MASTER DRAINAGE STUDY

FOR

STETSON HILLS

Job No. 5161701

April, 1985

PREPARED FOR

AMWEST, INC.
5455 North Union Blvd.
Colorado Springs, Colorado 80936-5069
(303) 598-5151

PREPARED BY

GREINER ENGINEERING SCIENCES, INC.
570 West 44th Avenue
Denver, Colorado 80216
(303) 455-7321

STATEMENTS

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by the negligent acts, errors, or omissions on my part in preparing this report.

Stephen A. Prokopiak, P.E. No. 15323
Vice President

GREINER ENGINEERING SCIENCES, INC.

COLORADO REGISTERED PROFESSIONAL ENGINEER STEPHEN A. PROKOPIAK 15323

The Developer and/or his representative has read and will comply with all the requirements specified in this drainage report and plan.

9/10/85
Authorized Representative
AmWest Development Corporation
5455 N. Union Boulevard
Colorado Springs, CO 80918

Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

9/10/85
City Engineer Date

CONDITIONS OF APPROVAL:

a) This report subject to the Corps of Engineers 404 Permit for drainage ways in the Sand Creek Basin.

b) Reimbursement for 100 year facilities will be based on an open channel section where alternate pipe or box sections are used (not applicable to culverts).

c) All construction subject to City criteria and final design requirements.

MASTER DRAINAGE STUDY
STETSON HILLS
CITY OF COLORADO SPRINGS, COLORADO

JOB. NO. 5161701

April, 1985

PURPOSE OF STUDY

The purpose of this Master Drainage Study is to provide calculations for the existing and future conditions internal drainage and natural stream flood flows through the Stetson Hills site and to prepare a Master Planning Document which acts to guide the Development of the property. This report also includes the analysis of several drainage facilities required to provide positive drainage through the site as well as recommendations of the preliminary sizes of channels, hydraulic structures and the overall impact of the development on downstream properties. This study fulfills the drainage and floodplain management requirements for the City of Colorado Springs, Colorado.

LOCATION AND DESCRIPTION OF STUDY AREA

The Stetson Hills project is located in Sections 17, 18, 19, 20, 29 and 30, Township 13 South, Range 65 West of the Sixth Principal Meridian, City of Colorado Springs, El Paso County Colorado. The location of its site is shown on the Vicinity Map (Figure 1, Appendix). The estimated total area of the proposed development is approximately 2,183 acres.

The Stetson Hills site is located within the Cottonwood Creek and Sand Creek Basins which originate in the Black Forest approximately 6 miles north of the property. Sand Creek flows in a southerly direction from the headwaters area through the center of the Stetson Hills project. Several major tributaries to Sand Creek enter the major channel through the Stetson Hills project. The natural channels are generally meandering, intermittent streams with side banks prone to erosion. The channel bottoms consist of bare soil with relatively no vegetative cover.

This condition is characteristic of streams which are in the process of obtaining an equilibrium condition through aggradation and degradation. The meandering, for example, takes place over a period of years and is caused by different magnitudes of storm runoff and with varying degrees of stream bank channel erosion and sediment deposition. Stabalization of the dynamic stream network must be attained to insure a stable floodplain for future development. The existing Sand Creek channel slope is 1.45% through the site and the average tributary slopes range from 1.2 % to 2.6%. Existing land use in the basin is basically fair to poor range native grassland. This condition was also used by the SCS and FEMA in previous studies.

Soils in the basin belong to A & B and D Hydrologic Soils Groups as identified by the Soil Conservation Service. The majority of the basin, however, consists of A & B soils. These soils are characterized by high to moderate infiltration rates. Runoff from these types of soils is low to medium. Within the site, a small portion of Type D soil can be found. This soil group is characterized by slow infiltration and high runoff potential.

The proposed Stetson Hills Development, as shown on the most current site plan (Figure 2, Appendix), consists of 1015.7 acres of single family residential dwellings, 223.3 acres of multi family residential dwellings, 381.7 acres of commercial, business and industrial development and 250.2 acres of parkland and open space. It is proposed to provide a positive drainage network within the site which will consist of a combination of streets, inlets, storm sewers and swales to convey the storm water runoff into the major tributaries of Sand Creek. The tributaries will then convey runoff into Sand Creek, prior to exiting the site. Sand Creek will require stabilization in order to contain the entire 100-year flood. This stabilization will consist of reshaping the existing channel bottom, lining the sides with rip rap and providing a number of drop structures. A more detailed discussion of this stabilization is contained within the hydraulic structures section of this text. It should be noted that all parcels located within the subject site will be platted outside both the designated FEMA 100-year floodplain (see Figure 3, Appendix and drainage plan) and the proposed ultimate conditions 100-year floodplain. The proposed channel will be designed to contain the floodplains with adequate freeboard to afford added protection for extreme storms of greater magnitude. The existing conditions FEMA Floodplain (which is still in the preliminary Phase) is wider than the proposed ultimate conditions floodplain in a number of places and narrower in others. This discrepancy can be attributed to differences in mapping and the number and location of cross sections used in each of the studies. The overall differences are considered to be small and insignificant.

CRITERIA

The storm drainage criteria published by the City of Colorado Springs (reference 1) was the basis of this report. The criteria was used as minimum standards and was modified to meet more stringent guidelines of the adjacent El Paso County and of the Federal Emergency Management Agency (FEMA).

For example, when performing the peak flow analyses on Sand Creek and major tributaries through the site, both El Paso County and FEMA require use of a 24-hour type IIA distribution. This rainfall distribution normally results in peak flows which are approximately 20-30% higher in magnitude than the flows generated using a 6-hour type IIA graph. In this study, the 24-hour type IIA distribution was used in the Sand Creek basin for the determination of peak flows on Sand Creek and all major tributaries.

The internal site drainage network on the other hand, consists of relatively small basins and is not of interest to FEMA or the County. As per Colorado Springs guidelines, the 100-year, 6-hour type IIA graph was used.

The basis of all hydrologic and drainage calculations was the SCS procedure (References 1, 2, 3). For Sand Creek and major tributaries the SCS TR-20 Computer Program was used to model the stream network calculations. For the internal site drainage, the modified SCS hand calculations were used. The rainfall intensities used in the study were obtained from the NOAA Atlas (Reference 4). The precipitation values used were 3.5 inches and 4.5 inches for the 100-year 6-hour and 24-hour storms, respectively, and 2.1 inches and 2.7 inches for the 5 year 6-hour and 24-hour storms, respectively. The point rainfall values were not adjusted for area since the adjustments are insignificant at the maximum acreage experienced (98.5%).

The base SCS Runoff curve numbers used for different land uses are included in the following table:

RUNOFF CURVE NUMBERS

	Soil Type			
	A	B	C	D
*Existing Conditions Range Land	59	74	83	87
**Future Ultimate Conditions Offsite	75.8	84.5	-	92
Future Conditions Stetson Hills Site				
Land Use				
Retail/Services Center	89	92	-	95
Office/Service	89	92	-	95
Research & Develpment (Business Park)	89	92	-	95
MF 18-22 Dwellings Units/Acres	80	87	-	93
SF 8-12 DU/A	74	83	-	91
MF (high density) 25-35 DU/A	83	89	-	95
SF 4-6 DU/A (1/5 acre)	65	78	-	89

School	68	79	-	89
Park (Good Cover)	39	61	-	80

* 50% Fair - 50% Poor as per SCS and FEMA (See Appendix)
** Obtained from preliminary study performed by Finn and Associates (See Appendix)

For the internal site drainage analysis, the storm sewer system was sized for a 5-year storm. The storm sewer system started at a point where the 5-year flow reached 20 cfs per curb on collector status streets. For arterial streets with medians, street capacity was determined by the quantity of flow leaving one lane clear, or 20 cfs, whichever was less. This criteria was established per consversation with the City of Colorado Springs' staff. The proposed curb is vertical 8-inch curb and gutter. The proposed inlets are D-10-R at sump areas and on continuous grade.

For the 100-year event, the maximum street capacity from right-of-way to right-of-way was calculated using Mannings Equation.

All channel sections were calculated using Mannings Equation. The channel analyses are explained in more detail in the Hydraulics portion of this report.

Culverts on the tributaries were sized for 100-year flow with HW/D = 1.5 when passing under collector streets, and with HW/D = 1.0 when passing under arterial streets with medians. A more detailed discussion of the hydraulic structure crossings is presented in the Hydraulics section of this report.

HYDROLOGIC CALCULATIONS

For the Master Drainage Study the flows for the 5- year and 100-year recurrence interval events were calculated using the SCS procedure (References 1, 2, 3). For Sand Creek and tributaries the flows were generated at critical design points using the TR-20 computer program (Reference 5). The critical design points are defined at property lines, at proposed hydraulic structure locations, and upstream and downstream of major point sources. A schematic diagram of the stream network calculations is included in the Appendix. All routings used in the TR-20 program were based on kinematic wave techniques using existing channel characteristics. Knowing the flows at critical design points, stream stationing-discharge profiles were generated to develop the design flows at proposed stream crossing locations. The stream stationing-discharge profiles are included in the Appendix of this report.

The 5-year and 100-year flows for the 24 hour type IIA event were calculated for existing conditions for the entire basin, ultimate conditions for the entire basin and existing offsite with the Developed Stetson Hills project.

For existing conditions, the land use was taken as Range Land in the fair-poor condition. The time of concentration included 20 minutes for the first 500 feet of overland flow and Figure 3 to define the existing conditions channel flow time.

For proposed conditions the land use for offsite areas was obtained from Finn and Associates and actual proposed land use on the Stetson Hills Project. The time of concentration included 10 minutes for the first 500 feet of overland flow, and 5.5 to 7.5 feet per second for proposed channel flows. All times for channels are average times for the entire length.

The results of the calculations at various design points along Sand Creek within the Stetson Hills Project are listed in the following table:

100-YEAR FLOW
24-HOUR TYPE IIA DISTRIBUTION

LOCATION	EXISTING	STETSON DEVELOPED ONLY	ULTIMATE
Upstream Property Line	1850	1850	3440
Upstream of Confluence Reach 021-024	1850	1850	3450
Downstream of Confluence Reach 021-024	1880	1880	3480
Upstream of Confluence Reaches 031-037 and 025-026	1880	1880	3480
Downstream of Confluence Reach 031-037 and 025-026	2170	2240	3945
Lariat Drive	2220	2550	4020
Upstream of Confluence Reach 041-042	2230	2600	4060
Downstream of Confluence Reach 041-042	2310	3480	5100
Upstream of Confluence Reach 051-052	2320	3580	5200
Downstream of Confluence Reach 051-052 Barnes Road	3220	5580	7080
Downstream Property Line	3420	6160	7660

Refering to the previous table, the flow leaving the Stetson Hills project on Sand Creek, increases from 3402 cfs to 6160 cfs due strictly to the Stetson hills project. Assuming the basin fully developed, as is required by the City of Colorado Springs, the flow change due to upstream undetained flows entering the site is 6160 cfs to 7660 cfs or an increase of 24%.

This passage of upstream undetained flows creates a negative impact on the Stetson Hills project and results in higher water surface profiles, velocities and wider floodplains. It is estimated that an additional 9.6 acres of land along Sand Creek will be inundated during the 100-year event. On the tributaries to Sand Creek which will be channelized through the Stetson Hills Site, the passage of upstream undetained flows will enlarge the size of the proposed drainage facilities.

A Master Drainage Planning Study has been completed in the Sand Creek Basin. The study was performed by Simons and Li and analyzed the existing and ultimate conditions flows in the basin and described the adequacy of downstream structures to pass the ultimate conditions 100-year flood. Initial observations by Simons and Li indicated that the ultimate conditions often produces flows of such magnitude that several existing stream crossing structures in the lower basin are inadequate to pass the 100-year flood. The full impact of the full basin development are addressed in the Major Drainageway Planning Report and, therefore, were not further analyzed in this report.

Colorado Springs Ranch, downstream, is proposing a detention pond to handle the first 3 years of development in Stetson Hills. However, if this detention pond is not provided for in the Springs Ranch then Stetson Hills will provide a temporary pond to detain the proposed developed flows and limit the release to the historic rate. The temporary pond location will be determined by the sequence of platting.

It is proposed to provide several regional recreational lakes off-line of Sand Creek through the Stetson Hills site. The lakes are proposed on the upstream side of several road crossings and would create a permanent water feature for aesthetic purposes. It should be noted that these lakes will be privately owned and maintained, will be located outside of the proposed 100-year floodplain, and will have no adverse effects on drainage within the subject site.

With regard to internal drainage within the site, the Modified SCS procedures, as required by the City of Colorado Springs, was used. The 5-year and 100-year flows for the 6-hour type IIA storm were generated for use in locating storm sewers, inlets, swales and channels. The results of the calculations, including all storm sewer and swale sizing, are shown in the Appendix of this report and on the Drainage Plan. It should be noted that the SCS calculations from the Final Drainage study for Stetson Hills Filing No. 1 were adopted for the Basins located to the south of Lariat Drive. These calculations are more detailed and superceed all previous calculations in the area. All calculations can be found in the internal drainage portion of this report, Section V. Costs for all drainage facilities designed from these calculations will be included as part of this master study.

Two areas exist within the porposed Stetson Hills development in which adjacent offsite and onsite developed flows will either pass through the site or will be detained to their historic levels. In the northwestern corner of the site, offsite flows from the Cotton Creek Drainage Basin are conveyed through the northwestern corner of the property along Templeton Gap Road. The facilities proposed to convey these flows through the property have been adequately sized for the full 100 year developed flow. A review of the Engineering Study of the Cotton Creek Drainage Basin by Lincoln DeVore in August of 1979 indicated that the upper basins of the Cotton Creek Drainage were not closely studied. The only problem indicated in the report was that a number of undersized culverts exist under various roadways in the upper basin. Since the Cotton Creek flows are simply passing through the subject site and follow the same general flowpath, no adverse downstream effects are expected. In the southeastern corner of the site, the developed flows will be detained to their historic rates before being discharged onto the adjacent property owned by Mobil Land. Since a temporary detention pond will be provided, no adverse downstream effects are expected. Downstream developments will construct permanent detention facilities at a later date.

HYDRAULIC CALCULATIONS

For this study, hydraulic calculations were performed on the proposed channels and hydraulic structures located within the Stetson Hills site to provide 100-year flood elevations, boundaries and velocity criteria which were used to design channel stabilization and erosion control measures. The results of the hydraulic analyses will be a positive drainage network within the project to provide flood protection for the 100-year event.

For Sand Creek through the Stetson Hills site, the HEC-2 computer model was used to determine the existing conditions 100-year and the ultimate conditions 100-year and 500-year flood elevations. These calculations were performed to identify the 100-year inundation limits based on the existing channel geometry, and the impact of the basin development on the flood elevations. The results of these calculations show that the average 100-year flood elevations through the Stetson Hills site increase approximately 1.7 feet due to the ultimate basin development. This results in an increase of 100-year floodplain areas from 62.8 to 72.3 acres or an increase of 15%. The average 500-year flood elevations based on the ultimate condition is approximately 1.1 feet higher than the 100-year ultimate condition.

The proposed 100-year drainage channels are explained in more detail in the Hydraulics section of this report.

All stream crossing structures, such as culverts, were sized based on the procedures outlined in the publication "Hydraulic Charts for the Selection of Highway Culverts" (Reference 6). The culverts were sized based on the assumption of acceptable headwater to a depth ratios of 1.5 and 1.0 depending on the street type, inlet control, 1 foot of freeboard to the top of road, a maximum embankment height of 10 feet and an average tailwater of 5 feet. A more detailed description of the culvert sizes and types is explained in the Hydraulics section of this report.

HYDRAULIC STRUCTURES - TRIBUTARIES TO SAND CREEK

Pipes:

Whenever possible, reinforced concrete pipes of 102 inch diameter or less were used to convey the 5 and 100-year off-site and on-site flows through the Stetson Hills Development to Sand Creek. These pipes are to be used in lieu of open rip-rap channels. However, when the required pipe sizes exceed 102 inches, the flows will be conveyed in the open channels. It should be noted that provisions will have to be made during final design to allow the 100-year flow to enter the proposed pipe systems. The location and sizes of all pipes can be found on the Drainage plan enclosed in the back of this report.

Open Channels:

Sand Creek has three major, proposed channels tributary to the reach within the proposed Stetson Hills development. The purpose of each channel is to provide a means to adequately convey runoff from the Stetson Hills develoments to Sand Creek. The channels have been designed to convey the 100-year, 24-hour type IIA runoff with adequate freeboard, and at non-erosive velocities. Under existing conditions, all of the tributaries are supercritical during the 100-year storm. In order to reduce the Froude numbers from greater than one to approximately 0.7, a slope of 1.0% is required, for both the minimum and maximum flows of 1,900 cfs and 2,320 cfs, respectively. Thus, for intermediate flows, a bottom slope of 1.0% will result in a stable flow regime, with a Froude number of approximately 0.7. Each tributary to Sand Creek is proposed to be rip-rap lined or a pipe not to exceed 102 inches in diameter. The rip-rap will be grouted accordingly to the City of Colorado Springs Criteria. The rip-rap channel was designed with a 10-foot base, 3:1 side slopes, and a Mannings "n" value dependent upon the velocity. The base of 10 feet was selected to allow for ease in construction. The rip-rap channels have been designed to flow under the subcritical flow regime by varying the bottom slope to create a Froude number of 0.7. It should be noted that there is an option for channels with base, 3:1 side slopes, and a Mannings "n" value dependent upon the velocity. The base of 10 feet was selected to allow for ease in construction. The rip-rap channels have been designed to flow under the subcritical flow regime by varying the bottom slope to create a Froude number of 0.7. It should be noted that there is an option for channels with natural bottoms and check structures. Final design will dictate if the bottom is lined.

Reach 051-052: Reach 051-052 comprises approximately 6,200 feet of proposed open channel at an existing slope of 2.6%. The developed peak discharge rate of 1900 cfs was used as the design flow for this reach. In order to maintain stable, sub-critical flow conditions, the rip-rap channel was designed for a bottom slope of 1.0%. This would require approximately 25 4-foot rip-rap drop structures. The normal depth for this design would be 7.20 feet. The freeboard requirement of 1.80 feet would produce a minimum channel depth of 9.0 feet.

Reach 041-042: Reach 041-042 comprises approximately 3800 feet of proposed open channel at an existing slope of 1.7%. A peak discharge rate of 1455 cfs was used as the design flow for this reach. The rip-rap channel design would require approximately 7 4-foot rip-rap drop structures for energy dissipation. The normal depth and freeboard would be 6.36 feet and 1.59 feet, respectively. The minimum channel depth would, therefore, have to be 7.95 feet.

Reach 031-037: Reach 031-037 comprises approximately 3,600 feet of proposed open channel at an existing slope of 1.2%. A peak discharge rate of 2320 cfs was used for the design of this reach. The rip-rap channel design would require approximately 2 4-foot rip-rap drop structures for energy dissipation. The normal depth and freeboard would be 7.82 feet and 1.96 feet, respectively. The minimum channel depth would be 9.78 feet.

Culverts:

The major tributaries to Sand Creek will each have at least one road crossing. The options that were investigated included circular metal and concrete culverts and box culverts. The assumptions made for these analyses have been described in the Hydraulic Calculations portion of this report. All backwater resulting from the culverts will be contained in the subcritical upstream channel. The culvert alternates are referenced by road crossing on the Drainage Plans (Sheet 2 of 2) in the back cover of this report, and are summarized in the Appendix of this report. Below Lariat culvert sizes were obtained from the Final Drainage Study for Stetson Hills, Filing No. 1 (see the Hydraulics portion of this report, Section III, for all calculations).

HYDRAULIC STRUCTURES - SAND CREEK

Sand Creek comprises approximately 19,000 feet of existing open channel through the Stetson Hills development. There will be four crossings of Sand Creek that will require hydraulic structures after development. The structures proposed for the crossings are bridges with concrete decks and prestressed concrete girders. The deck area for these bridges has been estimated at 11,000 square feet.

In addition to the hydraulic structures required for the Stetson Hills Development, stabilization of Sand Creek will also be required to prevent erosion that will occur with the developed flows. The proposed stabilization would require that the sides of Sand Creek be graded to a minimum slope of 3:1, and protected with a minimum 12-inch D50 rip-rap. The rip-rap protection should be buried a minimum of 5 feet and extend a distance of 0.25 x the water depth or 1.0 foot minimum above the 100-year water surface elevation. The existing channel bottom which varies in width should also be reshaped to remove existing flow obstructions. Rip Rap drop of check structures will be required to maintain the equilibrium slope. A typical channel section showing the proposed stabilization can be found in the Hydraulics section of this report.

COST ESTIMATES

Cost estimates have been provided for all major drainage facilities throughout the proposed Stetson Hills Development. The cost estimate for the rip-rap channels includes the cost for bedding material and gravel aggregate for the maintenance road. Storm sewer pipe costs are provided for reinforced concrete delivered to Colorado Springs. Installation costs are also included in the estimate. A lump sum cost was determined for all manholes required for the system. The cost of all culverts included the required headwalls, toewalls and wingwalls. Again, installation costs were estimated for the culvert systems. It should be noted that below Lariat Drive, cost estimates were taken from the final drainage study for Stetson Hills, Filing No. 1 by Greiner Engineering, dated April, 1985. These costs are more detailed than those costs to the north of Lariat, which will be updated upon final design. All cost estimate calculations can be found in the Appendix of this report. The bridge and basin fees for the areas to be platted within this development can be found in the letter on basin fees for Colorado Springs, dated January 3, 1985 (see section IV on cost estimate).

INTERNAL DRAINAGE

Due to the magnitude of the internal flows within Stetson Hills, storm sewer systems are proposed to provide positive drainage to the major tributary channels. The culverts under the road crossings were assumed to be either circular reinforced concrete pipe, or reinforced concrete boxes. It was assumed that the allowable depth from top-of-road to channel invert not exceed 7 feet, that a minimum 1-foot of freeboard be provided, and that the culverts convey flow under inlet control. The storm sewer was designed with the City of Colorado Springs guidelines for the 5-year storm. The 100-year flows from the internal basins will be carried within the right-of-way of streets or in minor swales to the channels.

The locations and sizes of the proposed overall drainage network of storm sewer, swales and channels are shown on the Drainage Plans (Sheet 2 of 2) located in the back cover of this report.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this Master Drainage Study was to document the existing and proposed conditons internal drainage and natural stream flood flows through the Stetson Hills site, and to prepare a Master Planning Document for the development. The results of our analyses are summarized on the two drainage maps in the back pocket of this report, and are documented in the Appendix of this report. The results of the TR20 100-year flow analysis along Sand Creek compare to within 10% of the flows in the Sand Creek Master Drainage Planning Study by Simons, Li and Associates. This flow comparison was made at the downstream Stetson Hills Property Line, which is the only downstream coincident design point between the studies. The difference in flows is within acceptable accuracy limits for the City of Colorado Springs.

The information contained within this report has been intended to serve as a Master Planning Document. The proposed facilities are conceptual, and are intended to be used only as a guide to final design. This report will be systematically updated after final design is completed on portions of the project.

This report is submitted for review and comments.

Designed by: ______________________
Jeffrey Baessler
Design Engineer

Reviewed by: ______________________
Tyler D. Smart, P.E.
Department Manager

JB/CMB:ld/lb

REFERENCES

1) City of Colorado Springs, "Determination of Storm Runoff Criteria", March 1977.

2) U.S. Department of Agriculture, Soil Conservation Service, "National Engineering Handbook Section 4 Hydrology", Unpublished.

3) Soil Conservation Service, "Procedures for Determining Peak Flows in Colorado", March 1980.

4) National Oceanic and Atmospheric Administration, "Precipitation - Frequency Atlas of the Western United States, Volume III - Colorado", 1973.

5) U.S. Department of Agriculture, Soil Conservation Service, "TECHNICAL RELEASE 20, TR-20 Computer Program for Project Formulation Hydrology", May 1982.

6) U.S. Department of Transportation, Federal Highway Administration, "Hydraulic charts for the Selection of Highway Culverts", December, 1983.

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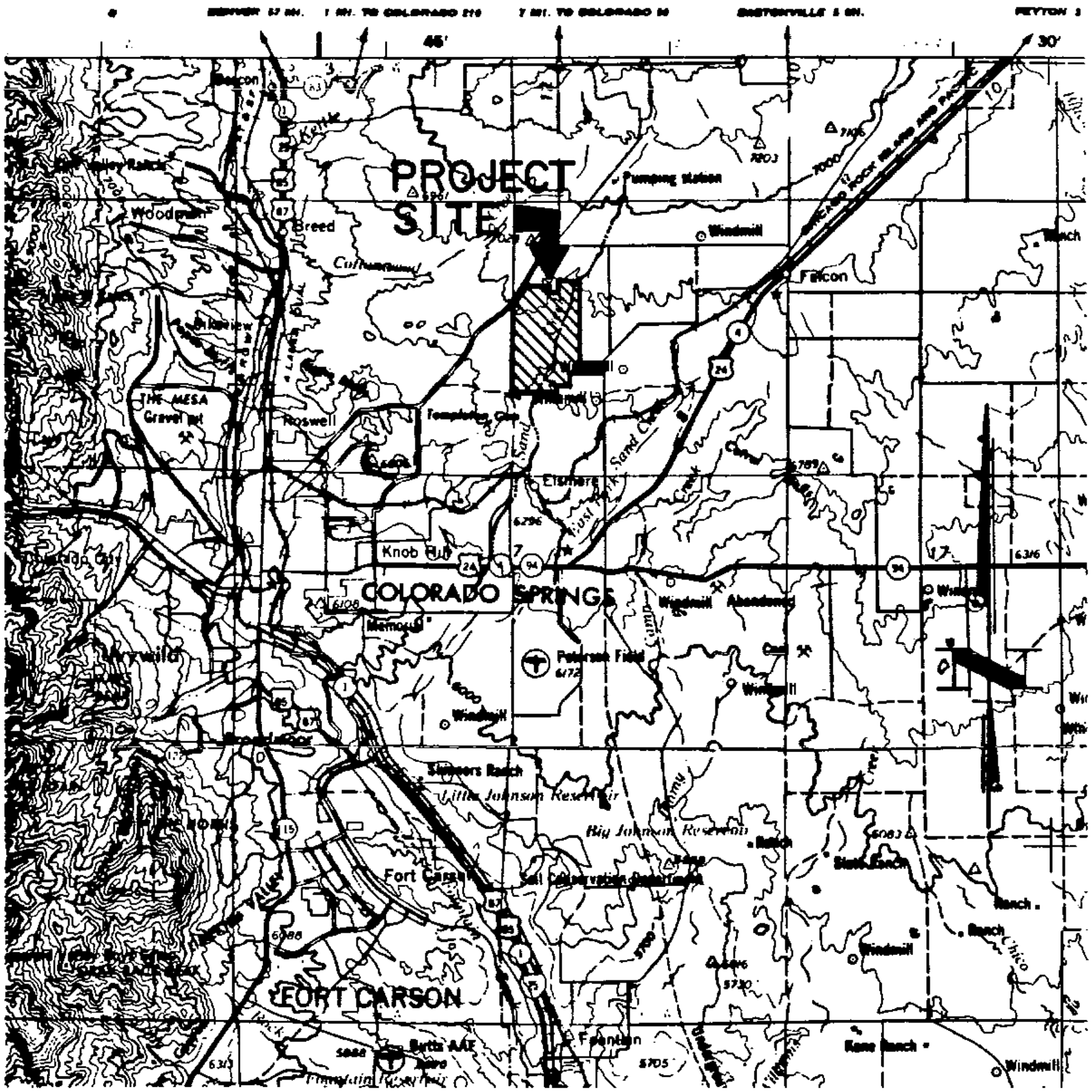
APPENDIX



SCALE: 1' = 250,000'

FALCON NW QUADRANGLE
SECTIONS 17,18,19,20,29 & 30
T. 13 S. , R. 65 W.

VICINITY MAP

GREINER ENGINEERING

FIGURE I

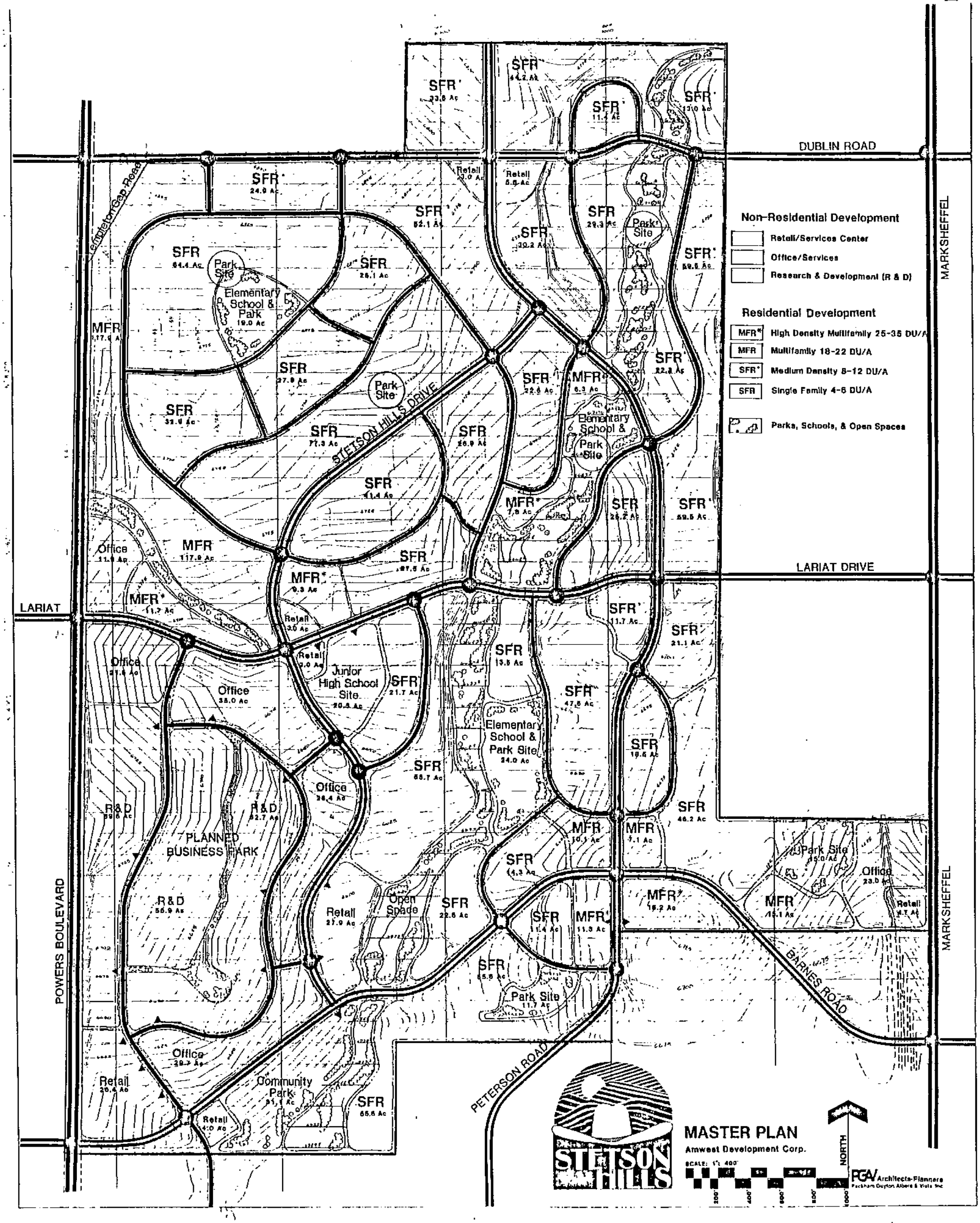

DUBLIN ROAD
LARIAT DRIVE
LARIAT
STETSON HILLS DRIVE
POWERS BOULEVARD
MARKSHEFFEL
BARNES ROAD
PETERSON ROAD
Non-Residential Development
Retail/Services Center
Office/Services
Research & Development (R & D)
Residential Development
MFR* High Density Multifamily 25-35 DU/A
MFR Multifamily 18-22 DU/A
SFR* Medium Density 8-12 DU/A
SFR Single Family 4-6 DU/A
Parks, Schools, & Open Spaces
Elementary School & Park
Junior High School Site
Elementary School & Park Site
PLANNED BUSINESS PARK
Community Park
Open Space
Park Site
MASTER PLAN
Amwest Development Corp.
STETSON HILLS
NORTH
Architects-Planners

FIGURE 2

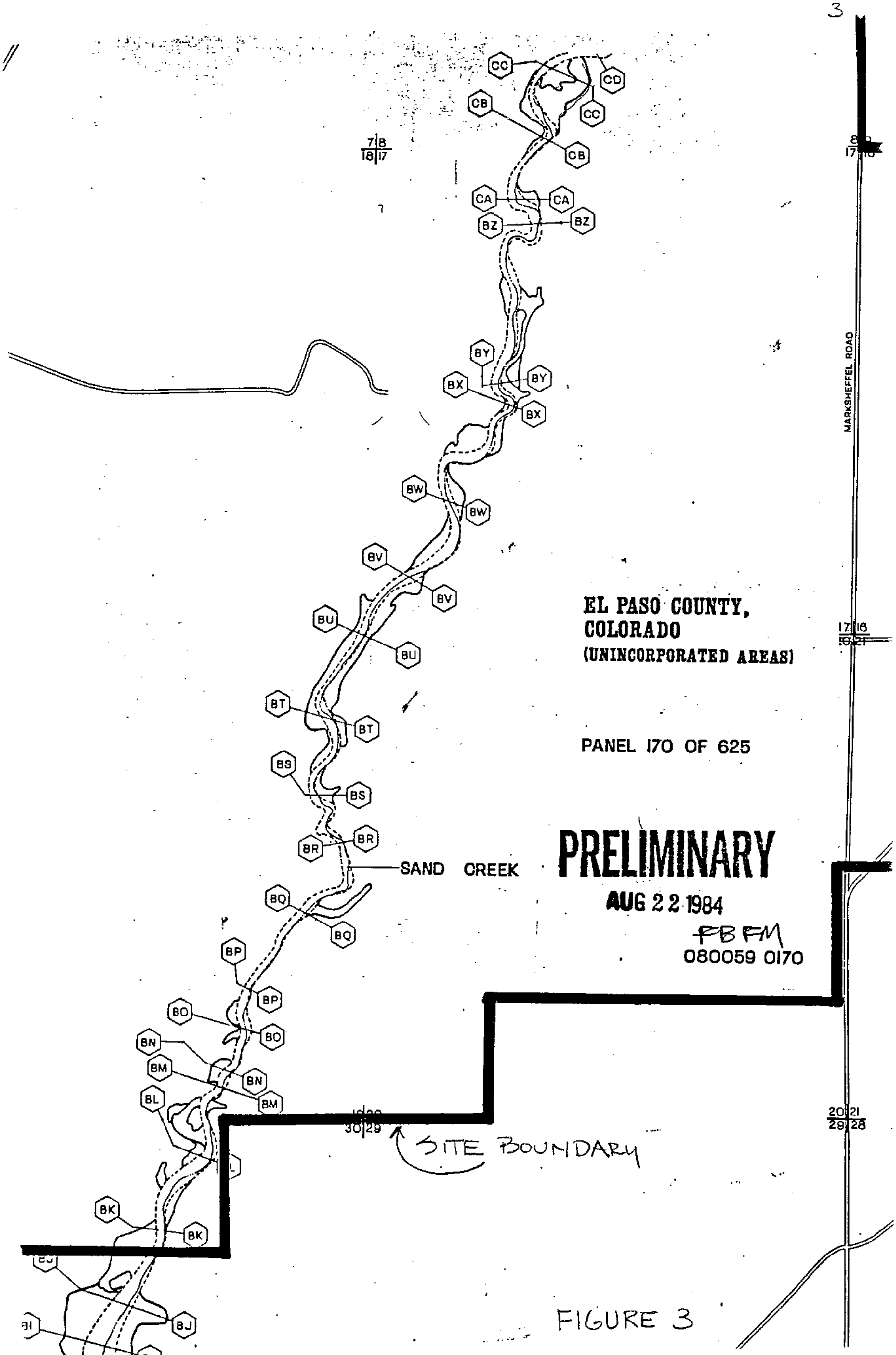

EL PASO COUNTY,
COLORADO
(UNINCORPORATED AREAS)
PANEL 170 OF 625
PRELIMINARY
AUG 22 1984
FBFM
080059 0170
SAND CREEK
MARKSHEFFEL ROAD
SITE BOUNDARY

FIGURE 3

CRITERIA

☑ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ CASPER, WYOMING
☐ KEMMERER, WYOMING

PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 4 OF
CALCULATED BY CMB DATE 8-16-84
CHECKED BY ECC DATE

5 YEAR - Capacity to T.O.C.

Conveyance		880.2		868.3		889.5		848.6	
Slope (%)	REDUCT. FACTOR	ROW = 66 ft		ROW = 82 ft		ROW = 92 ft		ROW = 120 ft	
		8" curb	44' FL-FL	8" curb	60' FL-FL	8" curb	2-28' FL-FL	8" curb	2-36' FL
0.1	BELOW MIN ALLOW. STREET GRADE	28		27		28		27	
0.2		39		39		40		38	
0.3		48		48		49	*	46	*
0.4	.5	56	28	55	28	56	28	54	27
0.5	.65	62	40	61	40	63	41	60	39
0.6	.8	68	54	67	54	69	55	66	53
0.8	.8	79	63	78	62	80	64	76	61
1.0	.8	88	70	87	70	89	71	85	68
1.2	.8	96	77	95	76	97	78	93	74
1.4	.8	104	83	103	82	105	84	100	80
1.6	.8	111	89	110	88	113	90	107	86
1.8	.8	118	94	116	93	119	95	114	91
2.0	.8	124	99	123	98	126	101	120	96
2.2	.8	131	105	129	103	132	106	126	101
2.4	.75	136	102	135	101	138	104	131	98
2.6	.68	142	97	140	95	143	97	137	93
2.8	.65	147	96	145	94	149	97	142	92
3.0	.6	152	91	150	90	154	92	147	88
3.2	.57	157	90	155	88	159	91	152	87
3.4	.55	162	89	160	88	164	90	156	86
3.6	.5	167	84	165	83	169	85	161	81
3.8	.47	172	81	169	79	173	81	165	78
4.0	.45	176	79	174	78	178	80	170	77
4.2	.4	180	72	178	71	182	73	174	70
4.4	.4	185	74	182	73	187	75	178	71
4.6	.37	189	70	186	69	191	71	182	67
4.8	.35	193	68	190	67	195	68	186	65
5.0	.34	199	68	194	66	199	68	190	65

* FOR CAPACITY WITH 1 LANE CLEAR SEE NEXT PAGE

Greiner Engineering

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PROJECT Stetson Hills
JOB NUMBER ____ SHEET 5 OF ____
CALCULATED BY ____ DATE ____
CHECKED BY ____ DATE ____

Arterial Streets (raised medians)

ROW'S 120' & 94'

Capacity w/ one lane clear (half of street)

120' ROW

S	Q cfs
0.006	17.4
0.008	20.1
0.010	>20
0.012	>20
0.014	>20
0.016	>20
0.018	>20
0.020	>20
0.022	>20

94'

S	Q
0.006	8.8
0.008	10.1
0.010	11.3
0.012	12.4
0.014	13.4
0.016	14.3
0.018	15.2
0.020	16.0
0.022	16.8
0.024	17.5
0.026	18.2
0.028	18.9
0.030	19.6
0.032	20.2

CRITERIA ESTABLISHED PER CONVERSATION WITH THE CITY OF COLORADO SPRINGS STAFF.

