Approved
El Paso County
Planning Commission
This 17th day of Jan. 1989

Chairman

Elaine Rebex, Secretary

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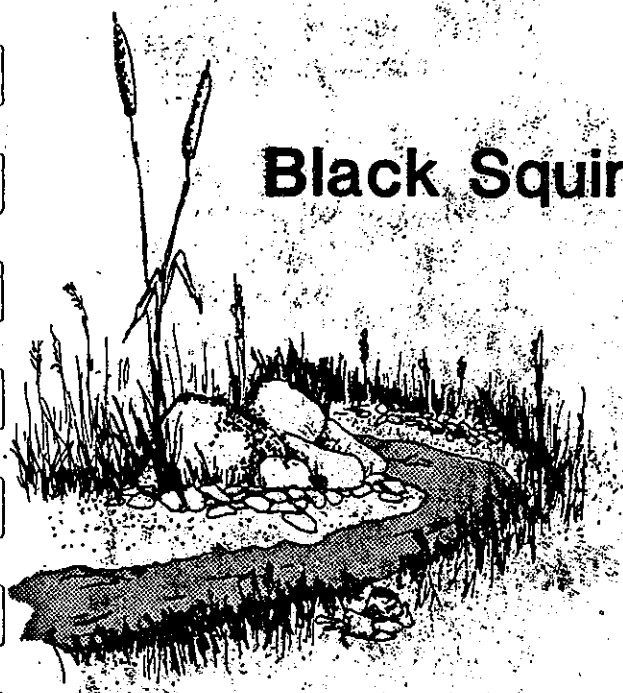

Black Squirrel Creek Drainage Basin Planning Study

City of Colorado Springs

and El Paso County

January, 1989

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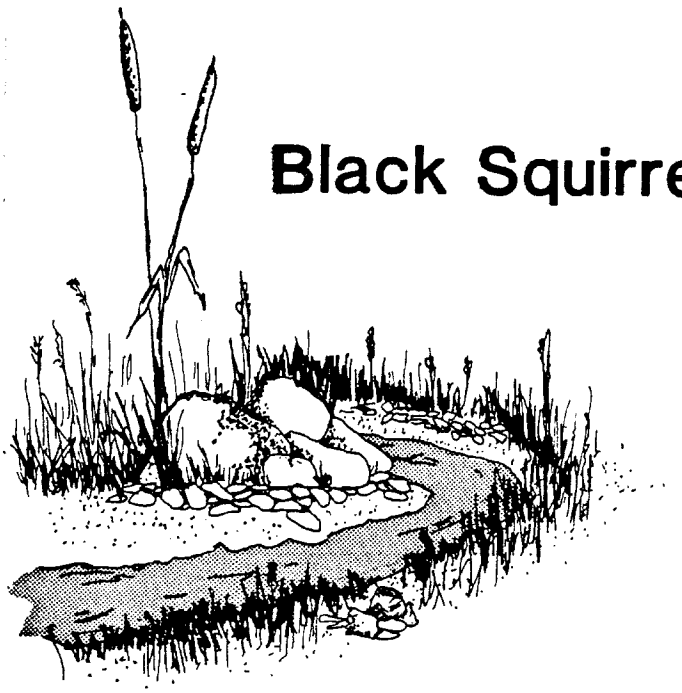


Black Squirrel Creek Drainage Basin Planning Study

City of Colorado Springs

and El Paso County

January, 1989

BLACK SQUIRREL CREEK DRAINAGE BASIN
PLANNING STUDY
(REVISION)
APRIL 1988
AUGUST 1988
NOVEMBER 1988

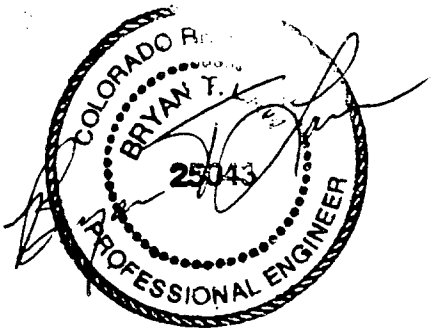
PREPARED BY: URS CORPORATION
5450 Tech Center Drive, Suite 327
Colorado Springs, Colorado 80919
(719) 590-7377

PREPARED FOR: THE OLIVE COMPANY
5450 Tech Center Drive, Suite 400
Colorado Springs, Colorado 80919
(719) 598-3000

URS PROJECT NO: 47380

CERTIFICATION

I, Bryan T. Law, a Registered Engineer in the State of Colorado, hereby certify that the attached Planning Study for the Black Squirrel Creek Drainage Basin was prepared under my direction and supervision and is correct to the best of my knowledge and belief.



Bryan T. Law, P.E.

APPROVAL

The El Paso County Planning Commission and Department of Public Works do hereby approve the contents of the attached Black Squirrel Creek Drainage Basin Planning Study as a guide for development of all drainage facilities within the study area.

Department of Public Works
(SEE ALSO ATTACHED MINUTES OF THE CITY/COUNTY DRAINAGE BOARD)

(SEE ATTACHED RESOLUTION)
Board of Commissioners
(SEE ALSO ATTACHED MINUTES OF THE EL PASO COUNTY PLANNING COMMISSION)

APPROVAL

The City of Colorado Springs City Council and Department of Public Works do hereby approve the contents of the attached Black Squirrel Creek Drainage Basin Planning Study. The Study shall be used as a guide for development of all drainage facilities within the study area.

Department of Public Works
(SEE ALSO ATTACHED MINUTES OF THE CITY/COUNTY DRAINAGE BOARD)

(SEE ATTACHED RESOLUTION)
City Council

Resolution No. 12-89

A RESOLUTION ADOPTING THE REVISED BLACK SQUIRREL CREEK DRAINAGE BASIN PLANNING STUDY AND ESTABLISHING THE REVISED DRAINAGE BASIN AND BRIDGE FEE FOR 1989.

WHEREAS, The City of Colorado Springs Department of Public Works has reviewed the revised hydrologic study of the Black Squirrel Creek Drainage Basin prepared by URS Corporation and dated November, 1988, and;

WHEREAS, the City/County Drainage Board has recommended approval of the above document;

NOW, THEREFORE BE IS RESOLVED BY THE CITY COUNCIL OF THE CITY OF COLORADO SPRINGS:

Section 1, that the Black Squirrel Creek Drainage Basin Planning Study prepared by URS Corporation and dated November, 1988 be adopted for use.

Section 2, that the Black Squirrel Creek Drainage Basin and Bridge Fee as recommended by the City/County Drainage Board at their December 15, 1988 meeting be established for the remainder of 1989 as follows:

The basin fee consisting of two components, namely, the drainage fee of $5660.00 per acre and a detention pond land fee of $144.00 per acre. Also, the bridge fee of $647.00 per acre.

Dated at Colorado Springs, Colorado this 24th day of January, 1989.

Mayor

ATTEST:

Acting City Clerk

Commissioner Morrison moved adoption of the following Resolution:

BEFORE THE BOARD OF COUNTY COMMISSIONERS
OF THE COUNTY OF EL PASO, STATE OF COLORADO

Resolution No. 89-93, Land Use-26

WHEREAS, section 30-28-133(11), C.R.S., as amended, authorizes counties to adopt subdivision regulations providing for the payment of a sum of money or proof of a line of credit or other fees in connection with a subdivision on a per-acre basis, to represent an equitable contribution to the total costs of the drainage facilities in the drainage basin in which the subdivision is located; and

WHEREAS, section 49.3(D) of the El Paso County Subdivision Regulations provides for the assessment of drainage basin fees and for the repayment to a subdivider, from any surplus basin funds available, of costs he incurs because of compliance with the plans for the development of drainage basins in excess of the sum of the drainage basin fees assessed against his acreage; and

WHEREAS, a plan for the development of drainage basins of mutual concern was adopted by the El Paso County Planning Commission as part of the County Master Plan on December 17, 1984; and revised August 19, 1985; and revised December 16, 1985; and revised September 10, 1986; and revised October 20, 1987; and revised January 19, 1988; and revised January 17, 1989; and

WHEREAS, the El Paso County Department of Public Works recommends that the County drainage fee resolution as adopted by the Board of County Commissioners, Resolution No. 89-31, Transportation-2, dated January 30, 1989, be amended; and

WHEREAS, The City of Colorado Springs ("City") and the Board of County Commissioners ("County") entered into an agreement, dated November 22, 1983, in which a joint city and county subdivision storm drainage board was established for those drainage basins of mutual concern; and

WHEREAS, the City and County have agreed to adopt subdivision regulations for drainage and control of flood and surface water as similar as practicably possible; and

WHEREAS, the County wishes to adopt, where practicable, the same drainage basin fee schedule as adopted by the City;

NOW, THEREFORE, BE IT RESOLVED by the Board of County Commissioners of El Paso County, Colorado:

1. Drainage basin fees shall consist of a drainage fee and where applicable, a bridge fee and, where applicable, a detention reservoir land fee. Drainage basin fees shall be paid prior to the time of the recording of the plat. The fees to be paid shall be those in effect at the time of the final plat approval and adjusted as needed to the time of facility construction bid opening.

2. The schedule attached hereto and incorporated by reference herein as Exhibit "A" is hereby adopted as the drainage basin fee on a per-acre basis for residential subdivisions having lot sizes of less than 1.0 acre and for all other non-residential subdivisions regardless of the size of lots.

3. Drainage basin fees for residential subdivisions having lot sizes of 1.0 acre or greater with one dwelling unit per lot shall be assessed only for the first acre of each lot.

4. The bridge fee, to be assessed only for arterial road, freeway, or expressway bridges, shall be determined on the following basis:

a. $$\text{Bridge Fee} = \frac{(\text{Improvement Cost} - \text{County Participation})}{(\text{County Undeveloped Basin Acreage})}$$

b. The minimum county participation, provided funds exist, for existing, inadequate bridge structures shall equal the following:

$$\left[\begin{matrix}\text{Improvement}\\ \text{Cost}\end{matrix}\right] \times \left[\frac{\text{Historic Flow} - \text{Existing Flow Capacity}}{\text{Ultimate Developed Flow}}\right]$$

c. An inadequate bridge structure shall be one in which its flow capacity is less than the historic flow.

5. The detention reservoir land fee shall be assessed only for drainage basins with public detention reservoirs as depicted on the applicable Drainage Basin Planning Study (plan for the development of the drainage basin) as being in the best interest of the drainage basin. The detention reservoir land fee shall be determined within each basin by dividing the number of acres within said drainage basin into the total land credit value. The total drainage land credit value shall be the City of Colorado Springs' Park Land Dedication Fee in effect at the time of the Drainage Basin Planning Study approval multiplied by the land required for public detention reservoirs as calculated within the drainage basin plannning study.

6. For vacations and replats, drainage fees assessed shall be dependent upon whether drainage fees have been previously paid.

a. If drainage basin fees have been previously paid, the fees assessed shall equal fees in effect at the time of vacation and replat minus the previous drainage fees paid; however, drainage basin fees shall not be assessed if the number of lots and the total acreage are unchanged, and a rezoning of the property in question has not occurred since the previous plat.

b. If drainage basin fees have not been previously paid, the drainage basin fees shall be the fees in effect at the time of vacation and replat assessed to a portion of the total acreage. Such fees shall be assessed if any of the following occur: There is an increase in the number of lots replatted, additional acreage is included in the replat, or a rezoning has occurred since the previous plat. For replats of subdivisions resulting in additional lots, but no additional total acreage, the assessed acreage shall equal the acreage of those additional lots comprising the largest of all the replatted lots. For those replats including previously unplatted acreage, such acreage shall be assessed the fees in effect at the time of vacation and replat.

7. Interest earned by the investment of surplus funds that may temporarily accumulate in the storm drainage fund shall be allocated to a drainage contingency fund which may be used to make up deficits in existing sub-funds for the purposes of reimbursement or for such other drainage purposes as determined by the Drainage Board with the prior approval of the Board of County Commissioners.

DONE THIS 27th day of March, 1989, at Colorado Springs Colorado.

ATTEST:

Deputy County Clerk

BOARD OF COUNTY COMMISSIONERS
OF EL PASO COUNTY, COLORADO

By:
Chairman

Commissioner Campbell seconded the adoption of the foregoing Resolution. The roll having been called, all five Commissioners voted "aye," and the Resolution was unanimously adopted by the Board of County Commissioners of the County of El Paso, State of Colorado.

EXHIBIT A

EL PASO COUNTY DRAINAGE BASIN FEES

BASIN NUMBER	BASIN NAME	1989 DRAINAGE FEE (per acre)	1989 BRIDGE FEE (per acre)	1989 LAND FEE (per acre)
FOFO2800	Widefield	$5,640.	-	-
FOFO2900	Security	$5,412.	-	-
FOFO3000	Windmill Gulch	$4,940.	$ 64.	-
FOFO3200	Little Johnson	$5,388.	-	$224.
FOFO3400	Peterson Field	$4,184.	$242.	-
FOFO4000	Sand Creek	$5,554.	$632.	-
FOFO4200	Spring Creek	$4,280.	-	-
FOFO4600	Southwest Area	$5,403.	-	-
FOFO4800	Bear Creek	$1,597.	$149.	-
FOFO5400	21st Street	$2,482.	-	-
FOFO5600	19th Street*	$1,625.	-	-
FOFO5800	Camp Creek	$ 916.	-	-
FOMO0400	Mesa*	$4,316.	-	-
FOMO1000	Douglas Creek	$4,981.	$114.	-
FOMO1200	Templeton Gap	$2,822.	$ 31.	-
FOMO1400	Popes Bluff*	$1,652.	$282.	-
FOMO1600	South Rockrimmon*	$1,940.	-	-
FOMO1800	North Rockrimmon*	$2,482.	-	-
FOMO2000	Pulpit Rock*	$2,735.	-	-
FOMO2200	Cottonwood Creek	$3,633.	$220.	-
FOMO2400	Dry Creek	$2,352.	-	-
FOMO3600	Black Squirrel Creek	$5,660.	$647.	$144.
FOMO3700	Middle Tributary	$2,821.	-	$205.
FOMO3800	Monument Branch	$3,812.	-	$162.
	Miscellaneous: **			
FOFO2000	a. Jimmy Camp Creek	$3,520	-	-
FOFO2200	b. Fort Carson		-	-
FOFO2600	c. Big Johnson		-	-
FOFO2700	d. West Little Johnson		-	-
FOFO3100	e. Carson Street		-	-
FOFO3600	f. Fishers Canyon		-	-
FOFO3800	g. Stratton		-	-
FOFO4400	h. Shook's Run*		-	-
FOFO5000	i. Midland		-	-
FOFO6000	j. Palmer Trail		-	-
FOFO6600	k. Balanced Rock*		-	-
FOFO6800	l. Black Canyon		-	-
FOMO0200	m. Monument Valley		-	-
FOMO0600	n. Papeton*		-	-
FOMO0800	o. Roswell*		-	-
FOMO3000	p. Kettle Creek		-	-
FOMO3400	q. Elkhorn		-	-
FOMO4000	r. Smith Creek		-	-

* Basin in which El Paso County has no jurisdiction since the basin is entirely within City incorporated limits.

** The miscellaneous drainage fee is the average of all other drainage fees.

BLACK SQUIRREL CREEK DRAINAGE BASIN PLANNING STUDY

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I. PURPOSE AND SCOPE

The purpose of this planning study is to revise the Black Squirrel Creek Drainage Basin Master Plan as approved by the City of Colorado Springs, dated November 1985 (Revised). This revision incorporates the new City/County drainage criteria as established in November 1987. As a result of the new criteria, the recommended facilities for ultimate conditions have been revised. However, present conditions have remained relatively the same and therefore show little change since the last study.

This study is to define the general nature and approximate location of drainage improvements required to meet present (1988) El Paso County and City of Colorado Springs drainage design criteria. This study reiterates the present conditions as described in the previous study. The recommended overall basin plan is considered to be the alternative most compatible with projected land uses, environmental concerns and economic considerations.

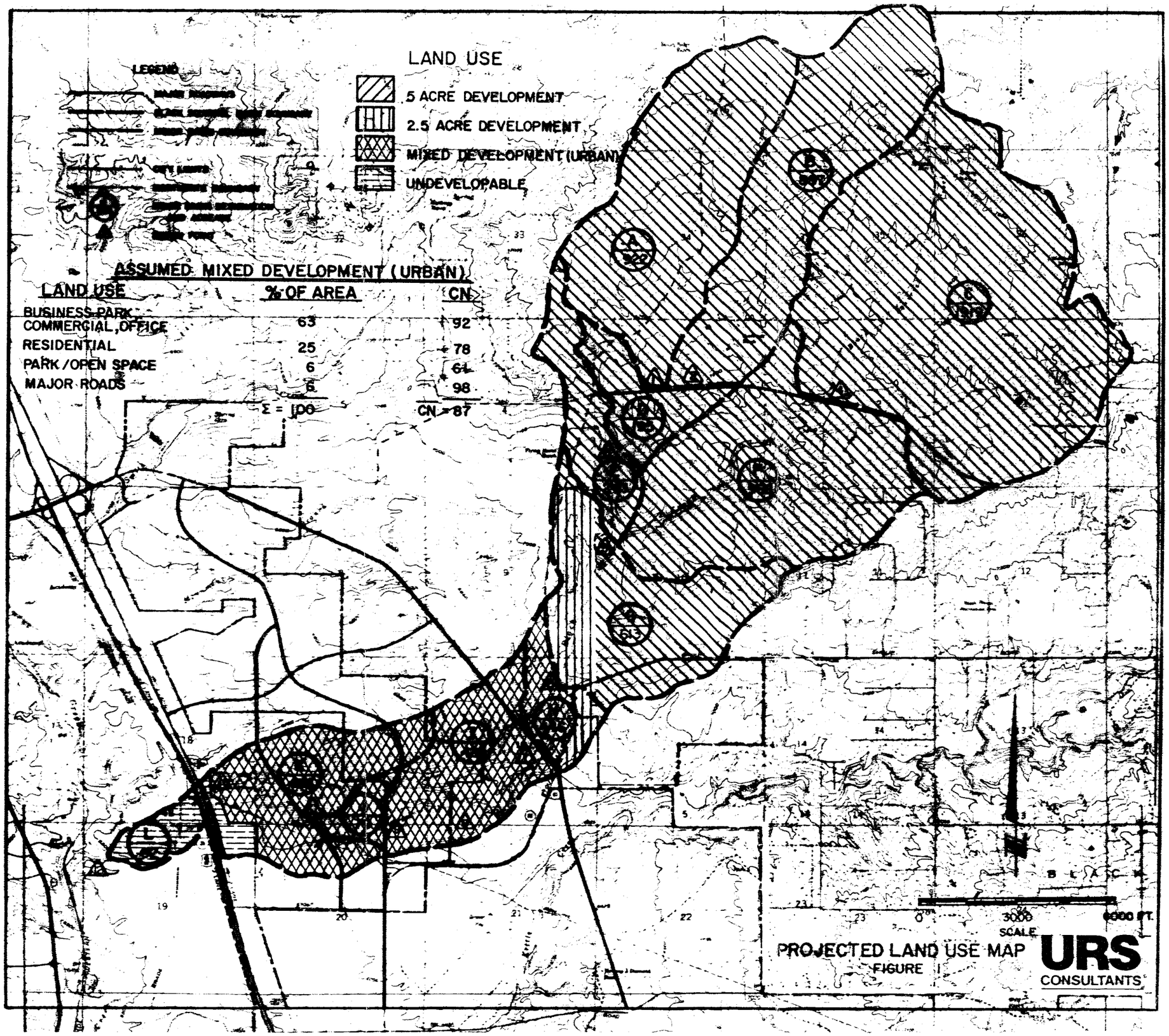
II. BASIN DESCRIPTION

The Project Study Area encompasses the entire Black Squirrel Creek Drainage Basin upstream of the outfall to Monument Creek as shown on Figure 1. The basin generally slopes from east to west and outfalls into Monument Creek on the Air Force Academy property west of Interstate 25.

