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DRAINAGE REPORT
for
OAK STREET STORM DRAIN
58th Street to Indian Bend Wash
FCD No. 97-39

Sections 33, 34 & 35, T2N, R4E
Maricopa County, Arizona

DRAINAGE REPORT
for
OAK STREET STORM DRAIN
58th Street to Indian Bend Wash
FCD No. 97-39

Sections 33, 34 & 35, T2N, R4E
Maricopa County, Arizona

Prepared for

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

December 31, 1998

EEC/MKE Job Number 98514

Prepared by:

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Date Signed 12/31/98
ARIZONA, U.S.A.

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1. INTRODUCTION

1.1 Project Location

The storm drain begins in Phoenix at approximately 58th Street and Oak Street. It follows Oak Street, into Scottsdale, until it discharges into Indian Bend Wash.

The project can be broken down into four different and distinct parts. From west to east, the first part is from the beginning at approximately 58th Street, along Oak Street, to 64th Street. This part of the storm drain collects runoff from Papago Park along the south side of Oak Street. The second part runs from 64th Street, along Oak Street, to the Cross Cut Canal. This part of the storm drain was designed by Entellus for the City of Scottsdale and is currently under construction. The third part is the Auto Park Basin area which lies at the southern end of 66th Street, south of Oak Street. This part of the project involves modification of the existing retention basin to increase storage volume. The last portion is from the Cross Cut Canal to Indian Bend Wash.

1.2 Purpose

The purpose of this report is:

1. Document hydrology used to size the storm drain.
2. Summarize runoff calculations for sizing inlets.
3. Document hydraulic grade line calculations for the storm drain.
4. Provide hydraulic calculations for inlet sizing.
5. Provide stage-storage calculations for the Auto Park Basin.

1.3 Methodologies and Procedures

1.3.1 Hydrology

The storm drain is designed to capture the 100-year flood from upstream of the Cross Cut Canal and convey it out to Indian Bend Wash. Downstream of the Cross Cut Canal the storm drain is designed to collect the 10-year street drainage. Refer to the S-T-P Papago Flood Control Project (reference 1).

The hydrology for the storm drain design flows and inlets upstream of the Canal is based on the report generated by Kimley-Horn (reference 1). Kimley-Horn used the HEC-1 "Flood Hydrograph Package" (reference 2) developed by the Army Corps of Engineers.

Hydrology for the inlet sizing downstream of the Canal is based on the rational method as outlined in the Flood Control District's Drainage Design Manual - Hydrology (reference 7).

1.3.2 Hydraulics

The hydraulic analysis for this project falls into two categories; Street Drainage and Storm Drains. The street drainage and inlet sizing is based on the methodology outlined in the Maricopa County Drainage Design Manual - Hydraulics (reference 3). The hydraulic analysis of the storm drain portion of this project was done using a computer software package called Auto-Storm (reference 4). This program is essentially the same as the Storm-Plus package used by Kimley-Horn in the S-T-P study.

1.3.3 Auto Park Basin

The enlargement of the Auto Park Basin is based on the HEC-1 model provided by the Kimley-Horn study (reference 1). The stage-storage relationship developed in their model was used to develop the grading plan for the enlarged basin.

1.4 Elevation Datum and Correlation

This project uses NVGD (1929) as the basis for vertical datum. Other projects and references in the area, including the Corps of Engineers analysis for the Indian Bend Wash, are based on NAVD (1988) vertical datum. The correlation between the two datum is:

NVGD (1929) = NAVD (1988) - 1.77

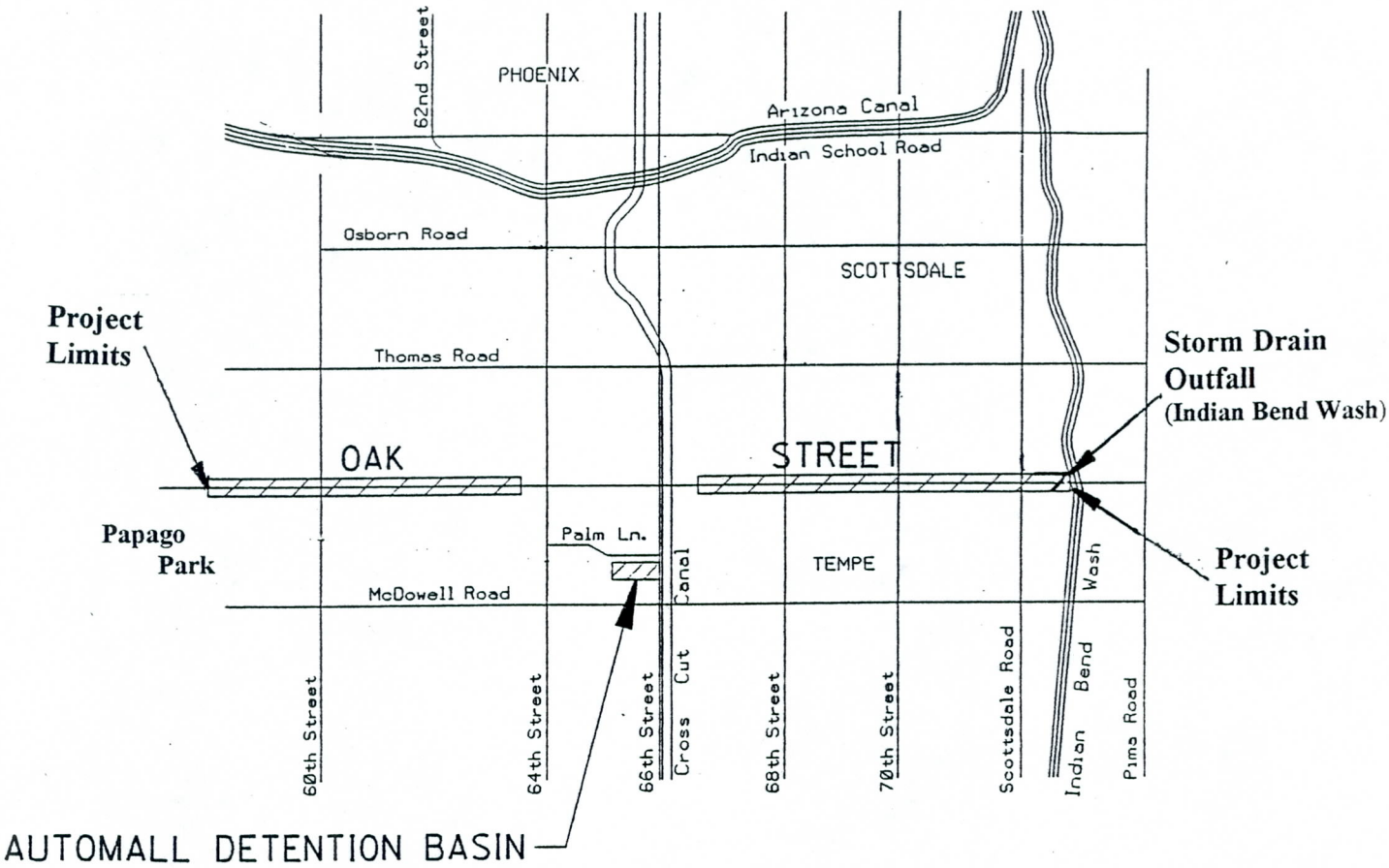

Figure 1
Location Map

2. HYDROLOGY

2.1 Storm Drain Design Flows (see Appendix A1)

Design flows for this project are based on the Kimley-Horn study (with modifications as described below in section 2.2). Refer to Appendix A1 for the summary table of peak discharges and supporting calculations.

2.2 Modifications to Kimley-Horn HEC-1 MODEL (see Appendix A1)

2.2.1 Eliminate Coronado High School from contributing drainage area:

Coronado High School was built so that runoff would flow east into the athletic fields along Miller Road. These fields are bounded by a berm which allows flood irrigation of about 6 inches. Therefore, for the purposes of this project, the High School was removed from runoff calculations.

2.2.2 Divert half of Subbasin 3e (040310) out of contributing drainage area:

There is an obvious flow split at the intersection of 74th Street and Virginia Avenue. This split is best described as 50/50 (see memo in Appendix A1); therefore only half of the runoff from the contributing drainage area (3e) would flow to Oak Street. The other half follows Virginia Avenue to Miller Road. The Kimley-Horn model that assumed 100% of the flow would be directed to Oak Street, has been modified to divert 50% of the flow to Miller Road.

The combination of these two changes reduces the storm drain design flow from 890 to 808 cfs at the intersection of 74th Street and Oak Street. The 808 cfs design flow is the sum of 693 cfs coming down Oak Street and 115 cfs inflow at 74th Street. The new storm drain will carry the 693 cfs while the existing dual 48" storm drains will carry the 115 cfs. The storm drains combine at the new junction structure located at Miller Road and Oak Street. From there to Indian Bend Wash the design flow is 808 cfs

It should be noted that, under current conditions, 115 cfs will not contribute at 74th Street.

74th Street is a minor collector with two 12' lanes which slopes at just two-tenths of a percent down to Oak Street. The flow capacity is calculated to be approximately 6 cfs. Runoff in excess of 6 cfs will overtop the curb and spill into the adjacent school parking lot and be retained on the school property. So, even though flow is currently overtopping 74th Street into the school, the design assumes that all flow from the drainage areas (3d & 50 percent of 3e) west of Coronado High School will reach the 74th Street and Oak Street intersection. A storm drain "stub-out" is provided at 74th Street to allow the future installation of a lateral storm drain up to Virginia Avenue capable of conveying the entire runoff from drainage areas 3d and 50% of 3e.

2.3 Inlet Design Flows (West of Cross Cut Canal - see Appendix A3)

Design flows for inlets west of the Cross Cut Canal in Papago Park were taken from the Kimley-Horn S-T-P Papago project. These flow rates can be found in Appendix A3 and are referenced in the drainage exhibits.

For a number of reasons no inlets were provided on Oak Street (west of 64th Street) to collect street drainage. First, much of the length of Oak Street doesn't have curb and, therefore, storm water simply flows off to the north without being collected. Second, in the areas that have curb and gutter, the runoff is minimal (less than 2 cfs) and the gutter is dewatered frequently through scuppers that drain to existing swales through the neighborhoods to the north. Third, putting inlets at the existing scupper points might give the impression that the swales to the north can be eliminated. They can't be because the storm drain is only collecting the 10-year flow. The 100-year flood will still drain through the swales. Leaving the scuppers in place without curb inlets will help to maintain the needed conveyance north of Oak Street and the benefit of putting inlets in the gutter is minimal with flows less than 2 cfs.

2.4 Inlet Design Flows (East of Cross Cut Canal - see Appendix A2)

Inlet designs flows for areas east of the Cross Cut Canal are based on the rational method (reference 7). Refer to Appendix A2 and the Drainage Exhibits located in the back of the report.

2.5 Split Flows (see Appendix A4)

There are two locations where split flows effect the contribution of runoff to the Oak Street storm drain. The first was described in section 2.2 and is located at the intersection of 74th Street and Virginia Avenue. The second is located at Virginia Avenue and 69th Place. After the split at this location the two flows reach off-site catch basins and are conveyed into the new storm drain. One flow joins at 70th Street while the second joins at Scottsdale Road. Refer to Appendix A4 for supporting calculations.

3. HYDRAULICS

3.1 Main Line Hydraulic Analysis (Appendix B1 and B2)

The hydraulic calculations for the mainline storm drain can be found in Appendix B1 and B2. They consist of Auto Storm Models input/output files. The H.G.L. is plotted on the plan and profile drawings. Appendix B1 contains the hydraulic calculations from Indian Bend Wash to 64th Street. Then continues to the inlet located at 64th Street and Hubble Road. Appendix B2 contains the hydraulic calculations from 64th Street to the inlet located in Papago Park at approximately 58th Street.

Appendix B4 contains hydraulic calculations for the existing storm drain from the junction at Miller Road to 74th Street. Also in Appendix B4 is a model of a future storm drain in 74th Street that was used to size the storm drain "stub-out" at 74th Street.

3.2 Starting Water Surface Elevation (Indian Bend Wash)

A starting water surface elevation for this project was selected using the Corps of Engineers 10-year water surface elevation in Indian Bend Wash (reference 5), 1211.83 (NVGD29).

3.3 100-Year Flood Analysis

3.3.1 Static Water Surface Elevation at the Outfall

The static water elevation in Indian Bend Wash for the 100-year storm was checked. The 100-year WSEL is 1217.98 NAVD according to the Corp of engineers HEC-2 study (reference 5). This is equivalent to 1216.21 NGVD which is the datum used in this study. Under static conditions, with a 100 year flow in Indian Bend Wash, a backwater effect in the designed storm drain would flood the intersection of Miller Road and Oak Street if inlets were located in the roadway. Therefore, no inlets were placed where the 100-year WSEL is above the street elevation. Additionally bolt down manhole covers are used to prevent flooding.

3.3.2 100-Year Flow (see Appendix B3)

The storm drain design flows provided by the Kimley-Horn study are based on the 100-year flood upstream of the Cross Cut Canal and the 10-year flood downstream of the canal. The hydraulic grade line (H.G.L.) calculations, with a 10-year water level downstream of the canal, does not necessarily represent the conditions during a 100-year flood. Since one of the main objectives of constructing the Oak Street Storm Drain is to eliminate the floodplain delineation upstream of the Canal, a 100-year flood analysis was done to ensure that the storm drain would adequately convey the 100-year flood under the Canal.

The key to the 100-year flood analysis is the starting water surface elevation. For purposes of this study the 100-year water surface elevation was assumed to be curb height at 70th street which is about half a mile downstream of the Canal. The point was chosen because it is the first major collection point for the storm drain on the

downstream side of the canal. The H.G.L. was calculated from this point upstream using the 100-year peak discharge of 598 cfs that is generated on the upstream side of the Canal.

This analysis resulted in upsizing the storm drain between 70th street and the cross cut Canal from 90" diameter to 96" diameter.

3.4 Street Drainage (Inlet Sizing - see Appendix B5)

The spread criteria used for this project is two 8-foot dry lanes, one each way, centered within a two lane residential street with a posted speed limit of 25 miles per hour. The spacing of inlets is dependent upon this allowable spread.

Street drainage involves using curb inlet catch basins (where appropriate) to capture runoff. For the purposes of this project both new and existing inlets were utilized. New inlets consist primarily of type M curb opening inlets found in the City of Phoenix Supplements (reference 9). Connector pipes were sized for the design discharge so that the water surface elevation in the catch basin was at least 6 inches below the lip of the gutter.

3.4.1 Intersection of Miller Road and Oak Street

The H.G.L. is near ground elevation at Miller Road and Oak Street. The effects of which are that inlets cannot be placed in Oak Street at Miller Road because there is little or no freeboard below the gutter line during the 10-year design storm. Bolted-down pressure manholes are used until the HGL drops a least a foot below the existing ground surface. This occurs at Sta. 181+00 or at approximately 74th Way.

3.4.2 Intersection of 74th Street and Oak Street

A new "stub-out" lateral line is to be installed, to the north, at the intersection of 74th Street and Oak Street. The lateral is to be sized to handle the 10-year runoff that reaches 74th Street. If extended up to the intersection of Virginia and 74th Street it could collect the discharge from drainage area 3d & 3e and prevent that runoff from flowing into Coronado High School (see section 2.2).

3.4.3 Inlets Located West of 64th Street (see appendix B6)

Head wall style catch basins will be used to collect the 10-year runoff from Papago Park. Flows greater than the 10-year flood will flow over Oak Street and drain through existing swales to the north. Inlets will not be used to collect street drainage west of 64th Street, rather this flow will also be conveyed away from Oak Street through the existing swales to the north (see section 2.3).

4. AUTO PARK BASIN (SEE APPENDIX C1)

Modifications of the Auto Park Basin located at the southern end of 66th Street, south of Oak Street, was also part of the Kimley-Horn design (reference 1). Storm water is detained in this basin where sediment drops out before the runoff enters a catch basin leading to the storm drain. The storm drain conveys runoff north to the junction structure located just west of the Cross Cut Canal.

The basin was graded to provide the stage-storage relationship called for in the Kimley-Horn S-T-P Papago study, refer to appendix C1 for supporting calculations.

5. REFERENCES

1. "S-T-P Papago Regional Flood Control Project, Watershed Study". Kimley-Horn, 1997.

2. "HEC-1 Flood Hydrograph Package, User's Manual". U.S. Army Corps of Engineers Hydrologic Engineering Center, September 1990.

3. "Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics". Flood Control District of Maricopa County, Phoenix, Arizona, January, 1996.

4. Auto-Storm as a part of Auto-Civil, Version 7.0 Computer Software Package. Research Engineers, Inc. May 1995.

5. "HEC-2 Study of Indian Bend Wash". Corps of Engineers

6. "Design Standards and Policies Manual". City of Scottsdale, Arizona, January 1993 includes revisions.

7. "Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology". Flood Control District of Maricopa County, Phoenix, Arizona, June, 1995.

8. "Final Drainage Design Report, 64th Street Improvements, McDowell Road to Thomas Road". Entellus, January 1997, revised March 1998.

9. "Uniform Standard Specifications for Public Work Construction". City of Phoenix Supplement, 1994.

APPENDIX A
HYDROLOGY

APPENDIX A1
MAINLINE FLOW DESIGNS

Summary of 10-Year Design Flows

for Mainline Storm Drain

Location		Kimley-Horn HEC-1 [cfs]	EEC/MKE Design [cfs]	Entellus Design [cfs]
Station (EEC)	**Description**			
	West of Crosscut Canal			
73+35 to 83+60	from 56th Street to 60th Street	28	28	
83+60 to 95+20	from 60th Street to just east of 61st Place	45	45	
95+20 to 109+20	just east of 61st Place to 64th Street	66	66	20
109+20 to 122+15	64th Street to 66th Street	267	267	267
122+15 to 123+00	66th Street to JX at Crosscut Canal		320 (1)	320
	East of Crosscut Canal			
123+00 to 163+15	JX at Crosscut Canal to Scottsdale Road	598	598	
163+15 to 175+75	Scottsdale Road to 74th Street	693	693	
175+75 to 187+70	74th Street to Miller Road	866	693 (2)	
187+70 to 193+98	Miller Road to Outlet in IBW	890	808 (2)	

Notes :

1. Flow between 66th Street and the JX at the Crosscut Canal was obtained from Entellus.

2. The reduction in flow between 74th St. and the outfall is due to the following (refer to the following memo dated 8-6-98):

   a. The removal of Coronado High School from the drainage area.
   b. Using the existing two 48-inch RCP's to carry the runoff from 74th Street to the Miller Road junction
   c. Reduction of contributing drainage area at 74th Street

Memo
8-6-98

To: Afshin Ahouraiyan

Subject: Revised Hydrology for the Oak Street Storm Drain Project

The problems which need to be addressed are as follows: Does the flow split from basin 040310, is basins 040310 and 040410 appropriately described. What happens when the capacity of 74th street is exceeded. Does this runoff enter the sports fields or does it get back into Oak Street.

Using data collected from a field visit to the parking lot a weir profile was calculated which showed that the flow would split almost 50/50 between the sports fields and Oak Street. It was decided to keep the model simple and size the main line in Oak Street to accept the flow as if it could all reach Oak from 74th Street. This allows future extension of the proposed lateral in 74th street up to Virginia Ave., thus allowing the capture of runoff from basin 040310 and basin 040050 through new inlets installed along the lateral.

In regards to the phone conversation we had on this date, I am documenting the agreed upon revisions to the Hydrology.

1. The Kimlee-Horn (K-H) Basin # 040310 will be revised in area and routed to the intersection of 74th Street and Virginia Ave. At which point 50% of the flow will be diverted down 74th Street to Oak Street, and the other 50% will be routed to basin 040410.
2. The K-H basin 040410 will be revised in size to include the reduced area of basin 040310, but will then be reduced so as to not include any portion of Coronado High School.
3. The K-H basin 040050 will be reduced so as to not include any portion of Coronado High School. Move the concentration point of this basin to the intersection of 74th and Oak Street.

These revision will have the following effect on the Hydraulics of the Main Line Storm Drain.

1. The main line will be sized to accept all local runoff at 74th street.
2. Laterals for both north and south of Oak Street will be placed in 74th Street.
3. The lateral to the north of Oak Street will be sized to accept all of the diverted runoff from basins 040310 and the portion of runoff from 040050 which reaches the north side inlets.

Lloyd A. Vick

Lloyd A. Vick,E.I.T.
EEC/MKE

EEC

Project Title OAK STREET STORM DRAIN Project No. 98514 Date

Subject Revised HEC-1 MODELS Designed by LAV Page

The Following pages contain the runoff summary Tables for The following HEC-1 models

File(s): A-610r2.OH1
B-610r2.OH2

The revisions represent the effect of The following

1. adding a split flow location at 74th ST & Virginia
2. removing Coronado High School From The Watershed.

File A-610r2.OH1

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						
+		070808	12.	3.43	2.	1.	1.	0.02
	DIVERSION TO						
+		808OUT	0.	3.43	0.	0.	0.	0.02
	HYDROGRAPH AT						
+		808PP	12.	3.43	2.	1.	1.	0.02
	ROUTED TO						
+		070610	12.	3.43	2.	1.	1.	0.02
	HYDROGRAPH AT						
+		070610	5.	3.43	1.	0.	0.	0.01
	DIVERSION TO						
+		610OUT	0.	3.40	0.	0.	0.	0.01
	HYDROGRAPH AT						
+		610PP	5.	3.40	1.	0.	0.	0.01
	2 COMBINED AT						
+		070610	17.	3.43	3.	2.	2.	0.02
	ROUTED TO						
+		070508	17.	3.43	3.	2.	2.	0.02
	HYDROGRAPH AT						
+		070508	4.	3.50	1.	0.	0.	0.01
	DIVERSION TO						
+		508OUT	0.	3.50	0.	0.	0.	0.01
	HYDROGRAPH AT						

+	508PP	4.	3.50	1.	0.	0.	0.01
	2 COMBINED AT						
+	070508	21.	3.47	3.	2.	2.	0.03
	ROUTED TO						
+	070010	21.	3.47	3.	2.	2.	0.03
	HYDROGRAPH AT						
+	070010	7.	3.43	1.	1.	1.	0.01
	DIVERSION TO						
+	010OUT	0.	3.43	0.	0.	0.	0.01
	HYDROGRAPH AT						
+	010PP	6.	3.43	1.	1.	1.	0.01
	2 COMBINED AT						
+	070010	27.	3.47	4.	3.	3.	0.04
	ROUTED TO						
+	070210	27.	3.47	4.	3.	3.	0.04
	HYDROGRAPH AT						
+	070209	12.	3.47	2.	1.	1.	0.02
	ROUTED TO						
+	070210	12.	3.47	2.	1.	1.	0.02
	HYDROGRAPH AT						
+	070210	5.	3.47	1.	0.	0.	0.01
	2 COMBINED AT						
+	070210	17.	3.47	3.	2.	2.	0.03
	DIVERSION TO						
+	210OUT	0.	3.43	0.	0.	0.	0.03
	HYDROGRAPH AT						
+	210PP	17.	3.43	3.	2.	2.	0.03
	2 COMBINED AT						
+	070210	44.	3.47	7.	4.	4.	0.07
	ROUTED TO						

+	050005	44.	3.47	7.	4.	4.	0.07
	HYDROGRAPH AT						
+	050005	21.	3.53	3.	2.	2.	0.04
	DIVERSION TO						
+	005OUT	0.	3.53	0.	0.	0.	0.04
	HYDROGRAPH AT						
+	005PP	21.	3.53	3.	2.	2.	0.04
	2 COMBINED AT						
+	050005	64.	3.47	10.	6.	6.	0.11
	ROUTED TO						
+	030510	64.	3.50	10.	6.	6.	0.11
	HYDROGRAPH AT						
+	030509	12.	3.33	1.	1.	1.	0.02
	ROUTED TO						
+	030510	12.	3.47	1.	1.	1.	0.02
	HYDROGRAPH AT						
+	030510	62.	3.13	8.	5.	5.	0.07
	2 COMBINED AT						
+	030510	62.	3.13	9.	6.	6.	0.09
	DIVERSION TO						
+	510RD	0.	3.13	0.	0.	0.	0.09
	HYDROGRAPH AT						
+	510PP	62.	3.13	9.	6.	6.	0.09
	HYDROGRAPH AT						
+	030809	10.	3.33	1.	1.	1.	0.01
	ROUTED TO						
+	030810	9.	3.47	1.	1.	1.	0.01
	HYDROGRAPH AT						
+	030810	37.	3.57	6.	4.	4.	0.07
	2 COMBINED AT						

+	030810	45.	3.57	7.	4.	4.	0.08
	DIVERSION TO						
+	810RD	0.	3.57	0.	0.	0.	0.08
	HYDROGRAPH AT						
+	810PP	45.	3.57	7.	4.	4.	0.08
	ROUTED TO						
+	030510	45.	3.57	7.	4.	4.	0.08
	3 COMBINED AT						
+	030510	159.	3.50	27.	16.	16.	0.28
	ROUTED TO						
+	030520	159.	3.50	27.	16.	16.	0.28
	HYDROGRAPH AT						
+	030710	28.	3.10	2.	1.	1.	0.02
	ROUTED TO						
+	030720	27.	3.13	2.	1.	1.	0.02
	HYDROGRAPH AT						
+	030720	29.	3.13	3.	2.	2.	0.03
	2 COMBINED AT						
+	030720	57.	3.13	5.	3.	3.	0.05
	ROUTED TO						
+	030520	55.	3.17	5.	3.	3.	0.05
	HYDROGRAPH AT						
+	030520	46.	3.10	4.	3.	3.	0.04
	2 COMBINED AT						
+	030520	94.	3.13	10.	6.	6.	0.09
	DIVERSION TO						
+	520RD	4.	3.13	0.	0.	0.	0.09
	HYDROGRAPH AT						
+	520PP	90.	3.13	10.	6.	6.	0.09
	HYDROGRAPH AT						

```
+                 030510    0.   3.13      0.      0.      0.    0.00

      ROUTED TO
+                 030520    0.   3.57      0.      0.      0.    0.00

      HYDROGRAPH AT
+                 030520    4.   3.13      0.      0.      0.    0.00

      2 COMBINED AT
+                 030520    4.   3.13      0.      0.      0.    0.00

      ROUTED TO
+                 030540    4.   3.40      0.      0.      0.    0.00

      HYDROGRAPH AT
+                 030810    0.   3.50      0.      0.      0.    0.00

      ROUTED TO
+                 030540    0.   5.20      0.      0.      0.    0.00

      HYDROGRAPH AT
+                 030540   43.   3.13      5.      3.      3.    0.04

      HYDROGRAPH AT
+                 030550   94.   3.13      7.      5.      5.    0.04

      4 COMBINED AT
+                 030550  137.   3.13     12.      7.      7.    0.08

      ROUTED TO
+                   AUTO  116.   3.20     85.     84.     84.    0.08
+                                                        62.19    3.20

      ROUTED TO
+                 030530  115.   3.20     85.     84.     84.    0.08

      HYDROGRAPH AT
+                 030530   47.   3.13      5.      3.      3.    0.04

      2 COMBINED AT
+                 030530  154.   3.20     90.     87.     87.    0.13

      ROUTED TO
+                 030520  152.   3.20     90.     87.     87.    0.13
```

	3 COMBINED AT						
+	030520	327.	3.20	126.	110.	110.	0.49
	ROUTED TO						
+	040120	324.	3.23	126.	110.	110.	0.49
	HYDROGRAPH AT						
+	040110	47.	3.20	6.	4.	4.	0.05
	ROUTED TO						
+	040120	47.	3.20	6.	4.	4.	0.05
	HYDROGRAPH AT						
+	040120	117.	3.20	13.	8.	8.	0.11
	3 COMBINED AT						
+	040120	483.	3.23	145.	121.	121.	0.66
	ROUTED TO						
+	040130	483.	3.23	145.	121.	121.	0.66
	HYDROGRAPH AT						
+	040130	36.	3.07	3.	2.	2.	0.02
	2 COMBINED AT						
+	040130	499.	3.23	148.	123.	123.	0.68
	ROUTED TO						
+	040040	498.	3.23	148.	123.	123.	0.68
	HYDROGRAPH AT						
+	040010	41.	3.13	4.	2.	2.	0.04
	ROUTED TO						
+	040020	40.	3.17	4.	2.	2.	0.04
	HYDROGRAPH AT						
+	040020	32.	3.23	4.	3.	3.	0.04
	2 COMBINED AT						
+	040020	70.	3.20	9.	5.	5.	0.08
	ROUTED TO						
+	040030	69.	3.23	8.	5.	5.	0.08

	HYDROGRAPH AT						
+	040030	61.	3.20	7.	4.	4.	0.06
	2 COMBINED AT						
+	040030	130.	3.23	16.	10.	10.	0.14
	ROUTED TO						
+	040040	129.	3.33	16.	10.	10.	0.14
	HYDROGRAPH AT						
+	040210	19.	3.10	1.	1.	1.	0.01
	ROUTED TO						
+	040040	18.	3.27	2.	1.	1.	0.01
	HYDROGRAPH AT						
+	040040	84.	3.20	8.	5.	5.	0.04
	4 COMBINED AT						
+	040040	693.	3.27	173.	138.	138.	0.88
	ROUTED TO						
+	040050	688.	3.27	173.	138.	138.	0.88
	HYDROGRAPH AT						
+	040310	93.	3.10	8.	5.	5.	0.06
	DIVERSION TO						
+	310DV	47.	3.10	4.	2.	2.	0.06
	HYDROGRAPH AT						
+	310ST	47.	3.10	4.	2.	2.	0.06
	ROUTED TO						
+	040050	45.	3.17	4.	2.	2.	0.06
	2 COMBINED AT						
+	040050	717.	3.27	177.	140.	140.	0.94
	HYDROGRAPH AT						
+	040050	100.	3.20	11.	6.	6.	0.08
	2 COMBINED AT						
+	040050	806.	3.27	187.	147.	147.	1.02

	ROUTED TO						
+	040060	804.	3.27	187.	147.	147.	1.02
	HYDROGRAPH AT						
+	040060	6.	3.13	0.	0.	0.	0.00
	2 COMBINED AT						
+	040060	808.	3.27	188.	147.	147.	1.02
	ROUTED TO						
+	040070	805.	3.27	188.	147.	147.	1.02
	HYDROGRAPH AT						
+	070010	0.	3.37	0.	0.	0.	0.00
	ROUTED TO						
+	070020	0.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	070030	0.	3.67	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	070030	5.	3.07	1.	0.	0.	0.00
	2 COMBINED AT						
+	070030	5.	3.07	1.	0.	0.	0.00
	ROUTED TO						
+	070040	5.	3.10	1.	0.	0.	0.00
	HYDROGRAPH AT						
+	070210	0.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	070220	0.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	070040	0.	3.77	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	070040	5.	3.20	1.	0.	0.	0.01
	3 COMBINED AT						
+	070040	9.	3.13	1.	1.	1.	0.01

```
      ROUTED TO
+                070050     9.   3.17       1.       1.       1.     0.01

      HYDROGRAPH AT
+                070050    23.   3.07       2.       1.       1.     0.02

      2 COMBINED AT
+                070050    30.   3.10       4.       2.       2.     0.03

      ROUTED TO
+                070060    30.   3.13       4.       2.       2.     0.03

      HYDROGRAPH AT
+                070310    30.   3.07       3.       2.       2.     0.02

      ROUTED TO
+                070060    30.   3.10       3.       2.       2.     0.02

      HYDROGRAPH AT
+                070060    26.   3.10       3.       2.       2.     0.02

      3 COMBINED AT
+                070060    83.   3.10       9.       6.       6.     0.07

      ROUTED TO
+                070070    82.   3.13       9.       6.       6.     0.07

      HYDROGRAPH AT
+                070070    43.   3.07       4.       3.       3.     0.03

      HYDROGRAPH AT
+                070080    52.   3.13       4.       2.       2.     0.02

      3 COMBINED AT
+                070080   168.   3.13      17.      10.      10.     0.12

      ROUTED TO
+                 07Det    46.   3.67      17.      10.      10.     0.12
+                                                                  69.95     3.67

      DIVERSION TO
+                07Qspl     0.   3.67       0.       0.       0.     0.12

      HYDROGRAPH AT
+                07Qpip    46.   3.67      17.      10.      10.     0.12
```

	ROUTED TO						
+	070420	46.	3.67	17.	10.	10.	0.12
	HYDROGRAPH AT						
+	070410	17.	3.13	2.	1.	1.	0.01
	ROUTED TO						
+	070420	17.	3.13	2.	1.	1.	0.01
	HYDROGRAPH AT						
+	070420	5.	3.20	0.	0.	0.	0.00
	3 COMBINED AT						
+	070420	59.	3.20	19.	12.	12.	0.14
	ROUTED TO						
+	210005	59.	3.20	19.	12.	12.	0.14
	HYDROGRAPH AT						
+	210005	13.	3.23	1.	1.	1.	0.01
	2 COMBINED AT						
+	210005	72.	3.23	20.	12.	12.	0.15
	ROUTED TO						
+	050030	72.	3.23	20.	12.	12.	0.15
	HYDROGRAPH AT						
+	050005	0.	3.40	0.	0.	0.	0.00
	ROUTED TO						
+	050010	0.	4.63	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	050010	96.	3.13	8.	5.	5.	0.07
	2 COMBINED AT						
+	050010	96.	3.13	8.	5.	5.	0.07
	ROUTED TO						
+	050020	93.	3.17	8.	5.	5.	0.07
	HYDROGRAPH AT						
+	050210	100.	3.13	8.	5.	5.	0.05

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      ROUTED TO
+                210ST     0.   5.53       0.       0.       0.    0.05
+                                                                 0.55     9.97

      ROUTED TO
+                050020    0.   4.73       0.       0.       0.    0.05

      HYDROGRAPH AT
+                050020   13.   3.17       1.       1.       1.    0.01

      3 COMBINED AT
+                050020  105.   3.17      10.       6.       6.    0.13

      ROUTED TO
+                050030  103.   3.20      10.       6.       6.    0.13

      HYDROGRAPH AT
+                050030   54.   3.10       3.       2.       2.    0.02

      ROUTED TO
+                 030ST   20.   3.27       2.       1.       1.    0.02
+                                                                68.13     3.27

      3 COMBINED AT
+                050030  190.   3.20      32.      20.      20.    0.30

      ROUTED TO
+                050305  188.   3.20      32.      20.      20.    0.30

      ROUTED TO
+                050050  186.   3.27      32.      20.      20.    0.30

      HYDROGRAPH AT
+                050040  105.   3.20      12.       7.       7.    0.10

      ROUTED TO
+                40STOR   37.   3.67      12.       7.       7.    0.10
+                                                                61.58     3.67

      ROUTED TO
+                050050   37.   3.67      12.       7.       7.    0.10

      HYDROGRAPH AT
+                050310   75.   3.13       6.       4.       4.    0.04
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      HYDROGRAPH AT
+             050065    37.  3.07     2.     1.     1.    0.01

      HYDROGRAPH AT
+             050060    53.  3.17     5.     3.     3.    0.03

      5 COMBINED AT
+             050050   341.  3.23    58.    35.    35.    0.48

      ROUTED TO
+              05Det    71.  4.70    55.    36.    36.    0.48
+                                                  54.77    4.70

      DIVERSION TO
+             05Qspl     0.  4.70     0.     0.     0.    0.48

      HYDROGRAPH AT
+             05Qpip    71.  4.70    55.    36.    36.    0.48

      HYDROGRAPH AT
+             050062    39.  3.07     2.     1.     1.    0.01

      ROUTED TO
+             050610    38.  3.13     2.     1.     1.    0.01

      HYDROGRAPH AT
+             050610    99.  3.17    10.     6.     6.    0.08

      3 COMBINED AT
+             050610   173.  3.17    67.    43.    43.    0.58

      ROUTED TO
+             050620   172.  3.17    67.    43.    43.    0.58

      HYDROGRAPH AT
+             050620   110.  3.17    12.     7.     7.    0.10

      2 COMBINED AT
+             050620   282.  3.17    78.    50.    50.    0.67

      ROUTED TO
+             050630   279.  3.20    78.    50.    50.    0.67

      HYDROGRAPH AT
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+	050630	120.	3.13	9.	6.	6.	0.06
	2 COMBINED AT						
+	050630	376.	3.17	87.	56.	56.	0.74
	ROUTED TO						
+	050640	375.	3.20	87.	56.	56.	0.74
	HYDROGRAPH AT						
+	050710	11.	3.13	1.	1.	1.	0.00
	ROUTED TO						
+	050720	11.	3.17	1.	1.	1.	0.00
	HYDROGRAPH AT						
+	050720	54.	3.20	5.	3.	3.	0.03
	2 COMBINED AT						
+	050720	64.	3.20	6.	3.	3.	0.03
	ROUTED TO						
+	050640	63.	3.20	6.	3.	3.	0.03
	HYDROGRAPH AT						
+	050640	65.	3.20	6.	3.	3.	0.03
	3 COMBINED AT						
+	050640	503.	3.20	98.	63.	63.	0.80
	ROUTED TO						
+	051510	498.	3.20	98.	63.	63.	0.80
	HYDROGRAPH AT						
+	050810	25.	3.17	2.	1.	1.	0.01
	ROUTED TO						
+	051510	25.	3.20	2.	1.	1.	0.01
	HYDROGRAPH AT						
+	051510	21.	3.13	2.	1.	1.	0.01
	3 COMBINED AT						
+	051510	541.	3.20	102.	65.	65.	0.82
	ROUTED TO						

+	051520	532.	3.20	102.	65.	65.	0.82
	HYDROGRAPH AT						
+	051610	39.	3.17	3.	2.	2.	0.02
	ROUTED TO						
+	051520	39.	3.17	3.	2.	2.	0.02
	HYDROGRAPH AT						
+	051710	8.	3.17	1.	0.	0.	0.00
	ROUTED TO						
+	051520	8.	3.17	1.	0.	0.	0.00
	HYDROGRAPH AT						
+	051520	43.	3.17	4.	2.	2.	0.02
	4 COMBINED AT						
+	051520	617.	3.20	109.	70.	70.	0.87
	ROUTED TO						
+	051530	609.	3.23	109.	70.	70.	0.87
	HYDROGRAPH AT						
+	051530	92.	3.17	7.	4.	4.	0.04
	2 COMBINED AT						
+	051530	681.	3.23	116.	74.	74.	0.91
	ROUTED TO						
+	051540	681.	3.23	116.	74.	74.	0.91
	HYDROGRAPH AT						
+	051810	12.	3.13	1.	1.	1.	0.00
	ROUTED TO						
+	051540	12.	3.13	1.	1.	1.	0.00
	HYDROGRAPH AT						
+	051540	9.	3.13	1.	0.	0.	0.00
	3 COMBINED AT						
+	051540	694.	3.23	118.	75.	75.	0.92
	ROUTED TO						

+	051550	692.	3.23	118.	75.	75.	0.92
	ROUTED TO						
+	051560	687.	3.23	118.	75.	75.	0.92
	HYDROGRAPH AT						
+	051560	10.	3.17	1.	1.	1.	0.01
	2 COMBINED AT						
+	051560	696.	3.23	119.	76.	76.	0.93
	ROUTED TO						
+	051570	692.	3.23	119.	76.	76.	0.93
	HYDROGRAPH AT						
+	05Qspl	0.	3.50	0.	0.	0.	0.00
	ROUTED TO						
+	050060	0.	4.23	0.	0.	0.	0.00
	ROUTED TO						
+	050070	0.	5.50	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	050410	86.	3.13	7.	4.	4.	0.04
	ROUTED TO						
+	050070	84.	3.13	7.	4.	4.	0.04
	HYDROGRAPH AT						
+	050070	179.	3.17	15.	9.	9.	0.08
	3 COMBINED AT						
+	050070	261.	3.17	22.	13.	13.	0.13
	ROUTED TO						
+	050080	255.	3.20	22.	13.	13.	0.13
	HYDROGRAPH AT						
+	050080	23.	3.13	2.	1.	1.	0.02
	2 COMBINED AT						
+	050080	275.	3.17	24.	15.	15.	0.15
	ROUTED TO						

+	050090	275.	3.20	24.	15.	15.	0.15
	HYDROGRAPH AT						
+	050510	78.	3.17	7.	4.	4.	0.05
	ROUTED TO						
+	050090	78.	3.17	7.	4.	4.	0.05
	HYDROGRAPH AT						
+	050090	76.	3.17	6.	4.	4.	0.04
	3 COMBINED AT						
+	050090	425.	3.17	37.	23.	23.	0.24
	ROUTED TO						
+	050100	418.	3.20	37.	23.	23.	0.24
	HYDROGRAPH AT						
+	050100	106.	3.13	8.	5.	5.	0.05
	2 COMBINED AT						
+	050100	521.	3.17	46.	28.	28.	0.28
	ROUTED TO						
+	050110	516.	3.20	46.	28.	28.	0.28
	HYDROGRAPH AT						
+	050910	23.	3.13	2.	1.	1.	0.01
	ROUTED TO						
+	050650	22.	3.17	2.	1.	1.	0.01
	HYDROGRAPH AT						
+	050650	42.	3.13	3.	2.	2.	0.02
	2 COMBINED AT						
+	050650	64.	3.13	5.	3.	3.	0.03
	ROUTED TO						
+	050660	64.	3.17	5.	3.	3.	0.03
	HYDROGRAPH AT						
+	050660	40.	3.17	3.	2.	2.	0.02
	2 COMBINED AT						

```
+                050660   104.  3.17     8.     5.     5.    0.05

     ROUTED TO
+                050110   103.  3.17     8.     5.     5.    0.05

     HYDROGRAPH AT
+                050110    22.  3.17     2.     1.     1.    0.01

     3 COMBINED AT
+                050110   635.  3.20    56.    34.    34.    0.34

     ROUTED TO
+                050120   635.  3.20    56.    34.    34.    0.34

     HYDROGRAPH AT
+                051010    42.  3.13     4.     2.     2.    0.02

     ROUTED TO
+                1010ST     3.  4.23     1.     0.     0.    0.02
+                                                         61.01     4.23

     ROUTED TO
+                051020     3.  4.43     1.     0.     0.    0.02

     HYDROGRAPH AT
+                051110    58.  3.13     5.     3.     3.    0.03

     ROUTED TO
+                051020    57.  3.17     5.     3.     3.    0.03

     HYDROGRAPH AT
+                051020    49.  3.20     4.     3.     3.    0.03

     3 COMBINED AT
+                051020   106.  3.17    10.     6.     6.    0.08

     ROUTED TO
+                051030   105.  3.20    10.     6.     6.    0.08

     HYDROGRAPH AT
+                051210    19.  3.10     1.     1.     1.    0.01

     ROUTED TO
+                051030    19.  3.13     1.     1.     1.    0.01
```

	HYDROGRAPH AT						
+	051310	7.	3.13	1.	0.	0.	0.00
	ROUTED TO						
+	051320	7.	3.17	1.	0.	0.	0.00
	HYDROGRAPH AT						
+	051320	22.	3.13	2.	1.	1.	0.01
	2 COMBINED AT						
+	051320	29.	3.13	2.	1.	1.	0.01
	ROUTED TO						
+	051030	29.	3.20	2.	1.	1.	0.01
	HYDROGRAPH AT						
+	051030	57.	3.20	5.	3.	3.	0.03
	4 COMBINED AT						
+	051030	206.	3.20	19.	11.	11.	0.13
	ROUTED TO						
+	051040	203.	3.23	19.	11.	11.	0.13
	HYDROGRAPH AT						
+	051040	53.	3.20	5.	3.	3.	0.04
	2 COMBINED AT						
+	051040	253.	3.23	24.	14.	14.	0.16
	ROUTED TO						
+	050120	249.	3.23	24.	14.	14.	0.16
	HYDROGRAPH AT						
+	050120	86.	3.17	7.	4.	4.	0.04
	3 COMBINED AT						
+	050120	942.	3.20	86.	52.	52.	0.54
	ROUTED TO						
+	050130	932.	3.23	86.	52.	52.	0.54
	HYDROGRAPH AT						
+	050130	197.	3.20	17.	10.	10.	0.10

	2 COMBINED AT						
+	050130	1111.	3.23	103.	62.	62.	0.64
	ROUTED TO						
+	050140	1109.	3.23	103.	62.	62.	0.64
	HYDROGRAPH AT						
+	051410	178.	3.13	13.	8.	8.	0.07
	ROUTED TO						
+	050140	173.	3.17	13.	8.	8.	0.07
	HYDROGRAPH AT						
+	050140	175.	3.13	14.	8.	8.	0.09
	3 COMBINED AT						
+	050140	1391.	3.23	130.	79.	79.	0.80
	ROUTED TO						
+	050150	1380.	3.23	130.	79.	79.	0.80
	HYDROGRAPH AT						
+	050150	12.	3.17	1.	1.	1.	0.01
	2 COMBINED AT						
+	050150	1390.	3.23	131.	79.	79.	0.81
	ROUTED TO						
+	050160	1381.	3.23	131.	79.	79.	0.81
	HYDROGRAPH AT						
+	070080	0.	3.50	0.	0.	0.	0.00
	ROUTED TO						
+	210110	0.	4.23	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	210110	19.	3.17	2.	1.	1.	0.01
	2 COMBINED AT						
+	210110	19.	3.17	2.	1.	1.	0.01
	ROUTED TO						
+	210120	19.	3.23	2.	1.	1.	0.01

	HYDROGRAPH AT						
+	070508	0.	3.50	0.	0.	0.	0.00
	ROUTED TO						
+	070509	0.	3.53	0.	0.	0.	0.00
	ROUTED TO						
+	070510	0.	3.80	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	070510	73.	3.10	7.	4.	4.	0.06
	2 COMBINED AT						
+	070510	73.	3.10	7.	4.	4.	0.06
	ROUTED TO						
+	070090	71.	3.10	7.	4.	4.	0.06
	HYDROGRAPH AT						
+	070090	28.	3.07	2.	1.	1.	0.01
	2 COMBINED AT						
+	070090	98.	3.10	10.	6.	6.	0.07
	ROUTED TO						
+	210120	96.	3.13	10.	6.	6.	0.07
	HYDROGRAPH AT						
+	210120	68.	3.13	6.	3.	3.	0.03
	3 COMBINED AT						
+	210120	176.	3.13	17.	10.	10.	0.12
	ROUTED TO						
+	210030	175.	3.20	17.	10.	10.	0.12
	HYDROGRAPH AT						
+	210210	35.	3.17	4.	2.	2.	0.04
	ROUTED TO						
+	210220	34.	3.23	4.	2.	2.	0.04
	HYDROGRAPH AT						
+	210220	13.	3.10	1.	1.	1.	0.01

	2 COMBINED AT						
+	210220	43.	3.20	5.	3.	3.	0.05
	ROUTED TO						
+	210030	42.	3.23	5.	3.	3.	0.05
	HYDROGRAPH AT						
+	210010	23.	3.37	3.	2.	2.	0.02
	ROUTED TO						
+	210020	22.	3.40	3.	2.	2.	0.02
	HYDROGRAPH AT						
+	210020	33.	3.13	3.	2.	2.	0.03
	2 COMBINED AT						
+	210020	36.	3.37	6.	4.	4.	0.05
	ROUTED TO						
+	210030	36.	3.40	6.	4.	4.	0.05
	HYDROGRAPH AT						
+	210030	66.	3.13	7.	4.	4.	0.06
	4 COMBINED AT						
+	210030	302.	3.20	35.	21.	21.	0.28
	ROUTED TO						
+	210040	302.	3.20	35.	21.	21.	0.28
	HYDROGRAPH AT						
+	070610	0.	3.43	0.	0.	0.	0.00
	ROUTED TO						
+	070620	0.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	070100	0.	4.30	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	070100	59.	3.17	6.	4.	4.	0.05
	2 COMBINED AT						
+	070100	59.	3.17	6.	4.	4.	0.05

	ROUTED TO						
+	070110	58.	3.17	6.	4.	4.	0.05
	HYDROGRAPH AT						
+	070110	14.	3.10	1.	1.	1.	0.01
	2 COMBINED AT						
+	070110	69.	3.17	7.	4.	4.	0.05
	ROUTED TO						
+	070120	68.	3.20	7.	4.	4.	0.05
	HYDROGRAPH AT						
+	070808	0.	3.43	0.	0.	0.	0.00
	ROUTED TO						
+	070809	0.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	070810	0.	3.97	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	070810	50.	3.10	5.	3.	3.	0.04
	2 COMBINED AT						
+	070810	50.	3.10	5.	3.	3.	0.04
	ROUTED TO						
+	070820	50.	3.10	5.	3.	3.	0.04

B-610r.OH2

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	030909	26.	3.17	2.	1.	1.	0.02		
+	ROUTED TO	030910	25.	3.37	2.	1.	1.	0.02		
+	HYDROGRAPH AT	030910	31.	3.60	5.	3.	3.	0.06		
+	2 COMBINED AT	030910	45.	3.53	8.	5.	5.	0.08		
+	ROUTED TO	030920	45.	3.53	8.	5.	5.	0.08		
+	HYDROGRAPH AT	031010	50.	3.57	8.	5.	5.	0.08		
+	ROUTED TO	030920	50.	3.57	8.	5.	5.	0.08		
+	2 COMBINED AT	030920	94.	3.57	16.	9.	9.	0.16		
+	ROUTED TO	030930	94.	3.57	16.	9.	9.	0.16		
+	HYDROGRAPH AT	030930	12.	3.17	1.	1.	1.	0.01		
+	2 COMBINED AT	030930	100.	3.57	17.	10.	10.	0.18		
+	ROUTED TO	030580	99.	3.60	17.	10.	10.	0.18		
+	ROUTED TO	030590	99.	3.67	17.	10.	10.	0.18		
+	HYDROGRAPH AT	030590	97.	3.63	17.	10.	10.	0.21		
+	2 COMBINED AT	030590	195.	3.63	34.	21.	21.	0.38		

	ROUTED TO							
+	DBG	53.	4.50	34.	21.	21.	0.38	
+							67.88	4.50
	ROUTED TO							
+	030610	53.	4.50	34.	21.	21.	0.38	
	HYDROGRAPH AT							
+	030610	31.	3.10	2.	1.	1.	0.02	
	2 COMBINED AT							
+	030610	54.	4.50	36.	22.	22.	0.40	
	ROUTED TO							
+	030620	54.	4.53	36.	22.	22.	0.40	
	HYDROGRAPH AT							
+	030620	41.	3.17	4.	3.	3.	0.04	
	2 COMBINED AT							
+	030620	72.	3.17	41.	25.	25.	0.44	
	ROUTED TO							
+	030630	71.	3.20	41.	25.	25.	0.44	
	HYDROGRAPH AT							
+	030630	76.	3.20	7.	4.	4.	0.04	
	2 COMBINED AT							
+	030630	147.	3.20	47.	29.	29.	0.48	
	ROUTED TO							
+	030640	146.	3.20	47.	29.	29.	0.48	
	HYDROGRAPH AT							
+	030010	74.	3.17	6.	4.	4.	0.03	
	ROUTED TO							
+	030020	73.	3.20	6.	4.	4.	0.03	
	HYDROGRAPH AT							
+	030020	29.	3.13	3.	2.	2.	0.03	
	2 COMBINED AT							
+	030020	97.	3.17	9.	5.	5.	0.06	
	ROUTED TO							
+	030030	96.	3.20	9.	5.	5.	0.06	
	HYDROGRAPH AT							
+	030210	55.	3.17	5.	3.	3.	0.05	
	ROUTED TO							

+	030030	54.	3.17	5.	3.	3.	0.05
	HYDROGRAPH AT						
+	030030	9.	3.13	1.	1.	1.	0.01
	3 COMBINED AT						
+	030030	157.	3.20	15.	9.	9.	0.12
	ROUTED TO						
+	030040	154.	3.27	15.	9.	9.	0.12
	HYDROGRAPH AT						
+	030040	50.	3.17	6.	4.	4.	0.06
	2 COMBINED AT						
+	030040	198.	3.23	21.	13.	13.	0.17
	ROUTED TO						
+	030050	197.	3.27	21.	13.	13.	0.17
	HYDROGRAPH AT						
+	030310	16.	3.17	1.	1.	1.	0.01
	ROUTED TO						
+	030320	16.	3.27	1.	1.	1.	0.01
	HYDROGRAPH AT						
+	030320	55.	3.20	6.	3.	3.	0.04
	2 COMBINED AT						
+	030320	65.	3.23	7.	4.	4.	0.05
	ROUTED TO						
+	030330	64.	3.27	7.	4.	4.	0.05
	HYDROGRAPH AT						
+	030410	23.	3.13	2.	1.	1.	0.02
	ROUTED TO						
+	030330	22.	3.13	2.	1.	1.	0.02
	HYDROGRAPH AT						
+	030330	16.	3.17	1.	1.	1.	0.01
	3 COMBINED AT						
+	030330	92.	3.23	11.	6.	6.	0.08
	ROUTED TO						
+	030050	91.	3.30	11.	6.	6.	0.08
	HYDROGRAPH AT						
+	030050	69.	3.13	5.	3.	3.	0.03
	3 COMBINED AT						

+	030050	329.	3.27	37.	22.	22.	0.29
	ROUTED TO						
+	030060	326.	3.27	37.	23.	23.	0.29
	HYDROGRAPH AT						
+	051910	24.	3.13	2.	1.	1.	0.01
	ROUTED TO						
+	051920	23.	3.20	2.	1.	1.	0.01
	HYDROGRAPH AT						
+	051920	74.	3.13	7.	4.	4.	0.06
	2 COMBINED AT						
+	051920	93.	3.13	9.	5.	5.	0.07
	ROUTED TO						
+	051930	92.	3.13	9.	5.	5.	0.07
	HYDROGRAPH AT						
+	052010	53.	3.13	5.	3.	3.	0.05
	ROUTED TO						
+	052020	52.	3.13	5.	3.	3.	0.05
	HYDROGRAPH AT						
+	210310	73.	3.17	7.	4.	4.	0.06
	ROUTED TO						
+	210320	72.	3.17	7.	4.	4.	0.06
	HYDROGRAPH AT						
+	070730	41.	3.10	4.	2.	2.	0.03
	ROUTED TO						
+	070740	41.	3.10	4.	2.	2.	0.03
	HYDROGRAPH AT						
+	070908	2.	3.50	0.	0.	0.	0.00
	ROUTED TO						
+	070909	2.	3.50	0.	0.	0.	0.00
	ROUTED TO						
+	070910	2.	3.63	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	070910	49.	3.10	5.	3.	3.	0.04
	2 COMBINED AT						
+	070910	49.	3.10	5.	3.	3.	0.04
	ROUTED TO						

+	070920	48.	3.10	5.	3.	3.	0.04
	HYDROGRAPH AT						
+	071010	3.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	071020	3.	3.47	0.	0.	0.	0.00
	ROUTED TO						
+	071030	3.	3.50	0.	0.	0.	0.00
	HYDROGRAPH AT						
+	071030	8.	3.07	1.	1.	1.	0.01
	2 COMBINED AT						
+	071030	8.	3.07	1.	1.	1.	0.01
	ROUTED TO						
+	071040	8.	3.07	1.	1.	1.	0.01
	HYDROGRAPH AT						
+	040310	93.	3.10	8.	5.	5.	0.06
	DIVERSION TO						
+	310DV	47.	3.10	4.	2.	2.	0.06
	HYDROGRAPH AT						
+	310ST	47.	3.10	4.	2.	2.	0.06
	ROUTED TO						
+	040410	44.	3.17	4.	2.	2.	0.06
	HYDROGRAPH AT						
+	040410	41.	3.30	5.	3.	3.	0.04
	2 COMBINED AT						
+	040410	73.	3.20	9.	6.	6.	0.11
	ROUTED TO						
+	040420	73.	3.20	9.	6.	6.	0.11

APPENDIX A2
INLET DESIGN FLOWS
(East of Cross Cut Canal)

Note

Runoff coefficients

single family homes 0.45–0.55

many of the homes in the subdivisions have block fences enclosing their backyards this reduces the runoff coefficient. For the purposes of these calculations we will use a runoff coefficient of 0.45 to represent areas under this condition.

