DOUBLETREE RANCH ROAD
DRAINAGE IMPROVEMENT PROJECT
- FINAL DESIGN STUDY REPORT -
(FCD 97-32)

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
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Since 1962

June, 2000

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DOUBLETREE RANCH ROAD DRAINAGE IMPROVEMENT PROJECT
DESIGN STUDY REPORT

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Diskette with HEC-RAS input and output files

DOUBLETREE RANCH ROAD DRAINAGE IMPROVEMENT PROJECT
DESIGN STUDY REPORT

1. INTRODUCTION

(A) General

This Design Study Report has been prepared for the Flood Control District of Maricopa County (FCDMC) and the Town of Paradise Valley (PV) as part of the Doubletree Ranch Road Drainage Improvement Project (DTRR). The purpose of the project is to provide protection from the10-year, 24-hour flood event to area residents. The project consists of a 10-year storm drain system within Doubletree Ranch Road beginning at Tatum Boulevard and discharging into Indian Bend Wash (IBW), with major storm drain laterals along Tatum Boulevard from Doubletree Ranch Road to the trailhead at the Phoenix Mountain Preserve; 52nd Street from Berneil Wash to Butler Drive then continuing up Butler Drive to 49th Street; and along 56th Street from Cherokee Wash to Doubletree Ranch Road. **Figure 1** shows the project location.

(B) Study Area

The study area is primarily within PV. A portion of the project extends into the City of Phoenix. The watershed that contributes runoff to the study area extends into the Phoenix Mountain Preserve to the west and Mummy Mountain to the south. The study area is bounded on the west by 47th Place west of Tatum Boulevard, on the north by the natural watershed divide at Berneil Wash, on the east by the IBW, and on the south by Cherokee Wash. Doubletree Ranch Road is on the section line between Sections 28 and 29 to the north and Sections 32 and 33 to the south, in Township 3N, Range 4E. The main inlet is west of Tatum Boulevard in Section 31. The study area is shown on **Figure 2**. Runoff entering the study area from the west crosses Tatum Boulevard and flows overland and along streets to the IBW.

(C) Existing Data & Reports

The FCDMC and PV have been collaborating on this project for several years. An initial Feasibility Study was performed that indicated that a solution for the 100-year flood event is cost prohibitive. As part of this design, the following data and reports were made available for use on this project:

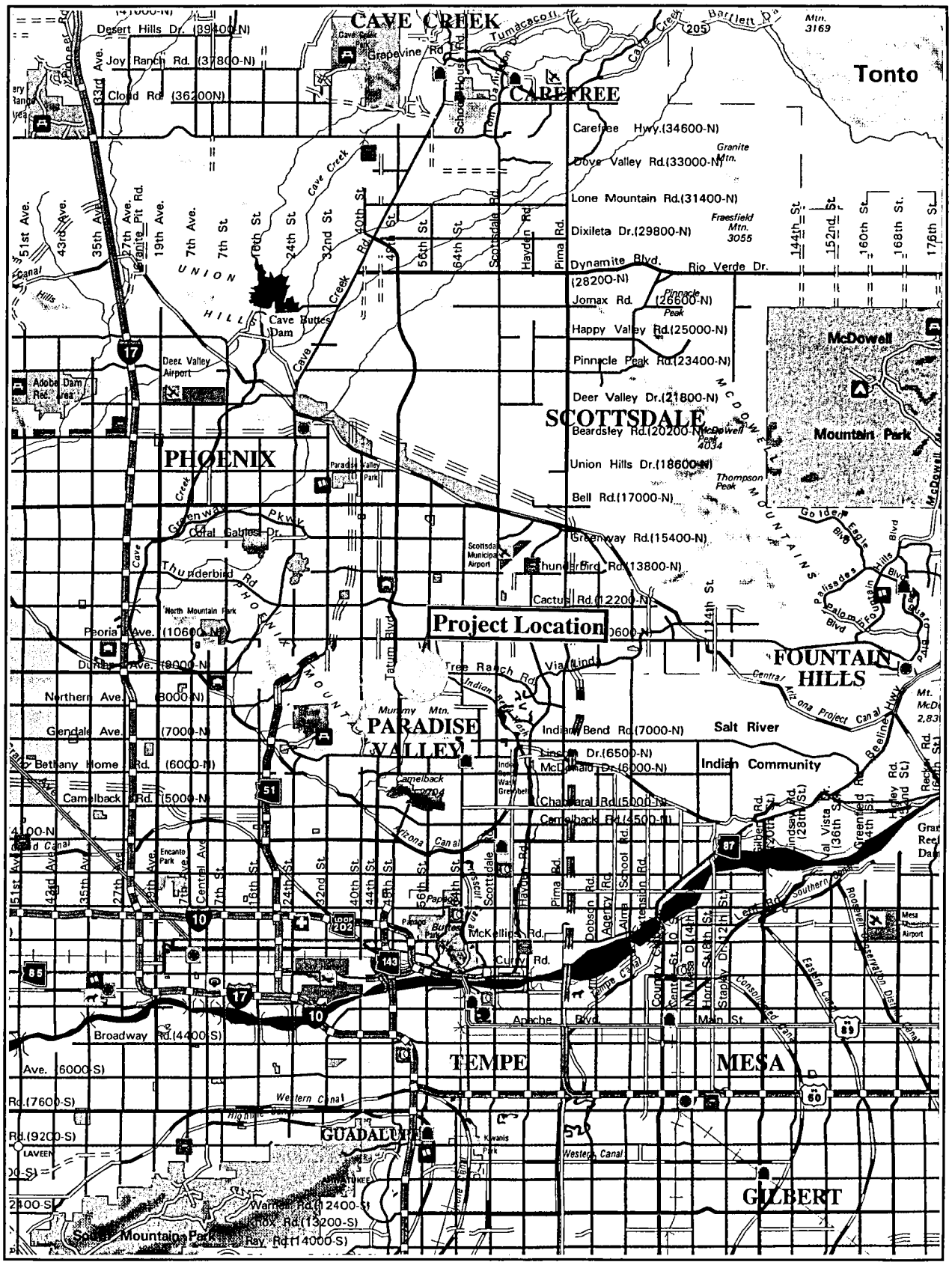

Figure 1 - Project Location

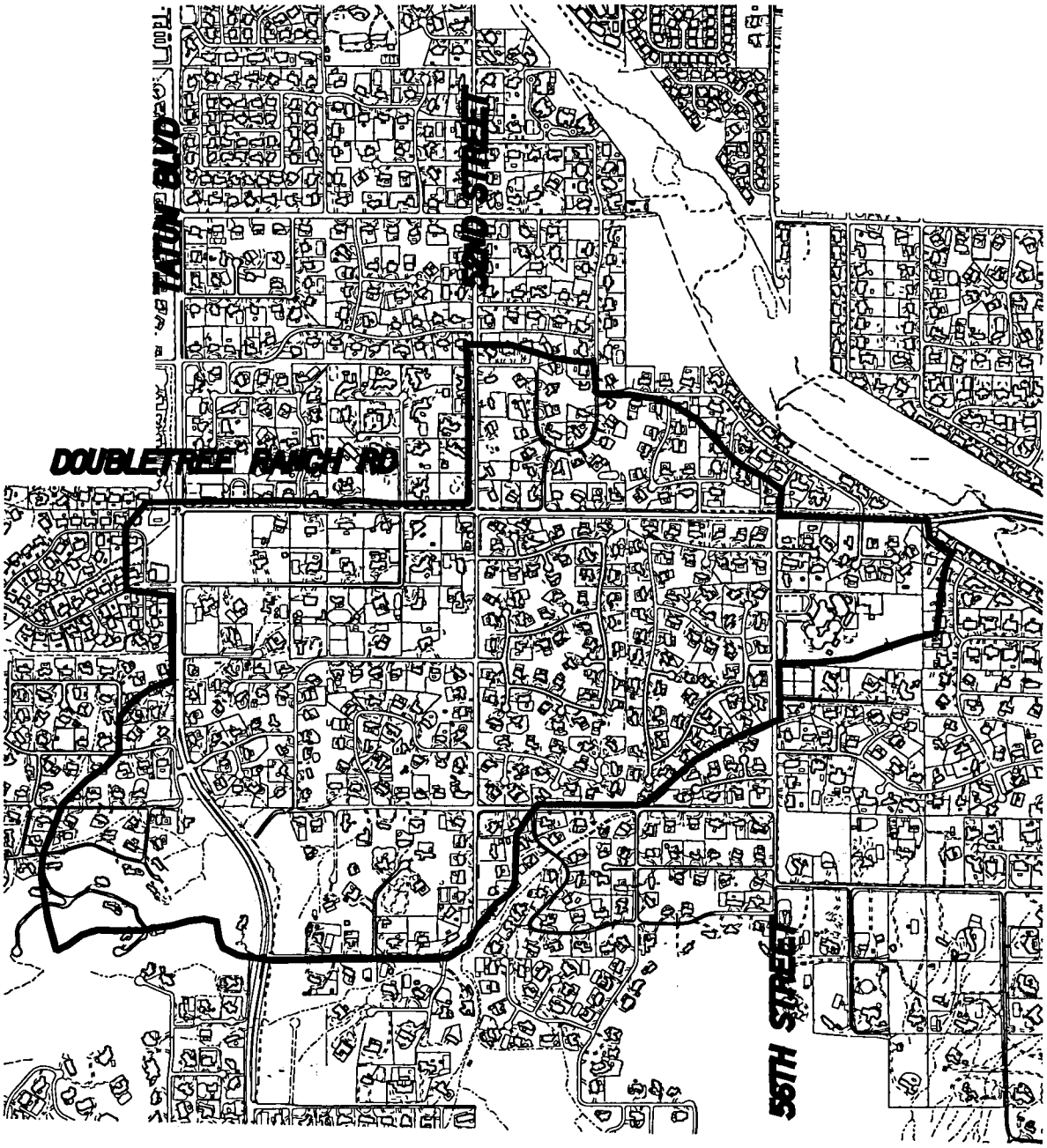

Figure 2 - Study Area

1. Hydrologic Report and HEC-1 Model dated November 1995.
2. Final Feasibility Report Study Report for the 100-year storm system dated March 1997.
3. Topographic mapping of the study area in digital format.

(D) Deliverables

The DTRR project was performed in two phases. **Phase I** investigated the feasibility and construction costs of a solution for the 10-year, 24-hour flood event based upon the alignment of the 100-year preferred alternative as determined in the Feasibility Study. If the findings of the preliminary design phase (Phase I) were acceptable to FCDMC and PV, the project would proceed into **Phase II** which is the final design phase. The findings in **Phase I** indicated that proposed design and estimates of probable costs were acceptable and authorization was given to proceed with **Phase II.**

This **Design Study Report** is part of the deliverables for Phase II of the project. The other Phase II deliverables consist of the Construction Drawings, special provisions and construction cost estimate for the recommended 10-year storm drain plan. This report describes the hydrology and hydraulics analysis and design and the evaluation of utilities, right-of-way, traffic control, and environmental and 404 permit issues. A discussion of the plans and the engineer's estimate of construction cost is also included. An amendment to the Phase I **Geotechnical Report** will be included as an appendix in the special provisions.

2. HYDROLOGY

(A) Introduction

The hydrology for the DTRR area was originally developed as part of the Feasibility Study. Hydrology was developed for existing conditions in the *Existing Hydrology Report*, November 1995, prepared by Kaminski-Hubbard Engineering. Hydrology for the 100-year recommended plan routing is presented in *Pre-Final Stormwater Management Plan, Volume I, Hydrology*, May 31, 1996, also prepared by Kaminski-Hubbard. Hydrology for this study was prepared by using portions of both models to develop a model of the 10-year runoff condition with the recommended storm drain routing and a model of the 100-year runoff condition that diverts 10-year flows into the storm drain and routes the remaining 100-year flow overland according to the

overland routing parameters from the existing conditions model. The 10-year model is used to size the storm drain system and the 100-year model is used to determine the excess overland flow during a 100-year storm event.

(B) Methodology

Hydrology for the DTRR area was developed using the U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package* (HEC-1) computer program. Guidance is given in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (DDM1) for application of the HEC-1 program within Maricopa County. Additionally, the computer program *Drainage Design Menu System* (DDMS) has been developed by the FCDMC as an aid in the application of the methods described in DDM1. Features within the DDMS used for this study include *Computation of Precipitation Frequency-Duration Values in the Western United States* (PREFRE) and *Maricopa County Unit Hydrograph Procedure 1* (MCUHP1). The application of these tools is more specifically described in the Kaminski-Hubbard Hydrology Report.

Runoff was originally evaluated under existing conditions for the 2-, 10-, 50-, and 100-year storms for 6- and 24-hour duration storms using the SCS Type II time distribution of rainfall. Aerial reduction factors were utilized from the NOAA Atlas II. Rainfall losses were estimated using the Green-Ampt method. The Clark Unit hydrograph was used to represent runoff characteristics for the watershed. The 10-year and 100-year, 24-hour duration storms were evaluated for this study. The drainage subarea boundaries and the HEC-1 Schematic for the area are contained in the **Appendix**.

(C) Drainage Area Characteristics

The watershed area is approximately 4 square miles in size and drains directly into Indian Bend Wash. The drainage area is bounded by Mountain View Road to the north, IBW to the east, Mummy Mountain to the south, and the Phoenix Mountain Preserve to the west. Significant features affecting drainage patterns in the area are residential developments, Tatum Boulevard, Doubletree Ranch Road and Cherokee Wash.

In general, the boundary between the City of Phoenix and the Town of Paradise Valley within the study area is Tatum Boulevard. A large percentage of storm runoff originates in the steep mountains west of Tatum Boulevard and drains northeasterly through residential streets and

subdivision drainageways to the IBW. Historically, runoff emanating from the mountains traveled overland through numerous small washes to the IBW. Developments have altered many of these flow paths due to parcel subdivision, landscaping and block wall construction. As a result, Doubletree Ranch Road becomes a major water carrier and is impassable to traffic. Many homes experience flooding during frequent rainfall events and standing water in streets isolates the community. In particular, Cherokee Elementary School at 56th Street, south of Doubletree Ranch Road is isolated during all but the smallest rainfall events.

Computed peak discharges at key concentration points are summarized in **Table 1** for the 10- and 100-year storms for existing conditions and with the recommended 10-year storm drain system in place. The 100-year flows with storm drain are residual overland flow values. The HEC-1 summary output for the 10-, and 100-year models is contained in the **Appendix**.

Table 1

Location	Existing Conditions		10-yr Storm Drain	
	10-yr Overland	100-yr Overland	10-yr with Storm Drain	100-yr Residual overland flow
Tatum Blvd @ Doubletree Ranch Rd.	284	686	284	402
52nd St. @ Butler Drive	92	220	92	128
52nd St. @ Doubletree Ranch Rd./South	N/A	515	209	215
Berneil Wash @ 52nd St.	135	326	135	191
52nd St. @ Doubletree Ranch Rd./North	2	5	135	5
Doubletree Ranch Rd. @ 52nd St.	295	N/A	627	409
Cherokee Wash @ 56th St.	789	1813	789	1813
56th St. @ Cherokee Wash	108	318	184	79
56th St. @ Doubletree Ranch Rd.	145	395	219	120
Doubletree Ranch Rd. @ 56th St.	726	2025	909	933
Doubletree Ranch Rd. @ IBW	925	2145	954	1432

Note: Decreasing flows going downstream include diversions into the storm drain.

3. HYDRAULICS

(A) Introduction

This section describes the hydraulic calculations used for the 10-year storm drain design. The storm drain is sized for the existing conditions 10-year, 24-hour runoff. The excess runoff, not carried in the storm drain system, during a 100-year storm is routed overland. The Doubletree Ranch Road roadway section is lowered as part of the design to contain the excess flow that is not conveyed in the closed conduit system during a 100-year storm event.

(B) Design Criteria

Drainage design for hydraulic structures in Maricopa County is governed by criteria presented in *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics*, January 28, 1996 (Hydraulics Manual.) The following criteria apply to the 10-year design:

Storm Drain Design Criteria:

Velocity: Where possible, a minimum cleansing velocity of 5 ft/s shall be maintained in the system. However, a minimum velocity of 2 ft/s must be maintained when flow is one-half of the design discharge.

Materials: The storm drain system is sized for concrete with a Manning's n of 0.012.

Hydraulic Grade Line: Storm drain systems shall be designed so that the hydraulic grade line is at least 1 foot below the gutter elevation.

Manhole Spacing: Manholes shall be spaced at intervals of approximately 500 feet for conduit diameter 48 inches or larger.

Pavement Drainage Criteria:

Hydrology: The flow rates used for pavement drainage are calculated with the FCDMC Rational Method.

Pavement Flow Spread: The flow spread in streets shall be limited to allow one dry 12-foot driving lane in each direction for collector and arterial streets during a 10-year storm.

Maximum flow in street: The flow within the right-of-way shall be limited to the 100 cfs maximum flow with 10 feet per second maximum velocity and a maximum depth of 8 inches during a 100-year storm.

Catch Basins: Pavement drainage inlets are sized for curb opening inlets with a 80% reduction factor applied.

Exceptions to Established Criteria:

A decision was made during early project coordination meetings to depress Doubletree Ranch Road to contain the difference between the 10-year flow in the storm drain system and the 100-

year flow to ensure that the 100-year flow is contained within the road right-of-way. As indicated in **Table 1**, the resulting surface flows within Doubletree Ranch Road are as high as 1432 cfs, which does not meet the stated criteria of 100 cfs maximum flow rate or 8 inches maximum depth. The design is based on this decision and is reflected in the plans and calculations.

Pavement drainage inlets are generally sized to limit pavement flow spread to 6 feet during a 10-year storm. The typical roadway section provides an 11 foot driving lane in each direction with a 6 foot bicycle lane adjacent to the gutter and a 1 foot paved shoulder adjacent to the median. The pavement spread criteria is modified to allow the full 11 foot driving lane to remain clear with pavement spread limited to the 6 foot bicycle lane. In limited cases the spread is allowed to exceed 6 feet, up to a maximum of 7 feet. This is allowed due to the 1 foot shoulder adjacent to the median that could be used by motorists if needed.

(C) Design Calculations

Initial estimates of required storm drain sizes were made based on the 10-year flows from the HEC-1 hydrology model using Manning's equation with the natural ground slopes along the storm drain alignments. The routing parameters in the HEC-1 hydrology model were then updated to reflect the preliminary pipe sizes. This was done to account for the hydrologic routing effects of the closed conduit system. The revised 10-year flows from the new routing calculations were then used to re-size the storm drain pipes. The 100-year HEC-1 model was then developed to divert the pipe flows out of the historical overland flow path. The excess overland flows were then routed along the historical overland flow path to determine the peak discharges that would be flowing on Doubletree Ranch Road during a 100-year storm event. A revised roadway profile was then developed for Doubletree Ranch Road. The roadway is depressed below existing grade to contain the full excess 100-year flow not intercepted by the storm drain system. The hydraulic capacity of the roadway for the depressed Doubletree Ranch Road is checked using the HEC-RAS model. These calculations are presented in the **Appendix**, and the diskette at the rear of the report contains the HEC-RAS input and output files.

Based on the revised roadway profile, pipe profiles were then developed for the storm drain pipes. The revised storm drain sizes and profiles were then coded into the StormPlus hydraulic model to develop a hydraulic grade line model that includes junction and transition losses in the system. Based on the StormPlus results, the storm drain sizes were finalized. The StormPlus model was run using the soffit (inside top of box culvert) elevation as the tailwater condition. The District requested that the higher of either the 10-year floodplain elevation in Indian Bend Wash or the soffit elevation for the box culvert be used for the starting condition. The 10-year design storm is used to evaluate outlet velocities important for designing the outlet energy dissipator and the grass-lined channel at IBW. The StormPlus output using the design flow rates from the 10-year, 24-hour storm is contained in the **Appendix**.

Pavement drainage calculations are performed using procedures from FHWA HEC-12, *Drainage of Highway Pavements*. The FCDMC Rational Method is used to determine peak discharges for inlet design. The Papadakis and Kazan time of concentration equation is used with a minimum time of concentration of 10 minutes. The rainfall intensities from Figure 3.2 in the Hydrology Manual are adjusted by a factor of 0.966 to convert Phoenix Metro intensity values to the appropriate intensity at the DTRR project location. The pavement drainage and inlet calculations are contained in the **Appendix**.

In addition to the pavement runoff, off site runoff must be admitted into the storm drain system. Off-site runoff is intercepted before it enters the street section, when possible. Inlets are typically either grate type or headwall type inlets located behind the curb or within an existing swale. In cases where the off-site runoff enters the roadway, curb opening drain inlets will be used to capture the runoff. The peak discharge reaching each inlet is computed using the Rational Method. The Rational Method runoff is typically from drainage subareas that are a breakdown of larger subbasins modeled in HEC-1. The storm drain pipe is sized using the HEC-1 flows from the larger subarea analysis and the inlets are sized from the Rational Method small area analysis. As a result, the sum of the Rational Method flows will typically be higher than the HEC-1 computed peak discharge for the same drainage area. As a result, there will be more inlet capacity than storm drain pipe capacity. Rational Method discharge and inlet capacity calculation sheets for off-site inlet flows are contained in the **Appendix** along with a sub-area exhibit showing the sub-area breakdown.

4. UTILITIES

Several utilities will be affected by the storm drain improvements. Underground and overhead telephone, underground power and underground cable generally parallel the right-of-way line. Other underground utilities in the project include water, sewer and gas lines. Letters of request were mailed to all utility companies in the area. Utility companies owning facilities within the project area are listed below.

Utilities have been shown on the plan and profile sheets based on information received from these companies and from field measurements. Additional potholing was performed to better determine the location and extent of utility conflicts.

Construction of the storm drain facilities will require the relocation of a number of underground utilities. The lowering of Doubletree Ranch Road to accommodate the excess 100-year flow will also require the relocation of some underground utilities. Relocation of these utilities has been identified on the Construction Drawings.

City of Phoenix (Sanitary Sewer and Potable Water)
Water and Wastewater Division
200 West Washington Street, 8th Floor
Phoenix, AZ 85003
Contact: Ralph Mosca
Phone: (602) 495-5601

City of Scottsdale (Sanitary Sewer)
City of Scottsdale
9312 North 94th Street
Scottsdale, AZ 85258
Contact: Dave Petty
Phone: (602) 391-5650

Cox Dimension Cable (formally Insight)
115 North 51st Avenue
Phoenix, AZ 85043
Contact: Carl McKay
Phone: (602) 352-5860

Arizona Public Service (Power)
P.O. Box 53999, Station 3539
Phoenix, AZ 85072
Contact: John Rael
Phone: (602) 371-6945

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

US West Communications (Telephone)
6350 South Maple Avenue, Room 125
Tempe, AZ 85283
Contact: Helen Sutt
Phone: (602) 831-4771

Utility Locations
Blue Stake
Phone: (602) 263-1100

5. RIGHT-OF-WAY & EASEMENTS

The existing right-of-way within the project varies from 65 feet to 80 feet. Existing right-of-way on Doubletree Ranch Road and 56th Street is 80 feet and is centered about the existing roadway alignment. Right-of-way on 52nd Street is primarily 80 feet in width and centered about the existing roadway alignment with the exception of that segment between Tomahawk Trail and Doubletree Ranch Road, where the westerly right-of -way is 25 feet in width.

The majority of the proposed drainage improvements will be contained within the existing rights-of-way and drainage easements with the exception of the points of collection and discharge. Land acquisition will be necessary for improvements associated with the 52nd Street laterals. The lateral to the north will require additional right-of-way/easements at its collection point within Berneil Wash. Improvements for the south lateral along 52nd Street will require land acquisition at Butler Drive. Limits are shown on the Construction Drawings.

6. TRAFFIC CONTROL

Maintenance of traffic is an important issue considering the volume of traffic on this roadway arterial. Drainage improvements will affect the entire existing roadway prism. Two major factors continued to surface during the investigation of traffic control, those being safety to the motoring public and construction progress of the contractor. It was determined that closure of the roadway would be the most beneficial due to these factors. The roadway will continue to be open to local traffic. Advance warning of the street closure prior to construction will help in reducing the impact to the motoring public. In addition, the contractor will be required to develop a public awareness program that will keep the public informed of the progress, scheduled work, and anticipated project completion. Notification of roadway closures and rerouting for emergency vehicles will be required. Access to schools and residences must be maintained during all phases of construction.

7. ENVIRONMENTAL & 404 PERMIT ISSUES

Section 404 of the Clean Water Act regulates construction activities within "Waters of the U.S." The U.S. Army Corps of Engineers (COE) enforces the Section 404 requirements through the 404 permit program. Prior to undertaking construction activities within waters of the U.S., a 404 permit must be obtained. The purpose of the 404 permit program is to avoid adverse impacts or to offset unavoidable adverse impacts to existing aquatic resources.

Waters claimed by the COE as waters of the U.S. are referred to as "jurisdictional waters." The 404 permit requirements and limitations apply only to jurisdictional waters that are impacted by the project. The FCDMC has assumed responsibility for delineating jurisdictional waters within the project limits.

8. CONSTRUCTION DRAWINGS

The Construction Drawings are prepared at a 1 inch = 20 feet scale and are submitted under separate cover. The design includes identification of: utility conflicts through as-built and record drawings, necessary acquisitions of permanent and temporary rights-of-way, inlets, catch basins, and an outlet into IBW that minimizes impacts to the existing golf course and utilizes the existing low flow channel. The following sections describe the major project features and special design considerations:

(A) Doubletree Ranch Road Trunkline

The Doubletree Ranch Road Trunkline will collect runoff west of Tatum Boulevard and convey it along the Doubletree Ranch Road alignment to the IBW. Doubletree Ranch Road will be lowered so that the roadway cross-section will convey the excess runoff that is not contained in the storm drain system during a 100-year storm. The roadway centerline profile is shown on the plans.

Runoff emanating from the Doubletree Canyon subdivision will be collected along the west side of Tatum Boulevard with a grass lined swale. The swale will collect the broad shallow sheet flow and concentrate it at the inlet for the dual 48-inch pipe. The 48-inch pipe will extend across Tatum Boulevard to a junction structure where the storm drain becomes a single 60-inch pipe. This 60-inch pipe will extend easterly to 52nd Street. A special junction structure was designed at the 52nd Street intersection to accept runoff from the 52nd Street laterals. Due to the large discharges combined at this point from opposing laterals, the potential for large junction losses exists. Special design considerations have been incorporated into the layout of the structure.

A two barrel 6' x 5' reinforced concrete box culvert (RCBC) section will be required for the combined flows east of 52nd Street. Surface runoff is collected and admitted into the storm drain approximately 1300 feet east of 52nd Street. The 2-6' x 5' section extends to 56th Street where the 56th Street lateral joins from the south. As with the 52nd Street junction, this junction required

special design consideration to limit junction losses.

A two barrel 10' X 5' RCBC is required from 56th Street to Indian Bend Wash. The storm drain leaves the roadway alignment east of Via Los Caballos and daylights into a new grass lined channel that is graded to match into the existing low flow channel within Indian Bend Wash. An energy dissipator outlet structure was developed at the IBW outlet as discussed in a later section.

(B) Tatum Lateral

The Tatum Lateral will collect runoff just north of the trailhead to the Phoenix Mountain Preserve and Horseshoe Road. Collected storm water will be conveyed to the Doubletree Ranch Road Trunkline. This lateral will consist of an 18-inch pipe from the Phoenix Mountain Preserve to Horseshoe Road, where the pipe is upsized to a 30-inch to its connection with the Doubletree Ranch Road Trunkline.

(C) 52nd Street Lateral

The 52nd Street Lateral will collect runoff at the intersection of 49th Street and Butler Drive; and convey it east along Butler Drive to 52nd Street. At 52nd Street the lateral will then extend north along 52nd Street to the Doubletree Ranch Road Trunkline. Runoff is also collected north of Doubletree Ranch Road at Berneil Wash and conveyed south to the Doubletree Ranch Road Trunkline. There is an existing wash and dip section in Butler Drive west of 52nd Street that will concentrate flows at the storm drain inlet which will be situated along the west side of 52nd Street, north of Butler Drive. A 30-inch pipe will be installed in Butler Drive for approximately 1300 feet, then upsized to a 48-inch pipe. This 48-inch pipe will extend to 52nd Street and then in 52nd Street to Tomahawk Trail. A 66-inch storm drain is required north of Alice Avenue.

Some field revisions have occurred, at the intersection of 49th Street and Butler Drive, prior to completion of the construction drawings. In this area, the wash has been paved over, the existing headwall has been removed, and the culvert has been extended approximately 100' to the west. In order to provide an inlet into the Butler Drive/52nd Street South storm drain lateral, the limits of the recently improved area must be surveyed, and a special manhole with a weir structure to divert flow needs to be designed. The District requested that the plans be completed without making the necessary revisions. Before construction, the design in this area should be revised. The natural terrain north of Doubletree Ranch Road drains north to Berneil Wash, which is the true low point in the area. The 60-inch pipe in the 52nd Street lateral will intercept 10-year runoff

within Berneil Wash and divert it south along 52nd Street to the Doubletree Ranch Road Trunkline.

(D) 56th Street Lateral

The 60-inch 56th Street Lateral will collect runoff at Cherokee Wash and convey it north along 56th Street to the Doubletree Ranch Road Trunkline. The inlet at Cherokee Wash is designed to intercept the portion of the 10-year discharge in Cherokee Wash that exceeds the channel capacity. The intent is to fully utilize the existing channel capacity and only provide storm drain capacity for the excess flow. This is discussed more fully in the following section.

(E) Cherokee Wash Crossing

One of the issues driving this project is the limitation of access to Cherokee School during small storm events. Cherokee School is located on the east side of 56th Street between Cherokee Wash and Doubletree Ranch Road. The existing Cherokee Wash crossing consists of only a dip section. Therefore, there is water crossing the roadway during any runoff event. Doubletree Ranch Road becomes flooded as well during relatively small storms, thus isolating Cherokee School. Under the proposed plan, access will be possible from Doubletree Ranch Road during a 10-year storm event. Providing a 10-year crossing at Cherokee Wash will allow a second access to the school. A 4 barrel 10' X3' RCBC is proposed for the crossing. The northern-most barrel will discharge into the 56th Street lateral. The remaining three barrels will discharge into Cherokee Wash east of 52nd Street. A short concrete wall at the northern-most barrel will allow low flows to continue in Cherokee Wash during all storms which will help support the existing vegetative habitat downstream from 56th Street. A handrail along each face of the RCBC is preferred by the Town of Paradise Valley over guardrail or any other type of barrier.

The effect of adding a box culvert at this location is investigated. Under existing conditions, the channel upstream of 56th Street has less than a 10-year capacity, as substantiated by an FCDMC two-dimensional hydraulic model. Once channel capacity is exceeded, runoff will flow northeasterly towards Doubletree Ranch Road. About 200 feet upstream of 56th Street, the channel capacity is 300 cfs, which is less than half of the 10-year flow 789 cfs. The hydraulic effect of the culvert before and after improvements is determined for the 300 cfs flow rate, using a HEC-RAS model. As shown in a comparative stream profile plot in the **Appendix**, there would be no increase in water surface elevation after the culvert is constructed.

The culvert is designed for the full 10-year flow rate of 789 cfs. At some point in the future,

channel improvements may be made to Cherokee Wash to contain the 10-year flow. Of the 789 cfs, 184 cfs would be intercepted by the 56th Street storm drain, and 605 cfs would continue downstream. The capacity of Cherokee Wash for a short distance downstream of 56th Street is about 605 cfs. The Cherokee Wash cross section locations and HEC-RAS model output are presented in the **Appendix**. The diskette at the rear of the report contains the HEC-RAS input and output files.

(F) Indian Bend Wash Outlet

The Doubletree Ranch Road storm drain daylights near Indian Bend Wash. At the storm drain outlet, riprap is placed for erosion protection. The storm drain exit velocity will be about 9.5 feet per second, and the 100-foot length of riprap should act to slow this down to the channel velocity of 4.2 feet per second. The riprap apron is set on the same grade as the grass lined swale, which is at a slope of 0.18 percent. The grass-lined swale conveys the flow to the low flow channel of the IBW. The **Appendix** contains the riprap protection design, and the grass-lined channel computations.

APPENDIX

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HEC-1 Output - 10-year, 24-hour storm

HEC-1 Output - 100-year, 24-hour storm

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- 56th Street South Lateral

Pavement Drainage Calculations for Doubletree Ranch Road

HEC-RAS Analysis for Doubletree Ranch Road

HEC-RAS Analysis for Cherokee Wash at 56th Street

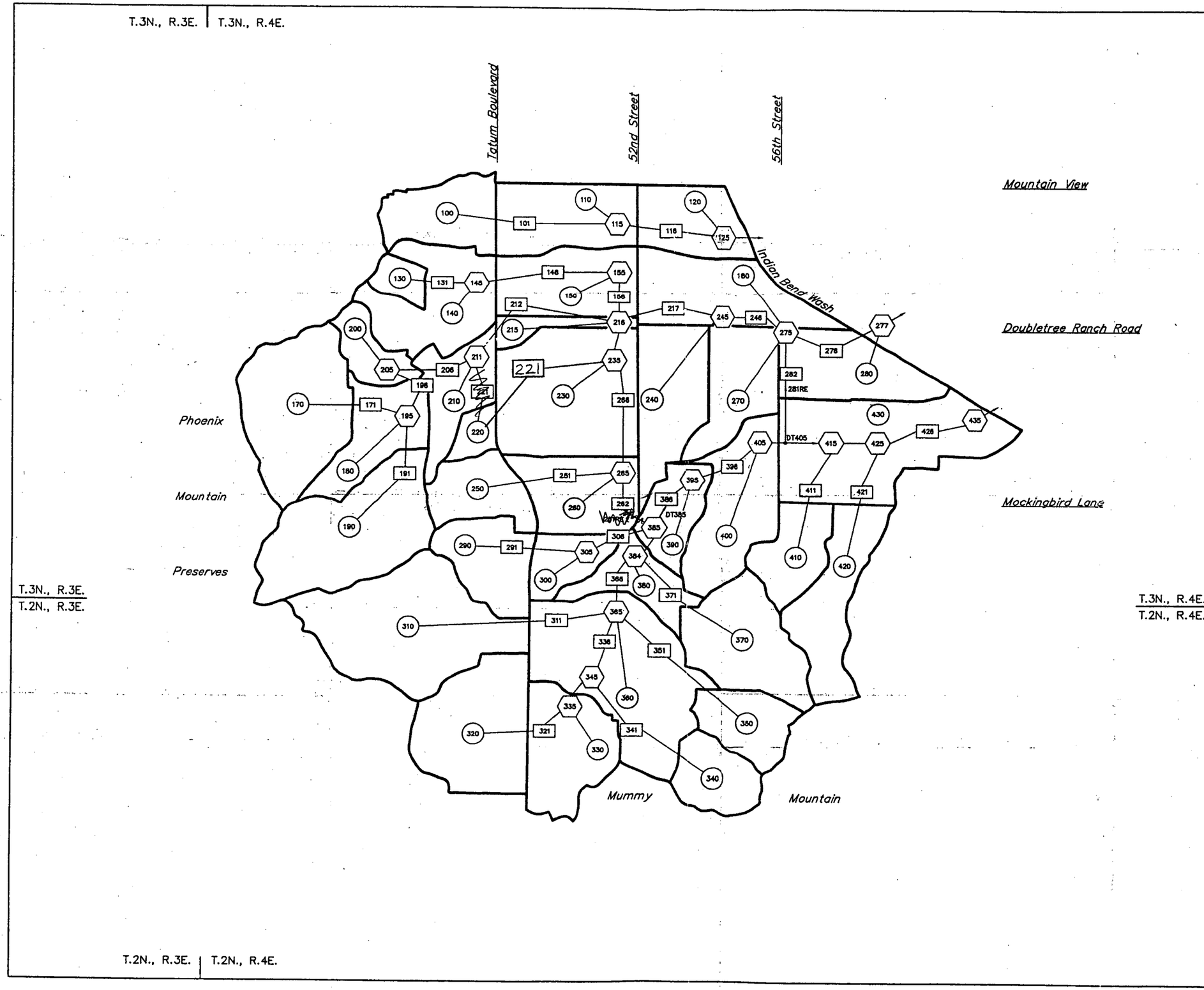
Inlet Calculations for Off-Site Flows

Indian Bend Wash Outlet - Riprap and Channel Design

Diskette with HEC-RAS input and output files

HEC-1 OUTPUT

10-YEAR, 24-HOUR STORM



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY FCD 94-28

LEGEND

- Drainage Basin Boundary
- (A) Compute Runoff from Sub-Basin A
- (B) Compute Runoff from Sub-Basin B
- (C) Combine Hydrographs
- [D] Route Hydrograph
- (E) Route Hydrograph through Retention Basin E
- G/F Divide Hydrograph into F and G

DRAINAGE AREA MAP & HEC-1 SCHEMATIC

IMPROVED CONDITIONS

PLATE 1

KAMINSKI HUBBARD engineering, inc.
SURVEYING • CIVIL • HYDROLOGY
4550 N. BLACK CANYON HWY., SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

N

SCALE

800 400 0 800 1600

FEET

PART OF:
Pre-Final Stormwater Management Plan
Volume 1 Hydrology May 31 1996

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1****************************************
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 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUL   1997              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   02FEB00  TIME  14:12:57  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY  FCD 97-32
  2           ID     FILENAME:  10YR24P1.DAT
  3           ID     10-YEAR 24-HOUR STORM DURATION for the ALTERNATIVE CONDITIONS
  4           ID
  5           ID        PREPARED BY DIBBLE & ASSOCIATES, SUB-CONSULTANT TO BROOKS HERSEY
  6           ID        Modified 12 June 98 by f. brown
  7           ID        See other modification notes at the end of this input file.
              *DIAGRAM
  8           IT       1                    1500
  9           IO       5
              *

 10           KK    290S
 11           KM   SUB-BASIN 290
```

```
 12          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 13          KM     L =  .38  Kb = .111  Adj. Slope =  315.0
 14          BA    .092
 15          IN      30
 16          KM   RAINFALL DEPTH OF 2.38 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 17          KM   AN AREAL REDUCTION FACTOR OF .976
 18          PB   2.323
 19          KM   THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II STORM
 20          PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 21          PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 22          PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 23          PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 24          PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 25          LG    .160    .250   4.150    .470  30.000
 26          UC    .283    .164
 27          UA       0       3       5       8      12      20      43      75      90      96
 28          UA     100
             *

 29          KK    R291
 30          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 290 THROUGH SUB-BASIN 300
 31          RS       4    FLOW      -1
 32          RC   0.035   0.030   0.035    1800  0.0268
 33          RX       0     0.5    20.0    30.0    40.0    60.0    68.0    80.0
 34          RY     7.0     5.0     3.0     1.0     0.0     3.0     5.0     7.0
             *

 35          KK    300S
 36          KM   SUB-BASIN 300
 37          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 38          KM     L =  .38  Kb = .059  Adj. Slope =  153.0
 39          BA    .052
 40          LG    .100    .250   3.950    .510  15.000
 41          UC    .258    .205
 42          UA       0       5      16      30      65      77      84      90      94      97
 43          UA     100
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 44          KK   HC305
 45          KM   COMBINE FLOWS FROM SUB-BASIN 290 AND SUB-BASIN 300
 46          HC       2
             *

 47          KK    R306
 48          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 300 THROUGH SUB-BASIN 380
 49          RS       1    FLOW      -1
 50          RC   0.035   0.030   0.035     400  0.0250
 51          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
```

```
52          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
            *

53          KK    310S
54          KM   SUB-BASIN 310
55          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
56          KM     L =  .95  Kb = .104  Adj. Slope =  315.0
57          BA    .249
58          LG    .170    .250   4.200    .460  40.000
59          UC    .488    .353
60          UA       0       3       5       8      12      20      43      75      90      96
61          UA     100
            *

62          KK    R311
63          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 310 THROUGH SUB-BASIN 360
64          RS       6    FLOW      -1
65          RC   0.035   0.030   0.035    2800  0.0204
66          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
67          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
            *

68          KK    320S
69          KM   SUB-BASIN 320
70          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
71          KM     L =  .68  Kb = .087  Adj. Slope =  315.0
72          BA    .170
73          LG    .140    .250   5.600    .230  30.000
74          UC    .333    .220
75          UA       0       5      16      30      65      77      84      90      94      97
76          UA     100
            *

77          KK    R321
78          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 320 THROUGH SUB-BASIN 330
79          RS       5    FLOW      -1
80          RC   0.035   0.030   0.035    1000  0.0100
81          RX       0     0.5    49.5    50.0   155.0   155.5   199.5   200.0
82          RY     5.0     1.0     1.0     0.0     0.0     1.0     1.0     5.0
            *
```



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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

83          KK    330S
84          KM   SUB-BASIN 330
85          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
86          KM     L =  .49  Kb = .067  Adj. Slope =  264.4
87          BA    .123
88          LG    .110    .150   7.300    .120  17.000
89          UC    .237    .140
```

```
 90          UA       0       5      16      30      65      77      84      90      94      97
 91          UA     100
             *

 92          KK   HC335
 93          KM   COMBINE FLOWS FROM SUB-BASIN 320 AND SUB-BASIN 330
 94          HC       2
             *

 95          KK    340S
 96          KM   SUB-BASIN 340
 97          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 98          KM     L =  .34  Kb = .132  Adj. Slope =  315.0
 99          BA    .069
100          LG    .180    .250   4.800    .320  42.000
101          UC    .279    .174
102          UA       0       3       5       8      12      20      43      75      90      96
103          UA     100
             *

104          KK    R341
105          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 340 THROUGH SUB-BASIN 360
106          RS       5    FLOW      -1
107          RC   0.035   0.030   0.035    2400  0.0369
108          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
109          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

110          KK   HC345
111          KM   COMBINE FLOWS FROM SUB-BASIN 330 &340
112          HC       2
             *

113          KK    R336
114          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 330 THROUGH SUB-BASIN 360
115          RS       5    FLOW      -1
116          RC   0.035   0.030   0.035    2400  0.0113
117          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
118          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

119          KK    350S
120          KM   SUB-BASIN 350
121          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
122          KM     L =  .38  Kb = .093  Adj. Slope =  315.0
123          BA    .076
124          LG    .140    .250   4.800    .320  48.000
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

125          UC    .237    .150
```

```
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*

KK    R351
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 350 THROUGH SUB-BASIN 360
RS       5    FLOW      -1
RC   0.035   0.030   0.035    2600  0.0373
RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
*

KK    360S
KM   SUB-BASIN 360
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .87  Kb = .054  Adj. Slope =  297.2
BA    .255
LG    .110    .250   4.100    .490  19.000
UC    .317    .201
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*

KK   HC365
KM   COMBINE FLOWS FROM SUB-BASINS 310, 340, 350, 360 & COMBINED FLOWS AT HC335
HC       4
*

KK    R366
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 360 THROUGH SUB-BASIN 380
RS       2    FLOW      -1
RC   0.035   0.030   0.035    1300  0.0135
RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
*

KK    370S
KM   SUB-BASIN 370
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .64  Kb = .111  Adj. Slope =  315.0
BA    .142
LG    .160    .250   4.800    .320  42.000
UC    .379    .268
UA       0       3       5       8      12      20      43      75      90      96
UA     100
*

KK    R371
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 370 THROUGH SUB-BASIN 380
RS       9    FLOW      -1
RC   0.100   0.030   0.100    3400  0.0135
RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
```

```
 166          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
              *
1                                          HEC-1 INPUT                                                    PAGE  5

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 167          KK    380S
 168          KM   SUB-BASIN 380
 169          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 170          KM     L =  .45  Kb = .057  Adj. Slope =  151.0
 171          BA    .068
 172          LG    .100    .250   4.000    .500  17.000
 173          UC    .279    .219
 174          UA       0       5      16      30      65      77      84      90      94      97
 175          UA     100
              *

 176          KK   HC384
 177          KM   COMBINE FLOWS FROM SUB-BASIN 370 & 380 AND COMBINED FLOWS AT HC365
 178          HC       3
              *

 179          KK   HC385
 180          KM   COMBINE FLOWS FROM HC305 & HC384
 181          HC       2
              *
              *       This next diversion removed, flow in Cherokee Wash not diverted, and
              *       the runoff to 52nd St. from Subbasins 230, 250, & 260 will be
              *       intercepted in the proposed storm drain lateral.
              *
              * KK DT385
              * KM 100% DIVERSION AT CHEROKEE WASH AND 52TH STREET TO DOUBLETREE RANCH ROAD
              * DT 261RE
              * DI     0    1000    5000
              * DQ     0    1000    5000
              *
              *       See above note concerning previously proposed diversion DT385
              *

 182          KK    R386
 183          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 380 THROUGH SUB-BASIN 390
 184          RS       4    FLOW      -1
 185          RC   0.035   0.030   0.035    1800  0.0061
 186          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
 187          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
              *

 188          KK    390S
 189          KM   SUB-BASIN 390
 190          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 191          KM     L =  .53  Kb = .058  Adj. Slope =   77.0
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```
192          BA    .066
193          LG    .100    .250   4.450    .400  15.000
194          UC    .417    .397
195          UA       0       5      16      30      65      77      84      90      94      97
196          UA     100
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

197          KK   HC395
198          KM   COMBINE FLOWS FROM SUB-BASIN 390 AND COMBINED FLOWS AT HC385
199          HC       2
             *

200          KK    R396
201          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 390 THROUGH SUB-BASIN 400
202          RS       3    FLOW      -1
203          RC   0.035   0.030   0.035    1600  0.0081
204          RX       0     0.5     1.0     9.0    31.0    39.0    39.5    40.0
205          RY    10.0     4.0     4.0     0.0     0.0     4.0     4.0    10.0
             *

206          KK    400S
207          KM   SUB-BASIN 400
208          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
209          KM     L =  .91  Kb = .079  Adj. Slope =  303.0
210          BA    .145
211          LG    .130    .250   4.650    .350  25.000
212          UC    .400    .373
213          UA       0       5      16      30      65      77      84      90      94      97
214          UA     100
             *

215          KK   HC405
216          KM   COMBINE FLOWS FROM SUB-BASIN 400 AND COMBINED FLOWS AT HC395
217          HC       2
             *

218          KK   DT405
219          KM   PROPOSED CONDITIONS DIVERSION AT CHEROKEE WASH AND 56TH STREET
220          KM     STREET HIGH POINT AT VIA BUENA VISTA RAISED TO ELEVATION 1348.71
221          DT   281RE
222          DI     181     544     725     789    1269    1450    1631    1813    2250    2500
223          DQ      45     136     177     184     197     197     197     197     197     197
             *

224          KK    410S
225          KM   SUB-BASIN 410
226          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
227          KM     L =  .45  Kb = .094  Adj. Slope =  315.0
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```
228          BA    .075
229          LG    .140    .250   4.550    .370  31.000
230          UC    .275    .204
231          UA       0       5      16      30      65      77      84      90      94      97
232          UA     100
             *

233          KK    R411
234          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 410 THROUGH SUB-BASIN 430
235          RS      10    FLOW      -1
236          RC   0.100   0.030   0.100    2480  0.0060
237          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
238          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

239          KK   HC415
240          KM   COMBINE FLOWS FROM DT405 AND  SUBBASIN 410
241          HC       2
             *

242          KK    420S
243          KM   SUB-BASIN 420
244          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
245          KM     L =  .80  Kb = .099  Adj. Slope =  315.0
246          BA    .123
247          LG    .150    .250   4.550    .370  31.000
248          UC    .421    .391
249          UA       0       5      16      30      65      77      84      90      94      97
250          UA     100
             *

251          KK    R421
252          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 420 THROUGH SUB-BASIN 430
253          RS       6    FLOW      -1
254          RC   0.100   0.030   0.100    1640  0.0060
255          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
256          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

257          KK   HC425
258          KM   COMBINE FLOWS FROM SUBBASIN 420 AND HC415
259          HC       2
             *

260          KK    R426
261          KM   NORMAL DEPTH FLOW ROUTING FOR HC425 THROUGH SUB-BASIN 430
262          RS       6    FLOW      -1
263          RC   0.100   0.030   0.100    1520  0.0060
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```
264          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
265          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

266          KK    430S
267          KM   SUB-BASIN 430
268          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
269          KM     L =  .98  Kb = .050  Adj. Slope =   29.0
270          BA    .237
271          LG    .100    .250   4.650    .350  15.000
272          UC    .904    .740
273          UA       0       5      16      30      65      77      84      90      94      97
274          UA     100
             *

275          KK   HC435
276          KM   COMBINE FLOWS FROM SUB-BASINS 410, 420, 430 & COMBINED FLOWS AT HC405
277          HC       2
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

278          KK    170S
279          KM   SUB-BASIN 170
280          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
281          KM     L =  .61  Kb = .138  Adj. Slope =  315.0
282          BA    .187
283          LG    .200    .250   4.250    .450  37.000
284          UC    .442    .262
285          UA       0       3       5       8      12      20      43      75      90      96
286          UA     100
             *

287          KK    R171
288          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 170 THROUGH SUB-BASIN 180
289          RS       3    FLOW      -1
290          RC   0.035   0.030   0.035    1200  0.0250
291          RX       0     8.0    16.0    24.0    32.0    50.0    60.0    80.0
292          RY     8.0     6.0     4.0     2.0     0.0     2.0     4.0     6.0
             *

293          KK    180S
294          KM   SUB-BASIN 180
295          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
296          KM     L =  .68  Kb = .100  Adj. Slope =  315.0
297          BA    .095
298          LG    .150    .250   4.150    .470  28.000
299          UC    .392    .367
300          UA       0       5      16      30      65      77      84      90      94      97
301          UA     100
```

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                *

 302            KK    190S
 303            KM   SUB-BASIN 190
 304            KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 305            KM     L =  .91  Kb = .115  Adj. Slope =  315.0
 306            BA    .208
 307            LG    .170    .250   4.250    .450  42.000
 308            UC    .496    .385
 309            UA       0       3       5       8      12      20      43      75      90      96
 310            UA     100
                *

 311            KK    R191
 312            KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 190 THROUGH SUB-BASIN 180
 313            RS       2    FLOW      -1
 314            RC   0.035   0.030   0.035    1200  0.0400
 315            RX       0    25.0    30.0    40.0    50.0    55.0    80.0   100.0
 316            RY     6.0     4.0     2.0     0.0     2.0     4.0     6.0     6.0
                *
1                                          HEC-1 INPUT                                                PAGE  9

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 317            KK   HC195
 318            KM   COMBINE FLOWS FROM SUB-BASIN 170, SUB-BASIN 180 & SUB-BASIN 190
 319            HC       3
                *

 320            KK    R196
 321            KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 180 THROUGH SUB-BASIN 200
 322            RS       1    FLOW      -1
 323            RC   0.035   0.030   0.035     200  0.0500
 324            RX       0     8.0    16.0    24.0    32.0    50.0    60.0    80.0
 325            RY     8.0     6.0     4.0     2.0     0.0     2.0     4.0     6.0
                *

 326            KK    200S
 327            KM   SUB-BASIN 200
 328            KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 329            KM     L =  .38  Kb = .093  Adj. Slope =  315.0
 330            BA    .048
 331            LG    .150    .250   4.150    .470  35.000
 332            UC    .250    .207
 333            UA       0       5      16      30      65      77      84      90      94      97
 334            UA     100
                *

 335            KK   HC205
 336            KM   COMBINE FLOW FROM SUB-BASIN 200 AND COMBINED FLOWS AT HC195
 337            HC       2
```

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                *

338             KK    R206
339             KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 200 THROUGH SUB-BASIN 210
340             RS       3    FLOW      -1
341             RC   0.035   0.030   0.035    1600  0.0125
342             RX       0     0.5     1.0     9.0    31.0    39.0    39.5    40.0
343             RY    10.0     4.0     4.0     0.0     0.0     4.0     4.0    10.0
                *

344             KK    220S
345             KM   SUB-BASIN 220
346             KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
347             KM     L =  .27  Kb = .064  Adj. Slope =  219.2
348             BA    .024
349             LG    .100    .250   3.950    .510  15.000
350             UC    .200    .182
351             UA       0       5      16      30      65      77      84      90      94      97
352             UA     100
                *

353             KK  10y220
354             KM   Divert the Q > Q10 from basin 220 east to basin 230 to be routed overland
355             DT  DIV220
356             DI       0      12      25     100     200     300     400     500
357             DQ       0       0      13      88     188     288     388     488
                *
1                                          HEC-1 INPUT                                          PAGE 10

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

358             KK  220pip
359             KM   MUSKINGUM-CUNGE ROUTING FOR Q10 FROM BASIN 220 NORTH THRU TATUM LATERAL
360             KM   The length-weighted average size and slope from the design plans were used
361             KM   for routing.  Avg Size = 22.8", Avg Slope = 0.0183
362             RD    1484   .0183    .012            CIRC     1.9
                *

363             KK    210S
364             KM   SUB-BASIN 210
365             KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
366             KM     L =  .61  Kb = .043  Adj. Slope =  185.0
367             BA    .080
368             LG    .100    .250    .340    .490  21.000
369             UC    .242    .217
370             UA       0       5      16      30      65      77      84      90      94      97
371             UA     100
                *

372             KK   HC211
373             KM   COMBINE FLOWS FROM SUB-BASIN 210, 220 Q10 AND COMBINED FLOWS AT HC205
```

```
374          HC       3
             *

375          KK    R212
376          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 210 THROUGH SUB-BASIN 215
377          KM   Pipe is 48"x76"HERCP.  Round Equivalent = 60" was used for routing.
378          RD    2604   .0103    .012            CIRC     5.0
             *

379          KK    215S
380          KM   SUB-BASIN 215
381          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
382          KM     L =  .51  Kb = .063  Adj. Slope =   51.0
383          BA    .028
384          LG    .100    .250   4.800    .320  15.000
385          UC    .492    .754
386          UA       0       5      16      30      65      77      84      90      94      97
387          UA     100
             *

388          KK  HC216W
389          KM   COMBINE FLOWS FROM 215S AND COMBINED FLOWS AT HC211 TO GET FLOW FROM THE WEST
390          KM   THIS IS THE MAIN LINE STORM SEWER DISCHARGE BEFORE LATERALS ADD IN.
391          HC       2
             *

392          KK    250S
393          KM   SUB-BASIN 250
394          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
395          KM     L =  .45  Kb = .112  Adj. Slope =  315.0
396          BA    .078
397          LG    .160    .250   4.200    .460  37.000
398          UC    .313    .230
399          UA       0       3       5       8      12      20      43      75      90      96
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

400          UA     100
             *

401          KK    R251
402          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 250 THROUGH SUB-BASIN 260
403          RS      15    FLOW      -1
404          RC   0.100   0.030   0.100    3200  0.0164
405          RX       0     0.5   235.0   235.5   264.5   265.0   499.5   500.0
406          RY     5.0     2.0     2.0     0.0     0.0     2.0     2.0     5.0
             *

407          KK    260S
408          KM   SUB-BASIN 260
409          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
```

```
410          KM     L =  .49  Kb = .053  Adj. Slope =  126.0
411          BA    .108
412          LG    .100    .250   4.350    .420  15.000
413          UC    .304    .198
414          UA       0       5      16      30      65      77      84      90      94      97
415          UA     100
             *

416          KK   HC265
417          KM   COMBINE FLOWS FROM SUB-BASIN 250 AND SUB-BASIN 260
418          KM
419          HC       2
             *

420          KK    R266
421          KM   MUSKINGUM-CUNGE ROUTING FOR SUB-BASIN 260 THROUGH SUB-BASIN 230
422          KM   The length-weighted average size and slope from the design plans were used
423          KM   for routing.  Avg Size = 61.95", Avg Slope = 0.0039
424          RD    2612   .0039    .012            CIRC     5.2
             *

425          KK  RET220
426          KM   Retrieve diverted flow from basin 220 (Q>10yr, 12cfs)
427          DR  DIV220
             *

428          KK    R221
429          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 220 THROUGH SUB-BASIN 230
430          RS      15    FLOW      -1
431          RC   0.100   0.015   0.100    3000  0.0183
432          RX       0     0.5   550.0   550.5   579.5   580.0  1999.5  2000.0
433          RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
             *

434          KK    230S
435          KM   SUB-BASIN 230
436          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
437          KM     L =  .72  Kb = .051  Adj. Slope =  104.0
438          BA    .221
439          LG    .100    .250   4.500    .380  15.000
440          UC    .417    .255
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

441          UA       0       5      16      30      65      77      84      90      94      97
442          UA     100
             *

443          KK  HC235W
444          KM   COMBINE FLOWS FROM SUB-BASIN 220 AND 230, TO GET FLOW FROM THE WEST @ HC235
445          HC       2
```

```
*

KK   HC235
KM   COMBINE FLOWS FROM HC235W AND COMBINED FLOWS AT HC265
HC       2
*

KK  216S&W
KM   COMBINE FLOWS HC216W AND HC235 TO GET FLOW FROM THE SOUTH AND WEST @ HC216
HC       2
*

KK    130S
KM   SUB-BASIN 130
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .23  Kb = .163  Adj. Slope =  315.0
BA    .027
LG    .200    .250   4.250    .450  32.000
UC    .262    .203
UA       0       3       5       8      12      20      43      75      90      96
UA     100
*

KK    R131
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 130 THROUGH SUB-BASIN 140
RS       6    FLOW      -1
RC   0.015   0.015   0.015    1800  0.0156
RX       0     0.5     1.0     1.5    28.5    29.0    29.5    30.0
RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
*

KK    140S
KM   SUB-BASIN 140
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .68  Kb = .074  Adj. Slope =  315.0
BA    .134
LG    .140    .250   4.300    .430  29.000
UC    .313    .235
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*

KK   HC145
KM   COMBINE FLOWS FROM SUB-BASIN 130 AND SUB-BASIN 140
HC       2
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK    R146
```

```
480          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 140 THROUGH SUB-BASIN 150
481          RS       5    FLOW      -1
482          RC   0.100   0.035   0.100    1355  0.0081
483          RX       0     0.5   100.0   100.5   129.5   130.0  1099.5  1100.0
484          RY     5.0     3.0     3.0     0.0     0.0     3.0     3.0     5.0
             *

485          KK    150S
486          KM   SUB-BASIN 150
487          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
488          KM     L =  .62  Kb = .054  Adj. Slope =   39.0
489          BA    .121
490          LG    .100    .250   4.650    .350  15.000
491          UC    .583    .462
492          UA       0       5      16      30      65      77      84      90      94      97
493          UA     100
             *

494          KK   HC155
495          KM   COMBINE FLOWS FROM SUB-BASIN 140 AND SUB-BASIN 150
496          HC       2
             *

497          KK    R156
498          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 150 TO DOUBLETREE RANCH\52ND ST
499          RD    1385   .0037    .012            CIRC     5.0
             *

500          KK   HC216
501          KM   COMBINE FLOWS 216S&W AND HC155 TO GET TOTAL FLOW AT HC216.
502          HC       2
             *

503          KK    R217
504          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 215 THROUGH SUB-BASIN 240
505          KM   2-6'x5' RCBC Modeled with a Trapazoidal Channel of the Same Bottom Width.
506          RD    1367   .0051    .012            TRAP    12.0       0
             *

507          KK    240S
508          KM   SUB-BASIN 240
509          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
510          KM     L =  .74  Kb = .059  Adj. Slope =   38.0
511          BA    .134
512          LG    .100    .250   4.700    .330  15.000
513          UC    .733    .648
514          UA       0       5      16      30      65      77      84      90      94      97
515          UA     100
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
516          KK   HC245
517          KM   COMBINE FLOWS FROM SUB-BASIN 240 AND COMBINED FLOW AT HC216
518          HC       2
             *

519          KK    R246
520          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 240 THROUGH SUB-BASIN 270
521          KM   2-7'x5' RCBC Modeled by Trapezoidal Channel with Same Bottom Width.
522          RD    1298   .0051    .012            TRAP    14.0       0
             *

523          KK    160S
524          KM   SUB-BASIN 160
525          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
526          KM     L =  .91  Kb = .053  Adj. Slope =   24.0
527          BA    .144
528          LG    .100    .250   4.650    .350  15.000
529          UC    .979   1.012
530          UA       0       5      16      30      65      77      84      90      94      97
531          UA     100
             *

532          KK  275N&W
533          KM   COMBINE FLOWS FROM SUB-BASIN 160 AND COMBINED FLOWS AT HC245 TO GET FLOW
534          KM   FROM THE NORTH AND WEST @ HC275, BEFORE 56th STREET LATERAL.
535          HC       2
             *

536          KK    270S
537          KM   SUB-BASIN 270
538          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
539          KM     L =  .59  Kb = .053  Adj. Slope =   41.0
540          BA    .094
541          LG    .100    .250   4.700    .330  15.000
542          UC    .542    .473
543          UA       0       5      16      30      65      77      84      90      94      97
544          UA     100
             *

545          KK   RE281
546          KM   RETRIEVE CHEROKEE WASH & 56TH STREET DIVERSION
547          DR   281RE
             *

548          KK    R282
549          KM   MUSKINGUM-CUNGE ROUTING FOR CHEROKEE WASH THROUGH SUB-BASIN 270
550          RD    1865   .0054    .012            CIRC     5.0
             *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 551          KK  HC275S
 552          KM   COMBINE FLOWS FROM SUB-BASIN 270 AND DIVERSION FLOWS AT RE281 TO GET
 553          KM   TOTAL FLOW IN 56th STREET LATERAL.
 554          HC       2
              *

 555          KK   HC275
 556          KM   COMBINE FLOWS FROM 275N&W AND
 557          KM   HC275S TO GET TOTAL FLOW AT HC275.
 558          HC       2
              *

 559          KK    R276
 560          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 270 THROUGH SUB-BASIN 280
 561          KM   The length-weighted average box size and slope used from the design plans.
 562          KM   Average box size = 1-20.60'x5'RCBC (modeled with Trapezoidal Channel with
 563          KM   same bottom width), Average slope = .0033
 564          RD    1687   .0033    .012            TRAP    20.6       0
              *

 565          KK    280S
 566          KM   SUB-BASIN 280
 567          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 568          KM     L =  .49  Kb = .054  Adj. Slope =   24.0
 569          BA    .115
 570          LG    .100    .250   4.650    .350  15.000
 571          UC    .613    .416
 572          UA       0       5      16      30      65      77      84      90      94      97
 573          UA     100
              *

 574          KK   HC277
 575          KM   COMBINE FLOWS FROM SUB-BASIN 160 & 280 AND COMBINED FLOWS AT HC275
 576          HC       2
              *

 577          KK    100S
 578          KM   SUB-BASIN 100
 579          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 580          KM     L =  .45  Kb = .088  Adj. Slope =  315.0
 581          BA    .088
 582          LG    .140    .250   4.150    .470  18.000
 583          UC    .279    .189
 584          UA       0       5      16      30      65      77      84      90      94      97
 585          UA     100
              *

 586          KK    R101
 587          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 100 THROUGH SUB-BASIN 110
```

```
588          RS      12    FLOW      -1
589          RC   0.100   0.025   0.100    2800  0.0086
590          RX       0     0.0    25.0    25.0    75.0    75.0   100.0   100.0
591          RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
             *
1                                        HEC-1 INPUT                                                    PAGE 16

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


592          KK    110S
593          KM   SUB-BASIN 110
594          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
595          KM     L =  .72  Kb = .054  Adj. Slope =   42.0
596          BA    .115
597          LG    .100    .250   4.450    .400  15.000
598          UC    .646    .601
599          UA       0       5      16      30      65      77      84      90      94      97
600          UA     100
             *

601          KK   HC115
602          KM   COMBINE FLOWS FROM SUB-BASIN 100 AND SUB-BASIN 110
603          HC       2
             *

604          KK    R116
605          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 110 THROUGH SUB-BASIN 120
606          RS       9    FLOW      -1
607          RC   0.100   0.025   0.100    2200  0.0055
608          RX       0     0.0    25.0    25.0    75.0    75.0   100.0   100.0
609          RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
             *

610          KK    120S
611          KM   SUB-BASIN 120
612          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
613          KM     L =  .45  Kb = .056  Adj. Slope =   27.0
614          BA    .086
615          LG    .100    .250   4.650    .350  15.000
616          UC    .558    .414
617          UA       0       5      16      30      65      77      84      90      94      97
618          UA     100
             *

619          KK   HC125
620          KM   COMBINE FLOWS FROM SUB-BASIN 110 AND SUB-BASIN 120
621          HC       2
             *
             * ***************************************************************************
             *  Modifications by Dibble & Associates.  Proposed conditions data is based
             *  upon KHE file 298IMP10.DAT, substituting 10-yr 24-hour parameters based upon
```

```
                    *  file DT124E.DAT, with new Tc and R calculated for the four subbasins that
                    *  changed in size due to proposed conditions (Subbasins 230, 240, 260, & 270.
                    *
                    *
                    * On 12 Jun 98: Removed diversion 261RE, reduced diversion at 281RE to existing
                    *               conditions situation.
                    *
                    * On 12 Jun 98: Revised subbasin 220 to route via natural channel to subbasin
                    *               230, revised HC to add three hydrographs, since no Tatum lateral
                    *               Revised R251 to natural channel route, since no Butler lateral
                    *
                    * On 7 July 98: Revised all Muskingum-Cunge routing to refelct the actual pipe
                    *               size used for the appraisal estimate.
                    *               The average slope and predominate pipe size is used
                    *               from the design plans.  In some cases, the weighted average
                    *               is used, as noted in the KM record for the particular routing.
                    *
                    * On 29 July 98: Revised all UC records to conform to those from the file
                    *                DT124E.DAT, which is Kaminski-Hubbard's hydrology model.
                    *                This is necessary to make the Tc and R values consistent
                    *                with the 24-hour rainfall.
                    *
                    * On 30 July 98: Revised the Tc and R values for subbasins 230, 240, 260,
                    *                and 270 to conform to the 24-hour storm.  The size of these
                    *                basins were revised, and KHE only ran the 6-hour storm for
                    *                the proposed conditions.
                    *
                    *
                    *
                    * ***************************************************************************
1                                                HEC-1 INPUT                                          PAGE 17

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           622          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    10        290S
                 V
                 V
    29        R291
                 .
                 .
    35           .        300S
                 .           .
                 .           .
    44       HC305............
```

```
            V
            V
 47       R306
            .
            .
 53         .        310S
            .           V
            .           V
 62         .        R311
            .           .
            .           .
 68         .           .        320S
            .           .           V
            .           .           V
 77         .           .        R321
            .           .           .
            .           .           .
 83         .           .           .        330S
            .           .           .           .
            .           .           .           .
 92         .           .       HC335............
            .           .           .
            .           .           .
 95         .           .           .        340S
            .           .           .           V
            .           .           .           V
104         .           .           .        R341
            .           .           .           .
            .           .           .           .
110         .           .       HC345............
            .           .           V
            .           .           V
113         .           .        R336
            .           .           .
            .           .           .
119         .           .           .        350S
            .           .           .           V
            .           .           .           V
128         .           .           .        R351
            .           .           .           .
            .           .           .           .
134         .           .           .           .        360S
            .           .           .           .           .
            .           .           .           .           .
143         .        HC365...................................
            .           V
            .           V
146         .        R366
            .           .
            .           .
152         .           .        370S
            .           .           V
```

```
                .           .           V
161             .           .        R371
                .           .           .
                .           .           .
167             .           .           .        380S
                .           .           .           .
                .           .           .           .
176             .       HC384.......................
                .           .
                .           .
179         HC385............
                V
                V
182          R386
                .
                .
188             .        390S
                .           .
                .           .
197         HC395............
                V
                V
200          R396
                .
                .
206             .        400S
                .           .
                .           .
215         HC405............
                .
                .
221             .------->   281RE
218         DT405
                .
                .
224             .        410S
                .           V
                .           V
233             .        R411
                .           .
                .           .
239         HC415............
                .
                .
242             .        420S
                .           V
                .           V
251             .        R421
                .           .
                .           .
257         HC425............
                V
```

```
                V
260          R426
                .
                .
266             .        430S
                .           .
                .           .
275         HC435............
                .
                .
278             .        170S
                .           V
                .           V
287             .        R171
                .           .
                .           .
293             .           .        180S
                .           .           .
                .           .           .
302             .           .           .        190S
                .           .           .           V
                .           .           .           V
311             .           .           .        R191
                .           .           .           .
                .           .           .           .
317             .       HC195.......................
                .           V
                .           V
320             .        R196
                .           .
                .           .
326             .           .        200S
                .           .           .
                .           .           .
335             .       HC205............
                .           V
                .           V
338             .        R206
                .           .
                .           .
344             .           .        220S
                .           .           .
                .           .           .
355             .           .           .-------> DIV220
353             .           .      10y220
                .           .           V
                .           .           V
358             .           .      220pip
                .           .           .
                .           .           .
363             .           .           .        210S
                .           .           .           .
```

```
372          .      HC211.......................
             .          V
             .          V
375          .       R212
             .
             .
379          .           215S
             .
             .
388          .     HC216W............
             .
             .
392          .           250S
             .              V
             .              V
401          .           R251
             .
             .
407          .                     260S
             .
             .
416          .         HC265............
             .              V
             .              V
420          .           R266
             .
             .
427          .                         .<-------  DIV220
425          .                   RET220
             .                        V
             .                        V
428          .                     R221
             .
             .
434          .                         .        230S
             .                         .           .
             .                         .           .
443          .                   HC235W............
             .
             .
446          .         HC235............
             .
             .
449          .     216S&W............
             .
             .
452          .           130S
             .              V
             .              V
461          .           R131
             .
```

```
                .           .           .
467             .           .           .        140S
                .           .           .           .
                .           .           .           .
476             .           .       HC145............
                .           .           V
                .           .           V
479             .           .        R146
                .           .           .
                .           .           .
485             .           .           .        150S
                .           .           .           .
                .           .           .           .
494             .           .       HC155............
                .           .           V
                .           .           V
497             .           .        R156
                .           .           .
                .           .           .
500             .       HC216............
                .           V
                .           V
503             .        R217
                .           .
                .           .
507             .           .        240S
                .           .           .
                .           .           .
516             .       HC245............
                .           V
                .           V
519             .        R246
                .           .
                .           .
523             .           .        160S
                .           .           .
                .           .           .
532             .      275N&W............
                .           .
                .           .
536             .           .        270S
                .           .           .
                .           .           .
547             .           .           .           .<-------   281RE
545             .           .           .       RE281
                .           .           .           V
                .           .           .           V
548             .           .           .       R282
                .           .           .           .
                .           .           .           .
551             .           .      HC275S............
                .           .           .
```

```
555          .      HC275............
             .          V
             .          V
559          .       R276
             .
             .
565          .                280S
             .
             .
574          .      HC277............
             .
             .
577          .                100S
             .                   V
             .                   V
586          .                R101
             .
             .
592          .                          110S
             .
             .
601          .              HC115............
             .                   V
             .                   V
604          .                R116
             .
             .
610          .                          120S
             .
             .
619          .              HC125............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUL   1997              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   02FEB00  TIME  14:12:57  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY FCD 97-32
FILENAME: 10YR24P1.DAT
10-YEAR 24-HOUR STORM DURATION for the ALTERNATIVE CONDITIONS

PREPARED BY DIBBLE & ASSOCIATES, SUB-CONSULTANT TO BROOKS HERSEY
Modified 12 June 98 by f. brown
See other modification notes at the end of this input file.

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9 IO          OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                    NMIN          1  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1    0  STARTING DATE
                   ITIME       0000  STARTING TIME
                      NQ       1500  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      2    0  ENDING DATE
                 NDTIME       0059  ENDING TIME
                 ICENT          19  CENTURY MARK

             COMPUTATION INTERVAL     .02 HOURS
                  TOTAL TIME BASE   24.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT
1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                   TIME IN HOURS,  AREA IN SQUARE MILES

                                 PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
       OPERATION       STATION   FLOW    PEAK                                            AREA      STAGE     MAX STAGE
+                                                    6-HOUR     24-HOUR     72-HOUR

       HYDROGRAPH AT
+                        290S     55.   12.13          7.          2.          2.       .09

       ROUTED TO
+                        R291     55.   12.18          7.          2.          2.       .09
+                                                                                                 1.09       12.18

       HYDROGRAPH AT
+                        300S     25.   12.07          3.          1.          1.       .05

       2 COMBINED AT
+                       HC305     76.   12.10         10.          3.          3.       .14

       ROUTED TO
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+		R306	76.	12.12	10.	3.	3.	.14		
+									1.43	12.12
+	HYDROGRAPH AT	310S	126.	12.28	23.	7.	7.	.25		
+	ROUTED TO	R311	125.	12.37	23.	7.	7.	.25		
+									1.83	12.37
+	HYDROGRAPH AT	320S	120.	12.07	16.	5.	5.	.17		
+	ROUTED TO	R321	119.	12.13	16.	5.	5.	.17		
+									.40	12.13
+	HYDROGRAPH AT	330S	113.	12.02	12.	3.	3.	.12		
+	2 COMBINED AT	HC335	224.	12.07	28.	8.	8.	.29		
+	HYDROGRAPH AT	340S	51.	12.12	7.	2.	2.	.07		
+	ROUTED TO	R341	51.	12.18	7.	2.	2.	.07		
+									1.12	12.18
+	2 COMBINED AT	HC345	271.	12.07	35.	10.	10.	.36		
+	ROUTED TO	R336	267.	12.13	35.	10.	10.	.36		
+									2.77	12.13
+	HYDROGRAPH AT	350S	62.	12.03	8.	3.	3.	.08		
+	ROUTED TO	R351	61.	12.10	8.	3.	3.	.08		
+									1.22	12.10
+	HYDROGRAPH AT	360S	129.	12.07	16.	5.	5.	.25		
+	4 COMBINED AT	HC365	535.	12.13	81.	25.	25.	.94		
+	ROUTED TO	R366	532.	12.17	81.	25.	25.	.94		

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+                                                                                                   3.51       12.17

        HYDROGRAPH AT
+                          370S       93.   12.20        14.        5.        5.       .14

        ROUTED TO
+                          R371       91.   12.32        14.        5.        5.       .14
+                                                                                                   1.75       12.32

        HYDROGRAPH AT
+                          380S       33.   12.07         4.        1.        1.       .07

        3 COMBINED AT
+                         HC384      636.   12.17       100.       31.       30.      1.15

        2 COMBINED AT
+                         HC385      711.   12.17       110.       35.       33.      1.30

        ROUTED TO
+                          R386      706.   12.22       110.       35.       33.      1.30
+                                                                                                   4.56       12.22

        HYDROGRAPH AT
+                          390S       27.   12.13         4.        1.        1.       .07

        2 COMBINED AT
+                         HC395      731.   12.22       114.       36.       34.      1.36

        ROUTED TO
+                          R396      728.   12.27       114.       36.       34.      1.36
+                                                                                                   3.15       12.27

        HYDROGRAPH AT
+                          400S       71.   12.13        11.        4.        3.       .14

        2 COMBINED AT
+                         HC405      789.   12.25       125.       39.       38.      1.51

        DIVERSION TO
+                         281RE      184.   12.25        48.       20.       19.      1.51

        HYDROGRAPH AT
+                         DT405      605.   12.25        77.       19.       19.      1.51

        HYDROGRAPH AT
+                          410S       48.   12.05         6.        2.        2.       .08

        ROUTED TO
+                          R411       47.   12.20         6.        2.        2.       .08
+                                                                                                   1.58       12.20

        2 COMBINED AT
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+		HC415	651.	12.25	84.	21.	20.	1.58		
+	HYDROGRAPH AT	420S	60.	12.13	10.	3.	3.	.12		
+	ROUTED TO	R421	59.	12.22	10.	3.	3.	.12		
+									1.74	12.22
+	2 COMBINED AT	HC425	710.	12.25	94.	25.	24.	1.71		
+	ROUTED TO	R426	707.	12.30	94.	25.	24.	1.71		
+									4.58	12.30
+	HYDROGRAPH AT	430S	63.	12.35	16.	5.	4.	.24		
+	2 COMBINED AT	HC435	769.	12.30	110.	29.	28.	1.94		
+	HYDROGRAPH AT	170S	103.	12.23	16.	5.	5.	.19		
+	ROUTED TO	R171	103.	12.28	16.	5.	5.	.19		
+									1.53	12.28
+	HYDROGRAPH AT	180S	42.	12.13	7.	2.	2.	.09		
+	HYDROGRAPH AT	190S	104.	12.30	20.	6.	6.	.21		
+	ROUTED TO	R191	104.	12.32	20.	6.	6.	.21		
+									1.57	12.32
+	3 COMBINED AT	HC195	240.	12.28	43.	14.	14.	.49		
+	ROUTED TO	R196	240.	12.28	43.	14.	14.	.49		
+									1.84	12.28
+	HYDROGRAPH AT	200S	29.	12.05	4.	1.	1.	.05		
+	2 COMBINED AT	HC205	255.	12.27	47.	15.	15.	.54		

	ROUTED TO								
+	R206	254.	12.30	47.	15.	15.	.54		
+								1.51	12.30
	HYDROGRAPH AT								
+	220S	12.	12.03	1.	0.	0.	.02		
	DIVERSION TO								
+	DIV220	0.	12.02	0.	0.	0.	.02		
	HYDROGRAPH AT								
+	10y220	12.	12.02	1.	0.	0.	.02		
	ROUTED TO								
+	220pip	12.	12.07	1.	0.	0.	.02		
	HYDROGRAPH AT								
+	210S	59.	12.05	7.	2.	2.	.08		
	3 COMBINED AT								
+	HC211	292.	12.20	55.	18.	17.	.64		
	ROUTED TO								
+	R212	292.	12.23	55.	18.	17.	.64		
	HYDROGRAPH AT								
+	215S	9.	12.18	2.	1.	1.	.03		
	2 COMBINED AT								
+	HC216W	301.	12.23	57.	18.	18.	.67		
	HYDROGRAPH AT								
+	250S	47.	12.17	7.	2.	2.	.08		
	ROUTED TO								
+	R251	46.	12.30	7.	2.	2.	.08		
+								.42	12.30
	HYDROGRAPH AT								
+	260S	58.	12.07	7.	2.	2.	.11		
	2 COMBINED AT								
+	HC265	92.	12.12	13.	4.	4.	.19		
	ROUTED TO								
+	R266	90.	12.18	13.	4.	4.	.19		
	HYDROGRAPH AT								
+	RET220	0.	12.03	0.	0.	0.	.00		
	ROUTED TO								
+	R221	0.	12.18	0.	0.	0.	.00		

+								.00	12.18
+	HYDROGRAPH AT	230S	112.	12.12	14.	4.	4.	.22	
+	2 COMBINED AT	HC235W	112.	12.12	14.	4.	4.	.22	
+	2 COMBINED AT	HC235	197.	12.15	28.	8.	8.	.41	
+	2 COMBINED AT	216S&W	492.	12.17	85.	27.	26.	1.08	
+	HYDROGRAPH AT	130S	16.	12.13	2.	1.	1.	.03	
+	ROUTED TO	R131	16.	12.22	2.	1.	1.	.03	
+								.11	12.22
+	HYDROGRAPH AT	140S	76.	12.08	11.	3.	3.	.13	
+	2 COMBINED AT	HC145	90.	12.08	13.	4.	4.	.16	
+	ROUTED TO	R146	89.	12.15	13.	4.	4.	.16	
+								.89	12.15
+	HYDROGRAPH AT	150S	47.	12.20	8.	2.	2.	.12	
+	2 COMBINED AT	HC155	135.	12.17	21.	6.	6.	.28	
+	ROUTED TO	R156	134.	12.20	21.	6.	6.	.28	
+	2 COMBINED AT	HC216	626.	12.18	106.	33.	32.	1.36	
+	ROUTED TO	R217	625.	12.20	106.	33.	32.	1.36	
+	HYDROGRAPH AT	240S	42.	12.28	9.	3.	3.	.13	
+	2 COMBINED AT	HC245	665.	12.20	115.	36.	34.	1.49	

	ROUTED TO								
+		R246	664.	12.22	115.	36.	34.	1.49	
	HYDROGRAPH AT								
+		160S	31.	12.43	9.	3.	3.	.14	
	2 COMBINED AT								
+		275N&W	690.	12.22	124.	39.	37.	1.64	
	HYDROGRAPH AT								
+		270S	37.	12.18	6.	2.	2.	.09	
	HYDROGRAPH AT								
+		RE281	184.	12.25	48.	20.	19.	.00	
	ROUTED TO								
+		R282	184.	12.28	48.	20.	19.	.00	
	2 COMBINED AT								
+		HC275S	219.	12.27	55.	22.	21.	.09	
	2 COMBINED AT								
+		HC275	907.	12.22	179.	60.	58.	1.73	
	ROUTED TO								
+		R276	906.	12.23	179.	60.	58.	1.73	
	HYDROGRAPH AT								
+		280S	46.	12.22	8.	2.	2.	.12	
	2 COMBINED AT								
+		HC277	952.	12.23	187.	63.	60.	1.85	
	HYDROGRAPH AT								
+		100S	46.	12.07	5.	2.	2.	.09	
	ROUTED TO								
+		R101	44.	12.22	5.	2.	2.	.09	
+									.32 12.22
	HYDROGRAPH AT								
+		110S	35.	12.25	7.	2.	2.	.12	
	2 COMBINED AT								
+		HC115	79.	12.23	13.	4.	4.	.20	
	ROUTED TO								
+		R116	76.	12.42	13.	4.	4.	.20	
+									.53 12.42
	HYDROGRAPH AT								
+		120S	35.	12.18	6.	2.	2.	.09	

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        2 COMBINED AT
+                          HC125       103.   12.38          18.          5.          5.        .29
1
                                        SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                            (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
          ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                   PEAK                                     PEAK

                              (MIN)     (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

          220pip   MANE        1.00     12.03    724.00       .62      1.00     12.03    724.00        .62

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .7920E+00 EXCESS= .0000E+00 OUTFLOW= .7920E+00 BASIN STORAGE= .1434E-03 PERCENT ERROR=    .0

             R212   MANE        1.00    292.00    734.00      1.04      1.00    292.00    734.00       1.04

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .3548E+02 EXCESS= .0000E+00 OUTFLOW= .3547E+02 BASIN STORAGE= .9295E-02 PERCENT ERROR=    .0

             R266   MANE        1.00     90.49    731.00       .84      1.00     90.49    731.00        .84

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .8304E+01 EXCESS= .0000E+00 OUTFLOW= .8297E+01 BASIN STORAGE= .2351E-02 PERCENT ERROR=    .0

             R156   MANE        1.00    134.10    732.00       .84      1.00    134.10    732.00        .84

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1267E+02 EXCESS= .0000E+00 OUTFLOW= .1267E+02 BASIN STORAGE= .1686E-02 PERCENT ERROR=    .0

             R217   MANE        1.00    625.10    732.00       .91      1.00    625.10    732.00        .91

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .6581E+02 EXCESS= .0000E+00 OUTFLOW= .6580E+02 BASIN STORAGE= .2792E-01 PERCENT ERROR=    .0

             R246   MANE         .99    664.57    732.37       .89      1.00    663.98    733.00        .89

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .7106E+02 EXCESS= .0000E+00 OUTFLOW= .7106E+02 BASIN STORAGE= .3279E-01 PERCENT ERROR=    .0

             R282   MANE        1.00    183.84    737.00     -1.00      1.00    183.84    737.00      -1.00
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R276  MANE        1.00    906.36    734.00      1.30      1.00    906.36    734.00        1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1199E+03 EXCESS= .0000E+00 OUTFLOW= .1198E+03 BASIN STORAGE= .1254E+00 PERCENT ERROR=   -.1


*** NORMAL END OF HEC-1 ***
```

