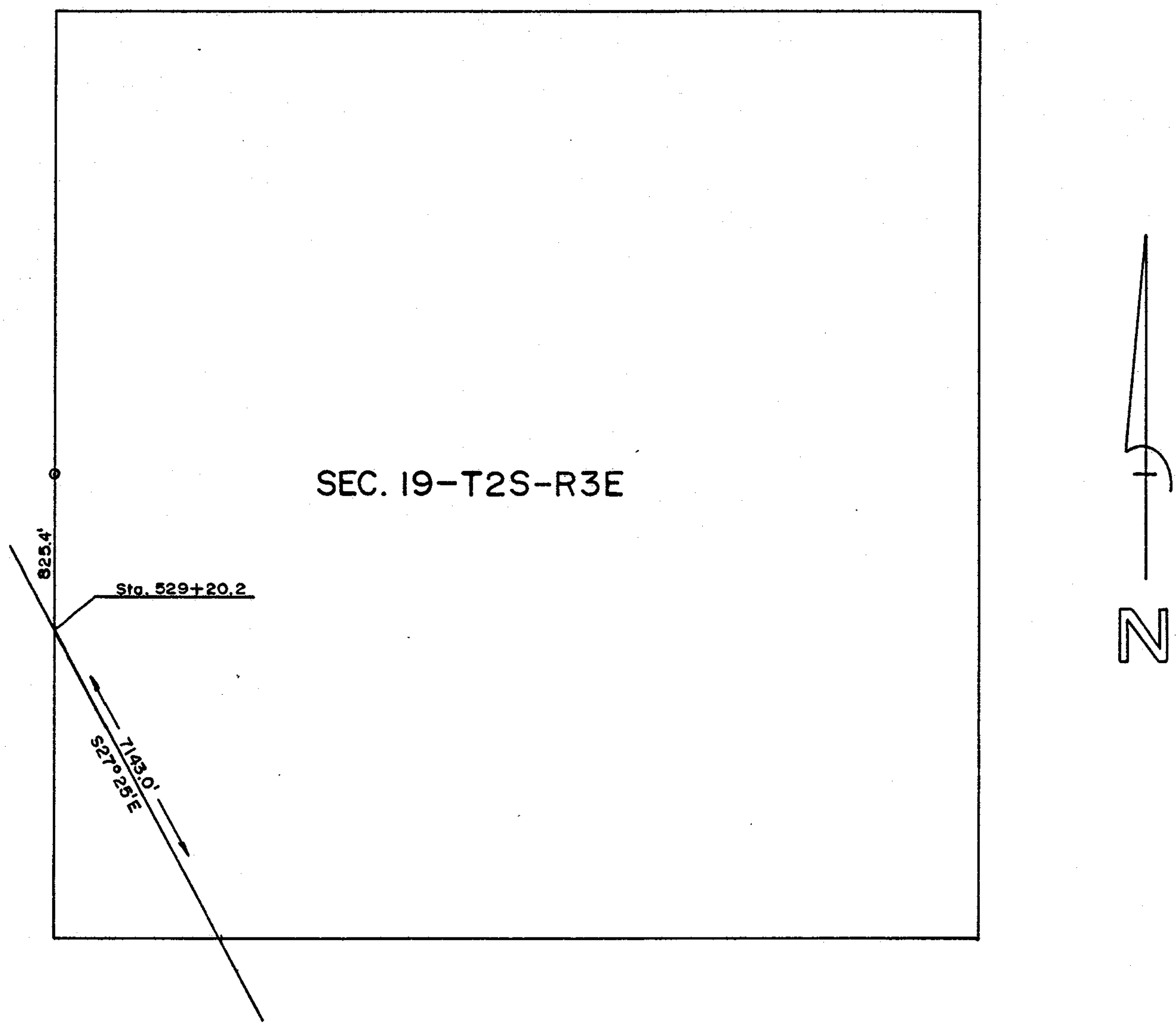
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline plotted.



