CITY OF GREELEY, COLORADO

EAST MEMORIAL PARK DRAINAGE BASIN STUDY

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The Engineering Co.
2310 East Prospect Road
Suite "B"
Fort Collins, CO 80525

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIX

LIST OF EXHIBITS

I - EXECUTIVE SUMMARY

Summary

This report discusses analyses and discussions of the stormwater management plan for the East Memorial Drainage Basin which is a portion of the East Greeley Drainage Basin as defined in the Comprehensive Drainage Plan for the City of Greeley that was prepared in 1974. This report includes investigation of the adequacy of the existing storm drainage systems, as well as alternatives available for future improvements.

Alternatives investigated include: 1) How much retention volume would be required in the East Memorial Basin assuming there is no storm sewer system to release water from the East Memorial Park Site; 2) How much detention would be required in the East Memorial Basin, using a pump station to release water to the Greeley No. 3 Ditch; and 3) The size and location of storm sewer lines required to carry stormwater released from the detention pond sites within the basin to a point of discharge north of 16th Street.

Information found in this study is to be used as the basis of preliminary and final designs of specific detention pond and storm sewers.

Currently, the East Memorial Basin suffers from site-specific drainage problems due the flat slopes and inadequate storm sewer system. As an example, localized flooding occurs in the vicinity of 1st Avenue and 18th Street. This is caused by the reduction in storm sewer size from 42 inches to 15 inches in the 1st Avenue storm sewer system at 18th Street. Currently, private property is flooded on the west side of 1st Avenue during minor rainfall events. There are also many locations throughout the basin that have standing water in fields and parking lots due to inadequate slopes or storm sewers.

The major concern and emphasis of this study is the impact of the East Memorial Park site on the drainage system. Because this site is located in a low spot, there is not a natural release of surface water except for infiltration into the soil. The concept of using the park site as a regional detention pond should include provisions for releasing stormwater while maintaining a water surface elevation that does not flood adjacent private property.

The first option considered is the potential for using the East Memorial Park site as a retention pond. Retention ponds are described as a site in which stormwater is allowed to percolate through the soil because there is no method of release. Generally, retention facilities are not

accepted as regional facilities due to the potential for the pond to hold water for extended periods of time. This can lead to operational problems, particularly in the case of a park with playing fields that must be used on a regular basis.

Another concern is the potential for flooding beyond the 100-year elevation which could flood private properties. The maximum flooding depth that could occur at the park site would be to elevation 4645 before it flows overland to the northeast. If this would occur, possibly 25 to 35 houses could be affected in the subdivision adjacent to the west side of the Park.

This option does eliminate the need for construction of a storm sewer outfall system. Alternate 1 in Section 3 discuss the retention pond option. This alternate would require the East Memorial Park site to have a volume of 49.5 AF. The existing site will contain approximately 10 AF. The preliminary plan for the park would be graded to provide approximately 24 AF. Therefore, an additional 26 AF of volume would be required on property adjacent to the park site. It is estimated that an additional 8 acres would be required. This alternate would also require 3 more ponds in the basin. One south of 24th (Pond 301) with a capacity of 17 AF, one north of 20th Street (Pond 302) with a capacity of 8.2 AF, one east of Balsam (Pond 303). These ponds would release 2-year existing flows to the East Memorial pond site.

Advantages of this option include: Lowest capital cost ($530,000) and potential for phasing of park site as development occurs.

Disadvantages include: Large land area required. Potential for flooding of adjacent homes during major storm events. Maintenance problems due to continual wet areas in the park.

The second option would be to construct a pump station that would release 2-year historical flows (20 cfs) from the park site to the Greeley No. 3 canal east of the park.

This option has the advantage to provide positive release of storm water from the park. It also will reduce the land requirements by reducing detention volumes to 22 AF. A small pump could be used to remove nuisance flows from the park.

Disadvantages include: Higher construction costs ($650,000), higher operation and maintenance costs. This system must be built at once without consideration of phasing. Shorter design life and less reliable than the storm sewer system.

The third option would be a system of detention ponds with a storm sewer system that carries release water to an outfall point. Although there are existing easements that could be used as

18TH ST'

the location of the storm sewer, an optional route would extend the line north along Balsam then west along 1st Avenue to a point where it would connect to the extension of the 1st Avenue system. This alternate is shown on Figure A - Proposed Improvements.

The advantages of this alternate are: Reduced detention volumes in East Memorial Park pond (22 AF), best reliability and design life, and potential for incorporation with storm sewer system north of 20th Street that would occur with development. Connection to the 1st Avenue system will provide a positive method for keeping the East Memorial Park site dry and provide a regional storm sewer system for this basin. The area between 16th Street and 18th Street and west of Balsam Avenue has potential for development before areas of Balsam and north of 24th.

The disadvantages are: Higher capital cost ($1,100,000), outfall must be completed from East Memorial Park to a discharge point if development occurs upstream of the park (no phasing), and easements will be required for new alignment.

Recommendations

Based on the study, we make the following recommendations based on initial and future phasing. The improvements are found on Figure A - Stormwater Improvement.

<u>Initial Improvements</u>

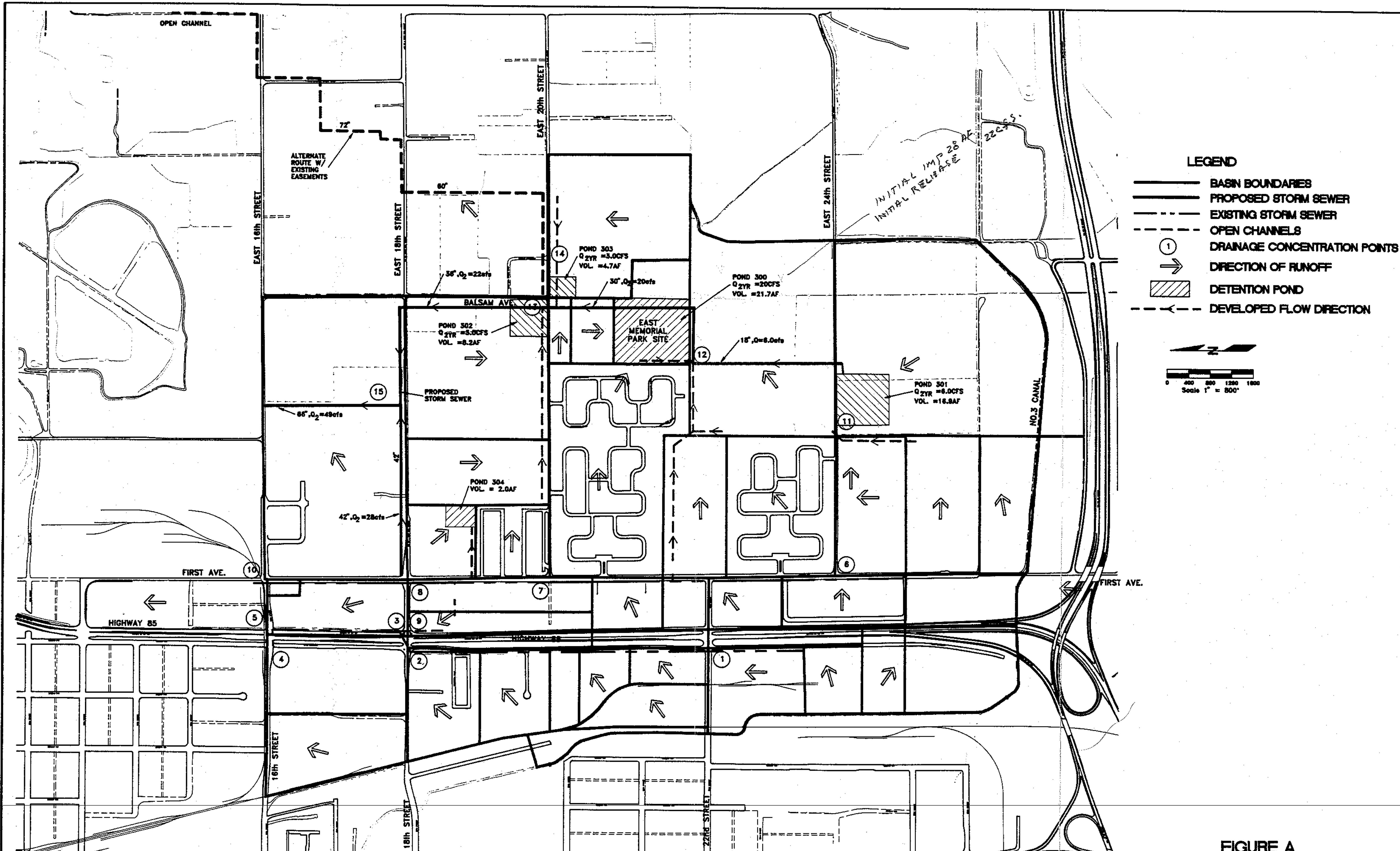
1. East Memorial Park - Provide for 28 AF of storage in the park site and adjacent land below elevation 4643.

2. Verify elevation of lowest foundation of houses in subdivision west of the park site to establish maximum flooding elevation during the 100-year storm.

3. Park should make provision for a stormwater release structure that will be constructed when storm sewer lines are completed. The design release rate is 22 cfs.

4. Begin land acquisition or require land dedication at the time of development for 3 pond sites. They are 301, which is a 17 AF pond south of East 24th Street; 303, which is a 4.7 AF pond to the east of Balsam; and 302, which is an 8.2 AF site west of Balsam and North of 20th.

5. Conduct detailed infiltration study prior to final design. Adjust SWMM model if imperviousness changes from study assumptions.



CITY OF GREELEY
EAST MEMORIAL PARK DRAINAGE BASIN STUDY

FIGURE A
PROPOSED IMPROVEMENTS

6. Construct 7 AF detention pond east of 1st Avenue to reduce flooding potential. Land acquisition and final design will be required. Included will be an overflow section from 1st Avenue to the pond and a return line back to the 1st Avenue storm sewer.

7. Provide for continued maintenance of storm sewer system throughout the basin to assure proper operation.

Future Improvements

1. Construct pond 301 to 17 AF and provide 18-inch storm sewer to East Memorial pond.

2. Construct pond 302 (8.2 AF) and 303 (4.7 AF) as development occurs in representative drainage areas.

3. Construct 30-inch storm sewer from East Memorial Park to 20th Street. Thirty-six inch (36") storm sewer from 20th Street to 18th Street and west to connection with a 42-inch line. Construct 66-inch line north to the outfall point.

4. Construct 42-inch storm sewer from 1st Avenue.

5. Total cost for improvements is $1,500,000. See Table A.

Table A

CITY OF GREELEY
East Memorial Park Drainage Basin
Opinion of Cost - Recommended Alternate

No.	Description	Qty.	Unit	Unit Price	Item Price
1	Excavation Pond 300	63,000	CY	$1.75	$110,250.00
2	Excavation Pond 301	18,000	CY	$1.75	$31,500.00
3	Excavation Pond 302	3,700	CY	$1.75	$6,475.00
4	Excavation Pond 303	76,000	CY	$1.75	$133,000.00
5	Haul (5,000 ft)	45,000	CY	$1.40	$63,000.00
6	Seeding	25	Acres	$1,500.00	$37,500.00
7	18 inch RCP	1,320	LF	$30.00	$39,600.00
8	30 inch RCP	1,320	LF	$65.00	$85,800.00
9	36 inch RCP	2,320	LF	$75.00	$174,000.00
9	42 inch RCP	1,700	LF	$90.00	$153,000.00
10	66 inch RCP	1,320	LF	$170.00	$224,400.00
11	Land Aquistion	4	Acres	$5,000.00	$20,000.00

Subtotal	$1,078,525.00
Contingeies @ 25%	$269,631.25
Subtotal Construction	$1,348,156.25
Engineering	$149,309.65
Total Construction	$1,497,465.90

II - INTRODUCTION

The purpose of this study is to develop a Master Drainage Plan for the City of Greeely in the East Memorial Drainage Basin. A stormwater management plan for the Basin is recommended which includes requirements for improvements to the existing drainage facilities and also drainage requirements for future development within the Basin. The plan is developed to safely provide, convey, and contain the 100-year storm. The study area is shown on Figure 1.

The report has been divided into three major sections which include:

1. Basin Characteristics
2. Hydrologic Analysis
3. Storm-Water Management Alternatives

In Section 1, general basin characteristics are discussed and existing drainage patterns, drainage facilities, and drainage problems are identified. In addition, existing and future land-use patterns are identified in order to determine the runoff characteristics within the Basin.

In Section 2, a detailed hydrologic analysis was developed for both existing and fully-developed conditions. This analysis determined the adequacy of existing drainage facilities, as well as the requirements for future drainage facilities. The hydrologic model developed was used in order to optimize the stormwater management plan for the City to provide the most efficient use of drainage facilities.

Section 3 discusses stormwater management alternatives for the City's drainage basins, including analysis of detention requirements for future developments and also drainage improvements and considerations for the current improvements to the East Memorial Park site.

The study does present feasibility level cost estimates for the recommended improvements. These estimates are intended to act as a tool for budgetary planning for drainage improvements and as a guide for selection of a management plan.

The basic data utilized in this study included AutoCAD maps of the study area. These maps are developed from the Water and Sewer Department's city-wide mapping project. The maps scale for the study varied for 1:100 to 1:400 scale based on the information required. Topography from the project was developed from a photogrammetric process that used existing aerial photography and ground control. Point elevations were developed throughout the Basin to determine flow patterns and Basin slopes. In addition, computer contour mapping was developed for the Basin to assist in understanding the drainage patterns. All of this point data can be made available to the City.

III - BASIN CHARACTERISTICS

The location and limits of the basins Study are shown on Figure 1. The small subbasins represent small areas used in the CUHP and SWMM models.

The overall basin is characterized by very flat slopes. The basin is bounded on the south and west by the Greeley No. 3 ditch. The east boundary also includes a portion of the No. 3 ditch and a small ridge running north to south in the proximity of Cedar Avenue. The comprehensive plan designation for the East Greeley Basin extends east of this. However, that portion was not considered in this study.

Highway 85 is a barrier for flows west of the highway. The area west of the highway is highly developed with industrial and commercial properties. The area drains to a storm sewer system along the Frontage Road. At 18th Street, the storm sewer crosses the highway in a 27" x 43" pipe. The pipe enters a concrete-lined, open channel that flows north along the east side of the highway. This system is part of the highway drainage and is maintained by the Highway Department.

The prime feature and key element of this study is the proposed park site, south of East Memorial School. The area is a natural depression that drains the area bounded by 1st Avenue on the east, 18th Street on the North, the No. 3 ditch on the south, and the No. 3 ditch on the east. Currently, the area that contributes flow directly to the park site is relatively undeveloped with the exception of trailer courts and residential developments along 1st Avenue.

IV - HYDROLOGIC ANALYSIS

The hydrology of the East Greeley Basin was analyzed for the existing basin conditions effective in 1992. This section of the report discusses the results of the hydrologic analysis for the existing basin conditions.

The basin hydrology was simulated with the Colorado Urban Hydrograph Procedure (CUHP) as developed by the Denver Urban Drainage and Flood Control District (UDFCD). The analysis

CITY OF GREELEY
EAST MEMORIAL PARK DRAINAGE BASIN STUDY

FIGURE 1
EXISTING DRAINAGE PATTERNS

was conducted on the UDFCD computer program for personal computers (PCs). Routing and analysis of detention elements was conducted using EPA's Stormwater Management Model (SWMM), modified by the Missouri River Division of the Army Corps of Engineers. The model used for this study is a PC version that was modified by the UDFCD in Denver, Colorado.