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PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 6 OF
CALCULATED BY CMB DATE 8-14-84
CHECKED BY ECB DATE

Discharge
100-YR Flow Capacity

Conveyance	1504.2	1731.0	1672.5	1795.5
Slope (%)	ROW=66 ft (8" curb, 44' Fl-Fl)	ROW=82 ft (8" curb, 60' Fl-Fl)	ROW=92 ft (8" curb, Median)	ROW=120 ft (8" curb, Median)
0.1	48	55	53	57
0.2	67	77	75	80
0.3	82	95	92	98
0.4	95	109	106	114
0.5	106	122	118	127
0.6	117	134	130	139
0.8	135	155	150	161
1.0	150	173	167	180
1.2	165	190	183	197
1.4	178	205	198	212
1.6	190	219	212	227
1.8	202	232	224	241
2.0	213	245	237	254
2.2	223	257	248	266
2.4	233	268	259	278
2.6	243	279	270	290
2.8	252	290	280	300
3.0	261	300	290	311
3.2	269	310	299	321
3.4	277	319	308	331
3.6	285	328	317	341
3.8	293	337	326	350
4.0	301	346	335	359
4.2	308	355	343	368
4.4	316	363	351	377
4.6	323	371	359	385
4.8	330	379	366	393
5.0	336	387	374	401

DC3.3 CHANNEL DESIGN (Cont'd)

years. Modifications to such channels should be held to a minimum. If a channel improvement is necessary, follow the natural water course if possible. Man-made channels, including roadway ditches, improperly designed, can be a source of excessive maintenance. Good channel design consits of the proper selection of:

1. Capacity, including freeboard.
2. Alignment
3. Erosion resistance
4. Esthetics

DC3.4 CHANNEL HYDRAULICS - *El Paso County Guidelines*

There are two types of open channel flow, subcritical or supercritical. Natural channels are usually subcritical and man-made channels are usually supercritical due to smooth linings and steeper slopes. To determine if the flow is supercritical or subcritical the Froude number must be calculated. The Froude number is:

$$F = \frac{Vm}{g(A/T)^{\frac{1}{2}}}$$

Where:

Vm = Velocity determined from Manning's equation. (See Section DC2.3 of the El Paso County Design Manual.)

A = Cross-sectional area of water in sq. ft.

g = Acceleration due to gravity 32 ft./sec.^{2}.

T = Width of water surface in feet.

If $F > 1$ the flow is supercritical, if $F < 1$ the flow is subcritical. This analysis is used in determining the freeboard.

Freeboard is the distance above the anticipated water surface to the top of the ditch or dike.

Freeboard Guidelines: Subcritical Flow

(Minor Channels < 500 cfs)

Freeboard (in ft.) = 1.0' min. or 25% of depth, which ever is greater

Supercritical Flow

(Major Channels > 500 cfs)

$$\text{Freeboard (in ft.)} = 2.0' + 0.025\ V\ (d)^{1/3}$$

V = Velocity determined by Manning's equation. (See Section DC2.3 of the El Paso County Design Manual.)

d = Depth of flow in feet.

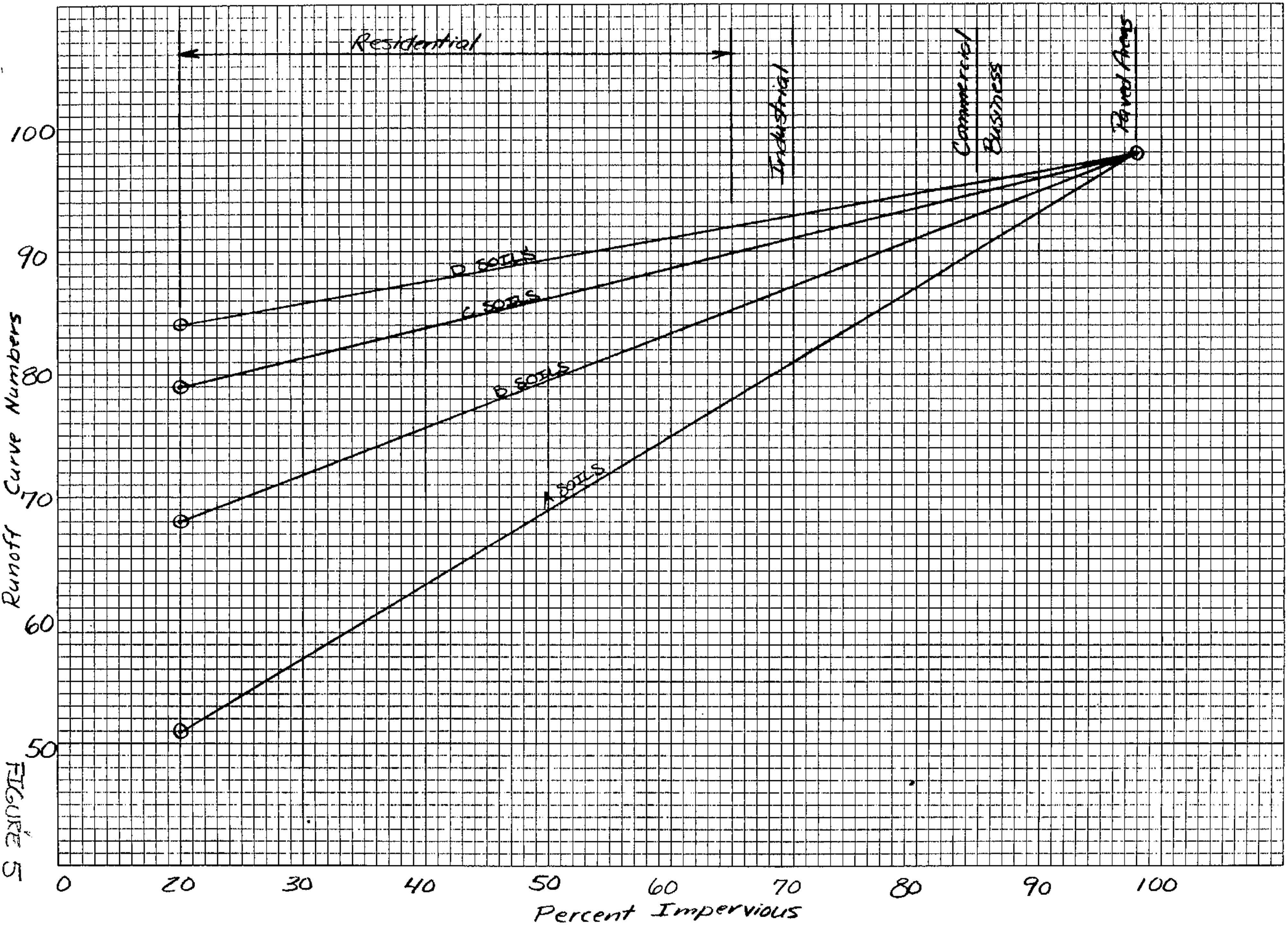
Table 2 - Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

Land Use Description		Hydrologic Soil Group A	B	C	D
Cultivated land[1] :	without conservation treatment	72	81	88	91
	: with conservation treatment	62	71	78	81
Pasture or range land:	Poor condition	68	79	86	89
	: Good condition	39	61	74	80
Meadow:	Good condition	30	58	71	78
Wood or Forest land:	thin stand, poor cover, no mulch	45	66	77	83
	: good cover[2]	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.					
good condition:	grass cover on 75% or more of the area	39	61	74	80
fair condition:	grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)		89	~~88~~ 92	~~91~~ 94	~~93~~ 95
Industrial districts (72% impervious).		81	88	91	93
Residential: [3]					
Average lot size	Average % Impervious[4]				
1/8 acre or less	65	77	85	90	92
1/5 acre	47	65	78	85	89
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
Paved parking lots, roofs, driveways, etc.-		98	98	98	98
Streets and roads:					
paved with curbs and storm sewers-		98	98	98	98
gravel		76	85	89	91
dirt		72	82	87	89

1. For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, August 1972.

2. Good cover is protected from grazing and litter and brush cover soil.

FIGURE 4



Residential
Industrial
Commercial
Business
Paved Areas
D SOILS
C SOILS
B SOILS
A SOILS
100
90
80
70
60
50
Runoff Curve Numbers
0
20
30
40
50
60
70
80
90
100
Percent Impervious

FIGURE 5

$$T = \left(\frac{11.9\,L^3}{H}\right)^{.385}$$

T = Tc in hours
L = Length of longest watercourse in miles
H = Elevation difference in feet

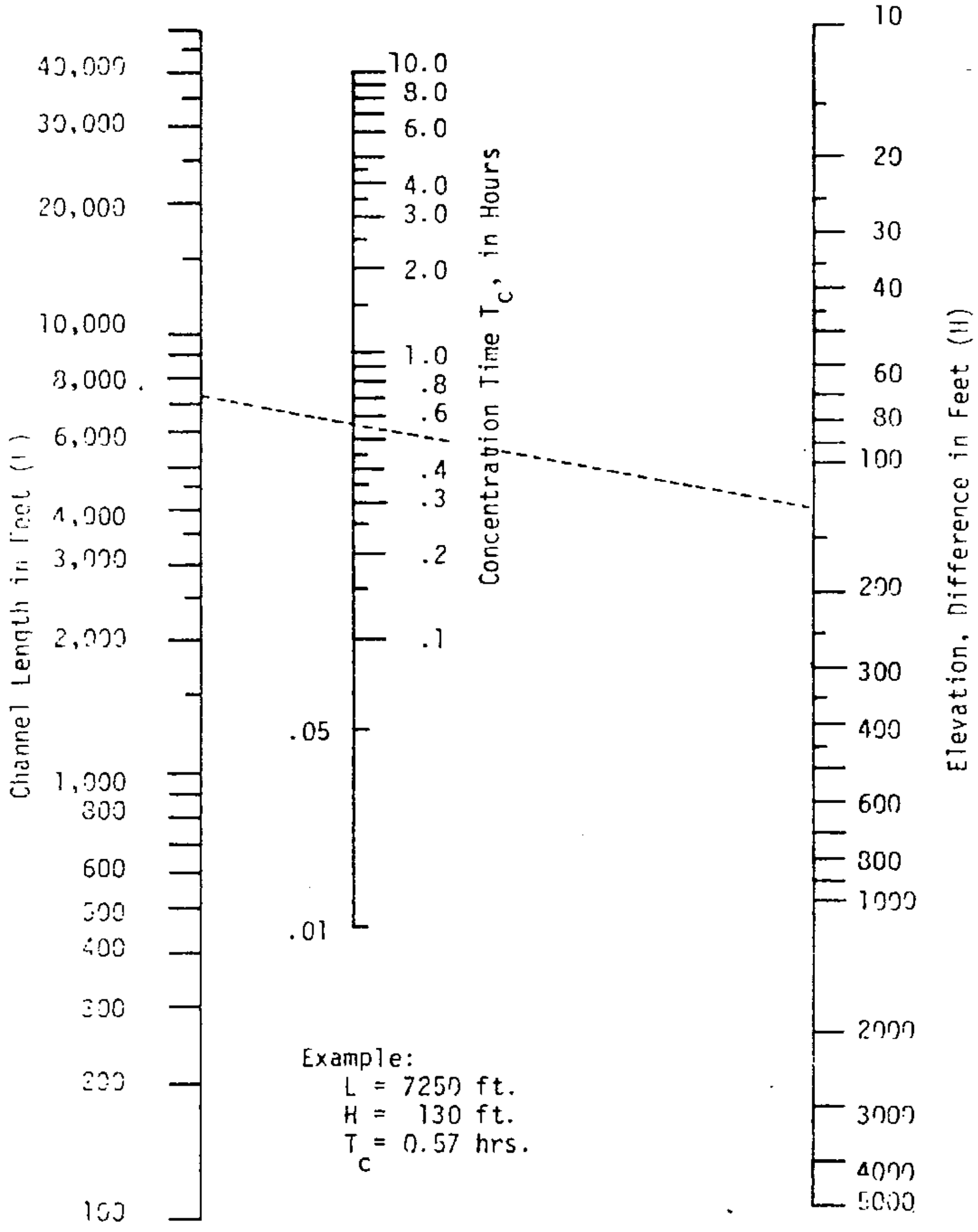


Figure II Estimating Tc from Lengths and Slopes of Natural Channels

FIGURE 6

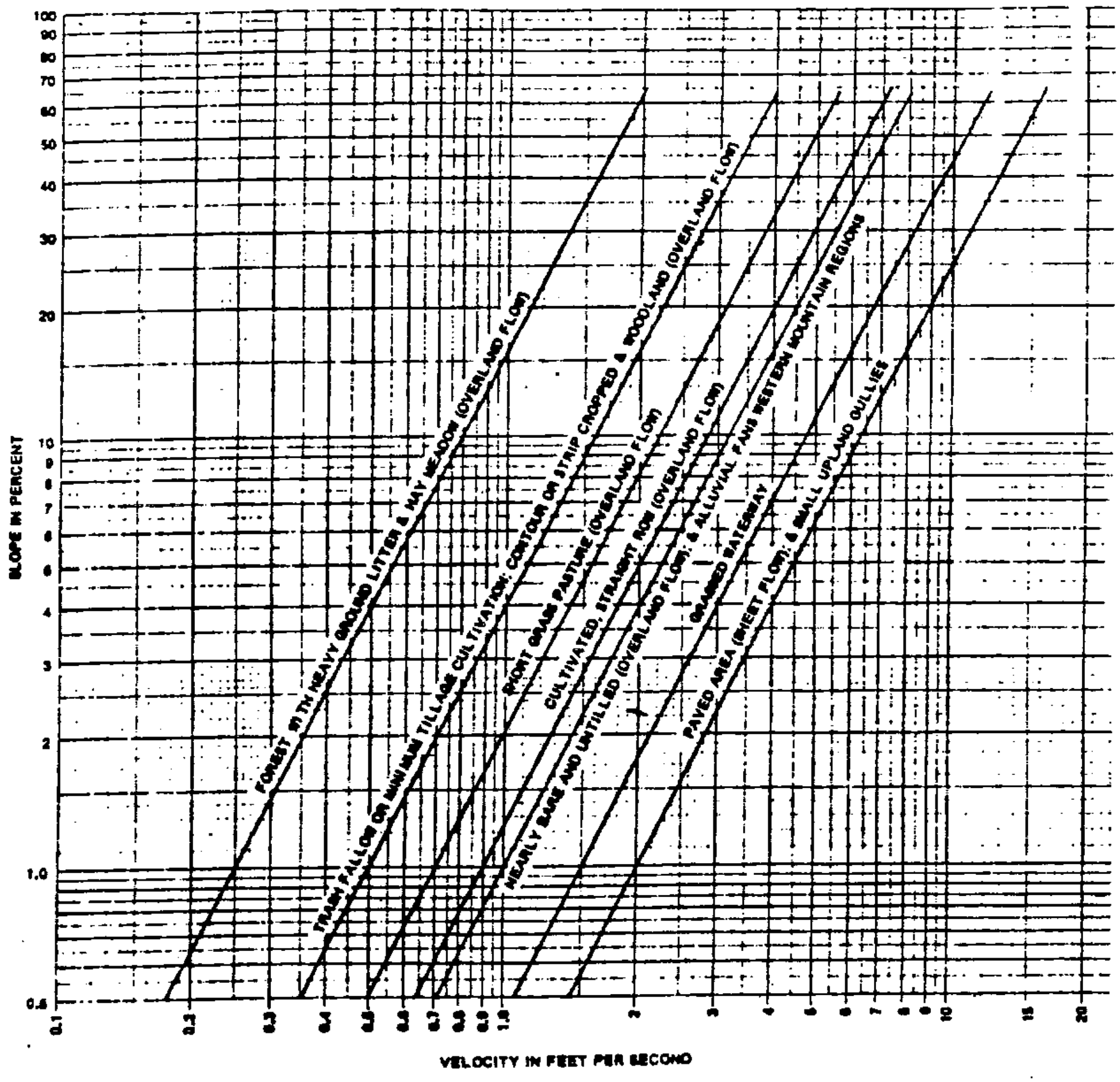


Figure 15.2.—Velocities for upland method of estimating T_c

Ref. SCS, NEH-4

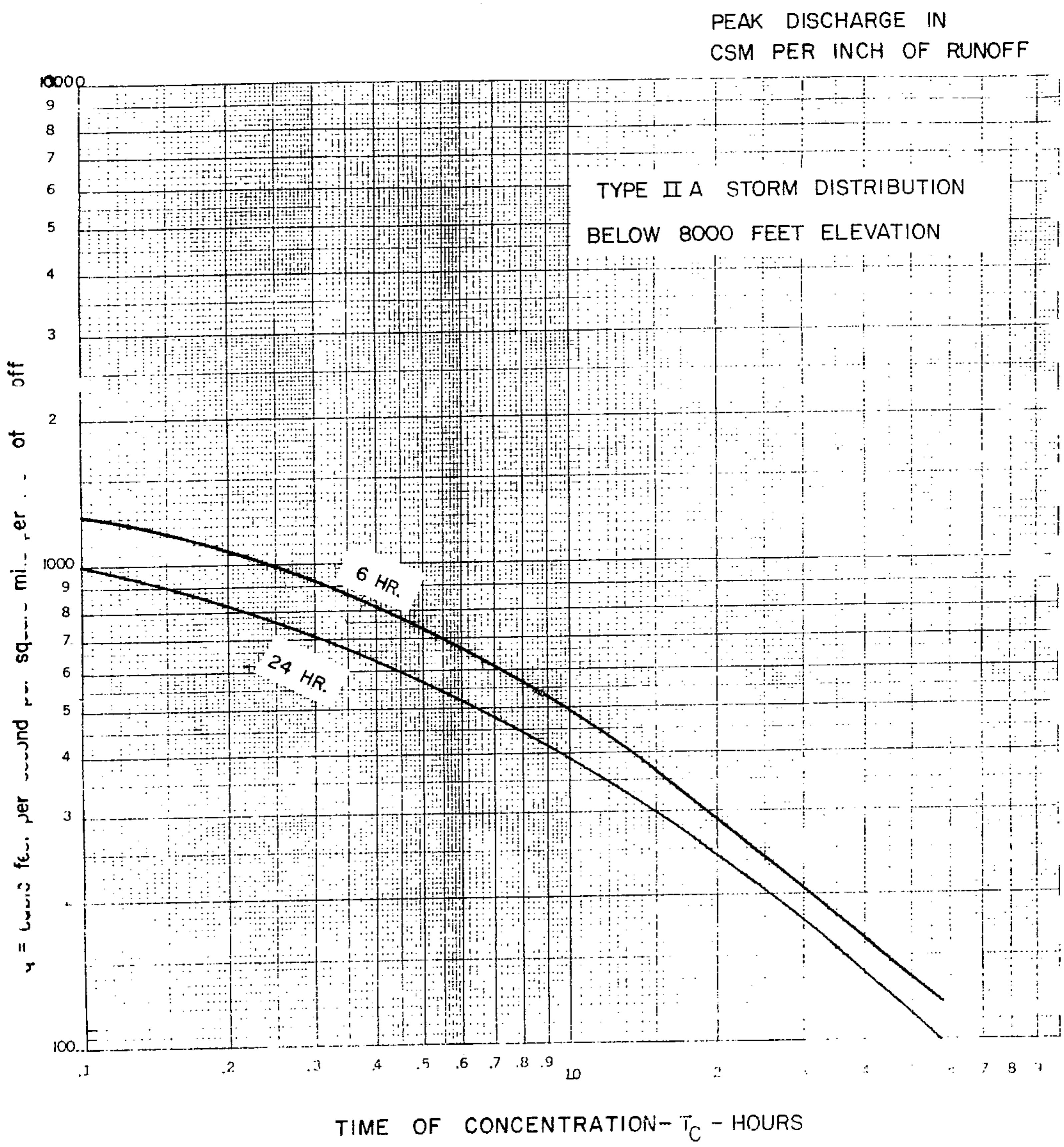


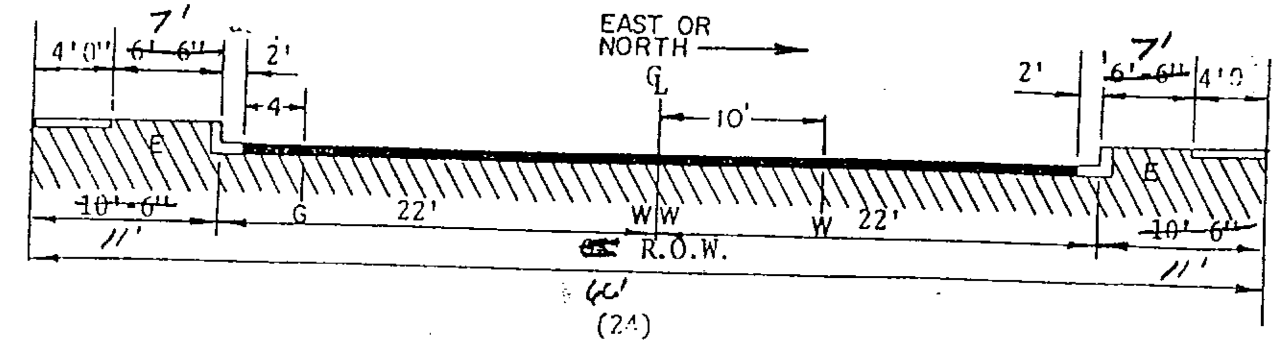
FIGURE III-4

FIGURE 8

FIGURE 9

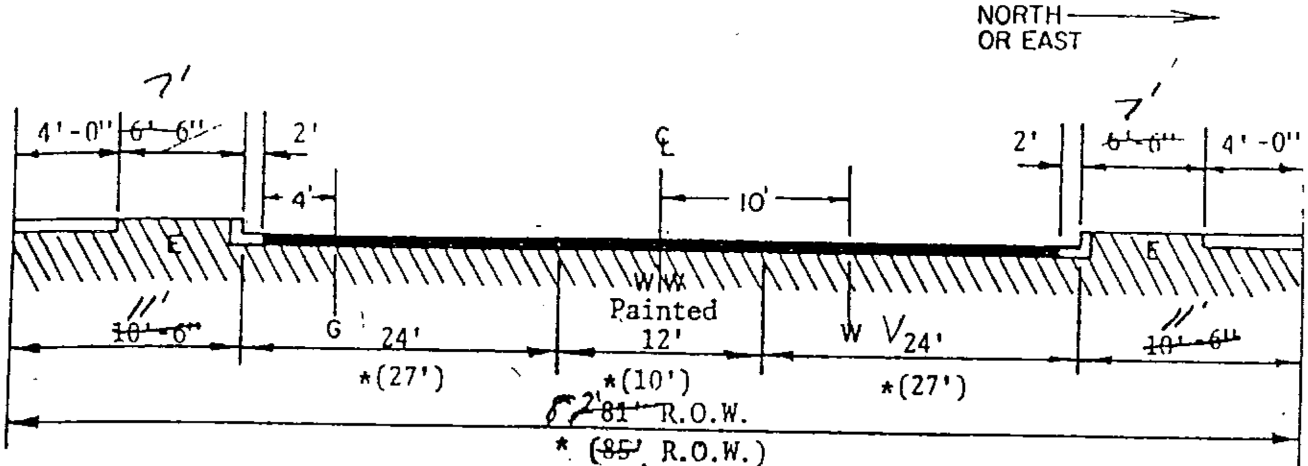
STREETS

E, F, G



STREETS

A, B, C, D

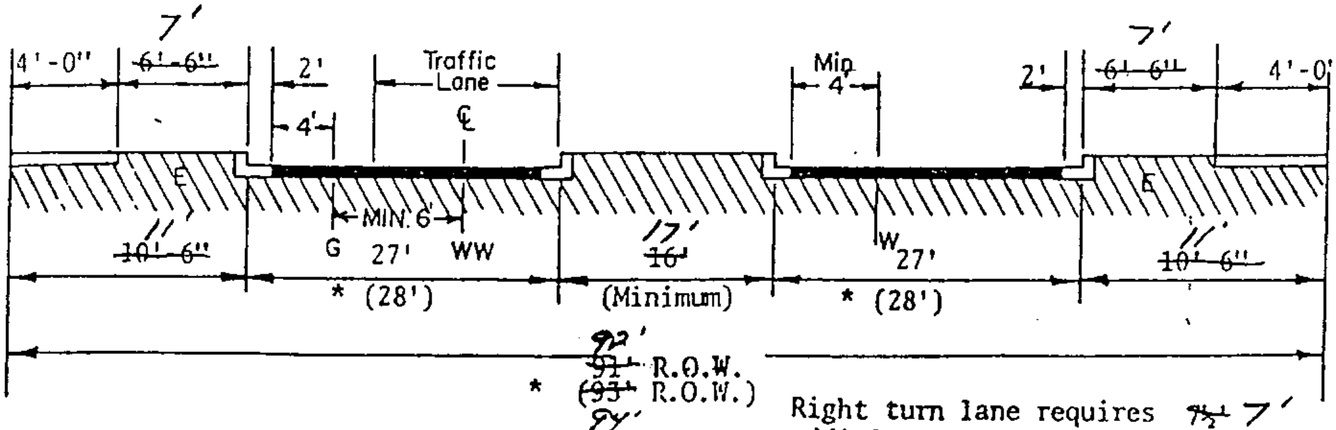


* Will accomodate on street bike lanes.

Right turn lane requires ~~9½'~~ 7' additional R.O.W.

STREETS

K

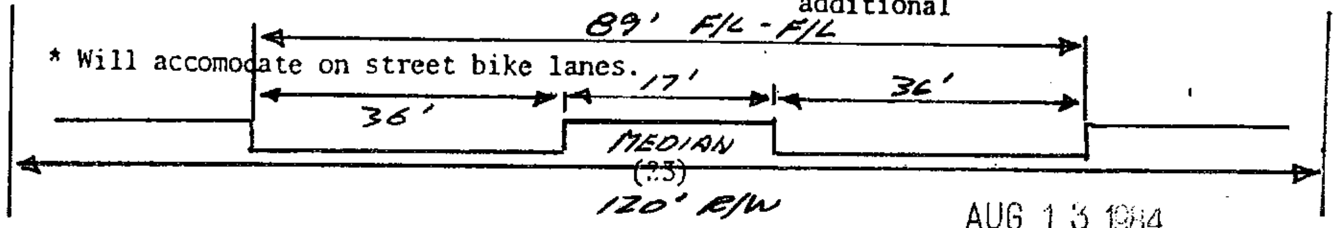


Right turn lane requires ~~9½'~~ 7' additional

* Will accomodate on street bike lanes.

STREETS

I, J



AUG 13 1984

Colorado
6-5-74 ~~JHE~~ 6-5-74
Runoff Curve Numbers

The original CN's were based on soils and Poor Range.
Discussion with Range specialist resulted in a modification - 50% of area in Poor Condition and 50% of area in Fair Condition

The Curve Numbers were Modified as follows.

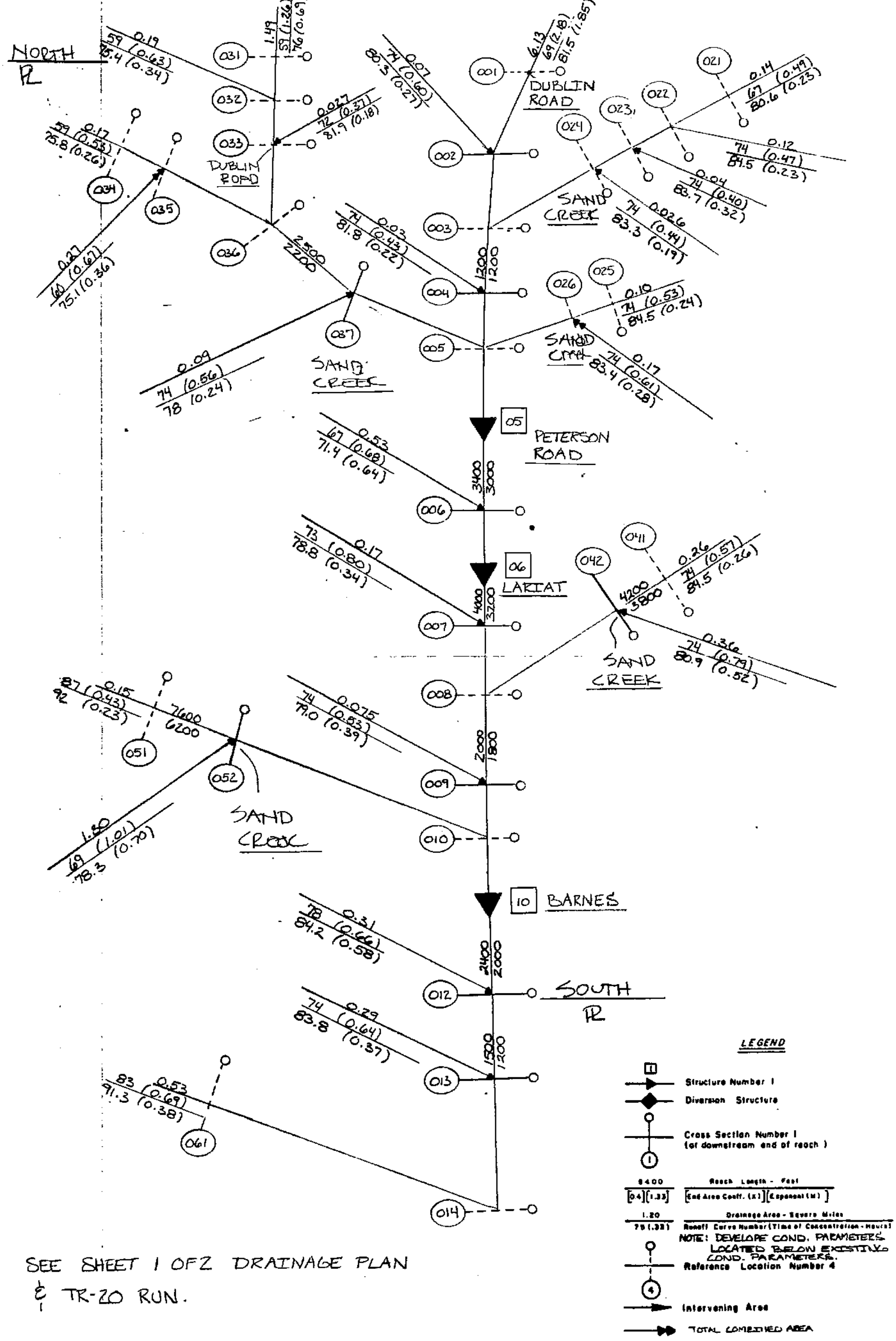
All Poor Cond		50% Poor 50% Fair Cond.
88	—	85
87	—	84
86	—	83
82	—	79
81	—	78

The 50% Fair & 50% Poor Curve Numbers will be used for TR20 Flood Routing

INSERT FROM SCS IN DENVER DESCRIBING THE EXISTING CONDITIONS LAND USE.

HYDROLOGY

STETSON HILLS DRAINAGE SCHEMATIC



SEE SHEET 1 OF 2 DRAINAGE PLAN & TR-20 RUN.