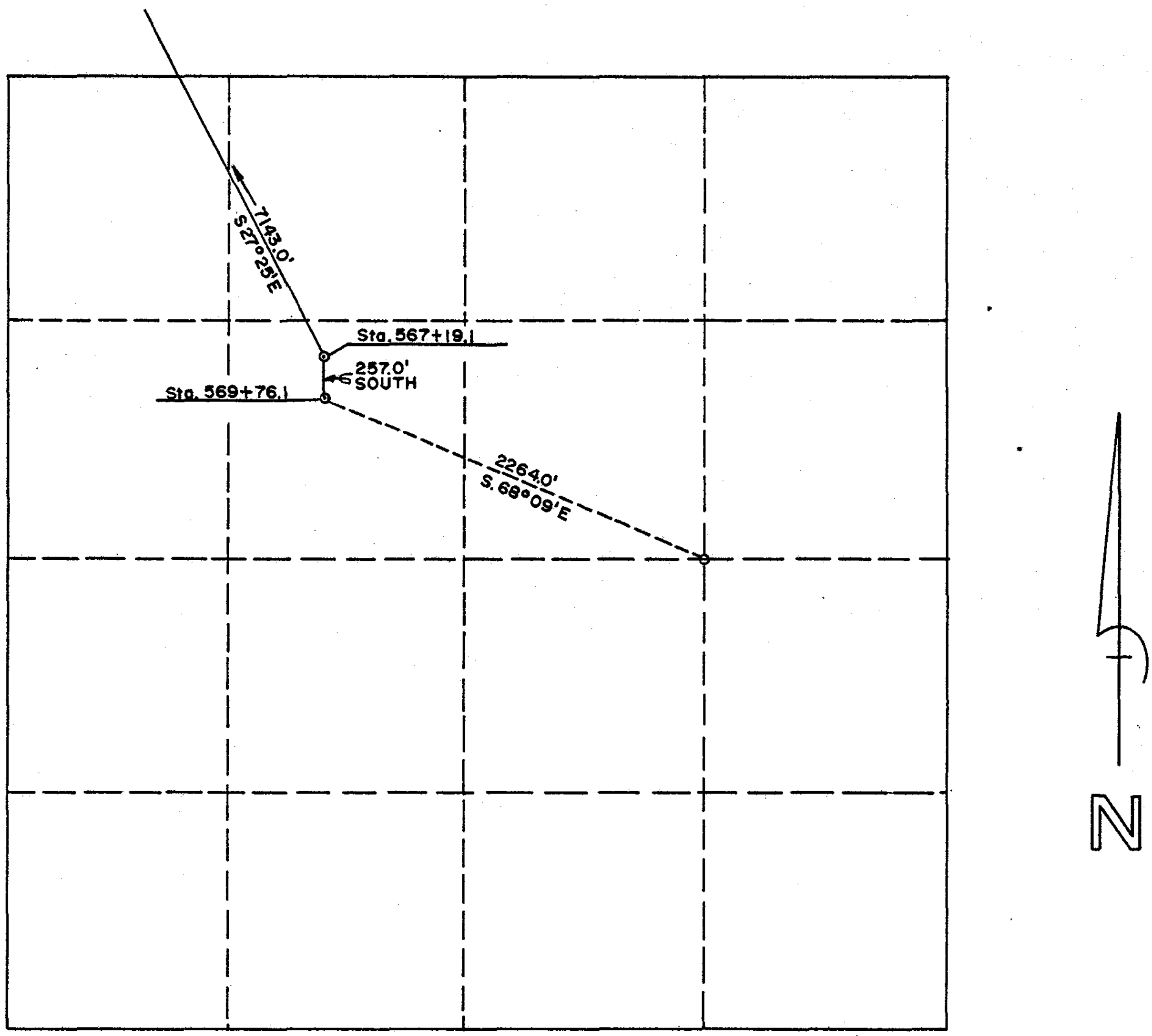
Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.



Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline plotted.



SEC. 30-T2S-R3E

Plotted as per Plat dated July 23, 1924,
Furnished by S.R.P.

Note: Assume 'as built', alignment does not follow description of original agreement dated 21st June, 1923. Description is for a 100' Right-of-Way, 50' either side of the centerline as plotted.