The program has provision to perform hydrologic analysis to determine runoff from the 2-, 5-, 10-, 50-, and the 100-year storm events. These storm events were developed based on 1-hour precipitation data obtained from Cities Rainfall Intensity Frequency Curves.

1-Hour Rainfall Intensities

Duration	Intensity (inches)
2-year	0.75
5-year	0.92
10-year	1.15
50-year	1.76
100-year	2.05

For CUHP calculations, the rational formula option of the CUHP/PC was used for the hydrograph computation. This option was selected because it is more effective when analyzing basins less than 90 acres. Time of Concentrations were calculated for each basin and input into CUHP for each basin. The specific basin parameter used for the CUHP calculations are found in Table 1.

Table 1
CUHP INPUT DATA

Basin No.	Area (sq.mi)	Length (mi.)	Existing Centroid (mi.)	Developed Impervious (percent)	Impervious Percent	Slope (ft/ft)
100	.0260	.23	.10	80.	80	0.0074
101	.0091	.16	.07	40.	40	0.0122
102	.0126	.12	.07	60.	60	0.0120
103	.0193	.26	.13	60.	60	0.0155
104	.0146	.19	.08	80.	80	0.0110
105	.0094	.15	.08	80.	80	0.0110
106	.0081	.14	.06	80.	80	0.0184
107	.0084	.14	.08	60.	60	0.0192
108	.0196	.25	.10	60.	60	0.0144
109	.0242	.27	.14	60.	60	0.0200
110	.0131	.36	.13	50.	50	0.0061
111	.0078	.20	.10	50.	50	0.0037
112	.0095	.32	.16	50.	50	0.0013
115	.0068	.27	.13	10.	10	0.0018
130	.0035	.25	.12	10.	10	0.0015
131	.0038	.25	.14	10.	10	0.0016
200	.0452	.42	.28	10.	10	0.0050
201	.0187	.26	.12	60.	80	0.0010
203	.0215	.24	.12	70.	80	0.0039
204	.0128	.16	.08	60.	60	0.0152
208	.0086	.12	.05	65.	80	0.0146
206	.0310	.32	.15	60.	70	0.0029
207	.0032	.09	.04	55.	70	0.0010
205	.0121	.15	.07	80.	80	0.0050
215	.0226	.29	.15	65.	80	0.0025
216	.0016	.04	.01	80.	80	0.0050
217	.1240	.35	.11	20.	50	0.0011
300	.0217	.27	.12	00.	50	0.0081
301	.0293	.33	.16	00.	50	0.0080
302	.0317	.36	.17	40.	70	0.0072
303	.0461	.40	.16	40.	45	0.0073
304	.0299	.28	.14	00.	50	0.0083
305	.0762	.39	.18	40.	45	0.0041
306	.0160	.24	.12	45.	45	0.0023
307	.0149	.16	.09	65.	80	0.0561
308	.0303	.31	.18	50.	50	0.0022
309	.0637	.40	.32	50.	50	0.0018
320	.1200	.42	.23	00.	50	0.0044
321	.0943	.29	.13	00.	50	0.0088
322	.0590	.30	.15	00.	50	0.0043
323	.0237	.14	.08	00.	2.0	0.0051
324	.0104	.08	.05	50.	50	0.0060
325	.0010	.12	.06	50.	50	0.0060

Hydrographs from the CUHP analyses were input into SWMM for the different storm frequencies.

To adequately simulate the watershed, the entire drainage area was divided into subbasins. Exhibit 1, found in the pocket in the Appendix, shows the boundaries used for these subbasin divisions, as well as the number designation used in CUHP. A total of 43 subbasins were used in the hydrologic analysis. A total of 61 storm sewers, detention ponds, and channel elements were used in the model. The description of all of the conveyance elements can also be found on Table 2. Some of the conveyance elements are represented by overland flow elements. Table 3 lists the percent impervious for various land uses within the basin, along with the corresponding "C" factor for Rational Method analysis. Percent imperviousness for each basin was determined by field investigations of the basins and values used on similar analyses.

TABLE 2
SWMM CONVEYANCE ELEMENT DATA

CITY OF GREELEY, COLORADO DEVELOPED BASIN
TEC, THE ENGINEERING COMPANY - APRIL 1992

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	J
15	20	0	5	PIPE	2.0	550.	.0040	.0	.0	.013	2.00	
				OVERFLOW	2.0	550.	.0040	20.0	20.0	.030	10.00	
16	21	0	3		.0	1.	.0010	.0	.0	.001	10.00	
17	22	0	2	PIPE	1.3	450.	.0050	.0	.0	.013	1.25	
20	23	0	5	PIPE	2.0	1250.	.0050	.0	.0	.013	2.00	
				OVERFLOW	20.0	1250.	.0050	20.0	20.0	.030	10.00	
21	23	0	4	CHANNEL	5.0	400.	.0075	2.0	2.0	.025	3.00	
				OVERFLOW	20.0	400.	.0075	20.0	20.0	.020	10.00	
22	25	0	3		.0	1.	.0010	.0	.0	.001	10.00	
23	24	0	5	PIPE	2.0	675.	.0080	.0	.0	.015	2.00	
				OVERFLOW	20.0	675.	.0080	20.0	20.0	.035	10.00	
24	25	0	5	PIPE	2.0	450.	.0050	.0	.0	.015	3.00	
				OVERFLOW	20.0	450.	.0050	20.0	20.0	.035	10.00	
25	27	0	5	PIPE	2.0	400.	.0050	.0	.0	.013	3.00	0
				OVERFLOW	20.0	400.	.0050	20.0	20.0	.035	10.00	
26	27	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
27	28	0	4	CHANNEL	3.0	600.	.0050	1.0	1.0	.020	3.00	0
				OVERFLOW	20.0	600.	.0050	20.0	20.0	.030	10.00	
28	29	0	4	CHANNEL	3.0	800.	.0040	1.5	1.5	.020	3.00	0
				OVERFLOW	20.0	800.	.0040	20.0	20.0	.030	10.00	
29	31	0	5	PIPE	2.0	250.	.0040	.0	.0	.013	2.00	0
				OVERFLOW	10.0	250.	.0040	20.0	20.0	.020	10.00	
30	31	0	2	PIPE	2.0	24.	.0055	.0	.0	.013	2.00	0
31	54	0	5	PIPE	5.0	1200.	.0020	1.0	1.0	.018	5.00	0
				OVERFLOW	20.0	1200.	.0020	20.0	20.0	.020	10.00	
50	0	0	5	PIPE	1.5	200.	.0040	20.0	20.0	.020	2.00	0
				OVERFLOW	1.0	200.	.0040	20.0	20.0	.020	10.00	
51	52	0	4	CHANNEL	.5	600.	.0040	12.0	12.0	.016	.50	0
				OVERFLOW	10.0	600.	.0040	20.0	20.0	.016	10.00	
52	54	0	2	PIPE	2.0	200.	.0050	.0	.0	.013	2.00	0
53	0	0	5	PIPE	1.5	200.	.0040	.0	.0	.015	1.50	0
				OVERFLOW	1.0	200.	.0040	20.0	20.0	.020	10.00	
54	0	0	4	CHANNEL	5.0	300.	.0100	1.0	1.0	.018	5.00	0
				OVERFLOW	20.0	300.	.0100	20.0	20.0	.020	10.00	
100	111	5	2	PIPE	1.5	300.	.0100	.0	.0	.015	1.50	15
		DIVERSION TO GUTTER NUMBER 15 - TOTAL Q VS DIVERTED Q IN CFS										
		.0	.0	9.0 2.0	20.0	11.0	50.0	41.0	100.0	91.0		
111	112	0	4	CHANNEL	.5	400.	.0040	12.0	12.0	.015	.50	0
				OVERFLOW	10.0	400.	.0040	20.0	20.0	.020	10.00	
112	113	0	5	PIPE	2.0	630.	.0015	.0	.0	.015	2.00	0
				OVERFLOW	1.0	630.	.0015	20.0	20.0	.020	10.00	
113	120	0	5	PIPE	2.5	1150.	.0055	.0	.0	.015	2.50	0
				OVERFLOW	1.0	1150.	.0055	20.0	20.0	.020	10.00	
115	116	0	5	PIPE	3.5	800.	.0015	.0	.0	.013	3.50	0
				OVERFLOW	1.0	800.	.0015	20.0	20.0	.015	10.00	
116	203	0	5	PIPE	3.5	400.	.0015	.0	.0	.015	3.50	0
				OVERFLOW	1.0	400.	.0015	20.0	20.0	.002	10.00	
120	202	0	5	PIPE	2.5	330.	.0055	.0	.0	.015	2.50	0

				OVERFLOW	1.0	330.	.0055	20.0	20.0	.020	10.00	
121	122	0	2	PIPE	.5	10.	.0040	.0	.0	.013	.50	0
123	115	0	2	PIPE	.5	25.	.0040	.0	.0	.013	.50	0
122	115	0	5	PIPE	2.8	775.	.0040	.0	.0	.013	2.75	0
				OVERFLOW	1.0	775.	.0040	20.0	20.0	.020	10.00	
126	219	0	5	PIPE	3.5	514.	.0015	.0	.0	.013	3.50	0
				OVERFLOW	1.0	514.	.0015	20.0	20.0	.015	10.00	
127	128	0	2	PIPE	1.3	1300.	.0015	.0	.0	.013	1.25	0
128	0	0	2	PIPE	1.3	1300.	.0015	.0	.0	.013	1.25	0
130	0	0	1	CHANNEL	2.0	500.	.0030	20.0	20.0	.020	2.00	0
131	0	0	2	PIPE	.1	1.	.0010	.0	.0	.010	.10	0
132	131	0	1	CHANNEL	5.0	10.	.0010	20.0	20.0	.020	10.00	0
202	122	7	5	PIPE	3.5	10.	.0015	.0	.0	.013	3.50	24
				OVERFLOW	1.0	10.	.0015	20.0	20.0	.020	10.00	

DIVERSION TO GUTTER NUMBER 243 - TOTAL Q VS DIVERTED Q IN CFS

.0 .0 15.0 .0 50.0 1.0 75.0 26.0 100.0 51.0 150.0 101.0

200.0 151.0

203	126	8	5	PIPE	3.5	10.	.0015	.0	.0	.013	3.50	13
				OVERFLOW	1.0	10.	.0015	20.0	20.0	.020	10.50	

DIVERSION TO GUTTER NUMBER 132 - TOTAL Q VS DIVERTED Q IN CFS

.0 .0 15.0 .0 50.0 1.0 75.0 26.0 100.0 51.0 150.0 101.0

200.0 151.0 .0 .0

211	212	0	1	CHANNEL	20.0	600.	.0001	20.0	2.0	.040	10.00	0
213	225	0	2	PIPE	5.0	1250.	.0100	.0	.0	.013	5.00	0
212	302	0	1	CHANNEL	20.0	1300.	.0001	20.0	2.0	.040	10.00	0
214	213	0	2	PIPE	4.0	60.	.0100	.0	.0	.013	4.00	0
215	214	0	2	PIPE	5.0	1320.	.0018	.0	.0	.013	5.00	0
218	214	0	2	PIPE	4.0	100.	.0500	.0	.0	.013	4.00	0
216	300	0	1	CHANNEL	5.0	200.	.0010	2.0	2.0	.030	10.00	0
217	303	0	1	CHANNEL	1.0	300.	.0040	20.0	20.0	.020	10.00	0
219	220	0	2	PIPE	3.5	1700.	.0100	.0	.0	.013	3.50	0
220	0	0	2	PIPE	5.0	1250.	.0200	.0	.0	.013	5.00	0
221	216	0	1	CHANNEL	5.0	550.	.0050	2.0	2.0	.030	10.00	0
222	216	0	1	CHANNEL	10.0	600.	.0050	20.0	20.0	.035	10.00	0
223	222	0	1	CHANNEL	10.0	400.	.0050	20.0	20.0	.035	10.00	0
224	301	0	1	CHANNEL	10.0	300.	.0020	20.0	20.0	.035	10.00	0
225	220	0	2	PIPE	4.0	1000.	.0200	.0	.0	.013	4.00	0
227	224	0	1	CHANNEL	10.0	1320.	.0010	20.0	20.0	.035	10.00	0
241	224	0	1	CHANNEL	10.0	650.	.0015	20.0	20.0	.035	10.00	0
245	216	0	2	PIPE	4.5	1320.	.0250	.0	.0	.013	4.50	0
243	222	0	1	CHANNEL	10.0	1450.	.0028	20.0	20.0	.020	10.00	0
250	215	0	2	PIPE	5.0	100.	.0100	.0	.0	.013	5.00	0
300	250	0	2	PIPE	1.5	10.	.0350	.0	.0	.013	1.50	0
301	245	0	2	PIPE	1.0	10.	.0250	.0	.0	.013	1.00	0
302	213	0	2	PIPE	1.0	10.	.0070	.0	.0	.013	1.00	0
303	218	0	2	PIPE	1.0	10.	.0050	.0	.0	.013	1.00	0

TOTAL NUMBER OF GUTTERS/PIPES, 62

Table 3
Impervious Areas for Various Land Uses

Corresponding Land Use	Zoning	% Imperious	" C" factor
Parks, Greenbelts, and Farmland		0 - 5	0.10 - 0.30
Low Density Residential	R-1	20 - 30	0.20 - 0.50
Medium Density Residential	R-2	30 - 45	0.25 - 0.50
High Density Residential	R-3	40 - 50	0.50 - 0.60
Mobile Homes	R-M	30 - 50	0.30 - 0.60
Industrial		60 - 90	0.50 - 0.90
Commercial		70 - 100	0.75 - 0.95

For pervious areas, an initial infiltration rate of 3.0 inches/hour and a final rate of 0.5 inches/hour was used for the 2-, 5-, and 10-year storms. An initial rate of 1.0 inches/hour and a final rate of 0.5 inches/hour was used for the 50- and 100-year models. The rates recommended for preliminary design in the Comprehensive Drainage Plan indicate values of 1.0 inches/hour for the initial rate and 0.5 inches/hr. for the final rate. These rates would tend to be to conservative based on the soils conditions in the basin. There is some historical reference to percolation rates based on drainage studies of the subdivision west of the East Memorial Park. The study indicates percolation rates of 6 to 10 inches/hr.

To determine the effect of such high percolation rates, CUHP analysis was conducted for the 100-year developed condition assuming an initial infiltration of 6.0 inches/hr and a final rate of 1.5 inches/hr. In areas with a high percentage of pervious areas, runoff was reduced 20% to 25%. Also, detention volumes were reduced 20% to 30%.

Detailed measurements of infiltration rates were not conducted as part of this study. It should be noted that, prior to final design of detention facilities, infiltration rates should be verified by field testing. Infiltration testing is different than peculation testing in that it is conducted under more controlled conditions. The procedures for field testing of infiltration rates are found in the Bureau of Reclamation Drainage Manual.

Table 4 shows the peak flows for existing conditions at concentration points for the various design storms. The specific locations of concentration points are indicated on Figure 1. Peak flows for all elements analyzed with SWMM are included in the Appendix.

All major storm sewer systems were included in SWMM. Critical sections of individual lines were modeled to determine the conveyance capacities of each element.

The analysis indicates that the storm sewer system along the Frontage Road is at its hydraulic capacity during the 2-year storms. This is caused by high runoff from the large impervious areas west of the highway. Also, it appears that the storm sewer and open channels generally suffer from lack of maintenance.

