NORTH SAND CREEK DRAINAGE BASIN PLANNING STUDY

FOR

CANON CITY, COLORADO

PREPARED BY:

ASSOCIATED DESIGN PROFESSIONALS, INC.
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Job No. 980907

ADP
Associated Design Professionals, Inc.

NORTH SAND CREEK DRAINAGE BASIN
PLANNING STUDY
INTERIM IMPROVEMENTS

GENERAL

Compared to other basins within Canon City, the overall cost to upgrade the drainage system throughout the North Sand Creek Drainage Basin is relatively small. Most of the proposed improvements are triggered by future development.

INTERIM RECOMMENDATIONS

Since a new triple 6' x 20' culvert crossing is being built for the new branch of Pueblo Community College, no additional crossings need be built along the southern portion of North Sand Creek at this time. It is recommended, however, that the County Road 69 crossing of North Sand Creek (Structure 11) be upgraded to a 100-year crossing. Currently, the crossing is impassable during storm events. Also, the low-flow crossing should be replaced with a 48-inch culvert crossing.

The estimated probable cost for interim construction is as follows:

Location	Structure No.	Description	Cost
County Rd 69 at N. Sand Creek	11	3-cell 20' x 8' RCBC	$480,000.00
County Rd 69 East of US Hwy 50	14	48" CMP	$5,760.00
		Total	$485,760.00

This cost does not include easement costs and is based on 1999 dollars.

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I. INTRODUCTION

A. Contract Authorization

The North Sand Creek Drainage Basin Planning Study was authorized under the terms of an agreement between the City of Canon City and Associated Design Professionals, Inc. This study covers drainage development alternatives within the North Sand Creek Drainage Basin.

B. Purpose and Scope of Work

The purpose of this study is to develop the most feasible drainage plans for the North Sand Creek Drainage Basin. The detailed scope of services is as follows:

I. North Sand Creek Drainage Basin as a whole

- A. Review previous studies, maps and other available information.
- B. Provide additional analysis and/or data that are critical to the project and not currently available, in order to accomplish II.

II. Conceptual Master Plan for Basin

- A. Recommend improvements for the basin
- B. Prioritize the improvements
- C. Provide a planning level cost estimate for each improvement

C. Previous Drainage Reports

There have been two previous drainage studies performed within the North Sand Creek Drainage Basin. The following is a summary of those reports:

"Preliminary Plan of a Storm Water Management Policy for the Four Major Drainage Basins located in the Northern Portions of Canon City, Colorado" by Great Divide Engineering and Surveying, 1986.

"Report on Storm Drainage Facilities for the City of Canon City, Colorado" by M & I, Inc., 1974.

D. Agency Jurisdictions

The City of Canon City has jurisdiction over the proposed drainage criteria and design requirements. Any proposed improvements or changes to the existing irrigation canals within the basins will need to be approved by the Fruitland Ditch Canal Board.

The US Army Corps of Engineers will have review approval for any work that disturbs existing wetland areas or for any modifications to the Arkansas River.

E. Drainage Criteria

The drainage criteria used in this study were obtained from the City of Canon City. Flow calculations are determined from the TR-20 Computer Program for Project Formulation Hydrology developed by the Soil Conservation Service. The charts used in determining input for the program are contained in the Appendix of this report.

F. Mapping

The Canon City, Colorado, 1:24,000 topographic quadrangle maps prepared by the U.S. Geological Survey was used as the basin map for this project. These maps use 40 feet contour intervals and was photo revised in 1976. The maps were used for the general purposes of basin boundary delineation and for the establishment of principal tributary regions and sub-basins within these regions. Recent road additions were added to the maps to reflect current conditions.

G. Field Reconnaissance

Field reconnaissance of the basin was performed in order to supplement existing roadway and site development plans, and existing drainage reports. Culvert locations, sizes and depths were field checked and sub-basin flow patterns were analyzed. In addition, existing as well as potential problem areas were noted for a more in-depth evaluation.

Aerial photography, taken in March 1994, was utilized to identify current land uses and drainage patterns throughout the North Sand Creek Drainage Basin.

H. Environmental Considerations

Few environmentally sensitive areas currently exist in the North Sand Creek Drainage Basin. The channel reach between U.S. Highway 50 and County Road 69 exhibits a well-vegetated riparian habitat with a broad channel base and stable side slopes. Any modifications to this area will be designed in such a manner as to create no adverse affects on any wetland areas. The remainder of the major channels in the basin appear to be dry washes with no constant base flow above County Road 69.

II. PROJECT DESCRIPTION

A. Basin Description and Location

The North Sand Creek Drainage Basin encompasses the western portion of Canon City and a portion of Fremont County. It runs from the Royal Gorge on the west to the Northeast Canon Drainage Basin on the east and the Arkansas River to the south. It is situated in Township 18S, Range 70W of the 6th PM, Fremont County, Colorado. The basin contains approximately 13.1 Square Miles. A majority of the lands are currently platted and undeveloped. The area west of County Road 69 and north of U.S. Highway 50 is currently being developed into 35-acre ranchettes.

The runoff from this basin flows in a southerly direction and crosses U.S. Highway 50 at a major single-span bridge. The topography varies from a mild slope of 1% in the lower portion of the basin to steep slopes along its western and northern roadway. The vegetation consists primarily of native rangeland grasses with some trees and wetland vegetation along portions of the main channel.

B. Major Drainageways and Facilities

The upper channels in the North Sand Creek Drainage Basin vary, depending which branch is followed.

The eastern branch, paralleling County Road 69, is approximately 20 feet wide with several stock ponds located along its route. Sparse rangeland vegetation exists along its banks with no large culvert crossings.

The western branch follows U.S. Highway 50, crossing back and forth under the roadway. This portion of the basin is more hilly and contains moderate stands of Pinon pines scattered throughout the area. The channel consists of a gravelly bottom for most of its length and forms deep ravines along its route.

The two channels join just upstream of the crossing at County Road 69. The County Road crossing consists of a 12-inch CMP for trickle flows. The remaining flows overtop the gravel road. From this crossing, south, vegetation increases until it nears the bridge over U.S. Highway 50. Here, well-established willows exist.

Although some base flow exists at U.S. Highway 50, vegetation becomes sparse south of the structure. The base flow eventually disappears in the 15- to 20-foot, gravelly-bottomed channel.

Most of the southern portion of the channel appears stable, except at some sharp bends where erosion occurs. From the U.S. Highway 50 bridge, south to Tunnel Drive, only low flow crossings exist for the ranch driveways.

The Tunnel Drive bridge consists of a triple-cell box culvert. This recently constructed structure was designed to pass only the 25-year storm. Low frequency storms will overtop the structure. The well vegetated channel continues south to the confluence with the Arkansas River, crossing under the D & RG Railroad Bridge just prior to emptying into the river.

C. Existing Surface Water Improvements

The five private ponds located in the northern reaches of the basin are the only significant surface water impoundments within the North Sand Creek Drainage Basin. The ponds are on average 4' deep and are well vegetated around their banks.

III. HYDROLOGIC EVALUATION

A. Basin Hydrology

The hydrologic model used to determine peak flows and volumes throughout North Sand Creek Drainage Basin was the TR-20 Computer Program for Project Formulation Hydrology developed by the Soil Conservation Service.

The overall basin was divided into tributary basins and then into smaller sub-basins. The sub-basins and existing structures were numbered to designate different variables for data entry into TR-20. The sub-basins were chosen with respect to the natural topography, roadway crossings and development considerations.

Peak flows for the 100-year, 50-year and 25-year, 24-hour storms, were calculated and evaluated.

B. Time of Concentration

The time of concentration (Tc) used in the TR-20 calculations was determined by first calculating an initial overland flow time from the sub-basin boundary to the naturally occurring swales and channels. Then a travel time was calculated in these natural swales to the bottom of the sub-basins and added to the initial overland flow time to determine the overall time of concentration for existing conditions. For future developed conditions, the channel travel times were adjusted to reflect improved conditions and therefore a shorter time of concentration.

C. Rainfall

Rainfall amounts for the North Sand Creek Basin were determined from the National Oceanic and Atmospheric Administration Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume III - Colorado, 1973.

Precipitation for the 100-year 50-year and 25-year, 24-hour storms were 3.40, 3.05 and 2.75 inches, respectively.

D. Land use

Existing land uses in the North Sand Creek Drainage Basin were determined by examining current development plans supplemented with field reconnaissance. Currently most of the development is occurring in the eastern and southern portion of the basin with the western and northern areas remaining in their natural state.

Proposed land use for the area was determined through examination of current development plans and through discussions with Fremont County Planning Department officials and Canon City officials. For design purposes undeveloped areas were assumed to be fully developed using projected densities. The land use map is a composite of this land use information. There is not a time frame or date associated with this ultimate projected land use.

E. Soil Characteristics

The soils information contained in this report is derived from the "Soil Survey of Fremont County Area, Colorado", currently being completed by the USDA Soil Conservation Service. Of the 15 soils classifications found within the North Sand Creek Drainage Basin, one belongs to Hydrologic Soil Group B, one belongs to the Hydrologic Soil Group C, and eight belong to the Hydrologic Soil Group D. The following is a table of the soils located within the basin:

TABLE 2
SOILS CLASSIFICATIONS

SCS Soils Map Numbering	*Soil Classification*	*Hydrologic Soil Group*
3	Aqua Ustifluvents	C
12	Bronell Variant	B
19	Cathedral	D
36	Fort Collins	B
50	Kim	B
64	Louviers	D
75	Neville	B
93/94	Rizozo	D
98	Roygorge	D
100	Sedillo	B
109	Shrine	B
118	Travessilla	D
120/121	Ustic Torriorthents	D

F. Runoff Curve Numbers
Runoff Curve Numbers (CN's) were determined for the basin by utilizing soils and land use information described in previous sections. Curve numbers for the undeveloped portions of the basin were prepared based on projected land densities with some agricultural land remaining in its existing rangeland conditions.

IV. HYDRAULIC DESIGN EVALUATION

A. Existing Structure Evaluation
Only the existing structures that transport flows out of major sub-basins have been examined in this report. These structures vary from low-flow crossings to single-span bridges. An allowable headwater of 6" below the edge of pavement was utilized to calculate maximum culvert capacities. The existing capacities of these structures were estimated primarily using inlet control analysis.

The analysis revealed that a portion of the existing structures throughout the basin are unable to effectively handle the existing 100 year, 24-hour storm without overflowing the roadways. An existing structure evaluation chart was developed to summarize these findings and is included at the end of this section.

B. Existing Drainageway Evaluation
As outlined in the Major Drainageway and Facilities section, most of the major drainageways within the North Sand Creek Drainage Basin are natural, unimproved channels. In the upper reaches of the basin, the channels are typically wide, grassed

swales with little or no signs of erosion. The existing capacities of major channel reaches within the basin were estimated using normal depth flow analysis.

C. Environmental Inventory

The significant environmentally sensitive area within the North Sand Creek Drainage Basin is the channel reach near U.S. Highway 50, as described in the Existing Surface Water Improvements Section.

V. ALTERNATE DRAINAGE SYSTEMS

A. Alternate Development Policies

The Alternative Drainage systems were developed in a cooperative effort with input from the City of Canon City, Colorado Department of Transportation, and the local residents. Several additional variations of the presented alternates were also examined but are not included in this report.