Rational Method

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.

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 7-21-98

Subject: Develop 10 YR 6 HR precipitation Rate Designed LPV Page

The city of scottsdale Design manual is missing Figure 2.2-3 "10 year 6 hour precipitation in Inches" which is needed to run the Rational method for the basins within the project site.

Solution

using the N.O.A.A EQUATION,

we find that: $P_{10,6'} = 0.496(P_{2,6'}) + 0.449(P_{100,6'})$

using the precipitation graphs provided in COS design manual...

$(P_{2,6'}) = 1.2''$ $(P_{100,6'}) = 3.2''$

$$P_{10,6'} = 0.496(1.2) + 0.449(3.2)$$

$$P_{10,6'} = \underline{2.03''} \leftarrow$$ This agrees with FCDMC NOAA MAPS. (Fig. 2.4)

Note: The Kimley-Horn plans and Hydrology was used to develop The Hydrology / Rational method. However there is a 1.77' Difference in Datum so the elevations shown in the Hydraulic Calcs of the Rational method may not agree with elevations surveyed and shown on The Constuction plans Developed By EEC.

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 7-14-98

Subject: Peak Discharge - Rational method Designed: LAI Page 1

DRAINAGE AREA ID [#]	Length of watercourse [ft]	Highest EL [ft]	Lowest EL [ft]	Drainage Area [acre]	tbl 3.2 10-YR runoff Coefficient "C"	Kb	STATION of catch basin
1A	600	1220	1217	0.83	0.65	0.041	184+89
1B	600	1220	1217	0.41	0.80	0.042	N/A
1C	2350	1230	1222	39.96	0.45	0.029	offsite
2A	500	1224	1220	1.46	0.45	0.039	180+48
2B	500	1224	1220	0.25	0.80	0.044	180+48
3A	1460	1231	1224	9.71	0.45	0.034	175+93
3B	910	1231	1224	1.90	0.45	0.038	175+11 171+50
3C	900	1230	1224	2.05	0.45	0.038	176+31 171+50
3D	2360	1234	1224	28.50	0.45	0.031	175+96
3E	1800	1235	1227	23.80	0.45	0.031	offsite
4A	360	1235	1230	1.71	0.5	0.035	166+81
4D	2500	1238	1234	15.37	0.60	0.033	offsite
4B	600	1235	1230	2.78	0.5	0.037	166+72
4C	300	1235	1230.3	4.61	0.80	0.036	P-lot RET
5A	450	1238	1236	2.28	0.55	0.038	161+68
5B	550	1238	1236	1.61	0.60	0.039	161+68
5C	2200	1243	1234	10.40	0.45	0.034	offsite
5D	3200	1252	1237	61.10	0.45	0.029	offsite
5E	2700	1268	1247	29.40	0.45	0.031	offsite

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title _____ Project No. _____ Date _____

Subject _____ Designed _____ Page 2

ID	Drainage Length [Ft]	HIGH EL [FT]	LOW EL [FT]	AREA [acres]	"C"	KB	STATION of Catch basin
6A	820	1244	1238	2.25	0.45	.0378	157+15
6B	700	1244	1238	1.21	0.45	0.039	156+36
6C	700	1243.5	1239	1.89	0.45	0.038	156+21
7A	1800	1256	1244	21.21	0.45	0.032	149+48
7B	620	1250	1244	1.02	0.45	0.0399	150+17
7C	650	1250	1244	1.56	0.45	0.0388	149+48
7D	2800	1268	1244	48.57	0.45	0.030	offsite
8A	620	1255	1250	1.05	0.45	0.04	143+00
8B	650	1255	1250	1.45	0.45	0.039	141+52
9A	1500	1268	1256	9.98	0.45	0.034	136+60
9B	1070	1268	1256	2.68	0.45	0.037	135+77
9C	1120	1268	1256	2.67	0.45	0.037	135+40

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 12-21-98

LOCATION DATA

Location: Oak St to Miller Rd.

Project Name: Oak Street Stor Subarea id: 1a

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.83	acres
Watercourse Length	600.0	feet
Top Elevation	1220.0	feet
Bottom Elevation	1217.0	feet
Slope	.00500	feet/feet
Roughness Coefficient (Kb)	.04100	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	2	2	3	4	5
C	0.650	0.650	0.650	0.715	0.780	0.813
Tc (min)	10.7	9.5	8.9	8.1	7.7	7.3
i (in/hr)	2.8	3.9	4.6	5.8	6.7	7.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 12-21-98

LOCATION DATA

Location: Oak Street to Miller Road

Project Name: Oak Street Stor Subarea id: 1b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.41	acres
Watercourse Length	600.0	feet
Top Elevation	1220.0	feet
Bottom Elevation	1217.0	feet
Slope	.00500	feet/feet
Roughness Coefficient (Kb)	.04200	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	2	2	3	3
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	10.9	9.6	9.0	8.2	7.8	7.4
i (in/hr)	2.8	3.9	4.6	5.8	6.7	7.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-11-98

LOCATION DATA

Location: miller & virginia

Project Name: Oak Street Subarea id: 1C

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	39.96	acres
Watercourse Length	2350.0	feet
Top Elevation	1230.0	feet
Bottom Elevation	1222.0	feet
Slope	.00340	feet/feet
Roughness Coefficient (Kb)	.02900	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	34	48	59	83	106	128
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	23.2	20.4	18.9	17.2	16.1	15.2
i (in/hr)	1.9	2.7	3.3	4.2	4.9	5.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 74th

Project Name: oak street Subarea id: 2a

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.46	acres
Watercourse Length	500.0	feet
Top Elevation	1224.0	feet
Bottom Elevation	1220.0	feet
Slope	.00800	feet/feet
Roughness Coefficient (Kb)	.03900	
10-Year, 6-Hour Rainfall	2.03	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	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	7.9	7.0	6.5	6.0	5.7	5.4
i (in/hr)	3.2	4.4	5.2	6.5	7.5	8.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 10-28-98

LOCATION DATA

Location: east of 74th on oak (N)

Project Name: Oak Street Subarea id: 2b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.25	acres
Watercourse Length	500.0	feet
Top Elevation	1224.0	feet
Bottom Elevation	1220.0	feet
Slope	.00800	feet/feet
Roughness Coefficient (Kb)	.04400	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	1	2	2
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	8.5	7.5	7.0	6.4	6.1	5.8
i (in/hr)	3.1	4.3	5.1	6.3	7.3	8.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 74th

Project Name: oak street Subarea id: 3a

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	9.71 acres
Watercourse Length	1460.0 feet
Top Elevation	1231.0 feet
Bottom Elevation	1224.0 feet
Slope	.00479 feet/feet
Roughness Coefficient (Kb)	.03400
10-Year, 6-Hour Rainfall	2.03 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	10	14	17	24	30	36
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	16.6	14.7	13.7	12.4	11.8	11.1
i (in/hr)	2.3	3.2	3.8	4.9	5.7	6.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 74th street

Project Name: oak street Subarea id: 3b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.90	acres
Watercourse Length	910.0	feet
Top Elevation	1231.0	feet
Bottom Elevation	1224.0	feet
Slope	.00769	feet/feet
Roughness Coefficient (Kb)	.03800	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	4	5	7	8
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	11.2	9.9	9.3	8.5	8.0	7.6
i (in/hr)	2.8	3.8	4.5	5.8	6.6	7.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 74th

Project Name: oak street Subarea id: 3c

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	2.05 acres
Watercourse Length	900.0 feet
Top Elevation	1230.0 feet
Bottom Elevation	1224.0 feet
Slope	.00667 feet/feet
Roughness Coefficient (Kb)	.03800
10-Year, 6-Hour Rainfall	2.03 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	4	6	7	9
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	11.7	10.4	9.7	8.8	8.4	8.0
i (in/hr)	2.7	3.7	4.4	5.7	6.5	7.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 74th

Project Name: oak street Subarea id: 3d

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	28.50	acres
Watercourse Length	2360.0	feet
Top Elevation	1234.0	feet
Bottom Elevation	1224.0	feet
Slope	.00424	feet/feet
Roughness Coefficient (Kb)	.03100	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	25	36	43	60	77	93
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	22.2	19.5	18.1	16.5	15.5	14.7
i (in/hr)	1.9	2.8	3.3	4.3	5.0	5.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-11-98

LOCATION DATA

Location: 74th & Virginia

Project Name: Oak Street Subarea id: 3e

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	23.80 acres
Watercourse Length	1800.0 feet
Top Elevation	1235.0 feet
Bottom Elevation	1227.0 feet
Slope	.00444 feet/feet
Roughness Coefficient (Kb)	.03140
10-Year, 6-Hour Rainfall	2.03 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	23	32	39	55	70	84
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	18.5	16.3	15.2	13.8	13.1	12.4
i (in/hr)	2.2	3.0	3.6	4.7	5.4	6.3

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 72nd Place

Project Name: oak street Subarea id: 4a

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.71	acres
Watercourse Length	360.0	feet
Top Elevation	1235.0	feet
Bottom Elevation	1230.0	feet
Slope	.01389	feet/feet
Roughness Coefficient (Kb)	.03500	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	5	6	8	9
C	0.500	0.500	0.500	0.550	0.600	0.625
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	4.9	5.8	6.8	7.8	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 72nd place

Project Name: oak street Subarea id: 4b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	2.78	acres
Watercourse Length	600.0	feet
Top Elevation	1235.0	feet
Bottom Elevation	1230.0	feet
Slope	.00833	feet/feet
Roughness Coefficient (Kb)	.03700	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	6	7	10	12	15
C	0.500	0.500	0.500	0.550	0.600	0.625
Tc (min)	8.3	7.4	6.9	6.4	6.0	5.7
i (in/hr)	3.1	4.3	5.1	6.4	7.3	8.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: p-lot on scottsdale rd

Project Name: oak street Subarea id: 4c

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	4.61	acres
Watercourse Length	300.0	feet
Top Elevation	1235.0	feet
Bottom Elevation	1230.3	feet
Slope	.01567	feet/feet
Roughness Coefficient (Kb)	.03600	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	14	18	21	28	34	39
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	4.9	5.8	6.8	7.8	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-11-98

LOCATION DATA

Location: scottsdale road

Project Name: oak street Subarea id: 4d

Drainage Area Cover: ááááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	15.37	acres
Watercourse Length	2500.0	feet
Top Elevation	1238.0	feet
Bottom Elevation	1234.0	feet
Slope	.00160	feet/feet
Roughness Coefficient (Kb)	.03300	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	12	18	24	35	44	53
C	0.600	0.600	0.600	0.660	0.720	0.750
Tc (min)	37.2	31.9	28.6	25.8	24.3	23.0
i (in/hr)	1.3	2.0	2.6	3.4	4.0	4.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and scottsdale rd

Project Name: oak street Subarea id: 5a

Drainage Area Cover: ááááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	2.28	acres
Watercourse Length	450.0	feet
Top Elevation	1238.0	feet
Bottom Elevation	1236.0	feet
Slope	.00444	feet/feet
Roughness Coefficient (Kb)	.03800	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	5	6	9	11	13
C	0.550	0.550	0.550	0.605	0.660	0.688
Tc (min)	9.0	8.0	7.5	6.8	6.5	6.2
i (in/hr)	3.0	4.2	5.0	6.2	7.1	8.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and scottsdale rd

Project Name: oak street Subarea id: 5b

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.61	acres
Watercourse Length	550.0	feet
Top Elevation	1238.0	feet
Bottom Elevation	1236.0	feet
Slope	.00364	feet/feet
Roughness Coefficient (Kb)	.03900	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	4	6	8	9
C	0.600	0.600	0.600	0.660	0.720	0.750
Tc (min)	11.1	9.8	9.2	8.4	8.0	7.5
i (in/hr)	2.8	3.8	4.5	5.8	6.6	7.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: area n-w of int.

Project Name: oak street Subarea id: 5c

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	10.40	acres
Watercourse Length	2200.0	feet
Top Elevation	1243.0	feet
Bottom Elevation	1234.0	feet
Slope	.00409	feet/feet
Roughness Coefficient (Kb)	.03400	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	9	13	15	22	28	34
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	23.0	20.2	18.7	17.0	16.0	15.1
i (in/hr)	1.9	2.7	3.3	4.2	4.9	5.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-11-98

LOCATION DATA

Location: 71st pl & virginia

Project Name: oak street Subarea id: 5d

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	61.10	acres
Watercourse Length	3200.0	feet
Top Elevation	1252.0	feet
Bottom Elevation	1237.0	feet
Slope	.00469	feet/feet
Roughness Coefficient (Kb)	.02900	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	49	70	88	122	157	190
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	25.0	21.9	20.0	18.4	17.3	16.3
i (in/hr)	1.8	2.5	3.2	4.0	4.8	5.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-11-98

LOCATION DATA

Location: 69th Pl & virginia

Project Name: oak street Subarea id: 5e

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	29.40	acres
Watercourse Length	2700.0	feet
Top Elevation	1268.0	feet
Bottom Elevation	1247.0	feet
Slope	.00778	feet/feet
Roughness Coefficient (Kb)	.03100	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	28	40	47	67	85	103
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	19.0	16.8	15.6	14.2	13.4	12.7
i (in/hr)	2.1	3.0	3.6	4.6	5.4	6.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 71st st.

Project Name: oak street Subarea id: 6a

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	2.25	acres
Watercourse Length	820.0	feet
Top Elevation	1244.0	feet
Bottom Elevation	1238.0	feet
Slope	.00732	feet/feet
Roughness Coefficient (Kb)	.03800	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	5	7	8	10
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	10.7	9.5	8.9	8.1	7.7	7.3
i (in/hr)	2.8	3.9	4.6	5.9	6.7	7.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 71st

Project Name: oak street Subarea id: 6b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.21	acres
Watercourse Length	700.0	feet
Top Elevation	1244.0	feet
Bottom Elevation	1238.0	feet
Slope	.00857	feet/feet
Roughness Coefficient (Kb)	.03900	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	2	3	4	5	6
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	9.3	8.3	7.7	7.1	6.7	6.4
i (in/hr)	3.0	4.1	4.9	6.1	7.1	8.1

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 71st

Project Name: oak street Subarea id: 6c

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.89	acres
Watercourse Length	700.0	feet
Top Elevation	1243.5	feet
Bottom Elevation	1239.0	feet
Slope	.00643	feet/feet
Roughness Coefficient (Kb)	.03800	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	4	6	7	8
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	10.2	9.0	8.5	7.7	7.3	7.0
i (in/hr)	2.9	4.0	4.7	5.9	6.8	7.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 70th

Project Name: oak street Subarea id: 7a

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	21.21	acres
Watercourse Length	1800.0	feet
Top Elevation	1256.0	feet
Bottom Elevation	1244.0	feet
Slope	.00667	feet/feet
Roughness Coefficient (Kb)	.03200	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	22	31	37	52	66	79
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	16.0	14.1	13.2	12.0	11.4	10.8
i (in/hr)	2.3	3.2	3.9	5.0	5.7	6.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 70th

Project Name: oak street Subarea id: 7b

Drainage Area Cover: áááááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.02	acres
Watercourse Length	620.0	feet
Top Elevation	1250.0	feet
Bottom Elevation	1244.0	feet
Slope	.00968	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	5
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	8.4	7.5	7.0	6.4	6.1	5.8
i (in/hr)	3.1	4.3	5.1	6.3	7.3	8.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 71st

Project Name: oak street Subarea id: 7c

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.56	acres
Watercourse Length	650.0	feet
Top Elevation	1250.0	feet
Bottom Elevation	1244.0	feet
Slope	.00923	feet/feet
Roughness Coefficient (Kb)	.03900	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	4	5	6	7
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	8.7	7.7	7.2	6.6	6.3	6.0
i (in/hr)	3.1	4.2	5.0	6.3	7.2	8.3

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: res. n of oak

Project Name: oak street Subarea id: 7d

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	48.57	acres
Watercourse Length	2800.0	feet
Top Elevation	1268.0	feet
Bottom Elevation	1244.0	feet
Slope	.00857	feet/feet
Roughness Coefficient (Kb)	.02946	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	48	67	80	113	143	172
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	18.1	16.0	14.9	13.6	12.8	12.1
i (in/hr)	2.2	3.1	3.7	4.7	5.5	6.3

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 68th place

Project Name: oak street Subarea id: 8a

Drainage Area Cover: ááááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.05	acres
Watercourse Length	620.0	feet
Top Elevation	1255.0	feet
Bottom Elevation	1250.0	feet
Slope	.00806	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	5
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	9.0	8.0	7.5	6.9	6.5	6.2
i (in/hr)	3.0	4.2	4.9	6.2	7.1	8.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 68th place

Project Name: oak street Subarea id: 8b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	1.45	acres
Watercourse Length	650.0	feet
Top Elevation	1255.0	feet
Bottom Elevation	1250.0	feet
Slope	.00769	feet/feet
Roughness Coefficient (Kb)	.03900	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	3	4	6	7
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	9.3	8.2	7.7	7.1	6.7	6.4
i (in/hr)	3.0	4.1	4.9	6.1	7.1	8.1

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: 68th street

Project Name: oak street Subarea id: 9a

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	9.98	acres
Watercourse Length	1500.0	feet
Top Elevation	1268.0	feet
Bottom Elevation	1256.0	feet
Slope	.00800	feet/feet
Roughness Coefficient (Kb)	.03400	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	11	16	19	26	33	39
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	13.9	12.3	11.5	10.4	9.9	9.4
i (in/hr)	2.5	3.5	4.1	5.3	6.1	7.0

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 68th street

Project Name: oak street Subarea id: 9b

Drainage Area Cover: oak street

DESIGN DATA

Drainage Area	2.68	acres
Watercourse Length	1070.0	feet
Top Elevation	1268.0	feet
Bottom Elevation	1256.0	feet
Slope	.01121	feet/feet
Roughness Coefficient (Kb)	.03700	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	5	6	8	10	12
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	10.5	9.3	8.7	8.0	7.6	7.2
i (in/hr)	2.8	3.9	4.6	5.9	6.8	7.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 7-21-98

LOCATION DATA

Location: oak and 68th

Project Name: oak street Subarea id: 9c

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	2.67	acres
Watercourse Length	1120.0	feet
Top Elevation	1268.0	feet
Bottom Elevation	1256.0	feet
Slope	.01071	feet/feet
Roughness Coefficient (Kb)	.03700	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	5	5	8	10	12
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	11.0	9.7	9.1	8.3	7.9	7.5
i (in/hr)	2.8	3.8	4.6	5.8	6.6	7.7

APPENDIX A3
INLET DESIGN FLOWS
(West of Cross Cut Canal)

Table A.1.3

Runoff Table - per Kimley-Horn* Hydrology Models

Concentration Point Station (EEC)	Watershed Identifier (EEC)	Watershed Identifier (K-H)	Runoff [cfs]
73+60	15	70808	12
75+74	14	70610	5
80+10	13	70508	4
82+70	12	70010	7
83+60	11	70210	17
95+60	10-1	50005(split)	4
93+14	10-2	50005(split)	17

* S-T-P Papago, Regional Flood Control Project, Watershed Study (FCD 95-46)

Split - the Kimley-Horn model shows 21 cfs from Basin 50005 reaching Sta. 95+60, however there is a definite flow split causing a second catch basin to be installed at Sta. 93+14. The 21 cfs is split weighted by the drainage areas reaching the concentration points.

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 8-19-98

Subject: WEST SIDE STREET Hydrology Designed LAV Page

Approximate STA	L	High	Lowest	Area	"c"	"kb"	Drainage AREAS
95+92	250	1300	1297.5	0.275	0.80	0.036	10 A
93+52	80	1300.5	1300	0.073	0.80	0.033	10B
92+79	400	1304	1300.5	0.367	0.80	0.037	10C
88+79	292	1312	1304	0.248	0.80	0.036	10D
85+00	60	1312	1311	0.193	0.80	0.035	11A
83+70	50'	1312	1311	0.055	0.80	0.032	11B

Capture 10-yr, Let Everything else overflow The Papago Park Catch basins to follow natural drainage path.

STREET INLETS WILL NOT BE INSTALLED WEST OF 64th STREET, due to the following:

1. we don't want to cut-off the natural drainage path
2. The discharge developed in the road way is very minor 0-2 cfs.

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-19-98

LOCATION DATA

Location: Sta. 95+92

Project Name: Oak Street Subarea id: 10a

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.28	acres
Watercourse Length	250.0	feet
Top Elevation	1300.0	feet
Bottom Elevation	1297.5	feet
Slope	.01000	feet/feet
Roughness Coefficient (Kb)	.03600	
10-Year, 6-Hour Rainfall	2.03	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	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	4.9	5.8	6.8	7.8	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-19-98

LOCATION DATA

Location: Sta. 93+52

Project Name: Oak Street Subarea id: 10b

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.07 acres
Watercourse Length	80.0 feet
Top Elevation	1300.5 feet
Bottom Elevation	1300.0 feet
Slope	.00625 feet/feet
Roughness Coefficient (Kb)	.03300
10-Year, 6-Hour Rainfall	2.03 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	0	0	0	0	1	1
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	4.9	5.8	6.8	7.8	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-19-98

LOCATION DATA

Location: Sta. 92+79

Project Name: Oak Street Subarea id: 10c

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.37	acres
Watercourse Length	400.0	feet
Top Elevation	1304.0	feet
Bottom Elevation	1300.5	feet
Slope	.00875	feet/feet
Roughness Coefficient (Kb)	.03700	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	2	2	3	3
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	6.5	5.7	5.4	5.0	5.0	5.0
i (in/hr)	3.4	4.7	5.6	6.8	7.8	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-19-98

LOCATION DATA

Location: Sta. 88+79

Project Name: Oak Street Subarea id: 10d

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.25	acres
Watercourse Length	292.0	feet
Top Elevation	1312.0	feet
Bottom Elevation	1311.0	feet
Slope	.00342	feet/feet
Roughness Coefficient (Kb)	.03600	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	1	2	2
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	7.4	6.6	6.2	5.7	5.4	5.1
i (in/hr)	3.3	4.5	5.3	6.6	7.6	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-19-98

LOCATION DATA

Location: Sta. 85+00

Project Name: Oak Street Subarea id: ~~10c~~ 11A

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.19	acres
Watercourse Length	60.0	feet
Top Elevation	1312.0	feet
Bottom Elevation	1311.0	feet
Slope	.01667	feet/feet
Roughness Coefficient (Kb)	.03500	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	1	1	2
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	4.9	5.8	6.8	7.8	8.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: lav Date: 8-19-98

LOCATION DATA

Location: Sta. 83+70

Project Name: Oak street Subarea id: ~~11a~~ 11B

Drainage Area Cover: áááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.05	acres
Watercourse Length	50.0	feet
Top Elevation	1312.0	feet
Bottom Elevation	1311.0	feet
Slope	.02000	feet/feet
Roughness Coefficient (Kb)	.03200	
10-Year, 6-Hour Rainfall	2.03	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	0	0	0	0	0	0
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	4.9	5.8	6.8	7.8	8.8

APPENDIX A4
SPLIT FLOW ESTIMATES

Split Flow

1 Virginia Ave. & 69th Place

Field Observation by: M.T.Gavan & L.A.Vick

The first location of split flow is at Virginia Avenue and 69th Place. At this location approximately 47 cfs is flowing east along Virginia Ave. At 69th Place a split occurs with some of the flow turning south along 69th Place and the rest jogging to the north and then continues east along Virginia Ave.

From field observations it appears that the majority of the flow follows Virginia Avenue. It appears that the flow which would split and follow 69th Place is only what would normally be found up to curb depth on the south side of Virginia Avenue.

Using curb high depth as the basis for calculations the following page show the results of the split flow which follows 69th Place. The remaining flow is assumed to continue down Virginia Avenue.

2 Virginia Ave. & 74th Street

Field Observation by: A.Ahouraiyan(FCDMC) & L.A.Vick(EEC)

1. The slope away from the intersection is approximately the same in both directions.
2. Field consensus of this location was that a 50/50 split most likely occurs.

1

Virginia at 69th Place 07/22/98

Split flow calculation- lane flow turns on 69th Place, majority continues along Virginia Ave.

Open Channel Flow for Irregular Channel

Input Quantities

	Manning's n:	0.0180	
	Channel Slope:	0.0079	ft/ft
Calculated	Flow Rate:	12.7116	cfs
Calculated	Elev. of Flow:	0.3330	ft

12 cfs

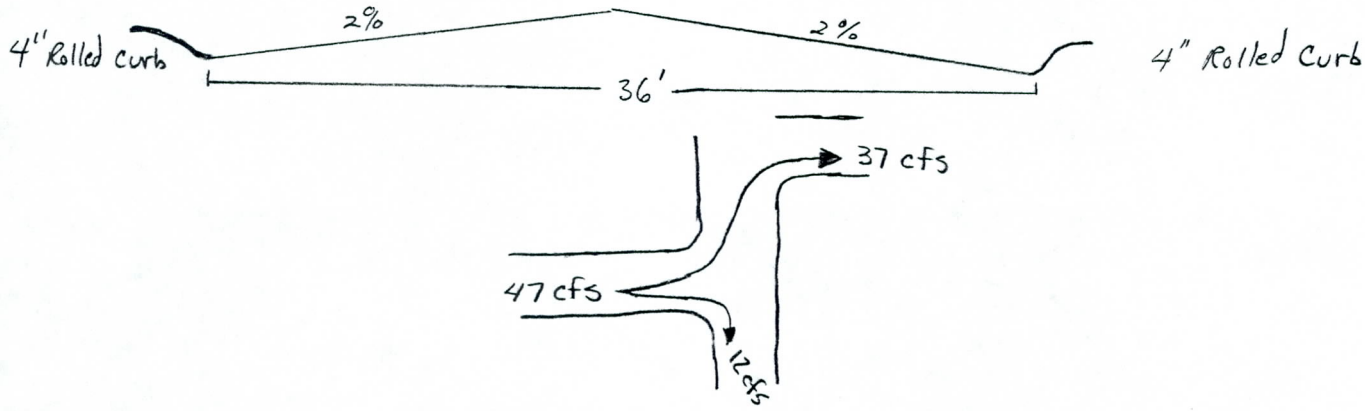
Calculated Quantities

Area Of Flow:	5.7940	sf
Wetted Perimeter:	35.4384	ft
Hydraulic Radius:	0.1635	ft
Velocity:	2.1940	ft/s
Critical Slope:	0.8727	%
Top Width:	35.3000	ft
Froude Number:	0.9543	
Critical Depth::	0.3269	ft
Depth of Flow:	0.3330	ft

Ground Shot Information

Num	Offset	Elevation
1	0.0000	0.3330
2	0.5000	0.2500
3	1.0000	0.0000
4	19.0000	0.3600
5	37.0000	0.0000
6	37.5000	0.2500
7	38.0000	0.3330

HHCalc, Version 7.0s
Eagle Point, 4131 WestMark Drive, Dubuque, IA, 52002, 1-800-678-6565



APPENDIX B
HYDRAULICS

APPENDIX B1
MAINLINE EAST OF 64TH STREET
(Auto Storm Model)

EEC

Project Title OAK STREET STORM DRAIN Project No. 98514 Date

Subject Auto-STORM models Designed by LLV Page

The computer program used to model the main line Hydraulics for this project is called Auto STORM, a portion of the Autocivil package.

Autocivil V. 7.0
distributed by Research Engineers, Inc.
22700 Savi Ranch, Yorba Linda, Ca 92687

This program was chosen since the auto-STORM portion of the program is compatible with STORM-Plus, a computer modeling program used by Kimley-Horn in the STP-Papago Watershed Study.

One problem with the software is that the program expects stationing to increase from the outlet, upstream to the system headworks. This is contradictory to the layout of the design. Therefore, the following equation can be used to convert between EEC's Construction Drawings and the stationing in the auto STORM model.

$$40000 - EEC_{plans} = EEC_{AUTO\ STORM}$$

Another difference is that Auto-Storm requires stationing along the pipe itself, while the plans use stationing along the monument line. This causes a difference of approximately 6' throughout the project.

Dec 31, 1998 8:54:14

INPUT FILE LISTING

1929 DATUM, starting WSEL in IBW (10-yr) = 1211.83

```
T1   OAK STREET STORM DRAIN
T2   EEC/MKE
T3   100-yr storm from scottsdale Rd to inlet at Hubbel & 64th St.  10-yr storm from IBW to Scottadale Rd.
SP      0.25          0  0
SO  20601.351206.65  1                          1211.83
R   20765.481206.98  2       .013                          0.00  0.00  0.00 0    Indian Bend Wash
R   20864.551207.18  3       .013                        125.00 46.29  0.00 0
R   21050.001207.55  4       .013                          0.00  0.00  0.00 1
R   21203.001207.73  5       .013                          0.00  0.00  0.00 0
JX  21231.001207.74  6200  0.013  115.00    0.001208.10   0.00 45.52  0.00      Miller Road & Oak St.
R   21302.631207.83  7       .013                        125.50 45.51  0.00 0
R   21470.001208.01  8       .013                          0.00  0.00  0.00 0
R   21690.141208.25  9       .013                          0.00  0.00  2.08 0
R   22394.141209.02 10       .013                          0.00  0.00  0.00 1
TS  22406.141209.03 11       .013                                                74th & Oak, East
R   22439.141209.06 12       .013                          0.00  0.00  0.00 0
TS  22451.141209.07 13       .013                                                74th & Oak, West
R   22460.141209.09 14       .013                          0.00  0.00  0.00 0
R   22576.191209.31 15       .013                          0.00  0.00 18.59 0
R   23675.191211.78 16       .013                          0.00  0.00  0.00 2
JX  23687.191211.83 17199  0.013   95.00    0.001221.85   0.00 45.00  0.00      Scottsdale & Oak, East
R   23806.191212.06 18       .013                          0.00  0.00  0.00 0
TS  23816.191215.26 19       .013                                                Scottsdale & Oak, West
R   23876.191215.86 20       .013                          0.00  0.00  1.91 0
R   25106.191228.16 21       .013                          0.00  0.00  0.00 3
R   26006.191236.71 22       .013                          0.00  0.00  0.00 2
R   27404.491245.34 23       .013                          0.00  0.00  0.00 2
TS  27410.491245.84 24       .013                                                Oak, East of Canal
R   27678.371247.60 25       .013                          0.00  0.00  0.00 0
JX  27696.431250.90 26198  0.013  278.00    0.001250.90   0.00 21.70  0.00      Oak, West of Canal
R   27777.431253.50 27       .013                          0.00  0.00  0.00 0
JX  27782.431254.00 28197  0.013   53.00    0.001259.29   0.00 75.00  0.00      66th & Oak
R   28677.431264.54 29       .013                          0.00  0.00  0.00 2
R   29074.431268.97 30       .013                          0.00  0.00  0.00 0
JX  29084.431270.83 31196  0.013   66.00    0.001271.04   0.00  0.10  0.00      64th & Oak
R   29141.921271.35 32       .013                          0.00  0.00 90.00 0
JX  29146.921272.05 33195  0.013   61.00    0.001273.02   0.00 75.00  0.00      64th, South of Oak
R   29356.921273.99 34       .013                          0.00  0.00  0.00 1
R   30191.921277.41 35       .013                          0.00  0.00  0.00 0
JX  30196.921277.91 36194  0.013    1.00    0.001278.73   0.00  0.10  0.00      64th & Hubbel
R   30220.921280.90 37       .013                          0.00  0.00 90.00 0
SH  30220.921280.90 38                          1286.20                           Inlet at 64th & Hubbel
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	3	1	1.00	4.00	21.00	0.00	0.00	0.00										
CD	2	3	1	1.00	4.00	21.00	0.00	0.00	0.00										
CD	3	3	1	1.00	4.00	21.00	0.00	0.00	0.00										
CD	4	3	1	1.00	4.00	21.00	0.00	0.00	0.00										
CD	5	3	1	1.00	4.00	21.00	0.00	0.00	0.00										
CD	6	3	0	0.00	6.00	11.00	0.00	0.00	0.00										
CD	7	3	0	0.00	6.00	11.00	0.00	0.00	0.00										

CD	8	3	0	0.00	6.00	11.00	0.00	0.00	0.00
CD	9	3	0	0.00	6.00	11.00	0.00	0.00	0.00
CD	10	3	0	0.00	6.00	11.00	0.00	0.00	0.00
CD	11	3	1	1.00	4.00	17.00	0.00	0.00	0.00
CD	12	3	1	1.00	4.00	17.00	0.00	0.00	0.00
CD	13	4			9.00				
CD	14	4			9.00				
CD	15	4			9.00				
CD	16	4			9.00				
CD	17	3	0	0.00	5.00	10.00	0.00	0.00	0.00
CD	18	3	0	0.00	5.00	10.00	0.00	0.00	0.00
CD	19	4			8.00				
CD	20	4			8.00				
CD	21	4			8.00				
CD	22	4			8.00				
CD	23	4			8.00				
CD	24	4			7.50				
CD	25	4			7.50				
CD	26	4			5.00				
CD	27	4			5.00				
CD	28	4			5.00				
CD	29	4			5.00				
CD	30	4			5.00				
CD	31	4			5.00				
CD	32	4			5.00				
CD	33	4			4.50				
CD	34	4			4.50				
CD	35	4			4.50				
CD	36	4			4.00				
CD	37	4			4.00				
CD	38	4			4.00				
CD	200	3	1	1.00	3.50	3.50	0.00	0.00	0.00
CD	199	4			6.00				
CD	198	4			6.00				
CD	197	4			3.00				
CD	196	4			3.00				
CD	195	4			4.50				
CD	194	4			2.00				

DESIGN OPTIMIZATION VALUES

ID	ELM	MINIMUM INVERT	MAXIMUM INVERT	MIN DIAM	MIN WIDTH	MAX DIAM	MAX WIDTH	MIN VELOC	MAX VELOC	DESIRED WSE	MIN COVER
OP	1	1206.65	1206.65	4.00	21.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	2	1206.65	1206.65	4.00	21.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	3	1206.65	1206.65	4.00	21.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	4	1206.65	1206.65	4.00	21.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	5	1206.65	1206.65	4.00	21.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	6	1206.65	1206.65	6.00	11.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	7	1206.65	1206.65	6.00	11.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	8	1206.65	1206.65	6.00	11.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	9	1206.65	1206.65	6.00	11.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	10	1206.65	1206.65	6.00	11.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	11	1206.65	1206.65	4.00	17.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	12	1206.65	1206.65	4.00	17.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	13	1206.65	1206.65	9.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	14	1206.65	1206.65	9.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	15	1206.65	1206.65	9.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	16	1206.65	1206.65	9.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00

```
 OP  17 1206.65 1206.65  5.00 10.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  18 1206.65 1206.65  5.00 10.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  19 1206.65 1206.65  8.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  20 1206.65 1206.65  8.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  21 1206.65 1206.65  8.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  22 1206.65 1206.65  8.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  23 1206.65 1206.65  8.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  24 1206.65 1206.65  7.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  25 1206.65 1206.65  7.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  26 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  27 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  28 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  29 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  30 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  31 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  32 1206.65 1206.65  5.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  33 1206.65 1206.65  4.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  34 1206.65 1206.65  4.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  35 1206.65 1206.65  4.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  36 1206.65 1206.65  4.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  37 1206.65 1206.65  4.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP  38 1206.65 1280.90  4.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00

1                                                                                                                    PAGE NO   1
0                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS - Oak Street Storm Drain
0
0HEADING LINE NO 2 IS - EEC/MKE
0
0HEADING LINE NO 3 IS - 6Hr 10-Year Storm in Mainline
0
0Box culverts have two fillets with an area of 0.25
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
                                 20601.35 1206.65    1                                          1211.83
0 ELEMENT NO   2 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
                                 20765.48 1206.98    2               0.013                         0.00   0.00    0.00      0
0 ELEMENT NO   3 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
                                 20864.55 1207.18    3               0.013                       125.00  46.29    0.00      0
0 ELEMENT NO   4 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
                                 21050.00 1207.55    4               0.013                         0.00   0.00    0.00      1
0 ELEMENT NO   5 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
                                 21203.00 1207.73    5               0.013                         0.00   0.00    0.00      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
                                 21231.00 1207.74    6   200     0  0.013   115.0      0.0  1208.10     0.00  45.52    0.00
0 ELEMENT NO   7 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
                                 21302.63 1207.83    7               0.013                       125.50  45.51    0.00      0
0 ELEMENT NO   8 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
                                 21470.00 1208.01    8               0.013                         0.00   0.00    0.00      0
0 ELEMENT NO   9 IS A REACH              *          *      *
                      U/S DATA   STATION    INVERT  SECT                N                       RADIUS  ANGLE  ANG PT  MAN H
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                                21690.14 1208.25    9              0.013                                  0.00   0.00    2.08     0
0 ELEMENT NO  10 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                22394.14 1209.02   10              0.013                                  0.00   0.00    0.00     1
0 ELEMENT NO  11 IS A TRANSITION         *        *     *
                     U/S DATA   STATION    INVERT  SECT              N
                                22406.14 1209.03   11              0.013
0 ELEMENT NO  12 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                22439.14 1209.06   12              0.013                                  0.00   0.00    0.00     0
0 ELEMENT NO  13 IS A TRANSITION         *        *     *
                     U/S DATA   STATION    INVERT  SECT              N
                                22451.14 1209.07   13              0.013
1                                                                                                                      PAGE NO   3
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  14 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                22460.14 1209.09   14              0.013                                  0.00   0.00    0.00     0
0 ELEMENT NO  15 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                22576.19 1209.31   15              0.013                                  0.00   0.00   18.59     0
0 ELEMENT NO  16 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                23675.19 1211.78   16              0.013                                  0.00   0.00    0.00     2
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
                                23687.19 1211.83   17   199     0  0.013    95.0      0.0  1221.85     0.00  45.00    0.00
0 ELEMENT NO  18 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                23806.19 1212.06   18              0.013                                  0.00   0.00    0.00     0
0 ELEMENT NO  19 IS A TRANSITION         *        *     *
                     U/S DATA   STATION    INVERT  SECT              N
                                23816.19 1215.26   19              0.013
0 ELEMENT NO  20 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                23876.19 1215.86   20              0.013                                  0.00   0.00    1.91     0
0 ELEMENT NO  21 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                25106.19 1228.16   21              0.013                                  0.00   0.00    0.00     3
0 ELEMENT NO  22 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                26006.19 1236.71   22              0.013                                  0.00   0.00    0.00     2
0 ELEMENT NO  23 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                27404.49 1245.34   23              0.013                                  0.00   0.00    0.00     2
0 ELEMENT NO  24 IS A TRANSITION         *        *     *
                     U/S DATA   STATION    INVERT  SECT              N
                                27410.49 1245.84   24              0.013
0 ELEMENT NO  25 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                27678.37 1247.60   25              0.014                                  0.00   0.00    0.00     0
0 ELEMENT NO  26 IS A JUNCTION           *        *     *     *                 *                    *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                27696.43 1250.90   26   198     0  0.013   278.0      0.0  1250.90     0.00  21.70    0.00
1                                                                                                                      PAGE NO   4
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  27 IS A REACH              *        *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                27777.43 1253.50   27              0.013                                  0.00   0.00    0.00     0
0 ELEMENT NO  28 IS A JUNCTION           *        *     *     *                 *                    *                 *
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                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               27782.43 1254.00   28   197     0  0.013     53.0      0.0  1259.29     0.00  75.00    0.00
0 ELEMENT NO  29 IS A REACH          *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                               28677.43 1264.54   29              0.013                                 0.00   0.00    0.00      2
0 ELEMENT NO  30 IS A REACH          *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                               29074.43 1268.97   30              0.013                                 0.00   0.00    0.00      0
0 ELEMENT NO  31 IS A JUNCTION       *         *     *     *                 *                 *              *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               29084.43 1270.83   31   196     0  0.013     66.0      0.0  1271.04     0.00   0.10    0.00
0 ELEMENT NO  32 IS A REACH          *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                               29141.92 1271.35   32              0.013                                 0.00   0.00   90.00      0
0 ELEMENT NO  33 IS A JUNCTION       *         *     *     *                 *                 *              *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               29146.92 1272.05   33   195     0  0.013     61.0      0.0  1273.02     0.00  75.00    0.00
0 ELEMENT NO  34 IS A REACH          *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                               29356.92 1273.99   34              0.013                                 0.00   0.00    0.00      1
0 ELEMENT NO  35 IS A REACH          *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                               30191.92 1277.41   35              0.013                                 0.00   0.00    0.00      0
0 ELEMENT NO  36 IS A JUNCTION       *         *     *     *                 *                 *              *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               30196.92 1277.91   36   194     0  0.013      1.0      0.0  1278.73     0.00   0.10    0.00
1                                                                                                                   PAGE NO    5
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  37 IS A REACH          *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                               30220.92 1280.90   37              0.013                                 0.00   0.00   90.00      0
0 ELEMENT NO  38 IS A SYSTEM HEADWORKS                *                 *
                    U/S DATA   STATION    INVERT  SECT                                   W S ELEV
                               30220.92 1280.90   38                                     1286.20
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WATER SURFACE PROFILE LISTING
Oak Street Storm Drain
EEC/MKE

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 20601.35	1206.65	5.18	1211.83	808.0	10.16	1.61	1213.44	0.00	3.70		4.00	21.00	0.00	1	1.00	I.B.W.
0 164.13	0.00201					0.00495	0.81			4.00			0.00			
0 20765.48	1206.98	5.66	1212.64	808.0	10.16	1.61	1214.25	0.00	3.70		4.00	21.00	0.00	1	1.00	
0 99.07	0.00202					0.00495	0.49			4.00			0.00			
0 20864.55	1207.18	6.18	1213.36	808.0	10.16	1.61	1214.97	0.00	3.70		4.00	21.00	0.00	1	1.00	
0 185.45	0.00200					0.00495	0.92			4.00			0.00			
0 21050.00	1207.55	6.81	1214.36	808.0	10.16	1.61	1215.97	0.00	3.70		4.00	21.00	0.00	1	1.00	
0 153.00	0.00118					0.00495	0.76			4.00			0.00			
0 21203.00	1207.73	7.39	1215.12	808.0	10.16	1.61	1216.73	0.00	3.70		4.00	21.00	0.00	1	1.00	
0JUNCT STR	0.00036					0.00424	0.12						0.00			MILLER & OAK
0 21231.00	1207.74	7.41	1215.15	693.0	10.54	1.73	1216.87	0.00	4.98		6.00	11.00	0.00	0	0.00	
0 71.63	0.00126					0.00353	0.25			6.00			0.00			
0 21302.63	1207.83	7.82	1215.65	693.0	10.54	1.73	1217.37	0.00	4.98		6.00	11.00	0.00	0	0.00	
0 167.37	0.00108					0.00353	0.59			6.00			0.00			
0 21470.00	1208.01	8.23	1216.24	693.0	10.54	1.73	1217.96	0.00	4.98		6.00	11.00	0.00	0	0.00	
0 220.14	0.00109					0.00353	0.78			6.00			0.00			
0 21690.14	1208.25	8.78	1217.03	693.0	10.54	1.73	1218.75	0.00	4.98		6.00	11.00	0.00	0	0.00	
0 704.00	0.00109					0.00353	2.48			6.00			0.00			
0 22394.14	1209.02	10.58	1219.60	693.0	10.54	1.73	1221.32	0.00	4.98		6.00	11.00	0.00	0	0.00	
0TRANS STR	0.00083					0.00490	0.06						0.00			74th & OAK, EAST
0 22406.14	1209.03	10.53	1219.56	693.0	10.91	1.85	1221.41	0.00	3.88		4.00	17.00	0.00	1	1.00	
0 33.00	0.00091					0.00628	0.21			4.00			0.00			
0 22439.14	1209.06	10.70	1219.76	693.0	10.91	1.85	1221.61	0.00	3.88		4.00	17.00	0.00	1	1.00	
0TRANS STR	0.00082					0.00468	0.06						0.00			74th & OAK, WEST
0 22451.14	1209.07	10.76	1219.83	693.0	10.89	1.84	1221.67	0.00	6.52		9.00	0.00	0.00	0	0.00	
0 9.00	0.00222					0.00308	0.03			9.00			0.00			
0 22460.14	1209.09	10.76	1219.85	693.0	10.89	1.84	1221.70	0.00	6.52		9.00	0.00	0.00	0	0.00	
0 116.05	0.00190					0.00308	0.36			9.00			0.00			
0 22576.19	1209.31	11.01	1220.32	693.0	10.89	1.84	1222.17	0.00	6.52		9.00	0.00	0.00	0	0.00	
0 1099.00	0.00225					0.00308	3.39			9.00			0.00			
0 23675.19	1211.78	12.11	1223.89	693.0	10.89	1.84	1225.74	0.00	6.52		9.00	0.00	0.00	0	0.00	
0JUNCT STR	0.00416					0.00436	0.05						0.00			Scottsdale & OAK, EAST
0 23687.19	1211.83	12.31	1224.14	598.0	12.02	2.25	1226.39	0.00	4.81		5.00	10.00	0.00	0	0.00	
0 119.00	0.00193					0.00563	0.67			5.00			0.00			
0 23806.19	1212.06	12.75	1224.82	598.0	12.02	2.25	1227.06	0.00	4.81		5.00	10.00	0.00	0	0.00	
0TRANS STR	0.31999					0.00497	0.05						0.00			Scottsdale & OAK, WEST
0 23816.19	1215.26	9.66	1224.92	598.0	11.90	2.20	1227.11	0.00	6.22		8.00	0.00	0.00	0	0.00	
0 60.00	0.01000					0.00430	0.26			4.72			0.00			
0 23876.19	1215.86	9.33	1225.19	598.0	11.90	2.20	1227.39	0.00	6.22		8.00	0.00	0.00	0	0.00	
0 242.19	0.01000					0.00430	1.04			4.72			0.00			
0 24118.38	1218.28	8.01	1226.29	598.0	11.90	2.20	1228.49	0.00	6.22		8.00	0.00	0.00	0	0.00	
0HYDRAULIC JUMP													0.00			
0 24118.38	1218.28	4.72	1223.01	598.0	19.36	5.82	1228.83	0.00	6.22		8.00	0.00	0.00	0	0.00	
0 386.14	0.01000					0.01000	3.86			4.72			0.00			
0 24504.52	1222.14	4.72	1226.87	598.0	19.36	5.82	1232.69	0.00	6.22		8.00	0.00	0.00	0	0.00	
0 601.67	0.01000					0.00973	5.86			4.72			0.00			
0 25106.19	1228.16	4.81	1232.97	598.0	18.94	5.58	1238.55	0.00	6.22		8.00	0.00	0.00	0	0.00	
0 516.92	0.00950					0.00913	4.72			4.80			0.00			
0 25623.11	1233.07	4.93	1238.00	598.0	18.41	5.27	1243.26	0.00	6.22		8.00	0.00	0.00	0	0.00	
0 227.39	0.00950					0.00830	1.89			4.80			0.00			