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PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 16 OF
CALCULATED BY JB DATE 8/13/84
CHECKED BY ECR DATE

TIME OF CONCENTRATION

THREE TYPES OF FLOWS WERE ANALYZED IN THE DETERMINATION OF THE TIME OF CONCENTRATION. THEY ARE : 1) OVERLAND FLOW; FLOW IN A CHANNEL, AND; 3) FLOW IN STREETS. IN ADDITION THE TIME OF CONCENTRATION WAS ANALYZED FOR BOTH EXISTING AND DEVELOPED CONDITIONS.

OVERLAND FLOW TIME WAS CALCULATED FOR THE FIRST 500 FEET OF THE BASIN. IT WAS ASSUMED THAT THE RUNOFF WOULD ENTER OR FORM A CHANNEL AFTER THIS DISTANCE. FOR EXISTING CONDITIONS IT WAS ASSUMED THAT THE OVERLAND TIME WOULD BE APPROXIMATELY 15 TO 20 MINUTES. FOR DEVELOPED CONDITIONS IT WAS ASSUMED THAT THE OVERLAND TIME WOULD BE APPROXIMATELY 10 MINUTES. THESE ASSUMPTIONS WERE CHECKED BY USING THE DENVER URBAN DRAINAGE AND FLOOD CONTROL DISTRICT CRITERIA FOR OVERLAND FLOW TIME (SEE CALCULATIONS BELOW)

OVERLAND FLOW EQUATION:* $t_i = \frac{1.8(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}}$

t_i = OVERLAND FLOW TIME

C_5 = RUNOFF COEFFICIENT (RATIONAL) RELATED TO % IMPERVIOUS

L = FLOW LENGTH

S = AVERAGE BASIN SLOPE

EXISTING CONDITIONS

USE C_5 OF 0.20 ≈ 0-20% IMP

SLOPE = 5%

L = 500'

t_i = 21.18 min Say 20 min.

DEVELOPED CONDITIONS

USE C_5 OF 0.65 - APPROXIMATELY 70% IMP

SLOPE = 5%

L = 500'

t_i = 10.6 min Say 10 min

* SOURCE: URBAN DRAINAGE AND FLOOD CONTROL DISTRICT DRAINAGE CRITERIA MANUAL.

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PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 17 OF
CALCULATED BY JB DATE 8/13/84
CHECKED BY EGB DATE

TIME OF CONCENTRATION CONT.

THE TIME OF FLOW IN NATURAL CHANNELS WAS ESTIMATED WITH KIRPITCH'S FORMULA (SEE BELOW). THE TIME OF FLOW IN CHANNELS UNDER DEVELOPED CONDITIONS CHANGES FROM THE NATURAL FLOW TIME DUE TO CHANNEL IMPROVEMENTS. GENERALLY, THE TIME OF FLOW WILL DECREASE AS A RESULT OF DECREASED CHANNEL LENGTH AND INCREASED VELOCITY. IN ORDER TO DETERMINE THE FLOW TIME SEVERAL ASSUMPTIONS ABOUT CHANNEL VELOCITY WERE MADE. FIRST, A VELOCITY OF 5.5 Ft/sec WAS ASSUMED FOR SAND CREEK. SECONDLY, A VELOCITY OF 7.5 Ft/sec WAS ASSUMED FOR ALL TRIBUTARIES. GREATER CONSIDERATION WILL BE GIVEN TO CHANNEL IMPROVEMENTS ON THE TRIBUTARIES, AND THEREFORE, HIGHER VELOCITIES CAN BE EXPECTED.

THE TIME OF FLOW IN THE STREETS WAS ALSO BASED ON THE EXPECTED VELOCITY. AN AVERAGE OF 3 Ft/sec WAS ASSUMED FOR ALL STREETS. IT SHOULD BE NOTED THAT STREET FLOW HAS BEEN CONSIDERED AS OVERLAND FLOW FOR THE DEVELOPED OFFSITE BASINS DUE TO THE LACK OF KNOWLEDGE AS TO THE FUTURE STREET LAYOUT IN THESE BASINS.

THE SUMMATION OF THE TIMES OBTAINED BY EACH OF THE DIFFERENT FLOWS RESULTS IN THE TIME OF CONCENTRATION FOR THE WATERSHED IN QUESTION.

Kirpitch's Formula – $T_1' = \left(\frac{11.9\ L^3}{H}\right)^{.385}$

T = t_c (hrs)
L = length of longest water course in miles
H = Elevation difference (Ft)

$$\text{Velocity} = \frac{L}{T\ 3600}$$

$$T_2 = \frac{L}{3600\ V}$$

$$T_i + T_1 + T_2 = t_c$$

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PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 18 OF
CALCULATED BY JB DATE 8/13/84
CHECKED BY [illegible] DATE

TIME OF CONCENTRATION EXISTING CONDITIONS

BASIN NO.	CHANNEL TIME LENGTH	△ HEIGHT	VEL	TIME	TOTAL Tc * (HRS)
001	36000	760	5.4	1.85	2.18
002	3100	75	3.2	0.27	0.60
004	1000	35	3.0	0.10	0.43
006	5200	175	4.1	0.35	0.68
007	5800	115	3.4	0.47	0.80
009	2000	45	2.8	0.20	0.53
012	5400	220	4.6	0.33	0.66
013	4500	160	4.0	0.31	0.64
021	2000	80	3.5	0.16	0.49
022	1700	60	3.4	0.14	0.47
023	700	25	2.8	0.07	0.40
024	1000	25	2.5	0.11	0.44
025	2000	40	2.8	0.20	0.53
+ 026	3000	60	3.0	0.28	0.61
031	14,500	300	4.3	0.93	1.26
032	5000	240	4.6	0.30	0.63
033	400	20	2.8	0.04	0.37
034	3000	140	4.2	0.20	0.53
+ 035	5500	220	4.5	0.34	0.67
037	2000	30	2.4	0.23	0.56
041	3000	90	3.5	0.24	0.57
042	5500	100	3.3	0.46	0.79
051	1500	100	4.2	0.10	0.43
052	11,000	290	4.5	0.68	1.01
061	6000	240	4.6	0.36	0.69

NOTE: AN INITIAL TIME (OVERLAND) OF 20MIN (0.33 hrs) WAS ADDED TO THE CHANNEL TIME TO GET THE TOTAL Tc

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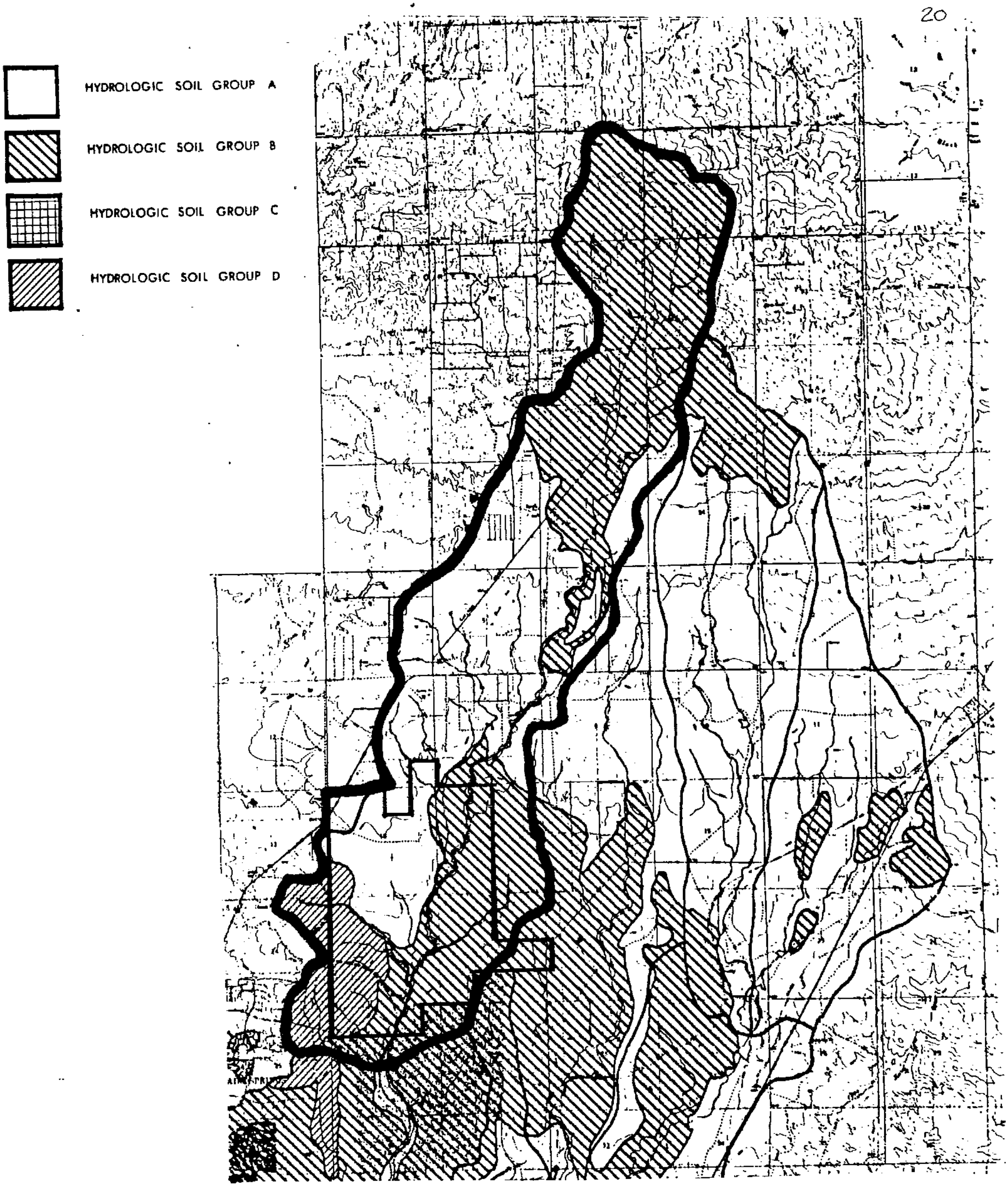
PROJECT STETSON HILLS
JOB NUMBER 516170I SHEET 19 OF
CALCULATED BY JB DATE 8/14/84
CHECKED BY ECB DATE

TIME OF CONCENTRATION DEVELOPED CONDITIONS

BASIN NO.	STREETS LENGTH	STREETS TIME	CHANNEL LENGTH	CHANNEL VEL	CHANNEL TIME	TOTAL** tc
001			33000	5.5	1.68	1.85
002			2000	↓	0.10	0.27
004			1000		0.05	0.22
006	4400	0.41	1200		0.06	0.64
007	800	0.07	2000		0.10	0.34
009	2400	0.22	-			0.39
012	3500	0.32	1700		0.09	0.58
013			4000	↓	0.20	0.37
021			1500	7.5	0.06	0.23
022			1500	↓	0.06	0.23
023	1600	0.15				0.32
024	200	0.02				0.19
025			1900		0.07	0.24
+ 026			2900		0.11	0.28
031			14000		0.52	0.69
032			4500		0.17	0.34
033			400		0.01	0.18
034			2500		0.09	0.26
+ 035			5000		0.19	0.36
037			2000		0.07	0.24
041			2500		0.09	0.26
042	3000	0.28	2000		0.07	0.52
051			1500		0.06	0.23
052	2800	0.26	7200		0.27	0.70
061			5800	↓	0.21	0.38

** AN INITIAL (OVERLAND) TIME OF 10 min (0.17hrs) WAS ADDED TO THE STREET AND CHANNEL FLOW TIMES TO GET THE TOTAL tc.



SCS SOILS

REFERENCE : FINN AND ASSOCIATES - IMPACT STUDY

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PROJECT STETSON HILLS
JOB NUMBER 516701 SHEET 21 OF
CALCULATED BY JB DATE 8/6/84
CHECKED BY ECB DATE

SOILS

BASIN NO.	PERCENTAGE A	B	D	COMPOSITE CN * EXISTING COND
001	35	65 →		69
002		100		74
004		100		74
006	45	55		67
007	5	95		73
009		100		74
012		70	30	78
013		98	2	74
021	45	55		67
022		100		74
023		100		74
024		100		74
025		100		74
026		100		74
031	98	2		59
032	100			59
033	15	85		72
034	100			59
035	90	10		61
037		100		74
041		100		74
042		100		74
051			100	87
052	60	10	30	69
061		30	70	83

*EXISTING LAND USE IS PRIMARILY RANGE AND 5AC AGRICULTURAL LOTS - RANGE LAND IN FAIR CONDITION WILL BE USED

A - 59.0 B - 74.0 C - 83 D - 87

IE: BASIN 001 .35 * 59 + .65 * 74

COMPOS CN = 69

FUTURE A = 75.8 B - 84.5 - D · 92

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PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 22 OF
CALCULATED BY CMB DATE 8-9-84
CHECKED BY ECB DATE

Curve Numbers - Future Conditions

Basin No.	Soil	Offsite	SF 4-6 Du/A	MF 8-12 Du/A	MF 16-22 Du/A	MF 25-35 Du/A	Retail-Office	School	Park	Comp CN
001	total	100%								81.5
	A	35%								
	B	65%								
002	total B		55%	45%						80.3
004	total B		25%	75%						81.8
006	total		33%	38%		10%			19%	71.4
	A		88%	75%		88%				
	B		12%	25%		12%			100%	
007	total		75%	25%						78.8
	A			20%						
	B		100%	80%						
009	total-B		80%	20%						79.0
012	total		25%		9%	4%	47%		15%	84.2
	B		100%		100%	100%	33%		100%	
	D						67%			
013	total B	69%			17%		7%		7%	83.8
021	total	100%								80.6
	A	45%								
	B	55%								
022	total B	100%								84.5
023	total B	45%		55%						83.7
024	total B	20%		80%						83.3
025	total B	100%								84.5
026	total B	29%		71%						83.9
031	total	100%								76.0
	A	98%								
	B	2%								
032	total A	80%		20%						75.4
033	total			100%						81.9
	A			12%						
	B			88%						
034	total A	100%								75.8

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PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 23 OF
CALCULATED BY CMB DATE 8-9-84
CHECKED BY ECB DATE

Curve Numbers - Future Conditions

Basin No.	Soil	Offsite	SF 4-6 Du/A	M.F. 8-12 Du/A	MF 18-22 Du/A	mF 25-35 Du/A	Retail-Office	School	Park	Comp CN
035	total	32%		65%			3%			75.1
	A	100%		100%			50%			
	B						50%			
037	total B		100%							78.0
041	total B	100%								84.5
042	total B	28%	53%	17%		2%				80.9
051	total D	100%								92.0
052	total	10%	41%	13%	14%		20%	2%		76.3
	A	33%	100%	83%	80%		20%	100%		
	B			17%			20%			
	D	67%			20%		60%			
061	total	68%					32%			91.3
	B	33%								
	D	67%					100%			

Sample Calculation: Basin 052

Offsite = 10% composed of (2/3) D + (1/3) A
SF 4-6 DU/A = 41% composed of A
mF 8-12 DU/A = 15% composed of (5/6) A + (1/6) D
mF 18-22 DU/A = 12% composed of (4/5) A + (1/5) D
Retail/office = 20% composed of (3/5) D + (1/5) A + (1/5) B
School = 2% composed of A

$$\text{Composite CN} = .10\left[(2/3)95^{*} + (1/3)75.8\right] + .41(65) + .15\left[(5/6)74 + (1/6)83\right]$$

$$+ .12\left[(4/5)80 + (1/5)93\right] + .20\left[(3/5)95 + (1/5)84 + (1/5)92\right]$$

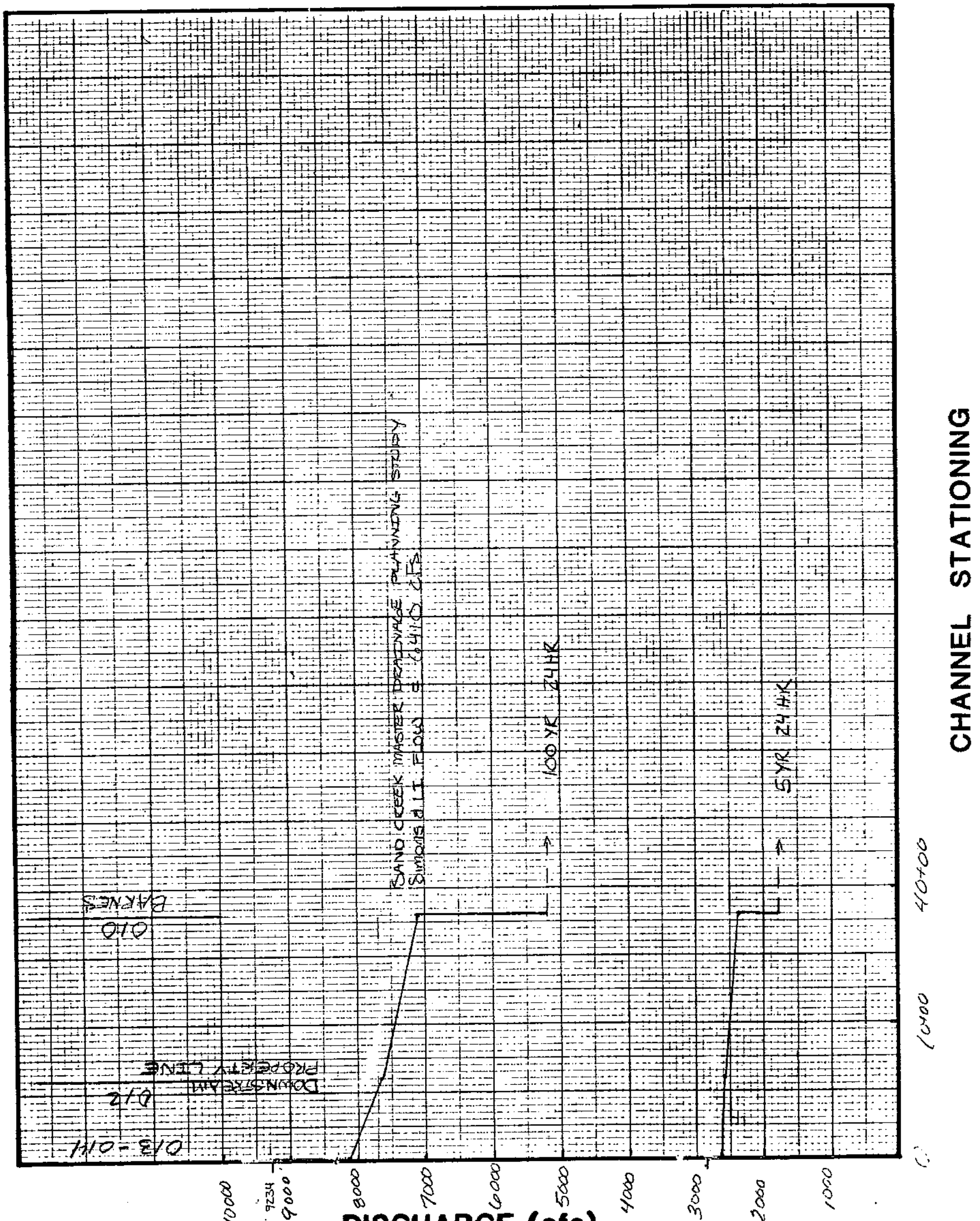
$$+ .02(68) = \underline{\underline{76.3}}$$

* For curve number for various land uses see Table 2. (Figure 3)

CMB 8-1184
24

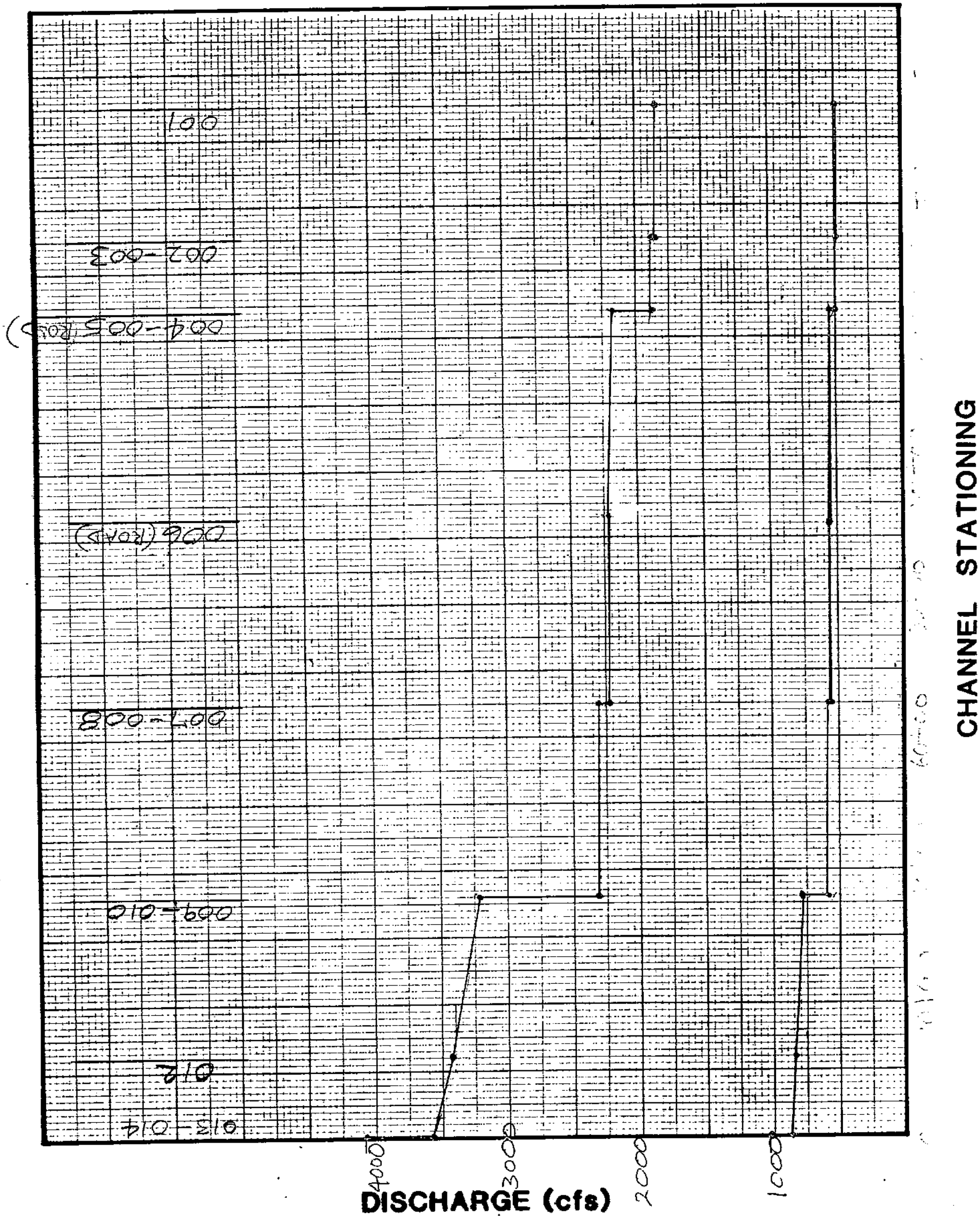
STREAM DISCHARGE PROFILES

LOCATION Sand Creek DEV. COND.



STREAM DISCHARGE PROFILES

LOCATION SAND CREEK (EXIST. COND.)



CUHB 8-14-84
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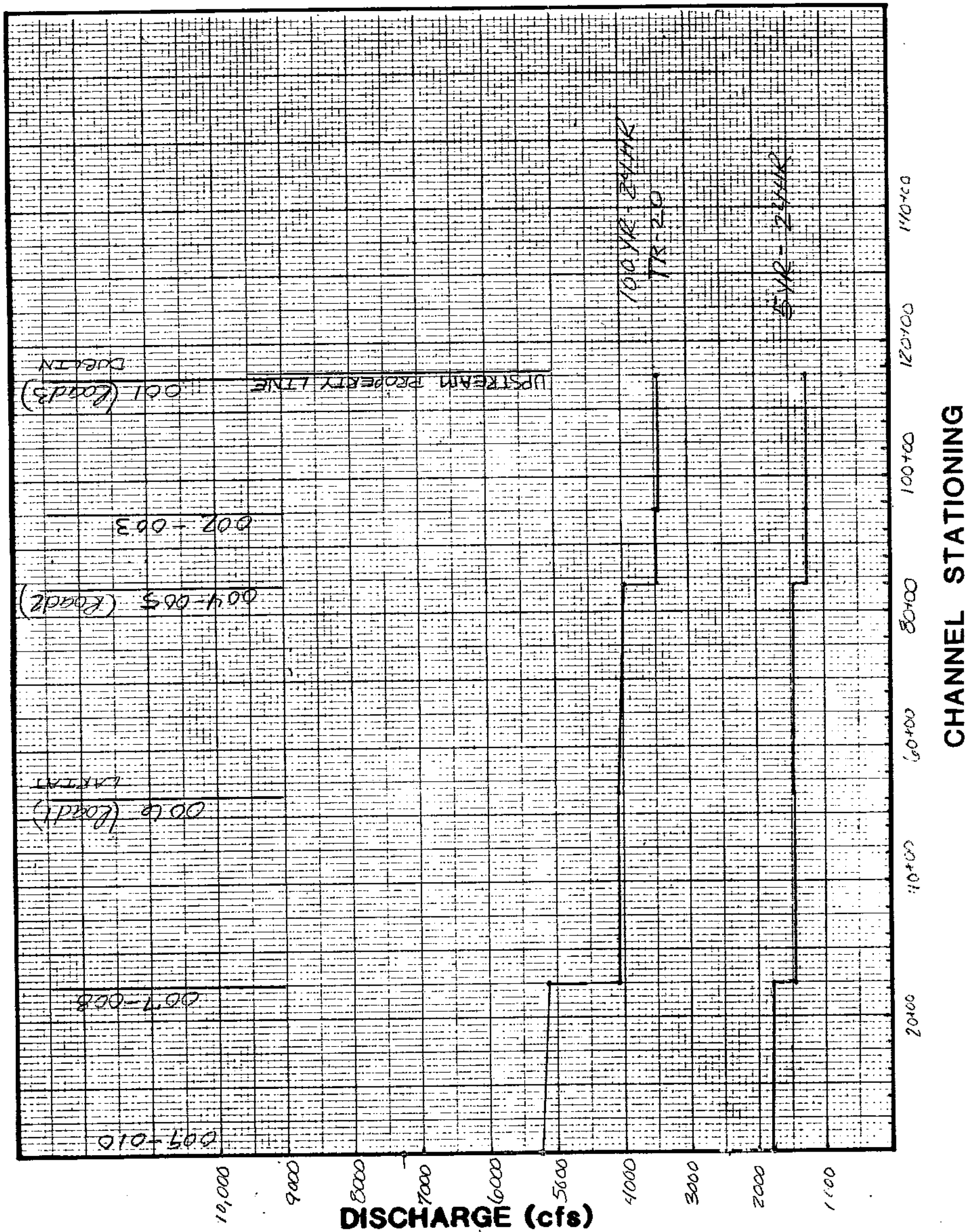
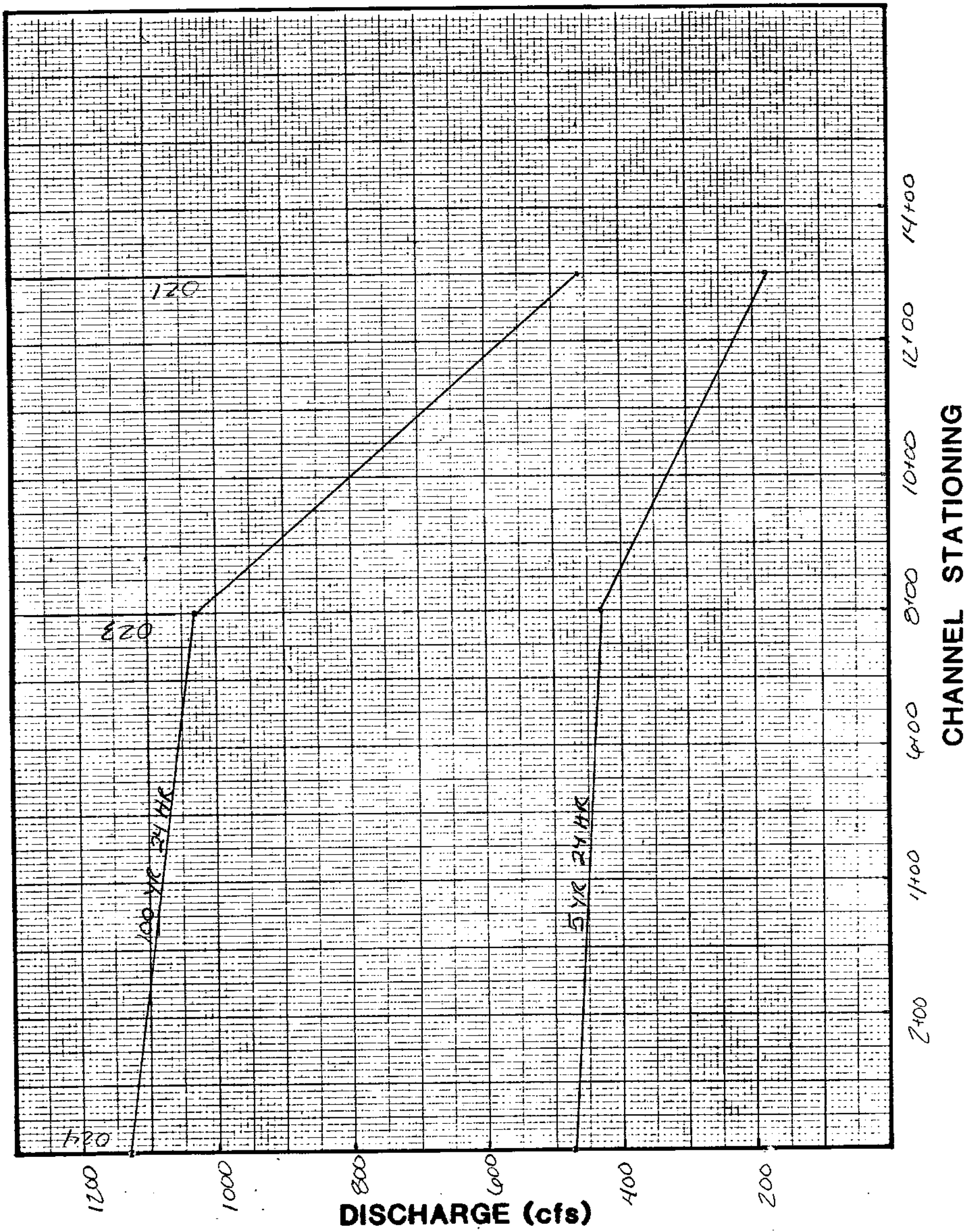
STREAM DISCHARGE PROFILES

LOCATION Sand Creek DEV. COND.