The total basin area consists of 10.9 square miles and lies in unincorporated El Paso County (10.3 square miles) and the City of Colorado Springs (0.6 square miles). Major roads planned within the basin were obtained from the El Paso County Major Transportation Corridors Plan, the City of Colorado Springs Transportation Plan, the Powers Boulevard Corridor Plans, Meetings with the El Paso County Department of Public Works and the Northgate Land Use Plan. Presently, the only major roads within the basin are Interstate 25, State Highway 83 and Voyager Parkway. Approximately 60% of the basin is covered by Ponderosa Pine trees and related growth, with the remaining 40% covered by pasture or rangeland. The forested area is a portion of the Colorado Black Forest which extends north and east of the Black Squirrel Creek Drainage Basin.

Historically, the area was sparsely populated with ranches, farms, and lumbering being the primary uses. Presently, less than 5% of the drainage basin area has been platted in approximately 5 acre sites. Fully developed conditions for the basin were estimated through meetings with the County Land Use Department, the County Parks Department, the County Public Works

Department, the City Public Works Department, the City Planning Department, along with the aid of the Black Forest Preservation Study, the Urban Planning Area Map, and the Northgate Master Plan. The area between Interstate 25 and State Highway 83 (Downstream of D.P. #6)was assumed to be developed as if it was an urban type development. A buffer area was also assumed along State Highway 83 consisting of 2.5 acre development. This buffer area was assumed to be included within the urban development. The remaining area was assumed to be developed in a rural type development with an average lot size of 5 acres per current zoning and presently platted subdivisions within the basin. This was assumed to be appropriate due to the limiting density where City services are anticipated to be available and the desirability of maintaining the forest area in a more rural type setting. The Air Force Academy land was assumed to remain undeveloped and was not included in the drainage and bridge fee calculations. Future changes in land use beyond this concept would require a revision to this study. Land use assumptions for the basin are depicted on Figure 1.


LAND USE
.5 ACRE DEVELOPMENT
2.5 ACRE DEVELOPMENT
MIXED DEVELOPMENT (URBAN)
UNDEVELOPABLE
ASSUMED MIXED DEVELOPMENT (URBAN)
LAND USE | % OF AREA | CN
BUSINESS PARK
COMMERCIAL, OFFICE | 63 | 92
RESIDENTIAL | 25 | 78
PARK / OPEN SPACE | 6 | 61
MAJOR ROADS | 6 | 98
Σ = 100 | CN = 87
B L A C K
0 3000 6000 FT.
SCALE
PROJECTED LAND USE MAP
FIGURE
URS
CONSULTANTS

III. BASIN GEOLOGY AND SOILS

The basin soils can be classified into two general categories of soils per the "Soil Survey of El Paso County Area, Colorado" by the Soil Conservation Service. The western 1/4 (by length along the main channel) of the basin is classified in the Truckton-Blakeland-Bresser Group and the remainder of the basin is classified in the Kettle-Pring-Peyton group. Both groups have evolved from material weathered from arkosic sedimentary rock. Arkosic sedimentary rock is considered a sandstone with granitic source for sand. The sand-sized feldspar particles are much stronger than the cementing material in the sandstone and remain as discrete particles after loss of cementation in the rock. This results in a granular soil which is easily erodible by surface water runoff.

Basin soil and land use characteristics directly affect the relationship between rainfall and runoff within a basin. The U. S. Soil Conservation Service classifies soils into four hydrologic groups (A, B, C and D) according to a soil's runoff potential. Group A soils exhibit high infiltration rates when thoroughly wetted and are considered to have low runoff potential. Group B soils exhibit moderate infiltration rates when thoroughly wetted. Group C soils exhibit slow infiltration rates when thoroughly wetted. Group D soils exhibit very slow infiltration rates when thoroughly wetted and are considered to have high runoff potential.

Soil types within the Black Squirrel Creek Basin are listed in Table 1 and delineated in Figure 2. Approximately 99% of the basin is hydrologic soil Group B soils with the remaining 1% split between groups A and C.

The soil types within the basin also influence the potential siting locations for reservoirs. Almost all of the soils within the basin are well drained and erode easily. Water storage reservoirs constructed in Black Squirrel Creek Basin soils may experience seepage. Final design of detention ponds and embankments should consider these problems and require detailed soils investigations. In addition, soils types 1, 21, 26, 67, 68, 69 and 93 have potential problems with low strength and may require importation of suitable fill material and/or excavation below the natural ground surface. Almost all of the soils are expected to have moderate potential for frost action.

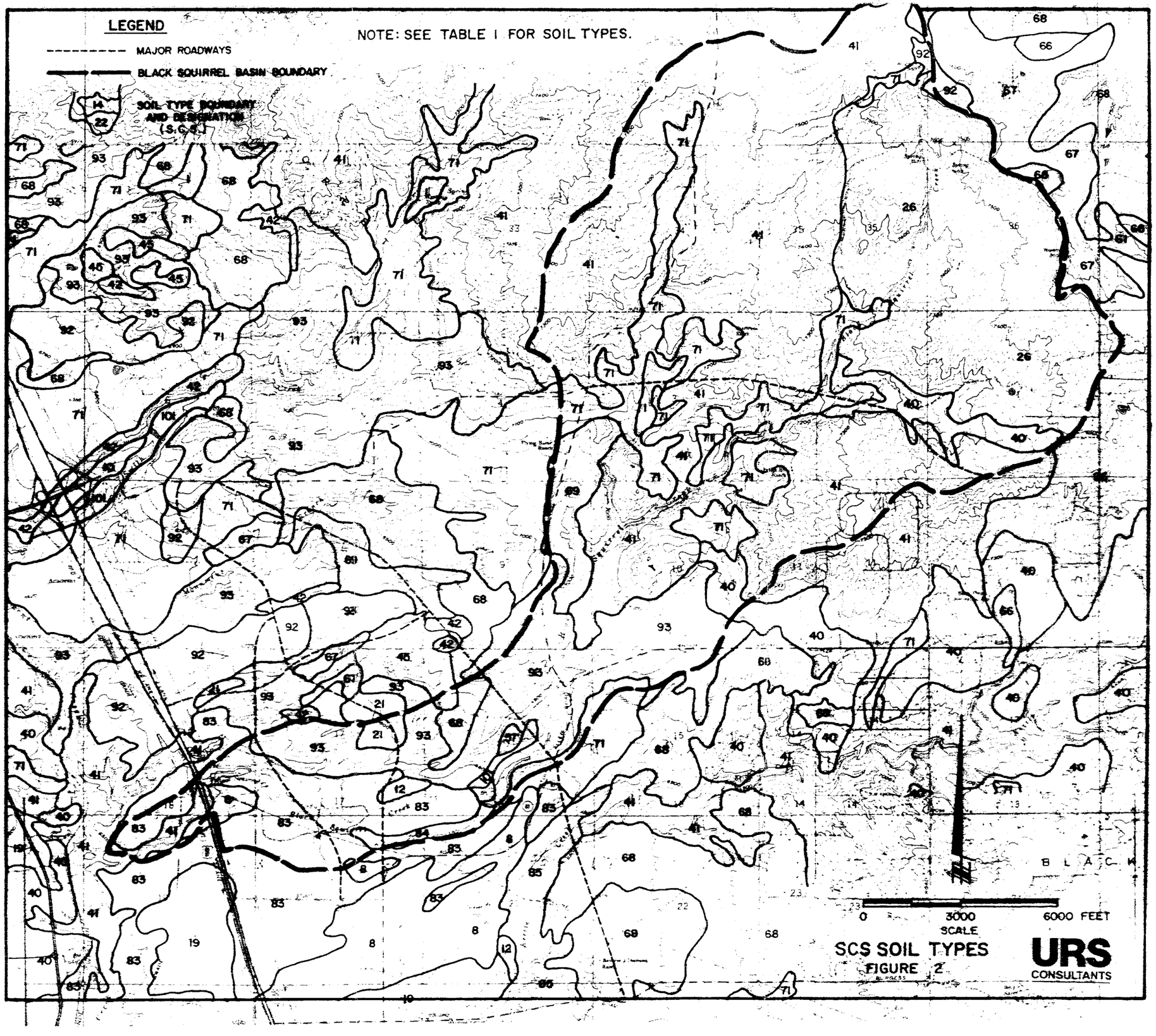

LEGEND
MAJOR ROADWAYS
BLACK SQUIRREL BASIN BOUNDARY
SOIL TYPE BOUNDARY AND DESIGNATION (S.C.S.)
NOTE: SEE TABLE I FOR SOIL TYPES.
0
3000
6000 FEET
SCALE
SCS SOIL TYPES
FIGURE 2
URS
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TABLE 1

SOIL TYPES

BLACK SQUIRREL CREEK BASIN

Soil Identification Number	Soil Name	Slope %	Hydrologic Soil Group
1	Alamosa Loam	1-3	C
8	Blakeland Loamy Sand	1-9	A
10	Blendon Sandy Loam	0-3	B
12	Bresser Sandy Loam	3-5	B
21	Cruckton Sandy Loam	1-9	B
26	Elbeth Sandy Loam	8-15	B
40	Kettle Gravelly Loamy Sand	3-8	B
41	Kettle Gravelly Loamy Sand	8-40	B
67	Peyton Sandy Loam	5-9	B
68	Peyton-Pring Complex	3-8	B
69	Peyton-Pring Complex	8-15	B
71	Pring Coarse Sandy Loam	3-8	B
83	Stapleton Sandy Loam	3-8	B
84	Stapleton Sandy Loam	8-15	B
93	Tomah-Crowfoot Loamy Sands	8-15	B
101	Ustic Torrifluvents, Loamy	----	B

Source: Soil Survey of El Paso County Area Colorado
U.S. Soil Conservation Service
June 1981

IV. EXISTING DRAINAGE FACILITIES

Existing drainage facilities and historic flows are shown on Figure 3 (attached). Currently, major drainage facilities are constructed at the following locations:

1) Double horseshoe-shaped culverts at old railroad grade (AT&SF)
2) Concrete bridge at Interstate 25
3) Reinforced box culvert at Voyager Parkway
4) Corrugated metal culverts at State Highway 83 (3 locations)

The structures at the old railroad grade, Interstate 25 and Voyager Parkway are adequate for the historic flow at these points. The structures on State Highway 83 are inadequately sized to handle the 100-year design storm and will have to be upgraded to pass the 100-year design flow. In addition, there are numerous small "stockpond" type reservoirs on the main channel of Black Squirrel Creek. After checking with the Colorado State Engineer's Office, it was found that one reservoir in the basin has construction plans on file. This is the Robinson Dam located in the SW 1/4 of Section 2, Township 12 South, Range 66 West, of the Sixth Principal Meridian. This facility was assumed to have a purpose other than storm management and therefore is not a part of the recommended plan. Field reconnaissance of several other "stockpond" type reservoirs showed that there was no embankment protection or emergency spillway. All "stockpond" type reservoirs were therefore assumed to be inadequate. All unregistered "stockpond" type reservoirs should be removed as part of this basin planning study recommendations.

The remainder of the existing drainage structures in the basin consist almost solely of small to medium sized culverts beneath roads and streets. These structures have been built in conjunction with the platted area (5 acre lots or larger off the main channels) within the basin and have been reviewed by the El Paso County staff during platting. The main channels for Black Squirrel Creek consist almost entirely of natural channels.

Wetlands do exist in the basin based on random field observations. The extent of these wetlands is unknown, however, its limits are probably inclined to fall within the 100 year floodplain, as designated of figure 4 along reaches 20, 22-24, 26 and 27. Corps of Engineer 404 permit requirements are to be addressed at the Master Development Drainage Plan, Preliminary and final Drainage Report levels.

The geomorphology of the Monument Creek basin in this area has been studied in conjunction with the construction of the U. S. Air Force Academy site. Geological Survey Professional Paper 551 has the following to say about the origin of the Monument Creek Basin:

> "The modern drainage pattern appears to have been formed by capture. During Tertiary time, streams probably flowed eastward from the mountains across the area called the Black Forest (fig. 1), but were captured in early Pleistocene time by small streams having steeper gradients, such as Monument Creek, that were cutting headward from the Arkansas River. As Monument Creek was cutting headward across the area, small streams from the east and west were cutting surfaces on bedrock at a gradient to meet the newly formed Monument Creek.
>
> These surfaces, called pediments, are the result of a stable base level that prevailed for a long time along the major streams. The stable base level allowed the small streams to meander laterally and widen their valleys. Lowering of base level, probably as a result of climatic change, resulted in downcutting. At least six cycles of this change of stream regimen from

lateral to downcutting are recorded in the dissected pediments and terraces of the Academy site. Because the gradients of the streams from the west were steeper than those of the streams flowing from the east, the stages of pedimentation west of Monument Creek never were completed, and ridges were stranded as most of the energy of the streams was concentrated on downcutting. Streams on the east side apparently completed at least the last stage of pedimentation and possible also the earlier stages. No ridges or remnants of the older pediments can be found for 3-4 miles east of Monument Creek along Kettle Creek and Black Squirrel Creek. The amount of coarse alluvium added to Monument Creek from the mountains on the west far exceeded the amount of fine alluvium from the Black Forest on the east; therefore, Monument Creek was forced to migrate eastward during the successive stages of downcutting. It now impinges on bedrock at many places along its eastern valley wall, but rarely exposes bedrock along its western valley wall.

The difference in grain size between alluvium composed of granite boulders west of Monument Creek and alluvium composed of sand from the Dawson Arkose east of Monument Creek makes a difference in the shape of the pediments west and east of the creek. Small buried ridges on the west side were protected from erosion by a mantle of boulders or by trains of boulders in ancient stream valleys. Longitudinal irregularities on the pediments thus resulted from the inability of the small intermittent streams to move the boulders. On the east side of Monument Creek the streams were not restricted by such obstructions; they flowed freely, cutting a smooth gently sloping pediment whose extent was controlled solely by the amount of time available."

Historic conditions for Black Squirrel Creek Drainage Basin were taken as present (1988) conditions. Figure 3 (attached) delineates the historic drainage basins and the 100-year flood plain as delineated by FEMA. Attached is the TR-20 run for historic conditions and the water surface profiles for the same. It should be noted that the hydrology and water surface profiles did not take into account any "stockpond" type reservoirs in the basin including the Robinson Dam.

The following discussion of existing channels refers to the design points on Figure 3 and the cross sections used in the historic TR-20 run, attached. Cross sections were obtained through field reconnaissance and USGS Quadrangle

Maps. Soils information was obtained from the Soil Survey of El Paso County, Colorado. The 100-year 24-hour storm flows were found to be greater than the 100-year 2-hour storm and are therefore used as the design flow throughout this report.

Design point 10 is located at the confluence of Black Squirrel Creek and Monument Creek. The channel for Black Squirrel Creek broadens out as it reaches the area of the confluence. The 100-year 24-hour historic flow at this point is 3950 cfs and the 10-year 24-hour flow is 1098 cfs.

The reach from design point 10 to design point 9 is a deep, fairly narrow channel with a bare sandy bottom and well vegetated side slopes. This reach falls within the United States Air Force Academy. The predominant soil type in this area is Kettle gravelly loamy sand which is considered erodible soil. The overbank velocities are expected to be 4-8 feet per second (fps) for the 100-year storm and 2-3 fps for the 10-year storm. The erosion for the more frequent storm events should occur along the channel bottom due to the lack of vegetation and higher velocities in the low flow channel. Also, some sloughing of the banks may occur due to undercutting. Larger, less frequent storm events will also cause some bank erosion due to scour.

Design point 9 is located at the bridge for Interstate 25. The bridge constricts the major flows and lets the lesser flows pass unimpeded. Although the 100-year storm causes a backwater effect, the bridge still passes the flow with ample freeboard. No adverse impacts were noticeable during field

reconnaissance of this area. The backwater effect should aid in providing an adequate tailwater depth for the future drop structure upstream of Interstate 25 as proposed near the City/USAFA boundary.

The 100-year 24-hour historic flow at this point is 3956 cfs and the 10-year 24-hour flow is 1104 cfs.

The reach from design point 9 to design point 8 is a series of man-made "stockponds" and channel diversions. Although the remaining sections of natural channels appear to be much the same as the previous reach, the man-made features are a problem. The ponds do not have adequate slope protection or emergency spillway capacity to prevent failure during a large storm event. They should be removed as soon as possible.

Design point 8 is located at the west boundary of the Northgate property. Also, a newly constructed (14' X 14') X 10' CBC with a special inlet is located here. Though this culvert was sized based on data generated from the original report, its capacity is still adequate under the plan recommendations of this report. The channel for Black Squirrel Creek becomes a broad, shallow channel upstream of this point. The 100-year 24-hour flow at this point is 4051 cfs and the 10-year 24-hour flow is 1129 cfs.

The reach from design point 8 halfway to design point 7 is a shallow, broad channel with a bare sandy bottom and well vegetated side slopes. The predominate soil type in this area is Stapleton sandy loam which is considered erodible soil. The overbank velocities are expected to be 3 fps and 1 fps for

the 100-year and 10-year storms, respectively. The erosion for the channel should predominate in the sandy bottom area with very little bank erosion expected.

The reach from midway between design points 7 and 8 to design point 7 is a narrow, deep channel with a bare sandy bottom. Generally, one side of the low flow channel consists of a sandy overbank with mild to moderate side slope vegetation. The other side of the low flow channel has a very steep to almost vertical side slope. This points out the possible presence of cohesive soils or sandstone outcroppings. The predominate soil type in this area is Tomah-Crowfoot loamy sands which is considered erodible soil. The overbank velocities are expected to be 7 fps and 5 fps for the 100-year and 10-year storms, respectively. The erosion potential is high for this soil and velocities, however, channel widening would probably take a long time due to the excessive depth (approximately 40 feet) of the channel and the large volume of soil to be transported downstream. Erosion would tend to predominate in the weaker soils present. Just downstream of the culvert under State Highway 83 is an area that is currently eroding due to the excessive velocities out of the culvert. The outlet toewall has been undercut and there is a 6-8 foot drop from the culvert to the channel bottom. Also, some gullying has formed from the concentrated runoff from the highway. The gullying does not require immediate repair due to its distance from any existing structures on State Highway 83. The Colorado CDOH will need to do repair when it approaches State Highway 83 as part of their regular maintenance.

Design point 7 is located at the entrance to the culvert under State Highway 83. The 100-year 24-hour flow at this point is 4389 cfs and the 10-year 24-hour flow is 1154 cfs. This culvert was found to be inadequate for this historic flow and will have to be replaced.

The reach from design point 7 to design point 6 is a deep, fairly narrow channel with some vegetation on the bottom and well vegetated side slopes. The predominant soil types in this reach are Tomah-Crowfoot loamy sands and Kettle gravelly loamy sand which are considered erodible soil. Just upstream of the culvert under State Highway 83 is an area that is undergoing deposition due to the backwater effect caused by the undersized culvert. The remainder of the reach upstream of the backwater has expected overbank velocities of 12-13 fps for the 100-year storm and 5-8 fps for the 10-year storm. The majority of the flows expected for this reach will cause erosion of the channel and banks. Due to the erosion upstream and deposition downstream in this reach, the channel will probably evolve into a broader channel with a flatter overall slope. This reach is the most unstable reach within the basin with the possible exception of the reach between design points 9 and 8 that has the "stockponds".

Design point 6 is located at the confluence of the two major sub-basins for Black Squirrel Creek. The combined flows at this point ar 4158 cfs for the 100-year 24-hour storm and 1118 cfs for the 10-year 24-hour storm.