O STATION / O 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	
O 25850.49	1235.23	5.13	1240.36	598.0	17.55	4.79	1245.15	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 101.20	0.00950					0.00736	0.75			4.80			0.00			
O 25951.69	1236.19	5.35	1241.54	598.0	16.73	4.35	1245.90	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 54.50	0.00950					0.00655	0.36			4.80			0.00			
O 26006.19	1236.71	5.59	1242.30	598.0	15.96	3.96	1246.25	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 0.00	0.00950					0.00617	0.00			4.80			0.00			
O 26006.19	1236.71	5.59	1242.30	598.0	15.96	3.96	1246.25	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 305.39	0.00617					0.00617	1.89			5.59			0.00			
O 26311.58	1238.59	5.59	1244.18	598.0	15.96	3.96	1248.14	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 399.12	0.00617					0.00635	2.53			5.59			0.00			
O 26710.71	1241.06	5.47	1246.53	598.0	16.33	4.14	1250.67	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 247.17	0.00617					0.00693	1.71			5.59			0.00			
O 26957.87	1242.58	5.24	1247.83	598.0	17.12	4.56	1252.38	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 150.38	0.00617					0.00780	1.17			5.59			0.00			
O 27108.25	1243.51	5.03	1248.54	598.0	17.96	5.01	1253.56	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 114.85	0.00617					0.00880	1.01			5.59			0.00			
O 27223.10	1244.22	4.83	1249.05	598.0	18.84	5.51	1254.57	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 96.60	0.00617					0.00993	0.96			5.59			0.00			
O 27319.70	1244.82	4.64	1249.46	598.0	19.76	6.07	1255.53	0.00	6.22		8.00	0.00	0.00	0	0.00	
O 84.79	0.00617					0.01124	0.95			5.59			0.00			
O 27404.49	1245.34	4.47	1249.81	598.0	20.72	6.67	1256.48	0.00	6.22		8.00	0.00	0.00	0	0.00	
OTRANS STR	0.08333					0.01110	0.07						0.00			OAK, EAST OF CROSS-CUT CANAL
O 27410.49	1245.84	4.93	1250.77	598.0	19.41	5.86	1256.63	0.00	6.28		7.50	0.00	0.00	0	0.00	
O 46.97	0.00657					0.01244	0.58			6.41			0.00			
O 27457.47	1246.15	4.78	1250.93	598.0	20.10	6.28	1257.21	0.00	6.28		7.50	0.00	0.00	0	0.00	
O 60.38	0.00657					0.01381	0.83			6.41			0.00			
O 27517.85	1246.55	4.59	1251.14	598.0	21.08	6.91	1258.05	0.00	6.28		7.50	0.00	0.00	0	0.00	
O 56.65	0.00657					0.01559	0.88			6.41			0.00			
O 27574.50	1246.92	4.41	1251.33	598.0	22.11	7.60	1258.93	0.00	6.28		7.50	0.00	0.00	0	0.00	
O 53.37	0.00657					0.01762	0.94			6.41			0.00			
O 27627.87	1247.27	4.24	1251.51	598.0	23.19	8.36	1259.87	0.00	6.28		7.50	0.00	0.00	0	0.00	
O 50.50	0.00657					0.01995	1.01			6.41			0.00			
O 27678.37	1247.60	4.08	1251.68	598.0	24.33	9.20	1260.88	0.00	6.28		7.50	0.00	0.00	0	0.00	
OJUNCT STR	0.18272					0.01865	0.34						0.00			OAK, WEST OF CROSS-CUT CANAL
O 27696.43	1250.90	3.68	1254.58	320.0	20.67	6.64	1261.22	0.00	4.74		5.00	0.00	0.00	0	0.00	
O 18.28	0.03210					0.01846	0.34			3.04			0.00			
O 27714.71	1251.49	3.77	1255.26	320.0	20.13	6.30	1261.56	0.00	4.74		5.00	0.00	0.00	0	0.00	
O 25.69	0.03210					0.01701	0.44			3.04			0.00			
O 27740.40	1252.31	3.96	1256.27	320.0	19.19	5.72	1261.99	0.00	4.74		5.00	0.00	0.00	0	0.00	
O 18.65	0.03210					0.01540	0.29			3.04			0.00			
O 27759.05	1252.91	4.17	1257.08	320.0	18.30	5.20	1262.28	0.00	4.74		5.00	0.00	0.00	0	0.00	
O 12.68	0.03210					0.01410	0.18			3.04			0.00			
O 27771.72	1253.32	4.41	1257.73	320.0	17.45	4.73	1262.46	0.00	4.74		5.00	0.00	0.00	0	0.00	
O 5.71	0.03210					0.01330	0.08			3.04			0.00			
O 27777.43	1253.50	4.74	1258.24	320.0	16.63	4.30	1262.54	0.00	4.74		5.00	0.00	0.00	0	0.00	
OJUNCT STR	0.10000					0.01179	0.06						0.00			OAK & 66th ST
O 27782.43	1254.00	7.00	1261.00	267.0	13.60	2.87	1263.87	0.00	4.52		5.00	0.00	0.00	0	0.00	
O 895.00	0.01178					0.01051	9.41			3.87			0.00			
O 28677.43	1264.54	6.15	1270.69	267.0	13.60	2.87	1273.57	0.00	4.52		5.00	0.00	0.00	0	0.00	
O 397.00	0.01116					0.01051	4.17			3.97			0.00			
O 29074.43	1268.97	5.90	1274.87	267.0	13.60	2.87	1277.74	0.00	4.52		5.00	0.00	0.00	0	0.00	
OJUNCT STR	0.18600					0.00823	0.08						0.00			OAK & 64th ST
O 29084.43	1270.83	5.63	1276.46	201.0	10.24	1.63	1278.09	0.00	4.05		5.00	0.00	0.00	0	0.00	
O 57.49	0.00905					0.00596	0.34			3.42			0.00			

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR	
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR			
0 29141.92	1271.35	5.94	1277.29	201.0	10.24	1.63	1278.92	0.00	4.05		5.00	0.00	0.00	0	0.00	
0JUNCT STR	0.14002					0.00551	0.03						0.00			64th ST, South of OAK
0 29146.92	1272.05	6.61	1278.66	140.0	8.80	1.20	1279.86	0.00	3.48		4.50	0.00	0.00	0	0.00	
0 210.00	0.00924					0.00507	1.06			2.88			0.00			
0 29356.92	1273.99	5.79	1279.78	140.0	8.80	1.20	1280.98	0.00	3.48		4.50	0.00	0.00	0	0.00	
0 835.00	0.00410					0.00507	4.23			4.50			0.00			
0 30191.92	1277.41	6.60	1284.01	140.0	8.80	1.20	1285.22	0.00	3.48		4.50	0.00	0.00	0	0.00	
0JUNCT STR	0.10000												0.00			64th ST, & Hubbel
0 30196.92	1277.91	2.19	1280.10	139.0	19.74	6.06	1286.16	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 2.80	0.12458					0.02673	0.07			1.43			0.00			
0 30199.72	1278.26	2.24	1280.50	139.0	19.20	5.73	1286.23	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 4.30	0.12458					0.02426	0.10			1.43			0.00			
0 30204.03	1278.80	2.33	1281.12	139.0	18.31	5.21	1286.33	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 3.67	0.12458					0.02145	0.08			1.43			0.00			
0 30207.70	1279.25	2.42	1281.68	139.0	17.45	4.73	1286.41	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 3.13	0.12458					0.01899	0.06			1.43			0.00			
0 30210.82	1279.64	2.52	1282.17	139.0	16.64	4.30	1286.47	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 2.65	0.12458					0.01684	0.04			1.43			0.00			
0 30213.47	1279.97	2.63	1282.60	139.0	15.87	3.91	1286.51	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 2.21	0.12458					0.01497	0.03			1.43			0.00			
0 30215.68	1280.25	2.74	1282.99	139.0	15.13	3.56	1286.55	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 1.80	0.12458					0.01334	0.02			1.43			0.00			
0 30217.48	1280.47	2.87	1283.34	139.0	14.42	3.23	1286.57	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 1.43	0.12458					0.01192	0.02			1.43			0.00			
0 30218.91	1280.65	3.00	1283.65	139.0	13.75	2.94	1286.59	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 1.06	0.12458					0.01071	0.01			1.43			0.00			
0 30219.97	1280.78	3.15	1283.93	139.0	13.11	2.67	1286.60	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 0.69	0.12458					0.00968	0.01			1.43			0.00			
0 30220.66	1280.87	3.31	1284.18	139.0	12.50	2.43	1286.61	0.00	3.50		4.00	0.00	0.00	0	0.00	
0 0.26	0.12458					0.00885	0.00			1.43			0.00			
0 30220.92	1280.90	3.50	1284.40	139.0	11.92	2.21	1286.61	0.00	3.50		4.00	0.00	0.00	0	0.00	Inlet @ Hubbel & 64th STREET.
1																

APPENDIX B2
MAINLINE WEST OF 64TH STREET
(Auto Storm Model)

Dec 28, 1998 14:30:20

INPUT FILE LISTING

1929 DATUM, STARTING WSEL AT 64TH ST. AND OAK ST. = 1276.46

```
T1  OAK STREET STORM DRAIN
T2  EEC/MKE
T3  6HR 10-YR STORM IN MAINLINE
SP      0.25          0  0
SO  29062.501271.04  1                          1276.46                          64TH STREET AND OAK
R   29402.501274.37  2       .013                           0.00  0.00  0.00 1
R   29762.501284.09  3       .013                           0.00  0.00  0.00 1
R   30122.501285.17  4       .013                           0.00  0.00  0.00 1
R   30440.001289.30  5       .013                           0.00  0.00  0.00 0
JX  30445.001289.36  6200  0.013    4.00     0.001290.37   0.00 90.00  0.00      STA. 95+60
R   30482.501289.85  7       .013                           0.00  0.00  0.00 1
R   30683.261291.55  8       .013                           0.00  0.00  0.00 0
JX  30688.261291.60  9199  0.013   17.00     0.001292.29   0.00 90.00  0.00      STA. 93+14
R   31242.261295.93 10       .013                           0.00  0.00  0.00 2
R   31639.761297.13 11       .013                           0.00  0.00  0.00 1
JX  31644.761297.18 12198  0.013   17.00     0.001298.18   0.00 90.00  0.00      STA. 83+60
R   31714.761298.00 13       .013                           0.00  0.00  0.00 0
JX  31719.761298.04 14197  0.013    7.00     0.001298.79   0.00 73.91  0.00      STA. 82+85
R   31989.761301.14 15       .013                           0.00  0.00  0.00 0
JX  31994.761301.18 16196  0.013    4.00     0.001302.68   0.00 90.00  0.00      STA. 80+10
R   32414.761302.44 17       .013                           0.00  0.00  0.00 1
JX  32419.761303.44 18195  0.013    5.00     0.001303.94   0.00 71.20  0.00      STA. 75+80
R   32627.261304.07 19       .013                           0.00  0.00  0.00 0    STA. 73+80
R   32681.111308.80 20       .013                           0.00  0.00 68.20 1    STA. 73+20
SH  32681.111308.80 21                          1310.20                          STA. 73+20
1                                                                SP
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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			3.00														
CD	2	4			3.00														
CD	3	4			3.00														
CD	4	4			3.00														
CD	5	4			3.00														
CD	6	4			3.00														
CD	7	4			3.00														
CD	8	4			3.00														
CD	9	4			3.00														
CD	10	4			3.00														
CD	11	4			3.00														
CD	12	4			3.00														
CD	13	4			3.00														
CD	14	4			3.00														
CD	15	4			3.00														
CD	16	4			3.00														
CD	17	4			3.00														
CD	18	4			2.00														
CD	19	4			2.00														
CD	20	4			2.00														
CD	21	4			2.00														
CD	195	4			1.50														
CD	196	4			2.00														
CD	197	4			2.00														

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 CD    198    4                        1.50
 CD    199    4                        1.50
 CD    200    4                        1.50
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DESIGN OPTIMIZATION VALUES

ID	ELM	MINIMUM INVERT	MAXIMUM INVERT	MIN DIAM	MIN WIDTH	MAX DIAM	MAX WIDTH	MIN VELOC	MAX VELOC	DESIRED WSE	MIN COVER
OP	1	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	2	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	3	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	4	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	5	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	6	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	7	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	8	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	9	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	10	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	11	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	12	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	13	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	14	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	15	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	16	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	17	1271.04	1271.04	3.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	18	1271.04	1271.04	2.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	19	1271.04	1271.04	2.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	20	1271.04	1271.04	2.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	21	1271.04	1308.80	2.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00

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1                                                                                                                    PAGE NO   1
0                                WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -  OAK STREET STORM DRAIN
0
0HEADING LINE NO 2 IS -  EEC/MKE
0
0HEADING LINE NO 3 IS -  6HR 10-YR STORM IN MAINLINE
0
0Box culverts have two fillets with an area of 0.25
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
                                   29062.50 1271.04    1                                          1276.46
0 ELEMENT NO    2 IS A REACH              *          *      *
                       U/S DATA   STATION     INVERT  SECT                N                                  RADIUS  ANGLE  ANG PT  MAN H
                                   29402.50 1274.37    2               0.013                                   0.00   0.00    0.00      1
0 ELEMENT NO    3 IS A REACH              *          *      *
                       U/S DATA   STATION     INVERT  SECT                N                                  RADIUS  ANGLE  ANG PT  MAN H
                                   29762.50 1284.09    3               0.013                                   0.00   0.00    0.00      1
0 ELEMENT NO    4 IS A REACH              *          *      *
                       U/S DATA   STATION     INVERT  SECT                N                                  RADIUS  ANGLE  ANG PT  MAN H
                                   30122.50 1285.17    4               0.013                                   0.00   0.00    0.00      1
0 ELEMENT NO    5 IS A REACH              *          *      *
                       U/S DATA   STATION     INVERT  SECT                N                                  RADIUS  ANGLE  ANG PT  MAN H
                                   30440.00 1289.30    5               0.013                                   0.00   0.00    0.00      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
                                   30445.00 1289.36    6   200     0  0.013      4.0      0.0  1290.37     0.00  90.00    0.00
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0 ELEMENT NO   7 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                30482.50 1289.85    7               0.013                                 0.00   0.00    0.00      1
0 ELEMENT NO   8 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                30683.26 1291.55    8               0.013                                 0.00   0.00    0.00      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
                                30688.26 1291.60    9   199     0  0.013     17.0      0.0  1292.29     0.00  90.00    0.00
0 ELEMENT NO  10 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                31242.26 1295.93   10               0.013                                 0.00   0.00    0.00      2
0 ELEMENT NO  11 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                31639.76 1297.13   11               0.013                                 0.00   0.00    0.00      1
0 ELEMENT NO  12 IS A JUNCTION           *         *     *     *                 *                 *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                31644.76 1297.18   12   198     0  0.013     17.0      0.0  1298.18     0.00  90.00    0.00
1                                                                                                                   PAGE NO   3
0                                WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  13 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                31714.76 1298.00   13               0.013                                 0.00   0.00    0.00      0
0 ELEMENT NO  14 IS A JUNCTION           *         *     *     *                 *                 *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                31719.76 1298.04   14   197     0  0.013      7.0      0.0  1298.79     0.00  73.91    0.00
0 ELEMENT NO  15 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                31989.76 1301.14   15               0.013                                 0.00   0.00    0.00      0
0 ELEMENT NO  16 IS A JUNCTION           *         *     *     *                 *                 *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                31994.76 1301.18   16   196     0  0.013      4.0      0.0  1302.68     0.00  90.00    0.00
0 ELEMENT NO  17 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                32414.76 1302.44   17               0.013                                 0.00   0.00    0.00      1
0 ELEMENT NO  18 IS A JUNCTION           *         *     *     *                 *                 *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                32419.76 1303.44   18   195     0  0.013      5.0      0.0  1303.94     0.00  71.20    0.00
0 ELEMENT NO  19 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                32627.26 1304.07   19               0.013                                 0.00   0.00    0.00      0
0 ELEMENT NO  20 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                32681.11 1308.80   20               0.013                                 0.00   0.00   68.20      1
0 ELEMENT NO  21 IS A SYSTEM HEADWORKS                 *                 *
                     U/S DATA   STATION    INVERT  SECT                                     W S ELEV
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WATER SURFACE PROFILE LISTING
OAK STREET STORM DRAIN
EEC/MKE

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 29062.50	1271.04	5.42	1276.46	66.0	9.34	1.35	1277.81	0.00	2.60		3.00	0.00	0.00	0	0.00
0 340.00	0.00979					0.00979	3.33			2.46			0.00		
0 29402.50	1274.37	5.49	1279.86	66.0	9.34	1.35	1281.21	0.00	2.60		3.00	0.00	0.00	0	0.00
0 97.04	0.02700					0.00979	0.95			1.68			0.00		
0 29499.54	1276.99	3.83	1280.82	66.0	9.34	1.35	1282.18	0.00	2.60		3.00	0.00	0.00	0	0.00
0HYDRAULIC JUMP													0.00		
0 29499.54	1276.99	1.70	1278.69	66.0	15.94	3.95	1282.64	0.00	2.60		3.00	0.00	0.00	0	0.00
0 94.42	0.02700					0.02504	2.36			1.68			0.00		
0 29593.96	1279.54	1.74	1281.27	66.0	15.57	3.77	1285.04	0.00	2.60		3.00	0.00	0.00	0	0.00
0 66.10	0.02700					0.02288	1.51			1.68			0.00		
0 29660.06	1281.32	1.81	1283.13	66.0	14.85	3.43	1286.55	0.00	2.60		3.00	0.00	0.00	0	0.00
0 35.04	0.02700					0.02025	0.71			1.68			0.00		
0 29695.10	1282.27	1.88	1284.15	66.0	14.16	3.11	1287.26	0.00	2.60		3.00	0.00	0.00	0	0.00
0 22.58	0.02700					0.01796	0.41			1.68			0.00		
0 29717.68	1282.88	1.96	1284.84	66.0	13.50	2.83	1287.67	0.00	2.60		3.00	0.00	0.00	0	0.00
0 15.70	0.02700					0.01595	0.25			1.68			0.00		
0 29733.37	1283.30	2.04	1285.35	66.0	12.87	2.57	1287.92	0.00	2.60		3.00	0.00	0.00	0	0.00
0 11.18	0.02700					0.01421	0.16			1.68			0.00		
0 29744.55	1283.61	2.13	1285.74	66.0	12.27	2.34	1288.08	0.00	2.60		3.00	0.00	0.00	0	0.00
0 8.02	0.02700					0.01269	0.10			1.68			0.00		
0 29752.56	1283.82	2.23	1286.05	66.0	11.70	2.13	1288.18	0.00	2.60		3.00	0.00	0.00	0	0.00
0 5.47	0.02700					0.01139	0.06			1.68			0.00		
0 29758.03	1283.97	2.34	1286.31	66.0	11.15	1.93	1288.24	0.00	2.60		3.00	0.00	0.00	0	0.00
0 3.34	0.02700					0.01028	0.03			1.68			0.00		
0 29761.37	1284.06	2.46	1286.52	66.0	10.64	1.76	1288.28	0.00	2.60		3.00	0.00	0.00	0	0.00
0 1.13	0.02700					0.00937	0.01			1.68			0.00		
0 29762.50	1284.09	2.60	1286.69	66.0	10.14	1.60	1288.29	0.00	2.60		3.00	0.00	0.00	0	0.00
0 5.05	0.00300					0.00873	0.04			3.00			0.00		
0 29767.55	1284.11	2.78	1286.88	66.0	9.67	1.45	1288.33	0.00	2.60		3.00	0.00	0.00	0	0.00
0 21.08	0.00300					0.00906	0.19			3.00			0.00		
0 29788.63	1284.17	3.00	1287.17	66.0	9.34	1.35	1288.52	0.00	2.60		3.00	0.00	0.00	0	0.00
0 333.87	0.00300					0.00972	3.24			3.00			0.00		
0 30122.50	1285.17	5.33	1290.50	66.0	9.34	1.35	1291.86	0.00	2.60		3.00	0.00	0.00	0	0.00
0 317.50	0.01301					0.00979	3.11			2.16			0.00		
0 30440.00	1289.30	4.31	1293.61	66.0	9.34	1.35	1294.96	0.00	2.60		3.00	0.00	0.00	0	0.00
0JUNCT STR	0.01199					0.00922	0.05						0.00		
0 30445.00	1289.36	4.61	1293.97	62.0	8.77	1.20	1295.17	0.00	2.54		3.00	0.00	0.00	0	0.00
0 37.50	0.01307					0.00864	0.32			2.05			0.00		
0 30482.50	1289.85	4.51	1294.36	62.0	8.77	1.20	1295.55	0.00	2.54		3.00	0.00	0.00	0	0.00
0 200.76	0.00847					0.00864	1.73			2.48			0.00		
0 30683.26	1291.55	4.54	1296.09	62.0	8.77	1.20	1297.29	0.00	2.54		3.00	0.00	0.00	0	0.00
0JUNCT STR	0.00998					0.00660	0.03						0.00		
0 30688.26	1291.60	5.66	1297.26	45.0	6.37	0.63	1297.89	0.00	2.18		3.00	0.00	0.00	0	0.00
0 554.00	0.00782					0.00455	2.52			1.96			0.00		
0 31242.26	1295.93	3.91	1299.84	45.0	6.37	0.63	1300.47	0.00	2.18		3.00	0.00	0.00	0	0.00
0 397.50	0.00302					0.00455	1.81			3.00			0.00		
0 31639.76	1297.13	4.55	1301.68	45.0	6.37	0.63	1302.31	0.00	2.18		3.00	0.00	0.00	0	0.00
0JUNCT STR	0.01001					0.00316	0.02						0.00		
0 31644.76	1297.18	5.29	1302.47	28.0	3.96	0.24	1302.71	0.00	1.71		3.00	0.00	0.00	0	0.00
0 70.00	0.01171					0.00176	0.12			1.30			0.00		

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 31714.76	1298.00	4.59	1302.59	28.0	3.96	0.24	1302.84	0.00	1.71		3.00	0.00	0.00	0	0.00
0JUNCT STR	0.00801					0.00138	0.01						0.00		
0 31719.76	1298.04	4.75	1302.79	21.0	2.97	0.14	1302.93	0.00	1.47		3.00	0.00	0.00	0	0.00
0 167.29	0.01148					0.00098	0.16			1.11			0.00		
0 31887.05	1299.96	3.00	1302.96	21.0	2.97	0.14	1303.10	0.00	1.47		3.00	0.00	0.00	0	0.00
0 25.02	0.01148					0.00092	0.02			1.11			0.00		
0 31912.07	1300.25	2.72	1302.97	21.0	3.12	0.15	1303.12	0.00	1.47		3.00	0.00	0.00	0	0.00
0 13.79	0.01148					0.00090	0.01			1.11			0.00		
0 31925.86	1300.41	2.56	1302.97	21.0	3.27	0.17	1303.13	0.00	1.47		3.00	0.00	0.00	0	0.00
0 11.08	0.01148					0.00097	0.01			1.11			0.00		
0 31936.93	1300.53	2.43	1302.96	21.0	3.43	0.18	1303.14	0.00	1.47		3.00	0.00	0.00	0	0.00
0 9.48	0.01148					0.00107	0.01			1.11			0.00		
0 31946.42	1300.64	2.31	1302.95	21.0	3.59	0.20	1303.15	0.00	1.47		3.00	0.00	0.00	0	0.00
0 8.25	0.01148					0.00119	0.01			1.11			0.00		
0 31954.66	1300.74	2.21	1302.94	21.0	3.77	0.22	1303.16	0.00	1.47		3.00	0.00	0.00	0	0.00
0 7.28	0.01148					0.00132	0.01			1.11			0.00		
0 31961.94	1300.82	2.11	1302.93	21.0	3.95	0.24	1303.17	0.00	1.47		3.00	0.00	0.00	0	0.00
0 6.47	0.01148					0.00148	0.01			1.11			0.00		
0 31968.41	1300.89	2.02	1302.92	21.0	4.15	0.27	1303.18	0.00	1.47		3.00	0.00	0.00	0	0.00
0 5.73	0.01148					0.00167	0.01			1.11			0.00		
0 31974.14	1300.96	1.94	1302.90	21.0	4.35	0.29	1303.19	0.00	1.47		3.00	0.00	0.00	0	0.00
0 5.06	0.01148					0.00188	0.01			1.11			0.00		
0 31979.21	1301.02	1.86	1302.88	21.0	4.56	0.32	1303.20	0.00	1.47		3.00	0.00	0.00	0	0.00
0 4.34	0.01148					0.00212	0.01			1.11			0.00		
0 31983.55	1301.07	1.79	1302.85	21.0	4.78	0.36	1303.21	0.00	1.47		3.00	0.00	0.00	0	0.00
0 3.68	0.01148					0.00239	0.01			1.11			0.00		
0 31987.22	1301.11	1.72	1302.83	21.0	5.02	0.39	1303.22	0.00	1.47		3.00	0.00	0.00	0	0.00
0 2.54	0.01148					0.00268	0.01			1.11			0.00		
0 31989.76	1301.14	1.66	1302.80	21.0	5.22	0.42	1303.23	0.00	1.47		3.00	0.00	0.00	0	0.00
0JUNCT STR	0.00801					0.00195	0.01						0.00		
0 31994.76	1301.18	1.99	1303.17	17.0	3.42	0.18	1303.35	0.00	1.32		3.00	0.00	0.00	0	0.00
0 34.09	0.00300					0.00114	0.04			1.44			0.00		
0 32028.85	1301.28	1.91	1303.19	17.0	3.58	0.20	1303.39	0.00	1.32		3.00	0.00	0.00	0	0.00
0 32.70	0.00300					0.00129	0.04			1.44			0.00		
0 32061.55	1301.38	1.83	1303.21	17.0	3.76	0.22	1303.43	0.00	1.32		3.00	0.00	0.00	0	0.00
0 31.69	0.00300					0.00145	0.05			1.44			0.00		
0 32093.25	1301.48	1.76	1303.24	17.0	3.94	0.24	1303.48	0.00	1.32		3.00	0.00	0.00	0	0.00
0 32.30	0.00300					0.00164	0.05			1.44			0.00		
0 32125.55	1301.57	1.69	1303.26	17.0	4.14	0.27	1303.53	0.00	1.32		3.00	0.00	0.00	0	0.00
0 32.82	0.00300					0.00186	0.06			1.44			0.00		
0 32158.37	1301.67	1.63	1303.30	17.0	4.34	0.29	1303.59	0.00	1.32		3.00	0.00	0.00	0	0.00
0 35.61	0.00300					0.00211	0.08			1.44			0.00		
0 32193.98	1301.78	1.57	1303.34	17.0	4.55	0.32	1303.67	0.00	1.32		3.00	0.00	0.00	0	0.00
0 42.46	0.00300					0.00239	0.10			1.44			0.00		
0 32236.44	1301.91	1.51	1303.41	17.0	4.77	0.35	1303.77	0.00	1.32		3.00	0.00	0.00	0	0.00
0 68.93	0.00300					0.00272	0.19			1.44			0.00		
0 32305.37	1302.11	1.45	1303.57	17.0	5.00	0.39	1303.96	0.00	1.32		3.00	0.00	0.00	0	0.00
0 24.61	0.00300					0.00289	0.07			1.44			0.00		
0 32329.98	1302.19	1.45	1303.64	17.0	5.00	0.39	1304.03	0.00	1.32		3.00	0.00	0.00	0	0.00
0HYDRAULIC JUMP													0.00		
0 32329.98	1302.19	1.19	1303.38	17.0	6.48	0.65	1304.03	0.00	1.32		3.00	0.00	0.00	0	0.00
0 1.16	0.00300					0.00586	0.01			1.44			0.00		
0 32331.13	1302.19	1.19	1303.38	17.0	6.51	0.66	1304.04	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.52	0.00300					0.00631	0.05			1.44			0.00		
0 32338.65	1302.21	1.15	1303.36	17.0	6.83	0.72	1304.08	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.74	0.00300					0.00720	0.06			1.44			0.00		

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 32346.40	1302.23	1.11	1303.34	17.0	7.16	0.80	1304.14	0.00	1.32		3.00	0.00	0.00	0	0.00
0 8.02	0.00300					0.00821	0.07			1.44			0.00		
0 32354.41	1302.26	1.07	1303.33	17.0	7.51	0.88	1304.21	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.97	0.00300					0.00936	0.07			1.44			0.00		
0 32362.39	1302.28	1.03	1303.32	17.0	7.88	0.96	1304.28	0.00	1.32		3.00	0.00	0.00	0	0.00
0 8.00	0.00300					0.01068	0.09			1.44			0.00		
0 32370.39	1302.31	1.00	1303.30	17.0	8.26	1.06	1304.37	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.85	0.00300					0.01219	0.10			1.44			0.00		
0 32378.24	1302.33	0.96	1303.29	17.0	8.67	1.17	1304.46	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.67	0.00300					0.01392	0.11			1.44			0.00		
0 32385.91	1302.35	0.93	1303.28	17.0	9.09	1.28	1304.57	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.48	0.00300					0.01589	0.12			1.44			0.00		
0 32393.39	1302.38	0.90	1303.27	17.0	9.53	1.41	1304.69	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.34	0.00300					0.01815	0.13			1.44			0.00		
0 32400.73	1302.40	0.87	1303.27	17.0	10.00	1.55	1304.82	0.00	1.32		3.00	0.00	0.00	0	0.00
0 7.13	0.00300					0.02074	0.15			1.44			0.00		
0 32407.86	1302.42	0.84	1303.26	17.0	10.49	1.71	1304.97	0.00	1.32		3.00	0.00	0.00	0	0.00
0 6.90	0.00300					0.02371	0.16			1.44			0.00		
0 32414.76	1302.44	0.81	1303.25	17.0	11.00	1.88	1305.13	0.00	1.32		3.00	0.00	0.00	0	0.00
0JUNCT STR	0.20000					0.01543	0.08						0.00		
0 32419.76	1303.44	1.25	1304.68	12.0	5.84	0.53	1305.21	0.00	1.25		2.00	0.00	0.00	0	0.00
0 1.78	0.00304					0.00526	0.01			1.57			0.00		
0 32421.54	1303.45	1.30	1304.74	12.0	5.57	0.48	1305.22	0.00	1.25		2.00	0.00	0.00	0	0.00
0 6.87	0.00304					0.00467	0.03			1.57			0.00		
0 32428.41	1303.47	1.35	1304.82	12.0	5.31	0.44	1305.26	0.00	1.25		2.00	0.00	0.00	0	0.00
0 18.00	0.00304					0.00416	0.07			1.57			0.00		
0 32446.40	1303.52	1.41	1304.93	12.0	5.06	0.40	1305.33	0.00	1.25		2.00	0.00	0.00	0	0.00
0 42.49	0.00304					0.00371	0.16			1.57			0.00		
0 32488.89	1303.65	1.48	1305.13	12.0	4.82	0.36	1305.49	0.00	1.25		2.00	0.00	0.00	0	0.00
0 57.45	0.00304					0.00343	0.20			1.57			0.00		
0 32546.34	1303.82	1.51	1305.33	12.0	4.73	0.35	1305.68	0.00	1.25		2.00	0.00	0.00	0	0.00
0HYDRAULIC JUMP													0.00		
0 32546.34	1303.82	1.01	1304.84	12.0	7.50	0.87	1305.71	0.00	1.25		2.00	0.00	0.00	0	0.00
0 2.99	0.00304					0.01099	0.03			1.57			0.00		
0 32549.33	1303.83	1.00	1304.83	12.0	7.64	0.91	1305.74	0.00	1.25		2.00	0.00	0.00	0	0.00
0 6.09	0.00304					0.01203	0.07			1.57			0.00		
0 32555.42	1303.85	0.96	1304.81	12.0	8.02	1.00	1305.81	0.00	1.25		2.00	0.00	0.00	0	0.00
0 6.10	0.00304					0.01368	0.08			1.57			0.00		
0 32561.51	1303.87	0.93	1304.80	12.0	8.41	1.10	1305.90	0.00	1.25		2.00	0.00	0.00	0	0.00
0 6.06	0.00304					0.01555	0.09			1.57			0.00		
0 32567.58	1303.89	0.89	1304.78	12.0	8.82	1.21	1305.99	0.00	1.25		2.00	0.00	0.00	0	0.00
0 6.07	0.00304					0.01768	0.11			1.57			0.00		
0 32573.64	1303.91	0.86	1304.77	12.0	9.25	1.33	1306.10	0.00	1.25		2.00	0.00	0.00	0	0.00
0 6.02	0.00304					0.02013	0.12			1.57			0.00		
0 32579.66	1303.93	0.83	1304.76	12.0	9.70	1.46	1306.22	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.89	0.00304					0.02293	0.14			1.57			0.00		
0 32585.55	1303.94	0.80	1304.75	12.0	10.17	1.61	1306.35	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.75	0.00304					0.02613	0.15			1.57			0.00		
0 32591.30	1303.96	0.78	1304.74	12.0	10.67	1.77	1306.51	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.60	0.00304					0.02979	0.17			1.57			0.00		
0 32596.91	1303.98	0.75	1304.73	12.0	11.19	1.95	1306.67	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.45	0.00304					0.03396	0.19			1.57			0.00		
0 32602.36	1303.99	0.72	1304.72	12.0	11.74	2.14	1306.86	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.30	0.00304					0.03873	0.21			1.57			0.00		
0 32607.66	1304.01	0.70	1304.71	12.0	12.31	2.35	1307.06	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.14	0.00304					0.04419	0.23			1.57			0.00		

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 32612.79	1304.03	0.67	1304.70	12.0	12.91	2.59	1307.29	0.00	1.25		2.00	0.00	0.00	0	0.00
0 4.98	0.00304					0.05042	0.25			1.57			0.00		
0 32617.78	1304.04	0.65	1304.69	12.0	13.54	2.85	1307.54	0.00	1.25		2.00	0.00	0.00	0	0.00
0 4.82	0.00304					0.05757	0.28			1.57			0.00		
0 32622.60	1304.06	0.63	1304.68	12.0	14.20	3.13	1307.82	0.00	1.25		2.00	0.00	0.00	0	0.00
0 4.66	0.00304					0.06575	0.31			1.57			0.00		
0 32627.26	1304.07	0.61	1304.68	12.0	14.89	3.45	1308.12	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.00	0.00304					0.07012	0.00			1.57			0.00		
0 32627.26	1304.07	0.61	1304.68	12.0	14.89	3.45	1308.12	0.00	1.25		2.00	0.00	0.00	0	0.00
0 9.31	0.08784					0.06725	0.63			0.57			0.00		
0 32636.57	1304.89	0.62	1305.51	12.0	14.45	3.24	1308.75	0.00	1.25		2.00	0.00	0.00	0	0.00
0 9.95	0.08784					0.06040	0.60			0.57			0.00		
0 32646.51	1305.76	0.64	1306.40	12.0	13.78	2.95	1309.35	0.00	1.25		2.00	0.00	0.00	0	0.00
0 7.02	0.08784					0.05292	0.37			0.57			0.00		
0 32653.53	1306.38	0.67	1307.04	12.0	13.14	2.68	1309.72	0.00	1.25		2.00	0.00	0.00	0	0.00
0 5.32	0.08784					0.04636	0.25			0.57			0.00		
0 32658.86	1306.85	0.69	1307.53	12.0	12.52	2.44	1309.97	0.00	1.25		2.00	0.00	0.00	0	0.00
0 4.16	0.08784					0.04062	0.17			0.57			0.00		
0 32663.02	1307.21	0.71	1307.92	12.0	11.94	2.22	1310.14	0.00	1.25		2.00	0.00	0.00	0	0.00
0 3.38	0.08784					0.03561	0.12			0.57			0.00		
0 32666.40	1307.51	0.74	1308.25	12.0	11.39	2.01	1310.26	0.00	1.25		2.00	0.00	0.00	0	0.00
0 2.76	0.08784					0.03123	0.09			0.57			0.00		
0 32669.16	1307.75	0.77	1308.52	12.0	10.86	1.83	1310.35	0.00	1.25		2.00	0.00	0.00	0	0.00
0 2.31	0.08784					0.02739	0.06			0.57			0.00		
0 32671.46	1307.95	0.79	1308.74	12.0	10.35	1.66	1310.41	0.00	1.25		2.00	0.00	0.00	0	0.00
0 1.92	0.08784					0.02403	0.05			0.57			0.00		
0 32673.38	1308.12	0.82	1308.94	12.0	9.87	1.51	1310.46	0.00	1.25		2.00	0.00	0.00	0	0.00
0 1.61	0.08784					0.02110	0.03			0.57			0.00		
0 32674.99	1308.26	0.85	1309.11	12.0	9.41	1.38	1310.49	0.00	1.25		2.00	0.00	0.00	0	0.00
0 1.34	0.08784					0.01854	0.02			0.57			0.00		
0 32676.34	1308.38	0.88	1309.26	12.0	8.97	1.25	1310.51	0.00	1.25		2.00	0.00	0.00	0	0.00
0 1.14	0.08784					0.01629	0.02			0.57			0.00		
0 32677.48	1308.48	0.92	1309.40	12.0	8.55	1.14	1310.53	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.93	0.08784					0.01432	0.01			0.57			0.00		
0 32678.41	1308.56	0.95	1309.51	12.0	8.16	1.03	1310.55	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.77	0.08784					0.01260	0.01			0.57			0.00		
0 32679.18	1308.63	0.99	1309.62	12.0	7.78	0.94	1310.56	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.63	0.08784					0.01109	0.01			0.57			0.00		
0 32679.81	1308.69	1.02	1309.71	12.0	7.41	0.85	1310.56	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.48	0.08784					0.00977	0.00			0.57			0.00		
0 32680.29	1308.73	1.06	1309.79	12.0	7.07	0.78	1310.57	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.37	0.08784					0.00862	0.00			0.57			0.00		
0 32680.67	1308.76	1.10	1309.87	12.0	6.74	0.71	1310.57	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.25	0.08784					0.00761	0.00			0.57			0.00		
0 32680.92	1308.78	1.15	1309.93	12.0	6.43	0.64	1310.57	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.14	0.08784					0.00673	0.00			0.57			0.00		
0 32681.06	1308.80	1.20	1309.99	12.0	6.13	0.58	1310.57	0.00	1.25		2.00	0.00	0.00	0	0.00
0 0.05	0.08784					0.00595	0.00			0.57			0.00		
0 32681.11	1308.80	1.25	1310.05	12.0	5.84	0.53	1310.57	0.00	1.25		2.00	0.00	0.00	0	0.00

1

APPENDIX B3
100-YEAR TEST
(Auto Storm Model)

Dec 30, 1998 16:34:44

INPUT FILE LISTING

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1929 DATUM, This file runs a test to determine the effect a 100-year storm would have on areas east of the Cross-Cut Canal.
            The starting station and WSEL are chosen to simulate a curb high water depth at 70th street, which is the first major
            location of inflow east of the canal.  This model is the basis for upsizing the 7.5' pipe to 8' in diameter.

 T1  Oak Street Storm Drain
 T2  EEC/MKE
 T3  100-yr storm from Scottsdale Road to inlet at Hubbel Street.  10-yr Storm from IBW to Scottsdale Road.
 SP      0.25          0  0
 SO  25050.001227.60  1                          1241.75                          70th St. & Oak
 R   25106.231228.16  2       .013                          0.00  0.00  0.00 0
 R   26006.231236.71  3       .013                          0.00  0.00  0.00 2
 R   27404.531245.34  4       .013                          0.00  0.00  0.00 2
 TS  27410.531245.84  5       .013
 R   27678.411247.60  6       .014                          0.00  0.00  0.00 0
 JX  27696.471250.90  7200  0.013  278.00    0.001250.90   0.00 21.70  0.00      JX Str. West of Canal
 R   27777.471253.50  8       .013                          0.00  0.00  0.00 0
 JX  27782.471254.00  9199  0.013   53.00    0.001259.29   0.00 75.00  0.00      JX at 66th & Oak
 R   28677.471264.54 10       .013                          0.00  0.00  0.00 2
 R   29074.471268.97 11       .013                          0.00  0.00  0.00 0
 JX  29084.471270.83 12198  0.013   66.00    0.001271.04   0.00  0.10  0.00      JX at 64th & Oak
 R   29141.961271.35 13       .013                          0.00  0.00 90.00 0
 JX  29146.961272.05 14197  0.013   61.00    0.001273.02   0.00 75.00  0.00      JX on 64th St. south of Oak
 R   29356.961273.99 15       .013                          0.00  0.00  0.00 1
 R   30191.961277.41 16       .013                          0.00  0.00  0.00 0
 JX  30196.961277.91 17196  0.013    1.00    0.001278.73   0.00  0.10  0.00      JX at Hubbel & 64th St.
 R   30220.961280.90 18       .013                          0.00  0.00 90.00 0
 SH  30220.961280.90 19                          1286.20                          Inlet at Hubbel & 64th St.
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                      8.00
  CD      2    4                      8.00
  CD      3    4                      8.00
  CD      4    4                      8.00
  CD      5    4                      7.50
  CD      6    4                      7.50
  CD      7    4                      5.00
  CD      8    4                      5.00
  CD      9    4                      5.00
  CD     10    4                      5.00
  CD     11    4                      5.00
  CD     12    4                      5.00
  CD     13    4                      5.00
  CD     14    4                      4.50
  CD     15    4                      4.50
  CD     16    4                      4.50
  CD     17    4                      4.00
  CD     18    4                      4.00
  CD     19    4                      4.00
  CD    200    4                      6.00
  CD    199    4                      3.00
  CD    198    4                      3.00
  CD    197    4                      4.50
  CD    196    4                      2.00
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DESIGN OPTIMIZATION VALUES

ID	ELM	MINIMUM INVERT	MAXIMUM INVERT	MIN DIAM	MIN WIDTH	MAX DIAM	MAX WIDTH	MIN VELOC	MAX VELOC	DESIRED WSE	MIN COVER
OP	1	1227.60	1227.60	8.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	2	1227.60	1227.60	8.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	3	1227.60	1227.60	8.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	4	1227.60	1227.60	8.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	5	1227.60	1227.60	7.50	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	6	1227.60	1227.60	7.50	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	7	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	8	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	9	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	10	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	11	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	12	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	13	1227.60	1227.60	5.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	14	1227.60	1227.60	4.50	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	15	1227.60	1227.60	4.50	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	16	1227.60	1227.60	4.50	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	17	1227.60	1227.60	4.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	18	1227.60	1227.60	4.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00
OP	19	1227.60	1280.90	4.00	0.00	0.00	0.00	0.10	20.00	1000.00	2.00

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1                                                                                                                    PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0
0HEADING LINE NO 2 IS -
0
0HEADING LINE NO 3 IS -
0
0Box culverts have two fillets with an area of 0.25
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
                                  25050.00 1227.60    1                                      1241.75
0 ELEMENT NO   2 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                  25106.23 1228.16    2               0.013                                 0.00   0.00    0.00      0
0 ELEMENT NO   3 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                  26006.23 1236.71    3               0.013                                 0.00   0.00    0.00      2
0 ELEMENT NO   4 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                  27404.53 1245.34    4               0.013                                 0.00   0.00    0.00      2
0 ELEMENT NO   5 IS A TRANSITION         *         *     *
                      U/S DATA   STATION    INVERT  SECT                N
                                  27410.53 1245.84    5               0.013
0 ELEMENT NO   6 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                  27678.41 1247.60    6               0.014                                 0.00   0.00    0.00      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
                                  27696.47 1250.90    7   200     0  0.013    278.0      0.0  1250.90     0.00   21.70    0.00
0 ELEMENT NO   8 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
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                                27777.47 1253.50    8              0.013                                  0.00    0.00    0.00     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
                                27782.47 1254.00    9   199     0  0.013     53.0      0.0  1259.29     0.00  75.00    0.00
0 ELEMENT NO  10 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                28677.47 1264.54   10              0.013                                  0.00    0.00    0.00     2
0 ELEMENT NO  11 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                29074.47 1268.97   11              0.013                                  0.00    0.00    0.00     0
0 ELEMENT NO  12 IS A JUNCTION          *         *     *     *                  *                    *                *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                29084.47 1270.83   12   198     0  0.013     66.0      0.0  1271.04     0.00   0.10    0.00
1                                                                                                                   PAGE NO   3
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  13 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                29141.96 1271.35   13              0.013                                  0.00    0.00   90.00     0
0 ELEMENT NO  14 IS A JUNCTION          *         *     *     *                  *                    *                *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                29146.96 1272.05   14   197     0  0.013     61.0      0.0  1273.02     0.00  75.00    0.00
0 ELEMENT NO  15 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                29356.96 1273.99   15              0.013                                  0.00    0.00    0.00     1
0 ELEMENT NO  16 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                30191.96 1277.41   16              0.013                                  0.00    0.00    0.00     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
                                30196.96 1277.91   17   196     0  0.013      1.0      0.0  1278.73     0.00   0.10    0.00
0 ELEMENT NO  18 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT               N                                RADIUS  ANGLE  ANG PT  MAN H
                                30220.96 1280.90   18              0.013                                  0.00    0.00   90.00     0
0 ELEMENT NO  19 IS A SYSTEM HEADWORKS                *                  *
                     U/S DATA   STATION    INVERT  SECT                                W S ELEV
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WATER SURFACE PROFILE LISTING
Oak Street Storm Drain - 100 Yr. TEST
EEC/MKE

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 25050.00	1227.60	14.15	1241.75	598.0	11.90	2.20	1243.95	0.00	6.22		8.00	0.00	0.00	0	0.00
0 56.23	0.00996					0.00430	0.24			4.73			0.00		
0 25106.23	1228.16	13.83	1241.99	598.0	11.90	2.20	1244.19	0.00	6.22		8.00	0.00	0.00	0	0.00
0 900.00	0.00950					0.00430	3.87			4.80			0.00		
0 26006.23	1236.71	9.37	1246.08	598.0	11.90	2.20	1248.28	0.00	6.22		8.00	0.00	0.00	0	0.00
0 798.66	0.00617					0.00428	3.42			5.59			0.00		
0 26804.89	1241.64	8.00	1249.64	598.0	11.90	2.20	1251.84	0.00	6.22		8.00	0.00	0.00	0	0.00
0 198.72	0.00617					0.00399	0.79			5.59			0.00		
0 27003.62	1242.87	7.42	1250.29	598.0	12.29	2.35	1252.64	0.00	6.22		8.00	0.00	0.00	0	0.00
0HYDRAULIC JUMP													0.00		
0 27003.62	1242.87	5.17	1248.04	598.0	17.40	4.70	1252.74	0.00	6.22		8.00	0.00	0.00	0	0.00
0 104.61	0.00617					0.00795	0.83			5.59			0.00		
0 27108.23	1243.51	5.03	1248.54	598.0	17.96	5.02	1253.56	0.00	6.22		8.00	0.00	0.00	0	0.00
0 115.09	0.00617					0.00880	1.01			5.59			0.00		
0 27223.32	1244.22	4.83	1249.05	598.0	18.84	5.52	1254.57	0.00	6.22		8.00	0.00	0.00	0	0.00
0 96.49	0.00617					0.00994	0.96			5.59			0.00		
0 27319.81	1244.82	4.64	1249.46	598.0	19.76	6.07	1255.53	0.00	6.22		8.00	0.00	0.00	0	0.00
0 84.72	0.00617					0.01125	0.95			5.59			0.00		
0 27404.53	1245.34	4.47	1249.81	598.0	20.73	6.68	1256.48	0.00	6.22		8.00	0.00	0.00	0	0.00
0TRANS STR	0.08333					0.01110	0.07						0.00		
0 27410.53	1245.84	4.93	1250.77	598.0	19.42	5.86	1256.63	0.00	6.28		7.50	0.00	0.00	0	0.00
0 46.91	0.00657					0.01244	0.58			6.41			0.00		
0 27457.44	1246.15	4.78	1250.93	598.0	20.11	6.28	1257.21	0.00	6.28		7.50	0.00	0.00	0	0.00
0 60.51	0.00657					0.01381	0.84			6.41			0.00		
0 27517.95	1246.55	4.59	1251.14	598.0	21.09	6.91	1258.05	0.00	6.28		7.50	0.00	0.00	0	0.00
0 56.63	0.00657					0.01559	0.88			6.41			0.00		
0 27574.58	1246.92	4.41	1251.33	598.0	22.12	7.60	1258.93	0.00	6.28		7.50	0.00	0.00	0	0.00
0 53.36	0.00657					0.01763	0.94			6.41			0.00		
0 27627.94	1247.27	4.24	1251.51	598.0	23.20	8.36	1259.87	0.00	6.28		7.50	0.00	0.00	0	0.00
0 50.47	0.00657					0.01996	1.01			6.41			0.00		
0 27678.41	1247.60	4.08	1251.68	598.0	24.33	9.20	1260.88	0.00	6.28		7.50	0.00	0.00	0	0.00
0JUNCT STR	0.18272					0.01865	0.34						0.00		
0 27696.47	1250.90	3.68	1254.58	320.0	20.67	6.64	1261.22	0.00	4.74		5.00	0.00	0.00	0	0.00
0 18.28	0.03210					0.01846	0.34			3.04			0.00		
0 27714.75	1251.49	3.77	1255.26	320.0	20.13	6.30	1261.56	0.00	4.74		5.00	0.00	0.00	0	0.00
0 25.69	0.03210					0.01701	0.44			3.04			0.00		
0 27740.44	1252.31	3.96	1256.27	320.0	19.19	5.72	1261.99	0.00	4.74		5.00	0.00	0.00	0	0.00
0 18.65	0.03210					0.01540	0.29			3.04			0.00		
0 27759.09	1252.91	4.17	1257.08	320.0	18.30	5.20	1262.28	0.00	4.74		5.00	0.00	0.00	0	0.00
0 12.68	0.03210					0.01410	0.18			3.04			0.00		
0 27771.77	1253.32	4.41	1257.73	320.0	17.45	4.73	1262.46	0.00	4.74		5.00	0.00	0.00	0	0.00
0 5.71	0.03210					0.01330	0.08			3.04			0.00		
0 27777.47	1253.50	4.74	1258.24	320.0	16.63	4.30	1262.54	0.00	4.74		5.00	0.00	0.00	0	0.00
0JUNCT STR	0.10000					0.01179	0.06						0.00		
0 27782.47	1254.00	7.00	1261.00	267.0	13.60	2.87	1263.87	0.00	4.52		5.00	0.00	0.00	0	0.00
0 895.00	0.01178					0.01051	9.41			3.87			0.00		
0 28677.47	1264.54	6.15	1270.69	267.0	13.60	2.87	1273.57	0.00	4.52		5.00	0.00	0.00	0	0.00
0 397.00	0.01116					0.01051	4.17			3.97			0.00		
0 29074.47	1268.97	5.90	1274.87	267.0	13.60	2.87	1277.74	0.00	4.52		5.00	0.00	0.00	0	0.00
0JUNCT STR	0.18600					0.00823	0.08						0.00		

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 29084.47	1270.83	5.63	1276.46	201.0	10.24	1.63	1278.09	0.00	4.05		5.00	0.00	0.00	0	0.00
0 57.49	0.00905					0.00596	0.34			3.42			0.00		
0 29141.96	1271.35	5.94	1277.29	201.0	10.24	1.63	1278.92	0.00	4.05		5.00	0.00	0.00	0	0.00
0JUNCT STR	0.14002					0.00551	0.03						0.00		
0 29146.96	1272.05	6.47	1278.52	140.0	8.80	1.20	1279.73	0.00	3.48		4.50	0.00	0.00	0	0.00
0 210.00	0.00924					0.00507	1.06			2.88			0.00		
0 29356.96	1273.99	5.66	1279.65	140.0	8.80	1.20	1280.85	0.00	3.48		4.50	0.00	0.00	0	0.00
0 835.00	0.00410					0.00507	4.23			4.50			0.00		
0 30191.96	1277.41	6.47	1283.88	140.0	8.80	1.20	1285.08	0.00	3.48		4.50	0.00	0.00	0	0.00
0JUNCT STR	0.10000												0.00		
0 30196.96	1277.91	2.19	1280.10	139.0	19.74	6.06	1286.16	0.00	3.50		4.00	0.00	0.00	0	0.00
0JUNCT STR	0.10000					0.02771	0.00						0.00		
0 30196.96	1277.91	2.19	1280.10	139.0	19.74	6.06	1286.16	0.00	3.50		4.00	0.00	0.00	0	0.00
0 2.80	0.12458					0.02673	0.07			1.43			0.00		
0 30199.76	1278.26	2.24	1280.50	139.0	19.20	5.73	1286.23	0.00	3.50		4.00	0.00	0.00	0	0.00
0 4.30	0.12458					0.02426	0.10			1.43			0.00		
0 30204.07	1278.80	2.33	1281.12	139.0	18.31	5.21	1286.33	0.00	3.50		4.00	0.00	0.00	0	0.00
0 3.67	0.12458					0.02145	0.08			1.43			0.00		
0 30207.74	1279.25	2.42	1281.68	139.0	17.45	4.73	1286.41	0.00	3.50		4.00	0.00	0.00	0	0.00
0 3.13	0.12458					0.01899	0.06			1.43			0.00		
0 30210.87	1279.64	2.52	1282.17	139.0	16.64	4.30	1286.47	0.00	3.50		4.00	0.00	0.00	0	0.00
0 2.65	0.12458					0.01684	0.04			1.43			0.00		
0 30213.51	1279.97	2.63	1282.60	139.0	15.87	3.91	1286.51	0.00	3.50		4.00	0.00	0.00	0	0.00
0 2.21	0.12458					0.01497	0.03			1.43			0.00		
0 30215.72	1280.25	2.74	1282.99	139.0	15.13	3.56	1286.55	0.00	3.50		4.00	0.00	0.00	0	0.00
0 1.80	0.12458					0.01334	0.02			1.43			0.00		
0 30217.52	1280.47	2.87	1283.34	139.0	14.42	3.23	1286.57	0.00	3.50		4.00	0.00	0.00	0	0.00
0 1.43	0.12458					0.01192	0.02			1.43			0.00		
0 30218.95	1280.65	3.00	1283.65	139.0	13.75	2.94	1286.59	0.00	3.50		4.00	0.00	0.00	0	0.00
0 1.06	0.12458					0.01071	0.01			1.43			0.00		
0 30220.01	1280.78	3.15	1283.93	139.0	13.11	2.67	1286.60	0.00	3.50		4.00	0.00	0.00	0	0.00
0 0.69	0.12458					0.00968	0.01			1.43			0.00		
0 30220.70	1280.87	3.31	1284.18	139.0	12.50	2.43	1286.61	0.00	3.50		4.00	0.00	0.00	0	0.00
0 0.26	0.12458					0.00885	0.00			1.43			0.00		
0 30220.96	1280.90	3.50	1284.40	139.0	11.92	2.21	1286.61	0.00	3.50		4.00	0.00	0.00	0	0.00

1

APPENDIX B4
EXISTING & PROPOSED 74TH STREET STORM DRAIN
(Auto Storm Model)

Oak Street Storm Drain
project # 98514

Hydraulic Calculations of Existing dual 48" RCP's in Oak Street from 74th to Miller.

The following Auto-storm model calculate the Hydraulic Grade Line in the existing dual 48" RCP pipes located between 74th Street and the proposed junction structure, of the mainline, located at Miller and Oak. To simplify the calculation only one pipe will be modeled conveying 50% of the flow. The starting WSEL, at the junction, is based on the HGL of the mainline at the structure, and is: 1215.63.

Once the upstream WSEL is determined it is input into the second Auto-storm model and the proposed storm drain (future) for 74th street is calculated. This allows us to design the connector pipe for the lateral which will be plugged after the first catch basin inlet located north of the intersection of 74th and Oak.

The stationing used for these two models is based on the physical location of the manhole, of the two 48" RCP's located in the intersection of Oak and 74th. This station is consistent with the plans developed for this study. Stationing both up and downstream from this point is based on either lengths of existing pipe or proposed distances to catch basins.

The existing/proposed storm drain is sized to be able to convey the entirety of drainage areas 1a, 2a, 2b, 3a, 3b, 3c and 3d, & 50% of 3e

Nov 12, 1998 13:30:14

INPUT FILE LISTING