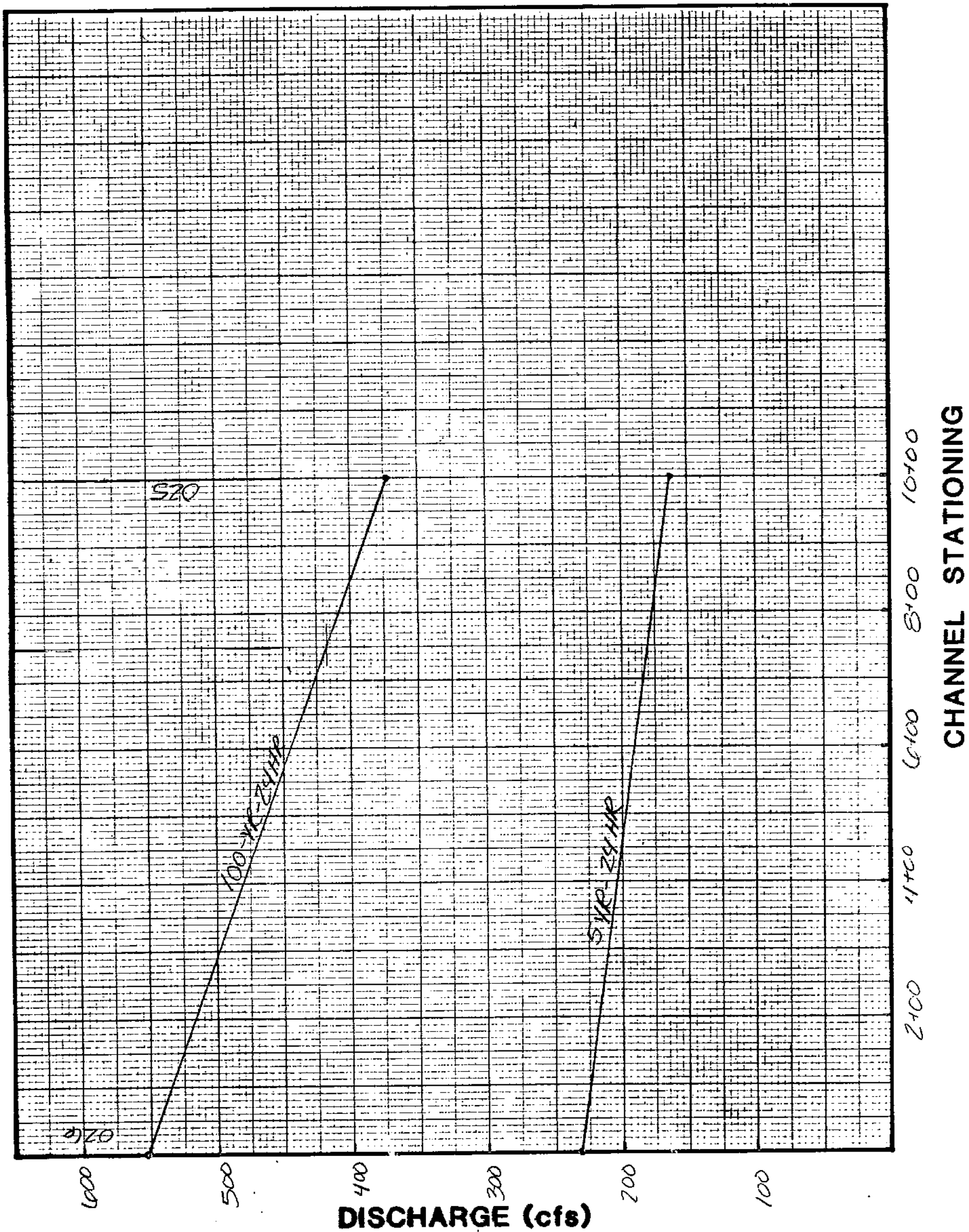
STREAM DISCHARGE PROFILES

LOCATION 022 → 024



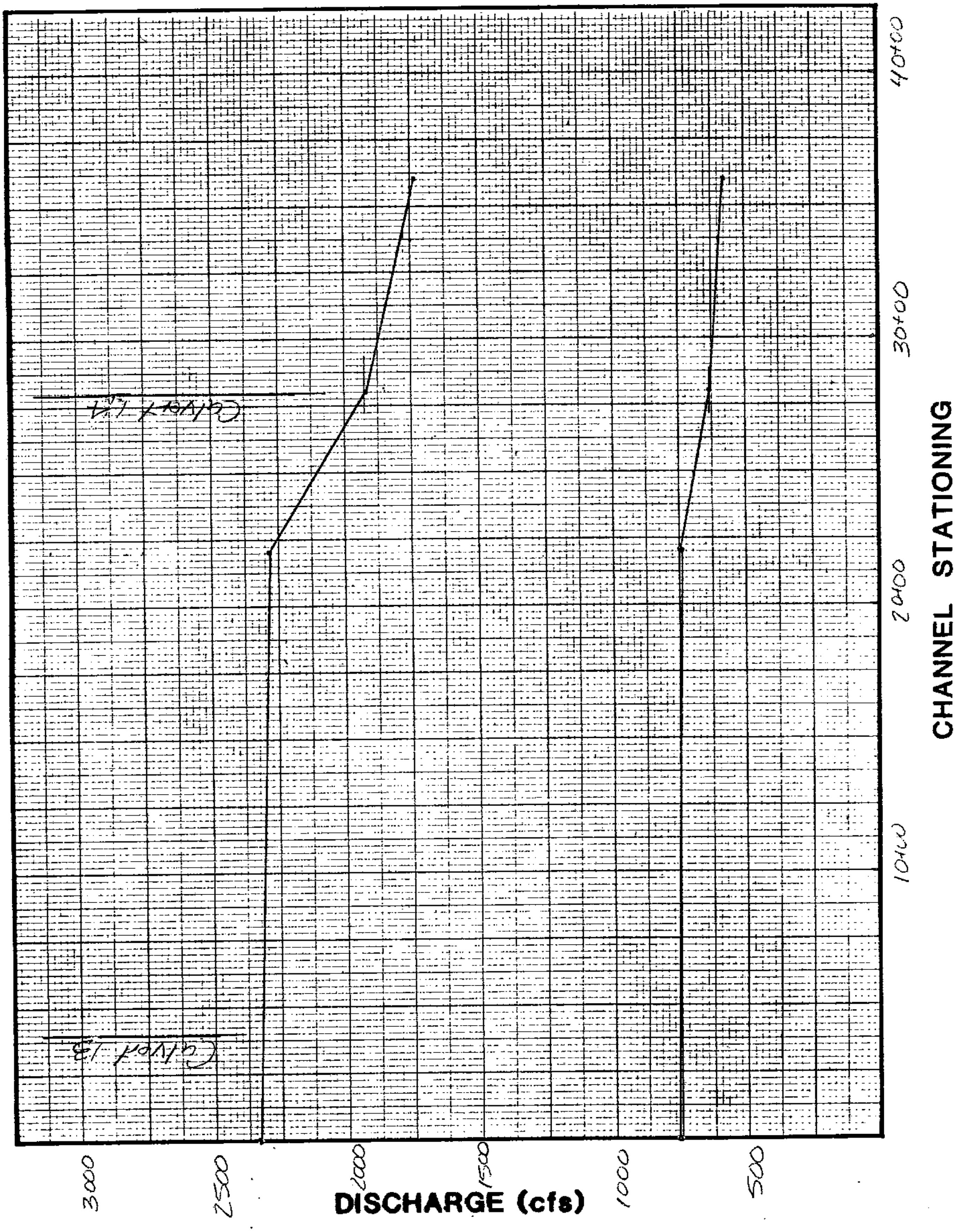
STREAM DISCHARGE PROFILES

LOCATION 025 → 026



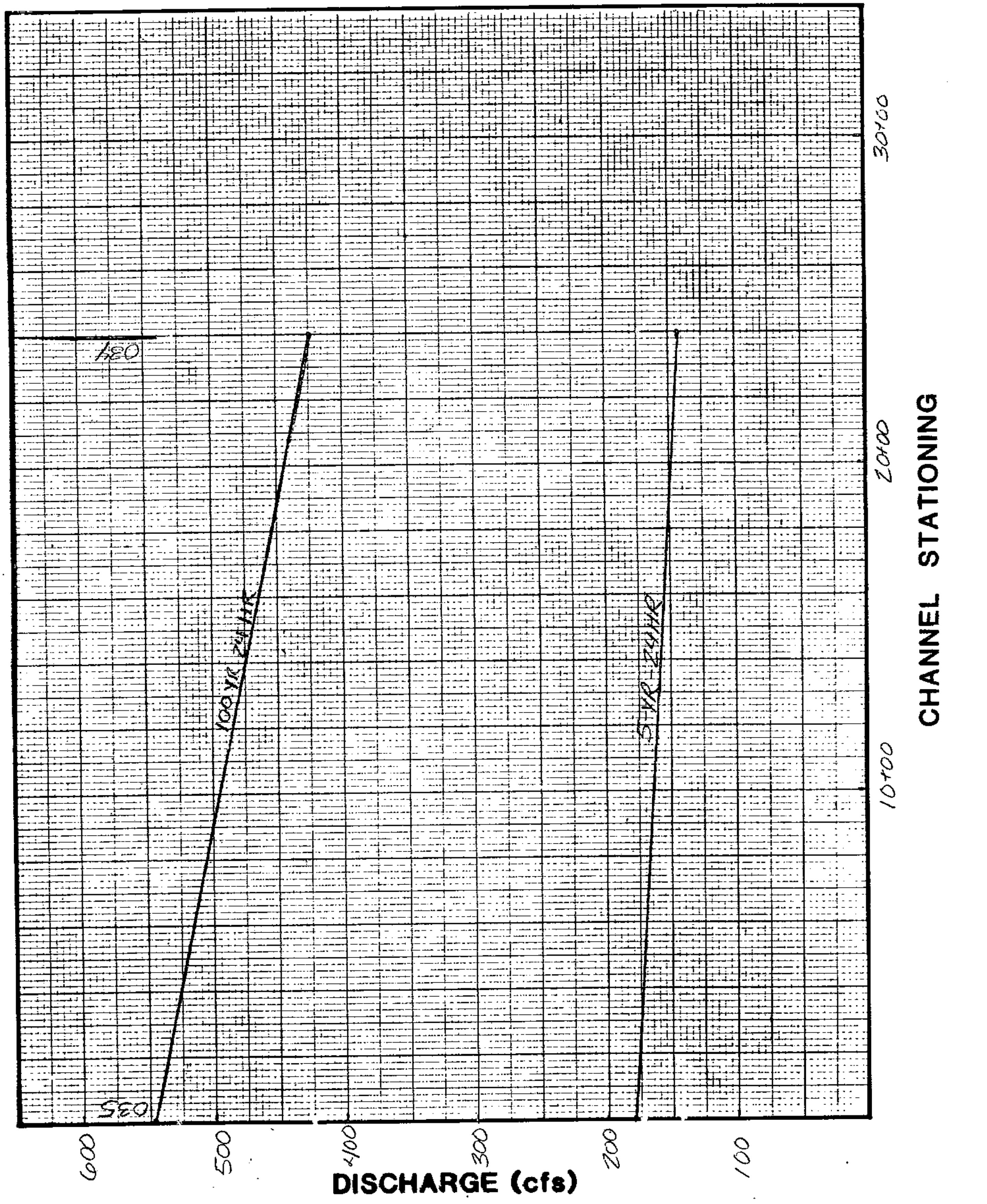
STREAM DISCHARGE PROFILES

LOCATION 031→037



STREAM DISCHARGE PROFILES

LOCATION 034 → 035



C..B 8-13-84

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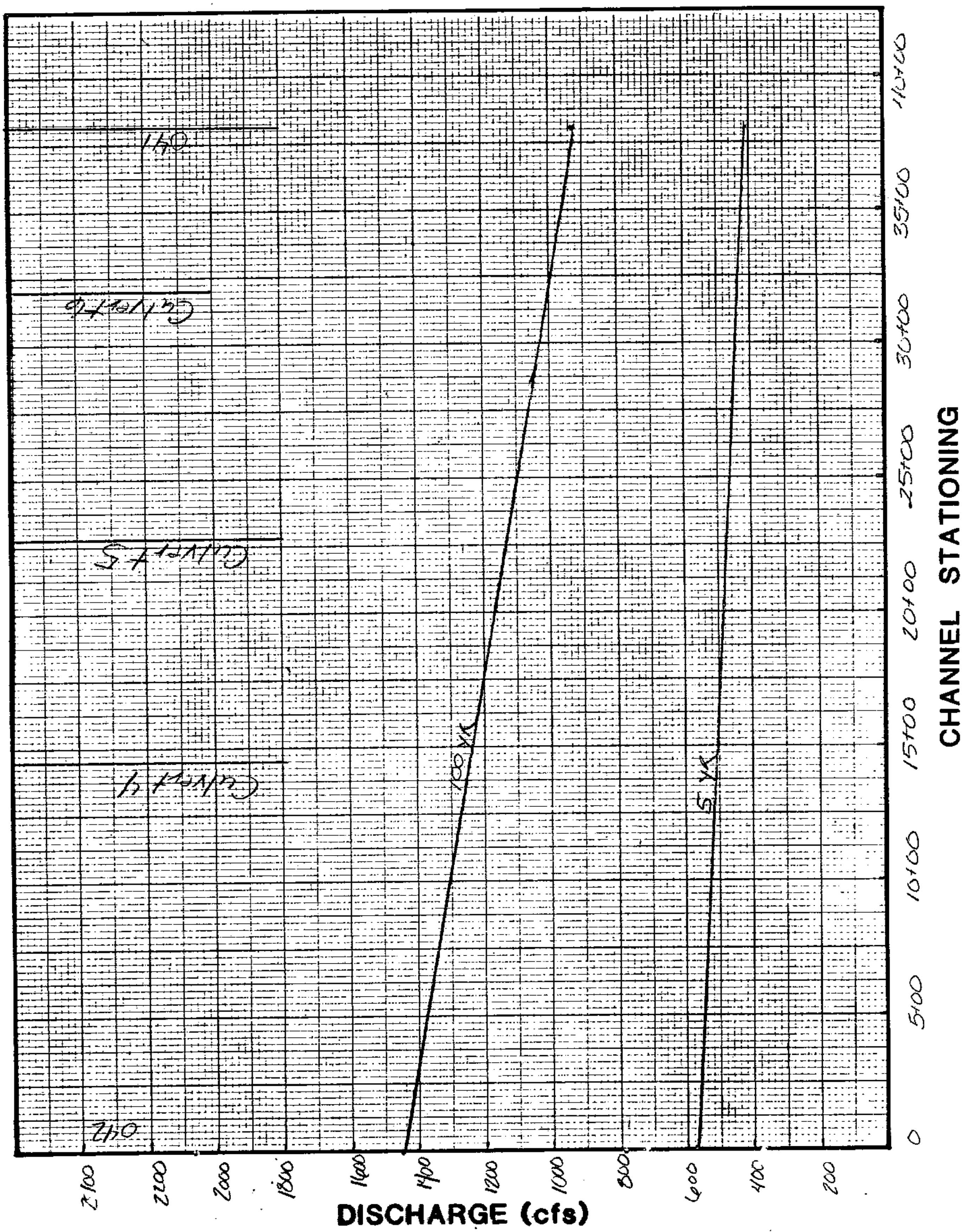
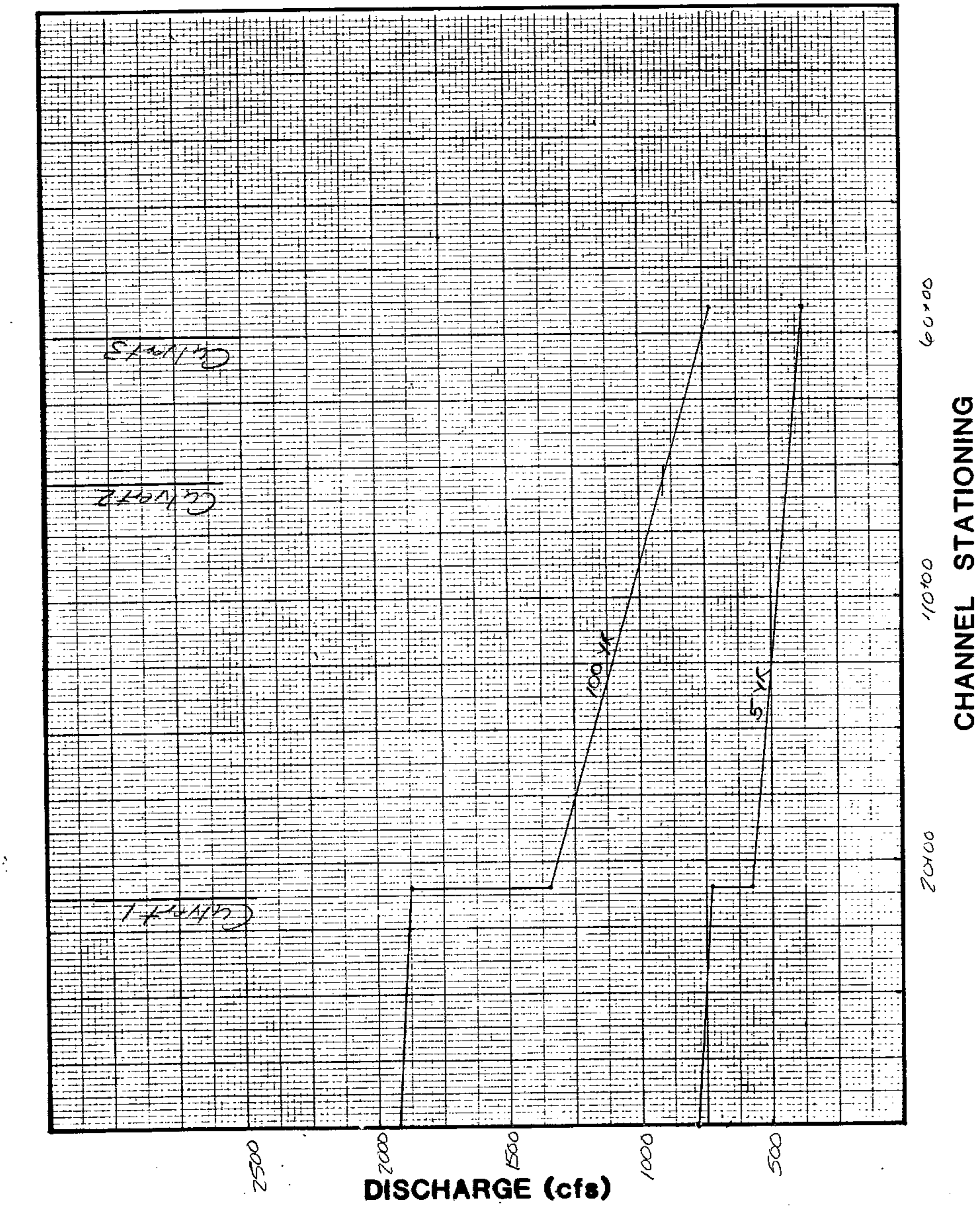
STREAM DISCHARGE PROFILES

LOCATION 041 → 042



STREAM DISCHARGE PROFILES

LOCATION 051 → 052



HYDRAULICS

Greiner Engineering

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☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT Stetson Hills
JOB NUMBER 516701 SHEET 33A OF
CALCULATED BY JB DATE 6/10/85
CHECKED BY WFL DATE 6/11/85

NORMAL DEPTH CALCULATIONS ALONG SAND CREEK

TYPICAL CROSS SECTION

SLOPE = 1.0%
UPSTREAM QDESIGN = 3450 cfs (TYPICAL SECTION)
n = .045
BOTTOM WIDTH = 75' (TYP.)
SIDES = 3:1

D = 4.7'
TW = 103'
A = 416
WP = 104.6
R = 4.0
V = 8.3 Ft/sec
FREEBOARD = 1.2'

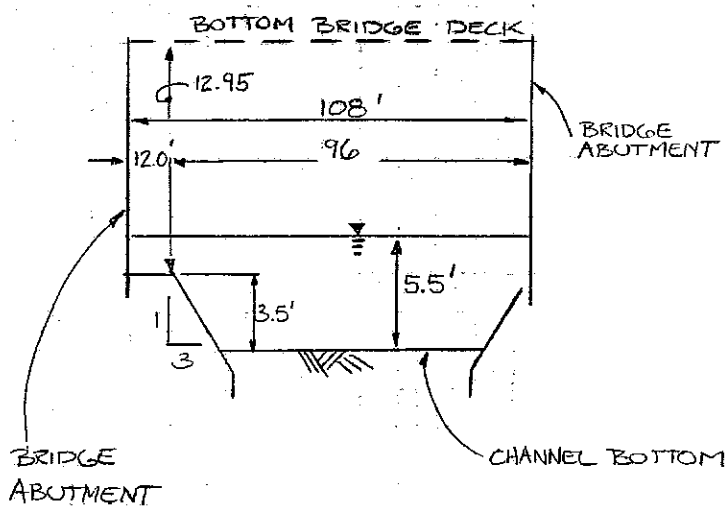
DOWNSTREAM Q DESIGN = 7660 (CRITICAL SECTION)

SAME CRITERIA AS ABOVE

D = 7.3
TW = 119
A = 712.9
WP = 121.5
R = 5.9
V = 10.7
FREEBOARD = 1.8'

TYPICAL BRIDGE SECTION

SLOPE = 1.3%
Q DESIGN = 7660
n = 0.29
BOTTOM WIDTH = 75'
SIDES 3:1
DEPTH = 5.5'
V = 13.9 ft/sec
Freeboard = 11.8'



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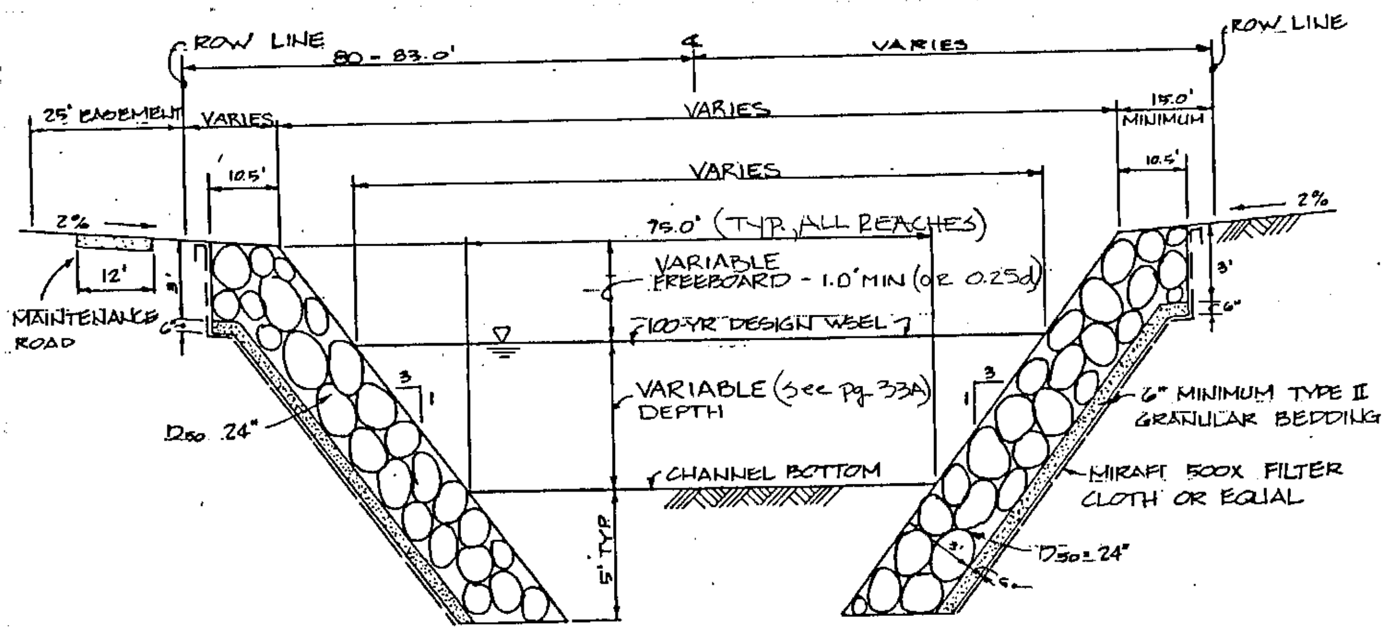
PROJECT STETSON HILLS

JOB NUMBER 516701 SHEET 33 OF

CALCULATED BY JB DATE 4/19/85

CHECKED BY DATE



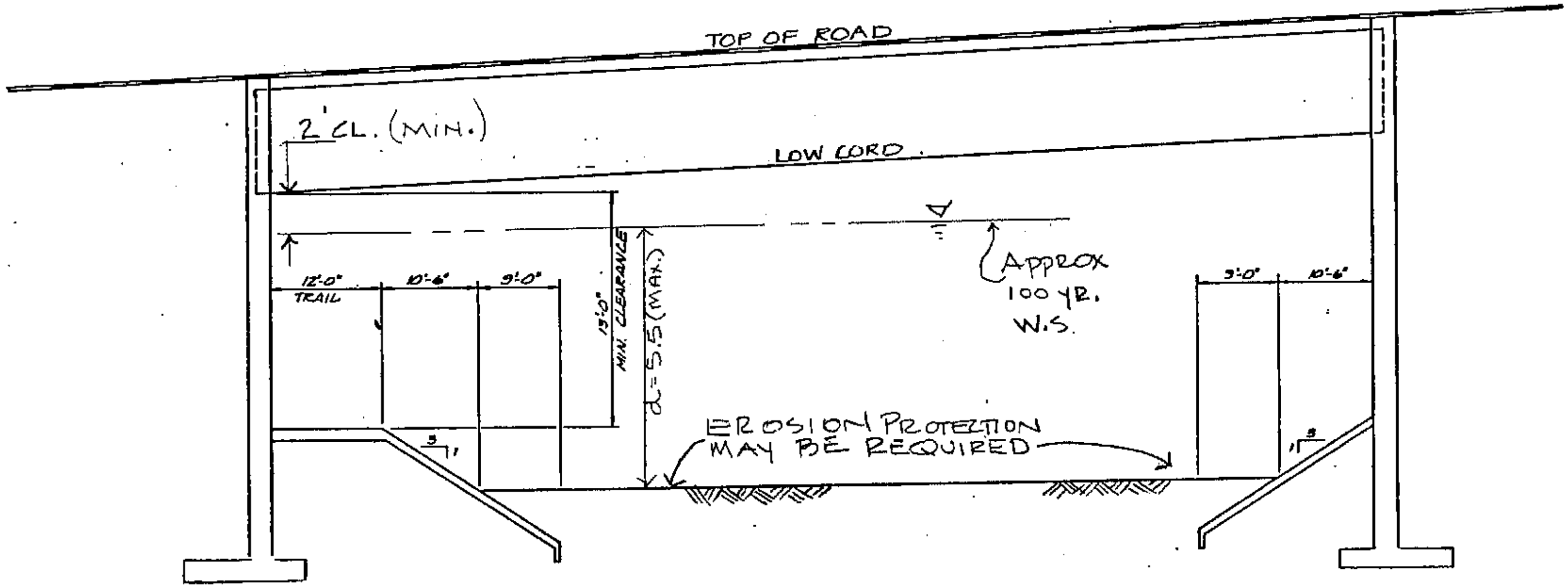
NOTE: SEE Pg. 33A

SAND CREEK CHANNEL SECTION

ALL CONSTRUCTION TO BE IN CONFORMANCE WITH THE CITY OF COLORADO SPRINGS STANDARDS AND SPECIFICATIONS

NOTE: RIP RAP DROP STRUCTURES REQUIRED FOR MAINTAINING EQULIBRIUM SLOPE. LOCATIONS BASED UPON FINAL DESIGN

TYPICAL BRIDGE CROSSING
(SAND CREEK)



NOTE: SEE PG 33A

NOTE: A MINIMUM 2 FOOT CLEARANCE WILL BE PROVIDED AT All BRIDGE CROSSINGS

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- ☐ KEMMERER, WYOMING

PROJECT STETSON HILLS
JOB NUMBER 516170I SHEET 34 OF
CALCULATED BY JB DATE 4/19/85
CHECKED BY DATE

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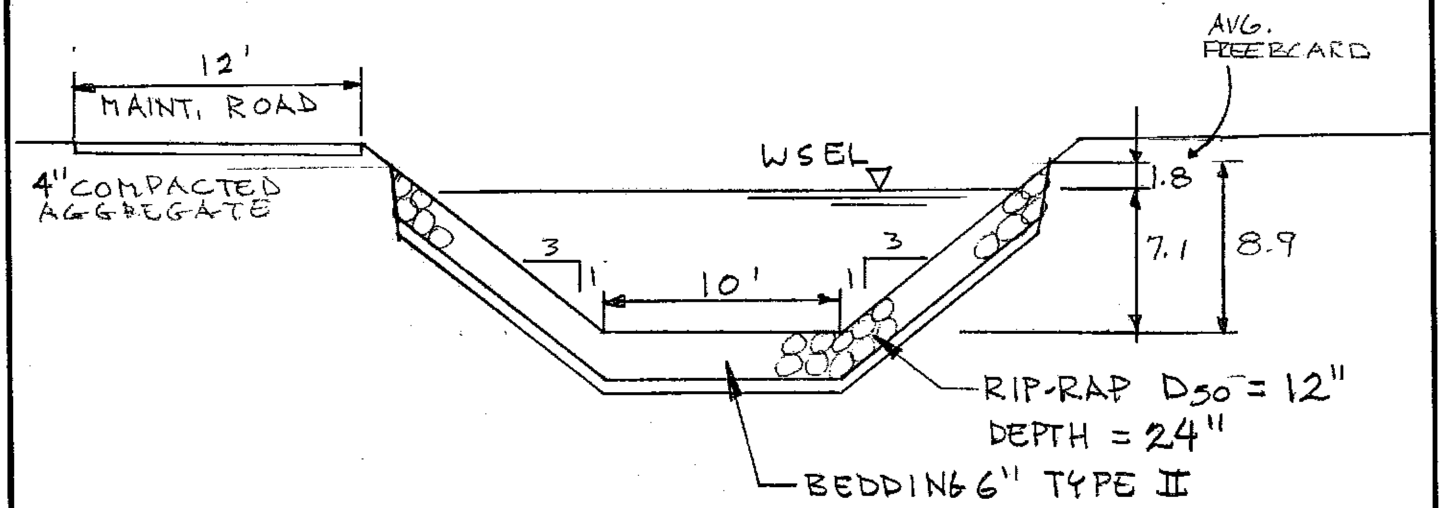
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ CASPER, WYOMING
☐ KEMMERER, WYOMING

PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 35 OF
CALCULATED BY WJM DATE 8-16-84
CHECKED BY E.P. DATE

RIP-RAP CHANNEL (TRIBUTARY REACH)



QUANTITIES / LN. FT

MAINT. ROAD (MEDIUM GRAVEL) = 0.148 CU. YDS. / L.F. AGGREGATE

RIP-RAP (28.10' x 2) + 10 = 66.20 LF X 2' = 132.4 CU.FT.
÷ 27 = 4.90 CU. YDS / LF. TYPE M RIP-RAP

RIP-RAP BED COURSE = 66.2 LF X 0.5' =
33.1 CU FT ÷ 27 = 1.23 CU YDS/LF TYPE II BEDDING

NOTE: RIP RAP CHANNELS ARE
PROPOSED TO BE GROUTED
AS PER CITY OF COLORADO
SPRINGS CRITERIA.

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PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 36 OF
CALCULATED BY JB REVISED DATE 4/18/85
CHECKED BY CMB DATE 5-7-85

CHANNEL SECTIONS A-A

SIDE SLOPE = 3:1

SEE PLAN SHT 2 OF 2 FOR TYPICAL SECT.

TRIBUTARY REACH	So (%)	BOTTOM WIDTH	QCFS	RIPRAP n value	TOP WIDTH	DEPTH	VELOCITY	FROUDE #	FREEBOARD 0.25d MIN 1.0'
031-037	1.0	10	2320	.045	56.9	7.82	8.9	.73	1.96
041-042	1.0	10	1455	.045	48.1	6.36	7.9	.71	1.59
051-052	1.0	10	1900	.045	53.0	7.2	8.4	.72	1.80

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PROJECT STETSON HILLS
JOB NUMBER 516701 SHEET 37 OF
CALCULATED BY JB DATE 1/10/85
CHECKED BY ? DATE

PIPE SIZING ON MAJOR TRIBS

LOCATION (REACH)	DESIGN FLOW (cfs)	EXISTING SLOPE %	RCP PIPE SIZE (in)	DESIGN SLOPE %	LENGTH (Ft)
021 DOWN ALONG EAST PROPERTY LINE TO 022	460	1.9	66"	1.9	1100
022 TO 024	916	1.4	90"	1.4	1000
025 TO ROAD	370	2.5	60	2.0	250
ROAD TO 026	550	2.5	72	1.7	600
031 to 037	RIP-RAP CHANNEL				
032 to 033	RIP RAP CHANNEL				
034 TO 035	530	1.9	72	1.6	2200
041 TO 042	RIP RAP CHANNEL				
051 TO 052	RIP RAP CHANNEL				

SEE FOLLOWING PAGES FOR ALL CULVERT SIZING.

GREINER ENGINEERING	CULVERT DESIGN #1	Made By GKS	Date 2/11/85	Job No. 5161706
		Checked By JB	Date	Sheet No.

For: Stetson Hills Dr. between Anna Lee & Jackpot

HYDROLOGIC AND CHANNEL INFORMATION

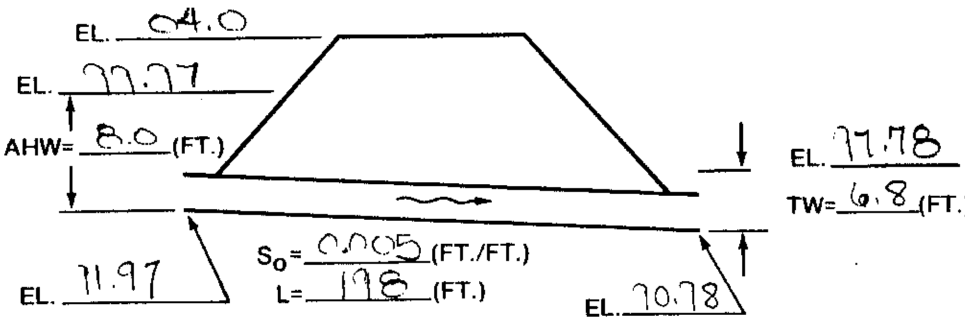
DRAINAGE AREA Basin B

METHOD OF DISCHARGE DETERMINATION TR-20 program, Master Drainage Study

(DESIGN) Q_1 = 1875 (cfs) TW$_1$ = 6.8 (FT.)

(CHECK) Q_2 = ______ (cfs) TW$_2$ = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION													
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$											
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
3 @ 6'x14'	625	44	Wing walls	1.0	6.0	0.4	2.0			6.8	6.8	1.0	7.8	7.8		
3 @ 8'x10'	625	65	"	1.0	8.0	0.4	2.0	5.0	6.5	6.8	6.8	1.0	7.8	8.0		

SUMMARY & RECOMMENDATIONS:
[illegible] 1.5? @ [illegible]/L.F Cast in Place
[illegible] Precast

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GREINER ENGINEERING	CULVERT DESIGN #2	Made By	Date	Job No.
		Checked By JB	Date	Sheet No.

For: Ajax Mine

HYDROLOGIC AND CHANNEL INFORMATION

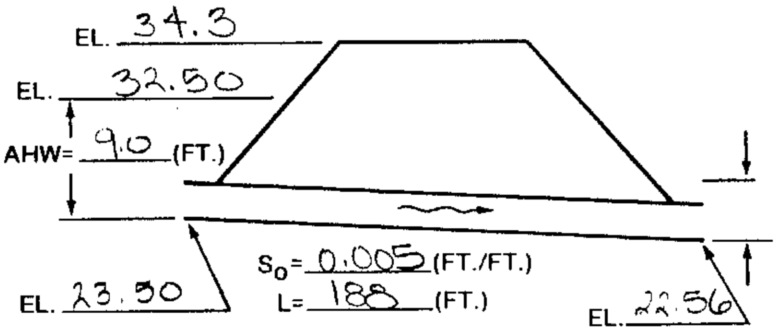
DRAINAGE AREA Basin B

METHOD OF DISCHARGE DETERMINATION TR-20 from Master Training Study

(DESIGN) Q_1 = 1175 (cfs) TW$_1$ = 5 (FT.)

(CHECK) Q_2 = ______ (cfs) TW$_2$ = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
2 @ 6'x10'	588	59	Wing walls	1.5	9.0	0.4	1.6	4.8	5.4	5'	5.4	0.90	5.7	9.0		
1 @ 8'x14	1175	84	"	1.5	12.0	0.4	3.2	6.0	7.0	5'	7.0	0.90	7.3	12.0		
4 @ 72"	300		FES			0.5										1,800/LF for 4

SUMMARY & RECOMMENDATIONS:

8x14 @ $585/LF Cast in Place

" 2 - 6x10' Precast

GREINER ENGINEERING	**CULVERT DESIGN** #3	Made By: GKS	Date: 2/11/85	Job No. 5161706
		Checked By: JB	Date	Sheet No.

For: Tutt near Lamar

HYDROLOGIC AND CHANNEL INFORMATION

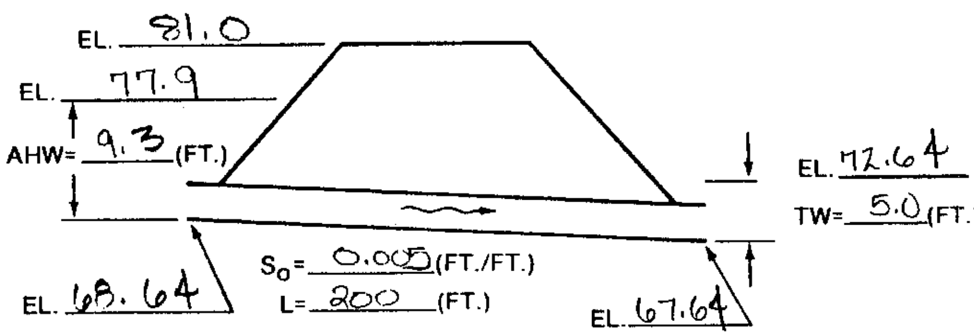
DRAINAGE AREA: Basin B

METHOD OF DISCHARGE DETERMINATION: TR-20 from Masters Drainage Study

(DESIGN) Q_1 = 900 (cfs) TW$_1$ = 5' (FT.)

(CHECK) Q_2 = ______ (cfs) TW$_2$ = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION													
				INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o											
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1@ 6'x14	900	65	Wing Walls	1.5	9.0	0.4	3.4	4.8	5.4	5'	5.4	1.0	7.8	9.0		$495/LF
1@ 8x10	900	100	"	1.5	12.0	0.4	3.3	6.0	7.0	5'	7.0	1.0	9.3	12.0		
3@72"	300															$600/LF

SUMMARY & RECOMMENDATIONS:
Single 8x10 @ $400/LF

GREINER ENGINEERING	**CULVERT DESIGN** #4	Made By GKS	Date 5/11/85	Job No. 5161706
		Checked By JB	Date	Sheet No.

