

**MDDP for
North Range @ Springs Ranch
and Final Drainage Report for
North Range @ Springs Ranch Filing Nos. 1 & 2**

January, 2001

Prepared for:

**BRE/Springs Ranch LLC
2 N Cascade Avenue, Suite 1100
Colorado Springs, CO 80903**

Prepared by:

**Rockwell-Minchow Consultants, Inc.
1873 Austin Bluffs Parkway
Colorado Springs, CO 80918
475-2575**

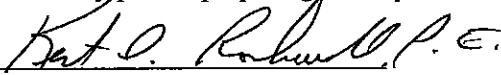
Project #99-044

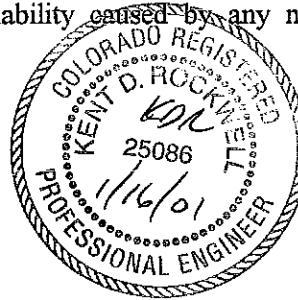
MDDP for
North Range @ Springs Ranch
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DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT


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/County 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 any negligent acts, errors or omissions on my part in preparing this report.


Kent D. Rockwell, P.E.




DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all the requirements specified in this drainage report and plan.

BRE/SPRINGS RANCH LLC
BY:  DATE 1/12/01
Donald S. Magill
TITLE: Vice President
ADDRESS: 2 N Cascade Ave., Suite 1100
Colorado Springs, CO 80903

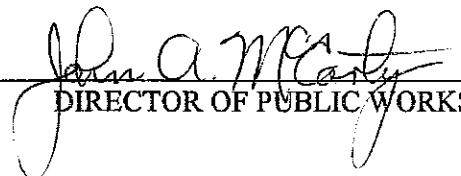
CITY OF COLORADO SPRINGS

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


CITY ENGINEER
DATE 1/23/01

EL PASO COUNTY

Filed in accordance with Section 51.1 of the El Paso County Land Development Code, as amended.


DIRECTOR OF PUBLIC WORKS
DATE 1-18-01

**MDDP for
North Range @ Springs Ranch
and Final Drainage Report for
North Range @ Springs Ranch Filing Nos. 1 & 2**

GENERAL LOCATION AND DESCRIPTION

The North Range at Springs Ranch is located east of Peterson Road and north of North Carefree Circle and consists of approximately 75 acres. The site lies within Section 29, Township 13 South, Range 65 West of the 6th P.M., El Paso County, Colorado (see Figure 1). The site is bound on the west by The Knolls at Springs Ranch, on the south by North Carefree Circle and on the north & east by undeveloped, unplatted land in the County.

The entire site lies within the Sand Creek Drainage Basin and will be developed as +1/8 acre single family residential lots. Existing ground cover consists of native grasses.

North Range at Springs Ranch Filing Nos. 1 & 2 are located at the south end of the development. Filing No. 1 contains 12.859 acres and Filing No. 2 contains 10.599 acres.

REFERENCES

1. The Springs Ranch MDDP Update (December, 1996), prepared by Kiowa Engineering, Colorado Springs, CO.
2. Final Drainage Report for North Carefree Circle, Pony Tracks Drive to East City Limit (June, 2000), prepared by Rockwell-Minchow Consultants, Inc., Colorado Springs, CO.
3. MDDP for The Knolls at Springs Ranch and Final Drainage Report for The Knolls at Springs Ranch Filing Nos. 1 & 2 (May, 1999), prepared by Rockwell-Minchow Consultants, Inc., Colorado Springs, CO.
4. The Sand Creek Drainage Basin Planning Study (March, 1996), prepared by Kiowa Engineering, Colorado Springs, CO.

SOILS

According to the US Department of Agriculture Soil Conservation Services Soil Survey of El Paso County, The Range at Springs Ranch is underlain by the Truckton Series (Soil 97) which is classified as a Hydrologic Group "B" soil (see Figure 2). Hydrologic Group "B" was used for runoff calculation purposes.

FLOOD PLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA), as depicted on Flood Insurance Rate Map (FIRM) 08041 CO539 F (March 1997), no portion of this site lies within a designated Flood Plain. See map in Appendix.