B. Alternate 1

This alternate investigates developed conditions throughout the project area with no detention. As stated previously, the north branch of North Sand Creek follows County Road 69. The 100-year flow in the channel just upstream of the confluence with the west tributary is 1704 cfs. The 100-year flow from the west tributary along U.S. Highway 50 is 2424 cfs. The combined flow of the two tributaries is 4128 cfs. Some signs of bank erosion were noted at bends within this reach. These areas should be protected with heavy riprap as noted on the plans.

Only a small area contributes to the flow prior to the North Sand Creek crossing of U.S. Highway 50 in a 55-foot single span bridge. The 100-year flow at the bridge is calculated at 4277 cfs. From the bridge the channel continues south, flowing over several low-flow crossings serving as driveways for the existing ranches. The channel crosses under the existing three-cell, 19' x 8' Tunnel Drive culvert near the confluence with the Arkansas River. The 100-year developed flow at this point is 6371 cfs. The existing box culvert was designed for a flow of approximately 3500 cfs.

It has been determined that based on the existing flow, the current U.S. Highway 24 crossings are adequate with some ponding occurring behind the culverts. The County Road 69 crossings, however, need upgrading. In order to pass the 100-year flow, a three-cell, 20' x 8' culvert is needed. In addition, a 48-inch CMP culvert should be constructed at the North Sand Creek main channel on the side tributary from Sub-basin 16.

Currently, the area south of the U.S. Highway 50 bridge can be accessed by low-flow crossings, only, except for the Tunnel Drive culvert. Development of the area west of the North Sand Creek channel will increase with the construction of the College Branch just north of Tunnel Drive. As the area develops, it is assumed that a collector road will be constructed along the west side of the channel with at least one additional 100-year flow crossing built between Tunnel Drive and U.S. Highway 50. For this report, it is assumed that the new structure will be constructed at the existing Structure 7 low-flow crossing. This new structure will require a 4-cell, 20' x 8' box culvert to pass the 100-year flow.

The estimated probable construction cost is $1,286,760. This cost does not include land or easement purchase cost and is based on 1999 dollars.

C. Alternate 2

This alternate examines the enhancement of three (3) existing detention areas, as well as the addition of an additional detention basin. The existing stock ponds in Sub-basin 34 will be upgraded with a 24-inch cmp outlet pipe and 20-foot riprap lined emergency spillway. The existing ponding area in Sub-basin 32 just north of the transmission line crossing will also be upgraded with a 24-inch cmp outlet pipe and a 20-foot riprap lined emergency spillway. This will reduce the flow to 1029 cfs at the end of Sub-basin 32.

A new 80 acre-foot detention facility will be constructed near the site of the smaller stock pond. An outlet structure with two, 72-inch cmp's and a 30-foot riprap lined emergency spillway will be provided. This will reduce the flow from the western tributary from 2424 cfs to 1155 cfs. This will reduce the 100-year culvert crossing at County Road 69 to a three-cell, 12' x 6' box culvert to pass the 2167 cfs. As in Alternate 1, a new culvert will be needed at the County Road 69 crossing of the Sub-basin 16 flows.

The total reduced flow at the U.S. Highway 50 bridge would be 2217 cfs for the 100-year flow. The flow at Tunnel Drive will be 5113 cfs, which will allow the 100-year flow to pass through the existing culvert. In order to provide adequate fire and emergency vehicle access to the area north of Tunnel Drive, an additional 100-year flow crossing will be constructed. For the purpose of this report, the new crossing is assumed at existing Structure 7. With the upstream detention, the size of this crossing can be reduced to a three-cell, 20' x 7' box culvert.

The estimated probable construction cost of Alternative 2 is $1,670,760. This cost does not include land or easement purchase cost and is based on 1999 dollars.

D. Alternate 3

This alternate encompasses the detention alternatives of Alternate 2, with the addition of a 70 acre-foot detention facility at the bottom of Sub-basin 10 just before the side tributary enters the main channel. With the addition of this detention facility, the 100-year flow at Tunnel Drive will be reduced to 3421 cfs. This would also reduce the size of the culvert crossing at existing Structure 7. The proposed culvert size is a three-cell 16' x 7' box culvert.

The estimated probable construction cost of Alternative 3 is $1,886,760. This cost does not include land or easement purchase cost and is based on 1999 dollars.

E. Summary of Selected Alternative

Factors used to evaluate the three alternatives explained in this report were:

- ❑ costs
- ❑ constructability
- ❑ citizen feedback
- ❑ City input

As a result of the meetings held with public and private individuals, Alternate 1 was selected as the preferred alternative. It is recommended that Alternate 1 be modified to include modifications to the existing storm pond located in Sub-basin 32, just north of the

existing electrical transmission line crossing adjacent to County Road 69. Currently, there is no pipe outlet through the 15-foot to 20-foot high embankment – only an overflow spillway on the west side of the structure. Due to the height of the embankment and the potential for damage if a failure should occur, the structure should either be breached or an outlet structure installed. Since this stock pond is privately owned at the present time, no public funds should be expended to repair the deficiencies.

VI. PRELIMINARY DESIGN

A. General

Based on the results of the alternatives, the evaluation and comments from the public meetings and the City, the concepts from the chosen alternative were developed into preliminary designs. Each major system in the North Sand Creek Drainage Basin is delineated on the conceptual plans contained in Appendix B with the associated costs for the facilities included in a summary table in the Economic Analysis section.

Although specific types of erosion protection and drop structures are delineated on the Preliminary Estimate of Probable Construction Costs, this does not preclude the use of other design materials or design schemes that will serve the intended purpose, as well as or better than, those presented herein both hydraulically and environmentally. The designs presented in this study represent one method of stabilizing the channel. Other methods of stabilization are permitted as long as they meet with the approval of the Canon City Engineering Department and other affected agencies.

VII. WATER QUALITY

A. General

Concern regarding storm water quality has been growing through the past decade. Recently the Environmental Protection Agency (EPA) has been working on regulations for monitoring and the use of best management practices to control storm water. The actual design for any necessary control facilities will vary according to the type of pollutants present.

Pollutants enter storm water in many ways, among which are the following:

1. Pollutants are absorbed as the raindrops pass through the atmosphere.
2. Pollutants are washed off the paved and unpaved surfaces by storm water runoff.
3. Pollutants that have accumulated since the last storm in sewers, ditches, and channels are picked up by the storm water.

B. Treatments

Most of the pollutants expected to reach the main stem of the channel should be of the suspended solid variety. However, it may be necessary to sample and analyze the storm water to determine the exact control measures to implement.

Dry basins should be designed in areas where the main pollutants are suspended solids, which simply settle out in the basin when the channel velocity drops. However, if

dissolved solids, nitrates and nitrites, and soluble phosphorus are present, a wet pond will need to be constructed to reduce these pollutants.

VIII. ECONOMIC ANALYSIS

A. General

The economic analysis of the channel improvements listed in this study was derived from current construction prices for materials and labor in the Canon City/Fremont County area. In addition, the 1997 edition of the Colorado Department of Highways "Cost Data" was utilized and updated for 1998 costs. Estimated probable construction costs were determined for each channel reach for the selected alternative utilizing the protection scheme delineated in the Alternate Drainage Systems section and on the Alternate Conceptual Plans located in Appendix B.

The following Table 9, Unit Construction Costs, lists the specific unit costs used in determining the estimated probable construction costs:

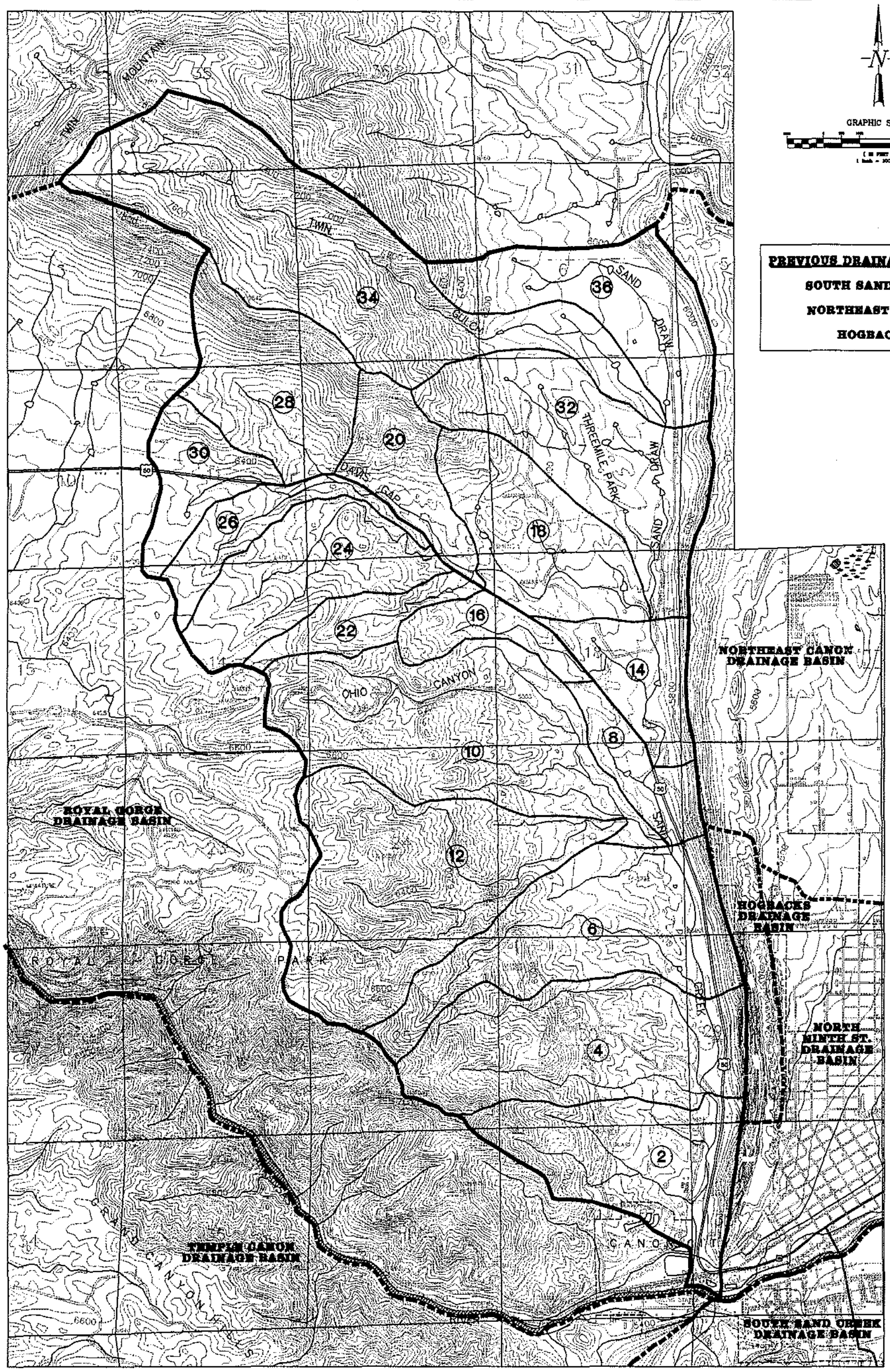
TABLE 9
UNIT CONSTRUCTION COSTS

Item Description	Unit	Estimated Unit Cost
Vortex Dissipater	EA	$1,500.00
Trash Rack	EA	$1,400.00
Gabion Baskets	CY	$85.00
Rip Rap	CY	$35.00
Heavy Rip Rap	CY	$50.00
Granular bedding materials	CY	$20.00
Reinforced concrete	CY	$300.00
Concrete channel lining	CY	$180.00
Structural backfill	CY	$8.00
Structural excavation	CY	$5.00
Unclassified excavation & embankment	CY	$2.50
Seeding (native)	Acre	$1000.00
24" CMP	LF	$45.00
48" CMP	LF	$80.00
72" CMP	LF	$170.00
3-cell, 12' x 6' Box culvert	LF	$6000.00
3-cell, 16' x 7' Box culvert	LF	$8000.00
3-cell, 20' x 7' Box culvert	LF	$9000.00
3-cell, 20' x 8' Box culvert	LF	$10,000.00
4-cell, 20' x 8' Box culvert	LF	$13,500.00

NOTE: Pipe and culvert costs do not include utility relocation costs. Preliminary construction costs include a 20% factor for contingencies.