For: J Smith Rd N of Pring Ranch

HYDROLOGIC AND CHANNEL INFORMATION

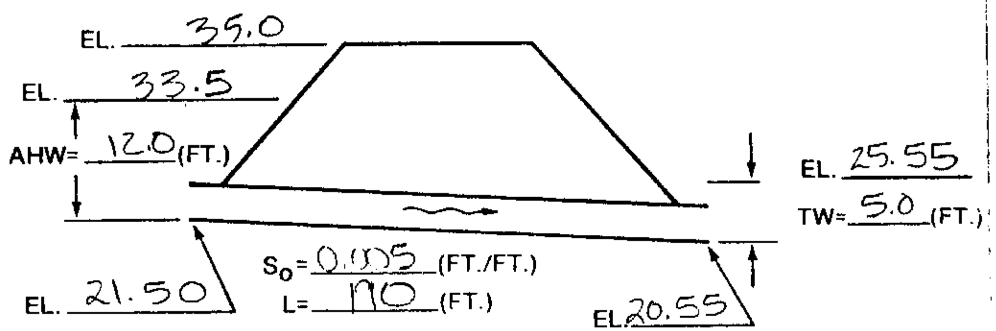
DRAINAGE AREA Basin K

METHOD OF DISCHARGE DETERMINATION TR 20 from Master Drainage Study

(DESIGN) Q_1 = 1565 (cfs) TW_1 = 5 (FT.)

(CHECK) Q_2 = ______ (cfs) TW_2 = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION											CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$											
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
double 6'x12'	780	65	wing walls	1.5	9.0	0.4	2.8	4.8	5.4	5.0	5.4	.095	7.3	9.0			
double 8x10	780	78	"	1.5	12.0	0.4	3.2	5.5	6.8	5.0	6.8	.095	9.0	12.0			

SUMMARY & RECOMMENDATIONS:

double 12x10 [illegible] $[illegible]/LF

GREINER ENGINEERING	CULVERT DESIGN # 5	Made By GKS	Date 2/12/85	Job No. 5161706
		Checked By JB	Date	Sheet No.

For: Peterson Rd N of Brahma

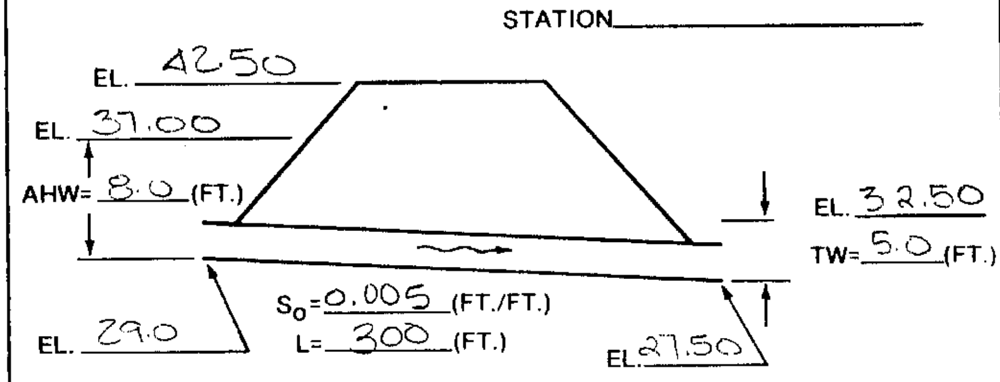
HYDROLOGIC AND CHANNEL INFORMATION

DRAINAGE AREA Basin H

METHOD OF DISCHARGE DETERMINATION TR 20 from Master Drainage Study

(DESIGN) Q_1 = 1260 (cfs) TW_1 = 5' (FT.)

(CHECK) Q_2 = ______ (cfs) TW_2 = ______ (FT.)



CULVERT DESIGN DATA				HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
double 6x14	630	44	wing walls	1.0	6	0.4	1.5	3.7	5.0	5.0	5.0	1.5	5.0	6.0		
double 8x10	630	65	"	1.0	8	0.4	1.7	5.0	6.5	5.0	6.5	1.5	6.7	8.0		$666/LF
4@84"	300			1.0	7.0	0.5										$1000/LF

SUMMARY & RECOMMENDATIONS:

double 8x10

ZH

GREINER ENGINEERING	CULVERT DESIGN #6	Made By GKS	Date	Job No.
		Checked By JB	Date	Sheet No.

For: Brainerd Trail

HYDROLOGIC AND CHANNEL INFORMATION

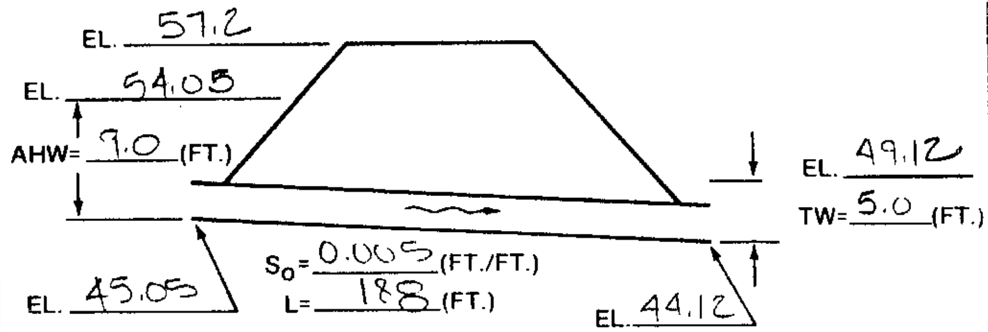
DRAINAGE AREA Basin H

METHOD OF DISCHARGE DETERMINATION TR-20 from Master Drainage Study

(DESIGN) Q_1 = 935 (cfs) TW$_1$ = 5' (FT.)

(CHECK) Q_2 = ______ (cfs) TW$_2$ = ______ (FT.)

STATION ____________



CULVERT DESIGN DATA				HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW=H+h_O-LS_O$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
3@72"	312		FES	1.5	9.0	0.5	3.8	4.7	5.35	5'	5.35	0.90	8.2	9.0		$600/LF
1@ 6x14'	935	66	wing walls	1.5	9.0	0.4	3.8	5.0	5.5	5	5.5	0.9	8.4	9.0		$475/LF
double 6X8	468	58	"	1.5	9.0	0.4	2.6	4.7	5.4	5	5.4	0.9	7.1	9.0		$439/LF
single 8x10	935	94	"	1.5	12.0	0.4	3.0	6.5	7.3	5	7.3	0.9	9.4	12.0		$380 LF

SUMMARY & RECOMMENDATIONS:

Single 8x10 b.c.

GREINER ENGINEERING	CULVERT DESIGN # 7	Made By JB	Date 4/22/85	Job No. 5161701
		Checked By CMB	Date 5-7-85	Sheet No.

For: Barnes @ Marksheffel

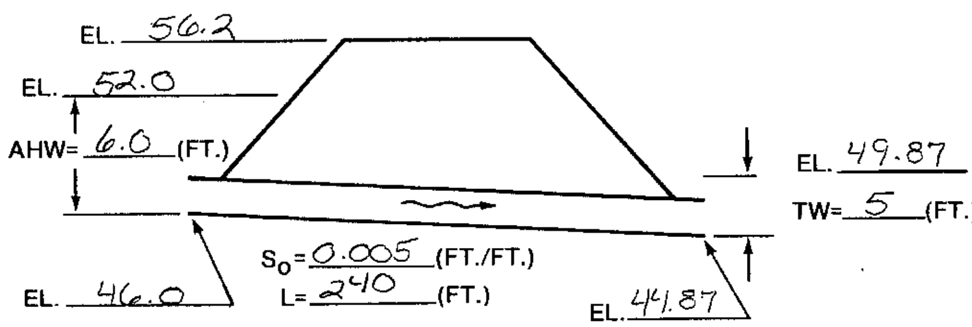
HYDROLOGIC AND CHANNEL INFORMATION

DRAINAGE AREA ________

METHOD OF DISCHARGE DETERMINATION SCS

(DESIGN) Q_1 = 294.8 (cfs) Q100 TW_1 = ________ (FT.)

(CHECK) Q_2 = ________ (cfs) TW_2 = ________ (FT.)



CULVERT DESIGN DATA				HEADWATER COMPUTATION												
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
72	294.8	—	F.E.S	1.0	6.0	0.5	3.4	4.75	5.4	5.0	5.4	1.2	7.6	7.6		

SUMMARY & RECOMMENDATIONS:

72" RCP

GREINER ENGINEERING	CULVERT DESIGN #8	Made By GKS	Date 2/11/85	Job No. 5161706
		Checked By JB	Date	Sheet No.

For: Stetson Hills Dr. N of Anna Lee Way

HYDROLOGIC AND CHANNEL INFORMATION

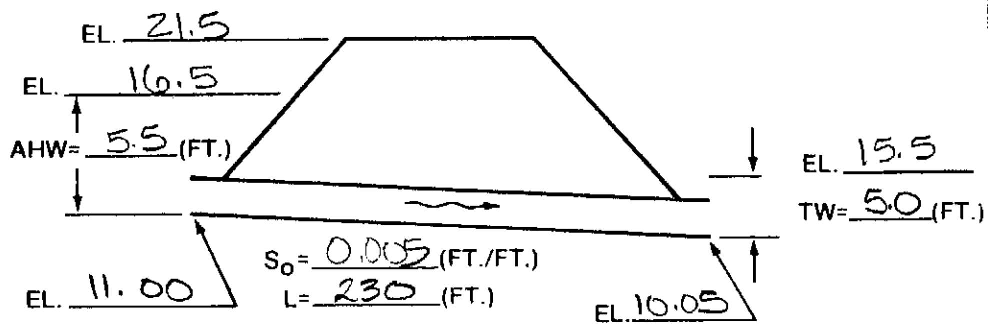
DRAINAGE AREA Basin D

METHOD OF DISCHARGE DETERMINATION SCS - Master Drainage Study

(DESIGN) Q_1 = 213 (cfs) Q100 TW_1 = 5.0 (FT.)

(CHECK) Q_2 = ______ (cfs) TW_2 = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION													
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1-72"	213		FES	1.0	6.0	0.5	1.7	3.8	4.7	5.0	5.0	1.2	5.5	6.0		$200/LF

SUMMARY & RECOMMENDATIONS:

GREINER ENGINEERING	CULVERT DESIGN #9	Made By	Date	Job No.
		Checked By JB	Date	Sheet No.

For: Local Solution Stolen Hills Dr & Anna Lee Way

HYDROLOGIC AND CHANNEL INFORMATION

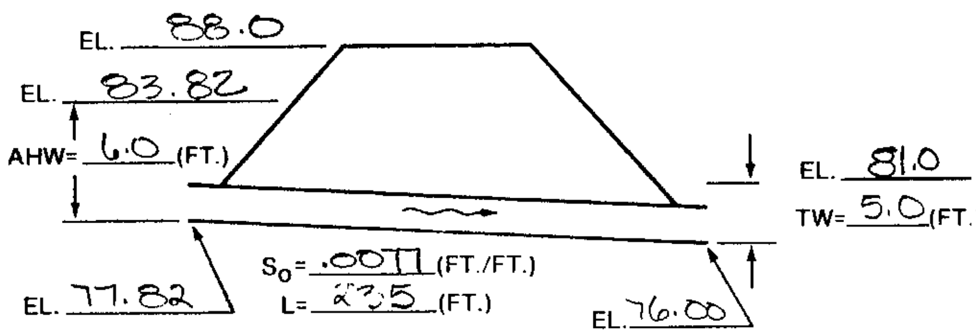
DRAINAGE AREA ______

METHOD OF DISCHARGE DETERMINATION SCS - Master Drainage Study

(DESIGN) Q_1 = 175 (cfs) TW_1 = 5.0 (FT.)

(CHECK) Q_2 = ______ (cfs) TW_2 = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION											CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$											
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
1x72"	175		FES	1.0	6.0	0.5	1.5	3.7	4.9	5.0	5.0	1.8	4.7	6.0		$200/LF

SUMMARY & RECOMMENDATIONS:

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GREINER ENGINEERING	CULVERT DESIGN #10	Made By GKS	Date 2/11/85	Job No. 5161706
		Checked By JB	Date	Sheet No.

For: Lariat @ Tutt

HYDROLOGIC AND CHANNEL INFORMATION

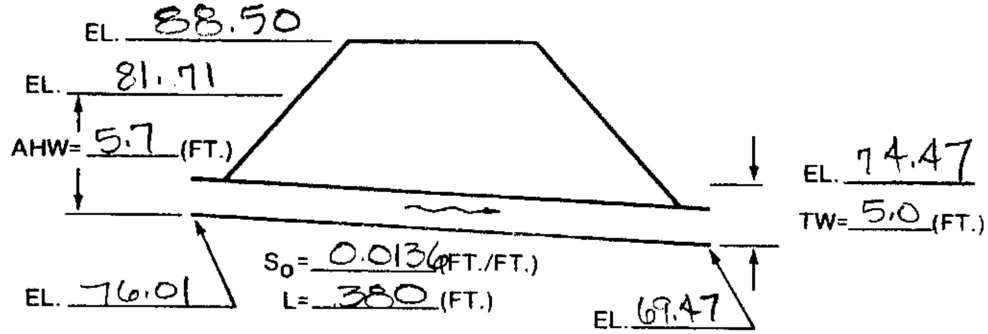
DRAINAGE AREA Basin B

METHOD OF DISCHARGE DETERMINATION SCS
Master Drainage Study

(DESIGN) Q_1 = 269 (cfs) TW_1 = 5.0 (FT.)

(CHECK) Q_2 = ____ (cfs) TW_2 = ____ (FT.)

STATION ____



CULVERT DESIGN DATA				HEADWATER COMPUTATION													
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$											
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1@54"	95		FES	1.0	4.5	0.5										Too Small
1@84	270		FES	1.0	7.0	0.5	1.7	4.4	5.7	5.0	5.7	5.2	2.2	9.0		±275 LF
68x106	270		FES	1.0	5.7	0.5	1.5	3.6	4.6	5.0	5.0	5.2	1.3	5.7		

SUMMARY & RECOMMENDATIONS:
Need to use 84" equivalent elliptical (68"x106")
(5.67x8.83)

47

GREINER ENGINEERING	CULVERT DESIGN #11	Made By	Date	Job No.
		Checked By JB	Date	Sheet No.

For: Lanai @ Stekenhills

HYDROLOGIC AND CHANNEL INFORMATION

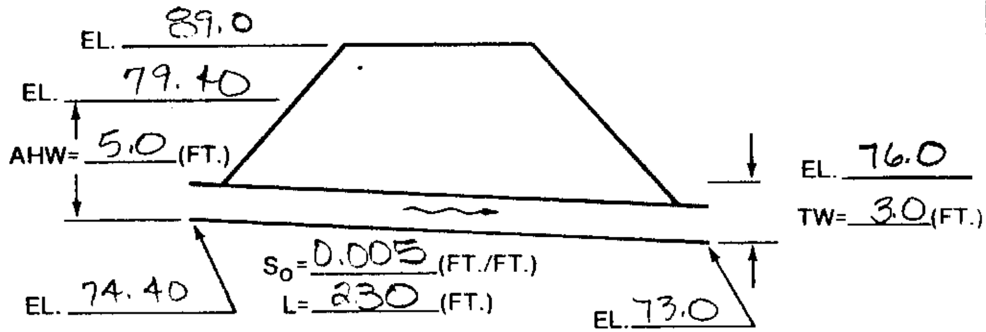
DRAINAGE AREA Basin B

METHOD OF DISCHARGE DETERMINATION Master Drainage Study (SCS)

(DESIGN) Q_1 = 267 (cfs) TW$_1$ = 3 (FT.)

(CHECK) Q_2 = ______ (cfs) TW$_2$ = ______ (FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1x84"	270		FES	1.0	7.0	0.5										
5x8	267	33	wingwalls	1.0	5.0	0.4	1.2	3.3	4.2	3.0	4.2	1.4	4.0	5.0		

SUMMARY & RECOMMENDATIONS:

5x8 RCB

GREINER ENGINEERING	CULVERT DESIGN 12	Made By GKS	Date	Job No.
		Checked By JB	Date	Sheet No.

For: Barnes Between Tuttle & Stetson

HYDROLOGIC AND CHANNEL INFORMATION

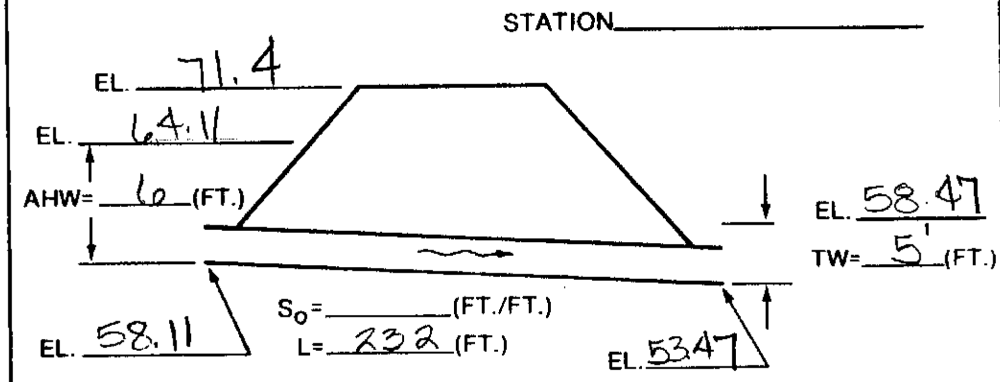
DRAINAGE AREA Basin C

METHOD OF DISCHARGE DETERMINATION

100 YEAR Proposed to go overland.

(DESIGN) Q_1 = 188 (cfs) 5 yr through culvert TW_1 = 5' (FT.)

(CHECK) Q_2 = ____ (cfs) TW_2 = ____ (FT.)



CULVERT DESIGN DATA				HEADWATER COMPUTATION												
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1-72"	188			1.0	6'	0.5	0.75	3.8	4.9	5	5.0	4.6	1.1	6'		

SUMMARY & RECOMMENDATIONS:

GREINER ENGINEERING	CULVERT DESIGN	Made By JB	Date 3/9/85	Job No.
		Checked By ECB	Date	Sheet No.

For: STRUCTURES # 13 & 14 above Lariat CULVERT CROSSINGS

HYDROLOGIC AND CHANNEL INFORMATION

DRAINAGE AREA ______

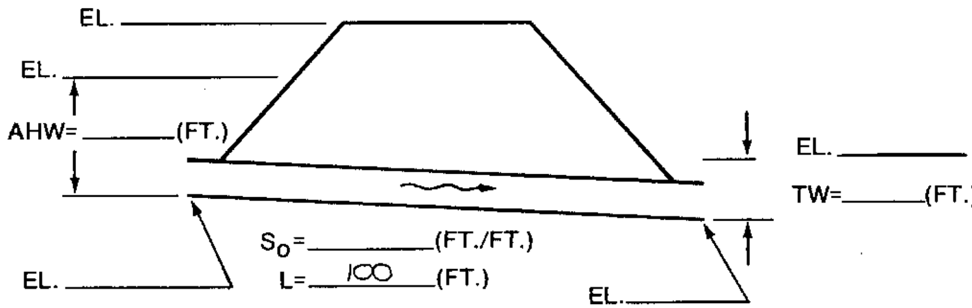
METHOD OF DISCHARGE DETERMINATION ______

INLET CONTROL ASSUMED

(DESIGN) Q_1 = ______(cfs) TW_1 = ______(FT.)

(CHECK) Q_2 = ______(cfs) TW_2 = ______(FT.)

STATION ______



CULVERT DESIGN DATA				HEADWATER COMPUTATION												
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
STRUCTURE 13	- COLLECTOR															
2-8×10 CBC	1170	117	WINGWALL 30° TO 75°	1.5	12.0											
STRUCTURE 14	ARTERIAL															
3-8×10 CBC	643	64.3	"	1.0	8.0											

SUMMARY & RECOMMENDATIONS:

GREINER ENGINEERING	CULVERT DESIGN	Made By WFL	Date 6/10/85	Job No. 516170G
		Checked By	Date	Sheet No. 50A

For:

HYDROLOGIC AND CHANNEL INFORMATION

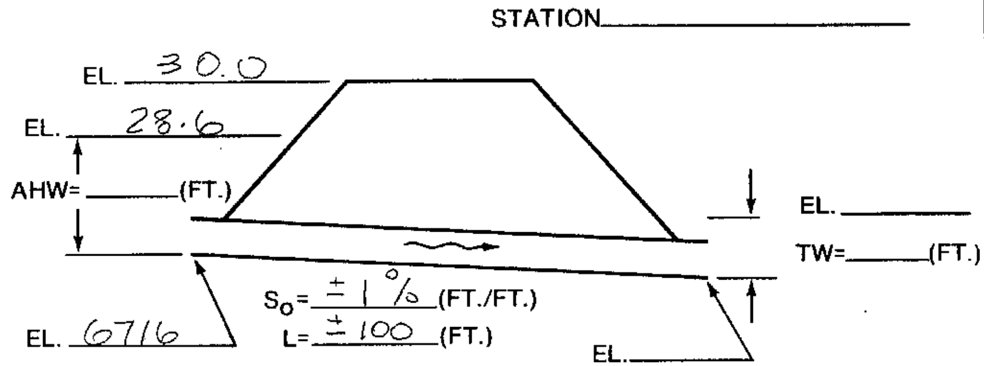
DRAINAGE AREA OFFSITE BASIN AT DES.PT. 051

METHOD OF DISCHARGE DETERMINATION TR 20

CULVERT TO BE CONSTRUCTED BY OTHERS

(DESIGN) Q_1 = 742 (cfs) TW$_1$ = ______ (FT.)

(CHECK) Q_2 = ______ (cfs) TW$_2$ = ______ (FT.)



CULVERT DESIGN DATA				HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
NUMBER AND SIZE OPENINGS	Q PER BARREL	RATIO OF DISCHARGE TO WIDTH (Q/B)	ENTRANCE CONDITION	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
6'x8'	742	92.75	30°-75°	2.1	12.6		STEEP SLOPE (±1.0%) + SHORT (<200') →									ASSUME INLET CONTROL

SUMMARY & RECOMMENDATIONS:

50A

COST ESTIMATE

Greiner Engineering

☐ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 51 OF
CALCULATED BY JB DATE 4/19-85
CHECKED BY CMB DATE 5-7-85

CRITERIA FOR ITEMS IN COST ESTIMATE

1. TRIBUTARY CHANNELS WILL BE RIP RAP LINED WITH 12 inch RIP RAP, TYPE II BEDDING, AND MEDIUM GRAVEL AGGREGATE FOR THE MAINT. ROAD. CONCRETE CHECK STRUCTURES WILL BE USED FOR THE DROPS IN THE CHANNEL. ONE STRUCTURE WILL BE USED AT THE TOE AND ONE STRUCTURE AT THE SILL. FULLY LINED RIP RAP CHANNELS WILL BE GROUTED IN ACCORDANCE WITH THE CITY Guidelines. IT SHOULD BE NOTED THAT DURING FINAL DESIGN THE RIP RAP BOTTOM MAY BE EXCLUDED. AT THIS POINT THE COST ESTIMATE WILL BE FOR A FULLY LINED GROUTED RIP RAP CHANNEL.

ALL MAJOR STORM SEWER SYSTEMS WERE INCLUDED IN THIS COST ESTIMATE. PIPE COST ARE FOR REINFORCED CONCRETE PIPE. PRICES ARE APPROXIMATE AND INCLUDE DELIVERY TO COLORADO SPRINGS. MANHOLES WERE PLACED AT 400' INTERVALS AND AT BENDS. A LUMP SUM COST FOR ALL MANHOLES AND INLETS IS INCLUDED IN THE COST ESTIMATE

SAND CREEK WILL BE LINED ON THE SIDES WITH 24" RIP RAP AND TYPE II BEDDING. DROP STRUCTURES AND BRIDGES ARE INCLUDED FOR THE COST ESTIMATE

BELOW LARIAT, THE COST FOR CULVERTS, AND ALL STORM SEWER SYSTEMS WERE TAKEN FROM THE COST ESTIMATE FOR STETSON HILLS FILING NO.1 FINAL DRAINAGE STUDY. A SUMMARY SHEET OF THIS COST ESTIMATE HAS BEEN INCLUDED. ABOVE LARIAT COSTS ARE STILL APPROXIMATE AND WILL BE UPDATED DURING FINAL DESIGN.

BASIN FEES CAN BE FOUND AT THE END OF THIS SECTION.

Greiner Engineering

☒ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 52 OF
CALCULATED BY JB DATE 4/19/85
CHECKED BY cme DATE 5-7-85

SUMMARY

COST ESTIMATE

ITEM A	QUANTITY	UNIT	UNIT PRICE	TOTAL
(NORTH OF LARIAT ONLY)				
1. STORM SEWER				
18"	600	LF	22.00	13,200
21"	3650	LF	25.00	91,250
30"	3200	LF	36.00	115,200
36"	4150	LF	44.00	182,600
42"	3200	LF	52.00	166,400
48"	800	LF	54.00	43,200
60"	250	LF	83.00	20,750
66"	1100	LF	101.00	111,100
72"	2800	LF	160.00	448,000
90"	1000	LF	206.00	206,000
			MATERIAL COST =	1,397,700
STORM SEWER WITH INSTALLATION				2,795,400
2. MANHOLES	44		AVG 2000	88,000
3. INLETS	34		AVG 1500	51,000
4. FLARED END SECT.	13		800	10,400
5. MAJOR TRIBUTARY CULVERTS (STRUCTURES 13 & 14)				
8'x10' PRECAST CONCRETE BOX	750	LF	650	487,500
CROSSINGS ASSUMED @ 150' LENGTH 150 × 5 = 750'			SUB-TOTAL	$3,432,300

Greiner Engineering

☒ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT: STETSON HILLS
JOB NUMBER: 5161701 SHEET 53 OF
CALCULATED BY: JB DATE 4/15/85
CHECKED BY: CMB DATE 5-7-85

COST CONT.

ITEM ℄	QUANTITY	UNIT	UNIT PRICE	TOTAL
(NORTH & SOUTH OF LARIAT)				
6. LINED CHANNELS OTHER THAN SAND CREEK RIP RAP D50 = 12" 30.00/CY TYPE II BEDDING 16.00/CY AGGREGATE 14.00/CY (SEE TYPICAL RIP RAP CHANNEL COST EST.)	23,300	LF	161.50	3,762,950
7. CHECK STRUCTURES FOR DROPS ON MAJOR TRIBS	68		1,175.00	79,900
8. BRIDGES - SAND CREEK CROSSINGS (CONCRETE DECK AND PRESTRESSED CONCRETE GIRDERS) AREA OF EACH = 10,922 SF	4		550,360	2,201,440
9. SAND CREEK CHANNEL	COST FOR NORTH & SOUTH OF LARIAT CAN BE FOUND ON THE FOLLOWING PAGE.			

Greiner Engineering Sciences, Inc.
Denver, Colorado

ITEM C (CONTINUED)

ENGINEER'S COST ESTIMATE SAND CREEK

NORTH & SOUTH OF LARIAT

Project: Stetson Hills
Location: Colorado Springs, Colorado
Job Number: 5161706
Date: April, 1985

Description	Quantity	Unit	Unit Price	Total Price
1. Riprap (D_{50}=24")	46,082	CY	$ 20.00	$ 921,640.00
2. Type II Bedding	10,296	CY	16.00	164,736.00
3. Filter Cloth	67,295	SY	3.50	235,532.50
4. Concrete Sills	618	CY	250.00	154,500.00
5. Concrete Maintenance Road at Barnes	83	CY	250.00	20,750.00
6. Concrete Slope Paving	131.6	CY	250.00	32,900.00
7. Gravel Maintenance Road (Class 6)	1,788	CY	16.00	28,608.00
8. Excavation	340,700	CY	2.50	851,750.00
9. Structural Backfill	992	CY	18.50	18,352.00
TOTAL				2,428,768.50

South of Lariat Drive:

Channel Length = 8120ft

Total Cost = 2,428,768.50

cost/ft = $ 299.11/ft

North of Lariat Drive:

Channel Length = 8800ft

Total cost = $ 299.11 /ft × 8800ft = 2,632,162.91

ITEM C SUB-TOTAL = $ 11,105,331.41

Greiner Engineering Sciences, Inc.
Denver, Colorado

ENGINEER'S COST ESTIMATE - LARIAT AND SOUTH ONLY (ITEM B)

Project: Stetson Hills
Location: Colorado Springs, Colorado
Job Number: 5161706
Date: April 22, 1985

Pipe Diameter	Length Incl. Fittings	Length Minus Fittings	Unit	Unit Cost	Total Cost
18"	1,928	1,826	LF	$22.00	40,172.00
21"	3,765	3,645	LF	25.00	91,125.00
24"	3,282	3,215	LF	30.00	96,450.00
27"	2,141	2,096	LF	33.00	69,168.00
30"	6,128	6,038	LF	36.00	217,368.00
36"	1,436	1,406	LF	44.00	61,864.00
42"	1,669	1,609	LF	52.00	83,668.00
54"	667	553	LF	100.00	55,300.00
72"	897	897	LF	160.00	143,520.00
68" x 106"	487	480	LF	275.00	132,000.00
	22,400	21,765			$ 990,635.00

Special Fittings

Wyes	Quantity	Unit	Unit Cost	Total Cost
18" x 18" x 18"	1	EA	$435.00	435.00
21" x 21" x 21"	1	EA	502.50	502.50
24" x 24" x 18"	2	EA	495.00	990.00
24" x 24" x 21"	1	EA	540.00	540.00
27" x 27" x 18"	1	EA	517.50	517.50
27" x 27" x 21"	3	EA	562.50	1,687.50
27" x 27" x 24"	1	EA	607.50	607.50
30" x 30" x 18"	2	EA	540.00	1,080.00
30" x 30" x 24"	2	EA	630.00	1,260.00
30" x 30" x 30"	2	EA	720.00	1,440.00
42" x 42" x 18"	2	EA	660.00	1,320.00
42" x 42" x 21"	3	EA	705.00	2,115.00
42" x 42" x 24"	3	EA	750.00	2,250.00
54" x 54" x 18"	2	EA	1,020.00	2,040.00
54" x 54" x 24"	1	EA	1,110.00	1,110.00
54" x 54" x 30"	1	EA	1,200.00	1,200.00
54" x 54" x 36"	1	EA	1,290.00	1,290.00
				$ 20,385.00

Greiner Engineering Sciences, Inc.
Denver, Colorado

ENGINEER'S COST ESTIMATE - LARIAT AND SOUTH ONLY

Project: Stetson Hills
Location: Colorado Springs, Colorado
Job Number: 5161706
Date: April 22, 1985

Tees	Quantity	Unit	Unit Cost	Total Cost
18" x 18" x 18"	4	EA	$435.00	$ 1,740.00
21" x 21" x 18"	4	EA	457.50	1,830.00
21" x 21" x 21"	1	EA	502.50	502.50
24" x 24" x 18"	2	EA	495.00	990.00
24" x 24" x 24"	1	EA	585.00	585.00
54" x 54" x 18"	1	EA	1,020.00	1,020.00
		SUBTOTAL		$ 6,667.50
Bends				
18" x 45°	6	EA	345.00	$ 2,070.00
21" x 12°	1	EA	397.50	397.50
21" x 30°	1	EA	397.50	397.50
21" x 45°	7	EA	397.50	2,782.50
24" x 14°	1	EA	465.00	465.00
24" x 45°	2	EA	465.00	930.00
27" x 23°	1	EA	517.00	517.00
30" x 21°	1	EA	570.00	570.00
30" x 36°	1	EA	570.00	570.00
30" x 45°	4	EA	570.00	2,280.00
36" x 21°	1	EA	690.00	690.00
36" x 45°	3	EA	690.00	2,070.00
42" x 44°	1	EA	810.00	810.00
42" x 45°	1	EA	810.00	810.00
54" x 45°	2	EA	1,290.00	2,580.00
68" x 106" x 45°	1	EA	2,859.00	2,859.00
		SUBTOTAL		$ 20,798.50
Flared End Sections				
24"	2	EA	$470.00	940.00
30"	1	EA	485.75	485.75
54"	5	EA	937.50	4,687.50
72"	8	EA	1,404.00	11,232.00
		SUBTOTAL		$ 17,345.25

Greiner Engineering Sciences, Inc.
Denver, Colorado

ENGINEER'S COST ESTIMATE - LARIAT AND SOUTH ONLY

Project: Stetson Hills
Location: Colorado Springs, Colorado
Job Number: 5161706
Date: April 22, 1985

Precast Concrete Boxes	Quantity	Unit	Unit Cost	Total Cost
5' x 8'	250	LF	$375.00	$ 93,750.00
6' x 10'	188	LF	575.00	108,100.00
8' x 10'	1,842	LF	650.00	1,197,300.00
		SUBTOTAL		$ 1,399,150.00
Trash Grates (subject to final design)				
24"	3	EA	$415.00	$ 1,245.00
30"	2	EA	450.00	900.00
36"	1	EA	475.00	475.00
54"	7	EA	525.00	3,675.00
72"	4	EA	595.00	2,380.00
		SUBTOTAL		$ 8,675.00
Manholes 4' Diameter				
0 - 8' Deep	3	EA	$1,100.00	$ 3,300.00
		SUBTOTAL		$ 3,300.00
Manholes 5' Diameter				
0 - 8' Deep	28	EA	$1,500.00	$ 42,000.00
8 - 12' Deep	5	EA	1,700.00	8,500.00
20' Deep	1	EA	2,700.00	2,700.00
		SUBTOTAL		$ 53,200.00
Manholes 6' Diameter				
0 - 8' Deep	7	EA	$1,800.00	$ 12,600.00
8 - 12' Deep	3	EA	2,000.00	6,000.00
		SUBTOTAL		$ 18,600.00

Greiner Engineering Sciences, Inc.
Denver, Colorado

ENGINEER'S COST ESTIMATE - LARIAT AND SOUTH ONLY

Project: Stetson Hills
Location: Colorado Springs, Colorado
Job Number: 5161706
Date: April 22, 1985

	Quantity	Unit	Unit Cost	Total Cost
Junction Boxes (based on structural concrete @ $250/cy plus manhole)				
MH #20	1	LS	$ 3,800.00	$ 3,800.00
MH #6B	1	LS	6,200.00	6,200.00
		SUBTOTAL		$ 10,000.00
Curb Opening Inlets (based on structural concrete @ $250/cy)				
4'	11	EA	$885.00	$ 9,735.00
6'	16	EA	1,025.00	16,400.00
8'	11	EA	1,214.69	13,362.00
10'	3	EA	1,325.00	3,975.00
12'	7	EA	1,510.71	10,575.00
14'	5	EA	1,875.00	9,375.00
16'	4	EA	1,822.50	7,290.00
20'	1	EA	2,075.00	2,075.00
22'	12	EA	2,225.00	26,700.00
		SUBTOTAL		$ 99,487.00
TOTAL COST		SUB-TOTAL ITEM B =		$2,648,243.25

This estimate has been prepared using the best available data known to the Engineer and is provided for informational purposes only. This estimate is not a guarantee of project costs nor should it be used as such.