The reach from design point 6 to design point 5 was considered the main channel for Black Squirrel Creek by FEMA as designated on their 100-year floodplain map. The flow in this reach is 2188 cfs for the 100-year 24-hour storm and 651

cfs for the 10-year 24-hour storm immediately upstream of design point 6. The channel in this reach is a fairly well defined, well vegetated section with a sandy low flow channel. The predominant soil type in this area is Kettle gravelly loamy sand which is considered erodible soil. The overbank velocities are expected to be 7-9 fps for the 100-year storm and the 10-year flow should be contained within the low flow channel. The erosion for the more frequent storm events should be confined to the low flow area. Larger, less frequent storm events will probably cause some bank erosion but it should be minimal due to the retardence and added resistance to erosion caused by the dense ground cover in the overbank area. This reach is wholly contained in the Black Forest.

Design point 5 is located just downstream of the Robinson Dam. Since this pond is registered with the State Engineer and retains water (has a water right), it is assumed to remain in place for developed conditions. However, if the Owner desires to utilize this pond as a flood control structure, then he must evaluate the pond and determine if it can be used in this capacity under current City/County drainage criteria. At this time, it is assumed the pond shall be operated and maintained by the owner since it is privately owned. The 100-year 24-hour flow at this point is 1832 cfs and the 10-year 24-hour flow is 496 cfs.

The reach upstream of design point 5 has a fairly broad, relatively shallow channel with well vegetated bottom and sides. The predominant soil types in this area are Pring coarse sandy loam and Elbeth sandy loam which are

considered erodible soils. The overbank velocities are expected to be 4-8 fps for the 100-year storm and the 10-year flow should be contained in the low flow channel. The erosion for the more frequent storm events should cause a widening and deepening of the low flow channel. The steeper slopes in the upper part of this basin may cause additional sub-channels and gullying. Large storm events should cause additional widening and deepening of the channel in this reach. The erosion in this area will probably by limited by the denser vegetation and lower flows compared to the rest of the basin. This reach extends to the upper basin boundary of Black Squirrel Creek. As the reach approaches the upper basin boundary it becomes stable due to the reduction in the area and peak flow near the upper basin boundary.

The north tributary of Black Squirrel Creek from design point 6 to design point 4 has a 100-year 24-hour flow of 1974 cfs and a 10-year 24-hour flow of 467 cfs immediately upstream of design point 6. This reach has a fairly deep, well defined, well vegetated channel section with a sandy low flow channel. The predominant soil type in this area is Kettle gravelly loamy sand which is considered erodible soil. The overbank velocities are expected to be 7-8 fps for the 100-year storm and the 10-year flow should be contained in the low flow channel. The erosion for the more frequent storm events should be confined to the low flow area. Large storm events should cause additional widening and deepening of the channel in this reach.

The north tributary of Black Squirrel Creek splits into two channels upstream of design point 4. The combined flow at this point is 1825 cfs and 405 cfs for the 100-year and 10-year 24-hour storms, respectively.

The reach from design point 4 to design point 2 has a flow immediately upstream of design point 4 of 922 cfs for the 100-year 24-hour storm and a flow of 213 cfs for the 10-year 24-hour storm. This reach has a fairly broad, well vegetated channel. The predominant soil types in this area are Pring coarse sandy loam and Alamosa loam. The overbank velocities are expected to be 4-6 fps for the 100-year storm and 3-4 fps for the 10-year storm. The erosion should predominate in the low flow channel with very little bank erosion.

Design point 2 is where the tributary crosses State Highway 83. The culverts cause a backwater effect upstream of this point. These culverts are inadequate for the 100-year flow and will be replaced. Field reconnaissance of this area did not indicate any deposition or erosion problems in this area. The 100-year 24-hour flow is 773 cfs and the 10-year 24-hour flow is 182 cfs.

The reach upstream of design point 2 is a fairly broad, shallow channel with well vegetated side slopes and bottom. The predominant soil type in this area is Pring coarse sandy loam which is considered erodible soil. The overbank velocities are expected to be 3-5 fps and 0-3 fps for the 100-year and 10-year storms, respectively. The predominant erosion should take place in the channel bottom and should occur only during large storm events.

Design point 1 is located at another crossing of State Highway 83. The culverts at this location also cause backwater effect although there was no evidence of significant erosion or deposition. These culverts are inadequate for the 100-year flow and will be replaced. The 100-year 24-hour flow is 307 cfs and the 10-year 24-hour flow is 86 cfs.

The reach upstream of design point 1 has a broad, shallow, well vegetated channel. The predominant soil type in this area is Kettle gravelly loamy sand which is considered erodible soil. The overbank velocities are expected to be 5 fps and 3 fps for the 100-year and 10-year storms, respectively. The channel in this reach is stable for a wide range of flow and very little erosion is expected.

The reach from design point 4 to design point 3 has a flow immediately upstream of design point 4 of 746 cfs for the 100-year 24-hour storm and a flow of 165 cfs for the 10-year 24-hour storm. The channel in this reach is a fairly deep, well vegetated channel. The predominant soil types in this area are Pring coarse sandy loam and Kettle gravelly loamy sand which are considered erodible soils. The overbank velocities are expected to be 1-5 fps for the 100-year storm and 0-4 fps for the 10-year storm. Erosion should occur only during large storm events. The channel banks are stable even for the 100-year storm.

Design point 3 is located midway between design point 4 and the upper basin boundary. the 100-year 24-hour flow is 686 cfs and the 10-year 24-hour flow is 194 cfs.

The reach upstream of design point 3 has a fairly broad, shallow channel with well vegetated side slopes and bottom. The predominant soil type in this area is Kettle gravelly loamy sand which is considered erodible soil. The overbank velocities are expected to be 3-5 fps and 0-4 fps for the 100-year and 10-year storms, respectively. Very little overbank erosion is expected with some erosion of the bottom for larger storm events.

V. BASIN HYDROLOGY

Determining runoff for a particular drainage basin needs to consider the effects of many different variables. In the absence of a reliable historic record of rainfall, runoff, and other pertinent variables, it is usually necessary to use a synthetic unit hydrograph method to determine the runoff that will occur for a given rainfall event. The SCS method of determining peak flood flows and hydrographs was used to estimate direct runoff. For an explanation of the procedures used, see the "SCS National Engineering Handbook, Section 4". Due to the number of computations necessary to determine the hydrographs and hydrologic routing of the given storm events, the calculations were performed with the aid of the TR-20 computer program.

For this study, the City of Colorado Springs/El Paso County Drainage Criteria Manual was used. For the major facilities, the design peak flow shall be the greater of the peak flows determined for the 100-year 24-hour (AMC-II) storm and the 100-year 2-hour (AMC-II) storm. These facilities were assumed to begin at the 100-acre limit. In all cases the 24-hour event produced greater flows. Design of initial drainage systems (basins less than 100 acres), shall be for the 10-year and 100-year storm in both El Paso County and the City of Colorado Springs. These initial systems are designated on Figure 5, attached. Flows for subbasins less than 100 acres should be calculated using the Rational Method, as outlined in the Colorado Springs/El Paso County Drainage Criteria Manual. Minor facilities shall be designed and planned to integrate with the major drainage system to provide overflow capability for major storms. The

intent of 100-year overflow provisions is to safely and economically direct 100-year flow from points of concentration without impacting buildings or structures. The drainage basin boundaries were determined from the topography on USGS 7-1/2 minute quadrangle maps. The subbasin boundaries and design points determined for fully developed conditions are shown on Figure 4 (attached). The hydrologic soil groups were then determined for each subbasin. For historic (present) conditions, a weighted curve number was determined for each subbasin based on soil types, type of cover, and taking into account presently platted areas. For future developed conditions, a weighted curve number was determined based on soil types, type of cover, and taking into account projected development. Time of concentration for the subbasins was determined by methods outlined in the Colorado Springs/El Paso County Drainage Criteria Manual.

As the calculations proceed downstream, the hydrograph was routed through each subsequent reach and combined with local inflow to produce a composite hydrograph at each design point. Hydrologic channel routing was performed by inputting flow vs. area vs. elevation for a representative cross section for each reach. The TR-20 computer program uses the Modified Att-Kin routing method for each reach based on the cross section entered. For detention ponds, the hydrologic reservoir routing was performed by inputting outflow vs. storage vs. elevation, for an assumed reservoir and outlet size. These variables were modified by trial and error until the desired volume of the reservoir and peak outflow were obtained. See Appendix A for TR-20 program input and output.

The rainfall depths of 3.0 and 4.6 inches were obtained from isopluvials for the project area for the 10-year 24-hour and 100-year 24-hour storm events, respectively. Table 2 shows the dimensionless precipitation distribution for the SCS Type IIA storm. The rainfall depths of 2.1 and 3.0 inches were obtained from the National Oceanic and Atmospheric Administration Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume III-Colorado, for the 10-year 2-hour and 100-year 2-hour storm events, respectively.

TABLE 2

BLACK SQUIRREL CREEK DRAINAGE BASIN
RAINFALL DISTRIBUTION

24-HOUR STORM - IIA	
TIME (hrs)	DISTRIBUTION
0.0	0.000
1.0	0.005
2.0	0.012
3.0	0.021
4.0	0.032
5.0	0.060
6.0	0.700
7.0	0.780
8.0	0.820
9.0	0.840
10.0	0.860
11.0	0.875
12.0	0.890
13.0	0.905
14.0	0.918
15.0	0.930
16.0	0.940
17.0	0.950
18.0	0.960
19.0	0.970
20.0	0.980
21.0	0.985
22.0	0.990
23.0	0.995
24.0	1.000

2-HOUR STORM - IIA		
TIME (min)	10 YEAR DISTRIBUTION	100 YEAR DISTRIBUTION
0	0.000	0.000
5	0.017	0.009
10	0.049	0.035
15	0.120	0.074
20	0.250	0.144
25	0.466	0.265
30	0.570	0.481
35	0.618	0.602
40	0.655	0.671
45	0.688	0.725
50	0.716	0.768
55	0.743	0.803
60	0.771	0.837
65	0.799	0.872
70	0.826	0.889
75	0.854	0.907
80	0.876	0.917
85	0.892	0.927
90	0.908	0.938
95	0.925	0.948
100	0.941	0.958
105	0.958	0.969
110	0.974	0.979
115	0.989	0.990
120	1.000	1.000

TABLE 3

BLACK SQUIRREL CREEK DRAINAGE BASIN
SUMMARY OF DEVELOPED SUBBASIN
HYDROLOGY DATA

SUBBASIN NO.	AREA (acres)	CN	C-10	C-100	Tc (hr)	Q-10 (cfs)	Q-100 (cfs)
A1 +	96	-	0.22	0.32	0.31	74	163
A2	177	68.8	-	-	0.30	131	364
A3	101	68.8	-	-	0.35	68	191
A4	259	68.8	-	-	0.42	152	443
A5	289	68.8	-	-	0.33	201	563
B1	234	69.4	-	-	0.34	167	462
B2	278	69.4	-	-	0.42	172	490
B3	385	69.4	-	-	0.41	241	683
C1	129	68.3	-	-	0.24	101	278
C2 +	90	-	0.14	0.21	0.23	50	113
C3	271	68.3	-	-	0.54	128	382
C4	381	68.3	-	-	0.50	194	574
C5	106	68.3	-	-	0.28	78	217
C6	179	68.3	-	-	0.47	95	277
C7	161	68.3	-	-	0.34	105	301
C8	138	68.3	-	-	0.34	90	258
C9	248	68.3	-	-	0.30	176	497
C10	216	68.3	-	-	0.39	127	373
D1 +	23	-	0.26	0.37	0.08	36	77
D2 +	99	-	0.22	0.30	0.22	89	187
D3 +	73	-	0.20	0.29	0.27	55	121
E1 +	39	-	0.12	0.18	0.13	23	53
E2 +	34	-	0.20	0.28	0.12	35	76
E3	170	69.1	-	-	0.45	99	281
F1	301	70.0	-	-	0.38	210	575
F2	332	70.0	-	-	0.41	219	608
F3	192	70.0	-	-	0.39	132	362
F4 +	48	-	0.12	0.18	0.12	30	69
F5 +	95	-	0.20	0.28	0.12	99	213
G1 +	39	-	0.28	0.39	0.21	45	96
G2	312	81.6	-	-	0.62	356	751
G3	273	71.4	-	-	0.41	202	536
H	135	87.0	-	-	0.23	321	586
I1 +	63	-	0.67	0.74	0.35	139	233
I2 +	76	-	0.67	0.74	0.11	285	472
J1	105	87.0	-	-	0.36	221	410
J2 +	67	-	0.67	0.74	0.32	157	263
J3 +	27	-	0.67	0.74	0.25	71	118
J4 +	82	-	0.67	0.74	0.17	258	425
K	100	87.0	-	-	0.33	215	397
L1	125	87.0	-	-	0.45	234	439
L2	168	87.0	-	-	0.35	291	539
L3	174	87.0	-	-	0.42	398	745
M +	92	-	0.67	0.74	0.41	185	313

+ The runoff in these subbasins is calculated using the Rational Method. All other runoff calculations are based on the SCS Method, 24 hour storm.

TABLE 4

BLACK SQUIRREL CREEK DRAINAGE BASIN
SUMMARY OF PRESENT SUBBASIN
HYDROLOGY DATA

SUBBASIN NO.	AREA (acres)	CN	C-10	C-100	Tc (hr)	Q-10 (cfs)	Q-100 (cfs)
A1 +	96	-	0.20	0.30	0.35	63	144
A2	177	65.0	-	-	0.33	85	281
A3	101	64.4	-	-	0.38	41	142
A4	259	64.4	-	-	0.46	94	324
A5	289	63.2	-	-	0.36	106	397
B1	234	65.1	-	-	0.37	103	349
B2	278	64.7	-	-	0.46	104	354
B3	385	64.7	-	-	0.45	145	496
C1	129	63.8	-	-	0.26	65	216
C2 +	90	-	0.13	0.20	0.25	46	106
C3	271	63.8	-	-	0.59	74	271
C4	381	63.8	-	-	0.55	110	403
C5	106	63.8	-	-	0.31	47	163
C6	179	63.8	-	-	0.52	54	197
C7	161	63.8	-	-	0.37	62	222
C8	138	63.8	-	-	0.37	53	190
C9	248	63.8	-	-	0.33	105	366
C10	216	63.8	-	-	0.43	76	270
D1 +	23	-	0.24	0.35	0.10	31	68
D2 +	99	-	0.20	0.28	0.24	79	166
D3 +	73	-	0.18	0.27	0.30	47	106
E1 +	39	-	0.11	0.17	0.14	21	50
E2 +	34	-	0.18	0.26	0.13	31	66
E3	170	65.6	-	-	0.49	67	220
F1	301	65.5	-	-	0.42	129	427
F2	332	65.5	-	-	0.45	137	449
F3	192	63.8	-	-	0.43	67	239
F4 +	48	-	0.11	0.17	0.13	26	61
F5 +	95	-	0.18	0.26	0.13	86	185
G1 +	39	-	0.26	0.37	0.23	41	87
G2	312	68.0	-	-	0.68	119	363
G3	273	68.0	-	-	0.45	144	426
H	135	69.0	-	-	0.25	112	301
I1 +	63	-	0.25	0.35	0.38	50	106
I2 +	76	-	0.25	0.35	0.11	99	213
J1	105	69.0	-	-	0.40	64	185
J2 +	67	-	0.25	0.35	0.35	55	117
J3 +	27	-	0.25	0.35	0.28	25	53
J4 +	82	-	0.25	0.35	0.19	90	195
K	100	68.1	-	-	0.36	62	182
L1	125	68.1	-	-	0.49	63	186
L2	168	68.1	-	-	0.38	82	239
L3	174	68.1	-	-	0.46	107	316
M +	92	-	0.25	0.35	0.45	67	142

+ The runoff in these subbasins is calculated using the Rational Method. All other runoff calculations are based on the SCS Method, 24 hour storm.

VI. PLANNING STUDY RECOMMENDATIONS

The overall recommendation of this drainage planning study is the use of subregional detention facilities in conjunction with partially lined and fully lined major drainage channels as shown on Figure 4. Furthermore, initial drainage systems (rural and urban) are designated on Figure 5. The plan should be used as a layout for future drainage facilities and take a natural regime approach to drainage. Channels should be designed to be stable under design flow conditions and still retain as many natural features as possible. This planning study incorporates the City of Colorado Springs/El Paso County Drainage Criteria Manual. Major and initial drainage systems, as described in this study, are reimbursable through the drainage basin funds. These facilities, ultimately, are to be publicly owned and maintained if located in an adequate drainage easement or road right-of-way and convey runoff from upstream public improvements.

Assumptions incorporated into this report are, 1) subregional off and on stream detention facilities are strategically placed within the study area for the purpose of reducing subregional developed runoff, 2) partially lined channels incorporating drop structures are provided for the purpose of stabilizing and maintaining the natural character of the channel, 3) fully lined channels are used where the natural channel is narrow and deep, and 4) channels within the rural area are assumed to be left natural with some facilities added for slope and bend protection. The design of the channels shall be based on maximum allowable velocities, determined by soil characteristics.

The use of detention for this basin is required due to the location of the U.S. Air Force Academy and Interstate 25 downstream of the development. Detention facilities are required to maintain storm runoff at or below historic levels at the Air Force Academy boundary and so that the capacities of existing Colorado Department of Highways structures at Interstate 25 are not exceeded. Subregional detention facilities are located as shown on Figure 4 (attached). The facilities should be designed to detain (and/or overdetain) the difference between the historic and developed peak flows for both the 10-year and the 100-year storm events. The bottom of the emergency spillway, in all cases, was assumed to be less than 10 feet high, thus, foregoing State Engineers jurisdiction. Inflow and outflow hydrograph data for detention ponds are shown in Appendix A. A summary of the peak flows for historic and developed conditions are shown on Tables 3, 4, 5 and 6.

The Black Squirrel Creek basin has two distinct types of ground cover. The upstream portion of the basin is part of the Colorado Black Forest and the downstream portion of the basin is rangeland. The type of vegetation present was a major consideration in determining projected land use and type of drainage improvements recommended. The low density residential development, east of State Highway 83, is an area within or just outside the Colorado Black Forest. This area, in general, has relatively stable natural channels and it is desirable to minimize the visible effect of man-made improvements in this area.

Curve number development for the rural area was generated by assuming five acre type development. The five acre parcel was assumed to consist of approximately 16% developed area (CN=93) with the remaining 84% being split based on percentage of forest (CN=63) and range (CN=69) land in the subbasin. The developed area, within the five acre parcel, was assumed to include approximately 7% of impervious area (CN=98) and 9% of gravel driveway and adjacent road (CN=89). The curve numbers presented are intended to be conservative to allow for uncertainties in land use predictions, present and future paved driveways and roads, and assuming "fair" to "poor" hydrological conditions for range and forest land uses due to a general lack of ground cover.

Drainage facilities are designed and constructed according to the City/County Criteria Manual. Other possible requirements may be imposed through the Corps of Engineers 404 permit process and through the Flood Plain Administrator concerning current FEMA mapping, map revisions, and amendments in conjunction with the planning process. Additional costs associated with these processes have not been included here.

MAJOR CHANNEL SYSTEM

Reaches 1 through 19 and 21 are primarily located in the upper reaches of the basin. These reaches are proposed to remain as natural as possible except for the addition of grade control structures and riprap at sharp horizontal bends for the purpose of stabilizing the channel. A total of 136 grade control

structures are provided, along with bend protection at approximately 32 locations within these reaches. The number of grade control structures was determined by assuming one per 500 lineal feet of channel.

Reaches 20, 22, 23, and 25-28 are proposed to be fully lined channels with grade control structures. The fully lined channels were used for the areas that are expected have very high velocities and would require extensive grading to widen the existing channel. This report assumes a fully lined riprap channel with sloping grouted riprap drops as grade control structures. Many alternatives exist for drop structures and their selection will depend on site specific, jurisdictional and economic factors. It is anticipated reaches 26-28 will be likely candidates for 404 permit consideration.

