STUDY PHASE
LETTER REPORT
FOR
SAN PEDRO COLLECTORS
TO THE NORTH PINO ARROYO
CITY PROJECT NO. 7168

April 2004

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INTRODUCTION AND SITE LOCATION

The San Pedro Collectors to the North Pino Arroyo project involves the installation of underground storm drains in San Pedro Boulevard north and south of the North Pino Arroyo connecting to existing storm drain stub-outs from the channel. The storm drain stub-outs, 60" diameter RCP on the south side and 54" RCP on the north side, were constructed with the North Pino Arroyo. To the south of the arroyo, the storm drain extends in San Pedro to just south of Fleetwood Avenue. From the intersection of San Pedro and Derickson, a storm drain is extended east to collect flows in Derickson. To the north of the arroyo, the storm drain extends to San Francisco Road and turns east to collect flows in San Francisco. One of the goals of the study is to determine if an existing floodplain in San Francisco Road can be removed. The amount of flow that can be collected in the storm drain systems north and south of the arroyo is limited by the capacity of the storm drain extensions connecting into the storm drain stub-outs at the arroyo. Therefore, the peak flow in San Pedro, Derickson, and San Francisco may not all be collected in the storm drain extensions.

NARRATIVE OF PROJECT REQUIREMENTS

The purpose of this project is to transport flows from the drainage basins north and south of the North Pino Arroyo in accordance with the "Far Northeast Heights Master Drainage Plan," October 1989, by Weston. The primary goal is to provide for interception of flows at San Pedro, San Francisco, and Derickson Roads. The MDP lists flows for the contributing basins using curve numbers. We understand that the hydrology will be updated using the AHYMO program, however we will model the hydrology using the basin characteristics as listed in the report and only for the basins that contribute to the project area as listed in the report. This project includes the preparation of preliminary and final design plans, specifications, and bid documents for the proposed storm drain system. A key to the success of the project will be providing design solutions to the utility conflicts, specifically sanitary sewer and water line conflicts.

The following issues will be addressed during the design of the project.

- North of the North Pino Arroyo: A storm drain will be constructed from San Francisco Street to the North Pino Arroyo through a public roadway with minimal roadway disturbance. These improvements will divert flows from San Francisco to the arroyo.

- South of the North Pino Arroyo: A storm drain from Fleetwood Avenue to the North Pino Arroyo through a public roadway with minimal roadway disturbance. These improvements will divert flows from San Pedro Boulevard and Derickson Street to the arroyo.

- Storm drain connections to the existing RCP storm drain stub-outs from the channel on the north and south sides of the North Pino Arroyo. A determination of whether drainage and construction easements will be required for the properties adjacent to the channel at the stub-out locations.

- Raising or lowering existing waterlines to accommodate the new storm drain alignment and sleeving existing small diameter sanitary sewer lines through the proposed storm drain lines using concrete collars.

- Design of traffic control to minimize the impact on local traffic. San Pedro is sufficiently wide to allow for two-way traffic and still provide adequate room for construction of the proposed storm drain.

- Possible completion of a CLOMR/LOMR for the reduction of the flood plain in San Francisco Street.

METHODOLOGY

The hydrologic and hydraulic criteria in Section 22 of the City of Albuquerque Development Process Manual (DPM), entitled "Drainage, Flood Control, and Erosion Control," was followed to perform the analyses given in this report. The design storm used for the project is the 100-year, 6-hour storm event for peak flow computations. The project is located in Zone 3, which has a 100-year, 6-hour design storm of 2.60 inches. An AHYMO model was developed for all basins draining to the intersections of San Pedro and San Francisco and San Pedro and Derickson.

Storm drain and street capacities were modeled using Flowmaster program from Haested to determine normal depths. Storm drains were sized assuming gravity flow conditions.

SUMMARY OF STUDY CONCLUSIONS

HYDROLOGY

The "Far Northeast Heights Master Drainage Plan," (FNHMDP) October 1989, by Weston, was used as a basis to define drainage basins that drain to San Pedro from San Francisco and Derickson. The scope of work identified analyzing the basins between San Pedro and Louisiana. But early in the analysis it was obvious that the area draining to San Francisco extended east of Louisiana. Aerial mapping of the project area with 2' contours was obtained from AMAFCA to determine drainage basin delineation. The aerial mapping shows that the basin that drains to San Francisco and San Pedro, begins east of Wyoming Boulevard at Union Street. The aerial mapping was also used to delineate the basin that drains to the intersection of Derickson and San Pedro. This basin does begin at Louisiana Boulevard.

Plate 1 shows the drainage basins that were delineated using the aerial mapping. Basins 1, 2, 3, & 4 all drain to San Francisco. Basins 3 and 4 together are similar to basin 338 in the FNHMDP. Basin 5 drains to the intersection of Derickson and San Pedro. Basin 6 drains to the sidewalk culvert that discharges to San Pedro from Frank Place. Basins 5 and 6 are less than half of basin 340 in the FNHMDP.

Basin characteristics were computed for input to AHYMO. To obtain the percent of Land Treatment D, first all of the residential lots in each basin were counted and divided by the basin area to get a DU/ACRE value, next the DU/ACRE value was input to the calculation for single family residential land use in Table A-5 of the DPM Section 22.2. The remaining percentage for land treatment types was divided equally into Type B and Type C. Input to AHYMO to calculate the Time to Peak for each basin followed the SCS Upland Method as described in Part B of the DPM Section 22.2. All of the basins had a watercourse length of less than 4000 feet, therefore the method described in section B.2.1 was followed. See Appendix B for basin characteristics calculations.

Once the basin characteristics were calculated, an AHYMO model was developed to determine the peak flows. A portion of the flows from Basin 1 were assumed to be collected by the existing 30" Storm Drain in Wyoming Boulevard that drains north to the South Domingo Baca Arroyo. According to the FNHMDP the capacity of the 30" storm drain is 22.8 CFS, therefore the peak flow from the basin that continues to drain west in San Francisco was reduced by 22.8 CFS. A Divide Hydrgraph command was used in AHYMO to split the flow. The remainder of flow from Basin 1 and Basins 2 and 3 were routed in San Francisco by the Muskingham Cunge Method. The results of the AHYMO model indicates that the peak flow at San Francisco and San Pedro is 308.6 CFS and the peak flow at Derickson and San Pedro is 160.5 CFS.

The peak flow in San Pedro from south of Derickson were calculated by multiplying the CFS/ACRE computed by AHYMO for Basin 5 (Derickson) by the remaining area of basin 340 in the FNHMDP (subtracting the areas of basins 5 & 6). The peak flow in San Pedro south of Derickson is 243.2 CFS. See Appendix B for hydrologic calculations.

Table 1 Existing Drainage Conditions

BASINS	Area (acres)	DU's/Acre	100yr-6hr Peak Flow (CFS)	CFS/Acre	Land Treatment
1	21.60	4.90	86.21	3.99	26%B, 25%C, 49%D
2	59.33	2.88	183.53	3.09	34%B, 33%C. 33%D
3	22.47	3.43	84.83	3.78	31%B, 31%C, 38%D
4	37.33	3.54	121.79	3.26	31%B, 30%C, 39%D
5	42.60	5.56	160.46	3.77	23%B, 23%C, 54%D
6	5.20	3.85	20.42	3.93	25%B, 24%C, 41%D
340B	64.7	5.56*	243.20	3.77*	

* Assumed to be the same as basin 5

STORM DRAIN ALIGNMENT NORTH OF THE NORTH PINO ARROYO

The proposed storm drain on the north side of the North Pino Arroyo will connect into the 54" stub-out on the north side of the channel and run north in San Pedro Boulevard to San Francisco Street and turn east in San Francisco. The stub-out is located at a 45-degree angle from the channel. The alignment of the stub-out dictates the alignment of the proposed 54" RCP extension. According to the approximate right-of-way boundary for the channel, the stub-out slightly impacts the property to the north. This will be discussed in further detail later. Please refer to Plate 2 and Plate 3.

San Pedro Boulevard has a 60-foot right-of-way with a crowned street with a width of 48.5 feet face to face. Existing utilities in San Pedro north of the arroyo include a 16" waterline located 8 feet west of the street centerline. There seems to be a sanitary sewer line at the centerline of the street that provides service to the three lots on the east side of San Pedro. This sanitary sewer line will need to be pot-holed. PNM has indicated that there is a 6" gas line that is located 6 feet from the east right-of-way line, which puts it under the east curb and gutter. Finally Qwest has underground facilities along the west right-of-way line behind the curb. The proposed north-south horizontal alignment of the 54" RCP in San Pedro will be in the north bound lane about 12 feet from the face of the east curb to the centerline of the storm drain. This alignment was selected because of the minimal conflicts with other utilities in San Pedro and it can be constructed by closing only one lane allowing for two-way traffic. The north-south storm drain alignment will tie into the 54" storm drain extension of the channel stub-out at a 75-degree pre-cast bend. Please refer to Plate 2.

San Francisco has a 60-foot right-of-way with a 44-foot wide crowned street face to face. There is an 8" sanitary sewer line along the centerline of the street, a 6" water line located 12 feet north of the street centerline, and a 4" gas line located 3 feet south of the north right-of-way, which is behind the north curb. The proposed east-west horizontal alignment of the storm drain in San Francisco will be in the east bound lane about 9 feet from the face of the south curb to the centerline of the pipe. Again, this alignment was chosen because of the minimal conflicts with existing utilities. The 90 degree turn in alignment will be accomplished by two 45-degree pre-cast bends at the intersection of San Pedro and San Francisco.

The vertical alignment of the storm drains in San Pedro and San Francisco were based on keeping a minimum cover of 2 feet from the pavement surface. The minimum cover of 2 feet allows for the installation of T-Man Holes on the larger diameter pipes and the top of the pipe will be below the pavement structure. The storm drain in San Pedro will connect into the 54" RCP stub-out on the north side of the channel. According to the location survey, the 54" stub-out on the north side of the North Pino Arroyo is 20.81 feet long with a slope of 0.017 ft/ft. The stub-out discharges into the channel at a 45 degree angle. The slope of San Pedro north of the arroyo is at 0.005 ft/ft with the high point approximately at the centerline of the intersection of San Pedro and San Francisco. Therefore, the vertical elevation of the 54" storm drain is set so that there is a minimum

of 2 feet of cover at the intersection. This ensures that the remainder of the storm drain has at least 2 feet of cover. The slope of the 54" storm drain in San Pedro from the stub-out to San Francisco is .0121 ft/ft. At the tie in to the stub-out, a manhole is required where the slope changes. The storm drain in San Francisco is at a 0.02 ft/ft slope, which is less than the street slope thereby ensuring that the storm drain has a minimum cover of 2 feet.

STORM DRAIN ALIGNMENT SOUTH OF THE NORTH PINO ARROYO

The proposed storm drain on the south side of the North Pino Arroyo will connect into the 60" stub-out on the south side of the channel and run south in San Pedro Boulevard to Fleetwood Street. At Derickson, a storm drain will connect into the 60" storm drain in San Pedro and extend east to collect street flows. The stub-out is located at a 45-degree angle from the channel. At the end of the stub-out an 8-foot diameter manhole will be built to allow the new 60" RCP to be placed at a 45-degree angle to parallel the channel. According to the approximate right-of-way boundary for the channel, the new 60" RCP parallel to the channel slightly impacts the property to the north. This will be discussed in further detail later. Please refer to Plate 2 and Plate 3.

San Pedro Boulevard has a 60-foot right-of-way with a crowned street with a width of 48.5 feet face to face. Existing utilities in San Pedro south of the arroyo include a 16" waterline located 8 feet west of the street centerline. South of Coronado the 16" waterline is reduced to a 12" waterline. An 8" sanitary sewer line is located at the centerline of the street. PNM has indicated that there is a 6" gas line that is located 6 feet from the east right-of-way line, which puts it under the east curb and gutter. Finally Qwest has underground facilities along the east and west right-of-way line behind the curb. The proposed north-south horizontal alignment of the 60" RCP, 48" RCP, and 42" RCP in San Pedro will be in the north bound lane about 12 feet from the face of the east curb to the centerline of the storm drain. This alignment was selected because of the minimal conflicts with other utilities in San Pedro and it can be constructed by closing only one lane allowing for two-way traffic. The north-south storm drain alignment will tie into the 60" storm drain extension of the channel stub-out at a 54-degree pre-cast bend. Please refer to Plate 2.

Derickson has a 60-foot right-of-way with a 40-foot wide crowned street face to face. There is an 8" sanitary sewer line along the centerline of the street, a 6" water line located 10 feet north of the street centerline, and a 4" gas line located 4 feet north of the south right-of-way, which is behind the north curb. The proposed east-west horizontal alignment of the storm drain in Derickson will be in the east bound lane about 7 feet from the face of the south curb to the centerline of the pipe. Again, this alignment was chosen because of the minimal conflicts with existing utilities. The connection to the San Pedro storm drain will be accomplished with a 60" x 48" Wye and a 48" 45-degree bend .

The vertical alignment of the storm drains in San Pedro and Derickson were based on keeping a minimum cover of 2 feet from the pavement surface. The minimum cover of 2

feet allows for the installation of T-Man Holes on the larger diameter pipes and the top of the pipe will be below the pavement structure. The storm drain in San Pedro will connect into the 60" RCP stub-out on the south side of the channel. According to the location survey, the 60" stub-out on the south side of the North Pino Arroyo is 21.71 feet long with a slope of 0.0294 ft/ft. The stub-out discharges into the channel at a 45 degree angle. The slope of San Pedro south of the arroyo is at 0.011 ft/ft to past Fleetwood. The vertical elevation of the 60" storm drain is set so that there is a minimum of 2 feet of cover at the intersection of San Pedro and Derickson. This ensures that the remainder of the storm drain has at least 2 feet of cover. The slope of the 60" storm drain in San Pedro from the stub-out to San Francisco is .0109 ft/ft. The storm drain in Derickson is at a 0,02 ft/ft slope, which is less than the street slope thereby ensuring that the storm drain has a minimum cover of 2 feet.

STORM DRAIN AND STREET HYDRAULICS

STORM DRAIN AND STREETS NORTH OF THE NORTH PINO

According to the FNHMDP, the North Pino Arroyo at San Pedro has a peak flow of 2388 CFS. Using the Flowmaster program, the channel has a normal depth of 4.37 feet. For these analyses, it is assumed that the peak discharge form the 54" RCP into the channel will come before the peek flow in the channel is achieved. The 54" RCP in San Pedro Boulevard has a slope of 0.0121 ft/ft. The capacity of the 54" storm drain under gravity flow conditions is 232 CFS. In San Francisco, a total of three cattle-guard type inlets will be constructed to collect a minimum of 232 CFS to be conveyed in the 54" RCP. The peak flow in San Francisco at San Pedro is 308.6 CFS. Therefore, 76.6 CFS will not be collected by the storm drain system. See Appendix C for hydraulic calculations.

The normal depth in San Francisco at a peak flow of 308.6 CFS is 0.98 feet. In order to determine the amount of flow that a cattle-guard inlet can collect, the weir equation was used because San Francisco has a constant slope. At a depth of 0.83 feet, which is the depth at the right-of-way, a cattle-guard inlet in San Francisco can collect 99.8 CFS. The number of cattle-guard inlets required to collect the 232 CFS is three. Therefore, three cattle-guard inlets are shown in San Francisco on Plate 2 with a 36" RCP between the upper two inlets and a 48" RCP between the lower two inlets.

At the intersection of San Pedro and San Francisco, the 76.6 CFS that is not collected by the inlets will have a normal depth of 0.59 feet. Since the crown continues in San Francisco through the intersection, at the elevation of the crown 25 CFS will drain north in San Pedro, 25 CFS will drain south in San Pedro to the arroyo, and 26.6 CFS will continue west in San Francisco. In San Pedro at the bridge over the arroyo, there is a 27.8-foot curb opening on the east side and a 34.3-foot curb opening on the west side. Using the weir equation, the capacity of the east curb opening at curb height is 45.7 CFS and the capacity of the west curb opening at curb height is 56.4 CFS. The 25 CFS

overflow from San Francisco will be discharged to the channel through the east curb opening.

STORM DRAIN AND STREETS SOUTH OF THE NORTH PINO

The 60" RCP in San Pedro Boulevard has a slope of 0.0109 ft/ft. The capacity of the 60" storm drain under gravity flow conditions is 292 CFS. The peak flow in Derickson at San Pedro is 160.5 CFS. The normal depth in Derickson with a peak flow of 160.5 CFS is 0.78 feet. In Derickson, a total of two cattle-guard type inlets and two Type A inlets will be constructed to collect the 160.5 CFS peak flow. According to Plate 22.3 D-5 in the DPM, a Type A inlet will collect 15 CFS at a depth of 0.78 feet. The two cattle-guard inlets can collect a total of 137.1 CFS. All of the street flow in Derickson will be collected by the series of storm inlets. The remaining capacity in the 60"RCP in San Pedro after the flows from Derickson are collected is 131.5 CFS.

To get as much flow in the San Pedro storm drain as possible the storm drain is extended south to past Fleetwood to collect street flows. The normal depth in San Pedro near Fleetwood at a peak flow of 243 CFS is 0.92 feet. Since San Pedro is a Minor Arterial, cattle-guard type inlets are not allowed. To collect the 131.5 CFS in San Pedro, a series of double C and single A type inlets will be constructed. At a depth of 0.92 feet, a double C inlet can collect 20 CFS and a single A inlet can collect 15 CFS. A pair of double C inlets, one in each curb and gutter is located just north of Fleetwood. Just south of Fleetwood a series of one single A inlet and two double C inlets in the east and west curb line. A 42" RCP conveys the flows from the series of inlets and a 48" RCP Ties into the 60" RCP at Derickson. The remaining 111.5 CFS in San Pedro will discharge into the North Pino at the bridge.

POTENTIAL CONFLICTS

STORM DRAIN NORTH OF THE NORTH PINO ARROYO

In San Pedro, at the location where the 54" RCP crosses the 16" water line, the waterline will be lowered. Also at the location where the 54" RCP crosses the 6" gas line, the gas line will need to be lowered. And in San Francisco, the 6" waterline will need to be lowered to allow for construction of cattle-guard inlets. See Appendix F for conceptual plan and profile sheets.

STORM DRAIN SOUTH OF THE NORTH PINO ARROYO

At the intersection of Derickson and San Pedro the existing 8" sanitary sewer line is at the same approximate invert of the 60" RCP. In order to minimize or eliminate the vertical conflict at this location, the 60" X 48" Wye fitting was moved to the north to allow for a 60" X 48" reducer to be connected to the south side of the wye so that the soffit of the 48" RCP lines up with the Soffit of the 60" RCP. At the wye, the soffit of the 48" leg is

also lined up with the soffit of the 60" run. This allows for additional clearance over the existing 8" sanitary sewer line. The 8" sanitary sewer line will either be replaced with ductile iron or a concrete cap will be placed over the pipe. See Appendix D for storm drain details. In San Pedro, at the location where the 60" RCP crosses the 16" water line, the waterline will be lowered. Also at the location where the 60" RCP crosses the 6" gas line, the gas line will need to be lowered. And in Derickson, the 6" waterline will need to be lowered to allow for construction of cattle-guard inlets.

NEED FOR SPECIALTY SERVICES

At the North Pino Arroyo where the new storm drains are extended from the storm drain stub-outs, the construction and maintenance of the extensions will impact the adjacent properties to the north and south (see Plate 3). The impact is caused by the stub-outs orientation into the channel and the lack of channel right-of-way. The stub-outs are placed at a 45-degree angle to the channel centerline. According to the approximate property boundaries performed by the surveyor, there is only 8 feet between the top of the channel and the south right-of-way and only 8 feet between the top of the channel and concrete block wall and the north right-of-way.

On the north side of the channel if the property line is correct, a small drainage and construction easement is required to construct the 54" RCP extension. The construction of the 54" RCP will require the removal and replacement of the existing chain link fence and the installation of a temporary chain link fence along the easement line.

On the south side of the channel if the property line is correct, a larger drainage and construction easement is required to construct the 60" RCP extension. The construction of the 60 " RCP will require the following existing items to be removed and replaced.

1. The 6' high block wall with stucco adjacent to the channel and along San Pedro to the driveway.
2. The 6' high chain link fence adjacent to the channel.
3. The concrete header curb and asphalt paving in the channel right-of-way at the top of the channel.

A temporary chain link fence will need to be installed along the easement line during construction of the 60" storm drain.

Obtaining easements or property from private owners can cause significant delays to projects. To attempt to expedite the property acquisition for this project the following Specialty Services need to be negotiated and started immediately.

1. Perform a boundary survey of the adjacent properties on the north and south side of the channel.
2. Write a legal description of the easements required.
3. Perform appraisals of the properties.

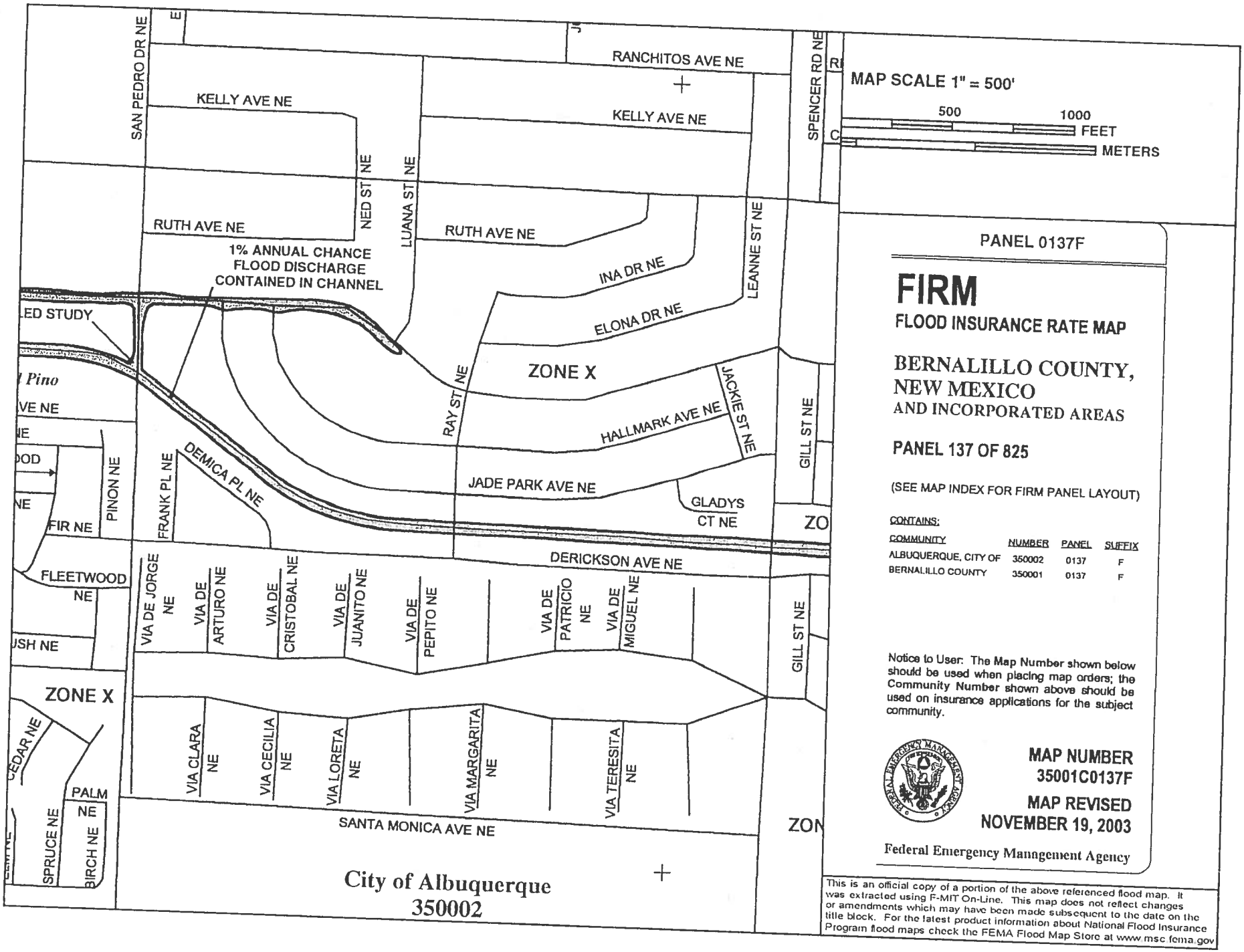
4. Negotiate with the property owners for the easements required.

FLOODPLAIN REMOVAL FEASIBILITY ANALYSIS

The FEMA Flood Insurance Rate Map Number 35001C0137F, effective date November 19, 2003, shown in Figure 1, indicates the presence of a Flood Hazard Zone AO with a depth of 1 foot in San Francisco Street from the I-25 Frontage Road past San Pedro to Luana Street. A hydraulic analysis of San Francisco Street has been completed to determine if the Flood Hazard Zone can be removed. According to the AHYMO model output the peak flow at the intersection of San Francisco and Ray Street is 233 CFS. The normal depth in San Francisco at Ray is 0.88 feet, which is less than the 1-foot flood depth, but more than the assumed elevation at the right-of-way of 0.83 feet. At the intersection of San Pedro and San Francisco the peak flow is 308.6 CFS. The normal depth in San Francisco under existing conditions is 0.98 feet, which is close to the 1-foot flood depth. After the storm drain improvements are constructed in San Francisco the peak flow in the street is 76.6 CFS, which results in a normal depth of 0.59 feet. As stated previously, only 26.6 CFS of the 76.6 CFS in San Francisco continues west in San Francisco past San Pedro.