Prepared by:________________ Date:__________

Checked by:________________ Date:__________

Approved by:________________ Date:__________

Greiner Engineering

☒ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 59 OF
CALCULATED BY JB DATE 4/19/85
CHECKED BY OMB DATE 5-7-85

GRAND TOTAL COST FOR ALL PROPOSED STETSON HILLS FACILITIES

ITEM	
A) SUBTOTAL NORTH OF LARIAT	$ 3,432,300.00
B) SUBTOTAL SOUTH OF LARIAT	$ 2,648,243.25
C) SUBTOTAL NORTH & SOUTH OF LARIAT (PRIMARILY CHANNEL FACILITIES)	$ 11,105,221.41
TOTAL	$ 17,185,764.66
5% CONTINGENCY	$ 859,288.23
10% ENGINEERING	$ 1,718,576.47
GRAND TOTAL	$ 19,763,629.36

Greiner Engineering

☒ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 60 OF
CALCULATED BY JB DATE
CHECKED BY CMB DATE 5-7-85

COST ESTIMATE (BACK UP)

TYPICAL
RIP RAP CHANNEL (TRIB).

12" Rip Rap 30^{00}/CY (GROUTED)
TYPE II BEDDING 16^{00}/CY
Aggregate (Med Gravel) 14^{00}/CY

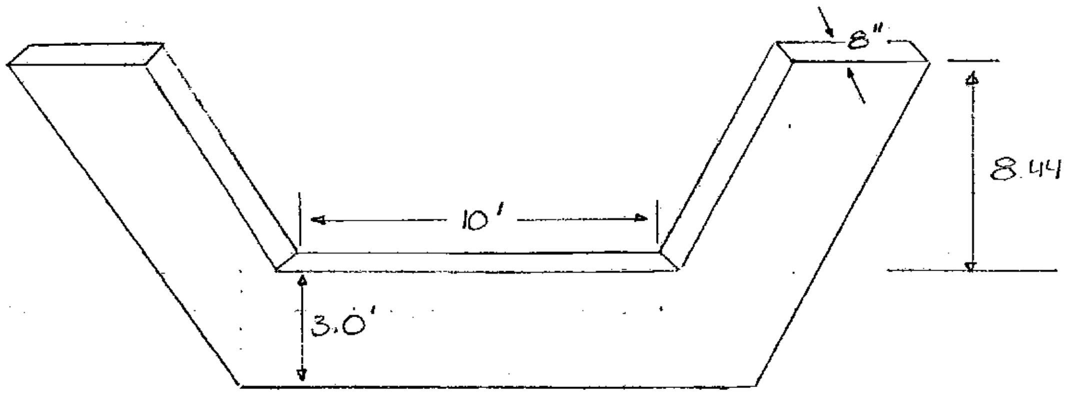
$$\text{COST/LF} = (0.148\ \text{CY/LF})(14^{00}/\text{CY}) + (4.69\ \text{CY/LF})(30^{00}/\text{CY}) + (1.17\ \text{CY/LF})(16^{00}/\text{CY}) = \boxed{\$161.49\ /\text{LF}}$$

Greiner Engineering

- [x] DENVER, COLORADO
- [ ] COLORADO SPRINGS, COLORADO
- [ ] ALBUQUERQUE, NEW MEXICO
- [ ] KEMMERER, WYOMING

PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 61 OF
CALCULATED BY JB DATE 4/15/85
CHECKED BY CMB DATE 5-7-85

CONCRETE CHECK STRUCTURES FOR DROPS ON TRIBS - QUANTITY & COST



(26.69' × 2) + 10 = 63.38 LF × 3' × 0.67' = 127.39 ft³ ÷ 27 = 4.7 CY

4.7 CY * 250.00/cy = 1,175.00/STRUCTURE
includes excavation & Backfill

REACH 051-052 25 drops × 2 structures/drop = 50 check structures

REACH 041-042 7 drops × 2 = 14

REACH 031-037 2 × 2 = 4

TOTAL CHECK STRUCTURES = 68

CITY OF COLORADO SPRINGS
The "America the Beautiful" City
DEPARTMENT OF PUBLIC WORKS CITY ENGINEERING INSPECTIONS (303) 578-6782
105 WEST COSTILLA P.O. BOX 1575
COLORADO SPRINGS, COLORADO 80901

January 3, 1985

To Whom It May Concern:

The City of Colorado Springs City Council at the December 26, 1984 meeting approved the Drainage Basin Fees for 1985 as follows:

CODE	BASIN	1984 DRAINAGE FEE/ACRE	1984 BRIDGE FEE/ACRE	% OF INCREASE	1985 DRAINAGE FEE/ACRE	1985 BRI[D]GE FEE/ACRE
01	SAND CREEK	$2,280.00	$434.00		$4,794.00 1	$400.00
02	SPRING CREEK	$3,519.00		5%	$3,695.00	
03	TEMPLETON GAP	$2,320.00	$ 26.00	5%	$2,436.00	$ 27.00
04	DOUGLAS CREEK	$4,095.00	$ 94.00	5%	$4,300.00	$ 99.00
05	19TH STREET	$1,336.00		5%	$1,403.00	
06	POPES BLUFF	$1,359.00	$231.00	5%	$1,427.00	$243.00
07	CAMP CREEK	$ 752.00		5%	$ 790.00	
08	PETERSON FIELD	$1,922.00	$198.00		$3,612.00 2	$209.00
09	SOUTH ROCKRIMMON	$1,595.00		5%	$1,675.00	
10	PULPIT ROCK	$2,249.00		5%	$2,361.00	
11	DRY CREEK	$1,933.00		5%	$2,030.00	
12	NORTH ROCKRIMMON	$2,040.00		5%	$2,142.00	
13	COTTONWOOD CREEK	$2,987.00	$137.00	5%	$3,136.00	$144.00
14	MISCELLANEOUS	$2,051.00			$2,601.00 3	
15	MESA	$2,124.00		5%	$2,230.00	
16	21ST STREET	$2,041.00		5%	$2,143.00	
17	BEAR CREEK	$1,313.00	$123.00	5%	$1,379.00	$129.00
18	SOUTHWEST AREA	$4,665.00			$4,665.00 4	

FOOTNOTES:

1 New fee, approved by the Drainage Board on 12/20/84, no increase proposed for 1985
2 New fee, approved by the Drainage Board on 11/15/84, no increase proposed for 1985
3 Miscellaneous fee is computed as a simple average of all studied basins
4 New fee, approved by the Drainage Board on 6/21/84, no increase proposed for 1985

THE FEE CHANGE IS EFFECTIVE JANUARY 1, 1985

Sincerely,

Gary R. Haynes

Gary R. Haynes
City Engineer

GRH/jgk

Greiner Engineering

☒ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT: STETSON HILLS
JOB NUMBER: 5161701 SHEET 63 OF ____
CALCULATED BY: JB DATE ____
CHECKED BY: CMB DATE 5-7-85

BRIDGE & BASIN FEES

SAND CREEK

2,183 ACRES X 400.00 Bridge Fee/AC = $873,200.00

2,183 ACRES X 4,794.00 DRAINAGE Fee/AC = $10,465,302.00

COTTONWOOD CREEK

12.5 X 144.00 = $1,800.00

12.5 X 3,136.00 = $39,200.00

INTERNAL DRAINAGE

Greiner Engineering

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- ☐ COLORADO SPRINGS, COLORADO
- ☐ ALBUQUERQUE, NEW MEXICO
- ☐ KEMMERER, WYOMING

PROJECT: STETSON HILLS
JOB NUMBER: 5161701 SHEET 64 OF
CALCULATED BY: JB DATE 4/24/85
CHECKED BY: CMB DATE 5-7-85

INTERNAL DRAINAGE SWALE SIZING

(NORTH & SOUTH OF LARIAT)

SEE TYPICAL SECTION PLAN SHEET 2 OF 2

n = .045 (GROUTED RIP RAP) SIDES 3:1 BW = 3'

LOCATION	So(%)	Q(cfs)	Yn	TW	AREA	WP	R	V	FREEBORD 0.25D (MIN 1.0)
(BELOW LARIAT)									
THROUGH BASIN H13	2.8	177	2.5	17.9	25.8	18.7	1.4	6.9	1.0
THROUGH BASIN F6	2.7	295	3.1	21.6	38.3	22.7	1.7	7.7	1.0
FROM BASINS A1 - A17	4.3	275	2.7	19.4	30.6	20.3	1.5	9.0	1.0
FROM BASINS C1-C9	3.8	311	3.0	20.7	35.1	21.7	1.6	8.9	1.0
FROM BASINS C1 - C10	6.7	370	2.8	19.9	32.3	20.8	1.5	11.5	1.0
THROUGH BASIN D7	2.6	213	2.7	19.4	30.5	20.2	1.5	6.9	1.0
(ABOVE LARIAT)									
THROUGH B5	2.1	267	3.1	21.8	39.1	22.9	1.7	6.8	1.0 (MAX)
THROUGH A18	2.5	251	2.9	20.7	34.9	21.7	1.6	7.2	1.0

INTERNAL DRAINAGE

NORTH OF LARIAT

DIVISION STETSON HILLS
ATION COLORADO SPRINGS
NO. 5161701
IGN STORM 5 YR. RECURRENCE INTERVAL
OR STORM 100 YR.
MPUTATIONS BY TB REVISED DATE 4/17/85
ECKED BY CMB DATE 5-6-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

DEV. COND.
OVERLAND ti = 10.0 min
Assume 7.5 Ft/sec Avg. in Swales
Assume 5 Ft/sec in streets

PAGE ___ OF ___

Area Designation	A (Acres) (Mi²)	CN	Frequency	Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
															OL	10	
A1	42.6	71	5	.31	.020		.27	960	19.2	20	CLOSE ENOUGH TO START SYSTEM		4.2	1800	5.0	6.0	
	.067		100	1.07	.072		.27	960	69.1								
															OL	10	
A2	27.5	74		.40	.017		.23	1020	17.3	20			2.5	1200	5.0	4.0	
	.043			1.24	.053		.23	1020	54.1	268							
A3	39.5	74		.40	.025												
	.062			1.24	.077												
A1-A3	109.6					.062	.33	880	54.6	TOTAL IN PIPE			2.9	1200	5.0	4.0	USED TO DETERMINE ENTIRE FLOW FOR PIPE SIZE ESTIMATE
	.171					.202	.33	880	177.8	300							NOTE: ALL PIPE SIZING CAN BE FOUND STARTING ON PAGE
A4	52.6	76		.47	.039												
	.082			1.36	.112												FOR PIPE SIZE ESTIMATE
A1-A4	162.2					.101	.42	800	80.8	TOTAL IN PIPE			2.2	1600	5.0	5.3	
	.253					.314	.42	800	251.2	257							
															OL	10	
A5	33.8	65		.16	.0085		.31	910	7.7	20			2.3	2600	5.0	8.7	
	.053			.75	.0398		.31	910	36.2								
															OL	10	
A6	51.3	74		.40	.032		.23	1020	32.6				2.0	1200	5.0	4.0	
	.080			1.24	.079		.23	1020	101.0								
																10	
	[illegible]			.40	.029		.22	1020	29.6					1500	[illegible]	[illegible]	

SUBDIVISION STETSON HILLS
LOCATION COLORADO SPRINGS
JOB NO. 5161701
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY CMB REV. DATE 4/17/85
CHECKED BY JB DATE 5/7/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

PAGE ___ OF ___

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
A8	19.5	83		.77	.023		.22	1040	23.9				2.5	1000	OL	10	
	.030			1.86	.056		.22	1040	58.2						5.0	3.3	
A9	24.2	83		.77	.029		.23	1020	29.6				2.1	1200	OL	10.0	Assume $(t_c)_i$ = 10 min.
	.038			1.86	.071		.23	1020	72.4						5.0	4.0	
A10	24.2	82		.71	.027		.29	950	25.7				2.5	2200	OL	10.0	
	.038			1.78	.068		.29	950	64.6						5.0	7.3	
A11	14.7	65		.16	.004		.28	975	3.9				2.3	2000	OL	10.0	
	.023			.75	.017		.28	975	16.6						5.0	6.7	
A12	46.7	72		.34	.025		.33	880	22.0				1.2	3000	OL	10.0	
	.073			1.12	.082		.33	880	72.2						5.0	10	

UBDIVISION Stetson Hills
OCATION Colorado Springs
OB NO. 5161701
ESIGN STORM 5 YR. RECURRENCE INTERVAL
AJOR STORM 100 YR.
OMPUTATIONS BY CMB DATE 4-17-85
HECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

PAGE ____ OF ____

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
A13	25.2	72		.34	.013		.25	1000	13.0				2.0	1500	OL	10	Assume $(t_c)_i$ =
	.039			1.12	.044		.25	1000	44.0						5.0	5.0	10 min.
OA1	11.5	78		.54	.010		.17	1100	11.0								Assume
	.018			1.50	.027		.17	1100	29.7								t_c = 10 min
+A14	34.1	83		.77	.041	.051	.25	1000	51.0				2.0	1500			
	.053			1.86	.099	.126	.25	1000	126.0						5.0	5.0	
OA2	12.0	78		.54	.010		.17	1100	11.0								Assume
	.018			1.50	.027		.17	1100	29.7								t_c = 10 min
+A15	33.8	83		.77	.041	.051	.26	980	50.0				1.6	1600			
	.053			1.86	.099	.126	.26	980	123.4						5.0	5.3	
OA3	10.9	87		.99	.017		.17	1100	18.7								Assume
	.017			2.19	.037		.17	1100	40.7								t_c = 10 min
+A16	14.2	83		.77	.017	.034	.23	1020	34.7				1.3	1200			
	.022			1.86	.041	.078	.23	1020	79.6						5.0	4.0	
A17	39.7	78		.54	.034		.33	880	29.9				2.2	3000	OL	10	
	.062			1.50	.093		.33	880	81.8						5.0	10	
A18	29.5	75		.44	.020		.28	975	19.5				2.0	2000	OL	10	
	.046			1.30	.060		.28	975	58.5						5.0	6.7	
A19	18.9	61		.10	.003		.28	975	2.9				2.0	2000	OL	10	Assume $(t_c)_i$ =
	.030			.58	.017		.28	975	16.6						5.0	6.7	10 min

SUBDIVISION STETSON HILLS
LOCATION COLORADO SPRINGS
JOB NO. 5161701
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY JB DATE
CHECKED BY GLB DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

PAGE ___ OF ___

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
OB1	68.9	75.8		0.46	0.05		0.72	600	30.0				1.3	5000	oc 2.5	10.0 33.3	
	0.11			1.35	.145		0.72	600	87.0								
+ B1	12.5	80		.624	.012	.062	0.78	540	33.5						7.5	3.6	
	0.20			1.64	.032	.177	0.78	540	95.6					1600			
B2	29.8	76		.47	.0221		.33	880	19.4	20			1.75	2850	oc	10	
	.047			1.36	.0639		.33	880	56.2	232					5.0	9.5	
B3	34.5	74		.40	.0216		.32	900	19.4	20			1.75	2800			
	.054			1.74	.0670		.32	900	60.3	232					5.0	9.3	
OB2	18.4	75.8		.459	.014		.25	1000	14.0								Assume t_c=15
	.03			1.35	.04		.25	1000	90.0								
B4	110.5	70		.28	.048												
	.173			1.01	.175												
B2-B4 +OB2	174.8					.106	.49	740	78.4	IN	Pipe		1.8	3000			
	.27					.346	.49	740	256	257					5.0	10	
B2-B5	191.[illegible]					.12	.57	670	80.4								
						.399	.57	670	267.0								

SUBDIVISION STETSON HILLS
LOCATION COLORADO SPRINGS
JOB NO. 5161701
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY JB DATE 8/16/84
CHECKED BY CMB DATE 5/6/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

FOR DEVELOPED COND.
t_i = 10 min
ASSUME
7.5 Ft/sec AVG IN SWALES
ASSUME 5 Ft/sec in Streets

PAGE ___ OF ___

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
B6	37.2	59.8		0.076	0.004		0.26	980	4.3					1600	∝	10	
	0.058			0.52	0.030		0.26	980	29.8						5.0	5.3	
+ B7	55.9	65		.163	.014	.018	.30	920	16.8					1000	7.5	2.2	
	0.087			.752	.066	.096	.30	920	88.0								
+ B8	36.7	62.4		.116	.007	.025	.33	880	21.7					800	7.5	1.8	
	.057			.633	.036	.132	.33	880	116.4								
+ B9	36.6	65		.163	.009	.034	.37	840	28.6					1100	7.5	2.4	
	.057			.752	.043	.175	.37	840	147.0								
+ B10	22.6	72.2		.341	.012	.046	.40	810	37.3					800	7.5	1.8	
	0.035			1.13	.040	.215	.40	810	174.1								

UBDIVISION STETSON HILLS
OCATION COLORADO SPRINGS
OB NO. 5161701
ESIGN STORM 5 YR. RECURRENCE INTERVAL
AJOR STORM 100 YR.
OMPUTATIONS BY JB DATE
HECKED BY ECB DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\, q$

Area Designation	A (Acres) (Mi^2)	CN		Q in.	AQ mi^2-in.	ΣAQ mi^2-in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)
OB3	19.3	92		1.327	0.04		0.26	980	39.2							
	0.030			2.64	0.08		0.26	980	78.0							
+ B11	53.8	91.6		1.30	0.11	0.15	0.34	880	131.1	FLOW AT DES. PT. 10 (NOT ALL FLOW CONCENTRATED IN CHANNEL)						
	0.08			2.60	0.22	0.30	0.34	880	262.6	321						
OB4	32.1	92		1.327	.066		.26	980	64.7							
	.050			2.64	.132		.26	980	129.4							

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☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 71 OF
CALCULATED BY JB REVISED DATE 4/17/85
CHECKED BY CMB DATE 5-7-85

ONSITE CURVE NUMBERS (NORTH OF LARIAT)

BASIN	SOIL	OFFSITE	SF (4-6)	SF (8-12)	MF (18-22)	MF (25-35)	RETAIL OFFICE	SCHOOL	PARK	CN
A1	A		33	67						71
A2	A			100						74
A3	50 A 50 B		50	50						74
A4	40 A 60 B		40	60						76
A5	A		100							65
A6	A			100						74
A7	A			100						74
A8	B			100						83
A9	B			100						83
A10	B		75				25			[illegible]2
A11	B		100							65
A12	B		67						33	72.4
A13	B			50					50	72.[illegible]
A14	B			100						83
A15	B			100						83.
A16	B			100						83.
A17	B		100							78.
A18	B					50			50	75.
A19	B								100	61.
OA1	B		100							78.
OA2	B		100							78
OA3	B				100					87

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PROJECT STETSON HILLS
JOB NUMBER 5161701 SHEET 72 OF
CALCULATED BY JB DATE 4/17/85
CHECKED BY OMB DATE 5-7-85

ONSITE CN CONT. (N. OF LARIAT)

BASIN	SOIL	OFFSITE	SF(4-6)	SF(8-12)	MF(18-22)	MF(25-35)	RETAIL OFFICE	SCHOOL	PARK	CN
OB1	A	100								75.8
B1	A				100					80
B2	A		67		33					76
B3	A		100							65
B4	A		67		33					70
B6	A		55						45	59.8
B7	A	100								65
B8	A	90							10	62.4
B9	A		100							65
B10	A		60			40				72.2
B11	TOTAL									
	A					40	60			
	D					70				
						30	100			91.6
OB3	D	100								92
OB4	D	100								92

SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 5161701
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY ECB DATE
CHECKED BY JB DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\ q$

APPROXIMATE CONVEYANCE
RCP STORM SEWER SIZING
ABOVE LARIAT

PAGE ___ OF ___

Q5

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
BASIN A MHSS 1 TO MHSS 2											19.2	21	1.5	1200			
MHSS 3 TO MHSS 4 TO MHSS 2											19.1	21	1.5	1800			
MHSS 2 TO MHSS 5											54.6	30	1.8	1600			
MHSS 5 TO DAYLIGHT											80.8	36	1.5	600			
BASIN B MHSS 1 TO MHSS 2											38.8	21	1.5	650			
STUBOUT TO MHSS 2											14.0	18	1.8	600			
MHSS 2 TO MHSS 3											53	30	1.7	1600			
MHSS 3 TO MHSS 4 & DAYLIGHT											65	36	1.0	1500			

SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO.
DESIGN STORM ____ YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY JB DATE 1/9/85
CHECKED BY ___ DATE ___
REVISED 3/9/85 JB

GREINER ENGINEERING
570 W. 44th. AVENUE
DENVER, COLORADO 80216

RUNOFF COMPUTATIONS
(Rational Method)

RCP PIPE SIZING:
NOT TO EXCEED 102 IN. pipe

NOTE: IT IS ASSUMED THAT THE FLOW WITHIN THE BASINS WILL ALL ENTER THE PROPOSED STORM SEWER.

PAGE ___ OF ___

Area Designation	A (Acres)	c	c_f	$\bar{c}$ = (c x c_f)	A·$\bar{c}$	ΣA·$\bar{c}$	tc (min)	I (in/hr)	Q = (ΣA·$\bar{c}$) x i cfs	Street capacity cfs	Flow in Pipe cfs (Q5)	Pipe Dia. in.	MAX Slope %	Length ft.	VEL V fps	Δt (min)	
BASIN B6 TO B7									88		88	42"	1.6	1200			
B7 TO B8									116		116	42"	2.8	700			
B8 TO B9									147		147	42"	2.1	1300			
B9 TO B10									174		174	48"	1.7	800			
& DAYLIGHT																	
OBI TO B1									95.6		95.6	36"	2.1	2050			

INTERNAL DRAINAGE

SOUTH OF LARIAT

Greiner Engineering

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☐ KEMMERER, WYOMING

PROJECT STETSON Hills
JOB NUMBER 5161706 SHEET 1A OF
CALCULATED BY WFL DATE 6-
CHECKED BY DATE

NOTE

THE FOLLOWING PAGES CONTAIN PRELIMINARY SIZING OF THE STORM SEWER INLETS. LOCATION AND SIZES OF STORM SEW. PIPE SHALL BE AS PER THE ATTACHED PLANS AND ATTACHED CALCS.

EXACT LOCATIONS AND SIZES OF INLETS WILL BE DETERMINED DURING STETSON HILLS FILING NO. 1 FINAL DRAINAGE STUDY.

SINCE LITTLE OR NO BYPASS WAS ASSUMED FOR THE FLOWRATES IN THE PIPE, THE FOLLOWING PIPE CAPACITY AND CALCS "PUSH" THE PIPE DIA. SIZES TO THE HIGH SIDE AND CONSERVATIVE.

SUBDIVISION Stetson Hills No. 1
LOCATION Co Springs
JOB NO. 5160706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/21/85
CHECKED BY MJJ DATE 1-24-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Assumptions
1. 10 min for flow off lot (o.L.)
2. street flow from SCS graph NEH-4
3. swale flow from natural channel nomograph

PAGE 1 OF

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm in.	Q p cfs	Street capacity one curb cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	*PRELIMINARY INLET SIZES
	9.183			1.58	0.0232		0.23	1020	23.6	20					OL	10	Inlet #1 L=22' c=14.7 cfs
A1	0.0147	95		2.94	0.0432		0.23	1020	44	86			1%	450	2	3.8	bypass = 8.9 cfs = 0.0087 AQ
	4.592			1.58	0.0116	0.0203	0.20 / 0.26	1080 / 980	12.5 / 19.9	20 ← check for dual peak							inlet #2 L=22' C=18.5
+ A2	0.0074	95		2.94	0.0216	0.0648	0.26	980	63.5	155			2.5	350	3.25	1.8	bypass = 1.4 cfs = 0.0014 AQ
	4.592			1.58	0.0116	0.0130	0.18 / 0.28	1100 / 950	14.3 / 12.3	20							
+ A3	0.0074	95		2.94	0.0216	0.0864	0.28	950	82.1	173			4	300	4.0	1.3	
	3.776			1.58	0.0096	0.0212 / 0.0226	0.20 / 0.30	1080 / 920	22.8 / 20.1	20							inlet #3 L=20' c: 22.9
+ A4	0.0061	95		2.94	0.0179	0.0840	0.30	920	95.9	193			6	300	5	1	bypass = 0
	3.796			1.58	0.0096	0.1222	0.18	1100	10.5	20	5yr tc = 10 +	300/(4·60) = 11.25					
+ A5	0.0061	95		2.94	0.0179	( )	0.32	900	109.9	193			6	300	5	1.0	
	4.316			1.58	0.0109	0.0205	0.18 / 0.20	1100 / 1080	[illegible] / 22.0	20							inlet #4 L=22' c=21.8
+ A6	0.0069	95		2.94	0.0203	0.1425	0.34	880	125.4	183			5	300	4.5	1.1	bypass = 0.2 cfs = 0 AQ
	4.316			1.58	0.0109		0.20	1080	11.7	20	5yr Tc = 10 + 1.7 = 11.7						
+ A7	0.0069	95		2.95	0.0203	0.1628	0.36	860	140	150			3	350	3.5	1.7	
	4.362			1.58	0.0111	0.0220	0.21	1050	23.1	20							inlet #5 L=22 c=20.2 cfs
+ A8	0.0070	95		2.94	0.0206	0.1834	0.37	850	155.9	173			4	175	4	0.7	bypass = 0.0034 AQ
	4.362			1.58	0.0111	0.0145	0.18 / 0.23	1100 / 1020	16.2 / 14.7	20							
+ A9	0.0070	95		2.94	0.0206	0.2040	0.37	820	167.3	173			4	250	4	1.0	
	2.386			1.58	0.0060	0.0205	0.29	930	19.0	20							
+ A10	0.0037	95		2.94	0.0112	0.2152	0.44	770	165.7	173			4	700	4	2.9	
																	*SEE REP. TEXT

DIVISION	Stetson Hills No. 1
ATION	Co. Springs
NO.	5161706
IGN STORM	5 YR. RECURRENCE INTERVAL
OR STORM	100 YR.
MPUTATIONS BY	GKS DATE 1/21/85
ECKED BY	MJJ DATE 1-24-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\, q$

Area Designation	A (Acres) (Mi^2)	CN		Q in.	AQ mi^2-in.	ΣAQ mi^2-in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	~~X~~ PRELIMINARY INLET SIZES
	7.805			1.58	0.0198		0.20	1080	21.4	20					OL	10.0	inlet #6 L = 22' C = 20.2 bypass = 1.2 cfs = 0.0011
A 11	0.0125	95		2.94	0.0368		0.20	1080	39.7	184			4	500	4	2.0	
	7.603			1.58	0.0173	0.0204	0.23 / 0.27	1020 / 760	17.6 / 17.5	20							
+ A12	0.0122	95		2.94	0.0359	0.0727	0.27	960	70	98			1.2	550	2.2	4.2	
Bypass inlet #5 A 10 + Bypass A11 + A12						0.0409	0.29	930	38.0	NA							inlet #7 sump L = 16' C = 38.0
						0.2676	0.44	770	206	NA							
	8.630			1.58	0.0218		0.20	1080	23.5	20					OL	2.0	
A13	0.0138	95		2.94	0.0406		0.20	1080	43.8	173			4	2400	4	10.0	
	3.8719			1.58	0.0098	0.0316	0.20	1080	34.1	NA					OL	10	inlet #8 sump L = 14' C = 34.1
+ A 14	0.0062	95		2.94	0.0182	0.0588	0.20	1080	63				1.6	300	2.6	2	
	4.044			1.58	0.0103		0.13	1220	12.5	20					OL	2	inlet #9 sump L = 6' C = 12.5
A 15	0.0065	95		2.94	0.0191		0.13	1220	23.0	173			4	1400	4	5.8	
																	*SEE PG 75A
A1 – A17						.090	.29	930	83.7								
						.357	.44	770	274.9								

DIVISION Stetson Hills No. 1
ATION Co. Springs
NO. 5161706
IGN STORM 5 YR. RECURRENCE INTERVAL
OR STORM 100 YR.
IPUTATIONS BY GKS DATE 1/21/85
ECKED BY MJJ DATE 1-25-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Area designation	A (Acres) (Mi^2)	CN		Q in.	AQ $mi.^2$ -in.	Σ AQ $mi.^2$ -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	*PRELIMINARY INLET SIZES (SEE PG 75A)
	2020			1.87	0.006		0.14	1180	7	20							inlet #10 L = 4 C = 7 cfs no bypass
A16	0.0032	98		3.27	0.0105		0.14	1180	12.4	90			1%	1000	2	8.3	
	0.2204			1.87	0.0007		0.02	1275	0.89	20							inlet #11 L = 4' C = 0.89 no bypass
A 17	0.0004	98		3.27	0.0013		0.02	1275	1.6	90			1%	200	2	1.6	
	6.8			1.58	.017		.17	1100	18.7						OL	10	
A18	.011	95		2.94	.032		.17	1100	35.2								
	8.72			1.58	0.0221		0.23	1020	22.5	20					OL	10	inlet # 12 L = 22 C = 14.7 bypass = 7.8 = 0.0076 AQ
B1	0.0140	95		2.94	0.0412		0.23	1020	42	86			1	500	2	4	
	4.13			1.58	0.0104	0.0180	0.25	1000	18.0	20							inlet # 13 L = 4' C = 8.6 bypass = 9.4 cfs = 0.0094 AQ
+ B2	0.0066	95		2.94	0.0194	0.0606	0.25	1000	60.6	86			1	200	2	1.6	
	4.13			1.58	0.0104	0.0198	0.28	950	18.8	20							inlet # 14 L = 22' C = 15.3 bypass = 3.5cfs = 0.0037 AQ
+B3	0.0066	95		2.94	0.0194	0.0800	0.28	950	76	86			1.25	200	2.2	1.5	
	8.17			1.58	0.0207	0.0244	0.31	910	22	20							inlet # 15 L = 22 C = 17.7 bypass = 43 = 0.0047 AQ
+B4	0.0131	95		2.94	0.0385	0.1185	0.31	910	107	137			2.5	400	3.2	2.1	
	7.4197			1.58	0.0188	0.0235	0.35	860	20.2	20							inlet #16 L = 22' C = 17.7 bypass = 2.5 = 0.0029 AQ
+ B5	0.0119	95		2.94	0.0350	0.1535	0.35	860	132	137			2.5	450	3.2	2.3	
	8.04			1.58	0.0204	0.0233	0.39	820	19.1	20							
+B6	0.0127	95		2.94	0.0379	0.1914	0.39	820	156	161			3	500	3.5	2.4	
	3.214			1.58	0.0081	0.0314	0.39	820	25.7	NA							inlet #17 sump L = 12' C = 25.7
+B7	0.0051	95		2.94	0.0150	0.2064	0.39	820	169	NA			2.5	1400	3.2	7.3	
	4.957			1.58	0.0125		0.11	1270	15.9	20					OL	2	inlet #18 sump L = 8' C = 15.9
B8	0.0079	95		2.94	0.0232		0.11	1270	29.5	137			2	800	2.9	4.6	

SUBDIVISION Stetson Hills
LOCATION Co Springs
JOB NO. 516170I
DESIGN STORM ______ YR. RECURRENCE INTERVAL
MAJOR STORM ______ YR.
COMPUTATIONS BY JB DATE ______
CHECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp=(AQ)\ q$

PAGE ____ OF ____

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	Σ AQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
B1-B10 (ABOVE LARIAT)				.046+ .0048+	.0058+ .007	.06	.40	810	48.6								
+ B9+B10 (BELOW LARIAT) + D7				.215+ .012+	.010+ .026	.263	.40	810	213								

DIVISION Stetson Hills
ATION Co. Springs
NO. 5161706
IGN STORM 5 YR. RECURRENCE INTERVAL
OR STORM 100 YR.
MPUTATIONS BY GKS DATE 1/21/85
CKED BY MJT DATE 1-25-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	Σ AQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE P675A)
	1.947			1.87	0.0058		0.09	1275	7.3	20							inlet #19 sump L = 4' c = 7.3
B9	0.0031	98		3.27	0.0101		0.09	1275	12.8	70			0.7	600	1.8	6	
	3.894			0.77	0.0048		0.09	1275	6.1	20							inlet # 20 sump L = 4' c = 6.1
B10	0.0062	83		1.86	0.0115		0.09	1275	14.6	70			0.7	600	1.8	6	
	2.149			1.87	0.0064		0.10	1275	8.2	20							inlet #23 sump L = 6' c = 8.2
B13	0.0034	98		3.27	0.0111		0.10	1275	14	70			2.5	1200	3.25	6	
	3.269			1.12	0.0058		0.05	1275	7.4	20							inlet # 24 sump L = 4' c = 7.4
B14	0.0052	89		2.36	0.0123		0.05	1275	15.6	70			2.5	600	3.25	3	
	4.738			1.58	0.012		0.12	1220	14.6	20					OL	2	inlet # 25 L = 8' c = 14.6 no bypass
B15	0.0076	95		2.94	0.0223		0.12	1220	27.2	193			5.0	1350	4.5	5	
	5.44			1.25	0.0109		0.16	1150	12.5	20					OL	2	
B16	0.0087	91		2.54	0.0221		0.16	1150	25.4	145			2.8	1600	3.4	7.8	
	7.60			1.12	0.0137	0.0246	0.25	1000	24.6	N/A					OL	2	inlet # 26 sump L = 12' c = 24.6
+ B17	0.0122	89		2.36	0.0288	0.0507	0.25	1000	50.7	N/A			1.7	1600	2	13	
	6.777			1.25	0.0135		0.14	1180	15.9	20					OL	2	inlet # 27 sump L = 8' c = 15.9
B18	0.0106	91		2.51	0.0274		0.14	1180	32.3	122			2.2	1200	3	6.7	

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DIVISION Stetson Hills
ATION Co Springs
NO. 5161706
IGN STORM 5 YR. RECURRENCE INTERVAL
OR STORM 100 YR.
MPUTATIONS BY GKS DATE 1/21/85
ECKED BY MJJ DATE 1-25-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

Area Designation	A (Acres) (Mi^2)	CN		Q in.	AQ mi^2-in.	ΣAQ mi^2-in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (See pg 75A)
	8.9807			1.58	0.0228		0.47	750	17.1	N/A					OL	10	
B19	0.0144	95		2.94	0.0423		0.47	750	31.7	N/A		channel	0.63	650	0.6	18	
	11.758			1.41	0.0265	0.0493	0.83	560	27.6	N/A							inlet #28 area drain, pipe to street MH
+B20	0.0188	93		2.74	0.0515	0.0938	0.83	560	52.5	N/A		channel	0.63	900	0.6	25	
	6.587			1.33	0.0140		0.07	1275	17.8	20							inlet #29 L=16' C=17.8 no bypass
B 21	0.0105	92		2.64	0.0277		0.07	1275	35.3	155			3.33	900	3.5	4.2	
	10.689			1.45	0.0248		0.21	1050	26	20					OL	10	1
B22	0.0171	93.5		2.79	0.0477		0.21	1050	50	135			2.5	550	3.25	2.8	
	10.285			1.58	0.0261	0.0509	0.24	1000	2 directions 50						OL	10	inlet #30 sump L=22 C=50
+B 23	0.0165	95		2.94	0.0485	0.0962	0.24	1000	2 directions 96.2	90			1.25	600	2.25	4.4	
	28.52			1.58	0.0720		0.35	860	61.9	N/A					OL	10	
C5	0.0456	95		2.94	0.1341		0.35	860	115.2	N/A	channel		2.5	1400	2.2	10.8	
	4.22			1.58	0.0107	0.0827	0.45	770	63.7	N/A							inlet #31 area drain, pipe to street MH
+C11	0.0068	95		2.94	0.0200	0.1541	0.45	770	118.6	N/A			2.5	800	2.2	6	

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SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 5161701
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY CMB DATE 4-17-85
CHECKED BY JB DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