Reach 24 is proposed to be a partially lined channel. The partially lined channel section was used in this area where the existing channel is 150 to 250 feet wide and would have developed velocities that range from 7-9 fps if no improvements were made. The use of drops to limit the vertical degradation and reduce velocities, along with the lining of the banks, should confine the channel to the limits of the proposed banks. Developed velocities in this type of channel must comply with those outlined in the Drainage Criteria Manual.

There are no improvements recommended for the channel on the Air Force Academy (reach 29). This reach will not be developed, so there are no major damages associated with leaving the channel in its present configuration since flows into the reach will be limited to historic levels by the upstream facilities.

Proposed easement widths (see Figures 6-9) include the channel width with a maintenance road. The width does not include "buffer areas". The necessity of these areas shall be determined at the preliminary and final drainage report level and be based on soil erosion potential.

The major channel system facilities are outlined in Table 8 and delineated on Figure 4.

BRIDGES AND CULVERTS

Proposed culverts, for existing and proposed roadways only, are located at design points 1A, 1B, 1 and 2, and within reaches 4, 8, 12, 14 and 15. Proposed bridges are located at design points 4, 6, 7 and 10. These facilities were sized assuming inlet control. If permanent downstream facilities are not in place, then temporary energy dissipation measures are required downstream of these facilities. These major facilities are outlined in Table 8 and on Figure 4.

DETENTION FACILITIES

Within the basin are nine proposed sub-regional detention facilities (see Figure 4). Detention facilities 1, 2 and 3 are recommended to be on-stream and are located along Northgate Road, extended. The remaining detention facilities (4 through 9) are proposed to be off-stream and are located within subbasins F2, I, J1, J2, J4, and L2. These facilities are assumed to be publicly owned and maintained and therefore facility and land costs are included in the basin fee.

It shall be the responsibility of the developers that plat and develop land tributary (including over detained areas, See Table 7) to the proposed detention facility(s) to either, 1) have the permanent detention facility(s) affecting his site constructed or 2) construct temporary onsite detention facilities to maintain onsite developed peak flows at historic levels and/or show through acceptable hydrologic and hydraulic analysis that developed runoff next to Black Squirrel Creek does not increase the overall basin peak flow at points downstream of itself. A temporary facility will be maintained and operated privately and is not reimburseable. Once permanent detention facility(s) are constructed, within the tributary area, the temporary facility(s) must become non-operational so that the basin drainage system may operate as intended by the Drainage Basin Planning Study. These issues shall be addressed in the preliminary and final drainage reports for each developed site.

Detention ponds were designed in combination to limit the peak 10-year 24-hour and 100-year 24-hour storms to historic levels at Interstate 25 and Monument Creek. Inflow and outflow hydrographs are shown in the TR-20 runs in Appendix A. The bottom of the emergency spillway, in all cases, was assumed to be less than 10 feet high, thus foregoing State Engineers jurisdiction. Table 7 provides a summary of all the proposed detention facilities. Table 7 also indicated basins to be detained and/or overdetained for.

INITIAL DRAINAGE SYSTEM (RURAL AND URBAN)

The rural initial system lies primarily east of State Highway 83 and upstream of design point 6 (Figure 5).

The rural initial systems were assumed to be grass-lined type channels using seed mixes from grasses designated in the Drainage Criteria Manual. Also incorporated into the channels were drop structures, excavation and revegetation costs.

Revegetation costs are assumed to reestablish ground distribution from this type of construction for erosion protection proposes only. Other, more elaborate methods of erosion protection such as filter fabric, grasses other than native mixes, shrubs and trees shall not be reimburseable under this basin account unless previously approved by the City/County.

The urban initial system lies between Interstate 25 and State Highway 83. The system's limits were based on ultimate site constraints and criteria from the Drainage Criteria Manual. The system was assumed to consist of drainage pipe and inlets, sized and located using the City/County criteria. However, these sizes and locations are for cost estimating purposes only and shall be subject to final design. Refer to Figure 5 for delineation of this system.

Other alternatives were considered for this basin, as discussed in the first approved version of this basin study and through discussions with City and County staff during this revision. The following is a list of the drainage alternatives analyzed for this basin:

1) Fully lined, full flow through

2) Left natural, full flow through

3) Onsite/subregional detention with improved channels

4) Regional detention with improved channels (recommendation/first version)

5) Nineteen pond scheme with improved channels

6) Twelve pond scheme with improved channels (recommendation/second version - this report)

TABLE 5

BLACK SQUIRREL CREEK DRAINAGE BASIN
DESIGN PEAK FLOWS FOR
PRESENT AND RECOMMEND CONDITIONS
24-HOUR STORM

DESIGN POINT	CONTRIBUTING SUBBASINS	PRESENT CONDITIONS 10-YR (cfs)	PRESENT CONDITIONS 100-YR (cfs)	RECOMMENDED CONDITIONS 10-YR (cfs)	RECOMMENDED CONDITIONS 100-YR (cfs)
1A	A5	106	307	201	563
1B	A4-A5	182	773	288	848
1	A	213	922	213 out	906 out
2	B	165	746	165 out	740 out
3	A,B,D	405	1825	405	1476
4E	C2-C4	174	645	343	1029
4W	C1,C5-C10	276	1019	276 out	1085 out
4	C	450	1661	450	1641
5E	C,F	651	2188	651	2202
5W	A,B,D,E	467	1974	467	1450
5	A-F	1118	4158	1118	3328
6	A-G	1154	4389	1154	3536
7	A-H	1387	4432	1387	3577
8	A-I	1142	4220	1142	3597
9	A-J	1129	4051	1129	3779
10	A-K	1117	4004	1117	3803
11	A-L	1104	3956	1104	3953
12	A-M	1098	3950	1098	3931

Notes: 1) Design points are taken from Figure 4.

2) Present conditions include routed flows without existing "stockponds". Present conditions are assumed to represent historic conditions.

3) Recommended conditions include routed flows through proposed detention facilities.

TABLE 6

BLACK SQUIRREL CREEK DRAINAGE BASIN
DESIGN PEAK FLOWS FOR
PRESENT AND RECOMMEND CONDITIONS
2-HOUR STORM

DESIGN POINT	CONTRIBUTING SUBBASINS	PRESENT CONDITIONS 10-YR (cfs)	PRESENT CONDITIONS 100-YR (cfs)	RECOMMENDED CONDITIONS 10-YR (cfs)	RECOMMENDED CONDITIONS 100-YR (cfs)
1A	A5	17	85	n/a	n/a
1B	A3-A5	53	249	n/a	n/a
1	A	7	313	n/a	n/a
2	B	84	373	n/a	n/a
3	A,B,D	164	688	n/a	n/a
4E	C2-C4	59	256	n/a	n/a
4W	C1,C5-C10	94	406	n/a	n/a
4	C	153	663	n/a	n/a
5E	C,F	237	969	n/a	n/a
5W	A,B,D,E	185	772	n/a	n/a
5	A-F	421	1739	n/a	n/a
6	A-G	470	1882	n/a	n/a
7	A-H	480	1859	n/a	n/a
8	A-I	490	1836	n/a	n/a
9	A-J	500	1813	n/a	n/a
10	A-K	465	1828	n/a	n/a
11	A-K,L2,L1	430	1844	n/a	n/a
12	A-M	424	1847	n/a	n/a

Notes: 1) Design points are taken from Figure 4.

2) Present conditions include routed flows without existing "stockponds". Present conditions are assumed to represent historic conditions.

n/a - The 24-hour storm was used as the design storm for detention routing.

TABLE 7

BLACK SQUIRREL CREEK DRAINAGE BASIN
SUMMARY OF
DETENTION FACILITIES

POND NO	LOCATION	TYPE	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)	PEAK HISTORIC (cfs)	SURFACE AREA (ac)	VOLUME (ac-ft)	DETAINED AREA (basin)
1	D.P. 1	ONSTREAM	1205	906	922	3.9	34	A1-A5
2	D.P. 2	ONSTREAM	985	740	746	4.1	34	B1-B3
3	D.P. 4W	ONSTREAM	1421	1085	1019	5.3	44	C1,C5-C10
4	S.B. F2	OFFSTREAM	608	389	449	2.7	14	F2
5	S.B. I1	OFFSTREAM	233	92	106	1.1	7	I1
6	S.B. J1	OFFSTREAM	410	183	185	1.7	12	J1
7	S.B. J2	OFFSTREAM	358	285	299	1.6	8	J1,J2
8	S.B. J4	OFFSTREAM	333	148	148	1.2	9	J4
9	D.P. 11S	OFFSTREAM	439	106	186	1.6	10	L1

NOTE: Subbasins C2-C4, D1-D3, E1-E3, F1, F3-F5, G1-G3, H, I2, J3, K ,L2 and L3, under ultimate conditions, will be maintained to historic flows due to a delayed peak from upstream ponds. Temporary detention is required as development occurs until the permanent detention facilities are constructed.

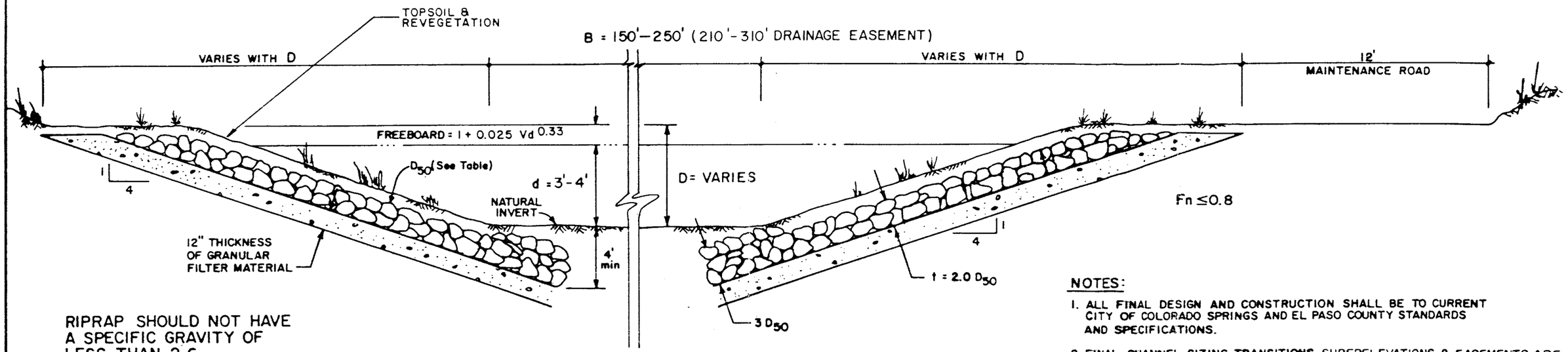
TABLE 8

BLACK SQUIRREL CREEK DRAINAGE BASIN
PROPOSED MAJOR DRAINAGE FACILITIES

DESIGN POINT	REACH	FACILITY	DESIGN FLOW (cfs) (1)
-	1	RURAL MAJOR DRAINAGEWAY	563
1A	-	8'x 8'x 120' CBC *	563
-	2	RURAL MAJOR DRAINAGEWAY	848
1B	-	10'x 10'x 120' CBC *	848
-	3	RURAL MAJOR DRAINAGEWAY	1205
-	3	DETENTION FACILITY #1	(see table 7)
1	-	10'x 10'x 120' CBC	906
-	4	RURAL MAJOR DRAINAGEWAY	364
-	4	7'x 7'x 120' CBC *	364
-	5	RURAL MAJOR DRAINAGEWAY	906
-	6	RURAL MAJOR DRAINAGEWAY	683-985
-	6	DETENTION FACILITY #2	(see table 7)
2	-	10'x 9'x 120' CBC	740
-	7	RURAL MAJOR DRAINAGEWAY	740
-	8	6'x 4'x 120' CBC (NORTHGATE ROAD)	141
-	8	RURAL MAJOR DRAINAGEWAY	281
-	8	6'x 7'x 120' CBC (S.H. 83)	281
-	9	RURAL MAJOR DRAINAGEWAY	1476
-	10	RURAL MAJOR DRAINAGEWAY	1450
-	11	RURAL MAJOR DRAINAGEWAY	277
-	12	RURAL MAJOR DRAINAGEWAY	497
-	12	8'x 8'x 120' CBC (MILAM ROAD)	497
-	13	RURAL MAJOR DRAINAGEWAY	373-1421
-	13	DETENTION FACILITY #3	(see table 7)
-	14	RURAL MAJOR DRAINAGEWAY	574
-	14	8'x 8'x 120' CBC (MILAM ROAD)	574
-	15	RURAL MAJOR DRAINAGEWAY	382
-	15	7'x 7'x 120' CBC (MILAM ROAD)	382
-	16	RURAL MAJOR DRAINAGEWAY	1029
4	-	(10'-10') x 10'x 150' CBC	1641
-	17	RURAL MAJOR DRAINAGEWAY	1719
-	18	RURAL MAJOR DRAINAGEWAY	608
-	18	DETENTION FACILITY #4	(see table 7)
-	19	RURAL MAJOR DRAINAGEWAY	2202
-	20	25'x 8'x 4500' FULLY LINED CHANNEL	3536
-	21	RURAL MAJOR DRAINAGEWAY	536
6	-	(11'-14'-11') x 10'x 210' CBC *	3536
-	22	25'x 8'x 2250' FULLY LINED CHANNEL	3577
7	-	(11'-14'-11') x 10'x 210' CBC	3577
-	23	25'x 8'x 2250' FULLY LINED CHANNEL	3597
-	-	DETENTION FACILITY #5	(see table 7)
-	24	PARTIALLY LINED CHANNEL	3779
-	-	DETENTION FACILITY #6	(see table 7)
-	25	8'x 3'x 3000' FULLY LINED CHANNEL	358
-	-	DETENTION FACILITY #7	(see table 7)
-	-	DETENTION FACILITY #8	(see table 7)
9	-	EXISTING (14'-14') x 10' CBC	3779
-	26	30'x 7'x 3200' FULLY LINED CHANNEL	3803
10	-	(11'-14'-11') x 10'x 120' CBC	3803
-	27	30'x 7'x 1800' FULLY LINED CHANNEL	3953
-	28	10'x 5'x 1000' FULLY LINED CHANNEL	745
-	28	10'x 9'x 120' CBC	745
-	-	DETENTION FACILITY #9	(see table 7)
11	-	CITY/AFA BOUNDARY	3953
12	-	CONFLUENCE w/ MONUMENT CREEK	3931

NOTE: Design flows shown are for the ultimate buildout conditions as represented in the Black Squirrel Creek hydrologic model. Interim flows may be higher at certain locations along the main channel. (See historic flows, for example). Where facilities are to be constructed along the main channel, the design flow must be analyzed and accepted by the City or County at the preliminary and final drainage report level.

* Replacement Facilities



RIPRAP SHOULD NOT HAVE A SPECIFIC GRAVITY OF LESS THAN 2.6

TYPICAL PARTIALLY LINED RIPRAP CHANNEL SECTION

nts

NOTES:

1. ALL FINAL DESIGN AND CONSTRUCTION SHALL BE TO CURRENT CITY OF COLORADO SPRINGS AND EL PASO COUNTY STANDARDS AND SPECIFICATIONS.
2. FINAL CHANNEL SIZING, TRANSITIONS, SUPERELEVATIONS & EASEMENTS ARE SUBJECT TO DETAILED DRAINAGE REPORTS OF THE SUBJECT AREA.
3. THIS DETAIL WAS USED FOR COST ESTIMATING PURPOSES FOR THIS MASTER PLAN ONLY.
4. TOPSOIL AND REVEGETATION ABOVE RIP-RAP ASSUMED TO BE NON-REIMBURSABLE.
5. MAINTENANCE ROAD MAY BE REQUIRED ON BOTH SIDES IF DETERMINED BY FINAL DRAINAGE REPORT.

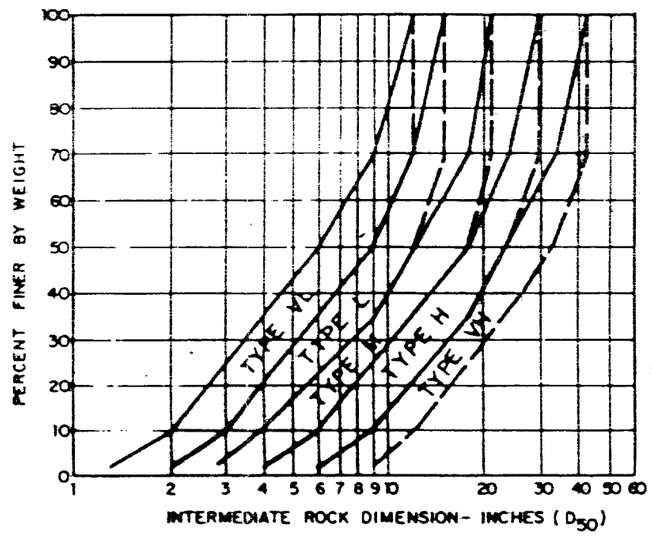
RIPRAP REQUIREMENTS FOR CHANNEL LININGS **

$V S^{0.17}/(S_s-1)^{0.66}$ * (feet per second)	Rock Type ***
1.4 to 3.2	VL
3.3 to 3.9	L
4.0 to 4.5	M
4.6 to 5.5	H
5.6 to 6.4	VH

* Use S_s = 2.5 unless the source of rock and its densities are known at the time of design.

** Table valid only for Froude number of 0.8 or less and side slopes no steeper than 2h:1v.

*** Type VL and L riprap shall be buried after placement to reduce vandalism.

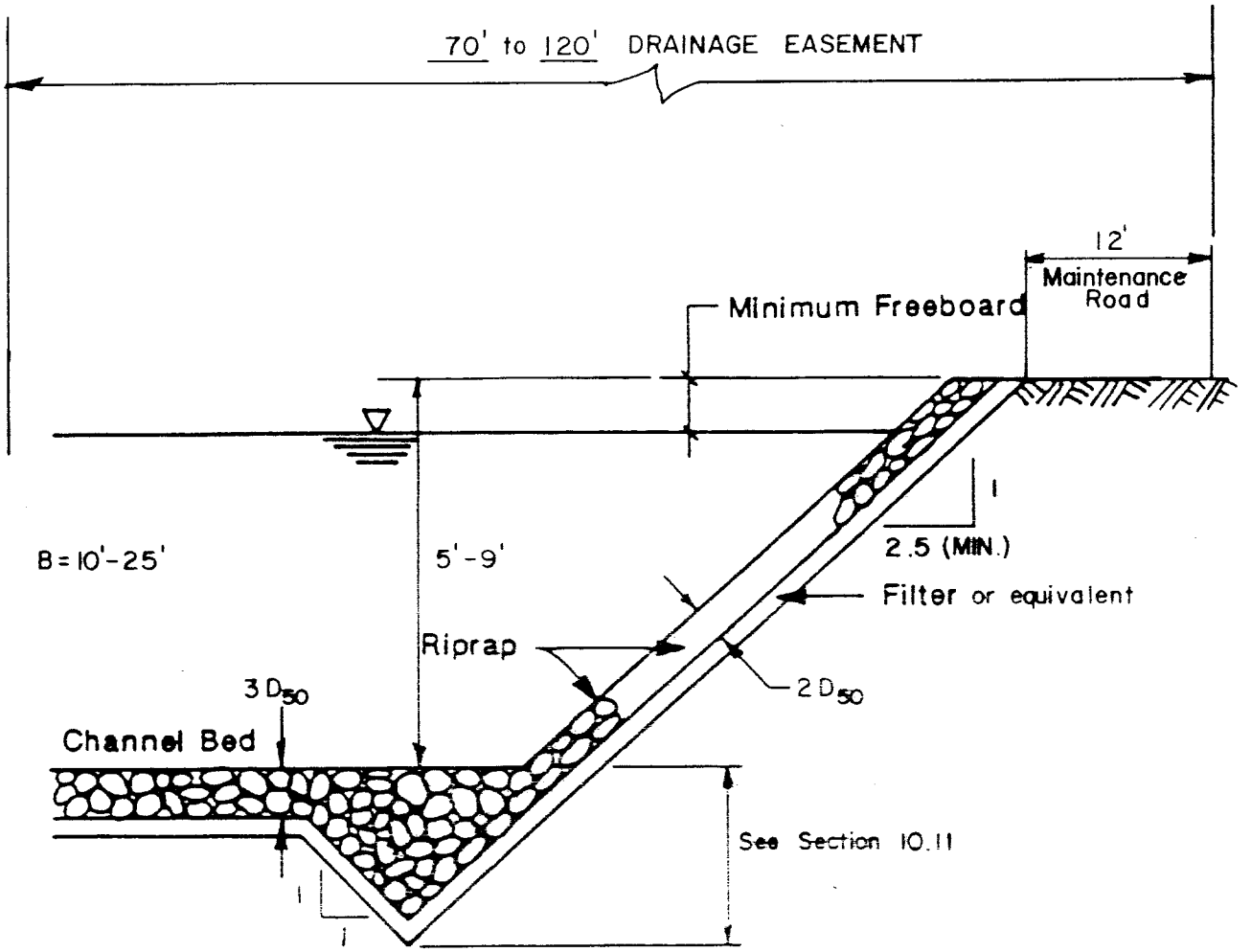


GRADATION OF ORDINARY RIPRAP

SOURCE: URBAN DRAINAGE & FLOOD CONTROL DISTRICT, DRAINAGE CRITERIA MANUAL

PARTIALLY LINED CHANNEL DETAIL
FIGURE 6

URS CONSULTANTS
MAKING TECHNOLOGY WORK



Reference : Urban Drainage & Flood Control District, Urban Storm Drainage Criteria Manual, November 15, 1982.