West of San Pedro, the peak flow in San Francisco was determined by multiplying the area of the basin (347) as given in the FNHMDP by the CFS/Acre calculated for a sub-basin within the overall basin. This basin has mostly industrial land uses. From the DPM Section 22.2, the percent D Land Treatment was assumed to be 70% for the sub-basin to be analyzed. The 3.59-acre sub-basin selected was just south of San Francisco and west of San Pedro. The CFS/Acre for the sub-basin was 4.42 CFS/ Acre. Therefore, the total peak flow in basin 347 is 294 CFS, which is conservative. It is assumed that the 26.6 CFS from San Francisco east of San Pedro will be negligible by the time it is routed in San Francisco to the I-25 Frontage Road. The normal depth in San Francisco at the I-25 Frontage Road is 0.96 feet, which is close to the 1-foot flood plain depth.

In conclusion, the floodplain in San Francisco east of San Pedro can be removed with the installation of the storm drain improvements. The most upstream cattle-guard inlet may need to be moved further east to a location just east of Luana Street to reduce the normal depth in the street to remove the flood plain. This would add about 800 feet of 36" RCP and pavement removal and replacement to the project. Also the majority of the floodplain in San Francisco west of San Pedro can be removed. At the intersection of San Francisco and I-25 where the flows turn to the south, a backwater effect would deepen the water surface and cause the flood plain to back up into San Francisco for a distance. A more detailed analysis would be required to where the flood plain would start in San Francisco.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ELONA DR NE
ZONE X
RAY ST NE
JACKIE ST NE
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JADE PARK AVE NE
GLADYS
CT NE
DEMICA PL NE
FRANK PL NE
PINON NE
FIR NE
DERICKSON AVE NE
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VIA DE CRISTOBAL NE
VIA DE JUANITO NE
VIA DE PEPITO NE
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VIA DE MIGUEL NE
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City of Albuquerque
350002
MAP SCALE 1" = 500'
500
1000
FEET
METERS
PANEL 0137F
FIRM
FLOOD INSURANCE RATE MAP
BERNALILLO COUNTY,
NEW MEXICO
AND INCORPORATED AREAS
PANEL 137 OF 825
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
ALBUQUERQUE, CITY OF 350002 0137 F
BERNALILLO COUNTY 350001 0137 F
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
35001C0137F
MAP REVISED
NOVEMBER 19, 2003
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

LIST OF SHEETS

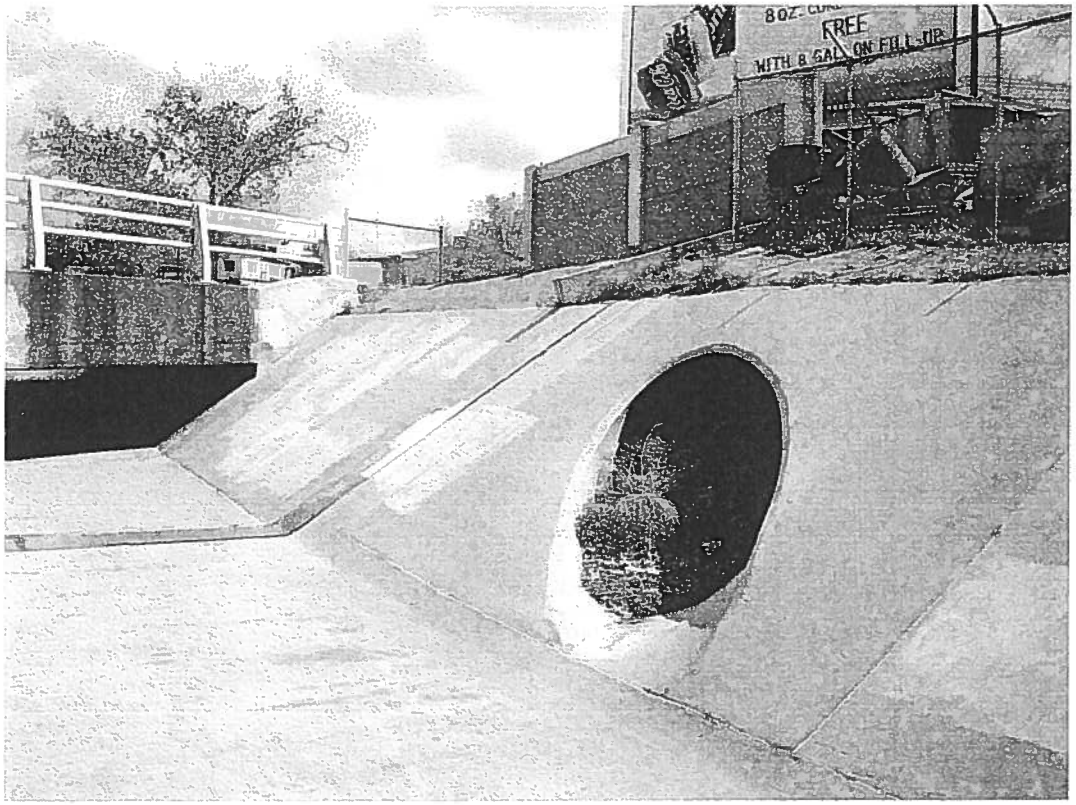
The following is a preliminary list of sheets in the plans for the San Pedro Collectors Project.

Sheet 1:	Title Sheet
Sheet 2:	General Notes
Sheet 3:	Overall Storm Drain Plan and Water Shut-off Plan
Sheets 4-9:	Storm Drain Plan & Profile Sheets
Sheets 10-11:	Utility Relocation Plan & Profile Sheets
Sheets 12-17:	Paving Remove & Replace Sheets
Sheet 18:	Typical Street Sections
Sheet 19-20:	Miscellaneous Details
Sheets 21-23:	Traffic Control Plans

CONCEPTUAL CONSTRUCTION COST ESTIMATE

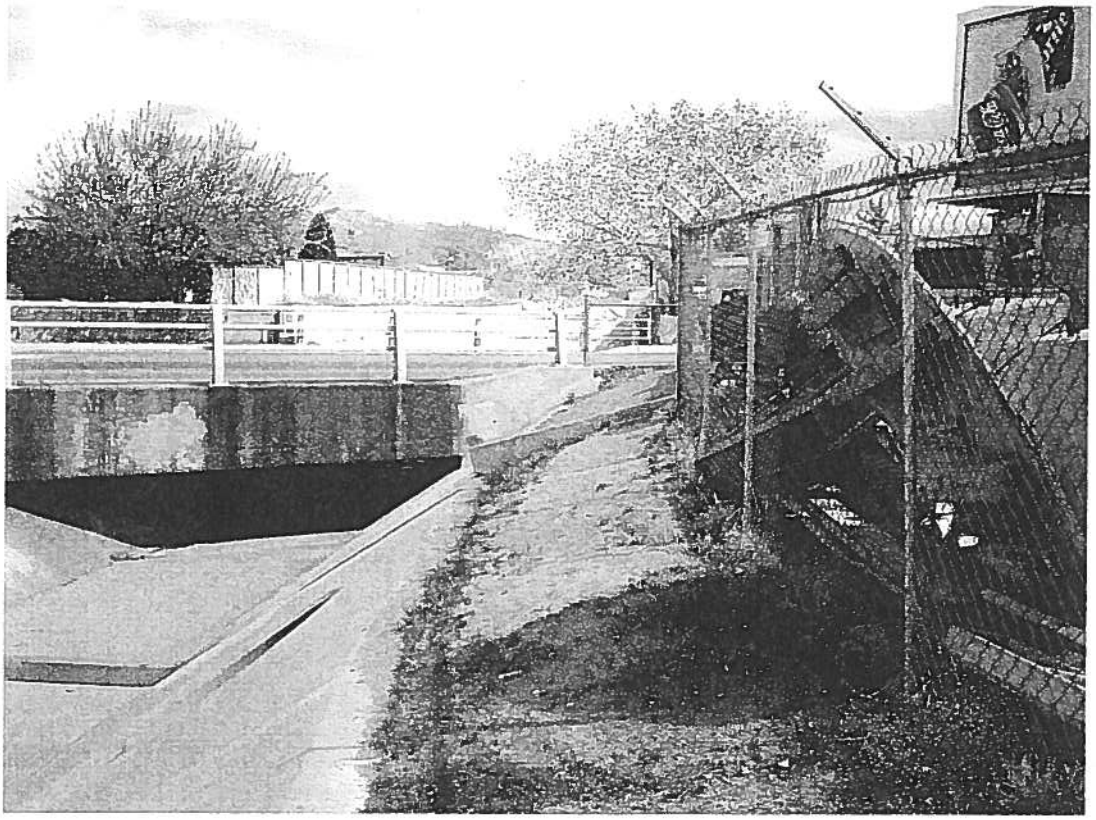
Conceptual construction cost estimates were developed for the storm drain system on the north side of the North Pino Arroyo and for the storm drain system on the south side of the North Pino Arroyo. The total cost of the storm drainage improvements on the north side of the arroyo including 15% contingencies and NMGRT is $274,760. The total cost of the storm drainage improvements on the south side of the arroyo including 15% contingencies and NMGRT is $594,830. The total cost of the project is $869,590. Please see Appendix E for detailed cost items.

APPENDIX A
PROJECT PHOTOS

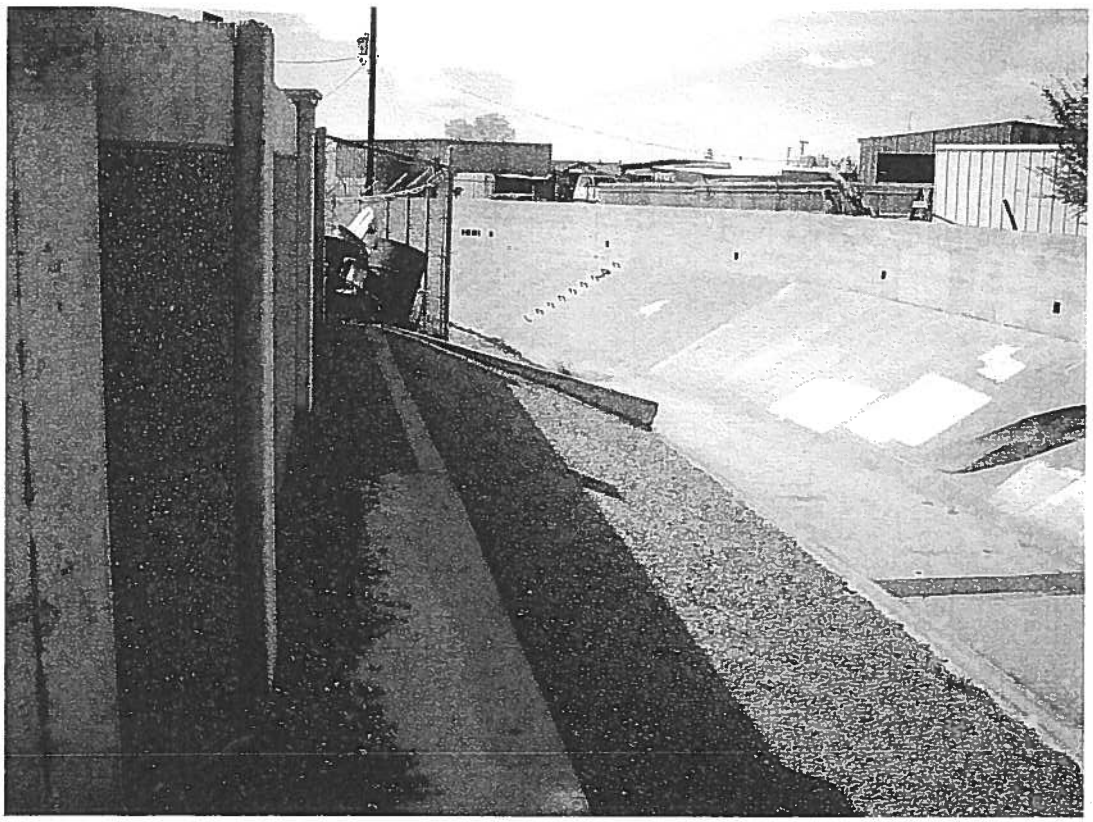


NORTH PINO ARROYO LOOKING EAST AT 60" STUB-OUT

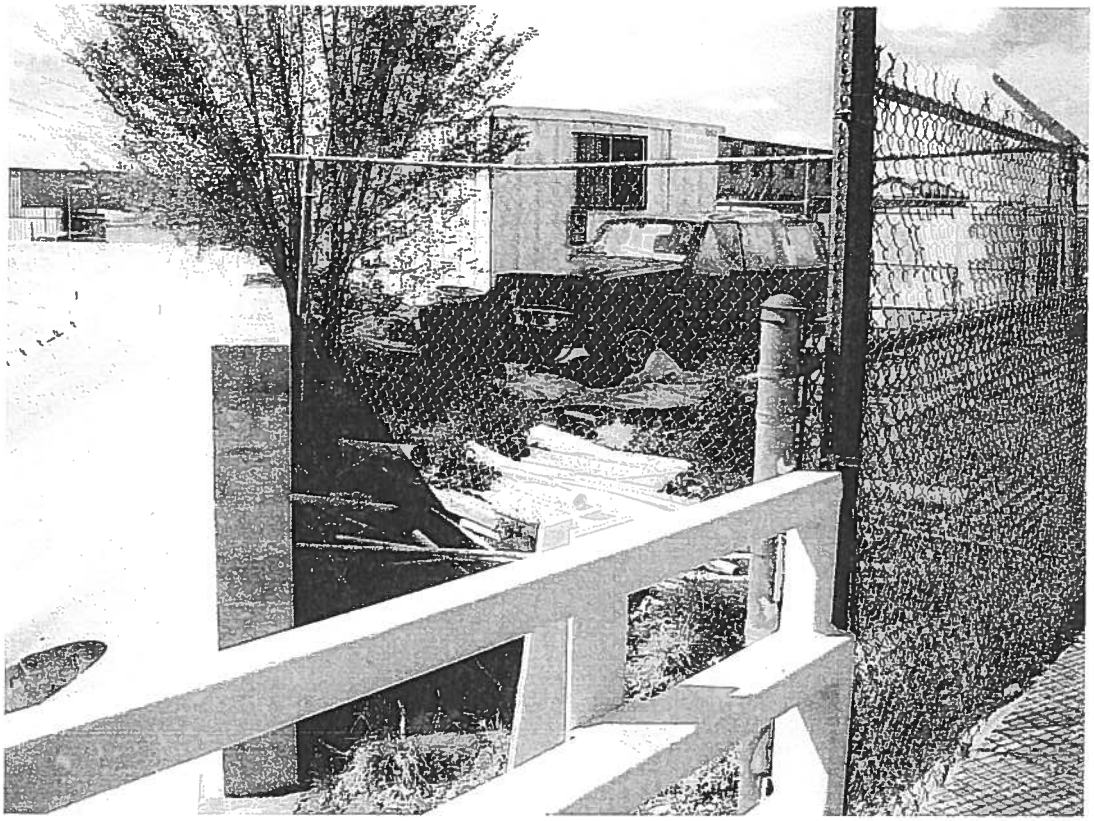
NORTH PINO ARROYO LOOKING EAST AT 54" STUB-OUT



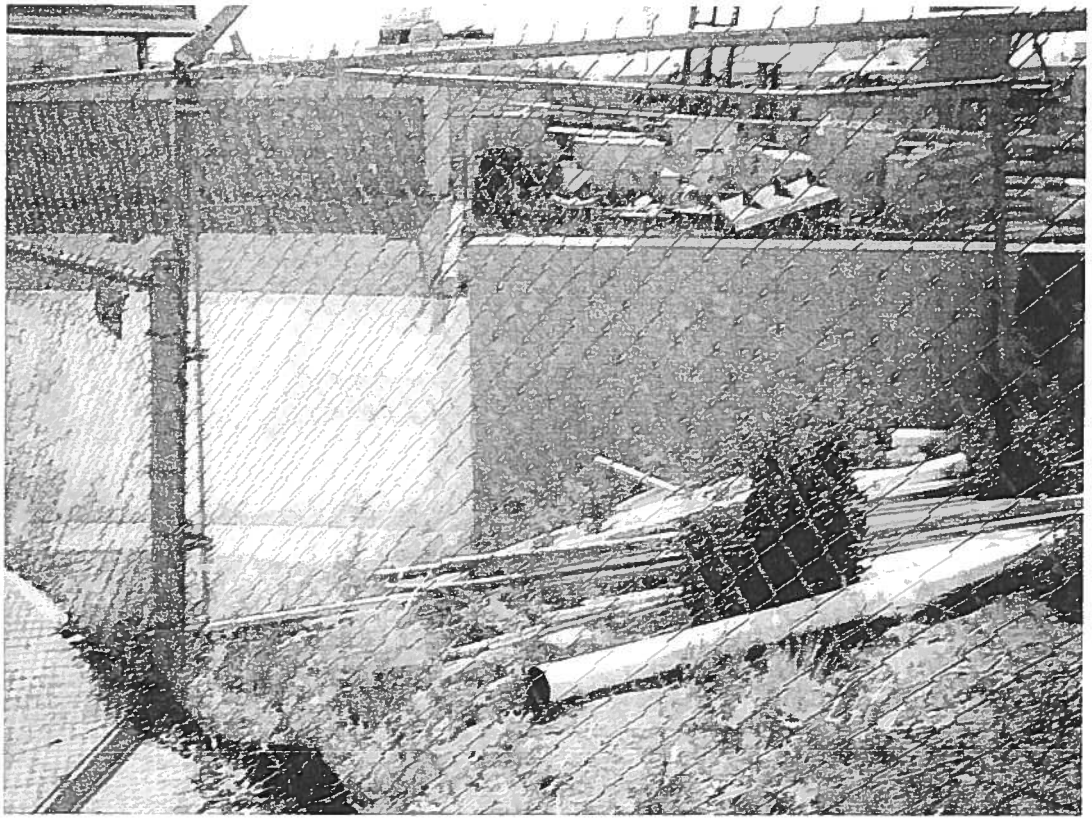
NORTH PINO ARROYO LOOKING EAST AT SOUTH ROW



NORTH PINO ARROYO LOOKING WEST AT SOUTH ROW



NORTH PINO ARROYO LOOKING NORTHWEST AT NORTH ROW



NORTH PINO ARROYO LOOKING SOUTHWEST AT NORTH ROW

APPENDIX B
HYDROLOGIC CALCULATIONS

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =04/02/2004
INPUT FILE = C:\Projects\COASAN~1\SANPED~3.TXT USER NO.= AHYMO~I-9702a01000K21-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
START										
RAINFALL TYPE= 1										TIME= .00
*SEDIMENT BULK	CODE=1 BULK FACTOR=1.10									RAIN6= 2.600
*S**********										
*s SAN FRANCISCO STREET BASINS										
*S**********										
*S BASIN 1 - EAST WYOMING										
*S**********										
COMPUTE NM HYD	1.00	-	10	.03375	86.21	3.075	1.70838	1.500	3.991	PER IMP= 49.00
*S DIVIDE HYDROGRAPH TO DIVERT 22.8 CFS INTO 30" RCP IN WYOMING										
*S THAT DISCHARGES TO THE SOUTH DOMINGO BACA ARROYO										
DIVIDE HYD	1A	10	21	.02037	22.80	1.856	1.70837	1.367	1.749	
	1B	and	22	.01338	63.41	1.219	1.70837	1.500	7.406	
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO LOUISIANA										
*S ASSUME 60' ROW AND 44' F-F										
*S										
*S ROUTE FLOWS USING MCCUNGE										
ROUTE MCUNGE	1BROUTE	22	30	.01338	61.27	1.209	1.69365	1.767	7.156	CCODE = .1
*S										
*S**********										
*S BASIN 2 - LOUISIANA TO WYOMING										
*S**********										
COMPUTE NM HYD	2.00	-	12	.09270	183.53	7.446	1.50603	1.567	3.093	PER IMP= 33.00
*S COMBINE ROUTED 1B AND 2										
ADD HYD	2.50	12&30	40	.10608	183.53	8.654	1.52969	1.567	2.703	
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO RAY STREET										
*S ASSUME 60' ROW AND 44' F-F										
*S										
*S ROUTE FLOWS USING MCCUNGE										
ROUTE MCUNGE	2.5ROUTE	40	31	.10608	182.03	8.647	1.52840	1.633	2.681	CCODE = .1
*S										
*S**********										
*S BASIN 3 - WEST OF LOUISIANA										
*S**********										
COMPUTE NM HYD	3.00	-	13	.03511	84.83	2.942	1.57114	1.500	3.775	PER IMP= 38.00
*S COMBINE ROUTED 2.5 AND 3										
ADD HYD	3.50	13&31	41	.14119	234.77	11.589	1.53902	1.633	2.598	
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO SAN PEDRO										
*S ASSUME 60' ROW AND 44' F-F										
*S										
*S ROUTE FLOWS USING MCCUNGE										
ROUTE MCUNGE	3.5ROUTE	41	32	.14119	233.04	11.581	1.53792	1.733	2.579	CCODE = .1
*S**********										
*S BASIN 4 - EAST OF SAN PEDRO										
*S**********										
COMPUTE NM HYD	4.00	-	14	.05833	121.79	4.921	1.58191	1.533	3.262	PER IMP= 39.00
*S COMBINE ROUTED 3.5 AND 4										
ADD HYD	4.50	14&32	42	.19952	308.59	16.502	1.55078	1.700	2.417	
*S DERRICKSON BASINS										
*S**********										

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.		TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
*S BASIN 5 - SAN PEDRO TO LOUISIANA											
*S**********											
COMPUTE NM HYD	5.00	-		15	.06656	160.46	6.296	1.77349	1.533	3.767	PER IMP= 54.00
*S**********											
*S BASIN 6 - EAST OF SAN PEDRO & SOUTH OF DERRICKSON											
*S**********											
COMPUTE NM HYD	5.00	-		15	.00813	20.42	.722	1.66461	1.500	3.925	PER IMP= 45.56
FINISH											

```
    AHYMO PROGRAM (AHYMO_97) -                          - Version:  1997.02c
         RUN DATE (MON/DAY/YR) = 04/02/2004
         START TIME (HR:MIN:SEC) = 16:38:50     USER NO.= AHYMO-I-9702a01000K21-AH
         INPUT FILE = C:\Projects\COASAN~1\SANPED~3.TXT

*
*                          SAN PEDRO COLLECTORS
*                 HYDROLOGIC MODEL--DEVELOPED CONDITIONS
*                           2 APRIL 2004
*
*
*************************************************************************
*
*       HYDROLOGIC MODEL FOR OFFSITE AND ONSITE BASINS
*       100-YEAR, 6-HOUR STORM:
*
*
*
*       PRECIPITATION:
*               P60 =   2.14"
*               P360 =  2.60"
*               P1440 = 3.10"
*
*
*
*************************************************************************
*
START               TIME=0.0 HR  PUNCH CODE=0
*
*    24-Hour rainfall distribution based on NOAA ATLAS
*
RAINFALL            TYPE=1   RAIN QUARTER=0.0 IN
                             RAIN ONE=2.14 IN  RAIN SIX=2.60 IN
                             RAIN DAY=3.10 IN  DT=0.033333 HRS

             COMPUTED 6-HOUR RAINFALL DISTRIBUTION BASED ON NOAA ATLAS 2 - PEAK AT 1.40 HR.
             DT =     .033333 HOURS       END TIME =     5.999940 HOURS
                .0000   .0027   .0055   .0084   .0113   .0143   .0173
                .0204   .0236   .0269   .0302   .0337   .0372   .0408
                .0445   .0484   .0523   .0564   .0606   .0649   .0694
                .0741   .0789   .0839   .0892   .0946   .1004   .1063
                .1126   .1193   .1263   .1322   .1385   .1453   .1598
                .1923   .2424   .3142   .4123   .5412   .7055   .9101
               1.1598  1.3908  1.4874  1.5691  1.6417  1.7077  1.7685
               1.8250  1.8777  1.9272  1.9737  2.0176  2.0591  2.0984
               2.1356  2.1708  2.2043  2.2361  2.2662  2.2737  2.2808
               2.2875  2.2939  2.3001  2.3061  2.3118  2.3173  2.3226
               2.3278  2.3328  2.3376  2.3424  2.3470  2.3515  2.3558
               2.3601  2.3643  2.3684  2.3724  2.3763  2.3801  2.3838
               2.3875  2.3911  2.3947  2.3982  2.4016  2.4050  2.4083
               2.4116  2.4148  2.4179  2.4210  2.4241  2.4271  2.4301
               2.4331  2.4360  2.4388  2.4417  2.4445  2.4472  2.4499
               2.4526  2.4553  2.4579  2.4605  2.4631  2.4656  2.4682
               2.4706  2.4731  2.4755  2.4780  2.4803  2.4827  2.4851
               2.4874  2.4897  2.4919  2.4942  2.4964  2.4986  2.5008
               2.5030  2.5052  2.5073  2.5094  2.5115  2.5136  2.5157
               2.5177  2.5198  2.5218  2.5238  2.5258  2.5278  2.5297
               2.5317  2.5336  2.5355  2.5374  2.5393  2.5412  2.5431
               2.5449  2.5468  2.5486  2.5504  2.5522  2.5540  2.5558
               2.5575  2.5593  2.5610  2.5628  2.5645  2.5662  2.5679
               2.5696  2.5713  2.5730  2.5746  2.5763  2.5779  2.5795
               2.5812  2.5828  2.5844  2.5860  2.5876  2.5892  2.5907
```

```
                2.5923  2.5939  2.5954  2.5969  2.5985  2.6000
*
*
*SEDIMENT BULK            CODE=1  BULK FACTOR=1.10
*
*S**************************************************************************
*
*s SAN FRANCISCO STREET BASINS
*
*S**********
*S BASIN 1 - EAST WYOMING
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP        LCODE=1 NK=3 ISLOPE=0
                                  LENGTH=100 FT  SLOPE=0.02   K=0.7
                                  LENGTH=1150 FT  SLOPE=0.0209   K=2
                                  LENGTH=750 FT  SLOPE=0.0267   K=3


     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                              LENGTH (FT)       SLOPE (FT/FT)        COMPOSITE K
     SHEET FLOW PORTION          100.0             .020000              .7000
     SHALLOW FLOW PORTION       1150.0             .020900             2.0000
     CHANNEL FLOW PORTION        750.0             .026700             3.0000
     TOTAL BASIN                2000.0             .023030             2.0221


     TIME OF CONCENTRATION (HRS)=    .1810      TIME TO PEAK (HRS)=    .1207      LAG TIME (HRS)=    .1358


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=    .2000      TIME TO PEAK (HRS)=    .1333      LAG TIME (HRS)=    .1500
*
COMPUTE NM HYD       ID=10  HYD NO=1  DA=.03375 SQ MI
                                %A=0  %B=26  %C=25 %D=49
                               TP=0.0 HR
                               MASS RAINFALL=-1
     TIME TO PEAK (hrs)=    .1333

     K =    .072666HR     TP =    .133333HR     K/TP RATIO =    .545000      SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =    65.275     CFS    UNIT VOLUME =     .9992       B =    526.28       P60 = 2.1400
     AREA =       .016538 SQ MI     IA =     .10000 INCHES     INF =     .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333


     K =    .121557HR     TP =    .133333HR     K/TP RATIO =    .911678      SHAPE CONSTANT, N =  3.884408
     UNIT PEAK =    44.846     CFS    UNIT VOLUME =     1.000       B =    347.39       P60 = 2.1400
     AREA =       .017213 SQ MI     IA =     .42647 INCHES     INF =    1.04412 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

PRINT HYD            ID=10 CODE=1

                                    OUTFLOW HYDROGRAPH REACH      1.00

    RUNOFF VOLUME =      1.70838 INCHES      =        3.0751 ACRE-FEET
```