DRAINAGE DESIGN CRITERIA

The current City of Colorado Springs and El Paso County Drainage Criteria was used in the preparation of this report. The Rational Method was used to determine the runoff quantities as required for basins containing less than 100 acres. Peak runoff was determined for both the 5 year and 100 year frequency storms.

HISTORIC DRAINAGE ANALYSIS

This portion of the report analyzes the historic runoff quantities and patterns for the site. The area has been depicted on the Historic Drainage Plan by four basins. Following is a description of each basin and the proposed runoff patterns and drainage improvements.

Basin H-I consists of the off-site area (4.3 acres) on the north end of the site covering existing residential lots and roadways. Runoff rates of 9.8 cfs (5yr) and 20.2 cfs (100yr) currently flow onto Springs Ranch property to the south as sheetflow and runoff from the Barnes Road pioneer roadway.

Basin H-II covers the off-site area encompassing 33.4 acres to the east of the site that is currently pasture land. Runoff rates of 23.4 cfs (5yr) and 56.1 cfs (100yr) currently sheetflow onto Springs Ranch property to the west. Future runoff onto Springs Ranch Property will be limited to historic runoff rates from this off-site property to the east.

Basin H-III encompasses the majority of the site, containing 162.3 acres. Runoff rates of 73.0 cfs (5yr) and 181.8 cfs (100yr) currently sheetflow and shallow swale flow over existing pasture to the south where the runoff exits the site onto land in El Paso County. Runoff release rates from the Springs Ranch Development will be limited to historic runoff rates at the discharge point by way of a Detention Pond (Springs Ranch MDDP Update Detention Site – DP 46).

Basin H-IV covers 14.5 acres at the southwest end of the site that is currently pasture. Runoff rates of 9.8 cfs (5yr) and 23.3 cfs (100yr) currently sheetflow to the southwest to North Carefree Circle where existing drainage facilities collect the runoff. Future developed runoff will be collected by these facilities and a 30" RCP stubbed into the Basin for future drainage facilities.

DEVELOPED DRAINAGE ANALYSIS

This portion of the report analyzes the developed runoff quantities and patterns for the site. The area has been depicted on the Developed Drainage Plan by thirty basins. Following is a description of each basin and the proposed runoff patterns and drainage improvements.

Basin I consists of a multi-family site and single family lots north of the proposed North Range Development along Stetson Hills Filing No. 13, covering 16.3 acres. Runoff rates of 27.4 cfs (5yr) and

55.9 (100yr) cfs will travel as street flow to a minor sump proposed in the neighboring street where all the runoff will be collected by a pair of proposed 10' sump inlets and discharge to the west (to storm system proposed in Peterson Road) via a 30" RCP.

Basin II encompasses 7.4 acres in both Springs Ranch and Stetson Hills along Barnes Road at the north end of the site. This basin will generate runoff rates of 15.5 cfs (5yr) and 31.6 cfs (100yr). The runoff will travel into Springs Ranch as street flow.

Basin III covers 10.7 acres of single family lots at the north end of Springs Ranch. Runoff rates of 22.5 cfs (5yr) and 44.9 cfs (100yr) will be generated by the Basin. A 4' sump inlet is proposed on the west end of the basin to collect runoff travelling to a proposed low point. Two 10' on-grade inlets are proposed on the east end of the Basin to collect more of the runoff from this Basin and runoff from Basin II.

Design Point #1 (DP#1) is located at the outfall of Basin III and covers 18.1 acres. Total runoff rates of 34.7 cfs (5yr) and 70.9 cfs (100yr) will pass through this design point, exiting in a proposed 27" RCP.

Developed Basin IV is located south of Basin III encompassing 7.6 acres of single family lots. Runoff rates of 16.0 cfs (5yr) and 31.9 cfs (100yr) will be generated by the Basin. A 16' on-grade inlet is proposed at the south end of the Basin to collect runoff, keep the street within capacity, and to collect bypass flows from Basin III.

Basin V covers 6.3 acres of single family lots along the east Boundary of Springs Ranch at the north end of the site. Runoff rates of 12.8 cfs (5yr) and 25.6 cfs (100yr) will be generated by the Basin and travel as street flow to a proposed 10' on-grade inlet at the south end of the Basin.

Basin VI consists of single family lots north of the proposed North Range Development covering 7.5 acres. Runoff rates of 16.2 cfs (5yr) and 32.5 (100yr) cfs will travel as street flow to a proposed 10' on-grade inlet where much of the runoff will be collected and discharge to the east via a 18" RCP.