B. Preliminary Estimate of Probable Construction Costs

As previously stated, the proposed improvements are illustrated on the alternate conceptual plans that are included in Appendix B. Conceptual construction costs were estimated for each alternate based on the unit construction costs provided in this section and are also in Appendix B. Preliminary construction costs for the selected alternate are provided in Appendix C.



NORTH SAND CREEK

DRAINAGE BASIN PLANNING STUDY

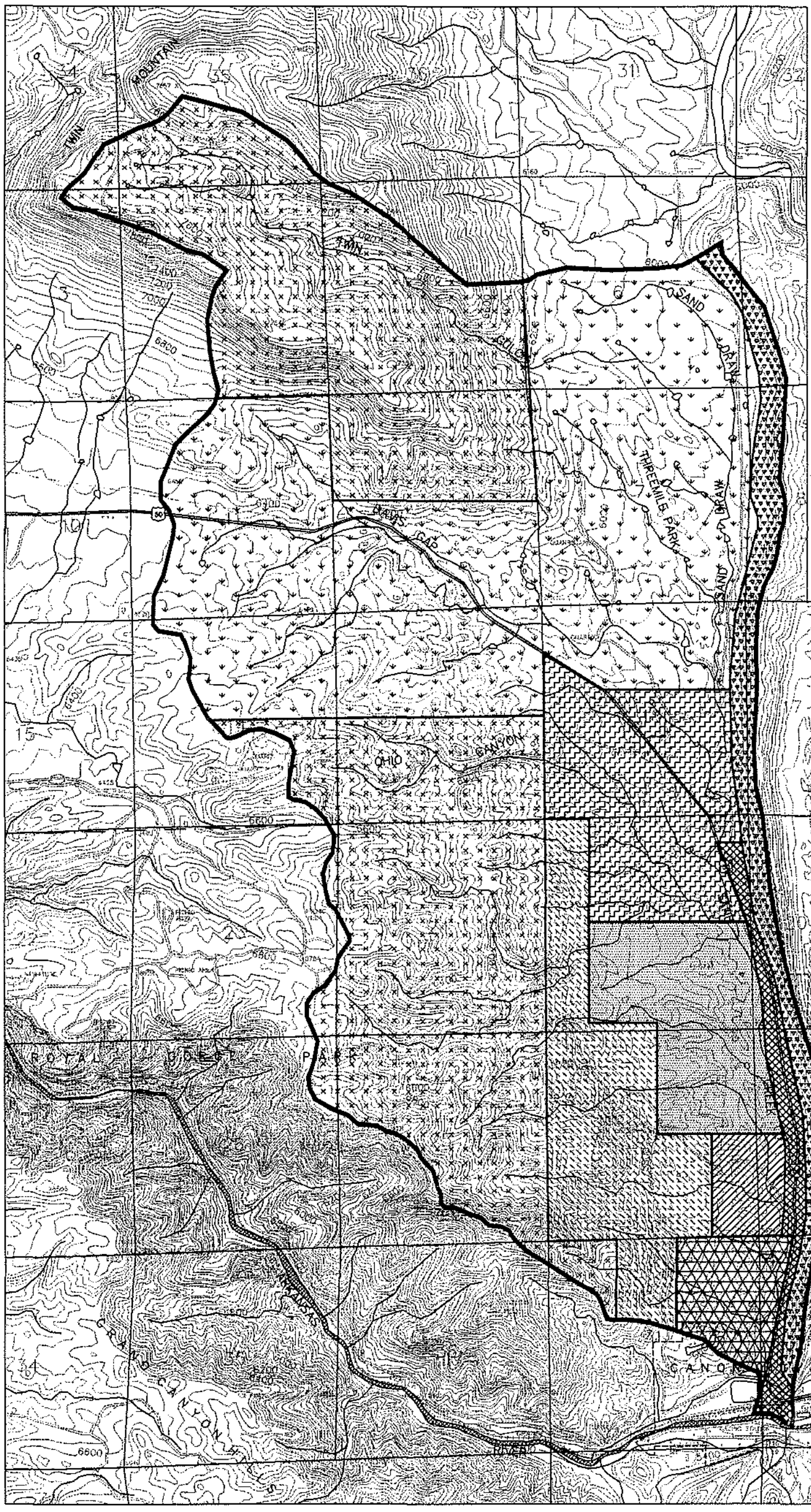
CITY OF CANON CITY, COLORADO

ADJACENT BASINS MAP

SHEET

NO.	DATE	REVISION	BY

PREPARED BY: ADP



NORTH SAND CREEK

DRAINGE BASIN PLANNING STUDY

CITY OF CANON CITY, COLORADO

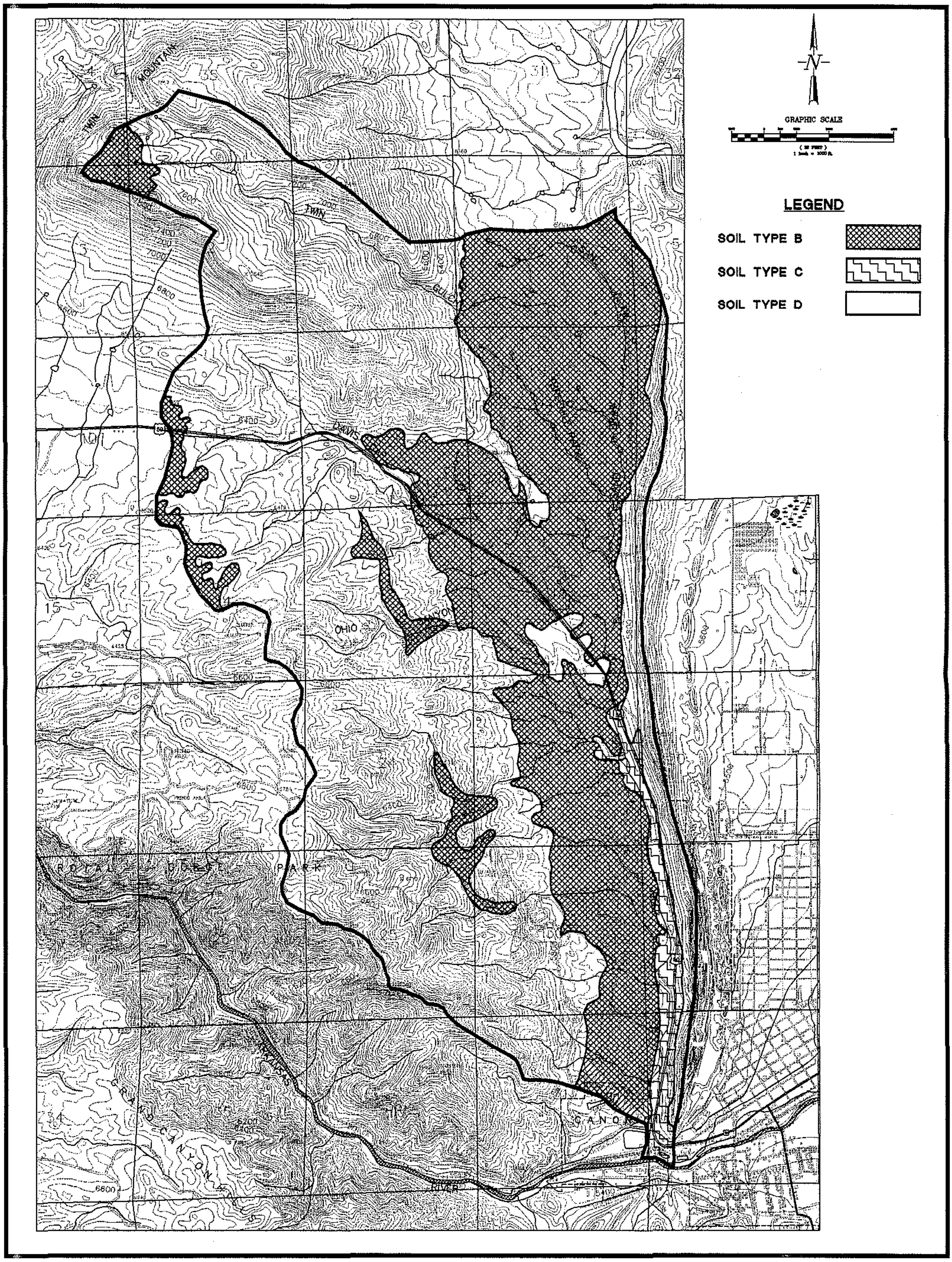
PROJECTED SURFACE CHARACTERISTICS

SHEET 1 of 1

NO.	DATE	REVISION	BY

PREPARED BY: ADP

DATE: 6/6/96
DESIGNED BY: JW
JOB NO. 96007
PROJECT ENGINEER: KAB
CAD FILE NO. KLANDUSE
PROJECT MANAGER: KAB
DRAWN BY: JW
SCALE: HORZ. 1000' VERT.