PEAK DISCHARGE RATE = 86.21 CFS AT 1.500 HOURS BASIN AREA = .0338 SQ. MI.

```
*
*S DIVIDE HYDROGRAPH TO DIVERT 22.8 CFS INTO 30" RCP IN WYOMING
*S THAT DISCHARGES TO THE SOUTH DOMINGO BACA ARROYO
*
DIVIDE HYD                ID=10 Q=22.8 ID=21 HYD NO=1A
                                          ID=22 HYD NO=1B
*
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO LOUISIANA
*S ASSUME 60' ROW AND 44' F-F
*
COMPUTE RATING CURVE  CID=1 VS NO=1 NO SEGS=1
                            NIN ELEV=0.00      MAX ELEV=1.23
                            CH SLOPE=0.0217  FP SLOPE=0.0217
                            N=0.017  DIST=100.0
                            DIST  ELEV  DIST  ELEV  DIST  ELEV
                            0.00  1.23  20.0  0.83  24.0  0.75
                            28.0  0.67  28.1  0.00  30.0  0.12
                            50.0  0.52  70.0  0.12  72.0  0.00
                            72.1  0.67  76.0  0.75  80.0  0.83
                            100.0 1.23

                           RATING CURVE VALLEY SECTION  1.0
                               WATER       FLOW        FLOW        TOP
                              SURFACE      AREA        RATE        WIDTH
                               ELEV        SQ FT       CFS         FT
                                .00          .00         .00         .00
                                .06          .07         .09        2.12
                                .13          .28         .51        4.89
                                .19          .80        1.74       11.38
                                .26         1.75        4.71       17.87
                                .32         3.12       10.04       24.37
                                .39         4.91       18.27       30.86
                                .45         7.11       29.90       37.35
                                .52         9.74       45.39       43.84
                                .58        12.59       69.29       44.07
                                .65        15.45       97.20       44.09
                                .71        18.39      122.50       48.26
                                .78        21.72      149.02       54.68
                                .84        25.47      180.61       61.16
                                .91        29.64      217.69       67.63
                                .97        34.23      260.60       74.11
                               1.04        39.23      309.67       80.58
                               1.10        44.66      365.25       87.05
                               1.17        50.51      427.68       93.53
                               1.23        56.77      497.27      100.00
*S
*
*S ROUTE FLOWS USING MCCUNGE
ROUTE MCUNGE          ID=30   HYD NO=1BROUTE   INFLOW ID=22
                      DT=0.0   L=2650 FT   NS=0   SLOPE=0.0217

     INFLOW END=  57              TABLE PTS= 20
     DT=  .033333                 QMED=       31.71  CKMED=      5.8955
     WIDTH MED=       38.11       NREACH=  8         DX=      331.25

  DEPTH   AREA      Q    TRAVEL  WIDTH      ck      VEL      C       D       C1      C2      C3      Q-M      C1-M    C2-M    C3-M
   (FT)  (SQ FT)  (CFS)  TIME(HR) (FT)     (FPS)   (FPS)                                                  (CFS)
    .00     .0      .0     .767     .0      2.76     .66    1.000   .000   1.000   .000    .000        .0   1.000   .000    .000
    .06     .1      .1     .583    2.1      2.75    1.26     .998   .002    .998   .000    .002        .0   1.000   .000    .000
```

```
      .13      .3       .5     .399     4.9     2.75    1.85      .995    .005    .995    .000    .005       .2     .997    .000    .003
      .19      .8      1.7     .341    11.4     2.79    2.16     1.011    .008    .992    .009   -.002      1.0     .994    .004    .003
      .26     1.8      4.7     .274    17.9     3.57    2.69     1.294    .010    .991    .132   -.123      3.0     .991    .063   -.054
      .32     3.1     10.0     .229    24.4     4.29    3.22     1.556    .013    .990    .222   -.211      7.1     .990    .172   -.162
      .39     4.9     18.3     .198    30.9     4.97    3.72     1.801    .017    .988    .290   -.278     13.9     .989    .253   -.241
      .45     7.1     29.9     .175    37.4     5.61    4.20     2.033    .020    .987    .345   -.332     23.8     .987    .315   -.303
      .52     9.7     45.4     .158    43.8     6.82    4.66     2.472    .021    .988    .427   -.415     37.3     .986    .366   -.352
      .58    12.6     69.3     .134    44.1     9.09    5.50     3.294    .024    .989    .537   -.526     56.8     .989    .508   -.497
      .65    15.4     97.2     .117    44.1     9.47    6.29     3.430    .032    .985    .552   -.537     82.8     .988    .562   -.551
      .71    18.4    122.5     .111    48.3     8.33    6.66     3.018    .042    .979    .507   -.487    109.6     .981    .512   -.493
      .78    21.7    149.0     .107    54.7     8.21    6.86     2.974    .046    .977    .502   -.480    135.5     .977    .490   -.467
      .84    25.5    180.6     .104    61.2     8.67    7.09     3.142    .047    .977    .523   -.500    164.6     .977    .512   -.489
      .91    29.6    217.7     .100    67.6     9.14    7.34     3.310    .049    .978    .541   -.519    198.9     .977    .531   -.509
      .97    34.2    260.6     .097    74.1     9.59    7.61     3.474    .051    .977    .558   -.535    238.8     .977    .549   -.526
     1.04    39.2    309.7     .093    80.6    10.03    7.89     3.635    .053    .977    .573   -.551    284.8     .977    .565   -.543
     1.10    44.7    365.3     .090    87.1    10.47    8.18     3.794    .056    .977    .588   -.565    337.1     .977    .580   -.557
     1.17    50.5    427.7     .087    93.5    10.91    8.47     3.951    .058    .977    .601   -.577    396.1     .977    .594   -.571
     1.23    56.8    497.3     .084   100.0    11.02    8.76     3.993    .063    .975    .604   -.580    462.1     .976    .607   -.583
MAXIMUM NO. ITERATIONS FOR SOLUTION (KKMAX) =    5 OCCURRED        1 TIMES.  AVERAGE NUMBER ITERATIONS =  1.0590
  DEPTH    AREA      Q     TRAVEL  WIDTH      ck       VEL       C        D       C1      C2      C3      Q-M      C1-M    C2-M    C3-M
   (FT)   (SQ FT)  (CFS)   TIME(HR) (FT)     (FPS)    (FPS)                                                 (CFS)
     .00      .0      .0     .767     .0     2.76      .66    1.000    .000   1.000    .000    .000       .0    1.000    .000    .000
     .06      .1      .1     .583    2.1     2.75     1.26     .998    .002    .998    .000    .002       .0    1.000    .000    .000
     .13      .3      .5     .399    4.9     2.75     1.85     .995    .005    .995    .000    .005       .2     .997    .000    .003
     .19      .8     1.7     .341   11.4     2.78     2.16    1.008    .008    .992    .008    .000      1.0     .994    .003    .003
     .26     1.8     4.7     .274   17.9     2.80     2.69    1.013    .013    .987    .013    .000      3.0     .990    .010    .000
     .32     3.1    10.0     .229   24.4     2.82     3.22    1.020    .020    .980    .020    .000      7.1     .984    .016    .000
     .39     4.9    18.3     .198   30.9     2.84     3.72    1.029    .029    .972    .028    .000     13.9     .976    .024    .000
     .45     7.1    29.9     .175   37.4     2.87     4.20    1.039    .039    .963    .037    .000     23.8     .967    .033    .000
     .52     9.7    45.4     .158   43.8     2.90     4.66    1.050    .050    .953    .047    .000     37.3     .958    .042    .000
     .58    12.6    69.3     .134   44.1     2.96     5.50    1.074    .074    .931    .069    .000     56.8     .942    .058    .000
     .65    15.4    97.2     .117   44.1     3.04     6.29    1.101    .101    .908    .092    .000     82.8     .920    .080    .000
     .71    18.4   122.5     .111   48.3     3.08     6.66    1.115    .115    .897    .103    .000    109.6     .903    .097    .000
     .78    21.7   149.0     .107   54.7     3.10     6.86    1.122    .122    .891    .109    .000    135.5     .894    .106    .000
     .84    25.5   180.6     .104   61.2     3.12     7.09    1.132    .132    .884    .116    .000    164.6     .887    .113    .000
     .91    29.6   217.7     .100   67.6     3.15     7.34    1.142    .142    .876    .124    .000    198.9     .880    .120    .000
     .97    34.2   260.6     .097   74.1     3.18     7.61    1.154    .154    .867    .133    .000    238.8     .871    .129    .000
    1.04    39.2   309.7     .093   80.6     3.22     7.89    1.166    .166    .858    .142    .000    284.8     .862    .138    .000
    1.10    44.7   365.3     .090   87.1     3.26     8.18    1.179    .179    .848    .152    .000    337.1     .853    .147    .000
    1.17    50.5   427.7     .087   93.5     3.29     8.47    1.193    .193    .838    .162    .000    396.1     .843    .157    .000
    1.23    56.8   497.3     .084  100.0     3.33     8.76    1.208    .208    .828    .172    .000    462.1     .833    .167    .000
MAXIMUM NO. ITERATIONS FOR SOLUTION (KKMAX) =    3 OCCURRED        8 TIMES.  AVERAGE NUMBER ITERATIONS =  1.0360
Equations solved with two passes: first using the Ponce correction to C1, second using the Fread correction to C1, C2 and C3
*

PRINT HYD           ID=30   CODE=1

                                  HYDROGRAPH FROM AREA 1BROUTE


    RUNOFF VOLUME =     1.69365 INCHES     =       1.2085 ACRE-FEET
    PEAK DISCHARGE RATE =      61.27 CFS  AT   1.767 HOURS   BASIN AREA =    .0134 SQ. MI.


*S
*
*S**********
*S BASIN 2 - LOUISIANA TO WYOMING
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
```

```
COMPUTE LT TP        LCODE=1 NK=3 ISLOPE=0
                                  LENGTH=100 FT  SLOPE=0.02    K=0.7
                                  LENGTH=1900 FT  SLOPE=0.0253   K=2
                                  LENGTH=1200 FT  SLOPE=0.0217   K=3

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                                LENGTH (FT)       SLOPE (FT/FT)        COMPOSITE K
     SHEET FLOW PORTION           100.0             .020000              .7000
     SHALLOW FLOW PORTION        1900.0             .025300             2.0000
     CHANNEL FLOW PORTION        1200.0             .021700             3.0000
     TOTAL BASIN                 3200.0             .023784             2.1395


     TIME OF CONCENTRATION (HRS)=   .2694     TIME TO PEAK (HRS)=   .1796     LAG TIME (HRS)=   .2020

*
COMPUTE NM HYD       ID=12  HYD NO=2  DA=.0927 SQ MI
                                %A=0  %B=34  %C=33 %D=33
                               TP=0.0 HR
                               MASS RAINFALL=-1
     TIME TO PEAK (hrs)=   .1796

     K =   .098206HR    TP =   .179595HR    K/TP RATIO =   .546817     SHAPE CONSTANT, N =  7.076199
     UNIT PEAK =   89.400    CFS   UNIT VOLUME =    .9999       B =   524.85      P60 = 2.1400
     AREA =      .030591 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .161271HR    TP =   .179595HR    K/TP RATIO =   .897969     SHAPE CONSTANT, N =  3.947315
     UNIT PEAK =   121.61    CFS   UNIT VOLUME =    1.000       B =   351.64      P60 = 2.1400
     AREA =      .062109 SQ MI    IA =    .42612 INCHES    INF =   1.04313 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

PRINT HYD            ID=12 CODE=1

                                  OUTFLOW HYDROGRAPH REACH     2.00

    RUNOFF VOLUME =     1.50603 INCHES     =       7.4458 ACRE-FEET
    PEAK DISCHARGE RATE =     183.53 CFS  AT   1.567 HOURS   BASIN AREA =   .0927 SQ. MI.


*
*S COMBINE ROUTED 1B AND 2
*
ADD HYD                    ID=40 HYD NO=2.5 ID I=12 ID II=30
PRINT HYD                  ID=40 CODE=1

                                  OUTFLOW HYDROGRAPH REACH     2.50

    RUNOFF VOLUME =     1.52969 INCHES     =       8.6542 ACRE-FEET
    PEAK DISCHARGE RATE =     183.53 CFS  AT   1.567 HOURS   BASIN AREA =   .1061 SQ. MI.


*
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO RAY STREET
*S ASSUME 60' ROW AND 44' F-F
*
```

COMPUTE RATING CURVE CID=1 VS NO=1 NO SEGS=1

MIN ELEV=0.00 MAX ELEV=1.23
CH SLOPE=0.0217 FP SLOPE=0.0217
N=0.017 DIST=100.0

DIST	ELEV	DIST	ELEV	DIST	ELEV
0.00	1.23	20.0	0.83	24.0	0.75
28.0	0.67	28.1	0.00	30.0	0.12
50.0	0.52	70.0	0.12	72.0	0.00
72.1	0.67	76.0	0.75	80.0	0.83
100.0	1.23				

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
.00	.00	.00	.00
.06	.07	.09	2.12
.13	.28	.51	4.89
.19	.80	1.74	11.38
.26	1.75	4.71	17.87
.32	3.12	10.04	24.37
.39	4.91	18.27	30.86
.45	7.11	29.90	37.35
.52	9.74	45.39	43.84
.58	12.59	69.29	44.07
.65	15.45	97.20	44.09
.71	18.39	122.50	48.26
.78	21.72	149.02	54.68
.84	25.47	180.61	61.16
.91	29.64	217.69	67.63
.97	34.23	260.60	74.11
1.04	39.23	309.67	80.58
1.10	44.66	365.25	87.05
1.17	50.51	427.68	93.53
1.23	56.77	497.27	100.00

*S
*
*S ROUTE FLOWS USING MCCUNGE
ROUTE MCUNGE ID=31 HYD NO=2.5ROUTE INFLOW ID=40
DT=0.0 L=1350 FT NS=0 SLOPE=0.0252

INFLOW END= 234 TABLE PTS= 20
DT= .033333 QMED= 91.76 CKMED= 9.7801
WIDTH MED= 44.09 NREACH= 3 DX= 450.00

DEPTH (FT)	AREA (SQ FT)	Q (CFS)	TRAVEL TIME(HR)	WIDTH (FT)	ck (FPS)	VEL (FPS)	C	D	C1	C2	C3	Q-M (CFS)	C1-M	C2-M	C3-M
.00	.0	.0	.391	.0	3.75	.66	1.000	.000	1.000	.000	.000	.0	1.000	.000	.000
.06	.1	.1	.297	2.1	3.75	1.26	.999	.001	.999	.000	.001	.0	1.000	.000	.000
.13	.3	.5	.203	4.9	3.74	1.85	.998	.002	.998	.000	.002	.2	.998	.000	.002
.19	.8	1.7	.174	11.4	3.74	2.16	.996	.004	.996	.000	.004	1.0	.997	.000	.003
.26	1.8	4.7	.139	17.9	3.73	2.69	.994	.006	.994	.000	.006	3.0	.995	.000	.005
.32	3.1	10.0	.116	24.4	4.29	3.22	1.145	.008	.992	.071	-.064	7.1	.992	.020	-.012
.39	4.9	18.3	.101	30.9	4.97	3.72	1.326	.011	.991	.144	-.135	13.9	.991	.104	-.095
.45	7.1	29.9	.089	37.4	5.61	4.20	1.497	.013	.990	.203	-.193	23.8	.990	.171	-.161
.52	9.7	45.4	.080	43.8	6.82	4.66	1.820	.013	.991	.294	-.285	37.3	.989	.226	-.215
.58	12.6	69.3	.068	44.1	9.09	5.50	2.425	.015	.991	.419	-.410	56.8	.992	.385	-.377
.65	15.4	97.2	.060	44.1	9.47	6.29	2.525	.021	.988	.436	-.424	82.8	.991	.448	-.439
.71	18.4	122.5	.056	48.3	8.33	6.66	2.222	.027	.983	.384	-.368	109.6	.985	.390	-.375
.78	21.7	149.0	.055	54.7	8.21	6.86	2.189	.029	.982	.379	-.360	135.5	.981	.365	-.346
.84	25.5	180.6	.053	61.2	8.67	7.09	2.313	.030	.982	.402	-.384	164.6	.982	.389	-.371
.91	29.6	217.7	.051	67.6	9.14	7.34	2.436	.031	.982	.423	-.405	198.9	.982	.412	-.394
.97	34.2	260.6	.049	74.1	9.59	7.61	2.557	.032	.982	.443	-.425	238.8	.982	.432	-.414

```
    1.04    39.2     309.7     .048    80.6     10.03    7.89     2.676    .034    .982    .461   -.443     284.8     .982    .451   -.433
    1.10    44.7     365.3     .046    87.1     10.47    8.18     2.793    .035    .982    .478   -.459     337.1     .982    .469   -.450
    1.17    50.5     427.7     .044    93.5     10.91    8.47     2.908    .037    .981    .493   -.474     396.1     .981    .485   -.466
    1.23    56.8     497.3     .043   100.0     11.02    8.76     2.939    .040    .980    .497   -.477     462.1     .981    .500   -.481
MAXIMUM NO. ITERATIONS FOR SOLUTION (KKMAX) =    5 OCCURRED         1 TIMES.  AVERAGE NUMBER ITERATIONS =  1.1307
  DEPTH    AREA       Q     TRAVEL  WIDTH      ck       VEL       C        D       C1      C2      C3      Q-M      C1-M    C2-M    C3-M
   (FT)   (SQ FT)   (CFS)   TIME(HR) (FT)     (FPS)    (FPS)                                                (CFS)
    .00      .0       .0     .391     .0      3.75      .66     1.000    .000   1.000    .000    .000        .0    1.000    .000    .000
    .06      .1       .1     .297    2.1      3.75     1.26      .999    .001    .999    .000    .001        .0    1.000    .000    .000
    .13      .3       .5     .203    4.9      3.74     1.85      .998    .002    .998    .000    .002        .2     .998    .000    .002
    .19      .8      1.7     .174   11.4      3.74     2.16      .996    .004    .996    .000    .004       1.0     .997    .000    .003
    .26     1.8      4.7     .139   17.9      3.73     2.69      .994    .006    .994    .000    .006       3.0     .995    .000    .005
    .32     3.1     10.0     .116   24.4      3.79     3.22     1.010    .010    .990    .010    .000       7.1     .992    .008    .000
    .39     4.9     18.3     .101   30.9      3.80     3.72     1.014    .014    .986    .014    .000      13.9     .988    .012    .000
    .45     7.1     29.9     .089   37.4      3.82     4.20     1.018    .018    .982    .018    .000      23.8     .984    .016    .000
    .52     9.7     45.4     .080   43.8      3.84     4.66     1.024    .024    .977    .023    .000      37.3     .979    .021    .000
    .58    12.6     69.3     .068   44.1      3.88     5.50     1.036    .036    .966    .034    .000      56.8     .971    .029    .000
    .65    15.4     97.2     .060   44.1      3.94     6.29     1.049    .049    .953    .047    .000      82.8     .959    .041    .000
    .71    18.4    122.5     .056   48.3      3.96     6.66     1.056    .056    .947    .053    .000     109.6     .950    .050    .000
    .78    21.7    149.0     .055   54.7      3.98     6.86     1.060    .060    .943    .057    .000     135.5     .945    .055    .000
    .84    25.5    180.6     .053   61.2      3.99     7.09     1.065    .065    .939    .061    .000     164.6     .941    .059    .000
    .91    29.6    217.7     .051   67.6      4.02     7.34     1.071    .071    .934    .066    .000     198.9     .936    .064    .000
    .97    34.2    260.6     .049   74.1      4.04     7.61     1.077    .077    .929    .071    .000     238.8     .931    .069    .000
   1.04    39.2    309.7     .048   80.6      4.06     7.89     1.083    .083    .923    .077    .000     284.8     .926    .074    .000
   1.10    44.7    365.3     .046   87.1      4.09     8.18     1.090    .090    .917    .083    .000     337.1     .920    .080    .000
   1.17    50.5    427.7     .044   93.5      4.12     8.47     1.098    .098    .911    .089    .000     396.1     .914    .086    .000
   1.23    56.8    497.3     .043  100.0      4.15     8.76     1.106    .106    .904    .096    .000     462.1     .908    .092    .000
MAXIMUM NO. ITERATIONS FOR SOLUTION (KKMAX) =    2 OCCURRED       168 TIMES.  AVERAGE NUMBER ITERATIONS =  1.0976
Equations solved with two passes: first using the Ponce correction to C1, second using the Fread correction to C1, C2 and C3
*

PRINT HYD           ID=31   CODE=1

                                    HYDROGRAPH FROM AREA 2.5ROUTE


    RUNOFF VOLUME =      1.52840 INCHES      =        8.6470 ACRE-FEET
    PEAK DISCHARGE RATE =      182.03 CFS  AT    1.633 HOURS   BASIN AREA =    .1061 SQ. MI.


*S
*
*S**********
*S BASIN 3 - WEST OF LOUISIANA
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP       LCODE=1 NK=3 ISLOPE=0
                                 LENGTH=100 FT  SLOPE=0.04    K=0.7
                                 LENGTH=1300 FT  SLOPE=0.0231    K=2
                                 LENGTH=200 FT  SLOPE=0.01    K=3

    Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

    SCS UPLAND METHOD FACTORS
                             LENGTH (FT)    ADJUSTED SLOPE (FT/FT)COMPOSITE K
    SHEET FLOW PORTION          100.0           .040000              .7000
    SHALLOW FLOW PORTION       1300.0           .023100             2.0000
    CHANNEL FLOW PORTION        200.0           .010000             3.0000
    TOTAL BASIN                1600.0           .022519             1.8846
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     TIME OF CONCENTRATION (HRS)=   .1572     TIME TO PEAK (HRS)=   .1048     LAG TIME (HRS)=   .1179


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME (HRS)=   .1500
*
COMPUTE NM HYD       ID=13  HYD NO=3  DA=.03511 SQ MI
                              %A=0  %B=31  %C=31 %D=38
                             TP=0.0 HR
                             MASS RAINFALL=-1
     TIME TO PEAK (hrs)=   .1333

     K =   .072666HR    TP =   .133333HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   52.661    CFS   UNIT VOLUME =    .9992      B =   526.28      P60 = 2.1400
     AREA =      .013342 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .121314HR    TP =   .133333HR    K/TP RATIO =   .909858     SHAPE CONSTANT, N =  3.892621
     UNIT PEAK =   56.806    CFS   UNIT VOLUME =    1.000      B =   347.95      P60 = 2.1400
     AREA =      .021768 SQ MI    IA =    .42500 INCHES    INF =   1.04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

PRINT HYD            ID=13 CODE=1

                                   OUTFLOW HYDROGRAPH REACH     3.00

    RUNOFF VOLUME =     1.57114 INCHES     =       2.9420 ACRE-FEET
    PEAK DISCHARGE RATE =      84.83 CFS  AT   1.500 HOURS   BASIN AREA =   .0351 SQ. MI.


*
*
*S COMBINE ROUTED 2.5 AND 3
*
ADD HYD                    ID=41 HYD NO=3.5 ID I=13 ID II=31
PRINT HYD                  ID=41 CODE=1

                                   OUTFLOW HYDROGRAPH REACH     3.50

    RUNOFF VOLUME =     1.53902 INCHES     =      11.5889 ACRE-FEET
    PEAK DISCHARGE RATE =     234.77 CFS  AT   1.633 HOURS   BASIN AREA =   .1412 SQ. MI.


*
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO SAN PEDRO
*S ASSUME 60' ROW AND 44' F-F
*
COMPUTE RATING CURVE  CID=1 VS NO=1 NO SEGS=1
                                  MIN ELEV=0.00      MAX ELEV=1.23
                                  CH SLOPE=0.0217  FP SLOPE=0.0217
                                  N=0.017  DIST=100.0
                                  DIST  ELEV  DIST  ELEV  DIST  ELEV
                                  0.00  1.23  20.0  0.83  24.0  0.75
                                  28.0  0.67  28.1  0.00  30.0  0.12
                                  50.0  0.52  70.0  0.12  72.0  0.00
```

```
72.1  0.67  76.0  0.75  80.0  0.83
100.0 1.23

RATING CURVE VALLEY SECTION  1.0
```