HEC-1 OUTPUT

100-YEAR, 24-HOUR STORM

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUL   1997              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   02FEB00  TIME  14:12:45  *
 *                                      *
 ****************************************
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   DOUBLETREE RANCH ROAD REGIONAL DRAINAGE STUDY  FCD 97-32
  2           ID     FILENAME:  100Y24P1.DAT
  3           ID     100-YEAR 24-HOUR STORM DURATION for the ALTERNATIVE CONDITIONS
  4           ID
  5           ID        PREPARED BY DIBBLE & ASSOCIATES, SUB-CONSULTANT TO BROOKS HERSEY
  6           ID        Modified 12 June 98 by F. Brown
  7           ID        See other modification notes at the end of this input file.
              *DIAGRAM
  8           IT       1                    1500
  9           IO       5
              *

 10           KK    290S
 11           KM   SUB-BASIN 290
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 12          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 13          KM     L =  .38  Kb = .111  Adj. Slope =  315.0
 14          BA    .092
 15          IN      30
 16          KM   RAINFALL DEPTH OF 3.77 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 17          KM   AN AREAL REDUCTION FACTOR OF .976
 18          PB    3.68
 19          KM   THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II STORM
 20          PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 21          PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 22          PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 23          PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 24          PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 25          LG    .160    .250   4.150    .470  30.000
 26          UC    .225    .127
 27          UA       0       3       5       8      12      20      43      75      90      96
 28          UA     100
             *

 29          KK    R291
 30          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 290 THROUGH SUB-BASIN 300
 31          RS       4    FLOW      -1
 32          RC   0.035   0.030   0.035    1800  0.0268
 33          RX       0     0.5    20.0    30.0    40.0    60.0    68.0    80.0
 34          RY     7.0     5.0     3.0     1.0     0.0     3.0     5.0     7.0
             *

 35          KK    300S
 36          KM   SUB-BASIN 300
 37          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 38          KM     L =  .38  Kb = .059  Adj. Slope =  153.0
 39          BA    .052
 40          LG    .100    .250   3.950    .510  15.000
 41          UC    .204    .158
 42          UA       0       5      16      30      65      77      84      90      94      97
 43          UA     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 44          KK   HC305
 45          KM   COMBINE FLOWS FROM SUB-BASIN 290 AND SUB-BASIN 300
 46          HC       2
             *

 47          KK    R306
 48          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 300 THROUGH SUB-BASIN 380
 49          RS       1    FLOW      -1
 50          RC   0.035   0.030   0.035     400  0.0250
 51          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
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52          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
            *

53          KK    310S
54          KM   SUB-BASIN 310
55          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
56          KM     L =  .95  Kb = .104  Adj. Slope =  315.0
57          BA    .249
58          LG    .170    .250   4.200    .460  40.000
59          UC    .375    .264
60          UA       0       3       5       8      12      20      43      75      90      96
61          UA     100
            *

62          KK    R311
63          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 310 THROUGH SUB-BASIN 360
64          RS       6    FLOW      -1
65          RC   0.035   0.030   0.035    2800  0.0204
66          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
67          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
            *

68          KK    320S
69          KM   SUB-BASIN 320
70          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
71          KM     L =  .68  Kb = .087  Adj. Slope =  315.0
72          BA    .170
73          LG    .140    .250   5.600    .230  30.000
74          UC    .258    .166
75          UA       0       5      16      30      65      77      84      90      94      97
76          UA     100
            *

77          KK    R321
78          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 320 THROUGH SUB-BASIN 330
79          RS       5    FLOW      -1
80          RC   0.035   0.030   0.035    1000  0.0100
81          RX       0     0.5    49.5    50.0   155.0   155.5   199.5   200.0
82          RY     5.0     1.0     1.0     0.0     0.0     1.0     1.0     5.0
            *
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

83          KK    330S
84          KM   SUB-BASIN 330
85          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
86          KM     L =  .49  Kb = .067  Adj. Slope =  264.4
87          BA    .123
88          LG    .110    .150   7.300    .120  17.000
89          UC    .200    .116
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 90          UA       0       5      16      30      65      77      84      90      94      97
 91          UA     100
             *

 92          KK   HC335
 93          KM   COMBINE FLOWS FROM SUB-BASIN 320 AND SUB-BASIN 330
 94          HC       2
             *

 95          KK    340S
 96          KM   SUB-BASIN 340
 97          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 98          KM     L =  .34  Kb = .132  Adj. Slope =  315.0
 99          BA    .069
100          LG    .180    .250   4.800    .320  42.000
101          UC    .229    .140
102          UA       0       3       5       8      12      20      43      75      90      96
103          UA     100
             *

104          KK    R341
105          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 340 THROUGH SUB-BASIN 360
106          RS       5    FLOW      -1
107          RC   0.035   0.030   0.035    2400  0.0369
108          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
109          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

110          KK   HC345
111          KM   COMBINE FLOWS FROM SUB-BASIN 330 &340
112          HC       2
             *

113          KK    R336
114          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 330 THROUGH SUB-BASIN 360
115          RS       5    FLOW      -1
116          RC   0.035   0.030   0.035    2400  0.0113
117          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
118          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

119          KK    350S
120          KM   SUB-BASIN 350
121          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
122          KM     L =  .38  Kb = .093  Adj. Slope =  315.0
123          BA    .076
124          LG    .140    .250   4.800    .320  48.000
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

125          UC    .200    .124
```

```
126          UA       0       5      16      30      65      77      84      90      94      97
127          UA     100
             *

128          KK    R351
129          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 350 THROUGH SUB-BASIN 360
130          RS       5    FLOW      -1
131          RC   0.035   0.030   0.035    2600  0.0373
132          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
133          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

134          KK    360S
135          KM   SUB-BASIN 360
136          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
137          KM     L =  .87  Kb = .054  Adj. Slope =  297.2
138          BA    .255
139          LG    .110    .250   4.100    .490  19.000
140          UC    .242    .149
141          UA       0       5      16      30      65      77      84      90      94      97
142          UA     100
             *

143          KK   HC365
144          KM   COMBINE FLOWS FROM SUB-BASINS 310, 340, 350, 360 & COMBINED FLOWS AT HC335
145          HC       4
             *

146          KK    R366
147          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 360 THROUGH SUB-BASIN 380
148          RS       2    FLOW      -1
149          RC   0.035   0.030   0.035    1300  0.0135
150          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
151          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

152          KK    370S
153          KM   SUB-BASIN 370
154          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
155          KM     L =  .64  Kb = .111  Adj. Slope =  315.0
156          BA    .142
157          LG    .160    .250   4.800    .320  42.000
158          UC    .296    .204
159          UA       0       3       5       8      12      20      43      75      90      96
160          UA     100
             *

161          KK    R371
162          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 370 THROUGH SUB-BASIN 380
163          RS       9    FLOW      -1
164          RC   0.100   0.030   0.100    3400  0.0135
165          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
```

```
 166          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
              *

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 167          KK    380S
 168          KM   SUB-BASIN 380
 169          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 170          KM     L =  .45  Kb = .057  Adj. Slope =  151.0
 171          BA    .068
 172          LG    .100    .250   4.000    .500  17.000
 173          UC    .221    .169
 174          UA       0       5      16      30      65      77      84      90      94      97
 175          UA     100
              *

 176          KK   HC384
 177          KM   COMBINE FLOWS FROM SUB-BASIN 370 & 380 AND COMBINED FLOWS AT HC365
 178          HC       3
              *

 179          KK   HC385
 180          KM   COMBINE FLOWS FROM HC305 & HC384
 181          HC       2
              *
              *       This next diversion removed, flow in Cherokee Wash not diverted, and
              *       the runoff to 52nd St. from Subbasins 230, 250, & 260 will be
              *       intercepted in the proposed storm drain lateral.
              *
              * KK DT385
              * KM 100% DIVERSION AT CHEROKEE WASH AND 52TH STREET TO DOUBLETREE RANCH ROAD
              * DT 261RE
              * DI     0    1000    5000
              * DQ     0    1000    5000
              *
              *       See above note concerning previously proposed diversion DT385
              *

 182          KK    R386
 183          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 380 THROUGH SUB-BASIN 390
 184          RS       4    FLOW      -1
 185          RC   0.035   0.030   0.035    1800  0.0061
 186          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
 187          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
              *

 188          KK    390S
 189          KM   SUB-BASIN 390
 190          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 191          KM     L =  .53  Kb = .058  Adj. Slope =   77.0
```

```
192          BA    .066
193          LG    .100    .250   4.450    .400  15.000
194          UC    .308    .284
195          UA       0       5      16      30      65      77      84      90      94      97
196          UA     100
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

197          KK   HC395
198          KM   COMBINE FLOWS FROM SUB-BASIN 390 AND COMBINED FLOWS AT HC385
199          HC       2
             *

200          KK    R396
201          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 390 THROUGH SUB-BASIN 400
202          RS       3    FLOW      -1
203          RC   0.035   0.030   0.035    1600  0.0081
204          RX       0     0.5     1.0     9.0    31.0    39.0    39.5    40.0
205          RY    10.0     4.0     4.0     0.0     0.0     4.0     4.0    10.0
             *

206          KK    400S
207          KM   SUB-BASIN 400
208          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
209          KM     L =  .91  Kb = .079  Adj. Slope =  303.0
210          BA    .145
211          LG    .130    .250   4.650    .350  25.000
212          UC    .304    .275
213          UA       0       5      16      30      65      77      84      90      94      97
214          UA     100
             *

215          KK   HC405
216          KM   COMBINE FLOWS FROM SUB-BASIN 400 AND COMBINED FLOWS AT HC395
217          HC       2
             *

218          KK   DT405
219          KM   PROPOSED CONDITIONS DIVERSION AT CHEROKEE WASH AND 56TH STREET
220          KM     STREET HIGH POINT AT VIA BUENA VISTA RAISED TO ELEVATION 1348.71
221          KM     281RE IS FLOW ENTERING BOX CULVERT AND FLOWING NORTH IN STORM DRAIN (Q10)
222          DT   281RE
223          DI     181     544     725     789    1269    1450    1631    1813    2250    2500
224          DQ      45     136     177     184     197     197     197     197     197     197
             *

225          KK  CHWASH
226          KM   SEPARATE 56TH ST OVERLAND BREAKOUT FROM FLOW REMAINING IN CHEROKEE WASH
227          DT  56THST
```

```
228          DI     136     408     548     605    1072    1253    1434    1616    2053    2303
229          DQ       0       0       4       8      40      53      67      79     110     123
             *

230          KK    410S
231          KM   SUB-BASIN 410
232          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
233          KM     L =  .45  Kb = .094  Adj. Slope =  315.0
234          BA    .075
235          LG    .140    .250   4.550    .370  31.000
236          UC    .221    .160
237          UA       0       5      16      30      65      77      84      90      94      97
238          UA     100
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

239          KK    R411
240          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 410 THROUGH SUB-BASIN 430
241          RS      10    FLOW      -1
242          RC   0.100   0.030   0.100    2480  0.0060
243          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
244          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

245          KK   HC415
246          KM   COMBINE FLOWS FROM DT405 AND  SUBBASIN 410
247          HC       2
             *

248          KK    420S
249          KM   SUB-BASIN 420
250          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
251          KM     L =  .80  Kb = .099  Adj. Slope =  315.0
252          BA    .123
253          LG    .150    .250   4.550    .370  31.000
254          UC    .321    .289
255          UA       0       5      16      30      65      77      84      90      94      97
256          UA     100
             *

257          KK    R421
258          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 420 THROUGH SUB-BASIN 430
259          RS       6    FLOW      -1
260          RC   0.100   0.030   0.100    1640  0.0060
261          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
262          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

263          KK   HC425
```

```
264          KM   COMBINE FLOWS FROM SUBBASIN 420 AND HC415
265          HC       2
             *

266          KK    R426
267          KM   NORMAL DEPTH FLOW ROUTING FOR HC425 THROUGH SUB-BASIN 430
268          RS       6    FLOW      -1
269          RC   0.100   0.030   0.100    1520  0.0060
270          RX       0     0.5     1.0    39.5    40.5    79.0    79.5    80.0
271          RY     8.0     8.0     8.0     0.0     0.0     8.0     8.0     8.0
             *

272          KK    430S
273          KM   SUB-BASIN 430
274          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
275          KM     L =  .98  Kb = .050  Adj. Slope =   29.0
276          BA    .237
277          LG    .100    .250   4.650    .350  15.000
278          UC    .629    .495
279          UA       0       5      16      30      65      77      84      90      94      97
280          UA     100
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

281          KK   HC435
282          KM   COMBINE FLOWS FROM SUB-BASINS 410, 420, 430 & COMBINED FLOWS AT HC405
283          HC       2
             *

284          KK    170S
285          KM   SUB-BASIN 170
286          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
287          KM     L =  .61  Kb = .138  Adj. Slope =  315.0
288          BA    .187
289          LG    .200    .250   4.250    .450  37.000
290          UC    .338    .194
291          UA       0       3       5       8      12      20      43      75      90      96
292          UA     100
             *

293          KK    R171
294          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 170 THROUGH SUB-BASIN 180
295          RS       3    FLOW      -1
296          RC   0.035   0.030   0.035    1200  0.0250
297          RX       0     8.0    16.0    24.0    32.0    50.0    60.0    80.0
298          RY     8.0     6.0     4.0     2.0     0.0     2.0     4.0     6.0
             *

299          KK    180S
```

```
300          KM   SUB-BASIN 180
301          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
302          KM     L =  .68  Kb = .100  Adj. Slope =  315.0
303          BA    .095
304          LG    .150    .250   4.150    .470  28.000
305          UC    .296    .269
306          UA       0       5      16      30      65      77      84      90      94      97
307          UA     100
             *

308          KK    190S
309          KM   SUB-BASIN 190
310          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
311          KM     L =  .91  Kb = .115  Adj. Slope =  315.0
312          BA    .208
313          LG    .170    .250   4.250    .450  42.000
314          UC    .383    .290
315          UA       0       3       5       8      12      20      43      75      90      96
316          UA     100
             *

317          KK    R191
318          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 190 THROUGH SUB-BASIN 180
319          RS       2    FLOW      -1
320          RC   0.035   0.030   0.035    1200  0.0400
321          RX       0    25.0    30.0    40.0    50.0    55.0    80.0   100.0
322          RY     6.0     4.0     2.0     0.0     2.0     4.0     6.0     6.0
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

323          KK   HC195
324          KM   COMBINE FLOWS FROM SUB-BASIN 170, SUB-BASIN 180 & SUB-BASIN 190
325          HC       3
             *

326          KK    R196
327          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 180 THROUGH SUB-BASIN 200
328          RS       1    FLOW      -1
329          RC   0.035   0.030   0.035     200  0.0500
330          RX       0     8.0    16.0    24.0    32.0    50.0    60.0    80.0
331          RY     8.0     6.0     4.0     2.0     0.0     2.0     4.0     6.0
             *

332          KK    200S
333          KM   SUB-BASIN 200
334          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
335          KM     L =  .38  Kb = .093  Adj. Slope =  315.0
336          BA    .048
337          LG    .150    .250   4.150    .470  35.000
```

```
338          UC    .204    .165
339          UA       0       5      16      30      65      77      84      90      94      97
340          UA     100
             *

341          KK   HC205
342          KM   COMBINE FLOW FROM SUB-BASIN 200 AND COMBINED FLOWS AT HC195
343          HC       2
             *

344          KK    R206
345          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 200 THROUGH SUB-BASIN 210
346          RS       3    FLOW      -1
347          RC   0.035   0.030   0.035    1600  0.0125
348          RX       0     0.5     1.0     9.0    31.0    39.0    39.5    40.0
349          RY    10.0     4.0     4.0     0.0     0.0     4.0     4.0    10.0
             *

350          KK    220S
351          KM   SUB-BASIN 220
352          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
353          KM     L =  .27  Kb = .064  Adj. Slope =  219.2
354          BA    .024
355          LG    .100    .250   3.950    .510  15.000
356          UC    .200    .182
357          UA       0       5      16      30      65      77      84      90      94      97
358          UA     100
             *

359          KK  10y220
360          KM   Divert the Q > Q10 from basin 220 east to basin 230 to be routed overland
361          DT  DIV220
362          DI       0      12      25     100     200     300     400     500
363          DQ       0       0      13      75     175     275     375     475
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

364          KK  220PIP
365          KM   MUSKINGUM-CUNGE ROUTING FOR Q10 FROM BASIN 220 NORTH THRU THE TATUM LATERAL
366          KM   The length-weighted averege size and slope from the design plans were used
367          KM   for routing.  Avg Size = 22.8", Avg Slope = .0183
368          RD    1484   .0183    .012            CIRC     1.9
             *

369          KK    210S
370          KM   SUB-BASIN 210
371          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
372          KM     L =  .61  Kb = .043  Adj. Slope =  185.0
373          BA    .080
```

```
374          LG    .100    .250    .340    .490  21.000
375          UC    .200    .176
376          UA       0       5      16      30      65      77      84      90      94      97
377          UA     100
             *

378          KK   HC211
379          KM   COMBINE FLOWS FROM SUB-BASIN 210 AND COMBINED FLOWS AT HC205
380          HC       3
             *

381          KK  211PIP
382          KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
383          DT   211OL
384          DI       0     284     300     400     500     600     700     800
385          DQ       0       0      16     116     216     316     416     516
             *

386          KK    R212
387          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 210 THROUGH SUB-BASIN 215
388          KM   Pipe is 48"x76"HERCP.  Round Equivalent = 60" was used for routing.
389          RD    2604   .0103    .012            CIRC     5.0
             *

390          KK    215S
391          KM   SUB-BASIN 215
392          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
393          KM     L =  .51  Kb = .063  Adj. Slope =   51.0
394          BA    .028
395          LG    .100    .250   4.800    .320  15.000
396          UC    .371    .551
397          UA       0       5      16      30      65      77      84      90      94      97
398          UA     100
             *

399          KK  215PIP
400          KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
401          DT   215OL
402          DI       0       9      20      30      40      50      60     100
403          DQ       0       0      11      21      31      41      51      91
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

404          KK  HC216W
405          KM   COMBINE FLOWS FROM 215S AND COMBINED FLOWS AT HC211 TO GET FLOW FROM THE WEST
406          KM   THIS IS THE MAIN LINE STORM SEWER DISCHARGE BEFORE LATERALS ADD IN.
407          HC       2
             *
```

```
408          KK    250S
409          KM   SUB-BASIN 250
410          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
411          KM     L =  .45  Kb = .112  Adj. Slope =  315.0
412          BA    .078
413          LG    .160    .250   4.200    .460  37.000
414          UC    .242    .173
415          UA       0       3       5       8      12      20      43      75      90      96
416          UA     100
             *

417          KK    R251
418          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 250 THROUGH SUB-BASIN 260
419          RS      15    FLOW      -1
420          RC   0.100   0.030   0.100    3200  0.0164
421          RX       0     0.5   235.0   235.5   264.5   265.0   499.5   500.0
422          RY     5.0     2.0     2.0     0.0     0.0     2.0     2.0     5.0
             *

423          KK    260S
424          KM   SUB-BASIN 260
425          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
426          KM     L =  .49  Kb = .053  Adj. Slope =  126.0
427          BA    .108
428          LG    .100    .250   4.350    .420  15.000
429          UC    .283    .216
430          UA       0       5      16      30      65      77      84      90      94      97
431          UA     100
             *

432          KK   HC265
433          KM   COMBINE FLOWS FROM SUB-BASIN 250 AND SUB-BASIN 260
434          KM
435          HC       2
             *

436          KK  265PIP
437          KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
438          DT   265OL
439          DI       0      92     100     200     300     400     500     600
440          DQ       0       0       8     108     208     308     408     508
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

441          KK    R266
442          KM   MUSKINGUM-CUNGE ROUTING FOR SUB-BASIN 260 THROUGH SUB-BASIN 230
443          KM   The length-weighted average size and slope from the design plans were used
444          KM   for routing.  Avg Size = 61.95", Avg Slope = 0.0039
445          RD    2612   .0039    .012            CIRC     5.2
```

```
*

KK  RET220
KM   Retrieve diverted flow from basin 220 (Q>10yr, 12cfs)
DR  DIV220
*

KK    R221
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 220 THROUGH SUB-BASIN 230
RS      15    FLOW      -1
RC   0.100   0.015   0.100    3000  0.0183
RX       0     0.5   550.0   550.5   579.5   580.0  1999.5  2000.0
RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
*

KK    230S
KM   SUB-BASIN 230
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .72  Kb = .051  Adj. Slope =  104.0
BA    .221
LG    .100    .250   4.500    .380  15.000
UC    .308    .182
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*

KK  HC235W
KM   COMBINE FLOWS FROM SUB-BASIN 220 AND 230, TO GET FLOW FROM THE WEST @ HC235
HC       2
*

KK  235PIP
KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
DT   235OL
DI       0     123     200     300     400     500     600     700
DQ       0       0      77     177     277     377     477     577
*

KK   HC235
KM   COMBINE FLOWS FROM HC235W AND COMBINED FLOWS AT HC265
HC       2
*

KK  216S&W
KM   COMBINE FLOWS HC216W AND HC235 TO GET FLOW FROM THE SOUTH AND WEST @ HC216
HC       2
*
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
KK    130S
KM   SUB-BASIN 130
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .23  Kb = .163  Adj. Slope =  315.0
BA    .027
LG    .200    .250   4.250    .450  32.000
UC    .213    .160
UA       0       3       5       8      12      20      43      75      90      96
UA     100
*

KK    R131
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 130 THROUGH SUB-BASIN 140
RS       6    FLOW      -1
RC   0.015   0.015   0.015    1800  0.0156
RX       0     0.5     1.0     1.5    28.5    29.0    29.5    30.0
RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
*

KK    140S
KM   SUB-BASIN 140
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .68  Kb = .074  Adj. Slope =  315.0
BA    .134
LG    .140    .250   4.300    .430  29.000
UC    .242    .177
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*

KK   HC145
KM   COMBINE FLOWS FROM SUB-BASIN 130 AND SUB-BASIN 140
HC       2
*

KK    R146
KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 140 THROUGH SUB-BASIN 150
RS       5    FLOW      -1
RC   0.100   0.035   0.100    1355  0.0081
RX       0     0.5   100.0   100.5   129.5   130.0  1099.5  1100.0
RY     5.0     3.0     3.0     0.0     0.0     3.0     3.0     5.0
*

KK    150S
KM   SUB-BASIN 150
KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
KM     L =  .62  Kb = .054  Adj. Slope =   39.0
BA    .121
LG    .100    .250   4.650    .350  15.000
UC    .425    .325
UA       0       5      16      30      65      77      84      90      94      97
UA     100
```

```
                *
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 520            KK   HC155
 521            KM   COMBINE FLOWS FROM SUB-BASIN 140 AND SUB-BASIN 150
 522            HC       2
                *

 523            KK  155PIP
 524            KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
 525            DT   155OL
 526            DI       0     135     200     300     400     500     600     700
 527            DQ       0       0      65     165     265     365     465     565
                *

 528            KK    R156
 529            KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 150 TO DOUBLETREE RANCH\52ND ST
 530            RD    1385   .0037    .012            CIRC       5
                *

 531            KK   HC216
 532            KM   COMBINE FLOWS 216S&W AND HC155 TO GET TOTAL FLOW AT HC216.
 533            HC       2
                *

 534            KK    R217
 535            KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 215 THROUGH SUB-BASIN 240
 536            KM   2-6'x5' RCBC Modeled with a Trapazoidal Channel of the Same Bottom Width.
 537            RD    1367   .0051    .012            TRAP    12.0       0
                *

 538            KK    240S
 539            KM   SUB-BASIN 240
 540            KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 541            KM     L =  .74  Kb = .059  Adj. Slope =   38.0
 542            BA    .134
 543            LG    .100    .250   4.700    .330  15.000
 544            UC    .350    .167
 545            UA       0       5      16      30      65      77      84      90      94      97
 546            UA     100
                *

 547            KK  240PIP
 548            KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
 549            DT   240OL
 550            DI       0      42     100     200     300     400     500
 551            DQ       0       0      58     158     258     358     458
                *
```

```
552          KK   HC245
553          KM   COMBINE FLOWS FROM SUB-BASIN 240 AND COMBINED FLOW AT HC216
554          HC       2
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

555          KK    R246
556          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 240 THROUGH SUB-BASIN 270
557          KM   2-7'x5' RCBC Modeled by Trapezoidal Channel with Same Bottom Width.
558          RD    1298   .0051    .012            TRAP    14.0       0
             *

559          KK    160S
560          KM   SUB-BASIN 160
561          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
562          KM     L =  .91  Kb = .053  Adj. Slope =   24.0
563          BA    .144
564          LG    .100    .250   4.650    .350  15.000
565          UC    .683   0.679
566          UA       0       5      16      30      65      77      84      90      94      97
567          UA     100
             *

568          KK  160PIP
569          KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
570          DT   160OL
571          DI       0      31     100     200     300     400
572          DQ       0      31      69     169     269     369
             *

573          KK  275N&W
574          KM   COMBINE FLOWS FROM SUB-BASIN 160 AND COMBINED FLOWS AT HC245 TO GET FLOW
575          KM   FROM THE NORTH AND WEST @ HC275, BEFORE 56th STREET LATERAL.
576          HC       2
             *

577          KK    270S
578          KM   SUB-BASIN 270
579          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
580          KM     L =  .59  Kb = .053  Adj. Slope =   41.0
581          BA    .094
582          LG    .100    .250   4.700    .330  15.000
583          UC    .475    .479
584          UA       0       5      16      30      65      77      84      90      94      97
585          UA     100
             *

586          KK  270PIP
587          KM   DIVERT 100YR BALANCE TO SURFACE AS OVERLAND FLOW
```

```
588          DT   270OL
589          DI       0      37     100     200     300     400
590          DQ       0       0      63     163     263     363
             *

591          KK   RE281
592          KM   RETRIEVE CHEROKEE WASH & 56TH STREET DIVERSION
593          DR   281RE
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

594          KK    R282
595          KM   MUSKINGUM-CUNGE ROUTING FOR CHEROKEE WASH THROUGH SUB-BASIN 270
596          RD    1865   .0054    .012            CIRC     5.0
             *

597          KK  HC275S
598          KM   COMBINE FLOWS FROM SUB-BASIN 270 AND DIVERSION FLOWS AT RE281 TO GET
599          KM   TOTAL FLOW IN 56th STREET LATERAL.
600          HC       2
             *

601          KK   HC275
602          KM   COMBINE FLOWS FROM 275N&W AND
603          KM   HC275S TO GET TOTAL FLOW AT HC275.
604          HC       2
             *

605          KK    R276
606          KM   MUSKINGUM-CUNGE FLOW ROUTING FROM SUB-BASIN 270 THROUGH SUB-BASIN 280
607          KM   The length-weighted average box size and slope used from the design plans.
608          KM   Average box size = 1-20.60'x5'RCBC (modeled with Trapezoidal Channel with
609          KM   same bottom width), Average slope = .0033
610          RD    1687   .0033    .012            TRAP    20.6       0
             *

611          KK    280S
612          KM   SUB-BASIN 280
613          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
614          KM     L =  .49  Kb = .054  Adj. Slope =   24.0
615          BA    .115
616          LG    .100    .250   4.650    .350  15.000
617          UC    .442    .290
618          UA       0       5      16      30      65      77      84      90      94      97
619          UA     100
             *

620          KK   HC277
621          KM   COMBINE FLOWS FROM SUB-BASIN 160 & 280 AND COMBINED FLOWS AT HC275
```

```
622          HC       2
             *  ******************************************************************************
             *  ******************************************************************************
             *  ******************************************************************************

623          KK  +211OL
624          KM   RETRIEVE 211OL OVERLAND FLOW
625          DR   211OL
             *

626          KK  R211OL
627          KM   ROUTE 211OL OVERLAND DOWN DOUBLETREE RANCH ROAD TO 52ND ST
628          RS       5    FLOW      -1
629          RC    .033    .015    .033    2600     .01
630          RX       0       2      23    23.1    56.9      57      78      80
631          RY     1.5     0.5     0.5       0       0     0.5     0.5     1.5
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

632          KK  +215OL
633          KM   RETRIEVE 215OL OVERLAND FLOW
634          DR   215OL
             *

635          KK   CPDT1
636          KM   COMBINE 211OL AND 215OL AT 52ND STREET
637          HC       2
             *

638          KK  RDT1OL
639          KM   ROUTE OVERLAND FLOW COMBINED AT 52ND ST OVERLAND TO BERNEIL WASH @ DOUBLETREE
640          RS       3    FLOW      -1
641          RC    .033    .015    .033    1350    .007
642          RX       0       2      23    23.1    56.9      57      78      80
643          RY     1.5     0.5     0.5       0       0     0.5     0.5     1.5
             *

644          KK  +155OL
645          KM   RETRIEVE 155OL OVERLAND FLOW
646          DR   155OL
             *

647          KK  R155OL
648          KM   ROUTE 155OL FLOW OVERLAND TO BERNEIL WASH @ DOUBLETREE
649          KM   ROUTING PARAMETERS TAKEN FROM EXISTING MODEL (R156)
650          RS       9    FLOW      -1
651          RC     0.1   0.035     0.1    2300  0.0046
652          RX       0     0.5     100   100.5   129.5   130.0  1099.5  1100.0
653          RY       5       3       3       0       0       3       3       5
```

```
*

KK  +235OL
KM   RETRIEVE 235OL OVERLAND FLOW
DR   235OL
*

KK  R235OL
KM   ROUTE 235OL FLOW OVERLAND TO BERNEIL WASH @ DOUBLETREE
KM   ROUTING PARAMETERS TAKEN FROM EXISTING MODEL (R236)
RS       3    FLOW      -1
RC     0.1    0.03     0.1    1000   0.007
RX       0     0.5     235   235.5   264.5     265   499.5     500
RY       5       2       2       0       0       2       2       5
*

KK  +265OL
KM   RETRIEVE 265OL OVERLAND FLOW
DR   265OL
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK  R265OL
KM   ROUTE 265OL FLOW OVERLAND TO BERNEIL WASH @ DOUBLETREE
KM   ROUTING PARAMETERS TAKEN FROM EXISTING MODEL (R266)
RS       4    FLOW      -1
RC     0.1    0.03     0.1    1400  0.0086
RX       0     0.5     235   235.5   264.5     265   499.5     500
RY       5       2       2       0       0       2       2       5
*

KK  +240OL
KM   RETRIEVE 240OL OVERLAND FLOW
DR   240OL
*

KK   CPDT2
KM   COMBINE ALL OVERLAND FLOWS AT BERNEIL WASH @ DOUBLETREE
HC       5
*

KK  RDT2OL
KM   ROUTE COMBINED OVERLAND FLOW TO 56TH ST/DOUBLETREE
RS       3    FLOW      -1
RC    .033    .015    .033    1250   .0048
RX       2       4      25    25.1    58.9      59      80      84
RY     2.5     0.5     0.5       0       0     0.5     0.5     2.5
*
```

```
686          KK  +1600L
687          KM   RETRIEVE 1600L OVERLAND FLOW
688          DR   1600L
             *

689          KK  +2700L
690          KM   RETRIEVE 2700L OVERLAND FLOW
691          DR   2700L
             *

692          KK  +56THS
693          KM   RETRIEVE 56TH STREET OVERLAND BREAKOUT FLOW
694          DR  56THST
             *

695          KK   R56OL
696          KM   ROUTE 56TH STREET OVERLAND BREAKOUT FLOW NORTH TO DOUBLETREE RANCH RD
697          RS       8    FLOW      -1
698          RC    .033    .015    .033    1600   .0045
699          RX       0       5      10    10.1    49.9      50      55      60
700          RY       1     0.5     0.5       0       0     0.5     0.5       1
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

701          KK   CPDT3
702          KM   COMBINE OVERLAND FLOW @ 56TH ST/DOUBLETREE
703          HC       4
             *

704          KK   CPIBW
705          KM   ROUTE COMBINED OVERLAND FLOW TO INDIAN BEND WASH
706          RS       2    FLOW      -1
707          RC    .033    .015    .033    1335    .004
708          RX       2       4      25    25.1    58.9      59      80      84
709          RY     2.5     0.5     0.5       0       0     0.5     0.5     2.5
             * ******************************************************************************
             * ******************************************************************************
             * ******************************************************************************

710          KK    100S
711          KM   SUB-BASIN 100
712          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
713          KM     L =  .45  Kb = .088  Adj. Slope =  315.0
714          BA    .088
715          LG    .140    .250   4.150    .470  18.000
716          UC    .217    .143
717          UA       0       5      16      30      65      77      84      90      94      97
718          UA     100
             *
```

```
 719          KK    R101
 720          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 100 THROUGH SUB-BASIN 110
 721          RS      12    FLOW      -1
 722          RC   0.100   0.025   0.100    2800  0.0086
 723          RX       0     0.0    25.0    25.0    75.0    75.0   100.0   100.0
 724          RY     5.0     0.5     0.5     0.0     0.0     0.5     0.5     5.0
              *

 725          KK    110S
 726          KM   SUB-BASIN 110
 727          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 728          KM     L =  .72  Kb = .054  Adj. Slope =   42.0
 729          BA    .115
 730          LG    .100    .250   4.450    .400  15.000
 731          UC    .458    .411
 732          UA       0       5      16      30      65      77      84      90      94      97
 733          UA     100
              *

 734          KK   HC115
 735          KM   COMBINE FLOWS FROM SUB-BASIN 100 AND SUB-BASIN 110
 736          HC       2
              *
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 737          KK    R116
 738          KM   NORMAL DEPTH FLOW ROUTING FROM SUB-BASIN 110 THROUGH SUB-BASIN 120
 739          RS       9    FLOW      -1
 740          RC   0.100   0.025   0.100    2200  0.0055
 741          RX       0     0.0    25.0    25.0    75.0    75.0   100.0   100.0
 742          RY     5.0     0.5     0.5       0       0     0.5     0.5     5.0
              *

 743          KK    120S
 744          KM   SUB-BASIN 120
 745          KM   24-HOUR SCS TYPE II RAINFALL USED TO FIND TC & R FOR THIS BASIN
 746          KM     L =  .45  Kb = .056  Adj. Slope =   27.0
 747          BA    .086
 748          LG    .100    .250   4.650    .350  15.000
 749          UC    .408    .293
 750          UA       0       5      16      30      65      77      84      90      94      97
 751          UA     100
              *

 752          KK   HC125
 753          KM   COMBINE FLOWS FROM SUB-BASIN 110 AND SUB-BASIN 120
 754          HC       2
              * ******************************************************************************
```

```
                    *  Modifications by Dibble & Associates.  Proposed conditions data is based
                    *  upon KHE file 298IMP10.DAT, substituting 10-yr 24-hour parameters based upon
                    *  file DT124E.DAT, with new Tc and R calculated for the four subbasins that
                    *  changed in size due to proposed conditions (Subbasins 230, 240, 260, & 270.
                    *
                    *
                    * On 12 Jun 98: Removed diversion 261RE, reduced diversion at 281RE to existing
                    *               conditions situation.
                    *
                    * On 12 Jun 98: Revised subbasin 220 to route via natural channel to subbasin
                    *               230, revised HC to add three hydrographs, since no Tatum lateral
                    *               Revised R251 to natural channel route, since no Butler lateral.
                    *
                    * On 7 July 98: Revised all Muskingum-Cunge routing to refelct the actual pipe
                    *               size used for the appraisal estimate.
                    *               The average slope and predominate pipe size is used
                    *               from the design plans.  In some cases, the weighted average
                    *               is used, as noted in the KM record for the particular routing.
                    *
                    * On 29 July 98: Revised all UC records to conform to those from the file
                    *                DT124E.DAT, which is Kaminski-Hubbard's hydrology model.
                    *                This is necessary to make the Tc and R values consistent
                    *                with the 24-hour rainfall.
                    *
                    * On 30 July 98: Revised the Tc and R values for subbasins 230, 240, 260,
                    *                and 270 to conform to the 24-hour storm.  The size of these
                    *                basins were revised, and KHE only ran the 6-hour storm for
                    *                the proposed conditions.
                    *
                    *
                    * ***************************************************************************
1                                                HEC-1 INPUT                                          PAGE 21

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           755          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    10        290S
                 V
                 V
    29        R291
                 .
                 .
    35           .        300S
                 .           .
                 .           .
```

```
44      HC305............
            V
            V
47       R306
            .
            .
53          .        310S
            .           V
            .           V
62          .        R311
            .           .
            .           .
68          .           .        320S
            .           .           V
            .           .           V
77          .           .        R321
            .           .           .
            .           .           .
83          .           .           .        330S
            .           .           .           .
            .           .           .           .
92          .           .       HC335............
            .           .           .
            .           .           .
95          .           .           .        340S
            .           .           .           V
            .           .           .           V
104         .           .           .        R341
            .           .           .           .
            .           .           .           .
110         .           .       HC345............
            .           .           V
            .           .           V
113         .           .        R336
            .           .           .
            .           .           .
119         .           .           .        350S
            .           .           .           V
            .           .           .           V
128         .           .           .        R351
            .           .           .           .
            .           .           .           .
134         .           .           .           .        360S
            .           .           .           .           .
            .           .           .           .           .
143         .        HC365.................................
            .           V
            .           V
146         .        R366
            .           .
            .           .
152         .           .        370S
```

```
              .           .           V
              .           .           V
161           .           .        R371
              .           .           .
              .           .           .
167           .           .           .        380S
              .           .           .           .
              .           .           .           .
176           .       HC384.......................
              .           .
              .           .
179       HC385............
              V
              V
182        R386
              .
              .
188           .        390S
              .           .
              .           .
197       HC395............
              V
              V
200        R396
              .
              .
206           .        400S
              .           .
              .           .
215       HC405............
              .
              .
222           .-------->   281RE
218       DT405
              .
              .
227           .-------->  56THST
225      CHWASH
              .
              .
230           .        410S
              .           V
              .           V
239           .        R411
              .           .
              .           .
245       HC415............
              .
              .
248           .        420S
              .           v
              .           V
```

```
257          .        R421
             .           .
             .           .
263      HC425............
             V
             V
266       R426
             .
             .
272          .        430S
             .           .
             .           .
281      HC435............
             .
             .
284          .        170S
             .           V
             .           V
293          .        R171
             .           .
             .           .
299          .           .        180S
             .           .           .
             .           .           .
308          .           .           .        190S
             .           .           .           V
             .           .           .           V
317          .           .           .        R191
             .           .           .           .
             .           .           .           .
323          .       HC195........................
             .           V
             .           V
326          .        R196
             .           .
             .           .
332          .           .        200S
             .           .           .
             .           .           .
341          .       HC205............
             .           V
             .           V
344          .        R206
             .           .
             .           .
350          .           .        220S
             .           .           .
             .           .           .
361          .           .           .-------> DIV220
359          .           .      10y220
             .           .           V
             .           .           V
```

```
364          .          .      220PIP
             .          .          .
             .          .          .
369          .          .          .        210S
             .          .          .          .
             .          .          .          .
378          .      HC211.......................
             .          .
             .          .
383          .          .-------->   211OL
381          .     211PIP
             .          V
             .          V
386          .       R212
             .          .
             .          .
390          .          .       215S
             .          .          .
             .          .          .
401          .          .          .-------->   215OL
399          .          .      215PIP
             .          .          .
             .          .          .
404          .     HC216W............
             .          .
             .          .
408          .          .       250S
             .          .          V
             .          .          V
417          .          .       R251
             .          .          .
             .          .          .
423          .          .          .        260S
             .          .          .          .
             .          .          .          .
432          .          .      HC265............
             .          .          .
             .          .          .
438          .          .          .-------->   265OL
436          .          .      265PIP
             .          .          V
             .          .          V
441          .          .       R266
             .          .          .
             .          .          .
448          .          .          .          .<-------  DIV220
446          .          .          .     RET220
             .          .          .          V
             .          .          .          V
449          .          .          .       R221
             .          .          .          .
             .          .          .          .
```

```
455          .          .          .          .       230S
             .          .          .          .          .
             .          .          .          .          .
464          .          .          .     HC235W............
             .          .          .          .
             .          .          .          .
469          .          .          .          .-------->   235OL
467          .          .          .     235PIP
             .          .          .          .
             .          .          .          .
472          .          .      HC235............
             .          .          .
             .          .          .
475          .     216S&W............
             .          .
             .          .
478          .          .       130S
             .          .          V
             .          .          V
487          .          .       R131
             .          .          .
             .          .          .
493          .          .          .       140S
             .          .          .          .
             .          .          .          .
502          .          .      HC145............
             .          .          V
             .          .          V
505          .          .       R146
             .          .          .
             .          .          .
511          .          .          .       150S
             .          .          .          .
             .          .          .          .
520          .          .      HC155............
             .          .          .
             .          .          .
525          .          .          .-------->   155OL
523          .          .     155PIP
             .          .          V
             .          .          V
528          .          .       R156
             .          .          .
             .          .          .
531          .      HC216............
             .          V
             .          V
534          .       R217
             .          .
             .          .
538          .          .       240S
             .          .          .
```

```
549          .          .          .-------->   240OL
547          .          .     240PIP
             .          .          .
             .          .          .
552          .      HC245............
             .          V
             .          V
555          .       R246
             .          .
             .          .
559          .          .       160S
             .          .          .
             .          .          .
570          .          .          .-------->   160OL
568          .          .     160PIP
             .          .          .
             .          .          .
573          .     275N&W............
             .          .
             .          .
577          .          .       270S
             .          .          .
             .          .          .
588          .          .          .-------->   270OL
586          .          .     270PIP
             .          .          .
             .          .          .
593          .          .          .          .<--------   281RE
591          .          .          .      RE281
             .          .          .          V
             .          .          .          V
594          .          .          .       R282
             .          .          .          .
             .          .          .          .
597          .          .     HC275S............
             .          .          .
             .          .          .
601          .      HC275............
             .          V
             .          V
605          .       R276
             .          .
             .          .
611          .          .       280S
             .          .          .
             .          .          .
620          .      HC277............
             .          .
             .          .
625          .          .          .<--------   211OL
623          .          .     +211OL
```

```
                 .           .           V
                 .           .           V
626              .           .       R211OL
                 .           .           .
                 .           .           .
634              .           .           .           .<-------   215OL
632              .           .           .      +215OL
                 .           .           .           .
                 .           .           .           .
635              .           .       CPDT1............
                 .           .           V
                 .           .           V
638              .           .       RDT1OL
                 .           .           .
                 .           .           .
646              .           .           .           .<-------   155OL
644              .           .           .      +155OL
                 .           .           .           V
                 .           .           .           V
647              .           .           .      R155OL
                 .           .           .           .
                 .           .           .           .
656              .           .           .           .           .<-------   235OL
654              .           .           .           .      +235OL
                 .           .           .           .           V
                 .           .           .           .           V
657              .           .           .           .      R235OL
                 .           .           .           .           .
                 .           .           .           .           .
666              .           .           .           .           .           .<-------   265OL
664              .           .           .           .           .      +265OL
                 .           .           .           .           .           V
                 .           .           .           .           .           V
667              .           .           .           .           .      R265OL
                 .           .           .           .           .           .
                 .           .           .           .           .           .
676              .           .           .           .           .           .           .<-------   240OL
674              .           .           .           .           .           .      +240OL
                 .           .           .           .           .           .           .
                 .           .           .           .           .           .           .
677              .           .       CPDT2.............................................
                 .           .           V
                 .           .           V
680              .           .       RDT2OL
                 .           .           .
                 .           .           .
688              .           .           .           .<-------   160OL
686              .           .           .      +160OL
                 .           .           .           .
                 .           .           .           .
691              .           .           .           .           .<-------   270OL
689              .           .           .           .      +270OL
```

```
                .          .          .          .          .
                .          .          .          .          .
  694           .          .          .          .          .          .<-------  56THST
  692           .          .          .          .          .     +56THS
                .          .          .          .          .          V
                .          .          .          .          .          V
  695           .          .          .          .          .      R56OL
                .          .          .          .          .          .
                .          .          .          .          .          .
  701           .          .      CPDT3.......................................
                .          .          V
                .          .          V
  704           .          .      CPIBW
                .          .          .
                .          .          .
  710           .          .          .       100S
                .          .          .          V
                .          .          .          V
  719           .          .          .       R101
                .          .          .          .
                .          .          .          .
  725           .          .          .          .        110S
                .          .          .          .          .
                .          .          .          .          .
  734           .          .          .      HC115............
                .          .          .          V
                .          .          .          V
  737           .          .          .       R116
                .          .          .          .
                .          .          .          .
  743           .          .          .          .        120S
                .          .          .          .          .
                .          .          .          .          .
  752           .          .          .      HC125............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUL   1997               *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   02FEB00  TIME  14:12:45   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

100-YEAR 24-HOUR STORM DURATION for the ALTERNATIVE CONDITIONS

PREPARED BY DIBBLE & ASSOCIATES, SUB-CONSULTANT TO BROOKS HERSEY
Modified 12 June 98 by F. Brown
See other modification notes at the end of this input file.

```
9 IO          OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                     NMIN           1  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME        0000  STARTING TIME
                       NQ        1500  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2    0  ENDING DATE
                   NDTIME        0059  ENDING TIME
                   ICENT           19  CENTURY MARK

              COMPUTATION INTERVAL     .02 HOURS
                   TOTAL TIME BASE   24.98 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
1
                                          RUNOFF SUMMARY
                                     FLOW IN CUBIC FEET PER SECOND
                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM    TIME OF
        OPERATION       STATION    FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                     6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                         290S     123.   12.05         14.         4.          4.       .09
        ROUTED TO
+                         R291     123.   12.10         14.         4.          4.       .09
+                                                                                          1.48       12.10

        HYDROGRAPH AT
+                         300S      63.   12.03          7.         2.          2.       .05
        2 COMBINED AT
+                        HC305     183.   12.05         21.         6.          6.       .14
```

	ROUTED TO									
+		R306	183.	12.07	21.	6.	6.	.14		
+									2.05	12.07
	HYDROGRAPH AT									
+		310S	288.	12.20	43.	14.	13.	.25		
	ROUTED TO									
+		R311	286.	12.25	43.	14.	13.	.25		
+									2.55	12.25
	HYDROGRAPH AT									
+		320S	244.	12.03	29.	9.	8.	.17		
	ROUTED TO									
+		R321	243.	12.08	29.	9.	8.	.17		
+									.63	12.08
	HYDROGRAPH AT									
+		330S	200.	12.02	22.	6.	6.	.12		
	2 COMBINED AT									
+		HC335	438.	12.03	51.	15.	14.	.29		
	HYDROGRAPH AT									
+		340S	101.	12.07	13.	4.	4.	.07		
	ROUTED TO									
+		R341	100.	12.12	13.	4.	4.	.07		
+									1.48	12.12
	2 COMBINED AT									
+		HC345	535.	12.05	63.	19.	18.	.36		
	ROUTED TO									
+		R336	530.	12.10	63.	19.	18.	.36		
+									3.62	12.10
	HYDROGRAPH AT									
+		350S	117.	12.02	15.	5.	5.	.08		
	ROUTED TO									
+		R351	116.	12.07	15.	5.	5.	.08		
+									1.57	12.07
	HYDROGRAPH AT									
+		360S	319.	12.03	34.	10.	10.	.25		
	4 COMBINED AT									
+		HC365	1188.	12.08	155.	47.	45.	.94		

	ROUTED TO									
+		R366	1183.	12.10	155.	47.	45.	.94		
+									4.77	12.10
	HYDROGRAPH AT									
+		370S	191.	12.13	26.	8.	8.	.14		
	ROUTED TO									
+		R371	189.	12.23	26.	8.	8.	.14		
+									2.34	12.23
	HYDROGRAPH AT									
+		380S	83.	12.03	9.	3.	2.	.07		
	3 COMBINED AT									
+		HC384	1430.	12.10	190.	58.	55.	1.15		
	2 COMBINED AT									
+		HC385	1609.	12.10	210.	64.	61.	1.30		
	ROUTED TO									
+		R386	1599.	12.15	210.	64.	61.	1.30		
+									6.24	12.15
	HYDROGRAPH AT									
+		390S	70.	12.08	9.	2.	2.	.07		
	2 COMBINED AT									
+		HC395	1666.	12.13	219.	66.	64.	1.36		
	ROUTED TO									
+		R396	1663.	12.17	219.	66.	64.	1.36		
+									4.84	12.17
	HYDROGRAPH AT									
+		400S	167.	12.08	22.	7.	6.	.14		
	2 COMBINED AT									
+		HC405	1813.	12.15	241.	73.	70.	1.51		
	DIVERSION TO									
+		281RE	197.	12.15	64.	29.	28.	1.51		
	HYDROGRAPH AT									
+		DT405	1616.	12.15	177.	44.	42.	1.51		
	DIVERSION TO									
+		56THST	79.	12.15	5.	1.	1.	1.51		
	HYDROGRAPH AT									
+		CHWASH	1537.	12.15	171.	43.	41.	1.51		

+	HYDROGRAPH AT	410S	103.	12.03	12.	4.	4.	.08	
+	ROUTED TO	R411	101.	12.13	12.	4.	4.	.08	2.15 12.13
+	2 COMBINED AT	HC415	1638.	12.15	184.	47.	45.	1.58	
+	HYDROGRAPH AT	420S	140.	12.08	20.	6.	6.	.12	
+	ROUTED TO	R421	138.	12.15	20.	6.	6.	.12	2.43 12.15
+	2 COMBINED AT	HC425	1776.	12.15	203.	53.	51.	1.71	
+	ROUTED TO	R426	1771.	12.18	203.	53.	51.	1.71	6.50 12.18
+	HYDROGRAPH AT	430S	184.	12.22	32.	9.	9.	.24	
+	2 COMBINED AT	HC435	1953.	12.20	236.	62.	59.	1.94	
+	HYDROGRAPH AT	170S	234.	12.15	31.	10.	9.	.19	
+	ROUTED TO	R171	234.	12.18	31.	10.	9.	.19	2.09 12.18
+	HYDROGRAPH AT	180S	105.	12.07	14.	4.	4.	.09	
+	HYDROGRAPH AT	190S	235.	12.20	37.	12.	11.	.21	
+	ROUTED TO	R191	235.	12.22	37.	12.	11.	.21	2.11 12.22
+	3 COMBINED AT	HC195	555.	12.17	82.	26.	25.	.49	
+	ROUTED TO	R196	555.	12.17	82.	26.	25.	.49	

```
+                                                                                                  2.51       12.17

          HYDROGRAPH AT
+                          200S        64.   12.03          8.          2.          2.        .05

          2 COMBINED AT
+                          HC205      602.   12.12         90.         28.         27.        .54

          ROUTED TO
+                           R206      600.   12.17         90.         28.         27.        .54
+                                                                                                  2.49       12.17

          HYDROGRAPH AT
+                          220S        28.   12.03          3.          1.          1.        .02

          DIVERSION TO
+                         DIV220       16.   12.03          1.          0.          0.        .02

          HYDROGRAPH AT
+                         10y220       13.   12.03          2.          1.          1.        .02

          ROUTED TO
+                         220PIP       13.   12.07          2.          1.          1.        .02

          HYDROGRAPH AT
+                          210S       113.   12.03         12.          4.          3.        .08

          3 COMBINED AT
+                          HC211      699.   12.12        104.         32.         31.        .64

          DIVERSION TO
+                          211OL      415.   11.82         30.          8.          7.        .64

          HYDROGRAPH AT
+                         211PIP      284.   11.82         74.         25.         24.        .64

          ROUTED TO
+                           R212      285.   11.87         74.         25.         24.        .64

          HYDROGRAPH AT
+                           215S       22.   12.13          4.          1.          1.        .03

          DIVERSION TO
+                          215OL       13.   11.78          1.          0.          0.        .03

          HYDROGRAPH AT
+                         215PIP        9.   11.78          3.          1.          1.        .03

          2 COMBINED AT
+                         HC216W      294.   11.87         77.         26.         25.        .67

          HYDROGRAPH AT
```

+		250S	102.	12.10	13.	4.	4.	.08	
	ROUTED TO								
+		R251	102.	12.20	13.	4.	4.	.08	
+									.70 12.20
	HYDROGRAPH AT								
+		260S	126.	12.05	14.	4.	4.	.11	
	2 COMBINED AT								
+		HC265	220.	12.08	27.	8.	8.	.19	
	DIVERSION TO								
+		265OL	128.	11.82	8.	2.	2.	.19	
	HYDROGRAPH AT								
+		265PIP	92.	11.82	20.	6.	6.	.19	
	ROUTED TO								
+		R266	92.	11.98	20.	6.	6.	.19	
	HYDROGRAPH AT								
+		RET220	16.	12.03	1.	0.	0.	.00	
	ROUTED TO								
+		R221	15.	12.17	1.	0.	0.	.00	
+									.10 12.17
	HYDROGRAPH AT								
+		230S	274.	12.05	30.	8.	8.	.22	
	2 COMBINED AT								
+		HC235W	287.	12.05	31.	9.	8.	.22	
	DIVERSION TO								
+		235OL	164.	11.72	10.	2.	2.	.22	
	HYDROGRAPH AT								
+		235PIP	123.	11.72	21.	6.	6.	.22	
	2 COMBINED AT								
+		HC235	215.	11.98	40.	12.	12.	.41	
	2 COMBINED AT								
+		216S&W	508.	11.92	117.	38.	37.	1.08	
	HYDROGRAPH AT								
+		130S	35.	12.07	4.	1.	1.	.03	
	ROUTED TO								
+		R131	35.	12.15	4.	1.	1.	.03	
+									.25 12.15

	HYDROGRAPH AT								
+		140S	174.	12.03	21.	6.	6.	.13	
	2 COMBINED AT								
+		HC145	206.	12.05	25.	8.	7.	.16	
	ROUTED TO								
+		R146	205.	12.08	25.	8.	7.	.16	
+									1.49 12.08
	HYDROGRAPH AT								
+		150S	122.	12.13	17.	5.	4.	.12	
	2 COMBINED AT								
+		HC155	326.	12.10	42.	12.	12.	.28	
	DIVERSION TO								
+		155OL	191.	11.78	12.	3.	3.	.28	
	HYDROGRAPH AT								
+		155PIP	135.	11.78	29.	9.	9.	.28	
	ROUTED TO								
+		R156	135.	11.92	29.	9.	9.	.28	
	2 COMBINED AT								
+		HC216	643.	11.92	146.	47.	45.	1.36	
	ROUTED TO								
+		R217	643.	11.98	146.	47.	45.	1.36	
	HYDROGRAPH AT								
+		240S	173.	12.05	18.	5.	5.	.13	
	DIVERSION TO								
+		240OL	131.	11.67	10.	2.	2.	.13	
	HYDROGRAPH AT								
+		240PIP	42.	11.67	9.	3.	3.	.13	
	2 COMBINED AT								
+		HC245	685.	11.98	155.	50.	48.	1.49	
	ROUTED TO								
+		R246	685.	12.00	155.	50.	48.	1.49	
	HYDROGRAPH AT								
+		160S	92.	12.27	20.	6.	5.	.14	
	DIVERSION TO								
+		160OL	64.	12.27	16.	5.	5.	.14	

	HYDROGRAPH AT								
+		160PIP	27.	12.27	3.	1.	1.	.14	
	2 COMBINED AT								
+		275N&W	712.	12.27	158.	51.	49.	1.64	
	HYDROGRAPH AT								
+		270S	79.	12.17	13.	4.	4.	.09	
	DIVERSION TO								
+		270OL	42.	11.85	3.	1.	1.	.09	
	HYDROGRAPH AT								
+		270PIP	37.	11.85	10.	3.	3.	.09	
	HYDROGRAPH AT								
+		RE281	197.	11.98	64.	29.	28.	.00	
	ROUTED TO								
+		R282	197.	12.07	64.	29.	28.	.00	
	2 COMBINED AT								
+		HC275S	234.	12.07	74.	32.	30.	.09	
	2 COMBINED AT								
+		HC275	946.	12.27	233.	82.	79.	1.73	
	ROUTED TO								
+		R276	946.	12.28	233.	82.	79.	1.73	
	HYDROGRAPH AT								
+		280S	121.	12.12	16.	4.	4.	.12	
	2 COMBINED AT								
+		HC277	1062.	12.15	248.	87.	83.	1.85	
	HYDROGRAPH AT								
+		+211OL	415.	12.12	30.	8.	7.	.00	
	ROUTED TO								
+		R211OL	409.	12.20	30.	8.	7.	.00	
+									1.02 12.20
	HYDROGRAPH AT								
+		+215OL	13.	12.13	1.	0.	0.	.00	
	2 COMBINED AT								
+		CPDT1	421.	12.18	31.	8.	8.	.00	
	ROUTED TO								
+		RDT1OL	418.	12.23	31.	8.	8.	.00	

+								1.14	12.23
+	HYDROGRAPH AT	+155OL	191.	12.10	12.	3.	3.	.00	
+	ROUTED TO	R155OL	187.	12.20	12.	3.	3.	.00	
+								1.67	12.20
+	HYDROGRAPH AT	+235OL	164.	12.05	10.	2.	2.	.00	
+	ROUTED TO	R235OL	163.	12.10	10.	2.	2.	.00	
+								1.22	12.10
+	HYDROGRAPH AT	+265OL	128.	12.08	8.	2.	2.	.00	
+	ROUTED TO	R265OL	125.	12.13	8.	2.	2.	.00	
+								.98	12.13
+	HYDROGRAPH AT	+240OL	131.	12.05	10.	2.	2.	.00	
+	5 COMBINED AT	CPDT2	934.	12.17	71.	18.	17.	.00	
+	ROUTED TO	RDT2OL	928.	12.20	71.	18.	17.	.00	
+								1.93	12.20
+	HYDROGRAPH AT	+160OL	64.	12.27	16.	5.	5.	.00	
+	HYDROGRAPH AT	+270OL	42.	12.17	3.	1.	1.	.00	
+	HYDROGRAPH AT	+56THS	79.	12.15	5.	1.	1.	.00	
+	ROUTED TO	R56OL	78.	12.23	5.	1.	1.	.00	
+								.48	12.23
+	4 COMBINED AT	CPDT3	1109.	12.20	96.	25.	24.	.00	
+	ROUTED TO	CPIBW	1095.	12.23	96.	25.	24.	.00	
+								2.22	12.23

```
          HYDROGRAPH AT
+                         100S       112.   12.02          12.          3.          3.        .09
          ROUTED TO
+                         R101       108.   12.20          12.          3.          3.        .09
+                                                                                                        .56       12.20
          HYDROGRAPH AT
+                         110S       100.   12.15          15.          4.          4.        .12
          2 COMBINED AT
+                        HC115       207.   12.17          27.          8.          7.        .20
          ROUTED TO
+                         R116       203.   12.32          27.          8.          7.        .20
+                                                                                                        .91       12.32
          HYDROGRAPH AT
+                         120S        91.   12.12          12.          3.          3.        .09
          2 COMBINED AT
+                        HC125       270.   12.25          39.         11.         11.        .29
1
                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
            ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                     PEAK                                     PEAK

                                (MIN)     (CFS)     (MIN)      (IN)    (MIN)     (CFS)     (MIN)       (IN)

            220PIP   MANE        1.00     12.58    724.00       .96     1.00     12.58    724.00        .96

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1231E+01 EXCESS= .0000E+00 OUTFLOW= .1231E+01 BASIN STORAGE= .1416E-03 PERCENT ERROR=    .0

               R212  MANE        1.00    285.24    712.00      1.44     1.00    285.24    712.00       1.44

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4935E+02 EXCESS= .0000E+00 OUTFLOW= .4935E+02 BASIN STORAGE= .8024E-02 PERCENT ERROR=    .0

               R266  MANE        1.00     92.00    720.00      1.24     1.00     92.00    720.00       1.24

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1232E+02 EXCESS= .0000E+00 OUTFLOW= .1231E+02 BASIN STORAGE= .1973E-02 PERCENT ERROR=    .1

               R156  MANE        1.00    135.00    718.00      1.21     1.00    135.00    718.00       1.21
```

```
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1822E+02 EXCESS= .0000E+00 OUTFLOW= .1820E+02 BASIN STORAGE= .1212E-02 PERCENT ERROR=    .1

          R217  MANE          .99    643.05    716.19      1.29      1.00    643.00    719.00        1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9370E+02 EXCESS= .0000E+00 OUTFLOW= .9369E+02 BASIN STORAGE= .2568E-01 PERCENT ERROR=    .0

          R246  MANE          .98    685.00    719.85      1.25      1.00    685.00    720.00        1.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9925E+02 EXCESS= .0000E+00 OUTFLOW= .9925E+02 BASIN STORAGE= .2989E-01 PERCENT ERROR=    .0

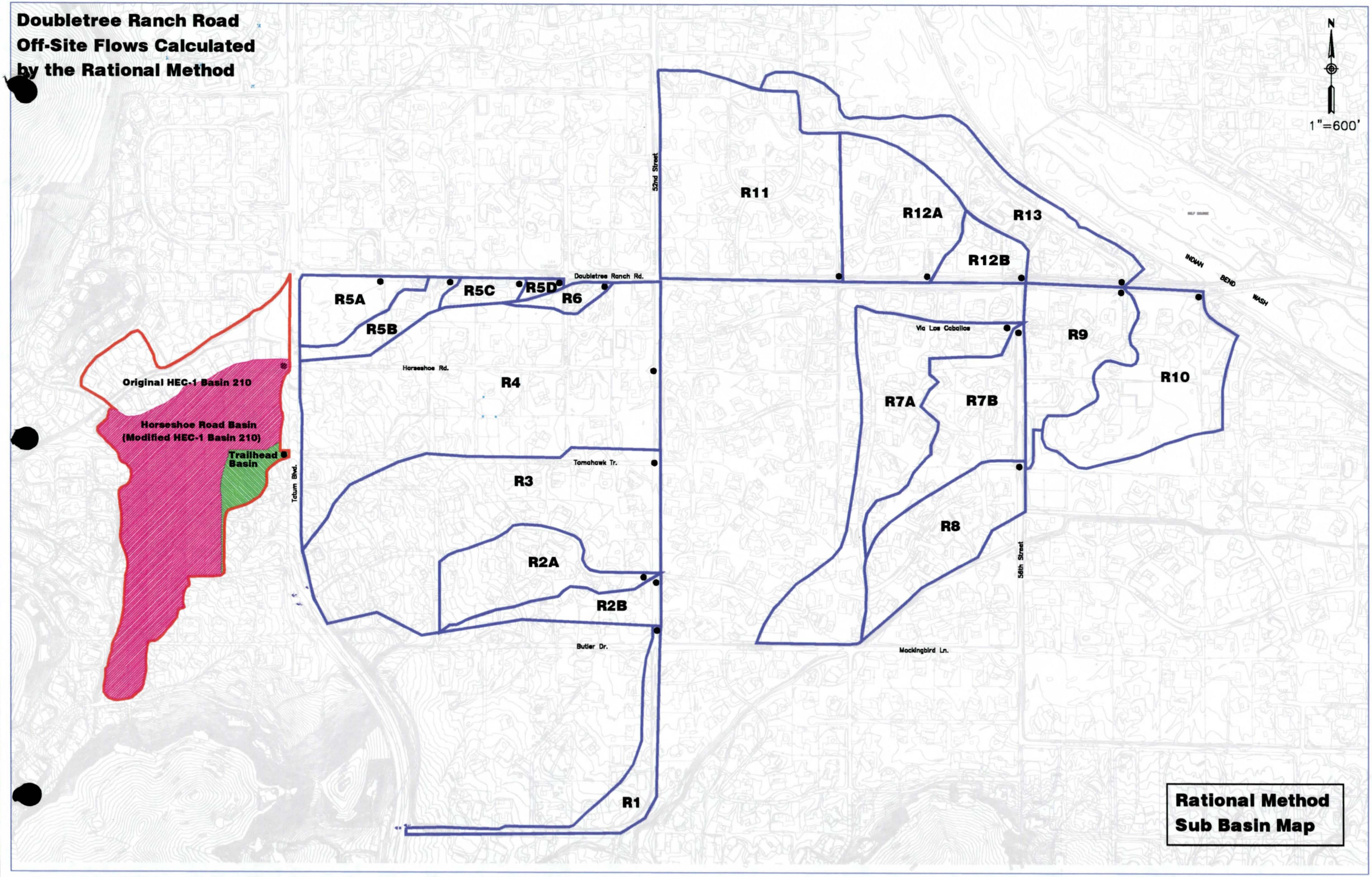
          R282  MANE         1.00    197.00    726.00     -1.00      1.00    197.00    726.00       -1.00

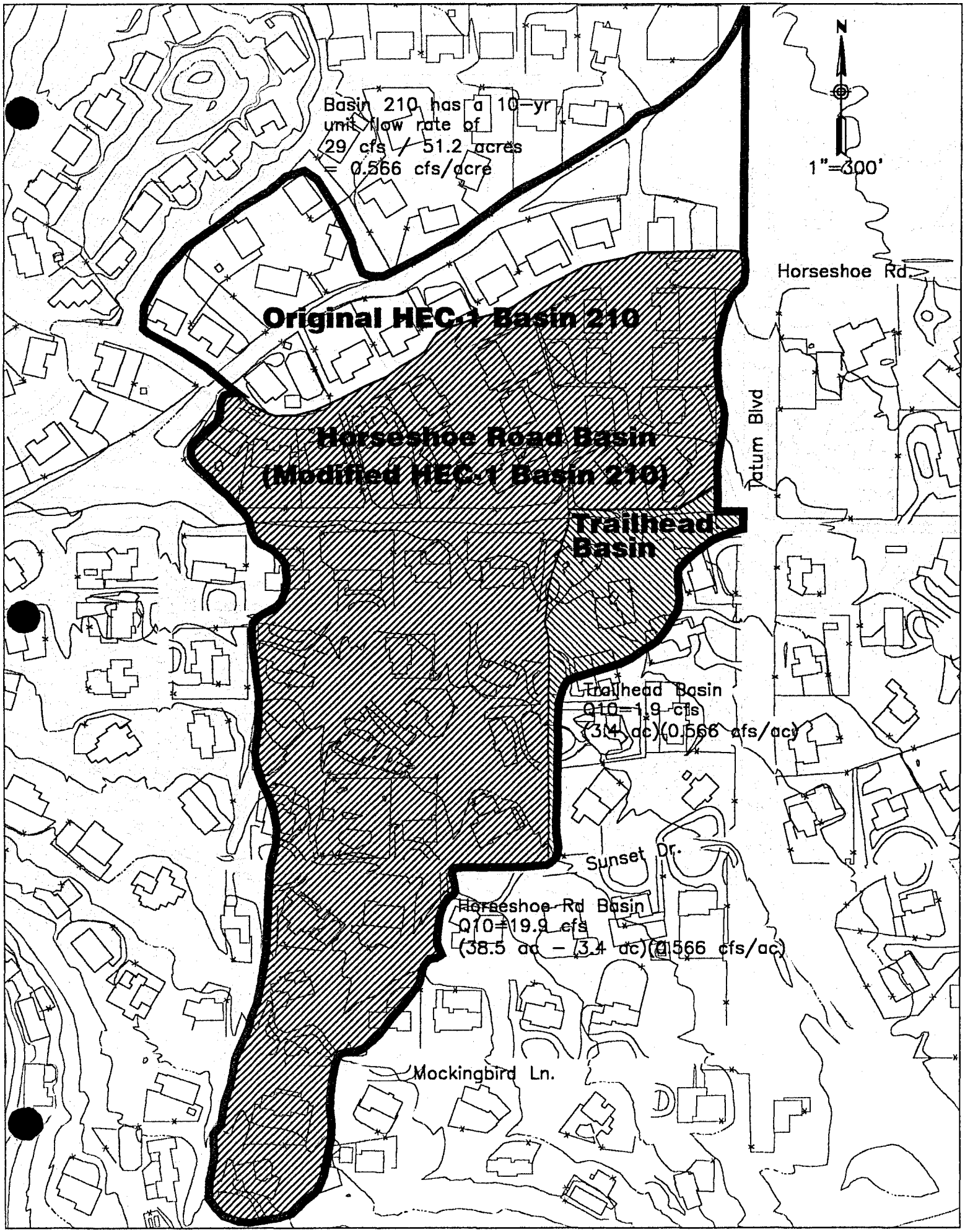
          R276  MANE         1.00    946.24    737.00      1.77      1.00    946.24    737.00        1.77

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1635E+03 EXCESS= .0000E+00 OUTFLOW= .1635E+03 BASIN STORAGE= .1387E+00 PERCENT ERROR=   -.1


*** NORMAL END OF HEC-1 ***
```

RATIONAL METHOD SUBBASIN MAPS & CALCULATION SHEETS


Doubletree Ranch Road
Off-Site Flows Calculated
by the Rational Method
N
1"=600'
52nd Street
R11
R12A
R13
R12B
INDIAN BEND WASH
Doubletree Ranch Rd.
R5A
R5C
R5D
R6
R5B
Via Los Caballos
R9
Horseshoe Rd.
R4
R10
Original HEC-1 Basin 210
R7A
R7B
Horseshoe Road Basin
(Modified HEC-1 Basin 210)
Trailhead Basin
Tomahawk Tr.
Tatum Blvd.
R3
R8
56th Street
R2A
R2B
Butler Dr.
Mockingbird Ln.
R1
Rational Method
Sub Basin Map


N
1"=300'
Basin 210 has a 10-yr
unit flow rate of
29 cfs / 51.2 acres
= 0.566 cfs/acre
Original HEC-1 Basin 210
Horseshoe Road Basin
(Modified HEC-1 Basin 210)
Trailhead
Basin
Horseshoe Rd.
Tatum Blvd
Trailhead Basin
Q10=1.9 cfs
(3.4 ac)(0.566 cfs/ac)
Sunset Dr.
Horseshoe Rd Basin
Q10=19.9 cfs
(38.5 ac - 3.4 ac)(0.566 cfs/ac)
Mockingbird Ln.