```
T1  Existing Oak Street Storm Drain
T2  EEC/MKE
T3  6 Hr 10 Yr Storm in Mainline.
SP      0.25          0  0
SO  16399.001208.20  1                          1215.63
R   17031.441210.70  2       .013                          0.00  0.00  0.00 1
TS  17036.441211.20  3       .013
R   17589.321215.60  4       .013                          0.00  0.00  0.00 1
JX  17595.321215.64  5  0  0.013   16.00   31.001216.501216.50 90.00 90.00
R   17635.391215.80  6       .013                          0.00  0.00  0.00 0
SH  17635.391215.80  7                          1218.80
```

— JX @ OAK & MILLER

— Transition at 74 WAY & OAK

— JX @ OAK & 74th

```
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                       4.00
  CD      2    4                       4.00
  CD      3    4                       3.50
  CD      4    4                       3.50
  CD      5    4                       3.50
  CD      6    4                       3.50
  CD      7    4                       3.50

                    DESIGN OPTIMIZATION VALUES

        MINIMUM MAXIMUM  MIN   MIN   MAX   MAX   MIN   MAX  DESIRED  MIN
 ID ELM  INVERT  INVERT  DIAM WIDTH  DIAM WIDTH VELOC VELOC   WSE   COVER

 OP   1 1208.20 1208.20  4.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   2 1208.20 1208.20  4.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   3 1208.20 1208.20  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   4 1208.20 1208.20  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   5 1208.20 1208.20  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   6 1208.20 1208.20  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   7 1208.20 1215.80  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00

1                                                                                                          PAGE NO    1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0
0HEADING LINE NO 2 IS -
0
0HEADING LINE NO 3 IS -
0                                  6 Hr 10 Yr Storm in Mainline.
0Box culverts have two fillets with an area of 0.25
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
                                   16399.00 1208.20    1                                      1215.63
0 ELEMENT NO    2 IS A REACH            *          *      *
                       U/S DATA   STATION    INVERT  SECT              N                   RADIUS  ANGLE  ANG PT  MAN H
                                   17031.44 1210.70    2           0.013                      0.00   0.00    0.00      1
```

```
0 ELEMENT NO   3 IS A TRANSITION        *         *     *
                U/S DATA   STATION    INVERT  SECT                N
                           17036.44 1211.20    3               0.013
0 ELEMENT NO   4 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           17589.32 1215.60    4               0.013                                 0.00    0.00    0.00      1
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
                           17595.32 1215.64    5     0     0  0.013     16.0     31.0  1216.50  1216.50  90.00   90.00
0 ELEMENT NO   6 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           17635.39 1215.80    6               0.013                                 0.00    0.00    0.00      0
0 ELEMENT NO   7 IS A SYSTEM HEADWORKS                  *                 *
                U/S DATA   STATION    INVERT  SECT                                        W S ELEV
1                                                                                                                        PAGE    1
                                                WATER SURFACE PROFILE LISTING
                          Existing Oak Street Storm Drain
                          EEC/MKE
                          6 Hr 10 Yr Storm in Mainline.
0 STATION     INVERT   DEPTH     W.S.        Q       VEL     VEL     ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
               ELEV   OF FLOW    ELEV                        HEAD   GRD.EL.   ELEV   DEPTH              DIA   ID NO.        PIER
0 L/ELEM       SO                                          SF AVE     HF                NORM DEPTH                    ZR
*****************************************************************************************************************************
0 16399.00  1208.20     7.43   1215.63      48.0    3.82    0.23   1215.86   0.00    2.08              4.00    0.00   0.00   0   0.00  — OAK & MILLER
0   632.44  0.00395                                      0.00112      0.71                   2.07                    0.00
0 17031.44  1210.70     5.65   1216.35      48.0    3.82    0.23   1216.57   0.00    2.08              4.00    0.00   0.00   0   0.00
0TRANS STR  0.10000                                      0.00170      0.01                                           0.00
0 17036.44  1211.20     5.03   1216.23      48.0    4.99    0.39   1216.61   0.00    2.16              3.50    0.00   0.00   0   0.00  — OAK & 74th WAY
0   270.60  0.00796                                      0.00226      0.61                   1.82                    0.00
0 17307.04  1213.35     3.50   1216.85      48.0    4.99    0.39   1217.24   0.00    2.16              3.50    0.00   0.00   0   0.00
0    48.83  0.00796                                      0.00212      0.10                   1.82                    0.00
0 17355.87  1213.74     3.18   1216.92      48.0    5.23    0.43   1217.34   0.00    2.16              3.50    0.00   0.00   0   0.00
0    24.66  0.00796                                      0.00206      0.05                   1.82                    0.00
0 17380.53  1213.94     2.99   1216.93      48.0    5.49    0.47   1217.39   0.00    2.16              3.50    0.00   0.00   0   0.00
0    19.07  0.00796                                      0.00223      0.04                   1.82                    0.00
0 17399.60  1214.09     2.83   1216.92      48.0    5.76    0.51   1217.44   0.00    2.16              3.50    0.00   0.00   0   0.00
0    15.36  0.00796                                      0.00245      0.04                   1.82                    0.00
0 17414.96  1214.21     2.70   1216.91      48.0    6.04    0.57   1217.47   0.00    2.16              3.50    0.00   0.00   0   0.00
0    12.49  0.00796                                      0.00272      0.03                   1.82                    0.00
0 17427.44  1214.31     2.57   1216.88      48.0    6.33    0.62   1217.51   0.00    2.16              3.50    0.00   0.00   0   0.00
0     3.44  0.00796                                      0.00292      0.01                   1.82                    0.00
0 17430.89  1214.34     2.54   1216.88      48.0    6.42    0.64   1217.52   0.00    2.16              3.50    0.00   0.00   0   0.00
0HYDRAULIC JUMP                                                                                                      0.00
0 17430.89  1214.34     1.83   1216.17      48.0    9.41    1.38   1217.55   0.00    2.16              3.50    0.00   0.00   0   0.00
0    67.26  0.00796                                      0.00768      0.52                   1.82                    0.00
0 17498.15  1214.87     1.85   1216.72      48.0    9.30    1.35   1218.07   0.00    2.16              3.50    0.00   0.00   0   0.00
0    59.61  0.00796                                      0.00711      0.42                   1.82                    0.00
0 17557.75  1215.35     1.92   1217.27      48.0    8.87    1.22   1218.49   0.00    2.16              3.50    0.00   0.00   0   0.00
0    20.95  0.00796                                      0.00628      0.13                   1.82                    0.00
0 17578.70  1215.52     2.00   1217.51      48.0    8.46    1.11   1218.62   0.00    2.16              3.50    0.00   0.00   0   0.00
0     8.33  0.00796                                      0.00555      0.05                   1.82                    0.00
0 17587.03  1215.58     2.08   1217.66      48.0    8.06    1.01   1218.67   0.00    2.16              3.50    0.00   0.00   0   0.00
0     2.29  0.00796                                      0.00491      0.01                   1.82                    0.00
0 17589.32  1215.60     2.16   1217.76      48.0    7.69    0.92   1218.68   0.00    2.16              3.50    0.00   0.00   0   0.00
0JUNCT STR  0.00667                                      0.00230      0.01                                           0.00  — OAK & 74th ST.
0 17595.32  1215.64     3.58   1219.22       1.0    0.10    0.00   1219.22   0.00    0.30              3.50    0.00   0.00   0   0.00
0    20.67  0.00399                                      0.00000      0.00                   0.31                    0.00
0 17615.99  1215.72     3.50   1219.22       1.0    0.10    0.00   1219.22   0.00    0.30              3.50    0.00   0.00   0   0.00
0    19.40  0.00399                                      0.00000      0.00                   0.31                    0.00
0 17635.39  1215.80     3.42   1219.22       1.0    0.10    0.00   1219.22   0.00    0.30              3.50    0.00   0.00   0   0.00
```

Nov 12, 1998 13:52:50

INPUT FILE LISTING

```
T1  Proposed (future) storm drain in 74th Street
T2  EEC/MKE
T3  6 Hr 10 Yr Storm in Mainline.
SP      0.25          0  0
SO  17587.001216.00  1                          1219.22
R   18242.001218.75  2       .013                          0.00  0.00  0.00 0
JX  18247.001218.79  3  0  0.013   43.00    0.001219.50   0.00 90.00  0.00
R   18907.631221.50  4       .013                          0.00  0.00  0.00 0
SH  18907.631221.50  5                          1227.50
1                                                   SP
```

- OAK & 74th ST
- 74th ST & Sheridan
- 74th ST & Virginia

```
                                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                       3.50
  CD      2    4                       3.50
  CD      3    4                       3.00
  CD      4    4                       3.00
  CD      5    4                       3.00

                DESIGN OPTIMIZATION VALUES

        MINIMUM MAXIMUM  MIN   MIN   MAX   MAX   MIN   MAX  DESIRED  MIN
 ID ELM  INVERT  INVERT  DIAM WIDTH  DIAM WIDTH VELOC VELOC   WSE   COVER

 OP   1 1216.00 1216.00  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   2 1216.00 1216.00  3.50  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   3 1216.00 1216.00  3.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   4 1216.00 1216.00  3.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00
 OP   5 1216.00 1221.50  3.00  0.00  0.00  0.00  0.10 20.00 1000.00  2.00