Table 4
COMPUTED PEAK FLOWS IN DRAINAGE ELEMENTS
(Existing Conditions)

Concentration Point	Location	PEAK FLOWS (cfs) 2-yr.	5-yr.	10-yr.	50-yr.	100-yr.
1	Frontage Rd. & 22nd St.	19	22	28	66	82
2	Frontage Rd. & 18th St.	46	54	67	151	182
3	Highway channel @ 18th (north)	55	65	84	154	190
4	Frontage Rd. & 16th St.	3	4	6	17	17
5	Highway Channel @ 16th St.	63	75	97	194	232
6	1st Ave & 24th St.	13	15	17	35	43
7	1st Ave & 20th St.	28	32	37	49	49
8	1st Ave & 18th St.	28	32	37	49	49
9	Highway Channel @ 18th (south)	14	17	18	18	18
10	1st Ave & 16th St.	3	3	3	3	3
11	South of 24th St.	0	0	4	120	168
12	East Memorial Park	18	38	57	353	488
13	North of 20th St.	3	4	7	70	99
14	South of 20th St.	0	0	3	70	91
15	North of 18th St.	2	2	9	150	196

There are several locations along the Frontage Road that pond water due to flat slopes. The most notable location will be the low-lying area southwest of the Frontage Road and 18th Street intersection. The existing culvert has the capacity of approximately 60 cfs. Backwater can occur when the capacity is exceeded and will pond the elevation of about 4,650, which is the crown of the road in the intersection. Excess flows generally spread out at the intersection and will flow north along the Frontage Road and east across the highway. The existing concrete canal acts as the low channel and will carry the majority of flows. Remaining flows will spread out in the area but will generally flow to the north.

The 1st Avenue system consists of storm sewers with sizes ranging from 24-inch to 42-inch. The 42-inch connects to a 15-inch line at 18th Street. This restriction reduces the capacity of the 42-inch and creates street overflows at the sump located 300 feet south of 18th Street. The property west of this sump becomes flooded during overflow conditions.

The 1st Avenue system has the capacity to carry the 10-year storm when the remaining portion is completed north of 18th street. The flow capacity was determined by storm sewer and street flows. When the east curb is overtopped, the flows will be diverted to the east towards the East Memorial Pond.

Currently, the existing topography of the East Memorial Park site has the capacity to contain approximately 10 AF of water below elevation 4643. This elevation was determined to be the maximum elevation that could be allowed without flooding residences west of the park. This should be confirmed by field surveys of the foundation elevations of these homes prior to any final designs. The pond does not release and will accumulate water which must percolate or evaporate. Table 5 shows inflows and detention volumes for the existing pond.

Table 5
Existing East Memorial Park Site Retention Volume

Design Storm	Inflow (cfs)	Retention (AF)	Elevation (FT)
2-year	18	2.0	4641.3
5-year	38	3.1	4641.7
10-year	57	4.6	4642.1
50-year	353	28.4	4644.3
100-year	488	39.8	4644.8

Impoundment could be as high as elevation 4645 before releasing to the northeast.

Detention ponds and retention ponds have been constructed with some of the subdivisions along 1st Avenue. If properly design and constructed these pons will reduce the runoff into the East Memorial Park during higher frequency storms. However, the after field inspection these ponds are in poor condition with irregular crest elevations and plugged or damaged outlet pipes. Because the operation and functionality of these ponds are unreliable, the models for both existing and developed flows do not include these detention ponds.

Many of the roads east of 1st Avenue were constructed with borrow ditches. This construction leaves the roadway considerably higher than the surrounding ground. Small lateral culverts are installed at access points. These small culverts reduce capacity along the roadway and typically create ponding problems at many locations. This is more prevalent when county roads are impacted by urban development. The ponding problems are caused by insufficient ditch grades, blocked or missing cross flow or driveway culverts, and lack of adequate discharge points.

There are also many irrigation laterals in the area that can present problems with the drainage system. The ditches sometimes bisect basins and direct flows in different directions.

V - STORMWATER MANAGEMENT PLAN

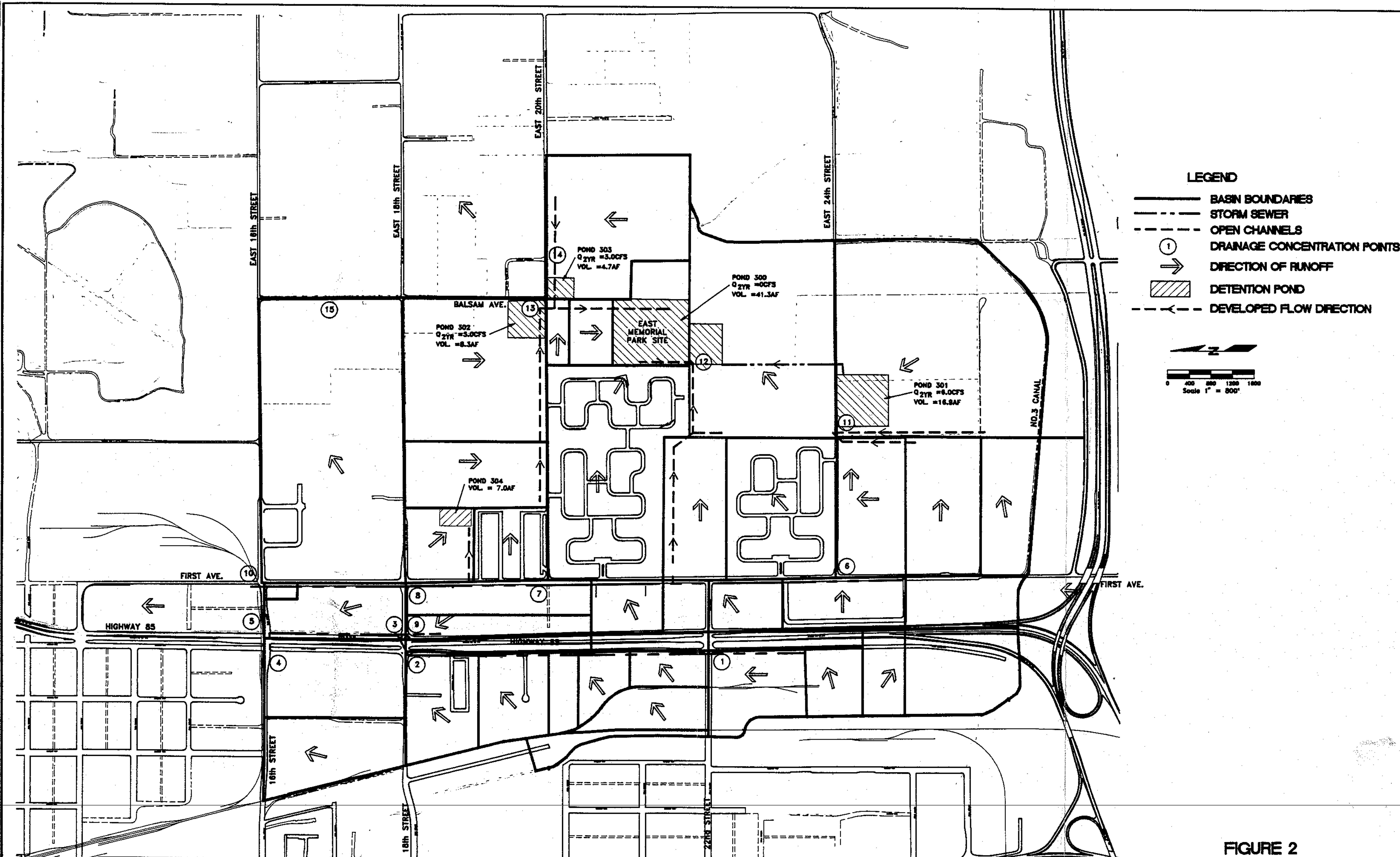
Adequate planning of future drainage improvements in the East Memorial Basin included an analysis of the basin hydrology under fully-developed conditions The Basin is contained in areas that are annexed into the City and other areas that are still in the County. The analysis was based on current zoning within these jurisdictions. Many of the basins presently are fully-developed. The most likely place for development to occur will be east of 1st Avenue between 16th Street on the north and the No. 3 ditch on the south. It is assumed that this area will be developed with residential-type areas similar to the existing subdivisions. The exact location for the development is impossible to determine as it is dependent on market conditions. The location of development also will impact the timing of construction of stormwater improvements. As an example, developments that occur at the southern or upstream portion of the Basin will require construction of downstream storm sewer systems. If the development first occurred at the lower portion of the Basin, then storm sewers could be incorporated with the development and upstream system may not be required until further development occurs.

The developed condition was analyzed to determine detention pond size, release rate, and storm sewer design flows for the entire Basin, independent of the location of development.

Figures 2, 3, and 4 show the improvement alternatives considered in the stormwater management plan. Table 6 shows peak flows at developed conditions for various concentration points within the Basin. These flows are from a SWMM model described in Alternate 6 in the following paragraphs.

Implementation of the improvements outlined below will be dependent upon the sequence and type of development that occurs. Modifications to the recommended improvements can be expected when future development actually occurs. The impact of any development on the storm drainage system must consider the entire system as a whole. Adjustments to this model can easily be modified with SWMM.

The following is a discussion of six development alternative improvements considered for the stormwater management system.



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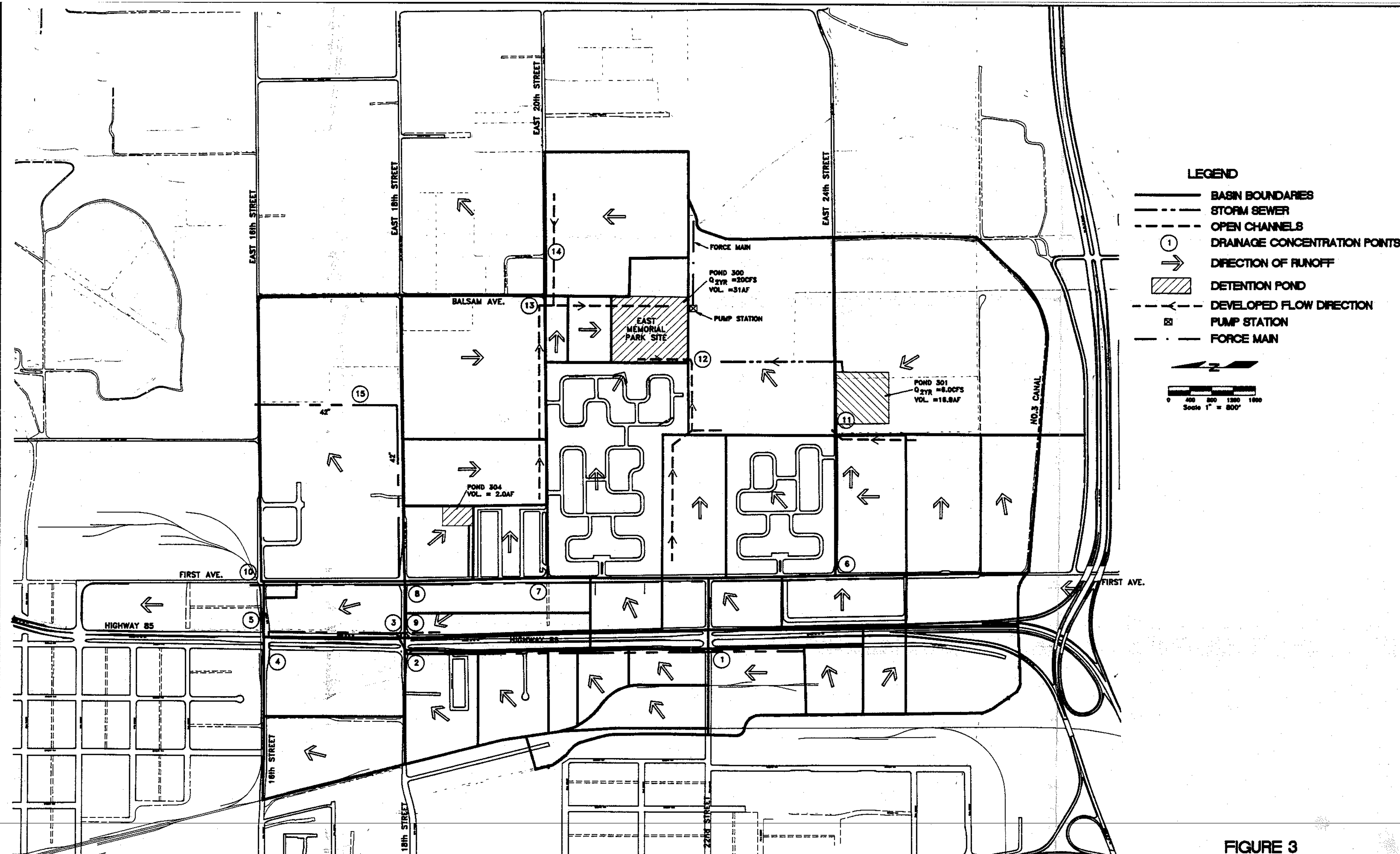
CITY OF GREELEY
EAST MEMORIAL PARK DRAINAGE BASIN STUDY

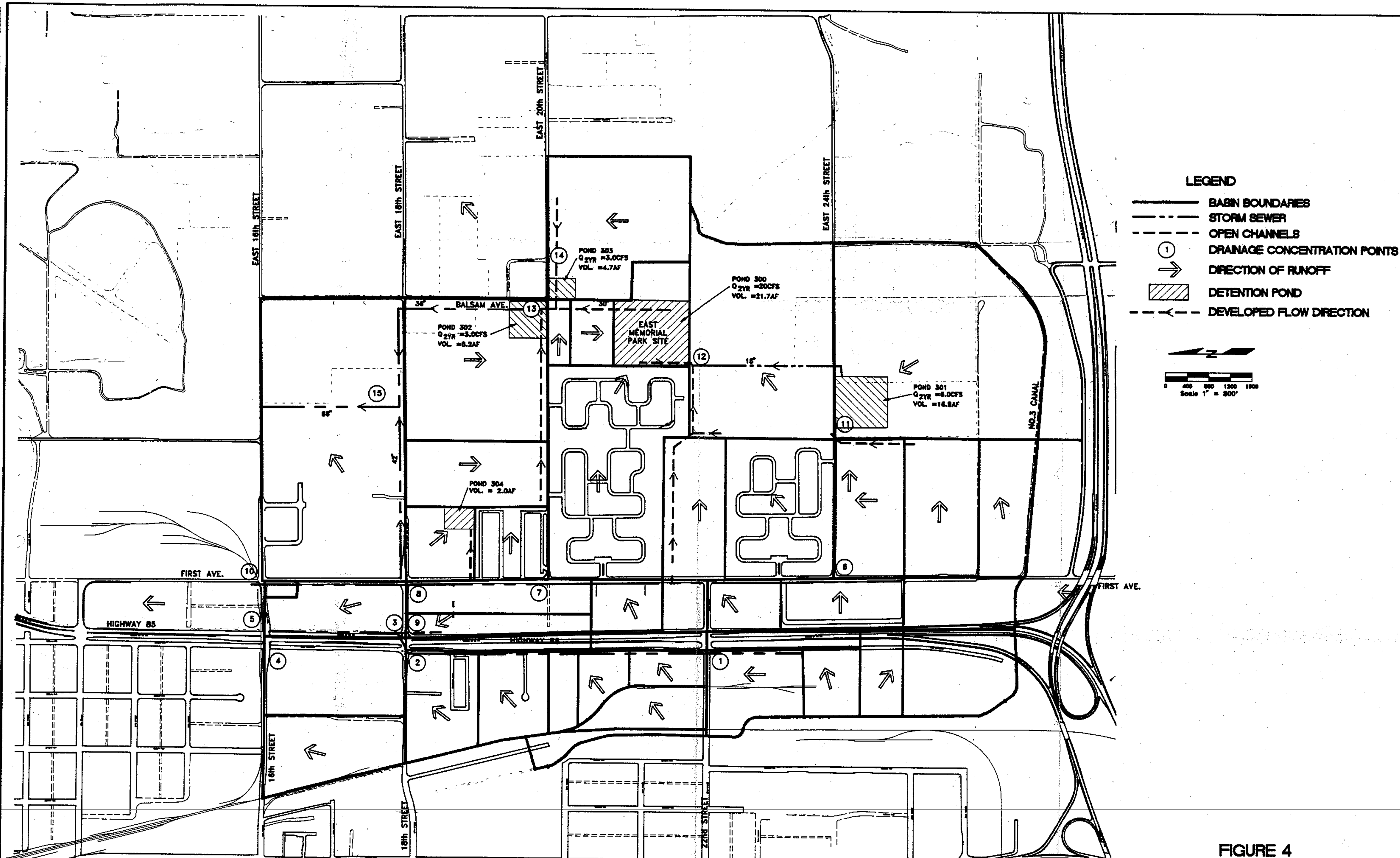
FIGURE 2
ALTERNATE NO.1
DEVELOPED CONDITIONS