Developed Basin VII is located adjacent to Basin VI encompassing 9.1 acres of single family lots. Runoff rates of 16.9 cfs (5yr) and 34.4 cfs (100yr) will be generated by the Basin. A 20' on-grade inlet (DP #2) is proposed at the south end of the Basin to collect runoff, keep the street within capacity, and to collect bypass flows from Basin VI.

Design Point #2 (DP#2) is located at the outfall of Basin VII and covers 16.6 acres. Total runoff rates of 30.9 cfs (5yr) and 62.7 cfs (100yr) will pass through this design point, exiting in a proposed 24" RCP.

Basin VIII covers 4.6 acres of single family lots east of Basin VII at the north end of the site. Runoff rates of 9.7 cfs (5yr) and 19.3 cfs (100yr) will be generated by the Basin and travel as street flow to a proposed 16' on-grade inlet at the southeast end of the Basin, also collecting bypass flows from DP #2.

Design Point #3 (DP#3) is located at the outfall of Basin VIII and covers 53.2 acres. Total runoff rates of 92.6 cfs (5yr) and 186.2 cfs (100yr) will pass through this design point, exiting in a proposed 36" RCP.

Basin IX consists of single family lots covering 8.4 acres at the north end of the North Range Development. Runoff rates of 15.6 cfs (5yr) and 31.7 (100yr) cfs will travel as street flow to proposed 20' on-grade inlet at the south end of the basin where most of the runoff will be collected.

Basin X covers 2.1 acres of single family lots along the east Boundary of Springs Ranch at the north end of North Range. Runoff rates of 4.8 cfs (5yr) and 9.5 cfs (100yr) will be generated by the Basin and travel as street flow to a proposed 20' on-grade inlet at the south end of the Basin.

Developed Basin XI is located at the north end of North Range, encompassing 8.0 acres of single family lots. Runoff rates of 16.3 cfs (5yr) and 32.5 cfs (100yr) will be generated by the Basin. A 10' on-grade inlet is proposed at the east end of the Basin to collect the runoff.

Design Point #4 (DP#4) is located at the outfall of Basin XI and covers 63.7 acres. Total runoff rates of 107.0 cfs (5yr) and 218.5 cfs (100yr) will pass through this design point, exiting in a proposed 42" RCP.

Basin XII encompasses 7.8 acres of single family lots northwest of the site. Runoff rates of 16.4 cfs (5yr) and 32.7 (100yr) cfs will travel as street flow to the southeast and enter Basin XIII to a proposed 10' on-grade inlet where most of the runoff will be collected.

Basin XIII covers 5.4 acres of single family lots just north and east North Range. Runoff rates of 11.6 cfs (5yr) and 23.0 cfs (100yr) will be generated by the Basin and travel as street flow to the east. A portion of the runoff will travel into Basin XIV, and a portion will be collected by a proposed 10' on-grade inlet at the northeast end of the Basin.

Design Point #6 (DP#6) is located at the outfall of Basin XIII and covers 13.2 acres. Total runoff rates of 25.3 cfs (5yr) and 51.7 cfs (100yr) will pass through this design point, exiting in a proposed 30" RCP.

Developed Basin XIV is located northeast of North Range, encompassing 26.3 acres of proposed single family lots, park and school. Runoff rates of 47.3 cfs (5yr) and 95.7 cfs (100yr) will be generated by the Basin. Pipes of adequate size will be stubbed into the Basin to handle the runoff, as the layout within the Basin is not set at this time. A 30" RCP is proposed to front the East side of the Basin, and a 36" RCP will outfall into Basin XX to the south.

Design Point #7 (DP#7) is located at the outfall of Basin XIV and covers 39.5 acres. Total runoff rates of 71.1 cfs (5yr) and 143.8 cfs (100yr) will pass through this design point, exiting in a proposed 36" RCP.

Basin XV encompasses 2.7 acres of proposed single family lots in the northeast corner of the site. Runoff rates of 6.1 cfs (5yr) and 12.5 (100yr) cfs will travel as street flow to the south and a proposed 10' on-grade inlet where most of the runoff will be collected.