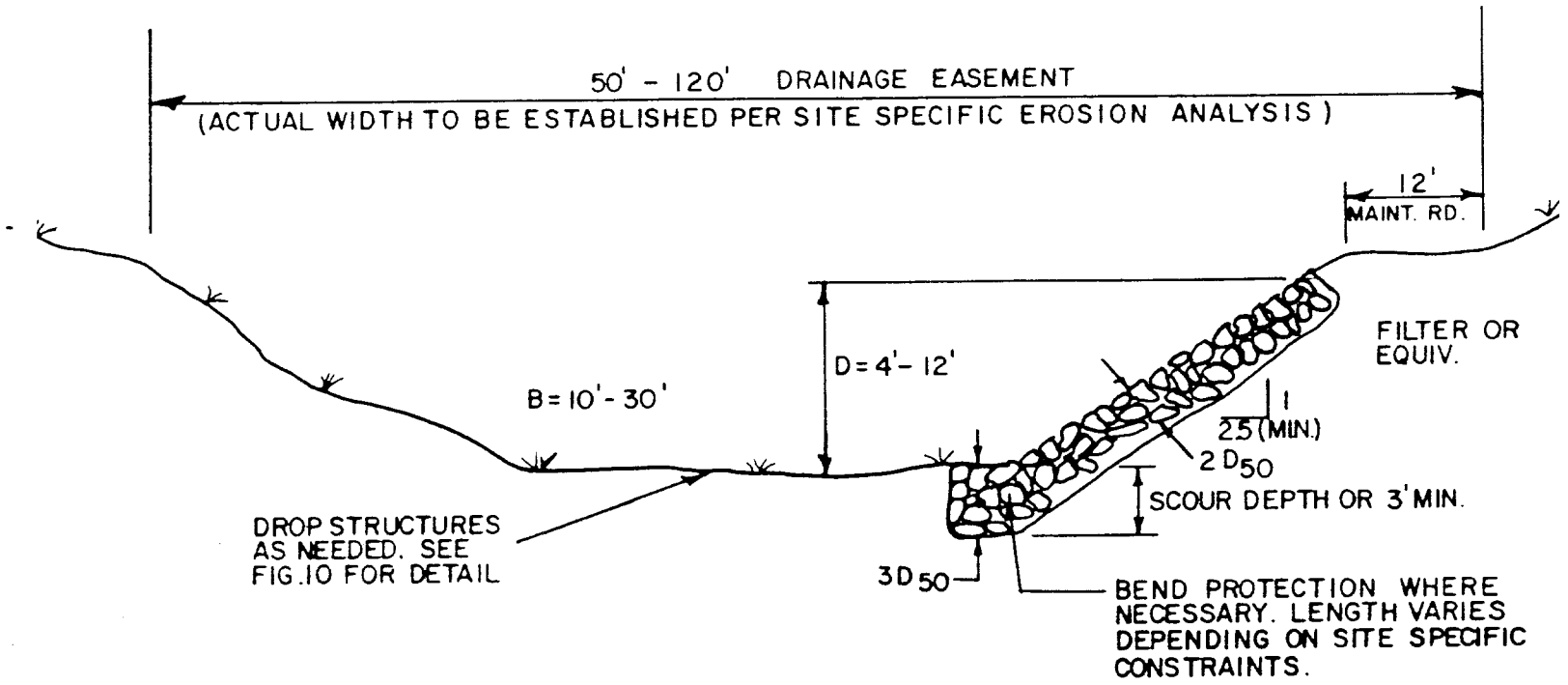
URS CONSULTANTS
MAKING TECHNOLOGY WORK

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Fully Lined
Ordinary Riprap Channel Section

Date
OCT. 1987

Figure
7



NOTES: 1) REVEGETATE ALL DISTURBED AREAS.

FIGURE 8

CONCEPTUAL BEND PROTECTION DETAIL
RURAL MAJOR SYSTEM SECTION

nts

URS
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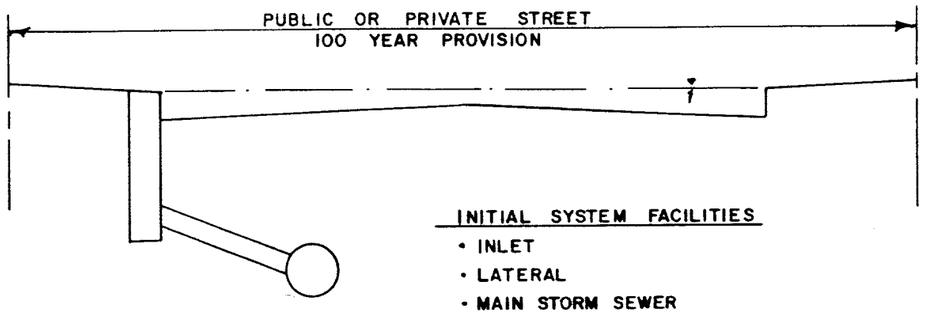
CONCEPTUAL
INITIAL SYSTEM DETAILS

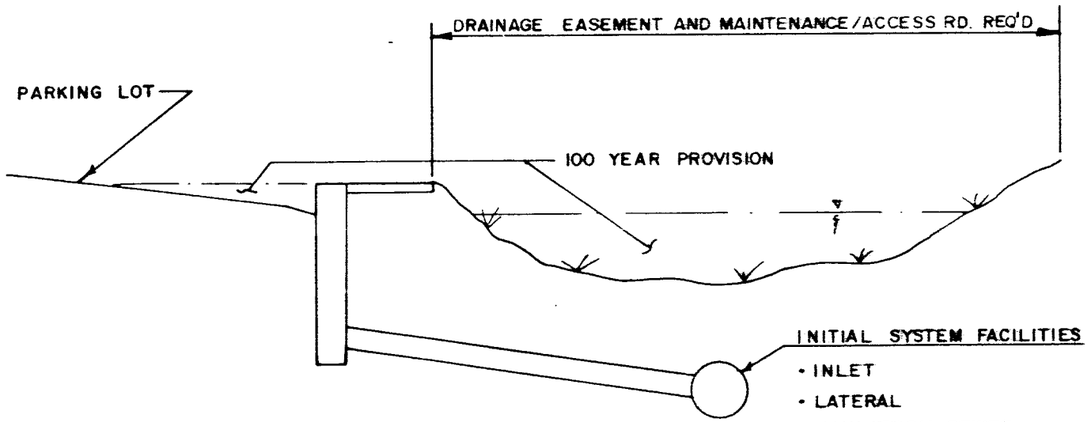
NTS

URBAN



INITIAL SYSTEM FACILITIES

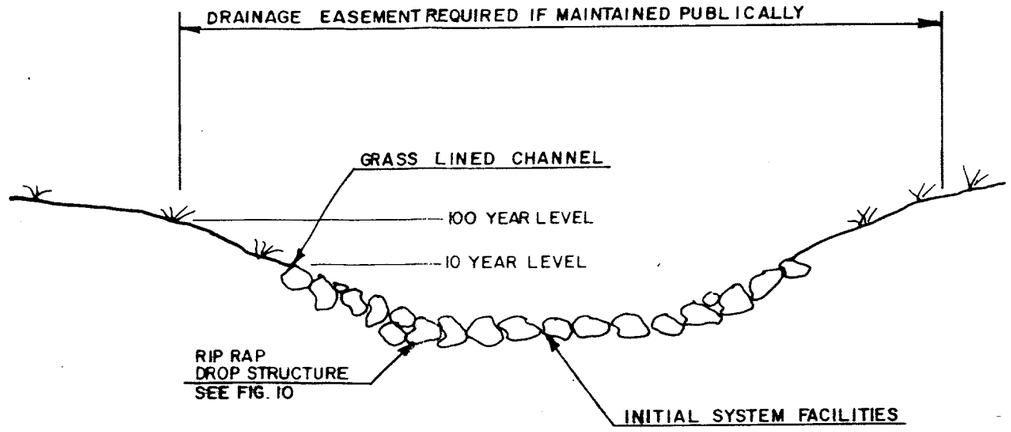
- INLET
- LATERAL
- MAIN STORM SEWER
- STREET & C&G



INITIAL SYSTEM FACILITIES

- INLET
- LATERAL
- MAIN STORM SEWER
- PARKING LOTS
- BERMED OR EXCAVATED CHANNELS

RURAL



INITIAL SYSTEM FACILITIES

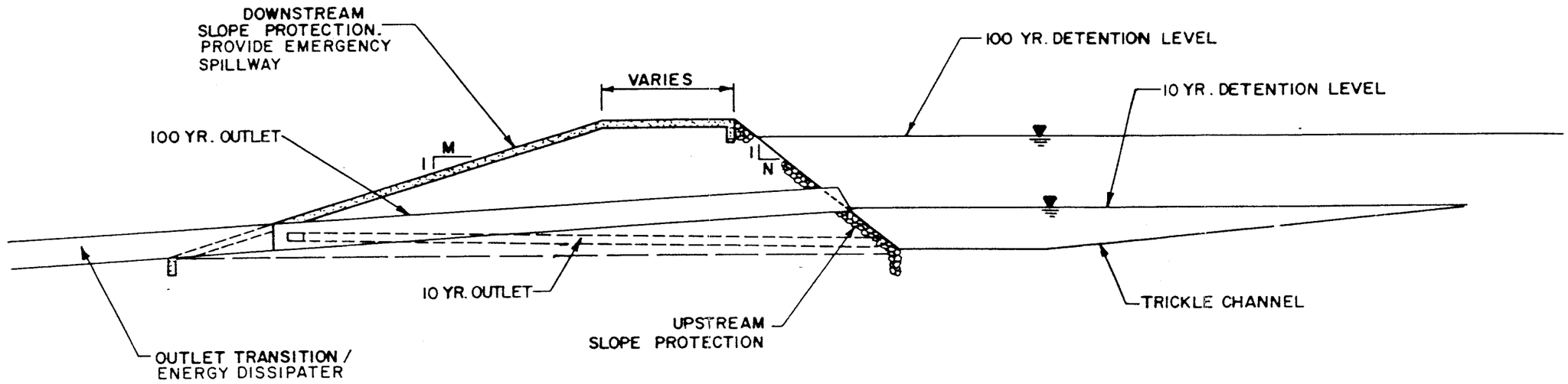
- IMPROVED CHANNEL (GRADING)
- DROP STRUCTURE

NOTES:

1. ALL FINAL DESIGN AND CONSTRUCTION SHALL BE TO CURRENT CITY OF COLORADO SPRINGS AND EL PASO COUNTY STANDARDS AND SPECIFICATIONS.
2. ALL IMPROVEMENTS ON BASINS GREATER THAN 100 ACRES SHALL BE DESIGNED FOR THE 100-YR., 24-HR. STORM.
3. SUBJECT TO FINAL DESIGN & EASEMENT REQUIREMENTS.

FIGURE 9

URS CONSULTANTS
MAKING TECHNOLOGY WORK



CONCEPTUAL DAM SECTION

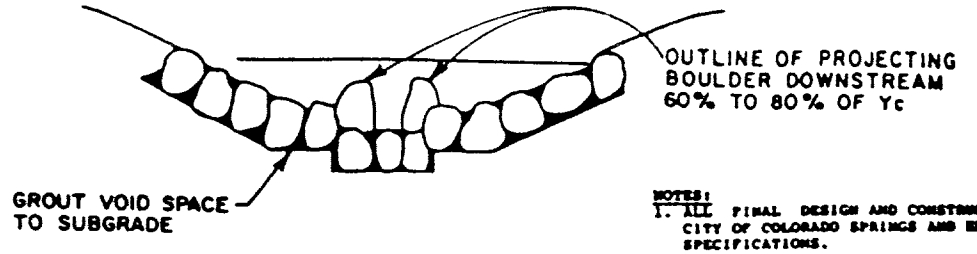
NOT TO SCALE

NOTES:

1. THIS SECTION WAS USED FOR COST ESTIMATING PURPOSES (THIS STUDY ONLY).
2. M & N SUBJECT TO GEOTECHNICAL DESIGN.
3. ALL FINAL DESIGN AND CONSTRUCTION SHALL BE TO CURRENT CITY OF COLORADO SPRINGS, EL PASO COUNTY, AND STATE OF COLORADO SPECIFICATIONS WHERE APPLICABLE.
4. DUAL OUTLET REQUIRED FOR 10 & 100 YEAR DISCHARGE.
5. IF DETENTION FACILITY IS AGAINST ROADWAY EMBANKMENT, THEN, A SPILLWAY/OVERFLOW STRUCTURE MUST BE PROVIDED BENEATH ROADWAY.

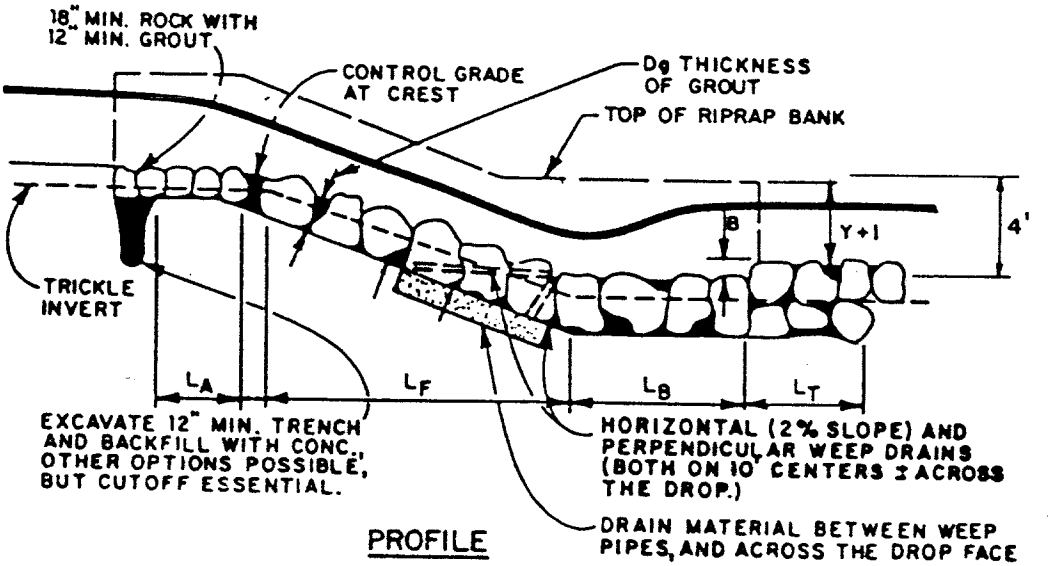
FIGURE 11

URS CONSULTANTS
MAKING TECHNOLOGY WORK

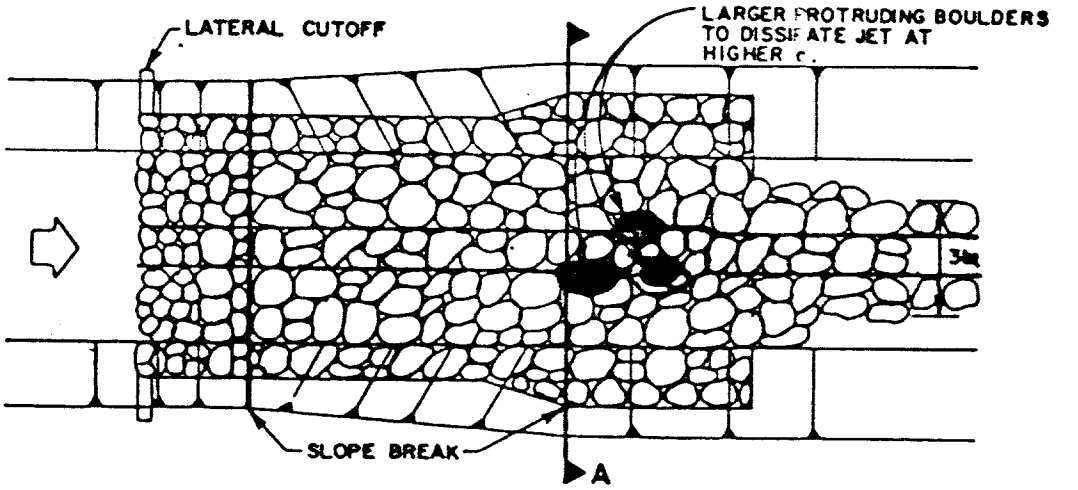


SECTION-A

NOTES:
1. ALL FINAL DESIGN AND CONSTRUCTION SHALL BE TO CURRENT CITY OF COLORADO SPRINGS AND EL PASO COUNTY STANDARDS AND SPECIFICATIONS.
2. FINAL DROP SIZING AND CONFIGURATION IS SUBJECT TO DETAILED DRAINAGE REPORTS OF THE SUBJECT AREA.
3. THIS DETAIL WAS USED FOR COST ESTIMATING PURPOSES FOR THIS MASTER PLAN ONLY.



PROFILE



PLAN

FIGURE 10

GSB-GROUTED SLOPING

BOULDER DROP

URS CONSULTANTS
MAKING TECHNOLOGY WORK

Reference: Urban Drainage & Flood Control District, Drop Structures in the Denver Metropolitan Area, Dec. 1986

VII. ESTIMATED MASTER PLAN COSTS

Estimated 1988 Black Squirrel Creek Drainage Basin Master Plan Costs are presented in Table 9 Each of the line item costs corresponds to an improvement shown on Figures 4 or 5 (attached). Initial system costs have been divided between rural and urban systems and are designated separately in Table 10 Initial system costs for urban and rural systems were estimated by using the Northgate Master Plan and low density type development to represent future development within the basin. The assumed densities are shown on Figure 1. Master plans outside of Northgate do not exist at this time.

Unit construction costs used in estimating the initial system costs as well as the major improvements are shown in Table 10. The subtotal for drainage improvements (urban plus rural) was then multiplied by 1.05 to provide a 5 percent allowance for construction contingency. This total was then multiplied by 1.10 to provide a 10 percent allowance for engineering. Also included in the reimbursable costs is the cost of preparing this Basin Plan and the previous Basin Plan.