NORTH SAND CREEK

DRAINAGE BASIN PLANNING STUDY

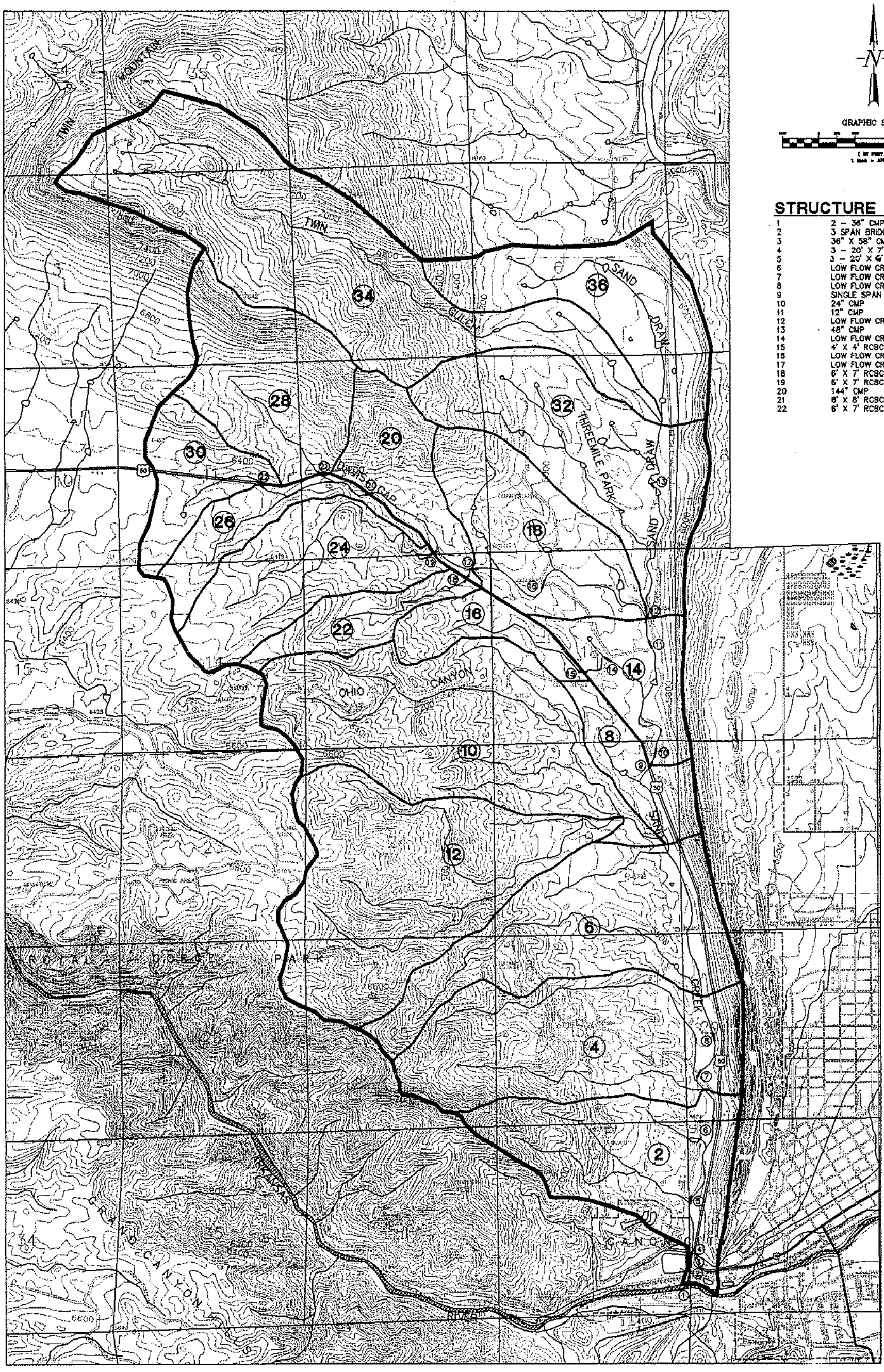
CITY OF CANON CITY, COLORADO

SOILS MAP

NO.	DATE	REVISION	BY

PREPARED BY: ADP

DATE:
JOB NO.
CAD FILE NO.
DRAWN BY
DESIGNED BY
PROJECT ENGINEER
PROJECT MANAGER
SCALE
HORZ. 1000'
VERT.



STRUCTURE LEGEND

1	2 – 36" CMP
2	3 SPAN BRIDGE
3	36" X 58" CMP ARCH / 48" STEEL PIPE
4	3 – 20' X 7' RCBC
5	3 – 20' X 6' RCBC
6	LOW FLOW CROSSING
7	LOW FLOW CROSSING
8	LOW FLOW CROSSING
9	SINGLE SPAN BRIDGE
10	24" CMP
11	12" CMP
12	LOW FLOW CROSSING
13	48" CMP
14	LOW FLOW CROSSING
15	4' X 4' RCBC
16	LOW FLOW CROSSING
17	LOW FLOW CROSSING
18	6' X 7' RCBC
19	6' X 7' RCBC
20	144" CMP
21	8' X 8' RCBC
22	6' X 7' RCBC

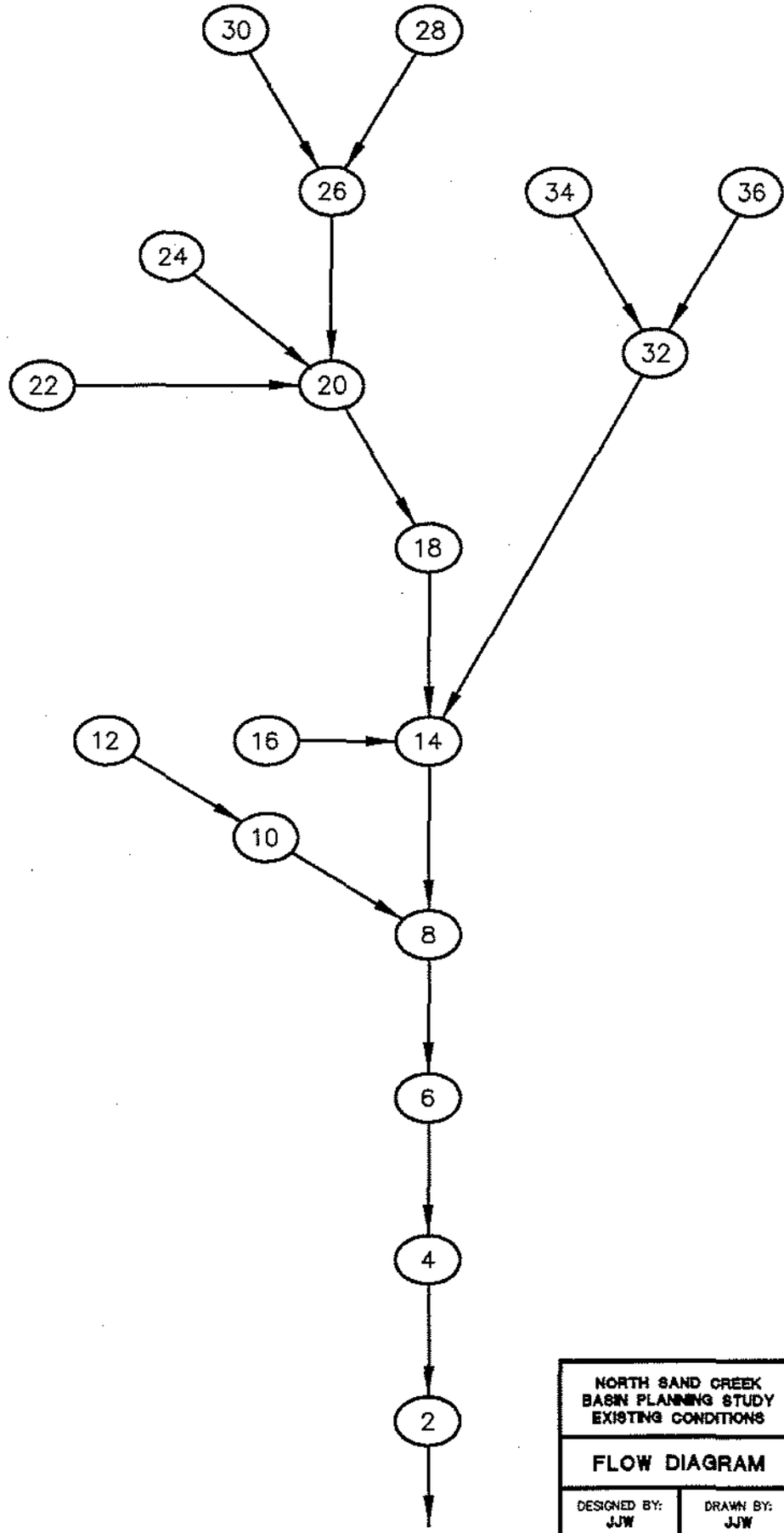
SHEET 1 of 1

NORTH SAND CREEK
DRAINAGE BASIN PLANNING STUDY
CITY OF CANON CITY, COLORADO
EXISTING STRUCTURES

NO.	DATE	REVISION	BY

PREPARED BY: ADP

DATE: 5/6/96 | DESIGNED BY: JJW
JOB NO. 960877 | PROJECT ENGINEER: KAB
CAD FILE NO. H_STRUCT.DWG | PROJECT MANAGER: KAB
DRAWN BY: JJW | SCALE: HORZ. 1000' VERT.



NORTH SAND CREEK BASIN PLANNING STUDY EXISTING CONDITIONS	
FLOW DIAGRAM	
DESIGNED BY: JJW	DRAWN BY: JJW
CHECKED BY: MAS	DATE: 5/8/98
FILE NO: N_XFLOW.DWG	JOB NO: 980907

ADP
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NORTH SAND CREEK DBPS
EXISTING CN CALCULATION 1 OF 2

BASIN #	AREA (ac.)	SOIL TYPE	AGRI	%	EST	%	S.F.	%	M.F.	%	QRY	%	COMM	%	PARK	%	FRST	%	CAMP	%	TOTAL SOIL %	DEV CN	BASIN #
		B	69	20	68		75		75	10	88	2.5	92		61		60		88		32.5		
2	515	C	79	15	79		83		83		91		94	5	74	5	73		91		25	80.4	2
		D	84	2.5	84		87		87		93	20	95		80	10	79	10	93		42.5		
		B	69	20	68		75		75		88	8.5	92	5	61		60		88		33.5		
4	708	C	79	2.5	79		83		83		91		94	5	74		73		91		7.5	83.8	4
		D	84	2	84		87		87		93	30	95	2	80	5	79	20	93		59		
		B	69	25	68		75		75		88	5	92		61		60	5	88		35		
6	646	C	79	2.5	79		83		83		91		94	5	74		73		91		7.5	80.5	6
		D	84	10	84		87		87		93	20	95	2.5	80	5	79	20	93		57.5		
		B	69	10	68		75		75		88	5	92		61		60	10	88		25		
12	858	C	79		79		83		83		91		94		74		73		91		0	78.2	12
		D	84	5	84		87		87		93	10	95		80		79	60	93		75		
		B	69	70	68		75		75		88		92	2.5	61		60		88		72.5		
14	238	C	79		79		83		83		91		94		74		73		91		0	72.9	14
		D	84	7.5	84		87		87		93		95		80	20	79		93		27.5		
		B	69	40	68		75		75		88		92	5	61		60		88		45		
8	166	C	79	15	79		83		83		91		94		74		73		91		15	77.7	8
		D	84	40	84		87		87		93		95		80		79		93		40		
		B	69	27.5	68		75		75		88		92		61		60	7.5	88		35		
10	850	C	79	2.5	79		83		83		91		94		74		73		91		2.5	76.9	10
		D	84	12.5	84		87		87		93	10	95		80		79	40	93		62.5		
		B	69	70	68		75		75		88		92		61		60	5	88		75		
16	146	C	79		79		83		83		91		94		74		73		91		0	72.1	16
		D	84	20	84		87		87		93		95		80		79	5	93		25		
		B	69	15	68		75		75		88		92		61		60		88		15		
22	155	C	79		79		83		83		91		94		74		73		91		0	81.5	22
		D	84	80	84		87		87		93		95		80		79	5	93		85		
		B	69	75	68		75		75		88		92		61		60		88		75		
18	441	C	79		79		83		83		91		94		74		73		91		0	72.5	18
		D	84	20	84		87		87		93		95		80		79	5	93		25		
		B	69	40	68		75		75		88		92		61		60		88		40		
20	242	C	79		79		83		83		91		94		74		73		91		0	75.8	20
		D	84	15	84		87		87		93		95		80		79	45	93		60		
		B	69	25	68		75		75		88		92		61		60	5	88		30		
24	411	C	79		79		83		83		91		94		74		73		91		0	79.1	24
		D	84	70	84		87		87		93		95		80		79		93		70		