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
.00	.00	.00	.00
.06	.07	.09	2.12
.13	.28	.51	4.89
.19	.80	1.74	11.38
.26	1.75	4.71	17.87
.32	3.12	10.04	24.37
.39	4.91	18.27	30.86
.45	7.11	29.90	37.35
.52	9.74	45.39	43.84
.58	12.59	69.29	44.07
.65	15.45	97.20	44.09
.71	18.39	122.50	48.26
.78	21.72	149.02	54.68
.84	25.47	180.61	61.16
.91	29.64	217.69	67.63
.97	34.23	260.60	74.11
1.04	39.23	309.67	80.58
1.10	44.66	365.25	87.05
1.17	50.51	427.68	93.53
1.23	56.77	497.27	100.00

```
*S
*
*S ROUTE FLOWS USING MCCUNGE
ROUTE MCUNGE         ID=32   HYD NO=3.5ROUTE   INFLOW ID=41
                     DT=0.0   L=1350 FT   NS=0   SLOPE=0.0237

     INFLOW END= 237             TABLE PTS= 20
     DT=  .033333                QMED=      117.38  CKMED=      8.5975
     WIDTH MED=       47.42      NREACH=  3          DX=      450.00
```

DEPTH (FT)	AREA (SQ FT)	Q (CFS)	TRAVEL TIME(HR)	WIDTH (FT)	ck (FPS)	VEL (FPS)	C	D	C1	C2	C3	Q-M (CFS)	C1-M	C2-M	C3-M
.00	.0	.0	.391	.0	3.75	.66	1.000	.000	1.000	.000	.000	.0	1.000	.000	.000
.06	.1	.1	.297	2.1	3.75	1.26	.999	.001	.999	.000	.001	.0	1.000	.000	.000
.13	.3	.5	.203	4.9	3.74	1.85	.997	.003	.997	.000	.003	.2	.998	.000	.002
.19	.8	1.7	.174	11.4	3.74	2.16	.996	.004	.996	.000	.004	1.0	.997	.000	.003
.26	1.8	4.7	.139	17.9	3.73	2.69	.993	.007	.993	.000	.007	3.0	.995	.000	.005
.32	3.1	10.0	.116	24.4	4.29	3.22	1.145	.009	.992	.072	-.063	7.1	.992	.020	-.012
.39	4.9	18.3	.101	30.9	4.97	3.72	1.326	.011	.990	.144	-.135	13.9	.991	.104	-.095
.45	7.1	29.9	.089	37.4	5.61	4.20	1.497	.013	.989	.203	-.193	23.8	.990	.171	-.161
.52	9.7	45.4	.080	43.8	6.82	4.66	1.820	.014	.990	.294	-.284	37.3	.989	.226	-.215
.58	12.6	69.3	.068	44.1	9.09	5.50	2.425	.016	.991	.419	-.409	56.8	.991	.386	-.377
.65	15.4	97.2	.060	44.1	9.47	6.29	2.525	.022	.988	.436	-.424	82.8	.990	.449	-.439
.71	18.4	122.5	.056	48.3	8.33	6.66	2.222	.029	.982	.385	-.367	109.6	.984	.390	-.374
.78	21.7	149.0	.055	54.7	8.21	6.86	2.189	.031	.981	.379	-.360	135.5	.980	.365	-.345
.84	25.5	180.6	.053	61.2	8.67	7.09	2.313	.032	.981	.402	-.383	164.6	.981	.389	-.370
.91	29.6	217.7	.051	67.6	9.14	7.34	2.436	.033	.981	.424	-.404	198.9	.981	.412	-.393
.97	34.2	260.6	.049	74.1	9.59	7.61	2.557	.034	.981	.443	-.424	238.8	.981	.433	-.414
1.04	39.2	309.7	.048	80.6	10.03	7.89	2.676	.036	.981	.461	-.442	284.8	.981	.452	-.432
1.10	44.7	365.3	.046	87.1	10.47	8.18	2.793	.038	.980	.478	-.458	337.1	.980	.469	-.449
1.17	50.5	427.7	.044	93.5	10.91	8.47	2.908	.039	.980	.493	-.473	396.1	.980	.485	-.465
1.23	56.8	497.3	.043	100.0	11.02	8.76	2.939	.042	.979	.498	-.476	462.1	.980	.500	-.480

```
MAXIMUM NO. ITERATIONS FOR SOLUTION (KKMAX) =    4 OCCURRED        4 TIMES.  AVERAGE NUMBER ITERATIONS =  1.1498
```

DEPTH (FT)	AREA (SQ FT)	Q (CFS)	TRAVEL TIME(HR)	WIDTH (FT)	ck (FPS)	VEL (FPS)	C	D	C1	C2	C3	Q-M (CFS)	C1-M	C2-M	C3-M
.00	.0	.0	.391	.0	3.75	.66	1.000	.000	1.000	.000	.000	.0	1.000	.000	.000

```
      .06      .1       .1    .297     2.1     3.75   1.26     .999    .001    .999    .000    .001       .0   1.000    .000    .000
      .13      .3       .5    .203     4.9     3.74   1.85     .997    .003    .997    .000    .003       .2    .998    .000    .002
      .19      .8      1.7    .174    11.4     3.74   2.16     .996    .004    .996    .000    .004      1.0    .997    .000    .003
      .26     1.8      4.7    .139    17.9     3.73   2.69     .993    .007    .993    .000    .007      3.0    .995    .000    .005
      .32     3.1     10.0    .116    24.4     3.79   3.22    1.010    .010    .990    .010    .000      7.1    .992    .008    .000
      .39     4.9     18.3    .101    30.9     3.80   3.72    1.015    .015    .986    .014    .000     13.9    .988    .012    .000
      .45     7.1     29.9    .089    37.4     3.82   4.20    1.020    .020    .981    .019    .000     23.8    .983    .017    .000
      .52     9.7     45.4    .080    43.8     3.84   4.66    1.025    .025    .975    .025    .000     37.3    .978    .022    .000
      .58    12.6     69.3    .068    44.1     3.89   5.50    1.038    .038    .964    .036    .000     56.8    .970    .030    .000
      .65    15.4     97.2    .060    44.1     3.95   6.29    1.052    .052    .950    .050    .000     82.8    .957    .043    .000
      .71    18.4    122.5    .056    48.3     3.97   6.66    1.060    .060    .944    .056    .000    109.6    .947    .053    .000
      .78    21.7    149.0    .055    54.7     3.99   6.86    1.064    .064    .940    .060    .000    135.5    .942    .058    .000
      .84    25.5    180.6    .053    61.2     4.01   7.09    1.069    .069    .935    .065    .000    164.6    .938    .062    .000
      .91    29.6    217.7    .051    67.6     4.03   7.34    1.075    .075    .930    .070    .000    198.9    .933    .067    .000
      .97    34.2    260.6    .049    74.1     4.05   7.61    1.081    .081    .925    .075    .000    238.8    .928    .072    .000
     1.04    39.2    309.7    .048    80.6     4.08   7.89    1.088    .088    .919    .081    .000    284.8    .922    .078    .000
     1.10    44.7    365.3    .046    87.1     4.11   8.18    1.096    .096    .913    .087    .000    337.1    .916    .084    .000
     1.17    50.5    427.7    .044    93.5     4.14   8.47    1.104    .104    .906    .094    .000    396.1    .909    .091    .000
     1.23    56.8    497.3    .043   100.0     4.17   8.76    1.112    .112    .899    .101    .000    462.1    .903    .097    .000
MAXIMUM NO. ITERATIONS FOR SOLUTION (KKMAX) =   2 OCCURRED     188 TIMES.  AVERAGE NUMBER ITERATIONS =  1.1092
Equations solved with two passes: first using the Ponce correction to C1, second using the Fread correction to C1, C2 and C3
*

PRINT HYD           ID=32   CODE=1

                                    HYDROGRAPH FROM AREA 3.5ROUTE

    RUNOFF VOLUME =     1.53792 INCHES     =      11.5806 ACRE-FEET
    PEAK DISCHARGE RATE =     233.04 CFS  AT   1.733 HOURS   BASIN AREA =   .1412 SQ. MI.


*
*S**********
*S BASIN 4 - EAST OF SAN PEDRO
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP       LCODE=1 NK=3 ISLOPE=0
                              LENGTH=100 FT  SLOPE=0.02   K=0.7
                              LENGTH=1300 FT  SLOPE=0.0231   K=2
                              LENGTH=1750 FT  SLOPE=0.0206   K=3

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                              LENGTH (FT)       SLOPE (FT/FT)        COMPOSITE K
     SHEET FLOW PORTION          100.0             .020000              .7000
     SHALLOW FLOW PORTION       1300.0             .023100             2.0000
     CHANNEL FLOW PORTION       1750.0             .020600             3.0000
     TOTAL BASIN                3150.0             .021613             2.2914


     TIME OF CONCENTRATION (HRS)=   .2598     TIME TO PEAK (HRS)=   .1732     LAG TIME (HRS)=   .1948

*
COMPUTE NM HYD      ID=14  HYD NO=4  DA=.05833 SQ MI
                             %A=0  %B=31  %C=30 %D=39
                           TP=0.0 HR
                           MASS RAINFALL=-1
     TIME TO PEAK (hrs)=   .1732
```

```
     K =    .094377HR    TP =    .173169HR    K/TP RATIO =    .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =    69.135    CFS   UNIT VOLUME =     .9997       B =    526.28      P60 = 2.1400
     AREA =       .022749 SQ MI    IA =     .10000 INCHES    INF =     .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333


     K =    .157823HR    TP =    .173169HR    K/TP RATIO =    .911380     SHAPE CONSTANT, N =  3.885755
     UNIT PEAK =    71.397    CFS   UNIT VOLUME =    1.000       B =    347.48      P60 = 2.1400
     AREA =       .035581 SQ MI    IA =     .42623 INCHES    INF =    1.04344 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

PRINT HYD           ID=14 CODE=1

                                    OUTFLOW HYDROGRAPH REACH     4.00


    RUNOFF VOLUME =     1.58191 INCHES     =       4.9212 ACRE-FEET
    PEAK DISCHARGE RATE =     121.79 CFS  AT    1.533 HOURS   BASIN AREA =    .0583 SQ. MI.



*
*S COMBINE ROUTED 3.5 AND 4
*
ADD HYD                     ID=42 HYD NO=4.5 ID I=14 ID II=32
PRINT HYD                   ID=42 CODE=1

                                    OUTFLOW HYDROGRAPH REACH     4.50


    RUNOFF VOLUME =     1.55078 INCHES     =      16.5017 ACRE-FEET
    PEAK DISCHARGE RATE =     308.59 CFS  AT    1.700 HOURS   BASIN AREA =    .1995 SQ. MI.



*
*
*S  DERRICKSON BASINS
*
*S**********
*S BASIN 5 - SAN PEDRO TO LOUISIANA
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP       LCODE=1 NK=3 ISLOPE=0
                                LENGTH=100 FT  SLOPE=0.02   K=0.7
                                LENGTH=1500 FT  SLOPE=0.0253   K=2
                                LENGTH=1300 FT  SLOPE=0.0246   K=3

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                              LENGTH (FT)      SLOPE (FT/FT)       COMPOSITE K
     SHEET FLOW PORTION          100.0           .020000             .7000
     SHALLOW FLOW PORTION       1500.0           .025300            2.0000
     CHANNEL FLOW PORTION       1300.0           .024600            3.0000
     TOTAL BASIN                2900.0           .024803            2.1693


     TIME OF CONCENTRATION (HRS)=    .2358     TIME TO PEAK (HRS)=    .1572     LAG TIME (HRS)=    .1768
```

```
*
COMPUTE NM HYD       ID=15  HYD NO=5  DA=.06656 SQ MI
                              %A=0  %B=23  %C=23 %D=54
                            TP=0.0 HR
                            MASS RAINFALL=-1
     TIME TO PEAK (hrs)=    .1572

     K =    .085706HR    TP =    .157189HR    K/TP RATIO =    .545244     SHAPE CONSTANT, N =  7.102337
     UNIT PEAK =   120.29    CFS   UNIT VOLUME =     .9998      B =   526.08      P60 = 2.1400
     AREA =       .035942 SQ MI    IA =     .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333


     K =    .142741HR    TP =    .157189HR    K/TP RATIO =    .908084     SHAPE CONSTANT, N =  3.900666
     UNIT PEAK =   67.880    CFS   UNIT VOLUME =     .9999      B =   348.49      P60 = 2.1400
     AREA =       .030618 SQ MI    IA =     .42500 INCHES    INF =   1.04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

PRINT HYD            ID=15 CODE=1

                                  OUTFLOW HYDROGRAPH REACH     5.00

    RUNOFF VOLUME =     1.77349 INCHES      =       6.2956 ACRE-FEET
    PEAK DISCHARGE RATE =     160.46 CFS  AT   1.533 HOURS   BASIN AREA =    .0666 SQ. MI.


*
*
*S**********
*S BASIN 6 - EAST OF SAN PEDRO & SOUTH OF DERRICKSON
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP        LCODE=1 NK=3 ISLOPE=0
                            LENGTH=100 FT  SLOPE=0.02   K=0.7
                            LENGTH=500 FT  SLOPE=0.0240   K=2
                            LENGTH=150 FT  SLOPE=0.0533   K=3

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                          LENGTH (FT)    ADJUSTED SLOPE (FT/FT)COMPOSITE K
     SHEET FLOW PORTION       100.0           .020000              .7000
     SHALLOW FLOW PORTION     500.0           .024000             2.0000
     CHANNEL FLOW PORTION     150.0           .049310             3.0000
     TOTAL BASIN              750.0           .028529             1.5585


     TIME OF CONCENTRATION (HRS)=    .0791     TIME TO PEAK (HRS)=    .0528     LAG TIME (HRS)=    .0594


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=    .2000     TIME TO PEAK (HRS)=    .1333     LAG TIME (HRS)=    .1500
*
COMPUTE NM HYD       ID=15  HYD NO=5  DA=.00813 SQ MI
                              %A=0  %B=25  %C=24 %D=41
                            TP=0.0 HR
                            MASS RAINFALL=-1
```

```
      TIME TO PEAK (hrs)=    .1333
      *****WARNING*****  SUM OF TREATMENT TYPES DOES NOT EQUAL 100 PERCENT OR TOTAL AREA


      K =    .072666HR     TP =    .133333HR     K/TP RATIO =    .545000      SHAPE CONSTANT, N =  7.106420
      UNIT PEAK =    14.619     CFS    UNIT VOLUME =     .9985       B =    526.28       P60 = 2.1400
      AREA =       .003704 SQ MI     IA =     .10000 INCHES     INF =     .04000 INCHES PER HOUR
      RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333


      K =    .121567HR     TP =    .133333HR     K/TP RATIO =    .911753      SHAPE CONSTANT, N =  3.884079
      UNIT PEAK =    11.532     CFS    UNIT VOLUME =     .9992       B =    347.37       P60 = 2.1400
      AREA =       .004426 SQ MI     IA =     .42653 INCHES     INF =    1.04429 INCHES PER HOUR
      RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

PRINT HYD           ID=15 CODE=1

                                    OUTFLOW HYDROGRAPH REACH      5.00

     RUNOFF VOLUME =      1.66461 INCHES      =         .7218 ACRE-FEET
     PEAK DISCHARGE RATE =       20.42 CFS  AT    1.500 HOURS    BASIN AREA =    .0081 SQ. MI.


*
*
*
*
*
*
*
*
*
*
*
*
*
*
FINISH

     NORMAL PROGRAM FINISH          END TIME (HR:MIN:SEC) = 16:38:50
```

```
*
*                              SAN PEDRO COLLECTORS
*                    HYDROLOGIC MODEL--DEVELOPED CONDITIONS
*                                 2 APRIL 2004
*
*
*************************************************************************
*
*       HYDROLOGIC MODEL FOR OFFSITE AND ONSITE BASINS
*       100-YEAR, 6-HOUR STORM:
*
*
*
*       PRECIPITATION:
*               P60 =   2.14"
*               P360 =  2.60"
*               P1440 = 3.10"
*
*
*
*************************************************************************
*
START                TIME=0.0 HR  PUNCH CODE=0
*
*    24-Hour rainfall distribution based on NOAA ATLAS
*
RAINFALL             TYPE=1   RAIN QUARTER=0.0 IN
                  RAIN ONE=2.14 IN  RAIN SIX=2.60 IN
                  RAIN DAY=3.10 IN  DT=0.033333 HRS
*
*
*SEDIMENT BULK          CODE=1      BULK FACTOR=1.10
*
*S************************************************************************
*
*s SAN FRANCISCO STREET BASINS
*
*S**********
*S BASIN 1 - EAST WYOMING
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP        LCODE=1 NK=3 ISLOPE=0
                     LENGTH=100 FT  SLOPE=0.02   K=0.7
                     LENGTH=1150 FT  SLOPE=0.0209   K=2
                     LENGTH=750 FT  SLOPE=0.0267   K=3

*
COMPUTE NM HYD       ID=10  HYD NO=1  DA=.03375 SQ MI
                     %A=0  %B=26  %C=25 %D=49
```

```
                    TP=0.0 HR
                    MASS RAINFALL=-1
PRINT HYD           ID=10 CODE=1
*
*S DIVIDE HYDROGRAPH TO DIVERT 22.8 CFS INTO 30" RCP IN WYOMING
*S THAT DISCHARGES TO THE SOUTH DOMINGO BACA ARROYO
*
DIVIDE HYD          ID=10 Q=22.8 ID=21 HYD NO=1A
                                 ID=22 HYD NO=1B
*
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO LOUISIANA
*S ASSUME 60' ROW AND 44' F-F
*
COMPUTE RATING CURVE  CID=1 VS NO=1 NO SEGS=1
                      MIN ELEV=0.00 MAX ELEV=1.23
                      CH SLOPE=0.0217  FP SLOPE=0.0217
                      N=0.017  DIST=100.0
                      DIST  ELEV  DIST  ELEV  DIST  ELEV
                      0.00  1.23  20.0  0.83  24.0  0.75
                      28.0  0.67  28.1  0.00  30.0  0.12
                      50.0  0.52  70.0  0.12  72.0  0.00
                      72.1  0.67  76.0  0.75  80.0  0.83
                      100.0 1.23
*S
*
*S ROUTE FLOWS USING MCCUNGE
ROUTE MCUNGE        ID=30   HYD NO=1BROUTE   INFLOW ID=22
                    DT=0.0   L=2650 FT   NS=0   SLOPE=0.0217
*

PRINT HYD           ID=30   CODE=1
*S
*
*S**********
*S BASIN 2 - LOUISIANA TO WYOMING
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP       LCODE=1 NK=3 ISLOPE=0
                    LENGTH=100 FT  SLOPE=0.02   K=0.7
                    LENGTH=1900 FT  SLOPE=0.0253   K=2
                    LENGTH=1200 FT  SLOPE=0.0217   K=3
*
COMPUTE NM HYD      ID=12  HYD NO=2  DA=.0927 SQ MI
                    %A=0  %B=34  %C=33 %D=33
                    TP=0.0 HR
                    MASS RAINFALL=-1
PRINT HYD           ID=12 CODE=1
*
*S COMBINE ROUTED 1B AND 2
```

```
*
ADD HYD             ID=40 HYD NO=2.5 ID I=12 ID II=30
PRINT HYD           ID=40 CODE=1
*
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO RAY STREET
*S ASSUME 60' ROW AND 44' F-F
*
COMPUTE RATING CURVE  CID=1 VS NO=1 NO SEGS=1
                      MIN ELEV=0.00 MAX ELEV=1.23
                      CH SLOPE=0.0217  FP SLOPE=0.0217
                      N=0.017  DIST=100.0
                      DIST  ELEV  DIST  ELEV  DIST  ELEV
                      0.00  1.23  20.0  0.83  24.0  0.75
                      28.0  0.67  28.1  0.00  30.0  0.12
                      50.0  0.52  70.0  0.12  72.0  0.00
                      72.1  0.67  76.0  0.75  80.0  0.83
                      100.0 1.23
*S
*
*S ROUTE FLOWS USING MCCUNGE
ROUTE MCUNGE        ID=31   HYD NO=2.5ROUTE   INFLOW ID=40
                    DT=0.0   L=1350 FT   NS=0   SLOPE=0.0252
*

PRINT HYD           ID=31   CODE=1
*S
*
*S**********
*S BASIN 3 - WEST OF LOUISIANA
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP       LCODE=1 NK=3 ISLOPE=0
                    LENGTH=100 FT  SLOPE=0.04   K=0.7
                    LENGTH=1300 FT  SLOPE=0.0231   K=2
                    LENGTH=200 FT  SLOPE=0.01   K=3
*
COMPUTE NM HYD      ID=13  HYD NO=3  DA=.03511 SQ MI
                    %A=0  %B=31  %C=31 %D=38
                    TP=0.0 HR
                    MASS RAINFALL=-1
PRINT HYD           ID=13 CODE=1
*
*
*S COMBINE ROUTED 2.5 AND 3
*
ADD HYD             ID=41 HYD NO=3.5 ID I=13 ID II=31
PRINT HYD           ID=41 CODE=1
*
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO SAN PEDRO
```

```
*S ASSUME 60' ROW AND 44' F-F
*
COMPUTE RATING CURVE  CID=1 VS NO=1 NO SEGS=1
                      MIN ELEV=0.00 MAX ELEV=1.23
                      CH SLOPE=0.0217  FP SLOPE=0.0217
                      N=0.017  DIST=100.0
                      DIST  ELEV  DIST  ELEV  DIST  ELEV
                      0.00  1.23  20.0  0.83  24.0  0.75
                      28.0  0.67  28.1  0.00  30.0  0.12
                      50.0  0.52  70.0  0.12  72.0  0.00
                      72.1  0.67  76.0  0.75  80.0  0.83
                      100.0 1.23
*S
*
*S ROUTE FLOWS USING MCCUNGE
ROUTE MCUNGE          ID=32   HYD NO=3.5ROUTE   INFLOW ID=41
                      DT=0.0   L=1350 FT   NS=0   SLOPE=0.0237
*

PRINT HYD             ID=32   CODE=1
*
*S**********
*S BASIN 4 - EAST OF SAN PEDRO
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
*
COMPUTE LT TP         LCODE=1 NK=3 ISLOPE=0
                      LENGTH=100 FT  SLOPE=0.02   K=0.7
                      LENGTH=1300 FT  SLOPE=0.0231   K=2
                      LENGTH=1750 FT  SLOPE=0.0206   K=3
*
COMPUTE NM HYD        ID=14  HYD NO=4  DA=.05833 SQ MI
                      %A=0  %B=31  %C=30 %D=39
                      TP=0.0 HR
                      MASS RAINFALL=-1
PRINT HYD             ID=14 CODE=1
*
*S COMBINE ROUTED 3.5 AND 4
*
ADD HYD               ID=42 HYD NO=4.5 ID I=14 ID II=32
PRINT HYD             ID=42 CODE=1
*
*
*S  DERRICKSON BASINS
*
*S**********
*S BASIN 5 - SAN PEDRO TO LOUISIANA
*S**********
*
*COMPUTE TIME TO PEAK USING UPLAND/LAG TIME
```

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =04/02/2004
INPUT FILE = C:\Projects\COASAN~1\SANPED~4.TXT USER NO.= AHYMO-I-9702a01000K21~AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
START										
RAINFALL TYPE= 1										TIME= .00
*SEDIMENT BULK	CODE=1 BULK FACTOR=1.10									RAIN6= 2.600
*S**********										
*s SAN FRANCISCO STREET BASINS										
*S**********										
*S BASIN 1 - EAST WYOMING										
*S**********										
COMPUTE NM HYD	1.00	-	10	.03375	74.18	2.529	1.40525	1.500	3.434	PER IMP= 32.00
*S DIVIDE HYDROGRAPH TO DIVERT 22.8 CFS INTO 30" RCP IN WYOMING										
*S THAT DISCHARGES TO THE SOUTH DOMINGO BACA ARROYO										
DIVIDE HYD	1A	10	21	.02165	22.80	1.622	1.40524	1.367	1.646	
	1B	and	22	.01210	51.38	.907	1.40524	1.500	6.634	
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO LOUISIANA										
*S ASSUME 60' ROW AND 44' F-F										
*S										
*S ROUTE FLOWS USING MCCUNGE										
ROUTE MCUNGE	1BROUTE	22	30	.01210	49.53	.896	1.38758	1.800	6.395	CCODE = .1
*S										
*S**********										
*S BASIN 2 - LOUISIANA TO WYOMING										
*S**********										
COMPUTE NM HYD	2.00	-	12	.09270	164.15	6.467	1.30813	1.567	2.767	PER IMP= 22.00
*S COMBINE ROUTED 1B AND 2										
ADD HYD	2.50	12&30	40	.10480	164.15	7.363	1.31730	1.567	2.447	
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO RAY STREET										
*S ASSUME 60' ROW AND 44' F-F										
*S										
*S ROUTE FLOWS USING MCCUNGE										
ROUTE MCUNGE	2.5ROUTE	40	31	.10480	162.70	7.356	1.31607	1.667	2.426	CCODE = .1
*S										
*S**********										
*S BASIN 3 - WEST OF LOUISIANA										
*S**********										
COMPUTE NM HYD	3.00	-	13	.03511	75.21	2.505	1.33773	1.500	3.347	PER IMP= 25.00
*S COMBINE ROUTED 2.5 AND 3										
ADD HYD	3.50	13&31	41	.13991	210.23	9.861	1.32150	1.633	2.348	
*S ROUTE REMAINING FLOWS DOWN SAN FRANCISCO TO SAN PEDRO										
*S ASSUME 60' ROW AND 44' F-F										
*S										
*S ROUTE FLOWS USING MCCUNGE										
ROUTE MCUNGE	3.5ROUTE	41	32	.13991	210.12	9.864	1.32196	1.667	2.347	CCODE = .2
*S**********										
*S BASIN 4 - EAST OF SAN PEDRO										
*S**********										
COMPUTE NM HYD	4.00	-	14	.05833	105.43	4.141	1.33098	1.533	2.824	PER IMP= 25.00
*S COMBINE ROUTED 3.5 AND 4										
ADD HYD	4.50	14&32	42	.19824	290.84	14.005	1.32461	1.633	2.292	
*S DERRICKSON BASINS										
*S**********										