Land costs for detention ponds are to be reimbursed at $15,600 per acre in the City and in the County. This land fee corresponds to the City's current park land fee. These land costs will be adjusted in subsequent years to reflect the park land value that year. The land to be reimbursed for detention ponds will be the difference between the detention pond area and the area required for a full flow through channel.

The estimated annual maintenance costs for major lined, partially lined and natural channels and detention ponds include sediment and debris removal, inspections, crack sealing, mowing, and other minor repair work, and are shown in Table 12.

TABLE 9

BLACK SQUIRREL CREEK DRAINAGE BASIN
ESTIMATED CONCEPTUAL DESIGN IMPROVEMENT COSTS & FEES

DESIGN POINT	REACH	DESIGN FLOW (cfs)	IMPROVEMENT	COMMENT	QTY.	UNIT	UNIT ($)	ESTIMATED 1988 CONSTRUCTION COSTS: DRAINAGE CONSTRUCTION COST ($)	DRAINAGE + LAND COST ($)	BRIDGE COST ($)
RURAL										
-	1-19,21	See Fig. 10	DROPS	-	140	EA	$9,000	$1,260,000		
-	1-19,21	See Fig. 8	BEND PROTECTION	-	40	EA	10,000	400,000		
1A	-	563	8'x 8' CBC	S.H. 83	120	LF	290	34,800		
1B	-	848	10'x 10' CBC	S.H. 83	120	LF	410	49,200		
-	3	See Tbl. 7	DETENTION POND #1	34 ac-ft	1	LS	256,800	256,800	$60,840	
1	-	906	10'x 10' CBC	NORTHGATE ROAD	120	LF	410	49,200		
-	4	364	7'x 7' CBC	S.H. 83	120	LF	240	28,800		
-	6	See Tbl. 7	DETENTION POND #2	34 ac-ft	1	LS	259,200	259,200	63,960	
2	-	740	10'x 9' CBC	NORTHGATE ROAD	120	LF	390	46,800		
-	8	141	6'x 4' CBC	NORTHGATE ROAD	120	LF	165	19,800		
-	8	281	6'x 7' CBC	S.H. 83	120	LF	200	24,000		
-	12	497	8'x 8' CBC	HILAH ROAD	120	LF	290	34,800		
-	13	See Tbl. 7	DETENTION POND #3	44 ac-ft	1	LS	396,000	396,000	82,680	
-	14	574	8'x 8' CBC	HILAH ROAD	120	LF	290	34,800		
-	15	382	7'x 7' CBC	HILAH ROAD	120	LF	240	28,800		
4	-	1641	(10'-10') x 10' CBC	NORTHGATE ROAD	150	LF	795			$119,250
-	18	See Tbl. 7	DETENTION POND #4	14 ac-ft	1	LS	126,000	126,000	42,120	
-	20	3536	25'x 8' FLC	-	4500	LF	190	855,000		
15 (See Fig. 5)		3350	(11'-14'-11') x 10' CBC	FUTURE ARTERIAL	120	LF	1,280			153,600
6	-	3536	(11'-14'-11') x 10' CBC	S.H. 83	210	LF	1,280			268,800
				MAJOR SYSTEM SUBTOTAL				$3,904,000	$249,600	$541,650
				INITIAL SYSTEM SUBTOTAL (SEE TABLE 10)				1,163,440		
				RURAL TOTAL				$5,067,440	$249,600	$541,650
URBAN										
-	22	3577	25'x 8' FLC	-	2250	LF	170	382,500		
7	-	3577	(11'x 14'x 11') x 10' CBC	POWERS BLVD.	210	LF	1,220			256,200
-	23	3597	25'x 8' FLC	-	2250	LF	170	382,500		
-	-	See Tbl. 7	DETENTION POND #5	7 ac-ft	1	LS	63,000	63,000	17,160	
-	24	3779	150'-250'x 4'-5' PLC	-	2900	LF	90	261,000		
			DROPS	-	6	EA	40,000	240,000		
-	-	See Tbl. 7	DETENTION POND #6	12 ac-ft	1	LS	108,000	108,000	26,520	
-	25	358	8'x 3' FLC	-	3000	LF	75	225,000		
-	-	See Tbl. 7	DETENTION POND #7	8 ac-ft	1	LS	72,000	72,000	24,960	
-	-	See Tbl. 7	DETENTION POND #8	9 ac-ft	1	LS	81,000	81,000	18,720	
9	-	3779	(14'x 14') x 10' CBC	VOYAGER PKWY	220	LF	1,345			295,900
-	26	3803	30'x 7' FLC	-	3200	LF	170	544,000		
10	-	3803	(11'x 14'x 11') x 10' CBC	MINOR ARTERIAL	120	LF	1,390			166,800
-	27	3953	30'x 7' FLC	-	1800	LF	170	306,000		
-	28	745	10'x 5' FLC		1000	LF	85	85,000		
-	28	745	10'x 9' CBC	MINOR ARTERIAL	120	LF	390	46,800		
-	-	See Tbl. 7	DETENTION POND #9	10 ac-ft	1	LS	90,000	90,000	24,960	
				MAJOR SYSTEM SUBTOTAL				$2,886,800	$112,320	$718,900
				INITIAL SYSTEM SUBTOTAL (SEE TABLE 10)				2,713,000		
				URBAN TOTAL				$5,599,800	$112,320	$718,900
				URBAN & RURAL SUBTOTALS				$10,667,240	$361,920	$1,260,550
				CONSTRUCTION CONTINGENCY 5%				533,362		63,028
				ENGINEERING 10%				1,120,860		132,358
				MASTER PLAN COST				115,000		
				GRAND TOTALS				$12,435,662	$361,920	$1,455,935
							FEE/ACRE	$5,527	$161	$647

RURAL TOTAL ASSESSED ACREAGE: 4970/5 = 994

URBAN TOTAL ASSESSED ACREAGE = 1256

TOTAL ASSESSED
ACREAGE = 2250

DETENTION LAND AREA COST/ACRE:
(* SEE TABLE 7 FOR DETENTION POND ACREAGES)
COUNTY $15,600
CITY $15,600

TABLE 10

BLACK SQUIRREL CREEK DRAINAGE BASIN
ESTIMATED CONCEPTUAL INITIAL SYSTEM COSTS

FACILITY NO.	IMPROVEMENT (1)	DESIGN FLOW	LENGTH	UNIT	NO OF DROPS (2)	UNIT ($)	CONSTRUCTION COST ($)
RURAL							
1	GRASS CHANNEL	189	2000	LF	8	$16	$32,000
2	GRASS CHANNEL	95	2200	LF	9	10	22,000
3	GRASS CHANNEL	57	1500	LF	6	10	15,000
4	GRASS CHANNEL	85	1500	LF	6	10	15,000
5	GRASS CHANNEL	85	1500	LF	6	10	15,000
6	GRASS CHANNEL	118	2000	LF	8	10	20,000
7	GRASS CHANNEL	77	2200	LF	9	10	22,000
8	48" RCP	77	120	LF	-	116	13,920
9	GRASS CHANNEL	187	1500	LF	6	16	24,000
10	5'x 6' CBC	187	120	LF	-	135	16,200
11	GRASS CHANNEL	106	3000	LF	12	10	30,000
12	GRASS CHANNEL	106	2500	LF	10	10	25,000
13	GRASS CHANNEL	106	2500	LF	10	10	25,000
14	GRASS CHANNEL	281	2500	LF	10	16	40,000
16	GRASS CHANNEL	44	1500	LF	6	10	15,000
17	GRASS CHANNEL	87	1500	LF	6	10	15,000
18	48" RCP	87	120	LF	-	116	13,920
19	GRASS CHANNEL	75	1500	LF	6	10	15,000
20	GRASS CHANNEL	60	2000	LF	8	10	20,000
21	GRASS CHANNEL	56	3000	LF	12	10	30,000
22	42" RCP	56	120	LF	-	104	12,480
23	GRASS CHANNEL	146	3000	LF	12	10	30,000
24	GRASS CHANNEL	108	1500	LF	6	10	15,000
25	GRASS CHANNEL	106	1500	LF	6	10	15,000
26	GRASS CHANNEL	106	2500	LF	10	10	25,000
27	GRASS CHANNEL	94	2000	LF	8	10	20,000
28	42" RCP	47	120	LF	-	104	12,480
29	GRASS CHANNEL	94	2000	LF	8	10	20,000
30	54" RCP	94	120	LF	-	124	14,880
31	GRASS CHANNEL	71	2000	LF	8	10	20,000
32	48" RCP	69	120	LF	-	116	13,920
33	GRASS CHANNEL	80	1500	LF	6	10	15,000
34	GRASS CHANNEL	192	3000	LF	12	16	48,000
35	GRASS CHANNEL	282	2500	LF	10	16	40,000
36	GRASS CHANNEL	186	2000	LF	8	16	32,000
37	GRASS CHANNEL	83	2000	LF	8	10	20,000
38	GRASS CHANNEL	83	1250	LF	5	10	12,500
39	GRASS CHANNEL	83	1500	LF	6	10	15,000
40	GRASS CHANNEL	125	2000	LF	8	10	20,000
41	GRASS CHANNEL	268	2250	LF	9	16	36,000
42	GRASS CHANNEL	125	1750	LF	7	10	17,500
43	GRASS CHANNEL	67	1500	LF	6	10	15,000
44	48" RCP	67	120	LF	-	116	13,920
45	8'x 7' CBC	423	120	LF	-	275	33,000
46	48" RCP	75	120	LF	-	116	13,920
47	10'x 9' CBC	756	120	LF	-	390	46,800
48	10'x 9' CBC	728	120	LF	-	390	46,800
49	8'x 8' CBC	450	120	LF	-	290	34,800
50	(10'x 10')x 8' CBC	1500	120	LF	-	670	80,400
						SUBTOTAL	$1,163,440
URBAN							
-	18" RCP		750	LF	-	$48	$36,000
-	24" RCP		9000	LF	-	61	549,000
-	30" RCP		4250	LF	-	76	323,000
-	36" RCP		10000	LF	-	87	870,000
-	42" RCP		3500	LF	-	104	364,000
-	48" RCP		3500	LF	-	116	406,000
-	INLETS		66	LF	-	2,500	165,000
						SUBTOTAL	$2,713,000

NOTES: 1) Grass channel costs include channel excavation, revegetation drop structure excavation and riprap construction.

2) Assume 1 drop structure for every 250' of channel length. Assume an average drop structure cost of $1500 (flow <150 cfs) and $3000 (flow >150 cfs)

TABLE 11

BLACK SQUIRREL CREEK DRAINAGE BASIN
ESTIMATED UNIT CONSTRUCTION COSTS

ITEM	UNIT	UNIT COST
RIP-RAP	CY	$25.00
RIP-RAP (GROUTED EMBANKMENT)	SY	30.00
DAM EMBANKMENT	CY	3.00
EXCAVATION & EMBANKMENT	CY	1.50
GRANULAR BEDDING FOR RIP-RAP	CY	12.00
BEND PROTECTION	EA	10,000.00
REVEGETATION (Non-reimbursable when placed over riprap only)	AC	2,500.00
DROP STRUCTURES -		
MAJOR URBAN	EA	60,000.00
MAJOR RURAL	EA	10,000.00
INITIAL RURAL (Q >150 cfs)	EA	3,000.00
INITIAL RURAL (Q <150 cfs)	EA	1,500.00
REINFORCED CONCRETE BOXES -		
CONCRETE	CY	180.00
STEEL	LB	0.50
TRANSITIONS & HEADWALL	EA	12,000.00
REINFORCED CONCRETE PIPE - (Including all appurtenances)		
15" Dia	LF	40.00
18" Dia	LF	48.00
24" Dia	LF	61.00
30" Dia	LF	76.00
36" Dia	LF	87.00
42" Dia	LF	104.00
48" Dia	LF	116.00
54" Dia	LF	124.00
60" Dia	LF	131.00

TABLE 12

BLACK SQUIRREL CREEK DRAINAGE BASIN
ESTIMATED ANNUAL MAINTENANCE COSTS

ITEM	UNIT	UNIT COST
Detention Ponds		
Sediment Removal	Cubic Yard	$5.00
Annual Inspection	Each Pond	200.00
Mowing	Per Acre	300.00
Debris Removal	Each Pond	600.00
Channels		
Lined	Per 1000 LF	850.00
Unlined	Per 1000 LF	300.00

VIII. DRAINAGE FEE DETERMINATION

Black Squirrel Creek encompasses a total drainage area of 6982 acres. Excluding the U. S. Air Force Academy land, the rights-of-way for major roads, and the presently platted acreage within the basin, there is approximately 6226 acres of unplatted developable acreage within the basin. Of this area, 1256 acres are within the assumed urban area (between Interstate 25 and State Highway 83) and 4970 acres are assumed to be rural (east of State Highway 83).

Per 1988 El Paso County Criteria, drainage fees for residential subdivisions having a lot size of 1.0 acres or greater shall be assessed only for the first acre of each lot. Since the area outside the urban planning boundary was assumed to have an average lot size of 5 acres, the total acres that would pay fees in this area would be 4970 acres divided by 5 acres per lot or 994 acres. The recommended drainage fee presented herein was computed by dividing the sum of the estimated costs to complete the master planned storm drainage system (including the estimated cost to prepare the Master Plans) by the total area within the basin paying fees upon future platting.

Black Squirrel Creek Drainage Fee:

$$\frac{\text{Costs}}{\text{Area}} = \frac{\$\ 12,435,662}{(1,256 + 994)\ \text{acres}} = \$5,527/\text{acre}$$

IX. BRIDGE AND DETENTION LAND FEE DETERMINATION

Currently, arterial road crossings are designated at design points 4, 6, 7, 9 and 10, and along reach 20 (see attached Figure 4). Presently, there are no funds established for either City or County participation in construction of arterial bridges in the basin. Per the Northgate annexation agreement, the City of Colorado Springs will not participate in the cost of any arterial bridges in the area presently in the City. It is assumed that future annexation agreements will contain similar provisions in regard to funding bridge construction. Therefore, the bridge and detention land fee will be calculated at this time in the same manner as the drainage fee. If money does become available at a later date, the fees should be recalculated, approved, and added as an addendum to this report.

Black Squirrel Creek Bridge Fee:

$$\frac{\text{Costs}}{\text{Area}} = \frac{\$\ 1{,}455{,}935}{(1{,}256 + 994 \text{ acres})} = \$647/\text{acre}$$

Black Squirrel Creek Detention Pond Land Fee:

$$\frac{\text{Costs}}{\text{Area}} = \frac{\$\ 324{,}800}{(1{,}256 + 994 \text{ acres})} = \$144/\text{acre}$$

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APPENDIX A

TR-20 HISTORIC AND RECOMMENDED COMPUTER PRINTOUTS

BLACK SQUIRREL CREEK DRAINAGE BASIN
TR-20 & HEC-2 CROSS-REFERENCE

IGURE 3 - PRESENT CONDITIONS TR-20 ID	LOCATION *	FIGURE 4 - DEVELOPED CONDITIONS TR-20 ID	LOCATION *	HEC-2 DATA HEC-2 ID
SECT 1	REACH 2	-	- -	-
..SECT 2	REACH 3 & 5	XSECT 1	REACH 5	-
XSECT 3	REACH 6 & 7	XSECT 2	REACH 7	-
SECT 4	REACH 9 & 10	XSECT 3	REACH 9 & 10	-
SECT 5	REACH 17 & 19	XSECT 4	REACH 17 & 19	-
XSECT 6	REACH 20	XSECT 5	REACH 20	-
-	- -	XSECT 6	REACH 22	-
SECT 7	REACH 22,23&24	XSECT 7	REACH 23 & 24	-
..SECT 8	REACH 26 & 27	XSECT 8	REACH 26	-
-	- -	XSECT 9	REACH 27	-
SECT 9	REACH 29	XSECT 10	REACH 29	-
-	- -	XSECT 12	REACH 25	-
STRUC 1	DES PT 1 - Ttl	-	DES PT 1A - Ttl	89
..TRUC 2	DES PT 2 - Ttl	-	DES PT 1B - Ttl	85
-	- -	STRUC 1	DES PT 1 - Ttl	-
STRUC 3	DES PT 3 - Ttl	-	- -	108
-	- -	STRUC 2	DES PT 2 - Ttl	-
TRUC 24	DES PT 4 - W	-	- -	-
..TRUC 44	DES PT 4 - E	-	- -	-
STRUC 4	DES PT 4 - Ttl	STRUC 3	DES PT 3 - Ttl	72
-	- -	STRUC 24	DES PT 4 - W	-
-	- -	STRUC 44	DES PT 4 - E	-
-	- -	STRUC 4	DES PT 4 - Ttl	-
..TRUC 5	DES PT 5 - Ttl	-	- -	45
TRUC 26	DES PT 6 - W	STRUC 25	DES PT 5 - W	-
STRUC 46	DES PT 6 - E	STRUC 45	DES PT 5 - E	-
STRUC 6	DES PT 6 - Ttl	STRUC 5	DES PT 5 - Ttl	38
TRUC 7	DES PT 7 - Ttl	STRUC 6	DES PT 6 - Ttl	33
-	- -	STRUC 7	DES PT 7 - Ttl	-
-	- -	STRUC 8	DES PT 8 - Ttl	-
TRUC 8	DES PT 8 - Ttl	STRUC 9	DES PT 9 - Ttl	24
-	- -	STRUC 10	DES PT 10 - Ttl	-
STRUC 9	DES PT 9 - Ttl	STRUC 11	DES PT 11 - Ttl	16
..TRUC 10	DES PT 10 - Ttl	STRUC 12	DES PT 12 - Ttl	10
-	- -	STRUC 51	DET PD 1	-
-	- -	STRUC 52	DET PD 2	-
-	- -	STRUC 53	DET PD 3	-
-	- -	STRUC 54	DET PD 4	-
-	- -	STRUC 55	DET PD 5	-
-	- -	STRUC 56	DET PD 6	-
-	- -	STRUC 57	DET PD 7	-
-	- -	STRUC 58	DET PD 8	-
-	- -	STRUC 59	DET PD 9	-

* - Reach & detention pond location is as shown on Figure 4.
Design point location is as shown on Figure 3 or 4, respectively.