NORTH SAND CREEK DBPS
EXISTING CN CALCULATION 2 OF 2

BASIN #	AREA (ac.)	SOIL TYPE	AGRI	%	EST	%	S.F.	%	M.F.	%	QRY	%	COMM	%	PARK	%	FRST	%	CAMP	%	TOTAL %	DEV CN	BASIN #
		B	69	10	68		75		75		88		92		61		60		88		10		
26	175	C	79		79		83		83		91		94		74		73		91		0	82.5	26
		D	84	90	84		87		87		93		95		80		79		93		90		
		B	69	25	68		75		75		88		92		61		60		88		25		
30	209	C	79		79		83		83		91		94		74		73		91		0	80.3	30
		D	84	75	84		87		87		93		95		80		79		93		75		
		B	69	70	68		75		75		88		92		61	2.5	60		88		72.5		
32	637	C	79		79		83		83		91		94		74		73		91		0	72.0	32
		D	84	7.5	84		87		87		93		95		80	10	79	10	93		27.5		
		B	69		68		75		75		88		92		61		60		88		0		
28	449	C	79		79		83		83		91		94		74		73		91		0	81.0	28
		D	84	40	84		87		87		93		95		80		79	60	93		100		
		B	69	65	68		75		75		88		92		61	20	60		88		85		
36	443	C	79		79		83		83		91		94		74		73		91		0	69.0	36
		D	84		84		87		87		93		95		80	5	79	10	93		15		
		B	69	30	68		75		75		88		92		61		60	10	88		40		
34	1077	C	79		79		83		83		91		94		74		73		91		0	74.1	34
		D	84		84		87		87		93		95		80		79	60	93		60		

NORTH SAND CREEK DBPS
DEVELOPED CN CALCULATION 1 OF 2

BASIN #	AREA (ac.)	SOIL TYPE	AGRI	%	EST	%	S.F.	%	M.F.	%	QRY	%	COMM	%	PARK	%	FRST	%	CAMP	%	TOTAL SOIL %	DEV CN	BASIN #
		B	69		68		75		75	10	88	2.5	92		61		60		88	20	32.5		
2	515	C	79		79		83		83		91		94	10	74	5	73		91	10	25	86.3	2
		D	84		84		87		87		93	20	95		80	10	79	10	93	2.5	42.5		
		B	69		68		75	10	75	10	88	8.5	92	5	61		60		88		33.5		
4	708	C	79		79		83		83	2.5	91		94	5	74		73		91		7.5	85.2	4
		D	84		84		87	2	87		93	30	95	2	80	5	79	20	93		59		
		B	69		68		75	25	75		88	5	92		61		60	5	88		35		
6	646	C	79		79		83	2.5	83		91		94	5	74		73		91		7.5	82.4	6
		D	84		84		87	10	87		93	20	95	2.5	80	5	79	20	93		67.5		
		B	69		68	5	75	5	75		88	5	92		61		60	10	88		25		
12	858	C	79		79		83		83		91		94		74		73		91		0	78.5	12
		D	84		84	2.5	87	2.5	87		93	10	95		80		79	60	93		75		
		B	69	10	68	60	75		75		88		92	2.5	61		60		88		72.5		
14	238	C	79		79		83		83		91		94		74		73		91		0	72.3	14
		D	84		84	7.5	87		87		93		95		80	20	79		93		27.5		
		B	69		68	40	75		75		88		92	5	61		60		88		45		
8	165	C	79		79	15	83		83		91		94		74		73		91		15	77.3	8
		D	84		84	40	87		87		93		95		80		79		93		40		
		B	69	2.5	68	25	75		75		88		92		61		60	7.5	88		35		
10	850	C	79		79	2.5	83		83		91		94		74		73		91		2.5	76.6	10
		D	84		84	12.5	87		87		93	10	95		80		79	40	93		62.5		
		B	69	20	68	50	75		75		88		92		61		60	5	88		75		
16	146	C	79		79		83		83		91		94		74		73		91		0	71.6	16
		D	84	20	84		87		87		93		95		80		79	5	93		25		
		B	69	15	68		75		75		88		92		61		60		88		15		
22	155	C	79		79		83		83		91		94		74		73		91		0	81.5	22
		D	84	80	84		87		87		93		95		80		79	5	93		85		
		B	69	75	68		75		75		88		92		61		60		88		75		
18	441	C	79		79		83		83		91		94		74		73		91		0	72.5	18
		D	84	20	84		87		87		93		95		80		79	5	93		25		
		B	69	40	68		75		75		88		92		61		60		88		40		
20	242	C	79		79		83		83		91		94		74		73		91		0	75.8	20
		D	84	15	84		87		87		93		95		80		79	45	93		60		
		B	69	25	68		75		75		88		92		61		60	5	88		30		
24	411	C	79		79		83		83		91		94		74		73		91		0	79.1	24
		D	84	70	84		87		87		93		95		80		79		93		70		

NORTH SAND CREEK DBPS
DEVELOPED CN CALCULATION 2 OF 2

BASIN #	AREA (ac.)	SOIL TYPE	AGRI	%	EST	%	S.F.	%	M.F.	%	QRY	%	COMM	%	PARK	%	FRST	%	CAMP	%	TOTAL %	DEV CN	BASIN #
		B	69	10	68		75		75		88		92		61		60		88		10		
26	175	C	79		79		83		83		91		94		74		73		91		0	82.5	26
		D	84	90	84		87		87		93		95		80		79		93		90		
		B	69	25	68		75		75		88		92		61		60		88		25		
30	209	C	79		79		83		83		91		94		74		73		91		0	80.3	30
		D	84	75	84		87		87		93		95		80		79		93		75		
		B	69	70	68		75		75		88		92		61	2.5	60		88		72.5		
32	637	C	79		79		83		83		91		94		74		73		91		0	72.0	32
		D	84	7.5	84		87		87		93		95		80	10	79	10	93		27.5		
		B	69		68		75		75		88		92		61		60		88		0		
28	449	C	79		79		83		83		91		94		74		73		91		0	81.0	28
		D	84	40	84		87		87		93		95		80		79	60	93		100		
		B	69	65	68		75		75		88		92		61	20	60		88		85		
36	443	C	79		79		83		83		91		94		74		73		91		0	69.0	36
		D	84		84		87		87		93		95		80	5	79	10	93		15		
		B	69	30	68		75		75		88		92		61		60	10	88		40		
34	1077	C	79		79		83		83		91		94		74		73		91		0	74.1	34
		D	84		84		87		87		93		95		80		79	60	93		60		

NORTH SAND CREEK BASIN
TR20 INPUT
file:nsndctr

BASIN #	BASIN AREA (Ac.)	AREA(SM)	BASIN LENGTH(FT	ELEV DIFF	BASIN SLOPE(%)	b	Z	n	V	CHAN L(FT)	ELEV DIFF	CHAN SLOPE	b	Z	n	BASIN #
2	487.39	0.762	9700	1748	18.02	10	2	0.06	12.00	5200	90	1.73	25	2	0.06	2
4	670.30	1.047	12400	1798	14.50	10	2	0.06	12.00	2800	65	2.32	25	2	0.06	4
6	611.77	0.956	12400	1590	12.82	15	2	0.06	12.00	4000	85	2.13	25	3	0.06	6
8	156.78	0.245	5750	235	4.09	20	2	0.06	6.00	2600	55	2.12	50	5	0.06	8
10	804.94	1.258	14800	1185	8.01	10	2	0.06	10.00	1600	50	3.13	15	3	0.06	10
12	812.19	1.269	12900	1485	11.51	10	2	0.06	12.00							12
14	225.73	0.353	6150	230	3.74	30	3	0.06	5.00	4400	110	2.50	30	3	0.06	14
16	137.32	0.215	10650	580	5.45	10	2	0.06	7.50							16
18	417.47	0.652	7000	1010	14.43	20	3	0.04	12.00	5600	165	0.00	20	3	0.04	18
20	228.93	0.358	7000	295	4.21	20	3	0.06	7.50	3600	175	4.86	50	3	0.06	20
22	147.22	0.230	6700	760	11.34	10	2	0.06	12.00							22
24	389.71	0.609	10600	715	6.75	10	2	0.06	9.00							24
26	165.71	0.259	7650	530	6.93	15	2	0.06	8.50	3400	170	5.00	15	2	0.06	26
28	425.36	0.665	7600	1470	19.34	15	2	0.06	12.00							28
30	197.49	0.309	4600	310	6.74	10	2	0.06	8.00							30
32	602.79	0.942	10900	1170	10.73	20	2	0.06	11.00	5900	140	2.37	20	2	0.06	32
34	1020.19	1.594	20300	1910	9.41	15	2	0.06	12.00							34
36	419.32	0.655	10300	910	8.83	15	3	0.04	10.00							36

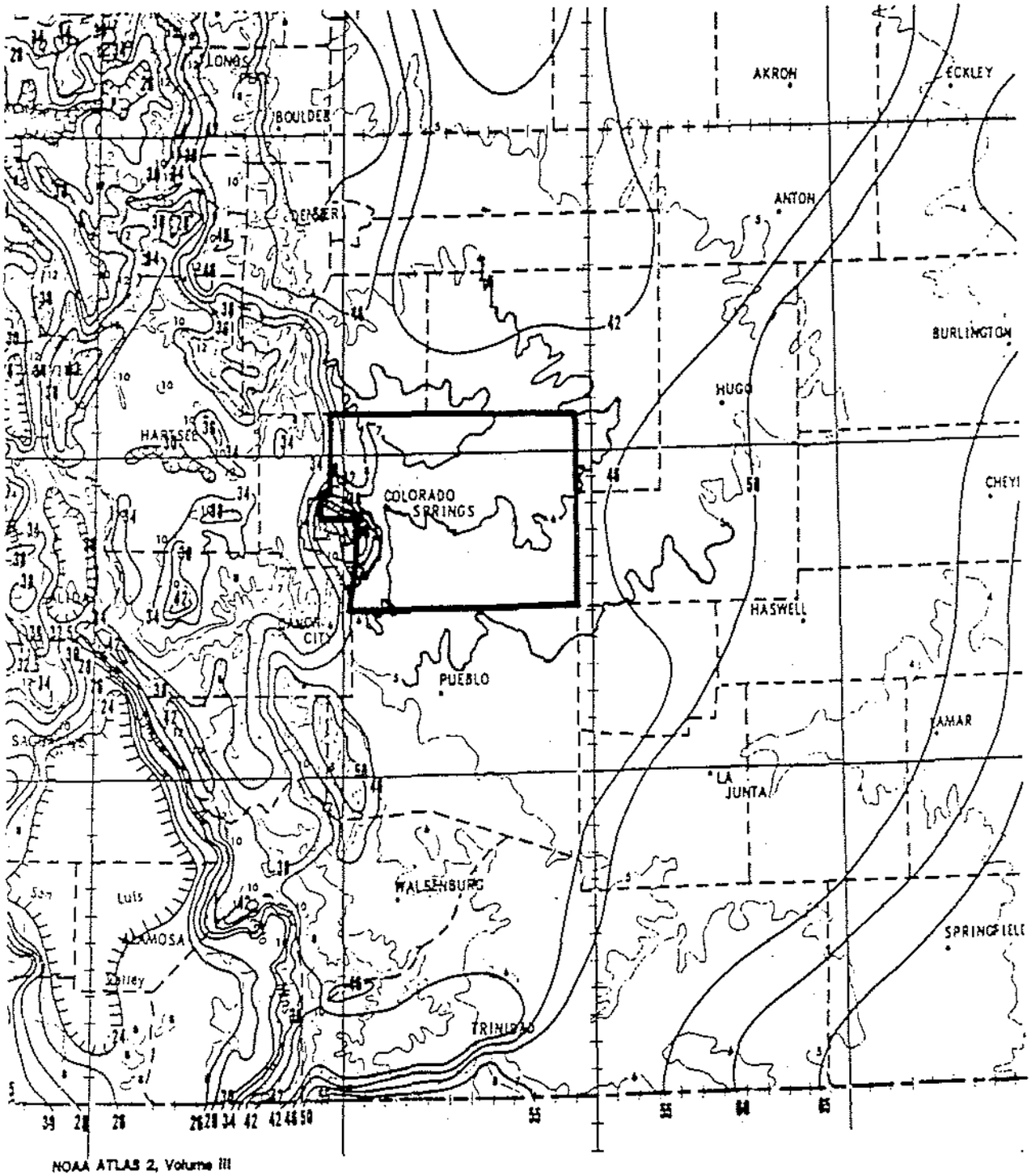
NORTH SAND CREEK BASIN
TIME OF CONCENTRATION AND CN CALCULATIONS
PROPOSED CONDITIONS
file:nsndctc