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
*S BASIN 5 - SAN PEDRO TO LOUISIANA										
*S**********										
COMPUTE NM HYD	5.00	-	15	.06656	135.14	5.096	1.43553	1.533	3.172	PER IMP= 35.00
*S**********										
*S BASIN 6 - EAST OF SAN PEDRO & SOUTH OF DERRICKSON										
*S**********										
COMPUTE NM HYD	5.00	-	15	.00813	17.76	.601	1.38652	1.500	3.414	PER IMP= 30.00
FINISH										

Far Northeast Heights Master Drainage Plan (FNHMDP)

Basin 390 South of the North Pino Arroyo to San Antonio

Area = 112.5 acres

Basins 5 & 6 are included in FNHMDP Basin 390

Area = 47.8 acres

Remaining Area = 64.7 acres

According to AHYMO run for Basin 5 which is similar to remaining are in density, $Q_{Peak} = 3.77$

Therefore peak flow in remaing Area = $64.7 \times 3.77 = 243.2$ cfs

This peak flow runs down San Pedro to the North Pino Arroyo

San Pedro has 60' ROW, 48.5' F-F $S = 1.1\%$

Basin	Area	Upper Reach Length	Upper Reach Slope	Mid. of the Reach Length	Mid. of the Reach Slope	Lower Reach Length	Lower Reach Slope
1	21.60	100	2%	1150	2.09%	750	2.67% (20)
2	59.33	100	2%	1100	2.53 (46)	1200	2.17 (24)
3	22.97	100	4%	1300	2.31 (30)	200	1.00 (2)
4	37.33	100	2%	1300	2.31 (30)	1350	2.06 (30)
5	42.60	100	2%	1500	2.53 (38)	1300	2.96 (32)
6	5.20	100	2%	500	2.40 (12)	150	5.33 (8)

Basin	Area	# Dwl	Dwl/ac	%A	35% reduction %A
1	21.60	106	4.90	49	32
2.	59.33	171	2.88	33	22
3	22.97	77	3.43	38	25
4.	37.33	132	3.54	39	25
5.	42.60	237	5.56	54	35
6.	5.20	20	3.85	41	27

San [illegible]

Basin	Area	# Lots	[illegible]	[illegible]	[illegible] Q_{100}	[illegible]
339A	4.52 ac	[illegible]	3.98	42	[illegible]	3.06
340 A	2.85 ac	9	3.16	[illegible]	[illegible]	[illegible]
397 A	3.59 ac	[illegible]	—	[illegible]	[illegible]	4.42

[illegible]

Zone 3

$P_{60} = 2.14$

$P_{360} = 2.60$

$P_{1440} = 3.10$

Basin	Area	[illegible] cfs/ac	Q_{100} [illegible]	Q_{100} [illegible]
338	579 ac	3.86	222 cfs	202 cfs
340	112.5	3.79	421	337
397	66.6	4.92	299	265

	[illegible]	[illegible]
338	222 cfs	233 cfs
340	426	520
397	299	299

APPENDIX C
HYDRAULIC CALCULATIONS

San Francisco
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.020700	ft/ft
Elevation range: 0.00 ft to 1.23 ft.		

Station (ft)	Elevation (ft)
0.00	1.23
20.00	0.83
24.00	0.75
28.00	0.67
28.10	0.00
30.00	0.12
50.00	0.52
70.00	0.12
72.00	0.00
72.10	0.67
76.00	0.75
80.00	0.83
100.00	1.23

Discharge	308.59	cfs

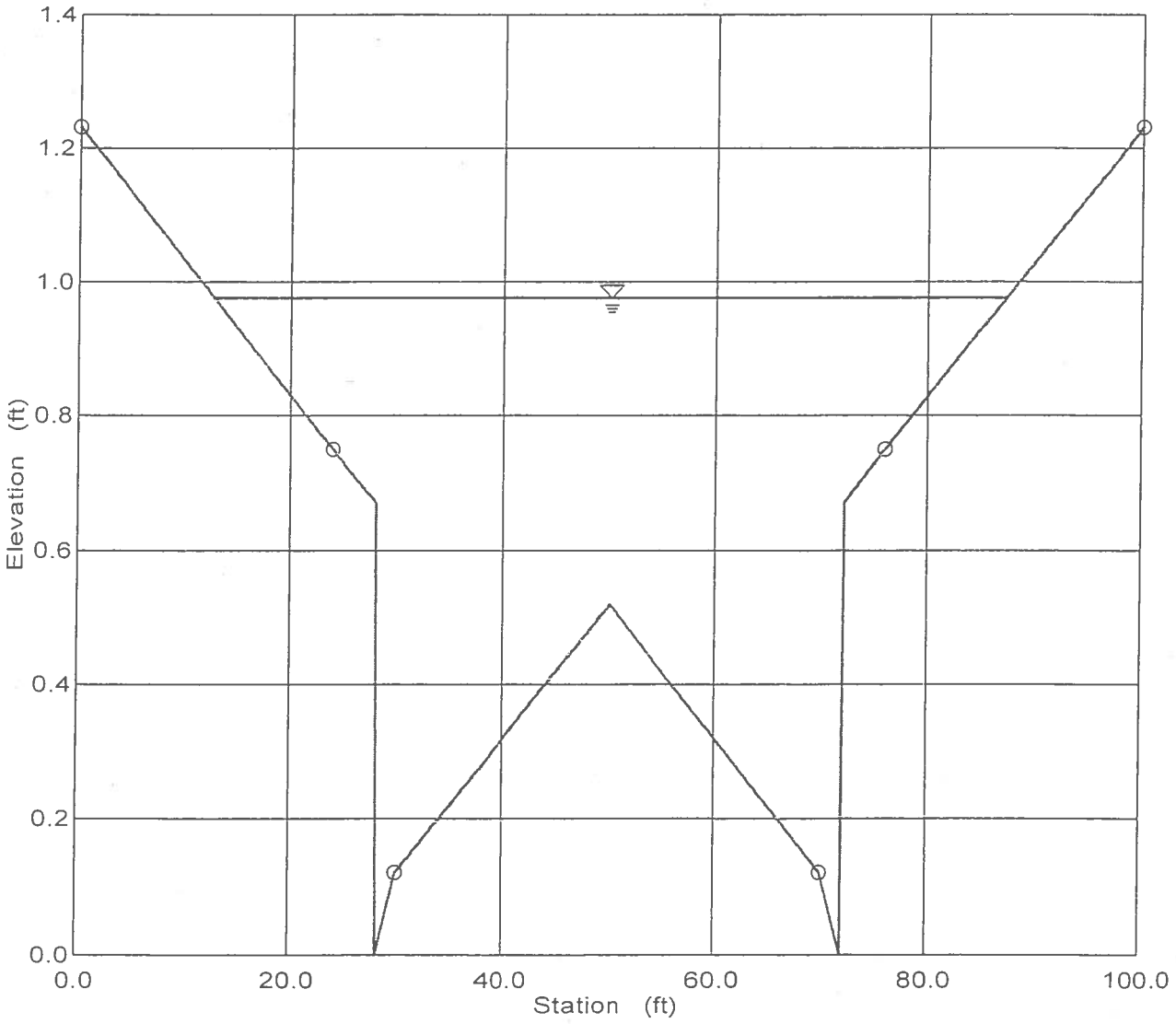
Start Station	End Station	Roughness
0.00	24.00	0.025
24.00	30.00	0.013
30.00	70.00	0.017
70.00	76.00	0.013
76.00	100.00	0.025

Results		
Wtd. Mannings Coefficient	0.014	
Water Surface Elevation	0.98	ft
Flow Area	34.52	ft²
Wetted Perimeter	75.68	ft
Top Width	74.50	ft
Height	0.98	ft
Critical Depth	1.33	ft
Critical Slope	0.003852	ft/ft
Velocity	8.94	ft/s
Velocity Head	1.24	ft
Specific Energy	2.22	ft
Froude Number	2.32	
Flow is supercritical.		

San Francisco
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.014	
Channel Slope	0.020700	ft/ft
Water Surface Elevation	0.98	ft
Discharge	308.59	cfs



San Francisco
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.020700	ft/ft
Elevation range: 0.00 ft to 1.23 ft.		
Discharge	233.00	cfs

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.23	0.00	24.00	0.025
20.00	0.83	24.00	30.00	0.013
24.00	0.75	30.00	70.00	0.017
28.00	0.67	70.00	76.00	0.013
28.10	0.00	76.00	100.00	0.025
30.00	0.12			
50.00	0.52			
70.00	0.12			
72.00	0.00			
72.10	0.67			
76.00	0.75			
80.00	0.83			
100.00	1.23			

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	0.88	ft
Flow Area	28.09	ft²
Wetted Perimeter	66.47	ft
Top Width	65.30	ft
Height	0.88	ft
Critical Depth	1.21	ft
Critical Slope	0.003631	ft/ft
Velocity	8.30	ft/s
Velocity Head	1.07	ft
Specific Energy	1.95	ft
Froude Number	2.23	
Flow is supercritical.		

San Francisco at San Pedro
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.020700	ft/ft
Elevation range: 0.00 ft to 1.23 ft.		
Discharge	76.60	cfs

Station (ft)	Elevation (ft)
0.00	1.23
20.00	0.83
24.00	0.75
28.00	0.67
28.10	0.00
30.00	0.12
50.00	0.52
70.00	0.12
72.00	0.00
72.10	0.67
76.00	0.75
80.00	0.83
100.00	1.23

Start Station	End Station	Roughness
0.00	24.00	0.025
24.00	30.00	0.013
30.00	70.00	0.017
70.00	76.00	0.013
76.00	100.00	0.025

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.59	ft
Flow Area	12.97	ft²
Wetted Perimeter	45.11	ft
Top Width	44.08	ft
Height	0.59	ft
Critical Depth	0.77	ft
Critical Slope	0.004983	ft/ft
Velocity	5.91	ft/s
Velocity Head	0.54	ft
Specific Energy	1.13	ft
Froude Number	1.92	
Flow is supercritical.		

San Francisco at San Pedro crown depth
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.020700	ft/ft
Water Surface Elevation	0.52	ft

Elevation range: 0.00 ft to 1.23 ft.

Station (ft)	Elevation (ft)
0.00	1.23
20.00	0.83
24.00	0.75
28.00	0.67
28.10	0.00
30.00	0.12
50.00	0.52
70.00	0.12
72.00	0.00
72.10	0.67
76.00	0.75
80.00	0.83
100.00	1.23

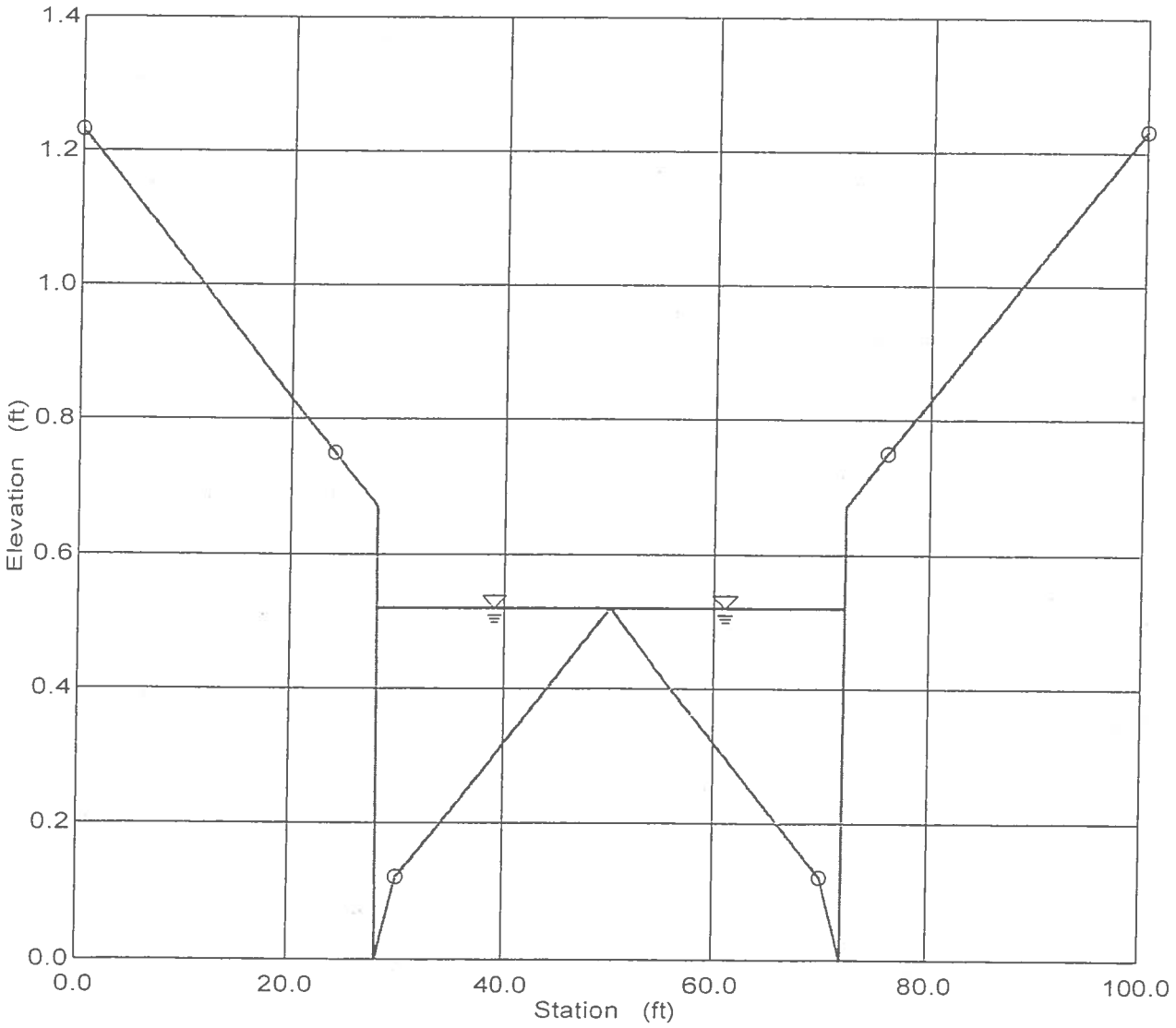
Start Station	End Station	Roughness
0.00	24.00	0.025
24.00	30.00	0.013
30.00	70.00	0.017
70.00	76.00	0.013
76.00	100.00	0.025

Results		
Wtd. Mannings Coefficient	0.015	
Discharge	49.95	cfs
Flow Area	9.83	ft²
Wetted Perimeter	44.97	ft
Top Width	44.06	ft
Height	0.52	ft
Critical Depth	0.64	ft
Critical Slope	0.005486	ft/ft
Velocity	5.08	ft/s
Velocity Head	0.40	ft
Specific Energy	0.92	ft
Froude Number	1.90	
Flow is supercritical.		
Flow is divided.		

San Francisco at San Pedro
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.020700	ft/ft
Water Surface Elevation	0.52	ft
Discharge	49.95	cfs



San Francisco at the I-25 Fromtage Road
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.020700	ft/ft

Elevation range: 0.00 ft to 1.23 ft.

Station (ft)	Elevation (ft)
0.00	1.23
20.00	0.83
24.00	0.75
28.00	0.67
28.10	0.00
30.00	0.12
50.00	0.52
70.00	0.12
72.00	0.00
72.10	0.67
76.00	0.75
80.00	0.83
100.00	1.23

Start Station	End Station	Roughness
0.00	24.00	0.025
24.00	30.00	0.013
30.00	70.00	0.017
70.00	76.00	0.013
76.00	100.00	0.025

Discharge	294.00	cfs

Results		
Wtd. Mannings Coefficient	0.014	
Water Surface Elevation	0.96	ft
Flow Area	33.29	ft²
Wetted Perimeter	74.00	ft
Top Width	72.83	ft
Height	0.96	ft
Critical Depth	1.31	ft
Critical Slope	0.003813	ft/ft
Velocity	8.83	ft/s
Velocity Head	1.21	ft
Specific Energy	2.17	ft
Froude Number	2.30	

Flow is supercritical.

Derrickson
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\derricks.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.024000	ft/ft
Elevation range: 0.00 ft to 1.23 ft.		
Discharge	160.46	cfs

Station (ft)	Elevation (ft)
0.00	1.23
20.00	0.83
26.00	0.75
30.00	0.67
30.10	0.00
32.00	0.12
50.00	0.52
68.00	0.12
70.00	0.00
70.10	0.67
74.00	0.75
80.00	0.83
100.00	1.23

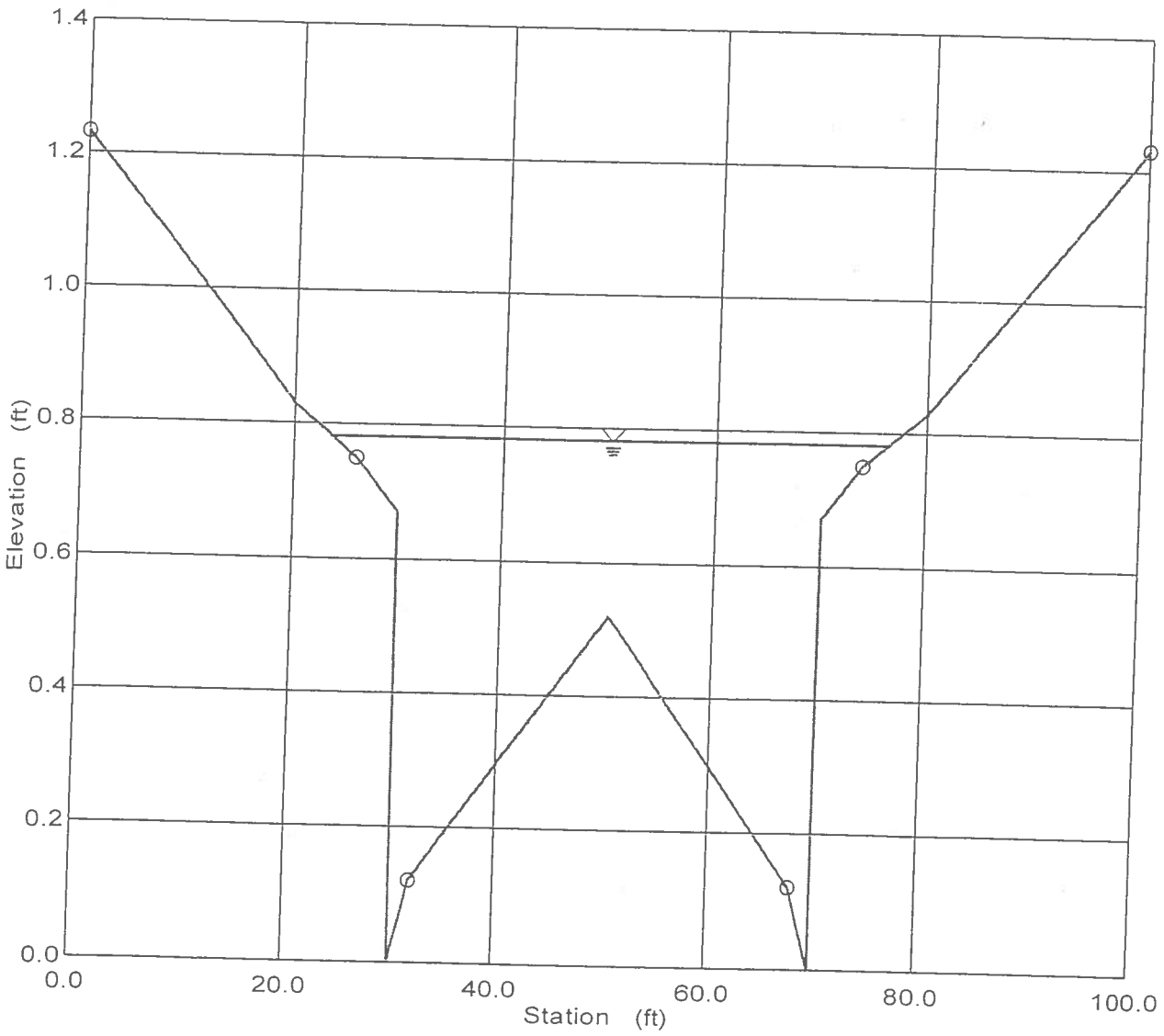
Start Station	End Station	Roughness
0.00	26.00	0.025
26.00	32.00	0.013
32.00	68.00	0.017
68.00	74.00	0.013
74.00	100.00	0.025

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	0.78	ft
Flow Area	20.23	ft²
Wetted Perimeter	54.10	ft
Top Width	52.92	ft
Height	0.78	ft
Critical Depth	1.08	ft
Critical Slope	0.003728	ft/ft
Velocity	7.93	ft/s
Velocity Head	0.98	ft
Specific Energy	1.76	ft
Froude Number	2.26	
Flow is supercritical.		

Derrickson
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\derricks.fm2
Worksheet	San Pedro Collectors Project
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.024000	ft/ft
Water Surface Elevation	0.78	ft
Discharge	160.46	cfs



San Pedro Boulevard
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Boulevard
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.011400	ft/ft
Elevation range: 0.00 ft to 1.00 ft.		
Discharge	243.20	cfs

Station (ft)	Elevation (ft)
0.00	1.00
1.75	0.75
5.75	0.67
5.85	0.00
30.00	0.49
54.25	0.00
54.35	0.67
58.50	0.75
60.00	1.00

Start Station	End Station	Roughness
0.00	1.75	0.025
1.75	5.85	0.013
5.85	54.25	0.017
54.25	58.50	0.013
58.50	60.00	0.025

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.92	ft
Flow Area	34.77	ft²
Wetted Perimeter	60.17	ft
Top Width	58.98	ft
Height	0.92	ft
Critical Depth	1.14	ft
Critical Slope	0.004157	ft/ft
Velocity	6.99	ft/s
Velocity Head	0.76	ft
Specific Energy	1.68	ft
Froude Number	1.61	
Flow is supercritical.		

San Pedro Boulevard east of Fleetwood
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	San Pedro Boulevard
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.011400	ft/ft
Elevation range: 0.00 ft to 1.00 ft.		
Discharge	203.20	cfs

Station (ft)	Elevation (ft)
0.00	1.00
1.75	0.75
5.75	0.67
5.85	0.00
30.00	0.49
54.25	0.00
54.35	0.67
58.50	0.75
60.00	1.00

Start Station	End Station	Roughness
0.00	1.75	0.025
1.75	5.85	0.013
5.85	54.25	0.017
54.25	58.50	0.013
58.50	60.00	0.025

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.86	ft
Flow Area	30.97	ft²
Wetted Perimeter	59.32	ft
Top Width	58.13	ft
Height	0.86	ft
Critical Depth	1.05	ft
Critical Slope	0.004242	ft/ft
Velocity	6.56	ft/s
Velocity Head	0.67	ft
Specific Energy	1.53	ft
Froude Number	1.59	
Flow is supercritical.		

North Pino Arroyo at San Pedro
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	North Pino Arroyo at San Pedro
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.016700	ft/ft
Left Side Slope	2.000000	H : V
Right Side Slope	2.000000	H : V
Bottom Width	10.00	ft
Discharge	2,388.00	cfs

Results		
Depth	4.37	ft
Flow Area	81.92	ft²
Wetted Perimeter	29.55	ft
Top Width	27.48	ft
Critical Depth	7.64	ft
Critical Slope	0.001640	ft/ft
Velocity	29.15	ft/s
Velocity Head	13.21	ft
Specific Energy	17.58	ft
Froude Number	2.98	
Flow is supercritical.		

San Pedro 54" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	54" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.012100	ft/ft
Depth	54.0	in
Diameter	54.00	in

Results		
Discharge	216.30	cfs
Flow Area	15.90	ft²
Wetted Perimeter	14.14	ft
Top Width	0.00	ft
Critical Depth	4.13	ft
Percent Full	100.00	
Critical Slope	0.010511	ft/ft
Velocity	13.60	ft/s
Velocity Head	2.87	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	232.68	cfs
Full Flow Capacity	216.30	cfs
Full Flow Slope	0.012100	ft/ft

San Pedro 60" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	60" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010900	ft/ft
Diameter	60.00	in
Discharge	292.00	cfs

Results		
Depth	55.4	in
Flow Area	18.94	ft²
Wetted Perimeter	12.89	ft
Top Width	2.67	ft
Critical Depth	4.64	ft
Percent Full	92.28	
Critical Slope	0.010881	ft/ft
Velocity	15.42	ft/s
Velocity Head	3.70	ft
Specific Energy	8.31	ft
Froude Number	1.02	
Maximum Discharge	292.48	cfs
Full Flow Capacity	271.90	cfs
Full Flow Slope	0.012572	ft/ft
Flow is supercritical.		