PAGE ___ OF ___

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL. V fps	Δt (min)	
B24	7.3	95		1.58	.017		.17	1100	18.7								Assume t_c=10 min
	.011			2.94	.032		.17	1100	35.2								
B25	9.3	95		1.58	.024		.17	1100	26.4								"
	.015			2.94	.044		.17	1100	48.4								
B26	9.1	89		1.12	.016		.17	1100	17.5								"
	.014			2.36	.033		.17	1100	36.3								
B27	12.6	89		1.12	.022		.17	1100	24.2								"
	.020			2.36	.047		.17	1100	51.9								
B28	4.6	89		1.12	.008		.17	1100	8.8								"
	.007			2.36	.017		.17	1100	18.2								
B29	3.2	89		1.12	.006		.17	1100	6.6								"
	.005			2.36	.012		.17	1100	13.0								

SUBDIVISION Stetson Hills No. 1
LOCATION Co. Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY CHS DATE 1/21/85
CHECKED BY MJJ DATE 1-25-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

PAGE 6 OF

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL. V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE [illegible])
	8.08			1.58	0.0204		0.22	1040	21.2	20					OL	10	inlet # 32 L = 12 c = 16
C6	0.0129	95		2.94	0.0379		0.22	1040	39	160			3.33	700	3.5	3.33	by pass = 5.2 cfs = 0.0050 AQ
	5.234			1.58	0.0133	0.0183	0.24	1000	13.3	20							inlet # 33 L = 8' c = 13.3
+ C4	0.0084	95		2.94	0.0247	0.0626	0.24	1000	24.7	193			5.0	400	4.5	1.5	bypass = 0
	7.714			1.58	0.0194		0.20	1080	20.9	20					OL	10	inlet # 34 L = 8" c = 17.7
C1	[illegible]23	95		2.94	0.0362		0.20	1080	39	187			5	500	4.5	1.8	by pass = 3.2 cfs = 0.0030 AQ
	5.308			1.58	0.0134	0.0164	0.21	1050	17.2	20							inlet # ~~35~~ 1 L = 16' c = 12.0
+ C2A	0.0085	95		2.94	0.0250	0.0612	0.21	1050	64.2	85			5	225	4.7	0.8	bypass = 5.2 cfs 0.0050
	5307			1.58	0.0134	0.0184	0.24	1000	18.4	20							inlet # 36 L = 22' c = 15.3
+ C2B	0.0085	95		2.94	0.0250	0.0862	0.24	1000	86.2	96			1.25	225	2.25	1.7	bypass = 0.0031
	8.871			1.49	0.0212	0.0243	0.30	920	22.3	20							inlet # 37 sump L = 10' c = 22.3
+ C3	0.0142	94		2.84	0.0403	0.1265	0.30	920	116	84 ← 100' storm spills curb to swale			1.0	400	2	3.3	
	6.685			1.45	0.0155		0.15	1150	17.8	20							inlet # 38 sump L = 8' c = 17.8
C8	0.0107	93.5		2.79	0.0299		0.15	1150	34.4	140							
C1-C9																	
						.404	.45	770	311								

DIVISION Stetson Hills No. 1
ATION Co Springs
NO. 516170 6
IGN STORM 5 YR. RECURRENCE INTERVAL
OR STORM 100 YR.
MPUTATIONS BY GKS DATE 1/21/85
ECKED BY MJJ DATE 1-25-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

Area designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (See Pg 75A)
	8.944			1.55	0.0222		0.21	1050	23.3	20					ok	10	inlet # 39 L = 22 C = 15.3
C7A	0.0143	94.7		2.91	0.0416		0.21	1050	43.6	102			1.33	400	2.4	2.8	bypass = 8 cfs = 0.0076 AQ
	4.224			1.41	0.0076	0.0172	0.26	980	16.8	20							inlet # 40 L = 8' C = 10.9
+C7B	0.0068	93		2.74	0.0186	0.0602	0.26	980	59	113			1.67	450	2.6	2.88	bypass = 5.9 = 0.0060
	7.400			1.33	0.0157	0.0217	0.32	900	19.5	20							inlet # 41 sump L = 10' C = 19.5
+C9	0.0118	92		2.64	0.0312	0.0914	0.32	900	82	64	← 100 yr spills over curb to swale		0.5	450	2	3.75	
	3.1589			1.87	0.0073		0.13	1220	11.6	20							inlet # 42 sump L = 6' C = 11.6
C10	0.0051	98		3.27	0.0167		0.13	1220	20.4	113			1.67	1250	2.6	8	
C1 -						.172	.45	770	132.4								1
C10						.481	.45	770	370.4								
	9.384			0.28	0.0042		0.25	1000	4.2	20					ok	10	
D1	0.0150	70		1.01	0.0152		0.25	1000	15.1	150			5.0	1100	3.6	5	
	8.834			0.40	0.0056		0.29	930	5.2	20					ok	10	
D3	0.0141	74		1.24	0.0175		0.29	930	16.3	135			3.3	1500	3.3	7.6	
	4.408			0.40	0.0028	0.0084	0.36	860	7.2	20							
+ D4	0.0071	74		1.24	0.0088	0.0263	0.36	860	22.6	89			1.4	600	2.5	4	
D1+D3+ D4	4.132			0.23	0.0015	0.0141	0.36	860	12.1	20							inlet # 43 sump L = 6' C = 12.1
+D2	0.0066	68		0.90	0.0059	0.0474	0.36	860	41	89							
	3.857			1.87	0.0116		0.31	910	10.6	20							inlet # 44 sump L = 6' C = 10.6 cfs
D5	0.0062	98		3.27	0.0203		0.31	910	18.4	83			1.0	2200	2	[illegible]	

SUBDIVISION Stetson Hills
LOCATION Colo. Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/21/85
CHECKED BY MJJ DATE 1-25-85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	Σ AQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEC D7 75A)
	3.489			1.12	0.0063		0.08	1275	8.0	20					OL	2	inlet # 45 sump
D6	0.0056	89		2.36	0.0132		0.08	1275	16.8	167			4	700	4	2.9	L=6' C = 8 cfs
	18.7			.23	.007		.17	1100	7.7								Assume
D7	.029	68		.90	.026		.17	1100	28.6								t_c = 10 min
	5.6015			1.22	0.0109		0.14	1180	12.9	13.9					OL	2	inlet 46 A L = 10' C = 11.5
E1A	0.0090	90.5		2.50	0.0225		0.14	1180	26.6	103			1.5	1050	2.6	6.7	bypass = 14 cfs = 0.0012 AQ
	3.7649			1.33	0.0080	0.0092	0.18	1100	10.1	13.9							t_c = 0.14 + 2.5/60 = 0.18
+E1B	0.0060	92		2.64	0.0158	0.0383	0.18	1100	42.1	103			1.5	400	2.6	2.5	inlet # 46 L = 6
																	C = 20.1
																	bypass = 0
	1.7199			1.33	0.0037		0.11	1275	4.7	20					OL	2	
E2A	0.0028	92		2.64	0.0074		0.11	1275	9.4	145			2.8	1000	3.4	4.9	
	2.6263			1.33	0.0056	0.0093	0.22	1040	9.6	13.9							t_c = 0.18 + 2.5/60
+E2B	0.0042	92		2.64	0.0111	0.0851	0.22	1040	11.5	103			1.5	400	2.6	2.5	inlet # 47 sump L = 6'
																	C = 11.5
	7.2802			1.33	0.0154		0.23	1020	15.7	20					OL	10	inlet 48 sump L = 8'
E3	0.0116	92		2.64	0.0306		0.23	1020	31.2	167			4	900	4	3.75	C = 15.7
	5.087			1.87	0.0151		0.26	980	14.8	17.8							inlet # 66 sump
E4	0.0081	98		3.27	0.0265		0.26	980	25.9	13.2			2.5	3000	3.25	15.3	L = 12'
																	C = 26.1

IVISION Stetson Hills - Storm Sewer
TION Colorado Springs CO
NO. 516 1706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJJ DATE 1-22-85
CKED BY CoKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp = (AQ)\ q$

t_c = 10 min for 1st 500'
+ channel time
+ street flow

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	at (min)	PRELIMINARY INLET SIZES (SEE PG 75A)
F1	7.45	94.7		1.55	0.0184		0.32	900	16.56	20					CL Street	10 9.8	
	0.0119			2.91	0.0346		0.32	900	31.14	130			2.1	1650	2.8		
F2	12.63	87.0		0.99	0.0200		0.25	990	19.80	20					OL Street	10 5.4	inlet #50 L=8.0' C=16.1
	0.0202			2.19	0.0442		0.25	990	43.76	165			3.3	1200	3.7		bypass 3.7=0.0037
bypass F2 + F5	30.80	75.4		0.41	0.0202	0.0239	0.30	920	21.9	N/A	at sump				OL street	10 8.3	
	0.0493			1.26	0.0621	0.0641	0.30	920	165	165			3.8	1900	3.8	- -	
F1+F2 +F5						0.0423	0.32	900	38.07	at sump							inlet #51 L=16.0 C=38.1
						0.1409	0.32	900	129.8	at sump							sump inlet
F3	9.28	93.0		1.41	0.0209		0.31	910	19.02	20					OL street	10 5.8	
	0.0148			2.74	0.0406		0.31	910	36.95	165			3.6	1900			
+F4	2.11	95.6		1.63	0.0055	0.0264	0.31	910	24.02	at sump					OL Street	10 3.3	inlet #52 L=12.0 C=24.0
	0.0034			3.00	0.0102	0.0508	0.31	910	46.23	165			1.6%	500	2.55		Sump inlet
OF1	87.2	84.5		.85	.116		.28	975	113.1						OL	.10	Assume 2.0%
	.136			1.98	.269		.28	975	262.3				2.0	2000	5.0	6.7	
+F6	16.0	92		1.33	.033	.149	.33	880	131.1						-	-	Assume 7.5 fps in swale
	.025			2.64	.066	.335	.33	880	294.8				2.3	1500	7.5	3.3	
OF1 + F1-F6						.218	.33	880	191.8								
						.527	.33	880	463.8								
HISTORIC 100 YR Pond release - OF1 F6 [illegible]	165.5 [illegible]	70		1.01	.26[illegible]		.67	640	166. ≈ 1 cfs / Ac								HISTORIC TIME ≈ 40 min [illegible]

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IVISION STETSON HILLS
TION COLORADO SPRINGS
NO.
GN STORM ____ YR. RECURRENCE INTERVAL
R STORM ____ YR.
PUTATIONS BY WM DATE 1-22-85
CKED BY COKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

ASSUME 10 MIN FROM LOTS TO STREETS
ASSUME 20% INCREASE IN DISTANCE PER BASIN FOR STREET

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	Σ AQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE PG 75A)
BASIN G																	
																	INLET #53
G1	18.67			.66	0.0197		0.28	975	19.2	20cfs							USE 6' INLET C = 10.6
	0.0299	81		1.71	0.051		0.28	975	49.7	140			2.5	1200	3	10 + 6.7	8.6/975 = 0.0088
+G2	2.4			0.54	0.0021	0.0109	0.32	890	9.7	20cfs							SUMP INLET #54
	0.0038	78		1.50	0.0058	0.0568	0.32	890	50.6	95			1.1	300	2	2.5	
+G3	1.38			1.87	.0041	0.0150	.32	890	13.4	20							#54 SUMP C = 13.4
	.0022	98		3.27	.0072	.0640	.32	890	57.0								USE 8' INLET
BASIN H																	
H1	6.78			.76	0.0082		0.24	1000	8.2	20						OL 10+	
	0.0106	83		1.86	0.0202		0.24	1000	20.2	170			3.5	1000	3.8	4.4	
+H2	7.12			0.54	0.0062	0.0144	0.33	880	12.7	20							
	0.0114	78		1.50	0.0171	0.0373	0.33	880	32.8	170			3.5	1300	3.8	5.7	
H3	2.0			0.54	.0017		.20	1010	1.8	20						OL 10+	
	.0032	78		1.50	0.0048		.20	1010	5.1	170			3.5	400	3.8	2	
H1→H3						0.0161	0.33	880	14.2	20							LOW PT INLET #55 C = 14.2
						0.0421	0.33	880	31.0	170							USE 8' INLET

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IVISION Stetson Hills
TION Colorado Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY WM DATE 1-23-85
CKED BY GOKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Preliminary Inlet Sizes (See pg 75A)
H4	4.55			0.54	.0039		0.24	1000	3.9	20						OL 10min +	
	0.0073	78		1.50	.0109		0.24	1000	10.9	110			3.5	1050	3.8	4.6	
+H5	3.21			.54	.0028	.0067	0.28	975	6.5	20							
	.0051	78		1.50	.0077	.0186	0.28	975	18.1	200			5	700	4.5	2.6	
H6	2.75			.54	.0024		.22	1050	2.5	20						OL 10+	
	0.0044	78		1.5	.0066		.22	1050	6.9	110			2	550	3	3.1	
H4→H6						.0091	.28	975	8.9	20							LP use 6' inlet
						.0252	.28	975	24.6	110							Inlet #56 C=8.9
H7	5.28			.54	.0045		0.21	1080	4.9	20						OL 10+	LP C=4.9 use 4' inlet
	.0084	78		1.50	.0126		0.21	1080	13.6	168			5	700	4.5	2.6	Inlet #57
H8	8.37			.67	.0090		.26	970	8.7	20					OL	10.0	
	.0134	81		1.71	.0229		.26	970	22.2	170			3.6	1400	3.8	6.0	
H9	20.44			.61	.0199		.30	920	18.3	20						OL 10+	
	.0327	79.8		1.63	.0533		.30	920	49.0	175			3.8	2000	2.9	[illegible]	

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IVISION STETSON HILLS
TION Colo SPRINGS
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY WM DATE 1-23-85
CKED BY COKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE Pg 75A)
									on 2 streets								
H8+H9						.0289	.30	920	26.6								
						.0762	.30	920	70.1	160			3.2				
H8+H9	11.39			0.54	0.0098	0.0387	0.30	920	35.6								inlet #58 L=14 C=34.5
+H10	0.0182	78		1.50	0.0273	0.1035	0.30	920	95.2								bypass = 1.1 cfs = 0.0012
	8.99			.54	.0078	0.0090	0.33	880	7.92	20cfs							to Inlet #60
+ H11	0.0144	78		1.50	0.0216	.1251	0.33	880	110.1	140			3.5	450	3.8	2	
H12	5.28			.54	.0046		.26	980	4.5	20						10+	INLET #60
	.0084	78		1.50	.0127		.26	980	12.4	167			3.5	1300	3.8	5.7	
H8→H12						0.0136	.33	880	11.9	20							INlet #60 sump
						.1378	.33	880	121.3	160			3.2				6' inlet C=11.6

SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 5161701
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY CMB DATE 4-18-85
CHECKED BY JB DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

PAGE ____ OF ____

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	Σ AQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE Pg 75A)
OH1	44.6	84.5		.85	.059		.25	1000	59.0				2.0	1500	OL	10	$(t_c)_i$ = 10 min
	.070			1.98	.139		.25	1000	139.0						5.0	5.0	Assume S_o = 2%
+ H14	7.70	78		.54	.007	.066	.28	975	64.4				1.7	600			
	.012			1.50	.018	.157	.28	975	153.1						5.0	2.0	
OH2	8.9	84.5		.85	.012		.17	1100	13.1						OL	10	Assume t_c = 10 min
	.014			1.98	.028		.17	1100	30.5								
+ H13	19.6	83		.76	.023	.035	.25	1000	35.0				3.0	1500			
	.031			1.86	.058	.086	.25	1000	86.0						5.0	5.0	
OA3 + A16 + m1						.040	.25	1000	40.0								
						.091	.25	1000	91.0								
OH2 + H13 + OA3 + A16 + m1						.075	.50	1000	75.0								t_c at end of channel = .50 hr
						.177	.50	1000	177.0								

IVISION Stetson Hills
TION Colorado Springs
NO. 516 1706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJJ DATE 1-23-85
CKED BY CDKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

t_c = 10 min for 1st 500'
+ channel time
+ street flow

Area Designation	A (Acres) (Mi^2)	CN		Q in.	AQ mi^2-in.	ΣAQ mi^2-in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE Pg. 75A)
I 1	4.78	89.0		1.12	0.0086		0.24	1000	8.6	20			3.5	1100	OL street	10 / 4.8	Require No Inlet
	0.0076			2.36	0.0179		0.24	1000	17.9	172					3.7		
I 2	6.95	86.0		0.92	0.0102		0.29	930	9.5	20			2.8	1600	OL Street	10 / 7.8	Requires No Inlet
	0.0111			2.10	0.0233		0.29	930	21.7	150					3.4		
J 1	17.93	89.0		1.12	0.0321		0.27	960	on 2 streets 30.8	20			3.0	1400	OL street	10 / 6.6	Inlet #61 sump L 14' C = 30.8 bypass = 0
	0.0287			2.36	0.0677		0.27	960	65.0	156					3.5		
J 2	8.20	84.0		0.82	0.0108		0.32	900	9.7	20			3.0	2000	OL street	10 / 9.6	
	0.0131			1.94	0.0254		0.32	900	22.9	156							
J1+J2						0.0108	0.32	900	9.7	20			3.0	3.5			Combine w/ inlet #63
						0.0931	0.32	900	83.79	156							
J 3	19.87	83.5		0.79	0.0251	0.0359	0.31	910	32.7	20			2.7	1800	OL street	10.0 / 9.0	Inlet #63 sump L = 14 C = 32.7
	0.0318			1.90	0.0604	0.1535	0.31	910	139	148					3.3		
J 4	4.73	73.0		0.37	0.0028		0.29	930	2.6	20			3.2	1500	OL street	10.0 / 7.8	Inlet #64 L = 4'
	0.0076			[illegible]	0.0090		0.29	[illegible]	[illegible]	[illegible]							[illegible]

SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 5160706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY CPS DATE
CHECKED BY MJJ DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\ q$

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	∆t (min)	PRELIMINARY INLET SIZES (SEE pg 75A)
	7.28			0.54	0.0063		0.31	910	5.7	20					OL street	10.0 9.0	
J5	0.0116	78		1.50	0.0174		0.31	910	15.8	170			3.6	2000	3.8		
J5 +						0.0063	0.32	900	5.7	20							inlet #65 L=4' C=5.7 sump
J4						0.1799	0.32	900	161.9	156	← other half is under capacity						
J6	7.86			0.65	0.0082		0.28	950	7.8	20					OL street	10 7.2	inlet 62A L=6' C=7.8 no bypass
	0.0126	80.7		1.69	0.0213		0.28	950	20.2	165			3.4	1500	3.7		
	8.14			0.54	0.0070		0.36	860	6.0	20					OL street	10 12	to inlet #66
J7	0.0130	78		1.50	0.0175		0.36	860	16.8	163			3.3	2400	3.6		
From West to inlet #66					0.0151	0.0221	0.36	860	19								inlet #66 L= 10' C = 19.0
					0.0265	0.0460	0.36	860	39.6								

IVISION Stetson Hills
TION Colo Springs
NO. 5061706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY WM DATE 1-23-85
CKED BY GOKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (SEE pg 75A)
BASIN	L																
	9.39			.98	.0147		.26	980	14.4	20						OL 10+	
L1	.015	87		2.18	.0328		.26	980	32.1	97			1.7	900	2.6	5.8	
	13.09			.58	.0121	.0268	.30	920	24.7	20							INLET #67 C = 24.7
+L2	.0209	79		1.57	.0329	.0657	.30	920	60.4	150			4	600	4	2.5	LP 12 INLET
	7.22			.11	.003		.31	900	1.1	20						OL 10+	
L3	.0116	62		.62	.0072		.31	900	6.5	126			2.8	1800	3.4	8.8	
	4.61			.11	.0008	.0021	.35	860	1.8	20							INLET #68 C=1.8
+L4	.0074	62		.62	.0046	.0118	.35	860	10.1	150			4	600	4	2.5	LP USE 4 INLET
BASIN	K																
	7.22			.54	.0063		.31	900	5.6	20						OL 10+	
K1	.0116	78		1.50	.0174		.31	900	15.7	126			2.8	1800	3.4	8.8	
	3.13			.54	.0027	.009	.31	900	8.1	20							INLET #69
+K2	.005	78		1.50	.0075	.0249	.31	900	22.4	126							LP USE 6' INLET C=8.1

IVISION Stetson Hills
TION Colo Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY WM DATE 1-23-85
CKED BY GKS DATE 1/26/85

GREINER ENGINEERING

5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)

$Q_p = (AQ)\,q$

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (See pg 75 A)
BASIN M																	
M1	4.51			.76	.0055		.25	1000	5.5	20						oc 10+	LP INLET #70, c=5.5
	.072	83		1.86	.0134		.25	1000	13.4	90			1	600	2	5	4' INLET
M2	24.41			.76	.0297		.32	900	26.7	20						oc 10+	LP INLET #71, c=26.7
	.0391	83		1.86	.0727		.32	900	65.4	110			1.5	1300	2.4	9.	12' INLET
M1+M2	– not used					.0352	.32	900	31.7								
						.0861	.32	900	77.5	110							
BASIN N																	
N1	19.58			.54	.0169		.33	880	14.9	20						10 oc +	
	.0313	78		1.50	.047		.33	880	41.4	150			2.8	2000	3.4	9.8	
+ N2	1.77			1.87	.0053	.0222	.41	800	17.8	20							
	.0028	98		3.27	.0093	.0563	.41	800	45.0	90			1	600	2	5	
(Not used																	

IVISION STETSON HILLS
TION Colo SPRINGS
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY WM DATE 1-23-85
CKED BY GKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	PRELIMINARY INLET SIZES (See PG 75A)
N3	54.73			.16	.014		.51	720	10.1	20						OL 10+	
	.0855	65		.75	.0656		.51	720	47.3	122			1.9	3500	2.80	20.8	
+N4	1.49			1.87	.0045	.0185	.56	690	12.7	20							
	.0024	98		3.27	.0078	.0734	.56	690	50.6	90			1	400	2	3.3	
NOT USED									from 2 directions								
N1 → N4						.0407	.56	690	28.1	20							LP INLET #72 C=28.1
						.1297	.56	690	89.5	90							14' INLET
O1	20.15			.54	.017		.27	960	16.3						OL	10	$(t_c)_i$ = 10 min
	.032	78		1.50	.048		.27	960	46.1				4.4	1800	5.0	6.0	

SUBDIVISION Stetson Hill
LOCATION Colorado Springs
JOB NO. 51617066
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY CMB DATE 4-18-85
CHECKED BY JB DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

PAGE ____ OF ____

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
P1	35.9	73		.37	.021		.31	910	19.1				2.0	2500	OL	10	$(t_c)_i$ = 10 min
	.056			1.18	.066		.31	910	60.1						5.0	8.3	
P2	70.2	81		.67	.074		.28	975	72.2				2.5	2000	OL	10	"
	.110			1.71	.188		.28	975	183.3						5.0	6.7	
P3	27.0	70		.28	.012		.22	1020	12.2				3.5	1000	OL	10	"
	.042			1.01	.042		.22	1020	42.8						5.0	3.3	
P4	27.3	71		.31	.013		.24	980	12.7				2.5	1600	OL	10	"
	.043			1.07	.046		.24	980	45.1						5.0	5.3	
P5	47.5	61		.10	.007		.23	1020	7.1				4.2	1200	OL	10	"
	.074			.58	.043		.23	1020	43.9						5.0	4.0	
P6	66.8	74		.40	.042		.33	880	37.0				3.0	3000	OL	10	"
	.104			1.24	.129		.33	880	113.5						5.0	10	

DIVISION Stetson Hills No. 1
ATION Co Springs
NO. 5161706
IGN STORM 5 YR. RECURRENCE INTERVAL
OR STORM 100 YR.
MPUTATIONS BY GKS DATE 1/21/85
ECKED BY ____ DATE ____

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp = (AQ)\, q$

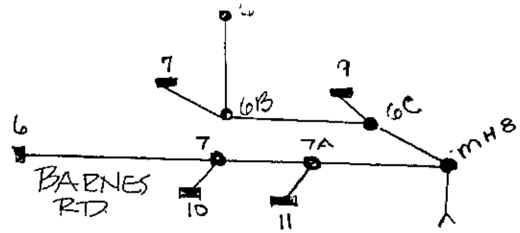
PIPE SIZING
n = 0.013

Area designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design size in parentheses BASED ON HAL CALCS.
Inlet #1 to MH1 to MH2					0.0144		0.24				14.7	18"	1.96	370	basin 8.3	13.8 0.74	TUTT AVE. (24") LOCATION
inlet #2 to MH 2					0.0189						18.5	18"	3.1	20	basin 10.4	15.6 0.03	(18")
MH2 to MH3						0.0333	0.26	980	32.6		32.6	21 24	4.26 2.08	650	13.5 10.3	1.05	(24")
inlet #3 to MH 3					0.0212						22.9	18 21	4.76 2.10	20	12.9	0.03	(21")
MH #3 to MH 4						0.0545	0.28	950	51.8		51.8	24 27 30	5.25 2.78 1.60	650	13	0.83	(30")
Inlet #4 to MH4					0.0202						21.8	18	4.31	20	12.3	0.03	basin tc = 12 min (21")
MH 4 to MH5						0.0747	0.29	930	67.4		67.4	30	2.87	450	14.1	0.53	basin tc = 12.6 min (30")

IVISION Stetson Hills No. 1
TION Co Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY GKS DATE 1/21/85
CKED BY DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q



Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL. V fps	Δt (min)	Final pipe design size in ()'s
Inlet #8 to MH 5					0.0316						34.1	24	2.28	30	10.8	0.05	(24")
MH 5 to MH 6						0.1063	0.29	930	98.9		98.9	30 33 36	5.82 3.48 2.21	100	14.0	0.12	(42")
Inlet #5 to MH 6					0.0192						20.2	18	3.7	20	11.4	0.03	(21")
MH #6 to MH 6B						0.1255	0.29	930	116.7		116.7	36 42	3.07 1.35	1050	16.5 12.1	1.4	(42"
Inlet #6 to MH 7					0.0187						20.2	18 21	3.7 1.63	800	8.3	1.6	tc = .20 (21")
Inlet #10 to MH 7					0.0059						7	18	0.44	20	3.96	0.08	basin tc = 0.20
MH 7 to MH 7A			0.0187+0.0059=			0.0246	0.22	1040	25.6		25.6	24	1.28	280	8.3	0.56	(24")
Inlet #11 to MH 7A					0.0007						0.9	18"	0.4	20	0.5	0.67	(18")
MH 7A to MH 8						0.0253	0.22	1040	26.3		26.3	24	1.35	105	9.3	0.21	(24")

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SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/21/85
CHECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	final pipe design size in ( )'s.
Inlet #7 to mH 6B					0.0352		0.29					24	2.83	30	12.09	0.04	basin tc = 0.29
											38	27	1.50	30	9.5	0.05	(36")
mH 6B to mH 6C			0.0352+0.1255=0.1607				0.29	930	149.5		149.5	48	1.08	200	11.9	0.28	(54")
Inlet #9 to mH 6C					0.0007						125	18	1.42	30			(18")
mH 6C to mH 8						0.1614	0.29	930	150								(54")
mH 8 to outfall				0.1614+0.0253=0.1867			0.29	930	174		174	54"	0.78				(54")

…IVISION Stetson Hills No 1
…TION Co Springs
NO. 5161706
…GN STORM 5 YR. RECURRENCE INTERVAL
…R STORM 100 YR.
…PUTATIONS BY GKS DATE 1/21/85
…CKED BY ______ DATE ______

GREINER ENGINEERING

5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp = (AQ)\,q$

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	
Inlet #12 to MH 10 to MH 11					0.0144						14.7	18"	1.96	20	8.3	0.04	basin tc = 0.23 hr (24")
Inlet #13 to MH 11					0.0086						8.6	18"	0.67	20	4.9	0.07	basin tc = 0.25 (21")
MH 11 to MH 12						0.0230	0.25	1000	23		23	18 / 21	4.8 / 2.12	200	9.6	0.35	(24")
												21	1.03				tc = 0.25 + .35/60 = 0.26
Inlet #14 to MH 12					0.0161						15.3	18"	2.12	20	8.7	0.04	basin tc = 0.28 (21")
MH 12 to MH 13		0.0230 + 0.0161 =				0.0391	0.28	950	37.1		37.1	24 / 27	2.69 / 1.43	400	9.3	0.72	(27") tc = 0.28 + .72/60 = 0.29
Inlet #15 to MH 13					0.0195						17.7	18"	2.84	20	10	0.03	basin tc = 0.31 (24")
MH 13 to MH 14			0.0391 + 0.0195 =			0.0586	0.31	910	53.3		53.3	30 / 33	1.69 / 1.01	150	8.8	0.28	tc = 0.31 + .03/60 = 0.31 (30") tc = 0.31 + 0.28/60 = 0.31

DIVISION Stetson Hills No.1
LOCATION Colo. Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/22/85
CHECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design in ( )'s.
Inlet #25 to MH 14					0.0120						14.6	18	1.93	20	8.3	0.04	basin Tc = 0.12 (18")
MH 14 to MH 13				0.0120 + 0.0586 =		0.0706	0.31	910	64.2		64.2	30 33	2.46 1.47	250	13	0.32	(30") tc = 0.31 + .32/60 = 0.32
Inlet #16 to MH 15					0.0206						17.7	18	2.84	20	10	0.03	basin Tc = 0.35 (18") tc = 0.35 + .03/60 = 0.35
MH 15 to culvert				0.0706 + .0206 =		0.0912	0.35	860	78.4		78.4	~~30~~ 33 36	~~3.65~~ 2.19 1.39	500	13.2	0.63	(30")
Inlet #17 to culvert					0.0313						25.7	21 18	2.65 5.97	20	10.7 14.5	0.03 0.02	basin Tc = 0.37
Inlet #18 to culvert					0.0125						15.9	18	2.29	20	7.0	0.04	basin Tc = 0.11

SUBDIVISION Stetson Hills

LOCATION

JOB NO.

DESIGN STORM ____ YR. RECURRENCE INTERVAL

MAJOR STORM ____ YR.

COMPUTATIONS BY ____ DATE ____

CHECKED BY ____ DATE ____

GREINER ENGINEERING

5455 N. UNION BOULEVARD

COLORADO SPRINGS, COLORADO

80918

RUNOFF COMPUTATIONS

(SCS METHOD)

Qp = (AQ) q

Pipe Sizing

PAGE 5A OF ___

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL. V fps	Δt (min)	final pipe design size in ( )'s
from B-10 into pipe						0.30	0.34	880	262.6		262.6	54 60'	1.78 1.02				from Master Storm Report (68"x106")
+ Inlet #23 into pipe					0.0064						8.2	18	0.61				(18")
Combined flows to culvert						0.3064	.34	880	269.6		269.6	48 54 60	3.52 1.88 1.07	420	13.7		(68"x106")
Inlet #19 to MH					0.0057						7.3		0.81				(18") tc=0.09
Inlet #20 to MH					0.0048						6.1		1.30				(18")
#19 #20 to culvert						0.0105	0.09	1275	13.4		13.4		0.81				

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IVISION	Stetson Hills No. 1
TION	Colo. Springs
NO.	5161706
GN STORM	5 YR. RECURRENCE INTERVAL
R STORM	100 YR.
PUTATIONS BY	GKS DATE 1/22/85
KED BY	DATE

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp=(AQ)\,q$

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design size in ( )'s
1.																	
inlet #25 to MH 16 To MH 17					0.0493			750			27.6	21	3.05	1050	11.5	1.52	basin Tc = 0.47 (21" → 24" → 27") Tc = 0.47 + 1.5/60 = tc = 0.50
inlet #26 To MH 17					0.0246						24.6	18 21	5.49 2.42	20	10.2	0.03	tc = 0.25 basin (21")
inlet # 29 To MH 17					0.0135						15.9	18	2.29	20	9.0	0.04	tc = 0.14 basin (18")
MH 17 To storm sewer		0.0006 + 0.0493 0.0135 =				0.0634	0.50	750	47.6		47.6	30" 27	1.35 2.36		9.70 11.97		(30")
Inlet #27 to storm sewer					0.0135						15.9	18	2.29	10	9	0.02	(18")
Inlet #30 to Storm Sewer					0.0476						50	27 24	2.60 4.89	10	12.5 15.9		(18")

IVISION Stetson Hills No. 1
TION Colo. Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY GKS DATE 1/22/85
CKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp = (AQ)\,q$

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL. V fps	Δt (min)	final pipe design size in ( )'s
storm to channel	0.0381 + 0.0135 + 0.0476 =					0.0992	0.25	1000	99.2		99.2	54 / 48	2.5% / 4.8%		6.2 / 7.9		(54")
inlet #32 to MH 18					0.0154						16	18	2.32				basin tc = 0.22 (36")
inlet #31 to MH 18					0.0827						63.7	30	2.41	50	12.9	0.06	basin tc = 0.45 (36") tc = 0.45 + .06/60 = 0.45
MH 18 to MH 19				0.0154 +	0.0827 =	0.0981	0.45	770	75.5		75.5	30 / 36	3.39 / 1.29	400	15 / 10.6	0.62	(36") tc = 0.45 + .62/60 = 0.46
inlet #33 to MH 19					0.0133						13.3	18"	1.60	20	7.5	0.04	(18")
MH 19 to MH 20				0.0981 +	0.0133 =	0.1114	0.46	760	84.7		84.7	36	1.62	350	12.0	0.48	(42") tc = 0.46 + .48/60 = 0.47

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IVISION Stetson Hills No. 1
TION Colo. Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY GKS DATE 1/22/85
CKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

Pipe Sizing

PAGE 8 OF ____

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	final pipe size in ()'s
inlet #37 to MH 20					0.0243						22.3	18	4.51	20	12.6	0.03	(18")
inlet #38 to outfall pipe					0.0155						17.8	18	2.87	20	10	0.03	(18")
inlet #34 to MH 21 to MH 22					0.0164						17.7	18"	2.84	250	10.0	0.42	basin Tc = 0.20 (18") 0.20 + .42/60 = 0.21
inlet #35 to MH 22					0.0114						12	18	1.31	10	6.8	0.02	(21")
MH 22 to MH 23						0.0278	0.21	1050	29.2		29.2	21	3.42	250	12.1	0.34	(27") Tc = 0.21 + .34/60 = 0.22
Inlet #36 to MH 23					0.0153						15.3	18	2.12	20	8.6	0.04	(24")
MH 23 to MH 20			0.0278+		0.0153	0.0431	0.22	1040	44.8		44.8	24 / 27	3.93 / 2.09	600	14.3 / 9.1	1.10	(27") tc = 0.22 + 1.10/60 = 0.24

IVISION Stetson Hills No. 1
TION Colo Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY GKS DATE 1/22/85
CKED BY ____ DATE ____

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	final pipe design sizes in ( )'s
mH20 to outfall		0.1143+0.0243+ 0.0155+0.0431 + 0.0153=				0.1943	0.47	750	145.7		145.7	42 / 48	2.10 / 1.03		15 / 11.6		(54")
inlet #22 to inlet 21					0.0077						9.8	18"	0.87	150	5.5	0.45	basin Tc = 0.10; 0.10 + 0.45/60 = 0.11; (21")
inlet 21 to culvert					0.0071	0.0148	0.11	1270	18.8		18.8	18"	3.21	125	10.6	0.20	(21"); 0.11 + .2/60 = 0.11
inlet 24 to culvert					0.0058		0.11	1270	7.4		7.4	18"		17'			(21)
inlet #19 to culvert											7.3	18"	0.5				
inlet 20 to culvert											6.1	18"	0.5				