AREA DESIG.	C10 (10 yr)	L (ft)	Initial Tci Slope (%)	ti (min)	L (ft)	Travel Time Slope (%)	V (fps)	Tt (min)	TC (min)	TC (hr)	EXIST CN	DEV CN	AREA DESIG.
2	0.20	300	18.00	11.23	9400	18.00	12.00	13.06	24.29	0.405	86.20	86.70	2
4	0.30	300	14.50	10.72	12100	14.50	12.00	16.81	27.53	0.459	88.15	86.00	4
6	0.40	300	12.80	9.78	12100	12.80	12.00	16.81	26.58	0.443	88.45	83.50	6
8	0.40	300	4.00	14.35	5450	4.00	6.00	15.14	29.49	0.491	86.20	81.50	8
10	0.20	300	8.00	14.68	14500	8.00	10.00	24.17	38.84	0.647	88.70	72.30	10
12	0.20	300	11.50	13.02	12600	11.50	12.00	17.50	30.52	0.509	86.25	77.30	12
14	0.40	300	3.70	14.72	5850	3.70	5.00	19.50	34.22	0.570	84.75	78.70	14
16	0.40	300	5.50	12.92	10350	5.50	7.50	23.00	35.92	0.599	81.70	71.10	16
18	0.40	300	14.40	9.40	6700	14.40	12.00	9.31	18.71	0.312	80.50	77.70	18
20	0.20	300	4.20	18.15	6700	4.20	7.50	14.89	33.04	0.551	80.00	71.70	20
22	0.20	300	11.30	13.10	6400	11.30	12.00	8.89	21.98	0.366	81.25	76.80	22
24	0.30	300	6.70	13.83	10300	6.70	9.00	19.07	32.91	0.548	82.75	75.90	24
26	0.30	300	6.90	13.70	7350	6.90	8.50	14.41	28.11	0.469	87.10	78.00	26
28	0.20	300	19.30	10.98	7300	19.30	12.00	10.14	21.11	0.352	86.40	76.50	28
30	0.30	300	6.70	13.83	4300	6.70	8.00	8.96	22.79	0.380	79.00	72.10	30
32	0.30	300	10.70	11.85	10600	10.70	11.00	16.06	27.91	0.465	84.95	81.40	32
34	0.20	300	9.40	13.92	20000	9.40	12.00	27.78	41.69	0.695	79.85	69.40	34
36	0.40	300	8.80	11.06	10000	8.80	10.00	16.67	27.73	0.462	84.60	77.10	36

NORTH SAND CREEK BASIN
SUMMARY OF DISCHARGES

	SUB-BASIN FLOW			ACCUMULATED FLOW			DETAINED FLOW			
AREA	100 YR	50 YR	25 YR	100 YR	50 YR	25 YR	100 YR	50 YR	25 YR	AREA
2	1230	1039	879	6371	4909	3789	3806	2997	2275	2
4	1495	1253	1052	6242	4784	3703	3251	2419	1969	4
6	1215	1004	831	5809	4465	3435	2962	2060	1465	6
8	222	178	142	5551	4275	3296	2913	2009	1379	8
10	908	720	570	2075	1659	1324	791	616	528	10
12	1201	967	778							12
14	213	163	124	4277	3320	2558	2221	1444	978	14
16	118	90	68							16
18	584	455	352	2424	1949	1558	1155	771	613	18
20	275	217	1536	2292	1880	1536	2292	1880	1536	20
22	314	259	214	314	259	214	297	244	204	22
24	574	464	374	574	464	374	556	464	396	24
26	320	264	218	1259	1046	863	1251	1052	871	26
28	899	740	609	899	740	609	887	743	618	28
30	382	313	256	382	313	256	176	143	116	30
32	646	497	380	1029	1296	978	1029	682	381	32
34	940	731	565	970	964	737	923	641	356	34
36	361	269	198	361	269	198	361	269	198	36

APPENDIX A
Design Charts



NOAA ATLAS 2, Volume III

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - URBAN AND SUBURBAN CONDITIONS 1/
(Antecedent Moisture Condition II)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

Land Use		Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition:	grass cover on 75% or more of the area	39*	61	74	80
Fair condition:	grass cover on 50% to 75% of the area	49*	69	79	84
Commercial and Business areas (85% Impervious)		89*	92	94	95
Industrial Districts 72% Impervious)		81*	88	91	93
Residential: 2/					
Acres per Dwelling Unit	Average % Impervious 3/				
1/8 acre or less	65	77*	85	90	92
1/4 acre	38	61*	75	83	87
1/3 acre	30	57*	72	81	86
1/2 acre	25	54*	70	80	85
1 acre	20	51*	68	79	84
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and Roads:					
paved with curbs and storm sewers		98	98	98	98
gravel		76*	85	89	91
dirt		72*	82	87	89

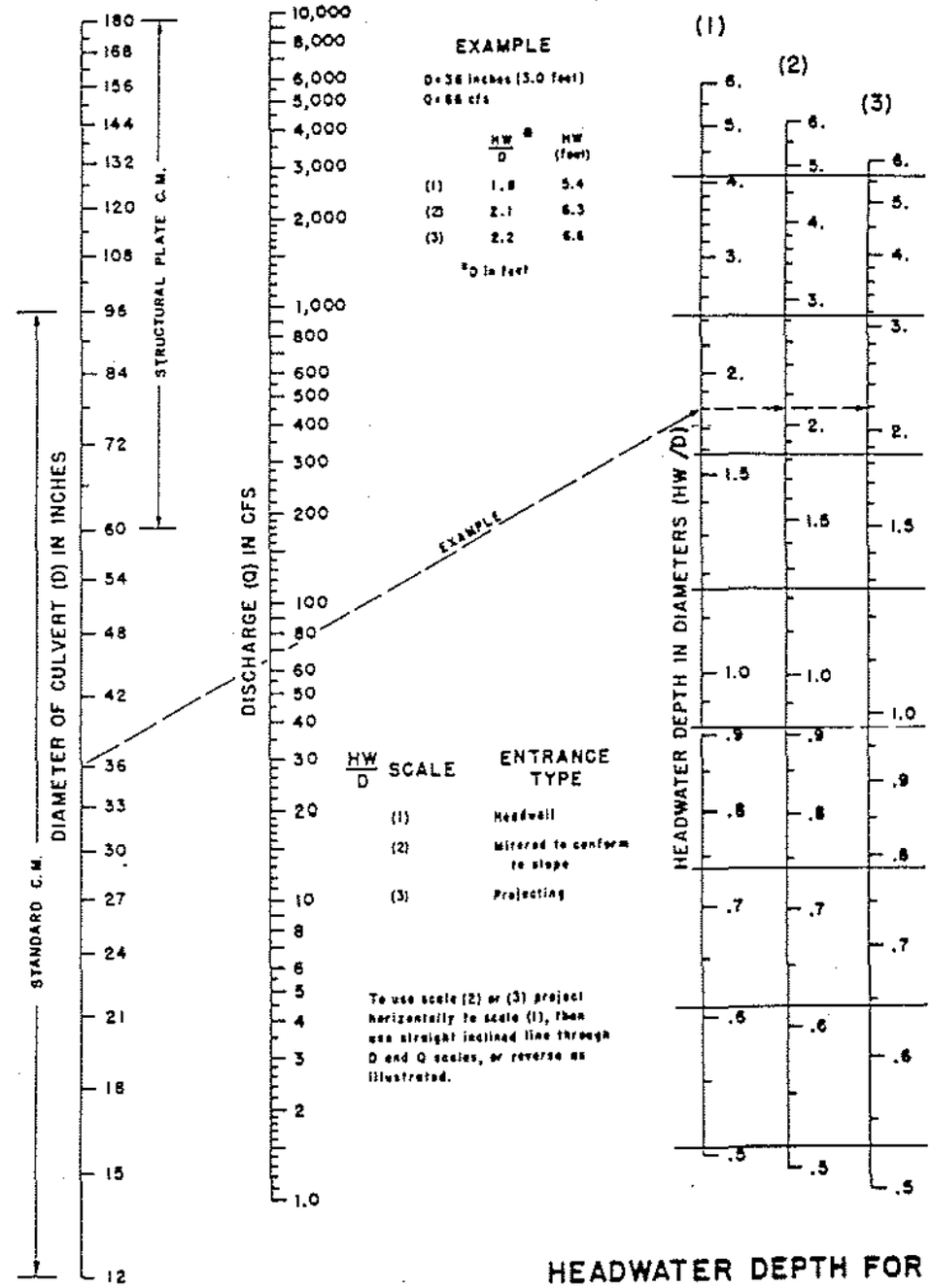
1/ For a more detailed description of agricultural land use curve numbers, refer to the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).
2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.
3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.

RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - RURAL CONDITIONS
(Antecedent Moisture Condition II, and Ia = 0.2 S)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