1                                                                                                          PAGE NO    1
0                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0
0HEADING LINE NO 2 IS -
0
0HEADING LINE NO 3 IS -
0                              6 Hr 10 Yr Storm in Mainline.
0Box culverts have two fillets with an area of 0.25
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
                                  17587.00 1216.00    1                                     1219.22
0 ELEMENT NO    2 IS A REACH             *         *     *
                       U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                  18242.00 1218.75    2                0.013                                 0.00   0.00   0.00      0
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
                                  18247.00 1218.79    3     0     0  0.013    43.0      0.0  1219.50     0.00  90.00    0.00
0 ELEMENT NO    4 IS A REACH             *         *     *
                       U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                                  18907.63 1221.50    4                0.013                                 0.00   0.00   0.00      0
```

0 ELEMENT NO 5 IS A SYSTEM HEADWORKS * *
U/S DATA STATION INVERT SECT W S ELEV

1

WATER SURFACE PROFILE LISTING

Proposed (future) storm drain in 74th Street
EEC/MKE
6 Hr 10 Yr Storm in Mainline.

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 17587.00	1216.00	3.22	1219.22	63.0	6.80	0.72	1219.94	0.00	2.49		3.50	0.00	0.00	0	0.00	74th ST & OAK.
0 184.08	0.00420					0.00351	0.65			2.77			0.00			
0 17771.08	1216.77	3.02	1219.79	63.0	7.14	0.79	1220.59	0.00	2.49		3.50	0.00	0.00	0	0.00	
0 194.11	0.00420					0.00378	0.73			2.77			0.00			
0 17965.19	1217.59	2.86	1220.45	63.0	7.48	0.87	1221.32	0.00	2.49		3.50	0.00	0.00	0	0.00	
0 276.81	0.00420					0.00407	1.13			2.77			0.00			
0 18242.00	1218.75	2.77	1221.52	63.0	7.71	0.92	1222.45	0.00	2.49		3.50	0.00	0.00	0	0.00	
0JUNCT STR	0.00801					0.00255	0.01						0.00			74th ST & SHERIDAN
0 18247.00	1218.79	4.49	1223.28	20.0	2.83	0.12	1223.41	0.00	1.43		3.00	0.00	0.00	0	0.00	
0 466.69	0.00410					0.00089	0.42			1.44			0.00			
0 18713.69	1220.70	3.00	1223.70	20.0	2.83	0.12	1223.83	0.00	1.43		3.00	0.00	0.00	0	0.00	
0 81.28	0.00410					0.00084	0.07			1.44			0.00			
0 18794.97	1221.04	2.72	1223.76	20.0	2.97	0.14	1223.90	0.00	1.43		3.00	0.00	0.00	0	0.00	
0 44.80	0.00410					0.00081	0.04			1.44			0.00			
0 18839.77	1221.22	2.56	1223.78	20.0	3.11	0.15	1223.93	0.00	1.43		3.00	0.00	0.00	0	0.00	
0 36.62	0.00410					0.00088	0.03			1.44			0.00			
0 18876.39	1221.37	2.43	1223.80	20.0	3.26	0.17	1223.96	0.00	1.43		3.00	0.00	0.00	0	0.00	
0 31.24	0.00410					0.00097	0.03			1.44			0.00			
0 18907.63	1221.50	2.31	1223.81	20.0	3.42	0.18	1224.00	0.00	1.43		3.00	0.00	0.00	0	0.00	74th ST. & VIRGINIA AVE

1

APPENDIX B5
CATCH BASINS
(East of Cross Cut Canal)

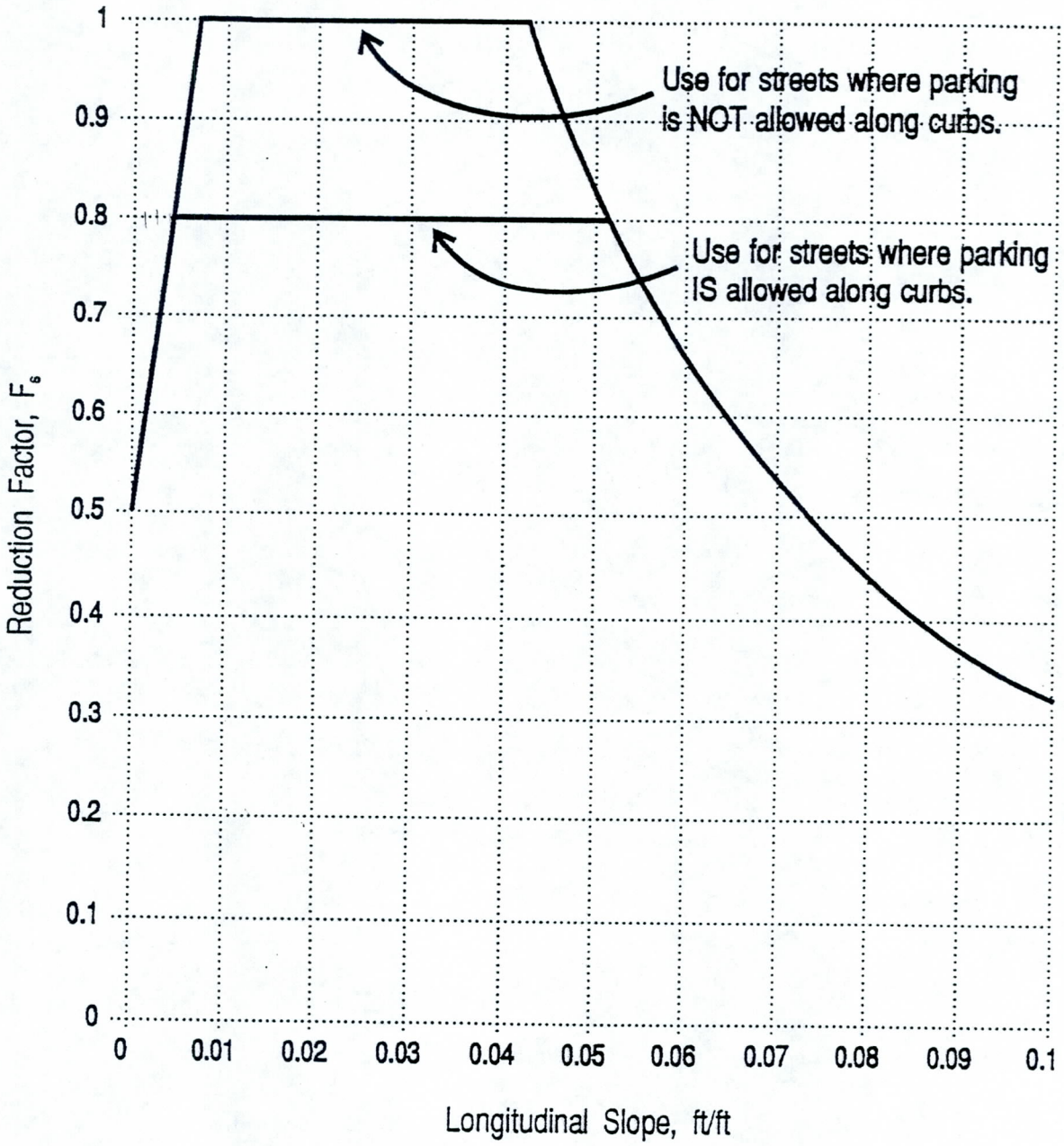


Figure 3.4
Gutter Capacity Reduction Factors

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:

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

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

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title OAK STREET STORM DRAIN Project No. 98512 Date 12-21-98

Subject Design Criteria for Catch basins Designed LAV Page

Design CRITERIA FOR STREET DRAINAGE

- FCDMC Volume II HYDRAULICS

with exception #1

1. The spread criteria was reduced from 2-12' lanes To 2-8' Lanes with the Aproval of the P.M. For FCDMC.

Table B5.1: Index of Inlets

Page #	Type	Station	Total Length	New or Existing	Drainage Area
1	M1, L=17	135+40, LT	20	new	9c
2	M1, L=17	135+77, RT	20	new	9b
3	M1, L=17	136+59.7, RT	20	new	9a
4	M1, L=17	137+30, RT	20	new	FB: 9a+9b
5	M1, L=10	141+80, LT	13	new	8b
6	M1, L=10	143+13, RT	13	new	FB + 8a
7	Slotted Drain	149+19 to 46, LT	27	existing	7c
8	Grate Inlet	149+48, LT	3	existing	7c
9	M1, L=10	147+29, RT	13	new	8a
10	Slotted Drain	149+48, RT	62	existing	FB + 7a
11	M2, L=17	150+17, RT	37	new	FB 7a
12	Slotted Drain	156+21, LT	20	existing	6c
13	Slotted Drain	156+36, RT	20	existing	6b
14	M1, L=17	157+29, RT	20	new	6a
15	M2, L=17	161+68, LT	37	existing	5b
16	M2, L=17	161+68, RT	37	existing	5a
17	M1, L=17	166+81, RT	20	new	4a
18	M1, L=10	166+72, LT	13	new	4b
19	M1, L=10	167+74, LT	13	existing	FB +4b
20	M1, L=10	171+50, LT	13	new	FB +1/2 3c
21	M1, L=10	171+50, RT	13	new	FB +1/2 3b
22	M1, L=9	175+11, RT	12	existing	3b
24	M1, L=10	175+96, LT	13	new	3d
25	M1, L=10	176+31, LT	13	new*	3c & 3d, fb
26	Q(triple),L=10	175+93, RT	13	new	3a
27	M1, L=3	176+24, RT	6	existing	3a & 3b, fb
28	M2, L=17	180+48, RT	37	new*	FB + 2a
29	M1, L=17	180+48, LT	20	new*	FB + 2b
30	M1, L=3	184+89, RT	6	existing	1a

* Sta. 176+31 (LT), replace existing M1, L=12 with new M1, L=10
* Sta. 180+48 (LT), replace existing M1, L=12 with new M1, L=10
* Sta. 180+48 (RT), replace existing M1, L=7 with new M2, L=17

Drainage Area 9C

CB ID: 9C

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 1

Station 135+40 22'LT **Location** NW of OAK & 68th ST.

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

n = 0.016
S(x) = 0.021
S = 0.0095
T = 13.5' Allowable spread
F(s) = 0.8

$Q_T = \left(\frac{0.56}{0.016}\right) 0.021^{1.67} \, 0.0095^{.5} \, 13.5^{2.67}$

$Q_T = 5.6$ cfs

$Q_{CAP} = Q_T * F_s$
$= 5.6 * 0.8$

$Q_{cap} = 4.50$ cfs $\approx$ 5.0 cfs

S(x) = ave of 0, 50, & 100 ft u/s of inlet

Q at this location = 5 cfs (Subbasin 9C)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 1A)
L(t) = total length required for curb opening to capture entire flow is 36 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - \left(1 - \frac{20}{36}\right)^{1.8}$

$= 0.77$

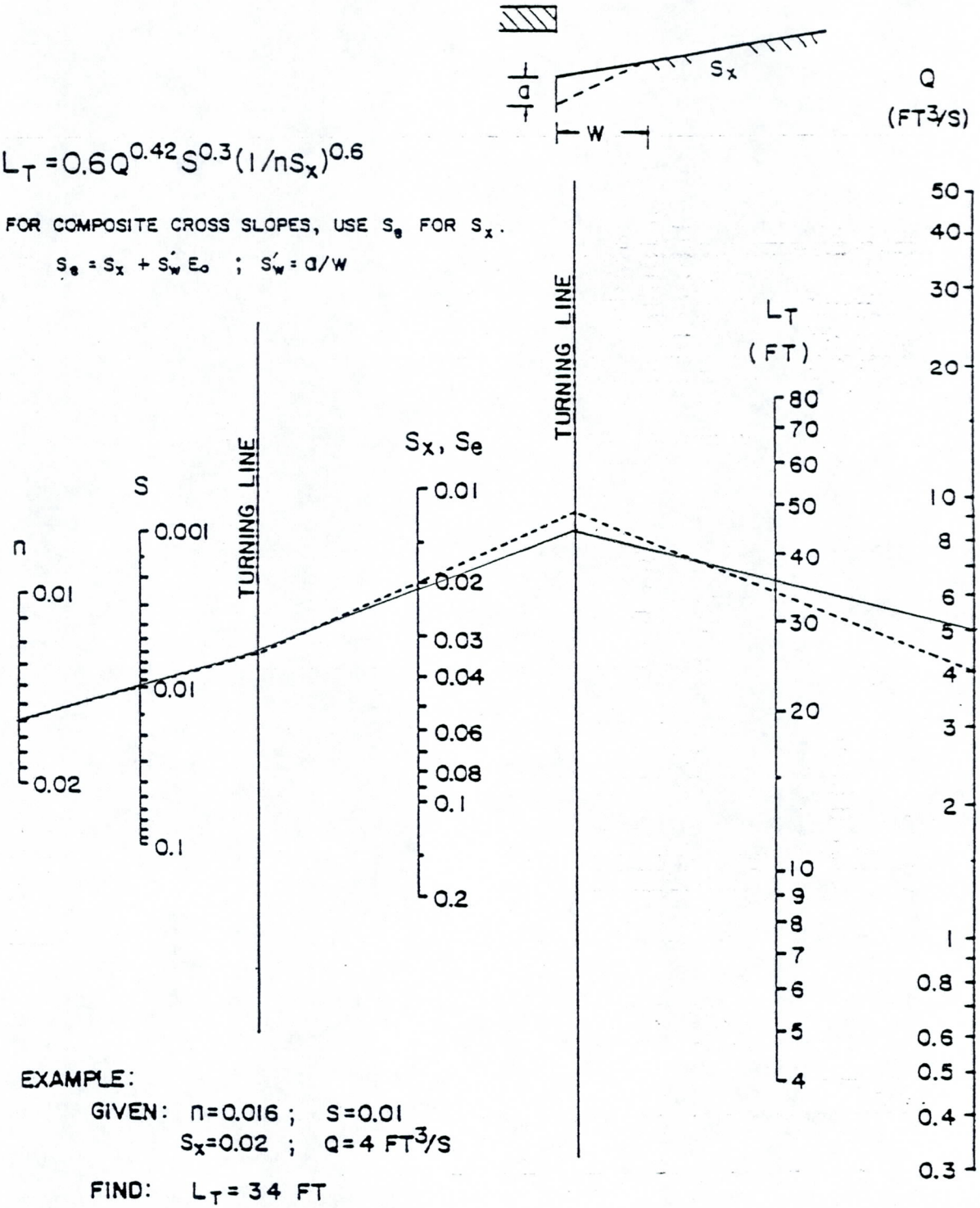
$\therefore Q_i = 0.77 \; (5\text{cfs}) \; (0.8)$

$Q_i = 3.08 \approx$ 3 cfs

Install a 3' CB w/ 17 ft. wing Type: M 1, L = 17

Flow by = 2 cfs.

1A



$L_T = 36'$

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA 9B

2

Oak Street - Design and locate Catch Basins

CB ID : 9B

Project # 98514
Date: 12-19-98
Designed by: lav

page # 2

Station 135+77 22'RT **Location** SW Corner OAK & 68th ST

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.025^{1.67}\ 0.0071^{0.5}\ 13.5^{2.67}$

$Q_T = 6.50$

$Q_{cap} = 6.50 \times F_s$

$= 6.50 \times 0.8$

$= 5.20$ cfs

n = 0.016
S(x) = 0.025
S = 0.0071
T = 13.5' Allowable Spread
F(s) = 0.8

Q at this location = 6 cfs (DA 9B)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 2A)
L(t) = total length required for curb opening to capture entire flow is 32 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1-\left(1-\frac{20}{32}\right)^{1.8}$

$E = 0.829$

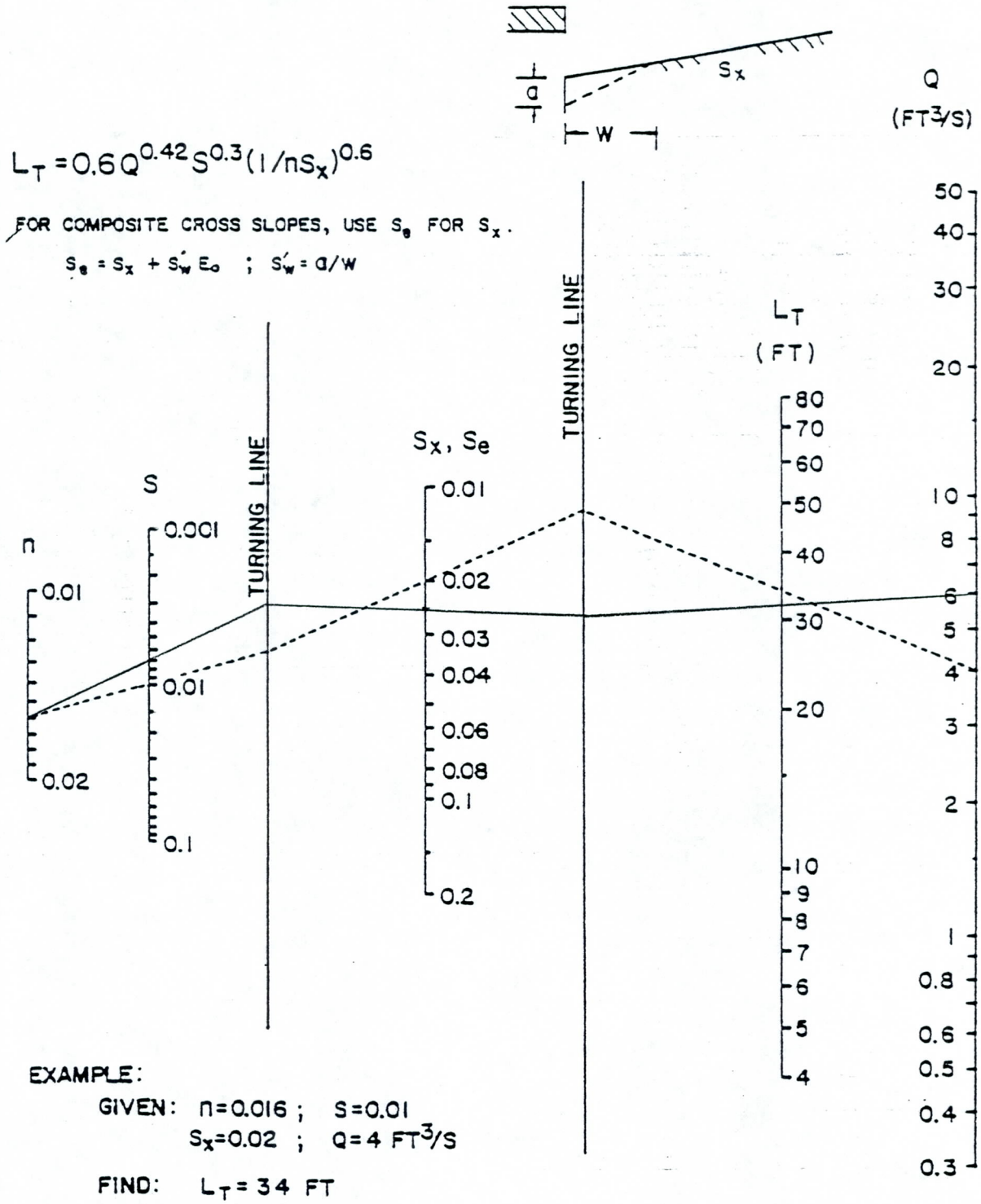
$Q_i = (0.829)(6\text{cfs})(0.8)$

$Q_i = 3.97$ cfs $\simeq$ 4 cfs

Install a 3' CB w/ 17 ft. wing Type: M 1, L = 17

Flow by = 2 cfs.

2A



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$

$S_x = 0.02$; $Q = 4\ FT^3/S$

FIND: $L_T = 34$ FT

$L_T = 32$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA 9A

CB ID : 9A-1

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 3

Station 136+60, RT **Location** SE at 68th & OAK

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

n = 0.016
S(x) = 0.024
S = 0.0028
T = 21 Allowable Spread
F(s) = 0.80
(No parking along 68th ST)

$Q_T = \left(\frac{0.56}{0.016}\right)(0.024)^{1.67}(0.0028)^{0.5}(21)^{2.67}$

$Q_T = 12.4$ cfs

$Q_{cap} = Q_T * F_s$
$= 12.4 \times 0.8$
$= 9.92 \simeq 10$ cfs

T = 9' in Roadway + 12' built back parking lane
S(x) = Ave 0, 50 & 100' u/s

Allow 19cfs so as to minimize The Affect & # of laterals in 68th ST.

Q at this location = 19 cfs (D.A. 9A)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 3A)
L(t) = total length required for curb opening to capture entire flow is 48 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$E = 1 - \left(1 - \frac{20}{48}\right)^{1.8}$

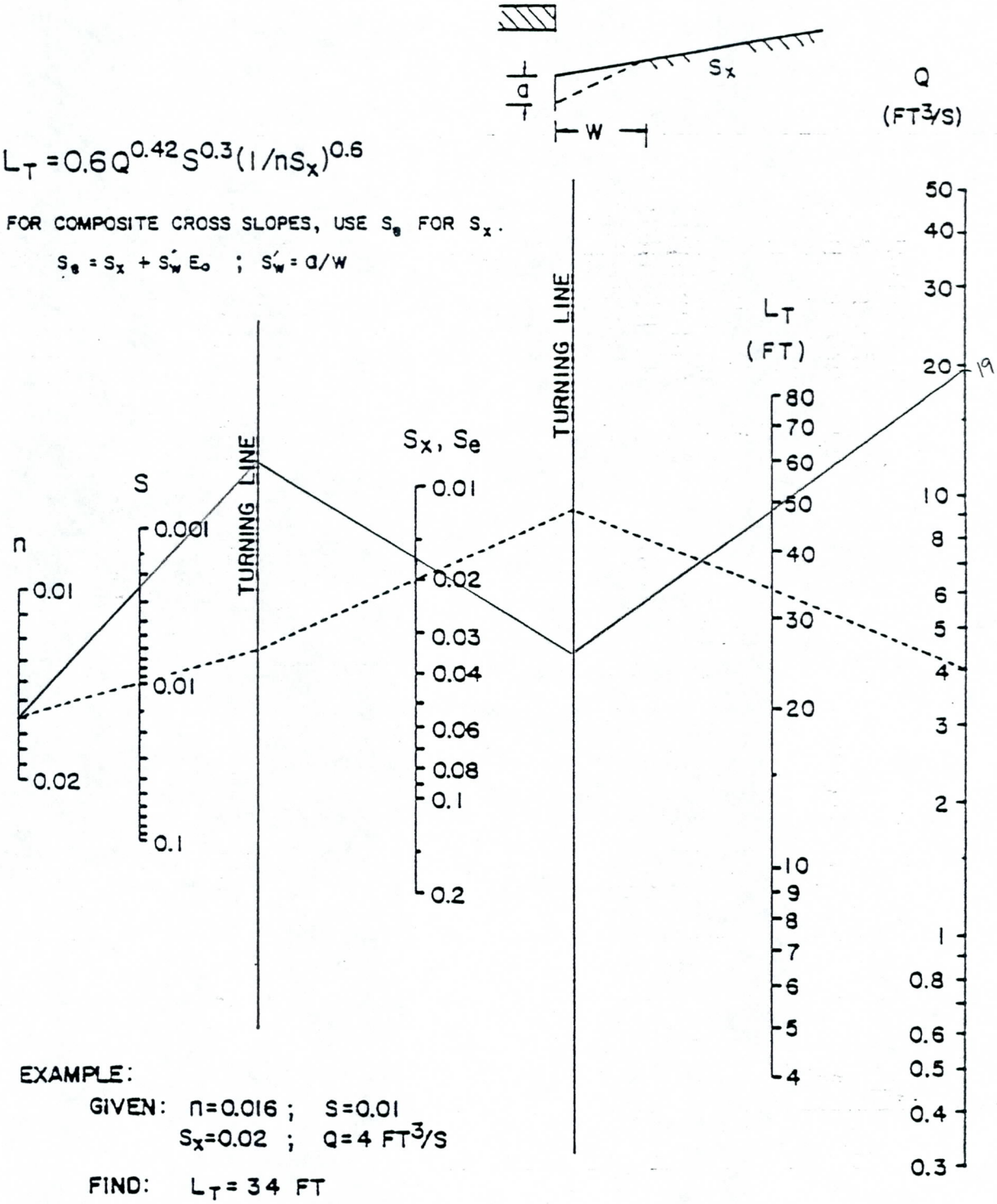
$E = 0.62$

$Q_i = E * Q * 0.8$
$= 0.62 * 19 * 0.8$
$= 9.43 \simeq 9$ cfs

Install a 3' CB w/ 17 ft. wing Type: M 1, L = 17

Flow by = 10 cfs. onto OAK STREET

3A



L_T = 48 ft.

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

FB from 9a & 9b

Oak Street - Design and locate Catch Basins

CB ID : 9A-2

Project # 98514
Date: 12-19-98
Designed by: lav

page # 4

Station 137+28, RT **Location** SE Corner OAK & 68th ST

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

$$Q_T = \left(\frac{0.56}{0.016}\right) 0.043^{1.67}\ 0.0015^{0.5}\ 13.5^{2.67}$$

n = 0.016
S(x) = 0.043
S = 0.0015
T = 13.5'
F(s) = 0.6

$Q_T = 7.38$ cfs

$Q_{CAP} = Q_T * F_s$

$= 7.38 * 0.6$

$= 4.43$ ≈ 4.50 cfs

we have 12 cfs for a short Duration between inlets

F(s) - no parking with 0.0015 slope

Q at this location = 12 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 4A)
L(t) = total length required for curb opening to capture entire flow is 19 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - (1 - \frac{20}{19})^{1.8}$

$E = 0.99$

$Q_c = E * Q * 0.8$

$= 0.99 * 12 * 0.8$

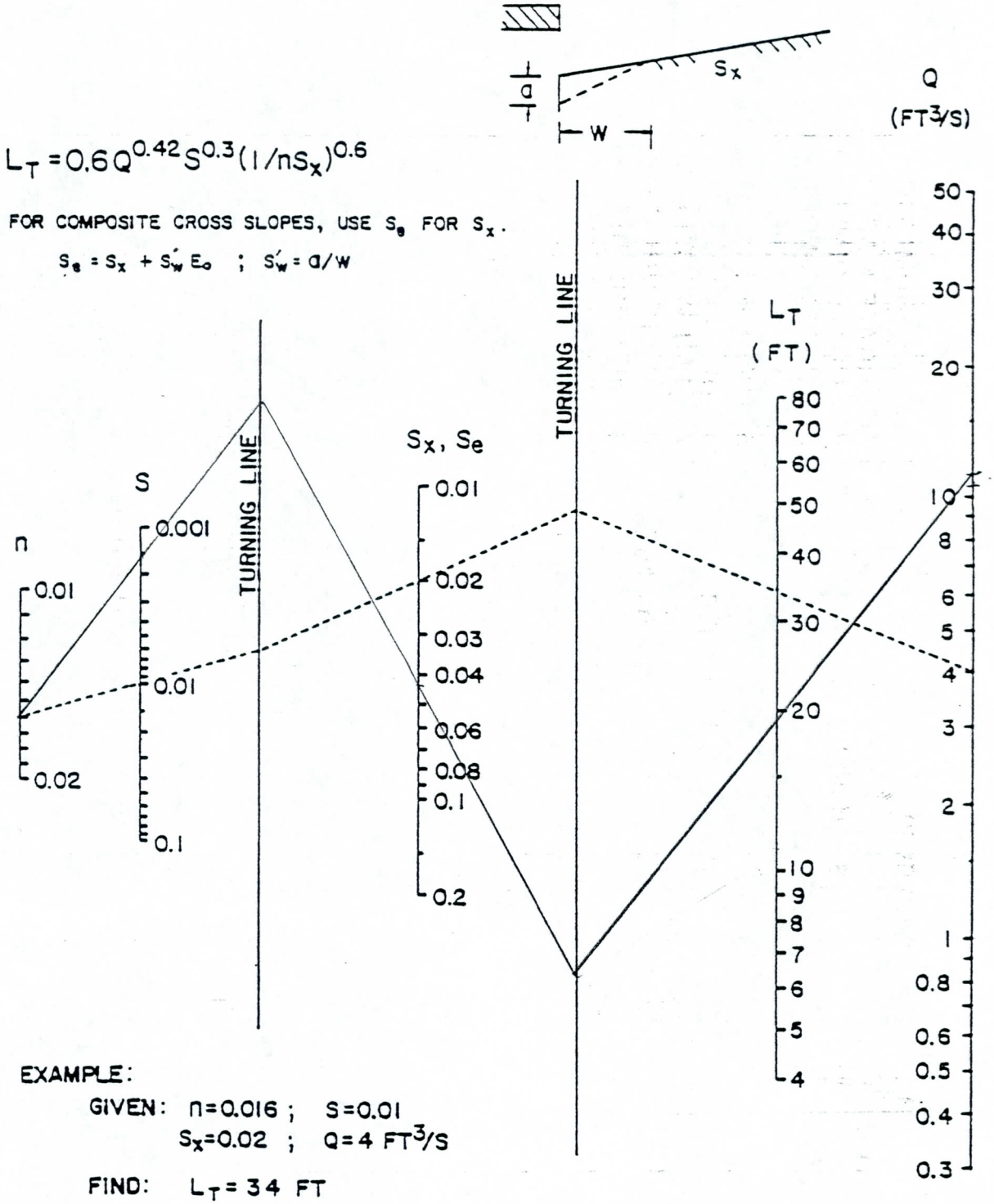
$= 9.50$ cfs

Install a 3' CB w/ 17 ft. wing Type: M | , L = 17

Flow by = 2.50 cfs.

overflow Drainage Area 9A & 9B

4A



L_T = 19 ft.

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA (8B)

CB ID : 8B

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 5

Station 141 + 52, LT **Location** NE corner OAK & 68th Place

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$ F(s) = Gutter Capacity Reduction Factor

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.024^{1.67}\ 0.0038^{.5}\ 13.5^{2.67}$

$Q_T = 5.73$ cfs

$Q_{cap} = 5.73 * .8$

$= \underline{4.60 \text{ cfs}} \simeq 5.0$ cfs

n = 0.016
S(x) = 0.028
S = 0.0038
T = 13.5 - Allowable spread
F(s) = 0.8

S_{∞} = Ave. of 50 & 100' U/S of inlet

Q at this location = 3 (8B) + 2 (FB) = 5 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$ (on-grade)
(see sheet 5A)
L(t) = total length required for ~~Slotted Drain~~ Curb opening to capture entire flow is 25 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - \left(1 - \frac{13}{25}\right)^{1.8}$

$E = 0.73$

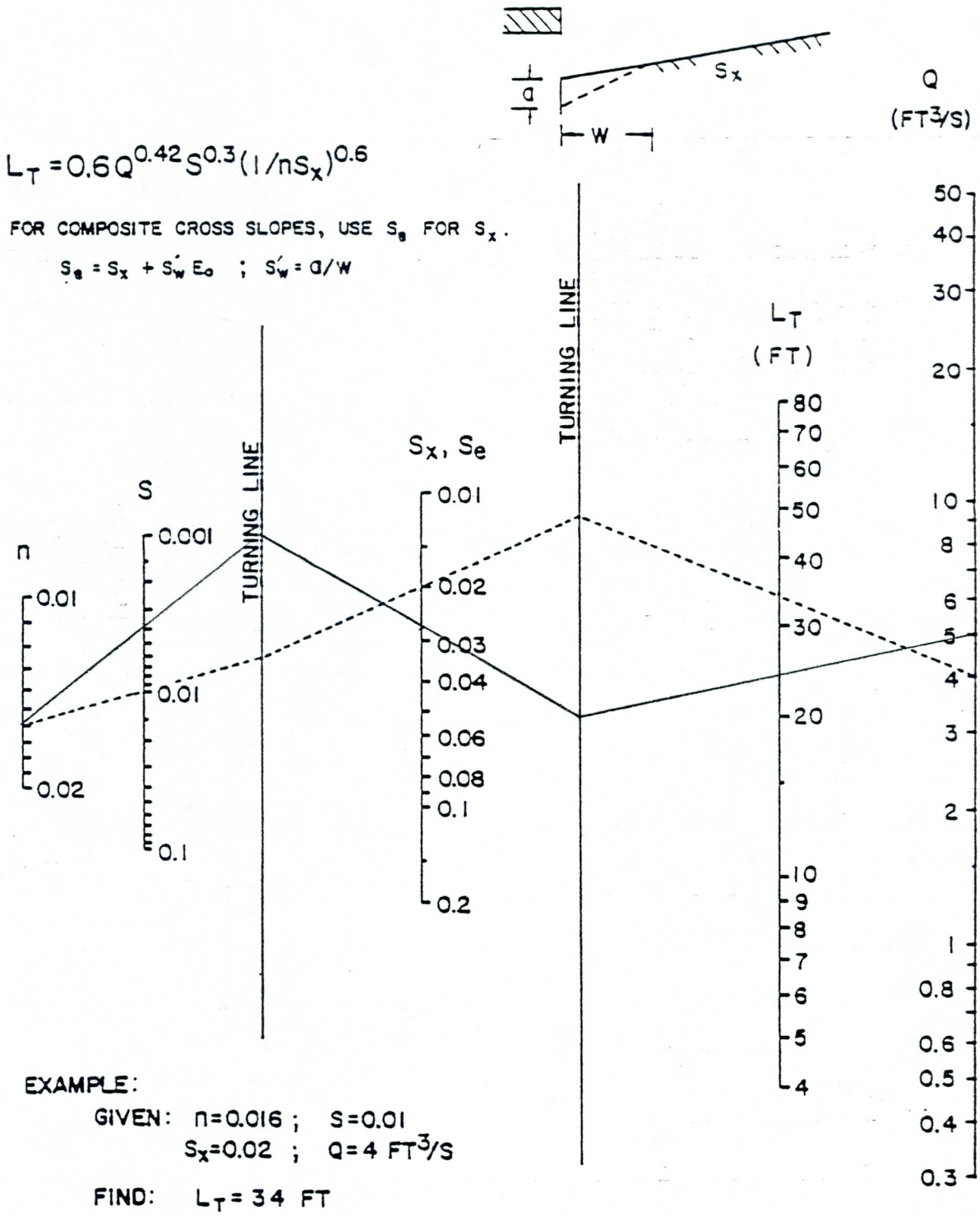
$Q_i = E * Q * 0.8$

$Q_i = 2.93$ cfs $\simeq \underline{3.0 \text{ cfs}}$

Install a 3' CB w/ 10 ft. wing Type: M 1, L = 10

Flow by = 2.0 cfs.

5A



L_T=25 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA (8A)

CB ID: 8A

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 6

Station 143+00 RT **Location** OAK ST. East of 68th Place

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

n = 0.016
S(x) = 0.024
S = 0.012
T = 13.5'
F(s) = 0.8

$Q_T = \left(\frac{0.56}{0.016}\right) 0.024^{1.67}\ 0.012^{0.5}\ 13.5^{(2.67)}$

$Q_T = 7.88$

$Q_{cap} = 7.88 \times 0.8$
$= 6.3$ cfs

S(x) = Ave 50' U/S & 50' D/S

Q at this location = 2(8A) + 2.5(FB) = 4.5 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 6A)
L(t) = total length required for curb opening to capture entire flow is 33 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1-\left(1-\frac{13}{33}\right)^{1.8}$

$E = 0.59$

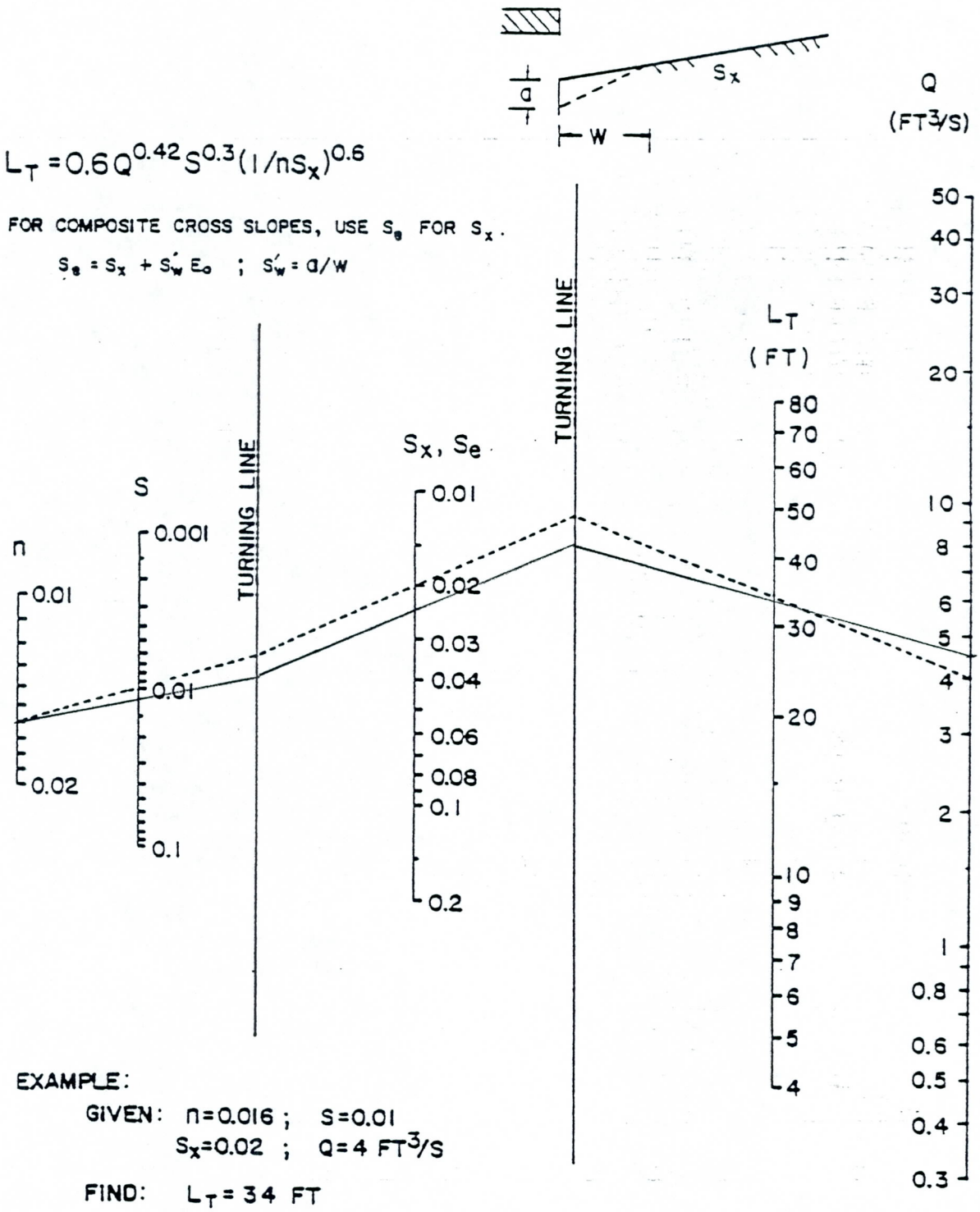
$Q_i = 0.59\ (4.5)(0.8)$

$Q_i = 2.14 \simeq \underline{\underline{2 \text{ cfs}}}$

Install a 3' CB w/ 10 ft. wing Type: M 1, L = 10'

Flow by = 2.5 cfs.

6A



$L_T = 33$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA (7C)

CB ID: 7C-1

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 7

27'LT 23'L

Station 149+19 to 46, LT **Location** OAK & 70th ST (North)

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$ F(s) = Gutter Capacity Reduction Factor

assumptions
& givens

n = 0.016
S(x) = 0.015
S = 0.0087
T = 13.5' Allow. spread
F(s) = 0.8

$Q_T = \left(\frac{0.56}{0.016}\right) 0.015^{1.67} * 0.0087^{.5} * 13.5^{2.67}$

$Q_T = 4.95$

$Q_{cap} = 4.95 \times 0.8$

$Q_{cap.} = 3.95 \simeq 4$ cfs

It is allowable to let a larger flow Reach the existing slotted Drain and The grate inlet in 70th ST

S(x) Ave 0.8 100' U/S of Catch basin

Q at this location = 4(7C) + 2(FB) = 6 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$ (on-grade)
(see sheet 7A)
L(t) = total length required for **Slotted Drain** to capture entire flow is 45 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$

Curb Opening Reduction Factor = 0.8
Slotted DRAIN Reduction Factor = 0.8 on grade

$E = 1 - \left(1 - \frac{27}{45}\right)^{1.8}$

$E = 0.81$

$Q_i = 0.81\,(6)\,0.8$

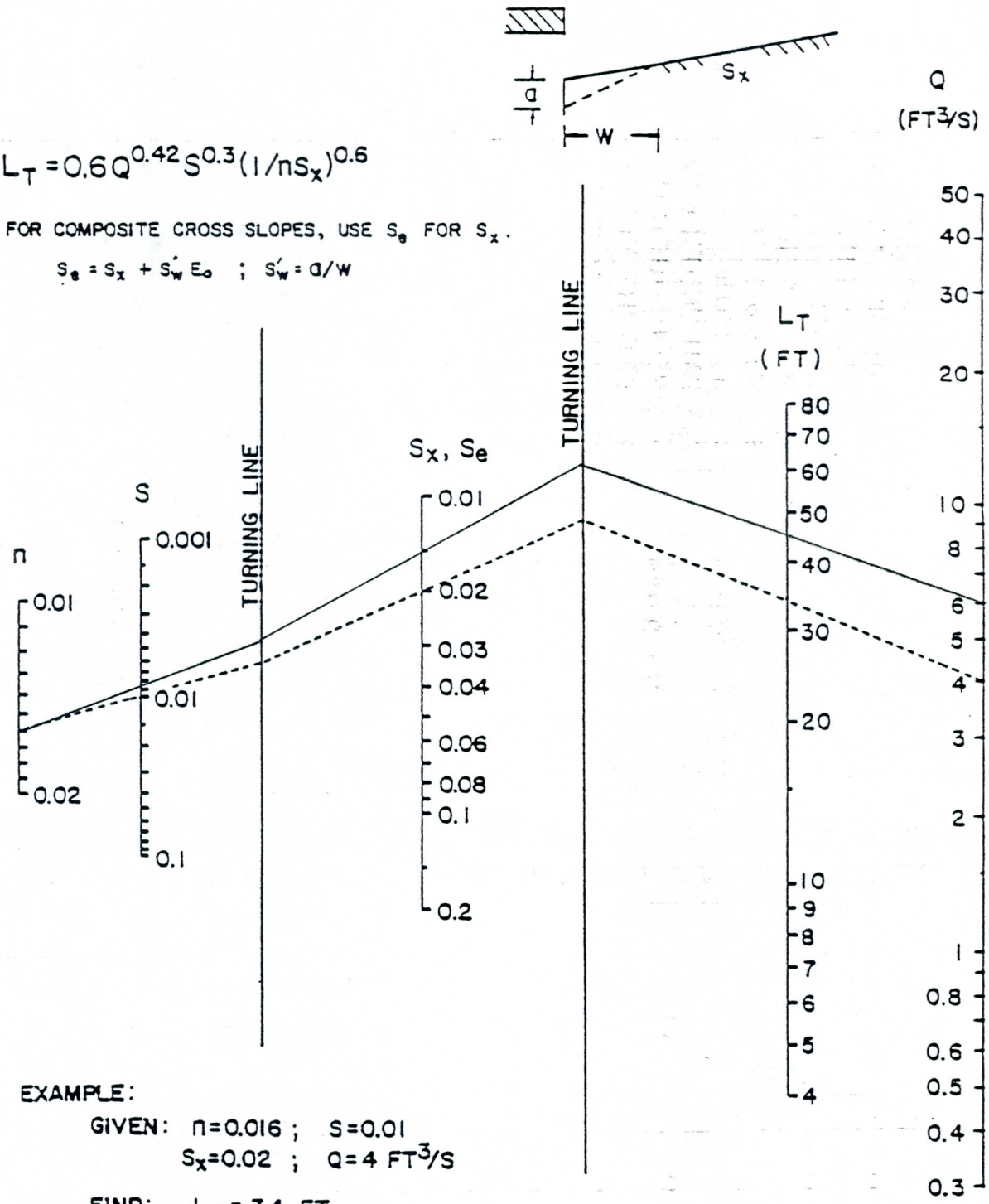
$= 3.89$ cfs $\simeq$ 4 cfs

Install a 3' CB w/ _____ ft. wing Type: M , L =

Existing 27 L.F. Slotted DRAIN

Flow by = 2 cfs.

7A



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$

$S_x = 0.02$; $Q = 4\ FT^3/S$

FIND: $L_T = 34$ FT

$L_T = 45$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

CB ID : 7C-2

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 12/17/98

Subject: Inlet Capacity of GRATED INLET DA (7C) Designed LAV Page 8

70th ST & OAK (North) STA 149+48, 23' LT Existing

3'x3' grated inlet

Sump condition $d = (41.05 - 40.85) = 0.2'$

$Q_i = C_w P d^{1.5}$

$= (3.0)(11)(0.2)^{1.5}$

$= 2.95$ cfs $\times 0.5 (R_f)$

$= \underline{1.475 \text{ cfs}}$ ← $\simeq 1.5$ cfs

$C_w = 3.0$

P = perimeter $= 12' - 48(0.25)'' = 11'$

d = depth

weir flow

$R_F = 0.5$

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

$= 0.67(7.5)[2 * 32.2 * .2]^{0.5}$

$= 18$ cfs $* 0.5 (R_f)$

$= \underline{9.0 \text{ cfs}}$ ←

orifice flow

$C_o = 0.67$

A = Total − Longitudinal Bars

d = depth

$A = (3 \times 3) - 24(36'' \times .25'')/144$

$= \underline{7.5 \text{ ft}^2}$

Using the value obtained from the weir flow eqn for the grated inlet we get 1.5 cfs.

F.B. = 0.5 cfs.

Drainage Area (7B)

CB ID : 7B

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 9

Station 147+29 RT **Location** SE Corner OAK & 69th ST.

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$$Q_T = \left(\frac{0.56}{0.016}\right) 0.027^{1.67}\ 0.007^{.5}\ 13.5^{2.67}$$

n = 0.016
S(x) = 0.027
S = 0.007
Allowable SPREAD T = 13.5 ft
F(s) = 0.8

$= 7.33$ cfs $\times$ 0.8

$Q_{cap} = 5.86 \simeq$ 6 cfs

Q at this location = 2(7B) + 2.5(F5) = 4.5

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 9A)
L(t) = total length required for curb opening to capture entire flow is 27 ft.

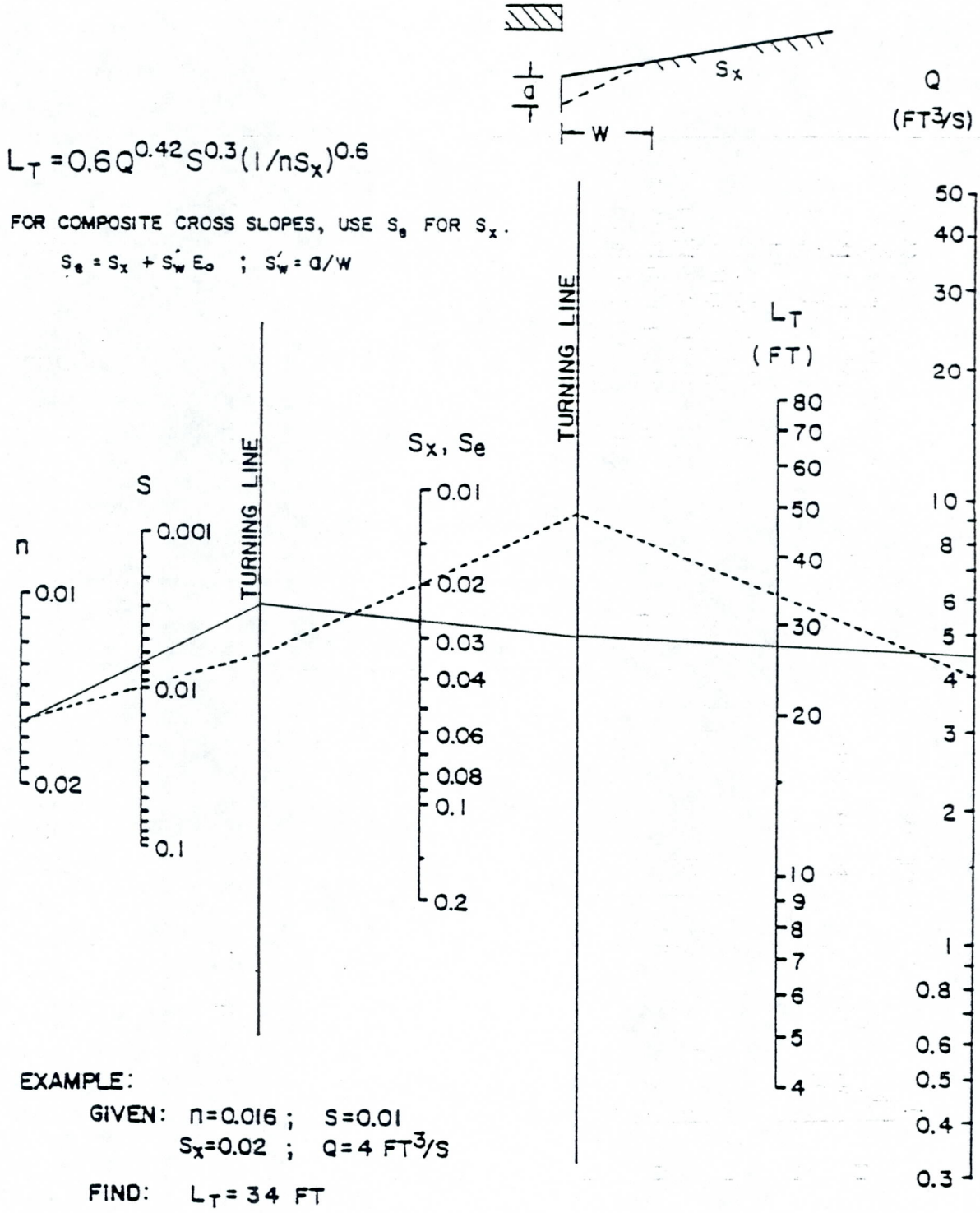
Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$$E = 1 - \left(1 - \frac{13}{27}\right)^{1.8}$$
$$E = 0.69$$
$$Q_i = 0.69\ (4.5)\ 0.8$$
$$= 2.48 \simeq 2.50 \text{ cfs}$$

Install a 3' CB w/ 10 ft. wing Type: M 1, L = 10

Flow by = 2 cfs.

9A



$L_T = 27'$

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

Drainage Area (7A) + F.B.

CB ID : 7A-1

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 10

Station 149+48 RT **Location** South - OAK & 70th ST

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$ F(s) = Gutter Capacity Reduction Factor

assumptions
& givens

n = 0.016
S(x) = 0.020
S = 0.0067
Allowable Spread T = 13.5
F(s) = 0.8

$Q_t = \left(\frac{0.56}{0.016}\right) 0.02^{1.67}\ 0.0067^{0.5}\ 13.5^{2.67}$

$= 4.3$ cfs * 0.8

$Q_{cap} = 3.47$ cfs ≈ 3.5 cfs ←

major inflow from south.

Q at this location = 37(7A) + 2(FB) = 39 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$ (on-grade)
(see sheet 10 A)
L(t) = total length required for **Slotted Drain** to capture entire flow is 80 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$

$1-\left(1-\frac{62}{80}\right)$

$E = 0.93$

$Q_i = 0.93\ (39)\ 0.8$

$= 29.1$ cfs ≈ 29 cfs ←

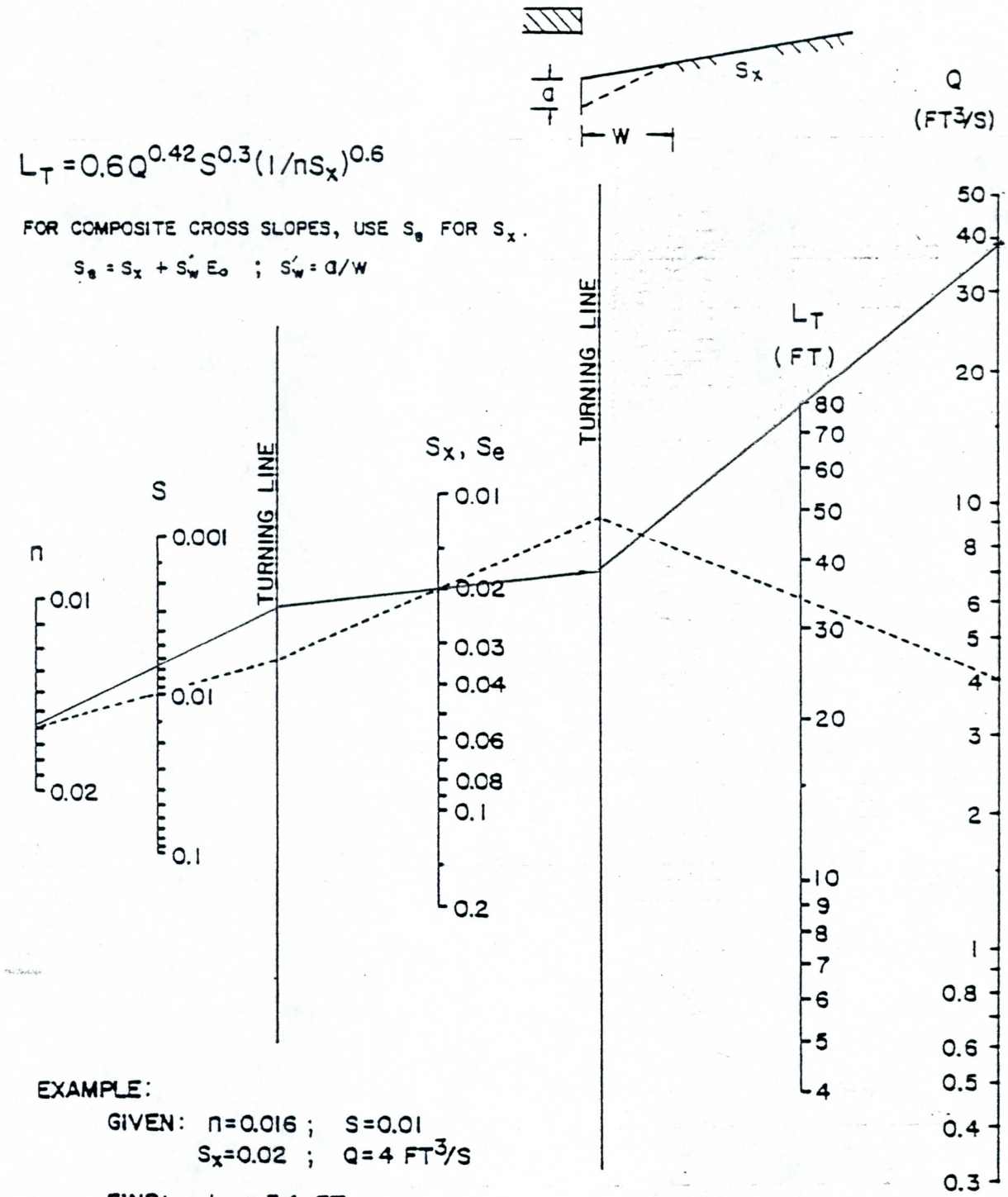
Curb Opening Reduction Factor = 0.8
Slotted DRAIN " " = 0.8

Install a 3' CB w/ _____ ft. wing Type: M , L =

Flow by = 10 cfs.

Existing : 62 LF of Slotted DRAIN

10A



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$

$S_x = 0.02$; $Q = 4$ FT³/S

FIND: $L_T = 34$ FT

$L_T = 80$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

F.B. From 7A

CB ID 7A-2

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 11

Station 150+17 RT **Location** SE corner of OAK & 70th