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R1** see note below.

Project Name: Double Tree Subarea id: R1

Drainage Area Cover:

DESIGN DATA

Drainage Area	7.7000	acres
Watercourse Length	3108.0000	feet
Top Elevation	1424.0000	feet
Bottom Elevation	1364.0000	feet
Slope	0.019	feet/feet
Roughness Coefficient (Kb)	0.1280	
10-year, 6-Hour Rainfall	2.0000	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	6	8	11	14	17
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	40.0	34.1	30.5	27.5	25.9	24.5
i (in/hr)	1.2	1.8	2.5	3.2	3.8	4.4

Not used for design, this catch basin was moved downstream. See calculations for Sub R1 + R2B.

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R2A**

Project Name: Double Tree Subarea id: R2A

Drainage Area Cover:

DESIGN DATA

Drainage Area 13.4000 acres

Watercourse Length 2106.0000 feet

Top Elevation 1392.0000 feet

Bottom Elevation 1362.0000 feet

Slope 0.014 feet/feet

Roughness Coefficient (Kb) 0.1220

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	8	11	15	21	27	32
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	33.2	28.6	25.8	23.4	22.1	20.9
i (in/hr)	1.4	2.1	2.7	3.6	4.2	4.8

Drains to Inlet #7A (CB 68 + CB 69)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R2B** See note below

Project Name: Double Tree Subarea id: R2B

Drainage Area Cover:

DESIGN DATA

Drainage Area 6.3000 acres

Watercourse Length 1745.0000 feet

Top Elevation 1392.0000 feet

Bottom Elevation 1362.0000 feet

Slope 0.017 feet/feet

Roughness Coefficient (Kb) 0.1300

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	6	8	11	14	16
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	27.9	24.3	22.2	20.2	19.0	18.0
i (in/hr)	1.6	2.3	3.0	3.8	4.5	5.2

Flow to catch basins from the west. This also receives runoff from Sub R1.

See Calculations for Sub R1 + R2B

Basin R1 + R2B

SUBBASIN R1 + R2B

The longest flow path is from Subbasin R1.

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Wtcrse. Length = 3630 (feet)
Top Elev. = 1424 (feet)
Bottom Elev. = 1362 (feet)
Slope = .0171 (feet/feet)

Kb = .1290
P(10,6) = 2 (inches)
Area = 14 (acres)
C(10) = .4

Hydrological Summary Table

PARAMETER		2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q	(cfs):	6	9	12	18	23	28
C	:	0.400	0.400	0.400	0.440	0.480	0.500
Tc	(min):	48.2	40.4	35.9	32.2	30.3	28.6
i(Adj)	(in/hr):	1.0	1.6	2.2	2.9	3.4	4.0
i(Phx)	(in/hr):	1.1	1.7	2.3	3.0	3.6	4.1

Drains to Inlet #7B (CB66 + CB67)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R3**

Project Name: Double Tree Subarea id: R3

Drainage Area Cover:

DESIGN DATA

Drainage Area 47.3000 acres

Watercourse Length 3120.0000 feet

Top Elevation 1424.0000 feet

Bottom Elevation 1356.0000 feet

Slope 0.022 feet/feet

Roughness Coefficient (Kb) 0.1080

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	27	40	52	74	94	113
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	33.2	28.7	25.9	23.4	22.1	20.9
i (in/hr)	1.4	2.1	2.7	3.6	4.2	4.8

Drains to Inlet # 6 (CB 72)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R4**

Project Name: Double Tree Subarea id: R4

Drainage Area Cover:

DESIGN DATA

Drainage Area 53.7000 acres

Watercourse Length 3025.0000 feet

Top Elevation 1406.0000 feet

Bottom Elevation 1356.0000 feet

Slope 0.016 feet/feet

Roughness Coefficient (Kb) 0.1070

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	28	42	56	80	103	123
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	36.6	31.4	28.2	25.5	24.0	22.7
i (in/hr)	1.3	2.0	2.6	3.4	4.0	4.6

Drains to Inlet #5 (CB75)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R5A**

Project Name: Double Tree Subarea id: R5A

Drainage Area Cover:

DESIGN DATA

Drainage Area 6.9000 acres

Watercourse Length 1067.0000 feet

Top Elevation 1384.0000 feet

Bottom Elevation 1372.0000 feet

Slope 0.011 feet/feet

Roughness Coefficient (Kb) 0.1290

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	5	7	9	12	16	19
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	23.7	20.8	19.2	17.5	16.5	15.6
i (in/hr)	1.8	2.6	3.2	4.1	4.8	5.6

Drains to Inlet #13 (CB4A)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R5B**

Project Name: Double Tree Subarea id: R5B

Drainage Area Cover:

DESIGN DATA

Drainage Area 4.8000 acres

Watercourse Length 1370.0000 feet

Top Elevation 1384.0000 feet

Bottom Elevation 1368.0000 feet

Slope 0.012 feet/feet

Roughness Coefficient (Kb) 0.1330

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	6	8	10	12
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	28.4	24.7	22.5	20.5	19.3	18.2
i (in/hr)	1.6	2.3	3.0	3.8	4.4	5.2

Drains to Inlet # 14 (CB 6 A)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R5C**

Project Name: Double Tree Subarea id: R5C

Drainage Area Cover:

DESIGN DATA

Drainage Area 2.3000 acres

Watercourse Length 667.0000 feet

Top Elevation 1371.0000 feet

Bottom Elevation 1364.0000 feet

Slope 0.010 feet/feet

Roughness Coefficient (Kb) 0.1410

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	3	5	6	7
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	19.1	16.8	15.7	14.2	13.4	12.7
i (in/hr)	2.1	2.9	3.5	4.5	5.3	6.1

Drains to Inlet #15 (CB11A)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R5D**

Project Name: Double Tree Subarea id: R5D

Drainage Area Cover:

DESIGN DATA

Drainage Area 0.8000 acres

Watercourse Length 394.0000 feet

Top Elevation 1364.0000 feet

Bottom Elevation 1362.0000 feet

Slope 0.005 feet/feet

Roughness Coefficient (Kb) 0.1520

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	2	2	2
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	19.1	16.8	15.7	14.2	13.5	12.7
i (in/hr)	2.1	2.9	3.5	4.5	5.3	6.1

Drains to Inlet #16 (CB 14B)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: Basin R6

Project Name: Doubletree Subarea id: R6

Drainage Area Cover:

DESIGN DATA

Drainage Area 1.9200 acres

Watercourse Length 780.0000 feet

Top Elevation 1366.0000 feet

Bottom Elevation 1360.0000 feet

Slope 0.008 feet/feet

Roughness Coefficient (Kb) 0.1370

10-year, 6-Hour Rainfall 2.0700 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	3	4	5	6
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	23.0	20.3	18.8	17.1	16.1	15.2
i (in/hr)	1.9	2.7	3.3	4.3	5.0	5.8

Drains to Inlet offsite (CB 16 A)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R7A**

Project Name: Double Tree Subarea id: R7A

Drainage Area Cover:

DESIGN DATA

Drainage Area 27.9000 acres

Watercourse Length 3564.0000 feet

Top Elevation 1360.0000 feet

Bottom Elevation 1340.0000 feet

Slope 0.006 feet/feet

Roughness Coefficient (Kb) 0.1140

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	7	13	19	28	35	43
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	77.0	60.0	51.9	46.6	44.0	41.5
i (in/hr)	0.6	1.2	1.7	2.3	2.6	3.1

Drains to Inlet #10a (CB82 + CB83)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R7B**

Project Name: Double Tree Subarea id: R7B

Drainage Area Cover:

DESIGN DATA

Drainage Area 15.7000 acres

Watercourse Length 2040.0000 feet

Top Elevation 1354.0000 feet

Bottom Elevation 1340.0000 feet

Slope 0.007 feet/feet

Roughness Coefficient (Kb) 0.1200

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	7	11	14	21	27	32
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	45.0	38.0	33.8	30.4	28.6	27.0
i (in/hr)	1.1	1.7	2.3	3.0	3.6	4.1

Drains to Inlet #10b (CB 80 + CB 81)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R8**

Project Name: Double Tree Subarea id: R8

Drainage Area Cover:

DESIGN DATA

Drainage Area 15.8000 acres

Watercourse Length 1874.0000 feet

Top Elevation 1360.0000 feet

Bottom Elevation 1346.0000 feet

Slope 0.007 feet/feet

Roughness Coefficient (Kb) 0.1200

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	8	12	15	22	29	35
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	40.5	34.5	30.8	27.7	26.1	24.7
i (in/hr)	1.2	1.8	2.4	3.2	3.8	4.4

Drains to Inlet #9 (CB 79)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R9**

Project Name: Double Tree Subarea id: R9

Drainage Area Cover:

DESIGN DATA

Drainage Area 15.1000 acres

Watercourse Length 1477.0000 feet

Top Elevation 1346.0000 feet

Bottom Elevation 1338.0000 feet

Slope 0.005 feet/feet

Roughness Coefficient (Kb) 0.1210

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	7	11	15	22	28	33
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	39.5	33.8	30.2	27.2	25.6	24.2
i (in/hr)	1.2	1.9	2.5	3.3	3.8	4.4

Drains to Inlet offsite (CB 51A + CB 51B)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R10**

Project Name: Double Tree Subarea id: R10

Drainage Area Cover:

DESIGN DATA

Drainage Area 23.2000 acres

Watercourse Length 1990.0000 feet

Top Elevation 1342.0000 feet

Bottom Elevation 1334.0000 feet

Slope 0.004 feet/feet

Roughness Coefficient (Kb) 0.1160

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	8	13	19	27	35	42
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	56.0	46.1	40.7	36.5	34.3	32.5
i (in/hr)	0.9	1.4	2.0	2.7	3.2	3.7

Drains to Inlet offsite (CB 57A)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R11**

Project Name: Double Tree Subarea id: R11

Drainage Area Cover:

DESIGN DATA

Drainage Area 40.6000 acres

Watercourse Length 2216.0000 feet

Top Elevation 1354.0000 feet

Bottom Elevation 1346.0000 feet

Slope 0.004 feet/feet

Roughness Coefficient (Kb) 0.1100

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	13	22	31	45	58	70
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	61.9	50.3	44.1	39.6	37.3	35.2
i (in/hr)	0.8	1.4	1.9	2.5	3.0	3.5

Drains to Inlet #12 (Bernell Wash Residual)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R12A**

Project Name: Double Tree Subarea id: R12A

Drainage Area Cover:

DESIGN DATA

Drainage Area 17.3000 acres

Watercourse Length 1434.0000 feet

Top Elevation 1346.5000 feet

Bottom Elevation 1343.0000 feet

Slope 0.002 feet/feet

Roughness Coefficient (Kb) 0.1190

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	6	10	14	20	26	32
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	56.4	46.4	40.9	36.7	34.5	32.6
i (in/hr)	0.9	1.4	2.0	2.7	3.1	3.6

Drains to Inlet offsite (CB36A + CB36B)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R12B**

Project Name: Double Tree Subarea id: R12B

Drainage Area Cover:

DESIGN DATA

Drainage Area 5.0000 acres

Watercourse Length 857.0000 feet

Top Elevation 1344.0000 feet

Bottom Elevation 1340.0000 feet

Slope 0.005 feet/feet

Roughness Coefficient (Kb) 0.1330

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	6	8	10	13
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	30.4	26.4	24.0	21.8	20.5	19.4
i (in/hr)	1.5	2.2	2.9	3.7	4.3	5.0

Drains to Inlet offsite (CB42A)

Flood Control District of Maricopa County
Drainage Design Manual Rational Method

Computed by: KWR Date: 11/9/98

LOCATION DATA

Location: **BASIN R13**

Project Name: Double Tree Subarea id: R13

Drainage Area Cover:

DESIGN DATA

Drainage Area 22.2000 acres

Watercourse Length 3277.0000 feet

Top Elevation 1352.0000 feet

Bottom Elevation 1336.0000 feet

Slope 0.005 feet/feet

Roughness Coefficient (Kb) 0.1160

10-year, 6-Hour Rainfall 2.0000 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	5	10	15	22	28	34
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	78.6	60.9	52.6	47.3	44.6	42.1
i (in/hr)	0.6	1.1	1.7	2.2	2.6	3.0

Drains to Inlet Offsite (CB52C + CB52D)

Table 3.1
Equation for Estimating K_b in the Tc Equation

$K_b = m \log A + b$ Where A is drainage area, in acres				
Type	Description	Typical Applications	Equation Parameters	
			m	b
A	Minimal roughness: Relatively smooth and/or well graded and uniform land surfaces. Surface runoff is sheet flow.	Commercial/ industrial areas Residential area Parks and golf courses	–0.00625	0.04
B	Moderately low roughness: Land surfaces have irregularly spaced roughness elements that protrude from the surface but the overall character of the surface is relatively uniform. Surface runoff is predominately sheet flow around the roughness elements.	Agricultural fields Pastures Desert rangelands Undeveloped urban lands	–0.01375	0.08
C	Moderately high roughness: Land surfaces that have significant large- to medium-sized roughness elements and/or poorly graded land surfaces that cause the flow to be diverted around the roughness elements. Surface runoff is sheet flow for short distances draining into meandering drainage paths.	Hillslopes Brushy alluvial fans Hilly rangeland Disturbed land, mining, etc. Forests with underbrush	–0.025	0.15
D	Maximum roughness: Rough land surfaces with torturous flow paths. Surface runoff is concentrated in numerous short flow paths that are often oblique to the main flow direction.	Mountains Some wetlands	–0.030	0.20

3.3 Assumptions

Application of the Rational Equation requires consideration of the following:

1. The peak discharge rate corresponding to a given intensity would occur only if the rainfall duration is at least equal to the time of concentration.

2. The calculated runoff is directly proportional to the rainfall intensity.

3. The frequency of occurrence for the peak discharge is the same as the frequency for the rainfall producing that event.

4. The runoff coefficient increases as storm frequency decreases.

CALCULATION OF SUBBASIN ROUGHNESS COEFFICIENT, Kb

$$K_b = m \log A = b$$

Type	m	b
A	-0.0063	0.04
B	-0.0138	0.08
C	-0.025	0.15
D	-0.03	0.20

Basin ID	Type	Basin Area	K_b
R1	C	7.70	0.1278
R2A	C	13.40	0.1218
R2B	C	6.30	0.1300
R3	C	47.30	0.1081
R4	C	53.70	0.1068
R5A	C	6.90	0.1290
R5B	C	4.80	0.1330
R5C	C	2.30	0.1410
R5D	C	0.80	0.1524
R6	C	11.60	0.1234
R7A	C	27.90	0.1139
R7B	C	15.70	0.1201
R8	C	15.80	0.1200
R9	C	15.10	0.1205
R10	C	23.20	0.1159
R11	C	40.60	0.1098
R12A	C	17.30	0.1190
R12B	C	5.00	0.1325
R13	C	22.20	0.1163
TRAILHEAD	C	3.40	0.1367

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

CALC _____ DATE _____ JOB _____
CHKD _____ DATE _____ SHT ____ OF ____

TITLE _____

RATIONAL METHOD C FACTOR OF 0.40 WAS USED IN CALC'S BECAUSE:

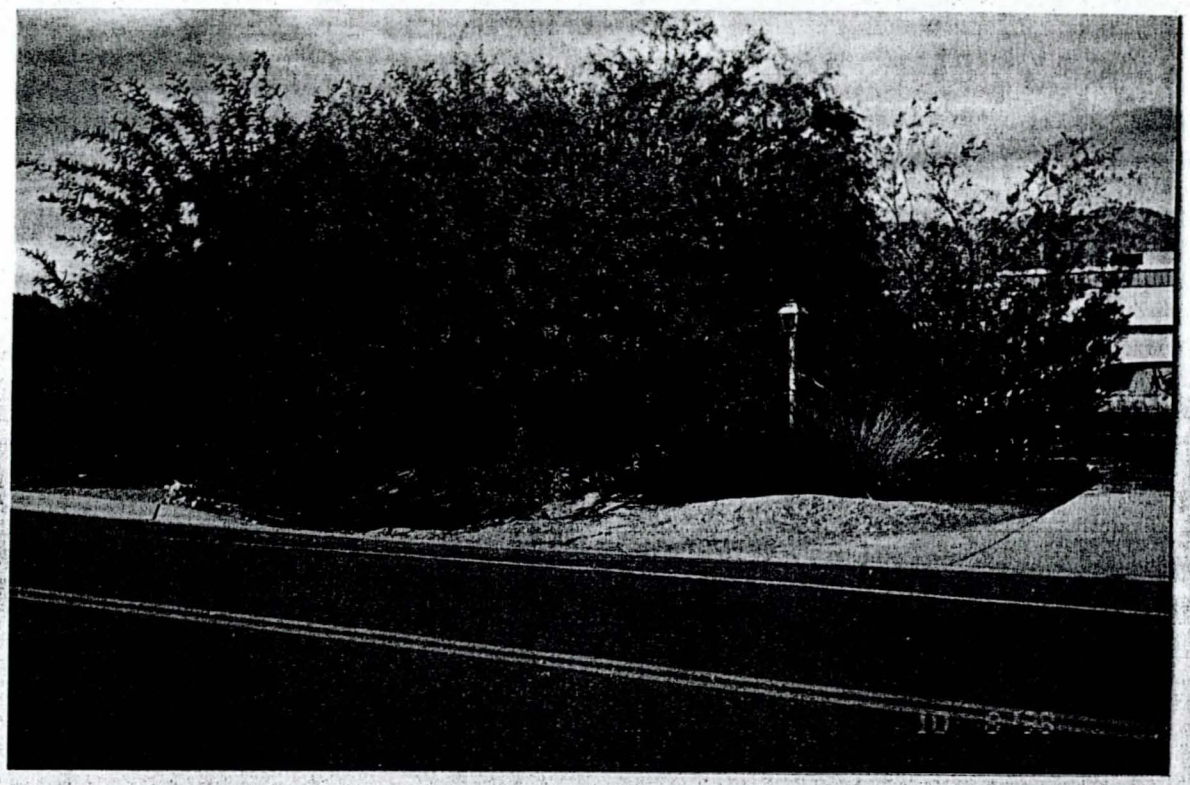
1) FROM TABLE 3.2 OF MARICOPA COUNTY DRAINAGE DESIGN MANUAL THE C FACTOR FOR SUBURBAN RESIDENTIAL AREAS AS WELL AS UNDEVELOPED DESERT IS 0.3 TO 0.4.
WITH THE LARGE LOT SIZE IN THE STUDY AREA (1/2 ACRE TO 2 ACRES AVERAGE) & THE FACT THAT MOST YARDS IN THE AREA HAVE BEEN LEFT AS UNDEVELOPED DESERT (SEE PHOTOS), THE STUDY AREA MORE CLOSELY REFLECTS A SUBURBAN RESIDENTIAL AREA THAN AN URBAN RESIDENTIAL AREA. 0.4 IS ON THE HIGH END OF THE RECOMMENDED RANGE & I FEEL IT IS JUSTIFIED TO BE USED IN OUR RATIONAL CALC'S.

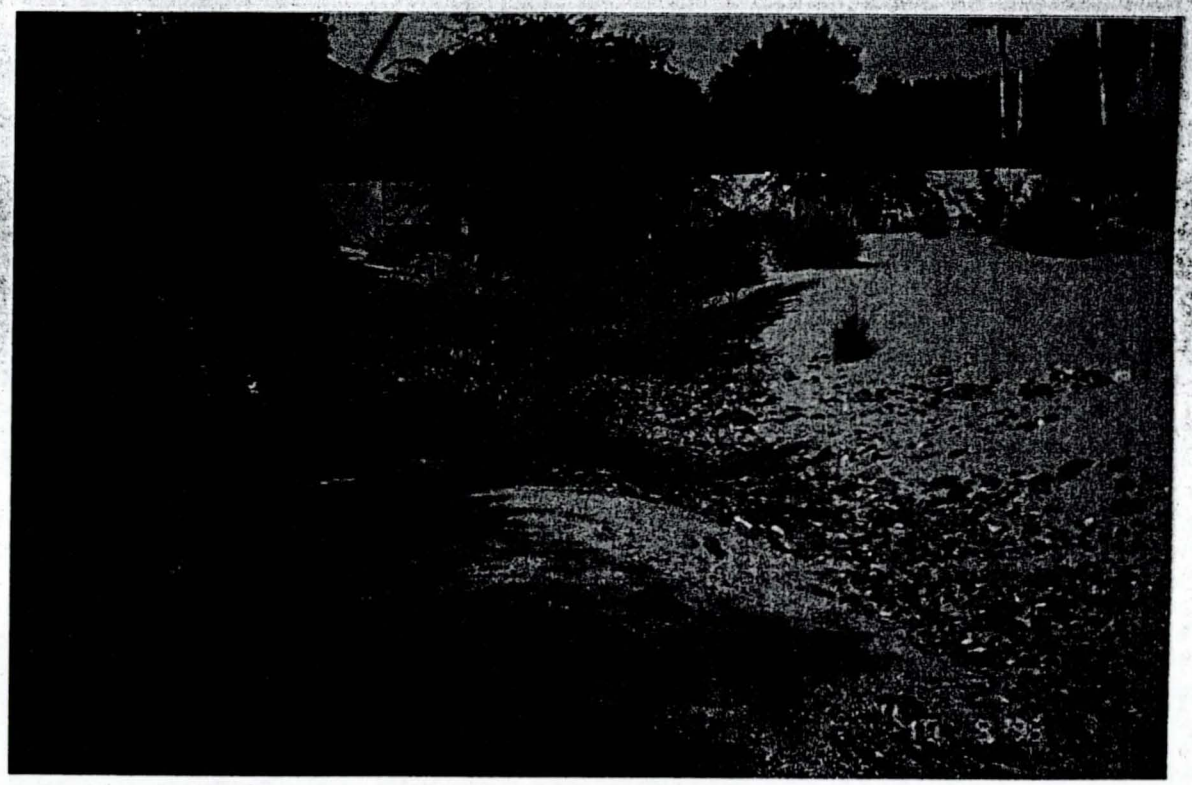
- KWR
11/10/98

Table 3.2
C Coefficients for Use with the Rational Method

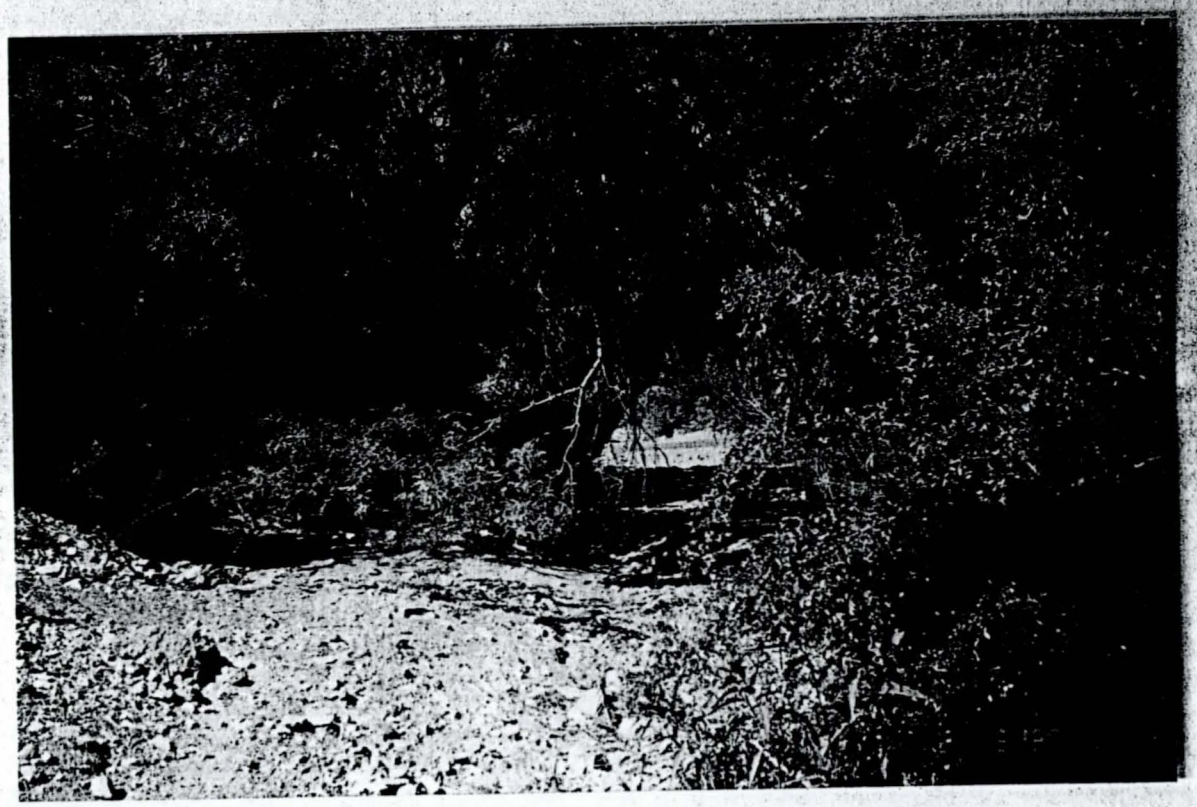
Land Use	Return Period			
	2-10 Year	25 Year	50 Year	100 Year
Streets and Roads				
Paved Roads	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Gravel Roadways & Shoulders	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Industrial Areas				
Heavy	0.70 – 0.80	0.77 – 0.88	0.84 – 0.95	0.88 – 0.95
Light	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Business Areas				
Downtown	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Neighborhood	0.55 – 0.65	0.61 – 0.72	0.66 – 0.78	0.69 – 0.81
Residential Areas				
Lawns – Flat	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
– Steep	0.25 – 0.40	0.28 – 0.44	0.30 – 0.48	0.31 – 0.50
Suburban	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Single Family	0.45 – 0.55	0.50 – 0.61	0.54 – 0.66	0.56 – 0.69
Multi-Unit	0.50 – 0.60	0.55 – 0.66	0.60 – 0.72	0.63 – 0.75
Apartments	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Parks/Cemetaries	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
Playgrounds	0.40 – 0.50	0.44 – 0.55	0.48 – 0.60	0.50 – 0.63
Agricultural Areas	0.10 – 0.20	0.11 – 0.22	0.12 – 0.24	0.13 – 0.25
Bare Ground	0.20 – 0.30	0.22 – 0.33	0.24 – 0.36	0.25 – 0.38
Undeveloped Desert	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Mountain Terrain (Slopes > 10%)	0.60 – 0.80	0.66 – 0.88	0.72 – 0.95	0.75 – 0.95

Note: Values of C for 25, 50 and 100 Year were derived using frequency adjustment factors of 1.10, 1.20, and 1.25, respectively, with an upper limit of 0.95 for C for the 2-10 Year values.





THESE PHOTOS ARE INDICATIVE OF THE YARDS IN THE AREA.



THESE PHOTOS ARE INDICATIVE OF THE CONDITION OF THE WASHES IN THE AREA.

HYDRAULIC GRADE LINE ANALYSIS USING StormPlus –

DOUBLETREE RANCH ROAD

Storm Plus Modeling Assumptions

➢ PARALLEL PIPE REACHES:

Parallel pipe reaches cannot be modeled in Storm Plus. These reaches were modeled by assuming each pipe carries half of the flow. The flow was reduced by half in the model, and conveyed by only one pipe. This accurately models the friction losses through the parallel pipe reach.

Double-barrel box culverts can be, and were, modeled accurately in Storm Plus.

➢ BENDS AND ANGLE POINTS:

Bends 15° or less in magnitude can be modeled accurately as angle points in Storm Plus.

Bends greater than 15° in magnitude must occur over a reach of length greater than 0' in Storm Plus. Wherever a bend greater than 15° occurs in the system, a short reach of approximately 5' was added, and the bend was forced to occur over that length.

For this reason, the stations in the model for the reaches immediately upstream and downstream from a bend greater than 15° will differ slightly (by about 2.5') from the true stations on the plans.

➢ BEGINNING TAILWATER ELEVATIONS (TWE):

The beginning TWE for the Doubletree Ranch Road (DTRR) model was provided by FCDMC. The instruction was to start at the 10-yr water surface elevation (WSE) in Indian Bend Wash, or the crown of the proposed outfall box culvert, whichever was higher. The 10-yr WSE in Indian Bend Wash is 1326.8', as provided by FCDMC. The soffit of the proposed outfall box culvert is 1329.31'. The beginning TWE for the DTRR model, therefore, is 1329.31'.

Once this was established, the DTRR model was run, and HGL elevations were read from the output at locations where the other models join the DTRR system. A list of the beginning TWE's for each model follows.

Location	File Name	Start HGL
DTRR	(dt_10.dat):	1329.31'
Tatum	(dtttm_10.dat):	1378.84'
52nd St. North	(dt52n_10.dat):	1349.07'
52nd St. South	(dt52s_10.dat):	1349.07'
56th St.	(dt56s_10.dat):	1334.22'

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

May 22, 2000 13: 6:43

Input file : dt_10.dat
Output file: dt_10.out

Note: Add 1,000 to all elevations to match construction drawing elevations.

INPUT FILE LISTING

```
T1  DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN  | BY: DIBBLE & ASSOCIATES
T2  TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
SO   1000.00 324.31 12      .012                 329.31
R    1215.00 324.83 12      .013                                          10.
R    1880.84 326.35 12      .012
JX   1885.84 326.37 12  1   .012     45.         328.12          90.
R    2574.28 328.86 12      .012
JX   2594.28 328.95 10  1  5.012     23.    219. 331.98 328.98   60.   60.
R    2637.00 329.18 10      .012
R    3861.26 335.92 10      .012
JX   3871.26 335.97 10  1   .012     17.         338.95          90.
R    3881.96 336.03 10      .012
JX   3891.96 336.08 10  1   .012     23.         336.06          90.
R    5186.00 343.20 10      .012
JX   5196.00 343.33  5  5  5.012    135.    197. 343.33 343.33   60.   60.
R    7776.00 369.84  5      .012                                          38.
JX   7786.00 369.94  4  3   .012   128.5         369.94           1.
R    7817.90 371.24  4      .012
JX   7819.90 371.33  4  2   .012     27.         327.08          45.
R    7950.48 376.72  4      .012
WE                   4
SH                   4
```

1

SP

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

0 CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			2.00														
CD	2	4			2.50														
CD	3	4			4.00														
CD	4	4			4.50														
CD	5	4			5.00														
CD	6	4			5.50														
CD	7	3	0	.00	5.00	5.00	.00	.00	.00										
CD	8	3	0	.00	6.00	5.00	.00	.00	.00										
CD	9	3	0	.00	4.00	5.13	.00	.00	.00										
CD	10	3	1	.75	5.00	12.70	.05	.00	.00										
CD	11	3	1	.75	5.00	14.70	.05	.00	.00										
CD	12	3	1	.92	5.00	20.90	.02	.00	.00										
CD	13	3	2	.75	5.00	25.50	.00	.00	.00										
CD	14	3	1	1.08	5.00	25.08	.03	.00	.00										
CD	15	3	1	.75	5.00	16.70	.05	.00	.00										
CD	16	3	1	.75	5.00	18.70	.05	.00	.00										

```
1
0                    WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                       DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN  | BY: DIBBLE & ASSOCIATES
0HEADING LINE NO 2 IS -
0                       TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
0HEADING LINE NO 3 IS -
0                       STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
```



```
1
0                    WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *         *     *
                      U/S DATA   STATION    INVERT  SECT                                W S ELEV
                                   1000.00  324.31   12                                  329.31
0 ELEMENT NO   2 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   1215.00  324.83   12              .013                            .00    .00   10.00      0
0 ELEMENT NO   3 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   1880.84  326.35   12              .012                            .00    .00     .00      0
0 ELEMENT NO   4 IS A JUNCTION           *         *     *     *                 *                     *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   1885.84  326.37   12     1     0  .012    45.0       .0   328.12      .00  90.00     .00
0 ELEMENT NO   5 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   2574.28  328.86   12              .012                            .00    .00     .00      0
0 ELEMENT NO   6 IS A JUNCTION           *         *     *     *                 *                     *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   2594.28  328.95   10     1     5  .012    23.0    219.0   331.98   328.98  60.00   60.00
0 ELEMENT NO   7 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   2637.00  329.18   10              .012                            .00    .00     .00      0
0 ELEMENT NO   8 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   3861.26  335.92   10              .012                            .00    .00     .00      0
0 ELEMENT NO   9 IS A JUNCTION           *         *     *     *                 *                     *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   3871.26  335.97   10     1     0  .012    17.0       .0   338.95      .00  90.00     .00
0 ELEMENT NO  10 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   3881.96  336.03   10              .012                            .00    .00     .00      0
0 ELEMENT NO  11 IS A JUNCTION           *         *     *     *                 *                     *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   3891.96  336.08   10     1     0  .012    23.0       .0   336.06      .00  90.00     .00
```



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1
0                    WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  12 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                   5186.00  343.20   10              .012                            .00    .00     .00      0
0 ELEMENT NO  13 IS A JUNCTION           *         *     *     *                 *                     *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   5196.00  343.33    5     5     5  .012   135.0    197.0   343.33   343.33  60.00   60.00
0 ELEMENT NO  14 IS A REACH              *         *     *
```

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                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                7776.00  369.84    5               .012                                  .00    .00   38.00      0
0 ELEMENT NO  15 IS A JUNCTION        *        *     *     *                 *                    *              *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                7786.00  369.94    4     3     0   .012    128.5       .0   369.94      .00   1.00     .00
0 ELEMENT NO  16 IS A REACH           *        *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                7817.90  371.24    4               .012                                  .00    .00     .00      0
0 ELEMENT NO  17 IS A JUNCTION        *        *     *     *                 *                    *              *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                7819.90  371.33    4     2     0   .012     27.0       .0   327.08      .00  45.00     .00
0 ELEMENT NO  18 IS A REACH           *        *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                7950.48  376.72    4               .012                                  .00    .00     .00      0
0 ELEMENT NO  19 IS A  WALL  ENTRANCE                 *
                    U/S DATA   STATION    INVERT  SECT             FP
                                7950.48  376.72    4               .500
0 ELEMENT NO  20 IS A SYSTEM HEADWORKS                *                        *
                    U/S DATA   STATION    INVERT  SECT                                   W S ELEV
                                7950.48  376.72    4                                         .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
```

WATER SURFACE PROFILE LISTING

DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 1000.00	324.31	5.00	329.31	943.0	9.46	1.39	330.70	.00	4.10		5.00	20.90	.02	1	.92
0 215.00	.00242					.00349	.75			4.65			.00		
0 1215.00	324.83	5.28	330.11	943.0	9.46	1.39	331.50	.00	4.10		5.00	20.90	.02	1	.92
0 665.84	.00228					.00297	1.98			4.48			.00		
0 1880.84	326.35	5.74	332.09	943.0	9.46	1.39	333.48	.00	4.10		5.00	20.90	.02	1	.92
0JUNCT STR	.00400					.00283	.01						.00		
0 1885.84	326.37	5.99	332.36	898.0	9.01	1.26	333.62	.00	3.97		5.00	20.90	.02	1	.92
0 688.44	.00362					.00270	1.86			3.66			.00		
0 2574.28	328.86	5.36	334.22	898.0	9.01	1.26	335.48	.00	3.97		5.00	20.90	.02	1	.92
0JUNCT STR	.00450					.00396	.08						.00		
0 2594.28	328.95	5.19	334.14	656.0	10.96	1.87	336.00	.00	4.53		5.00	12.70	.05	1	.75
0 42.72	.00538					.00522	.22			4.13			.00		
0 2637.00	329.18	5.18	334.36	656.0	10.96	1.87	336.23	.00	4.53		5.00	12.70	.05	1	.75
0 626.36	.00550					.00522	3.27			4.09			.00		
0 3263.36	332.63	5.00	337.63	656.0	10.96	1.87	339.49	.00	4.53		5.00	12.70	.05	1	.75
0 10.02	.00550					.00335	.03			4.09			.00		
0 3273.38	332.68	4.99	337.67	656.0	10.89	1.84	339.52	.00	4.53		5.00	12.70	.05	1	.75
0HYDRAULIC JUMP													.00		
0 3273.38	332.68	4.09	336.78	656.0	13.30	2.75	339.52	.00	4.53		5.00	12.70	.05	1	.75
0 241.21	.00550					.00551	1.33			4.09			.00		
0 3514.59	334.01	4.09	338.10	656.0	13.30	2.75	340.85	.00	4.53		5.00	12.70	.05	1	.75
0 211.32	.00550					.00546	1.15			4.09			.00		

WATER SURFACE PROFILE LISTING

DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 3725.91	335.17	4.12	339.29	656.0	13.22	2.71	342.01	.00	4.53		5.00	12.70	.05	1	.75
0 119.49	.00550					.00511	.61			4.09			.00		
0 3845.40	335.83	4.32	340.15	656.0	12.60	2.47	342.62	.00	4.53		5.00	12.70	.05	1	.75
0 15.86	.00550					.00452	.07			4.09			.00		
0 3861.26	335.92	4.53	340.45	656.0	12.01	2.24	342.69	.00	4.53		5.00	12.70	.05	1	.75
0JUNCT STR	.00500					.00460	.05						.00		
0 3871.26	335.97	5.10	341.07	639.0	10.67	1.77	342.84	.00	4.45		5.00	12.70	.05	1	.75
0 10.70	.00561					.00495	.05			3.98			.00		
0 3881.96	336.03	5.09	341.12	639.0	10.67	1.77	342.89	.00	4.45		5.00	12.70	.05	1	.75
0JUNCT STR	.00500					.00477	.05						.00		
0 3891.96	336.08	5.34	341.42	616.0	10.29	1.64	343.06	.00	4.34		5.00	12.70	.05	1	.75
0 376.31	.00550					.00460	1.73			3.90			.00		
0 4268.27	338.15	5.00	343.15	616.0	10.29	1.64	344.80	.00	4.34		5.00	12.70	.05	1	.75
0 24.99	.00550					.00309	.08			3.90			.00		
0 4293.26	338.29	4.82	343.10	616.0	10.60	1.75	344.85	.00	4.34		5.00	12.70	.05	1	.75
0HYDRAULIC JUMP													.00		
0 4293.26	338.29	3.90	342.19	616.0	13.11	2.67	344.86	.00	4.34		5.00	12.70	.05	1	.75
0 584.95	.00550					.00550	3.22			3.90			.00		
0 4878.21	341.51	3.90	345.41	616.0	13.11	2.67	348.08	.00	4.34		5.00	12.70	.05	1	.75
0 198.63	.00550					.00541	1.08			3.90			.00		
0 5076.84	342.60	3.95	346.55	616.0	12.95	2.61	349.15	.00	4.34		5.00	12.70	.05	1	.75
0 94.95	.00550					.00502	.48			3.90			.00		

WATER SURFACE PROFILE LISTING

DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 5171.79	343.12	4.14	347.26	616.0	12.35	2.37	349.63	.00	4.34		5.00	12.70	.05	1	.75
0 14.21	.00550					.00444	.06			3.90			.00		
0 5186.00	343.20	4.34	347.54	616.0	11.77	2.15	349.69	.00	4.34		5.00	12.70	.05	1	.75
0JUNCT STR	.01300					.00715	.07						.00		
0 5196.00	343.33	5.74	349.07	284.0	14.46	3.25	352.32	.00	4.60		5.00	.00	.00	0	.00
0 2580.00	.01027					.01013	26.14			4.07			.00		
0 7776.00	369.84	5.78	375.62	284.0	14.46	3.25	378.87	.00	4.60		5.00	.00	.00	0	.00
0JUNCT STR	.01000					.00773	.08						.00		
0 7786.00	369.94	7.98	377.92	155.5	9.78	1.49	379.41	.00	3.65		4.50	.00	.00	0	.00
0 31.90	.04075					.00533	.17			1.87			.00		
0 7817.90	371.24	6.85	378.09	155.5	9.78	1.49	379.58	.00	3.65		4.50	.00	.00	0	.00
0JUNCT STR	.04500					.00448	.01						.00		
0 7819.90	371.33	7.51	378.84	128.5	8.08	1.01	379.85	.00	3.34		4.50	.00	.00	0	.00
0 66.94	.04128					.00364	.24			1.68			.00		
0 7886.84	374.09	4.99	379.08	128.5	8.08	1.01	380.10	.00	3.34		4.50	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 7886.84	374.09	2.13	376.22	128.5	17.32	4.66	380.89	.00	3.34		4.50	.00	.00	0	.00
0 2.90	.04128					.01732	.05			1.68			.00		
0 7889.74	374.21	2.15	376.36	128.5	17.17	4.58	380.94	.00	3.34		4.50	.00	.00	0	.00
0 13.32	.04128					.01609	.21			1.68			.00		
0 7903.06	374.76	2.23	376.99	128.5	16.37	4.16	381.15	.00	3.34		4.50	.00	.00	0	.00
0 10.83	.04128					.01417	.15			1.68			.00		

WATER SURFACE PROFILE LISTING

DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 7913.89	375.21	2.31	377.52	128.5	15.61	3.79	381.31	.00	3.34	4.50	.00	.00	0	.00
0 8.86	.04128					.01248	.11		1.68			.00		
0 7922.75	375.58	2.40	377.98	128.5	14.88	3.44	381.42	.00	3.34	4.50	.00	.00	0	.00
0 7.23	.04128					.01101	.08		1.68			.00		
0 7929.98	375.87	2.50	378.37	128.5	14.19	3.13	381.50	.00	3.34	4.50	.00	.00	0	.00
0 5.88	.04128					.00972	.06		1.68			.00		
0 7935.86	376.12	2.59	378.71	128.5	13.53	2.84	381.55	.00	3.34	4.50	.00	.00	0	.00
0 4.70	.04128					.00859	.04		1.68			.00		
0 7940.56	376.31	2.70	379.01	128.5	12.90	2.59	381.60	.00	3.34	4.50	.00	.00	0	.00
0 3.68	.04128					.00760	.03		1.68			.00		
0 7944.24	376.46	2.81	379.27	128.5	12.30	2.35	381.62	.00	3.34	4.50	.00	.00	0	.00
0 2.77	.04128					.00674	.02		1.68			.00		
0 7947.01	376.58	2.93	379.51	128.5	11.73	2.14	381.64	.00	3.34	4.50	.00	.00	0	.00
0 1.93	.04128					.00599	.01		1.68			.00		
0 7948.95	376.66	3.05	379.71	128.5	11.18	1.94	381.65	.00	3.34	4.50	.00	.00	0	.00
0 1.16	.04128					.00533	.01		1.68			.00		
0 7950.11	376.70	3.19	379.89	128.5	10.66	1.77	381.66	.00	3.34	4.50	.00	.00	0	.00
0 .37	.04128					.00476	.00		1.68			.00		
0 7950.48	376.72	3.34	380.06	128.5	10.16	1.60	381.66	.00	3.34	4.50	.00	.00	0	.00
0 WALL ENTRANCE												.00		
0 7950.48	376.72	3.34	380.06	128.5	10.16	1.60	381.66	.00	3.34	4.50	.00	.00	0	.00

1

HYDRAULIC GRADE LINE ANALYSIS USING StormPlus –

TATUM BOULEVARD LATERAL

Storm Plus Modeling Assumptions

➤ PARALLEL PIPE REACHES:

Parallel pipe reaches cannot be modeled in Storm Plus. These reaches were modeled by assuming each pipe carries half of the flow. The flow was reduced by half in the model, and conveyed by only one pipe. This accurately models the friction losses through the parallel pipe reach.

Double-barrel box culverts can be, and were, modeled accurately in Storm Plus.

➤ BENDS AND ANGLE POINTS:

Bends 15° or less in magnitude can be modeled accurately as angle points in Storm Plus.

Bends greater than 15° in magnitude must occur over a reach of length greater than 0' in Storm Plus. Wherever a bend greater than 15° occurs in the system, a short reach of approximately 5' was added, and the bend was forced to occur over that length.

For this reason, the stations in the model for the reaches immediately upstream and downstream from a bend greater than 15° will differ slightly (by about 2.5') from the true stations on the plans.

➤ BEGINNING TAILWATER ELEVATIONS (TWE):

The beginning TWE for the Doubletree Ranch Road (DTRR) model was provided by FCDMC. The instruction was to start at the 10-yr water surface elevation (WSE) in Indian Bend Wash, or the crown of the proposed outfall box culvert, whichever was higher. The 10-yr WSE in Indian Bend Wash is 1326.8', as provided by FCDMC. The soffit of the proposed outfall box culvert is 1329.31'. The beginning TWE for the DTRR model, therefore, is 1329.31'.

Once this was established, the DTRR model was run, and HGL elevations were read from the output at locations where the other models join the DTRR system. A list of the beginning TWE's for each model follows.

Location	File Name	Start HGL
DTRR	(dt_10.dat):	1329.31'
Tatum	(dtttm_10.dat):	1378.84'
52nd St. North	(dt52n_10.dat):	1349.07'
52nd St. South	(dt52s_10.dat):	1349.07'
56th St.	(dt56s_10.dat):	1334.22'

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
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Version
Serial Number

May 22, 2000 13:11:41

Input file : dtttm_10.dat
Output file: dtttm_10.out

Note: Add 1,000 to all elevations to match construction drawings

INPUT FILE LISTING

```
T1  TATUM BLVD LATERAL                          | BY: DIBBLE & ASSOCIATES
T2  TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DTTTM_10.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE   | JOB NO: 9801
SO   2208.75 372.48  2                          378.84
R    2817.50 378.57  2      .012                                        2
JX   2822.50 379.65  1  1   .012     22.        379.59          90.
R    3210.00 389.34  1      .012                                        1
R    3425.44 393.47  1      .012
R    3430.44 393.57  1      .012                                90.     1
R    3479.44 394.51  1      .012
R    3481.44 394.61  1      .012                                90.
R    3733.44 402.58  1      .012                                        1
R    3738.44 402.74  1      .012                                90.
R    3753.77 406.20  1      .012
WE                   1
SH                   1
1                                                   SP
                                WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                          PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                      1.50
  CD      2    4                      2.50
  CD      3    4                      4.00
  CD      4    4                      4.50
  CD      5    4                      5.00
  CD      6    4                      5.50
  CD      7    4                      6.00
  CD      8    4                      6.50
  CD      9    3      0        .00    5.00    5.00    .00   .00   .00
  CD     10    3      0        .00    4.00    7.00    .00   .00   .00
  CD     11    3      1        .50    5.00   16.00    .05   .00   .00
  CD     12    3      2        .50    5.00   25.00    .00   .00   .00
  CD     13    3      2        .50    5.00   31.00    .00   .00   .00
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1                                                                                                                                  PAGE NO   1
0                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                             TATUM BLVD LATERAL                          | BY: DIBBLE & ASSOCIATES
0HEADING LINE NO 2 IS -
0                             TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DTTTM_10.DAT
0HEADING LINE NO 3 IS -
0                             STORM DRAIN DESIGN - HYDRAULIC GRADE LINE   | JOB NO: 9801
1                                                                                                                                  PAGE NO   2
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                   2208.75  372.48    2                                       378.84
0 ELEMENT NO   2 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2817.50  378.57    2             .012                                 .00    .00     .00      2
0 ELEMENT NO   3 IS A JUNCTION          *         *     *     *                 *                 *          *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   2822.50  379.65    1     1     0  .012    22.0       .0   379.59      .00  90.00     .00
0 ELEMENT NO   4 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3210.00  389.34    1             .012                                 .00    .00     .00      1
0 ELEMENT NO   5 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3425.44  393.47    1             .012                                 .00    .00     .00      0
0 ELEMENT NO   6 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3430.44  393.57    1             .012                                 .00  90.00     .00      1
0 ELEMENT NO   7 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3479.44  394.51    1             .012                                 .00    .00     .00      0
0 ELEMENT NO   8 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3481.44  394.61    1             .012                                 .00  90.00     .00      0
0 ELEMENT NO   9 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3733.44  402.58    1             .012                                 .00    .00     .00      1
0 ELEMENT NO  10 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3738.44  402.74    1             .012                                 .00  90.00     .00      0
0 ELEMENT NO  11 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3753.77  406.20    1             .012                                 .00    .00     .00      0
0 ELEMENT NO  12 IS A  WALL  ENTRANCE                 *
                      U/S DATA   STATION    INVERT  SECT             FP
                                   3753.77  406.20    1            .500
0 ELEMENT NO  13 IS A SYSTEM HEADWORKS                *                        *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                   3753.77  406.20    1                                         .00
1                                                                                                                                  PAGE NO   3
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
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** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

WATER SURFACE PROFILE LISTING

TATUM BLVD LATERAL | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DTTTM_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 2208.75	372.48	6.36	378.84	34.0	6.93	.75	379.59	.00	1.98		2.50	.00	.00	0	.00
0 608.75	.01000					.00585	3.56			1.64			.00		
0 2817.50	378.57	3.91	382.48	34.0	6.93	.75	383.22	.00	1.98		2.50	.00	.00	0	.00
0JUNCT STR	.21600					.00849	.04						.00		
0 2822.50	379.65	4.31	383.96	12.0	6.79	.72	384.67	.00	1.31		1.50	.00	.00	0	.00
0 178.12	.02501					.01112	1.98			.90			.00		
0 3000.62	384.10	1.85	385.95	12.0	6.79	.72	386.67	.00	1.31		1.50	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 3000.62	384.10	.90	385.00	12.0	10.84	1.83	386.83	.00	1.31		1.50	.00	.00	0	.00
0 98.19	.02501					.02464	2.42			.90			.00		
0 3098.81	386.56	.90	387.46	12.0	10.84	1.83	389.29	.00	1.31		1.50	.00	.00	0	.00
0 25.03	.02501					.02450	.61			.90			.00		
0 3123.83	387.19	.90	388.09	12.0	10.79	1.81	389.90	.00	1.31		1.50	.00	.00	0	.00
0 62.54	.02501					.02297	1.44			.90			.00		
0 3186.37	388.75	.94	389.69	12.0	10.29	1.65	391.33	.00	1.31		1.50	.00	.00	0	.00
0 23.63	.02501					.02036	.48			.90			.00		
0 3210.00	389.34	.98	390.32	12.0	9.81	1.50	391.82	.00	1.31		1.50	.00	.00	0	.00
0 80.60	.01917					.01915	1.54			.98			.00		
0 3290.60	390.89	.98	391.87	12.0	9.81	1.50	393.36	.00	1.31		1.50	.00	.00	0	.00
0 92.29	.01917					.01992	1.84			.98			.00		
0 3382.89	392.65	.95	393.61	12.0	10.12	1.59	395.20	.00	1.31		1.50	.00	.00	0	.00
0 42.55	.01917					.02202	.94			.98			.00		

WATER SURFACE PROFILE LISTING

TATUM BLVD LATERAL | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DTTTM_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 3425.44	393.47	.92	394.39	12.0	10.61	1.75	396.14	.00	1.31	1.50	.00	.00	0	.00
0 5.00	.02000					.02355	.12		.97			.00		
0 3430.44	393.57	.91	394.48	12.0	10.69	1.77	396.26	.00	1.31	1.50	.00	.00	0	.00
0 14.46	.01918					.02458	.36		.98			.00		
0 3444.90	393.85	.89	394.74	12.0	10.97	1.87	396.61	.00	1.31	1.50	.00	.00	0	.00
0 19.41	.01918					.02707	.53		.98			.00		
0 3464.31	394.22	.86	395.08	12.0	11.51	2.06	397.13	.00	1.31	1.50	.00	.00	0	.00
0 15.13	.01918					.03065	.46		.98			.00		
0 3479.44	394.51	.82	395.33	12.0	12.07	2.26	397.60	.00	1.31	1.50	.00	.00	0	.00
0 2.00	.04999					.03217	.06		.72			.00		
0 3481.44	394.61	.83	395.44	12.0	11.96	2.22	397.66	.00	1.31	1.50	.00	.00	0	.00
0 45.80	.03163					.03179	1.46		.83			.00		
0 3527.24	396.06	.83	396.89	12.0	11.96	2.22	399.11	.00	1.31	1.50	.00	.00	0	.00
0 73.40	.03163					.03246	2.38		.83			.00		
0 3600.64	398.38	.82	399.20	12.0	12.15	2.30	401.49	.00	1.31	1.50	.00	.00	0	.00
0 53.30	.03163					.03535	1.88		.83			.00		
0 3653.94	400.07	.79	400.85	12.0	12.75	2.52	403.38	.00	1.31	1.50	.00	.00	0	.00
0 26.38	.03163					.04010	1.06		.83			.00		
0 3680.32	400.90	.76	401.66	12.0	13.37	2.78	404.44	.00	1.31	1.50	.00	.00	0	.00
0 17.97	.03163					.04552	.82		.83			.00		
0 3698.30	401.47	.73	402.20	12.0	14.02	3.06	405.25	.00	1.31	1.50	.00	.00	0	.00
0 13.88	.03163					.05170	.72		.83			.00		

WATER SURFACE PROFILE LISTING

TATUM BLVD LATERAL | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DTTTM_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
3712.17	401.91	.70	402.61	12.0	14.71	3.36	405.97	.00	1.31	1.50	.00	.00	0	.00
11.46	.03163					.05877	.67		.83			.00		
3723.63	402.27	.68	402.95	12.0	15.42	3.70	406.65	.00	1.31	1.50	.00	.00	0	.00
9.81	.03163					.06689	.66		.83			.00		
3733.44	402.58	.66	403.24	12.0	16.18	4.07	407.30	.00	1.31	1.50	.00	.00	0	.00
5.00	.03200					.07389	.37		.83			.00		
3738.44	402.74	.64	403.38	12.0	16.61	4.29	407.67	.00	1.31	1.50	.00	.00	0	.00
.00	.03200					.07657	.00		.83			.00		
3738.44	402.74	.64	403.38	12.0	16.61	4.29	407.67	.00	1.31	1.50	.00	.00	0	.00
.44	.22570					.07551	.03		.48			.00		
3738.88	402.84	.65	403.48	12.0	16.45	4.20	407.69	.00	1.31	1.50	.00	.00	0	.00
2.30	.22570					.06994	.16		.48			.00		
3741.18	403.36	.67	404.03	12.0	15.68	3.82	407.85	.00	1.31	1.50	.00	.00	0	.00
1.96	.22570					.06148	.12		.48			.00		
3743.14	403.80	.70	404.50	12.0	14.95	3.47	407.97	.00	1.31	1.50	.00	.00	0	.00
1.68	.22570					.05409	.09		.48			.00		
3744.82	404.18	.72	404.90	12.0	14.26	3.16	408.06	.00	1.31	1.50	.00	.00	0	.00
1.46	.22570					.04762	.07		.48			.00		
3746.28	404.51	.75	405.26	12.0	13.59	2.87	408.13	.00	1.31	1.50	.00	.00	0	.00
1.26	.22570					.04193	.05		.48			.00		
3747.55	404.80	.78	405.57	12.0	12.96	2.61	408.18	.00	1.31	1.50	.00	.00	0	.00
1.10	.22570					.03696	.04		.48			.00		

WATER SURFACE PROFILE LISTING

TATUM BLVD LATERAL | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DTTTM_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 3748.65	405.04	.81	405.85	12.0	12.36	2.37	408.23	.00	1.31		1.50	.00	.00	0	.00
0 .95	.22570					.03260	.03			.48			.00		
0 3749.60	405.26	.84	406.10	12.0	11.78	2.16	408.26	.00	1.31		1.50	.00	.00	0	.00
0 .83	.22570					.02879	.02			.48			.00		
0 3750.43	405.45	.87	406.32	12.0	11.23	1.96	408.28	.00	1.31		1.50	.00	.00	0	.00
0 .72	.22570					.02544	.02			.48			.00		
0 3751.14	405.61	.91	406.52	12.0	10.71	1.78	408.30	.00	1.31		1.50	.00	.00	0	.00
0 .61	.22570					.02253	.01			.48			.00		
0 3751.75	405.74	.95	406.69	12.0	10.21	1.62	408.31	.00	1.31		1.50	.00	.00	0	.00
0 .52	.22570					.01998	.01			.48			.00		
0 3752.28	405.86	.99	406.85	12.0	9.74	1.47	408.32	.00	1.31		1.50	.00	.00	0	.00
0 .44	.22570					.01776	.01			.48			.00		
0 3752.71	405.96	1.03	406.99	12.0	9.28	1.34	408.33	.00	1.31		1.50	.00	.00	0	.00
0 .36	.22570					.01583	.01			.48			.00		
0 3753.07	406.04	1.08	407.12	12.0	8.85	1.22	408.34	.00	1.31		1.50	.00	.00	0	.00
0 .29	.22570					.01415	.00			.48			.00		
0 3753.37	406.11	1.12	407.23	12.0	8.44	1.11	408.34	.00	1.31		1.50	.00	.00	0	.00
0 .21	.22570					.01270	.00			.48			.00		
0 3753.58	406.16	1.18	407.34	12.0	8.05	1.01	408.34	.00	1.31		1.50	.00	.00	0	.00
0 .14	.22570					.01148	.00			.48			.00		
0 3753.72	406.19	1.24	407.43	12.0	7.67	.92	408.34	.00	1.31		1.50	.00	.00	0	.00
0 .05	.22570					.01049	.00			.48			.00		
0 3753.77	406.20	1.31	407.51	12.0	7.31	.83	408.34	.00	1.31		1.50	.00	.00	0	.00
0 WALL ENTRANCE													.00		
0 3753.77	406.20	1.32	407.52	12.0	7.31	.83	408.34	.00	1.31		1.50	.00	.00	0	.00

1

HYDRAULIC GRADE LINE ANALYSIS USING StormPlus –

52nd STREET NORTH LATERAL

Storm Plus Modeling Assumptions

➤ PARALLEL PIPE REACHES:

Parallel pipe reaches cannot be modeled in Storm Plus. These reaches were modeled by assuming each pipe carries half of the flow. The flow was reduced by half in the model, and conveyed by only one pipe. This accurately models the friction losses through the parallel pipe reach.

Double-barrel box culverts can be, and were, modeled accurately in Storm Plus.

➤ BENDS AND ANGLE POINTS:

Bends 15° or less in magnitude can be modeled accurately as angle points in Storm Plus.

Bends greater than 15° in magnitude must occur over a reach of length greater than 0' in Storm Plus. Wherever a bend greater than 15° occurs in the system, a short reach of approximately 5' was added, and the bend was forced to occur over that length.

For this reason, the stations in the model for the reaches immediately upstream and downstream from a bend greater than 15° will differ slightly (by about 2.5') from the true stations on the plans.

➤ BEGINNING TAILWATER ELEVATIONS (TWE):

The beginning TWE for the Doubletree Ranch Road (DTRR) model was provided by FCDMC. The instruction was to start at the 10-yr water surface elevation (WSE) in Indian Bend Wash, or the crown of the proposed outfall box culvert, whichever was higher. The 10-yr WSE in Indian Bend Wash is 1326.8', as provided by FCDMC. The soffit of the proposed outfall box culvert is 1329.31'. The beginning TWE for the DTRR model, therefore, is 1329.31'.

Once this was established, the DTRR model was run, and HGL elevations were read from the output at locations where the other models join the DTRR system. A list of the beginning TWE's for each model follows.

Location	File Name	Start HGL
DTRR	(dt_10.dat):	1329.31'
Tatum	(dtttm_10.dat):	1378.84'
52nd St. North	(dt52n_10.dat):	1349.07'
52nd St. South	(dt52s_10.dat):	1349.07'
56th St.	(dt56s_10.dat):	1334.22'

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

May 26, 2000 10:51: 7

Input file : dt52n_10.dat
Output file: dt52n_10.out

Note: Add 1,000 to all elevations to match construction drawings.

INPUT FILE LISTING

```
T1  52nd STREET LATERAL - NORTH LATERAL          | BY: DIBBLE & ASSOCIATES
T2  TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT52N_10.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
SO   1017.09 343.22  5                          349.07
R    1059.41 343.35  5      .012
R    1064.41 343.38  5      .012                                21.
R    2335.90 347.18  5      .012
R    2340.90 347.19  5      .012                                45.
R    2364.18 347.26  5      .012
R    2369.18 347.28  5      .012                                45.
R    2383.73 347.32  5      .012
WE                   5
SH                   5
1                                                   SP
                                   WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                          PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                      2.00
  CD      2    4                      2.50
  CD      3    4                      4.00
  CD      4    4                      4.50
  CD      5    4                      5.00
  CD      6    4                      5.50
  CD      7    4                      6.00
  CD      8    4                      6.50
  CD      9    3      0        .00    5.00    5.00    .00   .00   .00
  CD     10    3      0        .00    4.00    7.00    .00   .00   .00
  CD     11    3      1        .50    5.00   16.00    .05   .00   .00
  CD     12    3      2        .50    5.00   25.00    .00   .00   .00
  CD     13    3      2        .50    5.00   31.00    .00   .00   .00
```

```
1
0                                                                                                                                PAGE NO   1
                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                            52nd STREET LATERAL - NORTH LATERAL          | BY: DIBBLE & ASSOCIATES
0HEADING LINE NO 2 IS -
0                            TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT52N_10.DAT
0HEADING LINE NO 3 IS -
0                            STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
1
0                                                                                                                                PAGE NO   2
                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                  1017.09  343.22    5                                        349.07
0 ELEMENT NO   2 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  1059.41  343.35    5              .012                                 .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  1064.41  343.38    5              .012                                 .00  21.00     .00      0
0 ELEMENT NO   4 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  2335.90  347.18    5              .012                                 .00    .00     .00      0
0 ELEMENT NO   5 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  2340.90  347.19    5              .012                                 .00  45.00     .00      0
0 ELEMENT NO   6 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  2364.18  347.26    5              .012                                 .00    .00     .00      0
0 ELEMENT NO   7 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  2369.18  347.28    5              .012                                 .00  45.00     .00      0
0 ELEMENT NO   8 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                  2383.73  347.32    5              .012                                 .00    .00     .00      0
0 ELEMENT NO   9 IS A  WALL  ENTRANCE                 *
                      U/S DATA   STATION    INVERT  SECT             FP
                                  2383.73  347.32    5             .500
0 ELEMENT NO  10 IS A SYSTEM HEADWORKS                *                        *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                  2383.73  347.32    5                                           .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
```

WATER SURFACE PROFILE LISTING

52nd STREET LATERAL - NORTH LATERAL | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT52N_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	1017.09	343.22	5.85	349.07	135.0	6.88	.73	349.80	.00	3.33		5.00	.00	.00	0	.00
0	42.32	.00307					.00229	.10			3.58			.00		
0	1059.41	343.35	5.82	349.17	135.0	6.88	.73	349.90	.00	3.33		5.00	.00	.00	0	.00
0	5.00	.00600					.00229	.01			2.84			.00		
0	1064.41	343.38	5.87	349.25	135.0	6.88	.73	349.98	.00	3.33		5.00	.00	.00	0	.00
0	1242.59	.00299					.00228	2.83			3.62			.00		
0	2307.00	347.09	5.00	352.09	135.0	6.88	.73	352.83	.00	3.33		5.00	.00	.00	0	.00
0	28.90	.00299					.00221	.06			3.62			.00		
0	2335.90	347.18	4.98	352.16	135.0	6.88	.74	352.89	.00	3.33		5.00	.00	.00	0	.00
0	5.00	.00200					.00216	.01			4.54			.00		
0	2340.90	347.19	4.98	352.17	135.0	6.88	.74	352.90	.00	3.33		5.00	.00	.00	0	.00
0	23.28	.00301					.00214	.05			3.62			.00		
0	2364.18	347.26	4.95	352.21	135.0	6.89	.74	352.95	.00	3.33		5.00	.00	.00	0	.00
0	5.00	.00400					.00211	.01			3.25			.00		
0	2369.18	347.28	4.94	352.22	135.0	6.89	.74	352.96	.00	3.33		5.00	.00	.00	0	.00
0	14.55	.00275					.00209	.03			3.75			.00		
0	2383.73	347.32	4.93	352.25	135.0	6.89	.74	352.99	.00	3.33		5.00	.00	.00	0	.00
0	WALL ENTRANCE													.00		
0	2383.73	347.32	4.93	352.25	135.0	6.89	.74	352.99	.00	3.33		5.00	.00	.00	0	.00

1

HYDRAULIC GRADE LINE ANALYSIS USING StormPlus –

52nd STREET SOUTH LATERAL

Storm Plus Modeling Assumptions

➤ PARALLEL PIPE REACHES:

Parallel pipe reaches cannot be modeled in Storm Plus. These reaches were modeled by assuming each pipe carries half of the flow. The flow was reduced by half in the model, and conveyed by only one pipe. This accurately models the friction losses through the parallel pipe reach.

Double-barrel box culverts can be, and were, modeled accurately in Storm Plus.

➤ BENDS AND ANGLE POINTS:

Bends 15° or less in magnitude can be modeled accurately as angle points in Storm Plus.

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For this reason, the stations in the model for the reaches immediately upstream and downstream from a bend greater than 15° will differ slightly (by about 2.5') from the true stations on the plans.

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The beginning TWE for the Doubletree Ranch Road (DTRR) model was provided by FCDMC. The instruction was to start at the 10-yr water surface elevation (WSE) in Indian Bend Wash, or the crown of the proposed outfall box culvert, whichever was higher. The 10-yr WSE in Indian Bend Wash is 1326.8', as provided by FCDMC. The soffit of the proposed outfall box culvert is 1329.31'. The beginning TWE for the DTRR model, therefore, is 1329.31'.

Once this was established, the DTRR model was run, and HGL elevations were read from the output at locations where the other models join the DTRR system. A list of the beginning TWE's for each model follows.

Location	File Name	Start HGL
DTRR	(dt_10.dat):	1329.31'
Tatum	(dtttm_10.dat):	1378.84'
52nd St. North	(dt52n_10.dat):	1349.07'
52nd St. South	(dt52s_10.dat):	1349.07'
56th St.	(dt56s_10.dat):	1334.22'

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

May 22, 2000 14:48:45

Input file : dt52s_10.dat
Output file: dt52s_10.out

Note: Add 1,000 to all elevations to match construction drawings.

INPUT FILE LISTING