Developed Basin XVI is located at southwest of Basin XV, encompassing 7.4 acres of proposed single family lots. Runoff rates of 15.5 cfs (5yr) and 31.1 cfs (100yr) will be generated by the Basin. A 10' & 16' on-grade inlets are proposed at the south end of the Basin to collect most of the runoff and bypass flows from upstream.

Basin XVII covers 7.2 acres southwest of Basin XVI. Runoff rates of 14.3 cfs (5yr) and 28.7 cfs (100yr) will be generated by the Basin and travel as street flow to the south. The runoff from this Basin will be collected by three proposed 10' on-grade inlets at the southerly end of the Basin.

Basin XVIII covers 16.6 acres of off-site pasture at the east end of the site that will remain as pasture. No developed flows will be accepted from this area in the future, flows will be restricted to at or below historic. Runoff rates of 11.6 cfs (5yr) and 24.5 cfs (100yr) will be generated by the Basin and travel as overland flow into the North Range Development at Basin XIX. An 18" RCP will be stubbed to the east in Westland Drive to provide for collecting the historic runoff in the future.

Basin XIX encompasses 3.9 acres of single family lots along the east Boundary of North Range. Runoff rates of 8.4 cfs (5yr) and 16.6 cfs (100yr) will be generated by the Basin and travel as street flow to a proposed 16' on-grade inlet at the south end of the Basin. The runoff from Basin XVIII also passes through this Basin to the street.

Design Point #5 (DP#5) is located at the outfall of Basin XIX and covers 101.5 acres. Total runoff rates of 170.5 cfs (5yr) and 341.0 cfs (100yr) will pass through this design point, exiting in a proposed 60" RCP.

Developed Basin XX is located on the west side of North Range next to The Knolls at Springs Ranch encompassing 10.1 acres of proposed single family lots. Runoff rates of 21.2 cfs (5yr) and 41.7 cfs (100yr) will be generated by the Basin. A 10' sump inlet is proposed at the low point in the Basin to collect the developed runoff and bypass flows from upstream (DP#7).

Design Point #8 (DP#8) is located at the outfall of Basin XX and covers 45.2 acres. Total runoff rates of 78.6 cfs (5yr) and 161.4 cfs (100yr) will pass through this design point, exiting to the east in a proposed 42" RCP.

Basin XXI covers 4.0 acres in the center of North Range. Developed runoff rates of 8.6 cfs (5yr) and 17.1 cfs (100yr) will be generated by the Basin and travel as street flow to a proposed 10' on-grade inlet at the southeast end of the Basin.

Basin XXII lies just south of Basin XXI, and covers 4.0 acres in the center of North Range. Developed runoff rates of 9.6 cfs (5yr) and 19.3 cfs (100yr) will be generated by the Basin and travel as street flow to a proposed 16' on-grade inlet at the southeast end of the Basin.

Design Point #9 (DP#9) is located at the outfall of Basin XXII and covers 170.7 acres. Total runoff rates of 276.5 cfs (5yr) and 561.6 cfs (100yr) will pass through this design point, exiting in a proposed 72" RCP.

Basin XXIV covers 9.2 acres of proposed single-family lots south of Basin XXIII at the south end of the site. Developed runoff rates of 22.1 cfs (5yr) and 44.4 cfs (100yr) will be generated by the Basin and travel as street flow to the proposed 20' sump inlet in Basin XXIII.

Basin XXV covers 4.1 acres along the south and east side of the site at the proposed low point mentioned above. Developed runoff rates of 9.1 cfs (5yr) and 18.1 cfs (100yr) will be generated by the Basin and travel as street flow to a second proposed 20' sump inlet on the opposite side of the street at the low point.

Design Point #10 (DP#10) is located at the outfall of Basin XXV and covers the total 187.2 acres of area that will discharge to the Detention Pond (MDDP Pt. #46). Total runoff rates of 303.3 cfs (5yr) and 602.8 cfs (100yr) will pass through this design point, exiting to the Pond in a proposed 72" RCP. The Detention Pond release rates will be held to at or below Historic runoff rates. The pond is being designed by Kiowa Engineering using the TR-20 model that was used in the Springs Ranch MDDP Update to size the pond. Using the TR-20 model, runoff rates of 220 cfs (5yr) and 485 cfs (100yr) were obtained. Runoff rates into and out of the pond will differ from those in this report, as the Rational Method is more conservative and will show higher runoff rates than TR-20 model. Design by the TR-20 model will provide more than adequate storage, freeboard and sufficient hydraulic design to handle the developed flows. The Kiowa design provides for total release rates of 83 cfs (5yr) and 150 cfs (100yr) with storage volumes of 4.7 ac-ft & 11.7 ac-ft, respectively. Calculations by Kiowa Engineering are provided in the appendix.