San Pedro 48"RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	48" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	48.00	in
Discharge	131.50	cfs

Results		
Depth	3.01	ft
Flow Area	10.15	ft²
Wetted Perimeter	8.40	ft
Top Width	3.45	ft
Critical Depth	3.43	ft
Percent Full	75.26	
Critical Slope	0.007802	ft/ft
Velocity	12.96	ft/s
Velocity Head	2.61	ft
Specific Energy	5.62	ft
Froude Number	1.33	
Maximum Discharge	154.51	cfs
Full Flow Capacity	143.64	cfs
Full Flow Slope	0.008382	ft/ft
Flow is supercritical.		

San Pedro 42" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	42" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	42.00	in
Discharge	91.50	cfs

Results		
Depth	2.62	ft
Flow Area	7.72	ft²
Wetted Perimeter	7.32	ft
Top Width	3.04	ft
Critical Depth	2.96	ft
Percent Full	74.83	
Critical Slope	0.007834	ft/ft
Velocity	11.85	ft/s
Velocity Head	2.18	ft
Specific Energy	4.80	ft
Froude Number	1.31	
Maximum Discharge	108.22	cfs
Full Flow Capacity	100.60	cfs
Full Flow Slope	0.008272	ft/ft
Flow is supercritical.		

San Pedro 30" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	30" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	30.00	in
Discharge	41.50	cfs

Results		
Depth	1.56	ft
Flow Area	3.23	ft²
Wetted Perimeter	4.56	ft
Top Width	2.42	ft
Critical Depth	2.16	ft
Percent Full	62.56	
Critical Slope	0.009419	ft/ft
Velocity	12.84	ft/s
Velocity Head	2.56	ft
Specific Energy	4.13	ft
Froude Number	1.96	
Maximum Discharge	62.40	cfs
Full Flow Capacity	58.00	cfs
Full Flow Slope	0.010238	ft/ft
Flow is supercritical.		

San Pedro & Derrickson 24" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	24" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	24.00	in
Discharge	22.00	cfs

Results		
Depth	1.22	ft
Flow Area	2.00	ft^2
Wetted Perimeter	3.58	ft
Top Width	1.95	ft
Critical Depth	1.68	ft
Percent Full	60.93	
Critical Slope	0.009114	ft/ft
Velocity	10.98	ft/s
Velocity Head	1.87	ft
Specific Energy	3.09	ft
Froude Number	1.91	
Maximum Discharge	34.41	cfs
Full Flow Capacity	31.99	cfs
Full Flow Slope	0.009458	ft/ft
Flow is supercritical.		

San Pedro 18" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	18" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	18.00	in
Discharge	11.00	cfs

Results		
Depth	0.96	ft
Flow Area	1.20	ft^2
Wetted Perimeter	2.78	ft
Top Width	1.44	ft
Critical Depth	1.27	ft
Percent Full	64.05	
Critical Slope	0.010388	ft/ft
Velocity	9.20	ft/s
Velocity Head	1.32	ft
Specific Energy	2.28	ft
Froude Number	1.78	
Maximum Discharge	15.98	cfs
Full Flow Capacity	14.85	cfs
Full Flow Slope	0.010967	ft/ft
Flow is supercritical.		

Derrickson 48"RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	48" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	48.00	in
Discharge	160.50	cfs

Results		
Depth	2.68	ft
Flow Area	8.96	ft²
Wetted Perimeter	7.68	ft
Top Width	3.76	ft
Critical Depth	3.67	ft
Percent Full	67.05	
Critical Slope	0.010852	ft/ft
Velocity	17.92	ft/s
Velocity Head	4.99	ft
Specific Energy	7.67	ft
Froude Number	2.05	
Maximum Discharge	218.51	cfs
Full Flow Capacity	203.13	cfs
Full Flow Slope	0.012486	ft/ft
Flow is supercritical.		

Derrickson 36" RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	36"RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	36.00	in
Discharge	74.60	cfs

Results		
Depth	2.01	ft
Flow Area	5.04	ft²
Wetted Perimeter	5.76	ft
Top Width	2.82	ft
Critical Depth	2.71	ft
Percent Full	67.10	
Critical Slope	0.010968	ft/ft
Velocity	14.79	ft/s
Velocity Head	3.40	ft
Specific Energy	5.41	ft
Froude Number	1.95	
Maximum Discharge	101.46	cfs
Full Flow Capacity	94.32	cfs
Full Flow Slope	0.012511	ft/ft
Flow is supercritical.		

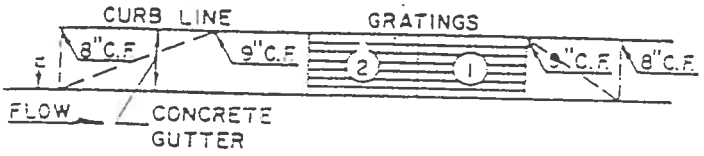
San Francisco 48"RCP Capacity
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\san pedr.fm2
Worksheet	48" RCP
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

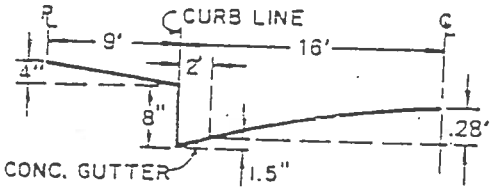
Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	48.00	in
Discharge	155.00	cfs

Results		
Depth	2.62	ft
Flow Area	8.71	ft²
Wetted Perimeter	7.54	ft
Top Width	3.81	ft
Critical Depth	3.63	ft
Percent Full	65.40	
Critical Slope	0.010182	ft/ft
Velocity	17.80	ft/s
Velocity Head	4.92	ft
Specific Energy	7.54	ft
Froude Number	2.07	
Maximum Discharge	218.51	cfs
Full Flow Capacity	203.13	cfs
Full Flow Slope	0.011645	ft/ft
Flow is supercritical.		

GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)

San Pedro Boulevard East of Hazelwood

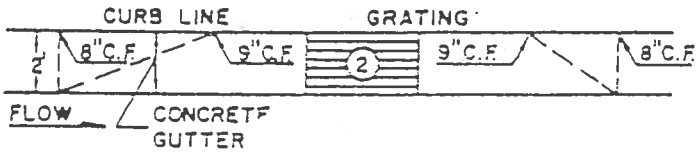
Q = 203.2 CFS

S = 1.1%

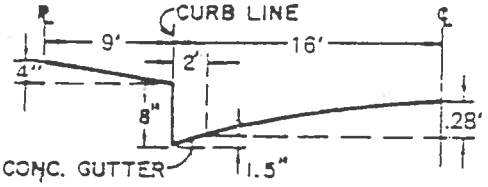
75

Depth = 0.96

GRATING CAPACITIES FOR TYPE "A" , "C" and "D"



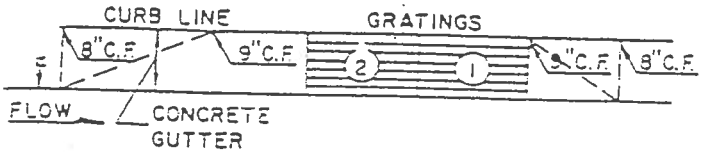
GRATING & GUTTER PLAN



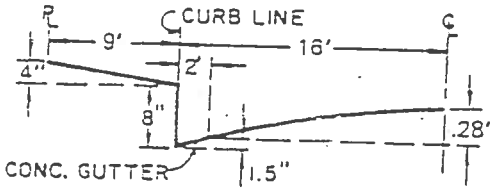
TYPICAL HALF STREET SECTION
(ABOVE BASIN)

San Pedro Boulevard East of Pleasant
Q = 203.2 CFS
S = 1.1%
Depth = 0.8'

GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN

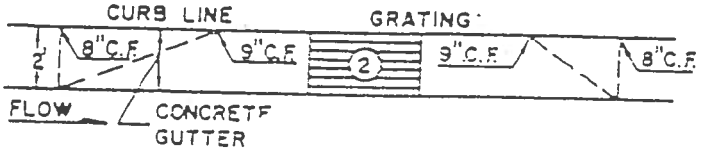


TYPICAL HALF STREET SECTION
(ABOVE BASIN)

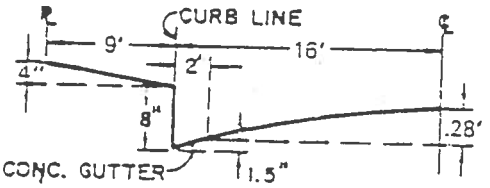
20 CFS @ 1.1

San Pedro Boulevard
Q = 243.2 CFS
Depth = 0.92'
S = 1.19%
at First Drop Inlet

GRATING CAPACITIES FOR TYPE "A", "C" and "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)

D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

Dennison Avenue
Q = 160.5 CFS
74 S = 2.47%
Depth = 0.78'

REV. 3-83

PLATE 22.3 D-5

Cattleguard Inlet Capacities

Cattleguards on slope, so use weir equation

Bernardson Street

Bernardson 40' wide (Face to Face)

Width of Each grate = 25" = 2.083'

40'/2.083' = 19 grates required

Open area per grate = 4.69 Square feet

Total Open area = 19 x 4.69 Square feet = 89.1 Square feet

Check Cattle guard acting as a weir

$Q = CLH^{3/2}$; C = 3.0 L = 40', H = 0.78'

$Q = 3(40)(0.78)^{3/2}$ = 82.7 CFS per Cattleguard inlet

Q left = 160.5 - 82.7 = 77.8 CFS ⇒ H = 0.59'

$Q = 3(40)(0.59)^{3/2}$ = 54.4 CFS

Q left in street = 77.8 - 54.4 = 23.4 ⇒ H = 0.38'

San Francisco Street

San Francisco 44' wide (Face to Face)

Width of grate = 25" = 2.083'

44'/2.083' = 21 grates required

Open area per grate = 4.69 Square feet

Total Open area = 21 x 4.69 = 98.49 Square feet

Check Cattle guard acting as weir

$Q = CLH^{3/2}$; C = 3.0 L = 44' H = 0.93 (assume max of gutter to Row)

$Q = 3.0(44)(0.93)^{3/2}$ = 99.8 CFS

54" Pipe Capacity = 232 cfs

Inlets = 232/99.8 = 2.32 ⇒ use 3 Cattle guards

Calculate capacity of curb opening at the San Pedro Bridge over the North Pine Arroyo

Use the weir equation to calculate the flow that goes through the curb opening

West side of San Pedro

Curb height = 0.67' Opening width = 39.3'

Weir equation $Q = CLH^{3/2}$; $C = 3.0$

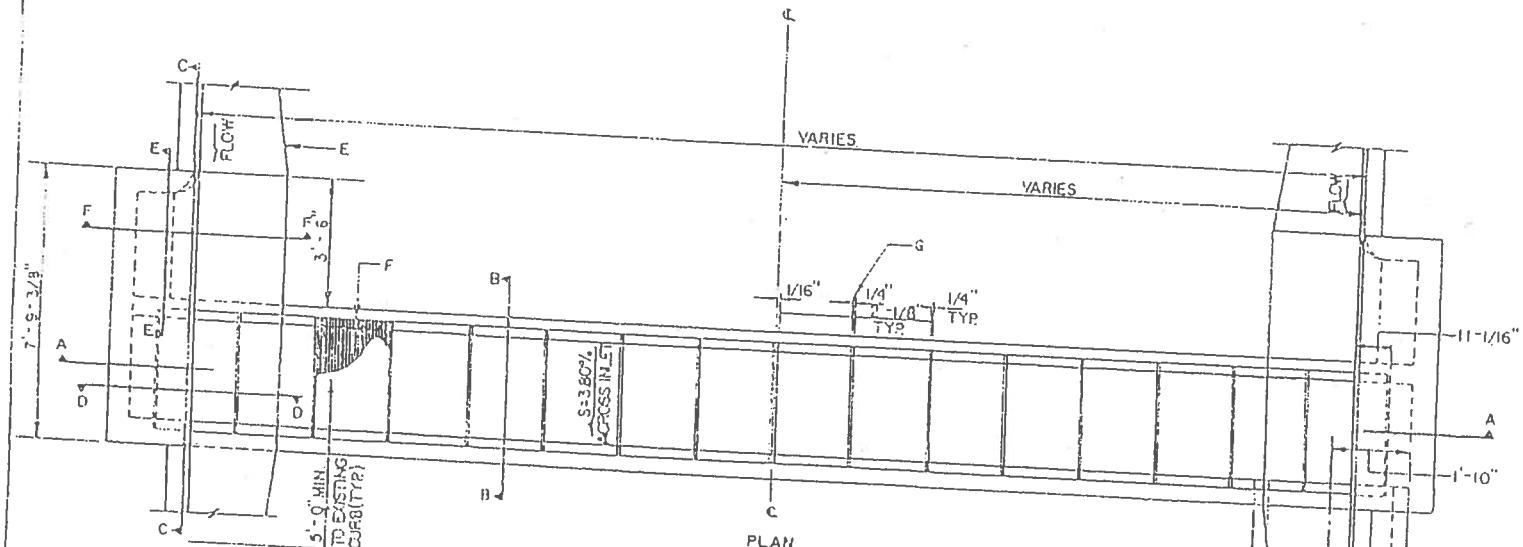
$Q = 3.0(39.3)(0.67)^{3/2} = 56.9$ CFS

East side of San Pedro

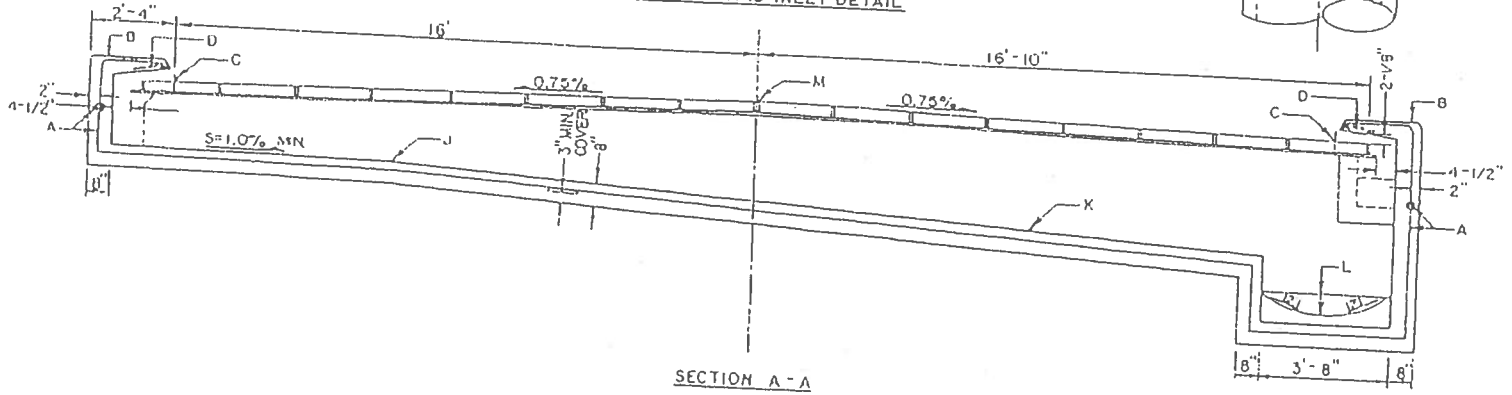
Curb height = 0.67' Opening width = 27.8'

$Q = 3.0(27.8)(0.67)^{3/2} = 45.7$ CFS

APPENDIX D
STORM DRAIN DETAILS



CATTLE GUARD INLET DETAIL



NOTE: SEE DWG. 2272 FOR SECTIONS B-B, C-C, D-D, E-E, AND F-F.

GENERAL NOTE

1. ALL EXPOSED METAL PARTS SHALL BE PAINTED PRIOR TO ASSEMBLY. WELDING, MACHINING AND DRILLING SHALL BE DONE PRIOR TO PAINTING. ALL DIMENSIONS ARE FINISH DIMENSIONS.
2. ALL PARTS SHALL BE OF STRUCTURE STEEL, GRADE 36.
3. FOR CLEANING AND PAINTING OF FRAME SEE DWG. 2215, GENERAL NOTE NO. 4.
4. FRAME MAY BE WELDED OR RIVETED.

CONSTRUCTION NOTES

A. NO. 4 BARS AT 6" O.C. EACH WAY.
B. TOP OF CURB.
C. CURB FLOWLINE.
D. ANGLE ANCHOR DETAIL, SEE DWG. 2205.
E. SEE CITY OF ALBUQUERQUE STD. DWG. 2207 FOR STORM INLET CUTTER TRANSITION.
F. GRATE PER CITY OF ALBUQUERQUE STD. DWG. 2220 (TYP.) 16 TOTAL MODIFIED WITH 1" GAP COVER PLATE PER DETAIL THIS SHEET.
G. 1/4" SPACE BETWEEN GRATES (TYP.).
H. OUTLET STORM DRAINAGE HORIZONTAL AND VERTICAL LOCATION MAY VARY PER SPECIFIC PROJECT.
J. GRADE BREAK.
K. GRADE BREAK LOCATIONS AND SLOPE MAY VARY DEPENDING ON LOCATION OF INLET.
L. CONCRETE FILL MINIMUM LONGITUDINAL SLOPE 4:1.
M. CROWN.

REVISIONS

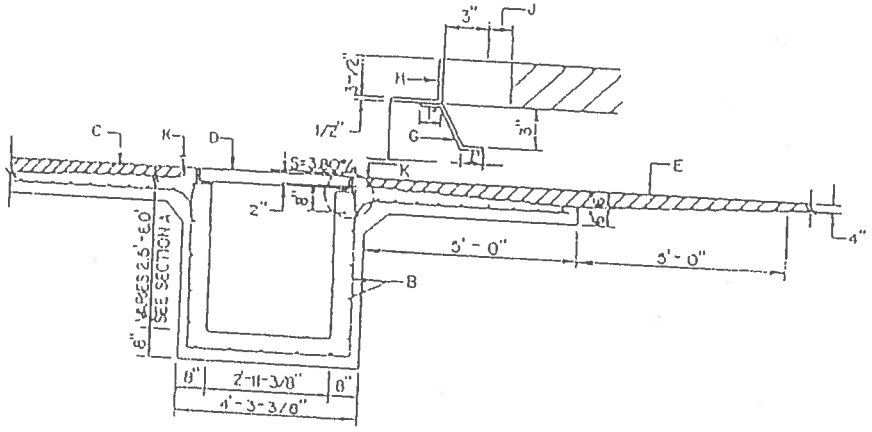
CITY OF ALBUQUERQUE

DRAINAGE

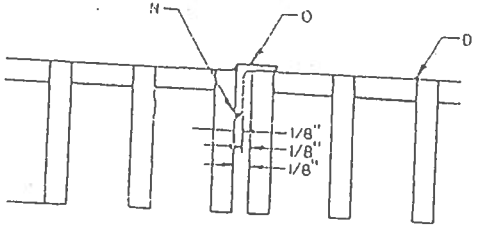
CATTLE GUARD INLET

DWG. 2271

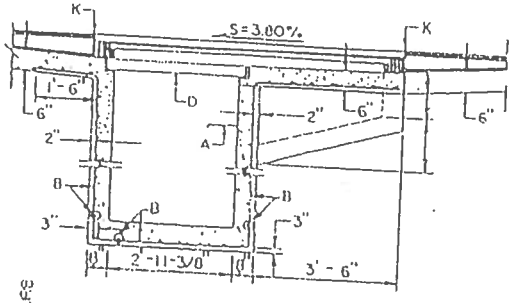
APRIL 1992



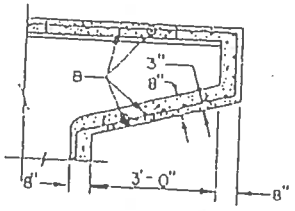
SECTION B-B



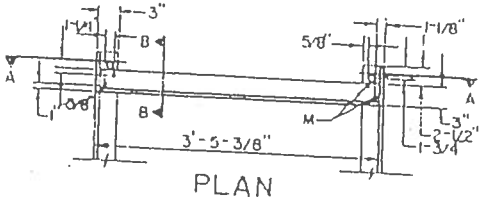
GRATE CAP COVER PLATE DETAIL



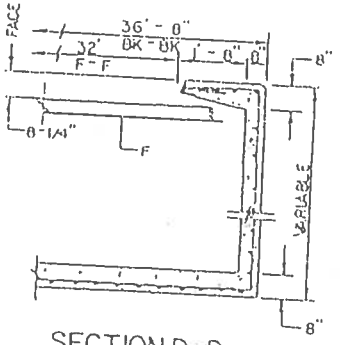
SECTION C-C



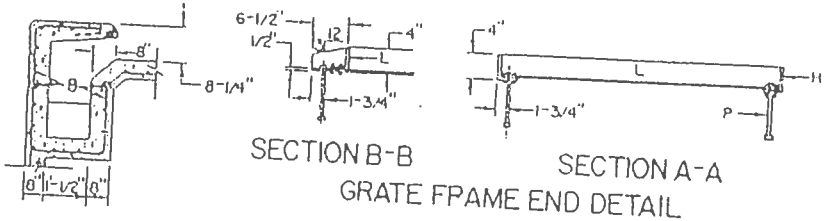
SECTION E-E



PLAN



SECTION D-D



SECTION F-F

SECTION B-B

SECTION A-A

GRATE FRAME END DETAIL

NOTE:
SEE DWG. 2271 FOR ADDITIONAL CATTLE GUARD INLET DETAIL

GENERAL NOTES

1. ALL EXPOSED METAL PARTS SHALL BE PAINTED PRIOR TO ASSEMBLY. WELDING, MACHINING AND DRILLING SHALL BE DONE PRIOR TO PAINTING. ALL DIMENSIONS ARE FINISH DIMENSIONS.
2. ALL PARTS SHALL BE OF STRUCTURE STEEL, GRADE 36.
3. FOR CLEANING AND PAINTING OF FRAME SEE DWG. 2215, GENERAL NOTE NO. 4.
4. FRAME MAY BE WELDED OR RIVETED.

CONSTRUCTION NOTES

A. FOR STORM INLET DEPTHS GREATER THAN 4', INSTALL STD. STEPS, SEE STD. DETAIL.
B. NO. 4 BARS AT 6" O.C. EACH WAY.
C. ROUGH TEXTURE CONCRETE SURFACE (TYP.)
D. GRATE.
E. THICKEN ASPHALT PAVEMENT TO 6" AT EDGE OF APRON BOTH SIDES OF INLET (TYP.)
F. GRATE FRAME.
G. 1" X 1/8" STEEL STRAP-WELD TO ANGLE 6" O.C.
H. 4" X 3" X 1/2".
J. 2" CLEARANCE.
K. SEE PLAN.
L. 3-1/2" X 3" X 3/8" X 3'-4"-3/8".
M. 2-3/8" RIVETS AT EACH CORNER, SEE GENERAL NOTE NO. 4.
N. 1/8" FILLET WELD 2" LONG AT 6" O.C. (TYP.)
O. 1/2" X 1" X 1/8" STEEL ANGLE FULL LENGTH OF GRATE ONE SIDE ONLY EACH GRATE.
P. FOUR (4) EACH 1/2" X 8" BOLTS WITH SQUARE HEADS AND NUTS. ONE BOLT AT EACH CORNER FOR ANCHORING THE FRAME INTO THE CONCRETE WALL.