CITY OF GREELEY
EAST MEMORIAL PARK DRAINAGE BASIN STUDY

FIGURE 3
ALTERNATE NO.3
DEVELOPED CONDITIONS

9202106



CITY OF GREELEY
EAST MEMORIAL PARK DRAINAGE BASIN STUDY

FIGURE 4
ALTERNATE NO.6
DEVELOPED CONDITIONS

9202107

Table 6
COMPUTED PEAK FLOWS IN DRAINAGE ELEMENTS
(Developed Conditions)

Concentration Point	Location	PEAK FLOWS (cfs) 2-yr.	5-yr.	10-yr.	50-yr.	100-yr.
1	Frontage Rd. & 22nd St.	19	22	28	66	82
2	Frontage Rd. & 18th St.	46	54	67	151	182
3	Highway channel @ 18th (north)	55	65	84	154	190
4	Frontage Rd. & 16th St.	3	4	6	17	17
5	Highway Channel @ 16th St.	63	75	97	194	232
6	1st Ave & 24th St.	13	15	17	35	43
7	1st Ave & 20th St.	28	32	37	49	49
8	1st Ave & 18th St.	28	32	37	49	49
9	Highway Channel @ 18th (south)	14	17	18	18	18
10	1st Ave & 16th St.	2	2	2	3	3
11	Pond 301 Inflow	7	80	102	120	328
12	East Memorial Park Pond Inflow	19	92	115	353	445
13	North of 20th St.	22	56	65	70	158
14	Pond 303 Inflow	0	26	33	70	108
15	North of 18th St.	49	78	100	150	358

Development Alternatives

Alternate 1. This alternate consists of developing four new pond sites. The locations of these sites are shown on Figure 2. Pond 300 (East Memorial) will act as a retention pond; and ponds 301, 302, and 303 will release to pond 300 at the 2-year existing release rate. The resulting pond volume requirements are:

Pond 300 - 41.3 AF, Q = 0 cfs
Pond 301 - 16.9 AF, Q = 3 cfs
Pond 302 - 8.3 AF, Q = 3 cfs
Pond 303 - 4.7 AF, Q = 4 cfs

The preliminary grading plan developed by the City of Greeley Parks Department for the East Memorial Park improvement would provide for 25 AF of storage below elevation 4643. This does include some storage adjacent to the park property to the south and east. As stated earlier, this elevation should be verified by field surveys to determine the lowest top of foundation in the houses west of the Park. Additional volume could be obtained by lowering the park site and obtaining additional land for the pond construction. This could be acquired south of the site on the existing farm ground. For this alternate, it is estimated that (with some pond regrading) approximately 4 acres would need to be obtained adjacent to the existing site.

Cost estimates were developed for this alternate and are shown on Table 7. The estimates include costs for excavation and hauling materials, approximately 5,000 feet. It is assumed that some materials could be used on site in the form of embankments. The cost also includes storm sewers, reseeding, and land acquisition which is base at $5,000.00 per acre. **The estimated cost for all improvements is $529,000.**

Alternate 2. This option includes providing all detention at Pond 300 and Pond 301. This would increase Pond 300 volume to 62 AF. This option would require additional land acquisition and larger storm sewers conveying undetained flows from parcels north of 20th and east of the park. We would anticipate that approximately 8 additional acres would be required to be purchased to provide for additional storage. **The estimated cost for this alternate is $615,390.**

Alternate 3. This option includes provision for release of water from Pond 300 via a pump station that would discharge to the No. 3 canal. The discharge rate is set at a 2-year existing condition inflow of 20 cfs or a pumping rate of 8,900 gpm. The volume of pond 300 would be reduced to 22 AF. The station would include two 25-HP propeller pumps. One small 200 gpm pump should be installed to remove nuisance flows and rainfall events of less than the 2-year

TABLE 7

CITY OF GREELEY
East Memorial Park Drainage Basin
Opinion of Cost

No.	Description	Qty.	Unit	Unit Price	Item Price
	Alt.1 - Pond 300 No Release				
1	Excavation Pond 300	63,000	CY	$1.75	$110,250.00
2	Excavation Pond 301	18,000	CY	$1.75	$31,500.00
3	Excavation Pond 302	3,700	CY	$1.75	$6,475.00
4	Excavation Pond 303	7,600	CY	$1.75	$13,300.00
6	Haul (5,000 ft)	45,000	CY	$1.40	$63,000.00
7	Seeding	25	Acres	$1,500.00	$37,500.00
8	24 inch RCP	2,640	LF	$30.00	$79,200.00
9	Manholes	10	EA	$2,000.00	$20,000.00
10	Land Aquistion	4	Acres	$5,000.00	$20,000.00
				Subtotal	$381,225.00
				Contingeies @ 25%	$95,306.25
				Subtotal Construction	$476,531.25
				Engineering	$52,776.31
				Total Construction	$529,307.56

No.	Description	Qty.	Unit	Unit Price	Item Price
	Alt.2 - Pond 300 No Release All At East Memorial				
1	Excavation Pond 300	74,300	CY	$1.75	$130,025.00
2	Excavation Pond 301	18,000	CY	$2.25	$40,500.00
3	Haul (5,000 ft)	45,000	CY	$1.40	$63,000.00
4	Seeding	25	Acres	$1,500.00	$37,500.00
5	24 inch RCP	1,320	LF	$30.00	$39,600.00
6	36 inch RCP	1,320	LF	$55.00	$72,600.00
7	Manholes	10	EA	$2,000.00	$20,000.00
8	Land Aquistion	8	Acres	$5,000.00	$40,000.00
				Subtotal	$443,225.00
				Contingeies @ 25%	$110,806.25
				Subtotal Construction	$554,031.25
				Engineering	$61,359.51
				Total Construction	$615,390.76

CITY OF GREELEY
East Memorial Park Drainage Basin
Opinion of Cost

No.	Description	Qty.	Unit	Unit Price	Item Price
	Alt.3 - Pond 300, 20 cfs Release All At East Memorial				
1	Excavation Pond 300	46,000	CY	$2.25	$103,500.00
2	Excavation Pond 301	18,000	CY	$2.25	$40,500.00
3	Haul (5,000 ft)	30,000	CY	$1.40	$42,000.00
4	Seeding	12	Acres	$1,500.00	$18,000.00
5	24 inch RCP	1,320	LF	$30.00	$39,600.00
6	36-inch RCP	1,320	EA	$55.00	$72,600.00
7	Manholes	10	EA	$2,000.00	$20,000.00
8	Pump Station concrete	35	CY	$300.00	$10,500.00
9	4500 gpm pumps	2	EA	$17,000.00	$34,000.00
10	200 gpm pump	1	EA	$2,500.00	$2,500.00
11	Piping and Valves	1	LS	$10,000.00	$10,000.00
12	20" Force Main Piping	900	LF	$55.00	$49,500.00
13	Electrical	1	LS	$10,000.00	$10,000.00
14	Building	1	LS	$15,000.00	$15,000.00

Subtotal	$467,700.00
Contingeies @ 25%	$116,925.00
Subtotal Construction	$584,625.00
Engineering	$64,747.80
Total Construction	$649,372.80

CITY OF GREELEY
East Memorial Park Drainage Basin
Opinion of Cost

No.	Description	Qty.	Unit	Unit Price	Item Price
	Alt.4 - All Ponds Nuisance Flow Pump Sta.				
1	Excavation Pond 300	63,000	CY	$1.75	$110,250.00
2	Excavation Pond 301	18,000	CY	$1.75	$31,500.00
3	Excavation Pond 302	3,700	CY	$1.75	$6,475.00
4	Excavation Pond 303	7,600	CY	$1.75	$13,300.00
5	Haul (5,000 ft)	45,000	CY	$1.40	$63,000.00
6	Seeding	25	Acres	$1,500.00	$37,500.00
7	24 inch RCP	2,640	LF	$30.00	$79,200.00
8	Manholes	10	EA	$2,000.00	$20,000.00
9	Land Aquistion	4	Acres	$5,000.00	$20,000.00
10	500 gpm Pump Station	1	EA	$65,000.00	$65,000.00
11	8 inch Force Main	900	LF	$15.00	$13,500.00

Subtotal	$459,725.00
Contingeies @ 25%	$114,931.25
Subtotal Construction	$574,656.25
Engineering	$63,643.75
Total Construction	$638,300.00

CITY OF GREELEY
East Memorial Park Drainage Basin
Opinion of Cost

No.	Description	Qty.	Unit	Unit Price	Item Price
	Alt.5 - Pond 300 Only Offsite Storm Sewer				
1	Excavation Pond 300	46,000	CY	$1.75	$80,500.00
2	Haul (5,000 ft)	22,000	CY	$1.40	$30,800.00
3	Seeding	10	Acres	$1,500.00	$15,000.00
4	36 inch RCP	1,320	LF	$60.00	$79,200.00
5	60 inch RCP	3,640	LF	$150.00	$546,000.00
6	Oversize 42 to 72 inch	1,320	LF	$120.00	$158,400.00
7	Junction Structures	2	EA	$30.00	$60.00
8	Manholes	16	ea	$2,000.00	$32,000.00

Subtotal	$941,960.00
Contingeies @ 25%	$235,490.00
Subtotal Construction	$1,177,450.00
Engineering	$130,403.76
Total Construction	$1,307,853.76

No.	Description	Qty.	Unit	Unit Price	Item Price
	Alt.6 - All Ponds Outfall Storm Sewer				
1	Excavation Pond 300	63,000	CY	$1.75	$110,250.00
2	Excavation Pond 301	18,000	CY	$1.75	$31,500.00
3	Excavation Pond 302	3,700	CY	$1.75	$6,475.00
4	Excavation Pond 303	76,000	CY	$1.75	$133,000.00
5	Haul (5,000 ft)	45,000	CY	$1.40	$63,000.00
6	Seeding	25	Acres	$1,500.00	$37,500.00
7	18 inch RCP	1,320	LF	$30.00	$39,600.00
8	30 inch RCP	1,320	LF	$65.00	$85,800.00
9	36 inch RCP	2,320	LF	$75.00	$174,000.00
10	Oversize 42 to 66 inch	1,320	LF	$85.00	$112,200.00
11	Land Aquistion	4	Acres	$5,000.00	$20,000.00

Subtotal	$813,325.00
Contingeies @ 25%	$203,331.25
Subtotal Construction	$1,016,656.25
Engineering	$112,595.70
Total Construction	$1,129,251.95

eliminating operation of the larger pumps. The motors and controls for this station should be located above elevation 4645 to prevent flooding in events larger than the 100-year storm. These pumps will deliver water to the No. 3 ditch through an 18-inch force main approximately 900 feet long. This option would reduce the requirement to obtain additional land as all of the volume could be confined on the park site with some regrading. **The cost for this alternate is $649,000.**

Alternate 4. This option is similar to option No. 1. However, a small pump station can be added to provide a positive method of removing nuisance flows. A 500-gpm pumping station would remove 2-year flows over a 15-hour period. This method would not reduce the required storage volumes but could provide a method for control of water in the Park and tailwater from the fields to the south. **The cost for this option is $638,000.**

Alternate 5. This alternate consists of providing a storm sewer line to carry flows from the Park site north to a point of discharge. The City has acquired easements for proposed storm sewer lines that extend from the Park site north and east towards the north side of Linn Grove Cemetery. It is possible that these easements can be used to locate storm sewer lines. However, we have evaluated an alternative that would extend the storm sewer north along Balsam and west along 18th to the point where the 42-inch line extension from the 1st Avenue system would eventually turn north. This route would require approximately 3500 feet to the outfall point where as the route for the easement would be approximately 6000 feet resulting in an initial capital cost savings. Also, the area between 18th Street and 16th Street and east of Balsam will potentially develop before areas east of Balsam. This storm sewer system could be constructed along with development in the area as a storm sewer system will lively be required for local street construction.

We feel that the 42-inch line from the 1st Avenue system should be extended in the future. Reference the "Additional Requirement" section for discussions about those improvements.

This alternate would provide for controlled-release rates our of ponds 300 and 301. Areas north of 20th Street and east of Balsam would contribute flows undetained into the storm sewer. Flows determined would require a 60-inch line from the point north of 20th Street to the connection to the 42-inch line on 18th Street. The 42-inch line that had been planned to run north would then need to be increased to 72 inches to handle the increased flows from the Park. **The cost for this alternate is $1,308,000.**

Alternate 6. This alternate consists of providing 4 detention ponds (300, 301, 302, and 303) to reduce flows in the off-site storm sewer. The pipe size required would be 36 inches north of 20th Street to the connection with the 42-inch line. After the 42-inch connection, a 66-inch line would carry flows to the river. **The cost for this alternate is $1,100,000.**

Summary of Alternates

The following summary discusses the advantages and disadvantages of each alternate.

Alternate 1.

Advantages:

- Lowest Capital Cost ($530,000).
- East Memorial Park site can be enlarged as phasing occurs.

Disadvantages:

- Large land area required.
- Increased maintenance cost for grass and weed control.
- Potential for flooding of adjacent homes during events larger than 100-year.
- Maintenance problems with continual wet areas in park.
- Inability to use park for extended periods after storm events.

Alternate 2.

Advantages:

- All detention contained at two sites.
- Low capital costs ($615,000).

Disadvantages:

- Same as Alternate 1.
- Increased storm sewer size for undetained flows from north of 20th Street.

Alternate 3.

Advantages:

- Reduced land area for detention.
- Positive methods of release of stormwater during design storms.
- Capability to remove nuisance and drainage flows from the park.
- Lowest capital costs for system that releases water from the park ($650,000).

Disadvantages:

- Operation and maintenance costs increased.
- Shorter design life than storm sewer system.
- Does not provide for integration of storm sewer system in parcels north of 20th. Street (These developments will still need to construct storm sewers).

Alternate 4.

Advantages:

- Same as Alternate 1.
- Provides positive methods for removal of nuisance or drainage flows.

Disadvantages:

- No reduction in detention volumes.
- Same as Alternate 1.
- Increase in operation and maintenance costs.

Alternate 5.

Advantages:

- Reduced detention volumes. None required north of 20th Street.
- Long-term reliability and design life.
- Potential for incorporating storm sewer systems in developments between 16th Street and 18th Street with outfall system.
- Connects to 1st Avenue system.

- Low maintenance costs.