APPENDIX "F"

EXISTING FLORA AND FAUNA

PLANT COMMUNITIES

TYPE "A" - Agricultural Border Vegetation

This vegetation type occurs on the access roads along the canal as well as on the margins between the roads and the adjacent farm fields. The farm fields transected by the Gila Drain are primarily cotton but a few may be fields of alfalfa or other forage crops. The plants in this vegetation type typically respond to disturbance of the soil and thus include few, if any, native perennials. The following list includes some of the more characteristic plants in this type. An asterisk indicates annual plants.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Trees and Shrubs		
Tamarix aphylla	Athel (evergreen salt cedar)	Limited to one area
Populus fremontii	Cotton wood	Limited to one area
Parkinsonia aculeata	Palo verde (exotic)	Rare
Lycium andersonii	Wolfberry	Occasional
Pluchea sericea	Arrow weed	Occasional in drain
Herbs		
*Salsola kali**	Russian thistle (tumbleweed)	Common
Sorghum halepense	Johnson grass	Common
Cynodon dactylon	Bermuda grass	Common
*Malva parviflora**	Cheese weed	Common
*Bromus rubens**	Foxtail Brome	Common
*Cruciferae**	Mustards (family)	Common

TYPE "B" - Alluvial Plain

This vegetation type occurs in the broad flat floodplain areas on the terraces above the Gila River. It is an area where groundwater was once shallow and salt depositions due to evaporation are common. Many of the plants found within this vegetational type are salt tolerant while others are common only because the area observed was along the access routes that have periodic disturbance. The relative composition of the plant species varies between locations but there are some plants that are more common than others and these are indicated. Depending on the rainfall, the annual plant composition fluctuates greatly between years and seasons. Because of this fluctuation, the annuals are not included for the alluvial plain type. The following, except *Salsola*, are all trees or shrubs.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Atriplex polycarpa	Desert salt bush	Abundant
A. canesceus	Four wing salt bush	Occasional
A. elegans	Salton salt bush	Common
Suaeda torreyana	Seepweed	Common
Lycium andersonii	Wolfberry	Common
L. fremontii	Wolfberry	Occasional
L. exsertium	Wolfberry	Occasional
Prosopis juliflora	Mesquite	Common
Baccharis sarothroides	Desert broom	Occasional
Opuntia arbuscula	Pencil cholla	Uncommon
O. leptacaulis	Christmas cholla	Uncommon
Salsola kali	Russian thistle	Occasional
Zizyphus obtusifolia	Gray thorn	Rare
Allenrolfea occidentalis	Iodine bush	Occasional
Larrea tridentata	Creosote bush	Uncommon

Other plants obviously are present in the above vegetation type but those included make up the more common or characteristic.

TYPE "C" - Large Washes or Drainage Areas

This type occurs along portions of the floodplain where there is intermittent drainage. These are commonly cut across the Gila Drain so that only small areas bordered the proposed area of expansion. The drainage area vegetation grades into the alluvial plain vegetation so that species found in one can often be found in the other. The following list of species represents only those plants that are common to this vegetation type or are normally found in this type and not in the alluvial plain type. They are all trees and shrubs. The herbaceous plants would normally be mostly annual species while other shrubs listed in the alluvial plain type may also occur in this type but are not listed.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Tamarix pentandra	Salt cedar	Abundant
Atriplex lentiformis	Quail bush	Common
Pluchea sericea	Arrowweed	Occasional
Prosopis juliflora	Mesquite	Uncommon

TYPE "D" - Gila River Channel

This vegetation type is a result of a constant water input from a variety of sources, including the Chandler sewage plant which discharges into the Gila Drain, runoff from the Gila Drain and irrigation tailwater coming down the Gila River. The vegetation is one of relatively dense stands of salt cedar interspersed with various shrubs that indicate some salt deposition, e.g., salt bushes, or disturbance, e.g., burroweed. There is an understory of herbs, predominantly annuals, although exotic grasses such as Bermuda grass may be common in some areas. The following list includes just the common shrubs and trees.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Tamarix pentandra	Salt cedar	Abundant
Atriplex canesceus	Four wing salt bush	Common
A. lentiformis	Quail bush	Common
Baccharis sarothroides	Desert broom	Occasional
Happlopappus tenuisectus	Burroweed	Occasional
Hymenoclea monogyra	Burrobush	Occasional

TYPE "E" - Creosote Bush Vegetation (ADOT Diversion Channel Alignment)

This vegetation type is dominated by a nearly pure stand of creosote bush (Larrea tridentata). The creosote bush clumps appear to be evenly spaced due to competition for moisture. Normally, this vegetation type includes sufficient bursage (Ambrosia deltoidea) to give the community a Larrea-Ambrosia title, however, in this area Ambrosia is only found near the small drainage washes that cut through the area. Other plants that are found in this type but only on an occasional basis include wolfberry (Lycium andersonii), ironwood (Olneya tesota) and mesquite (Prosopis juliflora).