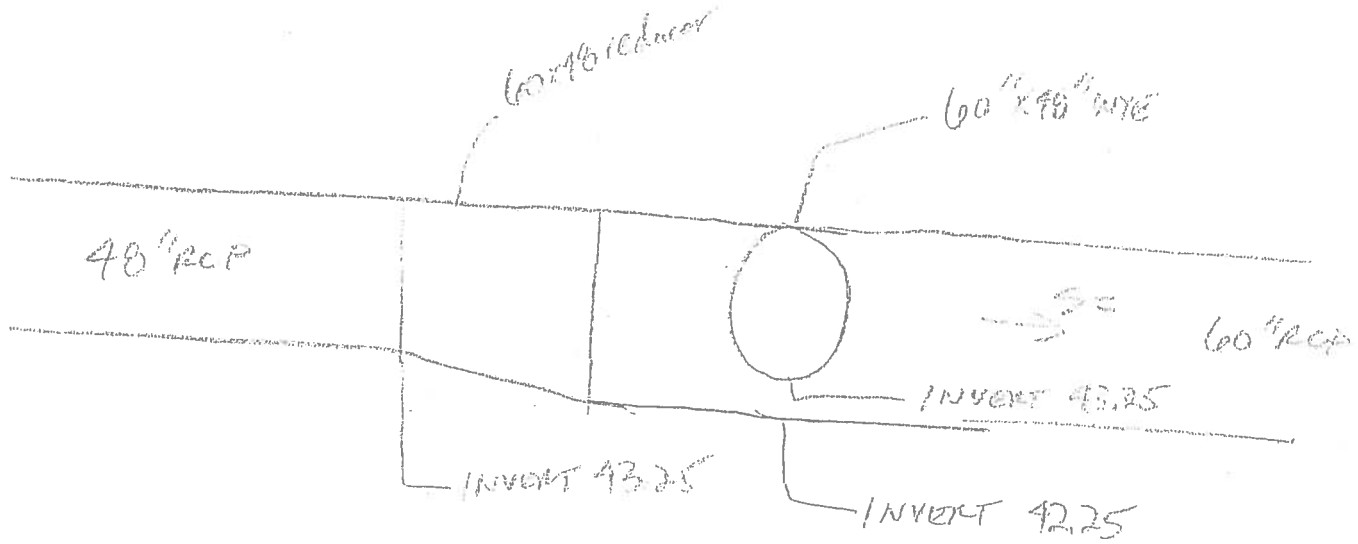
CITY OF ALBUQUERQUE

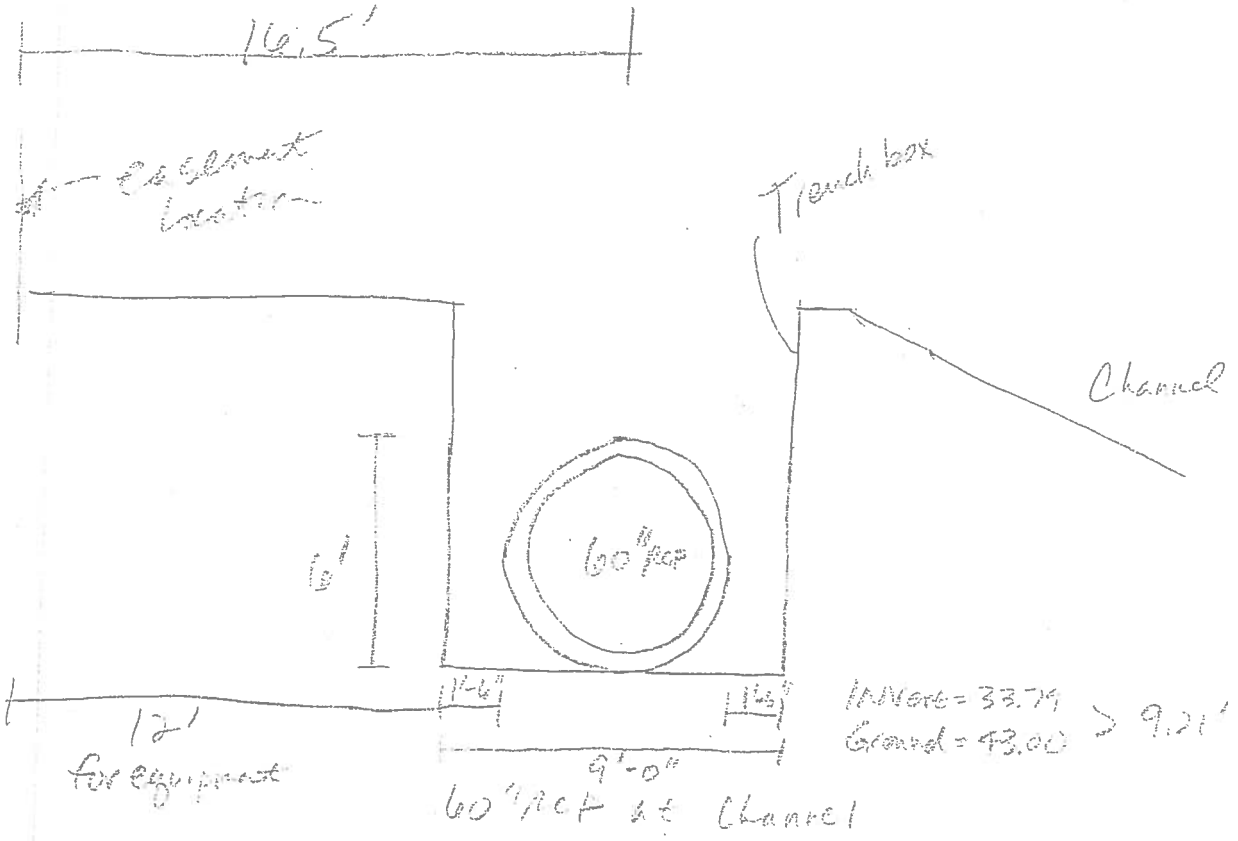
REVISIONS

DRAINAGE

CATTLE GUARD INLET

DWG 2272


60"x48" RCP
60"x48" RCP
48" RCP
60" RCP
INVERT 43.25
INVERT 43.25
INVERT 42.25


16.5'
Easement Location
Transition box
Channel
60" RCP
12'
for equipment
1'-6"
11'-6"
9'-0"
60" RCP at Channel
Invert = 33.79
Ground = 43.00
> 9.21'

APPENDIX E
CONCEPTUAL CONSTRUCTION COST ESTIMATE

2. UNIT PRICES

SAN PEDRO COLLECTORS TO THE NORTH PINO ARROYO PROJECT NO. 7168 SAN FRANCISCO TO NORTH PINO

BID ITEM NO.	SPEC. ITEM NO.	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	AMOUNT
1	4.01	Construction Staking, complete	LS	1	$ 5,000.00	$ 5,000.00
2	6.01	Construction Project Sign, complete-in-place	EA	2	$ 1,000.00	$ 2,000.00
3	6.05	Construction mobilization, Complete	LS	1	$ 15,000.00	$ 15,000.00
4	19.01	Construction Traffic Control & Barricading, complete	LS	1	$ 5,000.00	$ 5,000.00
5	20.01X	Control of Storm and Nuisance Flows	LS	1	$ 5,000.00	$ 5,000.00
6	21.01x	NPDES Compliance	LS	1	$ 5,000.00	$ 5,000.00
7	207.010	Lean Fill, cip.	CY	225	$ 75.19	$ 16,918.20
8	301.020	Subgrade Preparation, 12" at 95% compaction, complete-in-place	SY	810	$ 1.76	$ 1,428.84
9	336.022	Residential Asphalt Concrete, Type B, 1-1/2 inch thick, machine laydown, complete-in-place	SY	910	$ 4.36	$ 3,963.96
10	336.036	Arterial Asphalt Concrete, Type A, 2-1/2 inch thick, machine laydown, complete-in-place	SY	1,500	$ 5.88	$ 8,820.00
11	336.120	Tack Coat, cationic emulsified asphalt, complete-in-place	SY	1,620	$ 0.23	$ 369.36
12	340.010	Sidewalk, 4" Thick, Portland Cement Concrete, incl. Subgrade compaction, complete-in-place SD 2425	SY	50	$ 25.30	$ 1,264.80
13	343.020	Existing Pavement, Asphalt Concrete, up to 4" thick, sawcut, remove & dispose, complete	SY	310	$ 3.42	$ 1,060.20
14	343.030	Existing Pavement, Asphalt Concrete, more than 4" thick, sawcut, remove & dispose, complete	SY	500	$ 4.26	$ 2,130.00
15	343.075	Existing Curb & Gutter, PC Concrete, remove, dispose & replace, complete-in-place	LF	110	$ 19.94	$ 2,193.84
16	343.085	Existing Sidewalk, 4" PC Concrete, remove & dispose, complete	SY	50	$ 4.96	$ 247.80
17	410.030	Existing Chain Link Fence, remove & reinstall, complete	SF	210	$ 2.52	$ 529.20
18	410.050	Temporary Chain Link Fence, 5' high, provide, install & remove, complete	LF	35	$ 3.83	$ 133.98
19	701.110	Trenching, Backfilling, & Compaction for 18" to 36" storm drain, 8' to 12' in depth, pipe not incl., complete	LF	160	$ 18.36	$ 2,937.60
20	701.160	Trenching, Backfilling, & Compaction for 42" to 60" storm drain, 8' to 12' in depth, pipe not incl., complete	LF	301	$ 45.80	$ 13,787.00
21	801.002	6" Waterline Pipe excluding fittings (std. Spec. sec. 801), inlcuding trench & compacted backfill to 6' depth, complete-in-place	LF	200	$ 11.36	$ 2,272.80
22	801.007	16" Waterline Pipe excluding fittings (std. Spec. sec. 801), inlcuding trench & compacted backfill to 6' depth, complete-in-place	LF	40	$ 47.16	$ 1,886.40
23	801.055	Existing Waterline, 6" to 14", with fittings, Remove and Dispose, excl. trenching, complete	LF	200	$ 4.92	$ 984.00

SAN PEDRO COLLECTORS TO THE NORTH PINO ARROYO PROJECT NO. 7168 SAN FRANCISCO TO NORTH PINO

BID ITEM NO.	SPEC. ITEM NO.	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	AMOUNT
24	801.056	Existing Waterline, 16" to 36", with fittings, Remove and Dispose, excl. trenching, complete	LF	40	$ 5.53	$ 221.28
25	801.059	Non-pressurized Connection, existing waterline, all sizes, including fittings, complete-in-place	EA	4	$ 647.09	$ 2,588.35
26	801.065	Ductile Iron MJ Fittings, Class 250, 4" to 14" waterline, including jointing material, complete-in-place	LB	500	$ 2.52	$ 1,260.00
27	801.150	Mechanical Joint Restraining Gland, DI & PVC, 4"-8", complete-in-place	EA	10	$ 60.26	$ 602.64
28	901.71	Sewerline, 4" to 8", Remove & Dispose, trenching not included, complete-in-place, SD 2125	LF	90	$ 2.82	$ 253.80
29	905.05	4" New Sewer Service Line, from main to property line, including trenching, saddle & connection, complete-in-place	EA	3	$ 592.61	$ 1,777.82
30	910.018	36" Reinforced Concrete Pipe, Class IV, furnish and install in open trench, complete-in-place	LF	40	$ 59.11	$ 2,364.48
31	910.022	48" Reinforced Concrete Pipe, Class IV, furnish & place in open trench, complete-in-place	LF	120	$ 86.93	$ 10,431.36
32	910.024	54" Reinforced Concrete Pipe, Class V, furnish & place in open trench, complete-in-place	LF	301	$ 107.44	$ 32,338.24
33	910.067	Bend, 54" RCP, any degree, furnish & install in open trench, cip.	EA	3	$ 2,014.24	$ 6,042.71
34	915.08X	Catch Basin, Cattleguard Type, complete-in-place	EA	3	$ 20,000.00	$ 60,000.00
35	920.113X	54" T-MH, 1-2' deep, incl. saddle, 4' Dia. Risers, and Type "C" top, complete-in-place	EA	2	$ 2,014.24	$ 4,028.47
36	920.210	Manhole, 8' dia., Type "C" or "E", 6' to 10' deep, complete-in-place SD 2101	EA	1	$ 5,959.03	$ 5,959.03

SUB-TOTAL OF BID ITEMS 1-36	$225,796.17
CONTINGENCY AT 15%	$33,869.43
SUB-TOTAL OF BID ITEMS PLUS 15% CONTINGENCY	$259,665.59
NEW MEXICO GROSS RECEIPTS TAX @ 5.8125%	$ 15,093.06
TOTAL OF BID ITEMS PLUS NMGRT	$274,758.66

2. UNIT PRICES

SAN PEDRO COLLECTORS TO THE NORTH PINO ARROYO PROJECT NO. 7168 (DERRICKSON TO NORTH PINO)

BID ITEM NO.	SPEC. ITEM NO.	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	AMOUNT
1	4.01	Construction Staking, complete	LS	1	$ 9,000.00	$ 9,000.00
2	6.01	Construction Project Sign, complete-in-place	EA	2	$ 1,000.00	$ 2,000.00
3	6.05	Construction mobilization, Complete	LS	1	$ 25,000.00	$ 25,000.00
4	19.01	Construction Traffic Control & Barricading, complete	LS	1	$ 5,000.00	$ 5,000.00
5	20.01X	Control of Storm and Nuisance Flows	LS	1	$ 5,000.00	$ 5,000.00
6	21.01x	NPDES Compliance	LS	1	$ 5,000.00	$ 5,000.00
7	207.010	Lean Fill, cip.	CY	790	$ 75.19	$ 59,401.68
8	301.020	Subgrade Preparation, 12" at 95% compaction, complete-in-place	SY	2,240	$ 1.76	$ 3,951.36
9	336.022	Residential Asphalt Concrete, Type B, 1-1/2 inch thick, machine laydown, complete-in-place	SY	1,110	$ 4.36	$ 4,835.16
10	336.036	Arterial Asphalt Concrete, Type A, 2-1/2 inch thick, machine laydown, complete-in-place	SY	5,610	$ 5.88	$ 32,986.80
11	336.120	Tack Coat, cationic emulsified asphalt, complete-in-place	SY	4,480	$ 0.23	$ 1,021.44
12	340.010	Sidewalk, 4" Thick, Portland Cement Concrete, incl. Subgrade compaction, complete-in-place SD 2425	SY	170	$ 25.30	$ 4,300.32
13	340.030	Valley Gutter & Curb, Portland Cement Concrete, incl. Reinforcement and subgrade compaction, cip, SD 2420	SY	30	$ 47.64	$ 1,429.20
14	343.020	Existing Pavement, Asphalt Concrete, up to 4" thick, sawcut, remove & dispose, complete	SY	370	$ 3.42	$ 1,265.40
15	343.030	Existing Pavement, Asphalt Concrete, more than 4" thick, sawcut, remove & dispose, complete	SY	1,870	$ 4.26	$ 7,966.20
16	343.075	Existing Curb & Gutter, PC Concrete, remove, dispose & replace, complete-in-place	LF	380	$ 19.94	$ 7,578.72
17	343.078	Existing Header Curb, PC Concrete, remove, dispose & replace, complete-in-place	LF	30	$ 19.94	$ 598.32
18	343.085	Existing Sidewalk, 4" PC Concrete, remove & dispose, complete	SY	170	$ 4.96	$ 842.52
19	343.121	Temporary Pavement, Existing, Remove & Replace, complete-in-place	SY	40	$ 2.39	$ 95.52
20	410.030	Existing Chain Link Fence, remove & reinstall, complete	SF	150	$ 2.52	$ 378.00
21	410.050	Temporary Chain Link Fence, 5' high, provide, install & remove, complete	LF	80	$ 3.83	$ 306.24
22	510.120	Wall Footing, Reinforced PC Concrete, incl. Formwork, complete-in-place.	CY	28	$ 355.14	$ 9,943.92
23	540.010	Concrete Block Masonry Wall, hollow core, complete-in-place.	SF	360	$ 8.16	$ 2,937.60
24	540.030	Concrete Block Masonry Wall, incl. Foundation, remove & dispose, complete	SF	360	$ 0.71	$ 254.88

SAN PEDRO COLLECTORS TO THE NORTH PINO ARROYO PROJECT NO. 7168 (DERRICKSON TO NORTH PINO)

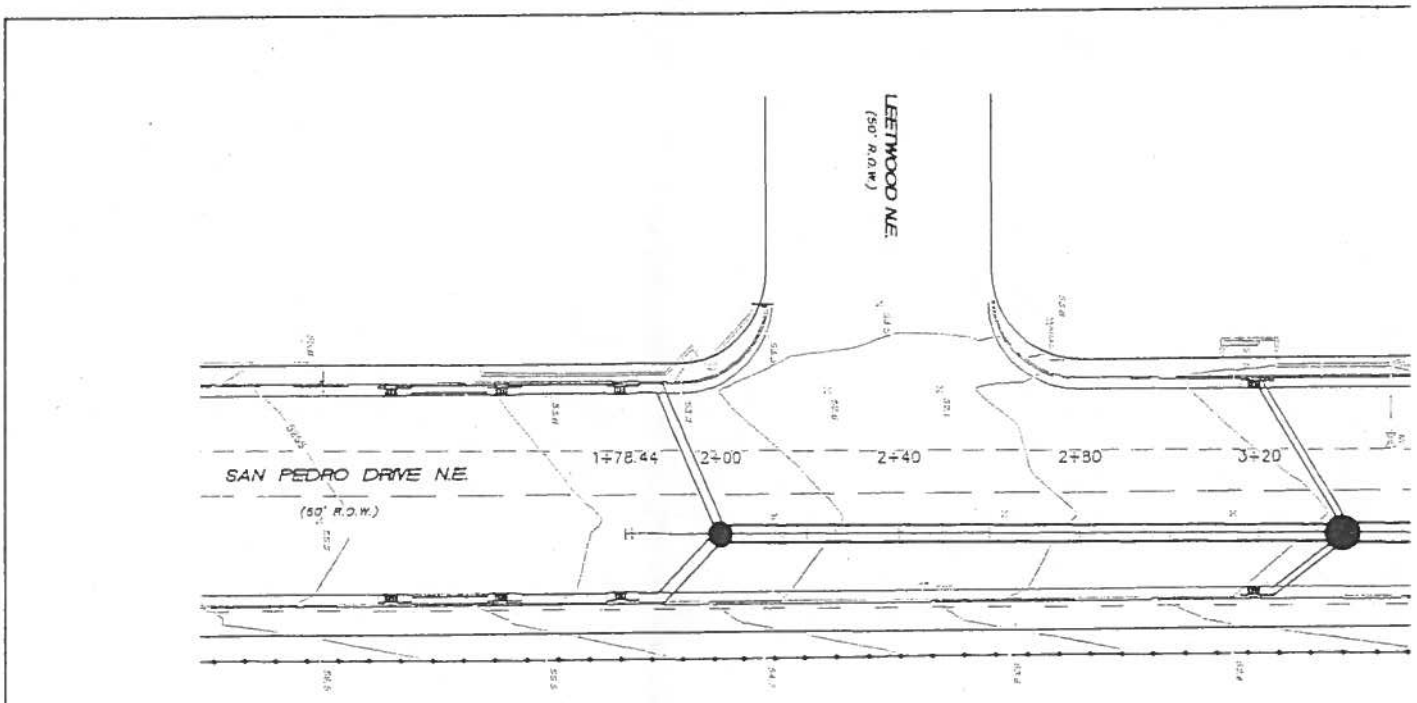
BID ITEM NO.	SPEC. ITEM NO.	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	AMOUNT
25	701.100	Trenching, Backfilling, & Compaction for 18" to 36" storm drain, up to 8' depth, pipe not incl., complete	LF	231	$ 16.04	$ 3,706.16
26	701.150	Trenching, Backfilling, & Compaction for 42" to 60" storm drain, up to 8' depth, pipe not incl., complete	LF	315	$ 33.36	$ 10,508.40
27	701.160	Trenching, Backfilling, & Compaction for 42" to 60" storm drain, 8' to 12' in depth, pipe not incl., complete	LF	808	$ 45.80	$ 37,009.63
28	801.002	6" Waterline Pipe excluding fittings (std. Spec. sec. 801), inlcuding trench & compacted backfill to 6' depth, complete-in-place	LF	40	$ 11.36	$ 454.56
29	801.005	12" Waterline Pipe excluding fittings (std. Spec. sec. 801), inlcuding trench & compacted backfill to 6' depth, complete-in-place	LF	80	$ 28.12	$ 2,249.28
30	801.055	Existing Waterline, 6" to 14", with fittings, Remove and Dispose, excl. trenching, complete	LF	120	$ 4.92	$ 590.40
31	801.059	Non-pressurized Connection, existing waterline, all sizes, including fittings, complete-in-place	EA	4	$ 647.09	$ 2,588.35
32	801.065	Ductile Iron MJ Fittings, Class 250, 4" to 14" waterline, including jointing material, complete-in-place	LB	500	$ 2.52	$ 1,260.00
33	801.150	Mechanical Joint Restraining Gland, DI & PVC, 4"-8", complete-in-place	EA	10	$ 60.26	$ 602.64
34	910.006	18" Reinforced Concrete Pipe, Class IV, furnish and install in open trench, complete-in-place	LF	146	$ 25.79	$ 3,765.05
35	910.010	24" Reinforced Concrete Pipe, Class IV, furnish and install in open trench, complete-in-place	LF	141	$ 31.28	$ 4,411.04
36	910.014	30" Reinforced Concrete Pipe, Class IV, furnish & place in open trench, complete-in-place	LF	57	$ 41.44	$ 2,361.85
37	910.018	36" Reinforced Concrete Pipe, Class IV, furnish & place in open trench, complete-in-place	LF	32	$ 59.11	$ 1,891.58
38	910.020	42" Reinforced Concrete Pipe, Class IV, furnish & place in open trench, complete-in-place	LF	140	$ 77.20	$ 10,807.44
39	910.022	48" Reinforced Concrete Pipe, Class IV, furnish & place in open trench, complete-in-place	LF	175	$ 86.93	$ 15,212.40
40	910.026	60" Reinforced Concrete Pipe, Class IV, furnish & place in open trench, complete-in-place	LF	808	$ 129.96	$ 105,007.68
41	910.05x	Eccentric Reducer, 60" x 48"RCP, furnish & install in open trench, complete-in-place	EA	1	$ 1,761.88	$ 1,761.88
42	910.066	Bend, 42"-48" RCP, any degree, fabrication, extra cost to furnish & install in open trench, complete-in-place.	EA	1	$ 767.77	$ 767.77
43	910.067	Bend, 60" RCP, any degree, furnish & install in open trench, cip.	EA	1	$ 2,014.24	$ 2,014.24
44	910.086	Wye, 60" x 48" RCP, fabrication, extra cost to furnish & install in open trench, complete-in-place.	EA	1	$ 3,231.98	$ 3,231.98
45	915.010	Catch Basin, Type "A", Single Grate, complete-in-place	EA	4	$ 2,642.63	$ 10,570.51
46	915.040	Catch Basin, Type "C", Double Grate, complete-in-place	EA	6	$ 3,635.39	$ 21,812.33

SAN PEDRO COLLECTORS TO THE NORTH PINO ARROYO PROJECT NO. 7168 (DERRICKSON TO NORTH PINO)

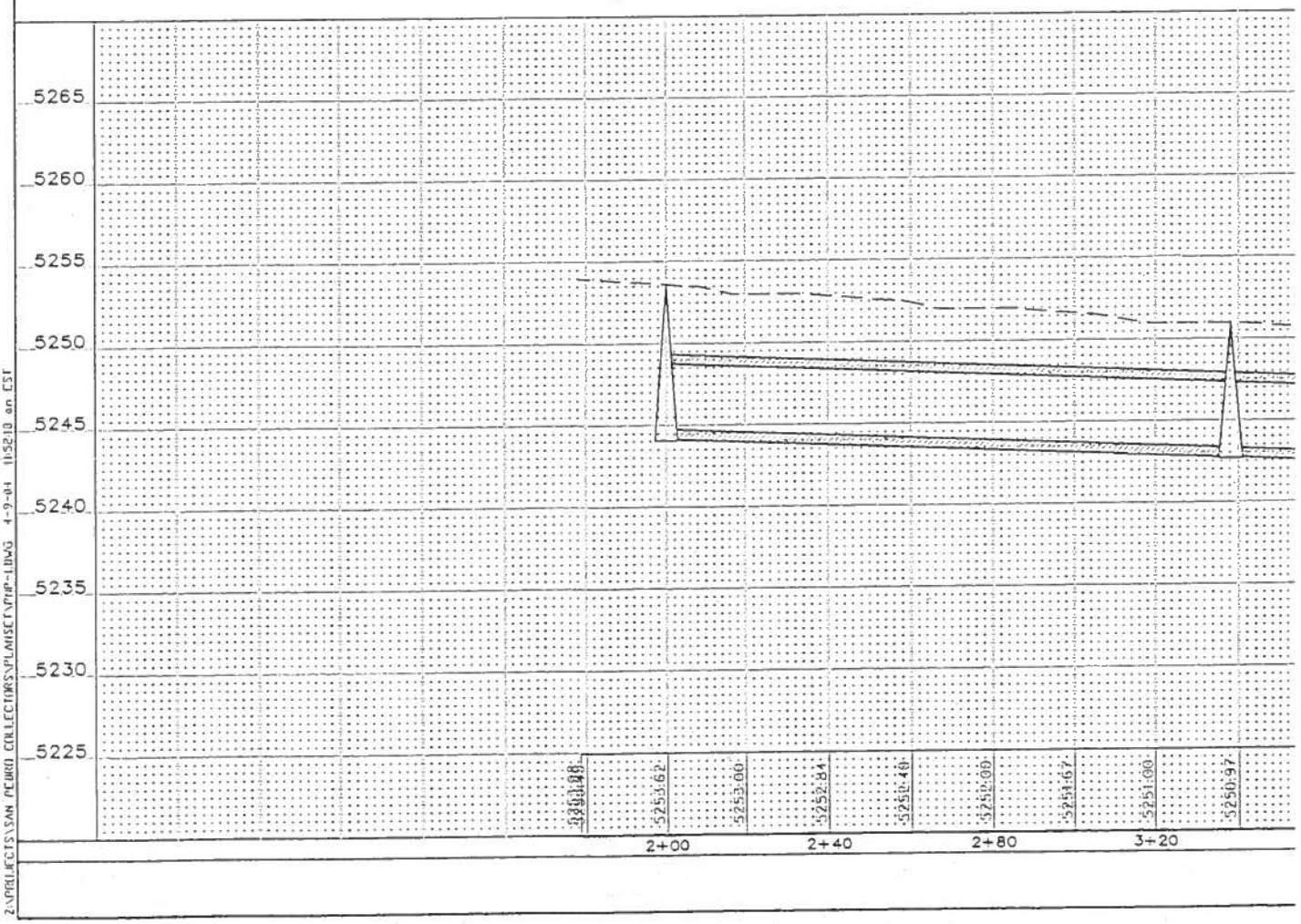
BID ITEM NO.	SPEC. ITEM NO.	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	AMOUNT
47	915.08X	Catch Basin, Cattleguard Type, complete-in-place	EA	2	$ 20,000.00	$ 40,000.00
48	920.140	Manhole, 6' dia., Type "C" or "E", 6' to 10' deep, complete-in-place SD 2101	EA	1	$ 3,231.62	$ 3,231.62
49	920.210	Manhole, 8' dia., Type "C" or "E", 6' to 10' deep, complete-in-place SD 2101	EA	2	$ 5,959.03	$ 11,918.06

SUB-TOTAL OF BID ITEMS 1-49	$488,828.15
CONTINGENCY AT 15%	$73,324.22
SUB-TOTAL OF BID ITEMS PLUS 15% CONTINGENCY	$562,152.37
NEW MEXICO GROSS RECEIPTS TAX @ 5.8125%	$ 32,675.11
TOTAL OF BID ITEMS PLUS NMGRT	$594,827.48