Disadvantages:

- Highest capital costs ($1,300,000).
- Outfall must be constructed with East Memorial Park to reduce detention volumes and if development occurs in upstream portion of basin.
- Easements will be required for new alignment.

Alternate 6.

Advantages:

- Long-term reliability and design life.
- Low capital costs ($1,100,000) caused by smaller storm sewer lines.
- Potential for incorporating storm sewer system in developments with outfall storm sewer.
- Connects to 1st Avenue system.
- Low maintenance costs.

Disadvantages:

- Same as Alternate 5.

Additional Requirements

The 1st Avenue Storm Sewer System has operational problems due to the reduction in line size at 18th Street. Design capacities in the 42-inch line cannot be obtained and are actually controlled by the 15-inch line north of 18th Street. The backwater caused by the restriction creates street flooding that overflows onto property west of 1st Street. And option would e to construct an overflow on the east side of the road and carry excess flows to a site that can be used for a detention pond. A 3-acre parcel would hold approximately 7.5 acres feet with a water depth of 2.5 feet. A return line would carry water back to the 42-inch line in 1st street. to drain the pond.

The Comprehensive Drainage Plan recommended the addition of a 42-inch line east along 18th Street the north to an outfall point. This report concurs with that recommendation to provide for consistency in the flows in the 1st Avenue system.

However as an interim measure to alleviate flooding problems in the sump south of 1st Avenue, a smaller detention pond could be constructed. The pond could be sized for the 10-year existing conditions with a capacity of 2 acre-feet. This would also handle overflows from the sump during the 100-year developed condition when the 42-inch storm sewer is completed.

REFERENCES

1. "Comprehensive Drainage Plan for the City of Greeley", June 4, 1974. Hogan & Olhausen, P.C.

2. "Preliminary Report on the East and South Drainage Improvements" for the City of Greeley, Colorado and the Greeley Planning Commission, April 1961. Parker and Associates.

3. "Report on the Location of the East Memorial Storm Drain" for the City of Greeley, May 1979. Norton, Underwood and Lamb.

4. "Appraisal of 12 Easement Parcels East Memorial Storm Drain Weld County" for the City of Greeley, June 15, 1979. Robert J. Mitchell, MAI.

5. "User Manual - Colorado Urban Hydrograph Procedure CUHPE/PC", January 1985. Urban Drainage and Flood Control District, Boyle Engineering.

6. Users Manual - Urban Drainage Stormwater Management Model - PC Version (UDSWM2-PC), March 1985. UDFCD, Boyle Engineering.

7. "Urban Storm Drainage Criteria Manual", Denver Regional Council of Governments, September 1978. Wright McLaughlin Engineers.

8. Aerial Photography from City of Greeley, 1987 datum State Plane Coordinates.

COMPUTER MODEL INFORMATION

1. Existing CUHP

Frequency (Yr.)	CUHP	SWMM Input
2	EAST 2	HYD 2
5	EAST 5	HYD 5
10	EAST 10	HYD 10
50	EAST 50	HYD 50
100	EAST 100	HYD 100

2. Developed CUHP

Frequency (Yr.)	CUHP	SWMM Input
2	DEVEL 2	DEVEL 2.HYD
5	DEVEL 5	DEVEL 5.HYD
10	DEVEL 10	DEVEL 10.HYD
50	DEVEL 50	DEVEL 50.HYD
100	EAST 100	DEVEL 100.HYD

3. Existing SWMM
   SWMM.EXT

4. Developed SWMM
   SWMM 1 - Alternate 1
   SWMM 2 - Alternate 2
   SWMM 3 - Alternate 3
   SWMM 10 - Alternate 5
   SWMM 6 - Alternate 6

5. DXF Point Information

APPENDIX

A-1

Existing Condition SWMM

& CUHP Input Data

& SWMM Output

2-, 5-, 10-, 50-, and 100-year

ENDPROGRAM PROGRAM CALLED

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1111

 2       MEMORIAL PARK DRAINAGE STUDY: 2-YEAR STORM
 1   2-YEAR 002 0.75

 91      5.100    100 MEMORIAL PARK BASIN 100
.0260  .22  .10 80.0.0074 17.0  .40  .10  3.0.0018  0.5
 91      5.101    101 MEMORIAL PARK BASIN 101
.0091  .16  .07 40.0.0122 15.0  .40  .10  3.0.0018  0.5
 91      5.102    102 MEMORIAL PARK BASIN 102
.0126  .12  .07 60.0.0120 14.0  .40  .10  3.0.0018  0.5
 91      5.103    103 MEMORIAL PARK BASIN 103
.0193  .26  .13 60.0.0155 18.0  .40  .10  3.0.0018  0.5
 91      5.104    104 MEMORIAL PARK BASIN 104
.0146  .19  .08 80.0.011  16.0  .40  .10  3.0.0018  0.5
 91      5.105    105 MEMORIAL PARK BASIN 105
.0094  .15  .08 80.0.0110 14.0  .40  .10  3.0.0018  0.5
 91      5.106    106 MEMORIAL PARK BASIN 106
.0081  .14  .06 80.0.0184 14.0  .40  .10  3.0.0018  0.5
 91      5.107    107 MEMORIAL PARK BASIN 107
.0084  .14  .08 60.0.0192 14.0  .40  .10  3.0.0018  0.5
 91      5.108    108 MEMORIAL PARK BASIN 108
.0196  .25  .10 60.0.0144 17.0  .40  .10  3.0.0018  0.5
 91      5.109    109 MEMORIAL PARK BASIN 109
.0242  .27  .14 60.0.0200 18.0  .40  .10  3.0.0018  0.5
 91      5.110    110 MEMORIAL PARK BASIN 110
.0131  .36  .13 50.0.0061 21.0  .40  .10  3.0.0018  0.5
 91      5.111    111 MEMORIAL PARK BASIN 111
.0078  .20  .10 50.0.0037 16.0  .40  .10  3.0.0018  0.5
 91      5.112    112 MEMORIAL PARK BASIN 112
.0095  .32  .16 50.0.0013 19.0  .40  .10  3.0.0018  0.5
 91      5.115    115 MEMORIAL PARK BASIN 115
.0068  .27  .13 10.0.0018 18.0  .40  .10  3.0.0018  0.5
 91      5.130    130 MEMORIAL PARK BASIN 130
.035   .25  .12 10.0.0015 11.0  .40  .10  3.0.0018  0.5
 91      5.131    131 MEMORIAL PARK BASIN 131
.038   .25  .14 10.0.0016 11.0  .40  .10  3.0.0018  0.5
 91      5.200    200 MEMORIAL PARK BASIN 200
.0452  .42  .28 10.0.0050 22.0  .40  .10  3.0.0018  0.5
 91      5.201    201 MEMORIAL PARK BASIN 201
.0187  .26  .12 60.0.0010 18.0  .40  .15  3.0.0018  0.5
 91      5.203    203 MEMORIAL PARK BASIN 203
.0215  .24  .12 70.0.0039 17.0  .40  .10  3.0.0018  0.5
 91      5.204    204 MEMORIAL PARK BASIN 204
.0128  .16  .08 60.0.0152 15.0  .40  .10  3.0.0018  0.5
 91      5.208    208 MEMORIAL PARK BASIN 208
.0086  .12  .05 65.0.0146 14.0  .40  .10  3.0.0018  0.5
 91      5.206    206 MEMORIAL PARK BASIN 206
.0310  .32  .15 60.0.0029 19.0  .40  .10  3.0.0018  0.5
 91      5.207    207 MEMORIAL PARK BASIN 207
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.0032  .09  .04 55.0.0010 13.0  .40  .10  3.0.0018  0.5
  91     5.205   205 MEMORIAL PARK BASIN 205
.0121  .15  .07 80.0.0050 14.0  .40  .10  3.0.0018  0.5
  91     5.215   215 MEMORIAL PARK BASIN 215
.0226  .29  .15 65.0.0025 19.0  .40  .10  3.0.0018  0.5
  91     5.216   216 MEMORIAL PARK BASIN 216
.0016  .04  .01 80.0.0050 11.0  .40  .10  3.0.0018  0.5
  91     5.217   217 MEMORIAL PARK BASIN 217
.1240  .35  .11  2.0.0011 20.0  .40  .10  3.0.0018  0.5
  91     5.300   300 MEMORIAL PARK BASIN 300
.0217  .27  .12 00.0.0081 18.0  .40  .10  3.0.0018  0.5
  91     5.301   301 MEMORIAL PARK BASIN 301
.0293  .33  .16 00.0.0080 20.0  .40  .10  3.0.0018  0.5
  91     5.302   302 MEMORIAL PARK BASIN 302
.0317  .36  .17 40.0.0072 21.0  .40  .10  3.0.0018  0.5
  91     5.303   303 MEMORIAL PARK BASIN 303
.0461  .40  .16 40.0.0073 22.0  .40  .10  3.0.0018  2.0
  91     5.304   304 MEMORIAL PARK BASIN 304
.0299  .28  .14 00.0.0083 28.0  .40  .10  3.0.0018  0.5
  91     5.305   305 MEMORIAL PARK BASIN 305
.0762  .39  .18 10.0.0041 21.0  .40  .10  3.0.0018  2.0
  91     5.306   306 MEMORIAL PARK BASIN 306
.0160  .24  .12 45.0.0023 22.0  .40  .10  3.0.0018  0.5
  91     5.307   307 MEMORIAL PARK BASIN 307
.0149  .16  .09 65.0.0561 15.0  .40  .10  3.0.0018  0.5
  91     5.308   308 MEMORIAL PARK BASIN 308
.0303  .31  .18  5.0.0022 19.0  .40  .10  3.0.0018  0.5
  91     5.309   309 MEMORIAL PARK BASIN 309
.0637  .40  .32  5.0.0018 22.0  .40  .10  3.0.0018  0.5
  91     5.320   320 MEMORIAL PARK BASIN 320
.1200  .42  .23  0.0.0044 22.0  .40  .10  3.0.0018  0.5
  91     5.321   321 MEMORIAL PARK BASIN 321
.0943  .29  .13  0.0.0088 19.0  .40  .10  3.0.0018  0.5
  91     5.322   322 MEMORIAL PARK BASIN 322
.0590  .30  .15  0.0.0043 19.0  .40  .10  3.0.0018  0.5
  91     5.323   323 MEMORIAL PARK BASIN 323
.0237  .14  .08  0.0.0051 14.0  .40  .10  3.0.0018  0.5
  91     5.324   324 MEMORIAL PARK BASIN 324
.0104  .08  .05 50.0.0060 12.0  .40  .10  3.0.0018  0.5
  91     5.325   325 MEMORIAL PARK BASIN 325
.001   .12  .06 50.0.0060 14.0  .40  .10  3.0.0018  0.5
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   2   1   1   2
   3   4
WATERSHED   1
CITY OF GREELEY, COLORADO  2 -YEAR STORM EVENT
TEC, THE ENGINEERING COMPANY - APRIL 1992
       200  0 0  5.0                                                              1
       100  100
       101  100
       102   16
       103   21
       104   17
       105   24
       106   25
       107   27
       108   28
       109  101
       110   23
       111   25
       112   29
       130   52
       131   50
       200  130
       201  112
       203  113
       204  120
       205  123
       206   30
       207  131
       208  121
       215   54
       216  128
       217  250
       300  227
       301  226
       302  224
       303  223
       304  222
       305  221
       306  211
       307  210
       308  212
       309  215
       320  245
       321  300
       322  251
       324  300
       325  231
  0   15   20  0 5   2.00     550 0.0040     0      0   0.013    2.00
                     2.00     550 0.0018    20     20   0.030   10.00
  0   16   21  0 3             1.0
  0   17   22  0 2   1.25     450 0.005      0      0   0.013    1.25
  0   20   23  0 5   2.00    1250 0.005      0      0   0.013    2.00   0  103  203  0 5    2.0    260 0.0016    0
                     20.0    1250 0.0050    20     20   0.030   10.00
  0   21   23  0 4    5.0     400 0.0075     2      2   0.025    3.0
                     20.0     400 0.0075    20     20   0.020   10.0
  0   22   25  0 3             1.0
  0   23   24  0 5    2.0     675 0.008                  .015    2.0
                      20.     675  .0080    20     20   0.035   10.0
  0   24   25  0 5    2.0     450 0.0050                 .015    3.0
```

					20.	450	.0022	20	20	0.035	10.
0	25	27	0	5	2.0	400	0.005			0.013	3.0
					20.	400	0.003	20	20	0.035	10.
0	26	27	0	3		1.					
0	27	28	0	4	3.0	600	0.005	1.	1.	0.020	3.0
					20.	600	0.002	20	20	0.030	10.0
0	28	29	0	4	3.0	800	0.004	1.5	1.5	0.020	3.0
					20.	800	0.002	20	20	0.030	10.0
0	29	31	0	5	2.0	250	0.004	0	0	0.013	2.0
					10.0	250	0.004	20	20	0.020	10.0
0	30	31	0	2	2.0	24	0.0055			0.013	2.0
0	31	54	0	5	5.0	1200	0.002	1.0	1.0	0.018	5.0
					20.	1200	0.001	20	20	0.020	10.0
0	50	0	0	5	1.50	200	0.004	20	20	0.020	2.0
					1.0	200	0.0025	20	20	0.020	10.0
0	51	52	0	4	0.50	600	0.004	12	12	0.016	0.5
					10.	600	0.004	20	20	0.016	10.0
0	52	54	0	2	2.00	200	0.0050	0	0	0.013	2.00
0	53	0	0	5	1.50	200	0.004	0	0	0.015	1.50
					1.0	200	0.005	20	20	0.020	10.0
0	54	0	0	4	5.0	300	0.010	1.0	1.0	0.018	5.0
					20.0	300	0.010	20	20	0.020	10.0
15	100	111	5	2	1.5	300	0.01			0.015	1.5
	0.		0.		9.0		2.00	20.	11.	50.0	41.0
	100.0		91.								
0	111	112	0	4	0.5	400	0.004	12.	12	0.015	0.5
					10.	400	0.004	20.	20.	.020	10.0
0	112	113	0	5	2.0	630	0.0015			0.015	2.0
					1.0	630	0.004	20.	20.	0.020	10.0
0	113	120	0	5	2.50	1150	0.0055	0	0	0.015	2.50
					1.0	1150	0.0055	20	20	0.020	10.0
0	115	116	0	5	3.5	800	0.0015			0.013	3.5
					1.0	800	.004	20	20	0.015	10.0
0	116	203	0	5	3.5	400	0.0015			0.015	3.5
					1.0	400	.004	20	20	.0015	10.0
0	120	202	0	5	2.50	330	0.0055	0	0	0.015	2.50
					1.0	330	0.004	20	20	0.020	10.0
0	121	122	0	2	0.5	10.	0.004	0	0	0.013	0.5
0	123	115	0	2	0.5	25.	0.004			0.013	0.5
0	122	115	0	5	2.75	775	0.004	0	0	0.013	2.75
					1.0	775	0.004	20	20	0.020	10.0
0	126	127	0	5	3.5	514	0.0015	0	0	0.013	3.5
					1.0	514	0.004	20	20	0.015	10.0
0	127	128	0	2	1.25	1300	0.0015	0	0	0.013	1.25
0	128	0	0	2	1.25	1300	0.0015	0	0	0.013	1.25
0	130	0	0	1	2.	500.	0.003	20	20	0.020	2.00
0	131	0	0	2	0.1	1	0.001			0.010	0.10
243	202	122	7	5	3.5	10.	.0015			0.013	3.5
					1.0	10.	.004	20	20	0.020	10.0
	0.		0.		15.0		0.	50.	1.	75.	26.
	100.		51.		150.		101.	200.	151.		
131	203	126	8	5	3.5	10.	.0015			0.013	3.5
					1.0	10.	.004	20	20	0.020	10.5
	0.		0.		5.0		1.	10.	6.	15.	11.
	25.		21.		35.		31.	45.	41.	65.0	61.0
0	210	211	0	1	20.	700.	.0014	20.	20.	0.040	10.0
0	211	212	0	1	20.	600.	.0001	20	2.	0.040	10.0
0	212	213	0	1	20.	1300.	.0001	20	2.	0.040	10.0
0	213	215	0	2	4.	40.	.001			0.013	4.0
0	215	300	0	1	20.	1100.	.0018	20	20	0.025	10.0