```
T1  52nd STREET LATERAL - SOUTH LATERAL          | BY: DIBBLE & ASSOCIATES
T2  DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
SO   2016.01 343.22  6                           349.07
R    2053.43 343.44  6      .012
R    2058.43 343.47  6      .012                                  23.
R    2385.00 344.67  6      .012
TS   2390.00 344.69  7      .012
R    2425.00 344.82  7      .012
TS   2430.00 344.84  6      .012
R    2645.50 345.64  6      .012
JX   2650.50 345.66  6  4   .012     50.         346.62          90.
R    3297.78 348.05  6      .012
JX   3302.78 348.07  3  4   .012     38.         348.31          45.
R    4124.86 352.10  3      .012                                          2
JX   4129.86 352.13  3  1   .012     11.         353.36          90.
R    4188.00 352.41  3      .012
JX   4193.00 352.44  3  1   .012      6.         353.67          90.
R    4616.27 354.51  3      .012                                          1
R    4621.27 354.53  3      .012                                  45.
R    4661.97 354.73  3      .012
R    4666.97 354.76  3      .012                                  45.
R    4952.18 356.16  3      .012                                          2
JX   4957.18 357.72  2  2   .012     45.         356.17          90.
R    5867.91 374.10  2      .012                                          3
R    5872.91 374.19  2      .012                                  30.     1
R    5924.06 375.11  2      .012
R    5929.06 375.20  2      .012                                  28.     1
R    6262.34 388.03  2      .012
R    6267.34 388.22  2      .012                                  66.
R    6280.84 388.74  2      .012
WE                   2
SH                   2
```

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

0 CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			2.00														
CD	2	4			2.50														
CD	3	4			4.00														
CD	4	4			3.50														
CD	5	4			5.00														
CD	6	4			5.50														
CD	7	4			5.00														
CD	8	4			6.50														
CD	9	3	0	.00	4.00	5.00	.00	.00	.00										
CD	10	3	0	.00	4.00	7.00	.00	.00	.00										
CD	11	3	1	.50	5.00	16.50	.00	.00	.00										
CD	12	3	2	.50	5.00	25.00	.00	.00	.00										
CD	13	3	2	.50	5.00	31.00	.00	.00	.00										
CD	14	3	0	.00	5.00	6.00	.00	.00	.00										

```
1                                                                                                                                PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                 52nd STREET LATERAL - SOUTH LATERAL          | BY: DIBBLE & ASSOCIATES
0HEADING LINE NO 2 IS -
0                                 DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
0HEADING LINE NO 3 IS -
0                                 STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
1                                                                                                                                PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *         *     *
                      U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                                   2016.01  343.22    6                                         349.07
0 ELEMENT NO   2 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2053.43  343.44    6             .012                                 .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2058.43  343.47    6             .012                                 .00  23.00     .00      0
0 ELEMENT NO   4 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2385.00  344.67    6             .012                                 .00    .00     .00      0
0 ELEMENT NO   5 IS A TRANSITION         *         *     *
                      U/S DATA   STATION    INVERT  SECT              N
                                   2390.00  344.69    7             .012
0 ELEMENT NO   6 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2425.00  344.82    7             .012                                 .00    .00     .00      0
0 ELEMENT NO   7 IS A TRANSITION         *         *     *
                      U/S DATA   STATION    INVERT  SECT              N
                                   2430.00  344.84    6             .012
0 ELEMENT NO   8 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2645.50  345.64    6             .012                                 .00    .00     .00      0
0 ELEMENT NO   9 IS A JUNCTION           *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   2650.50  345.66    6     4     0   .012     50.0       .0   346.62      .00  90.00     .00
0 ELEMENT NO  10 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3297.78  348.05    6             .012                                 .00    .00     .00      0
0 ELEMENT NO  11 IS A JUNCTION           *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   3302.78  348.07    3     4     0   .012     38.0       .0   348.31      .00  45.00     .00
1                                                                                                                                PAGE NO   3
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  12 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                   4124.86  352.10    3             .012                                 .00    .00     .00      2
0 ELEMENT NO  13 IS A JUNCTION           *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   4129.86  352.13    3     1     0   .012     11.0       .0   353.36      .00  90.00     .00
0 ELEMENT NO  14 IS A REACH              *         *     *
```

```
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                4188.00  352.41    3              .012                                   .00    .00     .00      0
0 ELEMENT NO  15 IS A JUNCTION          *         *     *     *                 *                 *                 *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                4193.00  352.44    3     1     0   .012      6.0       .0   353.67      .00  90.00     .00
0 ELEMENT NO  16 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                4616.27  354.51    3              .012                                   .00    .00     .00      1
0 ELEMENT NO  17 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                4621.27  354.53    3              .012                                   .00  45.00     .00      0
0 ELEMENT NO  18 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                4661.97  354.73    3              .012                                   .00    .00     .00      0
0 ELEMENT NO  19 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                4666.97  354.76    3              .012                                   .00  45.00     .00      0
0 ELEMENT NO  20 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                4952.18  356.16    3              .012                                   .00    .00     .00      2
0 ELEMENT NO  21 IS A JUNCTION          *         *     *     *                 *                 *                 *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                4957.18  357.72    2     2     0   .012     45.0       .0   356.17      .00  90.00     .00
1                                                                                                                     PAGE NO   4
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  22 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                5867.91  374.10    2              .012                                   .00    .00     .00      3
0 ELEMENT NO  23 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                5872.91  374.19    2              .012                                   .00  30.00     .00      1
0 ELEMENT NO  24 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                5924.06  375.11    2              .012                                   .00    .00     .00      0
0 ELEMENT NO  25 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                5929.06  375.20    2              .012                                   .00  28.00     .00      1
0 ELEMENT NO  26 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                6262.34  388.03    2              .012                                   .00    .00     .00      0
0 ELEMENT NO  27 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                6267.34  388.22    2              .012                                   .00  66.00     .00      0
0 ELEMENT NO  28 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                6280.84  388.74    2              .012                                   .00    .00     .00      0
0 ELEMENT NO  29 IS A  WALL  ENTRANCE                   *
                    U/S DATA   STATION    INVERT  SECT             FP
                                6280.84  388.74    2              .500
0 ELEMENT NO  30 IS A SYSTEM HEADWORKS                  *                       *
                    U/S DATA   STATION    INVERT  SECT                                   W S ELEV
                                6280.84  388.74    2                                          .00
```

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

WATER SURFACE PROFILE LISTING

52nd STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 2016.01	343.22	5.85	349.07	197.0	8.29	1.07	350.14	.00	3.93		5.50	.00	.00	0	.00
0 37.42	.00588					.00293	.11			3.41			.00		
0 2053.43	343.44	5.74	349.18	197.0	8.29	1.07	350.25	.00	3.93		5.50	.00	.00	0	.00
0 5.00	.00600					.00293	.01			3.39			.00		
0 2058.43	343.47	5.83	349.30	197.0	8.29	1.07	350.37	.00	3.93		5.50	.00	.00	0	.00
0 326.57	.00368					.00293	.96			4.05			.00		
0 2385.00	344.67	5.59	350.26	197.0	8.29	1.07	351.33	.00	3.93		5.50	.00	.00	0	.00
0TRANS STR	.00400					.00390	.02						.00		
0 2390.00	344.69	5.19	349.88	197.0	10.03	1.56	351.45	.00	4.01		5.00	.00	.00	0	.00
0 35.00	.00371					.00488	.17			5.00			.00		
0 2425.00	344.82	5.23	350.05	197.0	10.03	1.56	351.62	.00	4.01		5.00	.00	.00	0	.00
0TRANS STR	.00400					.00390	.02						.00		
0 2430.00	344.84	5.78	350.62	197.0	8.29	1.07	351.69	.00	3.93		5.50	.00	.00	0	.00
0 215.50	.00371					.00293	.63			4.04			.00		
0 2645.50	345.64	5.61	351.25	197.0	8.29	1.07	352.32	.00	3.93		5.50	.00	.00	0	.00
0JUNCT STR	.00400					.00228	.01						.00		
0 2650.50	345.66	6.55	352.21	147.0	6.19	.59	352.80	.00	3.38		5.50	.00	.00	0	.00
0 509.38	.00369					.00162	.83			3.28			.00		
0 3159.88	347.54	5.50	353.04	147.0	6.19	.59	353.64	.00	3.38		5.50	.00	.00	0	.00
0 137.90	.00369					.00151	.21			3.28			.00		
0 3297.78	348.05	5.17	353.22	147.0	6.34	.63	353.84	.00	3.38		5.50	.00	.00	0	.00
0JUNCT STR	.00400					.00316	.02						.00		

WATER SURFACE PROFILE LISTING

52nd STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 3302.78	348.07	4.96	353.03	109.0	8.67	1.17	354.20	.00	3.16		4.00	.00	.00	0	.00
0 822.08	.00490					.00491	4.03			3.28			.00		
0 4124.86	352.10	5.08	357.18	109.0	8.67	1.17	358.35	.00	3.16		4.00	.00	.00	0	.00
0JUNCT STR	.00600					.00444	.02						.00		
0 4129.86	352.13	5.52	357.65	98.0	7.80	.95	358.59	.00	3.00		4.00	.00	.00	0	.00
0 58.14	.00482					.00397	.23			2.99			.00		
0 4188.00	352.41	5.47	357.88	98.0	7.80	.95	358.82	.00	3.00		4.00	.00	.00	0	.00
0JUNCT STR	.00600					.00373	.02						.00		
0 4193.00	352.44	5.68	358.12	92.0	7.32	.83	358.95	.00	2.91		4.00	.00	.00	0	.00
0 423.27	.00489					.00350	1.48			2.82			.00		
0 4616.27	354.51	5.13	359.64	92.0	7.32	.83	360.48	.00	2.91		4.00	.00	.00	0	.00
0 5.00	.00400					.00350	.02			3.07			.00		
0 4621.27	354.53	5.25	359.78	92.0	7.32	.83	360.61	.00	2.91		4.00	.00	.00	0	.00
0 40.70	.00491					.00350	.14			2.82			.00		
0 4661.97	354.73	5.19	359.92	92.0	7.32	.83	360.75	.00	2.91		4.00	.00	.00	0	.00
0 5.00	.00600					.00350	.02			2.62			.00		
0 4666.97	354.76	5.29	360.05	92.0	7.32	.83	360.89	.00	2.91		4.00	.00	.00	0	.00
0 285.21	.00491					.00350	1.00			2.82			.00		
0 4952.18	356.16	4.98	361.14	92.0	7.32	.83	361.97	.00	2.91		4.00	.00	.00	0	.00
0JUNCT STR	.31200					.00734	.04						.00		
0 4957.18	357.72	4.25	361.97	47.0	9.57	1.42	363.39	.00	2.26		2.50	.00	.00	0	.00
0 200.55	.01799					.01119	2.24			1.67			.00		

WATER SURFACE PROFILE LISTING

52nd STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 5157.73	361.33	2.93	364.26	47.0	9.57	1.42	365.68	.00	2.26	2.50	.00	.00	0	.00
0HYDRAULIC JUMP												.00		
0 5157.73	361.33	1.67	363.00	47.0	13.47	2.82	365.82	.00	2.26	2.50	.00	.00	0	.00
0 369.65	.01799					.01805	6.67		1.67			.00		
0 5527.38	367.98	1.67	369.65	47.0	13.47	2.82	372.47	.00	2.26	2.50	.00	.00	0	.00
0 175.43	.01799					.01885	3.31		1.67			.00		
0 5702.82	371.13	1.62	372.75	47.0	13.95	3.02	375.77	.00	2.26	2.50	.00	.00	0	.00
0 81.18	.01799					.02091	1.70		1.67			.00		
0 5783.99	372.59	1.56	374.15	47.0	14.63	3.33	377.47	.00	2.26	2.50	.00	.00	0	.00
0 48.42	.01799					.02359	1.14		1.67			.00		
0 5832.42	373.46	1.50	374.96	47.0	15.34	3.66	378.61	.00	2.26	2.50	.00	.00	0	.00
0 35.49	.01799					.02666	.95		1.67			.00		
0 5867.91	374.10	1.44	375.54	47.0	16.09	4.02	379.56	.00	2.26	2.50	.00	.00	0	.00
0 5.00	.01800					.02859	.14		1.67			.00		
0 5872.91	374.19	1.43	375.62	47.0	16.21	4.09	379.70	.00	2.26	2.50	.00	.00	0	.00
0 27.52	.01799					.03075	.85		1.67			.00		
0 5900.43	374.69	1.37	376.06	47.0	17.00	4.49	380.55	.00	2.26	2.50	.00	.00	0	.00
0 23.63	.01799					.03482	.82		1.67			.00		
0 5924.06	375.11	1.32	376.43	47.0	17.83	4.94	381.37	.00	2.26	2.50	.00	.00	0	.00
0 5.00	.01801					.03755	.19		1.67			.00		
0 5929.06	375.20	1.31	376.51	47.0	18.02	5.05	381.56	.00	2.26	2.50	.00	.00	0	.00
0 .00	.01801					.03810	.00		1.67			.00		

WATER SURFACE PROFILE LISTING

52nd STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 5929.06	375.20	1.31	376.51	47.0	18.02	5.05	381.56	.00	2.26		2.50	.00	.00	0	.00
0 87.62	.03850					.03768	3.30			1.31			.00		
0 6016.68	378.57	1.32	379.89	47.0	17.88	4.97	384.86	.00	2.26		2.50	.00	.00	0	.00
0 116.91	.03850					.03508	4.10			1.31			.00		
0 6133.59	383.07	1.37	384.44	47.0	17.05	4.52	388.96	.00	2.26		2.50	.00	.00	0	.00
0 47.32	.03850					.03096	1.47			1.31			.00		
0 6180.91	384.90	1.43	386.32	47.0	16.25	4.10	390.43	.00	2.26		2.50	.00	.00	0	.00
0 28.37	.03850					.02735	.78			1.31			.00		
0 6209.28	385.99	1.48	387.47	47.0	15.50	3.73	391.20	.00	2.26		2.50	.00	.00	0	.00
0 19.46	.03850					.02420	.47			1.31			.00		
0 6228.75	386.74	1.54	388.28	47.0	14.77	3.39	391.67	.00	2.26		2.50	.00	.00	0	.00
0 14.33	.03850					.02144	.31			1.31			.00		
0 6243.08	387.29	1.61	388.90	47.0	14.09	3.08	391.98	.00	2.26		2.50	.00	.00	0	.00
0 10.86	.03850					.01904	.21			1.31			.00		
0 6253.94	387.71	1.68	389.38	47.0	13.43	2.80	392.19	.00	2.26		2.50	.00	.00	0	.00
0 8.40	.03850					.01694	.14			1.31			.00		
0 6262.34	388.03	1.75	389.78	47.0	12.81	2.55	392.33	.00	2.26		2.50	.00	.00	0	.00
0 5.00	.03800					.01534	.08			1.31			.00		
0 6267.34	388.22	1.81	390.03	47.0	12.38	2.38	392.41	.00	2.26		2.50	.00	.00	0	.00
0 1.79	.03852					.01447	.03			1.30			.00		
0 6269.13	388.29	1.83	390.12	47.0	12.19	2.31	392.43	.00	2.26		2.50	.00	.00	0	.00
0 4.92	.03852					.01349	.07			1.30			.00		

1

WATER SURFACE PROFILE LISTING

52nd STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT52S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 6274.04	388.48	1.92	390.40	47.0	11.63	2.10	392.50	.00	2.26		2.50	.00	.00	0	.00
0 3.56	.03852					.01215	.04			1.30			.00		
0 6277.61	388.62	2.02	390.63	47.0	11.09	1.91	392.54	.00	2.26		2.50	.00	.00	0	.00
0 2.35	.03852					.01104	.03			1.30			.00		
0 6279.96	388.71	2.12	390.83	47.0	10.57	1.74	392.57	.00	2.26		2.50	.00	.00	0	.00
0 .88	.03852					.01018	.01			1.30			.00		
0 6280.84	388.74	2.26	391.00	47.0	10.07	1.58	392.58	.00	2.26		2.50	.00	.00	0	.00
0 WALL ENTRANCE															
0 6280.84	388.74	2.26	391.00	47.0	10.07	1.58	392.58	.00	2.26		2.50	.00	.00	0	.00
1															

HYDRAULIC GRADE LINE ANALYSIS USING StormPlus –

56th STREET SOUTH LATERAL

Storm Plus Modeling Assumptions

➤ PARALLEL PIPE REACHES:

Parallel pipe reaches cannot be modeled in Storm Plus. These reaches were modeled by assuming each pipe carries half of the flow. The flow was reduced by half in the model, and conveyed by only one pipe. This accurately models the friction losses through the parallel pipe reach.

Double-barrel box culverts can be, and were, modeled accurately in Storm Plus.

➤ BENDS AND ANGLE POINTS:

Bends 15° or less in magnitude can be modeled accurately as angle points in Storm Plus.

Bends greater than 15° in magnitude must occur over a reach of length greater than 0' in Storm Plus. Wherever a bend greater than 15° occurs in the system, a short reach of approximately 5' was added, and the bend was forced to occur over that length.

For this reason, the stations in the model for the reaches immediately upstream and downstream from a bend greater than 15° will differ slightly (by about 2.5') from the true stations on the plans.

➤ BEGINNING TAILWATER ELEVATIONS (TWE):

The beginning TWE for the Doubletree Ranch Road (DTRR) model was provided by FCDMC. The instruction was to start at the 10-yr water surface elevation (WSE) in Indian Bend Wash, or the crown of the proposed outfall box culvert, whichever was higher. The 10-yr WSE in Indian Bend Wash is 1326.8', as provided by FCDMC. The soffit of the proposed outfall box culvert is 1329.31'. The beginning TWE for the DTRR model, therefore, is 1329.31'.

Once this was established, the DTRR model was run, and HGL elevations were read from the output at locations where the other models join the DTRR system. A list of the beginning TWE's for each model follows.

Location	File Name	Start HGL
DTRR	(dt_10.dat):	1329.31'
Tatum	(dtttm_10.dat):	1378.84'
52nd St. North	(dt52n_10.dat):	1349.07'
52nd St. South	(dt52s_10.dat):	1349.07'
56th St.	(dt56s_10.dat):	1334.22'

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
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Version
Serial Number

May 22, 2000 15:24:51

Input file : dt56s_10.dat
Output file: dt56s_10.out

Note: Add 1,000 to all elevations to match construction drawings

INPUT FILE LISTING

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T1  56th STREET LATERAL - SOUTH LATERAL          | BY: DIBBLE & ASSOCIATES
T2  DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT56S_10.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
SO   2020.18 328.85  5                           334.22
R    2037.57 328.97  5      .012
R    2042.57 329.00  5      .012                                  27.
R    2295.00 330.75  5      .012
JX   2297.00 330.76  5  1   .012     14.         332.50          90.
R    2352.68 331.14  5      .012
JX   2357.68 331.18  5  1   .012      5.         332.91          90.
R    2358.68 331.19  5      .012
JX   2363.68 331.22  5  1   .012      5.         332.95          90.
R    3313.62 337.77  5      .012
JX   3318.62 337.80  5  1   .012     11.         339.54          90.
R    3850.19 341.48  5      .012
WE                   5
TS   3851.19 341.49 12
TS   3886.00 344.30 11
WE                  11
SH                  11
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1 SP

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

0 CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			2.00														
CD	2	4			2.50														
CD	3	4			4.00														
CD	4	4			4.50														
CD	5	4			5.00														
CD	6	4			5.50														
CD	7	4			6.00														
CD	8	4			6.50														
CD	9	3	0	.00	4.00	5.00	.00	.00	.00										
CD	10	3	0	.00	4.00	7.00	.00	.00	.00										
CD	11	3	0	.00	3.00	10.00	.00	.00	.00										
CD	12	3	0	.00	5.00	10.00	.00	.00	.00										
CD	13	3	2	.50	5.00	31.00	.00	.00	.00										
CD	14	3	0	.00	5.00	5.00	.00	.00	.00										