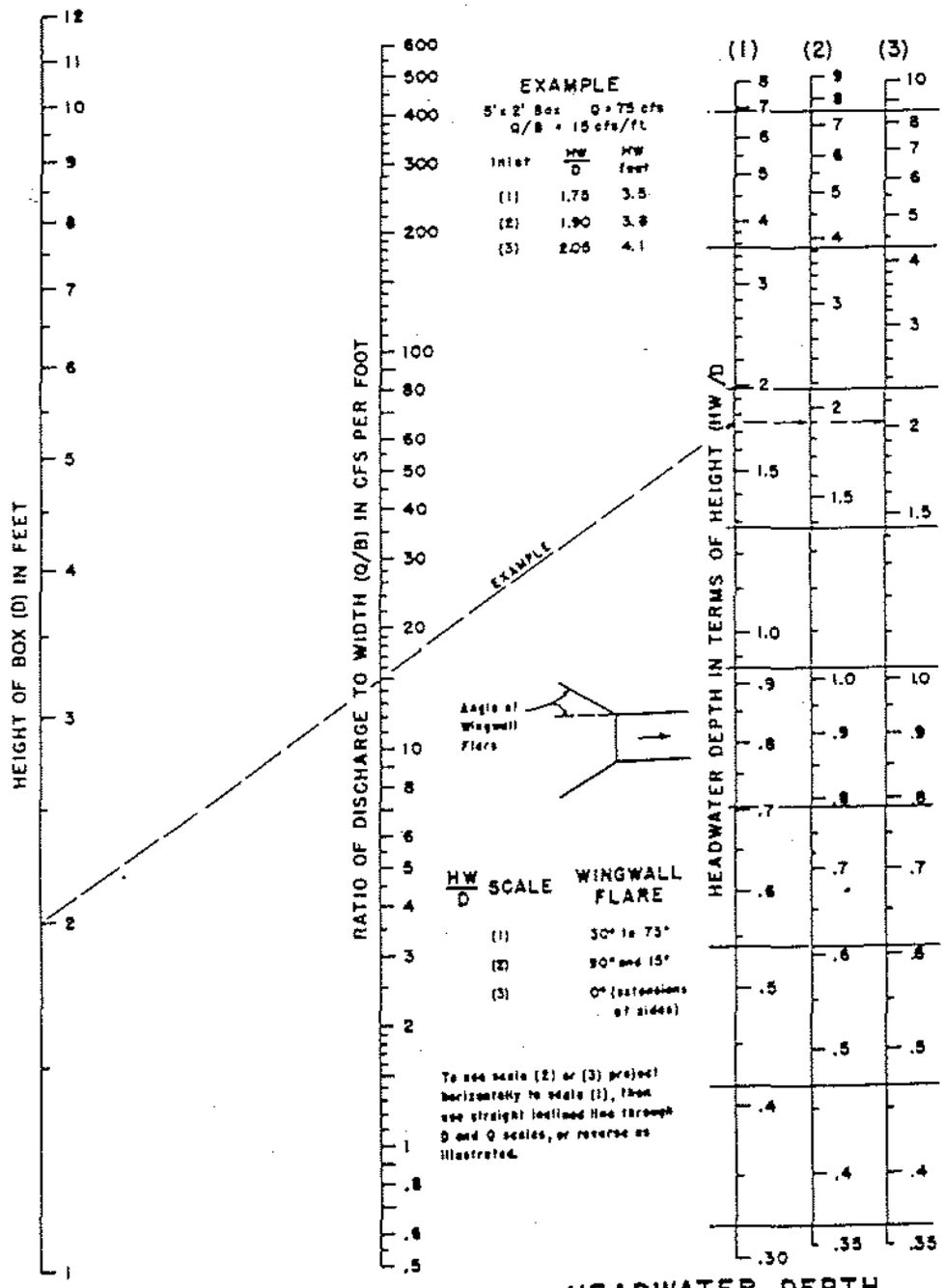
Land Use	Cover Treatment or Practice	Hydrologic Condition	Runoff Curve Number by Hydrologic Soil Group A	B	C	D
Fallow	Straight Row	----	77	86	91	94
Row Crops	Straight Row	Poor	72	81	88	91
	Straight Row	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	Contoured	Good	65	75	82	86
	Cont. & Terraced	Poor	66	74	80	82
	Cont. & Terraced	Good	62	71	78	81
Small Grain	Straight Row	Poor	65	76	84	88
	Straight Row	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
	Contoured	Good	61	73	81	84
	Cont. & Terraced	Poor	61	72	79	82
	Cont. & Terraced	Good	59	70	78	81
Close-seeded legumes 1/ or rotation meadow	Straight Row	Poor	66	77	85	89
	Straight Row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Cont. & Terraced	Poor	63	73	80	83
	Cont. & Terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads (dirt) 2/		----	72	82	87	89
(hard surface) 2/		----	74	84	90	92

1/ Close-drilled or broadcast
2/ Including right-of-way



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

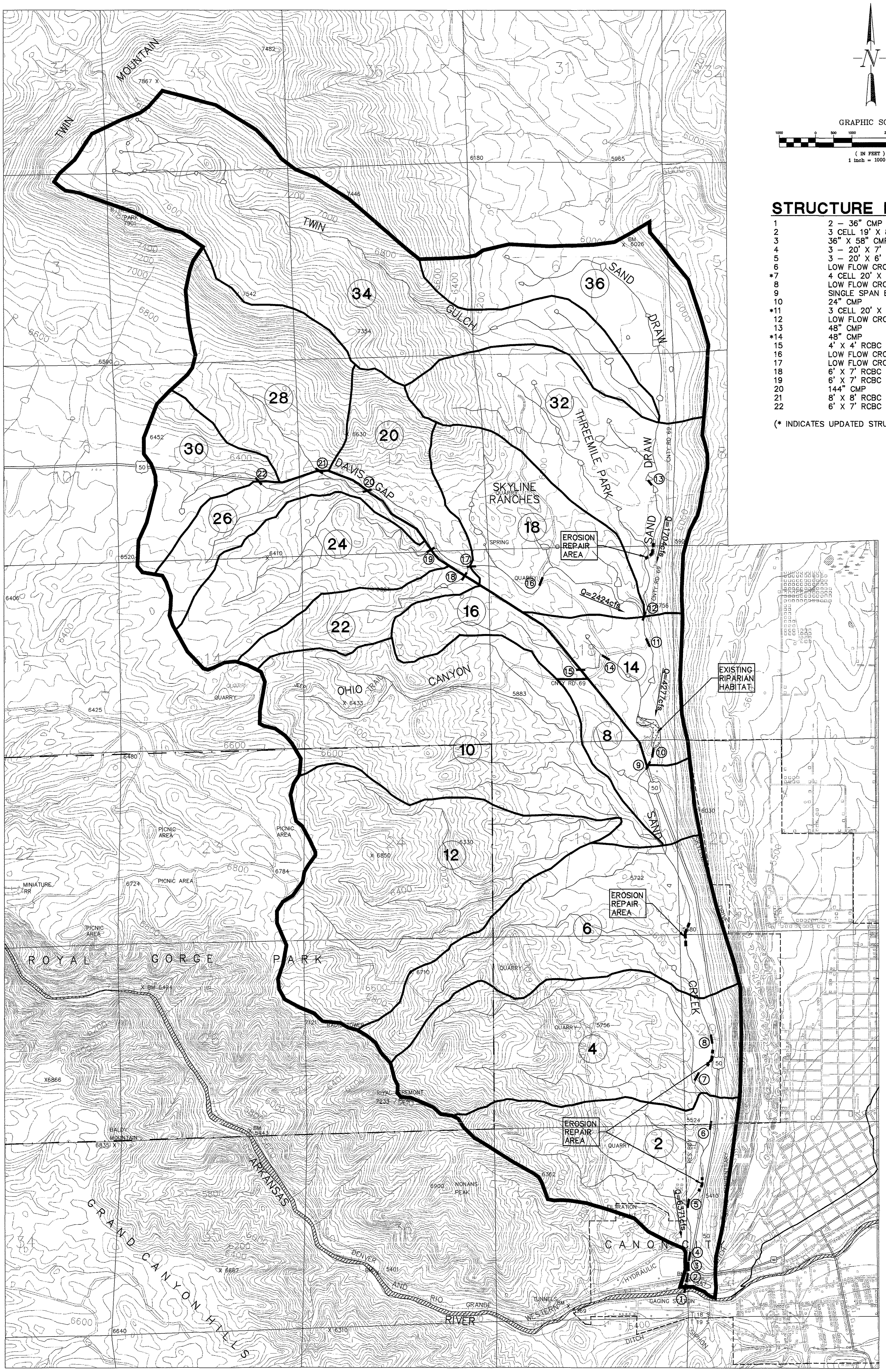
APPENDIX B
Alternate Conceptual Plans

ALTERNATE 1

ESTIMATED PROBABLE CONSTRUCTION COST

ALTERNATE 1

Arkansas River to Structure 7	200 LF Erosion Repair	30,000
	40 LF 4-cell 20' x 8' RCBC	540,000
Structure 7 to U.S. Highway 50	500 LF Erosion Repair	75,000
U.S. Highway 50 to County Road 69	60 LF 48" CMP	4,800
	40 LF 3-cell 20' x 8' RCBC	400,000
County Road 69 to End of Basin	150 LF Erosion Repair	22,500
	Sub-Total	1,072,300
	20% Contingencies	214,460
	TOTAL	**$1,286,760**



GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)
1 inch = 1000 ft.

STRUCTURE LEGEND

1	2 – 36" CMP
2	3 CELL 19' X 8' RCBC
3	36" X 58" CMP ARCH / 48" STEEL PIPE
4	3 – 20' X 7' RCBC
5	3 – 20' X 6' RCBC
6	LOW FLOW CROSSING
*7	4 CELL 20' X 8' RCBC
8	LOW FLOW CROSSING
9	SINGLE SPAN BRIDGE
10	24" CMP
*11	3 CELL 20' X 8' RCBC
12	LOW FLOW CROSSING
13	48" CMP
*14	48" CMP
15	4' X 4' RCBC
16	LOW FLOW CROSSING
17	LOW FLOW CROSSING
18	6' X 7' RCBC
19	6' X 7' RCBC
20	144" CMP
21	8' X 8' RCBC
22	6' X 7' RCBC

(* INDICATES UPDATED STRUCTURE)

SHEET 1 of 3

NORTH SAND CREEK

DRAINAGE BASIN PLANNING STUDY

CITY OF CANON CITY, COLORADO

ALTERNATE 1 - DEVELOPED FLOW WITHOUT DETENTION

NO.	DATE	REVISION	BY

PREPARED BY:

ADP Associated Design Professionals, Inc.

1861 Austin Bluffs Parkway
Suite 101
Colorado Springs, CO 80918
(719) 266-5212
fax: (719) 266-5341

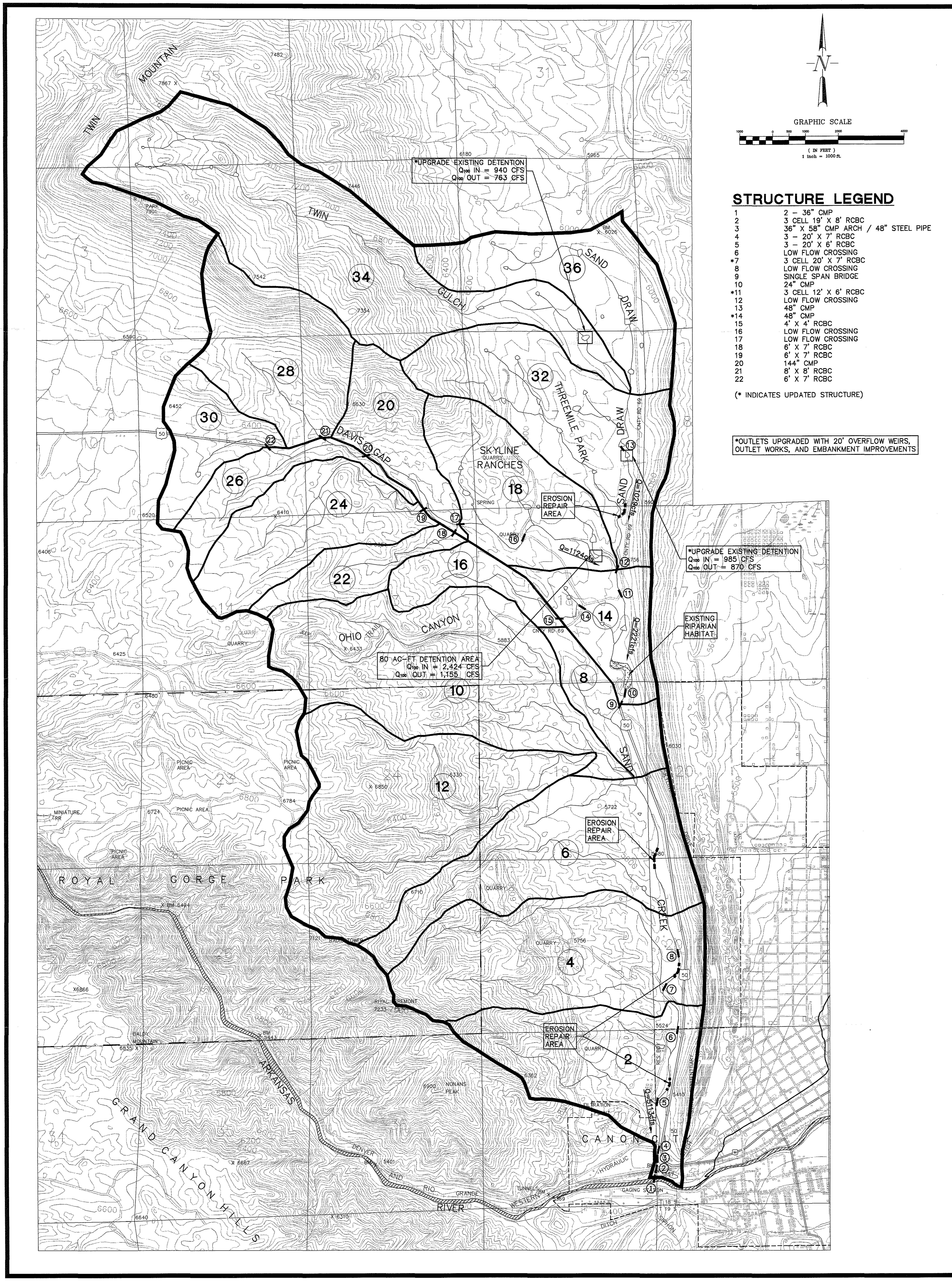
DATE: 6/24/99
JOB NO. 980907
CAD FILE NO. N_ALT_1.DWG
DRAWN BY JJW
DESIGNED BY JJW
PROJECT ENGINEER MAB
PROJECT MANAGER MAB
SCALE: HORZ. 1000' VERT. ______