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

n = 0.016
S(x) = 0.016
S = 0.0088
T = 13.5 ft
F(s) = 0.8

10 cfs flow By exceeds spread criteria Inlet is needed.

S(x) = Ave of 20' D/S + 50' U/S

Q at this location = 10 (F.B. from 7A)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 11A)
L(t) = total length required for curb opening to capture entire flow is 56 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$E = 1 - \left(1 - \frac{37}{56}\right)^{1.8}$

$E = 0.85$

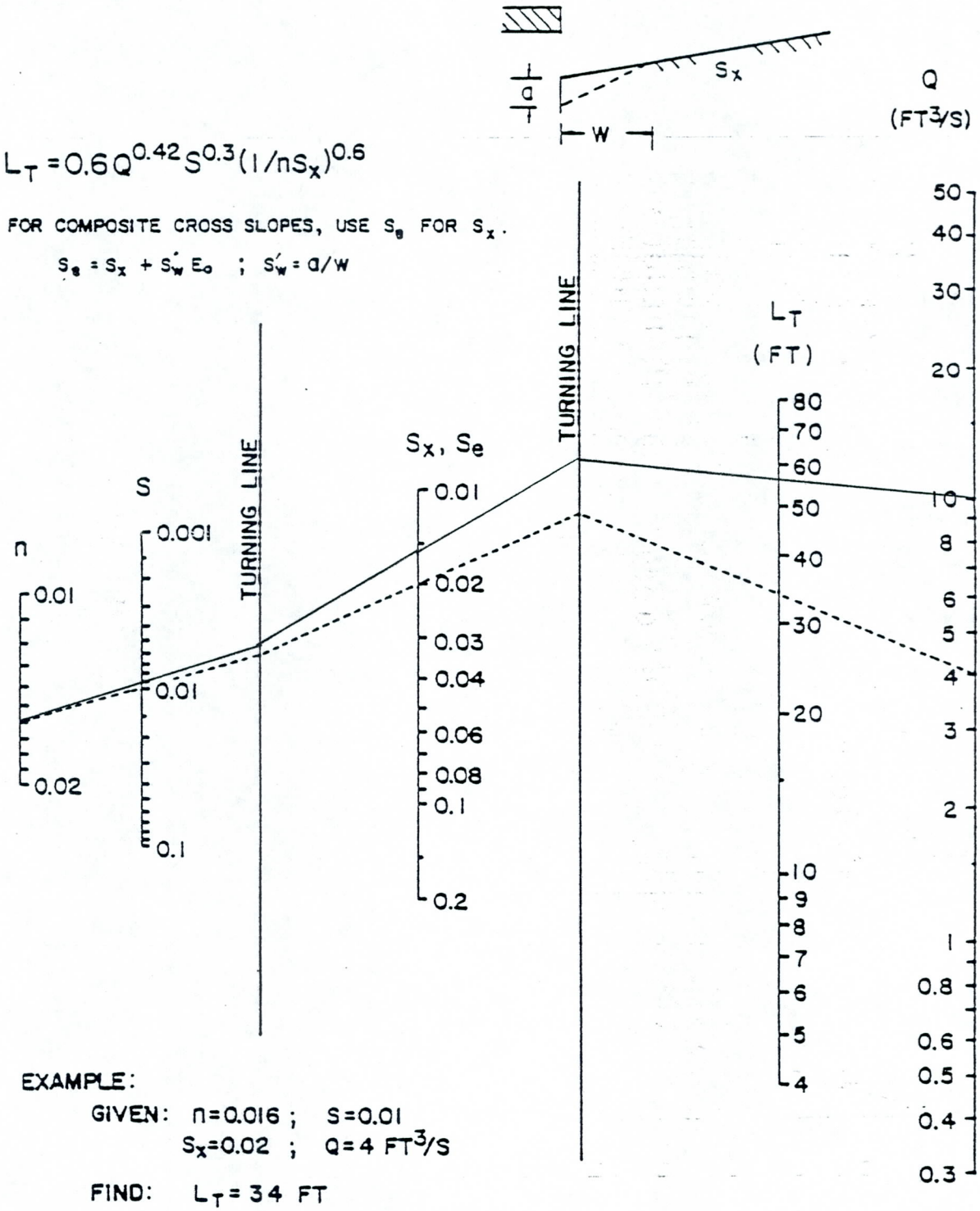
$Q_i = 0.85(10)(0.8)$

$= 6.85 \simeq \underline{7.0 \text{ cfs}}$

Install a 3' CB w/2 - 17 ft. wings Type: M2, L = 17

Flow by = 3 cfs.

11 A



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$
$S_x = 0.02$; $Q = 4$ FT³/S

FIND: $L_T = 34$ FT

$L_T = 56$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

D.A. 6C

CB ID : 6C

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 12

Station 156+21 LT **Location** NW Corner OAK & 71st ST.

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$ F(s) = Gutter Capacity Reduction Factor

assumptions
& givens

$$Q_T = \left(\frac{0.56}{0.016}\right) * 0.028^{1.67}\ 0.0073^{0.5}\ 13.5^{2.67}$$

n = 0.016
S(x) = 0.028
S = 0.0073
T = 13.5
F(s) = 0.8

$Q_{cap} = 7.95 * 0.8$
$= 6.36 \simeq$ 6.5 cfs

Q at this location = 4 (6C) + 0.5 (F.B) = 4.5 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$ (on-grade)
(see sheet 12A)
L(t) = total length required for **Slotted Drain** to capture entire flow is 27 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$

Curb Opening Reduction Factor = 0.8
Slotted Drain " " = 0.8

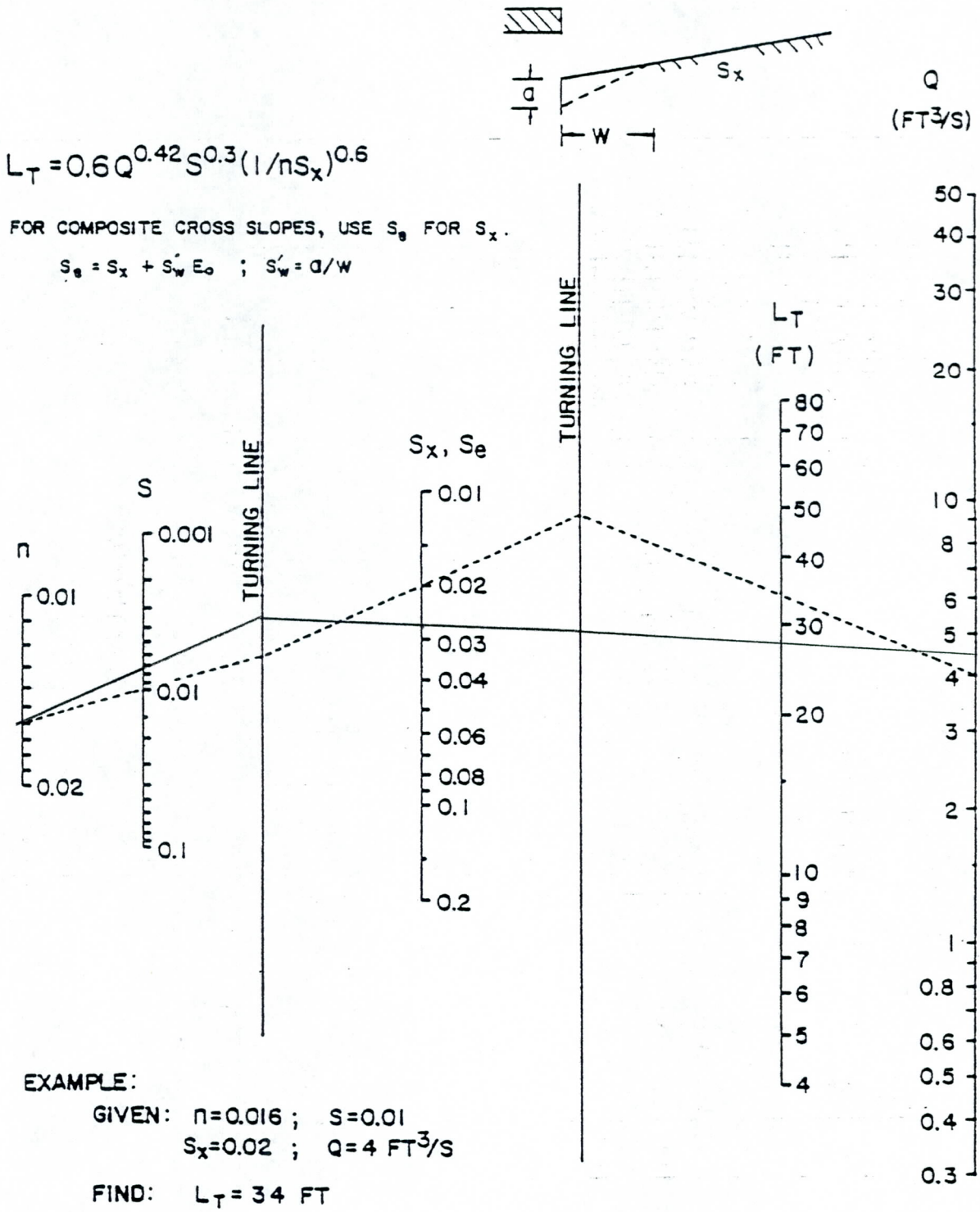
$E = 1 - \left(1 - \frac{20}{27}\right)^{1.8}$
$E = 0.91$
$Q_i = 0.91\ (4.5)\ 0.8$
$Q_i = 3.28 \simeq$ 3.5 cfs

Install a 3' CB w/ _____ ft. wing Type: M , L =

Existing: 20 L.F Slotted DRAIN

Flow by = 1.0 cfs.

12A



$L_T = 27$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

D.A. 6B

CB ID: 6B

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 13

Station 156+36 RT **Location** SW corner OAK & 71st ST

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$ F(s) = Gutter Capacity Reduction Factor

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.032^{1.67}\ 0.0064^{.5}\ 13.5^{2.67}$

n = 0.016
S(x) = 0.032
S = 0.0064
T = 13.5
F(s) = 0.8

$Q_T = 9.3$

$Q_{cap} = 9.3 * 0.8$

$= 7.4$ cfs $\simeq$ 7.5 cfs ←

Q at this location = 3(6B) + 3(F.B.) = 6 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$ (on-grade)
(see sheet 13A)
L(t) = total length required for **Slotted Drain** to capture entire flow is 27 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$

$E = 1 - (1 - \frac{20}{27})^{1.8}$

$= 0.91$

$Q_i = 0.91\ (6)\ 0.8$

$= 4.37 \simeq$ 4.5 cfs ←

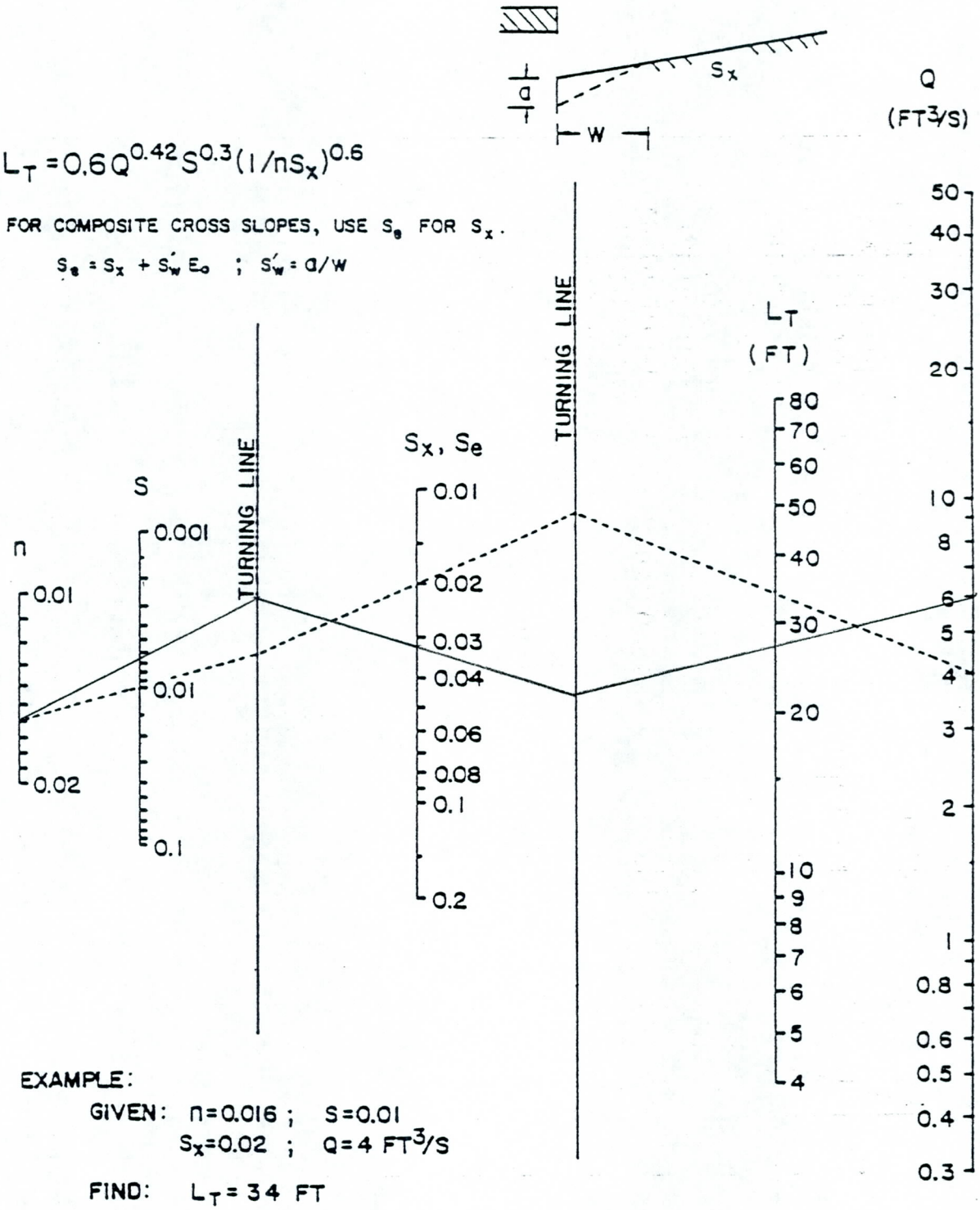
Curb Opening Reduction Factor = 0.8
Slotted Drain " " = 0.8

Install a 3' CB w/ _____ ft. wing Type: M , L =

Flow by = 1.5 cfs.

Existing: 20 L.F. Slotted DRAIN

13 A



$L_T = 27$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

East of 71st ST
Road widens from
43' To 46'

Drainage Area 6A + F.B.

CB ID : 6A

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 14

Station 157+15 RT **Location** SE corner OAK & 71st ST.

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.019^{1.67}\ 0.0056^{.5}\ 15^{2.67}$

n = 0.016
S(x) = 0.019
S = 0.0056
T = 15'
F(s) = 0.8

$Q_T = 4.8$ cfs

$Q_{cap} = 4.8$ cfs * 0.8
$= 3.86$ cfs ≃ 4 cfs

significant inflow from south exceeds spread criteria

Q at this location = 5(6A) + 1.5 (F.B.) = 6.5 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 14A)
L(t) = total length required for curb opening to capture entire flow is 36 ft.

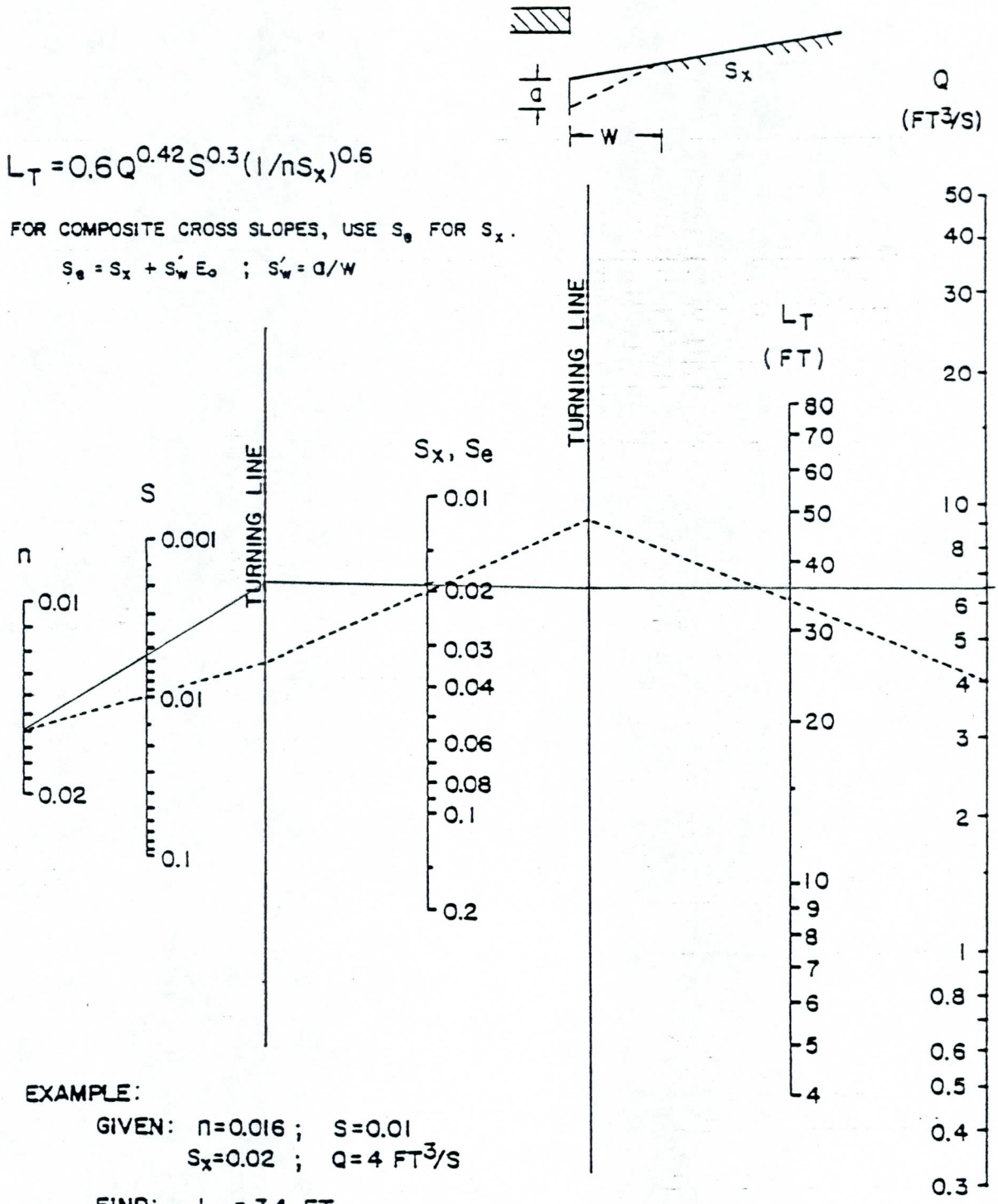
Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8
$= 1 - (1 - 20/36)^{1.8}$
$= 0.76$

$Q_i = 0.76\,(6.5)\,(0.8)$
$= 3.99$ cfs ≃ 4.0 cfs

Install a 3' CB w/ 17 ft. wing Type: M 1, L = 17

Flow by = 2.5 cfs.

14 A



$L_T = 36$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA (5B) + F.B.

CB ID : 5B

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 15

Station 161+68 LT **Location** NW corner OAK & Scottsdale Road

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

n = 0.016
S(x) = 0.028
S = 0.0054
T = 15
F(s) = 0.8

$Q_T = \left(\frac{0.56}{0.016}\right) 0.028^{1.67} * 0.0054^{.5} * 15^{2.67}$

$Q_T = 9.06$

$Q_{cap} = Q_T * 0.8$

$= 7.25 \simeq \underline{7.5 \text{ cfs}}$

Recommend allowing spread to exceed allowable To maximize use of existing MZ-L=17 CB.

Q at this location = 6 (5A) + 2.5 (F.B.) = 8.5 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 15A)
L(t) = total length required for curb opening to capture entire flow is 34 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$

$= 1 - \left(1 - \frac{37}{34}\right)^{1.8}$

$= 1.01$

$Q_i = 1.01 \cdot (8.5)(0.8)$

$= 6.87 \simeq \underline{7 \text{ cfs}}$

Curb Opening Reduction Factor = 0.8
Slotted Drain " " = 0.8

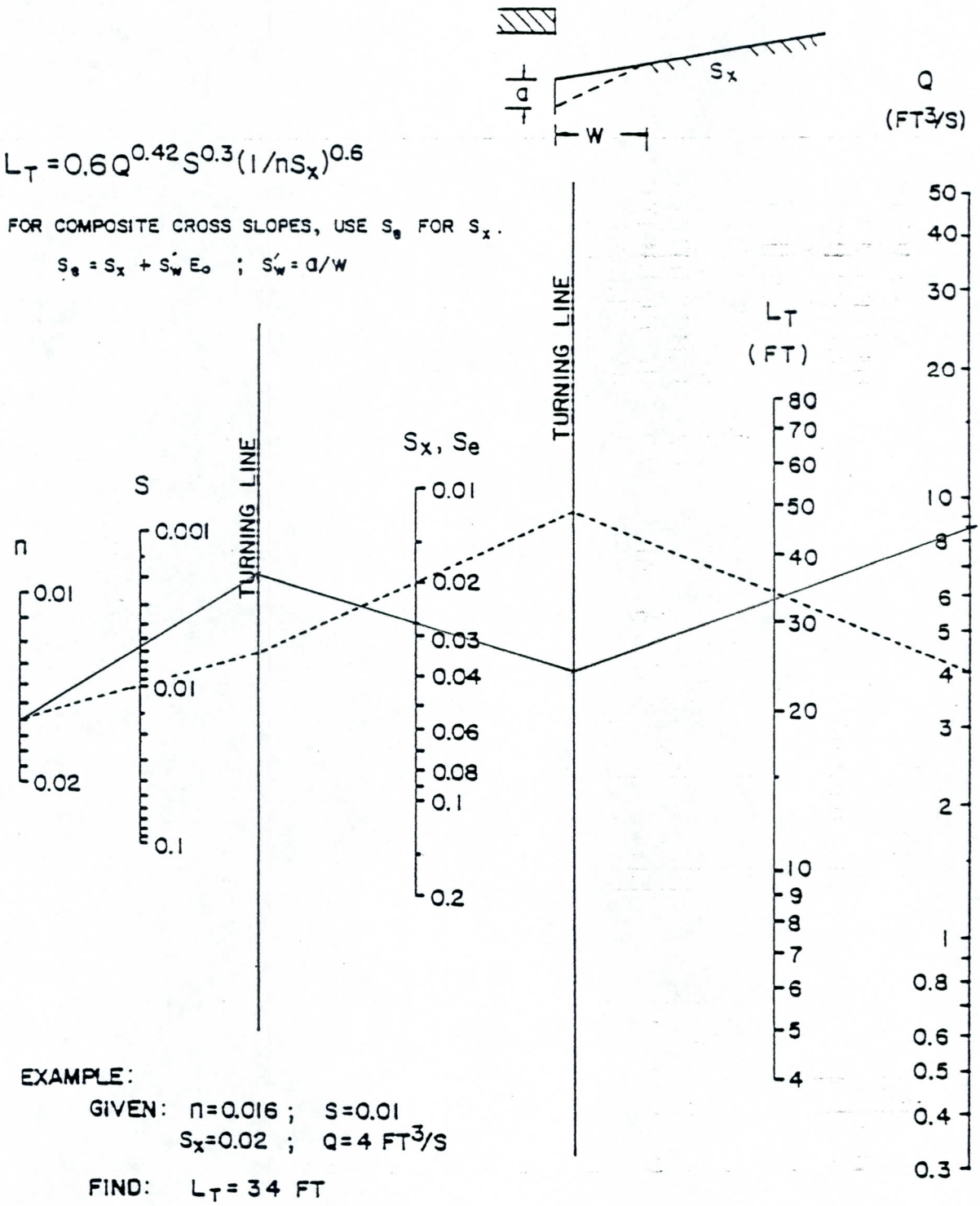
Install a 3' CB w/ _____ ft. wing Type: M , L =

Flow by = 1.5 cfs.

EXISTING MZ L=17

The 1.5 cfs flow by at Scottsdale Road flows to the South Down Scottsdale Road.

15A



$L_T = 34$

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA 5A - F.B

CB ID: 5A

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 16

Station 161+68 RT **Location** SW corner OAK & Scottsdale Road

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.028^{1.67} * 0.006^{.5} * 15^{2.67}$

n = 0.016
S(x) = 0.028
S = 0.006
T = 15
F(s) = 0.8

$Q_T = 9.55$

$Q_{cap} = Q_T * 0.8$

$Q_{cap} = 7.64$ cfs $\simeq$ 7.5 cfs

Q at this location = 4 (SB) + 1.0 (F.B) = 5.0 cfs,

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 16A)
L(t) = total length required for curb opening to capture entire flow is 27 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$

Curb Opening Reduction Factor = 0.8
Slotted Drain " " = 0.8

$E = 1 - (1 - \frac{37}{27})^{1.8}$

$E = 1.17$

$Q_i = 1.17\ (5.0)\ (0.8)$

$Q_i = 4.68 \simeq$ 4.50 cfs

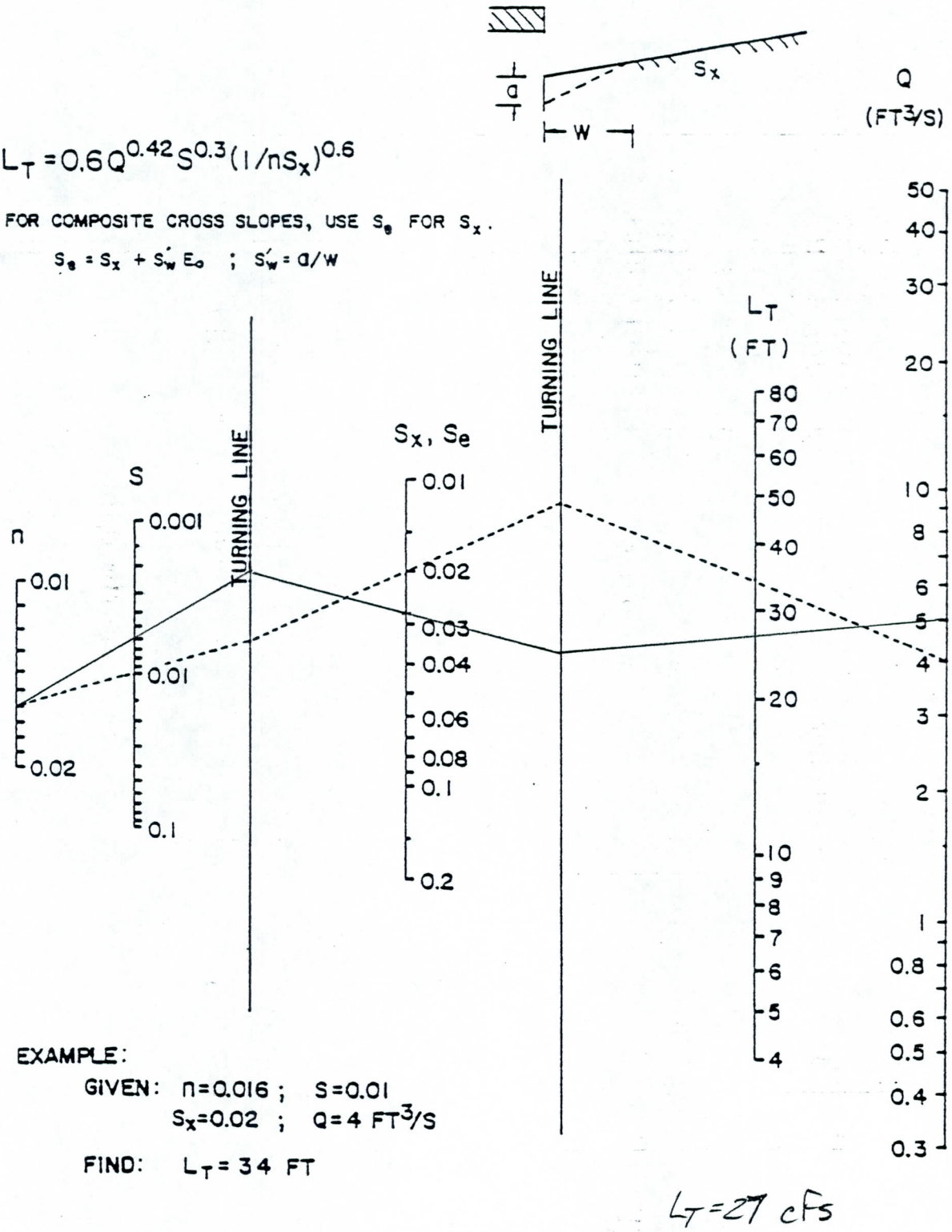
Install a 3' CB w/ _____ ft. wing Type: M , L =

Flow by = _____ cfs.

Existing MZ, L=17

The 0.5 cfs flow-by at Scottsdale Road turns south and flows down Scottsdale Road.

16 A



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$
$S_x = 0.02$; $Q = 4$ FT³/S

FIND: $L_T = 34$ FT

$L_T = 27$ cfs

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA (4A)

CB ID = 4A

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 17

Station 166+81 RT **Location** SW corner OAK & 72nd Place

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.013^{1.67} * 0.0037^{0.5} * 15^{2.67}$

$Q_T = 2.08 * F(s)$

$Q_{cap} = 1.67$ cfs $\simeq 1.5$ cfs

n = 0.016
S(x) = 0.013
S = 0.0037
T = 15 ft
F(s) = 0.8

THIS IS A SHORT REACH, WHICH STARTS OUT WITH S > 2% But Flattens out approaching 72nd Place

S(x) = Ave 0, 50 & 100 ft u/s

Q at this location = 5 (4A)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 17A)
L(t) = total length required for curb opening to capture entire flow is 36 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$1 - \left(1 - \frac{20}{36}\right)^{1.8}$

$E = 0.77$

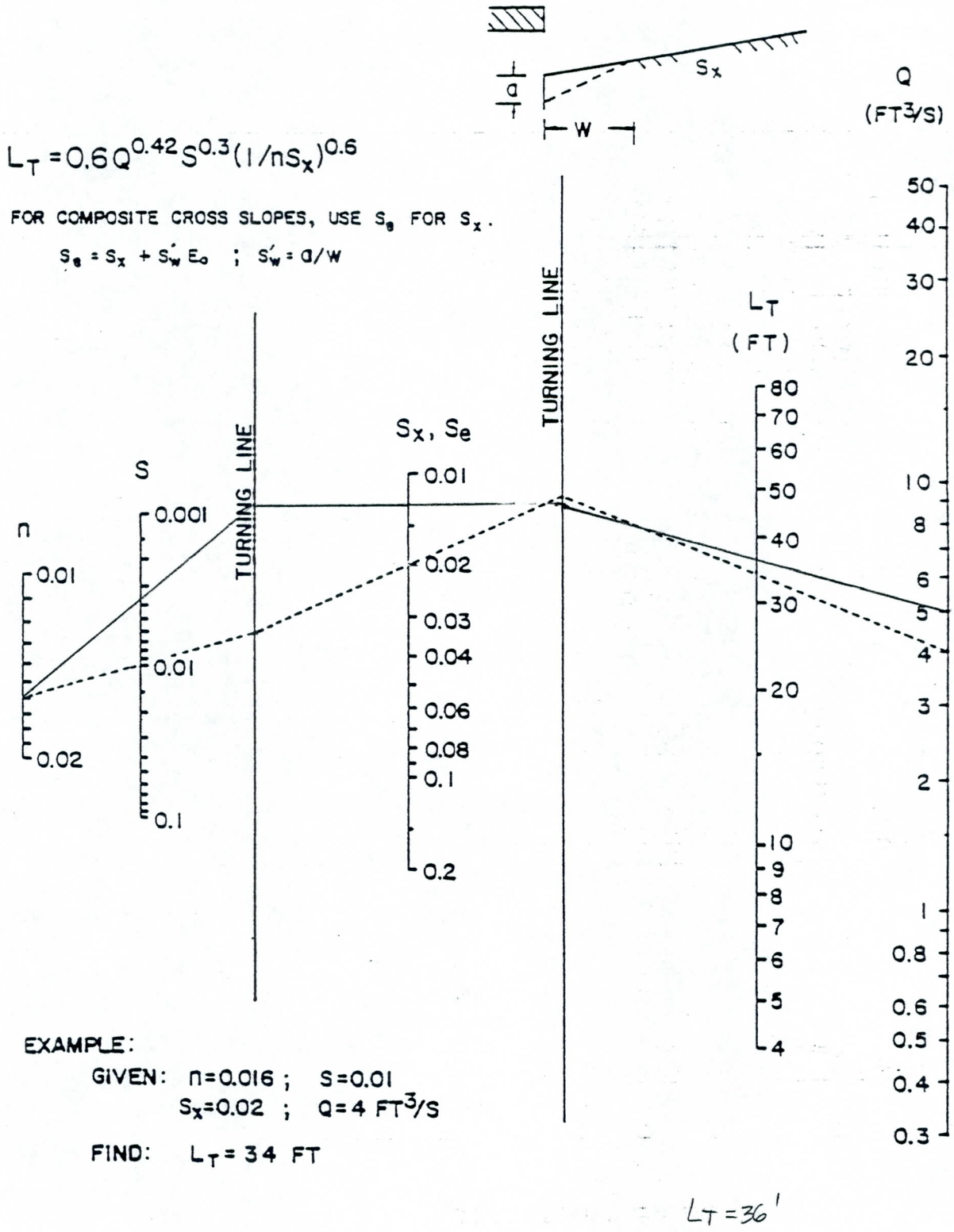
$Q_i = 0.77(5)(0.8)$

$= 3.07 \simeq \underline{\underline{3 \text{ cfs}}}$

Install a 3' CB w/ 17 ft. wing Type: M 1, L = 17

Flow by = 2 cfs.

17A



$L_T = 36'$

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DRAINAGE AREA (4B)

Oak Street - Design and locate Catch Basins

CB ID : 4B-1

Project # 98514
Date: 12-19-98
Designed by: lav

page # 18

Station 166+72 LT **Location** NW corner of OAK & 72nd Place

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.019^{1.67} * 0.0056^{.5} * 15^{2.67}$

$Q_T = 4.83$

n	= 0.016
S(x)	= 0.019
S	= 0.0056
T	= 15 ft
F(s)	= 0.8

$Q_{cap} = Q_T * F(s)$
$= 3.86 \simeq \underline{4.0 \text{ cfs}}$

This is a short Reach, which starts with a slope > 2% and flattens out as it aproaches 72nd Place. To increase efficency of CB Recommend exceeding Allowable SPREAD

Q at this location = 7 (4B)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 18A)
L(t) = total length required for curb opening to capture entire flow is 37 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - \left(1 - \frac{13}{37}\right)^{1.8}$

$E = 0.54$

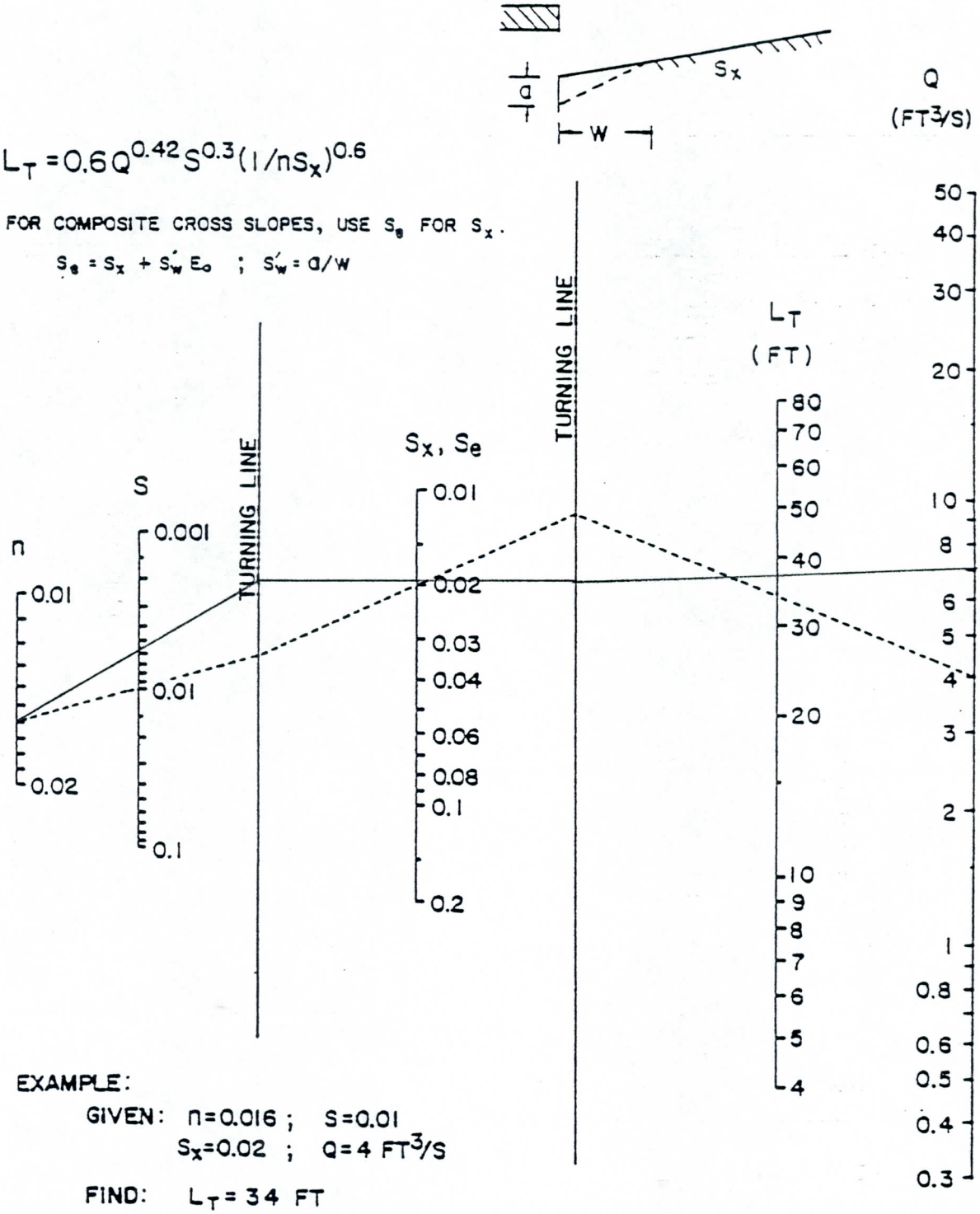
$Q_i = 0.54\ (7)\ (0.8)$

$Q_i = 3.03 \simeq \underline{3 \text{ cfs}}$

Install a 3' CB w/ 10 ft. wing Type: M 1 , L = 10

Flow by = 4 cfs.

18A



$L_T = 37$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

FB from DA (4B)

Oak Street - Design and locate Catch Basins

CB ID : 4B-2

Project # 98514
Date: 12-19-98
Designed by: lav

page # 19

Station 167+74 LT **Location** NE Corner OAK & 72nd PL

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.027^{1.67} * 0.0074^{.5} * 15^{2.67}$

$Q_T = 9.98$

n = 0.016
S(x) = 0.027
S = 0.0074
T = 15 ft
F(s) = 0.8

$Q_{cap} = 9.98 * 0.8$

$= 7.98 \simeq$ 8 cfs

Q at this location = 4 (F.B. from DA 4B)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 19A)
L(t) = total length required for curb opening to capture entire flow is 27 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - \left(1 - \frac{13}{27}\right)^{1.8}$

$E = 0.69$

$Q_i = 0.69\ (4)\ (0.8)$

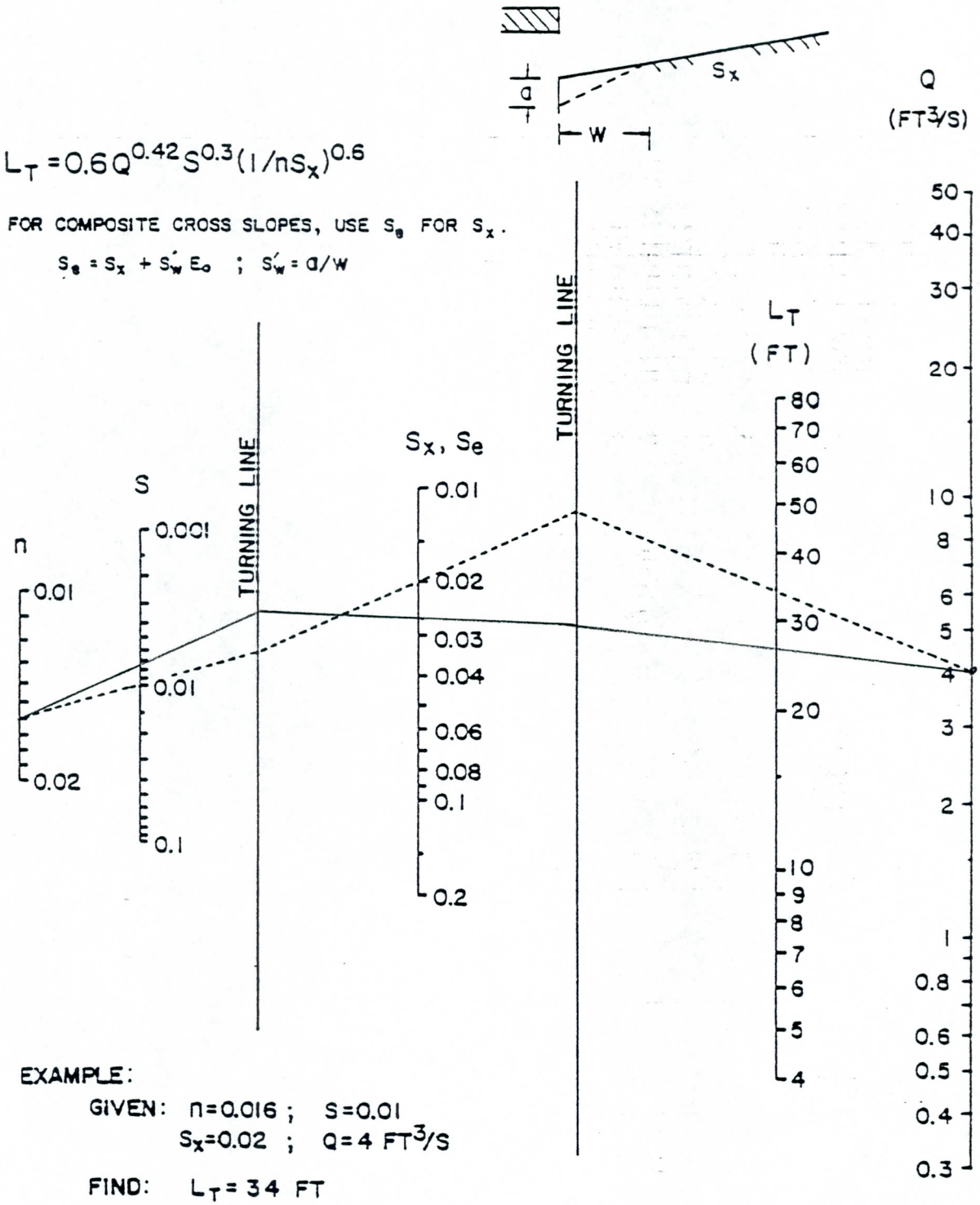
$Q_i = 2.22$ cfs $\simeq$ 2 cfs

Install a 3' CB w/ _____ ft. wing Type: M , L =

Flow by = 2 cfs.

Existing M1, L=10 CB.

19A



$L_T = 27$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

FB & ½ D.A. 3C

CB ID : 3C

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 20

Station 171+50 LT **Location** OAK ST East of 72nd PL

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \frac{0.56}{0.016} * 0.016^{1.67} * 0.0057^{1.67} * 15^{2.67}$

n = 0.016
S(x) = 0.016
S = 0.0057
T = 15 Ft
F(s) = 0.8

$Q_{cap} = 3.66 * 0.8$

$Q_{cap} = 2.93 \approx$ 3 cfs

Approx. 350' Between CB's
Recommend this as a minimum
IN straight Reaches

Q at this location = 2(FB) + 2 (½ of 3C) = 4

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 20A)
L(t) = total length required for curb opening to capture entire flow is 33 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - (1 - \frac{13}{33})^{1.8}$

$E = 0.59$

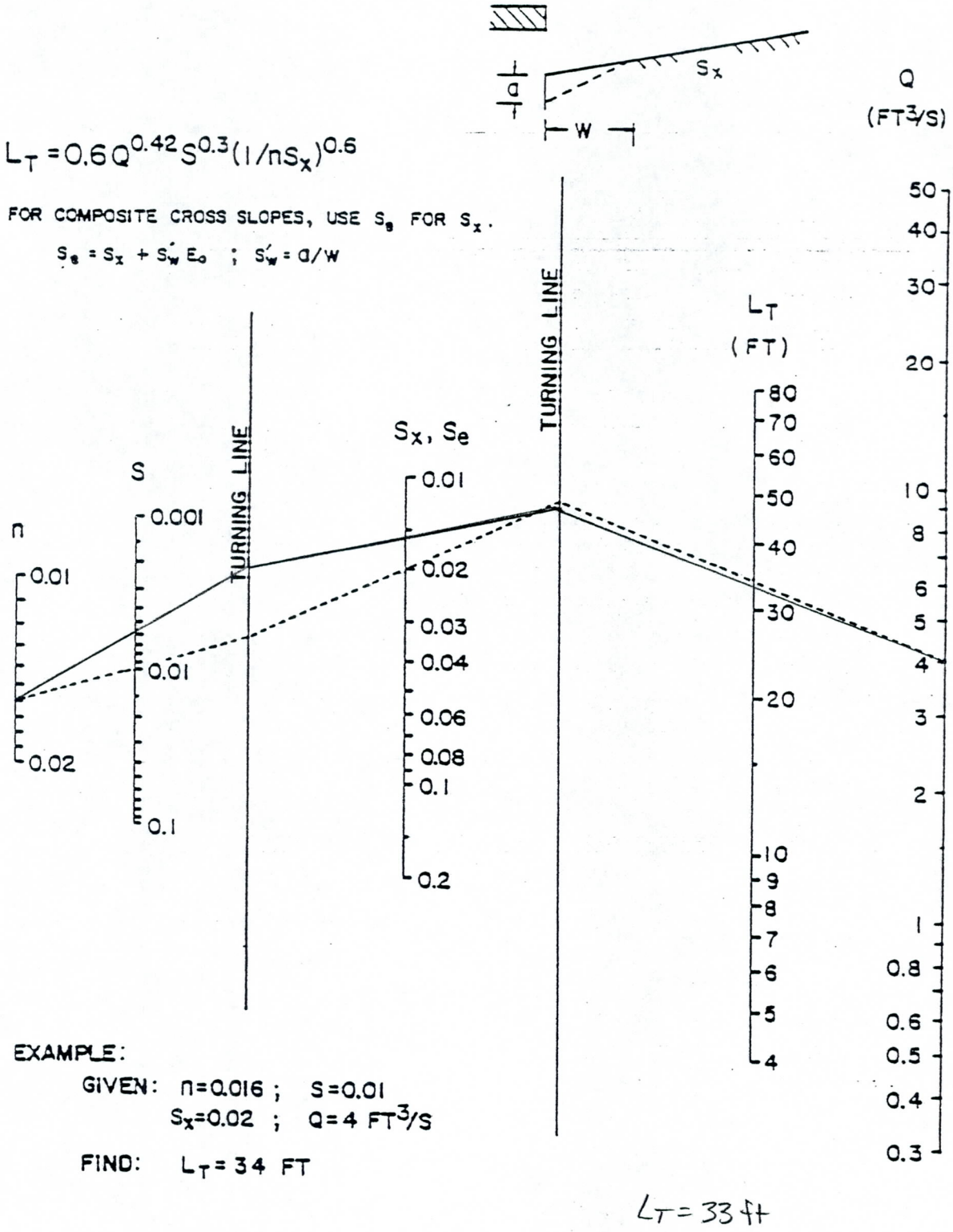
$Q_i = 0.59 (4) 0.8$

$= 1.90$ cfs $\approx$ 2.0 cfs

Install a 3' CB w/ 10 ft. wing Type: M 1, L = 10

Flow by = 2 cfs.

20 A



$L_T = 33$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

FB & ½ D.A (3B)

CB ID: 3B-1

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 21

Station 171+50 RT **Location** OAK ST, East of 72nd PL

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right) * 0.004^{1.67} * 0.004^{.5} * 15^{2.67}$

$= 0.3 * F(s)$

$Q_{cap} = 0.24$ cfs

n = 0.016
S(x) = 0.004
S = 0.004
T = 15
F(s) = 0.8

S(x) = Ave 0 & 100' U/S =

FROM STA 171+50 TO Approx 174+00 Road is Sloped to Drain to the north SIDE OF THE STREET.

Q at this location = 2 (FB) + 2 (½ of 3B) = 4

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 21A)
L(t) = total length required for curb opening to capture entire flow is 39 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$1-\left(1-\frac{13}{39}\right)^{1.8}$

$E = 0.52$

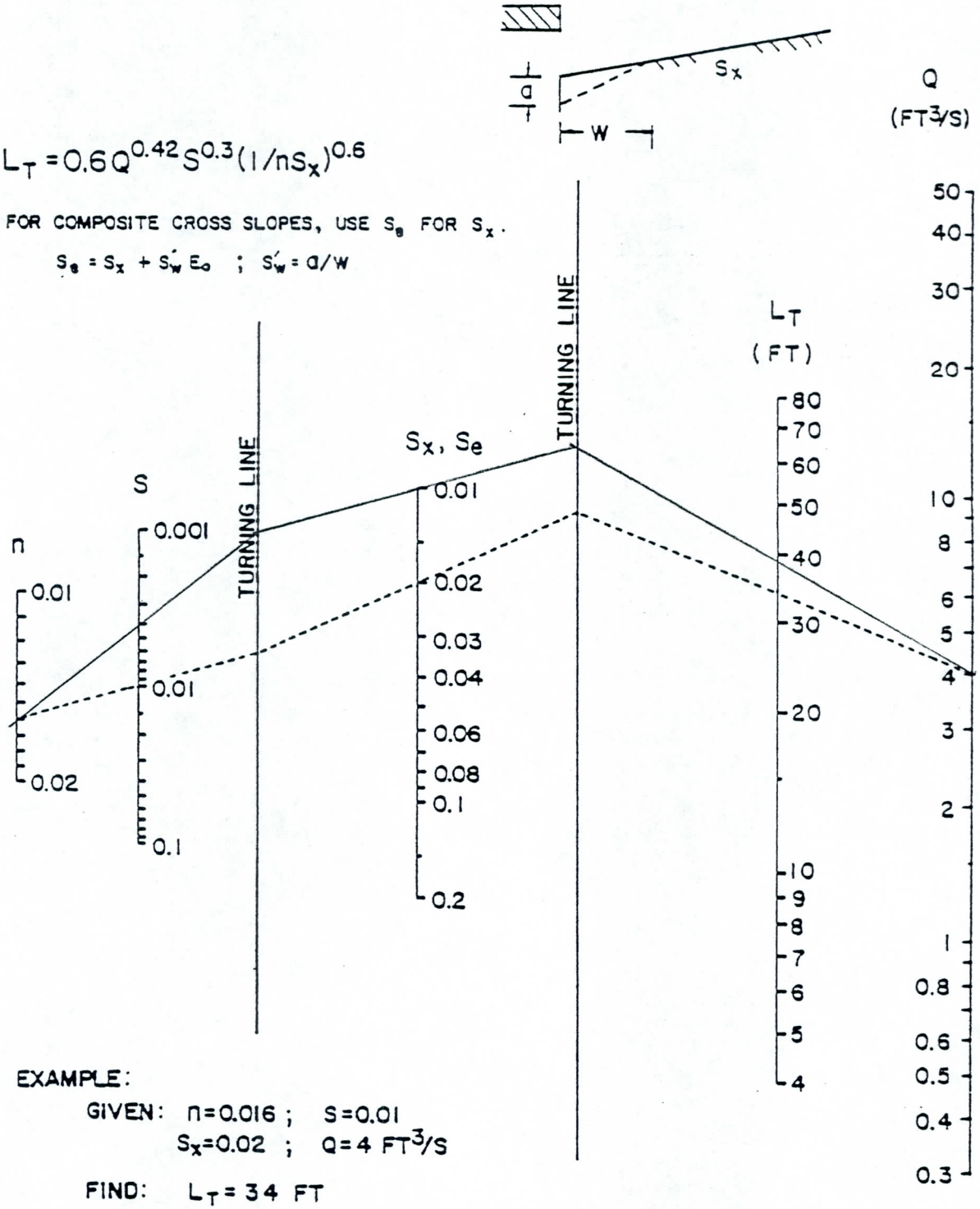
$Q_i = 0.52\,(4)(0.8)$

$= 1.66 \simeq 1.5$ cfs

Install a 3' CB w/ 10 ft. wing Type: M 1, L = 10

Flow by = 2.5 cfs.

21A



L_T=39 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

FB & ½ D.A. (3B)

CB ID: 3B-2

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 12-19-98
Designed by: lav

page # 22

Station 175+11 RT **Location** SW Corner OAK & 74th ST

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

$Q_T = \left(\frac{0.56}{0.016}\right) 0.025^{1.67}\ 0.0096^{.5}\ 15^{2.67}$

$= 10.0 * F_S$

$= \underline{\underline{8.0 \text{ cfs}}}$

n = 0.016
S(x) = 0.025
S = 0.0096
T = 15'
F(s) = 0.8

Q at this location = 2.5 (FB) + 2 (½ D.A. 3B) = 4.5

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 22A)
L(t) = total length required for curb opening to capture entire flow is 31 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$= 1 - \left(1 - \frac{12}{31}\right)^{1.8}$

$E = 0.59$

$Q_i = 0.59\ (4.5)\ (0.8)$

$Q_i = 2.12 \text{ cfs} \approx \underline{\underline{2 \text{ cfs}}}$

Install a 3' CB w/ 9 ft. wing Type: M1, L = 9

Flow by = 2.5 cfs.

EXISTING M1 L=9 CB

22A

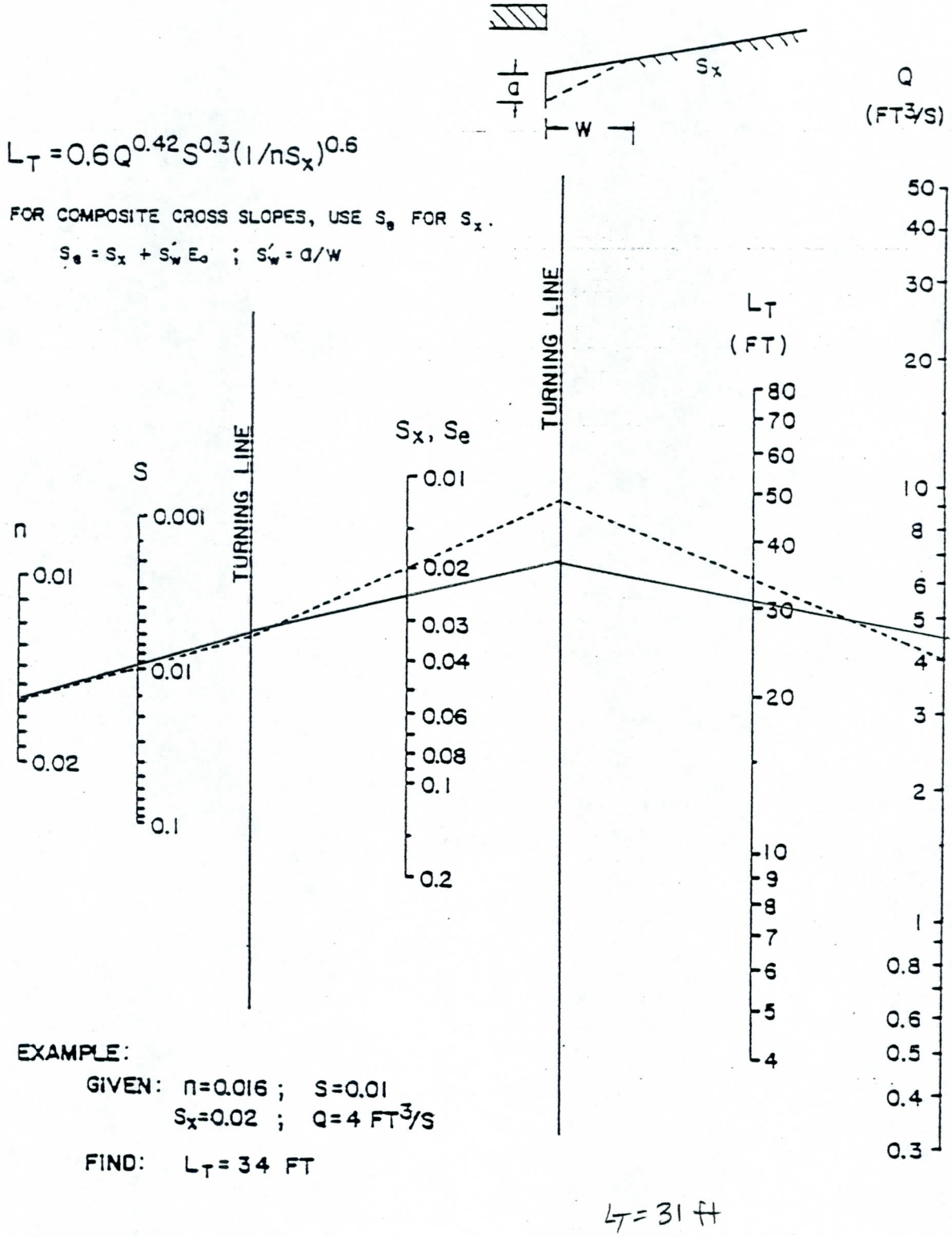


Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

Reduction of Flow at 74th STREET North of OAK.

THE sub-basin (30) in the EEC/MKE Hydrology is 28.5 acres and Develops 43 cfs during the 10-yR 6HR Event. The Roadway (74th STREET) cannot contain 43 cfs so excess runoff overtops the curb and side walk and is retained in the parking lots of the High School. According to Calculations (sheet 20a) only 6 cfs will continue down 74th ST to OAK.

We propose to place a lateral line in 74th ST which could handle the 10-yR STORM, and at the same time only install inlets to capture the existing flow which reaches OAK STREET.

The use of the 10-yR Design on the lateral will provide sufficient relief in the event of future construction.

74th ST. N. of OAK

23A

07/28/98

Open Channel Flow for Irregular Channel

Input Quantities

	Manning's n:	0.0160	
	Channel Slope:	0.0026	ft/ft
Calculated	Flow Rate:	5.7973	cfs ≈ 6 cfs
Calculated	Elev. of Flow:	22.3700	ft

Calculated Quantities

Area Of Flow:	4.2654	sf
Wetted Perimeter:	27.7423	ft
Hydraulic Radius:	0.1538	ft
Velocity:	1.3591	ft/s
Critical Slope:	0.7197	%
Top Width:	27.1226	ft
Froude Number:	0.6040	
Critical Depth::	0.4458	ft
Depth of Flow:	0.5300	ft

Ground Shot Information

Num	Offset	Elevation
1	0.0000	22.5500
2	4.0000	22.5100
3	4.1000	22.1200
4	6.0000	22.2000
5	24.0000	22.6300
6	43.0000	21.9200
7	43.9000	21.8400
8	44.0000	22.3400
9	49.0000	22.3700

D.A. (3D) Revised
CB ID : 3D-1

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 7-24-98
Designed by: lav

page # 24

Station 175+96, LT **Location** Lateral N of OAK on 74th

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$$Q_T = \left(\frac{0.56}{0.016}\right)(0.037)^{1.67}(0.0026)^{1/2}(16)^{2.67}$$

n = 0.016
S(x) = 0.037
S = 0.0026
T = 16
F(s) = 0.65

$Q_T = 11.9$ cfs

$Q_{cap} = Q_T\ (F_s)$
$= 11.9\ (0.65)$

$Q_{cap} = 7.7$ cfs
$\simeq$ 8cfs ←

Q at this location = 6 flow coming down 74th ST.

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 21a)
L(t) = total length required for curb opening to capture entire flow is 19 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

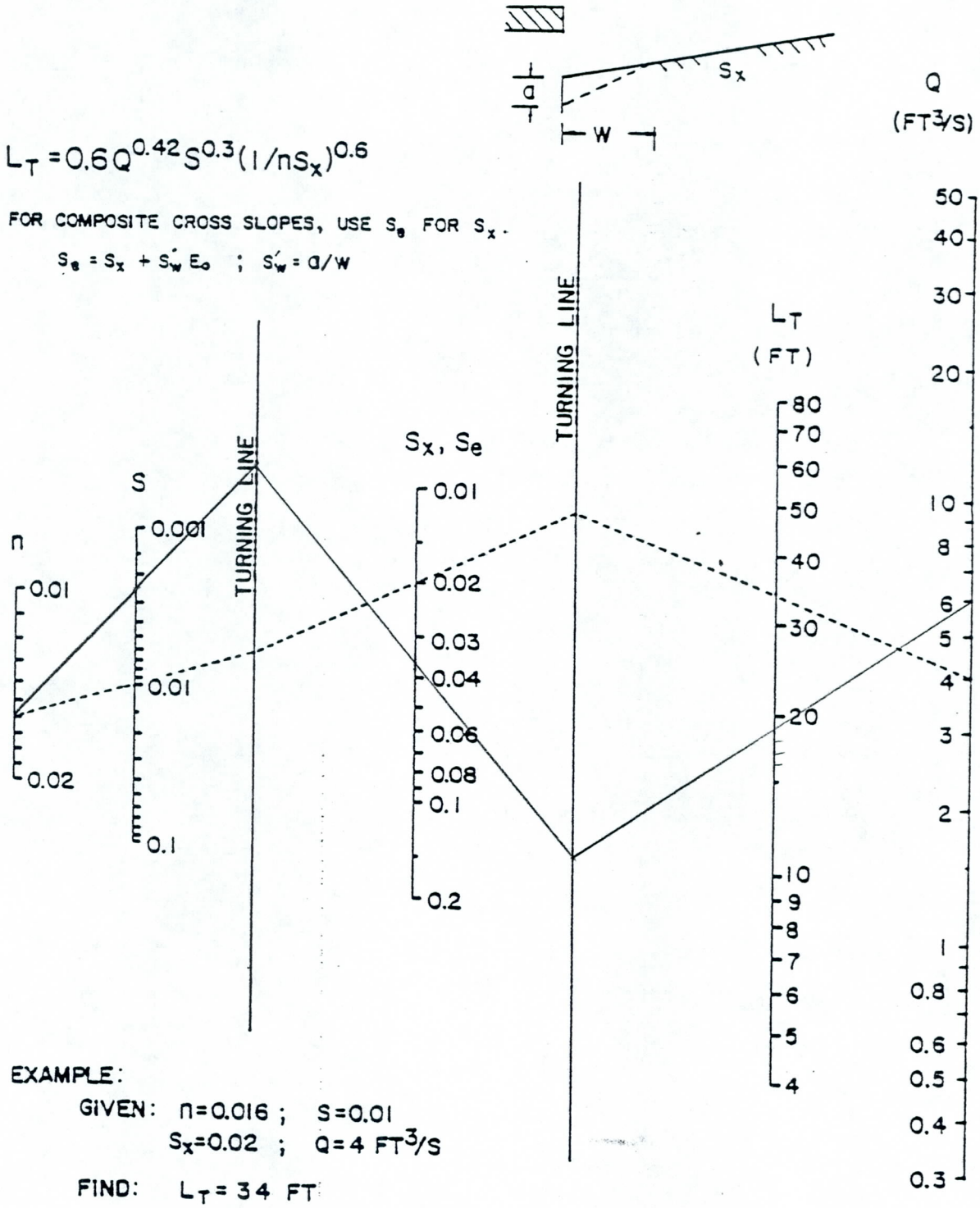
$E = 1-\left(1-\frac{13}{19}\right)^{1.8}$
$E = 0.87$

$Q_i = E\ Q\ R_F$
$= 0.87\ (6)(0.8)$
$Q = 4.18 \simeq 4.$ cfs

Install a 3' CB w/ 10' ft. wing Type: M 1, L = 10

Flow by = 2.0 cfs.

24A



L_T=19 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

overflow from DA's $\boxed{3C \& 3D}$

Oak Street - Design and locate Catch Basins

CB-ID : 3D-2

Project # 98514
Date: 7-24-98
Designed by: lav

page # 25

Station 176+31 , LT 74th ST & oak NE (EXISTING)

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$$Q_T = \left(\frac{0.56}{0.016}\right)(0.038)^{1.67}(0.0079)^{1/2}(16)^{2.67}$$

n = 0.016
S(x) = 0.038
S = 0.0079
T = 15
F(s) = 0.8

$Q_T = 18.25$

$Q_{CAP} = 18.25 * (0.8)$

$Q_{cap} = 14.6 \simeq \underline{\underline{14.5 \text{ cfs}}}$ ←

Q at this location = 2(FB-North) + 2(FB-West) + 2(½ DA 3C) = 6

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 22a)
L(t) = total length required for curb opening to capture entire flow is 27 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$$E = 1 - \left(1 - \frac{13}{27}\right)^{1.8} = 0.67$$

$$Q_i = E\ Q\ R_F$$
$$= 0.69\ (6)(0.8)$$
$$= 3.32 \simeq \underline{\underline{3.5 \text{ cfs}}}$$ ←

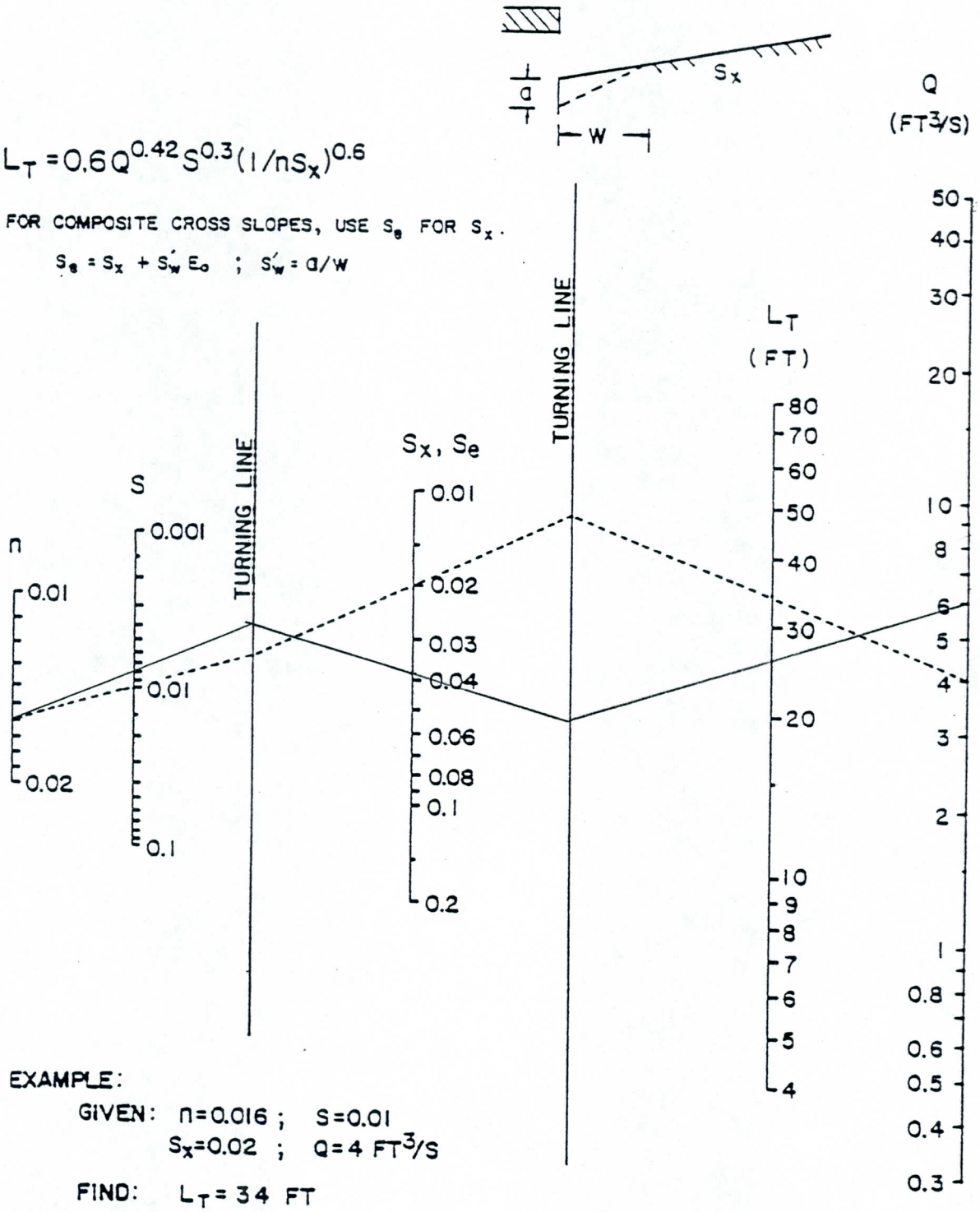
Install a 3' CB w/ 10 ft. wing Type: M 1 , L = 10

(Existing)

Flow by = 2.5 cfs.

Remove Existing CB and
Replace with M1, L=10

25A



L_T=27 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DA (3A)

Oak Street - Design and locate Catch Basins

CB ID : 3A-1

Project # 98514
Date: 7-24-98