OTE - The following codes correspond to the TR-20 ID's above:
"10" series codes refer to the total Design Point.
"20" series codes refer to the West side of Design Point.
"40" series codes refer to the East side of Design Point.
"50" series codes refer to the detention pond at that Design Point.

```
**********80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY**********

JOB TR-20                                          SUMMARY   NOPLOTS
 ITLE     BLACK SQUIRREL CREEK BASIN - DEVELOPED CONDITIONS W/ 9 PONDS
TITLE     10 YR & 100 YR 24-HR STORMS    3rd SUBMITTAL
 5 RAINFL 1                0.5
 8              0.0000     0.0015     0.0045     0.0080     0.0120
 8              0.0165     0.0210     0.0255     0.0320     0.0460
 8              0.0600     0.1000     0.7000     0.7500     0.7800
 8              0.8000     0.8200     0.8300     0.8400     0.8500
 8              0.8600     0.8675     0.8750     0.8825     0.8900
 8              0.8975     0.9050     0.9115     0.9180     0.9240
 8              0.9300     0.9350     0.9400     0.9450     0.9500
 8              0.9550     0.9600     0.9650     0.9700     0.9750
 8              0.9800     0.9825     0.9850     0.9875     0.9900
 8              0.9925     0.9950     0.9975     1.0000     1.0000
 9 ENDTBL
 2 XSECTN   001              1.0
 8                         7040.0        0.0        0.0
 8                         7041.2       50.0        8.9
 8                         7041.8      100.0       14.2
 8                         7042.3      150.0       18.6
 8                         7042.7      200.0       22.7
 8                         7043.1      250.0       26.1
 8                         7043.5      300.0       29.5
 8                         7043.8      350.0       32.9
 8                         7044.2      400.0       36.3
 8                         7045.3      600.0       47.9
 8                         7047.4      800.0      109.0
 8                         7047.9     1000.0      130.4
 8                         7048.8     1500.0      176.5
 9 ENDTBL
 2 XSECTN   002              1.0
 8                         7174.6        0.0        0.0
 8                         7175.6       50.0       12.5
 8                         7175.9      100.0       21.9
 8                         7176.1      150.0       30.4
 8                         7176.3      200.0       38.1
 8                         7176.4      250.0       44.4
 8                         7176.6      300.0       50.8
 8                         7176.7      350.0       57.1
 8                         7176.8      400.0       63.4
 8                         7177.2      600.0       85.4
 8                         7177.6      800.0      104.9
 8                         7177.9     1000.0      123.1
 8                         7178.6     1500.0      167.8
 9 ENDTBL
 2 XSECTN   003              1.0
```

```
                          6971.4        0.0        0.0
                          6972.6       50.0        8.9
                          6973.2      100.0       14.2
                          6973.7      150.0       18.5
                          6974.1      200.0       22.7
                          6975.6      400.0       36.3
                          6976.7      600.0       47.9
                          6978.9      800.0      109.6
                          6979.3     1000.0      128.5
                          6980.2     1500.0      177.3
                          6981.0     2000.0      217.9
                          6982.1     3000.0      283.4
ENDTBL
XSECTN   004               1.0
                          7000.0        0.0        0.0
                          7001.2       50.0        8.8
                          7001.8      100.0       14.2
                          7002.7      200.0       22.6
                          7004.1      400.0       36.2
                          7005.3      600.0       47.9
                          7007.4      800.0      108.5
                          7007.9     1000.0      131.7
                          7008.8     1500.0      176.1
                          7009.5     2000.0      215.4
                          7010.7     3000.0      283.1
ENDTBL
XSECTN   005               1.0
                          6905.0        0.0        0.0
                          6906.0       96.0       28.0
                          6907.0      316.0       60.0
                          6908.0      646.0       98.0
                          6909.0     1087.0      140.0
                          6910.0     1645.0      188.0
                          6911.0     2324.0      240.0
                          6912.0     3131.0      298.0
                          6913.0     4072.0      360.0
                          6914.0     5155.0      428.0
                          6915.0     6385.0      500.0
ENDTBL
XSECTN   006               1.0
                          6830.0        0.0        0.0
                          6831.0      164.0       17.0
                          6832.0      606.0       40.0
                          6833.0     1356.0       69.0
                          6834.0     2457.0      104.0
                          6835.0     3951.0      145.0
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**********80-80 LIST OF INPUT DATA (CONTINUED)**********

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 3                      6836.0     5879.0      192.0
 8                      6837.0     8280.0      245.0
 8                      6838.0    11193.0      304.0
 3                      6838.5    12853.0      336.0
 ? ENDTBL
 2 XSECTN   007           1.0
 3                      6719.0        0.0        0.0
 3                      6719.5      167.0      101.0
 8                      6720.0      535.0      204.0
 3                      6720.5     1063.0      309.0
 3                      6721.0     1733.0      416.0
 8                      6721.5     2539.0      525.0
 8                      6722.0     3472.0      636.0
 3                      6722.5     4531.0      749.0
 3                      6723.0     5712.0      864.0
 8                      6723.5     7014.0      981.0
 3                      6724.0     8434.0     1100.0
 ? ENDTBL
 2 XSECTN   008           1.0
 9                      6613.0        0.0        0.0
 3                      6614.0      174.0       18.0
 d                      6615.0      638.0       42.0
 8                      6616.0     1418.0       72.0
 3                      6617.0     2557.0      108.0
 3                      6618.0     4096.0      150.0
 8                      6619.0     6075.0      198.0
 ]                      6620.0     8534.0      252.0
 /                      6621.0    11510.0      312.0
 9 ENDTBL
 ? XSECTN   009           1.0
 /                      6560.0        0.0        0.0
 d                      6561.4      100.0       15.1
 8                      6562.2      200.0       24.2
 /                      6563.6      400.0       59.8
 3                      6564.0      600.0       75.7
 8                      6564.5      800.0       93.9
 ]                      6564.8     1000.0      108.1
 /                      6565.6     1500.0      144.7
 8                      6566.4     2000.0      178.0
 9                      6567.6     3000.0      238.9
                        6568.7     4000.0      294.6
 d                      6569.7     5000.0      347.7
 8                      6570.6     6000.0      397.9
                        6571.4     7000.0      446.1
   ENDTBL
 2 XSECTN   010           1.0
```

```
                          6516.0        0.0        0.0
                          6517.6      100.0       15.1
                          6518.4      200.0       24.1
                          6519.7      400.0       38.5
                          6520.7      600.0       50.8
                          6521.6      800.0       62.5
                          6523.3     1000.0      107.8
                          6524.9     1500.0      185.6
                          6525.9     2000.0      261.4
                          6526.9     3000.0      336.0
                          6527.7     4000.0      401.0
                          6528.4     5000.0      456.5
                          6529.7     7000.0      559.0
ENDTBL
XSECTN    012               1.0
                          6800.0        0.0        0.0
                          6801.0       17.0        3.8
                          6802.0      108.0       15.0
                          6803.0      319.0       33.8
                          6804.0      686.0       60.0
                          6805.0     1231.0       94.5
                          6806.0     2016.0      138.0
ENDTBL
STRUCT      51
                          7100.0        0.0        0.0
                          7102.0       20.0        4.5
                          7104.0       60.0        9.9
                          7106.0       90.0       15.2
                          7108.0      110.0       20.5
                          7110.0      130.0       25.9
                          7110.5      188.0       27.1
                          7111.0      290.0       28.4
                          7112.0      569.0       31.2
                          7113.0      929.0       33.7
ENDTBL
STRUCT      52
                          7120.0        0.0        0.0
                          7122.0       20.0        4.7
                          7124.0       60.0       10.4
                          7126.0       90.0       16.1
                          7128.0      110.0       21.6
                          7130.0      130.0       27.3
                          7130.5      188.0       28.6
                          7131.0      290.0       30.0
                          7132.0      569.0       32.9
                          7133.0      929.0       35.6
```

```
 9 ENDTBL
 3 STRUCT      53
 8                      7200.0         0.0         0.0
 8                      7202.0        20.0         5.9
 8                      7204.0        60.0        11.9
 8                      7206.0        90.0        19.3
 8                      7208.0       110.0        26.8
 8                      7210.0       130.0        34.2
 8                      7211.0       390.0        38.1
 8                      7212.0       851.0        41.7
 8                      7213.0      1448.0        45.6
 9 ENDTBL
 3 STRUCT      54
 8                      6900.0         0.0         0.0
 8                      6901.0         7.0         1.7
 8                      6902.0        18.0         3.6
 8                      6903.0        35.0         5.3
 8                      6904.0        50.0         7.1
 8                      6905.0        60.0         9.2
 8                      6906.0        70.0        10.7
 8                      6907.0       208.0        12.5
 8                      6908.0       456.0        14.2
 8                      6909.0       777.0        16.0
 9 ENDTBL
 3 STRUCT      55       6900.0         0.0         0.0
 8                      6902.0        18.0         0.9
 8                      6904.0        50.0         2.1
 8                      6906.0        70.0         3.4
 8                      6908.0        80.0         5.0
 8                      6910.0        90.0         6.8
 8                      6911.0       120.0         7.7
 8                      6912.0       175.0         9.0
 9 ENDTBL
 3 STRUCT      56
 8                      6900.0         0.0         0.0
 8                      6902.0        20.0         2.0
 8                      6904.0        60.0         4.0
 8                      6906.0        90.0         6.5
 8                      6908.0       110.0         9.0
 8                      6910.0       130.0        11.5
 8                      6911.0       390.0        12.8
 8                      6912.0       851.0        14.0
 8                      6913.0      1448.0        15.3
 7 ENDTBL
 3 STRUCT      57
 8                      6900.0         0.0         0.0
```

```
1**********80-80 LIST OF INPUT DATA (CONTINUED)**********
 8                        6901.0        7.0        1.1
 8                        6902.0       18.0        2.3
 8                        6903.0       35.0        3.4
 8                        6904.0       50.0        4.5
 8                        6905.0       60.0        5.6
 8                        6906.0       70.0        6.8
 8                        6907.0      208.0        7.9
 8                        6908.0      456.0        9.0
 8                        6909.0      777.0       10.1
 9 ENDTBL
 3 STRUCT      58
 8                        6900.0        0.0        0.0
 8                        6902.0       18.0        0.9
 8                        6904.0       50.0        2.1
 8                        6906.0       70.0        3.4
 8                        6908.0       80.0        5.0
 8                        6910.0       90.0        6.8
 8                        6911.0      120.0        7.7
 8                        6912.0      175.0        9.0
 9 ENDTBL
 3 STRUCT      59
 8                        6900.0        0.0        0.0
 8                        6902.0       20.0        2.3
 8                        6904.0       60.0        4.6
 8                        6906.0       90.0        7.4
 8                        6908.0      110.0       10.3
 8                        6910.0      130.0       13.1
 8                        6911.0      390.0       14.5
 8                        6912.0      851.0       16.0
 8                        6913.0     1448.0       17.4
 7 ENDTBL
 5 RUNOFF 1    01     5      1.441       68.8       0.62 1    1   1 BASIN A
 6 RESVOR 2    51 5   7                                  1    1   1 DET #1
 6 REACH  3 001 7     1   2200.                          1         PT 1-3
 5 RUNOFF 1    02     5      1.401       69.4       0.81 1    1   1 BASIN B
 6 RESVOR 2    52 5   6                                  1    1   1 DET #2
 6 REACH  3 002 6     7   3000.                          1         PT 2-3
 5 ADDHYD 4    03 7 1 5                                  1    1   1 PT 3
 5 RUNOFF 1    03     2      0.304       71.3       0.28 1    1   1 BASIN D
 6 ADDHYD 4    03 5 2 6                                  1    1   1 PT 3
 5 REACH  3 003 6     5   3400.                          1         PT 3-5
 5 RUNOFF 1    05     7      0.380       69.1       0.32 1    1   1 BASIN E
 6 ADDHYD 4    25 5 7 2                                  1    1   1 PT 5W
 6 RUNOFF 1    24     5      1.839       68.3       0.66 1    1   1 BN C1/4W
 5 RESVOR 2    53 5   7                                  1    1   1 DET #3
 6 RUNOFF 1    44     6      1.159       68.3       0.55 1    1   1 BN C2/4E
```

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**********80-80 LIST OF INPUT DATA (CONTINUED)**********

 5 ADDHYD 4   04 6 7 5                                    1    1   1 PT 4
 5 REACH  3 004   5   6   8500.                           1        PT 4-5
 6 RUNOFF 1   05      5      0.994      70.0      0.84 1   1   1 BN F1+
 5 ADDHYD 4   05 6 5 7                                    1    1   1 PT 5E-
 5 RUNOFF 1   05      5      0.519      70.0      0.45 1   1   1 BSN F2
 6 RESVOR 2   54 5   6                                    1    1   1 DET #4
 5 REACH  3 004   6   5   3000.                           1        F2-PT 5
 5 ADDHYD 4   45 5 7 6                                    1    1   1 PT 5E
 6 ADDHYD 4   05 2 6 5                                    1    1   1 PT 5
 6 REACH  3 005   5   6   5000.                           1        PT 5-6
 5 RUNOFF 1   06      5      0.548      81.6      0.62 1   1   1 BN 62+
 5 ADDHYD 4   06 6 5 7                                    1    1   1 PT 6-
 6 RUNOFF 1   06      6      0.427      71.4      0.41 1   1   1 BSN 63
 5 ADDHYD 4   06 6 7 5                                    1    1   1 PT 6
 5 REACH  3 006   5   7   2400.                           1        PT 6-7
 6 RUNOFF 1   07      2      0.211      87.0      0.34 1   1   1 BASIN H
 6 ADDHYD 4   07 7 2 6                                    1    1   1 PT 7
 5 REACH  3 007   6   7   3900.                           1        PT 7-8
 6 RUNOFF 1   08      5      0.098      87.0      0.22 1   1   1 BSN I1
 6 RESVOR 2   55 5   6                                    1    1   1 DET #5
 5 ADDHYD 4   08 7 6 3                                    1    1   1 PT 8-
 5 RUNOFF 1   08      5      0.119      87.0      0.26 1   1   1 BSN I2
 6 ADDHYD 4   08 5 3 7                                    1    1   1 PT 8
 5 REACH  3 007   7   1   2500.                           1        PT 8-9
 5 RUNOFF 1   09      5      0.164      87.0      0.25 1   1   1 BSN J1
 6 RESVOR 2   56 5   7                                    1    1   1 DET #6
 6 REACH  3 012   7   6   3300.                           1        DET8-P9
 5 RUNOFF 1   09      5      0.105      87.0      0.23 1   1   1 BSN J2
 5 ADDHYD 4   09 6 5 7                                    1    1   1 INF RS9
 6 RESVOR 2   57 7   6                                    1    1   1 DET #7
 5 ADDHYD 4   09 1 6 2                                    1    1   1 PT 9-
 5 RUNOFF 1   09      5      0.042      87.0      0.19 1   1   1 BSN J3
 6 ADDHYD 4   09 5 2 1                                    1    1   1 PT 9-
 5 RUNOFF 1   09      5      0.128      87.0      0.30 1   1   1 BSN J4
 6 RESVOR 2   58 5   7                                    1    1   1 DET #8
 6 ADDHYD 4   09 7 1 5                                    1    1   1 PT 9
 6 REACH  3 008   5   6   3150.                           1        PT 9-10
 6 RUNOFF 1   10      2      0.156      87.0      0.33 1   1   1 BASIN K
 6 ADDHYD 4   10 6 2 7                                    1    1   1 PT 10
 6 REACH  3 009   7   1   4700.                           1        PT 10-11
 6 RUNOFF 1   11      7      0.272      87.0      0.42 1   1   1 BSN L3
 6 ADDHYD 4   11 7 1 2                                    1    1   1 PT 11-
 6 RUNOFF 1   11      5      0.263      87.0      0.35 1   1   1 BSN L2
 6 ADDHYD 4   11 5 2 1                                    1    1   1 PT 11-
 6 RUNOFF 1   11      5      0.195      79.0      0.45 1   1   1 BSN L1
 6 RESVOR 2   59 5   7                                    1    1   1 DET #9
```

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**********BO-BO LIST OF INPUT DATA (CONTINUED)**********

  ADDHYD 4    11 1 7 6                                    1     1   1 PT 11
  REACH  3 010   6   7    4900.                           1           PT11-12
6 RUNOFF 1    12     1       0.144        68.3        0.38 1     1   1 BASIN M
  ADDHYD 4    12 7 1 5                                    1     1   1 PT 12
  ENDATA
7 INCREM 6                0.1
7 COMPUT 7    01    12                3.0       1.0       1 2  01  01 10 YEAR
  ENDCMP 1
  COMPUT 7    01    12                4.6       1.0       1 2  01  02 100 YEAR
  ENDCMP 1
  ENDJOB 2

**********END OF BO-BO LIST**********

EXECUTIVE CONTROL OPERATION INCREM     MAIN TIME INCREMENT =   .10 HOURS                                        RECORD ID

..ECUTIVE CONTROL OPERATION COMPUT     FROM STRUCTURE  1  TO STRUCTURE 12                                       RECORD ID 10 YEAR
       STARTING TIME =   .00    RAIN DEPTH =  3.00    RAIN DURATION=  1.00    RAIN TABLE NO.= 1    ANT. MOIST. COND= 2
       ALTERNATE NO.= 1         STORM NO.= 1    MAIN TIME INCREMENT =   .10 HOURS

"ERATION RUNOFF   STRUCTURE  1

          PEAK TIME(HRS)          PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              6.30                      408.96                       (RUNOFF)
              9.98                       25.71                       (RUNOFF)
             12.99                       20.28                       (RUNOFF)
             19.95                       14.54                       (RUNOFF)
             23.86                        7.40                       (RUNOFF)

 RUNOFF VOLUME ABOVE BASEFLOW =   .66 WATERSHED INCHES,    614.62 CFS-HRS,    50.79 ACRE-FEET;   BASEFLOW =    .00 CFS

OPERATION RESVOR   STRUCTURE 51

          PEAK TIME(HRS)          PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              7.11                       98.08                       7106.81

 RUNOFF VOLUME ABOVE BASEFLOW =   .66 WATERSHED INCHES,    611.32 CFS-HRS,    50.52 ACRE-FEET;   BASEFLOW =    .00 CFS

   ### WARNING  REACH   1 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT  ###

OPERATION REACH    CROSS SECTION   1

          PEAK TIME(HRS)          PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              7.22                       98.06                       7041.78

 RATION RUNOFF   STRUCTURE  2

          PEAK TIME(HRS)          PEAK DISCHARGE(CFS)          PEAK ELEVATION(FEET)
              6.43                      339.72                       (RUNOFF)
             13.01                       20.17                       (RUNOFF)
             19.92                       14.42                       (RUNOFF)
```

RUNOFF VOLUME ABOVE BASEFLOW = .69 WATERSHED INCHES, 620.99 CFS-HRS, 51.32 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 52

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.35	95.04	7126.50

RUNOFF VOLUME ABOVE BASEFLOW = .68 WATERSHED INCHES, 616.82 CFS-HRS, 50.97 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.59	94.56	7175.87

ERATION ADDHYD STRUCTURE 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.43	191.40	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .67 WATERSHED INCHES, 1227.59 CFS-HRS, 101.45 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.09	180.62	(RUNOFF)
7.95	11.65	(RUNOFF)
9.95	6.09	(RUNOFF)
19.90	3.36	(RUNOFF)
23.87	1.71	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .77 WATERSHED INCHES, 151.99 CFS-HRS, 12.56 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.10	186.39	(NULL)
7.36	203.16	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .68 WATERSHED INCHES, 1379.59 CFS-HRS, 114.01 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 3 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION REACH CROSS SECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.21	177.18	6973.92
7.48	203.10	6974.12

OPERATION RUNOFF STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.11	178.31	(RUNOFF)
7.96	13.14	(RUNOFF)
9.96	6.92	(RUNOFF)
19.91	3.88	(RUNOFF)
23.86	1.97	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .67 WATERSHED INCHES, 165.46 CFS-HRS, 13.67 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 25

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.16	329.93	(NULL)
7.26	217.00	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .68 WATERSHED INCHES, 1544.40 CFS-HRS, 127.63 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 24

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.33	473.09	(RUNOFF)
9.97	32.05	(RUNOFF)
13.00	25.33	(RUNOFF)
19.91	18.16	(RUNOFF)
23.86	9.26	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .64 WATERSHED INCHES, 756.85 CFS-HRS, 62.55 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 53

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.33	98.51	7206.85

RUNOFF VOLUME ABOVE BASEFLOW = .63 WATERSHED INCHES, 747.08 CFS-HRS, 61.74 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 44

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.26	343.06	(RUNOFF)
9.97	20.23	(RUNOFF)
12.98	15.98	(RUNOFF)
19.91	11.46	(RUNOFF)
23.86	5.84	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .64 WATERSHED INCHES, 477.83 CFS-HRS, 39.49 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.29	378.73	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .63 WATERSHED INCHES, 1224.91 CFS-HRS, 101.23 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.49	334.86	7003.64