ALTERNATE 2

ESTIMATED PROBABLE CONSTRUCTION COST

ALTERNATE 2

Arkansas River to Structure 7	200 LF Erosion Repair	30,000
	40 LF 3-cell 20' x 7' RCBC	540,000
Structure 7 to U.S. Highway 50	500 LF Erosion Repair	75,000
U.S. Highway 50 to County Road 69	60 LF 48" CMP	4,800
	40 LF 3-cell 12' x 6' RCBC	240,000
County Road 69 to End of Basin	Upgrade Existing Detention Area (2)	30,000
	80 Acre-Foot Detention Basin	450,000
	150 LF Erosion Repair	22,500
	Sub-Total	1,392,300
	20% Contingencies	278,460
	TOTAL	**$1,670,760**



NORTH SAND CREEK

DRAINAGE BASIN PLANNING STUDY

CITY OF CANON CITY, COLORADO

ALTERNATE 2

NO.	DATE	REVISION	BY

PREPARED BY: ADP Associated Design Professionals, Inc.

DATE: 6/24/98 — DESIGNED BY: JJW
JOB NO. 980907 — PROJECT ENGINEER: MAB
CAD FILE NO. N_ALT_2.DWG — PROJECT MANAGER: MAB
DRAWN BY: JJW — SCALE: HORZ. 1000'

SHEET 2 of 3

ALTERNATE 3

ESTIMATED PROBABLE CONSTRUCTION COST

ALTERNATE 3

Arkansas River to Structure 7	200 LF Erosion Repair	30,000
	40 LF 3-cell 16' x 7' RCBC	320,000
Structure 7 to U.S. Highway 50	500 LF Erosion Repair	75,000
	70 Acre-Foot Detention Basin	400,000
U.S. Highway 50 to County Road 69	60 LF 48" CMP	4,800
	40 LF 3-cell 12' x 6' RCBC	240,000
County Road 69 to End of Basin	Upgrade Existing Detention Area (2)	30,000
	80 Acre-Foot Detention Basin	450,000
	150 LF Erosion Repair	22,500
	Sub-Total	1,572,300
	20% Contingencies	314,460
	TOTAL	**$1,886,760**

GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)
1 inch = 1000 ft.

STRUCTURE LEGEND

1	2 – 36" CMP
2	3 CELL 19' X 8' RCBC
3	36" X 58" CMP ARCH / 48" STEEL PIPE
4	3 – 20' X 7' RCBC
5	3 – 20' X 6' RCBC
6	LOW FLOW CROSSING
*7	3 CELL 16' X 7' RCBC
8	LOW FLOW CROSSING
9	SINGLE SPAN BRIDGE
10	24" CMP
*11	3 CELL 12' X 6' RCBC
12	LOW FLOW CROSSING
13	48" CMP
*14	48" CMP
15	4' X 4' RCBC
16	LOW FLOW CROSSING
17	LOW FLOW CROSSING
18	6' X 7' RCBC
19	6' X 7' RCBC
20	144" CMP
21	8' X 8' RCBC
22	6' X 7' RCBC

(* INDICATES UPDATED STRUCTURE)

*OUTLETS UPGRADED WITH 20' OVERFLOW WEIRS, OUTLET WORKS, AND EMBANKMENT IMPROVEMENTS

SHEET 8 of 8

NORTH SAND CREEK
DRAINAGE BASIN PLANNING STUDY
CITY OF CANON CITY, COLORADO
ALTERNATE 3

NO.	DATE	REVISION	BY

1861 Austin Bluffs Parkway
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(719) 266-5212
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ADP
Associated Design Professionals, Inc.

PREPARED BY:

DATE: 6/24/98
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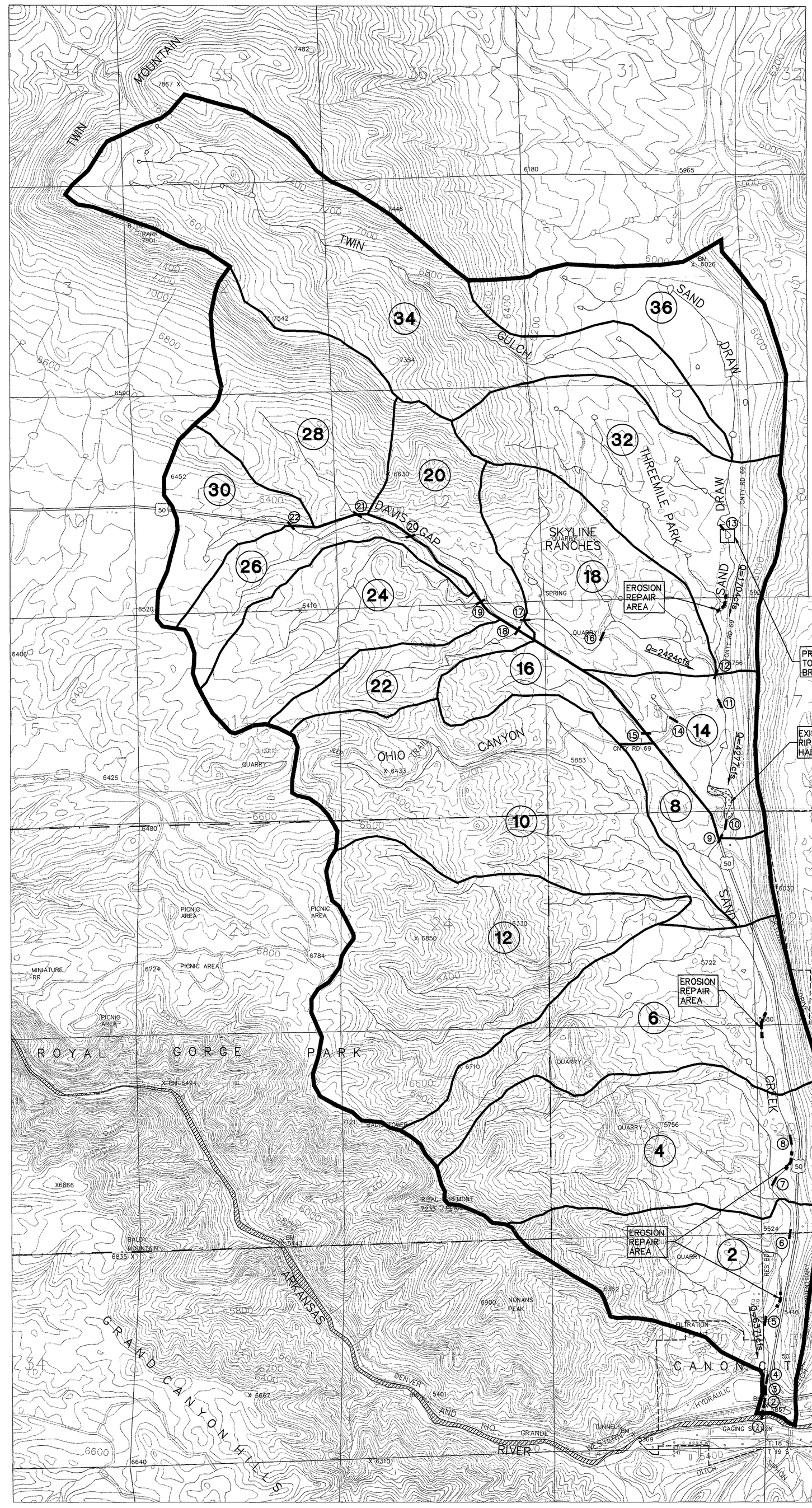
CAD FILE NO. N_ALT_3.DWG
DRAWN BY JJW
DESIGNED BY JJW
PROJECT ENGINEER MAB
PROJECT MANAGER MAB
SCALE: HORZ. 1000' VERT. ———

APPENDIX C
Selected Alternate
Preliminary Construction Costs

ESTIMATED PRELIMINARY CONSTRUCTION COST

SELECTED ALTERNATE

Arkansas River to Structure 7	200 LF Erosion Repair	30,000
	40 LF 4-cell 20' x 8' RCBC	540,000
Structure 7 to U.S. Highway 50	500 LF Erosion Repair	75,000
U.S. Highway 50 to County Road 69	60 LF 48" CMP	4,800
	40 LF 3-cell 20' x 8' RCBC	400,000
County Road 69 to End of Basin	150 LF Erosion Repair	22,500
	Sub-Total	1,072,300
	20% Contingencies	214,460
	TOTAL	**$1,286,760**



GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)
1 inch = 1000 ft.

STRUCTURE LEGEND

1	2 – 36" CMP
2	3 CELL 19' X 8' RCBC
3	36" X 58" CMP ARCH / 48" STEEL PIPE
4	3 – 20' X 7' RCBC
5	3 – 20' X 6' RCBC
6	LOW FLOW CROSSING
*7	4 CELL 20' X 8' RCBC
8	LOW FLOW CROSSING
9	SINGLE SPAN BRIDGE
10	24" CMP
*11	3 CELL 20' X 8' RCBC
12	LOW FLOW CROSSING
13	48" CMP
*14	48" CMP
15	4' X 4' RCBC
16	LOW FLOW CROSSING
17	LOW FLOW CROSSING
18	6' X 7' RCBC
19	6' X 7' RCBC
20	144" CMP
21	8' X 8' RCBC
22	6' X 7' RCBC

(* INDICATES UPDATED STRUCTURE)

SHEET 1 of 1

NORTH SAND CREEK
DRAINAGE BASIN PLANNING STUDY
CITY OF CANON CITY, COLORADO
IMPROVEMENT RECOMMENDATIONS

NO.	DATE	REVISION	BY

1861 Austin Bluffs Parkway
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ADP
Associated Design Professionals, Inc.

PREPARED BY:

DATE: 1/7/00
DESIGNED BY JJW
JOB NO. 980907
PROJECT ENGINEER MAB
CAD FILE NO. N_ALT_4.DWG
PROJECT MANAGER MAB
DRAWN BY JJW
SCALE: HORZ. 1000' VERT.