A list of the plants observed in the area follows:

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Trees and Shrubs		
Larrea Tridentata	Creosote bush	Abundant
Lycium andersonii	Wolfberry	Common
Olneya tesota	Ironwood	Occasional
Prosopis juliflora	Mesquite	Occasional
Ambrosia deltoidea	Bursage	Occasional
Echinocereus engelmannii	Hedgehog cactus	Uncommon
Sphaeralcea sp.	Desert mallow	Uncommon
Herbs (Common only)		
Amsinckia intermedia	Fiddle-neck	
Erodium sp.	Fileree	
Plantago insularis	Plantain	
Cruciferae	Mustards (family)	

TYPE "F" - Mesquite Bosque (ADOT Diversion Channel Alignment)

The mesquite bosque vegetation type is found in the hundred or more yards north of the Highline Canal near Warner Road. It is a result of ponding of water behind the roadway-dike on the north side of the canal. The groundwater seeping from the canal in addition to increased water input from ponding tend to maintain this vegetational community. The community is dominated by mesquite trees that grade into the creosote bush vegetation to the north. Wolfberry and a few creosote and gray thorn (Ziziphus obtusifolia) also are found within the mesquite stand. In disturbed areas within the stand, burroweed (Happlopappus tenuisectus) is common and desert broom (Baccharis sarothroides) occurs occasionally.

The following is a list of plants observed in this vegetation type.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Trees and Shrubs		
Prosopis juliflora	Mesquite	Abundant
Olneya tesota	Ironwood	Uncommon
Lycium andersonii	Wolfberry	Occasional
Larrea tridentata	Creosote bush	Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
Zizyphus obtusifolia	Gray thorn	Occasional
Baccharis sarothroides	Desert broom	Occasional
Happlopappus tenuisectus	Burroweed	

Ground cover in this vegetation type is limited to exotic grasses (e.g. foxtail brome) and herbs.

FAUNA

The animals associated with the above vegetational communities are varied and quite extensive in number. They are often limited to particular habitats depending on moisture or temperature requirements. For example, toads require moist ground and ducks, an aquatic environment. During a brief survey of the site the following animals were observed:

Birds

Red Tail Hawk
Nighthawk Roadrunner
Gambel's Quail
Robin
Mallad
Blackbird (sp. unknown)
Flicker (sp. unknown)

Reptiles

Rattlesnake (probably western diamond back)

Mammals

Roundtailed Ground Squirrel
Jackrabbit

The following list includes animals that might commonly be found in the area and the type of vegetation or habitat preferred. A - agricultural, B - alluvial plain, C - drainage or wash areas, D - Gila River, E - Creosote bush, F - Mesquite bosque, G - terrestrially ubiquitous, H - aquatic area. Only common names are used for simplicity of presentation.

NAME	HABITAT
Birds	
Green Winged Teal	H
Mallad	H
Pintail	H
Cinnamon Teal	H
American Widgeon	H
Turkey Vulture	G
Cooper's Hawk	A,C,D,F
Red Tailed Hawk	G
Sparrow Hawk	G
Gambel's Quail	B,C,D,E,F
Killdeer	H
Common Snipe	H
Spotted Sandpiper	H
Least Sandpiper	H
Wilson's Phalarope	H
White Winged Dove	G
Mourning Dove	G
Inca Dove	A
Roadrunner	G
Screech Owl	G
Great Horned Owl	G
Elf Owl	B,C,D,E,F
Poor Will	B,C,E,F
Lesser Nighthawk	G
Blackchinned Hummingbird	D
Costa's Hummingbird	B,C,D,E,F
Red Shafted Flicker	G
Yellow-Bellied Sapsucker	A,D
Ladder-Backed Woodpecker	B,C,D,E,F
Western Kingbird	G
Cassin's Kingbird	G
Ash Throated Flycatcher	B,C,D,E,F
Black Phoebe	A,H
Horned Lark	A
Violet-Green Swallow	G,H