```
                    U/S DATA   STATION    INVERT  SECT              N
                                 3851.19  341.49   12              .014
0 ELEMENT NO  15 IS A TRANSITION        *         *     *
                    U/S DATA   STATION    INVERT  SECT              N
                                 3886.00  344.30   11              .014
0 ELEMENT NO  16 IS A  WALL  ENTRANCE                   *
                    U/S DATA   STATION    INVERT  SECT             FP
                                 3886.00  344.30   11              .500
0 ELEMENT NO  17 IS A SYSTEM HEADWORKS                  *                       *
                    U/S DATA   STATION    INVERT  SECT                                W S ELEV
                                 3886.00  344.30   11                                      .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
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1                                                                                                                                PAGE NO   1
0                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                             56th STREET LATERAL - SOUTH LATERAL          | BY: DIBBLE & ASSOCIATES
0HEADING LINE NO 2 IS -
0                             DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT56S_10.DAT
0HEADING LINE NO 3 IS -
0                             STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
1                                                                                                                                PAGE NO   2
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                   2020.18  328.85    5                                       334.22
0 ELEMENT NO   2 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2037.57  328.97    5                .012                                   .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2042.57  329.00    5                .012                                   .00  27.00     .00      0
0 ELEMENT NO   4 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2295.00  330.75    5                .012                                   .00    .00     .00      0
0 ELEMENT NO   5 IS A JUNCTION          *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   2297.00  330.76    5     1     0   .012     14.0       .0   332.50      .00  90.00     .00
0 ELEMENT NO   6 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2352.68  331.14    5                .012                                   .00    .00     .00      0
0 ELEMENT NO   7 IS A JUNCTION          *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   2357.68  331.18    5     1     0   .012      5.0       .0   332.91      .00  90.00     .00
0 ELEMENT NO   8 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   2358.68  331.19    5                .012                                   .00    .00     .00      0
0 ELEMENT NO   9 IS A JUNCTION          *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   2363.68  331.22    5     1     0   .012      5.0       .0   332.95      .00  90.00     .00
0 ELEMENT NO  10 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3313.62  337.77    5                .012                                   .00    .00     .00      0
0 ELEMENT NO  11 IS A JUNCTION          *         *     *     *                 *                    *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                   3318.62  337.80    5     1     0   .012     11.0       .0   339.54      .00  90.00     .00
1                                                                                                                                PAGE NO   3
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  12 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                   3850.19  341.48    5                .012                                   .00    .00     .00      0
0 ELEMENT NO  13 IS A  WALL  ENTRANCE                   *
                      U/S DATA   STATION    INVERT  SECT               FP
                                   3850.19  341.48    5                .500
0 ELEMENT NO  14 IS A TRANSITION        *         *     *
```

WATER SURFACE PROFILE LISTING

56th STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT56S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 2020.18	328.85	5.37	334.22	219.0	11.15	1.93	336.15	.00	4.20		5.00	.00	.00	0	.00
0 17.39	.00690					.00602	.10			3.83			.00		
0 2037.57	328.97	5.35	334.32	219.0	11.15	1.93	336.26	.00	4.20		5.00	.00	.00	0	.00
0 5.00	.00600					.00602	.03			4.11			.00		
0 2042.57	329.00	5.57	334.57	219.0	11.15	1.93	336.50	.00	4.20		5.00	.00	.00	0	.00
0 252.43	.00693					.00602	1.52			3.82			.00		
0 2295.00	330.75	5.34	336.09	219.0	11.15	1.93	338.02	.00	4.20		5.00	.00	.00	0	.00
0JUNCT STR	.00501					.00565	.01						.00		
0 2297.00	330.76	5.82	336.58	205.0	10.44	1.69	338.27	.00	4.08		5.00	.00	.00	0	.00
0 55.68	.00683					.00528	.29			3.64			.00		
0 2352.68	331.14	5.73	336.87	205.0	10.44	1.69	338.57	.00	4.08		5.00	.00	.00	0	.00
0JUNCT STR	.00800					.00515	.03						.00		
0 2357.68	331.18	5.88	337.06	200.0	10.19	1.61	338.67	.00	4.04		5.00	.00	.00	0	.00
0 1.00	.01001					.00502	.01			3.11			.00		
0 2358.68	331.19	5.88	337.07	200.0	10.19	1.61	338.68	.00	4.04		5.00	.00	.00	0	.00
0JUNCT STR	.00600					.00490	.02						.00		
0 2363.68	331.22	6.03	337.25	195.0	9.93	1.53	338.78	.00	3.99		5.00	.00	.00	0	.00
0 485.81	.00690					.00475	2.31			3.48			.00		
0 2849.49	334.57	5.00	339.57	195.0	9.93	1.53	341.10	.00	3.99		5.00	.00	.00	0	.00
0 124.69	.00690					.00445	.55			3.48			.00		
0 2974.18	335.43	4.55	339.98	195.0	10.40	1.68	341.66	.00	3.99		5.00	.00	.00	0	.00
0HYDRAULIC JUMP													.00		

WATER SURFACE PROFILE LISTING

56th STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT56S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 2974.18	335.43	3.48	338.91	195.0	13.35	2.77	341.68	.00	3.99		5.00	.00	.00	0	.00
0 5.59	.00690					.00690	.04			3.48			.00		
0 2979.77	335.47	3.48	338.95	195.0	13.35	2.77	341.72	.00	3.99		5.00	.00	.00	0	.00
0 261.83	.00690					.00655	1.72			3.48			.00		
0 3241.60	337.27	3.63	340.90	195.0	12.77	2.53	343.44	.00	3.99		5.00	.00	.00	0	.00
0 59.13	.00690					.00589	.35			3.48			.00		
0 3300.73	337.68	3.80	341.48	195.0	12.18	2.30	343.79	.00	3.99		5.00	.00	.00	0	.00
0 12.90	.00690					.00530	.07			3.48			.00		
0 3313.62	337.77	3.99	341.76	195.0	11.61	2.09	343.85	.00	3.99		5.00	.00	.00	0	.00
0JUNCT STR	.00600					.00441	.02						.00		
0 3318.62	337.80	4.89	342.69	184.0	9.42	1.38	344.07	.00	3.88		5.00	.00	.00	0	.00
0 79.15	.00692					.00377	.30			3.33			.00		
0 3397.77	338.35	4.50	342.85	184.0	9.88	1.52	344.37	.00	3.88		5.00	.00	.00	0	.00
0 .79	.00692					.00375	.00			3.33			.00		
0 3398.56	338.35	4.50	342.85	184.0	9.89	1.52	344.37	.00	3.88		5.00	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 3398.56	338.35	3.33	341.69	184.0	13.23	2.72	344.41	.00	3.88		5.00	.00	.00	0	.00
0 273.32	.00692					.00676	1.85			3.33			.00		
0 3671.88	340.25	3.39	343.64	184.0	12.98	2.62	346.25	.00	3.88		5.00	.00	.00	0	.00
0 129.03	.00692					.00624	.81			3.33			.00		
0 3800.91	341.14	3.54	344.68	184.0	12.37	2.38	347.06	.00	3.88		5.00	.00	.00	0	.00
0 39.53	.00692					.00557	.22			3.33			.00		

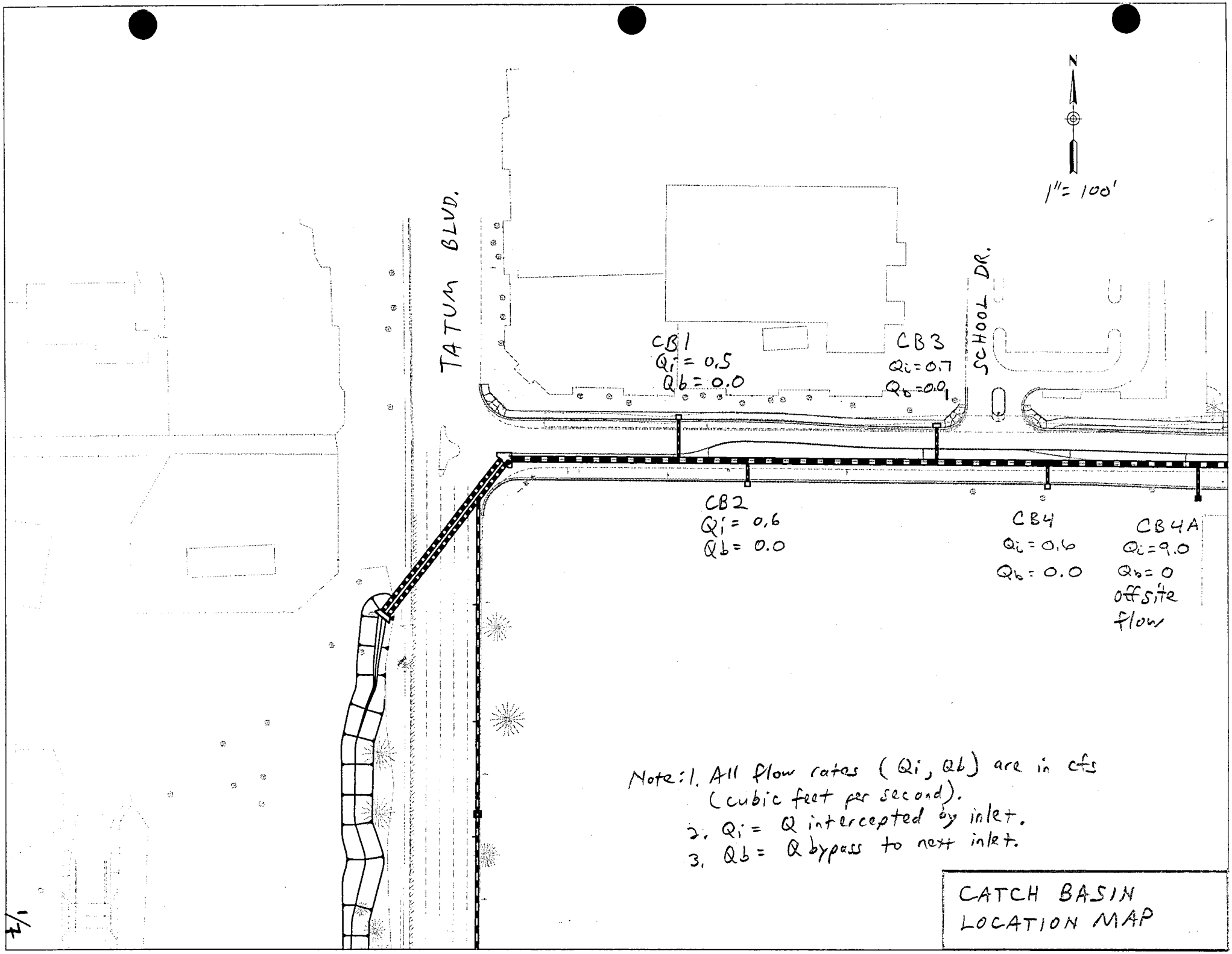
WATER SURFACE PROFILE LISTING

56th STREET LATERAL - SOUTH LATERAL | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: DT56S_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 3840.45	341.41	3.70	345.12	184.0	11.80	2.16	347.28	.00	3.88	5.00	.00	.00	0	.00
0 9.74	.00692					.00500	.05		3.33			.00		
0 3850.19	341.48	3.88	345.36	184.0	11.25	1.97	347.33	.00	3.88	5.00	.00	.00	0	.00
0 WALL ENTRANCE												.00		
0 3850.19	341.48	3.88	345.37	184.0	11.24	1.96	347.33	.00	3.88	5.00	.00	.00	0	.00
0TRANS STR	.00998					.00353	.00					.00		
0 3851.19	341.49	5.80	347.29	184.0	3.70	.21	347.51	.00	2.19	5.00	10.00	.00	0	.00
0TRANS STR	.08072					.00142	.05					.00		
0 3886.00	344.30	2.58	346.88	184.0	7.12	.79	347.67	.00	2.19	3.00	10.00	.00	0	.00
0 WALL ENTRANCE												.00		
0 3886.00	344.30	2.58	346.88	184.0	7.12	.79	347.67	.00	2.19	3.00	10.00	.00	0	.00

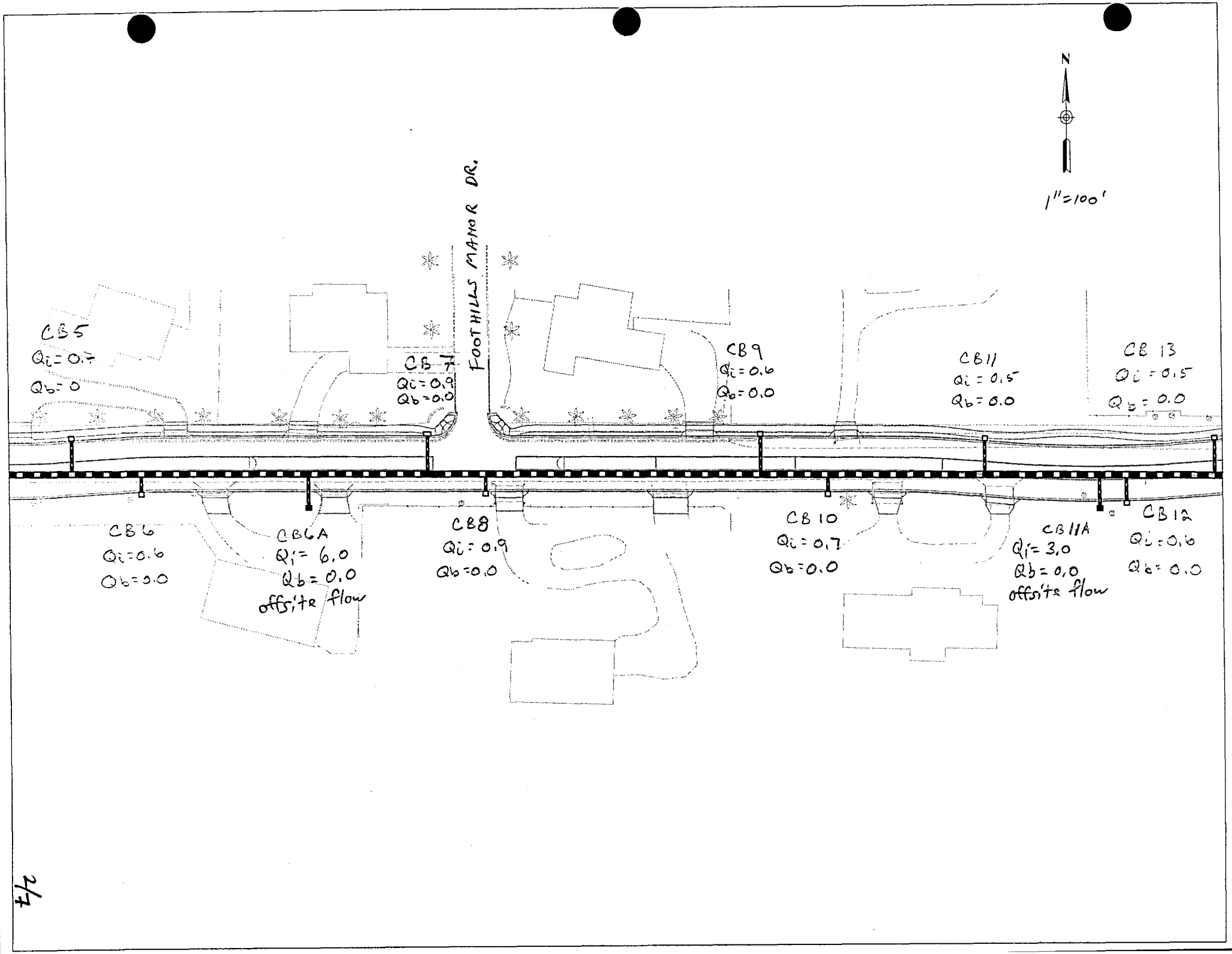
1

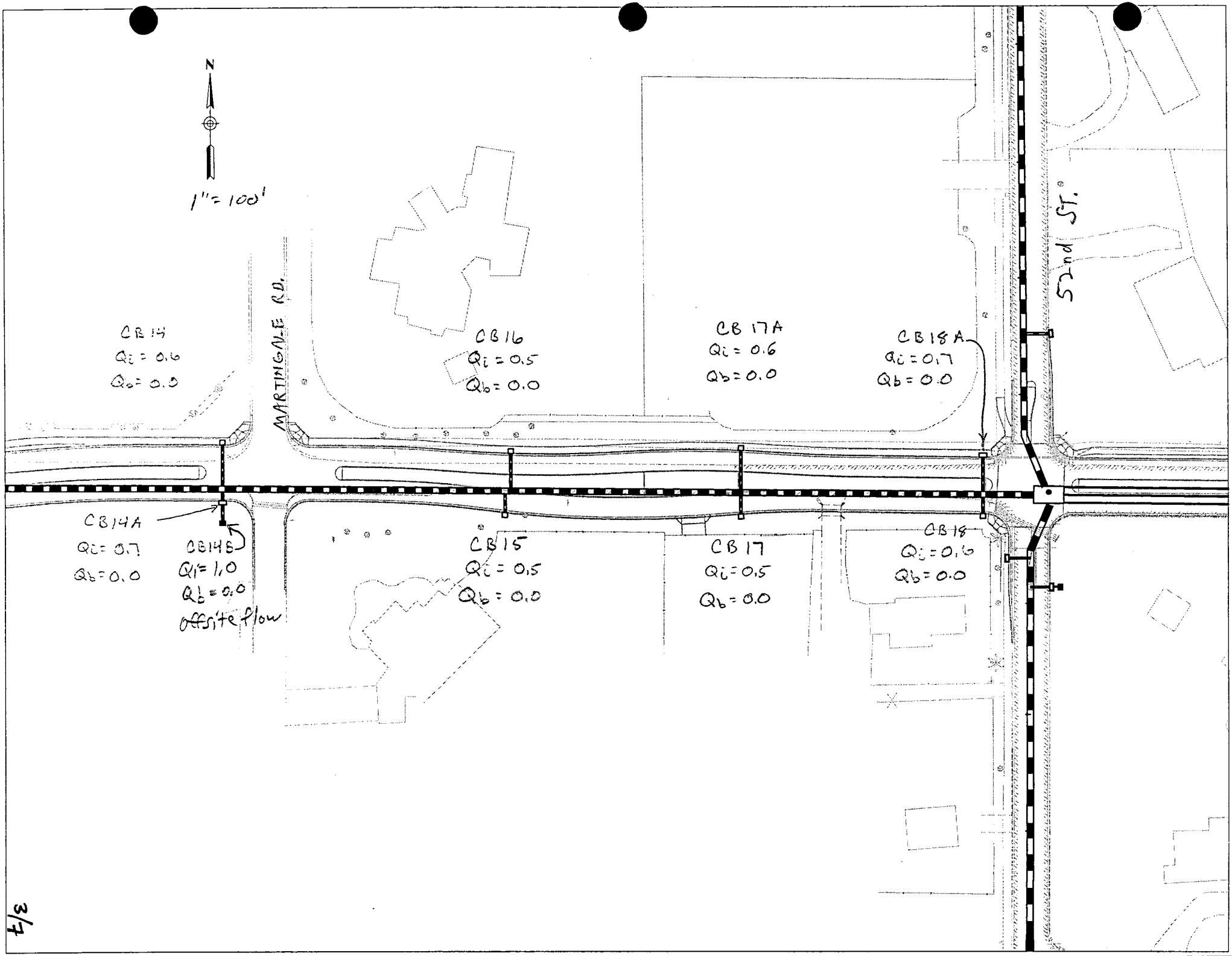
PAVEMENT DRAINAGE CALCULATIONS for DOUBLETREE RANCH ROAD

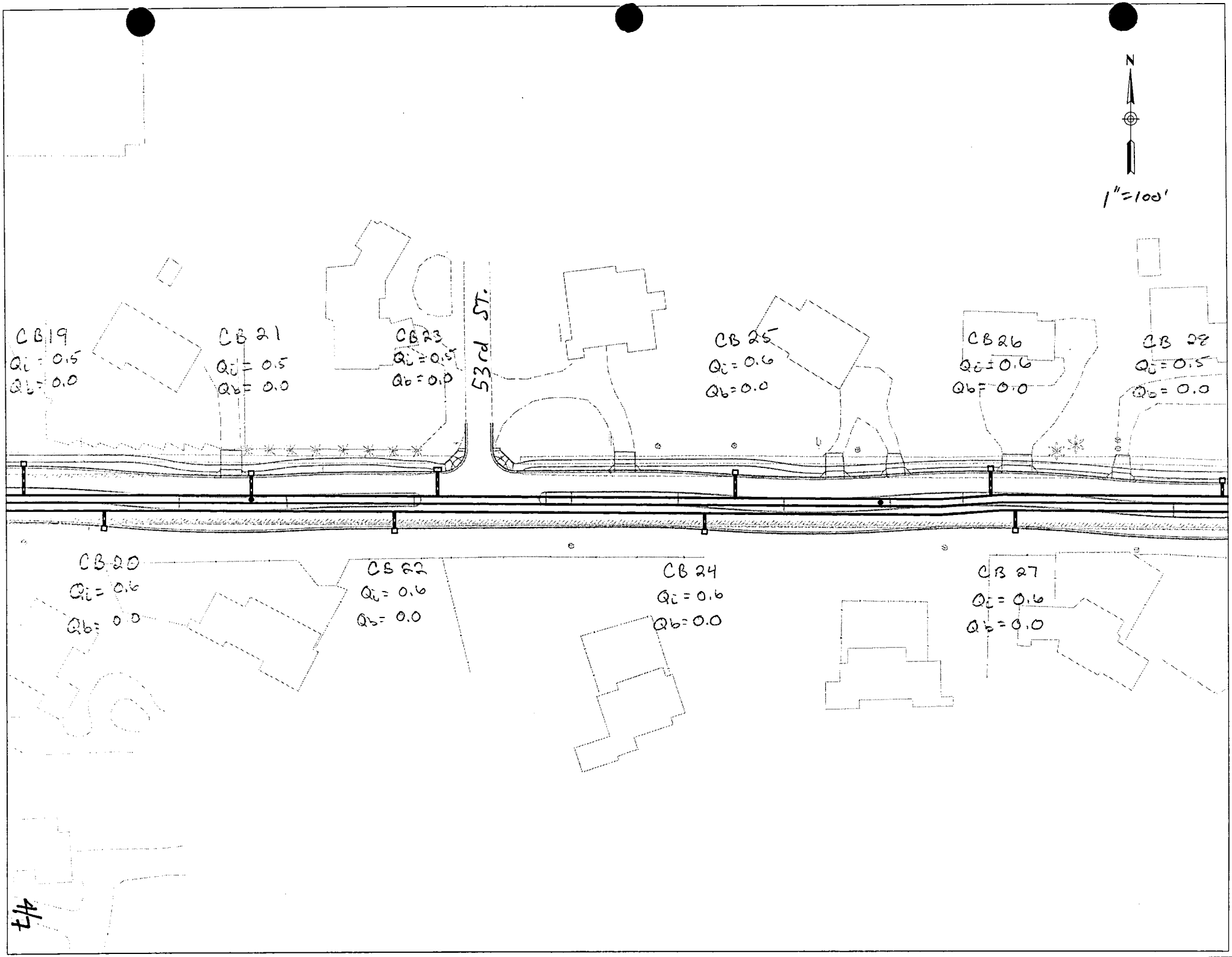


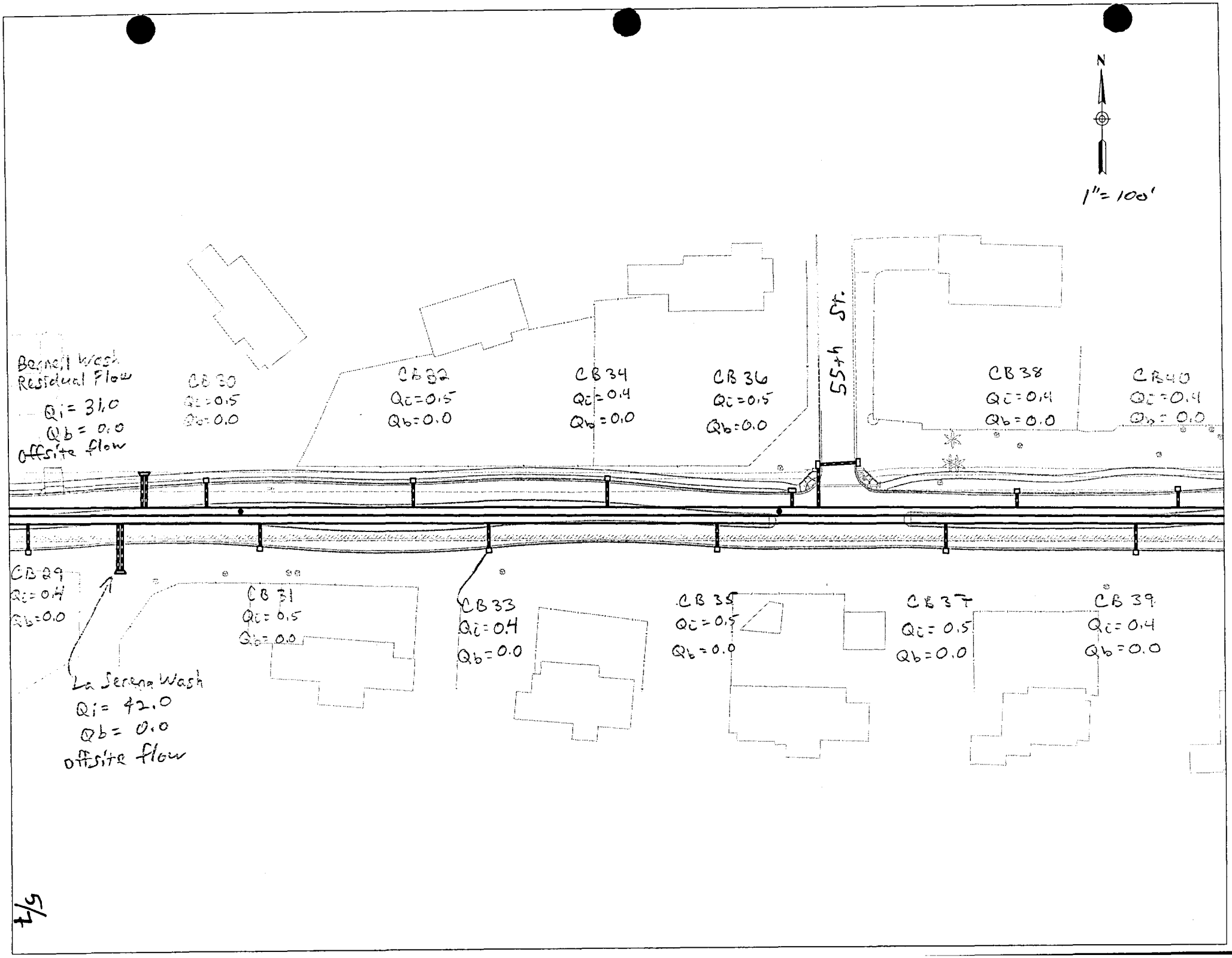
Note: 1. All flow rates (Q_i, Q_b) are in cfs (cubic feet per second).
2. Q_i = Q intercepted by inlet.
3. Q_b = Q bypass to next inlet.

CATCH BASIN LOCATION MAP

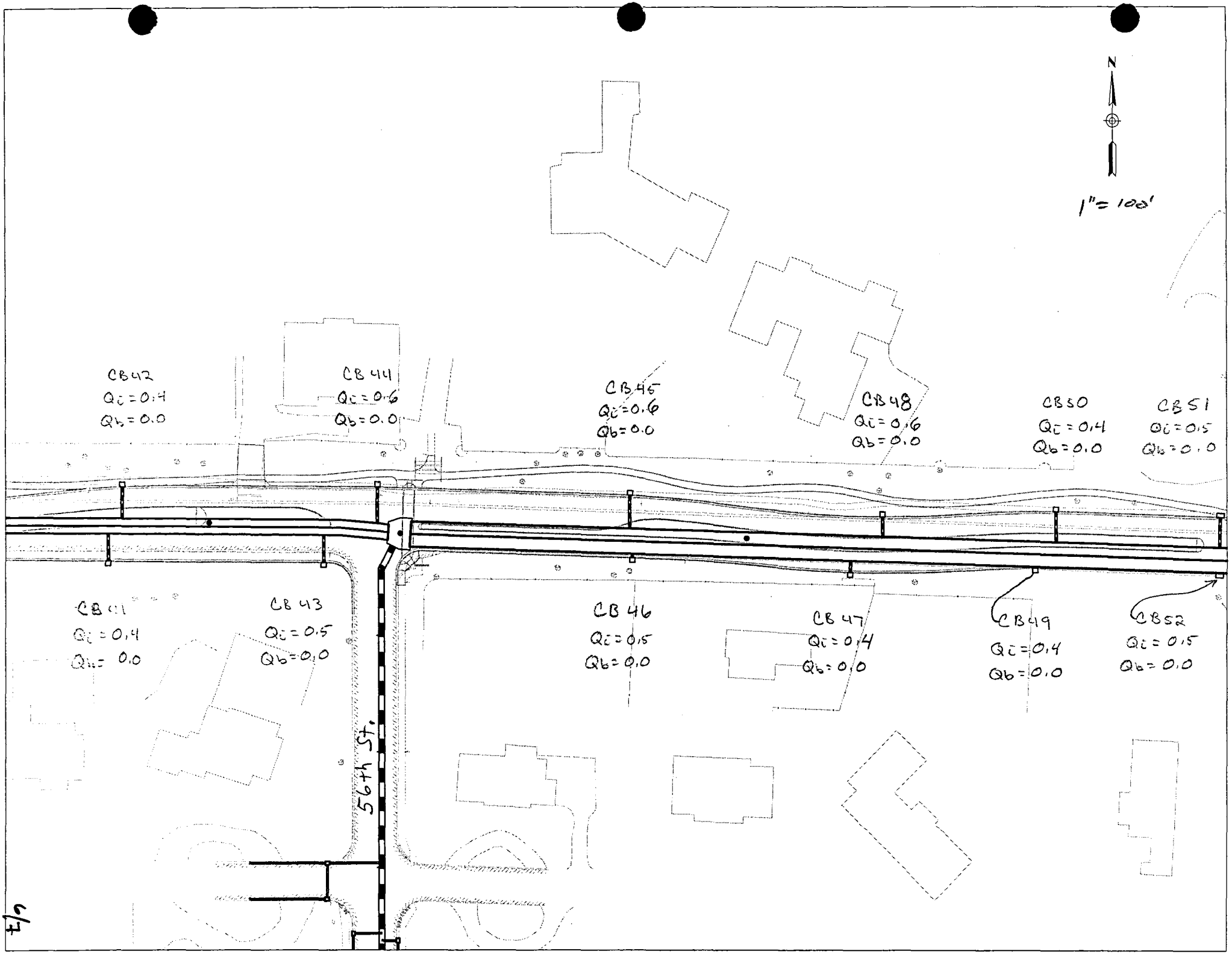

N
1"=100'
FOOTHILLS MANOR DR.
CB 5
Qi = 0.7
Qb = 0
CB 7
Qi = 0.9
Qb = 0.0
CB 9
Qi = 0.6
Qb = 0.0
CB 11
Qi = 0.5
Qb = 0.0
CB 13
Qi = 0.5
Qb = 0.0
CB 6
Qi = 0.6
Qb = 0.0
CB 6A
Qi = 6.0
Qb = 0.0
offsite flow
CB 8
Qi = 0.9
Qb = 0.0
CB 10
Qi = 0.7
Qb = 0.0
CB 11A
Qi = 3.0
Qb = 0.0
offsite flow
CB 12
Qi = 0.6
Qb = 0.0

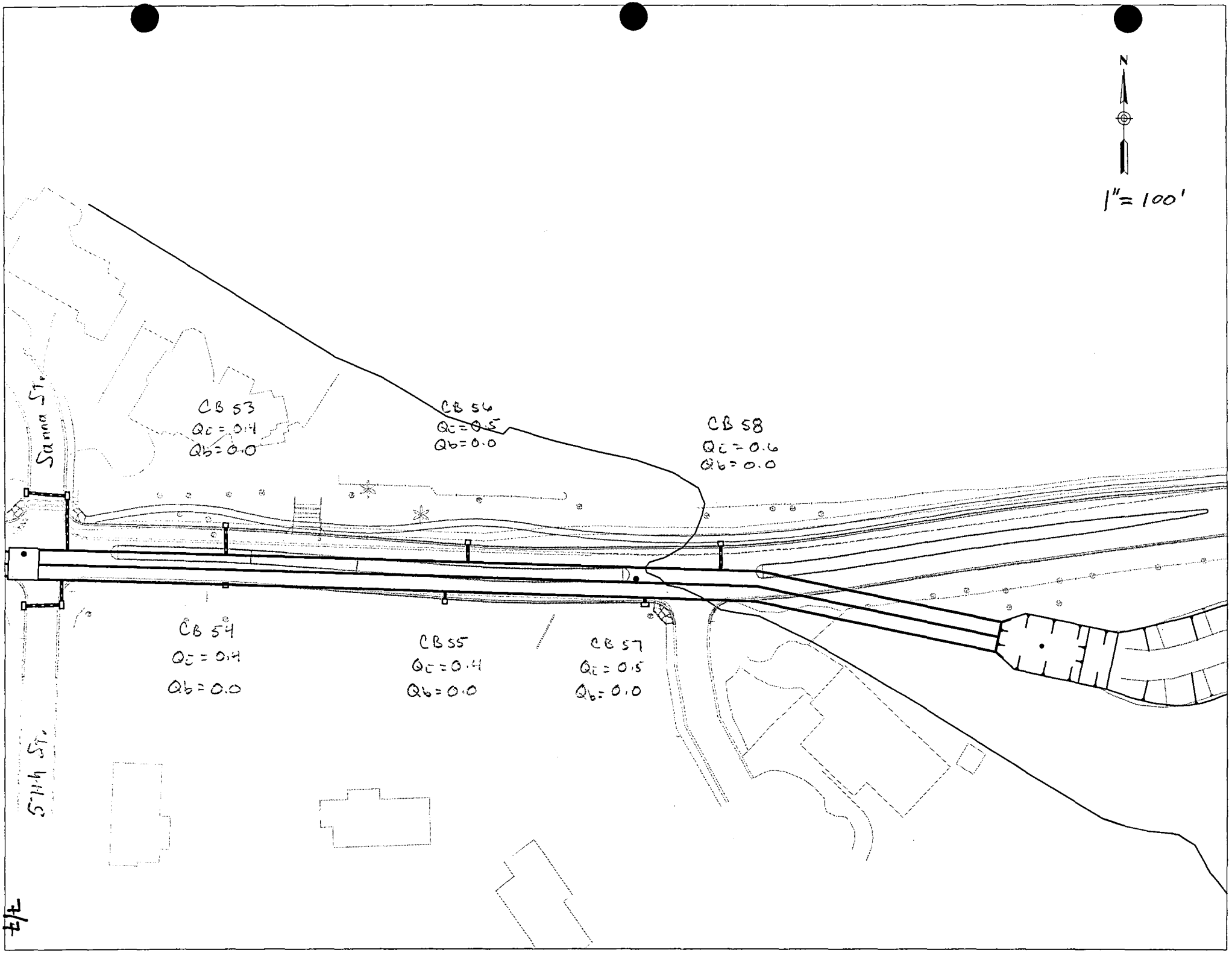

N
1" = 100'
MARTINGALE RD.
52nd ST.
CB 14
Qi = 0.6
Qb = 0.0
CB 16
Qi = 0.5
Qb = 0.0
CB 17A
Qi = 0.6
Qb = 0.0
CB 18A
Qi = 0.7
Qb = 0.0
CB 14A
Qi = 0.7
Qb = 0.0
CB 14B
Qi = 1.0
Qb = 0.0
offsite flow
CB 15
Qi = 0.5
Qb = 0.0
CB 17
Qi = 0.5
Qb = 0.0
CB 18
Qi = 0.6
Qb = 0.0


N
1"=100'
53rd ST.
CB 19
Qi = 0.5
Qb = 0.0
CB 21
Qi = 0.5
Qb = 0.0
CB 23
Qi = 0.5
Qb = 0.0
CB 25
Qi = 0.6
Qb = 0.0
CB 26
Qi = 0.6
Qb = 0.0
CB 28
Qi = 0.5
Qb = 0.0
CB 20
Qi = 0.6
Qb = 0.0
CB 22
Qi = 0.6
Qb = 0.0
CB 24
Qi = 0.6
Qb = 0.0
CB 27
Qi = 0.6
Qb = 0.0


N
1" = 100'
55th St.
Bernell Wash
Residual Flow
Qi = 31.0
Qb = 0.0
offsite flow
CB 30
Qi = 0.5
Qb = 0.0
CB 32
Qi = 0.5
Qb = 0.0
CB 34
Qi = 0.4
Qb = 0.0
CB 36
Qi = 0.5
Qb = 0.0
CB 38
Qi = 0.4
Qb = 0.0
CB 40
Qi = 0.4
Qb = 0.0
CB 29
Qi = 0.4
Qb = 0.0
CB 31
Qi = 0.5
Qb = 0.0
CB 33
Qi = 0.4
Qb = 0.0
CB 35
Qi = 0.5
Qb = 0.0
CB 37
Qi = 0.5
Qb = 0.0
CB 39
Qi = 0.4
Qb = 0.0
La Serena Wash
Qi = 42.0
Qb = 0.0
offsite flow

5/7


N
1" = 100'
CB 42
Qi = 0.4
Qb = 0.0
CB 44
Qi = 0.6
Qb = 0.0
CB 45
Qi = 0.6
Qb = 0.0
CB 48
Qi = 0.6
Qb = 0.0
CB 50
Qi = 0.4
Qb = 0.0
CB 51
Qi = 0.5
Qb = 0.0
CB 41
Qi = 0.4
Qb = 0.0
CB 43
Qi = 0.5
Qb = 0.0
CB 46
Qi = 0.5
Qb = 0.0
CB 47
Qi = 0.4
Qb = 0.0
CB 49
Qi = 0.4
Qb = 0.0
CB 52
Qi = 0.5
Qb = 0.0
56th St.


N
1" = 100'
Sanna St.
CB 53
Qc = 0.4
Qb = 0.0
CB 56
Qc = 0.5
Qb = 0.0
CB 58
Qc = 0.6
Qb = 0.0
CB 54
Qc = 0.4
Qb = 0.0
CB 55
Qc = 0.4
Qb = 0.0
CB 57
Qc = 0.5
Qb = 0.0
5th St.

1/2

STREET DRAINAGE RUNOFF CALCULATIONS:

Doubletree Ranch Road is classified as a Minor Arterial by Town P.V. The allowable spread is 6.0 ft., leaving one 11-foot lane in each direction.

10 YR, 1HR Rain= 1.57 in. Pvmt. C= 0.85

For R/W 40 ft., C= 0.66

Sta. 10000=intersection of Tatum and Doubletree Ranch Rd. $C_{(north)}$= 0.65

Catch Basin Numbers are from Sheets C3 to C16 $C_{(south)}$= 0.56 Eq. 3-3 *factor* = 0.966

Catch Basin No.	Side	Roadway Station From	Roadway Station To	Length (Ft.)	Width (ft) Pvmt.	Width (ft) R/W	D.A. (Acres) Pvmt.	D.A. (Acres) R/W	Runoff C Value Pvmt.	Runoff C Value Compos.	Time of Conc. (min) Tc 10	Time of Conc. (min) Tc 100	Intensity (In/Hr) 10 yr	Intensity (In/Hr) 100 yr	Peak Disch. (cfs) Q10	Peak Disch. (cfs) Q100
2	**S**	10000.00	10260.30	260.30	17	40	0.102	0.239	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
1	N	10000.00	10199.67	199.67	17	40	0.078	0.183	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
4	**S**	10260.30	10510.32	250.02	17	40	0.098	0.230	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
3	N	10199.67	10424.19	224.52	17	40	0.109	0.256	0.85	0.65	10.0	10.0	4.35	6.76	0.7	1.1
6	**S**	10510.32	10789.70	279.38	17	40	0.109	0.257	0.85	0.56	10.0	10.0	4.35	6.76	0.6	1.0
5	N	10478.00	10731.44	253.44	17	40	0.099	0.233	0.85	0.65	10.0	10.0	4.35	6.76	0.7	1.0
8	**S**	10789.70	11086.91	297.21	17	40	0.116	0.273	0.85	0.56	10.0	10.0	4.35	6.76	0.7	1.0
7	N	10731.44	11039.00	307.56	17	40	0.136	0.320	0.85	0.65	10.0	10.0	4.35	6.76	0.9	1.4
10	**S**	11086.91	11390.54	303.63	17	40	0.118	0.279	0.85	0.56	10.0	10.0	4.35	6.76	0.7	1.1
9	N	11079.57	11330.96	251.39	17	40	0.098	0.231	0.85	0.65	10.0	10.0	4.35	6.76	0.7	1.0
12	**S**	11390.54	11650.18	259.64	17	40	0.101	0.238	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
11	N	11330.96	11525.07	194.11	17	40	0.076	0.178	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
14A	**S**	11650.18	11921.22	271.04	17	40	0.121	0.285	0.85	0.56	10.0	10.0	4.35	6.76	0.7	1.1
13	N	11525.07	11729.59	204.52	17	40	0.079	0.188	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
15	**S**	11960.93	12164.33	203.40	17	40	0.079	0.187	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
14	N	11729.59	11914.65	185.06	17	40	0.090	0.212	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
17	**S**	12164.33	12369.20	204.87	17	40	0.080	0.188	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
16	N	11960.93	12168.49	207.56	17	40	0.081	0.191	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
18	**S**	12369.20	12575.23	206.03	17	40	0.099	0.233	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
17A	N	12168.49	12379.33	210.84	17	40	0.082	0.194	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
20	**S**	12623.48	12880.16	256.68	17	40	0.100	0.236	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
18A	N	12379.33	12581.37	202.04	17	40	0.095	0.224	0.85	0.65	10.0	10.0	4.35	6.76	0.6	1.0
22	**S**	12880.16	13128.22	248.06	17	40	0.097	0.228	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
19	N	12623.48	12808.33	184.85	17	40	0.072	0.170	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
24	**S**	13128.22	13400.02	271.80	17	40	0.106	0.250	0.85	0.56	10.0	10.0	4.35	6.76	0.6	1.0
21	N	12808.33	13008.06	199.73	17	40	0.078	0.183	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
27	**S**	13400.02	13669.41	269.39	17	40	0.105	0.247	0.85	0.56	10.0	10.0	4.35	6.76	0.6	0.9
23	N	13008.06	13165.91	157.85	17	40	0.076	0.178	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
29	**S**	13669.41	13868.32	198.91	17	40	0.078	0.183	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.7
25	N	13202.35	13423.62	221.27	34	40	0.173	0.203	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
31	**S**	13868.32	14071.34	203.02	34	40	0.158	0.186	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
26	N	13423.62	13644.00	220.38	34	40	0.172	0.202	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
33	**S**	14071.34	14267.63	196.29	34	40	0.153	0.180	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.7
28	N	13644.00	13848.03	204.03	34	40	0.159	0.187	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8

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STREET DRAINAGE RUNOFF CALCULATIONS:

Doubletree Ranch Road is classified as a Minor Arterial by Town P.V. The allowable spread is 6.0 ft., leaving one 11-foot lane in each direction.

10 YR, 1HR Rain= 1.57 in. Pvmt. C= 0.85

For R/W 40 ft., C= 0.66

Sta. 10000=intersection of Tatum and Doubletree Ranch Rd. C=(north) 0.65

Catch Basin Numbers are from Sheets C3 to C16 C=(south) 0.56 Eq. 3-3 *factor* = 0.966

Catch Basin No.	Side	Roadway Station From	Roadway Station To	Length (Ft.)	Width (ft) Pvmt.	Width (ft) R/W	D.A. (Acres) Pvmt.	D.A. (Acres) R/W	Runoff C Value Pvmt.	Runoff C Value Compos.	Time of Conc. (min) Tc 10	Time of Conc. (min) Tc 100	Intensity (In/Hr) 10 yr	Intensity (In/Hr) 100 yr	Peak Disch. (cfs) Q10	Peak Disch. (cfs) Q100
35	**S**	14267.63	14471.39	203.76	34	40	0.159	0.187	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
30	N	13848.03	14021.88	173.85	34	40	0.136	0.160	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.7
37	**S**	14471.39	14671.11	199.72	34	40	0.156	0.183	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
32	N	14021.88	14203.88	182.00	17	40	0.071	0.167	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.7
39	**S**	14671.11	14834.62	163.51	17	40	0.064	0.150	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.6
34	N	14203.88	14373.25	169.37	17	40	0.066	0.156	0.85	0.65	10.0	10.0	4.35	6.76	0.4	0.7
Start new sequence at Berneil / La Serena Wash																
36	N	14373.25	14535.51	162.26	17	40	0.079	0.187	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.8
41	**S**	14834.62	14999.85	165.23	17	40	0.064	0.152	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.6
38	N	14576.42	14731.65	155.23	17	40	0.061	0.143	0.85	0.65	10.0	10.0	4.35	6.76	0.4	0.6
43	**S**	14999.85	15185.77	185.92	17	40	0.090	0.213	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.8
40	N	14731.65	14873.16	141.51	17	40	0.055	0.130	0.85	0.65	10.0	10.0	4.35	6.76	0.4	0.6
46	**S**	15231.31	15455.24	223.93	17	40	0.087	0.206	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.8
42	N	14873.16	15012.11	138.95	17	40	0.054	0.128	0.85	0.65	10.0	10.0	4.35	6.76	0.4	0.6
47	**S**	15455.24	15645.74	190.50	17	40	0.074	0.175	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.7
44	N	15012.11	15231.14	219.03	17	40	0.062	0.201	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
49	**S**	15645.74	15804.90	159.16	17	40	0.062	0.146	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.6
45	N	15231.14	15451.28	220.14	17	40	0.086	0.202	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
52	**S**	15804.90	15965.47	160.57	17	40	0.078	0.184	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
48	N	15451.28	15672.67	221.39	17	40	0.086	0.203	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9
54	**S**	16005.26	16161.32	156.06	17	40	0.061	0.143	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.5
50	N	15672.67	15822.62	149.95	17	40	0.059	0.138	0.85	0.65	10.0	10.0	4.35	6.76	0.4	0.6
55	**S**	16161.32	16352.65	191.33	17	40	0.075	0.176	0.85	0.56	10.0	10.0	4.35	6.76	0.4	0.7
51	N	15822.62	15964.33	141.71	17	40	0.071	0.168	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.7
57	**S**	16352.65	16524.79	172.14	17	40	0.083	0.195	0.85	0.56	10.0	10.0	4.35	6.76	0.5	0.7
53	N	16005.26	16159.12	153.86	17	40	0.060	0.141	0.85	0.65	10.0	10.0	4.35	6.76	0.4	0.6
56	N	16159.12	16369.03	209.91	17	40	0.082	0.193	0.85	0.65	10.0	10.0	4.35	6.76	0.5	0.9
58	N	16365.00	16591.65	226.65	17	40	0.088	0.208	0.85	0.65	10.0	10.0	4.35	6.76	0.6	0.9

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INLET CALCULATIONS:

Catch Basin No.	Side	Station	So (ft/ft)	Sx (ft/ft)	*1 D (ft)	*1 T (ft)	Q (cfs)	Qb (cfs)	Qt (cfs)	Inlet	*2 E	Qi (cfs)	Qb (cfs)
2	S	10260.3	0.0081	0.02	0.15	5.82	0.6		0.6	MAG 531, Type "B"	1.000	0.6	0.0
1	N	10199.67	0.0124	0.02	0.13	5.06	0.5		0.5	MAG 531, Type "B"	0.999	0.5	0.0
4	S	10510.32	0.0081	0.02	0.15	5.72	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0
3	N	10424.19	0.0000	0.02	0.15	0.97	0.7	0.001	0.7	MAG 530, Type "A"	1.000	0.7	0.0
6	S	10789.7	0.0096	0.02	0.15	5.79	0.6	0.000	0.6	MAG 531, Type "B"	0.997	0.6	0.0
5	N	10731.44	0.0096	0.02	0.15	5.91	0.7	0.000	0.7	MAG 531, Type "B"	0.993	0.7	0.0
8	S	11086.91	0.0118	0.02	0.15	5.69	0.7	0.002	0.7	MAG 531, Type "B"	0.979	0.7	0.0
7	N	11039	0.0000	0.02	0.17	1.13	0.9	0.005	0.9	MAG 530, Type "A"	1.000	0.9	0.0
10	S	11390.54	0.0118	0.02	0.15	5.79	0.7	0.014	0.7	MAG 531, Type "B"	0.973	0.7	0.0
9	N	11330.96	0.0118	0.02	0.15	5.64	0.7	0.000	0.7	MAG 531, Type "B"	0.982	0.6	0.0
12	S	11650.18	0.0085	0.02	0.15	5.84	0.6	0.019	0.6	MAG 531, Type "B"	1.000	0.6	0.0
11	N	11525.07	0.0085	0.02	0.14	5.48	0.5	0.012	0.5	MAG 531, Type "B"	1.000	0.5	0.0
14A	S	11921.22	0.0000	0.02	0.13	0.86	0.7	0.000	0.7	MAG 530, Type "A"	1.000	0.7	0.0
13	N	11729.59	0.0085	0.02	0.14	5.54	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
15	S	12164.33	0.0063	0.02	0.14	5.53	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
14	N	11914.65	0.0000	0.02	0.15	0.95	0.6	0.000	0.6	MAG 530, Type "A"	1.000	0.6	0.0
17	S	12369.2	0.0063	0.02	0.14	5.54	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
16	N	12168.49	0.0063	0.02	0.15	5.93	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
18	S	12575.23	0.0000	0.02	0.14	0.89	0.6	0.000	0.6	MAG 530, Type "A"	1.000	0.6	0.0
17A	N	12379.33	0.0063	0.02	0.15	5.97	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0
20	S	12880.16	0.0086	0.02	0.15	5.72	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0
18A	N	12581.37	0.0000	0.02	0.13	0.83	0.6	0.000	0.6	MAG 530, Type "A"	1.000	0.6	0.0
22	S	13128.22	0.0080	0.02	0.15	5.72	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0
19	N	12808.33	0.0086	0.02	0.14	5.30	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
24	S	13400.02	0.0080	0.02	0.15	5.94	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0
21	N	13008.06	0.0086	0.02	0.14	5.47	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
27	S	13669.41	0.0099	0.02	0.15	5.66	0.6	0.000	0.6	MAG 531, Type "B"	0.998	0.6	0.0
23	N	13165.91	0.0000	0.02	0.12	0.77	0.5	0.000	0.5	MAG 530, Type "A"	1.000	0.5	0.0
29	S	13868.32	0.0048	0.02	0.15	5.81	0.4	0.001	0.4	MAG 531, Type "B"	1.000	0.4	0.0
25	N	13423.62	0.0080	0.02	0.15	5.80	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0
31	S	14071.34	0.0048	0.02	0.15	5.86	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
26	N	13644	0.0099	0.02	0.14	5.54	0.6	0.000	0.6	MAG 531, Type "B"	1.000	0.6	0.0

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INLET CALCULATIONS:

Catch Basin No.	Side	Station	So (ft/ft)	Sx (ft/ft)	*1 D (ft)	*1 T (ft)	Q (cfs)	Qb (cfs)	Qt (cfs)	Inlet	*2 E	Qi (cfs)	Qb (cfs)
33	S	14267.63	0.0048	0.02	0.15	5.77	0.4	0.000	0.4	MAG 531, Type "B"	1.000	0.4	0.0
28	N	13848.03	0.0099	0.02	0.14	5.36	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
35	S	14471.39	0.0048	0.02	0.15	5.87	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
30	N	14021.88	0.0048	0.02	0.15	5.84	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
37	S	14671.11	0.0048	0.02	0.15	5.82	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
32	N	14203.88	0.0048	0.02	0.15	5.92	0.5	0.000	0.5	MAG 531, Type "B"	1.000	0.5	0.0
39	S	14834.62	0.0038	0.02	0.14	5.60	0.4	0.000	0.4	MAG 531, Type "B"	1.000	0.4	0.0
34	N	14373.25	0.0048	0.02	0.15	5.78	0.4	0.000	0.4	MAG 531, Type "B"	1.000	0.4	0.0
	Start new sequence at Berneil / La Serena Wash												
36	N	14535.51	0.0000	0.02	0.09	0.62	0.5		0.5	MAG 530, Type "A"	1.000	0.5	0.0
41	S	14999.85	0.0038	0.02	0.15	5.62	0.4		0.4	MAG 531, Type "B"	1.000	0.4	0.0
38	N	14731.65	0.0032	0.02	0.15	6.04	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
43	S	15185.77	0.0000	0.02	0.12	0.78	0.5	0.0	0.5	MAG 530, Type "A"	1.000	0.5	0.0
40	N	14873.16	0.0032	0.02	0.15	5.81	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
46	S	15455.24	0.0055	0.02	0.15	5.92	0.5	0.0	0.5	MAG 531, Type "B"	1.000	0.5	0.0
42	N	15012.11	0.0032	0.02	0.15	5.77	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
47	S	15645.74	0.0054	0.02	0.14	5.56	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
44	N	15231.14	0.0055	0.02	0.16	6.24	0.6	0.0	0.6	MAG 531, Type "B"	1.000	0.6	0.0
49	S	15804.9	0.0037	0.02	0.14	5.57	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
45	N	15451.28	0.0055	0.02	0.16	6.25	0.6	0.0	0.6	MAG 531, Type "B"	1.000	0.6	0.0
52	S	15965.47	0.0000	0.02	0.11	0.71	0.5	0.0	0.5	MAG 530, Type "A"	1.000	0.5	0.0
48	N	15672.67	0.0054	0.02	0.16	6.29	0.6	0.0	0.6	MAG 531, Type "B"	1.000	0.6	0.0
54	S	16161.32	0.0037	0.02	0.14	5.53	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0

INLET CALCULATIONS:

Catch Basin No.	Side	Station	So (ft/ft)	Sx (ft/ft)	*1 D (ft)	*1 T (ft)	Q (cfs)	Qb (cfs)	Qt (cfs)	Inlet	*2 E	Qi (cfs)	Qb (cfs)
50	N	15822.62	0.0037	0.02	0.15	5.79	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
55	S	16352.65	0.0083	0.02	0.13	5.09	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
51	N	15964.33	0.0000	0.02	0.11	0.73	0.5	0.0	0.5	MAG 530, Type "A"	1.000	0.5	0.0
57	S	16524.79	0.0000	0.02	0.11	0.74	0.5	0.0	0.5	MAG 530, Type "A"	1.000	0.5	0.0
53	N	16159.12	0.0037	0.02	0.15	5.85	0.4	0.0	0.4	MAG 531, Type "B"	1.000	0.4	0.0
56	N	16369.03	0.0083	0.02	0.15	5.64	0.5	0.0	0.5	MAG 531, Type "B"	1.000	0.5	0.0
58	N	16591.65	0.0083	0.02	0.15	5.82	0.6	0.0	0.6	MAG 531, Type "B"	1.000	0.6	0.0

NOTES:

*1. Depth at curb (D) and total spread (T) are upstream of inlet in normal gutter section (i.e. no depression).

*2. Inlet efficiency based on 20% plugging for curb opening inlets.

1/3

CURB OPENING INLET INTERCEPTION EFFICIENCY (On Grade):

CR. SLOPE DEP, Sw= 0.153 (RELATIVE TO HORIZONTAL) (.153 FOR MAG220 CURB W/ 2" DEPRESSION)
MANNING'S n = 0.016
WIDTH OF DEP. = 1.5 ft.
PLUG FACTOR = 20.00%

Catch Basin No.	Side	Station	So (ft/ft)	Sx (ft/ft)	@ inlet T (ft)	Eo	*1 Qo (calc)	*2 Qt (Hydrol)	*3 Se (ft/ft)	*4 Lt (ft)	---Inlet Length---- Actual	Effect.	*5 E	Qi (cfs)	Qb (cfs)	*Sump*
2	S	10260.3	0.0081	0.020	3.09	0.97	0.587	0.587	0.149	4.2	5.5	4.4	1.000	0.6	0.0	
1	N	10199.67	0.0124	0.020	1.68	1.00	0.522	0.522	0.153	4.5	5.5	4.4	0.999	0.5	0.0	
4	S	10510.32	0.0081	0.020	2.92	0.98	0.563	0.563	0.150	4.1	5.5	4.4	1.000	0.6	0.0	
3	N	10424.19	0.0000	0.020		1.00	0.000	0.728	0.153	0.0		0	*Sump*	0.0	0.0	
6	S	10789.7	0.0096	0.020	3.04	0.97	0.629	0.630	0.150	4.6	5.5	4.4	0.997	0.6	0.0	
5	N	10731.44	0.0096	0.020	3.25	0.97	0.662	0.662	0.149	4.7	5.5	4.4	0.993	0.7	0.0	
8	S	11086.91	0.0118	0.020	2.87	0.98	0.671	0.671	0.150	5.0	5.5	4.4	0.979	0.7	0.0	
7	N	11039	0.0000	0.020		1.00	0.000	0.914	0.153	0.0		0	*Sump*	0.0	0.0	
10	S	11390.54	0.0118	0.020	3.04	0.97	0.699	0.699	0.150	5.1	5.5	4.4	0.973	0.7	0.0	
9	N	11330.96	0.0118	0.020	2.78	0.98	0.657	0.657	0.151	4.9	5.5	4.4	0.982	0.6	0.0	
12	S	11650.18	0.0085	0.020	3.12	0.97	0.604	0.604	0.149	4.3	5.5	4.4	1.000	0.6	0.0	
11	N	11525.07	0.0085	0.020	2.48	0.99	0.519	0.519	0.152	4.0	5.5	4.4	1.000	0.5	0.0	
14A	S	11921.22	0.0000	0.020		1.00	0.000	0.700	0.153	0.0		0	*Sump*	0.0	0.0	
13	N	11729.59	0.0085	0.020	2.60	0.99	0.534	0.534	0.151	4.1	5.5	4.4	1.000	0.5	0.0	
15	S	12164.33	0.0063	0.020	2.58	0.99	0.458	0.458	0.152	3.5	5.5	4.4	1.000	0.5	0.0	
14	N	11914.65	0.0000	0.020		1.00	0.000	0.604	0.153	0.0		0	*Sump*	0.0	0.0	
17	S	12369.2	0.0063	0.020	2.61	0.99	0.462	0.462	0.151	3.5	5.5	4.4	1.000	0.5	0.0	
16	N	12168.49	0.0063	0.020	3.29	0.96	0.542	0.542	0.148	3.8	5.5	4.4	1.000	0.5	0.0	
18	S	12575.23	0.0000	0.020		1.00	0.000	0.573	0.153	0.0		0	*Sump*	0.0	0.0	
17A	N	12379.33	0.0063	0.020	3.35	0.96	0.551	0.551	0.148	3.8	5.5	4.4	1.000	0.6	0.0	
20	S	12880.16	0.0086	0.020	2.92	0.98	0.578	0.578	0.150	4.3	5.5	4.4	1.000	0.6	0.0	
18A	N	12581.37	0.0000	0.020		1.00	0.000	0.638	0.153	0.0	5.5	4.4	*Sump*	0.0	0.0	
22	S	13128.22	0.0080	0.020	2.92	0.98	0.559	0.559	0.150	4.1	5.5	4.4	1.000	0.6	0.0	
19	N	12808.33	0.0086	0.020	2.15	1.00	0.483	0.483	0.153	3.9	5.5	4.4	1.000	0.5	0.0	
24	S	13400.02	0.0080	0.020	3.31	0.96	0.612	0.612	0.148	4.3	5.5	4.4	1.000	0.6	0.0	
21	N	13008.06	0.0086	0.020	2.48	0.99	0.522	0.522	0.152	4.1	5.5	4.4	1.000	0.5	0.0	
27	S	13669.41	0.0099	0.020	2.82	0.98	0.607	0.607	0.151	4.5	5.5	4.4	0.998	0.6	0.0	
23	N	13165.91	0.0000	0.020		1.00	0.000	0.508	0.153	0.0		0	*Sump*	0.0	0.0	
29	S	13868.32	0.0048	0.020	3.08	0.97	0.449	0.449	0.149	3.2	5.5	4.4	1.000	0.4	0.0	
25	N	13423.62	0.0080	0.020	3.07	0.97	0.578	0.578	0.150	4.2	5.5	4.4	1.000	0.6	0.0	
31	S	14071.34	0.0048	0.020	3.16	0.97	0.457	0.457	0.149	3.3	5.5	4.4	1.000	0.5	0.0	
26	N	13644	0.0099	0.020	2.60	0.99	0.576	0.576	0.152	4.4	5.5	4.4	1.000	0.6	0.0	
33	S	14267.63	0.0048	0.020	3.02	0.98	0.442	0.442	0.150	3.2	5.5	4.4	1.000	0.4	0.0	

CURB OPENING INLET INTERCEPTION EFFICIENCY (On Grade):

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CR. SLOPE DEP, Sw= 0.153 (RELATIVE TO HORIZONTAL) (.153 FOR MAG220 CURB W/ 2" DEPRESSION)
MANNING'S n = 0.016
WIDTH OF DEP. = 1.5 ft.
PLUG FACTOR = 20.00%

Catch Basin No.	Side	Station	So (ft/ft)	Sx (ft/ft)	@ inlet T (ft)	Eo	*1 Qo (calc)	*2 Qt (Hydrol)	*3 Se (ft/ft)	*4 Lt (ft)	---Inlet Length---- Actual	Effect.	*5 E	Qi (cfs)	Qb (cfs)	*Sump*
28	N	13848.03	0.0099	0.020	2.26	1.00	0.533	0.533	0.152	4.3	5.5	4.4	1.000	0.5	0.0	
35	S	14471.39	0.0048	0.020	3.17	0.97	0.459	0.459	0.149	3.3	5.5	4.4	1.000	0.5	0.0	
30	N	14021.88	0.0048	0.020	3.13	0.97	0.454	0.454	0.149	3.2	5.5	4.4	1.000	0.5	0.0	
37	S	14671.11	0.0048	0.020	3.09	0.97	0.450	0.450	0.149	3.2	5.5	4.4	1.000	0.5	0.0	
32	N	14203.88	0.0048	0.020	3.32	0.96	0.476	0.475	0.148	3.3	5.5	4.4	1.000	0.5	0.0	
39	S	14834.62	0.0038	0.020	2.71	0.99	0.369	0.368	0.151	2.8	5.5	4.4	1.000	0.4	0.0	
34	N	14373.25	0.0048	0.020	3.02	0.98	0.442	0.442	0.150	3.2	5.5	4.4	1.000	0.4	0.0	
	Start new sequence at Berneil / La Serena Wash															
36	N	14535.51	0.0000	0.020		1.00	0.000	0.531	0.153	0.0		0	*Sump*	0.0	0.0	
41	S	14999.85	0.0038	0.020	2.75	0.98	0.372	0.372	0.151	2.8	5.5	4.4	1.000	0.4	0.0	
38	N	14731.65	0.0032	0.020	3.47	0.96	0.406	0.406	0.147	2.8	5.5	4.4	1.000	0.4	0.0	
43	S	15185.77	0.0000	0.020		1.00	0.000	0.522	0.153	0.0		0	*Sump*	0.0	0.0	
40	N	14873.16	0.0032	0.020	3.08	0.97	0.370	0.370	0.149	2.6	5.5	4.4	1.000	0.4	0.0	
46	S	15455.24	0.0055	0.020	3.27	0.97	0.505	0.505	0.148	3.6	5.5	4.4	1.000	0.5	0.0	
42	N	15012.11	0.0032	0.020	3.01	0.98	0.363	0.363	0.150	2.6	5.5	4.4	1.000	0.4	0.0	
47	S	15645.74	0.0054	0.020	2.63	0.99	0.429	0.429	0.151	3.3	5.5	4.4	1.000	0.4	0.0	
44	N	15231.14	0.0055	0.020	3.79	0.94	0.572	0.572	0.145	3.8	5.5	4.4	1.000	0.6	0.0	
49	S	15804.9	0.0037	0.020	2.66	0.99	0.359	0.359	0.151	2.7	5.5	4.4	1.000	0.4	0.0	
45	N	15451.28	0.0055	0.020	3.81	0.94	0.575	0.575	0.145	3.8	5.5	4.4	1.000	0.6	0.0	
52	S	15965.47	0.0000	0.020		1.00	0.000	0.451	0.153	0.0		0	*Sump*	0.0	0.0	
48	N	15672.67	0.0054	0.020	3.87	0.94	0.578	0.578	0.144	3.8	5.5	4.4	1.000	0.6	0.0	
54	S	16161.32	0.0037	0.020	2.58	0.99	0.352	0.352	0.152	2.7	5.5	4.4	1.000	0.4	0.0	

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CURB OPENING INLET INTERCEPTION EFFICIENCY (On Grade):

CR. SLOPE DEP, Sw= 0.153 (RELATIVE TO HORIZONTAL) (.153 FOR MAG220 CURB W/ 2" DEPRESSION)
MANNING'S n = 0.016
WIDTH OF DEP. = 1.5 ft.
PLUG FACTOR = 20.00%

Catch Basin No.	Side	Station	So (ft/ft)	Sx (ft/ft)	@ inlet T (ft)	Eo	*1 Qo (calc)	*2 Qt (Hydrol)	*3 Se (ft/ft)	*4 Lt (ft)	---Inlet Length--- Actual	Effect.	*5 E	Qi (cfs)	Qb (cfs)	*Sump*
50	N	15822.62	0.0037	0.020	3.04	0.98	0.392	0.392	0.150	2.8	5.5	4.4	1.000	0.4	0.0	
55	S	16352.65	0.0083	0.020	1.73	1.00	0.431	0.431	0.153	3.7	5.5	4.4	1.000	0.4	0.0	
51	N	15964.33	0.0000	0.020		1.00	0.000	0.477	0.153	0.0		0	*Sump*	0.0	0.0	
57	S	16524.79	0.0000	0.020		1.00	0.000	0.479	0.153	0.0		0	*Sump*	0.0	0.0	
53	N	16159.12	0.0037	0.020	3.14	0.97	0.402	0.402	0.149	2.9	5.5	4.4	1.000	0.4	0.0	
56	N	16369.03	0.0083	0.020	2.77	0.98	0.548	0.548	0.151	4.1	5.5	4.4	1.000	0.5	0.0	
58	N	16591.65	0.0083	0.020	3.09	0.97	0.592	0.592	0.149	4.3	5.5	4.4	1.000	0.6	0.0	

NOTES:
*1. Qo calculated using equations from HEC-12, Charts 3 and 4 for the assumed T.
*2. Qt calculated from runoff calculations plus carryover flows for comparison to Qo.
*3. Se = Sx+Sw'Eo; Sw' = Sw-Sx
*4. Lt = 0.6(Qo^0.42)(So^0.3)(1/nSe)^0.6; Chart 9.
*5. E = 1-(1-L/Lt)^1.8; Chart 10.

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CURB OPENING INLET INTERCEPTION EFFICIENCY (Sump Location):
NOTE: *** Considers Weir Inflow Only ***

CR. SLOPE DEP, Sw= 0.153 (RELATIVE TO HORIZONTAL) (.153 FOR MAG220 CURB W/2"DEPRESSION)
MANNING'S n = 0.016
WIDTH OF DEP. = 1.5 ft.
PLUG FACTOR = 20.00%

Catch Basin No.	Side	Station	Sx (ft/ft)	---Inlet Length---- Actual	Effect.	d (ft)	*1 Qi (calc)	*2 Qt (Hydrol)	T (ft)
3	N	10424.19	0.020	3.5	2.8	0.149	0.728	0.728	0.97
7	N	11039	0.020	3.5	2.8	0.173	0.913	0.914	1.13
14	N	11914.65	0.020	3.5	2.8	0.132	0.604	0.604	0.86
14A	S	11921.22	0.020	3.5	2.8	0.145	0.700	0.700	0.95
18A	N	12581.37	0.020	3.5	2.8	0.136	0.638	0.638	0.89
18	S	12575.23	0.020	3.5	2.8	0.127	0.573	0.573	0.83
23	N	13165.91	0.020	3.5	2.8	0.117	0.507	0.508	0.77
36	N	14535.51	0.020	3.5	2.8	0.095	0.370	0.370	0.62
43	S	15185.77	0.020	3.5	2.8	0.119	0.521	0.522	0.78
51	N	15964.33	0.020	3.5	2.8	0.112	0.477	0.477	0.73
52	S	15965.47	0.020	3.5	2.8	0.108	0.451	0.451	0.71
57	S	16524.79	0.020	3.5	2.8	0.113	0.479	0.479	0.74

NOTES:
*1. Qi = 2.3(L+1.8W)d^1.5 calculated for the assumed d.
*2. Qt calculated from the runoff calculations plus carryover flows for comparison to Qi.

HEC-RAS ANALYSIS for

DOUBLETREE RANCH ROAD

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	560	990.00	1331.54	1334.08		1334.62	0.005922	5.90	167.89	99.50	0.80
Reach-1	540	990.00	1331.37	1334.00		1334.48	0.004958	5.56	178.12	100.86	0.74
Reach-1	520	990.00	1330.88	1334.00		1334.34	0.002718	4.63	213.70	101.38	0.56
Reach-1	500	990.00	1331.04	1333.37	1333.37	1334.12	0.009817	6.96	142.34	96.71	1.01
Reach-1	480	990.00	1330.40	1332.88	1332.85	1333.62	0.009178	6.90	143.52	93.54	0.98
Reach-1	460	990.00	1330.06	1332.82		1333.39	0.006349	6.05	163.76	98.70	0.83
Reach-1	440	990.00	1330.10	1332.74		1333.24	0.005076	5.69	174.00	97.02	0.75
Reach-1	420	990.00	1329.95	1332.29	1332.24	1333.04	0.008743	6.97	142.11	87.25	0.96
Reach-1	400	990.00	1329.59	1332.43		1332.73	0.002231	4.41	224.31	95.32	0.51
Reach-1	379	990.00	1329.19	1332.44		1332.66	0.001364	3.82	259.22	93.10	0.40
Reach-1	359	990.00	1328.80	1332.44		1332.62	0.000909	3.39	291.98	91.82	0.34
Reach-1	339	990.00	1326.48	1332.45		1332.58	0.000512	2.83	350.04	91.82	0.26
Reach-1	319	990.00	1326.00	1332.45		1332.56	0.000414	2.66	372.21	90.41	0.23
Reach-1	299	990.00	1325.69	1332.45		1332.55	0.000352	2.54	389.18	88.46	0.21
Reach-1	279	990.00	1327.63	1332.43		1332.54	0.000386	2.66	372.13	87.47	0.23
Reach-1	259	990.00	1327.48	1332.42		1332.53	0.000390	2.68	369.15	86.85	0.23
Reach-1	239	990.00	1327.38	1332.41		1332.52	0.000379	2.67	370.10	86.23	0.23
Reach-1	219	990.00	1327.30	1332.39		1332.51	0.000407	2.75	360.36	85.62	0.24
Reach-1	199	990.00	1328.15	1332.29		1332.48	0.000880	3.51	282.16	85.00	0.34
Reach-1	179	990.00	1328.69	1332.02		1332.39	0.002670	4.93	200.96	83.90	0.56
Reach-1	159	990.00	1328.10	1331.88		1332.32	0.003357	5.30	186.90	82.68	0.62
Reach-1	139	990.00	1328.20	1331.26	1331.26	1332.09	0.009448	7.31	135.37	81.45	1.00
Reach-1	119	990.00	1327.90	1329.68	1329.68	1330.52	0.009430	7.35	134.71	80.23	1.00

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	1280	990.00	1335.20	1338.15		1338.64	0.004227	5.63	175.91	86.77	0.70
Reach-1	1260	990.00	1335.17	1338.10		1338.53	0.003459	5.26	188.16	88.27	0.64
Reach-1	1240	990.00	1335.10	1338.07		1338.44	0.002843	4.86	203.68	92.98	0.58
Reach-1	1220	990.00	1335.03	1338.02		1338.38	0.002807	4.84	204.43	92.95	0.58
Reach-1	1200	990.00	1334.95	1337.97		1338.32	0.002739	4.80	206.33	93.53	0.57
Reach-1	1180	990.00	1334.88	1337.92		1338.26	0.002609	4.71	210.20	94.39	0.56
Reach-1	1160	990.00	1334.80	1337.88		1338.20	0.002425	4.59	215.76	95.35	0.54
Reach-1	1140	990.00	1334.56	1337.84		1338.15	0.002173	4.42	224.22	96.56	0.51
Reach-1	1120	990.00	1334.65	1337.64		1338.06	0.003450	5.19	190.85	91.46	0.63
Reach-1	1100	990.00	1334.58	1337.41		1337.94	0.004574	5.85	169.25	83.44	0.72
Reach-1	1080	990.00	1334.24	1337.43		1337.78	0.002802	4.79	206.64	95.19	0.57
Reach-1	1060	990.00	1334.39	1337.37		1337.72	0.002760	4.76	208.15	95.93	0.57
Reach-1	1040	990.00	1334.36	1337.28		1337.66	0.003085	4.92	201.13	96.03	0.60
Reach-1	1020	990.00	1334.28	1337.19		1337.59	0.003343	5.07	195.37	94.93	0.62
Reach-1	1000	990.00	1334.21	1337.02		1337.49	0.004274	5.51	179.54	92.34	0.70
Reach-1	980	990.00	1334.10	1336.99		1337.38	0.003208	4.99	198.54	95.66	0.61
Reach-1	960	990.00	1334.06	1336.68		1337.24	0.005671	6.02	164.41	90.98	0.79
Reach-1	940	990.00	1333.98	1336.59		1337.11	0.004909	5.78	171.24	90.72	0.74
Reach-1	920	990.00	1333.46	1336.54		1336.99	0.003884	5.35	185.13	92.49	0.67
Reach-1	900	990.00	1333.13	1336.48		1336.90	0.003577	5.19	190.68	93.34	0.64
Reach-1	880	990.00	1333.40	1336.35		1336.81	0.004147	5.45	181.53	92.45	0.69
Reach-1	860	990.00	1333.56	1336.26		1336.73	0.004208	5.48	180.73	92.53	0.69
Reach-1	840	990.00	1333.60	1336.12		1336.63	0.004807	5.72	173.22	91.95	0.73
Reach-1	820	990.00	1333.50	1335.98		1336.52	0.005262	5.89	168.10	91.24	0.76
Reach-1	800	990.00	1333.46	1335.86		1336.41	0.005535	5.94	166.72	93.09	0.78
Reach-1	780	990.00	1333.23	1335.42	1335.42	1336.20	0.009753	7.10	139.39	90.96	1.01
Reach-1	760	990.00	1332.57	1335.33		1335.97	0.007104	6.42	154.20	92.10	0.87
Reach-1	740	990.00	1332.63	1335.07	1335.01	1335.79	0.008668	6.82	145.18	92.19	0.96
Reach-1	720	990.00	1332.32	1334.93		1335.60	0.007622	6.56	150.86	92.02	0.90
Reach-1	700	990.00	1331.89	1334.81		1335.44	0.006823	6.36	155.71	91.38	0.86
Reach-1	680	990.00	1331.53	1334.71		1335.28	0.005780	6.05	163.71	91.37	0.80
Reach-1	660	990.00	1331.59	1334.62		1335.15	0.005459	5.86	168.87	94.70	0.77
Reach-1	640	990.00	1331.87	1334.57		1335.01	0.004068	5.27	187.71	98.49	0.67
Reach-1	620	990.00	1330.75	1334.56		1334.89	0.002659	4.61	214.81	99.55	0.55
Reach-1	600	990.00	1330.30	1334.53	1333.63	1334.83	0.002185	4.39	225.76	97.21	0.51
Reach-1	580	990.00	1331.59	1334.38		1334.75	0.003061	4.88	202.69	95.80	0.59

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2001	762.00	1339.06	1341.53		1341.90	0.003506	4.86	156.91	82.70	0.62
Reach-1	1981	762.00	1339.00	1341.34		1341.79	0.005714	5.34	142.72	93.87	0.76
Reach-1	1961	762.00	1338.92	1341.27		1341.65	0.004619	4.91	155.16	98.80	0.69
Reach-1	1941	762.00	1338.69	1341.26		1341.53	0.002618	4.13	184.68	99.26	0.53
Reach-1	1921	762.00	1338.42	1341.22		1341.47	0.002367	4.00	190.72	99.94	0.51
Reach-1	1901	762.00	1338.09	1341.20		1341.41	0.001693	3.62	210.44	100.43	0.44
Reach-1	1881	990.00	1337.40	1340.90		1341.30	0.003604	5.06	195.58	99.89	0.64
Reach-1	1861	990.00	1337.02	1340.83		1341.22	0.003586	5.06	195.78	99.97	0.64
Reach-1	1841	990.00	1336.69	1340.76		1341.15	0.003416	5.02	197.31	98.19	0.62
Reach-1	1821	990.00	1336.93	1340.67		1341.08	0.003587	5.10	194.07	97.86	0.64
Reach-1	1801	990.00	1336.93	1340.63		1340.99	0.002998	4.80	206.17	99.11	0.59
Reach-1	1781	990.00	1336.66	1340.59		1340.92	0.002576	4.57	216.68	99.99	0.55
Reach-1	1761	990.00	1336.42	1340.55		1340.86	0.002368	4.46	222.13	99.99	0.53
Reach-1	1741	990.00	1336.35	1340.51		1340.81	0.002292	4.41	224.41	99.99	0.52
Reach-1	1721	990.00	1336.32	1340.47		1340.76	0.002138	4.32	229.12	99.99	0.50
Reach-1	1701	990.00	1336.69	1340.43		1340.71	0.001993	4.24	233.58	99.77	0.49
Reach-1	1681	990.00	1337.36	1340.34		1340.66	0.002374	4.49	220.43	98.81	0.53
Reach-1	1661	990.00	1337.25	1340.07		1340.54	0.004308	5.52	179.26	92.20	0.70
Reach-1	1641	990.00	1337.14	1339.50	1339.50	1340.32	0.009546	7.27	136.17	84.43	1.01
Reach-1	1621	990.00	1337.03	1339.42		1340.03	0.006987	6.29	157.50	96.40	0.87
Reach-1	1601	990.00	1336.92	1339.35		1339.86	0.005151	5.72	173.16	96.98	0.75
Reach-1	1581	990.00	1336.24	1339.28		1339.74	0.004404	5.44	181.97	97.45	0.70
Reach-1	1561	990.00	1336.10	1339.21		1339.64	0.003996	5.27	187.78	98.02	0.67
Reach-1	1540	990.00	1335.99	1339.15		1339.55	0.003535	5.07	195.24	98.59	0.63
Reach-1	1520	990.00	1335.89	1339.11		1339.47	0.002997	4.82	205.39	98.80	0.59
Reach-1	1500	990.00	1335.79	1339.06		1339.40	0.002748	4.73	209.37	96.77	0.57
Reach-1	1480	990.00	1335.75	1339.01		1339.34	0.002497	4.59	215.50	96.59	0.54
Reach-1	1460	990.00	1335.69	1338.98		1339.28	0.002221	4.43	223.44	96.62	0.51
Reach-1	1440	990.00	1335.67	1338.94		1339.23	0.002053	4.31	229.73	97.67	0.50
Reach-1	1420	990.00	1335.64	1338.91		1339.18	0.001870	4.16	237.80	99.07	0.47
Reach-1	1400	990.00	1335.83	1338.70		1339.10	0.003416	5.03	196.77	97.59	0.62
Reach-1	1380	990.00	1335.72	1338.64		1339.03	0.003279	4.99	198.46	96.89	0.61
Reach-1	1360	990.00	1335.61	1338.56		1338.95	0.003356	5.05	196.06	95.83	0.62
Reach-1	1340	990.00	1335.50	1338.50		1338.88	0.003052	4.93	200.77	94.83	0.60
Reach-1	1320	990.00	1335.40	1338.46		1338.81	0.002741	4.78	207.05	94.40	0.57
Reach-1	1300	990.00	1335.32	1338.36		1338.75	0.003140	4.99	198.29	93.87	0.61

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2721	762.00	1341.87	1344.37		1344.81	0.004423	5.36	142.20	77.79	0.70
Reach-1	2701	762.00	1341.78	1344.28		1344.72	0.004379	5.34	142.68	77.91	0.70
Reach-1	2681	762.00	1341.69	1344.19		1344.63	0.004295	5.31	143.55	78.03	0.69
Reach-1	2661	762.00	1341.59	1344.11		1344.54	0.004169	5.26	144.91	78.17	0.68
Reach-1	2641	762.00	1341.49	1344.02		1344.45	0.004286	5.29	143.96	78.28	0.69
Reach-1	2621	762.00	1341.39	1343.92		1344.36	0.004469	5.36	142.14	78.32	0.70
Reach-1	2601	762.00	1341.29	1343.82		1344.27	0.004513	5.37	141.80	78.39	0.70
Reach-1	2581	762.00	1341.20	1343.73		1344.18	0.004436	5.35	142.55	78.50	0.70
Reach-1	2561	762.00	1341.10	1343.65		1344.08	0.004325	5.30	143.80	78.72	0.69
Reach-1	2541	762.00	1341.01	1343.56		1344.00	0.004260	5.28	144.31	78.54	0.69
Reach-1	2521	762.00	1340.91	1343.48		1343.91	0.004127	5.23	145.59	78.37	0.68
Reach-1	2501	762.00	1340.82	1343.41		1343.82	0.003966	5.17	147.32	78.25	0.66
Reach-1	2481	762.00	1340.72	1343.35		1343.73	0.003701	4.95	153.93	83.28	0.64
Reach-1	2461	762.00	1340.63	1343.28		1343.65	0.003552	4.87	156.50	84.49	0.63
Reach-1	2441	762.00	1340.50	1343.21		1343.58	0.003475	4.85	157.18	83.72	0.62
Reach-1	2421	762.00	1340.43	1343.14		1343.51	0.003390	4.84	157.58	82.65	0.62
Reach-1	2401	762.00	1340.36	1343.09		1343.43	0.003194	4.68	162.74	85.69	0.60
Reach-1	2381	762.00	1340.30	1342.98		1343.35	0.003485	4.88	156.16	82.47	0.62
Reach-1	2361	762.00	1340.23	1342.91		1343.28	0.003498	4.90	155.48	81.73	0.63
Reach-1	2341	762.00	1340.17	1342.84		1343.21	0.003553	4.91	155.29	82.45	0.63
Reach-1	2321	762.00	1340.10	1342.77		1343.14	0.003584	4.91	155.10	82.72	0.63
Reach-1	2301	762.00	1340.00	1342.68		1343.07	0.003694	4.95	153.90	82.98	0.64
Reach-1	2281	762.00	1339.98	1342.61		1342.99	0.003705	4.94	154.35	83.87	0.64
Reach-1	2261	762.00	1339.90	1342.57		1342.89	0.003122	4.53	168.25	91.85	0.59
Reach-1	2241	762.00	1339.84	1342.52		1342.83	0.002974	4.48	169.97	90.85	0.58
Reach-1	2221	762.00	1339.77	1342.40		1342.75	0.003487	4.76	160.06	88.06	0.62
Reach-1	2201	762.00	1339.71	1342.34		1342.68	0.003249	4.66	163.58	88.12	0.60
Reach-1	2181	762.00	1339.64	1342.28		1342.61	0.003146	4.59	166.07	89.36	0.59
Reach-1	2161	762.00	1339.58	1342.22		1342.54	0.003119	4.55	167.34	90.51	0.59
Reach-1	2141	762.00	1339.51	1342.16		1342.47	0.002987	4.47	170.31	91.51	0.58
Reach-1	2121	762.00	1339.46	1342.11		1342.41	0.002859	4.38	173.85	93.28	0.57
Reach-1	2101	762.00	1339.39	1342.00		1342.34	0.003235	4.66	163.45	87.51	0.60
Reach-1	2081	762.00	1339.30	1341.94		1342.27	0.003281	4.60	165.56	91.40	0.60
Reach-1	2061	762.00	1339.26	1341.86		1342.20	0.003448	4.68	162.97	91.20	0.62
Reach-1	2041	762.00	1339.19	1341.77		1342.13	0.003656	4.78	159.51	90.21	0.63
Reach-1	2021	762.00	1339.13	1341.58		1342.02	0.004625	5.29	144.02	83.23	0.71

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3442	343.00	1346.22	1347.70		1348.11	0.009263	5.12	67.02	68.41	0.91
Reach-1	3422	343.00	1346.01	1347.54		1347.92	0.008139	4.93	69.61	68.26	0.86
Reach-1	3402	343.00	1345.80	1347.42		1347.75	0.006516	4.58	74.82	69.23	0.78
Reach-1	3382	343.00	1345.60	1347.35		1347.60	0.004520	4.05	84.61	71.76	0.66
Reach-1	3362	343.00	1345.40	1347.30		1347.50	0.003209	3.64	94.16	72.40	0.56
Reach-1	3342	343.00	1345.21	1347.26		1347.43	0.002250	3.25	105.52	73.70	0.48
Reach-1	3322	343.00	1345.02	1347.24		1347.37	0.001572	2.90	118.45	75.16	0.41
Reach-1	3302	343.00	1344.83	1347.23		1347.34	0.001150	2.63	130.60	75.78	0.35
Reach-1	3282	343.00	1344.63	1347.22		1347.31	0.000827	2.37	144.67	76.27	0.30
Reach-1	3262	343.00	1344.46	1347.21		1347.29	0.000634	2.19	156.87	76.51	0.27
Reach-1	3242	343.00	1344.36	1347.20		1347.27	0.000543	2.09	164.48	76.82	0.25
Reach-1	3222	343.00	1344.26	1347.19		1347.26	0.000514	2.05	166.97	76.84	0.25
Reach-1	3202	343.00	1344.16	1347.19		1347.25	0.000439	1.94	176.59	77.59	0.23
Reach-1	3182	762.00	1344.06	1346.69		1347.11	0.004186	5.20	146.62	76.12	0.66
Reach-1	3162	762.00	1343.97	1346.68		1346.99	0.002564	4.49	169.67	78.84	0.54
Reach-1	3142	762.00	1343.88	1346.48		1346.90	0.003872	5.17	147.30	76.97	0.66
Reach-1	3122	762.00	1343.78	1346.29		1346.78	0.004766	5.65	134.79	71.80	0.73
Reach-1	3102	762.00	1343.69	1346.19		1346.69	0.004792	5.66	134.70	71.94	0.73
Reach-1	3082	762.00	1343.60	1346.10		1346.59	0.004809	5.63	135.29	73.23	0.73
Reach-1	3062	762.00	1343.50	1346.02		1346.49	0.004562	5.51	138.20	74.27	0.71
Reach-1	3042	762.00	1343.39	1345.93		1346.39	0.004383	5.44	140.18	74.49	0.70
Reach-1	3022	762.00	1343.30	1345.83		1346.30	0.004486	5.49	138.76	73.86	0.71
Reach-1	3002	762.00	1343.20	1345.72		1346.21	0.004747	5.63	135.39	72.44	0.73
Reach-1	2981	762.00	1343.10	1345.61		1346.11	0.004922	5.70	133.62	71.96	0.74
Reach-1	2961	762.00	1343.00	1345.50		1346.01	0.005107	5.75	132.60	72.52	0.75
Reach-1	2941	762.00	1342.90	1345.40		1345.91	0.005096	5.70	133.65	73.97	0.75
Reach-1	2921	762.00	1342.80	1345.31		1345.80	0.005016	5.63	135.37	75.32	0.74
Reach-1	2901	762.00	1342.73	1345.21		1345.69	0.004900	5.56	136.95	76.40	0.73
Reach-1	2881	762.00	1342.60	1345.12		1345.59	0.004841	5.53	137.80	76.91	0.73
Reach-1	2861	762.00	1342.50	1345.03		1345.49	0.004744	5.47	139.42	78.07	0.72
Reach-1	2841	762.00	1342.43	1344.93		1345.40	0.004678	5.45	139.89	77.91	0.72
Reach-1	2821	762.00	1342.34	1344.84		1345.30	0.004591	5.44	140.15	77.03	0.71
Reach-1	2801	762.00	1342.25	1344.75		1345.21	0.004720	5.47	139.22	77.49	0.72
Reach-1	2781	762.00	1342.15	1344.63		1345.11	0.004957	5.57	136.80	77.05	0.74
Reach-1	2761	762.00	1342.06	1344.54		1345.01	0.004770	5.50	138.60	77.28	0.72
Reach-1	2741	762.00	1341.97	1344.45		1344.91	0.004614	5.44	140.06	77.50	0.71

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4163	343.00	1352.39	1353.90		1354.28	0.008302	4.96	69.13	68.02	0.87
Reach-1	4143	343.00	1352.20	1353.72		1354.10	0.008648	5.00	68.63	68.96	0.88
Reach-1	4123	343.00	1352.04	1353.55		1353.93	0.008548	4.97	68.98	69.27	0.88
Reach-1	4103	343.00	1351.86	1353.37		1353.76	0.008732	5.00	68.64	69.50	0.89
Reach-1	4083	343.00	1351.69	1353.20		1353.58	0.008641	4.97	68.97	69.94	0.88
Reach-1	4063	343.00	1351.50	1353.03		1353.41	0.008236	4.89	70.11	70.35	0.86
Reach-1	4042	343.00	1351.35	1352.87		1353.24	0.008217	4.92	69.76	69.19	0.86
Reach-1	4022	343.00	1351.18	1352.71		1353.08	0.007867	4.86	70.65	69.08	0.85
Reach-1	4002	343.00	1351.01	1352.54		1352.91	0.008055	4.89	70.13	69.03	0.86
Reach-1	3982	343.00	1350.86	1352.38		1352.75	0.008073	4.89	70.17	69.24	0.86
Reach-1	3962	343.00	1350.70	1352.22		1352.59	0.008124	4.88	70.27	69.81	0.86
Reach-1	3942	343.00	1350.54	1352.06		1352.43	0.007972	4.84	70.86	70.37	0.85
Reach-1	3922	343.00	1350.38	1351.91		1352.27	0.007878	4.81	71.30	70.85	0.85
Reach-1	3902	343.00	1350.22	1351.75		1352.11	0.007956	4.82	71.13	70.92	0.85
Reach-1	3882	343.00	1350.06	1351.59		1351.95	0.007831	4.79	71.54	71.07	0.84
Reach-1	3862	343.00	1349.90	1351.42		1351.79	0.008096	4.86	70.54	70.33	0.86
Reach-1	3842	343.00	1349.74	1351.26		1351.63	0.008034	4.85	70.71	70.41	0.85
Reach-1	3822	343.00	1349.58	1351.10		1351.47	0.008059	4.84	70.88	71.02	0.85
Reach-1	3802	343.00	1349.42	1350.94		1351.30	0.008140	4.83	71.03	71.95	0.86
Reach-1	3782	343.00	1349.26	1350.78		1351.14	0.007899	4.78	71.79	72.21	0.84
Reach-1	3762	343.00	1349.10	1350.62		1350.98	0.008310	4.84	70.93	72.88	0.86
Reach-1	3742	343.00	1348.90	1350.46		1350.81	0.008039	4.78	71.74	73.05	0.85
Reach-1	3722	343.00	1348.79	1350.30		1350.65	0.008023	4.76	72.12	73.98	0.85
Reach-1	3702	343.00	1348.60	1350.13		1350.48	0.008041	4.74	72.41	74.89	0.85
Reach-1	3682	343.00	1348.47	1349.98		1350.32	0.007813	4.69	73.16	75.24	0.84
Reach-1	3662	343.00	1348.30	1349.82		1350.16	0.007966	4.69	73.09	76.19	0.84
Reach-1	3642	343.00	1348.10	1349.67		1350.00	0.007564	4.63	74.11	75.79	0.82
Reach-1	3622	343.00	1347.99	1349.49		1349.84	0.008118	4.74	72.41	75.42	0.85
Reach-1	3602	343.00	1347.79	1349.27		1349.66	0.009418	4.99	68.67	73.92	0.91
Reach-1	3582	343.00	1347.59	1349.06	1349.01	1349.47	0.010003	5.14	66.71	71.91	0.94
Reach-1	3562	343.00	1347.39	1348.86		1349.27	0.009850	5.14	66.75	71.17	0.94
Reach-1	3542	343.00	1347.19	1348.67		1349.07	0.009593	5.10	67.31	71.27	0.92
Reach-1	3522	343.00	1347.00	1348.47		1348.88	0.009731	5.14	66.67	70.14	0.93
Reach-1	3502	343.00	1346.80	1348.27		1348.68	0.009676	5.15	66.57	69.63	0.93
Reach-1	3482	343.00	1346.60	1348.08		1348.49	0.009571	5.14	66.68	69.33	0.92
Reach-1	3462	343.00	1346.41	1347.88		1348.30	0.009536	5.15	66.65	68.97	0.92

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4883	402.00	1357.97	1359.64		1359.99	0.006257	4.75	84.58	71.80	0.77
Reach-1	4863	402.00	1357.80	1359.50		1359.85	0.006414	4.80	83.83	71.45	0.78
Reach-1	4843	402.00	1357.70	1359.36		1359.72	0.006762	4.83	83.17	73.00	0.80
Reach-1	4823	402.00	1357.58	1359.24		1359.58	0.006191	4.63	86.83	76.21	0.76
Reach-1	4803	402.00	1357.45	1359.12		1359.45	0.006224	4.60	87.33	77.71	0.77
Reach-1	4783	402.00	1357.30	1359.01		1359.32	0.005745	4.49	89.57	78.01	0.74
Reach-1	4763	402.00	1357.19	1358.87		1359.20	0.006218	4.60	87.33	77.82	0.77
Reach-1	4743	402.00	1357.07	1358.75		1359.08	0.006007	4.57	87.96	77.12	0.75
Reach-1	4723	402.00	1356.94	1358.62		1358.95	0.006226	4.63	86.76	76.58	0.77
Reach-1	4703	402.00	1356.80	1358.48		1358.82	0.006347	4.67	86.05	76.06	0.77
Reach-1	4683	402.00	1356.69	1358.35		1358.70	0.006452	4.71	85.34	75.31	0.78
Reach-1	4663	402.00	1356.57	1358.23		1358.57	0.006381	4.70	85.54	75.11	0.78
Reach-1	4643	402.00	1356.44	1358.10		1358.44	0.006154	4.64	86.60	75.35	0.76
Reach-1	4623	402.00	1356.32	1357.91		1358.29	0.007657	4.97	80.90	74.92	0.84
Reach-1	4603	402.00	1356.16	1357.74		1358.14	0.008015	5.06	79.45	74.19	0.86
Reach-1	4583	402.00	1355.99	1357.57		1357.97	0.007976	5.07	79.30	73.47	0.86
Reach-1	4563	402.00	1355.82	1357.43		1357.81	0.007436	4.98	80.75	72.95	0.83
Reach-1	4543	402.00	1355.65	1357.30		1357.66	0.006439	4.77	84.31	72.98	0.78
Reach-1	4523	402.00	1355.47	1356.94	1356.94	1357.45	0.011333	5.71	70.45	71.13	1.01
Reach-1	4503	343.00	1355.30	1356.83		1357.16	0.006789	4.59	74.79	71.37	0.79
Reach-1	4483	343.00	1355.10	1356.73		1357.02	0.005639	4.33	79.24	71.68	0.73
Reach-1	4463	343.00	1354.96	1356.46		1356.85	0.008542	5.02	68.36	67.64	0.88
Reach-1	4443	343.00	1354.79	1356.29		1356.68	0.008462	5.00	68.65	67.87	0.88
Reach-1	4423	343.00	1354.62	1356.12		1356.51	0.008566	5.01	68.47	68.03	0.88
Reach-1	4403	343.00	1354.40	1355.94		1356.33	0.008579	5.01	68.51	68.16	0.88
Reach-1	4383	343.00	1354.27	1355.78		1356.16	0.008390	4.96	69.08	68.51	0.87
Reach-1	4363	343.00	1354.10	1355.60		1355.99	0.008697	5.01	68.47	68.91	0.89
Reach-1	4343	343.00	1353.93	1355.43		1355.82	0.008673	4.98	68.91	69.87	0.88
Reach-1	4323	343.00	1353.76	1355.25		1355.64	0.009175	5.03	68.14	70.91	0.90
Reach-1	4303	343.00	1353.59	1355.08		1355.45	0.008338	4.87	70.47	71.84	0.87
Reach-1	4283	343.00	1353.41	1354.93		1355.28	0.007880	4.77	71.94	72.49	0.84
Reach-1	4263	343.00	1353.23	1354.76		1355.12	0.007669	4.78	71.73	70.45	0.84
Reach-1	4243	343.00	1353.09	1354.62		1354.97	0.007406	4.75	72.18	69.69	0.82
Reach-1	4223	343.00	1352.90	1354.43		1354.80	0.008017	4.89	70.17	68.97	0.85
Reach-1	4203	343.00	1352.70	1354.24		1354.63	0.008638	5.01	68.40	68.28	0.88
Reach-1	4183	343.00	1352.55	1354.06		1354.46	0.008642	5.04	68.04	67.42	0.88

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

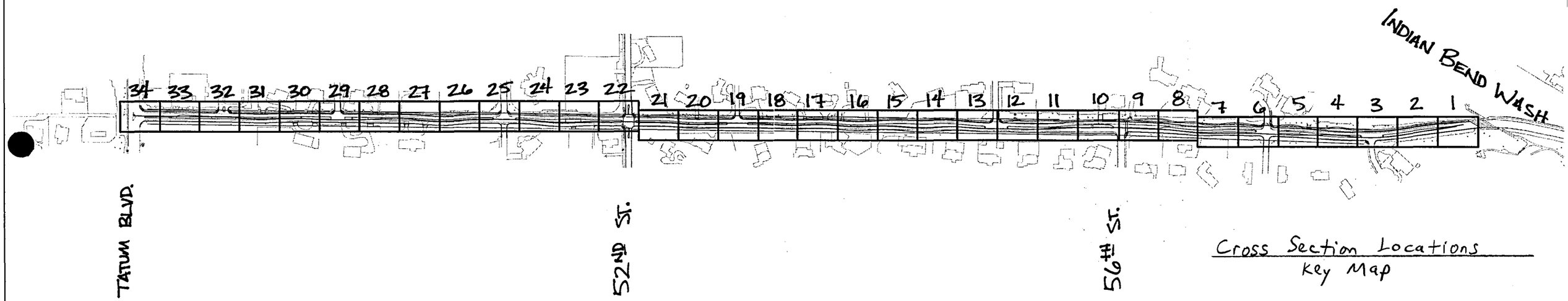
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5604	402.00	1363.52	1365.11		1365.51	0.008081	5.09	78.96	73.43	0.87
Reach-1	5584	402.00	1363.39	1364.97		1365.35	0.007597	4.97	80.92	74.56	0.84
Reach-1	5564	402.00	1363.20	1364.77		1365.18	0.008377	5.15	78.09	73.35	0.88
Reach-1	5544	402.00	1363.00	1364.61		1365.01	0.008025	5.09	78.94	72.88	0.86
Reach-1	5524	402.00	1362.87	1364.44		1364.85	0.008056	5.13	78.33	71.66	0.87
Reach-1	5504	402.00	1362.69	1364.26		1364.68	0.008422	5.22	77.03	71.05	0.88
Reach-1	5484	402.00	1362.50	1364.08		1364.51	0.008571	5.26	76.49	70.66	0.89
Reach-1	5464	402.00	1362.34	1363.91		1364.34	0.008639	5.25	76.53	71.28	0.89
Reach-1	5444	402.00	1362.17	1363.74		1364.16	0.008278	5.17	77.82	71.99	0.88
Reach-1	5424	402.00	1362.00	1363.57		1363.99	0.008526	5.21	77.15	72.05	0.89
Reach-1	5404	402.00	1361.82	1363.40		1363.82	0.008578	5.18	77.63	73.65	0.89
Reach-1	5384	402.00	1361.65	1363.25		1363.63	0.007618	4.95	81.18	75.36	0.84
Reach-1	5364	402.00	1361.48	1363.12		1363.48	0.007065	4.82	83.43	76.24	0.81
Reach-1	5344	402.00	1361.31	1363.00		1363.33	0.006014	4.61	87.25	75.27	0.75
Reach-1	5324	402.00	1361.16	1362.90		1363.21	0.005259	4.45	90.44	74.13	0.71
Reach-1	5304	402.00	1361.01	1362.82		1363.10	0.004487	4.23	94.98	74.08	0.66
Reach-1	5284	402.00	1360.86	1362.53		1362.94	0.007605	5.14	78.23	68.34	0.85
Reach-1	5264	402.00	1360.71	1362.38		1362.79	0.007553	5.14	78.25	68.03	0.84
Reach-1	5244	402.00	1360.55	1362.24		1362.64	0.006968	5.04	79.82	67.25	0.81
Reach-1	5224	402.00	1360.40	1362.07		1362.49	0.007534	5.18	77.54	66.26	0.84
Reach-1	5204	402.00	1360.25	1361.92		1362.34	0.007563	5.21	77.14	65.67	0.85
Reach-1	5184	402.00	1360.09	1361.76		1362.19	0.007713	5.26	76.45	65.04	0.85
Reach-1	5164	402.00	1359.94	1361.61		1362.03	0.007582	5.23	76.88	65.17	0.85
Reach-1	5144	402.00	1359.79	1361.46		1361.88	0.007587	5.22	76.97	65.41	0.85
Reach-1	5124	402.00	1359.63	1361.30		1361.72	0.007471	5.20	77.30	65.36	0.84
Reach-1	5104	402.00	1359.48	1361.15		1361.58	0.007462	5.20	77.29	65.26	0.84
Reach-1	5084	402.00	1359.32	1361.02		1361.42	0.006955	5.06	79.48	66.43	0.81
Reach-1	5064	402.00	1359.17	1360.76	1360.70	1361.24	0.009546	5.56	72.25	66.41	0.94
Reach-1	5044	402.00	1359.01	1360.64		1361.02	0.007330	4.99	80.61	71.01	0.82
Reach-1	5024	402.00	1358.85	1360.51		1360.87	0.006677	4.84	83.03	71.47	0.79
Reach-1	5003	402.00	1358.71	1360.39		1360.73	0.006260	4.72	85.12	72.73	0.77
Reach-1	4983	402.00	1358.60	1360.27		1360.60	0.006164	4.66	86.23	74.65	0.76
Reach-1	4963	402.00	1358.49	1360.15		1360.48	0.005817	4.55	88.41	76.24	0.74
Reach-1	4943	402.00	1358.30	1360.05		1360.36	0.005451	4.48	89.75	75.26	0.72
Reach-1	4923	402.00	1358.21	1359.90		1360.24	0.006017	4.66	86.32	73.45	0.76
Reach-1	4903	402.00	1358.10	1359.76		1360.11	0.006389	4.77	84.26	72.34	0.78

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6325	402.00	1371.48	1373.01		1373.44	0.009372	5.26	76.36	75.63	0.92
Reach-1	6305	402.00	1371.29	1372.81		1373.25	0.009653	5.33	75.49	75.14	0.94
Reach-1	6285	402.00	1371.10	1372.62		1373.06	0.009628	5.34	75.28	74.36	0.94
Reach-1	6265	402.00	1370.91	1372.43		1372.87	0.009547	5.32	75.61	74.72	0.93
Reach-1	6245	402.00	1370.72	1372.24		1372.68	0.009519	5.30	75.78	74.98	0.93
Reach-1	6225	402.00	1370.53	1372.05		1372.48	0.009461	5.29	76.02	75.26	0.93
Reach-1	6205	402.00	1370.34	1371.87		1372.29	0.009094	5.22	77.05	75.56	0.91
Reach-1	6185	402.00	1370.14	1371.71		1372.11	0.008144	5.04	79.81	75.94	0.87
Reach-1	6165	402.00	1369.95	1371.41	1371.41	1371.90	0.011222	5.57	72.11	75.05	1.00
Reach-1	6145	402.00	1369.72	1371.18	1371.18	1371.67	0.011392	5.60	71.75	74.90	1.01
Reach-1	6125	402.00	1369.48	1370.94	1370.94	1371.43	0.011379	5.63	71.46	74.06	1.01
Reach-1	6105	402.00	1369.24	1370.72	1370.70	1371.19	0.010701	5.53	72.73	73.94	0.98
Reach-1	6085	402.00	1369.00	1370.48	1370.48	1370.97	0.011374	5.65	71.09	73.03	1.01
Reach-1	6065	402.00	1368.77	1370.24	1370.24	1370.73	0.011312	5.67	70.89	72.16	1.01
Reach-1	6045	402.00	1368.54	1370.00	1370.00	1370.51	0.011302	5.70	70.53	71.19	1.01
Reach-1	6025	402.00	1368.30	1369.77	1369.77	1370.28	0.011306	5.72	70.31	70.54	1.01
Reach-1	6005	402.00	1368.06	1369.53	1369.53	1370.04	0.011204	5.70	70.47	70.48	1.01
Reach-1	5985	402.00	1367.83	1369.30	1369.30	1369.80	0.011278	5.72	70.33	70.53	1.01
Reach-1	5965	402.00	1367.59	1369.06	1369.06	1369.57	0.011308	5.71	70.39	70.76	1.01
Reach-1	5945	402.00	1367.35	1368.83	1368.83	1369.33	0.011250	5.70	70.58	71.05	1.01
Reach-1	5925	402.00	1367.10	1368.58	1368.58	1369.08	0.011366	5.68	70.81	72.20	1.01
Reach-1	5905	402.00	1366.87	1368.36	1368.34	1368.84	0.010513	5.53	72.65	72.55	0.97
Reach-1	5885	402.00	1366.63	1368.19		1368.62	0.008874	5.23	76.80	73.41	0.90
Reach-1	5865	402.00	1366.39	1368.09		1368.43	0.006142	4.67	86.15	73.87	0.76
Reach-1	5845	402.00	1366.16	1367.70	1367.70	1368.21	0.011160	5.75	69.96	69.05	1.01
Reach-1	5825	402.00	1365.93	1367.47	1367.47	1367.98	0.011165	5.76	69.76	68.60	1.01
Reach-1	5805	402.00	1365.70	1367.24	1367.24	1367.76	0.011115	5.79	69.43	67.48	1.01
Reach-1	5785	402.00	1365.47	1367.00	1367.00	1367.52	0.011139	5.80	69.28	67.20	1.01
Reach-1	5765	402.00	1365.23	1366.76	1366.76	1367.28	0.011201	5.82	69.05	66.92	1.01
Reach-1	5745	402.00	1364.99	1366.52	1366.52	1367.04	0.011098	5.75	69.89	68.50	1.00
Reach-1	5725	402.00	1364.76	1366.29	1366.28	1366.79	0.010785	5.67	70.95	69.74	0.99
Reach-1	5705	402.00	1364.52	1366.05	1366.05	1366.57	0.011291	5.78	69.52	68.55	1.01
Reach-1	5685	402.00	1364.27	1365.81	1365.81	1366.33	0.011095	5.79	69.39	67.31	1.01
Reach-1	5664	402.00	1364.00	1365.60		1366.04	0.008726	5.32	75.51	68.95	0.90
Reach-1	5644	402.00	1363.90	1365.43		1365.86	0.008548	5.25	76.54	70.46	0.89
Reach-1	5624	402.00	1363.69	1365.27		1365.68	0.008147	5.13	78.33	72.19	0.87

HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7045	402.00	1378.90	1380.36	1380.36	1380.84	0.011517	5.56	72.29	76.91	1.01
Reach-1	7025	402.00	1378.50	1379.97	1379.97	1380.46	0.011493	5.58	72.00	76.11	1.01
Reach-1	7005	402.00	1378.10	1379.57	1379.57	1380.05	0.011392	5.56	72.35	76.55	1.01
Reach-1	6985	402.00	1377.70	1379.17	1379.17	1379.65	0.011478	5.56	72.35	76.95	1.01
Reach-1	6965	402.00	1377.30	1378.79	1378.79	1379.28	0.011405	5.56	72.26	76.31	1.01
Reach-1	6945	402.00	1377.00	1378.47	1378.47	1378.96	0.011437	5.60	71.79	75.26	1.01
Reach-1	6925	402.00	1376.73	1378.21	1378.19	1378.68	0.010683	5.49	73.25	75.20	0.98
Reach-1	6905	402.00	1376.50	1378.04		1378.46	0.009004	5.19	77.39	75.83	0.91
Reach-1	6885	402.00	1376.30	1377.88		1378.28	0.008223	5.04	79.78	76.51	0.87
Reach-1	6865	402.00	1376.10	1377.73		1378.11	0.007834	4.96	81.03	76.63	0.85
Reach-1	6845	402.00	1375.99	1377.57		1377.95	0.007928	4.98	80.66	76.44	0.86
Reach-1	6825	402.00	1375.80	1377.41		1377.79	0.007664	4.94	81.40	76.28	0.84
Reach-1	6805	402.00	1375.66	1377.23		1377.63	0.008131	5.06	79.40	74.87	0.87
Reach-1	6785	402.00	1375.50	1377.07		1377.47	0.008310	5.08	79.19	75.60	0.87
Reach-1	6765	402.00	1375.30	1376.91		1377.30	0.008044	5.01	80.18	76.13	0.86
Reach-1	6745	402.00	1375.17	1376.76		1377.14	0.007771	4.95	81.13	76.46	0.85
Reach-1	6725	402.00	1375.00	1376.60		1376.98	0.007787	4.95	81.21	76.73	0.85
Reach-1	6705	402.00	1374.80	1376.46		1376.82	0.007126	4.80	83.71	77.46	0.81
Reach-1	6685	402.00	1374.69	1376.28		1376.67	0.007601	4.96	80.97	74.70	0.84
Reach-1	6665	402.00	1374.50	1376.10		1376.50	0.007923	5.06	79.42	73.40	0.86
Reach-1	6645	402.00	1374.36	1375.94		1376.35	0.008009	5.09	78.99	73.02	0.86
Reach-1	6625	402.00	1374.20	1375.79		1376.18	0.007914	5.04	79.69	74.05	0.86
Reach-1	6605	402.00	1374.04	1375.64		1376.02	0.007446	4.93	81.56	75.00	0.83
Reach-1	6585	402.00	1373.87	1375.47		1375.86	0.007573	5.02	80.07	72.40	0.84
Reach-1	6565	402.00	1373.70	1375.28		1375.70	0.008464	5.22	76.98	71.27	0.89
Reach-1	6545	402.00	1373.54	1375.11		1375.53	0.008319	5.18	77.57	71.78	0.88
Reach-1	6525	402.00	1373.39	1374.95		1375.36	0.008371	5.18	77.60	72.12	0.88
Reach-1	6505	402.00	1373.20	1374.74		1375.18	0.009362	5.35	75.07	72.26	0.93
Reach-1	6485	402.00	1373.00	1374.54		1374.99	0.009667	5.42	74.11	71.64	0.94
Reach-1	6465	402.00	1372.82	1374.33	1374.29	1374.80	0.009997	5.49	73.20	71.18	0.95
Reach-1	6445	402.00	1372.60	1374.16		1374.59	0.009267	5.30	75.78	73.43	0.92
Reach-1	6425	402.00	1372.40	1373.98		1374.40	0.008900	5.20	77.25	74.79	0.90
Reach-1	6405	402.00	1372.24	1373.77		1374.22	0.009553	5.36	74.99	73.22	0.93
Reach-1	6385	402.00	1372.04	1373.57	1373.52	1374.02	0.009758	5.40	74.50	73.15	0.94
Reach-1	6365	402.00	1371.85	1373.38		1373.82	0.009660	5.34	75.29	74.60	0.94
Reach-1	6345	402.00	1371.66	1373.20		1373.63	0.009378	5.27	76.30	75.51	0.92

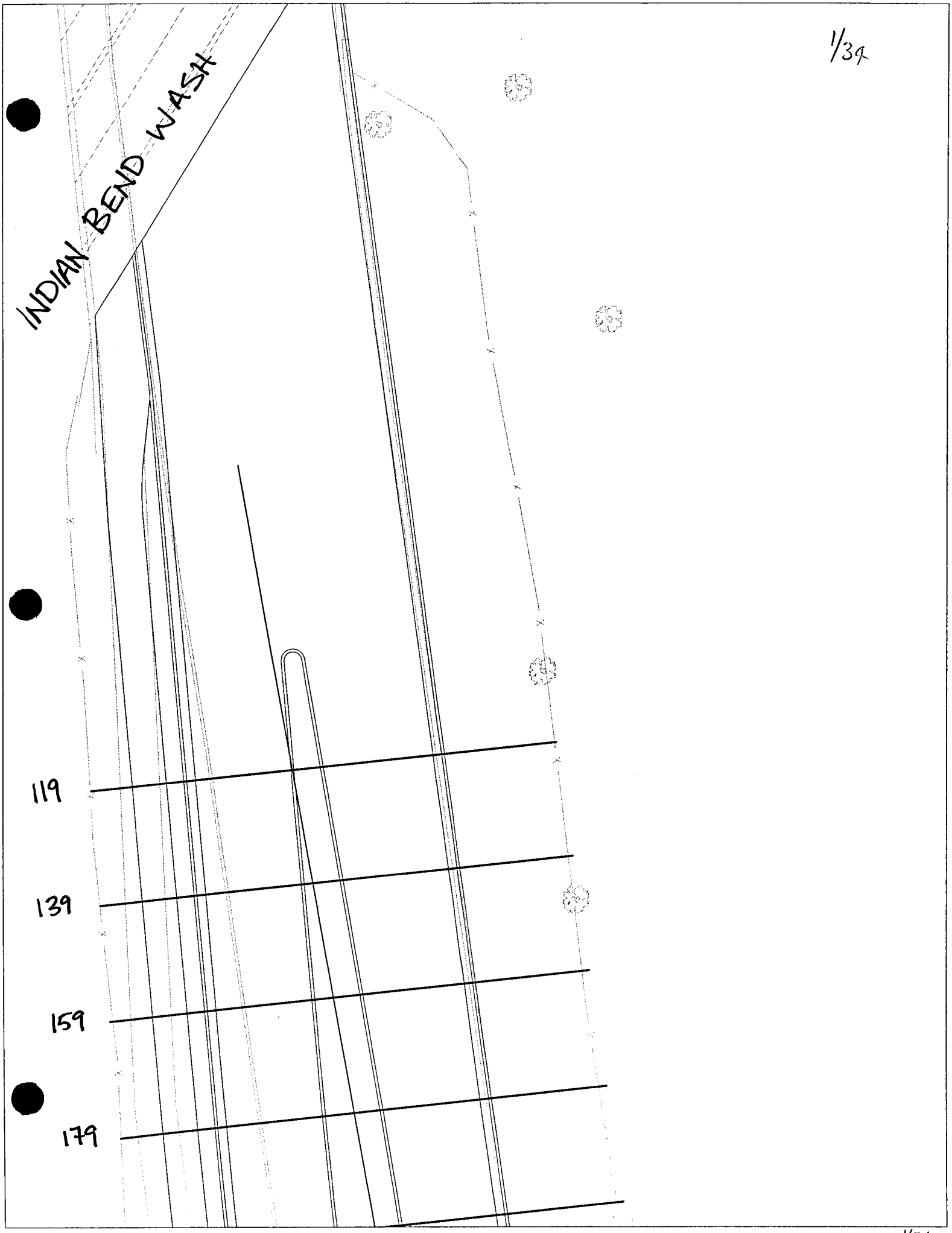


Cross Section Locations
Key Map

No Scale

N

Note: North is to the right on each of the 34 sheets depicting the cross section locations.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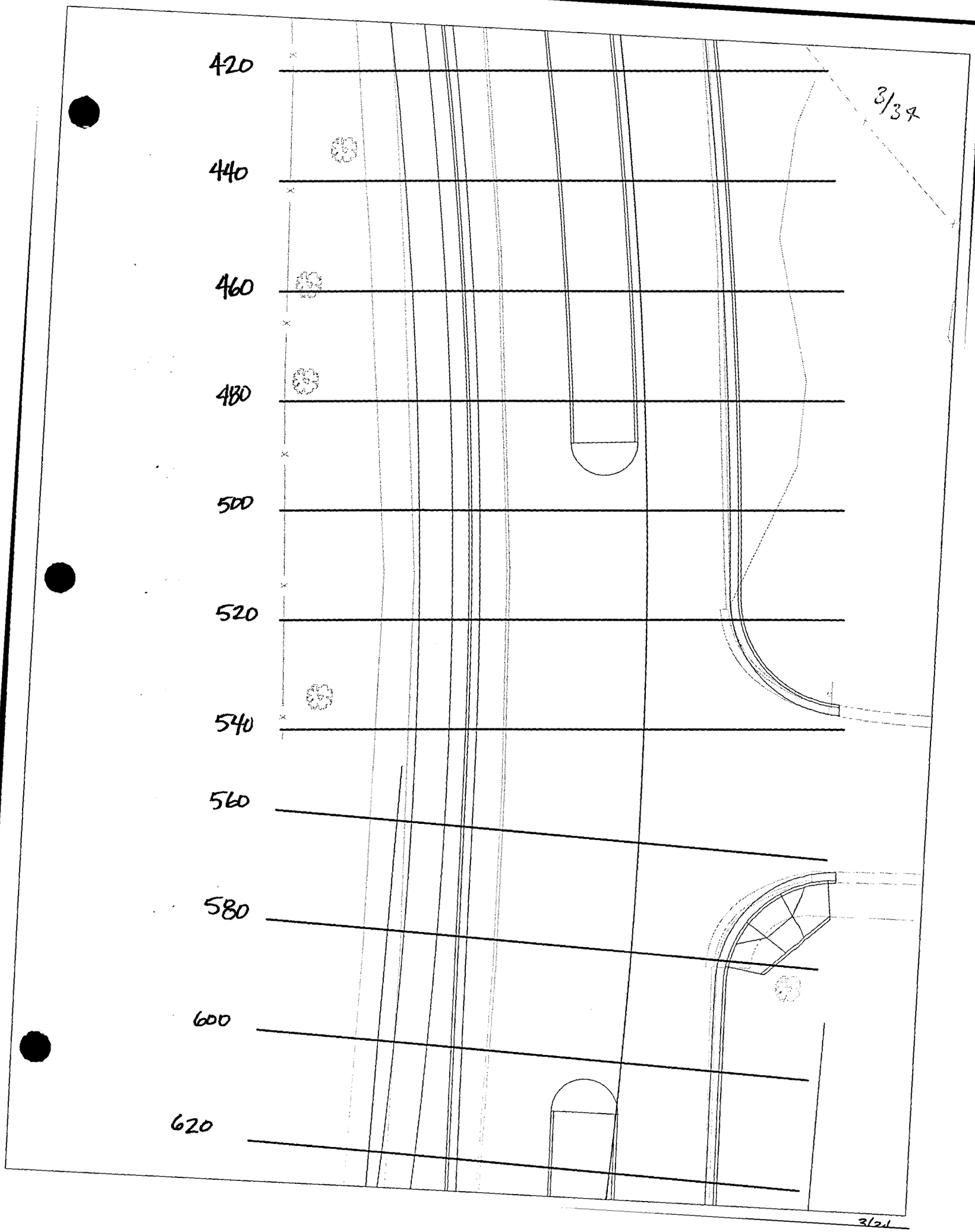
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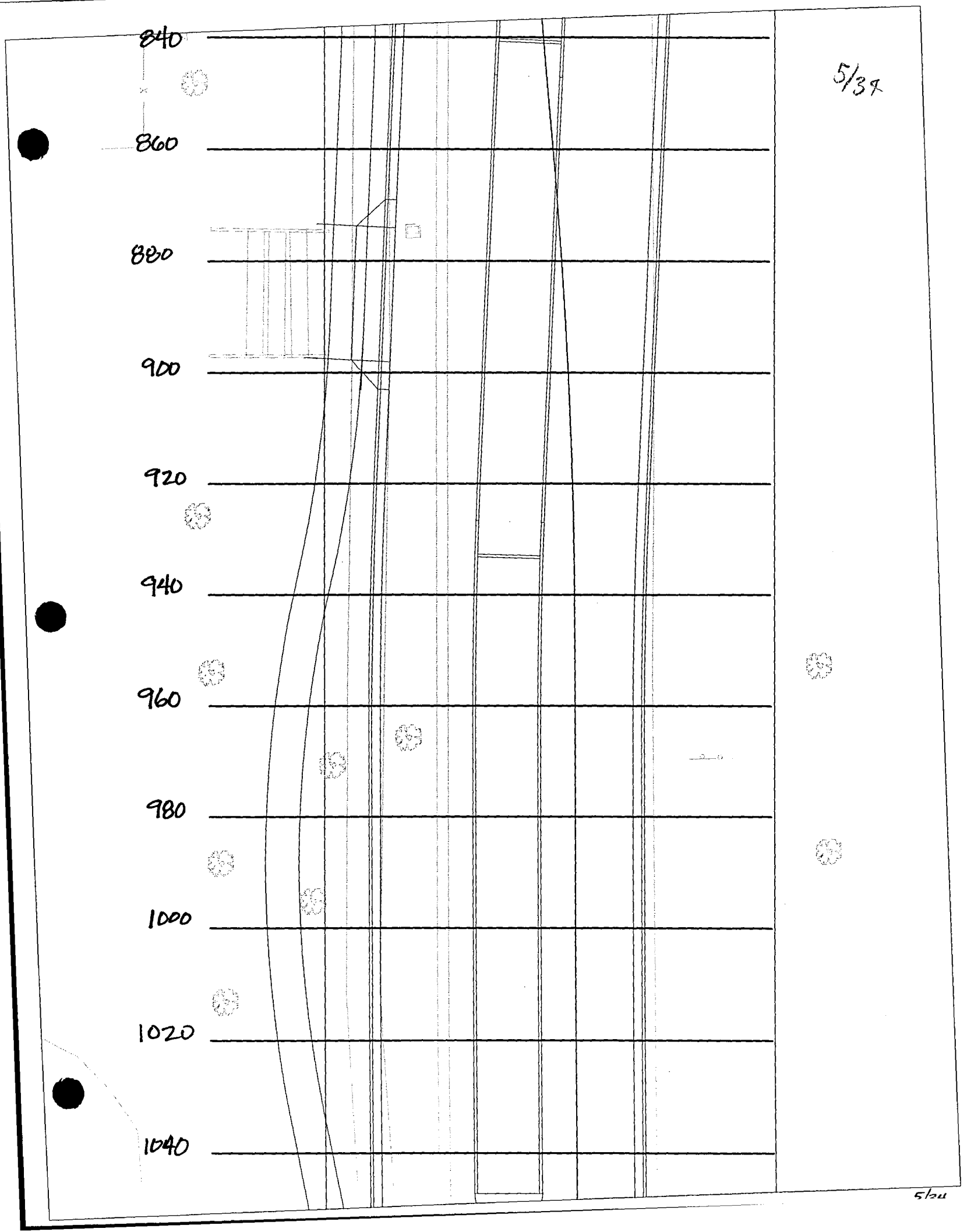
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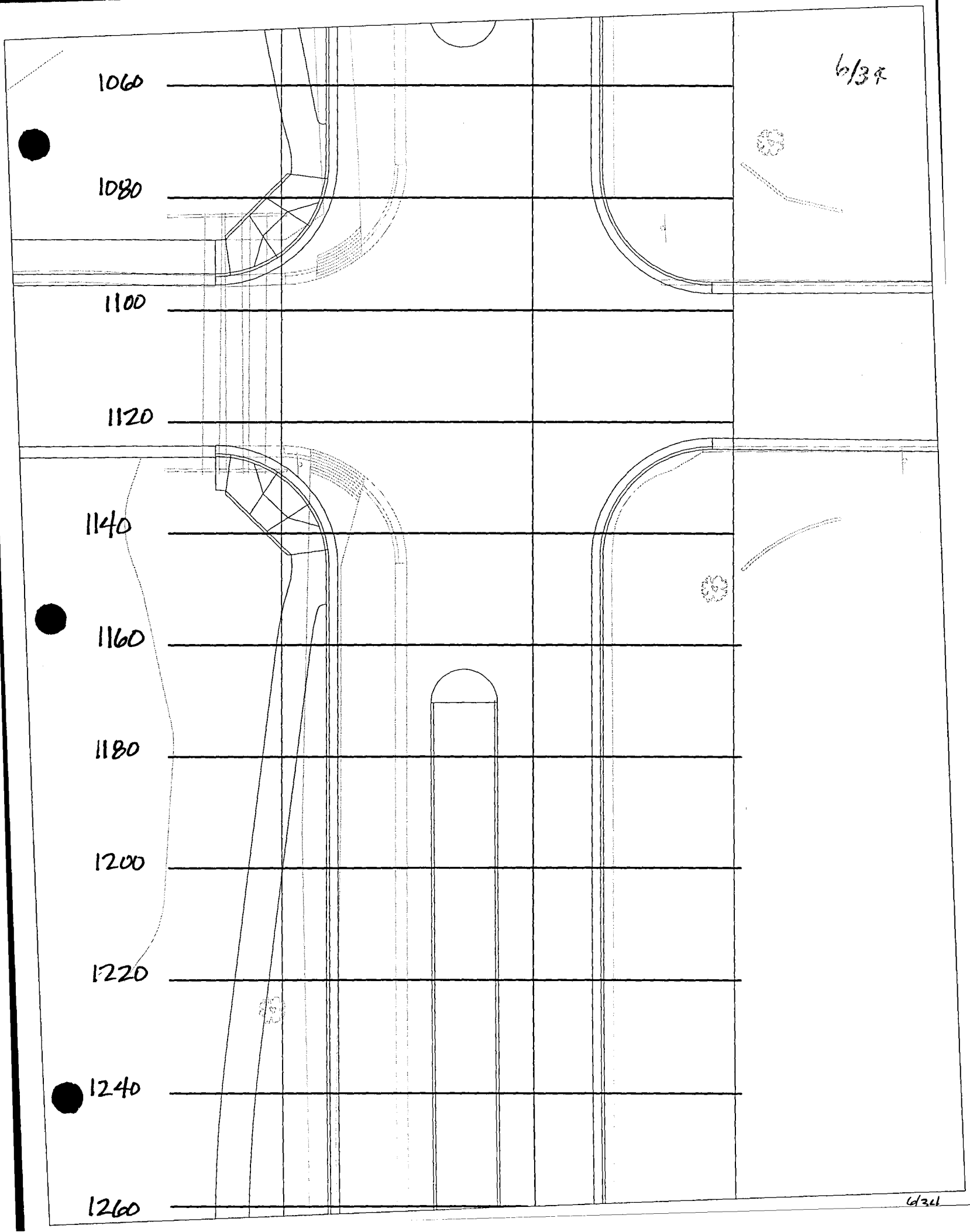
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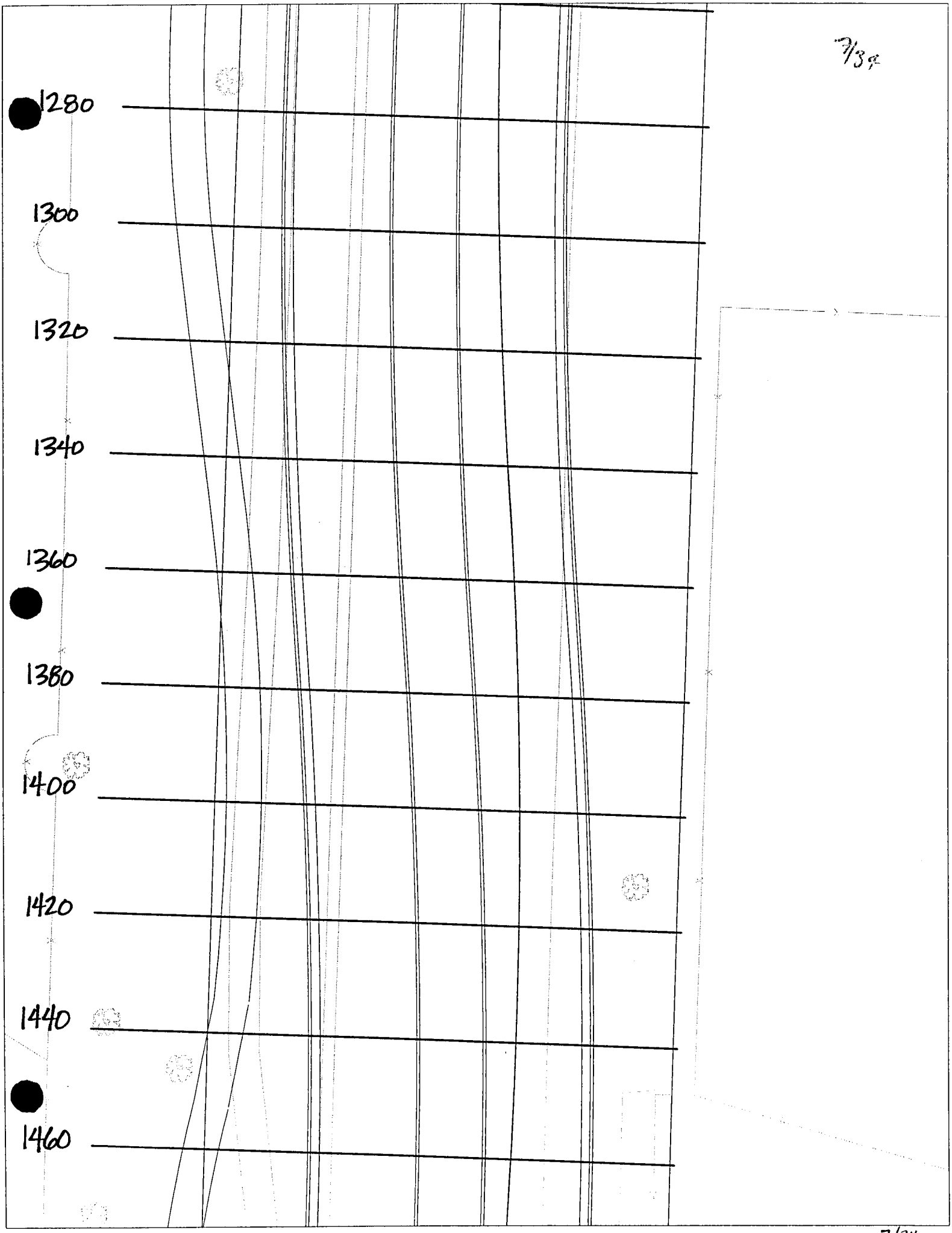

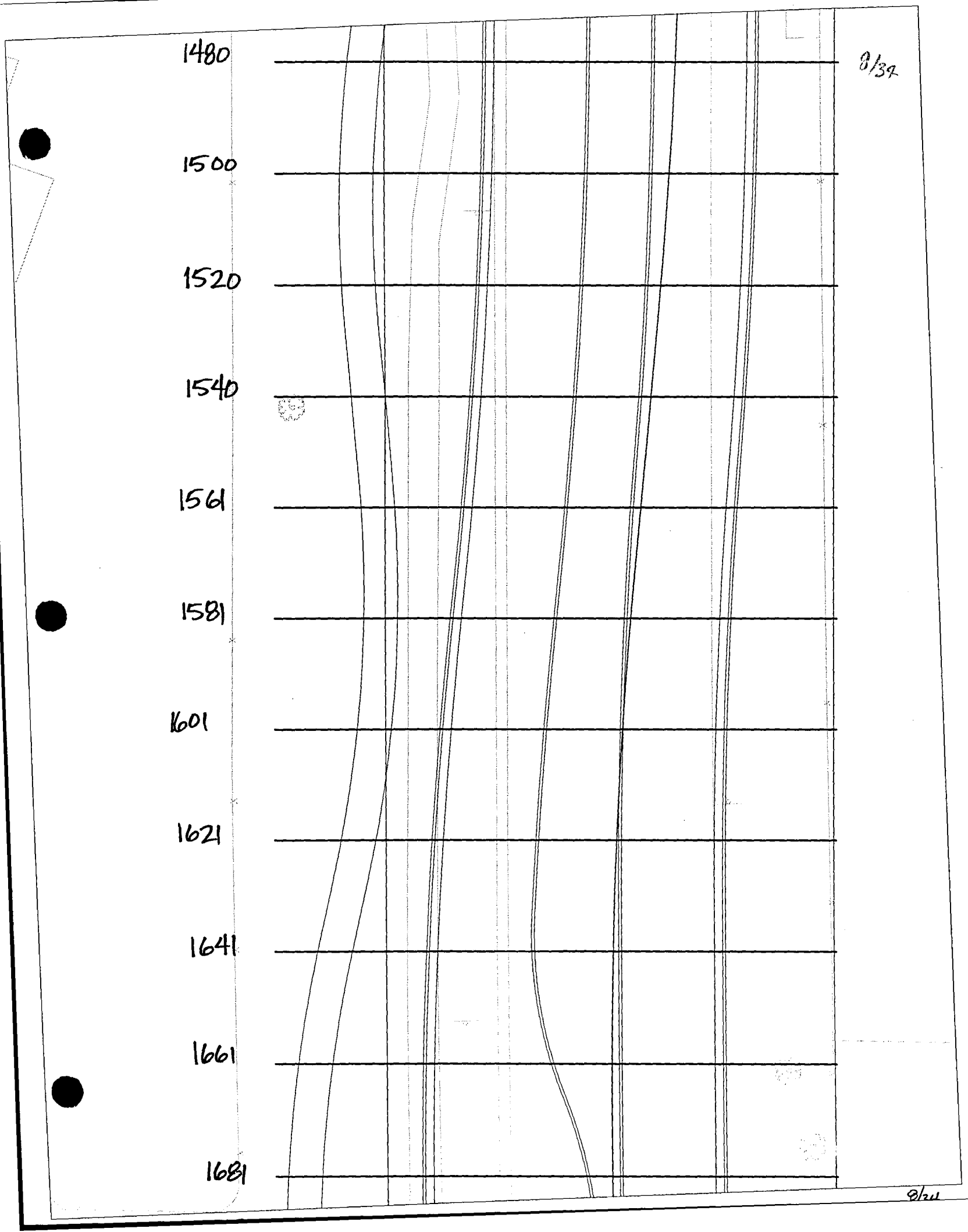
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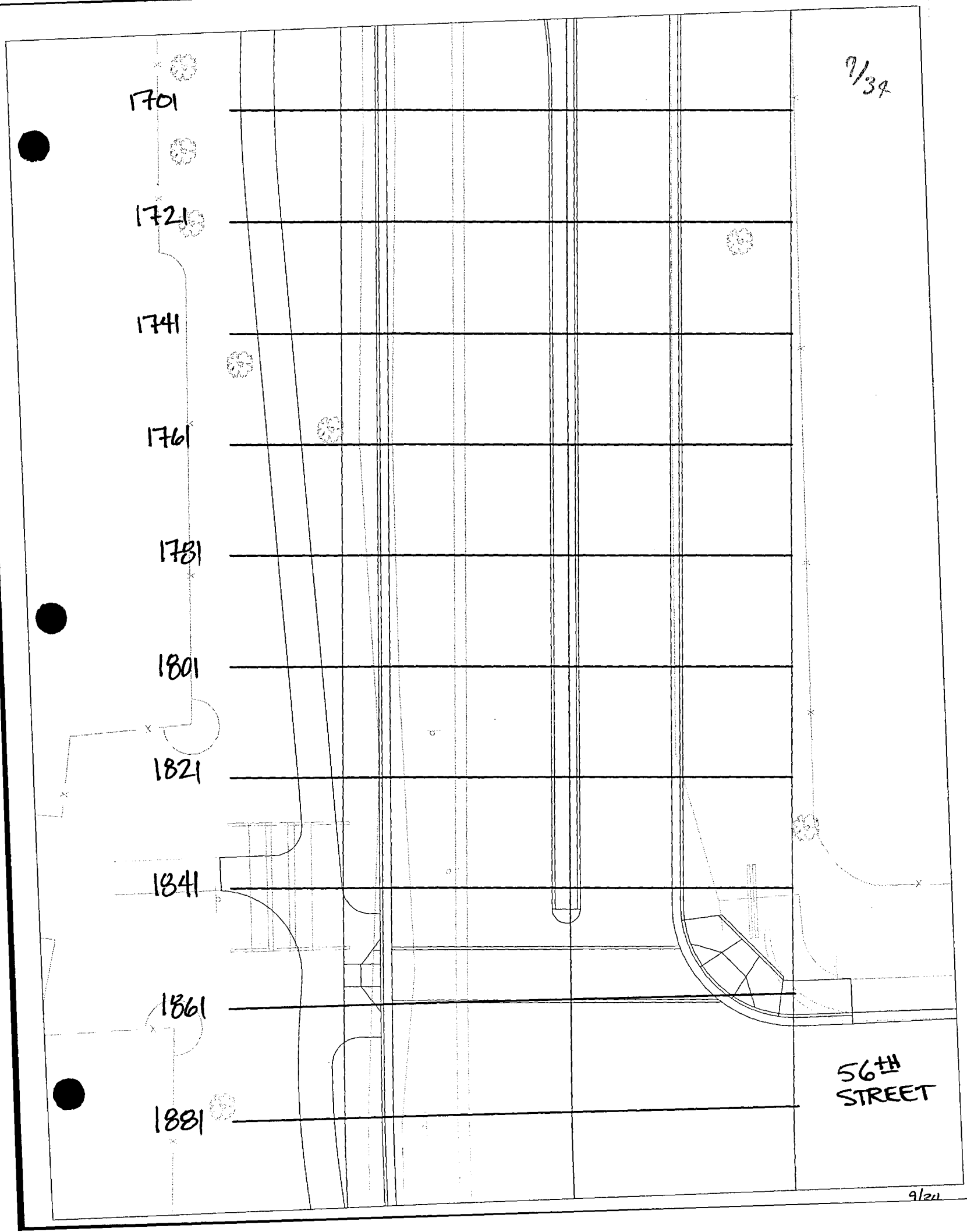
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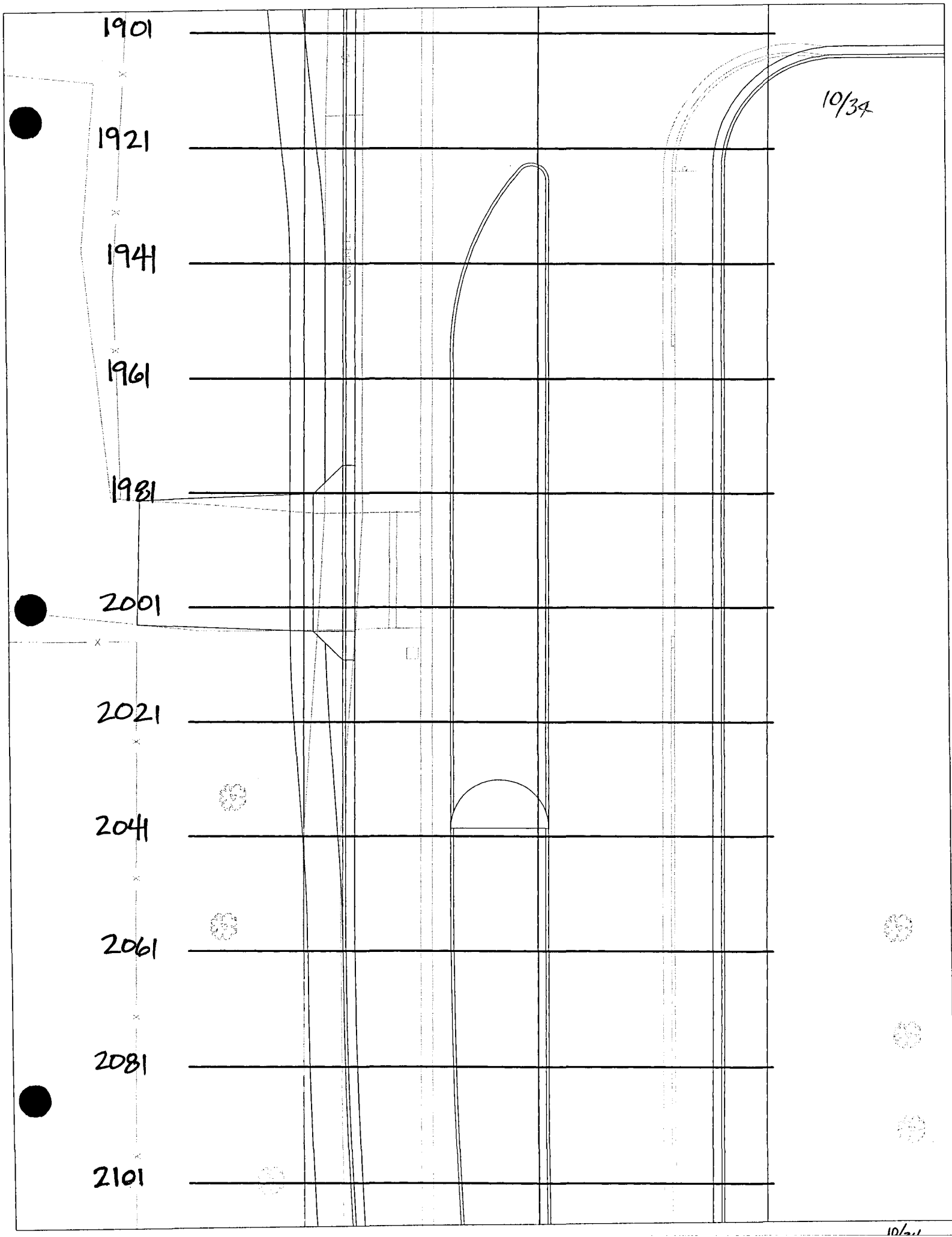
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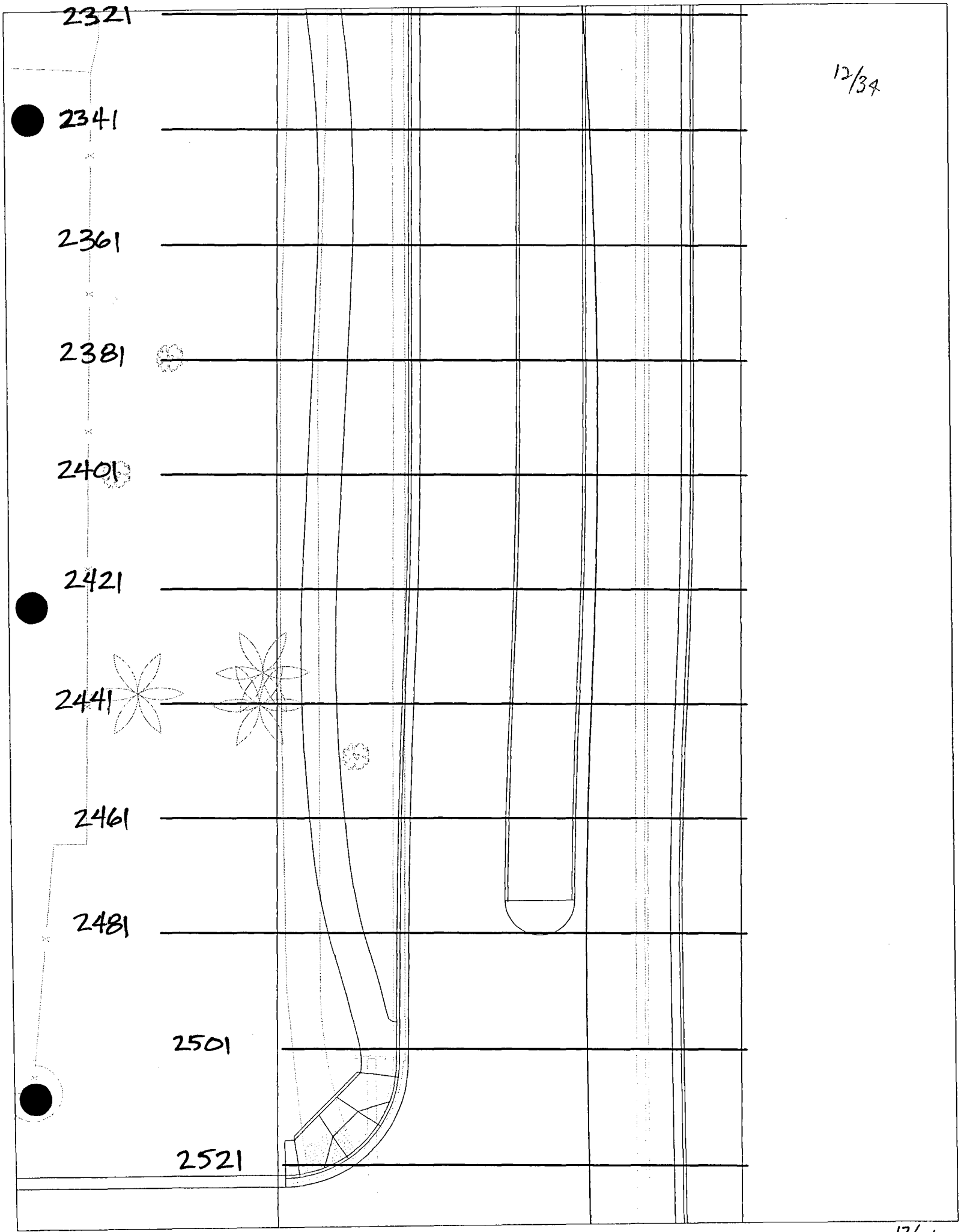
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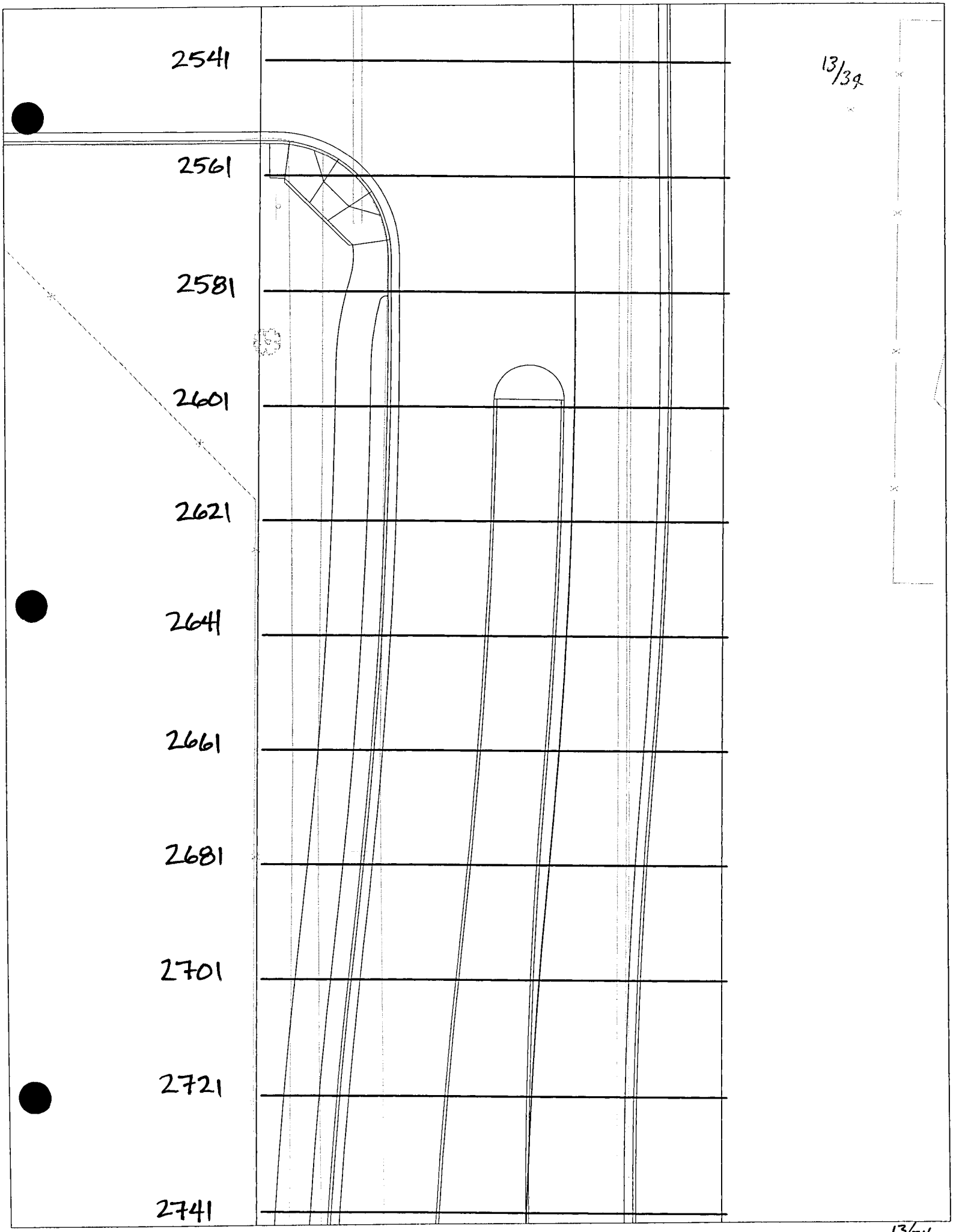
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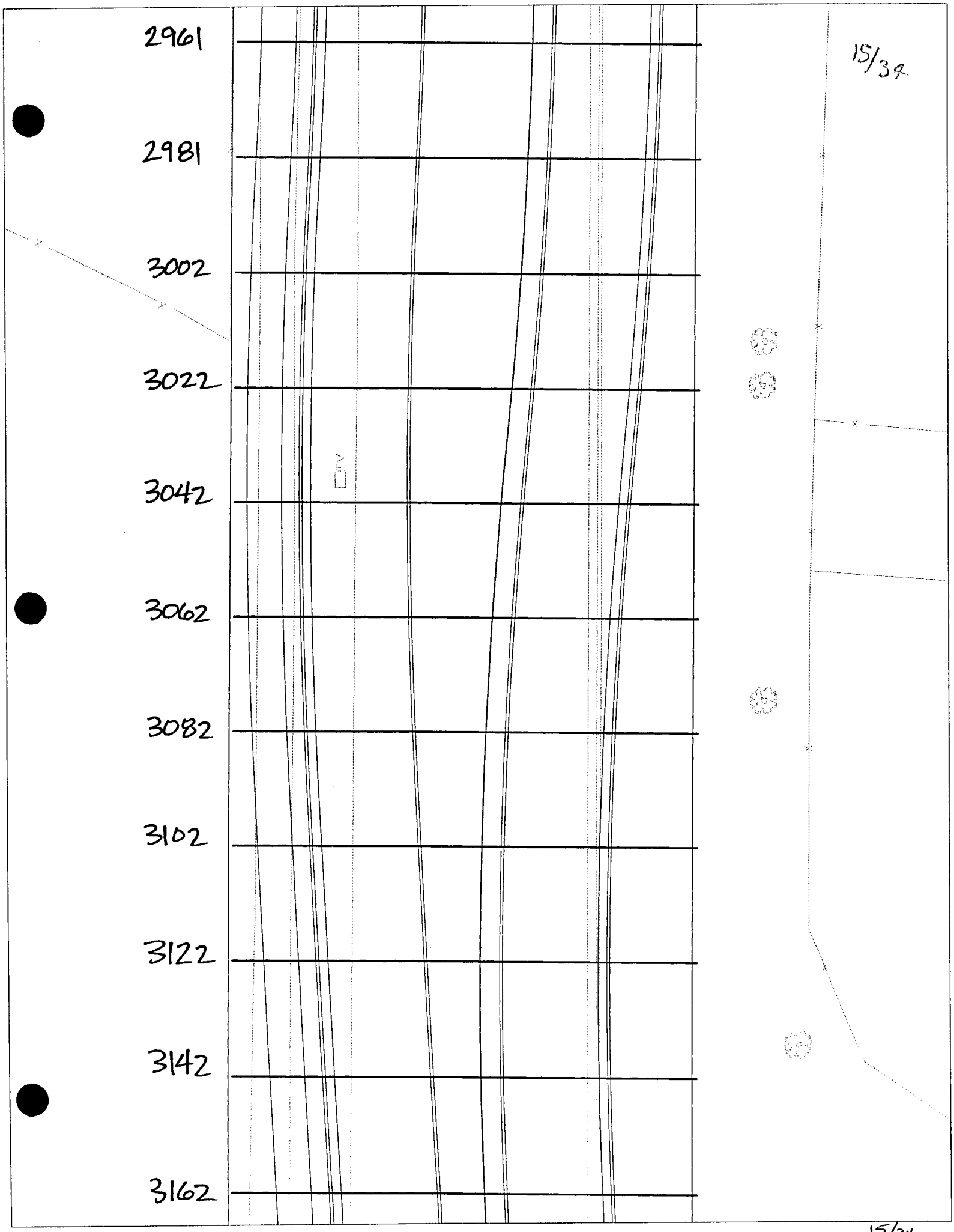
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16/39

3182

3202

3222

3242

3262

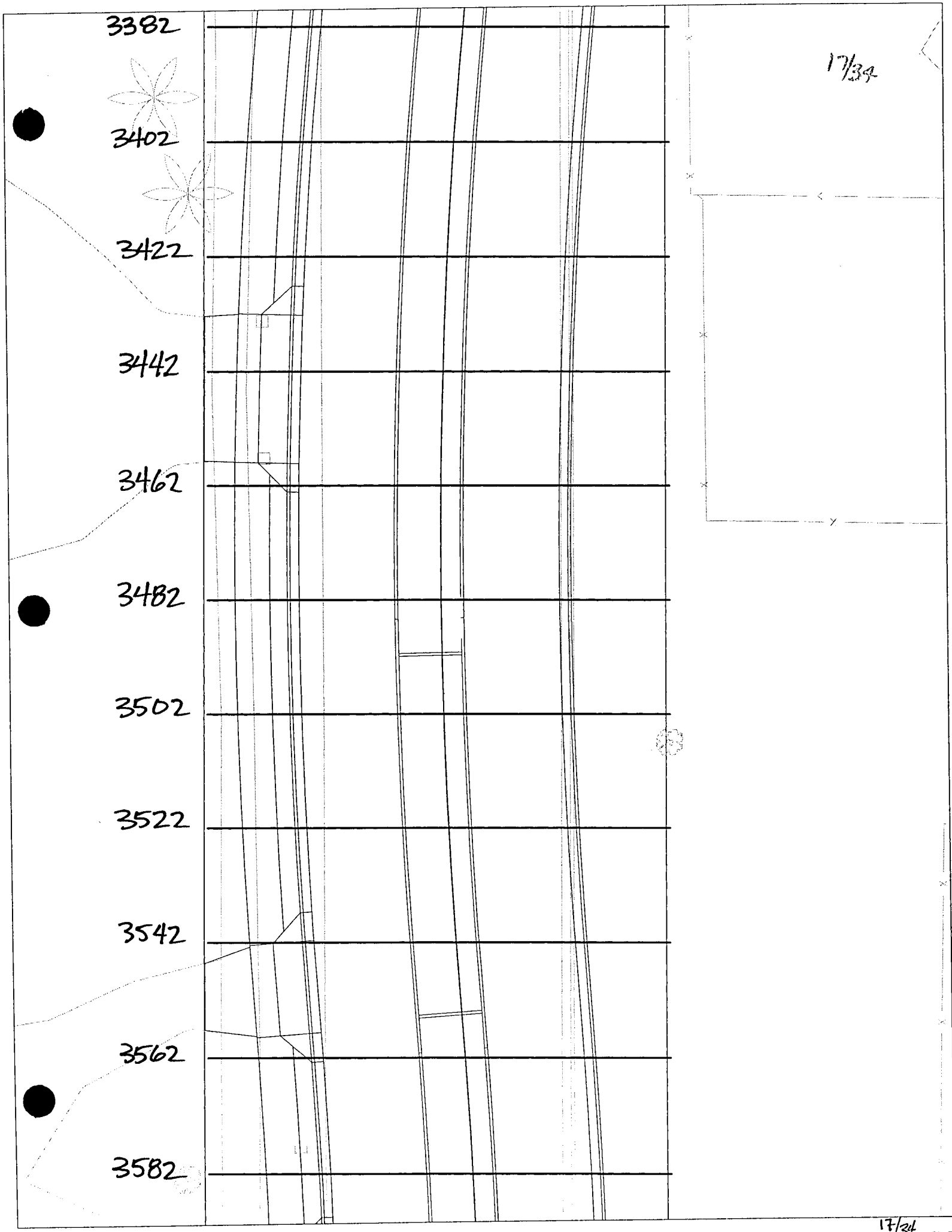
3282

3302

3322

3342

3362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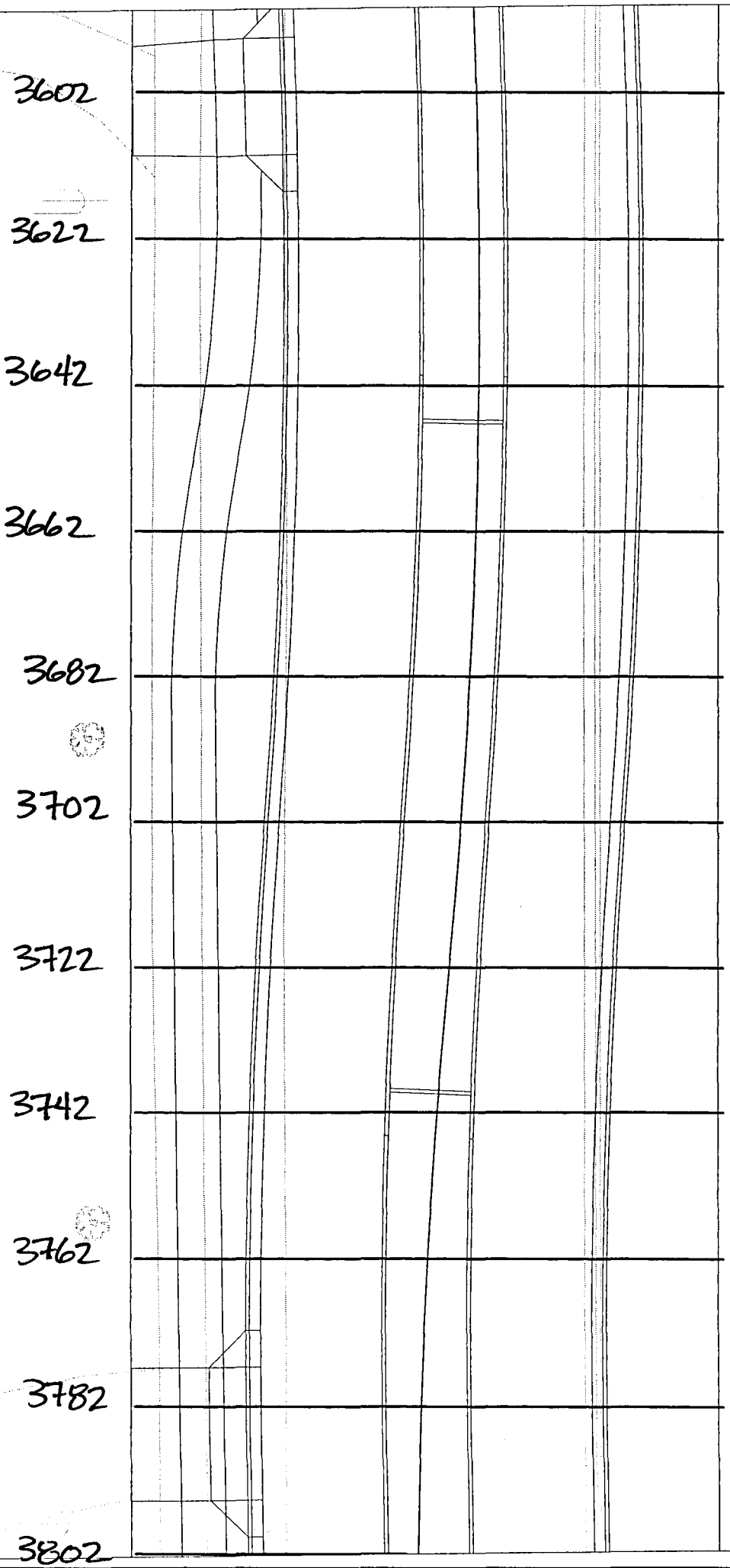
3562
3582
17/34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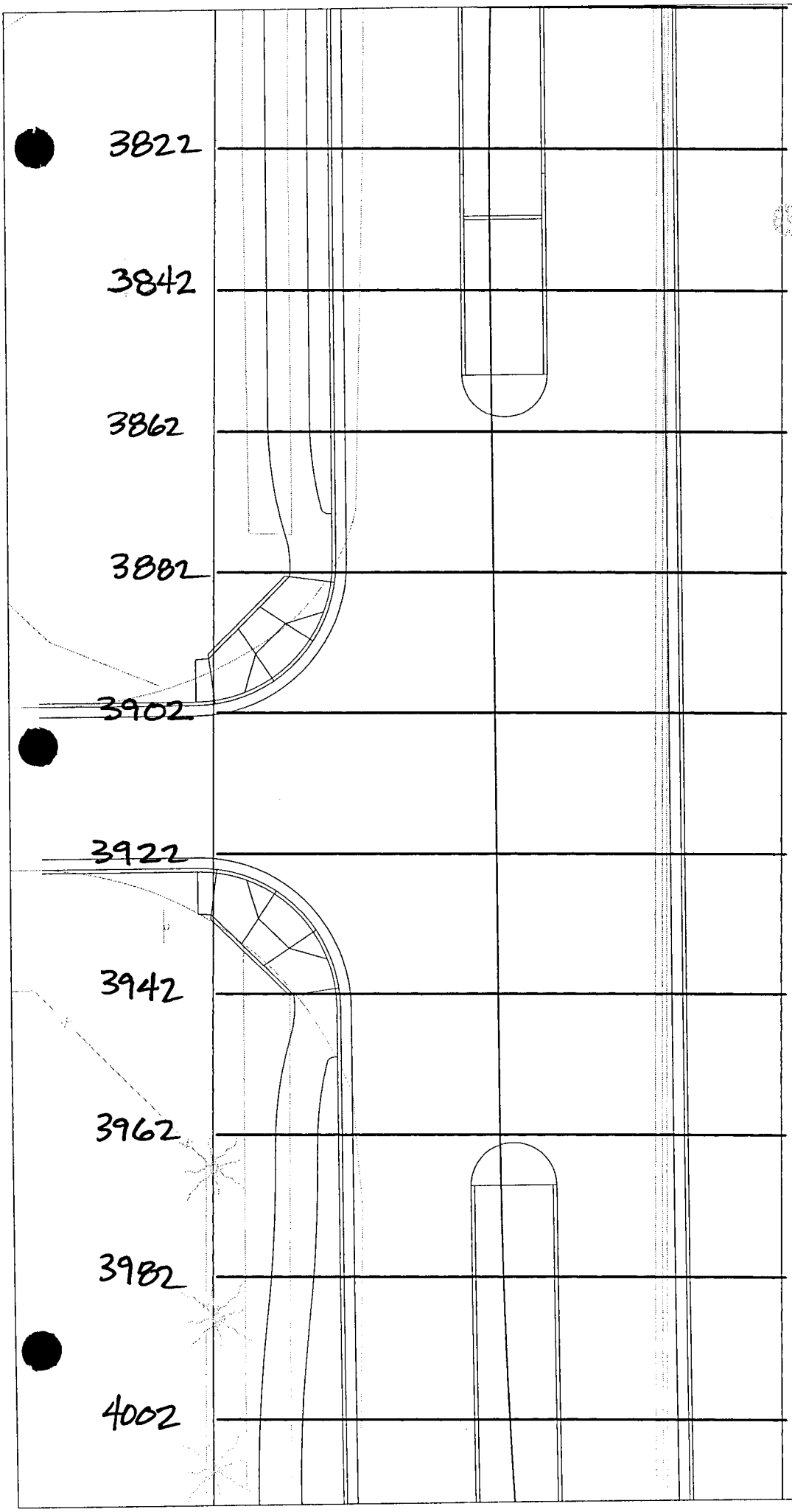
3762
3782
3802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3962
3982
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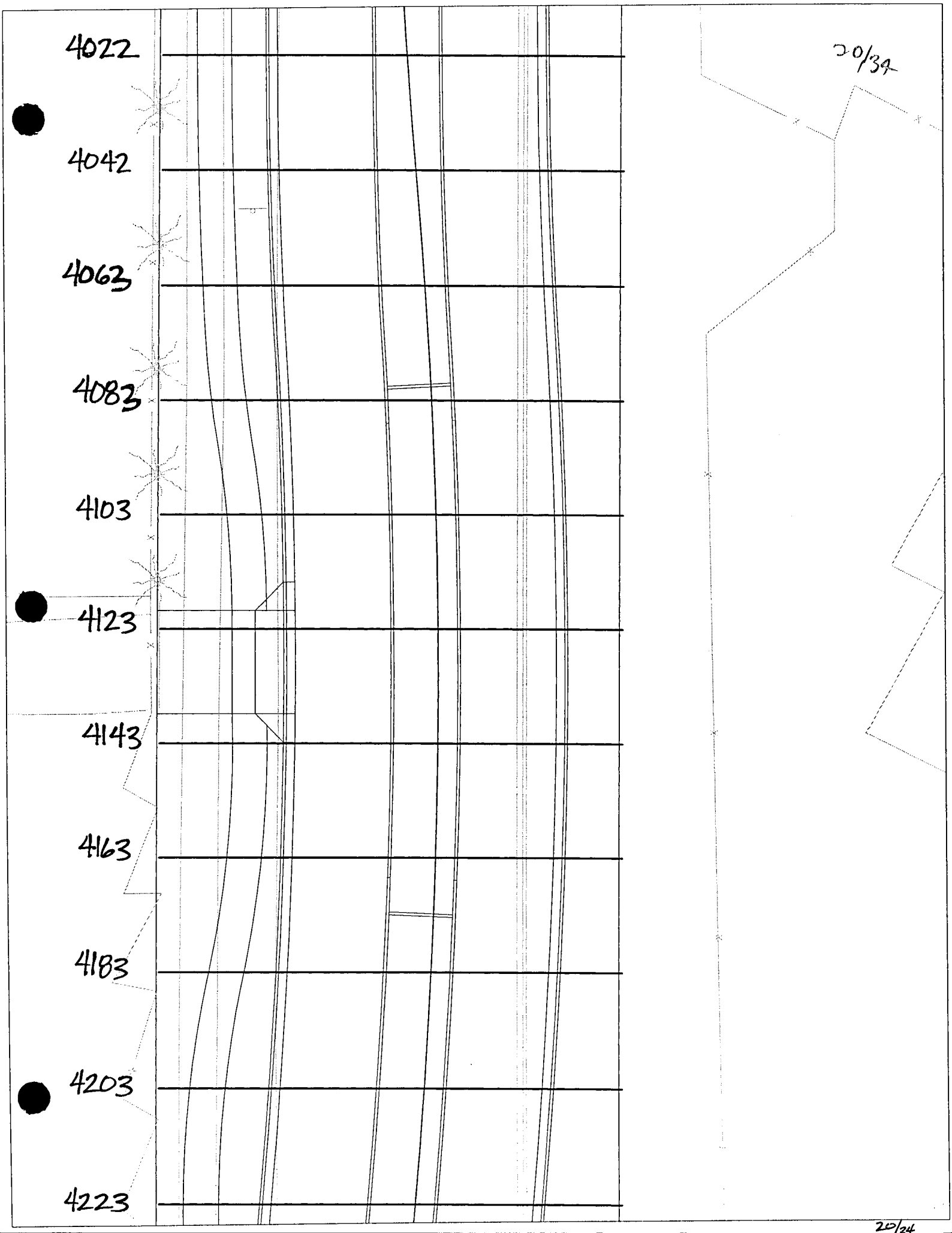
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4042
4063
4083
4103
4123
4143
4163
4183
4203
4223
20/34
20/24

21/32

4243

4263

4283

4303

4323

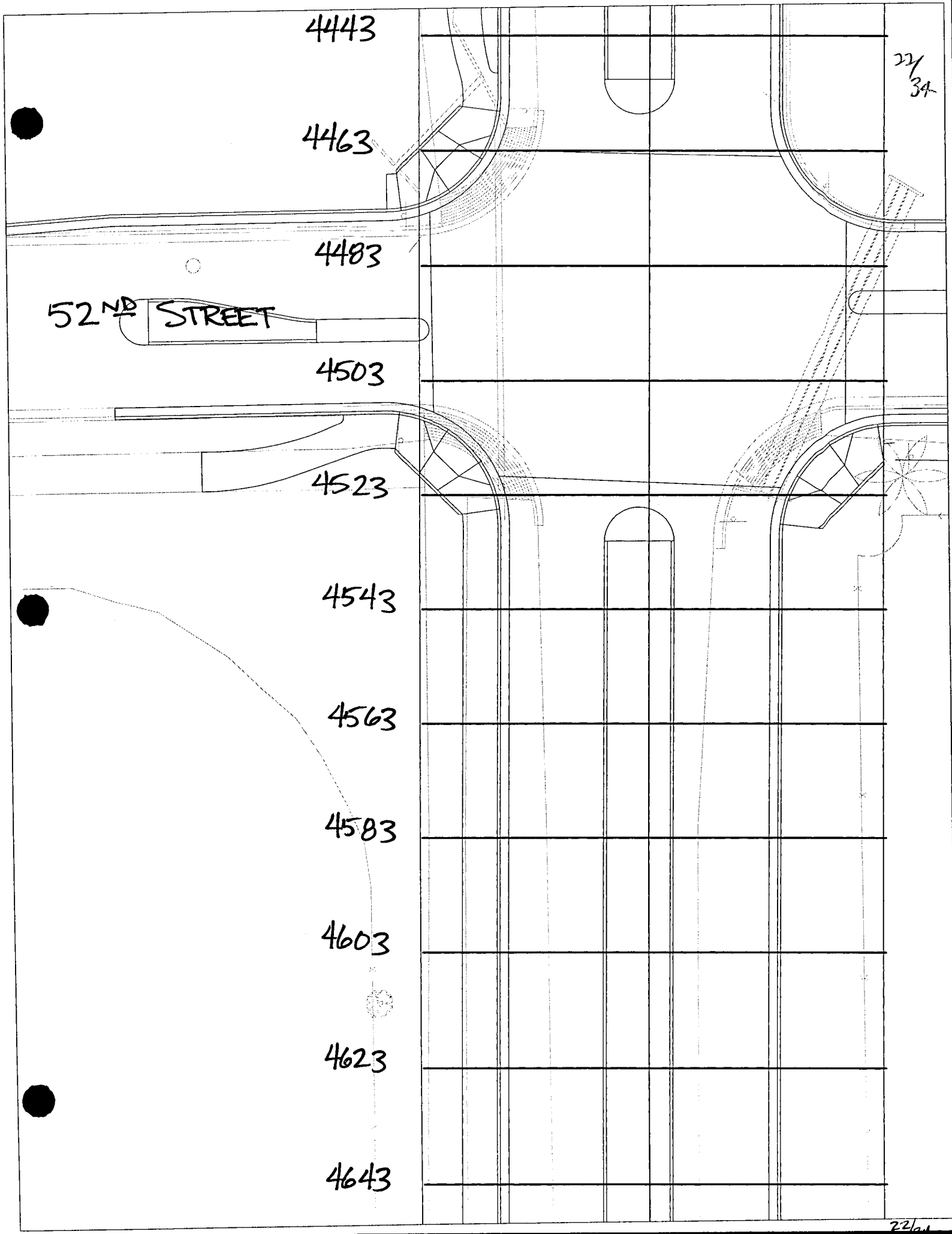
4343

4363

4383

4403

4423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4463
4483
52ND STREET
4503
4523
4543
4563
4583
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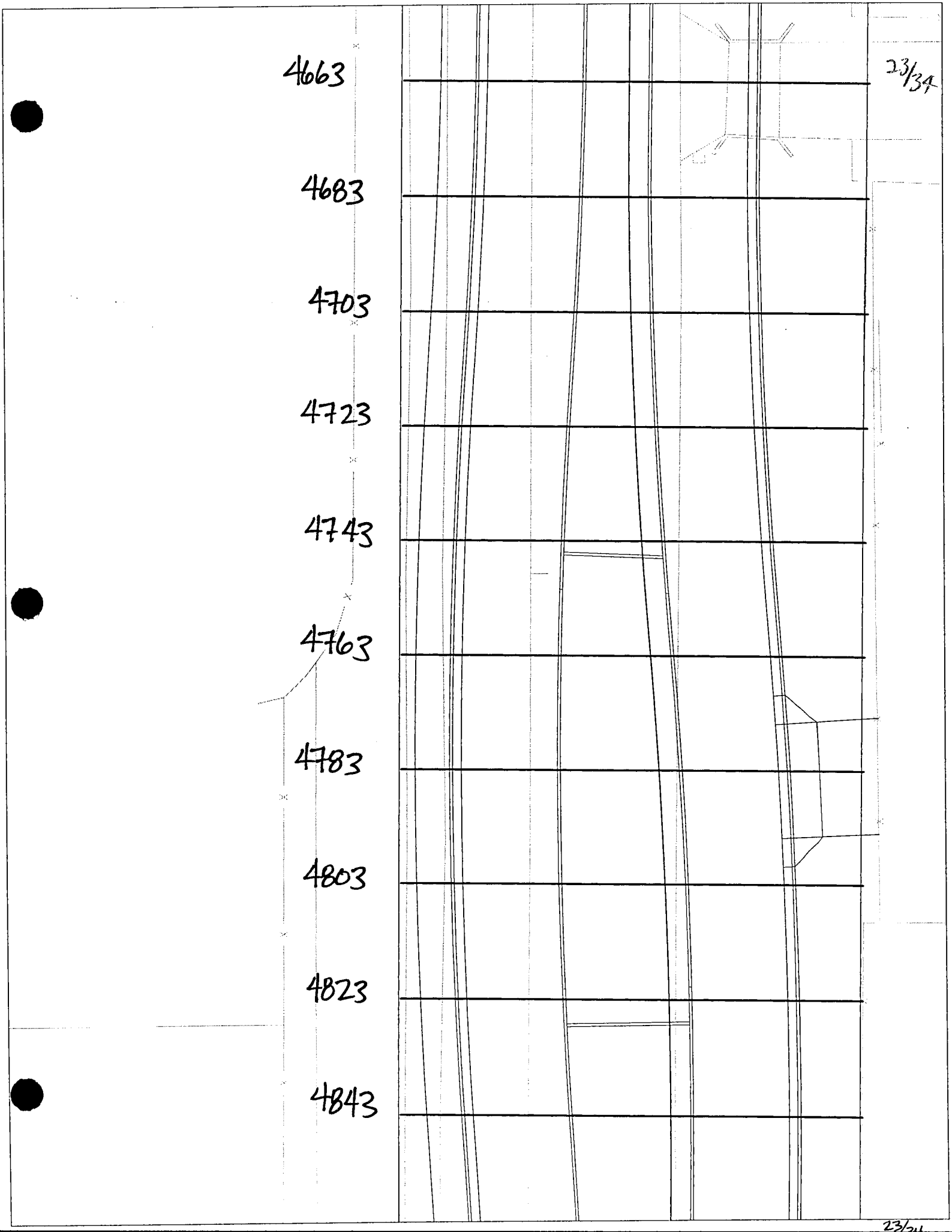
4623
4643
22/34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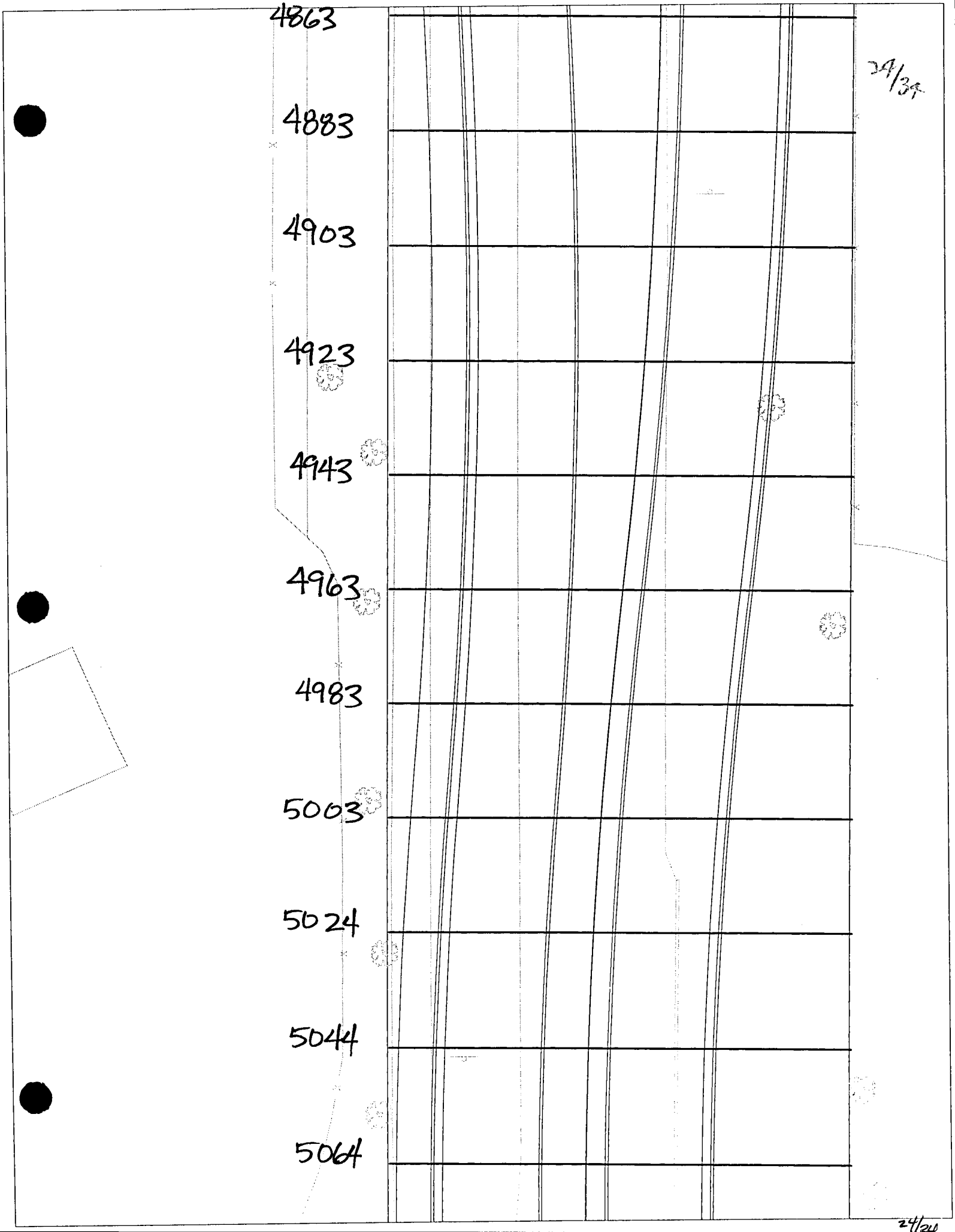
4843
23/34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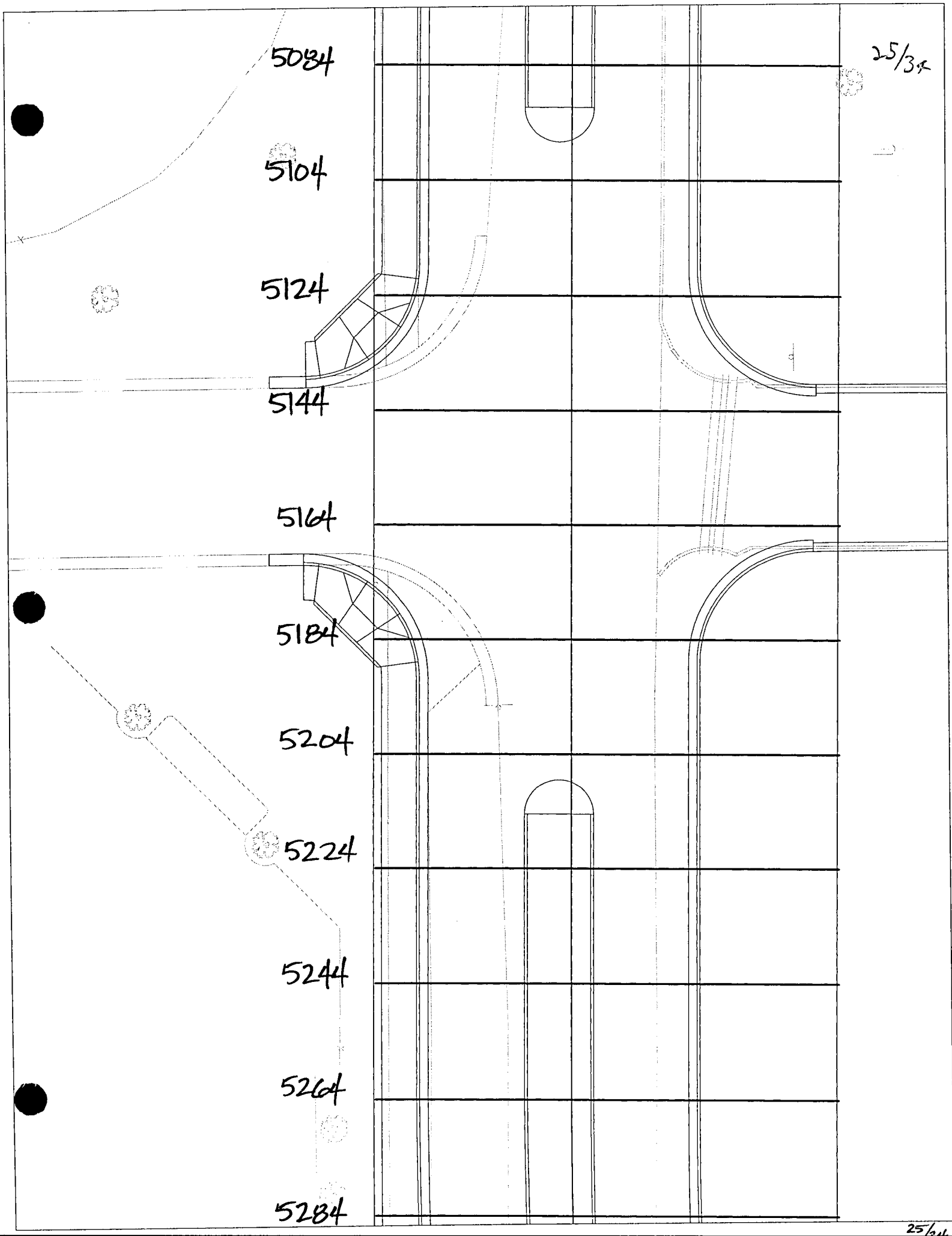
5044
5064
29/34
24/24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25/3x

26/38

5304

5324

5344

5364

5384

5404

5424

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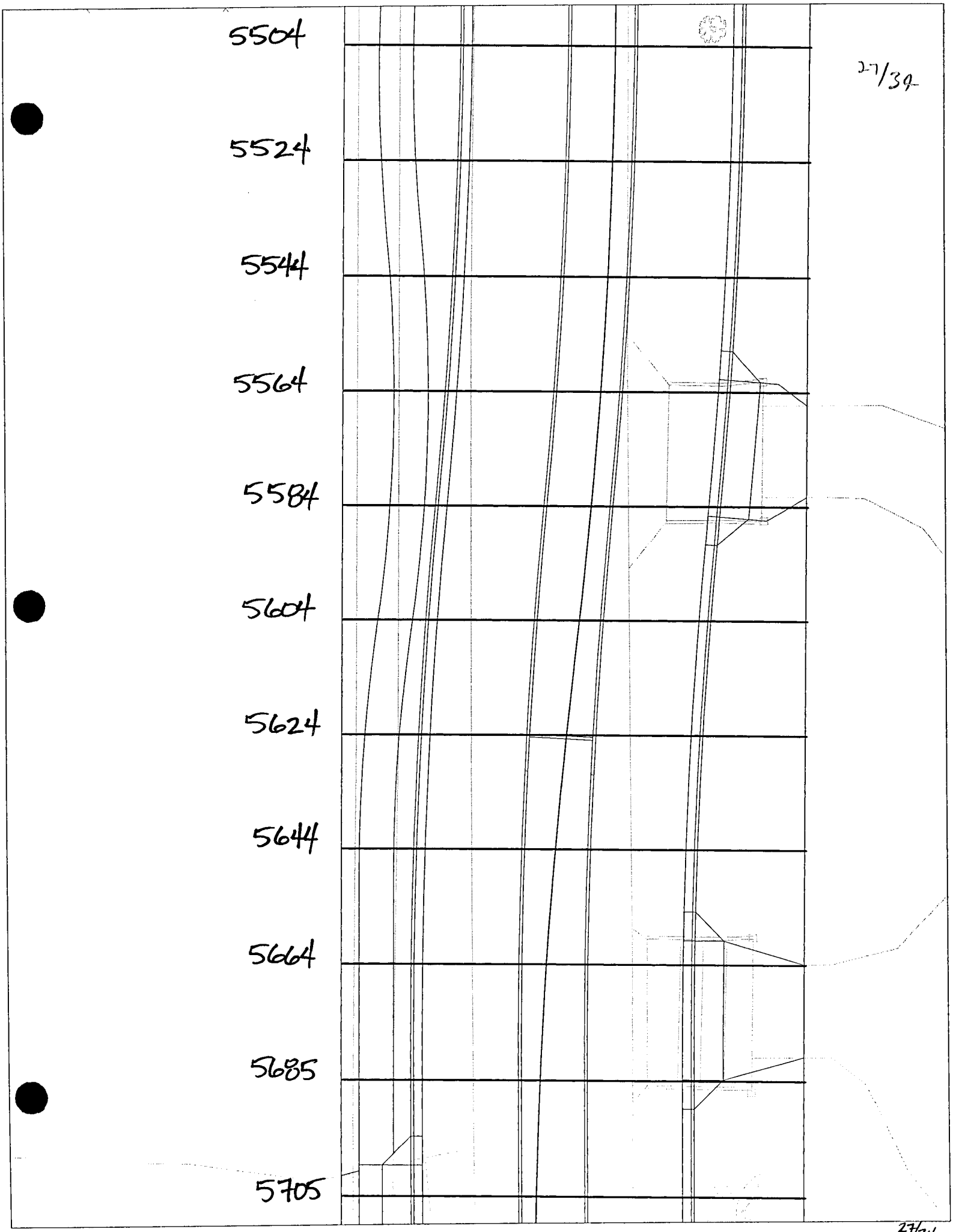
5464

5484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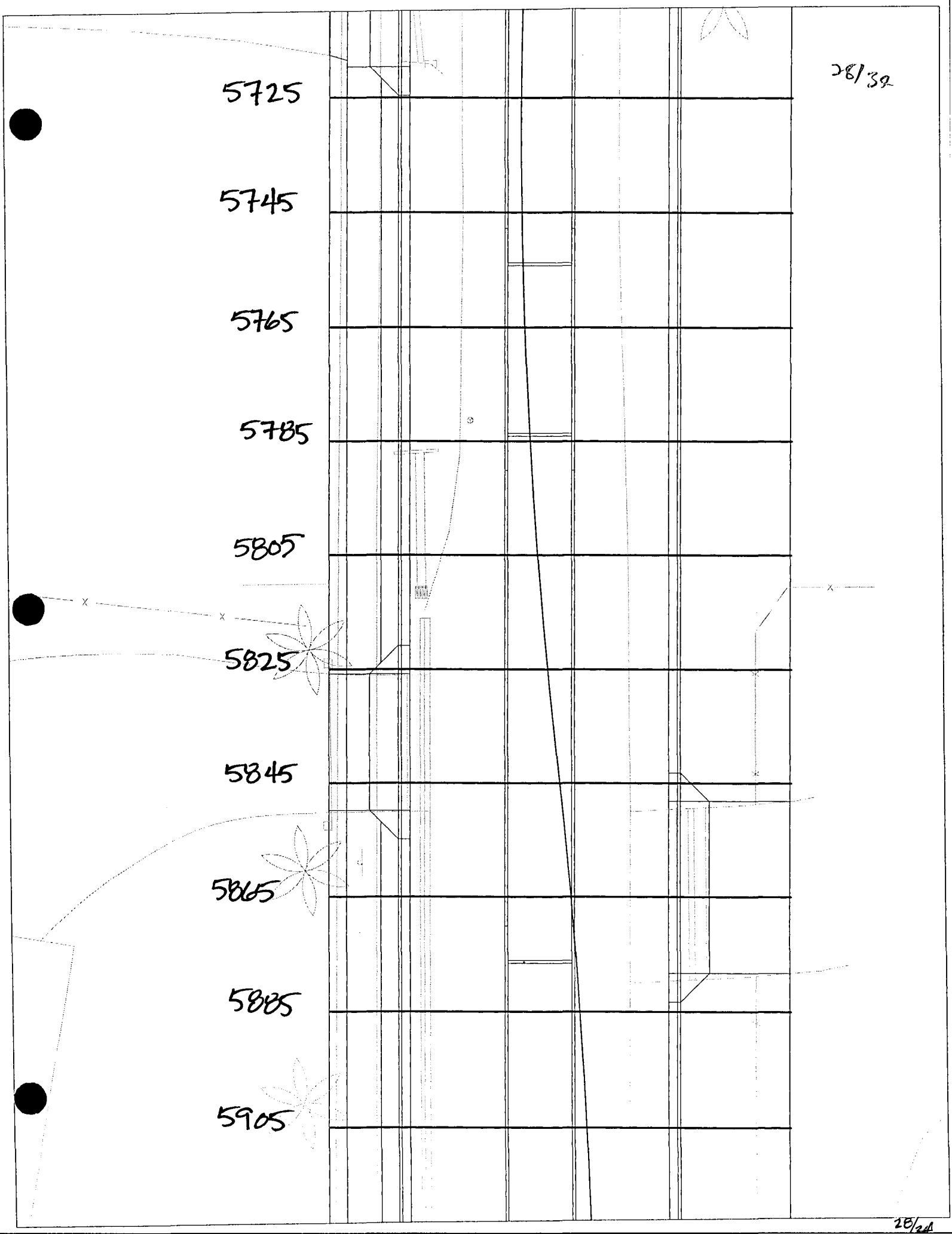
5685
5705
27/39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5765
5785
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5825
5845
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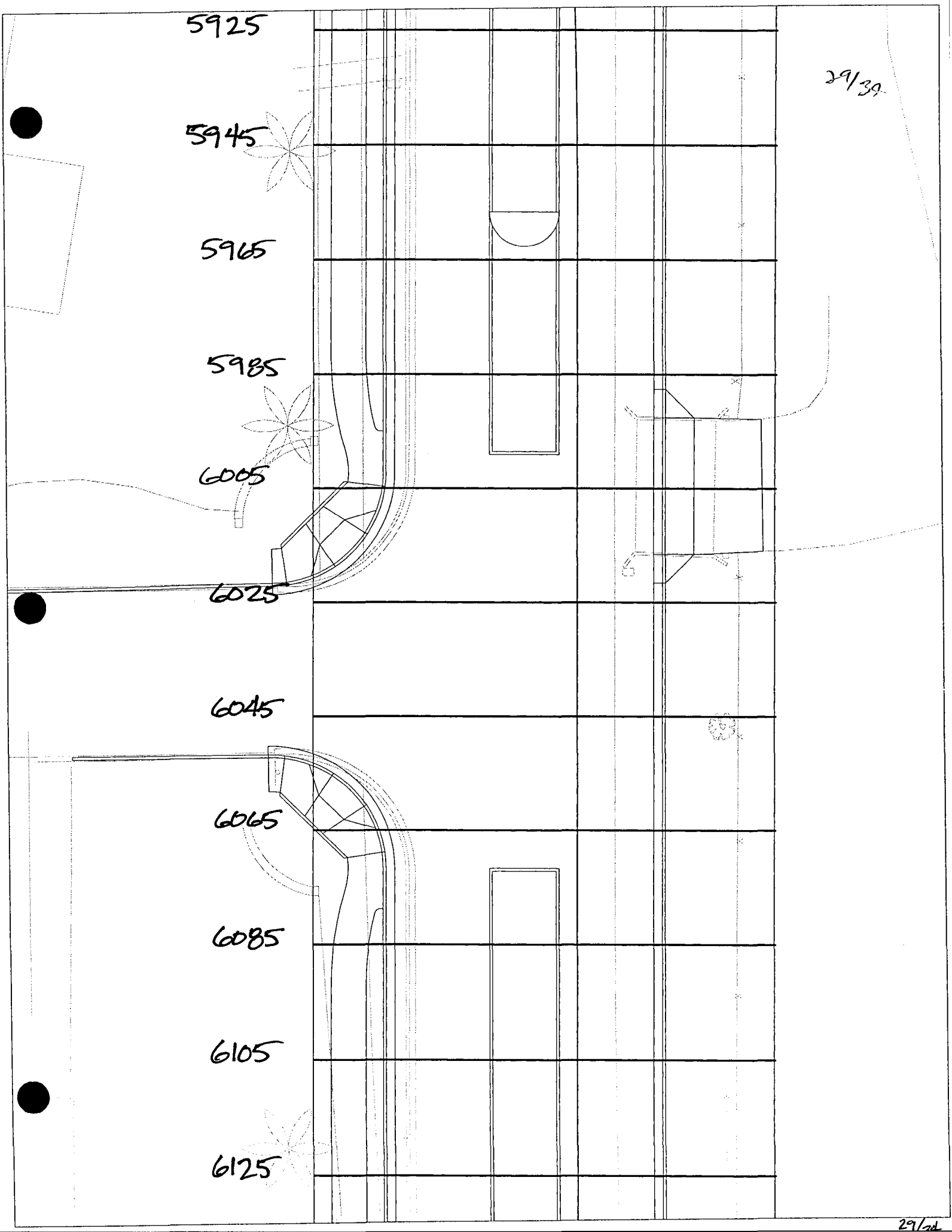
5885
5905
28/28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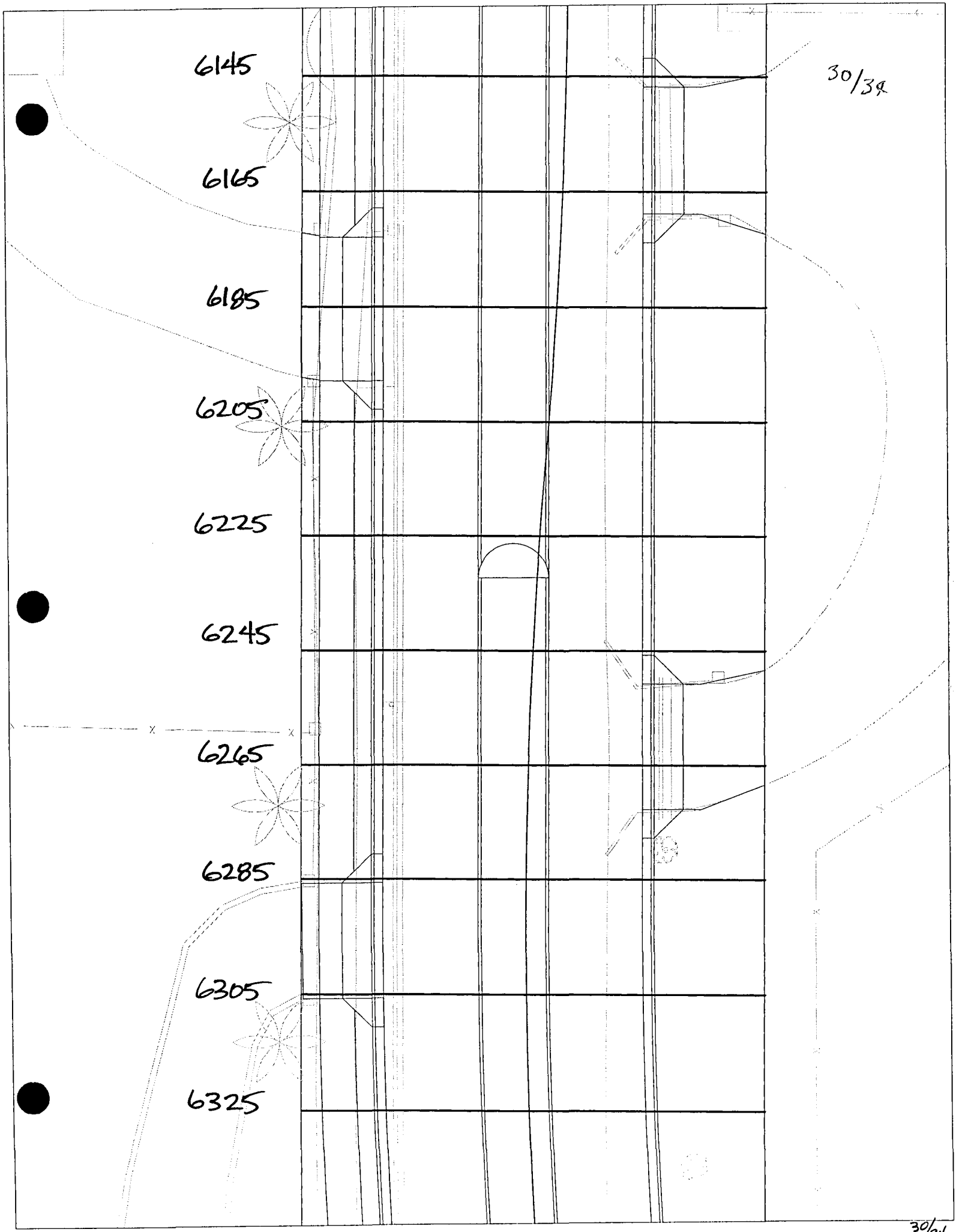
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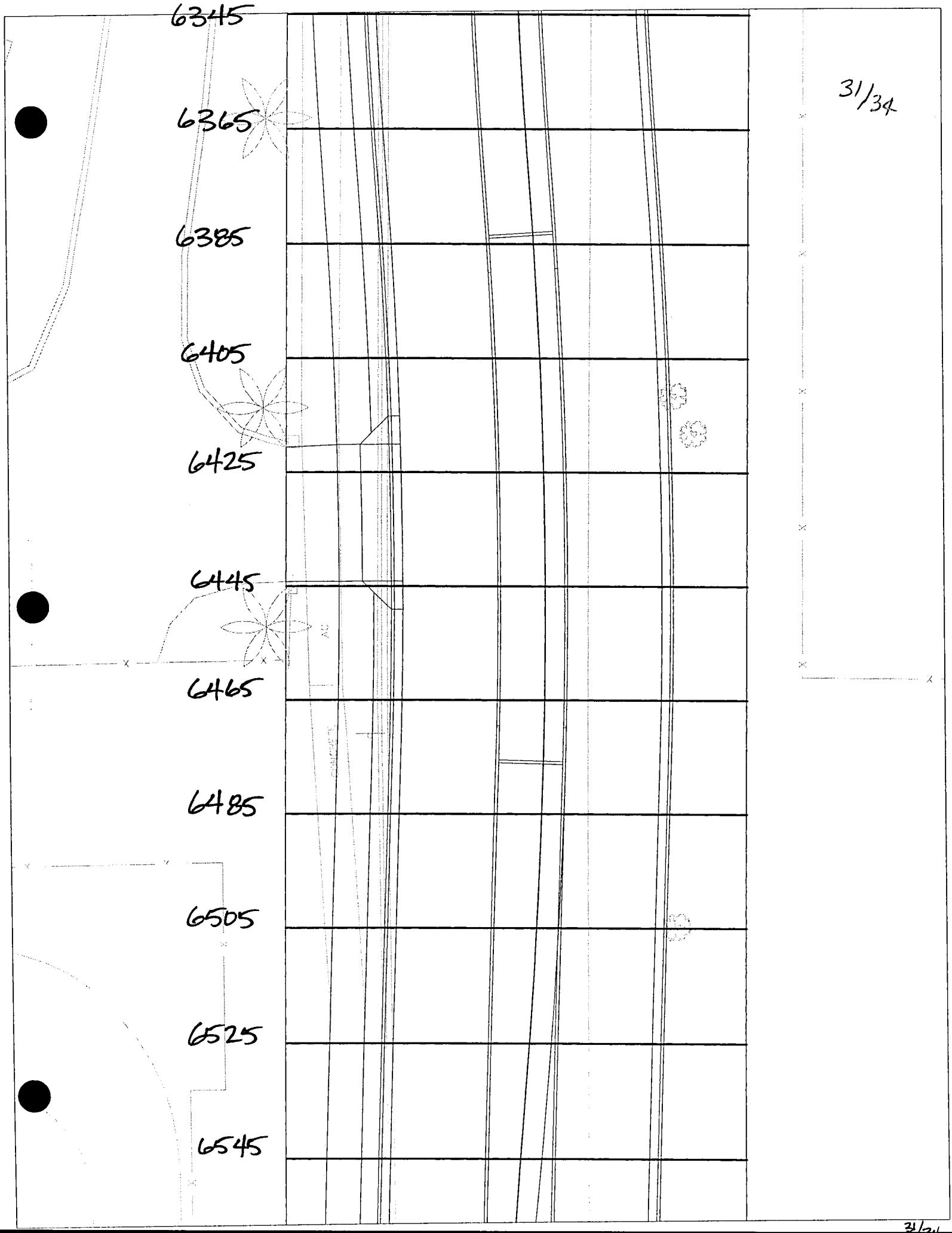
6325
30/39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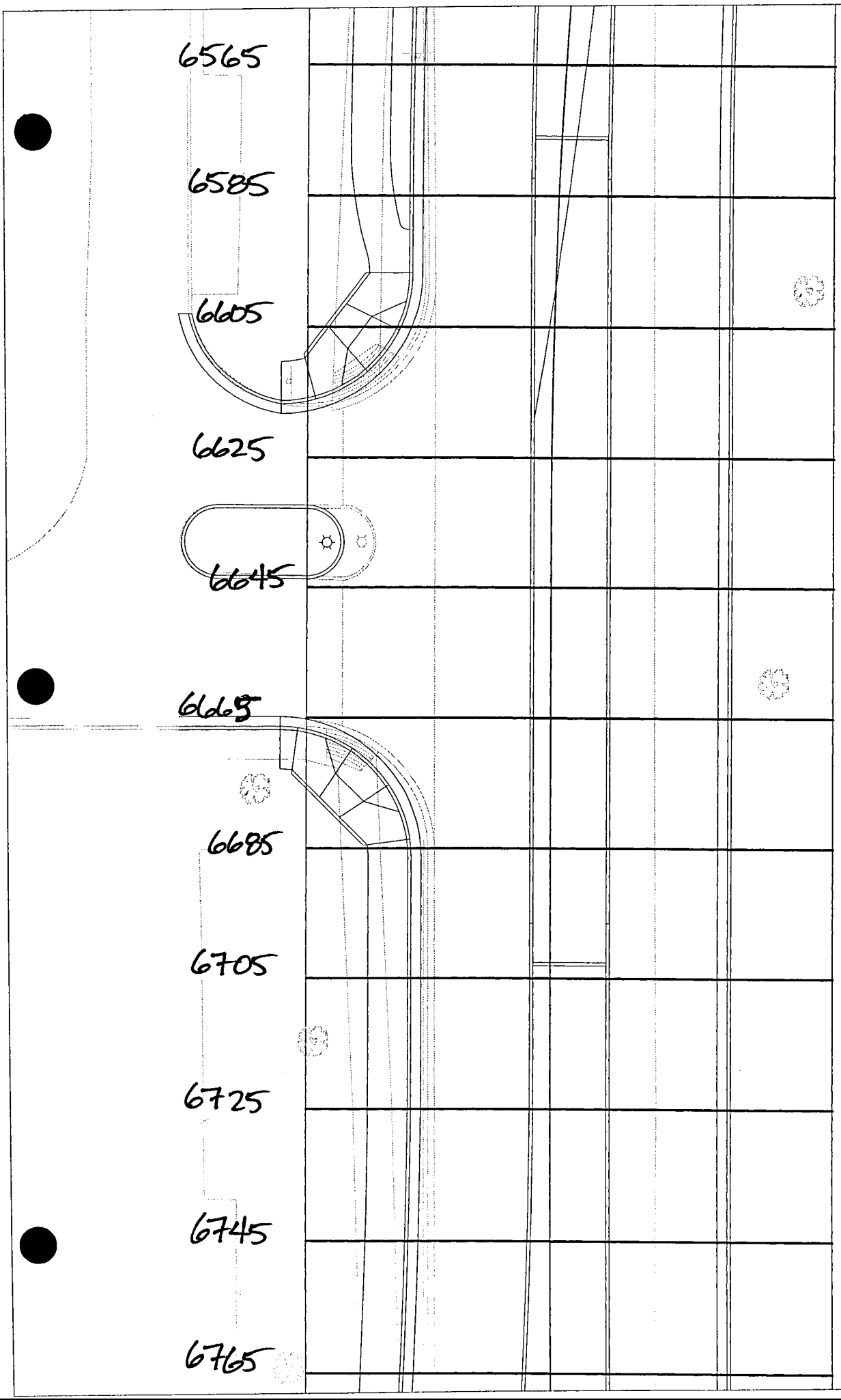
6525
6545
31/34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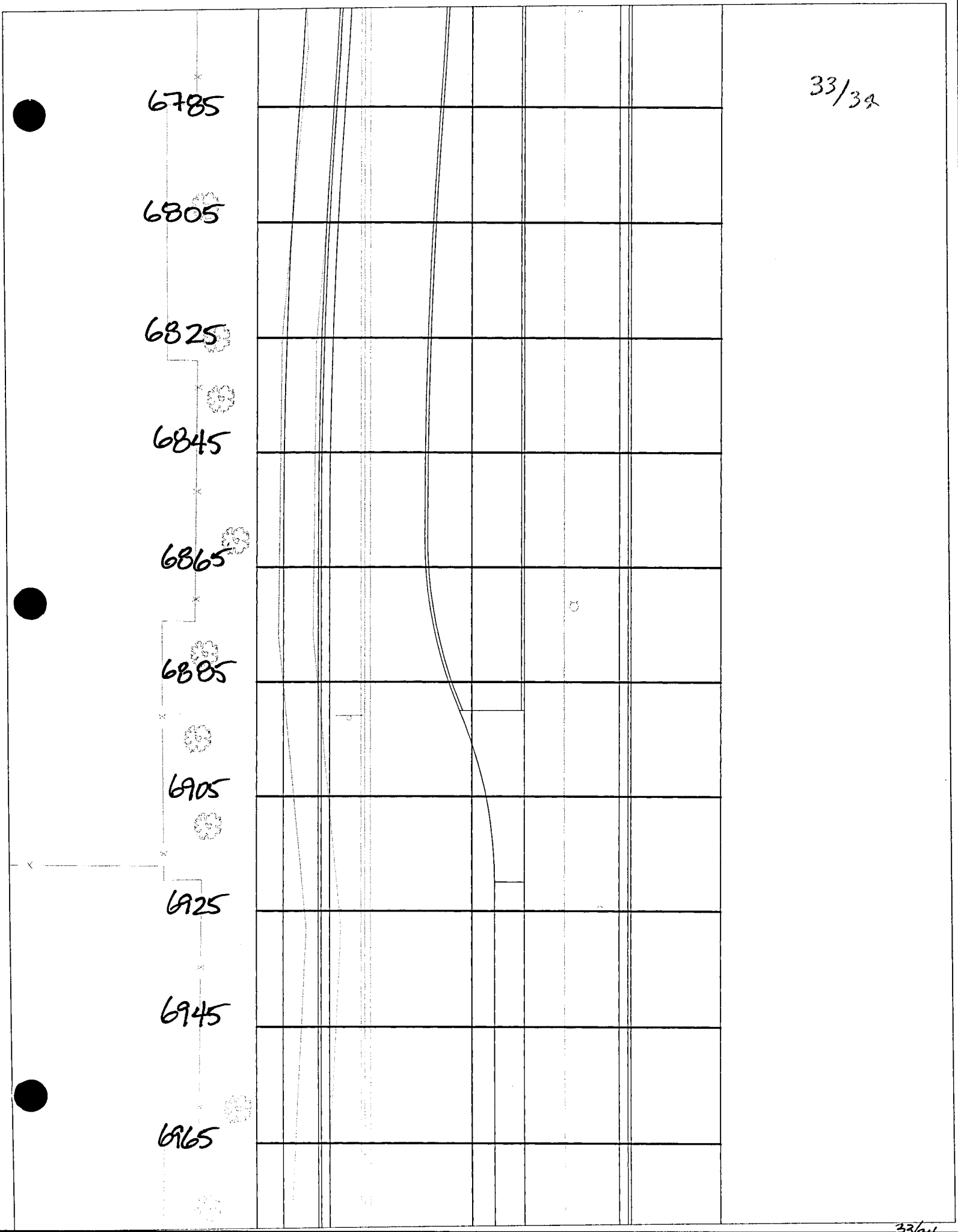
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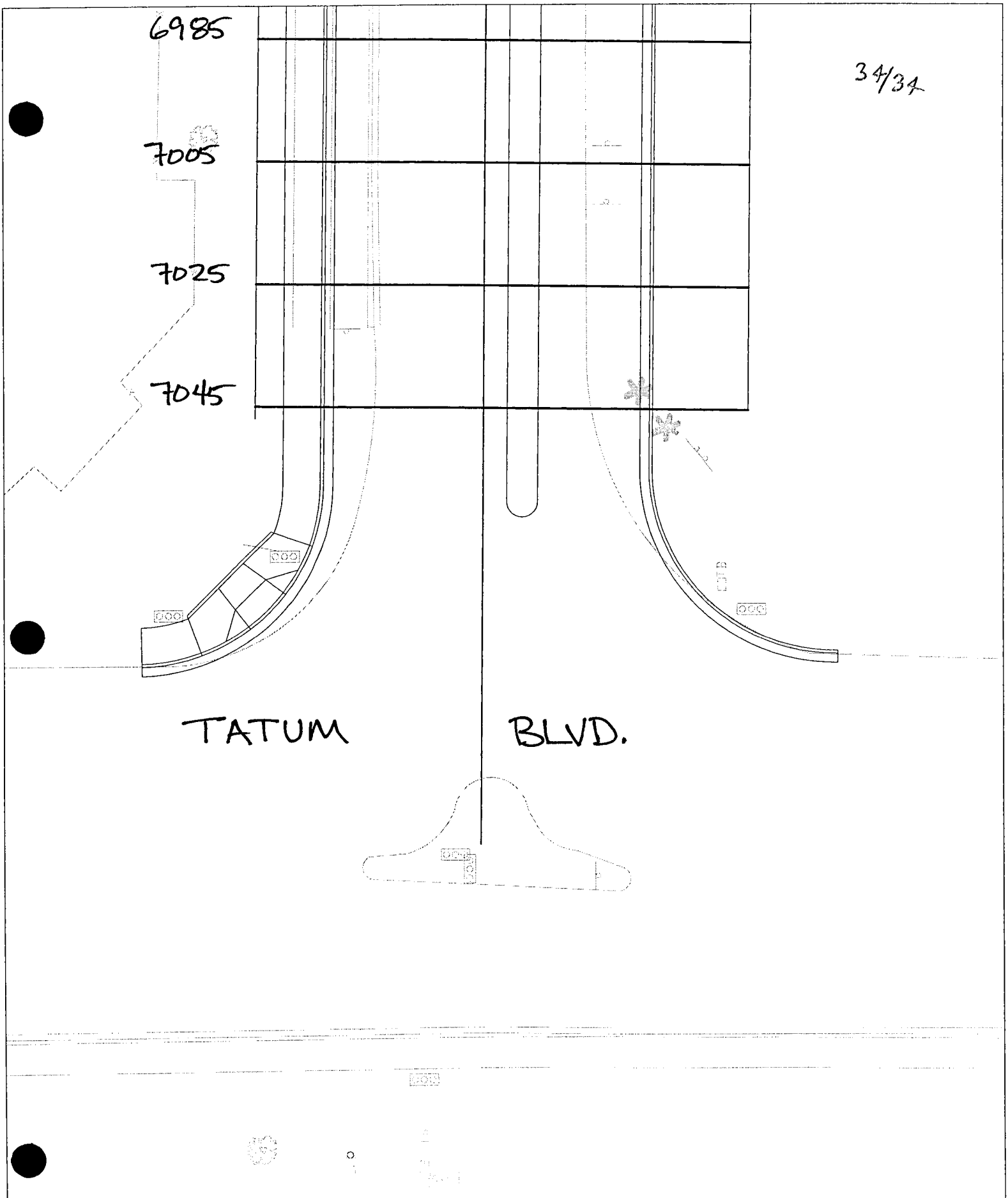
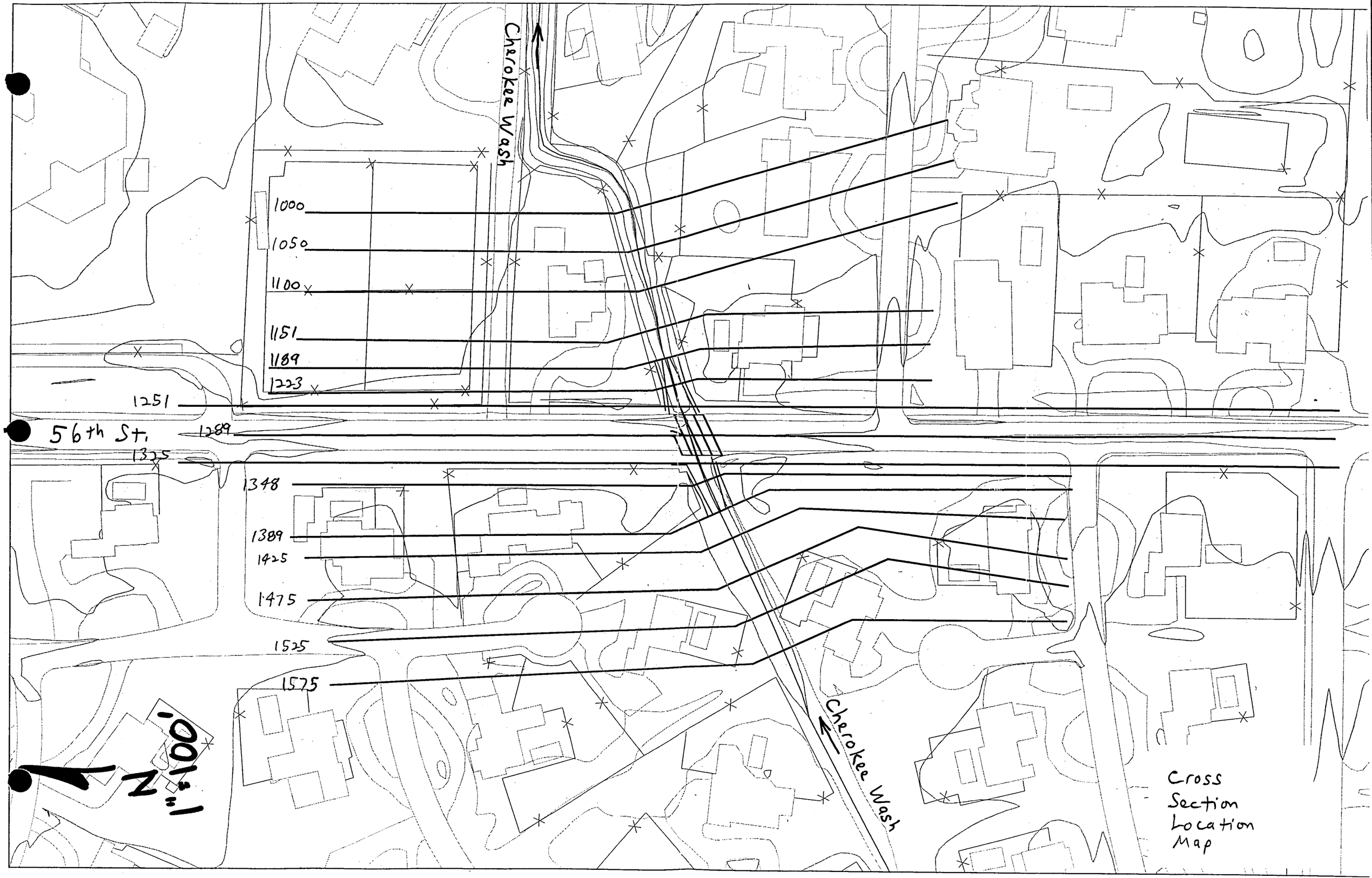
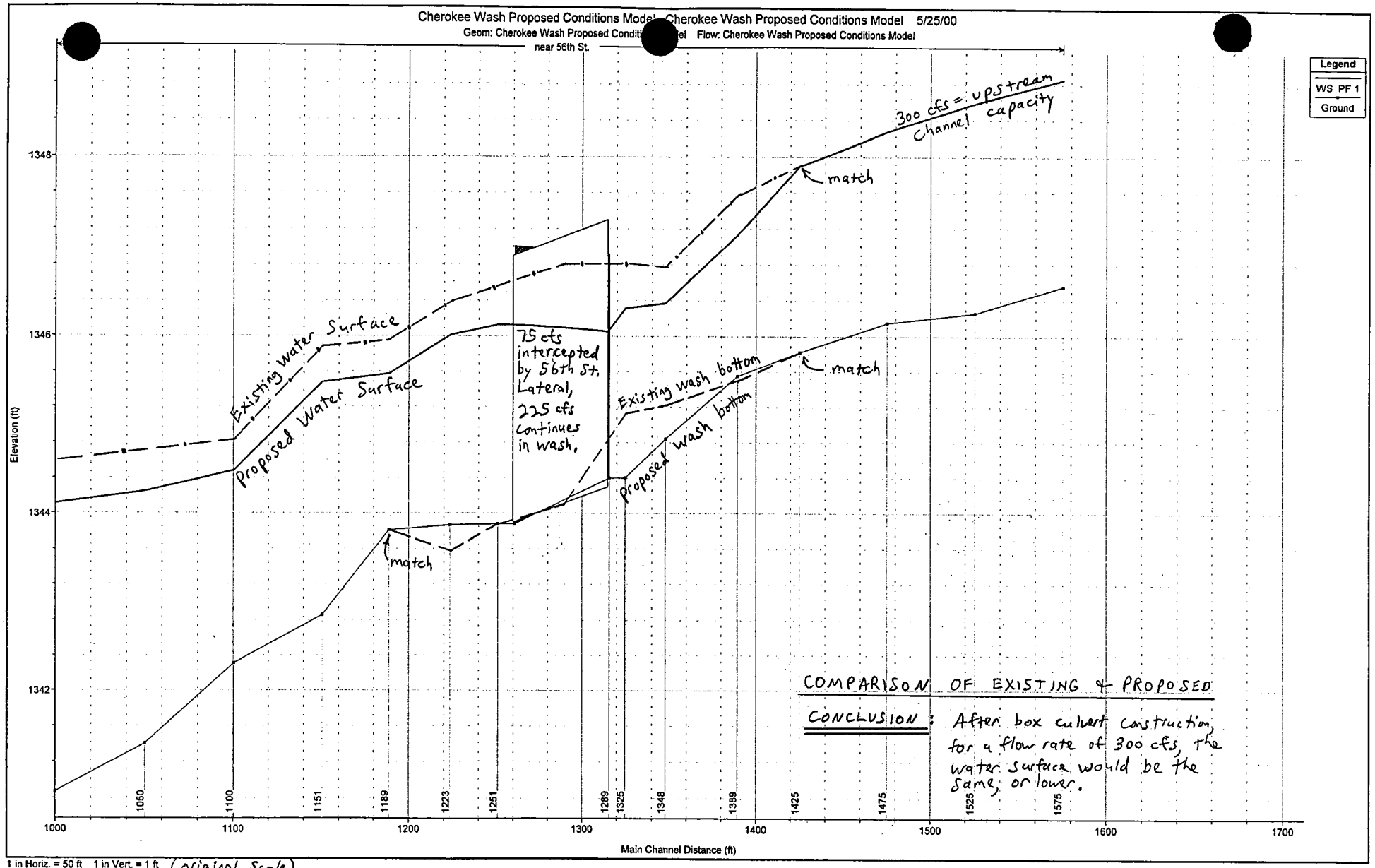
6925
6945
6965


6985
7005
7025
7045
TATUM
BLVD.

HEC-RAS ANALYSIS for

CHEROKEE WASH at 56th ST.


Cherokee Wash
1000
1050
1100
1151
1189
1223
1251
56th St.
1289
1325
1348
1389
1425
1475
1525
1575
Cherokee Wash
1" = 100'
N
Cross Section Location Map



1 in Horiz. = 50 ft 1 in Vert. = 1 ft (original Scale)

CHEROKEE WASH at 56th STREET

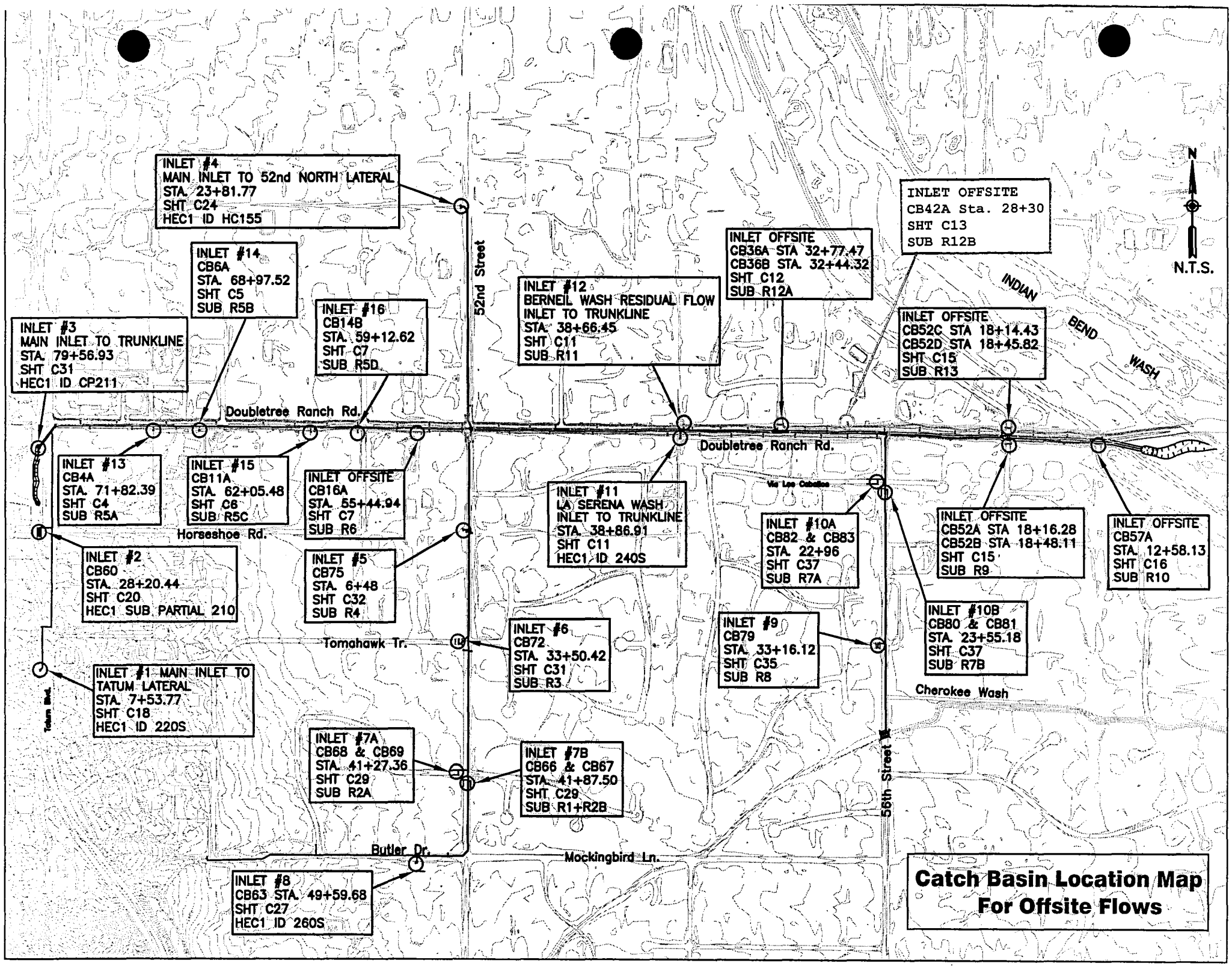
Prepared 25 May 2000

EXISTING CONDITIONS							PROPOSED CONDITIONS							DIFFERENCES PROPOSED - EXISTING			
															300 cfs	300 cfs	300 cfs
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Froude # XS	Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Froude # XS	Min. Chnl	W.S. Elev.	Vel.	Froude #
		(cfs)	(ft)	(ft)	(ft/s)				(cfs)	(ft)	(ft)	(ft/s)		(ft)	(ft)	(ft/s)	
near 56th Street	1575	300	1346.56	1348.86	3.4	0.62	near 56th St.	1575	300	1346.56	1348.85	3.4	0.62	0.00	-0.01	0.0	0.0
near 56th Street	1525	300	1346.26	1348.59	3.1	0.62	near 56th St.	1525	300	1346.26	1348.59	3.1	0.62	0.00	0.00	0.0	0.0
near 56th Street	1475	300	1346.15	1348.27	1.9	0.46	near 56th St.	1475	300	1346.15	1348.27	1.9	0.46	0.00	0.00	0.0	0.0
near 56th Street	1425	300	1345.82	1347.91	2.1	0.53	near 56th St.	1425	300	1345.82	1347.89	2.2	0.56	0.00	-0.02	0.1	0.0
near 56th Street	1389	300	1345.55	1347.58	2.4	0.56	near 56th St.	1389	300	1345.55	1347.13	4.8	0.85	0.00	-0.45	2.4	0.3
near 56th Street	1348	300	1345.23	1346.78	4.3	0.99	near 56th St.	1348	300	1344.84	1346.37	5.2	0.87	-0.39	-0.41	0.9	-0.1
near 56th Street	1325	300	1345.13	1346.82	1.4	0.29	near 56th St.	1325	225	1344.4	1346.31	3.3	0.44	-0.73	-0.51	1.9	0.2
near 56th Street	1289	300	1344.1	1346.81	0.9	0.14	near 56th St.	1289	Culvert #1	225							
near 56th Street	1251	300	1343.89	1346.57	3.5	0.55	near 56th St.	1251	225	1343.88	1346.13	2.9	0.36	-0.01	-0.44	-0.6	-0.2
near 56th Street	1223	300	1343.58	1346.39	3.7	0.51	near 56th St.	1223	225	1343.87	1346.01	3.1	0.44	0.29	-0.38	-0.6	-0.1
near 56th Street	1189	300	1343.81	1345.97	4.8	0.74	near 56th St.	1189	225	1343.81	1345.57	4.7	0.76	0.00	-0.40	-0.1	0.0
near 56th Street	1151	300	1342.86	1345.89	3.1	0.41	near 56th St.	1151	225	1342.86	1345.48	3	0.42	0.00	-0.41	-0.1	0.0
near 56th Street	1100	300	1342.31	1344.83	7.2	1	near 56th St.	1100	225	1342.31	1344.48	6.8	1	0.00	-0.35	-0.4	0.0
near 56th Street	1050	300	1341.4	1344.73	4.3	0.52	near 56th St.	1050	225	1341.4	1344.25	4.1	0.52	0.00	-0.48	-0.2	0.0
near 56th Street	1000	300	1340.87	1344.6	3.5	0.41	near 56th St.	1000	225	1340.87	1344.11	3.3	0.4	0.00	-0.49	-0.2	0.0

Conclusion: The upstream channel capacity is 300 cfs. For that flow rate, the water surface is the same, or lower, after the proposed improvements.

The flow velocity and Froude Number compare favorably. The proposed improvements are acceptable for the 300 cfs channel capacity flow rate.

INLET CALCULATIONS for OFF-SITE FLOWS


INLET #4
MAIN INLET TO 52nd NORTH LATERAL
STA. 23+81.77
SHT C24
HEC1 ID HC155
INLET #14
CB6A
STA. 68+97.52
SHT C5
SUB R5B
INLET #16
CB14B
STA. 59+12.62
SHT C7
SUB R5D
INLET #3
MAIN INLET TO TRUNKLINE
STA. 79+56.93
SHT C31
HEC1 ID CP211
52nd Street
INLET #12
BERNEIL WASH RESIDUAL FLOW
INLET TO TRUNKLINE
STA. 38+66.45
SHT C11
SUB R11
INLET OFFSITE
CB36A STA 32+77.47
CB36B STA. 32+44.32
SHT C12
SUB R12A
INLET OFFSITE
CB42A Sta. 28+30
SHT C13
SUB R12B
N
N.T.S.
INDIAN
BEND
WASH
INLET OFFSITE
CB52C STA 18+14.43
CB52D STA 18+45.82
SHT C15
SUB R13
Doubletree Ranch Rd.
Doubletree Ranch Rd.
INLET #13
CB4A
STA. 71+82.39
SHT C4
SUB R5A
INLET #15
CB11A
STA. 62+05.48
SHT C6
SUB R5C
INLET OFFSITE
CB16A
STA. 55+44.94
SHT C7
SUB R6
INLET #11
LA SERENA WASH
INLET TO TRUNKLINE
STA. 38+86.91
SHT C11
HEC1 ID 240S
Via Los Caballos
INLET #10A
CB82 & CB83
STA. 22+96
SHT C37
SUB R7A
INLET OFFSITE
CB52A STA 18+16.28
CB52B STA 18+48.11
SHT C15
SUB R9
INLET OFFSITE
CB57A
STA. 12+58.13
SHT C16
SUB R10
Horseshoe Rd.
INLET #2
CB60
STA. 28+20.44
SHT C20
HEC1 SUB PARTIAL 210
INLET #5
CB75
STA. 6+48
SHT C32
SUB R4
INLET #6
CB72
STA. 33+50.42
SHT C31
SUB R3
INLET #9
CB79
STA. 33+16.12
SHT C35
SUB R8
INLET #10B
CB80 & CB81
STA. 23+55.18
SHT C37
SUB R7B
Tomahawk Tr.
INLET #1 MAIN INLET TO
TATUM LATERAL
STA. 7+53.77
SHT C18
HEC1 ID 220S
Tatum Blvd.
Cherokee Wash
INLET #7A
CB68 & CB69
STA. 41+27.36
SHT C29
SUB R2A
INLET #7B
CB66 & CB67
STA. 41+87.50
SHT C29
SUB R1+R2B
56th Street
Butler Dr.
Mockingbird Ln.
INLET #8
CB63 STA. 49+59.68
SHT C27
HEC1 ID 260S
Catch Basin Location Map
For Offsite Flows

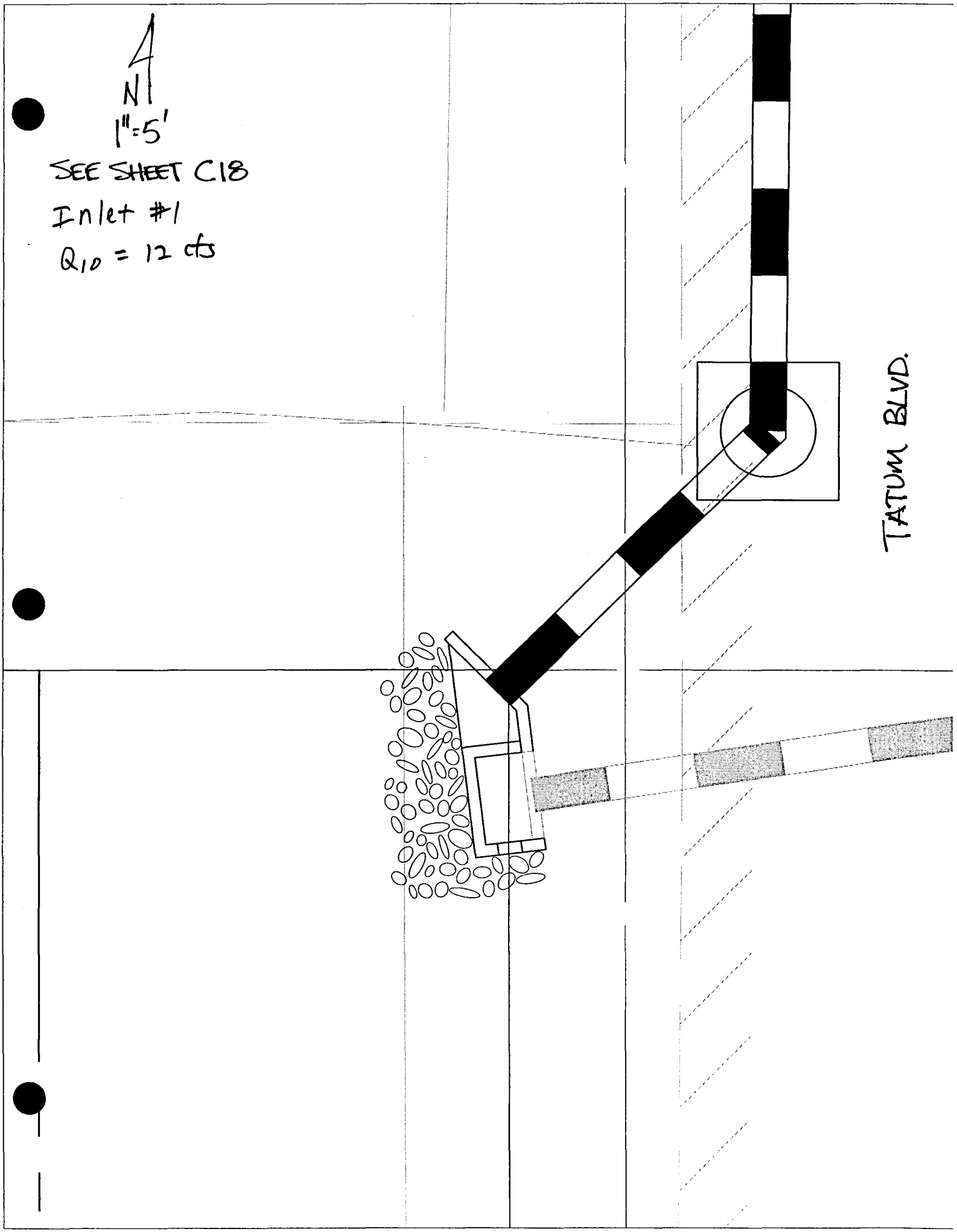
N

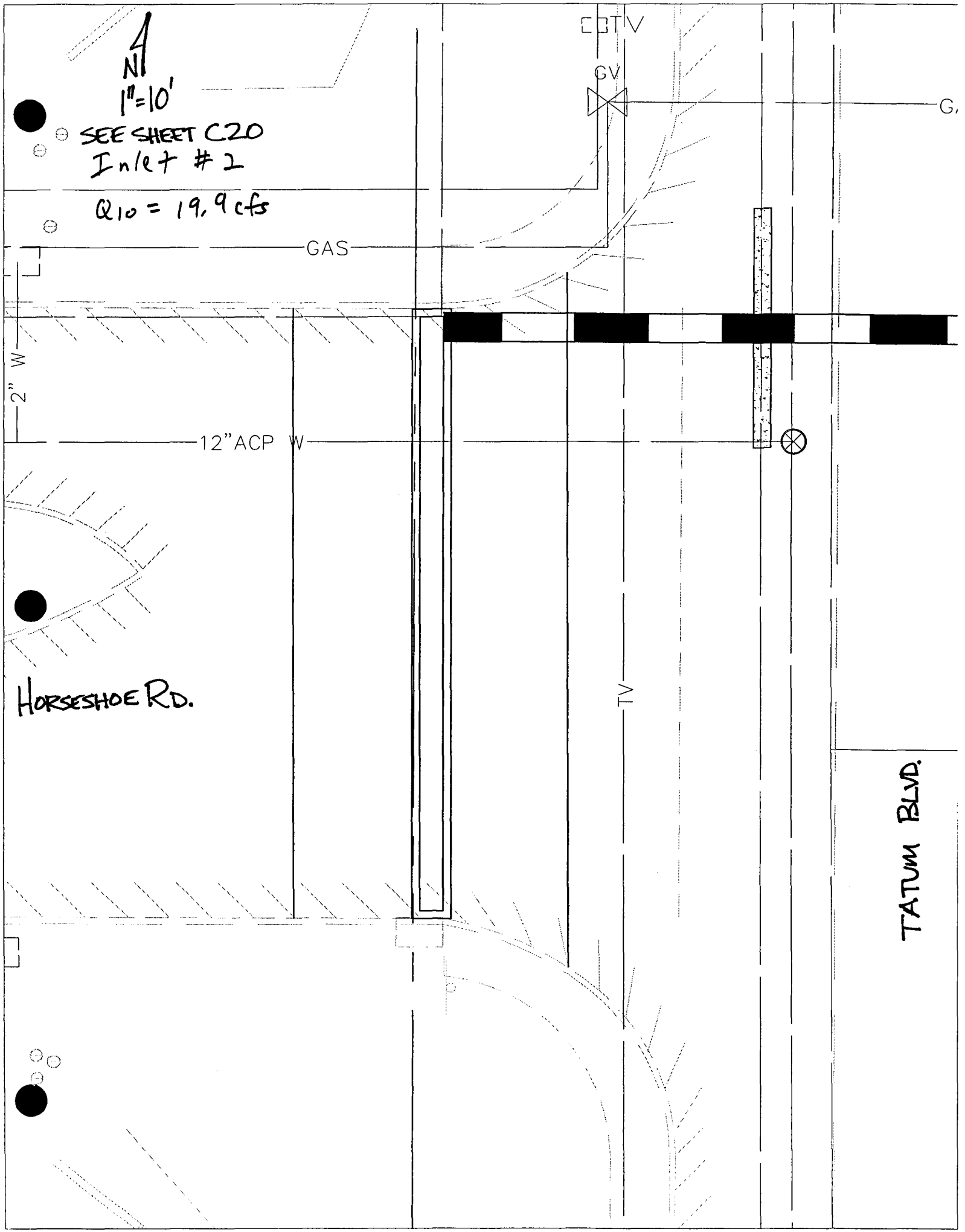
1" = 5'

SEE SHEET C18

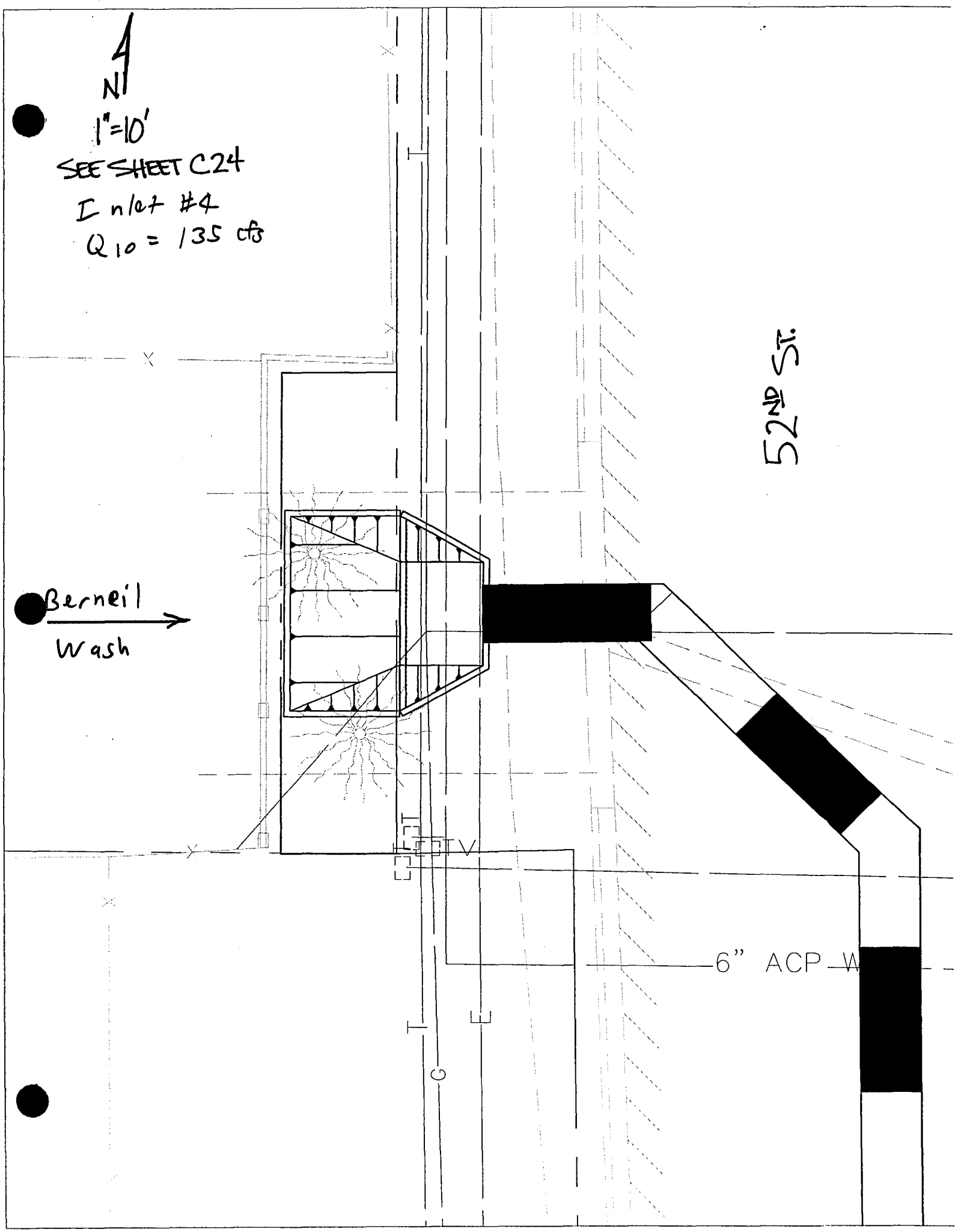
Inlet #1

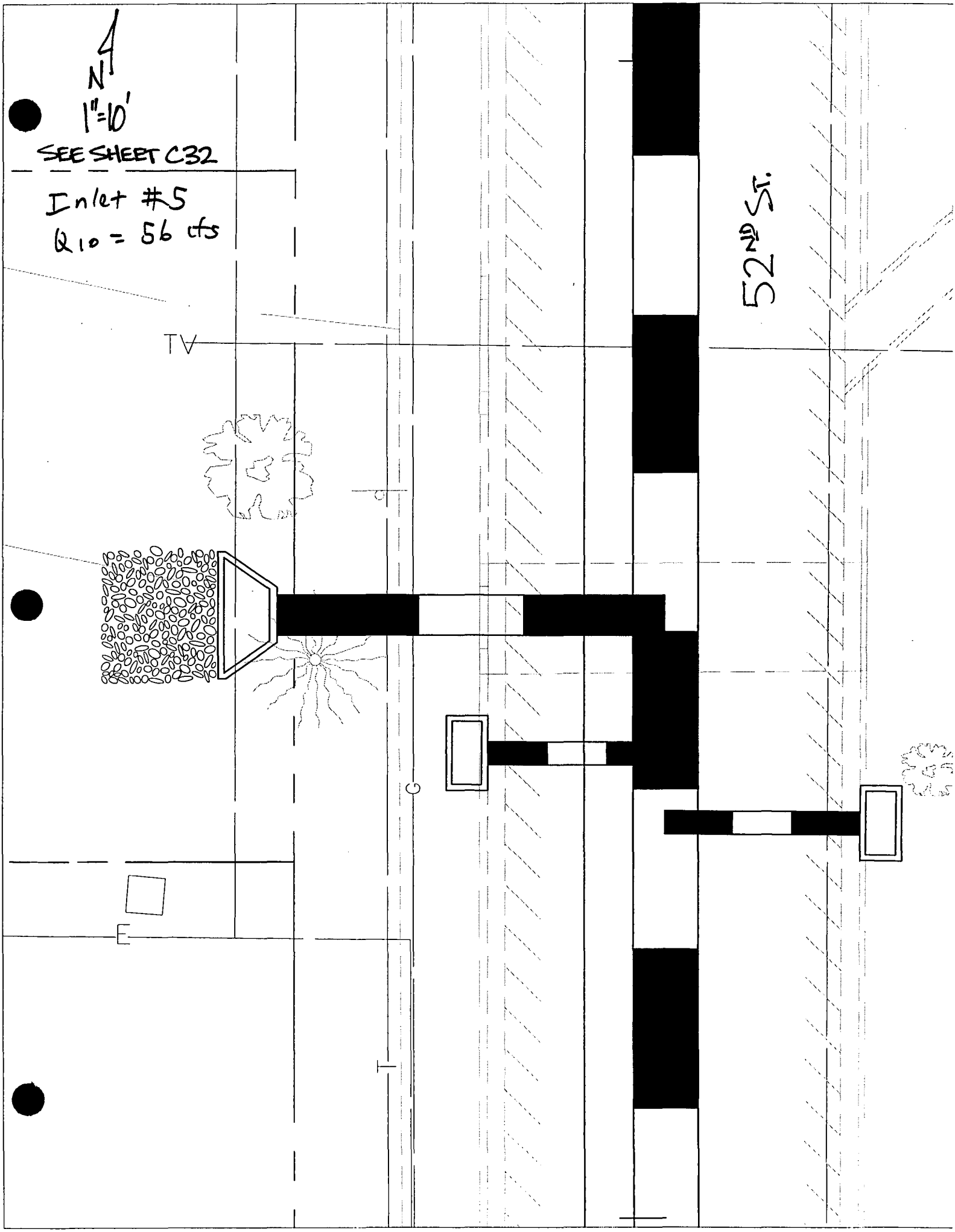
Q_{10} = 12 cfs

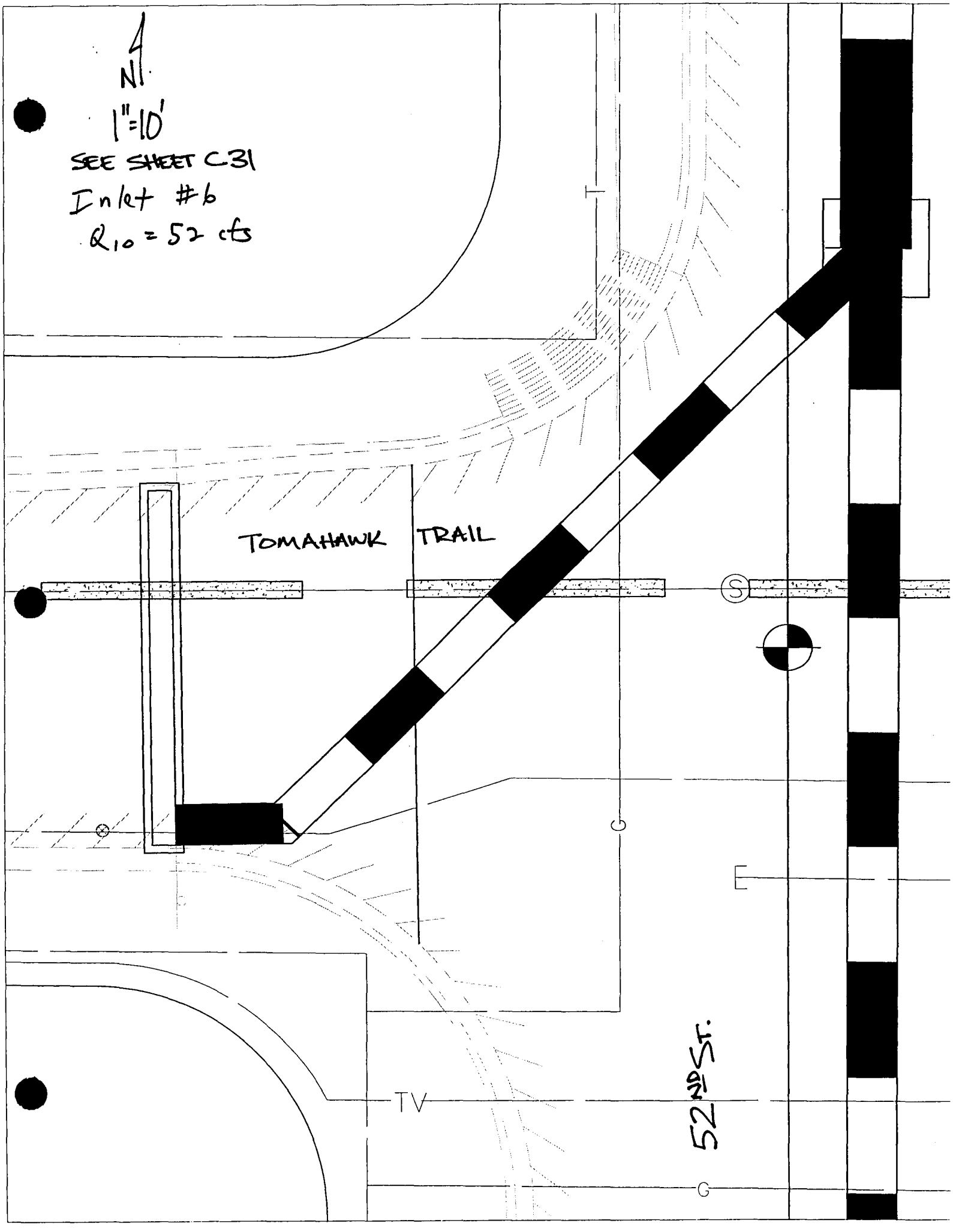


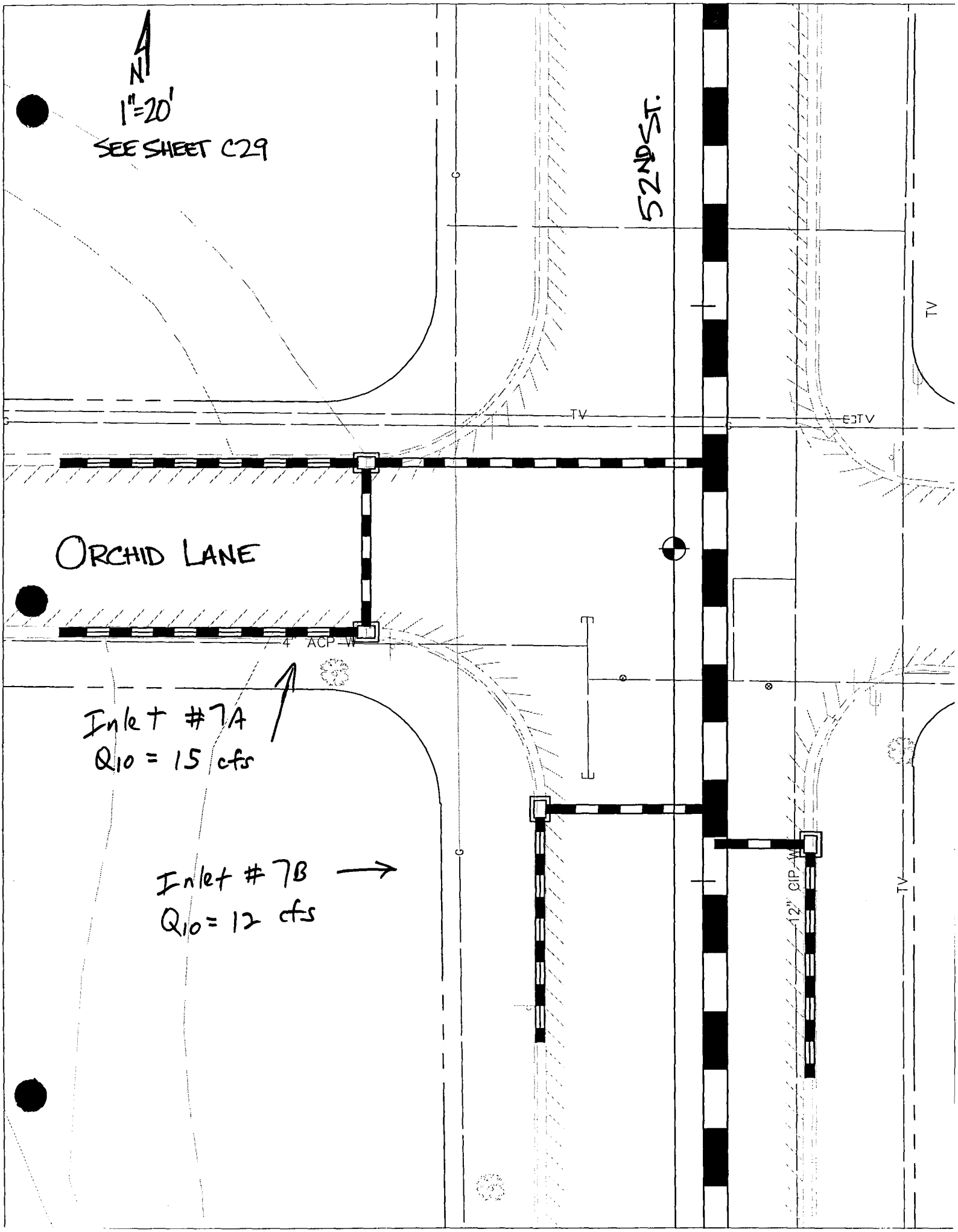

N
1"=10'
SEE SHEET C20
Inlet #2
Q10 = 19.9 cfs
TV
GV
GAS
2" W
12"ACP W
TV
HORSESHOE RD.
TATUM BLVD.

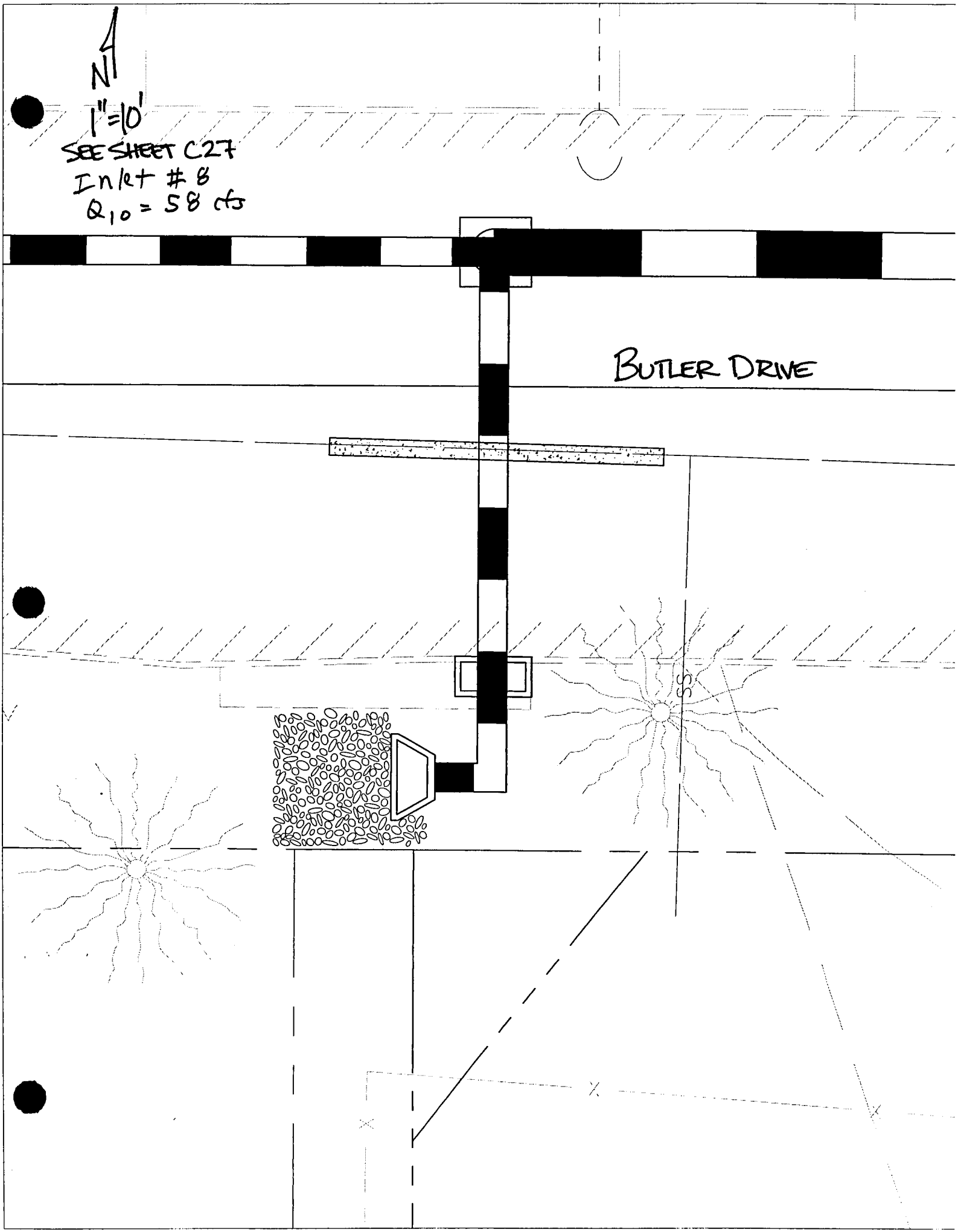
N
1"=10'
SEE SHEET C1
Inlet #3
Q10 = 257 cfs
ELEC
ELEC
TEL
ELEC
+13841
TATUM BLVD.

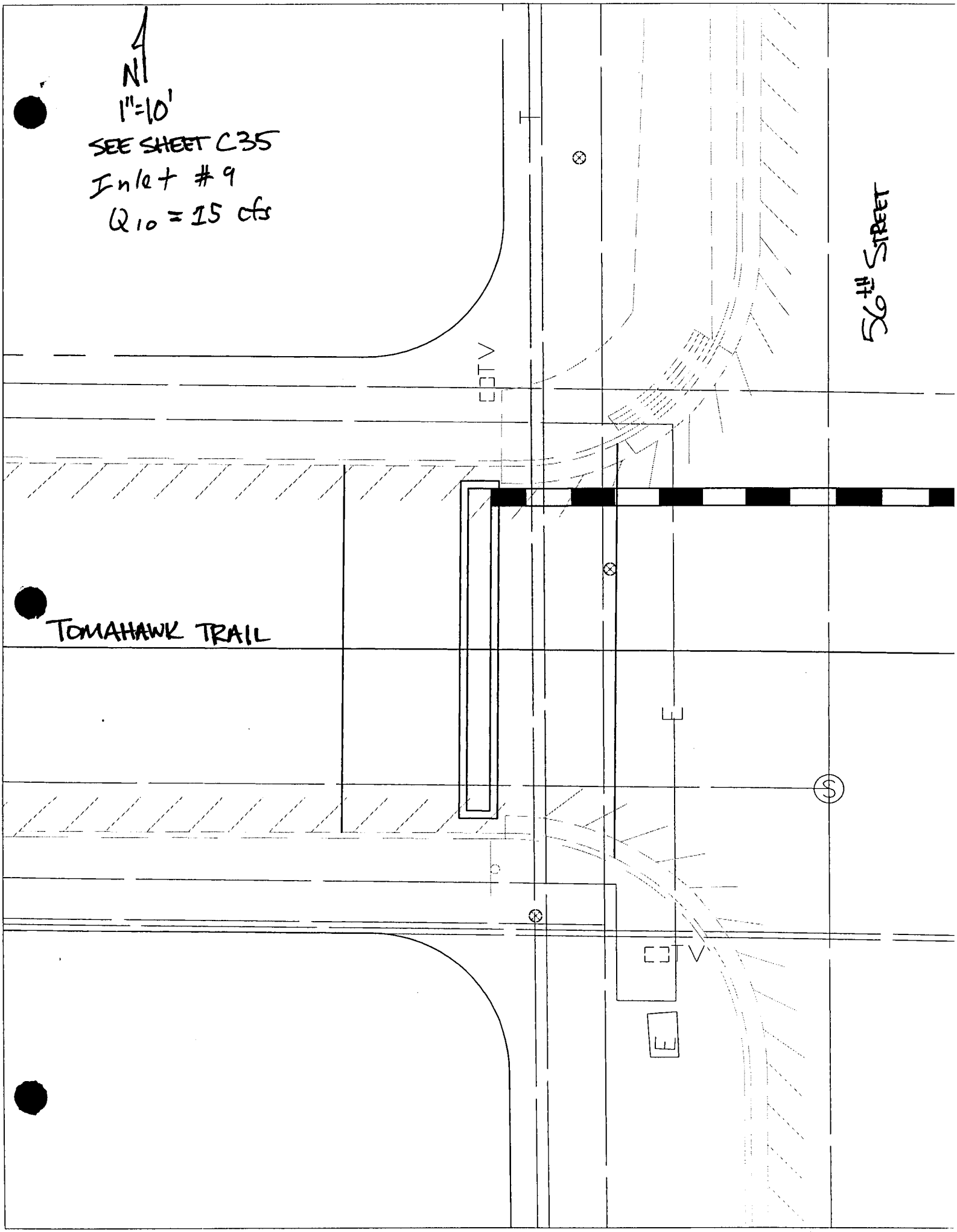

N
1"=10'
SEE SHEET C24
Inlet #4
Q10 = 135 cfs
52nd St.
Berneil
Wash
6" ACP W

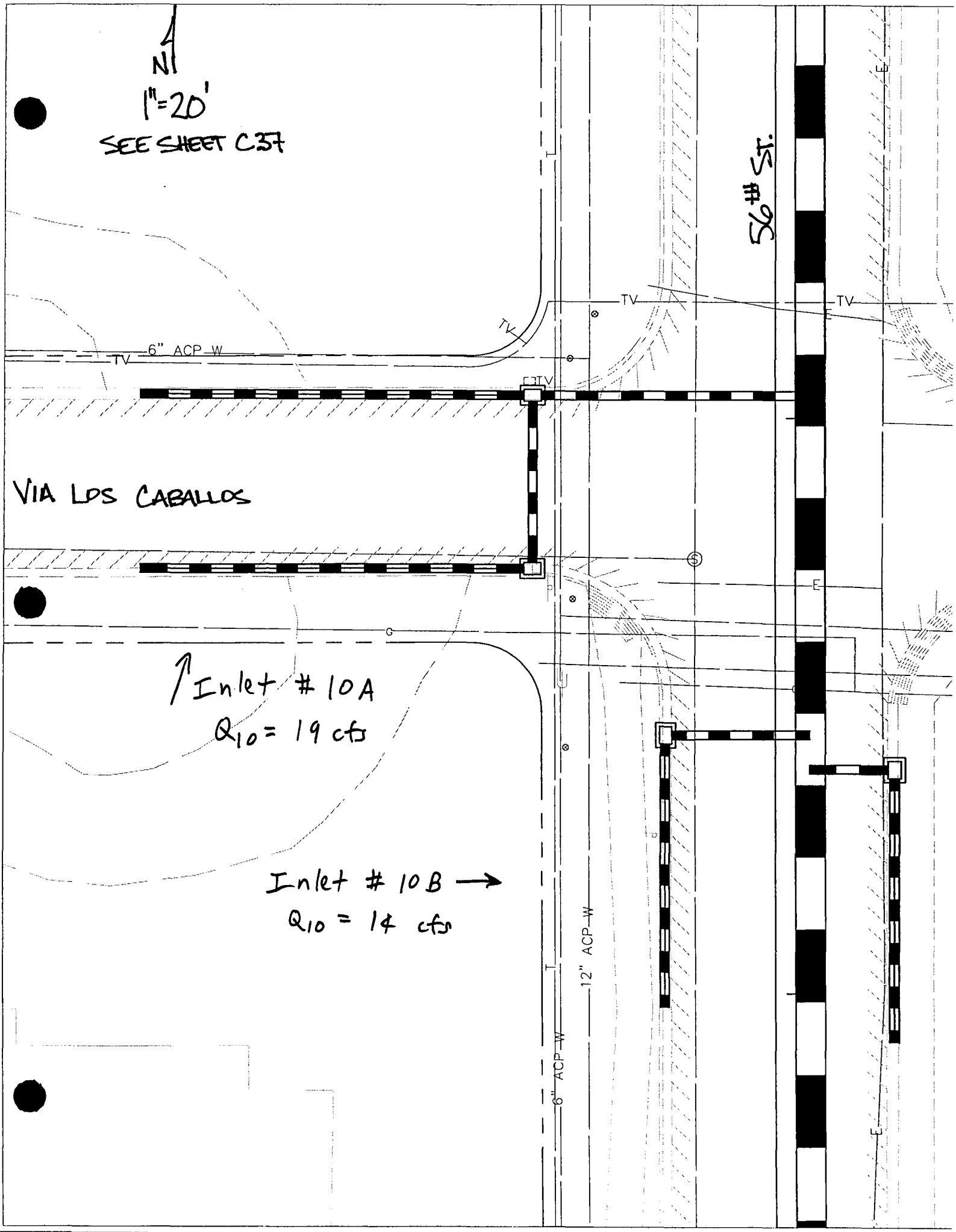

N
1"=10'
SEE SHEET C32
Inlet #5
Q10 = 56 cfs
TV
52 yd²
E


N
1"=10'
SEE SHEET C31
Inlet #6
Q10 = 52 cfs
TOMAHAWK TRAIL
52ND ST.
TV


N
1"=20'
SEE SHEET C29
52ND ST.
TV
TV
TV
ORCHID LANE
4" ACP W
Inlet #7A
Q10 = 15 cfs
Inlet #7B
Q10 = 12 cfs
12" CIP W
TV


N
1"=10'
SEE SHEET C27
Inlet # 8
Q_{10} = 58 cfs
BUTLER DRIVE


N
1"=10'
SEE SHEET C35
Inlet #9
Q10 = 15 cfs
56th STREET
TOMAHAWK TRAIL


N
1"=20'
SEE SHEET C37
56th St.
TV
6" ACP W
VIA LOS CABALLOS
Inlet # 10A
Q_{10} = 19 cfs
Inlet # 10B
Q_{10} = 14 cfs
12" ACP W
6" ACP W

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

CALC _____ DATE _____ JOB _____
CHKD _____ DATE _____ SHT ____ OF ____

TITLE _____

CAPACITY OF INLET #1

ASSUME 1' OF HEAD ABOVE GRATE (CONSERVATIVE)

OPERATING AS A WEIR:

$$Q = C_W P d^{1.5}$$

$C_W = 3.0$

$P = 2(2.5) + 2(2.167) = 9.33'$ FOR MAG 535

$d = 1'$

$$Q = (3.0)(9.33)(1)^{1.5}$$

$$= \boxed{28 \text{ CFS}}$$

OPERATING AS AN ORIFICE:

$$Q = C_o A (2gd)^{.5}$$

$C_o = .67$

$A = (2.5)(2.167) = 5.42$ S.F. FOR MAG 535

$d = 1'$

$$Q = (.67)(5.42)\left[(2)(32.2)(1)\right]^{.5}$$

$$= \boxed{29 \text{ CFS}}$$

∴ WEIR FLOW ≤ ORIFICE FLOW ∴ GOVERNS

$Q_{Capacity} = 28$ CFS

10-Year CULVERT DESIGN DATA RECORD

ighway: Doubletree Ranch Road County: Maricopa
ocation: Town of Paradise Valle Project: 9801- Doubletree Ranch Road

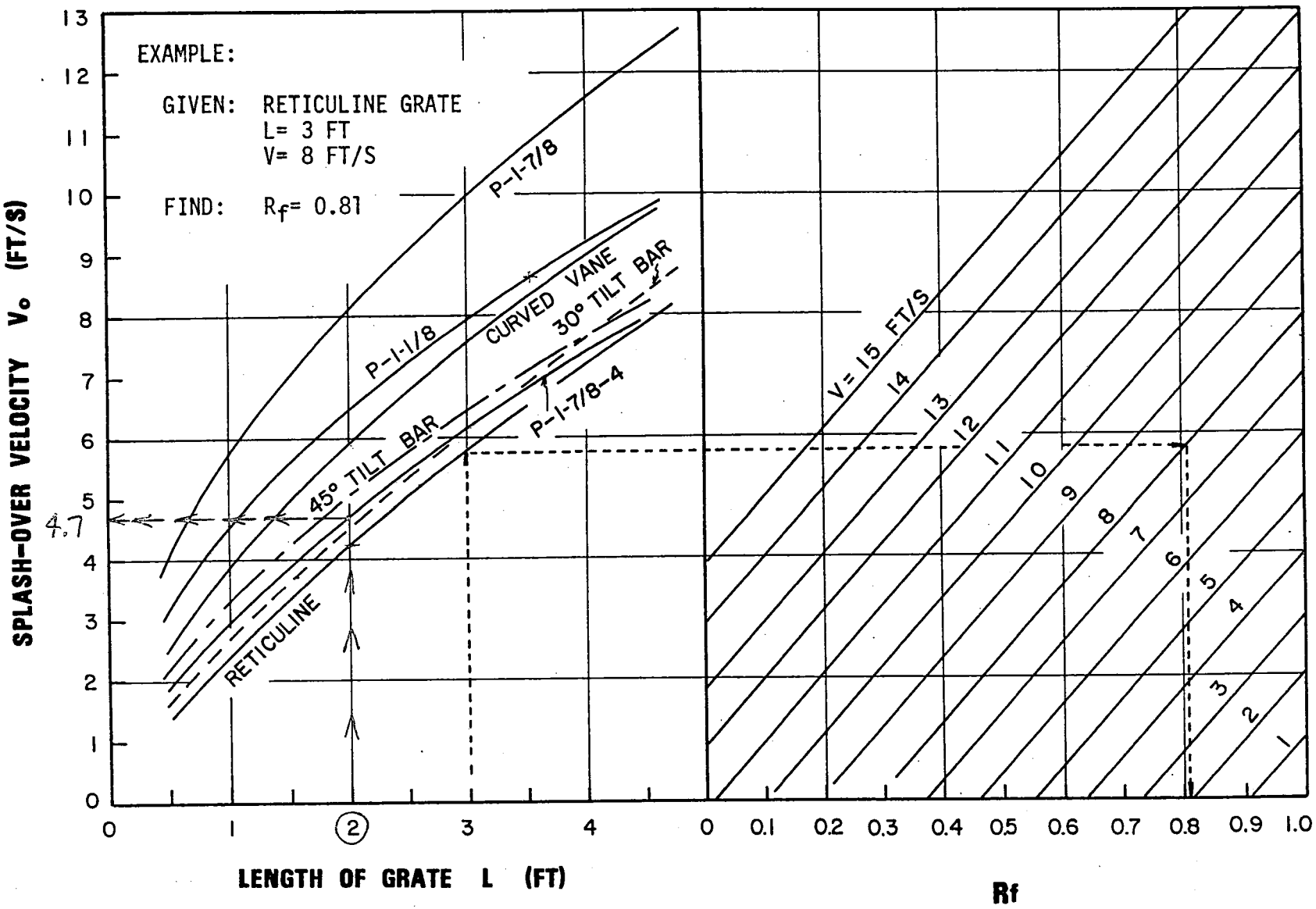
Subarea -Reach	Peak Q 10yr (cfs)	No. bbl	Culvert Diam./ Height	Unit	Box/ Arch Width	Barrel/ Material	Entrance	Length (ft)	Invert Elev. Inlet (ft)	Invert Elev. Outlet (ft)	Barrel Slope (%)	TW Depth (ft)	Allowable HW (ft)	Allowable HW/D	HW (ft)	Calculated HW/D	Controlling HW
ID: refer to StormPlus Model, which shows a HW of 1380.06. By comparison, this sheet has HW 1382.60. Both are less than the allowable=OK																	
let #3 (HEC1 ID CP211) ain Inlet Trunk Line Sheet ta. 79+56.93 Sheet C1	257	2	48	in.		RCP	headwall	186	1376.72	1370.55	3.32%	7.51	1383.46	1.69	1382.60	1.47	IC
let #4 (HEC1 ID HC155) ain Inlet 52nd St. South ta. 23+81.77 Sheet C24	135	1	60	in.		RCP	headwall	14.6	1347.32	1347.28	0.27%	5	1355.50	1.64	1353.19 (Less than allowable = ok.	1.17	TW
let #5 (Sub R4) B 75 ta. 26+48 Sheet C32	56	1	42	in.		RCP	headwall	33.2	1350.45	1346.65	11.45%	5.4	1355.80	1.53	1353.89 (Less than allowable = ok.	0.98	IC

or Inlet #8, please refer to the StormPlus Analysis. at the end of this section.

otes: 1. An asterisk (*) next to the HW/D column means that the HW/D exceeds 1.5. 2. These pipes not modeled in StormPlus, culvert hydraulics used to check headwater depth.

CONCLUSION: These inlets would act to intercept the design flow rate, with a HW Elevation of less than the allowable.

Excerpt from Drainage of Highway Pavements, FHWA, HEC No. 12



For Inlets #2, #6, #9.

CONCLUSION:

CHART 7. Grate inlet frontal flow interception efficiency.

The MAG 535 Type F catch basin has a P-1-7/8-4 grate. The splash-over velocity is 4.7 ft/s. Velocities less than or equal to this will be captured by the catch basin. Therefore, Flow to Inlet #2 (3.2 ft/s), Inlet #6 (4.7 ft/s), and Inlet #9 (2.6 ft/s) will be captured.

STREET FLOW CALCULATIONS TO COMPLEMENT CATCH BASIN SIZING CALCULATIONS

Inlet #2 (HEC-1 Subbasin Partial 210)
CB60 Sheet C20
Sta. 28+20.44

$V_o = 3.1 \frac{ft}{s} \leq 4.7 \frac{ft}{s}$
Splash-over velocity
= OK.

Flow depth and velocity from the Quick2 program.
At each inlet, the road crown will be reshaped to a flat or inverted crown section. These calculations are for a flat crown section, with flow contained by the curb.