APPENDIX F
CONCEPTUAL PLAN & PROFILE SHEETS



CONCEPTUAL PLAN & PROFILES



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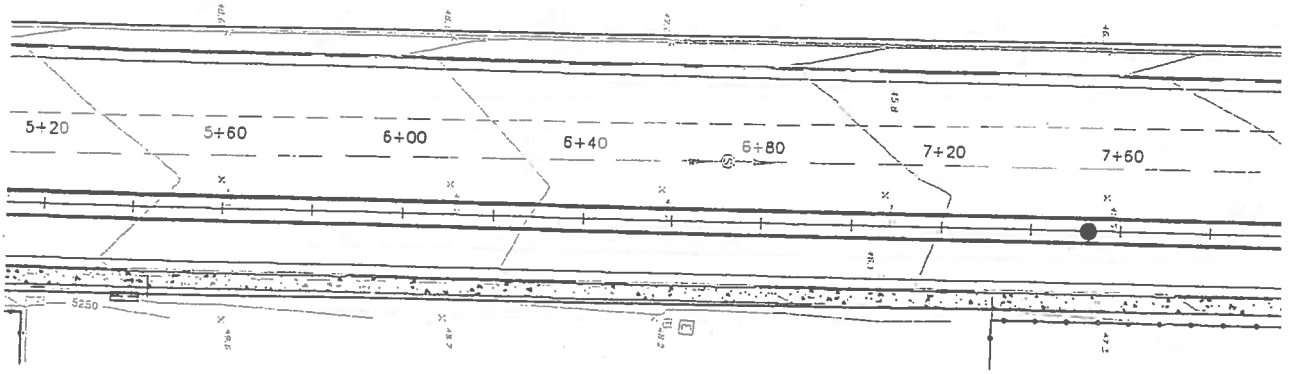

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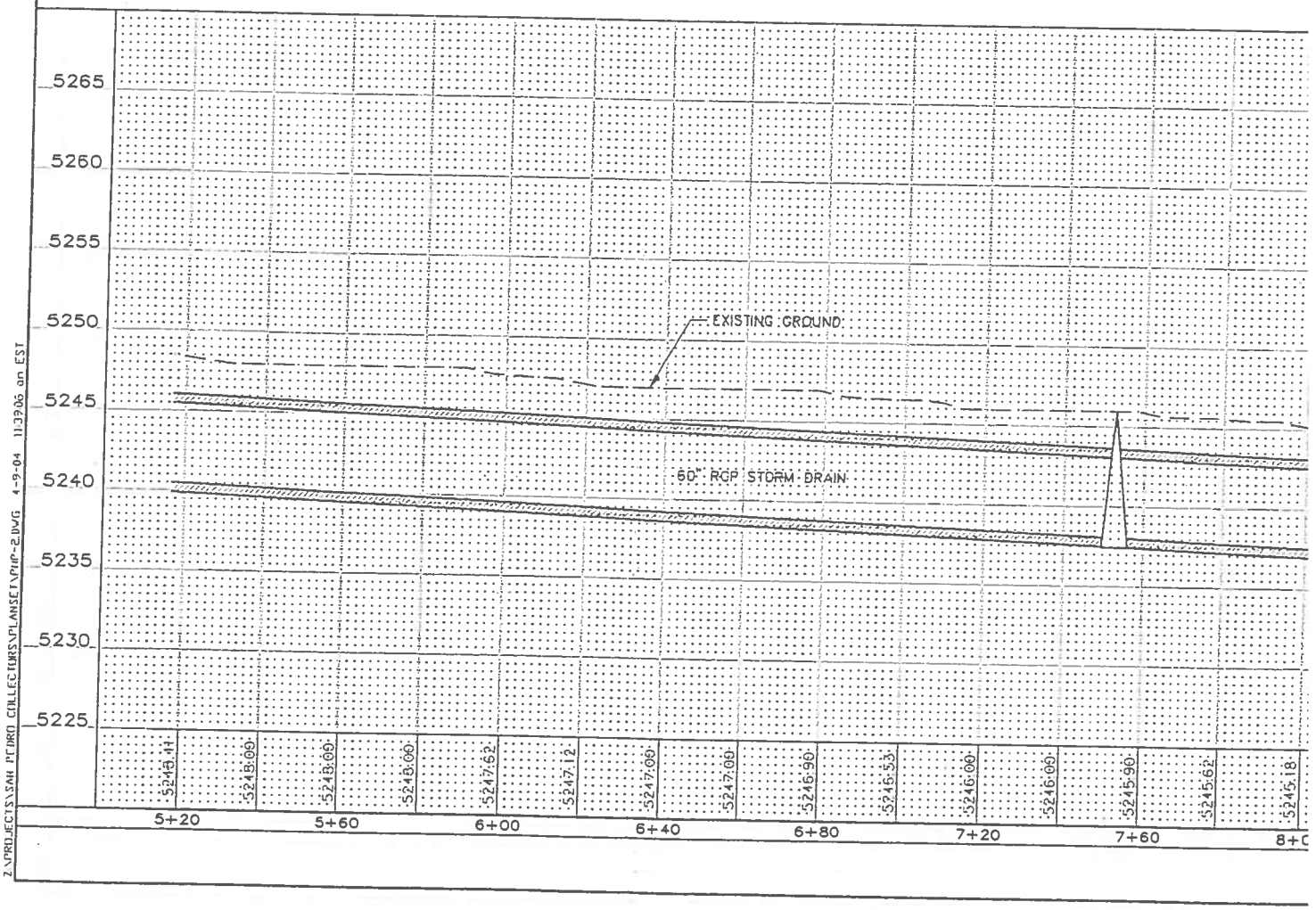

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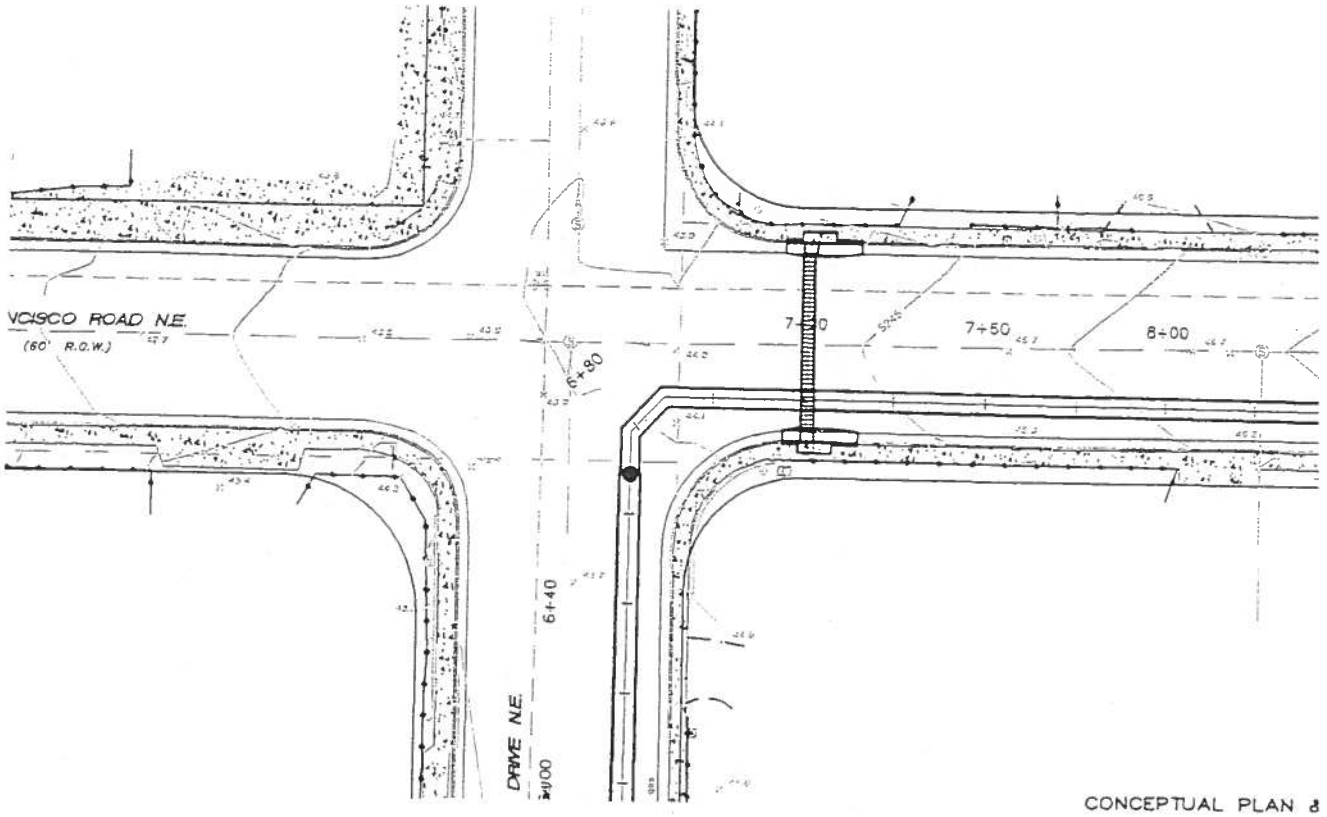
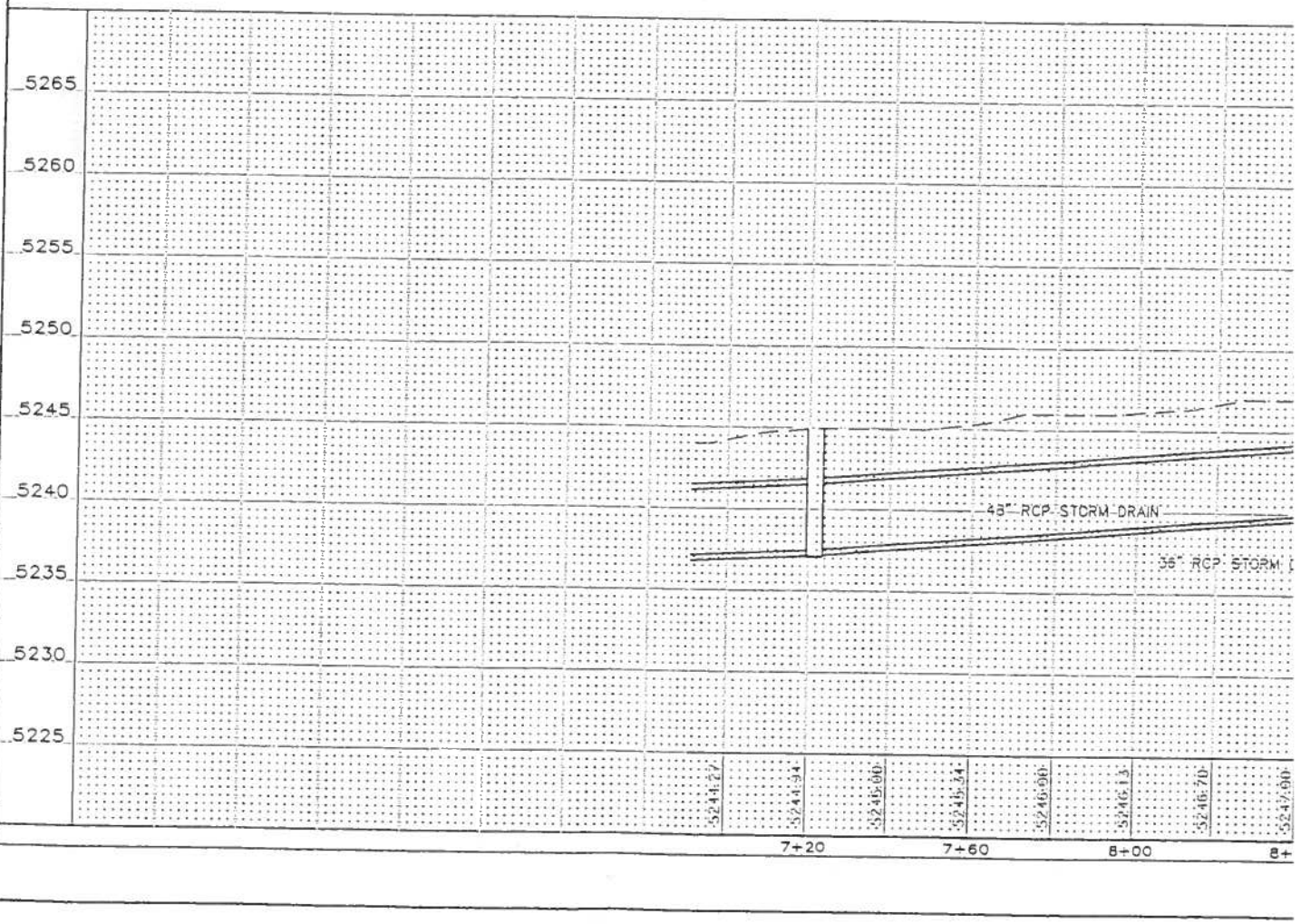


CONCEPTUAL PLAN &



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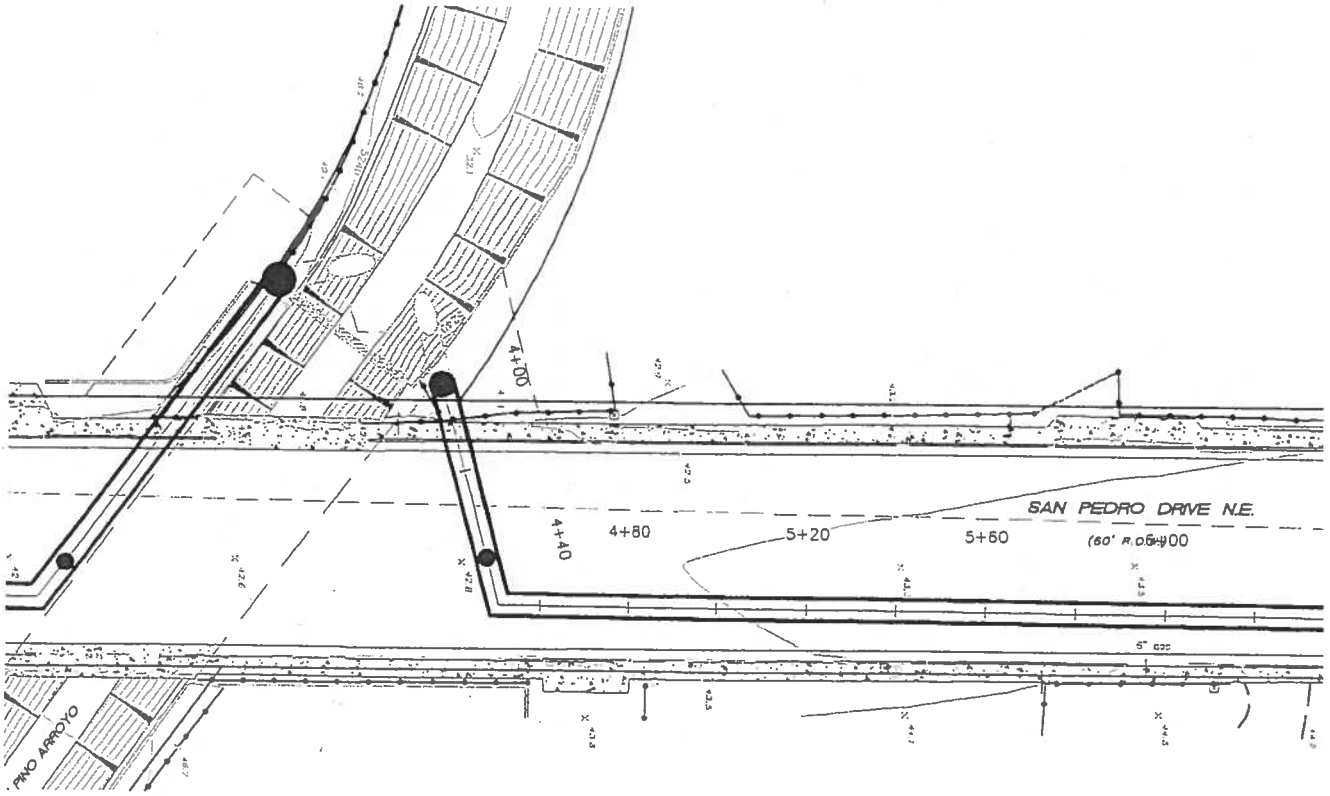

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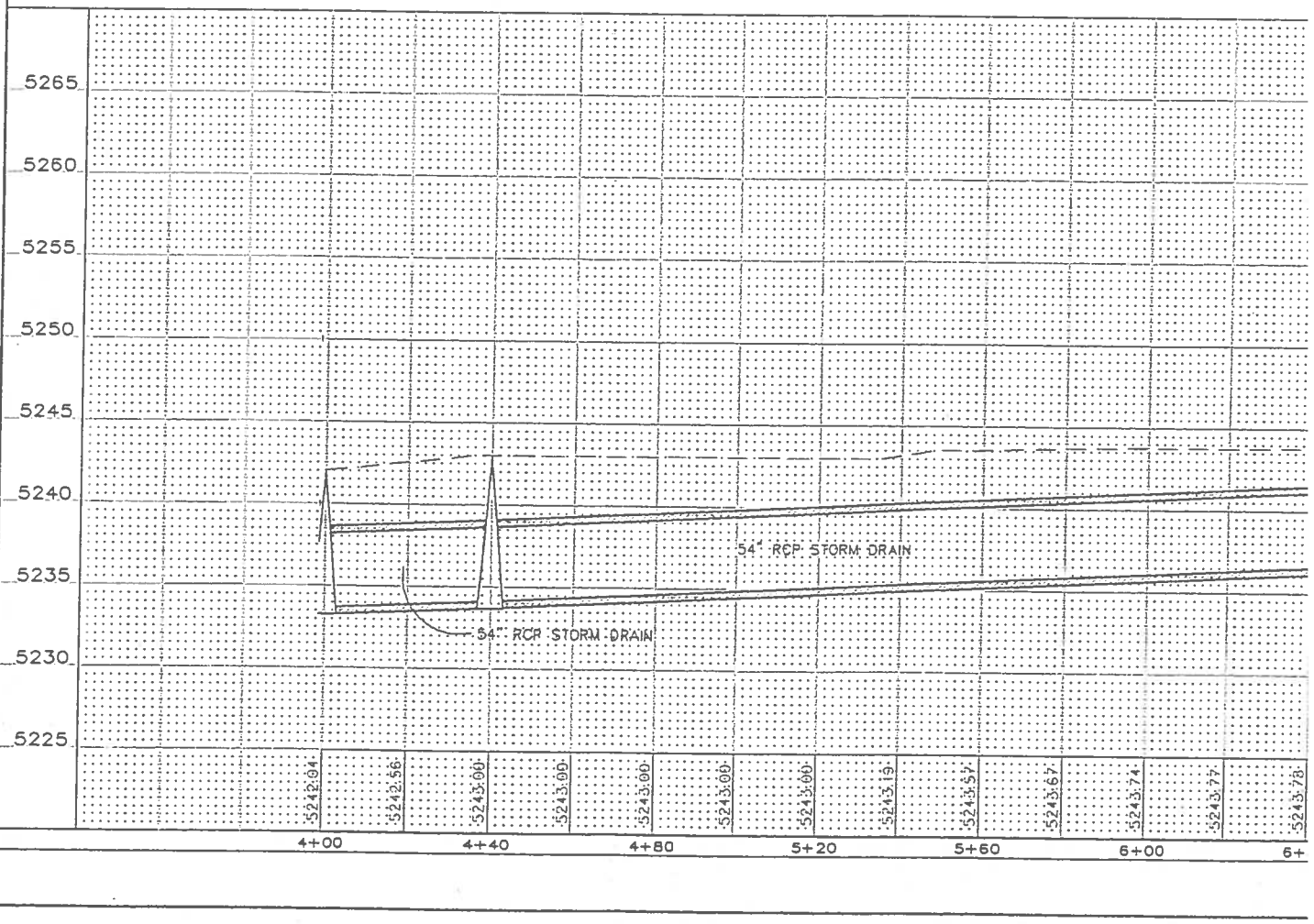

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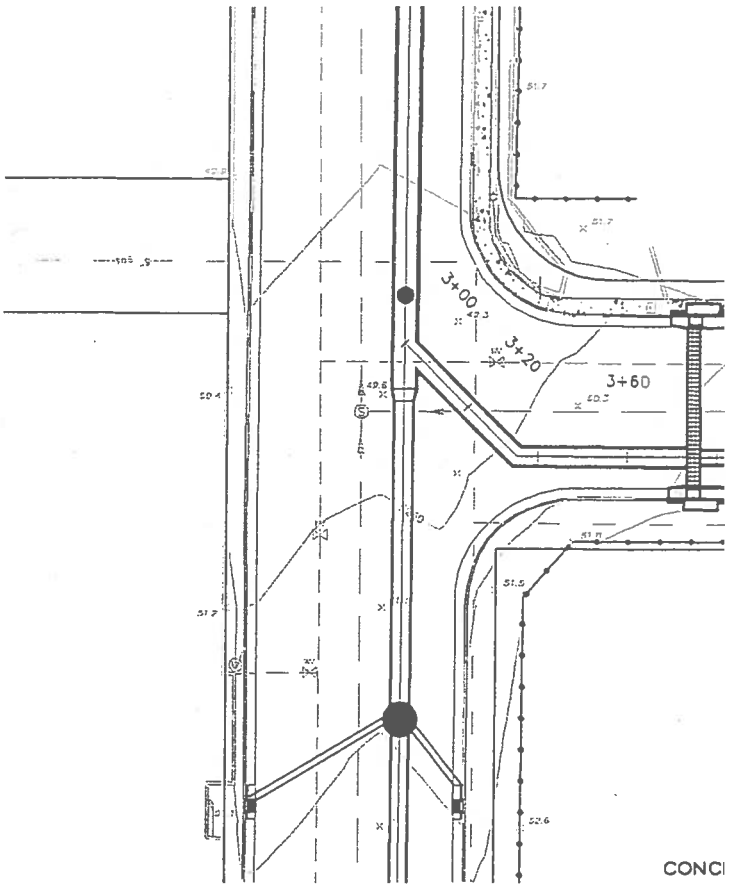

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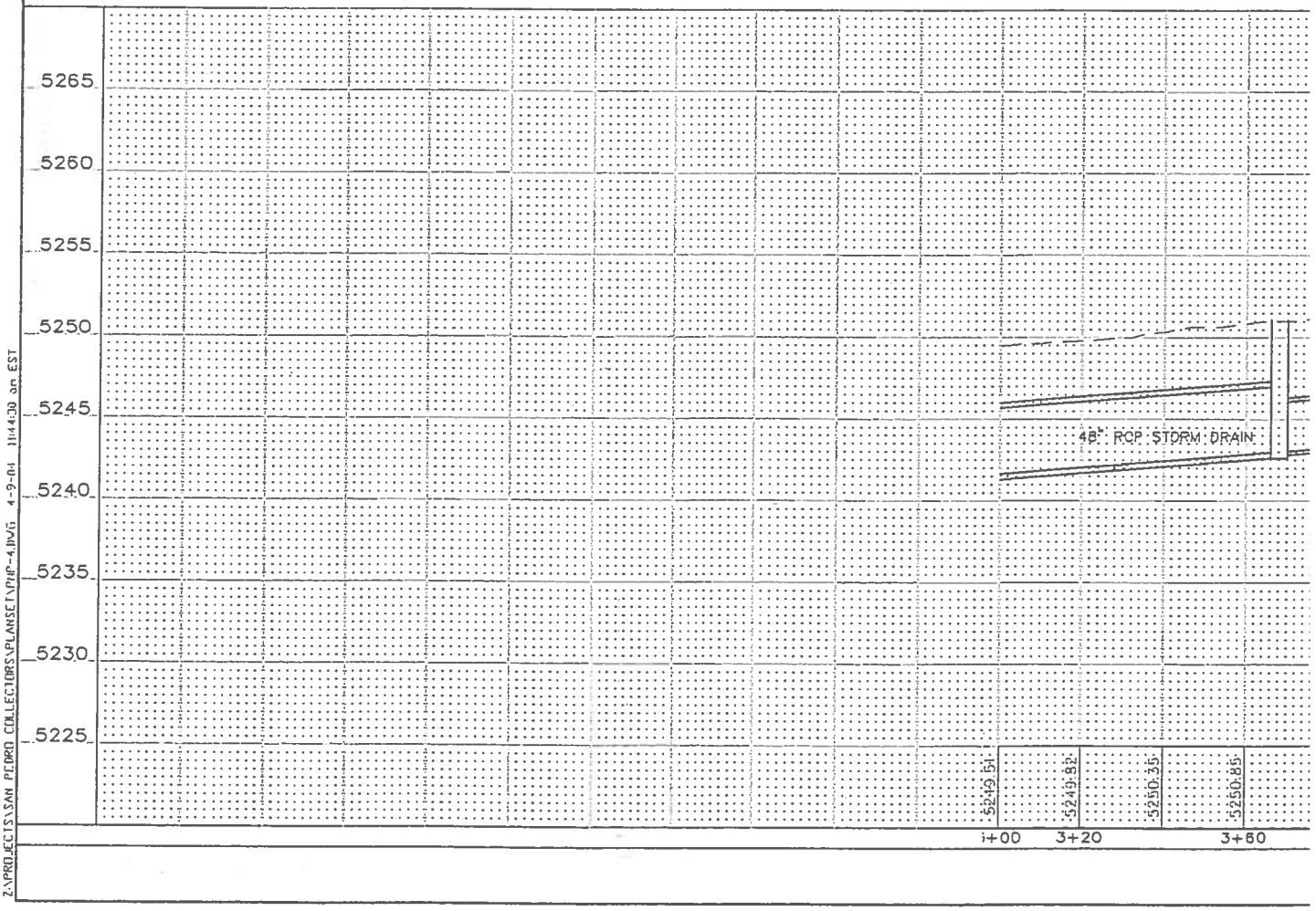

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