SUBDIVISION Stetson Hills
LOCATION Colo. Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/22/85
CHECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design sizes in ( )'s
INLET #39 TO MH 24					0.0146						15.3	18"	2.12	20	8.7	0.04	basin Tc = 0.21 (24")
MH 24 TO MH 25											15.3	18	2.12	475	8.7	0.91	tc = 0.21 + .91/60 (24)" = 0.23
Inlet #40 TO MH 25					0.0111						10.9	18"	1.08	20	6.2	0.05	basin Tc = 0.26 0.26 + 0.05/60 = 0.26 (18")
MH 25 TO MH 26			0.0111+		0.0146=	0.0257	0.26	980	25.2		25.2	18" 21" 24"	5.75 2.54 1.24	450	10.5 8.5	0.71	(36")
																	Tc = 0.26 + 0.71/60 = 0.27
Inlet #41 TO MH 26					0.0217						19.5	18	3.45	20	11.0	0.03	basin Tc = 0.32 (18")
MH 26 TO Inlet 42			0.0257+		0.0217	= 0.0474	0.32	900	42.6		42.6	24 27	3.56 1.89	20	13.5 10.7	0.03	(36")
Inlet 42 TO OUTFALL					0.0095						11.6	18"	1.22	20	6.56	0.05	
OUTFALL + OUTFALL FROM MH 20			0.1943+ 0.0095+		0.0474	= 0.2512	0.47	750	188.4		188.4	54"	0.92	50	11.8		(54")

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SUBDIVISION Stetson Hills
LOCATION Colo Springs
JOB NO. 5161766
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/21/85
CHECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design size in ( )'s
inlet #46A to MH 27A					0.0097						11.5	18	1.2	20	6.5	0.06	basin Tc = 0.14 (21")
MH 27A to MH 27											11.5	18	1.2	400	6.5	1.0	(21")
inlet 46 to MH 27					0.0092						10.1	18	0.93	20	5.7	0.06	tc = 0.18 (18")
MH 27 to MH 28						0.0189	0.18	1100	20.7		20.7	21	1.72	450	8.6	0.87	tc = 0.18 + .87/60 = 0.19 (24")
inlet #47 to MH 28					0.0111		0.22	1040			11.5	18	1.20	20	6.5	0.05	(18")
MH 28 to MH 29				0.0189+	0.0111	=0.0300	0.22	1040	31.2		31.2	24	1.9	600	9.9		(24" → 27")
inlet 48 to MH 29					0.0154						15.7	18"	2.24	30	8.9	0.06	(18")

SUBDIVISION Stetson Hills
LOCATION Colo Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY GKS DATE 1/21/85
CHECKED BY ______ DATE ______

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp = (AQ)\,q$

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design sizes in ( )'s
MH 29 to MH 30			0.0300+0.0154			= 0.0454	0.23	1020	46.3			27	2.23				
											46.3	30	1.28	400	9.4	0.71	
MH 30 to MH66						0.0454											

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SUBDIVISION
LOCATION
JOB NO.
DESIGN STORM ____ YR. RECURRENCE INTERVAL
MAJOR STORM ____ YR.
COMPUTATIONS BY ____ DATE ____
CHECKED BY ____ DATE ____

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

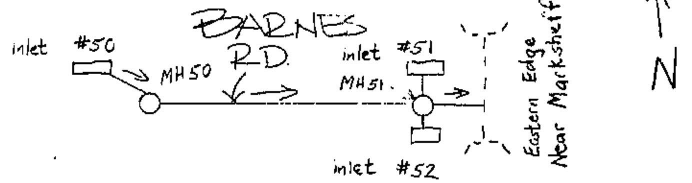
RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

Pipe Sizing

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design size in ( )'s.
Inlet #43 TO MH 31					0.0141						12.1	18	1.33	20	6.8	0.05	basin Tc = 0.36 (21")
MH 31 TO MH 32											12.1	18	1.32	200	6.8	0.49	(21")
																	Tc = 0.36 + .49/60 = 0.37
Inlet #45 TO MH 32					0.0063						8.0	18	0.58	20	4.5	0.07	(18")
Inlet 44 to MH 32			0.0063+0.0141 =			0.0204	0.37	840	17.1		17.1	18	2.66	20	9.6		(21")
MH 32 to discharge					0.0016	0.0320	0.37	840	26.9		26.9	18 / 21	6.25 / 2.90	50	11.2		(21")

PIPE SIZING

$n = 0.013$



SUBDIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 5161706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY MJJ DATE 1-24-85
CHECKED BY GKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Qp = (AQ) q$

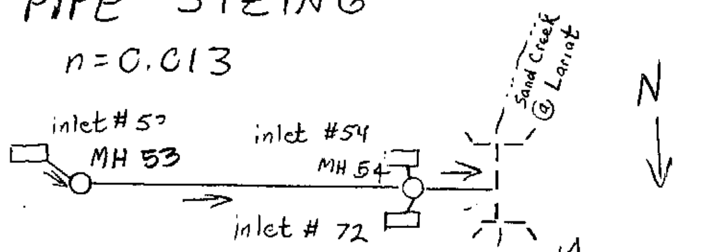
Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	tc. hr.	q csm in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design sizes in ( )'s.
Inlet 50 to MH 50					0.0163		0.25				16.1	18"	2.35	20	9.11	0.04	basin Tc = 0.25 (18")
MH 50 To MH 50 A					0.0175	-	0.30	-			16.1	18"	2.35	750	9.11	0.04 +1.37 (1.41)	basin Tc = 0.30 (21")
MH 50A to culvert																	(30")
inlet 51 to MH 51					0.0423		0.32				38.1	24"	2.84	20	12.54	0.03	(30")
inlet 52 to culvert					0.0265		0.31				24.0	21"	2.31	20	11.48	0.03	(21")
MH 51 to Culvert				0.0163 +	0.0423	= 0.0586	0.32	900	52.7		52.7	30"	1.65	20	11.65	1.41 +0.03 (1.44)	(30")

IVISION Stetson Hills
TION Colorado Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJT DATE 1-23-85
CKED BY GKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\ q$

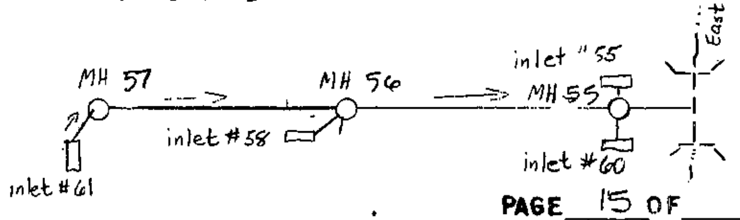
PIPE SIZING
n = 0.013



Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design size in ( )'s
inlet #53 to MH 53					0.0109		0.28	975			10.6	18"	1.02	20	6.00		(18")
i) MH 53 to MH 54											10.6	18"	1.02	400	6.00	1.17	t_c = 0.28 + 1.17/60 = 0.30 (18")
ii) inlet #54 to MH 54					0.0131		0.32	890			13.4	18"	1.63	20	8.00	0.04	(18")
iii) inlet #72 to MH 54					0.0407		0.56	690			28.1	24"	1.55	20	8.94	0.04	(21")
Sum i + ii + iii						0.0667	0.56	690	46.0		46.0	27"	2.20	20	11.6		
MH 54 to Culvert											46.0	27"	2.20	20			(21")

PIPE SIZING N →

n = 0.013



ivision Stetson Hills
tion Colorado Springs
No. 5161706
gn storm 5 yr. recurrence interval
r storm 100 yr.
putations by MJJ date 1-23-85
cked by GKS date 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design sizes in ( )'s
inlet #61 to MH 57					0.0321		0.27	960			30.8	30"	0.6				(30")
1) MH 57 to MH 56					0.0321						30.8	30"		787	6.27	2.09	(30")
2) inlet #58 to MH 56					0.0375		0.30	920			34.5	30	0.71	20	7.0	0.04	(36")
sum of 1+2						0.0696	0.30	920	64.0		64.0	36"	0.92		9.0	1.0	(36")
MH 56 to MH 55											64.0	36"	0.92	500	9.0	1.0 +0.85 = 1.85	t_c = 0.30 + 1.85/60 = 0.33
5) inlet #55 to MH 55					0.0161		0.23	880			14.2	18"	1.83	20	8.04	0.04	(21")
6) inlet #60 to MH 55					0.0228		0.33	850			21.6	21"	1.87	20	[illegible]	[illegible]	(24")

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PIPE SIZING

n=0.013

IVISION Stetson Hills
TION Colorado Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJJ DATE 1-23-85
CKED BY GKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp=(AQ) q

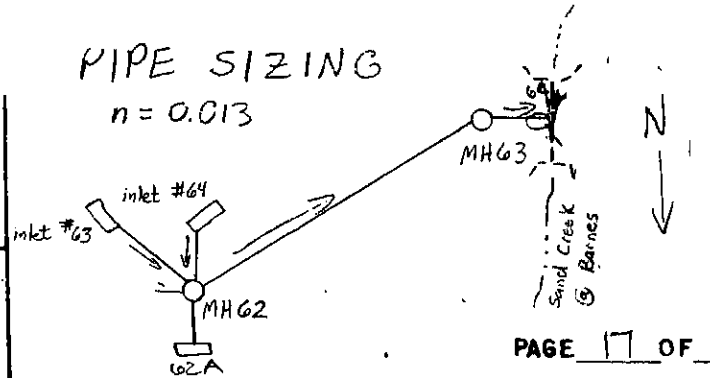
Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm/in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	final pipe design sizes in ( )'s
Sum A+5+6		0.0696+0.0161+0.0228=				0.1085	0.33	880	95.5							2.25	(42")
MH 55 to Culvert						0.1085	0.33	880	95.5		95.5	36	2.06				(42")

DIVISION Stetson Hills
TION Colorado Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJJ DATE 1-23-85
CKED BY GKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

PIPE SIZING
n = 0.013



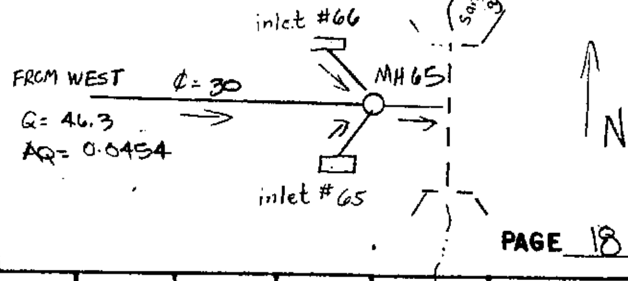
Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi² -in	ΣAQ mi² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	final pipe design size in ( )'s
1) inlet #63 to MH 62					0.0359		0.31	910			32.7	24	2.09	30	8.09	0.06	(30")
2) inlet #64 to MH 62					0.0028			930			2.6	18"	0.5	20	8.38	0.04	(18")
3) inlet 62A to MH62					0.0082		0.28	950			2.8	18"	0.6				(18")
1+2+3+ MH62-64						0.0469	0.32	900	42.2		42.2	33	1.06	2000	7.2	4.6	(30")

DIVISION Stetson Hills
LOCATION Colorado Springs
JOB NO. 516 1706
DESIGN STORM 5 YR. RECURRENCE INTERVAL
MAJOR STORM 100 YR.
COMPUTATIONS BY MJJ DATE 1-24-85
CHECKED BY CKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

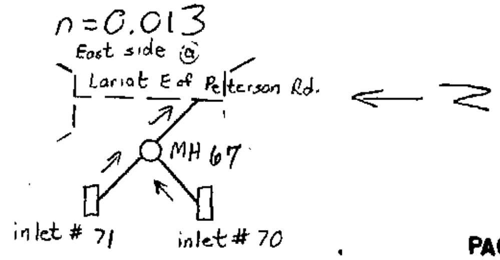
PIPE SIZING
n=0.013



Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in.	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design size in ( )'s
A) FROM WEST					0.0454		0.23	1020	46.3								(36")
B) inlet #66 to MH 65					0.0303		0.36	860			19.0	24"	1.44	20	8.78	0.04	(21")
C) inlet #65 to MH 65					0.0063		0.32	900			5.7	18	0.3	20	6.79	0.09	(18")
Sum A+B+C						0.0820	0.36	860	70.5			"				0.53	
MH 65 to culvert					0.0820		0.36	860	70.5		70.5	33 30	3.45	200	12.8 15.5		(36")

PIPE SIZING

n=0.013



IVISION Stetson Hills
TION Colorado Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJJ DATE 1-24-85
CKED BY COKS DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
$Q_p = (AQ)\,q$

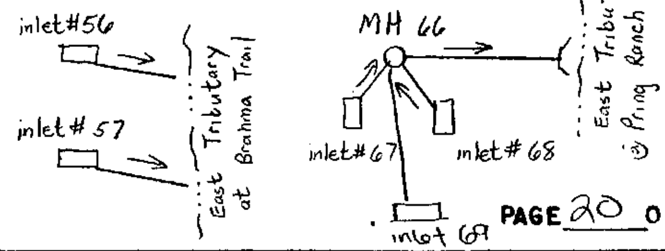
Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	Final pipe design in ( )'s
inlet #71 to MH 67					0.0297		0.32				27.6	21 24"	3.05 1.49	20	11.5 8.78	0.03 0.04	(24")
inlet #70 to MH 67					0.0055		0.25				5.5	18"	0.50	20	4.47	0.07	(18")
MH 67 to Culvert						0.0352	0.32	900			31.6	21 24"	4.00 1.96	20	13.1 10.06		(24")

IVISION Stetson Hills
TION Colorado Springs
NO. 5161706
GN STORM 5 YR. RECURRENCE INTERVAL
R STORM 100 YR.
PUTATIONS BY MJJ DATE 1-24-85
CKED BY CoKs DATE 1/26/85

GREINER ENGINEERING
5455 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO
80918

RUNOFF COMPUTATIONS
(SCS METHOD)
Qp = (AQ) q

PIPE SIZING
n = 0.013



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Area Designation	A (Acres) (Mi²)	CN		Q in.	AQ mi.² -in.	ΣAQ mi.² -in.	t_c hr.	q csm / in.	Q p cfs	Street capacity cfs	Flow in Pipe cfs	Pipe Dia. in	Min. Slope %	Length ft.	VEL V fps	Δt (min)	final pipe design size in ( )'s
inlet #56 to MH 56A					0.0091		0.28	975			8.9	18"	0.72	20	5.04	0.07	(21)
Inlet # 57 to 56A					0.0045		0.21	1080			4.9	18	0.40	20	2.77	0.12	(18)
56+57 to culvert						0.0136	0.28	975	13.2		13.2	21 / 24	0.70 / 0.4				(21)
inlet #67 to MH 66					0.0268		0.30	920			24.7	21"	2.44	20	10.27	0.03	(27")
inlet #68 to MH 66					0.0021		0.35	860			1.8	18"	0.40	20	0.75	0.44	(27")
inlet 69 to MH66					0.0090		0.31	900			8/	18"	0.006	600	4.5	÷2.2 = 0.04 hr	(18")
Sum @ MH66						0.0379	0.35	860	32.6								
MH 66 to Tributary											32.6	27	1.11				(27")

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☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT Stetson Hills
JOB NUMBER 516170I SHEET 118 OF
CALCULATED BY GKS DATE
CHECKED BY DATE

BASIN	SOIL	SF 4-6	SF 8-12	MF 18-22	MF 25-35	OFFICE	SCHOOL	PARK	STREETS	CURVE No.
A1	D					100				95
A2	D					100				95
A3	D					100				95
A4	D					100				95
A5	D					100				95
A6	D					100				95
A7	D					100				95
A8	D					100				95
A9	D					100				95
A10	D					100				95
A11	D					100				95
A12	D					100				95
A13	D					100				95
A14	D					100				95
A15	D					100				95
A16	D								100	98
A17	D								100	98
B1	D					100				95
B2	D					100				95
B3	D					100				95
B4	D					100				95
B5	D					100				95
B6	D					100				95
B7	D					100				95
B8	D					100				95
B9	A								100	98
B10	A						50		50	83
B11	A								100	98
B12	A								100	98
B13	A								100	98
B16	A					67				
	D					33				91
B14	A					100				89
B18	A					75				
	D					25				91
B17	A					100				89
B15	D					100				95
B20	A					40				
	D					60				93
B19	D					100				95

Greiner Engineering

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☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT ____________________
JOB NUMBER ____________ SHEET ____ OF ____
CALCULATED BY ____________ DATE ____
CHECKED BY ____________ DATE ____

BASIN	SOIL	SF 4-6	SF 8-12	MF 18-22	MF 25-35	OFFICE	SCHOOL	PARK	STREETS	CN
B21'	A					50				92
	D					50				
B22	A					25				93.5
	D					75				
B23	D					100				95
C5	D					100				95
C11	D					100				95
C6	D					100				95
C4	D					100				95
C3	D					75				94.2
	B					25				
C1	D					100				95
C2A	D					100				95
C2B	D					100				95
C3	B					0.33				94
	D					0.67				
C8	B					50				93.5
	D					50				
C7A	B					.10				94.7
	D					.90				
C9	B					100				92
C7B	B					.67				93
	D					.33				
C10									100	98
D1	A					10	90			70
D2	A						100			68
D3	A		100							74
D4	A		100							74
D5									100	98
D6	A					100				89
E1A	A					50				90.50
	B					50				
E2A	B					100				92
E3	B					100				92
E4	B								100	98
E1B E2B	B					100				92

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- [ ] COLORADO SPRINGS, COLORADO
- [ ] ALBUQUERQUE, NEW MEXICO
- [ ] KEMMERER, WYOMING

PROJECT Stetson Hills - Curve # for Storm Sewer
JOB NUMBER 5161706 SHEET 120 OF ____
CALCULATED BY MJJ DATE 1-22-85
CHECKED BY ____ DATE ____

BASIN	SOIL	SF 4-6	SF 8-12	MF 18-22	MF 25-35	OFFICE	SCHOOL	PARK	STREETS	CURVE NUMBER
F1	B					55			45	94.70
F2	B			100						87.00
F3	B				55				45	93.05
F4	B					40			60	95.60
F5		10				41		49		75.41
H8	B	67		33						80.97
H9	B	80		20						79.80
H10	B	100								78.00
H11	B	100								78.00
I1	B	45							55	89.00
I2	B	60							40	86.00
J1					100					89.00
J2		45			55					84.05
J3		50			50					83.50
J4		65						35		73.05
J5		100								78.00
J6		70		30						80.70
J7		100								78.00
G1	B	57	43							80.85
L1	B			100						87
L2	B	85		15						79.4
L3	B	25						75		62
L4	B	25						75		62
K1		100								78
K2		100								78

Greiner Engineering

☒ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT Stetson Hills
JOB NUMBER 5161701 SHEET 121 OF
CALCULATED BY CMB DATE 4/18/85
CHECKED BY JB DATE

ADDITIONAL BASINS AND RESPECTIVE CN'S

BASIN	SOIL	SF (4-6)	SF (8-12)	MF (18-22)	MF (25-35)	OFFICE	SCHOOL	PARK	CN
B24	D					100			95
B25	D					100			95
B26	A					100			89
B27	A					100			89
B28	A					100			89
B29	A					100			89
D7	A						100		68
OF1	B								84.5
F6	B					100			92
OH1	B								84.5
OH2	B								84.5
H13	B		100						83
H14	B	100							78
O1	B	100							78
P1	B	33 1/3					33 1/3	33 1/3	73
P2	B		90					10	81
P3	B	50						50	70
P4	B					50		50	71
P5	B							100	61
P6	B	75						25	74

TR-20

```
VAX/VMS  MSMENG      SHTR206 11-MAR-1985 10:21   LPA0: 11-MAR-1985 10:27   DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1      VAX/VMS
```

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VAX/VMS  MSMENG      SHTR206 11-MAR-1985 10:21   LPA0: 11-MAR-1985 10:27   DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1      VAX/VMS
VAX/VMS  MSMENG      SHTR206 11-MAR-1985 10:21   LPA0: 11-MAR-1985 10:27   DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1      VAX/VMS
```


MSMENG

SHTR206.

PRT;1

MSMENG

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VAX/VMS  MSMENG      SHTR206 11-MAR-1985 10:21   LPA0: 11-MAR-1985 10:27   DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1      VAX/VMS
VAX/VMS  MSMENG      SHTR206 11-MAR-1985 10:21   LPA0: 11-MAR-1985 10:27   DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1      VAX/VMS
VAX/VMS  MSMENG      SHTR206 11-MAR-1985 10:21   LPA0: 11-MAR-1985 10:27   DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1      VAX/VMS
```

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

JOB TR-20                                                  SUMMARY    NOPLOTS
TITLE      STETSON HILLS JN-5161701 5 AND 100 YEAR STORMS
TITLE      24 HR TYPE IIA STORM & 6 HR
5 RAINFL 1                     0.25
8                   0.000        .018         .032         .055         .080
8                    .106        .132         .181         .228         .400
8                    .590        .650         .698         .740         .780
8                    .810        .835         .860         .885         .905
8                    .925        .942         .962         .981        1.000
9  ENDTBL
5  RAINFL 2                    0.25
8                    .000        .000         .001         .002         .003
8                    .004        .005         .008         .010         .011
8                    .012        .013         .014         .017         .020
8                    .025        .030         .040         .050         .055
8                    .060        .080         .100         .130         .700
8                    .725        .750         .765         .780         .790
8                    .800        .810         .820         .825         .830
8                    .835        .840         .845         .850         .855
8                    .860        .863         .865         .867         .870
8                    .877        .885         .888         .890         .895
8                    .900        .903         .905         .907         .910
8                    .912        .915         .918         .921         .924
8                    .927        .930         .933         .936         .940
8                    .942        .945         .948         .950         .953
8                    .955        .956         .960         .963         .965
8                    .968        .970         .973         .975         .978
8                    .980        .981         .982         .984         .986
8                    .988        .990         .991         .992         .993
8                    .994        .995         .996         .997         .998
8                    .999       1.000        1.000        1.000        1.000
9  ENDTBL
2  XSECTN    002          1.0          5.0
8                                 0.0          0.0          0.0
8                                 1.0        185.0         49.0
8                                 2.0        650.0        116.0
8                                 3.0       1410.0        201.0
8                                 4.0       2499.0        304.0
8                                 5.0       3954.0        425.0
8                                 6.0        5811.        564.0
8                                 7.0        8150.        721.0
8                                 8.0       10869.        896.0
9  ENDTBL
2  XSECTN    004          1.0          5.0
8                                 0.0          0.0          0.0
8                                 1.0        487.0        123.0
```

```
**********************80-80 LIST CF INPUT DATA (CONTINUED)**********************
8                                    2.0        1627.0        272.0
8                                    3.0        3370.0        447.0
8                                    4.0        5739.0        648.0
8                                    5.0        8770.0        875.0
8                                    6.0       12503.0       1128.0
8                                    7.0       16981.0       1407.0
8                                    8.0       22246.0       1712.0
8                                    9.0       28342.0       2043.0
8                                   10.0       35309.0       2400.0
9 ENDTBL
2 XSECTN    006          1.0              5.0
8                                    0.0           0.0          0.0
8                                    1.0         277.0         69.0
8                                    2.0         987.0        166.0
8                                    3.0        2165.0        291.0
8                                    4.0        3873.0        444.0
8                                    5.0        6174.0        625.0
8                                    6.0        9131.0        834.0
8                                    7.0       12803.0       1071.0
8                                    8.0       17246.0       1336.0
9 ENDTBL
2 XSECTN    007          1.0              5.0
8                                    0.0           0.0          0.0
8                                    1.0         134.0         33.0
8                                    2.0         490.0         82.0
8                                    3.0        1098.0        147.0
8                                    4.0        1998.0        228.0
8                                    5.0        3231.0        325.0
8                                    6.0        4832.0        438.0
8                                    7.0        6839.0        567.0
8                                    8.0        9286.0        712.0
9 ENDTBL
2 XSECTN    009          1.0              5.0
8                                    0.0           0.0          0.0
8                                    1.0         109.0         27.0
8                                    2.0         401.0         68.0
8                                    3.0         908.0        123.0
8                                    4.0        1665.0        192.0
8                                    5.0        2707.0        275.0
8                                    6.0        4066.0        372.0
8                                    7.0        5775.0        483.0
8                                    8.0        7864.0        608.0
8                                    9.0       10362.0        747.0
8                                   10.0       13298.0        900.0
9 ENDTBL
2 XSECTN    012          1.0              5.0
```

```
*********************80-80 LIST CF INPUT DATA (CONTINUED)*********************
8                                  0.0         0.0        0.0
8                                  1.0       271.0       70.0
8                                  2.0       926.0      160.0
8                                  3.0      1960.0      270.0
8                                  4.0      3405.0      400.0
8                                  5.0      5295.0      550.0
8                                  6.0      7668.0      720.0
8                                  7.0     10559.0      910.0
8                                  8.0     14005.      1120.0
9 ENDTBL
2 XSECTN    013         1.0           5.0
8                                  C.0         0.0        0.0
8                                  1.0       271.0       70.0
8                                  2.0       926.0      160.0
8                                  3.0      1960.0      270.0
8                                  4.0      3405.0      400.0
8                                  5.0      5295.0      550.0
8                                  6.0      7668.0      720.0
8                                  7.0     10559.0      910.0
8                                  8.0     14005.0     1120.0
9 ENDTBL
2 XSECTN    037         1.0           4.0
8                                  0.0         0.0        0.0
8                                  1.0        47.0       13.0
8                                  2.0       171.0       32.0
8                                  3.0       379.0       57.0
8                                  4.0       685.0       88.0
8                                  5.0      1101.0      125.0
8                                  6.0      1640.0      168.0
8                                  7.0      2314.0      217.0
8                                  8.0      3133.0      272.0
9 ENDTBL
2 XSECTN    042         1.0           4.0
8                                  C.0         0.0        0.0
8                                  1.0        47.0       13.0
8                                  2.0       171.0       32.0
8                                  3.0       379.0       57.0
8                                  4.0       685.0       88.0
8                                  5.0      1101.0      125.0
8                                  6.0      1640.0      168.0
8                                  7.0      2314.0      217.0
8                                  8.0      3133.0      272.0
9 ENDTBL
6 RUNOFF 1 001        6           6.13        78.5        1.851 1    1 1
6 REACH  3 002    6   7          20C0.                        1      1
6 RUNOFF 1 002        5           0.07        80.3        0.271      1
```

```
***********************80-80 LIST CF INPUT DATA (CONTINUED)**********************
6  ADDHYD 4 002   7 5 6                                 1  1    1
6  SAVMOV 5 002   6   1                                 1       1
6  RUNOFF 1 021       5      0.14        80.6       0.231       1
6  RUNOFF 1 022       6      0.12        84.5       0.231       1
6  ADDHYD 4 022   5 6 7                                 1       1
6  RUNOFF 1 023       5      0.04        83.7       0.321       1
6  ADDHYD 4 023   7 5 6                                 1       1
6  RUNOFF 1 024       5     0.026        83.3       0.191       1
6  ADDHYD 4 024   5 6 7                                 1       1
6  SAVMOV 5 003   1   5                                 1       1
6  ADDHYD 4 003   7 5 6                                 1  1    1
6  REACH  3 004   6   5     12C0.                       1       1
6  RUNOFF 1 004       6      0.03        81.8       0.221       1
6  ADDHYD 4 004   5 6 7                                 1  1    1
6  SAVMOV 5 004   7   1                                 1       1
6  RUNOFF 1 025       5      0.10        84.5       0.241       1
6  RUNOFF 1 026       5      0.17        83.4       0.271       1
6  SAVMOV 5 026   5   2                                 1       1
6  RUNOFF 1 031       5      1.49        76.0        .691       1
6  RUNOFF 1 032       6      0.19        75.4       0.341       1
6  ADDHYD 4 032   5 6 7                                 1       1
6  RUNOFF 1 033       5     0.C27        81.9       0.181       1
6  ADDHYD 4 033   7 5 6                                 1       1
6  RUNOFF 1 034       5      0.17        75.8       0.261       1
6  RUNOFF 1 035       5      0.27        75.1       0.331       1
6  ADDHYD 4 036   6 5 7                                 1       1
6  REACH  3 037   7 2 5     22C0.                       1       1
6  RUNOFF 1 037       6      0.09        78.0       0.241       1
6  ADDHYD 4 037   5 6 7                                 1       1
6  SAVMOV 5 005   1   6                                 1       1
6  ADDHYD 4 005   7 6 5                                 1  1    1
6  SAVMOV 5 005   2   7                                 1       1
6  ADDHYD 4 005   5 7 6                                 1  1    1
6  RESVOR 2     05 6  7                                 1       1
6  REACH  3 006   7   5     30C0.                       1       1
6  RUNOFF 1 006       6      C.53        71.4       0.641       1
6  ADDHYD 4 006   5 6 7                                 1  1    1
6  RESVOR 2     06 7  5                                 1       1
6  REACH  3 007   5   6     32C0.                       1       1
6  RUNOFF 1 007       5      0.17        78.8       0.341       1
6  ADDHYD 4 007   6 5 7                                 1  1    1
6  SAVMOV 5 007   7   1                                 1       1
6  RUNOFF 1 041       5      0.26        84.5       0.261       1
6  REACH  3 042   5   6     38C0.                       1       1
6  RUNOFF 1 042       5      0.36        80.9       0.521       1
6  ADDHYD 4 042   6 5 7                                 1       1
```

```
***********************80-80 LIST CF INPUT DATA (CONTINUED)***********************

6 SAVMOV 5 008    1   6                                           1       1
6 ADDHYD 4 008    7 6 5                                           1  1    1
6 REACH  3 009    5   6        1800.                              1       1
6 RUNOFF 1 009        5        0.075         79.0        0.391            1
6 ADDHYD 4 009    6 5 7                                           1  1    1
6 SAVMOV 5 009    7   1                                           1       1
6 RUNOFF 1 051        6          .15         92.0        0.231            1
6 REACH  3 052    6   5        6200.          .50        1.391            1
6 RUNOFF 1 052        6         1.30         76.3        0.691            1
6 ADDHYD 4 052    5 6 7                                           1       1
6 SAVMOV 5 010    1   6                                           1       1
6 ADDHYD 4 010    7 6 5                                           1  1    1
6 RESVOR 2     10 5   6                                           1       1
6 REACH  3 012    6   5        2000.                              1       1
6 RUNOFF 1 012        6         0.31         84.2        0.581            1
6 ADDHYD 4 012    5 6 7                                           1  1    1
6 REACH  3 013    7   6        1200.                              1       1
6 RUNOFF 1 013        7         0.29         83.8        0.371            1
6 ADDHYD 4 013    6 7 5                                           1       1
6 RUNOFF 1 061        6         0.53         91.3        0.381            1
6 ADDHYD 4 014    5 6 7                                           1  1    1  1
  ENDATA
7 LIST
7 INCREM 6                     0.083
7 COMPUT 7 001     014           C.0          2.1         1.01 2    2    1
  ENDCMP 1
7 COMPUT 7 001     014           C.0          3.5         1.01 2    2    2
  ENDCMP 1
7 COMPUT 7 001     014           C.0          2.7         1.02 2    2    3
  ENDCMP 1
7 COMPUT 7 001     014           C.0          4.5         1.02 2    2    4
  ENDCMP 1
  ENDJOB 2
*********************************END OF 80-80 LIST*********************************
```

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS........... 1	2	3	4	
			5 YEAR 6HR	100YR-6HR	5 YR-24HR	100YR 24HR	DESIGN POINT
STRUCTURE 10	ALTERNATE 2	11.64	1044.37	3111.90	2383.81	7080.99	
STRUCTURE 6	ALTERNATE 2	9.32	860.20	2574.62	1466.83	4021.81	
STRUCTURE 5	ALTERNATE 2	8.79	835.46	2484.87	1444.60	3945.36	
XSECTION 1	ALTERNATE 2	6.13	637.92	1903.72	1250.16	3439.60	001
XSECTION 2	ALTERNATE 2	6.20	642.22	1915.53	1251.46	3446.07	002
XSECTION 3	ALTERNATE 2	6.53	670.07	1978.35	1268.14	3480.91	003
XSECTION 4	ALTERNATE 2	6.56	672.30	1983.98	1269.62	3484.01	004
XSECTION 5	ALTERNATE 2	8.79	835.46	2484.87	1444.60	3945.36	005
XSECTION 6	ALTERNATE 2	9.32	860.20	2574.62	1466.83	4021.81	006
XSECTION 7	ALTERNATE 2	9.49	871.04	2601.34	1470.67	4063.48	007
XSECTION 8	ALTERNATE 2	10.11	924.70	2739.60	1704.08	5096.24	008
XSECTION 9	ALTERNATE 2	10.19	930.11	2754.12	1727.43	5194.18	009
XSECTION 10	ALTERNATE 2	11.64	1044.37	3111.90	2383.81	7080.99	010 BARNES ROAD
XSECTION 12	ALTERNATE 2	11.95	1073.17	3190.89	2529.80	7657.89	012

012 ← @ POINT OF COMPARISON-WITHIN 10% → At D.P. H1A

SAND CREEK MASTER DRAINAGE PLANNING STUDY BY SIMONS, LI & ASSOCIATES. FLOW = 6870 At D.P. H1A

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 1	2	3	4	DP
XSECTION 13 ALTERNATE 2	12.24	1099.33	3255.81	2611.03	8084.18	013
XSECTION 14 ALTERNATE 2	12.77	1161.35	3484.56	2845.78	9234.81	014
XSECTION 21 ALTERNATE 2	0.14	45.47	127.13	182.11	460.08	021
XSECTION 22 ALTERNATE 2	0.26	98.71	256.91	381.94	916.56	022
XSECTION 23 ALTERNATE 2	0.30	113.41	294.79	429.48	1031.42	023
XSECTION 24 ALTERNATE 2	0.33	124.22	321.99	473.58	1133.71	024
XSECTION 25 ALTERNATE 2	0.10	43.93	107.34	162.18	371.83	025
XSECTION 26 ALTERNATE 2	0.17	66.02	168.82	237.47	565.89	026
XSECTION 31 ALTERNATE 2	1.49	184.75	678.83	576.75	1740.75	031
XSECTION 32 ALTERNATE 2	1.68	205.65	754.38	633.25	1917.88	032
XSECTION 33 ALTERNATE 2	1.71	209.48	764.94	637.57	1928.66	033
XSECTION 34 ALTERNATE 2	0.17	32.74	116.70	143.42	424.54	034
XSECTION 35 ALTERNATE 2	0.27	42.72	162.91	180.88	548.77	035
XSECTION 36 ALTERNATE 2	1.98	238.47	883.77	745.08	2271.61	036

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS........... 1	2	3	4	D.P.
XSECTION 37	ALTERNATE 2	2.07	246.37	912.32	748.56	2322.67	037
XSECTION 41	ALTERNATE 2	0.26	111.94	274.87	403.93	932.09	041
XSECTION 42	ALTERNATE 2	0.62	178.00	497.98	577.98	1455.19	042
XSECTION 51	ALTERNATE 2	0.15	107.62	211.75	377.47	724.02	051
XSECTION 52	ALTERNATE 2	1.45	222.03	726.35	656.41	1903.51	052
XSECTION 61	ALTERNATE 2	0.53	324.03	660.37	946.97	1870.88	061