```
+-------------------------------------------------------+
|                    NORMAL  DEPTH                      |
|                RECTANGULAR CHANNEL                    |
|                                                       |
|                  INPUT VARIABLES                      |
|                                                       |
| L Side Slope (H:V) 0.0:1   R Side Slope (H:V) 0.0:1   |
| Bottom Width (ft)   53.0   Manning's n        0.0160  |
| Discharge (cfs)       20   Depth (ft)          0.12  |
| Slope (ft/ft)     0.0180                              |
|-------------------------------------------------------|
|                 OUTPUT VARIABLES                      |
|                                                       |
| Area (sq ft)         6.5   Wet Perimeter (ft)  53.2   |
| Velocity (ft/s)      3.1   Hyd Radius (ft)      0.1   |
| Top Width (ft)      53.0   Froude #             1.5   |
|                            Flow Type  SUPERCRITICAL   |
|-------------------------------------------------------|
| Begin Calculations  <Enter>                           |
| Print               <F5>          New Shape  <F9>     |
| <- Back Tab         <F2>          Main Menu  <F7>     |
+-------------------------------------------------------+
```

STREET FLOW CALCULATIONS TO COMPLEMENT CATCH BASIN SIZING CALCULATIONS

Inlet #6 (Subbasin R3)
CB72 Sheet C31
Sta. 33+50.42

$V_o = 4.7 \frac{ft}{s} \leq 4.7 \frac{ft}{s}$ splash-over velocity = OK

Flow depth and velocity from the Quick2 program.
At each inlet, the road crown will be reshaped to a flat or inverted crown section. These calculations are for a flat crown section, with flow contained by the curb.