Designed by: lav

page # 26

Station 175+93, RT **Location** 74th ST & OAK, South on 74th

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

n = 0.016
S(x) = 0.033
S = 0.0022
T = 16
F(s) = 0.65

$Q_T = \left(\frac{0.56}{0.016}\right)(0.033)^{1.67}(0.0022)^{1/2}(16)^{2.67}$

$Q_T = 9.04$

$Q_{CAP} = 9.04(0.65)$

$Q_{cap} = 5.88 \simeq$ 6cfs

Q at this location = 17 cfs (3a) (ON GRADE) Combination CB's calculated as GRATE INLET

using Figure ~~3.20~~ (FCDMC manual) Eqn: ~~$L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$~~
(see sheet _____)
~~L(t) = total length required for curb opening to capture entire flow is _____ ft.~~

Efficiency: ~~$E = 1 - (1 - L/L(t))^{1.8}$~~

CONTINUOUS GRADE
~~Curb Opening~~ Reduction Factor = [redacted] 0.60
Longitudinal Bar Grate
w/ recessed traverse bars

$Q_i = EQ = Q[R_F E_o + R_s(1-E_o)]$

$Q_i = QE = (17)[0.97(0.42) + 0.025(1-0.42)]$

= 7.2 cfs for a 3' grate

page	
23a	E_o = 0.42
23b	R_F = 0.97
23c	R_s = 0.025

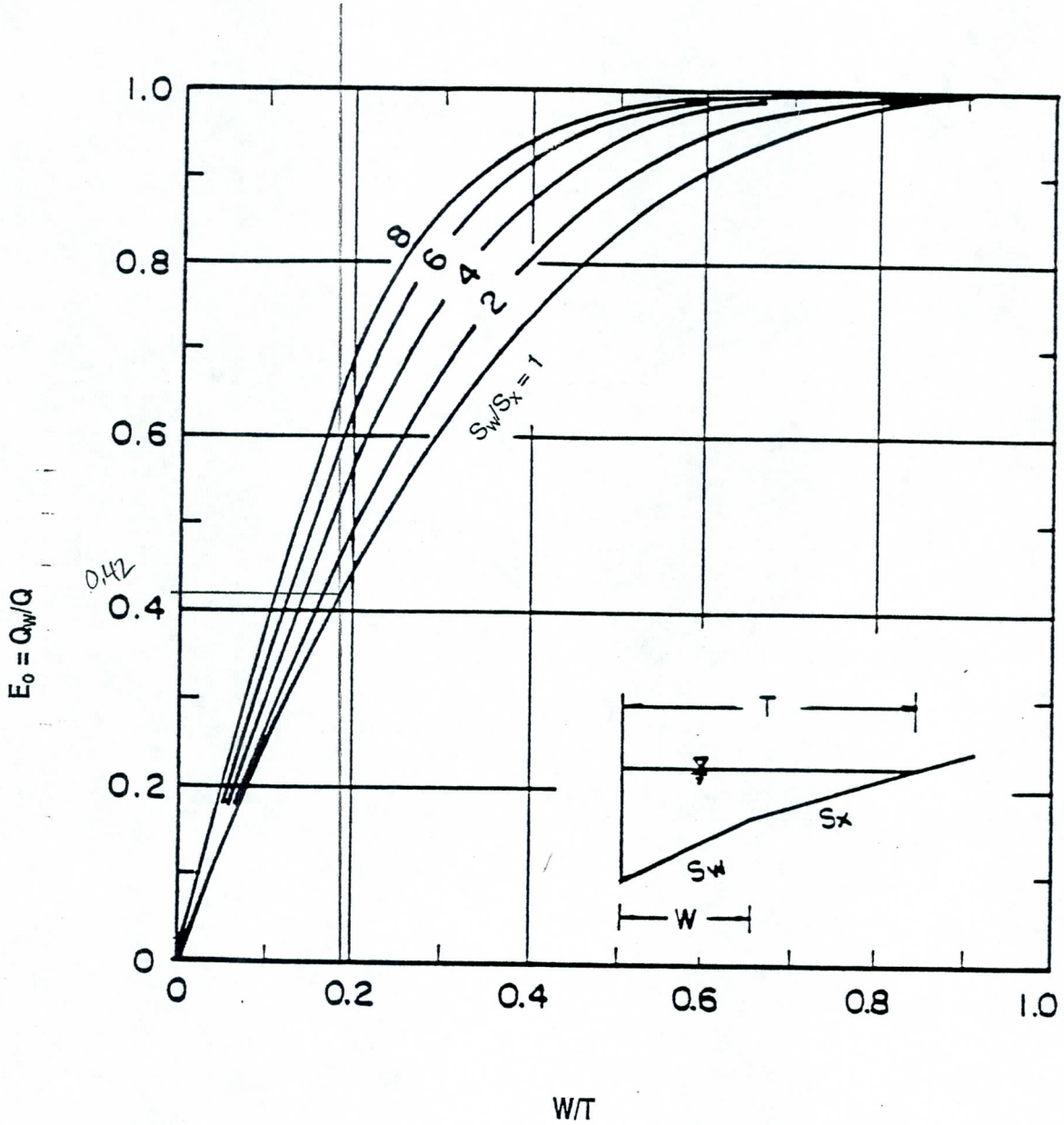
7.2 x 3 (Triple grate) = 21.6 cfs
21.6 x 0.6 = 12.96 ≃ 13.0 cfs

~~Install a [redacted] w/ _____ ft. wing~~

Type: [redacted]
Q(3) L≃10'
Q TRIPLE
COP STD. DET. P1572

Flow by = 4 cfs.

26A

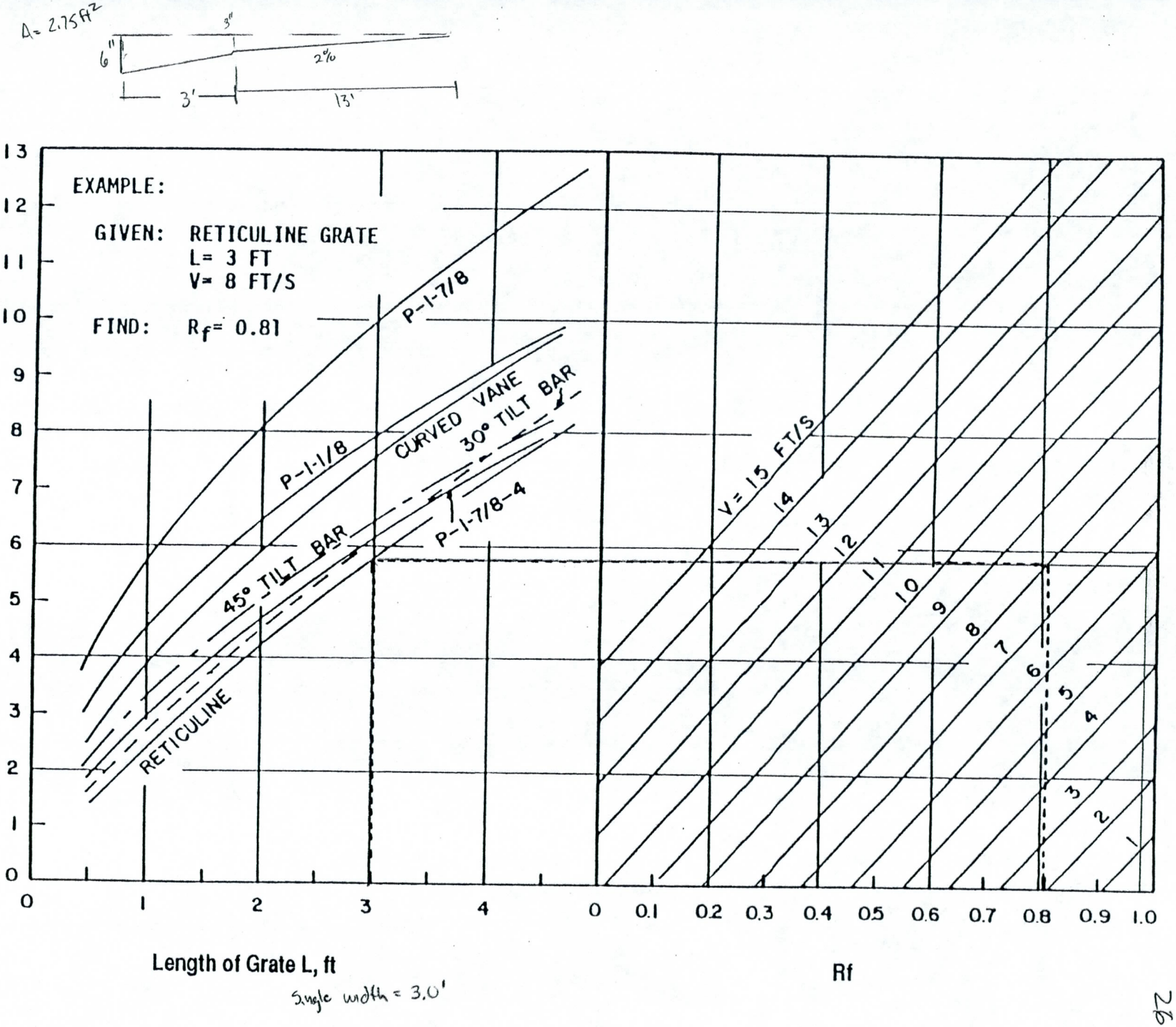


w=3
T=16

w/T = 0.1875

Figure 3.23
Ratio of Frontal Flow to Total Gutter Flow
(USDOT, FHWA, 1984, HEC-12, Chart 4)

26B



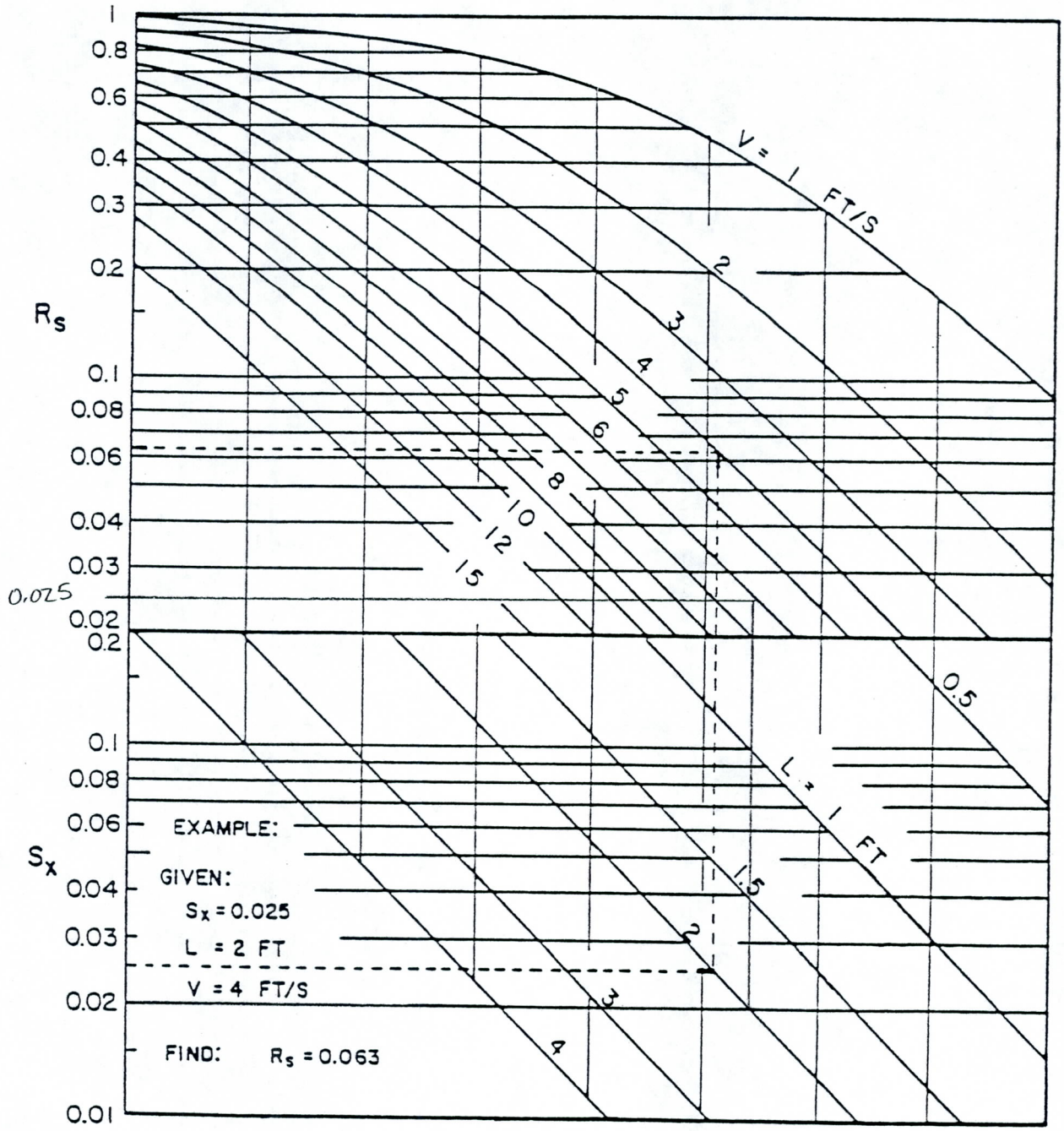
Single width = 3.0'

$17 \frac{ft^3}{s} \cdot \frac{1}{2.75 ft^2} = V = 6.2 ft/s$

Reticuline GRATE = Rf = 0.97

Figure 3.27
Grate Inlet Frontal Flow Interception Efficiency
(USDOT, FHWA, 1984, HEC-12, Chart 7)

26C



V=6.2 ft/s
Sx = 0.02
L = 2'

Figure 3.28
Grate Inlet Side Flow Interception Efficiency
(USDOT, FHWA, 1984, HEC-12, Chart 8)

D.A. overflow from 3A & 3B

Oak Street - Design and locate Catch Basins
Project # 98514
Date: 7-24-98
Designed by: lav

CB ID: 3A-2

page # 27

Station 176+24, RT 74th ST & OAK S-E (Existing)

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions
& givens

$Q_T = \left(\frac{0.56}{0.016}\right)(0.028)^{1.67}(0.0072)^{1/2}(15)^{2.67}$

n = 0.016
S(x) = 0.028
S = 0.0072
T = 16
F(s) = 0.8

$Q_T = 10.46$

$Q_{cap} = 10.46 * (0.8)$

$Q_{cap} = \underline{8.37 \text{ cfs}}$

Q at this location = 8.5 = 4 (FB-South) + 2.5 (FB-West) + 2 (½ D.A. 3B)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$
(see sheet 24a)
L(t) = total length required for curb opening to capture entire flow is 35 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$E = 1 - \left(1 - \frac{6}{33}\right)^{1.8}$

$E = 0.30$

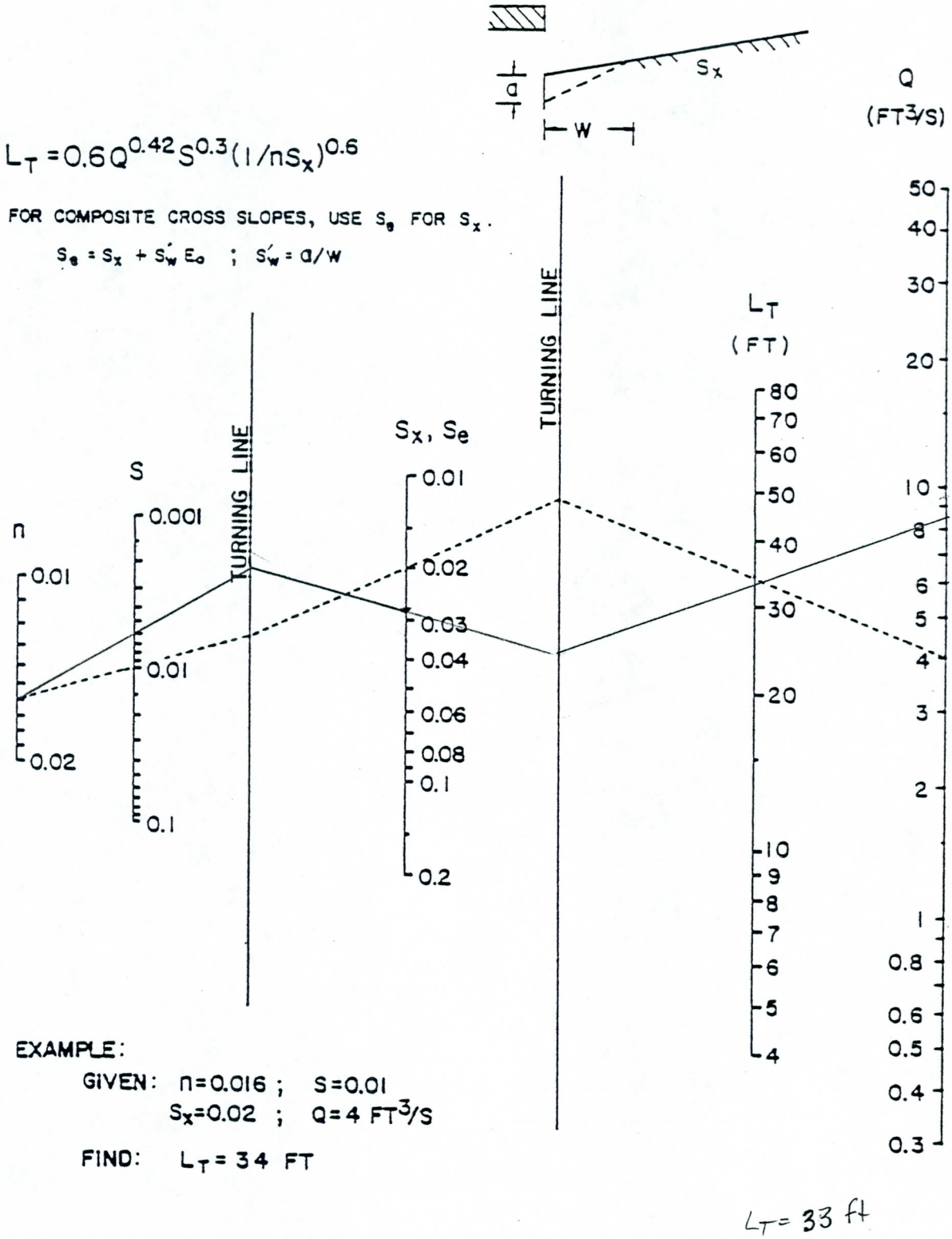
$Q_i = E(Q)(0.8)$

$Q_i = 2.06$ cfs $\simeq \underline{2.0 \text{ cfs}}$

Install a 3' CB w/ 3 ft. wing Type: M |, L = 3 (Existing)

Flow by = 6.5 cfs.

27A



L_T = 33 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DA (2A)

Oak Street - Design and locate Catch Basins

Project # 98514

Date: 7-24-98

Designed by: lav

CB ID : 2A

page # 28

Station 180+48 24' RT **Location** 74th WAY & OAK S-W EXISTING

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

n	= 0.016
S(x)	= 0.028
S	= 0.0075
T	= 15
F(s)	= 0.8

$Q_T = \left(\frac{0.56}{0.016}\right)(0.028)^{1.67}(0.0075)^{1/2}(15)^{2.67}$

$= 10.7$ cfs

$Q_{cap} = Q_T \; F_s$

$= 10.7*(0.8)$

$= 8.54$ cfs $\simeq$ 8.50 cfs

Q at this location = (6.5 + 3) = 9.5 cfs
FB & (2A)

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$

(see sheet 25a)

L(t) = total length required for curb opening to capture entire flow is 37 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$E = 1 - (1 - \frac{37}{37})^{1.8}$

$E = 1.00$

$Q_i = E(Q)(R_F)$

$= 1.0 \; (9.5)(0.8)$

$Q_i = 7.6 \simeq 7.5$ cfs

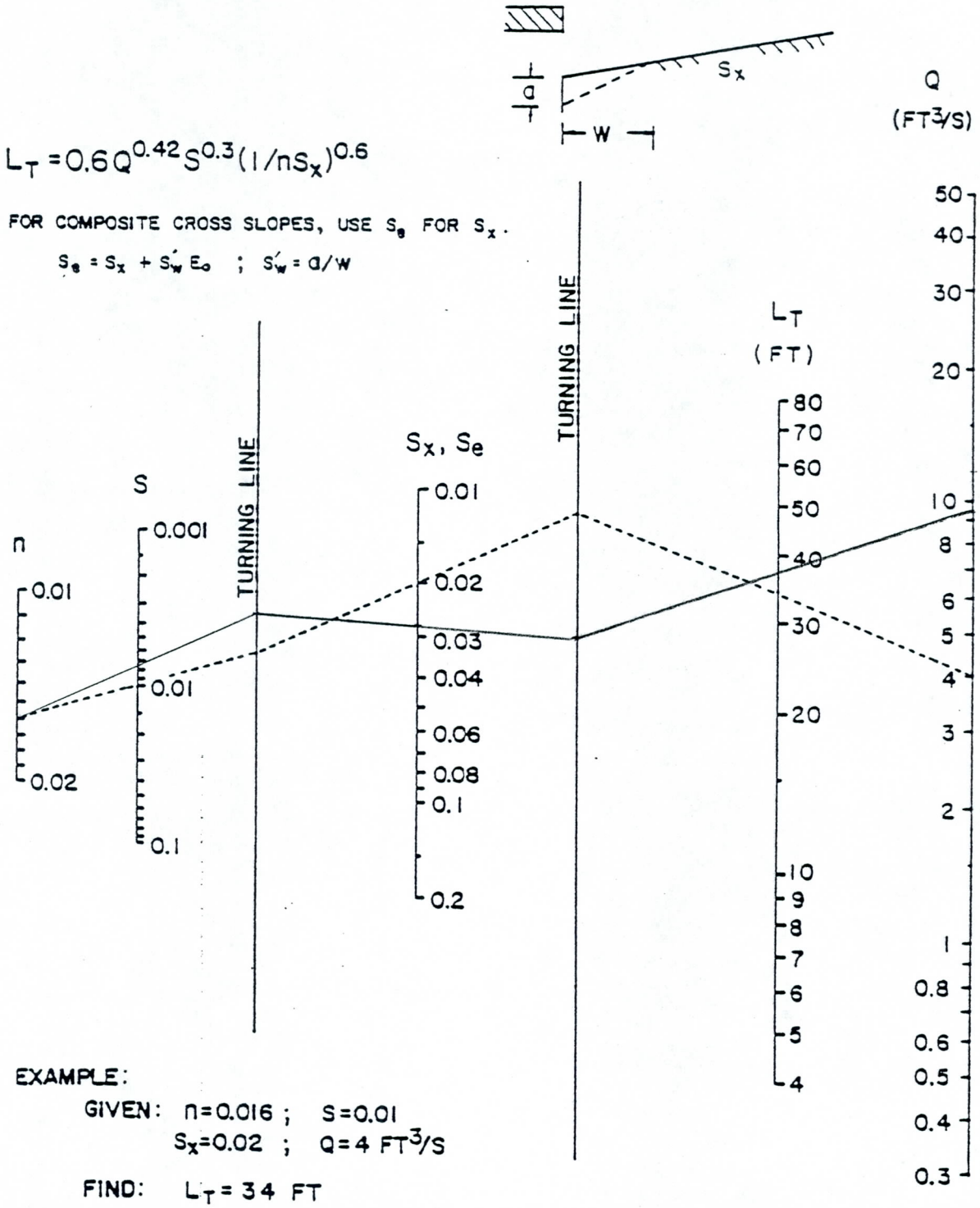
Install a 3' CB w/2-17 ft. wings Type: M2, L = 17

Flow by = 2.0 cfs.

Existing

Remove & Replace with M2, L=17

28 A



L_T = 37 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

DA (2B)

Oak Street - Design and locate Catch Basins

Project # 98514

Date: 7-24-98

Designed by: lav

CB ID : 2B

page # 29

Station 180+48 , LT **Location** 74th WAY & OAK NW (EXISTING)

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

assumptions & givens

$Q_T = \left(\frac{0.54}{0.016}\right)(0.025)^{1.67}(0.0061)^{1/2}(15)^{2.67}$

n = 0.016

S(x) = 0.025

S = 0.0061

T = 16

F(s) = 0.8

$Q_T = 7.97$

$Q_{cap} = Q_T \, F_s$

$= 7.97\,(0.8)$

$Q_{cap} = 6.38$ cfs $\simeq$ 6.5 cfs

Q at this location = 2.5 (F.B.) + 1 (D.A. 2B) = 3.5

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$

(see sheet 26a)

L(t) = total length required for curb opening to capture entire flow is 25 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$E = 1 - \left(1 - \frac{10}{25}\right)^{1.8}$

$E = 0.94$

$Q_i = E \; Q \; R_F$

$= .94 \; (3.5)(0.8)$

$= 2.63$ cfs $\simeq 2.50$

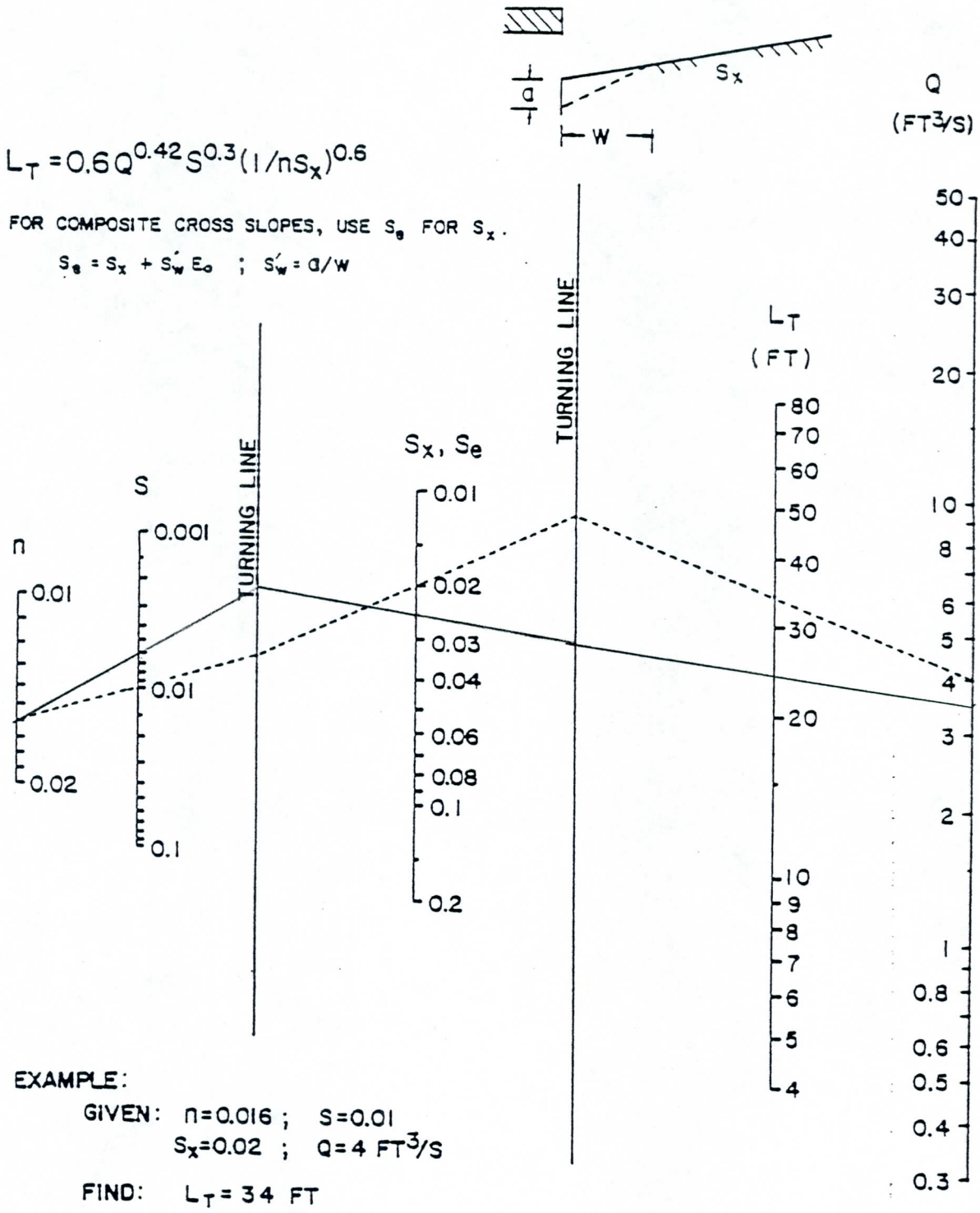
Install a 3' CB w/ 17 ft. wing Type: M 1, L = 17

Flow by = 1.0 cfs.

M1, L=12 (EXISTING)

REPLACE W M1, L=17

29A



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$
$S_x = 0.02$; $Q = 4\ FT^3/S$

FIND: $L_T = 34$ FT

$L_T = 25$ ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

(south)

D.A. 1A & overflow from west

Oak Street - Design and locate Catch Basins

Project # 98514

Date: 7-24-98

Designed by: lav

CB ID = 1A

page # 30

Station 184+89 RT **Location** OAK ST Approx 380' E of 74th WAY

Street Capacity: Eqn: $Q(t) = (0.56/n)*S(x)^{1.67}*S^{0.5}*T^{2.67}$

S- Existing

assumptions & givens

$$Q_T = \left(\frac{0.56}{0.016}\right)(0.024)^{1.67}(0.003)^{1/2}(15)^{2.67}$$

n = 0.016

S(x) = 0.024

S = 0.003

T = 15

F(s) = 0.8

$Q_T = 5.22$ cfs

$Q_{cap} = Q_T \; F_s$

$= 5.22\,(0.8)$

$Q_{cap} = 4.17$ cfs $\simeq$ 4 cfs

Q at this location = 2 FB + 3 (1A) = 5 cfs

using Figure 3.20 (FCDMC manual) Eqn: $L(t) = 0.6*Q^{0.42}*S^{0.3}*(1/n*S(x))^{0.6}$

(see sheet 27a)

L(t) = total length required for curb opening to capture entire flow is 22 ft.

Efficiency: $E = 1 - (1 - L/L(t))^{1.8}$ Curb Opening Reduction Factor = 0.8

$$E = 1-\left(1-\frac{6}{22}\right)^{1.8}$$

$E = 0.44$

$Q_i = E \; Q \; R_F$

$= 0.44\,(5)\;0.8$

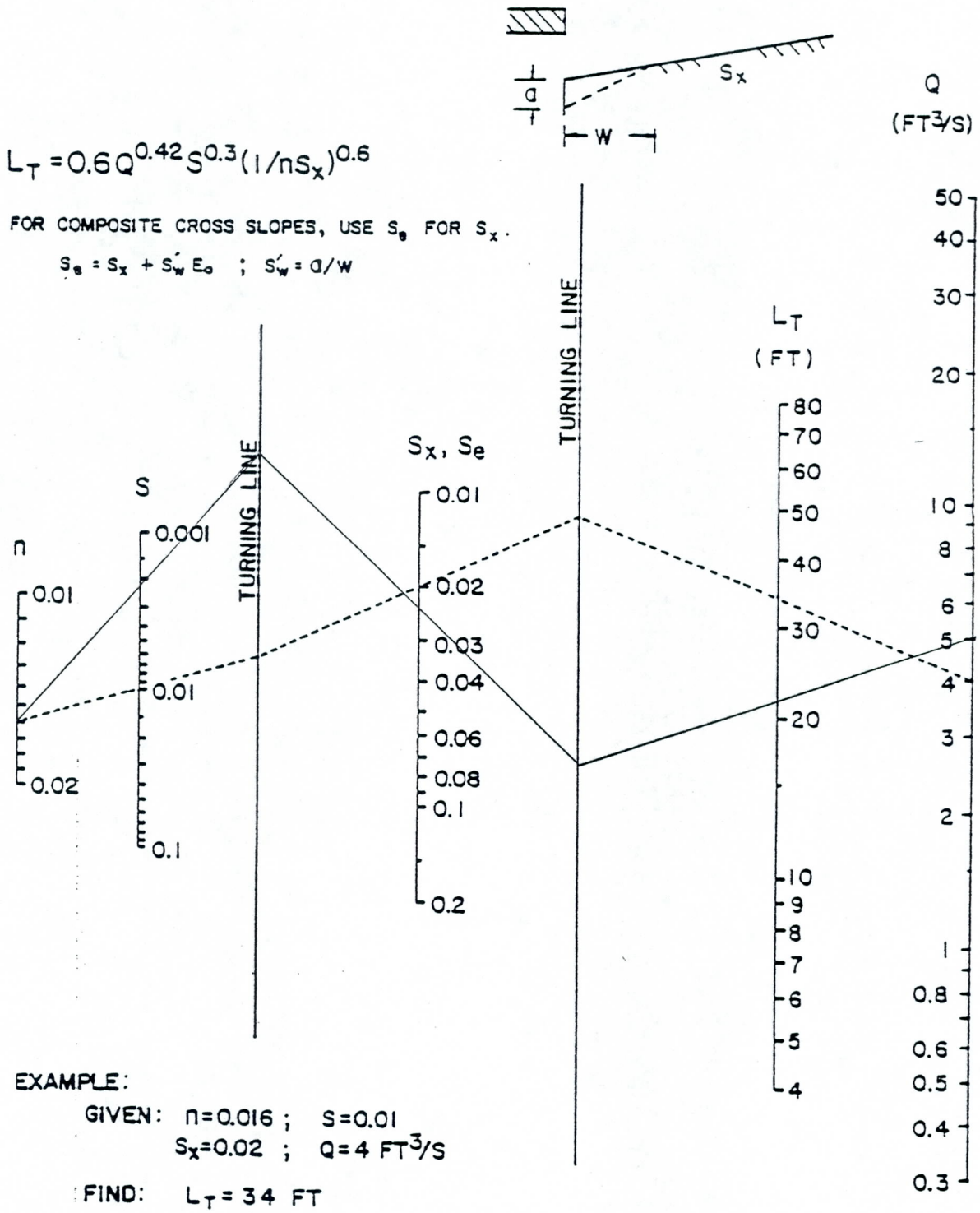
$= 1.76 \simeq$ 2.0 cfs

Install a 3' CB w/ 3 ft. wing Type: M | , L = 3

Flow by = 3.0 cfs.

Existing

30A



L_T=22 ft

Figure 3.20
Curb Opening and Slotted Drain Inlet Length for Total Interception
(USDOT, FHWA, 1984, HEC-12, Chart 9)

APPENDIX B6
CATCH BASINS
(West of Cross Cut Canal)

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 8-12-98

Subject: Hydrology - West END Designed LHV Page 1

Hydrology for locations WEST of 64th STREET WILL BE BASED on the HEC-1 model developed by KIMLEY-HORN (File: A-610r.hc1) As Applied in their CLOMR REPORT.

Kimley-Horn BASIN ID	EEC BASIN ID	100-YR Developed Q [cfs]	10-YR Captured Q [cfs]
(050005)	10	64	21
(070210 & 070209)	11	50	17
(070010)	12	18	7
(070508)	13	14	4
(070610)	14	14	5
(070808)	15	34	12

FOR REFERENCE TO CORRESPONDING WATER SHED, SEE HYDROLOGY MAPS AT BACK OF THIS REPORT.

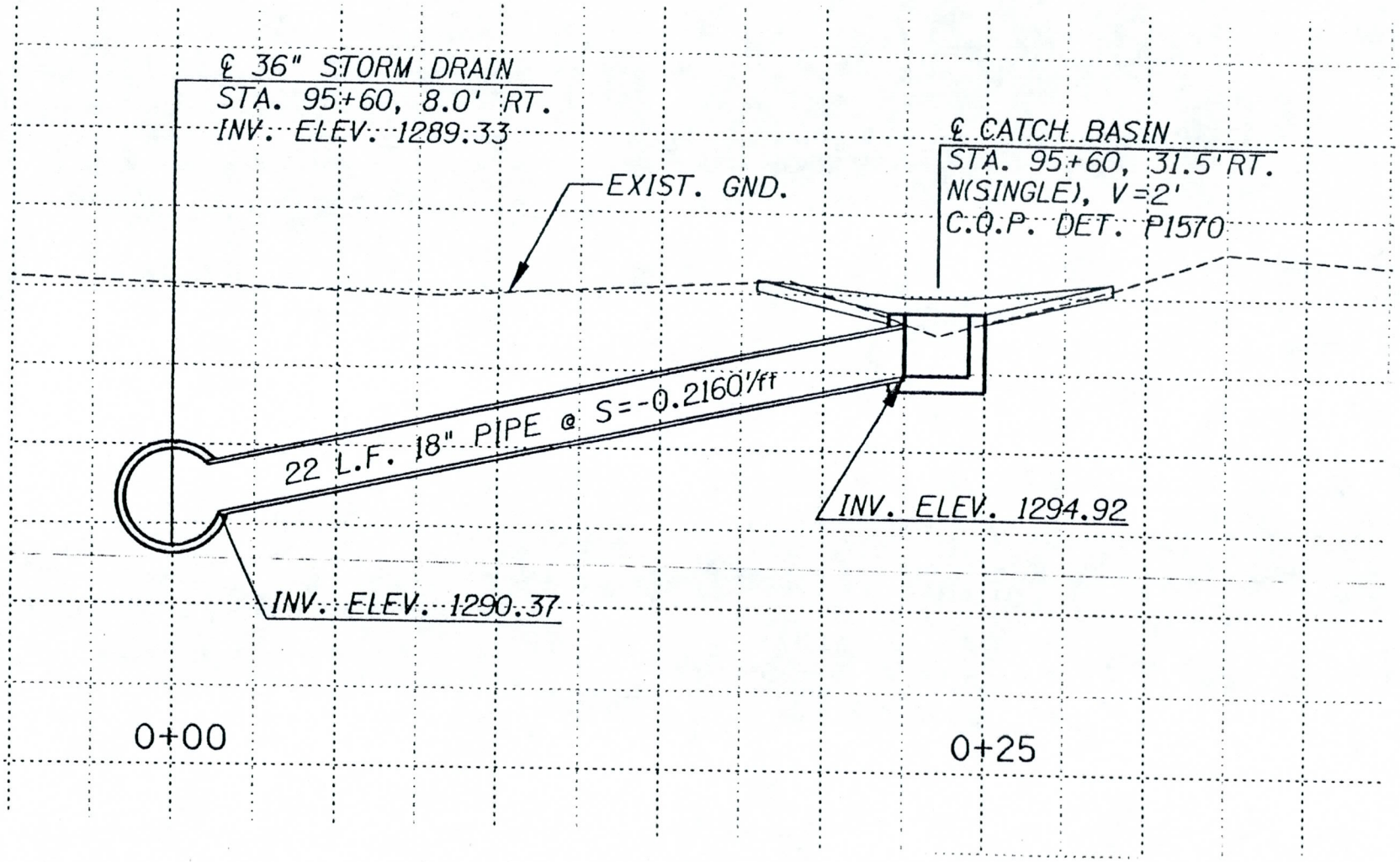
Revision

In order to place CB's at appropriate locations the Drainage AREA 050005 (Kimley-Horn) or 10 (EEC) will be split into 10-1 and 10-2

		Sta (EEC)	
050005	10-1 *	95+60	4 cfs
	10-2 *	93+14	17 cfs

* Developed Runoff weighted by area of Drainge Area

Sub basin 10-1 (4cfs)

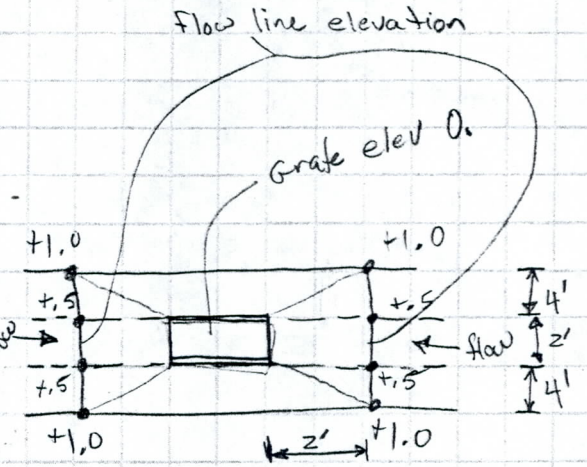


EEC

Project Title OAK STREET STORM DRAIN Project No. 98514 Date 12/10/98

Subject DA 10-1 & 10-2 Catch basins Designed by LAV Page 3

Q_{10} DA 10-1 = 3 cfs
Q_{10} DA 10-2 = 18 cfs



OPEN AREA

Single 'N' Type 2

FRAME $16\frac{3}{4} \times (40\frac{1}{2} - (2 * 3)) = 4.01\ ft^2$

GRATE

$7 \times .5 \times 16.5 = 57.75\ in^2$
$2 \times .25 \times 16.5 = 8.25\ in^2$
$10 \times .5 \times 39.5 = 197.5$
$263.5 \div 144 = 1.83\ ft^2$

Open Area = 4.01
− 1.83
2.18 ft^2 ←

sump (MAX) $Q_i = C_o A (2gd)^{.5}$

Sump location

$C_o = 0.67$
$A = 2.18\ ft^2$
$g = 32.2$
$d = 1'$ head

$Q_i = 0.67 (2.18) (2(32.2)(1))^{1/2}$
$= 11.72$ cfs

Apply
0.5 Reduction Factor

= 5.86 cfs ← ≈ 6 cfs

Double (23.4 × 0.5) = 11.72 cfs ← ≈ 12 cfs

Triple (35.16 × 0.5) = 17.58 cfs ← ≈ 18 cfs

use 'N' Type 2 single for DA 10-1
use 'N' Type 2 Triple for DA 10-2

EEC

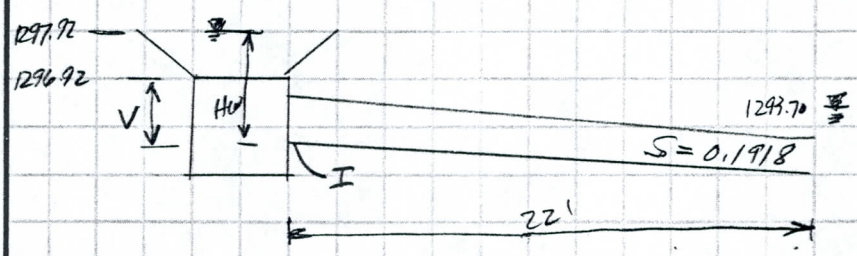
Project Title: OAK STREET Project No. 98514 Date

Subject: CONNECTOR PIPE CAPACITY Designed by Page 4

STA 95+60 Single 'N'

$Q_{design} = 3$ cfs

$Q_{capacity} = 49$ cfs



$S = \frac{97.92 - 93.70}{22}$

$S = 0.1918$

Calculate 'V'

Try 18" ϕ RCP

FROM FHWA HY8 Nomograph 1

$\frac{HW}{D} = 0.68$

$HW = 1.02 \Rightarrow$ I → el. 1296.90

$I_{max} = 1294.92$

$S = \frac{95.94 - 93.70}{22} =$

$S = 0.1018$

$Q_{capacity} = 36$ cfs >> 3 cfs Inlet control OK

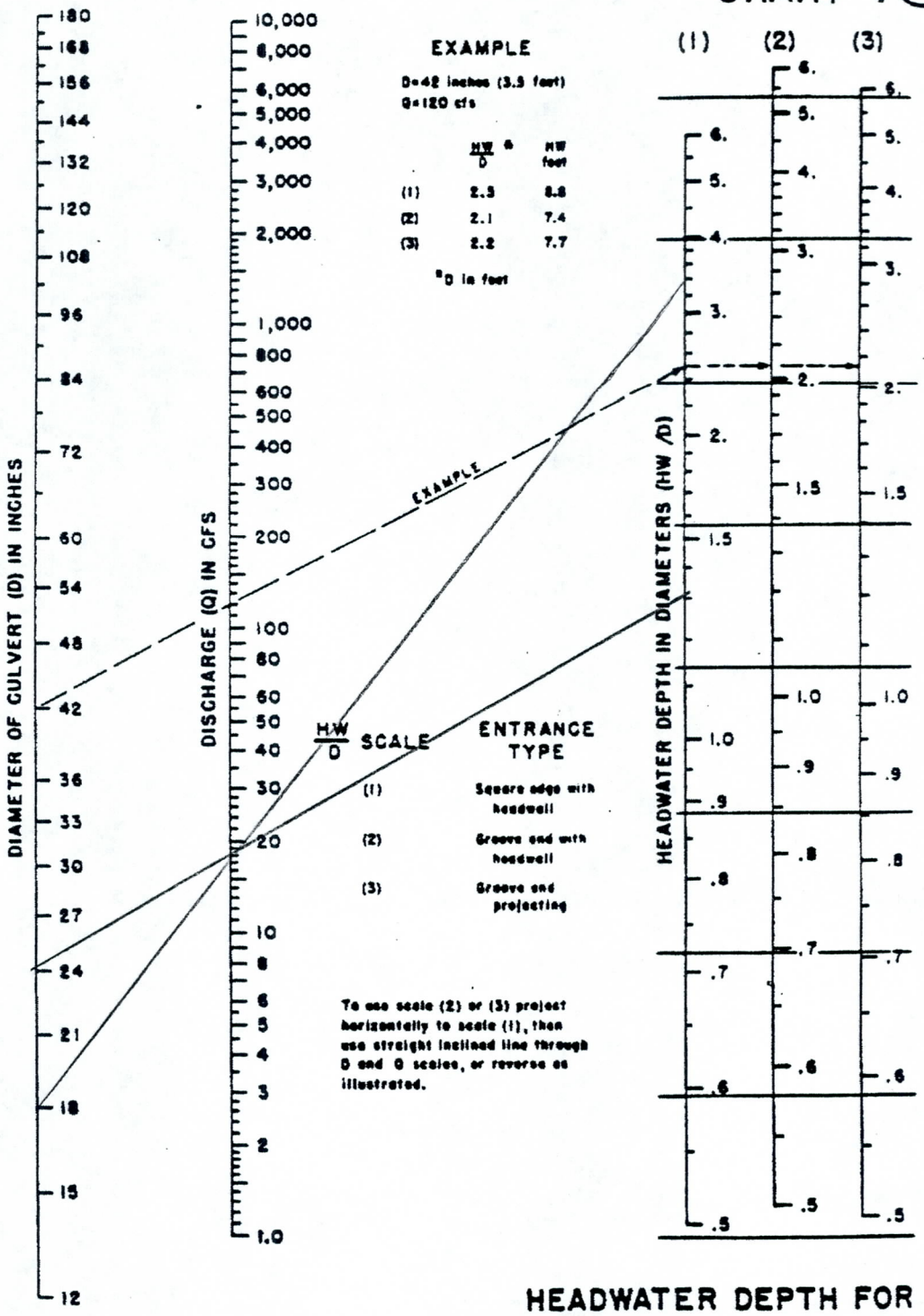
$\boxed{V = 2.0 \text{ FT}}$

Use 18" ϕ RCP.

95+60, 31.5' Rt., E.C.B.

5

CHART 1



HEADWATER SCALES 2 & 3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

#6

CURRENT DATE: 12-22-1998
CURRENT TIME: 08:44:33

FILE DATE: 10-27-1998
FILE NAME: OS9560
STA: 95+60

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1294.92	1290.37	22.47	1 RCP	1.50	1.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: OS9560 DATE: 10-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1295.09	0	0	0	0	0	0	0	0	1
1296.06	0	0	0	0	0	0	0	0	1
1295.17	1	1	0	0	0	0	0	0	1
1295.29	1	1	0	0	0	0	0	0	1
1295.40	2	2	0	0	0	0	0	0	1
1295.50	2	2	0	0	0	0	0	0	1
1295.59	2	2	0	0	0	0	0	0	1
1295.68	3	3	0	0	0	0	0	0	1
1295.75	3	3	0	0	0	0	0	0	1
1295.83	4	4	0	0	0	0	0	0	1
1295.90	10-YR 4	4	0	0	0	0	0	0	1
1297.60	12	12	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OS9560 DATE: 10-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1295.09	0.00	0	0	0.00
1296.06	0.00	0	0	0.00
1295.17	0.00	1	0	0.00
1295.29	0.00	1	0	0.00
1295.40	0.00	2	0	0.00
1295.50	0.00	2	0	0.00
1295.59	0.00	2	0	0.00
1295.68	0.00	3	0	0.00
1295.75	0.00	3	0	0.00
1295.83	0.00	4	0	0.00
1295.90	0.00	4	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-22-1998 FILE DATE: 10-27-1998
CURRENT TIME: 08:44:33 FILE NAME: OS9560

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (1.5 BY 1.5) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1295.09	0.00	0.17	0-NF	0.00	0.00	0.00	0.00	0.00	4.72
0	1296.06	0.12	1.14	3-M1t	0.06	0.22	0.23	1.50	0.00	4.72
1	1295.17	0.25	0.25	1-S1f	0.11	0.33	0.45	1.50	0.00	4.72
1	1295.29	0.37	0.37	1-S1f	0.16	0.40	0.68	1.50	0.00	4.72
2	1295.40	0.48	0.48	1-S1f	0.17	0.47	0.91	1.50	0.00	4.72
2	1295.50	0.58	0.58	1-S1f	0.19	0.53	1.13	1.50	0.00	4.72
2	1295.59	0.67	0.67	1-S1f	0.21	0.58	1.36	1.50	0.00	4.72
3	1295.68	0.76	0.76	1-S1f	0.22	0.63	1.58	1.50	0.00	4.72
3	1295.75	0.83	0.83	1-S1f	0.24	0.68	1.81	1.50	0.00	4.72
4	1295.83	0.91	0.91	1-S1f	0.26	0.72	2.04	1.50	0.00	4.72
4	1295.90	0.98	0.98	1-S1f	0.28	0.76	2.26	1.50	0.00	4.72

El. inlet face invert 1294.92 ft El. outlet invert 1290.37 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

**** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1294.92
OUTLET STATION (FT)	22.00
OUTLET ELEVATION (FT)	1290.37
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.2068
CULVERT LENGTH ALONG SLOPE (FT)	22.47

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 12-22-1998
CURRENT TIME: 08:44:33

FILE DATE: 10-27-1998
FILE NAME: OS9560

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1295.09

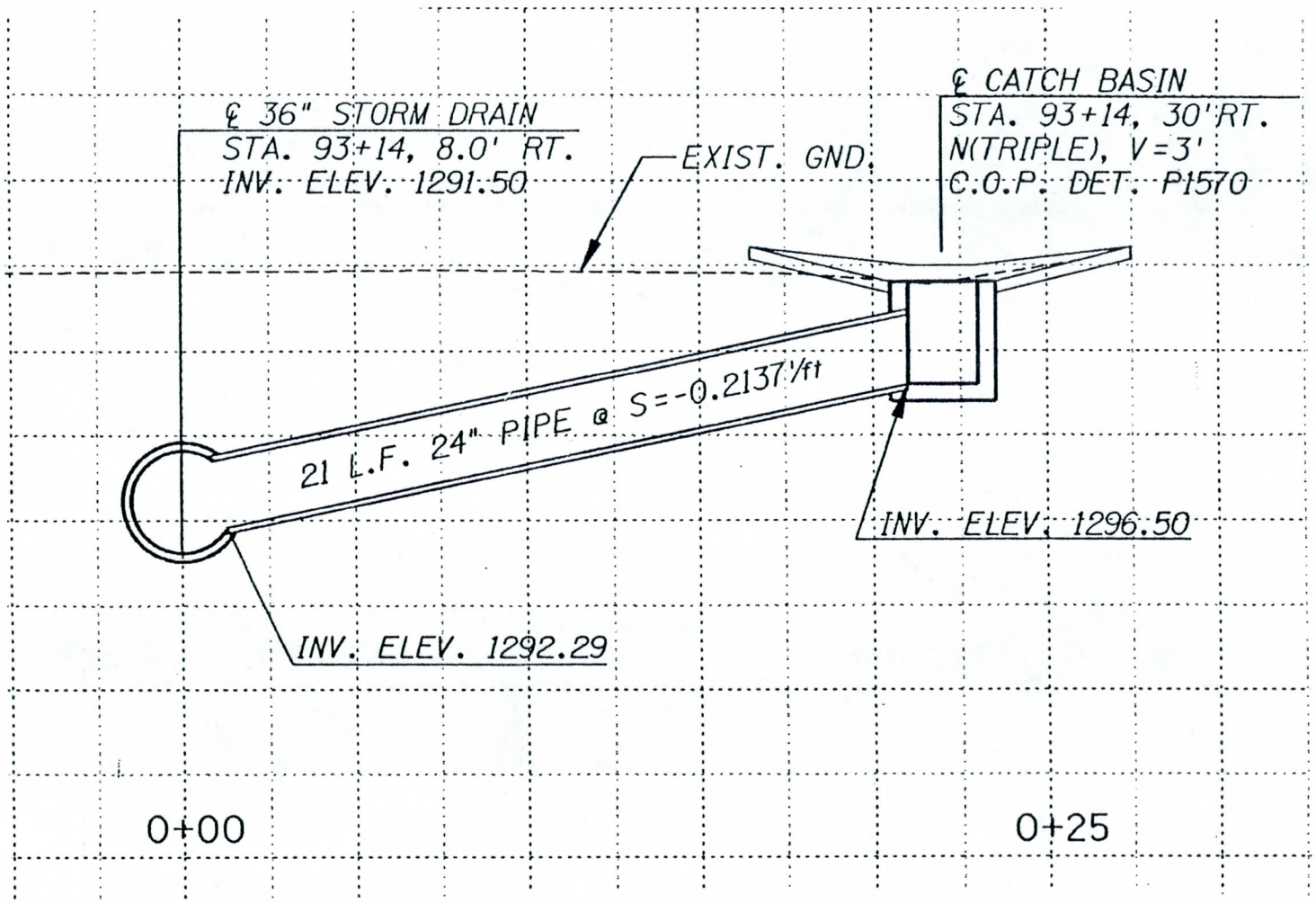
ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 35.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1299.20
2	50.00	1298.06
3	70.00	1297.60
4	90.00	1298.00
5	110.00	1298.20

Sub basin 10-2 (17cfs)

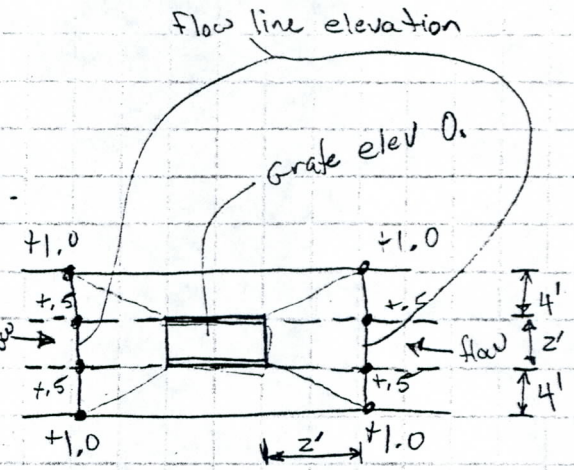


EEC

Project Title OAK STREET STORM DRAIN Project No. 98514 Date 12/10/98

Subject DA 10-1 & 10-2 Catch basins Designed by LAV Page 10

Q_{10} DA 10-1 = 3 cfs
Q_{10} DA 10-2 = 18 cfs



OPEN AREA

Single 'N' Type 2

FRAME $16\frac{3}{4} \times (40\frac{1}{2} - (2 * 3)) = 4.01\ ft^2$

GRATE

$7 \times .5 \times 16.5 = 57.75\ in^2$
$2 \times .25 \times 16.5 = 8.25\ in^2$
$10 \times .5 \times 39.5 = 197.5$
$263.5 \div 144 = 1.83\ ft^2$

Open Area = 4.01
− 1.83
2.18 ft^2

Sump (MAX) $Q_i = C_o A (2gd)^{.5}$ Sump location

$C_o = 0.67$
$A = 2.18\ ft^2$
$g = 32.2$
$d = 1'$ head

$Q_i = 0.67 (2.18) (2(32.2)(1))^{1/2}$
$= 11.72$ cfs

Apply 0.5 Reduction Factor

Grate Elev 98.50

= 5.86 cfs ← ≈ 6 cfs

Double $(23.4 \times 0.5) = 11.72$ cfs ← ≈ 12 cfs

Triple $(35.16 \times 0.5) = 17.58$ cfs ← ≈ 18 cfs

use 'N' Type 2 single for DA 10-1
use 'N' Type 2 Triple for DA 10-2

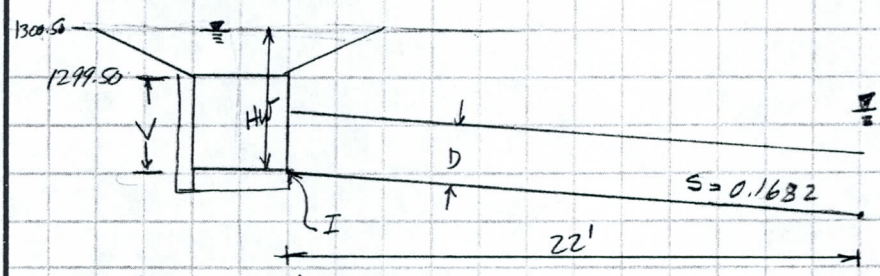
EEC

Project Title OAK STREET Project No. 98514 Date

Subject CONNECTOR PIPE CAPACITY Designed by Page 11

STA 93+14 Triple 'N'

Qdesign = 18 cfs
Qcapacity = 44 cfs
Assume inlet control



CALCULATE 'V' –

– TRY 18"ϕ RCP

FROM FHWA – HY-8 NOMOGRAPH #1

$\frac{HW}{D} = 3.4$

HW = 5.1 FT ⇒ I = EL. 1295.4

Qcapacity = 44 cfs OK

V = 4.1 FT REQUIRES 8" WALL THICKNESS

TRY 24" PIPE TO REDUCE V

– $\frac{HW}{D} = 1.3$

HW = 2.6 FT ⇒ I = EL. 1297.9

I_{max} = EL. ~~1296~~ 1296.5

$\boxed{V = 3.0 \text{ FT}}$

REQUIRES 6" WALL THICKNESS

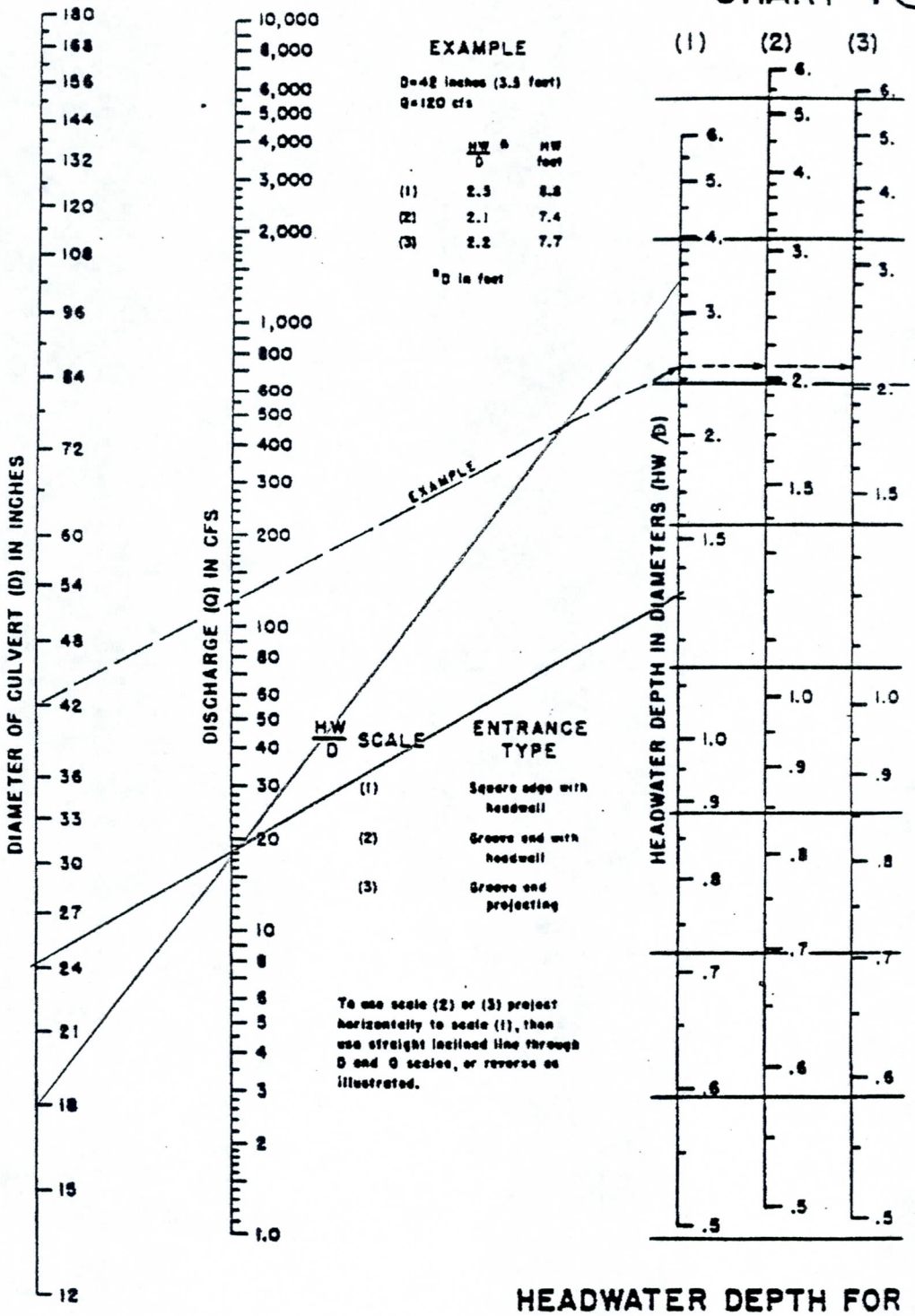
USE I = 1295.50

USE 24"ϕ RCP

93+14
~~93+14~~, 30' Rt., E.C.B.

12

CHART 1



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

13

CURRENT DATE: 12-22-1998
CURRENT TIME: 08:57:50

FILE DATE: 12-22-1998
FILE NAME: OS9314
STA: 93+14

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~~~~~~~~~~~~~~~~~~~~~~~~~~~~ FHWA CULVERT ANALYSIS ~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~ HY-8, VERSION 4.3 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~

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CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1296.50	1292.29	21.42	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

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SUMMARY OF CULVERT FLOWS (CFS) FILE: OS9314 DATE: 12-22-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1296.50	0	0	0	0	0	0	0	0	1
1296.86	2	2	0	0	0	0	0	0	1
1297.17	3	3	0	0	0	0	0	0	1
1297.43	5	5	0	0	0	0	0	0	1
1297.65	7	7	0	0	0	0	0	0	1
1297.84	9	9	0	0	0	0	0	0	1
1297.90	9	9	0	0	0	0	0	0	1
1298.21	12	12	0	0	0	0	0	0	1
1298.40	14	14	0	0	0	0	0	0	1
1298.59	15	15	0	0	0	0	0	0	1
1298.81	10-YR 17	17	0	0	0	0	0	0	1
1299.78	23	23	0	0	0	0	0	OVERTOPPING	

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SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OS9314 DATE: 12-22-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1296.50	0.00	0	0	0.00
1296.86	0.00	2	0	0.00
1297.17	0.00	3	0	0.00
1297.43	0.00	5	0	0.00
1297.65	0.00	7	0	0.00
1297.84	0.00	9	0	0.00
1297.90	0.00	9	0	0.00
1298.21	0.00	12	0	0.00
1298.40	0.00	14	0	0.00
1298.59	0.00	15	0	0.00
1298.81	0.00	17	0	0.00

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<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

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CURRENT DATE: 12-22-1998 FILE DATE: 12-22-1998
CURRENT TIME: 08:57:50 FILE NAME: OS9314

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1296.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	3.93
2	1296.86	0.36	0.36	1-S1f	0.15	0.44	0.54	2.00	0.00	3.93
3	1297.17	0.67	0.67	1-S1f	0.23	0.64	1.08	2.00	0.00	3.93
5	1297.43	0.93	0.93	1-S1f	0.28	0.80	1.62	2.00	0.00	3.93
7	1297.65	1.15	1.15	1-S1f	0.32	0.92	2.16	2.00	0.00	3.93
9	1297.84	1.34	1.34	1-S1f	0.37	1.04	2.71	2.00	0.00	3.93
9	1297.90	1.40	1.40	1-S1f	0.38	1.07	2.86	2.00	0.00	3.93
12	1298.21	1.71	1.71	1-S1f	0.44	1.24	3.79	2.00	0.00	3.93
14	1298.40	1.90	1.90	1-S1f	0.47	1.32	4.33	2.00	0.00	3.93
15	1298.59	2.09	2.09	1-S1f	0.50	1.41	4.87	2.00	0.00	3.93
17	1298.81	2.31	2.31	1-S1f	0.52	1.48	5.41	2.00	0.00	3.93

El. inlet face invert 1296.50 ft El. outlet invert 1292.29 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1296.50
OUTLET STATION (FT)	21.00
OUTLET ELEVATION (FT)	1292.29
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.2005
CULVERT LENGTH ALONG SLOPE (FT)	21.42

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

15

CURRENT DATE: 12-22-1998
CURRENT TIME: 08:57:50

FILE DATE: 12-22-1998
FILE NAME: OS9314