OPERATION RUNOFF STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.45	247.14	(RUNOFF)
13.03	14.66	(RUNOFF)
19.93	10.46	(RUNOFF)
23.88	5.33	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .71 WATERSHED INCHES, 457.44 CFS-HRS, 37.80 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.47	580.40	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .65 WATERSHED INCHES, 1681.57 CFS-HRS, 138.97 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.19	208.50	(RUNOFF)
9.96	9.79	(RUNOFF)
12.97	7.69	(RUNOFF)
19.90	5.47	(RUNOFF)
23.95	2.80	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .71 WATERSHED INCHES, 239.07 CFS-HRS, 19.76 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 54

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.77	47.85	6903.86

RUNOFF VOLUME ABOVE BASEFLOW = .71 WATERSHED INCHES, 237.50 CFS-HRS, 19.63 ACRE-FEET; BASEFLOW = .00 CFS

**WARNING - LACK OF LOW FLOW DEFINITION FOR XSECT TABLE 4. MAX.FLOW LESS THAN 2ND TABLE VALUE.

OPERATION REACH CROSS SECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.94	47.51	7001.14

OPERATION ADDHYD STRUCTURE 45

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.49	613.98	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .66 WATERSHED INCHES, 1918.89 CFS-HRS, 158.58 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.46	765.48	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .67 WATERSHED INCHES, 3463.29 CFS-HRS, 286.21 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.65	741.22	6908.22

'ERATION RUNOFF STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.24	399.98	(RUNOFF)
9.96	15.52	(RUNOFF)
12.96	11.90	(RUNOFF)
19.94	8.19	(RUNOFF)
23.86	4.13	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.35 WATERSHED INCHES, 478.16 CFS-HRS, 39.51 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.44	983.93	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .71 WATERSHED INCHES, 3940.15 CFS-HRS, 325.61 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RUNOFF STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.16	201.63	(RUNOFF)
9.96	8.55	(RUNOFF)
19.93	4.74	(RUNOFF)
23.91	2.41	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .78 WATERSHED INCHES, 214.42 CFS-HRS, 17.72 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.37	1081.21	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .71 WATERSHED INCHES, 4154.57 CFS-HRS, 343.33 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 6 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

ERATION REACH CROSS SECTION 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.37	1081.21	6832.63

OPERATION RUNOFF STRUCTURE 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.07	287.59	(RUNOFF)
9.92	6.87	(RUNOFF)
12.95	5.23	(RUNOFF)
19.87	3.55	(RUNOFF)
23.85	1.78	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 236.52 CFS-HRS, 19.55 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.29	1206.40	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .74 WATERSHED INCHES, 4391.09 CFS-HRS, 362.88 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.58	1091.59	6720.52

OPERATION RUNOFF STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.01	150.75	(RUNOFF)
7.94	6.29	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 110.23 CFS-HRS, 9.11 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 55

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.21	68.06	6905.81

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 109.85 CFS-HRS, 9.08 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.56	1144.30	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .75 WATERSHED INCHES, 4499.19 CFS-HRS, 371.81 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.04	175.40	(RUNOFF)
7.95	7.71	(RUNOFF)
23.85	1.01	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 133.83 CFS-HRS, 11.06 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.55	1167.26	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .76 WATERSHED INCHES, 4633.03 CFS-HRS, 382.87 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.73	1140.21	6720.56

OPERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.03	244.81	(RUNOFF)
7.95	10.64	(RUNOFF)
9.95	5.37	(RUNOFF)
19.95	2.78	(RUNOFF)
23.90	1.38	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 184.39 CFS-HRS, 15.24 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 56

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.28	84.91	6905.66

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 183.81 CFS-HRS, 15.19 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 12

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.44	82.66	6801.72

ERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.01	159.61	(RUNOFF)
7.95	6.83	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 118.09 CFS-HRS, 9.76 ACRE-FEET; BASEFLOW = .00 CFS

PERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.06	189.70	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 302.09 CFS-HRS, 24.96 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 57

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.93	75.75	6906.04

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 301.30 CFS-HRS, 24.90 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.74	1209.61	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .79 WATERSHED INCHES, 4932.73 CFS-HRS, 407.64 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
5.99	67.34	(RUNOFF)
7.95	2.75	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 47.21 CFS-HRS, 3.90 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.74	1213.91	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .79 WATERSHED INCHES, 4979.94 CFS-HRS, 411.54 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.06	183.85	(RUNOFF)
7.95	8.28	(RUNOFF)
9.95	4.18	(RUNOFF)
19.95	2.17	(RUNOFF)
23.89	1.08	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 143.64 CFS-HRS, 11.87 ACRE-FEET; BASEFLOW = .00 CFS

PERATION RESVOR STRUCTURE 58

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.30	74.11	6906.82
19.95	2.15	6900.24

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 143.50 CFS-HRS, 11.86 ACRE-FEET; BASEFLOW = .00 CFS

PERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.72	1274.13	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .80 WATERSHED INCHES, 5123.44 CFS-HRS, 423.40 ACRE-FEET; BASEFLOW = .00 CFS

WARNING REACH 8 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT

PERATION REACH CROSS SECTION 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.72	1274.13	6615.82

OPERATION RUNOFF STRUCTURE 10

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.07	215.22	(RUNOFF)
9.93	5.08	(RUNOFF)
12.93	3.86	(RUNOFF)
19.86	2.62	(RUNOFF)
23.85	1.32	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 174.99 CFS-HRS, 14.46 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 10

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.71	1297.60	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .82 WATERSHED INCHES, 5298.43 CFS-HRS, 437.86 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 9 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION REACH CROSS SECTION 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.86	1282.64	6565.25

OPERATION RUNOFF STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.11	339.69	(RUNOFF)
9.92	8.85	(RUNOFF)
12.95	6.73	(RUNOFF)
19.87	4.57	(RUNOFF)
23.85	2.30	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 305.24 CFS-HRS, 25.23 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.83	1324.53	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .84 WATERSHED INCHES, 5602.15 CFS-HRS, 462.96 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.08	354.59	(RUNOFF)
9.93	8.56	(RUNOFF)
12.93	6.51	(RUNOFF)
19.86	4.42	(RUNOFF)
23.85	2.22	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 294.75 CFS-HRS, 24.36 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.21	1226.92	(NULL)
6.82	1357.55	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .86 WATERSHED INCHES, 5896.90 CFS-HRS, 487.32 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.15	148.59	(RUNOFF)
9.95	5.12	(RUNOFF)
12.96	3.94	(RUNOFF)
19.88	2.73	(RUNOFF)
23.95	1.39	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.19 WATERSHED INCHES, 149.41 CFS-HRS, 12.35 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 59

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.52	54.29	6903.71

RUNOFF VOLUME ABOVE BASEFLOW = 1.19 WATERSHED INCHES, 149.35 CFS-HRS, 12.34 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.22	1260.72	(NULL)
6.81	1405.50	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .87 WATERSHED INCHES, 6046.25 CFS-HRS, 499.66 ACRE-FEET; BASEFLOW = .00 CFS

'ERATION REACH CROSS SECTION 10

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.00	1379.33	6524.51

'ERATION RUNOFF STRUCTURE 12

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.15	55.38	(RUNOFF)
7.96	4.79	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = .64 WATERSHED INCHES, 59.39 CFS-HRS, 4.91 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 12

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.00	1386.82	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = .87 WATERSHED INCHES, 6103.67 CFS-HRS, 504.41 ACRE-FEET; BASEFLOW = .00 CFS

ECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1 RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM STRUCTURE 1 TO STRUCTURE 12 RECORD ID 100 YEAR
STARTING TIME = .00 RAIN DEPTH = 4.60 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .10 HOURS

'ERATION RUNOFF STRUCTURE 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.26	1204.75	(RUNOFF)
9.97	54.56	(RUNOFF)
12.97	42.19	(RUNOFF)
19.95	29.42	(RUNOFF)
23.86	14.86	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.66 WATERSHED INCHES, 1541.15 CFS-HRS, 127.36 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 51

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.50	905.81	7112.94

RUNOFF VOLUME ABOVE BASEFLOW = 1.65 WATERSHED INCHES, 1530.44 CFS-HRS, 126.48 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 1 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

PERATION REACH CROSS SECTION 1

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.62	879.80	7047.60

PERATION RUNOFF STRUCTURE 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.39	985.09	(RUNOFF)
12.98	41.59	(RUNOFF)
19.89	28.94	(RUNOFF)
23.86	14.64	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.70 WATERSHED INCHES, 1536.36 CFS-HRS, 126.96 ACRE-FEET; BASEFLOW = .00 CFS

PERATION RESVOR STRUCTURE 52

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.67	739.72	7132.47

RUNOFF VOLUME ABOVE BASEFLOW = 1.69 WATERSHED INCHES, 1529.91 CFS-HRS, 126.43 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 2 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

PERATION REACH CROSS SECTION 2

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.81	708.05	7177.42

PERATION ADDHYD STRUCTURE 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.72	1430.20	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.67 WATERSHED INCHES, 3065.68 CFS-HRS, 253.35 ACRE-FEET; BASEFLOW = .00 CFS

PERATION RUNOFF STRUCTURE 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.07	458.76	(RUNOFF)
7.95	24.11	(RUNOFF)
9.95	12.37	(RUNOFF)
12.95	9.50	(RUNOFF)
14.95	7.71	(RUNOFF)
19.88	6.56	(RUNOFF)
23.86	3.31	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.84 WATERSHED INCHES, 361.29 CFS-HRS, 29.86 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.09	487.73	(NULL)
6.72	1476.47	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.69 WATERSHED INCHES, 3426.97 CFS-HRS, 283.21 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 3 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION REACH CROSS SECTION 3

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.22	455.40	6975.90
6.86	1402.29	6980.02

OPERATION RUNOFF STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.09	492.26	(RUNOFF)
7.95	28.28	(RUNOFF)
9.95	14.58	(RUNOFF)
12.95	11.25	(RUNOFF)
14.94	9.12	(RUNOFF)
19.89	7.81	(RUNOFF)
23.86	3.95	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.68 WATERSHED INCHES, 412.09 CFS-HRS, 34.05 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 25

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.14	881.86	(NULL)
6.86	1449.65	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.68 WATERSHED INCHES, 3833.65 CFS-HRS, 316.81 ACRE-FEET; BASEFLOW = .00 CFS

PERATION RUNOFF STRUCTURE 24

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.29	1421.39	(RUNOFF)
9.91	68.61	(RUNOFF)
12.97	53.13	(RUNOFF)
19.88	37.04	(RUNOFF)
23.86	18.75	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.62 WATERSHED INCHES, 1919.16 CFS-HRS, 158.60 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RESVOR STRUCTURE 53

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.54	1084.93	7212.39

RUNOFF VOLUME ABOVE BASEFLOW = 1.60 WATERSHED INCHES, 1900.17 CFS-HRS, 157.03 ACRE-FEET; BASEFLOW = .00 CFS

PERATION RUNOFF STRUCTURE 44

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.22	1029.34	(RUNOFF)
9.96	43.29	(RUNOFF)
12.96	33.52	(RUNOFF)
19.89	23.35	(RUNOFF)
23.86	11.82	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.62 WATERSHED INCHES, 1211.96 CFS-HRS, 100.16 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.24	1135.02	(NULL)
6.50	1640.67	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.61 WATERSHED INCHES, 3112.12 CFS-HRS, 257.19 ACRE-FEET; BASEFLOW = .00 CFS

'ERATION REACH CROSS SECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.69	1345.55	7008.52

'ERATION RUNOFF STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.41	703.88	(RUNOFF)
12.99	29.95	(RUNOFF)
19.90	20.81	(RUNOFF)
23.87	10.52	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 1117.07 CFS-HRS, 92.31 ACRE-FEET; BASEFLOW = .00 CFS

'ERATION ADDHYD STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.63	1909.34	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.64 WATERSHED INCHES, 4230.86 CFS-HRS, 349.64 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.16	575.37	(RUNOFF)
9.95	20.33	(RUNOFF)
12.96	15.69	(RUNOFF)
19.88	10.88	(RUNOFF)
23.95	5.53	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 583.87 CFS-HRS, 48.25 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 54

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.35	388.59	6907.73

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 583.33 CFS-HRS, 48.21 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 4 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

PERATION REACH CROSS SECTION 4

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.46	386.66	7004.01

PERATION ADDHYD STRUCTURE 45

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.58	2202.41	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.65 WATERSHED INCHES, 4809.51 CFS-HRS, 397.46 ACRE-FEET; BASEFLOW = .00 CFS

JPERATION ADDHYD STRUCTURE 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.76	3327.85	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.67 WATERSHED INCHES, 8643.16 CFS-HRS, 714.27 ACRE-FEET; BASEFLOW = .00 CFS

WARNING REACH 5 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT

JPERATION REACH CROSS SECTION 5

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.89	3268.58	6912.15

PERATION RUNOFF STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.22	843.76	(RUNOFF)
9.95	27.46	(RUNOFF)
12.95	20.86	(RUNOFF)
19.90	14.16	(RUNOFF)
23.85	7.12	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 2.69 WATERSHED INCHES, 950.11 CFS-HRS, 78.52 ACRE-FEET; BASEFLOW = .00 CFS

PERATION ADDHYD STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.87	3467.32	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.73 WATERSHED INCHES, 9596.11 CFS-HRS, 793.02 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.13	535.93	(RUNOFF)
9.96	17.35	(RUNOFF)
12.96	13.35	(RUNOFF)
19.90	9.23	(RUNOFF)
23.89	4.66	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 1.85 WATERSHED INCHES, 508.84 CFS-HRS, 42.05 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.87	3536.11	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.74 WATERSHED INCHES, 10104.95 CFS-HRS, 835.07 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 6 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION REACH CROSS SECTION 6

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.87	3536.11	6834.72

OPERATION RUNOFF STRUCTURE 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.06	531.83	(RUNOFF)
9.89	11.45	(RUNOFF)
12.91	8.65	(RUNOFF)
19.86	5.83	(RUNOFF)
23.85	2.92	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 434.25 CFS-HRS, 35.89 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.31	3207.40	(NULL)
6.86	3577.29	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.77 WATERSHED INCHES, 10539.19 CFS-HRS, 870.96 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION REACH CROSS SECTION 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.00	3507.29	6722.02

OPERATION RUNOFF STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
5.99	275.01	(RUNOFF)
7.90	10.55	(RUNOFF)
9.95	5.36	(RUNOFF)
19.86	2.71	(RUNOFF)
23.85	1.36	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.20 WATERSHED INCHES, 202.36 CFS-HRS, 16.72 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 55

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.22	91.89	6910.06
12.95	4.02	6901.13
19.95	2.71	6901.04

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 201.66 CFS-HRS, 16.67 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.00	3578.04	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.78 WATERSHED INCHES, 10736.38 CFS-HRS, 887.25 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.02	321.44	(RUNOFF)
7.90	12.81	(RUNOFF)
9.89	6.46	(RUNOFF)
19.88	3.29	(RUNOFF)
23.85	1.65	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.20 WATERSHED INCHES, 245.66 CFS-HRS, 20.30 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.00	3597.40	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.80 WATERSHED INCHES, 10982.04 CFS-HRS, 907.56 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 7 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

PERATION REACH CROSS SECTION 7

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.12	3575.59	6722.05

OPERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.01	448.07	(RUNOFF)
7.95	17.84	(RUNOFF)
9.95	8.95	(RUNOFF)
19.95	4.57	(RUNOFF)
23.88	2.27	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.20 WATERSHED INCHES, 338.51 CFS-HRS, 27.97 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 56

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.24	183.03	6910.20

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 337.42 CFS-HRS, 27.88 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 12 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

ERATION REACH CROSS SECTION 12

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.37	169.61	6802.29

ERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.00	291.61	(RUNOFF)
7.94	11.31	(RUNOFF)
9.95	5.73	(RUNOFF)
19.86	2.90	(RUNOFF)
23.85	1.45	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.20 WATERSHED INCHES, 216.81 CFS-HRS, 17.92 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.04	358.14	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 554.54 CFS-HRS, 45.83 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 57

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.22	284.81	6907.31

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 552.96 CFS-HRS, 45.70 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.12	3696.03	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.84 WATERSHED INCHES, 11533.75 CFS-HRS, 953.15 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
5.98	122.11	(RUNOFF)
7.91	4.52	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.20 WATERSHED INCHES, 86.69 CFS-HRS, 7.16 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.11	3701.98	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.85 WATERSHED INCHES, 11620.44 CFS-HRS, 960.31 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RUNOFF STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.04	332.94	(RUNOFF)
7.95	13.88	(RUNOFF)
9.95	6.97	(RUNOFF)
19.95	3.56	(RUNOFF)
23.87	1.77	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 263.67 CFS-HRS, 21.79 ACRE-FEET; BASEFLOW = .00 CFS

PERATION RESVOR STRUCTURE 58

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.29	148.14	6911.51
19.95	3.53	6900.39

RUNOFF VOLUME ABOVE BASEFLOW = 3.18 WATERSHED INCHES, 263.09 CFS-HRS, 21.74 ACRE-FEET; BASEFLOW = .00 CFS

ERATION ADDHYD STRUCTURE 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.11	3778.76	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.86 WATERSHED INCHES, 11883.53 CFS-HRS, 982.05 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 8 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

ERATION REACH CROSS SECTION 8

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.11	3778.76	6617.79

ERATION RUNOFF STRUCTURE 10

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.06	397.37	(RUNOFF)
9.89	8.47	(RUNOFF)
12.89	6.40	(RUNOFF)
19.86	4.31	(RUNOFF)
23.85	2.16	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 321.22 CFS-HRS, 26.55 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 10

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.67	3508.11	(NULL)
7.11	3803.30	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.88 WATERSHED INCHES, 12204.75 CFS-HRS, 1008.60 ACRE-FEET; BASEFLOW = .00 CFS

*** WARNING REACH 9 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

ERATION REACH CROSS SECTION 9

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
7.23	3788.09	6568.47

ERATION RUNOFF STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.10	635.09	(RUNOFF)
9.89	14.76	(RUNOFF)
12.94	11.15	(RUNOFF)
19.86	7.51	(RUNOFF)
23.85	3.77	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 560.23 CFS-HRS, 46.30 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.74	3592.01	(NULL)
7.22	3829.45	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.92 WATERSHED INCHES, 12762.94 CFS-HRS, 1054.73 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RUNOFF STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.07	656.65	(RUNOFF)
9.89	14.27	(RUNOFF)
12.89	10.78	(RUNOFF)
19.86	7.26	(RUNOFF)
23.85	3.64	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 3.19 WATERSHED INCHES, 540.98 CFS-HRS, 44.71 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.72	3661.48	(NULL)
7.22	3866.55	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.95 WATERSHED INCHES, 13303.91 CFS-HRS, 1099.44 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION RUNOFF STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.13	326.81	(RUNOFF)
9.94	9.33	(RUNOFF)
12.95	7.12	(RUNOFF)
19.87	4.85	(RUNOFF)
23.90	2.44	(RUNOFF)

RUNOFF VOLUME ABOVE BASEFLOW = 2.46 WATERSHED INCHES, 309.28 CFS-HRS, 25.56 ACRE-FEET; BASEFLOW = .00 CFS

ERATION RESVOR STRUCTURE 59

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.53	106.03	6907.60

RUNOFF VOLUME ABOVE BASEFLOW = 2.46 WATERSHED INCHES, 309.33 CFS-HRS, 25.56 ACRE-FEET; BASEFLOW = .00 CFS

OPERATION ADDHYD STRUCTURE 11

PEAK TIME(HRS)	PEAK DISCHARGE(CFS)	PEAK ELEVATION(FEET)
6.71	3764.85	(NULL)
7.21	3952.51	(NULL)

RUNOFF VOLUME ABOVE BASEFLOW = 1.96 WATERSHED INCHES, 13613.24 CFS-HRS, 1125.00 ACRE-FEET; BASEFLOW = .00 CFS