```
+-------------------------------------------------------+
|                    NORMAL  DEPTH                      |
|                 RECTANGULAR CHANNEL                   |
|                                                       |
|                   INPUT VARIABLES                     |
|                                                       |
| L Side Slope (H:V) 0.0:1   R Side Slope (H:V) 0.0:1   |
| Bottom Width (ft)   31.0   Manning's n        0.0160  |
| Discharge (cfs)       52   Depth (ft)           0.36  |
| Slope (ft/ft)     0.0100                              |
|-------------------------------------------------------|
|                  OUTPUT VARIABLES                     |
|                                                       |
| Area (sq ft)        11.2   Wet Perimeter (ft)   31.7  |
| Velocity (ft/s)      4.7   Hyd Radius (ft)       0.4  |
| Top Width (ft)      31.0   Froude #              1.4  |
|                            Flow Type  SUPERCRITICAL   |
|-------------------------------------------------------|
| Enter Bottom Width  and Press  <Enter>                |
|                                                       |
| <- Back Tab         <F2>           Main Menu  <F7>    |
+-------------------------------------------------------+
```

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Inlet #2 Design

Summary of Calculations thus far: The use of chart 7 from HEC No.12 showed that 100% interception will occur. Now the question is can the pipe carry all of the flow? Grate elevation = 1385.76±

Use HGL equation from p.31 of City of Phoenix manual:

$$Q = \frac{A(2gH)^{1/2}}{\left(1.2 + \frac{0.021L}{D^{1.2}}\right)^{1/2}} \quad \text{solve for H:} \quad Q^2 = \frac{A^2(2gH)}{1.2 + \frac{0.021L}{D^{1.2}}}$$

$$Q^2\left(1.2 + \frac{0.021L}{D^{1.2}}\right) = A^2(2gH), \text{ thus } H = \frac{Q^2}{2gA^2}\left(1.2 + \frac{0.021L}{D^{1.2}}\right)$$ ← HGL equation solved for H.

$$H = \frac{19.9^2}{2g(1.767)^2}\left[1.2 + \frac{0.021(75.8)}{1.5^{1.2}}\right] \qquad H = 4.29 \text{ ft}$$

H @ catch basin is 1383.96 + 4.29 = 1388.25 No Good for 18"

Since the grate elevation is 1385.76, this pipe needs to be up-sized.

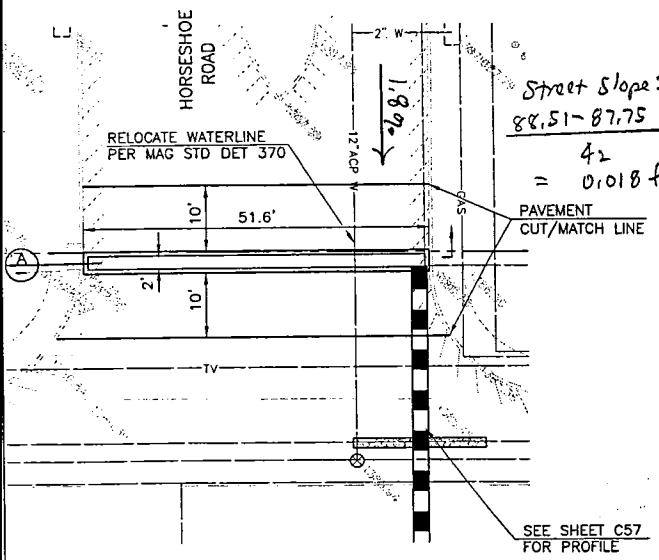
Try 24" pipe: $H = \frac{19.9^2}{2g(3.14)^2}\left[1.2 + \frac{0.021(75.8)}{2^{1.2}}\right]$ H = 1.17 ft

H @ catch basin is 1383.96 + 1.17 = 1385.13 This is 0.63 ft ± below the grate elevation. Section 4.2.2.6 of FCDMC Hydraulic Manual allows to design for 0.5 feet below grate, but since it is important to insure capacity,

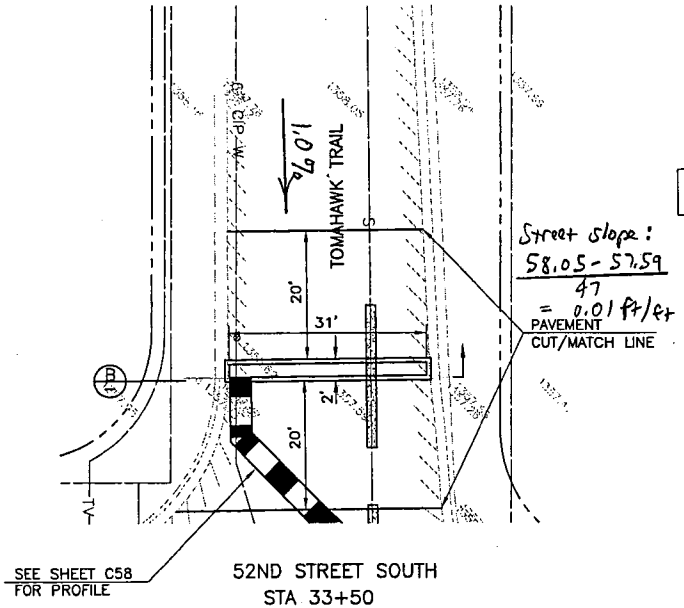
Try 30": $H = \frac{19.9^2}{2g(4.91)^2}\left[1.2 + \frac{0.021(75.8)}{2.5^{1.2}}\right]$ H = 0.44 ft

H @ catch basin is 1383.96 + 0.44 = 1384.4, which is 1.36 ft below Grate Elevation of 1385.76 ±.

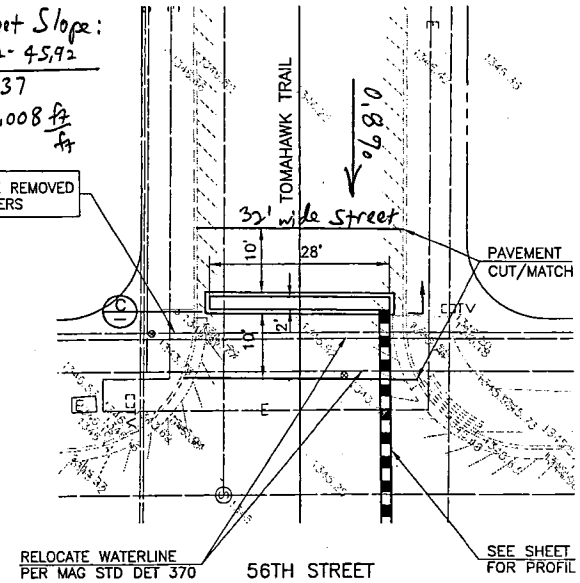
CONCLUSION: Use a 30" pipe with a minimum slope of 0.5%.



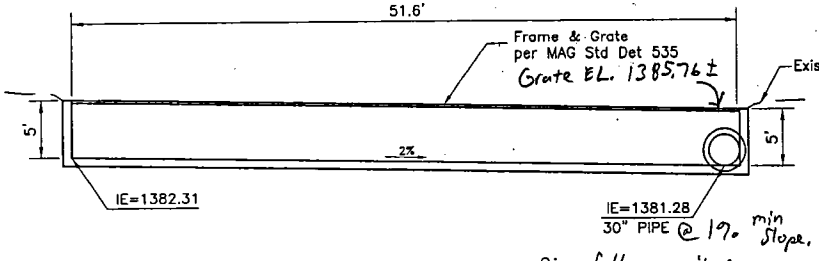
TATUM BLVD
STA 28+20



52ND STREET SOUTH
STA 33+50



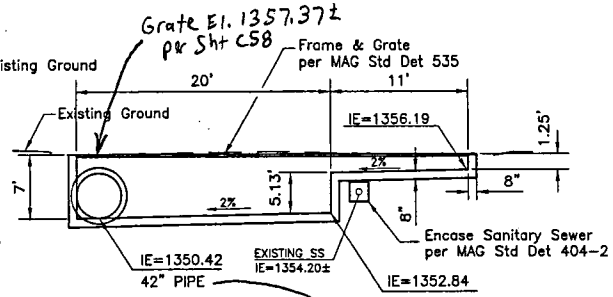
56TH STREET
STA 33+16



Pipe full capacity:
$Q = 410\ S^{1/2}$
$Q = 41$ cfs > 19.9 cfs OK
Pipe Length = 75.8 ft

SECTION A

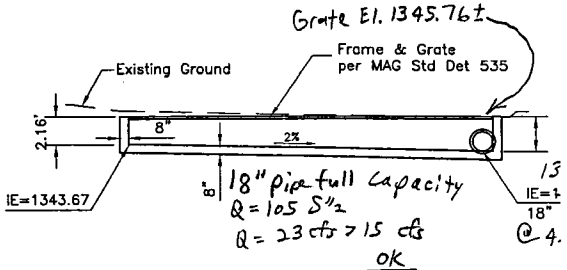
Inlet #2
CB 60 Sta 28+20.44
Sheet C20
HEC1 Partial Subbasin 210S
$Q_{10} = 19.9$ cfs
HGL @ outlet = 1383.96
H per p.31 City of Phoenix = 0.44 ft
(See following calculation sheet)
HGL @ CB 60 = 1383.96 + 0.44 = 1384.4
which is below grate elevation by 1.36 ft
OK



42" pipe @ 2.67%
Pipe full capacity:
$Q = 1006\ S^{1/2}$
$Q = 164$ cfs > 52 cfs
OK
Pipe length = 80.3 ft

SECTION B

Inlet #6
CB 72 Sta 33 + 50.42
Sheet C31
Sub R3
$Q_{10} = 52$ cfs
HGL @ outlet = 1353.03
H per p.31 City of Phoenix, (using Equation) H = 0.71 ft
HGL @ CB72 = 1353.03 + 0.71
= 1353.74 < 1357.37, OK @ 3.6' below



SECTION C

Inlet #9
CB79 Sta 33 + 16.12
Sheet C35
Sub R8
$Q_{10} = 15$ cfs
HGL @ Pipe Outlet = 1342.69
Pipe length = 46.8 ft
H per p.31 City Phoenix H = 2.1, HGL = 1344.79
This is below grate by 0.97 ft, OK

NO.	REVISION	BY
3		
2		
1		

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
DOUBLETREE RANCH ROAD DRAINAGE PLANS
PROJECT CONTROL NO. 580-03-30

	BY
DESIGNED	KWR
DRAWN	KWR
CHECKED	

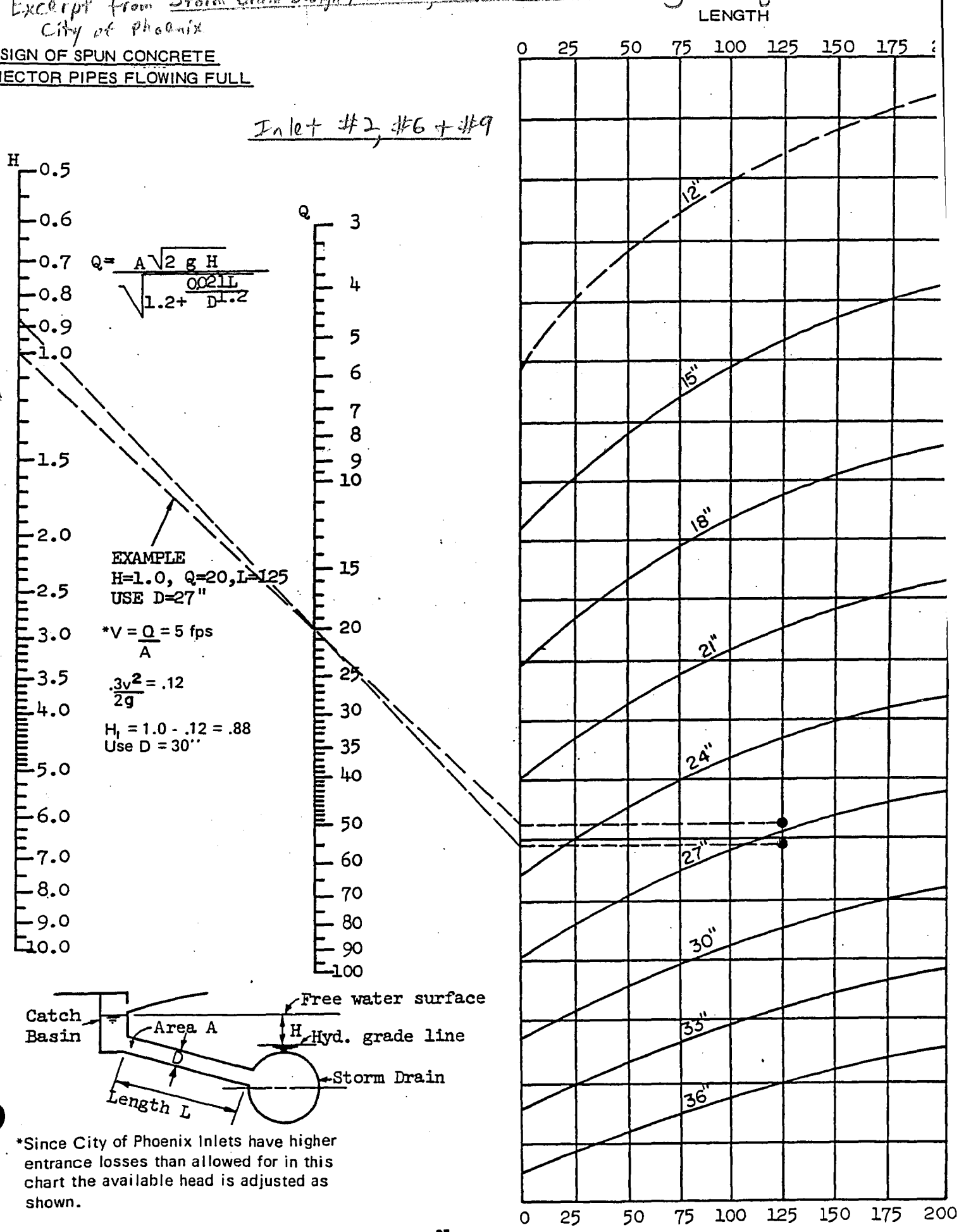
DIBBLE & ASSOCIATES CONSULTING ENGINEERS
CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)
DRAWING NO. D4
PLAN SHEET SPECIAL INLET DETAILS

CONCLUSION Inlets #2, #6 + #9, during a 10-year Storm, would operate adequately.

Excerpt from Storm Drain Design Manual, Storm Drains with Paving of Major Streets
City of Phoenix

DESIGN OF SPUN CONCRETE
NNECTOR PIPES FLOWING FULL

Inlet #2, #6 + #9



$$Q = \frac{A\sqrt{2gH}}{\sqrt{1.2 + \frac{0.021L}{D^{1.2}}}}$$

*Since City of Phoenix Inlets have higher entrance losses than allowed for in this chart the available head is adjusted as shown.

Doubletree Ranch Road - Inlets for Off-Site Flows
Required Length of Slotted Drain for Total Interception

I.D.	Q10 on both street sides	Half Street Q10/2	K	Road Slope S_o	Road Width FL to FL	Manning's n	Cross Slope S_x	Total Interception Length, L_t	Reduction Factor	Total Inlet Length each side (Leff.)
Inlet #7a (Sub R2A) CB68 & CB69 Sheet C29 Sta. 41+27.36	15	7.5	0.6	0.007	32	0.016	0.02	39.5	0.80	**49.3**
Inlet #7b (Sub R1 + R2B) CB66 & CB67 SheetC29 Sta. 41+87.50	12	6	0.6	0.004	47	0.016	0.02	30.4	0.80	**38.0**
Inlet #10a (Sub R7A) CB82 & CB83 Sheet C37 Sta. 22+96	19	9.5	0.6	0.011	32	0.016	0.02	49.9	0.80	**62.4**
Inlet #10b (Sub R7B) CB80 & CB81 Sheet C37 Sta. 23+55.18	14	7	0.6	0.004	40	0.016	0.02	32.4	0.80	**40.5**

$$L_t = K \times Q^{.42} \times S^{.3} \times (1/nS_x)^{.6}$$

Equation 3.4, Drainage Design Manual for Maricopa County, Volume II, Hydraulics

Note: These streets appear to have a standard 2% cross slope for the crown, but were not surveyed. FL = flowline.

CONNECTOR PIPE HYDRAULIC ANALYSIS

Determine the difference in hydraulic grade line between the main trunkline in Doubletree Ranch Road and a few of the connector pipes. The calculation method will be from the City of Phoenix "Storm Drain Design Manual, Storm Drains with Paving of Major Streets", page 31 (see copy on next sheet).

Inlet # 11 (see offsite Catch Basin Location Map)
CB 29A Sheet C11
La Serena Wash Inlet
Sta. 38 + 86.91
HEC1 ID 240S

Q10= 42 cfs. This is split into twin 24" RCP's, thus each pipe will take 21 cfs.
The tailwater on the pipe is the hydraulic grade line in the Doubletree Ranch Road trunkline. Per StormPlus results at Sta. 38+91.96 (upstream side of connector pipes), HGL = 1341.42

Reading from the City of Phoenix chart for pipe length 32.69 + 8.36 = 41.05 feet, the difference in HGL is 1.05 feet.
Thus the HGL at upstream end is 1341.42 + 1.05 = 1342.47. (This is about at the upstream invert elevation.)
Compared to the allowable (top of headwall) elevation of 1345.0, this size of pipe is sufficient.

Other checks: Check the pipe full capacity of 24" RCP: This is a broken-back pipe, the average pipe slope is 1342.50 - 1336.06 / 41.05 = 0.1569 ft/ft. Q capacity = 226S^0.5 Q capacity = 89.5 cfs in each barrel.

CONCLUSION: The twin 24" RCP's should be adequate for the Q10 flow of 42 cfs draining into the DTRR main trunkline.

Inlet # 12 (see offsite Catch Basin Location Map)
CB 29B Sheet C11
Berneil Wash Residual Flow Inlet
Sta. 38 + 66.45
Sub R11

Q10= 31 cfs. This is split into twin 24" RCP's, thus each pipe will take 15.5 cfs.
The tailwater on the pipe is the hydraulic grade line in the Doubletree Ranch Road trunkline. Per StormPlus results at Sta. 38+66.45 (upstream side of connector pipes), HGL = 1341.07

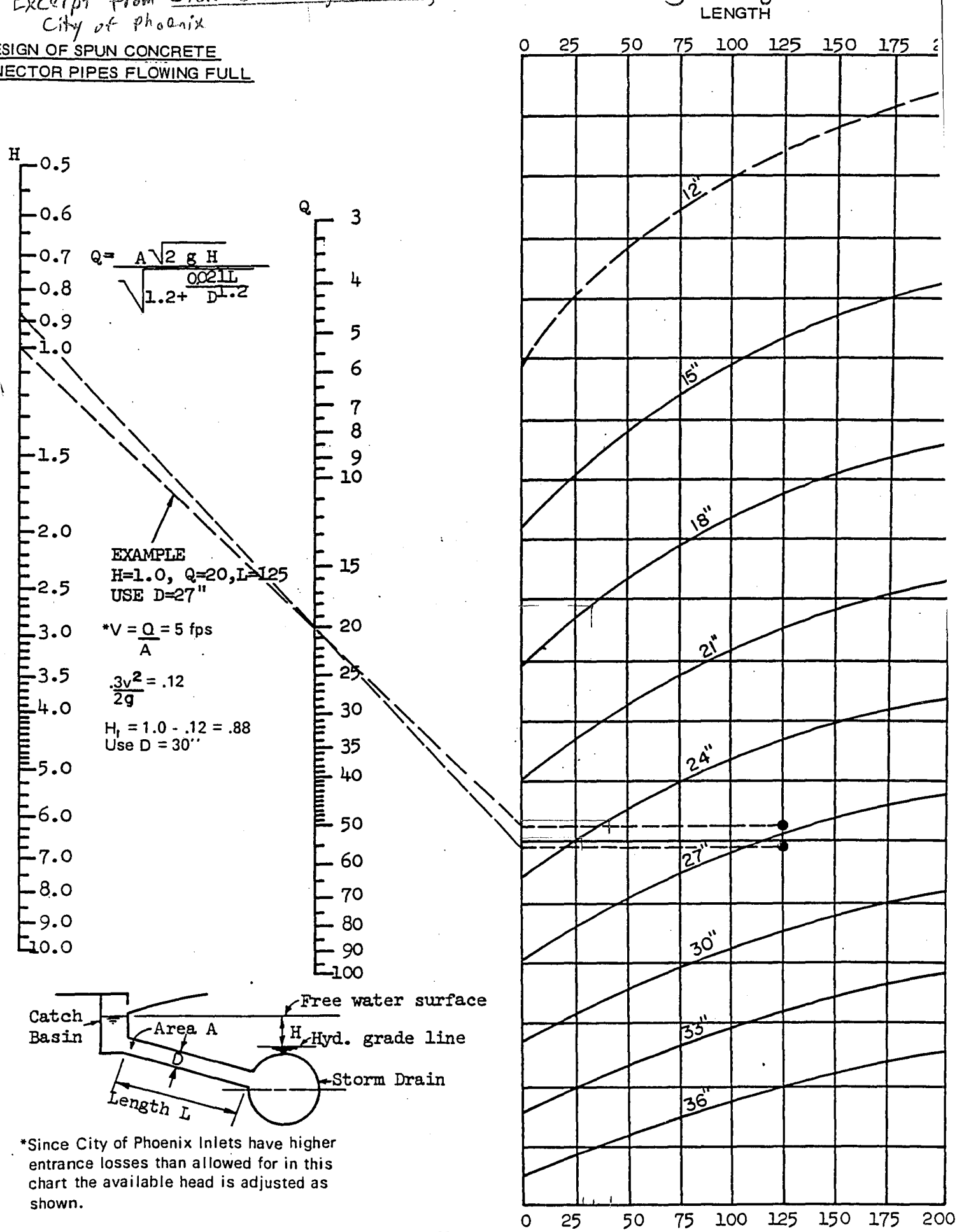
Reading from the City of Phoenix chart for pipe length 15.87 + 13.02 = 28.89 feet, the difference in HGL is 0.55 feet.
Thus the HGL at upstream end is 1341.07 + .55 = 1341.62. (This is below the upstream invert elevation.)
Compared to the allowable (top of headwall) elevation of 1346.3, this size of pipe is sufficient.

Other checks: Check the pipe full capacity of 24" RCP: This is a broken-back pipe, the average pipe slope is 1342.35 - 1338.95 / 28.89 = 0.1177 ft/ft. Q capacity = 226S^0.5 Q capacity = 77.5 cfs in each barrel.

CONCLUSION: The twin 24" RCP's should be adequate for the Q10 flow of 31 cfs draining into the DTRR main trunkline.

Excerpt from Storm Drain Design Manual, Storm Drains with Paving of Major Streets
City of Phoenix

DESIGN OF SPUN CONCRETE
CONNECTOR PIPES FLOWING FULL



*Since City of Phoenix Inlets have higher entrance losses than allowed for in this chart the available head is adjusted as shown.

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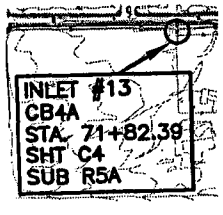
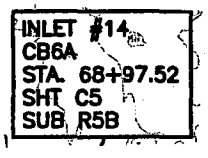
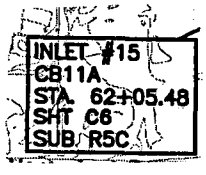
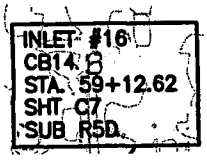
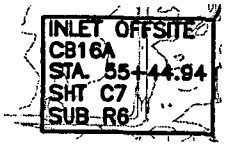
Design for Catch Basins 4A, 6A, 11A, 14B & 16A

All are sump inlets, MAG 535F. Effective open area of grate calculation follows this sheet. The orifice equation will govern during the design flow rates. See equation 3.18 in the FCDMC Volume II Hydraulics Manual. $Q_i = 0.67\,A(2gd)^{0.5}$

Solve for depth: $(2gd)^{0.5} = \dfrac{Q_i}{0.67A}$ $\quad d^{0.5} = \dfrac{Q_i}{0.67A(2g)^{0.5}}$ $\quad d = \left[\dfrac{Q_i}{0.67A(2g)^{0.5}}\right]^2$

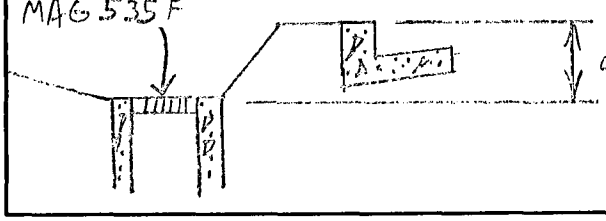
$A = 4.23\ ft^2$ for MAG 535F.
At 50% reduction, effective area $= 2.12\ ft^2$

$d = \left[\dfrac{Q_i}{11.3987}\right]^2$ All Flows from the Rational Method Calculations.

				
INLET #13 CB4A STA. 71+82.39 SHT C4 SUB R5A	INLET #14 CB6A STA. 68+97.52 SHT C5 SUB R5B	INLET #15 CB11A STA. 62+05.48 SHT C6 SUB R5C	INLET #16 CB14B STA. 59+12.62 SHT C7 SUB R5D	INLET OFFSITE CB16A STA. 55+44.94 SHT C7 SUB R6
Q_i = 9.0 cfs	Q_i = 6 cfs	Q_i = 3.0	Q_i = 1.0 cfs	Q_i = 3.0
d = 0.62 ft	d = 0.28 ft	d = 0.1	d = <0.1 ft	d = 0.1
use d = 0.67 to 0.75 ft	use d = 0.5 ft	use d = 0.5 ft	use d = 0.5 ft	use d = 0.5 ft

Calculation for Inlet #12A: Q_i = 6 cfs
SHT C13 SUB R12B d = 0.28 ft
use d = 0.5 ft

MAG 535F



d = distance from grate to spill point adjacent which usually is top of curb.

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Clear Opening Area for Grated Inlets

MAG 535-F

Total box area = 2 ft (3.4167 ft) = 6.83 ft²

Area of bars: 21 (0.5/12 ft) 2 ft long (flat bars) + 6 (0.5/12 ft) 3.417 ft long (transverse rods) = 2.60 ft²

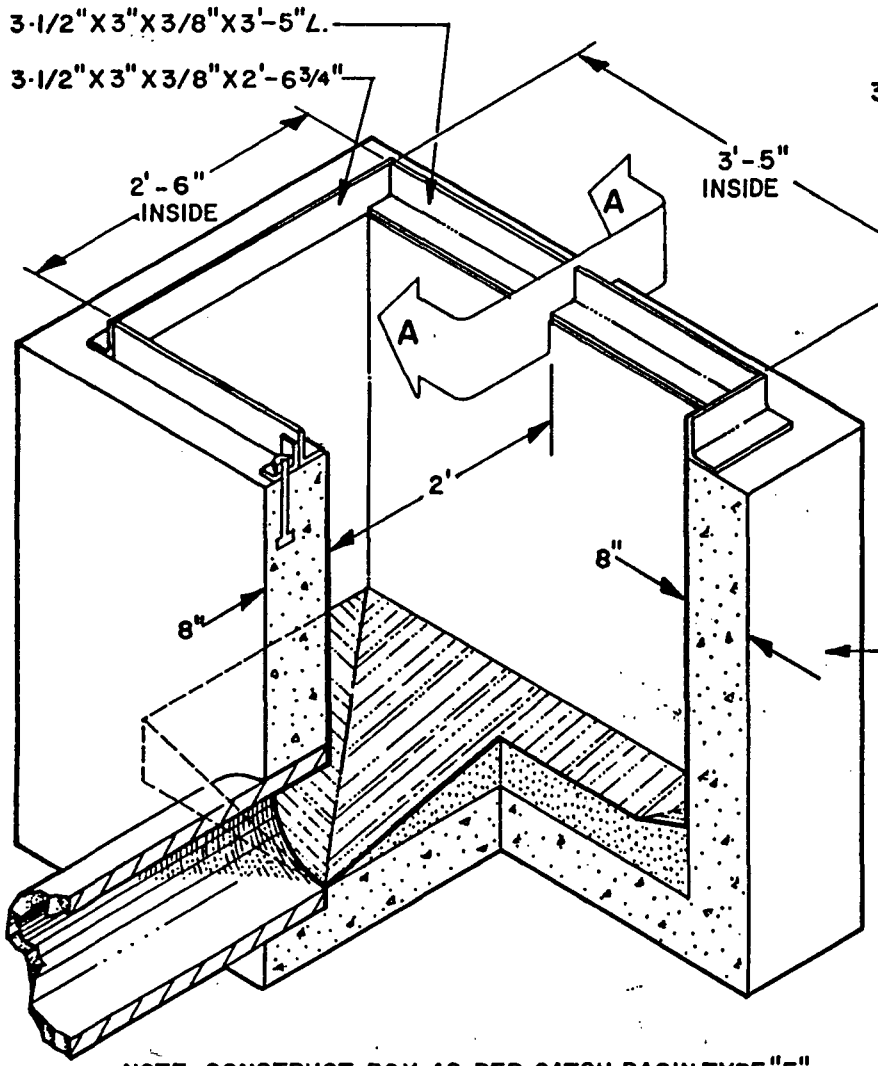
Total open area = 6.83 ft² − 2.60 ft² = 4.23 ft²

Weir perimeter = 10.83 ft.

Will operate under orifice flow for design condition.

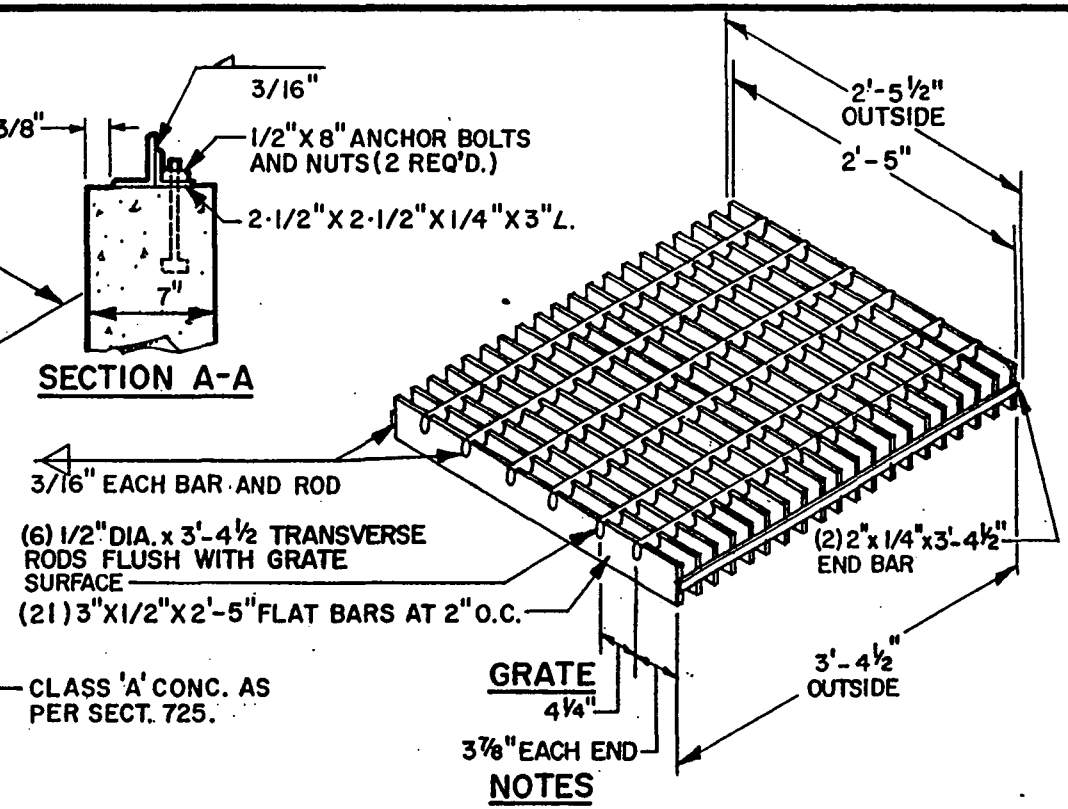
$Q_i = C_o A (2gd)^{0.5}$ equation 3.18 Jan. 28, 1996 Hydraulics

$C_o = 0.67$



NOTE: CONSTRUCT BOX AS PER CATCH BASIN TYPE "E" (LOWER PORTION ONLY)

SECTION A-A



GRATE

NOTES

1. PIPES MAY ENTER OR LEAVE ANY WALL. BOTTOM OF BOX TO BE SLOPED TO OUTLET PIPE FROM ALL DIRECTIONS AND TROWELLED TO A HARD SMOOTH SURFACE.
2. CONNECTION PIPES MAY BE PLACED IN ANY POSITION AROUND THE WALLS PROVIDED THE POSITION IS CONSISTENT WITH THE PLAN.
3. OUTLET PIPE SHALL BE TRIMMED TO FINAL SHAPE AND LENGTH BEFORE CONCRETE IS POURED
4. ALL STRUCTURAL STEEL TO BE PAINTED ONE SHOP COAT OF NO. 1 PAINT AND TWO FIELD COATS OF NO. 10 PAINT AS PER SECT. 790.
5. ALL WELDS ON FRAME AND SIDE BARS ON GRATE SHALL BE FULL LENGTH OF JOINT.

DETAIL NO.				DETAIL NO.
535	MARICOPA ASSOCIATION of GOVERNMENTS STANDARD DETAIL	CATCH BASIN · TYPE "F" (FOR USE WITHOUT CURB)		535

REVISED 1998

The interception capacity of a grate catch basin on grade is equal to the efficiency of the grate multiplied by the total gutter flow:

$$Q_i = EQ = Q[R_f E_o + R_s(1-E_o)] \tag{3.16}$$

Sumps: The efficiency of catch basins in passing debris is critical in sump locations because all runoff which enters the sump must be passed through the catch basin. Total or partial clogging of catch basins in these locations can result in hazardous ponding conditions. Grate catch basins alone are not recommended for use in sump locations because of the tendencies of grates to become clogged. Combination catch basins or curb-opening catch basins are recommended for use in these locations.

A grate catch basin in a sump location operates as a weir to depths dependent on the bar configuration and size of the grate and as an orifice at greater depths. Grates of larger dimension and grates with more open area, i.e., (with less space occupied by lateral and longitudinal bars), will operate as weirs to greater depths than smaller grates or grates with less open area.

The capacity of grate catch basins operating as weirs is:

$$Q_i = C_w P d^{1.5} \tag{3.17}$$

where $C_w = 3.0$.

The capacity of a grate catch basin operating as an orifice is:

$$Q_i = C_o A (2gd)^{0.5} \tag{3.18}$$

where $C_o = 0.67$.

Use of Equation 3.18 requires the clear opening area of the grate. Tests of three grates for the Federal Highway Administration showed that for flat bar grates, such as P–1–7/8–4 and P–1–1/8 grates, the clear opening is equal to the total area of the grate less the area occupied by longitudinal and lateral bars.

Figure 3.29 (page 3-47) is a plot of Equations 3.17 and 3.18 for various grate sizes. The effects of grate size on the depth at which a grate operates as an orifice is apparent from the chart. Transition from weir to orifice flow results in interception capacity less than that computed by either the weir or the orifice equation. This capacity can be approximated by drawing in a curve between the lines representing the perimeter and net area of the grate to be used.

f 80% Lee.
20% Cyn
closed.

Table 3.2
Reduction Factors to Apply to Catch Basins

Condition	Inlet Type	Reduction Factor
Sump	Curb Opening	0.80
Sump	Grated	0.50
Sump	Combination	0.65
Continuous Grade	Curb Opening	0.80
Continuous Grade	Longitudinal Bar Grate Longitudinal Bar Grate with recessed transverse bars	0.75 0.60
Continuous Grade	Combination (1)	Apply factors separately to grate and curb opening
Shallow Sheet Flow (2)	Slotted Drains	0.80

(1) See Section 3.3.4.3, Combination Catch Basins
(2) Slotted drains are most effective for shallow sheet flow conditions. With greater depths and flows, a different type of inlet should be used.

3.3.4 Catch Basin Design Procedures

Figures 3.9 to 3.19 (pages 3-27 to 3-37) are capacity curves for standard catch basins. When designing a *nonstandard* catch basin, use the equations and procedures outlined herein. The approval of the governing municipality should be obtained before designing a nonstandard catch basin. The procedures and equations in this section are adapted from the Federal Highway Administration Hydraulic Engineering Circular No. 12 (HEC-12), *Drainage of Highway Pavements* (USDOT, FHWA, 1984). Refer to Section 3.1 for definitions of coefficients used in the following equations.

3.3.4.1 Curb Opening Catch Basins:

On-Grade: The length of curb opening catch basin required for total interception of gutter flow on a pavement section with a straight cross slope is expressed as:

$$L_T = 0.6Q^{0.42}S^{0.3}\left(\frac{1}{nS_x}\right)^{0.6} \qquad (3.4)$$

Figure 3.20 (page 3-38) is a nomograph for the solution of Equation 3.4.

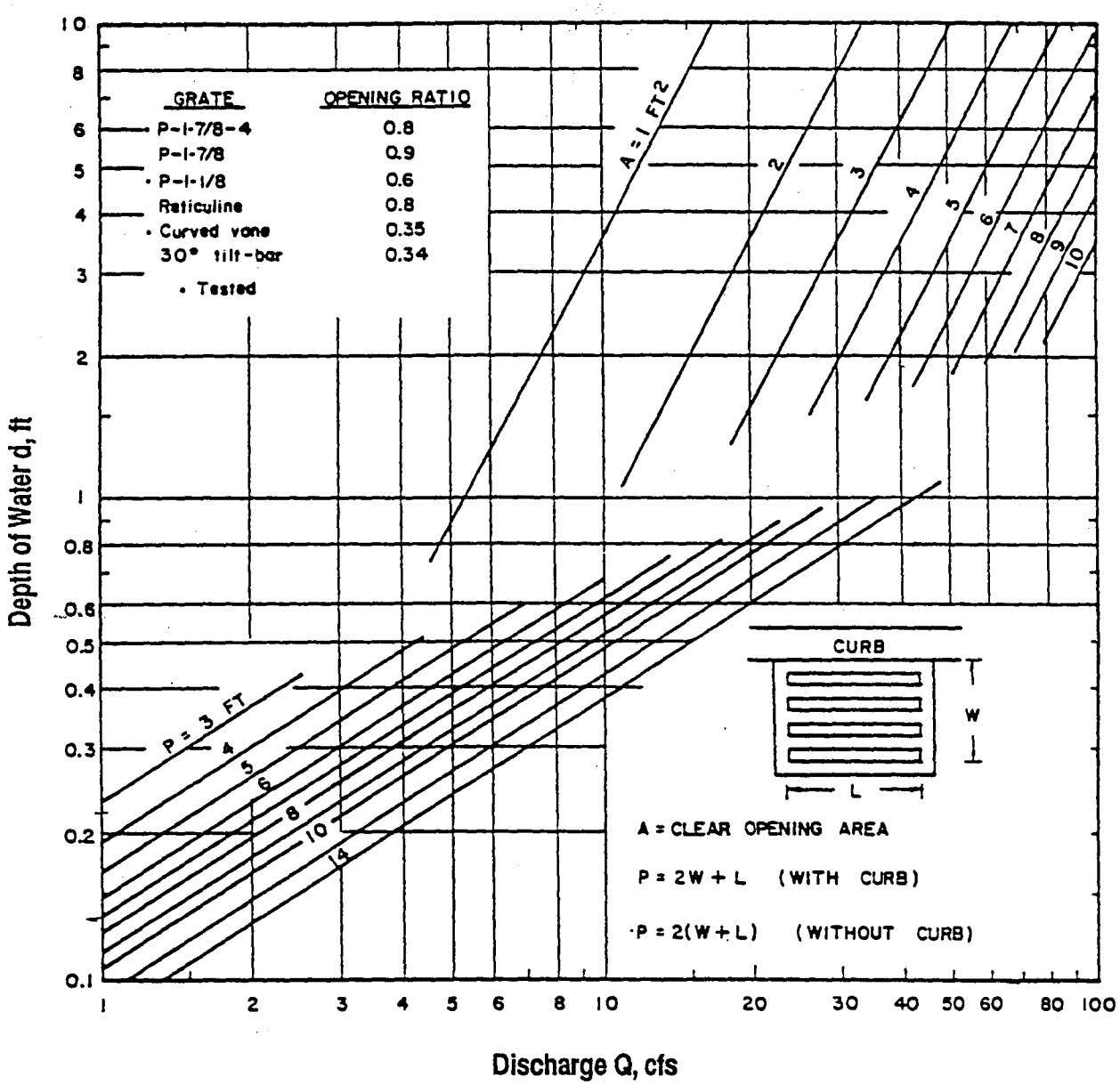


Figure 3.29
Grate Inlet Capacity in Sump Conditions
(USDOT, FHWA, 1984, HEC-12, Chart 11)

STREET FLOW CALCULATIONS TO COMPLEMENT CATCH BASIN SIZING CALCULATIONS

Inlet Offsite Flow
CB36A & 36B Sheet C12
Sta. 32+77.47 43.72' LT and Sta. 32+44.32 45.69'LT

$V_0 = 3.4 \frac{ft}{s} \leq 4.7 \frac{ft}{s}$ Splash-over Velocity = OK

Flow depth and velocity from the Quick2 program.
At each inlet, the road crown will be reshaped to a flat or inverted crown section. These calculations are for a flat crown section, with flow contained by the curb.