~~~~~~~~~~~~~~~~~~~~~~~~~ TAILWATER ~~~~~~~~~~~~~~~~~~~~~~~~~

CONSTANT WATER SURFACE ELEVATION
1296.22

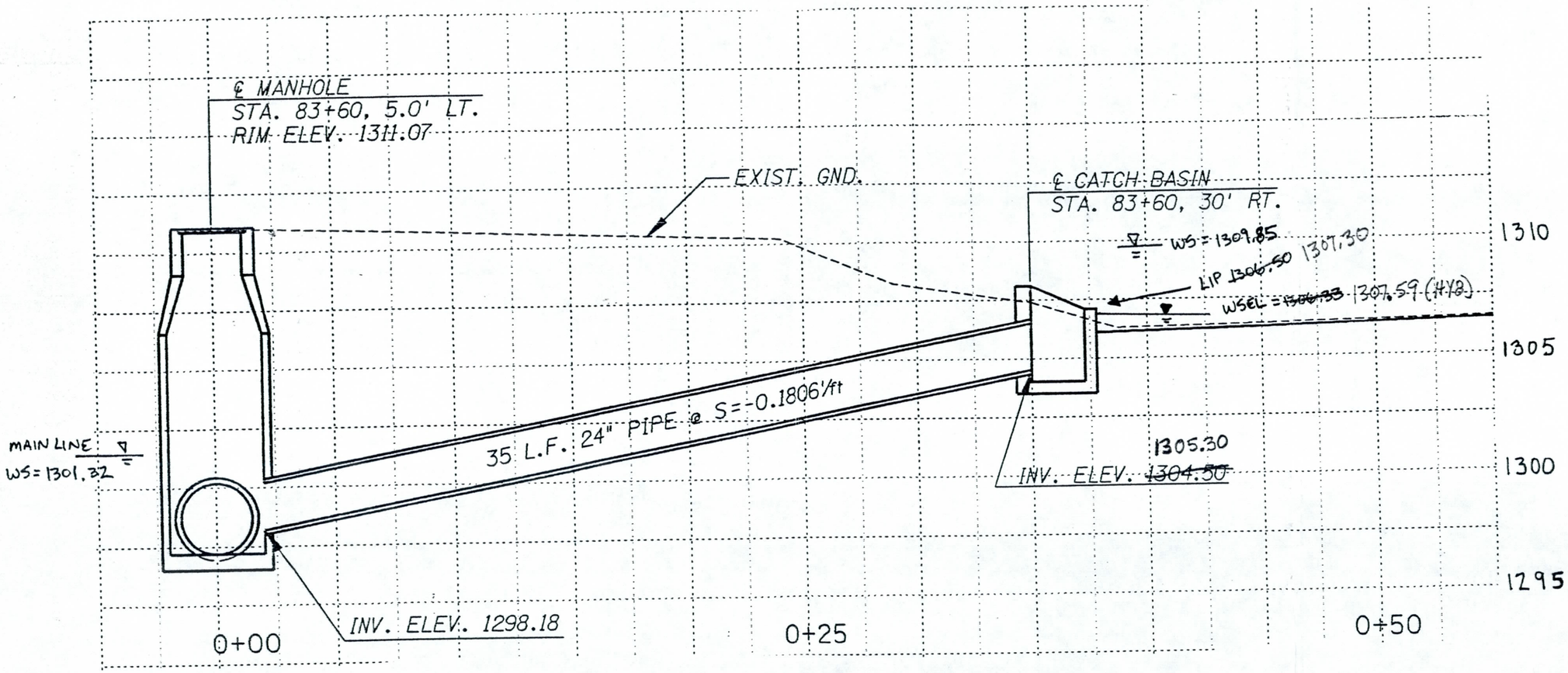
~~~~~~~~~~~~~~~~~~~~~~~~~ ROADWAY OVERTOPPING DATA ~~~~~~~~~~~~~~~~~~~~~~~~~

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	35.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1299.78
2	17.00	1299.93
3	34.00	1300.07

Sub basin 11 (17 cfs)



CURRENT DATE: 12-22-1998 FILE DATE: 10-27-1998
CURRENT TIME: 17:19:50 FILE NAME: OS8360

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1305.30	1297.68	35.82	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: OS8360 DATE: 10-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1305.30	0	0	0	0	0	0	0	0	1
1305.64	2	2	0	0	0	0	0	0	1
1305.95	3	3	0	0	0	0	0	0	1
1306.21	5	5	0	0	0	0	0	0	1
1306.43	7	7	0	0	0	0	0	0	1
1306.63	9	9	0	0	0	0	0	0	1
1306.81	10	10	0	0	0	0	0	0	1
1306.99	12	12	0	0	0	0	0	0	1
1307.18	14	14	0	0	0	0	0	0	1
1307.38	15	15	0	0	0	0	0	0	1
1307.59 10-48	17	17	0	0	0	0	0	0	1
1309.85	29	29	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OS8360 DATE: 10-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1305.30	0.00	0	0	0.00
1305.64	0.00	2	0	0.00
1305.95	0.00	3	0	0.00
1306.21	0.00	5	0	0.00
1306.43	0.00	7	0	0.00
1306.63	0.00	9	0	0.00
1306.81	0.00	10	0	0.00
1306.99	0.00	12	0	0.00
1307.18	0.00	14	0	0.00
1307.38	0.00	15	0	0.00
1307.59	0.00	17	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-22-1998 FILE DATE: 10-27-1998
CURRENT TIME: 17:19:50 FILE NAME: OS8360

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1305.30	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	3.64
2	1305.64	0.34	0.34	1-S1f	0.14	0.44	0.54	2.00	0.00	3.64
3	1305.95	0.65	0.65	1-S1f	0.23	0.64	1.08	2.00	0.00	3.64
5	1306.21	0.91	0.91	1-S1f	0.27	0.80	1.62	2.00	0.00	3.64
7	1306.43	1.13	1.13	1-S1f	0.32	0.92	2.16	2.00	0.00	3.64
9	1306.63	1.33	1.33	1-S1f	0.36	1.04	2.71	2.00	0.00	3.64
10	1306.81	1.51	1.51	1-S1f	0.40	1.14	3.25	2.00	0.00	3.64
12	1306.99	1.69	1.69	1-S1f	0.43	1.24	3.79	2.00	0.00	3.64
14	1307.18	1.88	1.88	1-S1f	0.46	1.32	4.33	2.00	0.00	3.64
15	1307.38	2.08	2.08	1-S1f	0.48	1.41	4.87	2.00	0.00	3.64
17	1307.59	2.29	2.29	1-S1f	0.51	1.48	5.41	2.00	0.00	3.64

El. inlet face invert 1305.30 ft El. outlet invert 1297.68 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1305.30
OUTLET STATION (FT)	35.00
OUTLET ELEVATION (FT)	1297.68
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.2177
CULVERT LENGTH ALONG SLOPE (FT)	35.82

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 12-22-1998
CURRENT TIME: 17:19:50

FILE DATE: 10-27-1998
FILE NAME: OS8360

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~~~~~~~~~~~~~~~~~~~~~~~~~~ TAILWATER ~~~~~~~~~~~~~~~~~~~~~~~~~~
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CONSTANT WATER SURFACE ELEVATION
1301.32

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~~~~~~~~~~~~~~~~~~~~~~~~~~ ROADWAY OVERTOPPING DATA ~~~~~~~~~~~~~~~~~~~~~~~~~~
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WEIR COEFFICIENT 2.63
EMBANKMENT TOP WIDTH (FT) 10.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1309.85
2	29.00	1310.47
3	56.00	1310.83
4	79.00	1309.98

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EEC

Project Title OAK STREET STORM DRAIN Project No. 98512 Date 10-27-98

Subject Catch basin @ STA. 83+60 Designed by LAV Page 20

Catch basin Drop STRUCTURE

Check ponding depth caused by flow into catch basin using weir flow equation

(1) $Q = CLH^{1.5}$

$Q_{10} = 17$ CFS
$C = 3.00$ (FCDMC 3-18) } solve for H.
$L = 5.25'$ for 24" S.D.

$$H = \left[\frac{Q}{CL}\right]^{0.667} = \left[\frac{17}{(3.00)(5.25)}\right]^{0.667} = 1.05'$$

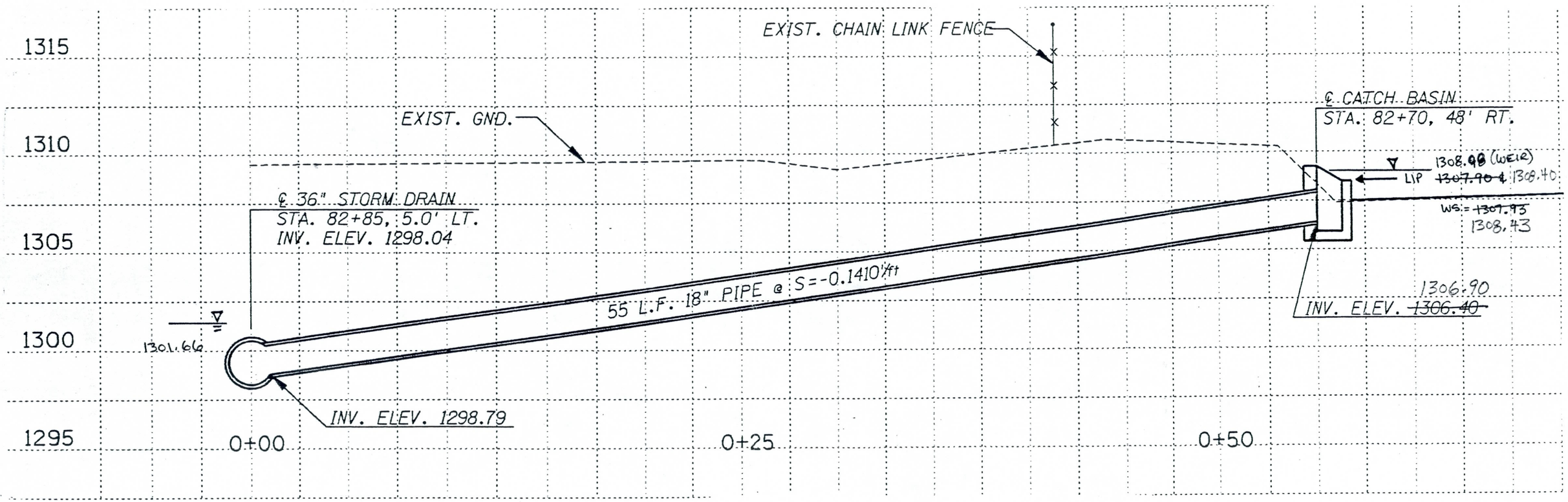
The elevation of the catch basin opening is = 1307.30

$$\begin{array}{r} 1307.30 \\ +\ 1.05 \\ \hline 1308.35 \end{array}$$

The overtopping elevation is = 1308.35

∴ The catch basin will accept the 10-yR storm without break-out occuring.

Sub basin 12 (7 cfs)



22
1

CURRENT DATE: 12-22-1998
CURRENT TIME: 17:27:04

FILE DATE: 10-27-1998
FILE NAME: OS8285

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1306.90	1298.79	54.61	1 RCP	1.50	1.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: OS8285 DATE: 10-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1306.90	0	0	0	0	0	0	0	0	1
1307.16	1	1	0	0	0	0	0	0	1
1307.37	1	1	0	0	0	0	0	0	1
1307.55	2	2	0	0	0	0	0	0	1
1307.70	3	3	0	0	0	0	0	0	1
1307.83	4	4	0	0	0	0	0	0	1
1307.96	4	4	0	0	0	0	0	0	1
1308.07	5	5	0	0	0	0	0	0	1
1308.19	6	6	0	0	0	0	0	0	1
1308.30	6	6	0	0	0	0	0	0	1
1308.43	7	7	0	0	0	0	0	0	1
1310.58	15	15	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OS8285 DATE: 10-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1306.90	0.00	0	0	0.00
1307.16	0.00	1	0	0.00
1307.37	0.00	1	0	0.00
1307.55	0.00	2	0	0.00
1307.70	0.00	3	0	0.00
1307.83	0.00	4	0	0.00
1307.96	0.00	4	0	0.00
1308.07	0.00	5	0	0.00
1308.19	0.00	6	0	0.00
1308.30	0.00	6	0	0.00
1308.43	0.00	7	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-22-1998 FILE DATE: 10-27-1998
CURRENT TIME: 17:27:04 FILE NAME: OS8285

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (1.5 BY 1.5) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1306.90	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	2.87
1	1307.16	0.26	0.26	1-S1f	0.11	0.31	0.40	1.50	0.00	2.87
1	1307.37	0.47	0.47	1-S1f	0.17	0.44	0.79	1.50	0.00	2.87
2	1307.55	0.65	0.65	1-S1f	0.21	0.54	1.19	1.50	0.00	2.87
3	1307.70	0.80	0.80	1-S1f	0.25	0.63	1.58	1.50	0.00	2.87
4	1307.83	0.93	0.93	1-S1f	0.28	0.71	1.98	1.50	0.00	2.87
4	1307.96	1.06	1.06	1-S1f	0.31	0.78	2.38	1.50	0.00	2.87
5	1308.07	1.17	1.17	1-S1f	0.33	0.85	2.77	1.50	0.00	2.87
6	1308.19	1.29	1.29	1-S1f	0.35	0.91	3.17	1.50	0.00	2.87
6	1308.30	1.40	1.40	1-S1f	0.38	0.97	3.57	1.50	0.00	2.87
7	1308.43	1.53	1.53	1-S1f	0.40	1.02	3.96	1.50	0.00	2.87

El. inlet face invert 1306.90 ft El. outlet invert 1298.79 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1306.90
OUTLET STATION (FT)	54.00
OUTLET ELEVATION (FT)	1298.79
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.1502
CULVERT LENGTH ALONG SLOPE (FT)	54.61

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 12-22-1998
CURRENT TIME: 17:27:04

FILE DATE: 10-27-1998
FILE NAME: OS8285

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1301.66

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.63
EMBANKMENT TOP WIDTH (FT)	10.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1311.83
2	29.00	1310.75
3	48.00	1310.58
4	76.00	1311.19

EEC

Project Title OAK STREET STORM DRAIN Project No. 98512 Date 10-27-98

Subject Catch basin @ STA 82+70 Designed by LAV Page 25

Catch basin Drop structure

check ponding depth caused by flow into catch basin using weir flow equation.

(1) $Q = C L H^{1.5}$

$Q_{10} = 7$ cfs , solve for H
$C = 3.0$ (FCDMC 3-1B)
$L = 5.25'$

$$H = \left[\frac{Q}{CL}\right]^{2/3} = \left[\frac{7}{(3.0)(5.25)}\right]^{2/3} = 0.58'$$

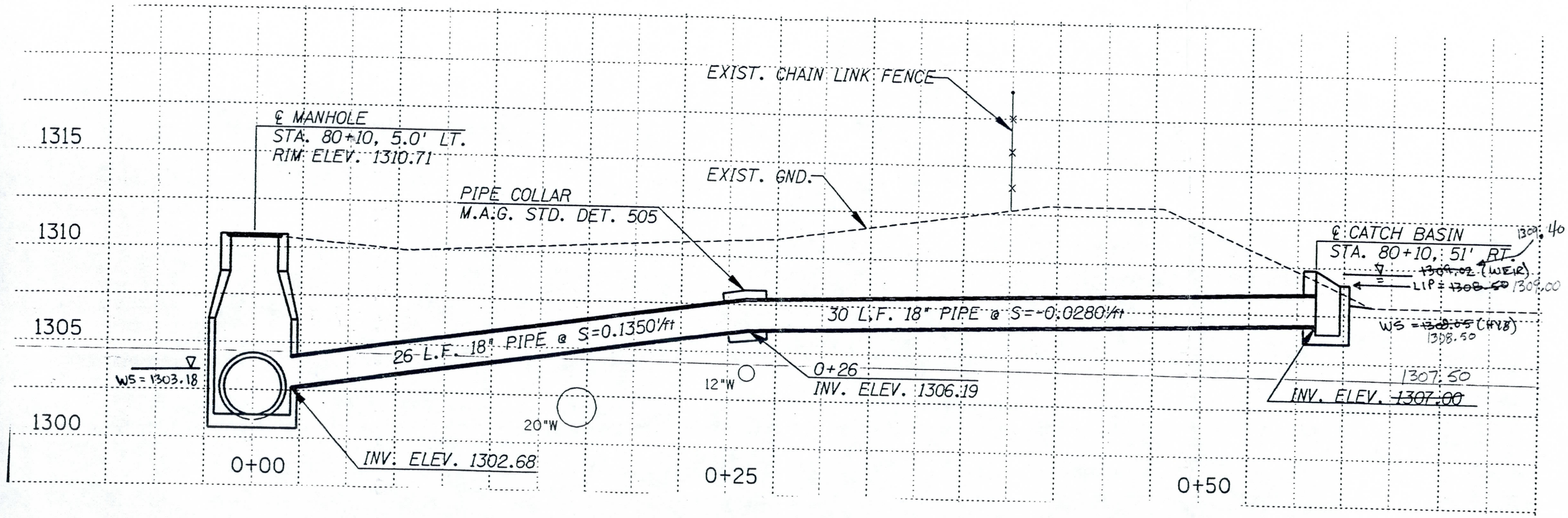
THE elevation of the catch basin opening lip is = 1308.40

1308.40
+ .58
1308.98

The overtopping elevation is = 1310.58

∴ The catch basin will accept the 10-yr STORM without break-out occuring.

Sub basin 13 (4 cfs)



CURRENT DATE: 12-23-1998
CURRENT TIME: 07:15:31

FILE DATE: 10-27-1998
FILE NAME: OS8010

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1307.50	1302.68	56.21	1 RCP	1.50	1.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: OS8010 DATE: 10-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1307.50	0	0	0	0	0	0	0	0	1
1307.71	0	0	0	0	0	0	0	0	1
1307.84	1	1	0	0	0	0	0	0	1
1307.96	1	1	0	0	0	0	0	0	1
1308.07	2	2	0	0	0	0	0	0	1
1308.17	2	2	0	0	0	0	0	0	1
1308.26	2	2	0	0	0	0	0	0	1
1308.35	3	3	0	0	0	0	0	0	1
1308.42	3	3	0	0	0	0	0	0	1
1308.50	4 10-yr	4	0	0	0	0	0	0	1
1308.57	4	4	0	0	0	0	0	0	1
1312.72	18	18	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OS8010 DATE: 10-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1307.50	0.00	0	0	0.00
1307.71	0.00	0	0	0.00
1307.84	0.00	1	0	0.00
1307.96	0.00	1	0	0.00
1308.07	0.00	2	0	0.00
1308.17	0.00	2	0	0.00
1308.26	0.00	2	0	0.00
1308.35	0.00	3	0	0.00
1308.42	0.00	3	0	0.00
1308.50	0.00	4	0	0.00
1308.57	0.00	4	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-23-1998 FILE DATE: 10-27-1998
CURRENT TIME: 07:15:31 FILE NAME: OS8010

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (1.5 BY 1.5) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1307.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.50
0	1307.71	0.21	0.21	1-S2n	0.09	0.22	5.32	0.09	0.00	0.50
1	1307.84	0.34	0.34	1-S2n	0.16	0.33	8.72	0.16	0.00	0.50
1	1307.96	0.46	0.46	1-S2n	0.18	0.40	13.74	0.18	0.00	0.50
2	1308.07	0.57	0.57	1-S2n	0.21	0.47	10.23	0.21	0.00	0.50
2	1308.17	0.67	0.67	1-S2n	0.24	0.53	10.81	0.24	0.00	0.50
2	1308.26	0.76	0.76	1-S2n	0.26	0.58	11.23	0.26	0.00	0.50
3	1308.35	0.85	0.85	1-S2n	0.29	0.63	11.36	0.30	0.00	0.50
3	1308.42	0.92	0.92	1-S2n	0.31	0.68	11.84	0.32	0.00	0.50
4	1308.50	1.00	1.00	1-S2n	0.33	0.72	12.80	0.33	0.00	0.50
4	1308.57	1.07	1.07	1-S2n	0.34	0.76	13.39	0.34	0.00	0.50

El. inlet face invert 1307.50 ft El. outlet invert 1302.68 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1307.50
OUTLET STATION (FT)	56.00
OUTLET ELEVATION (FT)	1302.68
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0861
CULVERT LENGTH ALONG SLOPE (FT)	56.21

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 12-23-1998
CURRENT TIME: 07:15:31

FILE DATE: 10-27-1998
FILE NAME: OS8010

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1303.18

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.63
EMBANKMENT TOP WIDTH (FT)	10.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1313.10
2	29.00	1312.72
3	54.00	1313.07
4	95.00	1313.50

EEC

Project Title OAK STREET STORM DRAIN Project No. 98512 Date 10-27-98

Subject Catch Basin @ STA 80+10 Designed by LAJ Page 30

Catch basin Drop STRUCTURE

Check ponding depth caused by flow into catch basin using weir flow equation.

(1) $Q = C L H^{1.5}$

$Q_{10} = 4 cfs$, solve for H

$C = 3.0$ (FCDMC 3-18)

$L = 5.25'$

$$H = \left[\frac{Q}{CL}\right]^{0.667} = \left[\frac{4}{(3.00)(5.25)}\right]^{0.667} = 0.40'$$

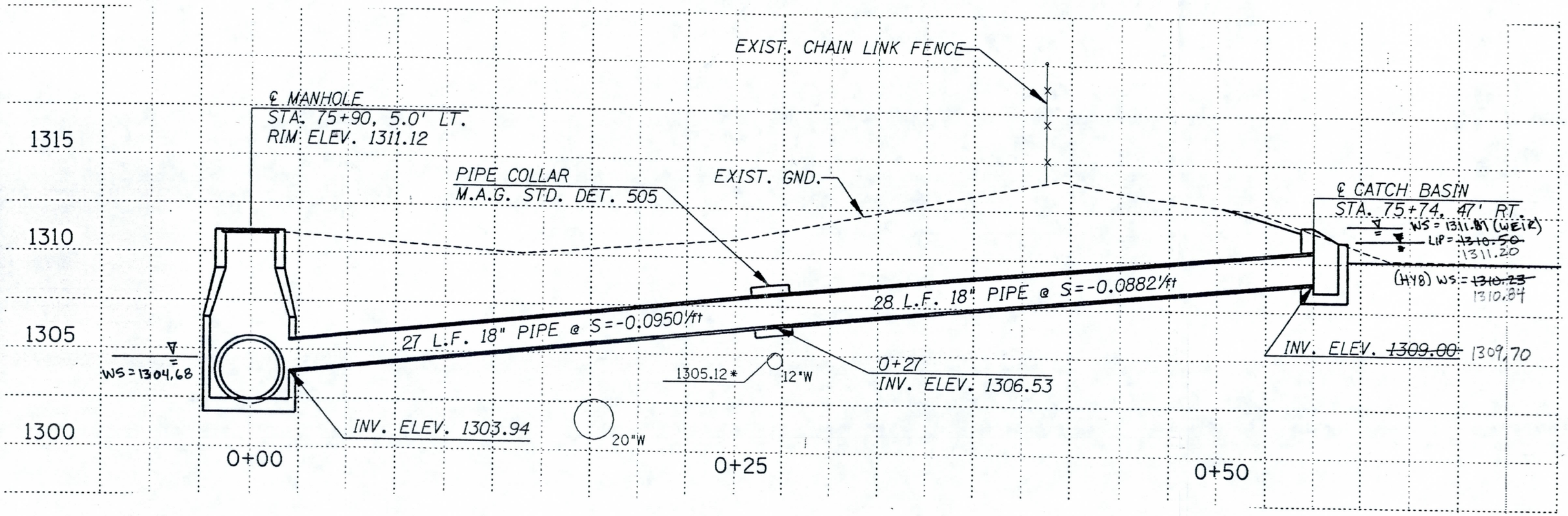
THE W.S. elevation of the top of the catch basin opening is

$1309.00 + 0.40 = 1309.40$

The overtopping elevation = 1313.10

∴ The catch basin will accept the 10-YR STORM without break-out occuring.

Subbasin 14 (5 cfs)



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CURRENT DATE: 12-23-1998
CURRENT TIME: 07:24:28

FILE DATE: 10-27-1998
FILE NAME: OS7590

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1309.70	1303.94	55.30	1 RCP	1.50	1.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: OS7590 DATE: 10-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1309.70	0	0	0	0	0	0	0	0	1
1309.93	1	1	0	0	0	0	0	0	1
1310.09	1	1	0	0	0	0	0	0	1
1310.23	2	2	0	0	0	0	0	0	1
1310.36	2	2	0	0	0	0	0	0	1
1310.47	3	3	0	0	0	0	0	0	1
1310.57	3	3	0	0	0	0	0	0	1
1310.67	4	4	0	0	0	0	0	0	1
1310.75	4	4	0	0	0	0	0	0	1
1310.84 10-YR	5	5	0	0	0	0	0	0	1
1310.92	5	5	0	0	0	0	0	0	1
1313.00	14	14	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OS7590 DATE: 10-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1309.70	0.00	0	0	0.00
1309.93	0.00	1	0	0.00
1310.09	0.00	1	0	0.00
1310.23	0.00	2	0	0.00
1310.36	0.00	2	0	0.00
1310.47	0.00	3	0	0.00
1310.57	0.00	3	0	0.00
1310.67	0.00	4	0	0.00
1310.75	0.00	4	0	0.00
1310.84	0.00	5	0	0.00
1310.92	0.00	5	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-23-1998 FILE DATE: 10-27-1998
CURRENT TIME: 07:24:28 FILE NAME: OS7590

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (1.5 BY 1.5) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1309.70	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.74
1	1309.93	0.23	0.23	1-S2n	0.10	0.25	6.20	0.10	0.00	0.74
1	1310.09	0.39	0.39	1-S2n	0.16	0.37	10.97	0.16	0.00	0.74
2	1310.23	0.53	0.53	1-S2n	0.19	0.46	17.88	0.19	0.00	0.74
2	1310.36	0.66	0.66	1-S2n	0.22	0.53	11.65	0.22	0.00	0.74
3	1310.47	0.77	0.77	1-S2n	0.26	0.60	12.25	0.26	0.00	0.74
3	1310.57	0.87	0.87	1-S2n	0.29	0.65	12.39	0.29	0.00	0.74
4	1310.67	0.97	0.97	1-S2n	0.31	0.71	13.34	0.31	0.00	0.74
4	1310.75	1.05	1.05	1-S2n	0.33	0.76	14.17	0.33	0.00	0.74
5	1310.84	1.14	1.14	1-S2n	0.35	0.81	13.71	0.36	0.00	0.74
5	1310.92	1.22	1.22	1-S2n	0.37	0.86	14.04	0.38	0.00	0.74

El. inlet face invert 1309.70 ft El. outlet invert 1303.94 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1309.70
OUTLET STATION (FT)	55.00
OUTLET ELEVATION (FT)	1303.94
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.1047
CULVERT LENGTH ALONG SLOPE (FT)	55.30

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 12-23-1998 FILE DATE: 10-27-1998
CURRENT TIME: 07:24:28 FILE NAME: OS7590

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1304.68

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT 2.63
EMBANKMENT TOP WIDTH (FT) 10.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1313.49
2	26.00	1313.37
3	53.00	1313.28
4	79.00	1313.33
5	105.00	1313.00

EEC

Project Title OAK STREET STORM DRAIN Project No. 98514 Date 10-27-98

Subject Catch basin @ STA 75+90 Designed by LAV Page 35

Catch basin Drop STRUCTURE

Check ponding depth for breakout based on flow into catch basin drop STRUCTURE

(1) weir flow equation $Q = CLH^{1.5}$

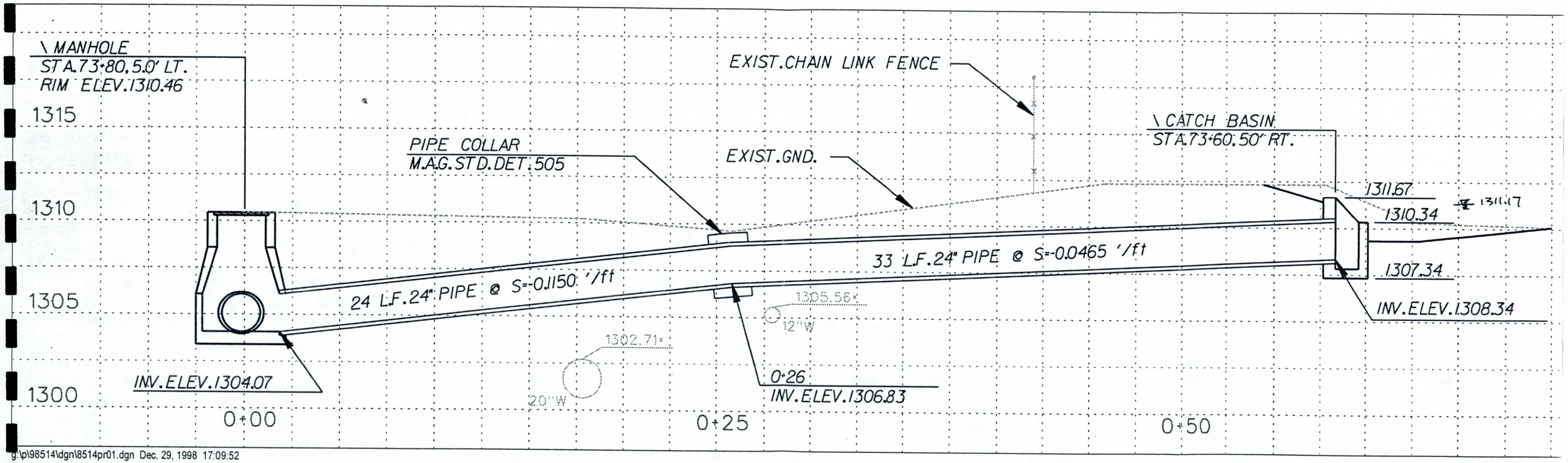
$Q_{10} = 5$ cfs
$C = 3.0$ (FCDMC 3-18)
$L = 5.25$, solve for H

$$H = \left(\frac{Q}{CL}\right)^{0.667} = \left(\frac{5}{3.0(5.25)}\right)^{0.667} = 0.47'$$

Elevation of weir opening = 1311.20 + 0.47' = 1311.67

The overtopping elevation = 1313.00

∴ The catch basin will accept the 10-yr STORM without break-out occuring.



g:\p\98514\dgn\8514pr01.dgn Dec. 29, 1998 17:09:52

37

1

CURRENT DATE: 12-29-1998
CURRENT TIME: 16:18:40

FILE DATE: 10-27-1998
FILE NAME: OAK7380
STA 73+80

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV #	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
1	1308.34	1304.07	58.16	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: OAK7380 DATE: 10-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1308.34	0	0	0	0	0	0	0	0	1
1308.72	1	1	0	0	0	0	0	0	1
1308.96	2	2	0	0	0	0	0	0	1
1309.17	4	4	0	0	0	0	0	0	1
1309.35	5	5	0	0	0	0	0	0	1
1309.51	6	6	0	0	0	0	0	0	1
1309.66	7	7	0	0	0	0	0	0	1
1309.80	8	8	0	0	0	0	0	0	1
1309.93	10	10	0	0	0	0	0	0	1
1310.06	11	11	0	0	0	0	0	0	1
1310.19 10-YR	12	12	0	0	0	0	0	0	1
1312.14	25	25	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: OAK7380 DATE: 10-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1308.34	0.00	0	0	0.00
1308.72	0.00	1	0	0.00
1308.96	0.00	2	0	0.00
1309.17	0.00	4	0	0.00
1309.35	0.00	5	0	0.00

1309.51	0.00	6	0	0.00
1309.66	0.00	7	0	0.00
1309.80	0.00	8	0	0.00
1309.93	0.00	10	0	0.00
1310.06	0.00	11	0	0.00
1310.19	0.00	12	0	0.00

~~~~~~

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

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□

2

CURRENT DATE: 12-29-1998 FILE DATE: 10-27-1998
CURRENT TIME: 16:18:40 FILE NAME: OAK7380

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PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) RCP

~~~~~~

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1308.34	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.72
1	1308.72	0.38	0.38	1-S2n	0.17	0.37	7.48	0.17	0.00	0.72
2	1308.96	0.62	0.62	1-S2n	0.25	0.53	15.48	0.25	0.00	0.72
4	1309.17	0.83	0.83	1-S2n	0.30	0.66	11.02	0.31	0.00	0.72
5	1309.35	1.01	1.01	1-S2n	0.35	0.77	12.59	0.35	0.00	0.72
6	1309.51	1.17	1.17	1-S2n	0.40	0.86	12.70	0.42	0.00	0.72
7	1309.66	1.32	1.32	1-S2n	0.44	0.95	13.89	0.45	0.00	0.72
8	1309.80	1.46	1.46	1-S2n	0.47	1.03	13.65	0.50	0.00	0.72
10	1309.93	1.59	1.59	1-S2n	0.50	1.10	14.01	0.54	0.00	0.72
11	1310.06	1.72	1.72	1-S2n	0.54	1.18	15.77	0.54	0.00	0.72
12	1310.19	1.85	1.85	1-S2n	0.57	1.24	14.74	0.61	0.00	0.72

~~~~~~

El. inlet face invert 1308.34 ft El. outlet invert 1304.07 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

~~~~~~

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1308.34
OUTLET STATION (FT)	58.00
OUTLET ELEVATION (FT)	1304.07
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0736
CULVERT LENGTH ALONG SLOPE (FT)	58.16

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CONCRETE

```
      BARREL MANNING'S N    0.012
      INLET TYPE            CONVENTIONAL
      INLET EDGE AND WALL   SQUARE EDGE WITH HEADWALL
      INLET DEPRESSION      NONE

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
□
                                                                            3

CURRENT DATE: 12-29-1998                                FILE DATE: 10-27-1998
CURRENT TIME: 16:18:40                                  FILE NAME: OAK7380

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~~~~~~~~~~~~~~~~~~~~~~~~~~           TAILWATER           ~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

           CONSTANT WATER SURFACE ELEVATION
                    1304.79

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~   ROADWAY OVERTOPPING DATA   ~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

      WEIR COEFFICIENT                                   2.63
      EMBANKMENT TOP WIDTH (FT)                         10.00
***** USER DEFINED ROADWAY PROFILE
      CROSS-SECTION         X          Y
      COORD. NO.          (FT)        (FT)
           1               0.00    1312.22
           2              26.00    1312.25
           3              54.00    1312.23
           4              80.00    1312.51
           5             118.00    1312.14
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
□
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EEC

Project Title OAK STREET STORM DRAIN Project No. 98514 Date 10-27-98

Subject Catch Basin @ 73+80 Designed by ZAV Page 40

Catch basin Drop STRUCTURE

Check ponding depth caused by flow into catch basin using weir flow equation (1).

(1) $Q = C L H^{1.5}$

$Q_{10} = 12$ cfs
$C = 3.00$ (FCDMC 3-18)
$L = 4.0$

Solve for H

$$H = \left(\frac{Q}{CL}\right)^{0.667} = \left[\frac{12}{(3.0)(5.25)}\right]^{0.667} = 0.83'$$

The Elev. of the Top of the catch Basin opening is

1310.34. Add 0.83 = 1311.17.

The overtopping elevation in this area is Approx. 1311.17

∴ The catch basin will accept the 10-yr storm with little if any breakout occuring

APPENDIX B7
OFFSITE CATCH BASINS

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98512 Date 8-12-98

Subject: Hydraulics Designed LLV Page

THE Following is a list and description of drainage basins and split flows which are not located on OAK STREET. Several of the basins are collected into off site catch basins. SEE EXHIBITS 1 & 2 FOR LOCATION REFERENCE.

MAP ID	Basin	Description
2	3E	This basin is split 50/50, with half the flow going To Basin 1B and the other 1/2 To basin 3D
2	4C	This basin consists of a shopping mall with the parking lot in a sump condition. a grated inlet collects runoff and routes through a S.D. lateral in Scottsdale road.
5	5C	is routed through ① a shopping mall, ② TREE-TOP nursery To scottsdale road.
3	5D	This basin is collected in a grated inlet located at 71ST Place and Virginia - a 42" lateral delivers it into the Scottsdale road lateral.
1	5E	The runoff from this basin splits with flow equal to the capacity of one side of the street going to basin 7D (69th Pl) and the remaining flow going to basin 5D (virgina)
4	7D	Slotted drains located at 70th ST & Vernon Ave collect the Combined flow and direct it into a latteral which connects to the main line in OAK STREET.
1	1B	DRAINAGE Flows South down Miller Road and is intercepted by

WEST < a. 87 L.F of Slotted Drain
b. combination Curb opening & grate inlet

EAST < C M2, L = 17' Curb opening
D 3'x2' grated inlet

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 7-23-98

Subject: EXISTING CATCH BASIN CAPACITIES Designed HN Page 1

Location	Basin Type	Basin 5-D
Virginia & 71st PL	grated inlet ($d = 18''$)	

(weir) $Q_i = C_w P d^{1.5}$

$C_w = 3.0$
$d = 1.5$
$P = 2(40'' + 34') = 37.33'$

$= (3.0)(37.33)(1.5)^{1.5}$

$= 205.7$ cfs $\times$ Reduction Factor

$= 205.7 \times 0.5$

$Q_i = \underline{102.85 \text{ cfs}}$ ←

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

$C_o = 0.67$
$A = (40/12) \times 34 = 113.33 \text{ ft}^2$
$g = 32.2$
$d = 1.5$

$Q_i = 0.67(89.43 \text{ ft}^2)(2(32.2)(1.5))^{.5}$

$= 588.9$ cfs $\times$ Reduction Factor

$= 588.9 \times 0.5$

$Q_i = \underline{294.45 \text{ cfs}}$ ←

$A - A_{bars} = 113.33 - 23.90 = 89.43 \text{ ft}^2$

$2 \times 1'' \times 40'' = 80 \text{ in}^2$
$11 \text{ L} \times \frac{1}{4} \times 34' = 1122 \text{ in}^2$
$14 \times 4'' \times 40'' = 2240$
3442 in^2
$= 23.90 \text{ ft}^2$

NOTE: Given the Conditions and size of the Grate inlet it is CONSERVATIVE TO ACCEPT THAT THE INLET IS OPERATING UNDER WEIR FLOW AND THEREFORE HAS A CAPACITY OF 103 cfs.

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title: OAK STREET Project No. 98514 Date 7-23-98

Subject: EXISTING CATCH BASIN CAPACITIES Designed LAV Page 2

LOCATION: 70th ST. & VERNON

BASIN TYPE: Basin 7D

Slotted Drains max depth = 0.75 ft (sump)

$Q_i = 0.8LW(2gd)^{0.5} \rightarrow 0.94L(d)^{.5}$ where $W = 1.75''$

(orifice) $d \geq 0.4'$

			R.F.		
$L_1 = 30'$	$Q_i = 0.94(30')(.75)^{.5} =$	24.42	x 0.80	=	20.0 cfs
$L_2 = 28.5'$	$Q_i = 0.94(28.5)(.75)^{.5} =$	23.2	x 0.80	=	19.0 cfs
$L_3 = 36'$	$Q_i = 0.94(36)(.75)^{.5} =$	29.31	x 0.80	=	23.0 cfs
$L_4 = 36'$	$Q_i = 0.94(36)(.75)^{.5} =$	29.31	x 0.80	=	23.0 cfs

TOTAL = 85 cfs

EXISTING INLETS ON MILLER ROAD NORTH OF OAK STREET INTERCEPT FLOW FROM BASINS 1b which have a developed runoff of 94 cfs.

* DETERMINE IF THE EXISTING INLETS CAN CAPTURE THE FLOW before it Reaches OAK STREET.

Slotted Drain inlets 84' (W)
37' Curb opening Inlet MZ L=17 (E)
2' x 3' grate inlet (E)
3' Combo (curb & grate) (W)

STEP 1 STREET CAPACITY

See Sheet 3a = 79 cfs

flow in excess of 79 cfs will over top the side walk and flow accross the golf course to indian bend wash.

STEP 2 Calculate capacities of existing Inlets

West ① Slotted Drain L=87 see sheet 3b

② Combination Curb & grate L=3' (")

EAST ① MZ, L=17' Curb opening

② 3' x 2' grated inlet

flow reaching intersection of oak & miller

3.5 + 5 = 8.5 cfs ←

Miller Road STREET CAPACITY 07/30/98

Flow from North Down miller Road toward OAK ST.

Open Channel Flow for Irregular Channel

Input Quantities

	Manning's n:	0.0160	
	Channel Slope:	0.0042	ft/ft
Calculated	Flow Rate:	78.9727	cfs
Calculated	Elev. of Flow:	20.2500	ft

= 79 cfs

Calculated Quantities

Area Of Flow:	23.2500	sf
Wetted Perimeter:	54.8437	ft
Hydraulic Radius:	0.4239	ft
Velocity:	3.3967	ft/s
Critical Slope:	0.5129	%
Top Width:	54.0000	ft
Froude Number:	0.9122	
Critical Depth::	0.7212	ft
Depth of Flow:	0.7500	ft

Ground Shot Information

Num	Offset	Elevation
1	0.0000	21.0000
2	18.0000	20.2500
3	23.0000	20.0000
4	23.1000	19.5000
5	45.0000	20.0000
6	66.9000	19.5000
7	67.0000	20.0000
8	72.0000	20.2500
9	88.0000	21.0000

Slotted drain on grade

given
$n = 0.016$
$S_x = 0.02$
$S = 0.004$
$Q = 39.5$ cfs
$R_F = 0.8$
$L = 84$ ft

$$L_T = 0.6\, Q^{0.42} S^{0.3} \left(\frac{1}{n S_x}\right)^{0.6}$$

$$L_T = 0.6\,(39.5)^{.42}\,(0.004)^{0.3}\left(\frac{1}{(.016)(.02)}\right)^{0.6}$$

$$L_T = 67 \text{ ft}$$

$$E = 1 - \left(1 - \frac{84}{67}\right)^{1.8} = 1.08$$

$$Q_i = E\, Q\, R_F$$

$$= (1.08)(39.5)(0.8)$$

$$= 34.1 \simeq 34 \text{ cfs}$$

Flow by = 5 cfs

Curb opening inlet

$n = 1$, $L = 3$

$Q = 5$
$n = 0.016$
$S_x = 0.02$
$S = 0.004$

$$L_T = 0.6\,(5)^{0.42}\,(.004)^{.3}\left(\frac{1}{(0.016)(0.02)}\right)^{0.6}$$

$$L_T = 26 \text{ ft}$$

$$E = 1 - \left(1 - \frac{6}{26}\right)^{1.8} = 0.38$$

$$Q_i = (0.38)(5)(0.8)$$

$$Q_i = 1.52 \simeq 1.5 \text{ cfs}$$

flow by = 3.5 cfs

Curb opening on grade

given

$n = 0.016$
$S_x = 0.02$
$S = 0.004$
$Q = 39.5$
$R_f = 0.8$

$L = 37$

$$L_T = 0.6\ Q^{0.42} S^{0.3} \left(\frac{1}{n\ S_x}\right)^{0.6}$$

$$L_T = 0.6(39.5)^{.42}(0.004)^{0.3}\left(\frac{1}{(0.016)(0.02)}\right)^{0.6}$$

$$L_T = 67 \text{ ft}$$

$$E = 1 - \left(1 - \frac{37}{67}\right)^{1.8}$$

$$E = 0.76$$

$$Q_i = E\ Q\ R_f$$

$$= 0.76(39.5)(0.8)$$

$$Q_i = 24 \text{ cfs}$$

flow by = 15.5 cfs

2'x 3' grated inlet

Sump conditions

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

$d = 0.5'$
$P = 2+2+3+3 = 10'$
$C_w = 3.0$

$$= 3.0(10')(0.5)^{1.5}$$

$$= 10.60 \text{ cfs} \simeq 10.5 \text{ cfs}$$

flow by = 5 cfs

APPENDIX C
AUTO PARK BASIN

APPENDIX C1
DETENTION BASIN CALCULATIONS

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title OAK STREET STORM DRAIN Project No. 98514 Date

Subject Auto - MALL BASIN Designed LHV Page 1

The basin is graded so that the lower basin is at a 5:1 slope and is 3 ft Deep. The upper basin remains relatively the same as it is now.

- secondary basin(s) will be added to help prevent the overtopping of the sidewalk during low flows.

The lower basin will have a gradual slope leading toward the inlet STRUCTURE. The STRUCTURE ITSELF will have a 6" diameter PVC pipe which will help Drain low flows and prevent ponding of standing water in the basin.

Stage - Storage Relationship
(Automall Detention Basin)

Stage Storage Comparisson Between Kimley-Horn and EEC

Primary Basin

Kimley-Horn			EEC/MKE			
Stage Elev. [ft]	Storage Volume [A-Ft]		Stage Elev. [ft]	Area [acres]	Volume Retained [A-ft]	Sum of Storage Volume [A-Ft]
1261	**0**		**1259**	**0.105**	**0**	**0**
1262	**0.13**		**1260**	**0.149**	**0.126**	**0.126**
			1261	**0.203**	**0.175**	**0.302**
1264	**0.51**		**1262**	**0.252**	**0.227**	**0.529**
1265	**0.97**		**1263**	**0.670**	**0.444**	**0.973**
1266	**1.83**		**1264**	**0.869**	**0.767**	**1.740**
1267	**2.88**		**1265**	**1.020**	**0.943**	**2.684**
1267.2	**3.19***	Peak Stage	**1265.5**	**1.095**	**0.529**	**3.213**
1268	**4.45**		**1266**	**1.170**	**0.566**	**3.779**
1269	**7.11**					

* represents interpolated value.

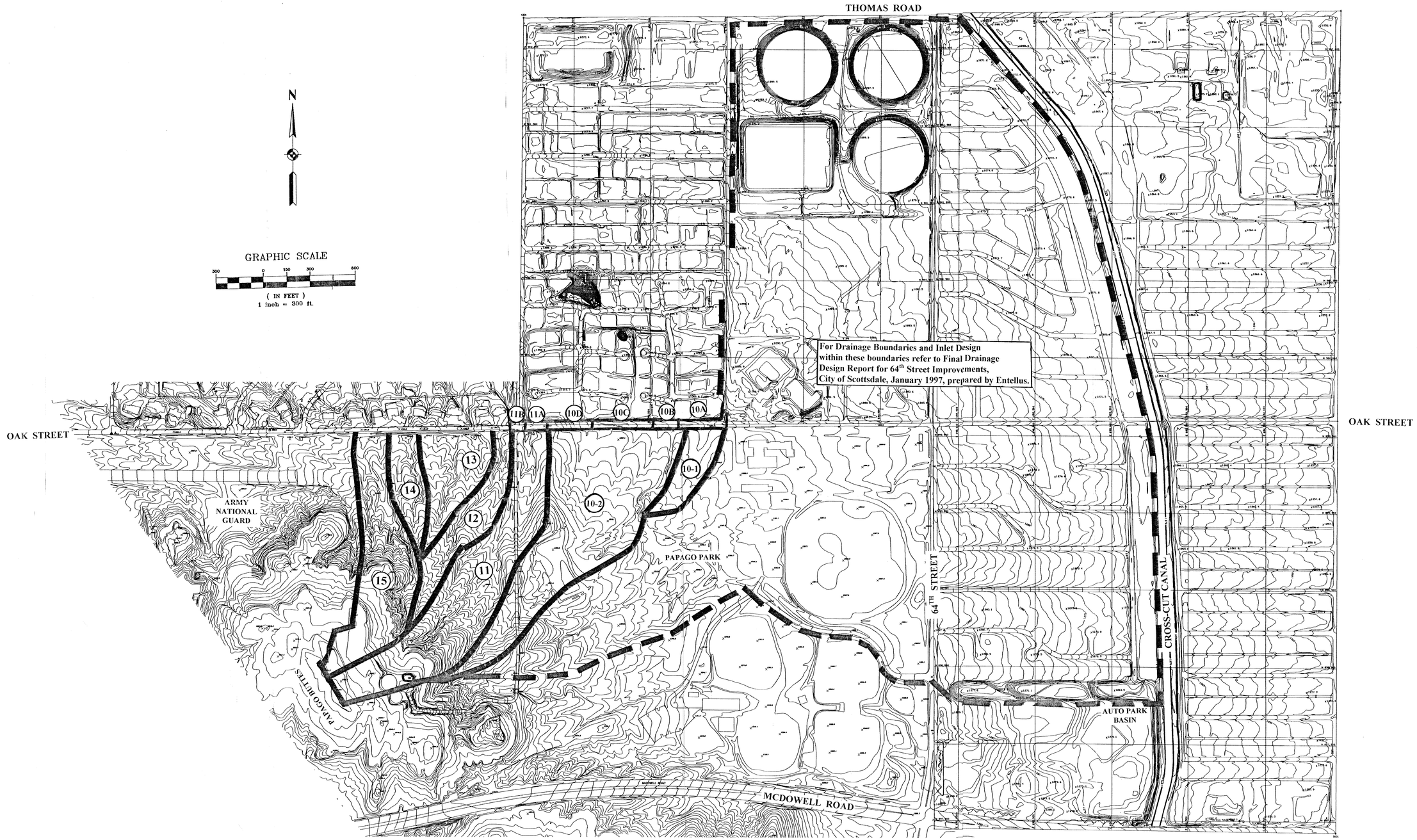
Secondary Basin

			EEC/MKE			
Stage Elev. [ft]	Storage Volume [A-Ft]		Stage Elev. [ft]	Area [acres]	Volume Retained [A-ft]	Sum of Storage Volume [A-Ft]
			1260	**0.020**	**0**	**0**
			1261	**0.039**	**0.029**	**0.029**
			1262	**0.096**	**0.065**	**0.094**

Notes:

1. The difference in stage elevations is due to the 1.77' difference in datum elevation
2. Area measured by planimeter
3. Volume Equation:

   V = [(depth/3) * (Area(top) + Area(bottom) + Sqrt{ Area(top) * Area(bottom) })]
4. The storage capacity of the secondary basin is relatively insignificant and is not included in the primary basin calculations/comparisson to Kimley-Horn.



LEGEND

- (13) SUB-BASIN NO. (SEE APPENDIX A1)
- DRAINAGE BOUNDARY
- OVERLAND FLOW PATH
- AREA RETAINED ONSITE
- (1) EXISTING OFFSITE INLET (SEE APPENDIX B6)
- EXISTING STORM DRAIN

No.	Revision	Date:	By:	Chk:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
OAK STREET STORM DRAIN PROJECT
58TH STREET TO INDIAN BEND WASH
FCD NO. 97-39

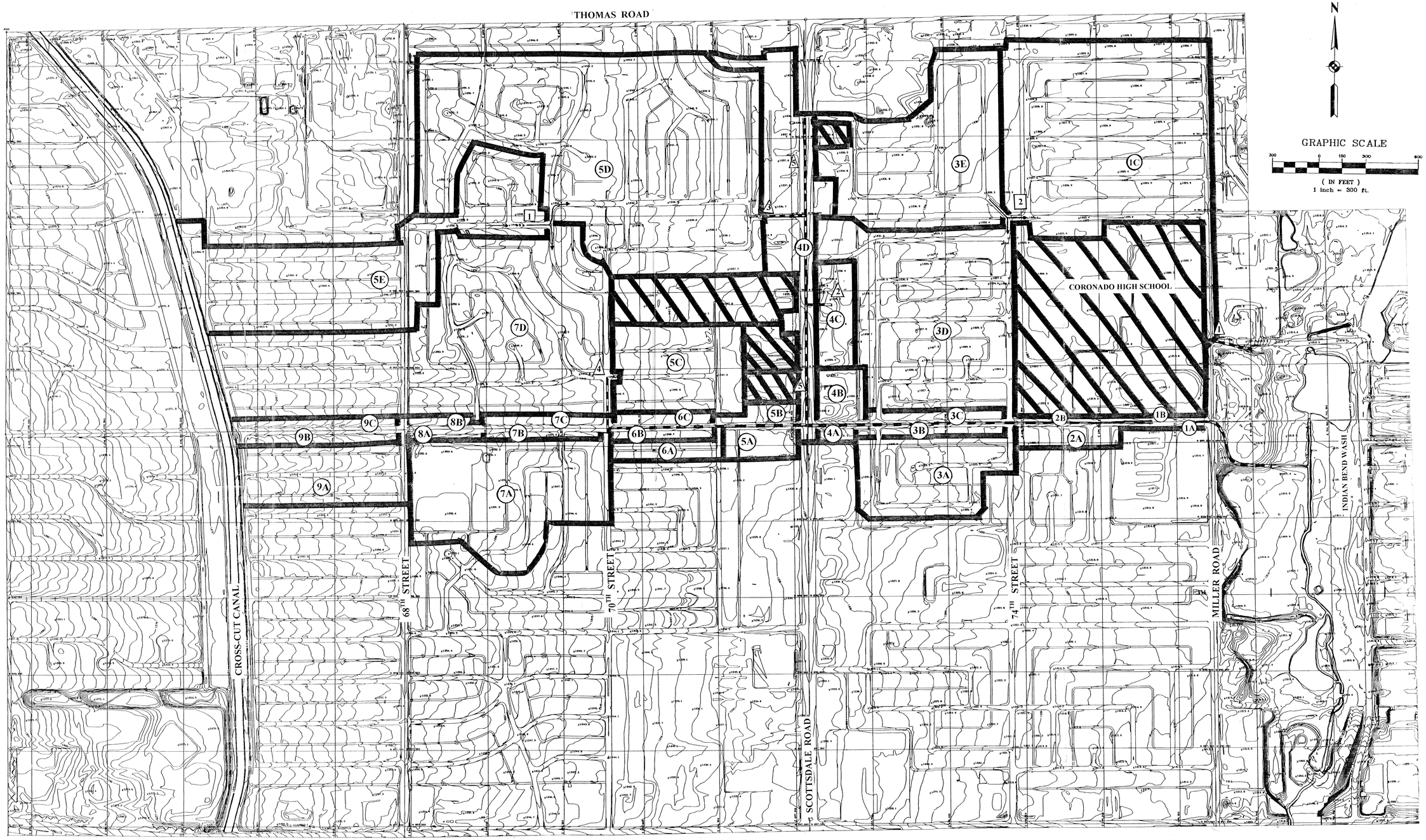
JOB NO.	98514
DESIGNED BY:	L.A. VICK
DRAWN BY:	L.A. VICK
CHECKED BY:	M.T. GAVAN
APPROVED BY:	
DATE:	10-27-98

EXHIBIT 1
DRAINAGE BOUNDARY MAP
WEST OF CROSSCUT CANAL

EEC/MKE
3501 NORTH 16th STREET
PHOENIX, ARIZONA 85016
PHONE (602) 248-7702

SCALE 1" = 300'

SHEET NO. 1 OF 2



LEGEND

- (13) SUB-BASIN NO. (SEE APPENDIX A1)
- DRAINAGE BOUNDARY
- 3 SPLIT FLOW (SEE APPENDIX A4)
- AREA RETAINED ONSITE
- 1 EXISTING OFFSITE INLET (SEE APPENDIX B6)
- EXISTING STORM DRAIN

No.	Revision	Date:	By:	Chk:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
OAK STREET STORM DRAIN PROJECT
58TH STREET TO INDIAN BEND WASH
FCD NO. 97-39

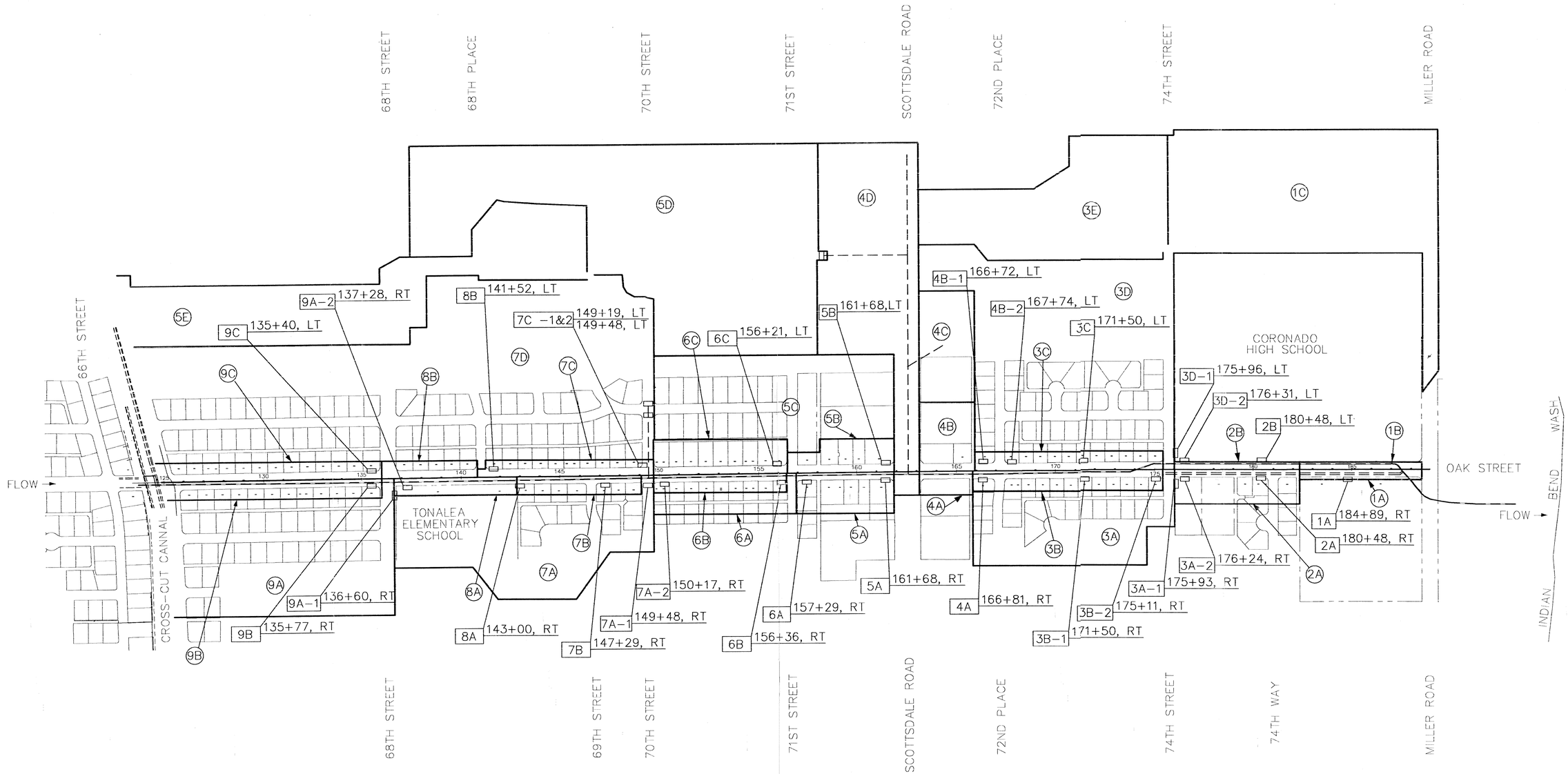
JOB NO.	98514
DESIGNED BY:	L.A. VICK
DRAWN BY:	L.A. VICK
CHECKED BY:	M.T. GAVAN
APPROVED BY:	
DATE:	10-27-98

EXHIBIT 2
DRAINAGE BOUNDARY MAP
EAST OF CROSSCUT CANAL

EEC/MKE
3501 NORTH 16th STREET
PHOENIX, ARIZONA 85016
PHONE (602) 248-7702

SCALE 1" = 300'

SHEET NO. 2 OF 2



No.	Revision	Date:	By:	Chk:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

OAK STREET STORM DRAIN PROJECT
58TH STREET TO INDIAN BEND WASH
FCD NO. 97-39

JOB NO.	98514
DESIGN'D BY:	L.A. VICK
DRAWN BY:	L.A. VICK
CHECKED BY:	M.T. GAVAN
APPROVED BY:	
DATE:	12-21-98

EXHIBIT 3
INLET LOCATIONS AND DRAINAGE AREAS
EAST OF CROSSCUT CANAL

EEC/MKE
3501 NORTH 16th STREET
PHOENIX, ARIZONA 85016
PHONE (602) 248-7702

SCALE	SHEET NO.	OF
1"= 250'	1	1