NAME	HABITAT
Rough Winged Swallow	G
Cliff Swallow	G,H
Common Raven	G
Verdin	G
Cactus Wren	G
Rock Wren	B,C,D,E,F
Mockingbird	G
Curve Billed Thrasher	B,C,D,E,F
Black Tailed Gnatcatcher	B,C,D,E,F
Ruby Crowned Kinglet	G
Phainopepla	G
Starling	A
Solitary Vireo	G
Orange Crowned Warbler	G
Yellow Warbler	G
Yellow-Rumped Warbler	G,H
House Sparrow	A
Western Meadowlark	A
Yellow Headed Blackbird	A,H
Red Winged Blackbird	A,H
Western Tananger	G
Black-Headed Grosbeak	A,D
House Finch	G
Lark Sparrow	G
Dark Eyed Junco	G
Chipping Sparrow	G
Brewer's Sparrow	G
White Crowned Sparrow	G
Lincoln's Sparrow	G

Amphibians and Reptiles

Couch's Spadefoot Toad	B,C,D,E,F
Colorado River Toad	G
Banded Gecko	B,C,D,E,F
Zebra-Tailed Lizard	B,C,D,E,F
Desert Spiny Lizard	B,C,D,E,F

NAME	HABITAT
Amphibians and Reptiles	
Western Whiptail	G
Gila Monster	B,C,D
Couch Whip Snake	G
Western Patch Nose Snake	G
Gopher Snake	A,D
Common Kingsnake	G
Western Diamond Back Rattlesnake	G
Sidewinder	G
Mojave Rattlesnake	G
Mammals	
California Leaf Nosed Bat	G
Yuma Myotis	G
California Myotis	G
Western Pipistrelle	G
Palled Bat	G
Black-Tailed Jackrabbit	B,C,E,E,F
Desert Cottontail	G
Round-Tailed Ground Squirrel	G
Harris' Antelope Squirrel	B,C,E,H
Arizona Pocket Mouse	G
Desert Pocket Mouse	G
Merriam's Kangaroo Rat	G
Cactus Mouse	G
White-Throated Wood Rat	G
Coyote	G
Gray Fox	G
Kit Fox	B,C
Badger	B,C

COE & VAN LOO
CONSULTING ENGINEERS INC.
ENGINEERING · PLANNING

OF COUNSEL
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June 27, 1979

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

Attention: Mr. Stanley Smith

Re: Preliminary Design Report
Gila Drain Project

Dear Mr. Smith:

In response to your letter of June 15, 1979, we have reviewed the Gila Drain Committee's findings regards our final report and we submit the following comments and corrections:

a) The peak flow and discharge volumes estimated in our report for the Retention Basin System of the Arizona Department of Transportation Borrow Pit were reviewed and it was determined that the combining and routing of the storm discharges presented in our report are virtually identical with the combining and routing of the Corps of Engineers' analysis.

b) Exhibit No. 13 entitled "Alignment Relocation Parallel to Rural Road," page 47 of the report, has been revised as requested and a copy attached hereto.

c) Typographical error corrected and noted in attached errata sheet.

d) Typographical error corrected and percentages adjusted in attached errata sheet.

e) Correction shown in errata sheet.

f) Requested statement added to page 94 of the report, revised copy attached hereto.

g) Typographical corrections are noted in the errata sheet.

Sixteen (16) copies of this letter and its attachment are hereby submitted for your distribution. If has been a pleasure to work with you and other

4550 NORTH 12TH STREET · PHOENIX, ARIZONA 85014 · TELEPHONE (602) 264-6831 · TELEX 910-951-1372

members of the District. Our participation with the Gila Drain Committee, individually, and in the Milestone Meetings has been most rewarding in terms of professional cooperation.

Sincerely,

COE & VAN LOO
Consulting Engineers, Inc.

A. B. Cutler Jr.

Albert B. Cutler, Jr.
Consultant

ABC:dp
Encl. (3)

PROJECT COSTS

Earthwork construction quantities have been determined by average of end areas planimetered from plots of channel cross-sections on ground line plots of the 1976 SCS survey. Structures have been identified and typical quantities determined as shown on the plans and profile sheets. A 15 percent contingency factor is used in the cost estimates.

A three year design and construction period was selected. Engineering costs of 4 percent for design and 5 percent for construction were added to the base cost estimate. Escalation at 9 percent per year was added to both engineering and construction costs for each year after 1979. Schedule of expenditures for engineering was 50 percent each in 1979 and 1980. Schedule of expenditures for construction was 25 percent in 1980, 50 percent in 1981 and 25 percent in 1982. Costs are presented in Table No. 10.