```
0  216  300  0 1     5.    200.   .001      2      2   0.030   10.0
0  221  216  0 1     5.    550.  .005       2      2   0.030   10.0
0  222  216  0 1    10.    600.  .005      20     20   0.035   10.0
0  223  222  0 1    10.    400.  .005      20     20   0.035   10.0
0  224  223  0 1    10.    900.  .002      20     20   0.035   10.0
0  227  224  0 1    10.   1320.  .001      20     20   0.035   10.0
0  241  224  0 1    10.     650  .0015     20     20   0.035   10.0
0  243  222  0 1    10.    1450  .0028     20     20   0.020   10.0
0  245  300  0 1    10.    1320  .0045     20     20   0.020   10.0
0  250    0  0 1    10.    100.  .001     2.0    2.0   0.015   10.0
0  251    0  0 1    10.    100.  .001     10.    10.   0.025   10.0
0  300    0  0 2     .1     10.  .001                  0.015    0.1

0
0
ENDPROGRAM
```

CITY OF GREELEY, COLORADO 2 -YEAR STORM EVENT
TEC, THE ENGINEERING COMPANY - APRIL 1992

2-YEAR EXISTING

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	.2	0 45.
111	8.	.5		0 25.
112	13.	2.4		0 40.
113	22.	1.8		0 35.
16	6.	(DIRECT FLOW)		0 30.
15	3.	.6		0 30.
120	28.	2.2		0 35.
21	15.	.7		0 30.
20	3.	.6		1 15.
202	28.	2.2		0 35.
121	0.	.5	.1	0 55.
23	19.	2.0		0 40.
17	5.	1.3	.1	0 45.
122	28.	1.9		0 40.
123	0.	.5	.3	1 15.
24	24.	3.3		0 40.
22	8.	(DIRECT FLOW)		0 25.
241	0.	.0		0 0.
227	0.	.0		0 0.
210	5.	.3		0 45.
115	28.	2.2		0 40.
26	0.	(DIRECT FLOW)		0 0.
25	35.	3.4		0 40.
— 224	5.	.4		0 50.
211	5.	.7		1 10.
116	27.	2.4		0 45.
27	38.	1.6		0 40.
— 243	0.	.0		0 55.
— 223	14.	.5		0 40.
212	2.	.4		2 0.
203	27.	2.2		0 45.
28	44.	1.7		0 45.
— 222	13.	.5		0 45.
221	5.	.4		0 35.
213	2.	.5		2 0.
126	4.	.8		0 35.
51	0.	.0		0 0.
30	14.	1.4		0 30.
29	46.	2.6		0 45.
245	0.	.0		0 0.
216	17.	1.4		0 45.
215	2.	.1		2 30.
127	3.	1.3	.1	2 10.
52	3.	.6		0 30.
31	55.	2.9		0 45.
231	0.	(DIRECT FLOW)		0 0.
226	0.	(DIRECT FLOW)		0 0.

101	11.	(DIRECT FLOW)		0	30.
300	0.	.1	2.0	16	40.
251	0.	.0		0	0.
250	2.	.2		0	30.
131	0.	.1	1.5	11	10.
130	2.	.3		0	40.
128	3.	1.3	.0	0	45.
54	63.	1.3		0	40.
53	0.	.0		0	0.
50	3.	1.0		0	30.

CITY OF GREELEY, COLORADO
THE ENGINEERING COMPANY - APRIL 1992

5-YEAR EXISTING

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	.3	0 50.
111	8.	.5		0 25.
112	15.	2.5		0 40.
113	26.	2.0		0 35.
16	8.	(DIRECT FLOW)		0 30.
15	3.	.6		0 30.
120	32.	2.8		0 40.
21	18.	.8		0 30.
20	3.	.6		1 15.
202	32.	2.4		0 40.
121	0.	.5	.2	1 5.
23	22.	2.1		0 40.
17	5.	1.3	.2	0 45.
122	32.	2.1		0 40.
123	0.	.5	.4	1 40.
24	27.	3.4		0 40.
22	7.	(DIRECT FLOW)		0 25.
241	0.	.0		0 0.
227	0.	.0		0 0.
210	6.	.4		0 40.
115	32.	2.4		0 40.
26	0.	(DIRECT FLOW)		0 0.
25	40.	3.5		0 40.
224	6.	.4		0 45.
211	6.	.8		1 10.
116	32.	2.7		0 45.
27	43.	1.7		0 40.
243	0.	.0		0 55.
223	18.	.6		0 40.
212	3.	.5		2 0.
203	32.	2.4		0 45.
28	51.	1.8		0 40.
222	17.	.5		0 45.
221	25.	1.1		0 35.
213	0.	.1	.8	16 40.
126	4.	.8		0 35.
51	0.	.0		0 0.
30	17.	1.7		0 30.
29	54.	2.6		0 45.
245	0.	.0		0 0.
216	37.	2.1		0 40.
215	1.	.1		0 45.
127	3.	1.3	.2	2 20.
52	4.	.6		0 30.
31	65.	3.3		0 45.
231	0.	(DIRECT FLOW)		0 0.
226	0.	(DIRECT FLOW)		0 0.

101	14.	(DIRECT FLOW)		0	30.
300	0.	.1	3.1	16	40.
251	0.	.0		0	0.
250	2.	.2		0	30.
131	0.	.1	2.1	15	30.
130	3.	.3		0	35.
128	3.	1.3	.0	0	45.
54	75.	1.4		0	40.
53	0.	.0		0	0.
50	4.	1.1		0	30.

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	.5	0 55.
111	8.	.5		0 20.
112	17.	2.6		0 40.
113	30.	2.7		0 40.
16	10.	(DIRECT FLOW)		0 30.
15	3.	.6		0 25.
120	38.	3.0		0 35.
21	23.	.9		0 30.
20	3.	.6		1 15.
202	38.	2.8		0 35.
121	0.	.5	.3	1 25.
23	28.	2.3		0 40.
17	5.	1.3	.2	0 50.
122	36.	2.9		0 45.
123	0.	.5	.6	2 0.
24	34.	3.4		0 40.
22	5.	(DIRECT FLOW)		0 25.
241	0.	.0		0 0.
227	0.	.0		0 0.
210	8.	.4		0 40.
115	37.	2.7		0 45.
26	0.	(DIRECT FLOW)		0 0.
25	48.	3.6		0 40.
224	9.	.5		0 45.
211	8.	.9		1 5.
116	36.	3.3		0 50.
27	53.	1.9		0 40.
243	0.	.0		1 0.
223	24.	.6		0 40.
212	4.	.7		2 0.
203	36.	2.7		0 50.
28	64.	2.0		0 40.
222	23.	.6		0 45.
221	33.	1.3		0 35.
213	0.	.1	1.2	16 40.
126	4.	.8		0 35.
51	0.	.0		0 0.
30	18.	2.0	.0	0 35.
29	67.	2.7		0 40.
245	4.	.2		0 45.
216	50.	2.4		0 40.
215	3.	.2		0 50.
127	3.	1.3	.2	2 35.
52	6.	.8		0 30.
31	84.	4.1		0 45.
231	0.	(DIRECT FLOW)		0 0.
226	2.	(DIRECT FLOW)		0 35.

101	17.	(DIRECT FLOW)		0	30.
300	0.	.1	4.6	16	40.
251	3.	.3		0	40.
250	9.	.5		0	35.
131	0.	.1	2.9	16	40.
130	5.	.4		0	40.
128	3.	1.3	.0	0	45.
54	97.	1.6		0	45.
53	0.	.0		0	0.
50	6.	2.2		0	35.

CITY OF GREELEY, COLORADO 2 -YEAR STORM EVENT

TEC, THE ENGINEERING COMPANY - APRIL 1992

50-YEAR EXISTING

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	1.7	1 15.
111	7.	.5		0 25.
112	32.	2.8		0 45.
113	60.	3.2		0 45.
16	22.	(DIRECT FLOW)		0 35.
15	3.	.6		0 25.
120	77.	3.4		0 45.
21	53.	1.4		0 35.
20	3.	.6		1 15.
202	77.	4.5		0 45.
121	0.	.5	.7	1 35.
23	66.	2.6		0 40.
17	5.	1.3	.7	1 10.
122	49.	3.3		1 0.
123	0.	.5	1.0	2 5.
24	79.	3.8		0 45.
22	5.	(DIRECT FLOW)		0 25.
241	0.	.0		0 0.
227	11.	.7		1 0.
210	19.	.7		0 45.
115	49.	4.0		1 5.
26	0.	(DIRECT FLOW)		0 0.
25	105.	4.0		0 45.
224	37.	1.0		0 55.
211	24.	1.6		1 5.
116	49.	3.7		1 5.
27	117.	2.9		0 45.
243	19.	.5		0 55.
223	82.	1.1		0 45.
212	21.	1.5		1 20.
203	49.	4.0		1 5.
28	140.	2.9		0 45.
222	116.	1.3		0 50.
221	101.	2.3		0 40.
213	21.	1.9		1 20.
126	4.	.8		0 35.
51	0.	.0		0 0.
30	18.	2.0	.8	1 0.
29	151.	3.1		0 45.
245	109.	1.0		0 40.
216	195.	4.6		0 45.
215	55.	.8		0 50.
127	3.	1.3	.4	4 20.
52	17.	2.0	.7	0 50.
31	154.	5.8		0 55.
231	0.	(DIRECT FLOW)		0 0.
226	28.	(DIRECT FLOW)		0 35.
101	39.	(DIRECT FLOW)		0 35.
300	0.	.1	28.4	16 40.

251	70.	1.5		0	35.
250	150.	2.3		0	35.
131	0.	.1	5.0	16	40.
130	43.	.9		0	40.
128	3.	1.3	.1	1	0.
54	194.	2.4		0	50.
53	0.	.0		0	0.
50	62.	3.0		0	35.

[illegible]-YEAR STORM EVENT
TEC, THE ENGINEERING COMPANY - APRIL 1992

100-YEAR EXISTING

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	2.4	1 20.
111	8.	.5		0 20.
112	43.	3.0		0 40.
113	79.	3.4		0 45.
16	28.	(DIRECT FLOW)		0 35.
15	3.	.6		0 25.
120	101.	3.5		0 45.
21	65.	1.5		0 35.
20	3.	.6		1 15.
202	101.	4.7		0 45.
121	0.	.5	.9	1 35.
23	82.	2.7		0 40.
17	5.	1.3	1.0	1 15.
122	49.	3.3		1 5.
123	0.	.5	1.3	2 5.
24	98.	4.0		0 45.
22	5.	(DIRECT FLOW)		0 25.
241	0.	.0		0 0.
227	17.	.8		1 0.
210	26.	.8		0 45.
115	49.	4.0		1 5.
26	0.	(DIRECT FLOW)		0 0.
25	131.	4.1		0 45.
224	~~50.~~ 78	1.1		0 55.
211	33.	1.9		1 5.
116	49.	3.7		1 5.
27	141.	3.1		0 45.
243	39.	.7		0 50.
223	109.	1.3		0 45.
212	32.	1.9		1 20.
203	49.	4.0		1 5.
28	169.	3.1		0 50.
222	170.	1.5		0 50.
221	132.	2.7		0 40.
213	32.	2.5		1 20.
126	4.	.8		0 35.
51	0.	.0		0 0.
30	18.	2.0	1.3	1 10.
29	182.	3.3		0 50.
245	151.	1.2		0 40.
216	270.	5.4		0 45.
215	77.	1.0		0 50.
127	3.	1.3	.5	5 5.
52	17.	2.0	1.1	0 55.
31	190.	6.0		0 55.
231	0.	(DIRECT FLOW)		0 0.
226	38.	(DIRECT FLOW)		0 35.
101	48.	(DIRECT FLOW)		0 35.
300	0.	.1	39.8	16 40.
251	91.	1.7		0 35.

250	196.	2.7		0	35.
131	0.	.1	5.7	16	40.
130	56.	1.0		0	40.
128	3.	1.3	.2	1	10.
54	232.	2.7		0	50.
53	0.	.0		0	0.
50	80.	3.1		0	35.

A-2

Developed Condition SWMM

& CUHP Input Data

& SWMM Output

2-, 5-, 10-, 50-, and 100-year

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  2       MEMORIAL PARK DRAINAGE STUDY: 2-YEAR STORM
  1   2-YEAR 002 0.75

  91      5.100   100 MEMORIAL PARK BASIN 100
.0260  .22  .10 80.0.0074 17.0  .40  .10  3.0.0018  0.5
  91      5.101   101 MEMORIAL PARK BASIN 101
.0091  .16  .07 40.0.0122 15.0  .40  .10  3.0.0018  0.5
  91      5.102   102 MEMORIAL PARK BASIN 102
.0126  .12  .07 60.0.0120 14.0  .40  .10  3.0.0018  0.5
  91      5.103   103 MEMORIAL PARK BASIN 103
.0193  .26  .13 60.0.0155 18.0  .40  .10  3.0.0018  0.5
  91      5.104   104 MEMORIAL PARK BASIN 104
.0146  .19  .08 80.0.011  16.0  .40  .10  3.0.0018  0.5
  91      5.105   105 MEMORIAL PARK BASIN 105
.0094  .15  .08 80.0.0110 14.0  .40  .10  3.0.0018  0.5
  91      5.106   106 MEMORIAL PARK BASIN 106
.0081  .14  .06 80.0.0184 14.0  .40  .10  3.0.0018  0.5