```
+-------------------------------------------------------+
|                    NORMAL  DEPTH                      |
|                 RECTANGULAR CHANNEL                   |
|                                                       |
|                   INPUT VARIABLES                     |
|                                                       |
| L Side Slope (H:V) 0.0:1   R Side Slope (H:V) 0.0:1   |
| Bottom Width (ft)   32.0   Manning's n        0.0160  |
| Discharge (cfs)       14   Depth (ft)           0.13  |
| Slope (ft/ft)     0.0209                              |
|-------------------------------------------------------|
|                  OUTPUT VARIABLES                     |
|                                                       |
| Area (sq ft)         4.1   Wet Perimeter (ft)   32.3  |
| Velocity (ft/s)      3.4   Hyd Radius (ft)       0.1  |
| Top Width (ft)      32.0   Froude #              1.7  |
|                            Flow Type  SUPERCRITICAL   |
|-------------------------------------------------------|
| Begin Calculations  <Enter>                           |
| Print               <F5>          New Shape  <F9>     |
| <- Back Tab         <F2>          Main Menu  <F7>     |
+-------------------------------------------------------+
```

STREET FLOW CALCULATIONS TO COMPLEMENT CATCH BASIN SIZING CALCULATIONS

Inlet Offsite Flow ()
CB52A & 52B Sheet C15
Sta. 18+16.28, 31.30' LT and Sta. 18+48.11, 36.37' LT

$V_o = 3.8 \frac{ft}{s} \leq 4.7 \frac{ft}{s}$ Splash-over velocity = OK

Flow depth and velocity from the Quick2 program.
At each inlet, the road crown will be reshaped to a flat or inverted crown section. These calculations are for a flat crown section, with flow contained by the curb.

```
+-------------------------------------------------------+
|                    NORMAL  DEPTH                      |
|                RECTANGULAR CHANNEL                    |
|                                                       |
|                  INPUT VARIABLES                      |
|                                                       |
| L Side Slope (H:V) 0.0:1   R Side Slope (H:V) 0.0:1   |
| Bottom Width (ft)   32.0   Manning's n        0.0160  |
| Discharge (cfs)       15   Depth (ft)           0.12  |
| Slope (ft/ft)     0.0273                              |
|-------------------------------------------------------|
|                 OUTPUT VARIABLES                      |
|                                                       |
| Area (sq ft)         3.9   Wet Perimeter (ft)   32.2  |
| Velocity (ft/s)      3.8   Hyd Radius (ft)       0.1  |
| Top Width (ft)      32.0   Froude #              1.9  |
|                            Flow Type  SUPERCRITICAL   |
|-------------------------------------------------------|
| Begin Calculations  <Enter>                           |
| Print               <F5>          New Shape   <F9>    |
| <- Back Tab         <F2>          Main Menu   <F7>    |
+-------------------------------------------------------+
```

STREET FLOW CALCULATIONS TO COMPLEMENT CATCH BASIN SIZING CALCULATIONS

Inlet Offsite Flow
CB52C & 52D Sheet C15
Sta. 18+14.43 56.67' LT and Sta. 18+45.82 61.68'LT

$V_0 = 3.8 \frac{ft}{s} \leq 4.7 \frac{ft}{s}$ splash-over velocity = ok

Flow depth and velocity from the Quick2 program.
At each inlet, the road crown will be reshaped to a flat or inverted crown section. These calculations are for a flat crown section, with flow contained by the curb.

```
+-------------------------------------------------------+
|                    NORMAL  DEPTH                      |
|                RECTANGULAR CHANNEL                    |
|                                                       |
|                   INPUT VARIABLES                     |
|                                                       |
| L Side Slope (H:V) 0.0:1   R Side Slope (H:V) 0.0:1   |
| Bottom Width (ft)   32.0   Manning's n        0.0160  |
| Discharge (cfs)       15   Depth (ft)           0.12  |
| Slope (ft/ft)     0.0264                              |
|-------------------------------------------------------|
|                  OUTPUT VARIABLES                     |
|                                                       |
| Area (sq ft)         4.0   Wet Perimeter (ft)   32.2  |
| Velocity (ft/s)      3.8   Hyd Radius (ft)       0.1  |
| Top Width (ft)      32.0   Froude #              1.9  |
|                            Flow Type  SUPERCRITICAL   |
|-------------------------------------------------------|
| Begin Calculations  <Enter>                           |
| Print               <F5>          New Shape  <F9>     |
| <- Back Tab         <F2>          Main Menu  <F7>     |
+-------------------------------------------------------+
```

Storm Plus Modeling Assumptions

➤ PARALLEL PIPE REACHES:

Parallel pipe reaches cannot be modeled in Storm Plus. These reaches were modeled by assuming each pipe carries half of the flow. The flow was reduced by half in the model, and conveyed by only one pipe. This accurately models the friction losses through the parallel pipe reach.

Double-barrel box culverts can be, and were, modeled accurately in Storm Plus.

➤ BENDS AND ANGLE POINTS:

Bends 15° or less in magnitude can be modeled accurately as angle points in Storm Plus.

Bends greater than 15° in magnitude must occur over a reach of length greater than 0' in Storm Plus. Wherever a bend greater than 15° occurs in the system, a short reach of approximately 5' was added, and the bend was forced to occur over that length.

For this reason, the stations in the model for the reaches immediately upstream and downstream from a bend greater than 15° will differ slightly (by about 2.5') from the true stations on the plans.

➤ BEGINNING TAILWATER ELEVATIONS (TWE):

The beginning TWE for the Doubletree Ranch Road (DTRR) model was provided by FCDMC. The instruction was to start at the 10-yr water surface elevation (WSE) in Indian Bend Wash, or the crown of the proposed outfall box culvert, whichever was higher. The 10-yr WSE in Indian Bend Wash is 1326.8', as provided by FCDMC. The soffit of the proposed outfall box culvert is 1329.31'. The beginning TWE for the DTRR model, therefore, is 1329.31'.

Once this was established, the DTRR model was run, and HGL elevations were read from the output at locations where the other models join the DTRR system. A list of the beginning TWE's for each model follows.

Location	File Name	Start HGL
DTRR	(dt_10.dat):	1329.31'
Tatum	(dtttm_10.dat):	1378.84'
52nd St. North	(dt52n_10.dat):	1349.07'
52nd St. South	(dt52s_10.dat):	1349.07'
56th St.	(dt56s_10.dat):	1334.22'

Inlet #8
Butler Drive Drop Inlet
Sta 49 + 54.68 CB 63
Sheet C27 HECI ID 2605 Q10 = 58 cfs

This inlet to the Storm Drain System is analyzed with Storm Plus.

Note: Add 1,000' to all elevations to match construction drawings.

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

May 31, 2000 15:28:37

Input file : butldrop.dat
Output file: butldrop.out

INPUT FILE LISTING

```
T1  Butler Drive- Drop Inlet- Sta 49+54.68        | BY: DIBBLE & ASSOCIATES
T2  DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32  | FILENAME: butldrop.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE     | JOB NO: 9801
SO      0.00 356.17  2                           361.97
R      35.62 357.20  2      .013
R      38.12 357.20  2      .013                                    1
R      45.14 359.45  2      .013
R      46.14 359.77  2      .013                              90.
R      53.81 362.24  2      .013
WE                   4
SH                   4
1                                                  SP
                                                                                                                PAGE    1
                                WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR    INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH                DROP

  CD      1    4                     2.00
  CD      2    4                     2.50
  CD      3    4                     4.50
  CD      4    3      0       .00    4.00     3.00    .00   .00   .00
```

CONCLUSIONS:

1. The hydraulic grade line inside catch basin 64 (CB64, Sheet C27) is more than 6" below gutter flowline (1366.0 − 1362.84) = 3.16').
2. The hydraulic grade line at the entrance to CB 63 (HGL = 1367.42) is above the ground surface elevation of 1366.0 ±; Therefore a berm will be constructed to contain the flow.
3. This design is acceptable.

WATER SURFACE PROFILE LISTING

Butler Drive- Drop Inlet- Sta 49+54.68 | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: butldrop.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	.00	356.17	5.80	361.97	58.0	11.82	2.17	364.14	.00	2.38	2.50	.00	.00	0	.00
0	35.62	.02892					.02000	.71		1.74			.00		
0	35.62	357.20	5.48	362.68	58.0	11.82	2.17	364.85	.00	2.38	2.50	.00	.00	0	.00
0	2.50	.00000					.02000	.05		.00			.00		
0	38.12	357.20	5.64	362.84	58.0	11.82	2.17	365.01	.00	2.38	2.50	.00	.00	0	.00
0	1.66	.32051					.02000	.03		.85			.00		
0	39.78	357.73	5.14	362.87	58.0	11.82	2.17	365.04	.00	2.38	2.50	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0	39.78	357.73	1.34	359.08	58.0	21.58	7.24	366.31	.00	2.38	2.50	.00	.00	0	.00
0	1.35	.32051					.06065	.08		.85			.00		
0	41.13	358.17	1.37	359.54	58.0	20.98	6.84	366.38	.00	2.38	2.50	.00	.00	0	.00
0	2.14	.32051					.05500	.12		.85			.00		
0	43.27	358.85	1.43	360.28	58.0	20.01	6.22	366.50	.00	2.38	2.50	.00	.00	0	.00
0	1.87	.32051					.04860	.09		.85			.00		
0	45.14	359.45	1.49	360.94	58.0	19.08	5.66	366.59	.00	2.38	2.50	.00	.00	0	.00
0	1.00	.31998					.04402	.04		.85			.00		
0	46.14	359.77	1.52	361.29	58.0	18.55	5.35	366.64	.00	2.38	2.50	.00	.00	0	.00
0	.13	.32203					.04223	.01		.85			.00		
0	46.27	359.81	1.53	361.34	58.0	18.48	5.31	366.64	.00	2.38	2.50	.00	.00	0	.00
0	1.48	.32203					.03964	.06		.85			.00		
0	47.75	360.29	1.59	361.88	58.0	17.62	4.82	366.70	.00	2.38	2.50	.00	.00	0	.00
0	1.29	.32203					.03516	.05		.85			.00		

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1

WATER SURFACE PROFILE LISTING

Butler Drive- Drop Inlet- Sta 49+54.68 | BY: DIBBLE & ASSOCIATES
DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: butldrop.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	49.05	360.71	1.66	362.36	58.0	16.80	4.38	366.75	.00	2.38	2.50	.00	.00	0	.00
0	1.12	.32203					.03126	.04		.85			.00		
0	50.17	361.07	1.73	362.80	58.0	16.02	3.99	366.78	.00	2.38	2.50	.00	.00	0	.00
0	.97	.32203					.02787	.03		.85			.00		
0	51.14	361.38	1.81	363.19	58.0	15.27	3.62	366.81	.00	2.38	2.50	.00	.00	0	.00
0	.82	.32203					.02494	.02		.85			.00		
0	51.96	361.64	1.89	363.54	58.0	14.56	3.29	366.83	.00	2.38	2.50	.00	.00	0	.00
0	.69	.32203					.02242	.02		.85			.00		
0	52.65	361.87	1.98	363.85	58.0	13.88	2.99	366.85	.00	2.38	2.50	.00	.00	0	.00
0	.55	.32203					.02030	.01		.85			.00		
0	53.21	362.05	2.09	364.13	58.0	13.24	2.72	366.86	.00	2.38	2.50	.00	.00	0	.00
0	.41	.32203					.01860	.01		.85			.00		
0	53.62	362.18	2.21	364.39	58.0	12.62	2.48	366.86	.00	2.38	2.50	.00	.00	0	.00
0	.19	.32203					.01760	.00		.85			.00		
0	53.81	362.24	2.38	364.62	58.0	12.03	2.25	366.87	.00	2.38	2.50	.00	.00	0	.00
0	WALL ENTRANCE												.00		
0	53.81	362.24	5.18	367.42	58.0	4.94	.38	367.80	.00	2.27	4.00	3.00	.00	0	.00

1

CB63
(Inlet #8)

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```
1
0                    WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                       Butler Drive- Drop Inlet- Sta 49+54.68        | BY: DIBBLE & ASSOCIATES
0HEADING LINE NO 2 IS -
0                       DOUBLETREE RANCH ROAD DRAINAGE FCD NO. 97-32 | FILENAME: butldrop.DAT
0HEADING LINE NO 3 IS -
0                       STORM DRAIN DESIGN - HYDRAULIC GRADE LINE    | JOB NO: 9801
1
0                    WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *         *      *
                  U/S DATA   STATION    INVERT  SECT                                W S ELEV
                                 .00  356.17    2                                   361.97
0 ELEMENT NO   2 IS A REACH              *         *      *
                  U/S DATA   STATION    INVERT  SECT            N                   RADIUS  ANGLE  ANG PT  MAN H
                               35.62  357.20    2            .013                      .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH              *         *      *
                  U/S DATA   STATION    INVERT  SECT            N                   RADIUS  ANGLE  ANG PT  MAN H
                               38.12  357.20    2            .013                      .00    .00     .00      1
0 ELEMENT NO   4 IS A REACH              *         *      *
                  U/S DATA   STATION    INVERT  SECT            N                   RADIUS  ANGLE  ANG PT  MAN H
                               45.14  359.45    2            .013                      .00    .00     .00      0
0 ELEMENT NO   5 IS A REACH              *         *      *
                  U/S DATA   STATION    INVERT  SECT            N                   RADIUS  ANGLE  ANG PT  MAN H
                               46.14  359.77    2            .013                      .00  90.00     .00      0
0 ELEMENT NO   6 IS A REACH              *         *      *
                  U/S DATA   STATION    INVERT  SECT            N                   RADIUS  ANGLE  ANG PT  MAN H
                               53.81  362.24    2            .013                      .00    .00     .00      0
0 ELEMENT NO   7 IS A  WALL  ENTRANCE                      *
                  U/S DATA   STATION    INVERT  SECT           FP
                               53.81  362.24    4           .500
0 ELEMENT NO   8 IS A SYSTEM HEADWORKS                     *                  *
                  U/S DATA   STATION    INVERT  SECT                                W S ELEV
                               53.81  362.24    4                                       .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
```

INDIAN BEND WASH OUTLET – RIPRAP and CHANNEL DESIGN

BROOKS HERSEY & ASSOCIATES, INC.
4602 East Elwood Street #16
PHOENIX, AZ 85040-1960
(602) 437-3733

JOB DOUBLE TREE RANCH ROAD DTRD
SHEET NO. 1 OF 9
CALCULATED BY LUTE OBAIDI DATE 3/27/00
CHECKED BY DATE
SCALE REVISED 6/8/00 MB 6/14/00

RIPRAP BLANKET CONFIGURATION AT OUTLET

CULVERT OUTLET VELOCITY = 9.46 FPS
CHANNEL VELOCITY = 4.23 FPS
SEE ATTACHED CALCS.
(1.3)(4.23) = 5.50 FPS (4.5.2.3.1) & 4.5.2.3.2 DRAINAGE DESIGN MANUAL

9.46/5.50 = 1.72
9.46 FPS > 5.53 FPS

5.56 FPS < 9.46 < 13.90 OR 1.3 < 1.72 < 2.5

SINCE 1.3 < 1.70 < 2.5 A RIPRAP APRON IS REQUIRED @ THE CULVERT'S OUTLET TO CONTROL SCOUR. DRAINAGE DESIGN MANUAL FOR MARICOPA COUNTY HAS BEEN USED.

$F = V^2/gD = 9.46^2/(32.2 \times 4.98) = 0.56$

OPTION 1 - CULVERT DIA. CRITERIA.

WHEN FROUDE NUMBER ≤ 1 APPRON LENGTH IS (8)(CULVERT DIA.)

DEPTH OF FLOW @ CULVERT OUTLET = 4.98'
MAX. TAILWATER = 4.98 ≈ 5.0 FEET

LENGTH OF SCOUR BASIN L_{SB} =

$L_{SB} = D(8 + 55 \log F)$ ------- (4.22)
$= (5)(8) = 40$ FT MIN. LENGTH OF TAILWATER TO PROTECT AGAINST SCOUR.

BROOKS HERSEY & ASSOCIATES, INC.
4602 East Elwood Street #16
PHOENIX, AZ 85040-1960
(602) 437-3733

JOB DTRD
SHEET NO. 2 OF 9
CALCULATED BY LUTE OBAIDI DATE 3/27/00
CHECKED BY MS DATE 6/14/00
SCALE

OPTION 2 – DETERMINE SCOUR GEOMETRY
(COHESIONLESS MATERIAL)

1) $Q_{10} = 943$ CFS

THE DURATION OF 943 CFS IS NOT KNOWN ∴ A PEAK FLOW DURATION OF 30 MINUTES WILL BE ESTIMATED

2. THE 2 – 10'X5' BOX CULVERT WILL HAVE A DISCHARGE INTENSITY OF

$$D.I. = Q / [g^{0.5} \times Y_e^{5/2}] ;$$

WATER DEPTH @ CULVERT OUTLET = 4.98

$$A = (2)(4.98)(10) = 99.60 \text{ ft}^2$$

$$(99.60/2)^2 = 7.06 \text{ ft}$$

$$D.I. = 943 / (32.2^{0.5} \times 7.06^{5/2})$$

$$= 1.25$$

3)

	α_θ	β	θ
D	1.53	0.57	0.10
W	9.14	0.35	0.07
L	14.78	0.43	0.09
V	61.84	1.42	0.23

BROOKS HERSEY & ASSOCIATES, INC.
4602 East Elwood Street #16
PHOENIX, AZ 85040-1960
(602) 437-3733

JOB DTRCD
SHEET NO. 3 OF 9
CALCULATED BY LUTE OBAIDI DATE 3/27/00
CHECKED BY MA DATE 6/14/02
SCALE

$t/t_0 = 30 \text{ MIN.} / 316 \text{ MIN.} = 0.0949$

$$h_s/Y_e = \alpha_\theta \left[\frac{Q}{g^{0.5}\, Y_e^{5/2}} \right]^{\beta} \left[t/t_0 \right]^{\theta}$$

$$h_s/Y_e = 1.53 \left[1.25 \right]^{0.57} \left[0.0949 \right]^{0.10}$$

$$= 1.37$$

$$h_s = (7.06)(1.37) = 9.69 \approx 10'$$

$$W_s/Y_e = 9.14 \left[1.25 \right]^{0.35} \left[0.0949 \right]^{0.07}$$

$$= 8.38$$

$$W_s = (7.06)(8.38) = 59.17 \text{ FT} \approx 59'$$

$$L_s/Y_e = 14.78 \left[1.25 \right]^{0.43} \left[0.0949 \right]^{0.09}$$

$$= 13.16$$

$$L_s = (7.06)(13.16) = 92.91 \approx \boxed{94 \text{ FT}}$$

$$V_s/Y_e^3 = 61.84 \left[1.25 \right]^{1.42} \left[0.0949 \right]^{0.23}$$

$$= 49.39$$

$$V_s = (6.62)^3 (49.39) = 14{,}329 \text{ FT}^3$$

BROOKS HERSEY & ASSOCIATES, INC.
4602 East Elwood Street #16
PHOENIX, AZ 85040-1960
(602) 437-3733

USING ANGULAR STONE FOR AN ANGLE OF REPOSE OF 41 (ACTUAL MIN. ANGLE OF REPOSE = 34°), FIG. 5.9 RECOMMENDS A MEAN STONE SIZE OF D_{50} = 0.4 FT ≅ 5"

RECOMMENDED D_{50} ≅ 8"

D_{100} = 16"

THE RIPRAP SHOULD BE COMPOSED OF A WELL GRADED MIXTURE. MOST STONES SHOULD BE OF THE SIZE D_{50} OR LARGER. SHOULD THE RIPRAP SIZE, D_{50} USED IS COMPOSED OF LESS THAN 50% OF THE TOTAL RIPRAP VOLUME, ALL RIPRAP SHALL BE GROUTED.

CONCLUSION:

IN OPTION 1 MAXIMUM LENGTH OF SCOUR, ACCORDING TO EQUATION 4-22 OF THE DRAINAGE DESIGN MANUAL FOR MARICOPA COUNTY WAS FOUND TO BE 40 FT. (SHEET 1 OF 8)

IN OPTION 2 DETERMINING THE LENGTH OF

BROOKS HERSEY & ASSOCIATES, INC.
4602 East Elwood Street #16
PHOENIX, AZ 85040-1960
(602) 437-3733

JOB
SHEET NO. 5 OF 9
CALCULATED BY DATE
CHECKED BY MB DATE 6/14/00
SCALE

RIP RAP AT THE POINT OF OUTFALL TO PREVENT SCOURING WAS FOUND TO BE 94- FEET. (SHEET 3 OF 8) FOR COHESIONLESS MATERIAL, USING EQUATION V-2, PAGE 4-137. AS A SAFETY PRECAUTION OPTION 2 WAS USED. A TOTAL OF 100 FEET RIPRAP WAS ADOPTED TO PREVENT EROSION AND SCOUR IN THE EDENT OF HIGH STORM.

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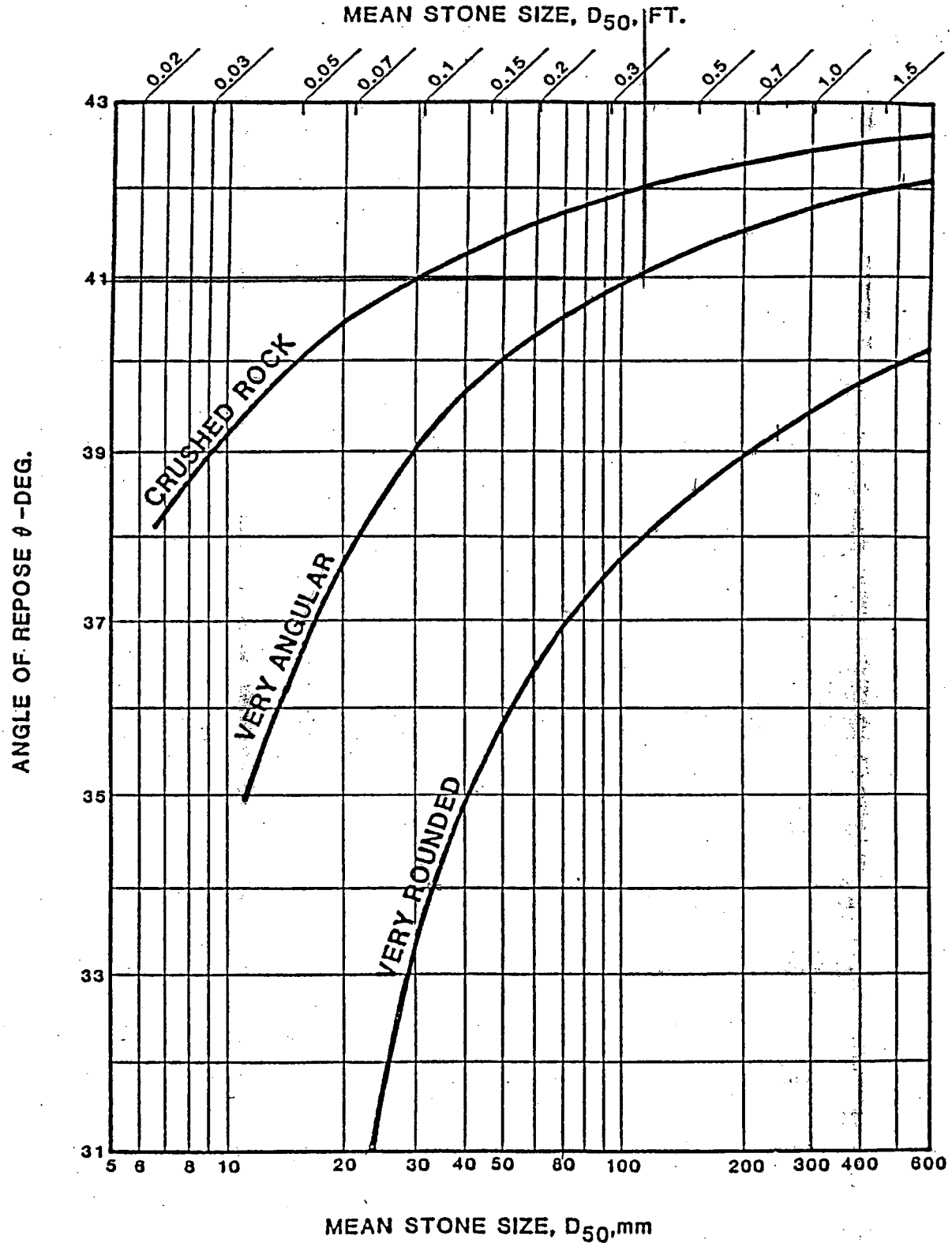

Figure 5.9
Angle of Repose of Riprap in Terms of Mean Size and Shape of Stone
(FHWA 1988b, HEC-15, Chart 12)

WATER SURFACE PROFILE LISTING

DOUBLE TREE RANCH ROAD - STORM DRAIN DESIGN | BY: DIBBLE & ASSOCIATES
TOWN OF PARADISE VALLEY, MARICOPA COUNTY, AZ | FILENAME: DT_10.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE | JOB NO: 9801

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 1000.00	324.31	5.00	329.31	943.0	9.46	1.39	330.70	.00	4.10		5.00	20.90	.02	1	.92
0 215.00	.00242					.00349	.75			4.65			.00		
0 1215.00	324.83	5.28	330.11	943.0	9.46	1.39	331.50	.00	4.10		5.00	20.90	.02	1	.92
0 665.84	.00228					.00297	1.98			4.48			.00		
0 1880.84	326.35	5.74	332.09	943.0	9.46	1.39	333.48	.00	4.10		5.00	20.90	.02	1	.92
0JUNCT STR	.00400					.00283	.01						.00		
0 1885.84	326.37	5.99	332.36	898.0	9.01	1.26	333.62	.00	3.97		5.00	20.90	.02	1	.92
0 688.44	.00362					.00270	1.86			3.66			.00		
0 2574.28	328.86	5.36	334.22	898.0	9.01	1.26	335.48	.00	3.97		5.00	20.90	.02	1	.92
0JUNCT STR	.00450					.00396	.08						.00		
0 2594.28	328.95	5.19	334.14	656.0	10.96	1.87	336.00	.00	4.53		5.00	12.70	.05	1	.75
0 42.72	.00538					.00522	.22			4.13			.00		
0 2637.00	329.18	5.18	334.36	656.0	10.96	1.87	336.23	.00	4.53		5.00	12.70	.05	1	.75
0 626.36	.00550					.00522	3.27			4.09			.00		
0 3263.36	332.63	5.00	337.63	656.0	10.96	1.87	339.49	.00	4.53		5.00	12.70	.05	1	.75
0 10.02	.00550					.00335	.03			4.09			.00		
0 3273.38	332.68	4.99	337.67	656.0	10.89	1.84	339.52	.00	4.53		5.00	12.70	.05	1	.75
0HYDRAULIC JUMP													.00		
0 3273.38	332.68	4.09	336.78	656.0	13.30	2.75	339.52	.00	4.53		5.00	12.70	.05	1	.75
0 241.21	.00550					.00551	1.33			4.09			.00		
0 3514.59	334.01	4.09	338.10	656.0	13.30	2.75	340.85	.00	4.53		5.00	12.70	.05	1	.75
0 211.32	.00550					.00546	1.15			4.09			.00		

602 957 2838 # 5/ 5

Doubletree Ranch Road Channel at Indian Bend Wash
Worksheet for Trapezoidal Channel

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Project Description	
Worksheet	DTRRD Trap. Chanl Sta. 9+25 +- @ culvert outl
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.001800	ft/ft
Left Side Slope	0.17	V : H
Right Side Slope	0.17	V : H
Bottom Width	25.00	ft
Discharge	943.00	cfs

Results		
Depth	4.36	ft
Flow Area	222.9	ft²
Wetted Perimeter	78.01	ft
Top Width	77.28	ft
Critical Depth	2.81	ft
Critical Slope	0.010516	ft/ft
Velocity	4.23	ft/s
Velocity Head	0.28	ft
Specific Energy	4.64	ft
Froude Number	0.44	
Flow Type	Subcritical	

Cross Section
Cross Section for Trapezoidal Channel

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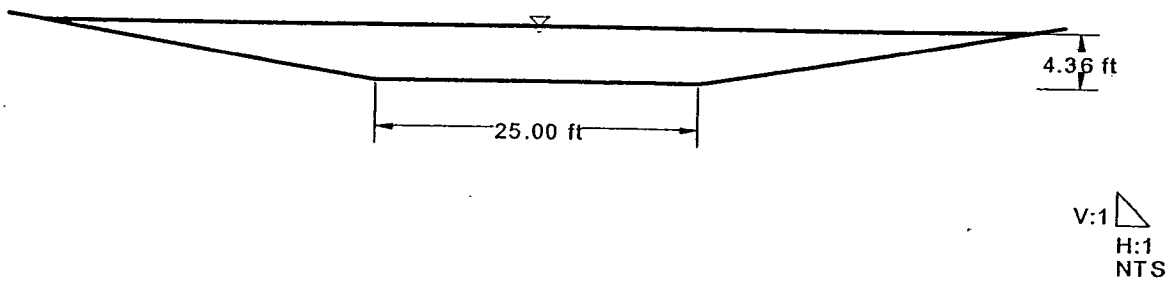
Project Description	
Worksheet	DTRRD Trap. Chanl Sta. 9+25 +- @ culvert outl
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Slope	0.001800	ft/ft
Depth	4.36	ft
Left Side Slope	0.17	V : H
Right Side Slope	0.17	V : H
Bottom Width	25.00	ft
Discharge	943.00	cfs