The total estimated cost of the project is $11,896,000.

It should be noted that in neither the "Recommended Project" nor the "Maximum Project Permissible Under the 1923 Agreement" are total costs competitive with onsite retention (inflationary factors considered) as the means for providing 100 year level protection for the cities of Gilbert and Chandler[1].

1) U.S. Army Corps of Engineers: "Summary Report for Flood Control - Gila Floodway - Maricopa and Pinal Counties, Arizona. Table 1, Page 11, September 1977.

ERRATA

PRELIMINARY DESIGN REPORT
GILA DRAIN
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

June 1979

Page 27, Line 16 - Correct spelling: estimated

Page 27, Line 11 - Change Appendix "C" to read: Appendix "E"

Page 89, Line 23 - Delete the word: serious

Page 110, Line 26 - Correct spelling: exhaust

Page 111, Line 14 - Correct spelling: improvement

Page 111, Line 28 - Correct 156 acre feet to read: 1,562 acre feet

Page 112, Last Paragraph - Delete entire paragraph and substitute

"The 100 year frequency storm runoff through Highway I-10 culvert is estimated at 465 acre feet. When added to the SRVWUA base flow release of 1,562 acre feet, the total discharge of uncontrolled flow through the culvert under future conditions would amount to 2,027 acre feet. In comparison with the Corps of Engineers estimate this is equivalent to a 15 percent increase over present discharges without a project (1,770 acre feet). To this must be added releases of retained/ detained flows after the storm."

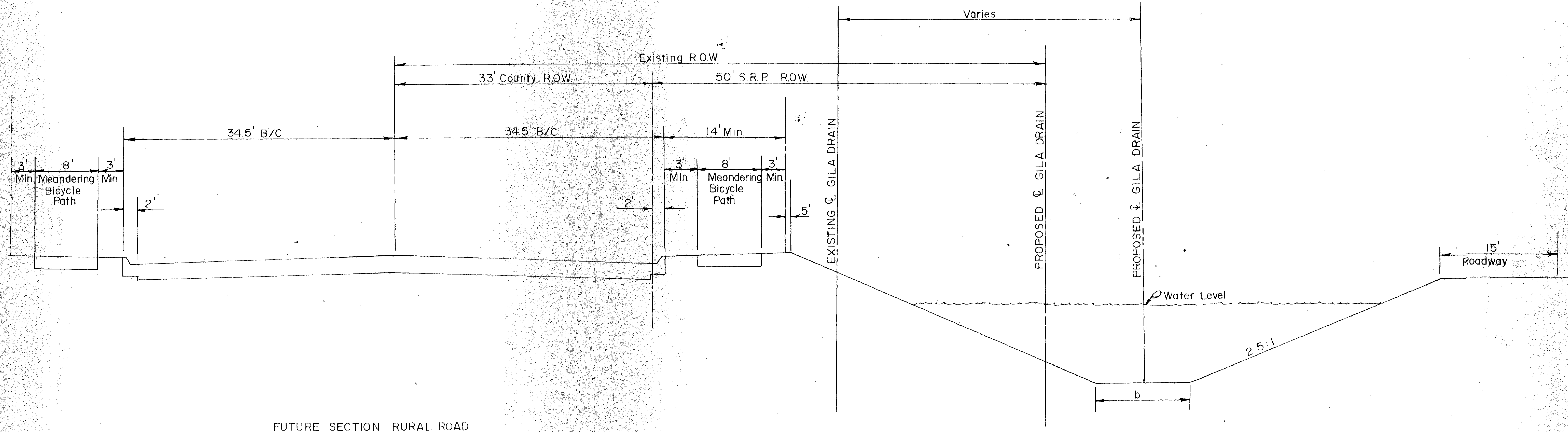
Page 120, Line 27 - Delete (3,620 A.F.) and substitute: (5,060 A.F.)

Page 124, Line 8 - Correct spelling: History

Page A-11, Line 3 - Change the/ ounty to read: the county

Page E-11 - Delete the entire page

GILA DRAIN PROJECT



FUTURE SECTION RURAL ROAD

TYPICAL SECTION GILA DRAIN

ALIGNMENT RELOCATION PARALLEL TO RURAL ROAD

EXHIBIT NO. 13