  91      5.107   107 MEMORIAL PARK BASIN 107
.0084  .14  .08 60.0.0192 14.0  .40  .10  3.0.0018  0.5
  91      5.108   108 MEMORIAL PARK BASIN 108
.0196  .25  .10 60.0.0144 17.0  .40  .10  3.0.0018  0.5
  91      5.109   109 MEMORIAL PARK BASIN 109
.0242  .27  .14 60.0.0200 18.0  .40  .10  3.0.0018  0.5
  91      5.110   110 MEMORIAL PARK BASIN 110
.0131  .36  .13 50.0.0061 21.0  .40  .10  3.0.0018  0.5
  91      5.111   111 MEMORIAL PARK BASIN 111
.0078  .20  .10 50.0.0037 16.0  .40  .10  3.0.0018  0.5
  91      5.112   112 MEMORIAL PARK BASIN 112
.0095  .32  .16 50.0.0013 19.0  .40  .10  3.0.0018  0.5
  91      5.115   115 MEMORIAL PARK BASIN 115
.0068  .27  .13 10.0.0018 18.0  .40  .10  3.0.0018  0.5
  91      5.130   130 MEMORIAL PARK BASIN 130
.035   .25  .12 10.0.0015 11.0  .40  .10  3.0.0018  0.5
  91      5.131   131 MEMORIAL PARK BASIN 131
.038   .25  .14 10.0.0016 11.0  .40  .10  3.0.0018  0.5
  91      5.200   200 MEMORIAL PARK BASIN 200
.0452  .42  .28 10.0.0050 22.0  .40  .10  3.0.0018  0.5
  91      5.201   201 MEMORIAL PARK BASIN 201
.0187  .26  .12 60.0.0010 18.0  .40  .15  3.0.0018  0.5
  91      5.203   203 MEMORIAL PARK BASIN 203
.0215  .24  .12 70.0.0039 17.0  .40  .10  3.0.0018  0.5
  91      5.204   204 MEMORIAL PARK BASIN 204
.0128  .16  .08 60.0.0152 15.0  .40  .10  3.0.0018  0.5
  91      5.208   208 MEMORIAL PARK BASIN 208
.0086  .12  .05 65.0.0146 14.0  .40  .10  3.0.0018  0.5
  91      5.206   206 MEMORIAL PARK BASIN 206
.0310  .32  .15 60.0.0029 19.0  .40  .10  3.0.0018  0.5
  91      5.207   207 MEMORIAL PARK BASIN 207
.0032  .09  .04 55.0.0010 13.0  .40  .10  3.0.0018  0.5
  91      5.205   205 MEMORIAL PARK BASIN 205
.0121  .15  .07 80.0.0050 14.0  .40  .10  3.0.0018  0.5
  91      5.215   215 MEMORIAL PARK BASIN 215
.0226  .29  .15 65.0.0025 19.0  .40  .10  3.0.0018  0.5
  91      5.216   216 MEMORIAL PARK BASIN 216
.0016  .04  .01 80.0.0050 11.0  .40  .10  3.0.0018  0.5
  91      5.217   217 MEMORIAL PARK BASIN 217
.1240  .35  .11  2.0.0011 20.0  .40  .10  3.0.0018  0.5
  91      5.300   300 MEMORIAL PARK BASIN 300
.0217  .27  .12 50.0.0081 18.0  .40  .10  3.0.0018  0.5
  91      5.301   301 MEMORIAL PARK BASIN 301
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 .0293  .33  .16 50.0.0080 20.0  .40  .10  3.0.0018  0.5
  91     5.302   302 MEMORIAL PARK BASIN 302
 .0317  .36  .17 70.0.0072 21.0  .40  .10  3.0.0018  0.5
  91     5.303   303 MEMORIAL PARK BASIN 303
 .0461  .40  .16 40.0.0073 22.0  .40  .10  3.0.0018  2.0
  91     5.304   304 MEMORIAL PARK BASIN 304
 .0299  .28  .14 50.0.0083 28.0  .40  .10  3.0.0018  0.5
  91     5.305   305 MEMORIAL PARK BASIN 305
 .0762  .39  .18 10.0.0041 21.0  .40  .10  3.0.0018  2.0
  91     5.306   306 MEMORIAL PARK BASIN 306
 .0160  .24  .12 45.0.0023 22.0  .40  .10  3.0.0018  0.5
  91     5.307   307 MEMORIAL PARK BASIN 307
 .0149  .16  .09 65.0.0561 15.0  .40  .10  3.0.0018  0.5
  91     5.308   308 MEMORIAL PARK BASIN 308
 .0303  .31  .18 50.0.0022 19.0  .40  .10  3.0.0018  0.5
  91     5.309   309 MEMORIAL PARK BASIN 309
 .0637  .40  .32 50.0.0018 22.0  .40  .10  3.0.0018  0.5
  91     5.320   320 MEMORIAL PARK BASIN 320
 .1200  .42  .23 50.0.0044 22.0  .40  .10  3.0.0018  0.5
  91     5.321   321 MEMORIAL PARK BASIN 321
 .0943  .29  .13 50.0.0088 19.0  .40  .10  3.0.0018  0.5
  91     5.322   322 MEMORIAL PARK BASIN 322
 .0590  .30  .15 50.0.0043 19.0  .40  .10  3.0.0018  0.5
  91     5.323   323 MEMORIAL PARK BASIN 323
 .0237  .14  .08 50.0.0051 14.0  .40  .10  3.0.0018  0.5
  91     5.324   324 MEMORIAL PARK BASIN 324
 .0104  .08  .05 50.0.0060 12.0  .40  .10  3.0.0018  0.5
  91     5.325   325 MEMORIAL PARK BASIN 325
 .001   .12  .06 50.0.0060 14.0  .40  .10  3.0.0018  0.5
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   2   1   1   2
   3   4
WATERSHED   1
CITY OF GREELEY, COLORADO  DEVELOPED BASIN
TEC, THE ENGINEERING COMPANY - APRIL 1992
        200  0 0  5.0                                              1
        100  100
        101  100
        102   16
        103   21
        104   17
        105   24
        106   25
        107   27
        108   28
        109  101
        110   23
        111   25
        112   29
        130   52
        131   50
        200  130
        201  112
        203  113
        204  120
        205  123
        206   30
        207  131
        208  121
        215   54
        216  128
        217  220
        300  227
        301  241
        302  224
        303  223
        304  222
        305  221
        306  211
        307  132
        308  212
        309  212
        320  224
        321  216
        322  217
        323  216
        324  215
        325  214

  0   15   20   0 5    2.00     550 0.0040     0      0   0.013    2.00
                       2.00     550 0.0018    20     20   0.030   10.00
  0   16   21   0 3              1.0
  0   17   22   0 2    1.25     450 0.005      0      0   0.013    1.25
  0   20   23   0 5    2.00    1250 0.005      0      0   0.013    2.00   0  103  203  0 5    2.0    260 0.0016     0
                       20.0    1250 0.0050    20     20   0.030   10.00
  0   21   23   0 4     5.0     400 0.0075     2      2   0.025    3.0
                       20.0     400 0.0075    20     20   0.020   10.0
  0   22   25   0 3              1.0
  0   23   24   0 5     2.0     675 0.008                  .015    2.0
                        20.     675  .0080    20     20   0.035   10.0
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0	24	25	0 5	2.0	450	0.0050			.015	3.0
				20.	450	.0022	20	20	0.035	10.
0	25	27	0 5	2.0	400	0.005			0.013	3.0
				20.	400	0.003	20	20	0.035	10.
0	26	27	0 3		1.					
0	27	28	0 4	3.0	600	0.005	1.	1.	0.020	3.0
				20.	600	0.002	20	20	0.030	10.0
0	28	29	0 4	3.0	800	0.004	1.5	1.5	0.020	3.0
				20.	800	0.002	20	20	0.030	10.0
0	29	31	0 5	2.0	250	0.004	0	0	0.013	2.0
				10.0	250	0.004	20	20	0.020	10.0
0	30	31	0 2	2.0	24	0.0055			0.013	2.0
0	31	54	0 5	5.0	1200	0.002	1.0	1.0	0.018	5.0
				20.	1200	0.001	20	20	0.020	10.0
0	50	0	0 5	1.50	200	0.004	20	20	0.020	2.0
				1.0	200	0.0025	20	20	0.020	10.0
0	51	52	0 4	0.50	600	0.004	12	12	0.016	0.5
				10.	600	0.004	20	20	0.016	10.0
0	52	54	0 2	2.00	200	0.0050	0	0	0.013	2.00
0	53	0	0 5	1.50	200	0.004	0	0	0.015	1.50
				1.0	200	0.005	20	20	0.020	10.0
0	54	0	0 4	5.0	300	0.010	1.0	1.0	0.018	5.0
				20.0	300	0.010	20	20	0.020	10.0
15	100	111	5 2	1.5	300	0.01			0.015	1.5
	0.		0.	9.0		2.00	20.	11.	50.0	41.0
	100.0		91.							
0	111	112	0 4	0.5	400	0.004	12.	12	0.015	0.5
				10.	400	0.004	20.	20.	.020	10.0
0	112	113	0 5	2.0	630	0.0015			0.015	2.0
				1.0	630	0.004	20.	20.	0.020	10.0
0	113	120	0 5	2.50	1150	0.0055	0	0	0.015	2.50
				1.0	1150	0.0055	20	20	0.020	10.0
0	115	116	0 5	3.5	800	0.0015			0.013	3.5
				1.0	800	.004	20	20	0.015	10.0
0	116	203	0 5	3.5	400	0.0015			0.015	3.5
				1.0	400	.004	20	20	.0015	10.0
0	120	202	0 5	2.50	330	0.0055	0	0	0.015	2.50
				1.0	330	0.004	20	20	0.020	10.0
0	121	122	0 2	0.5	10.	0.004	0	0	0.013	0.5
0	123	115	0 2	0.5	25.	0.004			0.013	0.5
0	122	115	0 5	2.75	775	0.004	0	0	0.013	2.75
				1.0	775	0.004	20	20	0.020	10.0
0	126	219	0 5	3.5	514	0.0015	0	0	0.013	3.5
				1.0	514	0.004	20	20	0.015	10.0
0	127	128	0 2	1.25	1300	0.0015	0	0	0.013	1.25
0	128	0	0 2	1.25	1300	0.0015	0	0	0.013	1.25
0	130	0	0 1	2.	500.	0.003	20	20	0.020	2.00
0	131	0	0 2	0.1	1	0.001			0.010	0.10
0	132	131	0 1	5.0	10.	0.001	20	20	0.020	10.00
243	202	122	7 5	3.5	10.	.0015			0.013	3.5
				1.0	10.	.004	20	20	0.020	10.0
	0.		0.	15.0		0.	50.	1.	75.	26.
	100.		51.	150.		101.	200.	151.		
132	203	126	8 5	3.5	10.	.0015			0.013	3.5
				1.0	10.	.004	20	20	0.020	10.5
	0.		0.	15.0		0.	50.	1.	75.	26.
	100.		51.	150.		101.	200.	151.		
0	211	212	0 1	20.	600.	.0001	20	2.	0.040	10.0
0	213	225	0 2	5.0	1250.	.010			0.013	5.0
0	212	302	0 1	20.	1300.	.0001	20	2.	0.040	10.0

0	214	213	0	2	4.0	60.	.010			0.013	4.0
0	215	214	0	2	5.0	1320.	.0018			0.013	5.0
0	218	214	0	2	4.0	100.	.050			0.013	4.0
0	216	300	0	1	5.	200.	.0010	2	2	0.030	10.0
0	217	218	0	1	1.0	300.	.004	20	20	0.020	10.0
0	219	220	0	2	3.5	1700.	.01			0.013	3.5
0	220	0	0	2	5.0	1250.	.02			0.013	5.0
0	221	216	0	1	5.	550.	.005	2	2	0.030	10.0
0	222	216	0	1	10.	600.	.005	20	20	0.035	10.0
0	223	222	0	1	10.	400.	.005	20	20	0.035	10.0
0	224	301	0	1	10.	300.	.002	20	20	0.035	10.0
0	225	220	0	2	4.0	1000.	.020			0.013	3.5
0	227	224	0	1	10.	1320.	.001	20	20	0.035	10.0
0	241	224	0	1	10.	650.	.0015	20	20	0.035	10.0
0	245	216	0	2	4.5	1320.	.0250			0.013	4.5
0	243	222	0	1	10.	1450.	.0028	20	20	0.020	10.0
0	250	215	0	2	5.0	100.	.010			0.013	5.0
0	300	250	0	2	1.5	10.	.0350			0.013	1.5
0	301	245	0	2	1.0	10.	.0250			0.013	1.0
0	302	213	0	2	1.0	10.	.0070			0.013	1.0

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ENDPROGRAM

CITY OF GREELEY, COLORADO DEVELOPED BASIN
TEC, THE ENGINEERING COMPANY - APRIL 1992

2-YEAR DEVELOPED

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

	CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
	100	10.	1.5	.2	0 45.
	241	0.	.0		0 0.
	227	0.	.0		0 0.
	111	8.	.5		0 25.
11	224	7.	.4		0 35.
6	112	13.	2.4		0 40.
	301	6.	1.0	.0	0 45.
	243	0.	.0		1 0.
	223	11.	.4		0 35.
	113	22.	1.8		0 35.
	16	6.	(DIRECT FLOW)		0 30.
	15	3.	.6		0 30.
	245	6.	.4		0 35.
	222	10.	.4		0 45.
	221	5.	.4		0 35.
	120	28.	2.2		0 35.
	21	15.	.7		0 30.
	20	3.	.6		1 15.
12	216	19.	1.5		0 45.
	202	28.	2.2		0 35.
	121	0.	.5	.1	0 55.
1	23	19.	2.0		0 40.
	17	5.	1.3	.1	0 45.
	300	19.	1.2		0 45.
	122	28.	1.9		0 40.
	123	0.	.5	.3	1 15.
	24	24.	3.3		0 40.
	22	8.	(DIRECT FLOW)		0 25.
	211	2.	.4		1 10.
14	217	0.	.0		0 0.
	250	19.	.9		0 45.
7	115	28.	2.2		0 40.
	26	0.	(DIRECT FLOW)		0 0.
	25	35.	3.4		0 40.
	212	1.	.2		2 0.
	218	0.	.0		0 0.
	215	22.	1.5		0 45.
8	116	27.	2.4		0 45.
	27	38.	1.6		0 40.
	302	1.	.3		2 0.
	214	22.	1.0		0 45.
	203	27.	2.2		0 45.
	28	44.	1.7		0 45.
13	213	22.	1.0		0 50.
	126	27.	2.2		0 45.
	51	0.	.0		0 0.
9	30	14.	1.4		0 30.

2	29	46.	2.6		0	45.
	225	22.	.9		0	50.
	219	27.	1.2		0	50.
	132	8.	.5		0	30.
	127	0.	.0		0	0.
4	52	3.	.6		0	30.
3	31	55.	2.9		0	45.
	101	11.	(DIRECT FLOW)		0	30.
15	220	49.	1.2		0	50.
	131	0.	.1	.4	1	20.
	130	2.	.3		0	40.
10	128	2.	.7		0	40.
5	54	63.	1.3		0	40.
	53	0.	.0		0	0.
	50	3.	1.0		0	30.

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	.3	0 50.
241	9.	.5		0 45.
227	4.	.4		0 55.
111	8.	.5		0 25.
224	80.	1.3		0 35.
112	15.	2.5		0 40.
301	6.	1.0	4.0	2 15.
243	0.	.0		1 0.
223	14.	.5		0 35.
113	26.	2.0		0 35.
16	8.	(DIRECT FLOW)		0 30.
15	3.	.6		0 30.
245	6.	.4		0 25.
222	12.	.5		0 45.
221	25.	1.1		0 35.
120	32.	2.8		0 40.
21	18.	.8		0 30.
20	3.	.6		1 15.
216	92.	3.3		0 35.
202	32.	2.4		0 40.
121	0.	.5	.2	1 5.
23	22.	2.1		0 40.
17	5.	1.3	.2	0 45.
300	21.	1.5	2.9	1 45.
122	32.	2.1		0 40.
123	0.	.5	.4	1 40.
24	27.	3.4		0 40.
22	7.	(DIRECT FLOW)		0 25.
211	3.	.5		1 10.
217	26.	.7		0 30.
250	25.	1.1		0 25.
115	32.	2.4		0 40.
26	0.	(DIRECT FLOW)		0 0.
25	40.	3.5		0 40.
212	13.	1.2		1 10.
218	26.	.8		0 30.
215	26.	1.7		0 35.
116	32.	2.7		0 45.
27	43.	1.7		0 40.
302	3.	1.0	1.3	3 20.
214	52.	1.7		0 35.
203	32.	2.4		0 45.
28	51.	1.8		0 40.
213	56.	1.6		0 35.
126	31.	2.4		0 45.
51	0.	.0		0 0.
30	17.	1.7		0 30.
29	54.	2.6		0 45.
225	57.	1.4		0 35.
219	31.	1.3		0 50.

132	10.	.6		0	30.
127	0.	.0		0	0.
52	4.	.6		0	30.
31	65.	3.3		0	45.
101	14.	(DIRECT FLOW)		0	30.
220	78.	1.6		0	40.
131	0.	.1	.5	1	45.
130	3.	.3		0	35.
128	2.	.8		0	40.
54	75.	1.4		0	40.
53	0.	.0		0	0.
50	4.	1.1		0	30.

RADO DEVELOPED BASIN
TEC, THE ENGINEERING COMPANY - APRIL 1992

10-YEAR DEVELOPED

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	.5	0 55.
241	12.	.6		0 40.
227	6.	.5		0 55.
111	8.	.5		0 20.
224	102.	1.5		0 35.
112	17.	2.6		0 40.
301	6.	1.0	5.6	2 20.
243	0.	.0		1 5.
223	17.	.5		0 35.
113	30.	2.7		0 40.
16	10.	(DIRECT FLOW)		0 30.
15	3.	.6		0 25.
245	6.	.4		0 25.
222	27.	.7		0 40.
221	31.	1.3		0 35.
120	38.	3.0		0 35.
21	23.	.9		0 30.
20	3.	.6		1 15.
216	115.	3.6		0 35.
202	38.	2.8		0 35.
121	0.	.5	.3	1 25.
23	28.	2.3		0 40.
17	5.	1.3	.2	0 50.
300	21.	1.5	4.5	2 5.
122	36.	2.9		0 45.
123	0.	.5	.6	2 0.
24	34.	3.4		0 40.
22	5.	(DIRECT FLOW)		0 25.
211	4.	.6		1 10.
217	33.	.8		0 30.
250	23.	1.0		0 25.
115	37.	2.7		0 45.
26	0.	(DIRECT FLOW)		0 0.
25	48.	3.6		0 40.
212	19.	1.4		1 5.
218	33.	.9		0 35.
215	28.	1.7		0 35.
116	36.	3.3		0 50.
27	53.	1.9		0 40.
302	3.	1.0	2.1	3 40.
214	61.	1.8		0 35.
203	36.	2.7		0 50.
28	64.	2.0		0 40.
213	65.	1.7		0 35.
126	36.	2.6		0 50.
51	0.	.0		0 0.
30	18.	2.0	.0	0 35.
29	67.	2.7		0 40.
225	66.	1.6		0 35.
219	36.	1.4		0 50.

132	13.	.6		0	30.
127	0.	.0		0	0.
52	6.	.8		0	30.
31	84.	4.1		0	45.
101	17.	(DIRECT FLOW)		0	30.
220	100.	1.8		0	40.
131	0.	.1	.7	2	5.
130	5.	.4		0	40.
128	2.	1.0		0	40.
54	97.	1.6		0	45.
53	0.	.0		0	0.
50	6.	2.2		0	35.

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	1.7	1 15.
241	22.	.8		0 50.
227	11.	.7		1 0.
111	7.	.5		0 25.
224	185.	1.9		0 40.
112	32.	2.8		0 45.
301	6.	1.0	8.2	1 55.
243	19.	.5		1 0.
223	56.	.9		0 40.
113	60.	3.2		0 45.
16	22.	(DIRECT FLOW)		0 35.
15	3.	.6		0 25.
245	6.	.4		0 30.
222	77.	1.1		0 45.
221	101.	2.3		0 40.
120	77.	3.4		0 45.
21	53.	1.4		0 35.
20	3.	.6		1 15.
216	292.	5.6		0 40.
202	77.	4.5		0 45.
121	0.	.5	.7	1 35.
23	66.	2.6		0 40.
17	5.	1.3	.7	1 10.
300	21.	1.5	12.5	1 45.
122	49.	3.3		1 0.
123	0.	.5	1.0	2 5.
24	79.	3.8		0 45.
22	5.	(DIRECT FLOW)		0 25.
211	11.	1.1		1 10.
217	67.	1.0		0 35.
250	27.	1.1		0 30.
115	49.	4.0		1 5.
26	0.	(DIRECT FLOW)		0 0.
25	105.	4.0		0 45.
212	41.	2.1		1 5.
218	67.	1.2		0 35.
215	38.	2.0		0 35.
116	49.	3.7		1 5.
27	117.	2.9		0 45.
302	3.	1.0	4.0	3 50.
214	105.	2.5		0 35.
203	49.	4.0		1 5.
28	140.	2.9		0 45.
213	108.	2.2		0 40.
126	47.	3.9		1 10.
51	0.	.0		0 0.
30	18.	2.0	.8	1 0.
29	151.	3.1		0 45.
225	111.	2.1		0 40.
219	47.	1.7		1 10.

132	27.	.9		0	35.
127	0.	.0		0	0.
52	17.	2.0	.7	0	50.
31	154.	5.8		0	55.
101	39.	(DIRECT FLOW)		0	35.
220	265.	3.1		0	40.
131	0.	.1	1.5	2	10.
130	43.	.9		0	40.
128	3.	1.3	.1	0	50.
54	194.	2.4		0	50.
53	0.	.0		0	0.
50	62.	3.0		0	35.

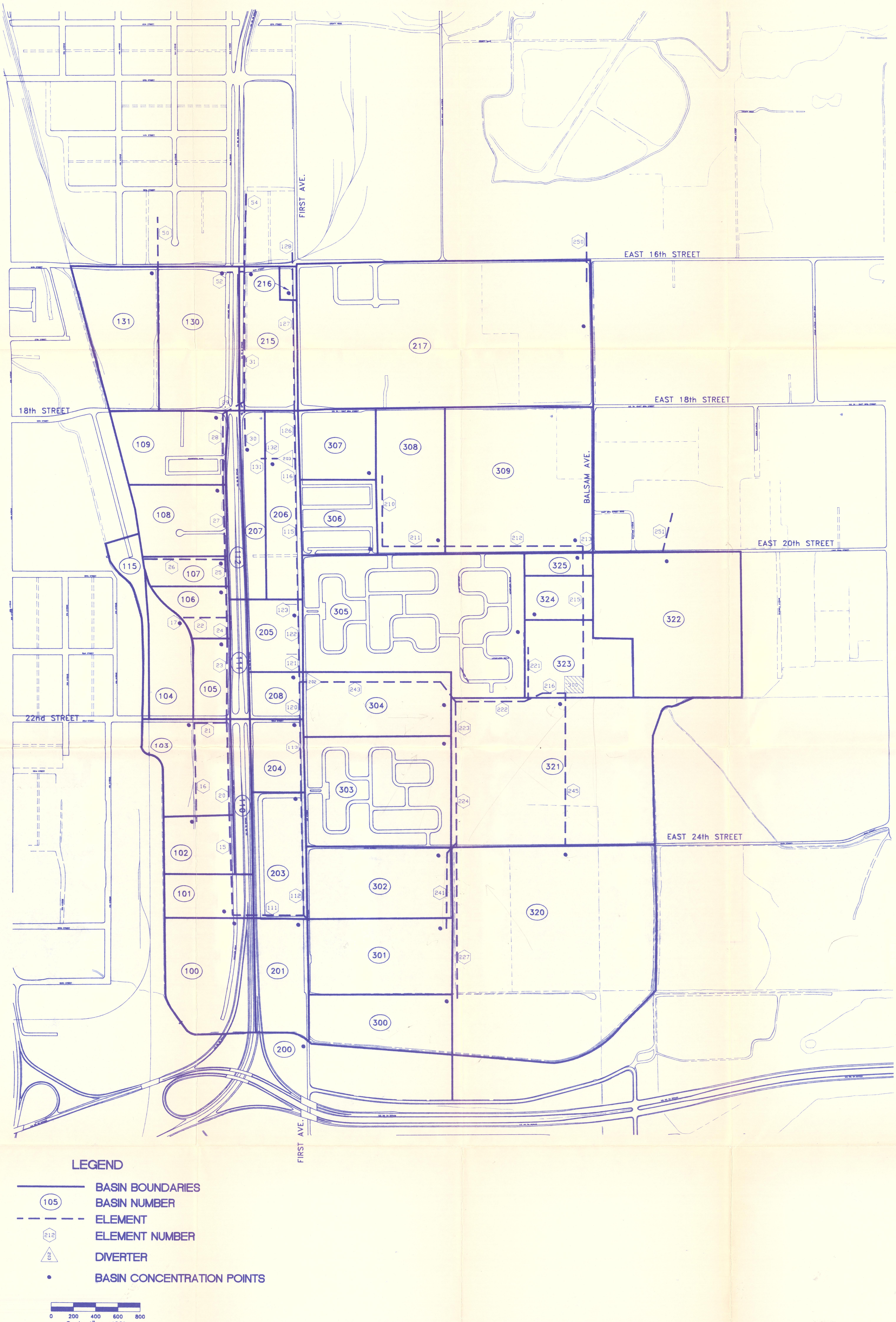
OPED BASIN
TEC, THE ENGINEERING COMPANY - APRIL 1992

100-YEAR DEVELOPED

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
100	10.	1.5	2.4	1 20.
241	42.	1.1		0 45.
227	23.	.9		0 55.
111	8.	.5		0 20.
224	328.	2.4		0 40.
112	43.	3.0		0 40.
301	6.	1.0	16.9	2 25.
243	39.	.7		0 55.
223	73.	1.1		0 40.
113	79.	3.4		0 45.
16	28.	(DIRECT FLOW)		0 35.
15	3.	.6		0 25.
245	6.	.4		0 25.
222	~~123.~~ 150	1.3		0 55.
221	132.	2.7		0 40.
120	101.	3.5		0 45.
21	65.	1.5		0 35.
20	3.	.6		1 15.
216	445.	6.7		0 40.
202	101.	4.7		0 45.
121	0.	.5	.9	1 35.
23	82.	2.7		0 40.
17	5.	1.3	1.0	1 15.
300	21.	1.5	21.7	2 10.
122	49.	3.3		1 5.
123	0.	.5	1.3	2 5.
24	98.	4.0		0 45.
22	5.	(DIRECT FLOW)		0 25.
211	15.	1.3		1 10.
217	108.	1.2		0 40.
250	38.	1.3		0 20.
115	49.	4.0		1 5.
26	0.	(DIRECT FLOW)		0 0.
25	131.	4.1		0 45.
212	79.	2.8		1 5.
218	108.	1.6		0 40.
215	43.	2.2		0 35.
116	49.	3.7		1 5.
27	141.	3.1		0 45.
302	3.	1.0	8.2	4 15.
214	151.	3.5		0 40.
203	49.	4.0		1 5.
28	169.	3.1		0 50.
213	158.	2.8		0 40.
126	48.	3.9		1 10.
51	0.	.0		0 0.
30	18.	2.0	1.3	1 10.
29	182.	3.3		0 50.
225	158.	2.7		0 40.
219	48.	1.7		1 15.

132	37.	1.0		0	35.
127	0.	.0		0	0.
52	17.	2.0	1.1	0	55.
31	190.	6.0		0	55.
101	48.	(DIRECT FLOW)		0	35.
220	358.	4.0		0	40.
131	0.	.1	2.1	2	15.
130	56.	1.0		0	40.
128	3.	1.3	.1	0	55.
54	232.	2.7		0	50.
53	0.	.0		0	0.
50	80.	3.1		0	35.

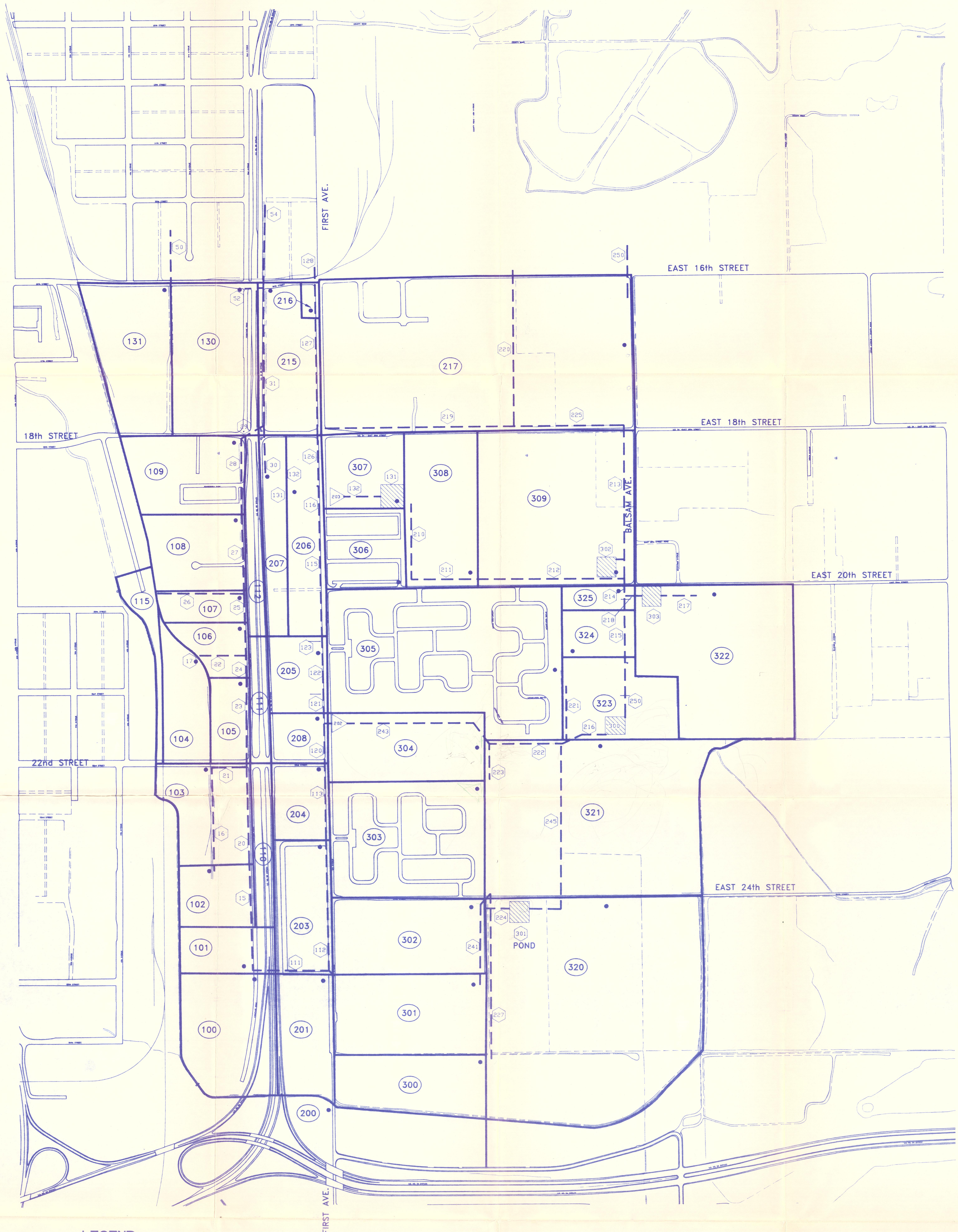


EAST GREELEY DRAINAGE BASIN MASTER PLAN

The Engineering Company
FORT COLLINS, COLORADO

EXHIBIT 1
EXISTING CONDITIONS
SWMM MODEL

9202103



LEGEND

BASIN BOUNDARIES
105 BASIN NUMBER
ELEMENT
212 ELEMENT NUMBER
203 DIVERTER
BASIN CONCENTRATION POINTS

0 200 400 600 800
Scale 1" = 400'

EAST GREELEY DRAINAGE BASIN MASTER PLAN

TEC The Engineering Company
FORT COLLINS, COLORADO

EXHIBIT 2
DEVELOPED CONDITIONS
SWMM MODEL