Basin XXVI encompasses 16.0 acres of off-site pasture at the east end of the site that will remain as pasture. No developed flows will be accepted from this area in the future, flows will be restricted to at or below historic. Runoff rates of 11.2 cfs (5yr) and 27.4 cfs (100yr) will be generated by the Basin and travel as overland flow into the North Range Development at Basin XXV. An 18" RCP will be stubbed to the east in Campstool Drive to provide for collecting the historic runoff in the future.

Basin XXVII surrounds the Detention Pond (MDDP Pt. #46), covering 4.6 acres of on-site and some off-site area. Runoff rates of 4.8 cfs (5yr) and 11.0 cfs (100yr) will be generated by the Basin and travel as overland flow to the Detention Pond.

Developed Basin XXVIII covers 2.3 acres on the back of several proposed lots and a trail tract. Runoff rates of 6.1 cfs (5yr) and 12.2 cfs (100yr) will be generated by the Basin and travel as overland flow into the existing natural drainageway to the east.

Basin XXIX encompasses 3.3 acres of proposed single family lots at the south end of the site along North Carefree Circle. Runoff rates of 8.9 cfs (5yr) and 18.0 cfs (100yr) will be generated by the Basin and travel as street flow to an existing 6' sump inlet in North Carefree Circle. The runoff will be collected by the inlet and discharged to the east via an existing 18" RCP.

Basin XXX covers 6.5 acres in the southern portion of the site near North Carefree Circle. Developed runoff rates of 14.0 cfs (5yr) and 28.2 cfs (100yr) will be generated by the Basin and travel as street flow to a pair of proposed 4' sump inlets at the low point in the street. The runoff will discharge to the southwest via a proposed 24" RCP that will tie into an existing 30" RCP stubbed out the back of a 12' inlet at the northeast corner of North Carefree and Springs Ranch Drive.

Basin XXXI encompasses 7.5 acres of proposed single family lots at the southwest end of the site along North Carefree Circle and Springs Ranch Drive. Runoff rates of 14.8 cfs (5yr) and 30.4 cfs (100yr) will be generated by the Basin and travel as street flow to the existing 12' sump inlet mentioned above. The runoff will be collected by the inlet and discharged to the west via an existing 30" RCP.

Street capacities will not be exceeded within the proposed development under this drainage plan and report. All streets except Springs Ranch Drive and Pioneer Creek Drive (Springs Ranch Drive to Ranch Creek Drive) are classified as residential and will be 34' fl-fl with ramp type curb & gutter. Springs Ranch Drive and Pioneer Creek Drive as noted is classified as a collector and will be 36' fl-fl with vertical curb and gutter.

The Lot Owner/Home Builder/Home Owner will be responsible for individual lot drainage.

PROPOSED FACILITIES (Construction Cost Estimate):

Following is a cost estimate of the proposed drainage facilities required for this development. All proposed drainage facilities will be public and non-reimbursable.

Filing No. 1:

1. 4' D-10-R Inlet	2 Ea. @ \$2,850.00/Ea.	\$ 5,700.00
2. 18" RCP	100 L.F. @ \$26.00/L.F.	\$ 2,600.00
3. 24" RCP	330 L.F. @ \$32.00/L.F.	\$ 10,560.00
4. Type II MH	1 Ea. @ \$2,000.00/Ea.	<u>\$ 2,000.00</u>
	Sub-total:	\$ 20,860.00
	15% Engineering & Contingency:	<u>\$ 3,129.00</u>
	TOTAL:	\$ 23,989.00

Filing No. 2:

1. None

Detention Pond – MDDP Pt. #46 (Public – Non-reimbursable):

1. Earthwork	1 LS @ \$15,000/LS	\$ 15,000.00
2. Inlet/Dissipator	1 EA @ \$10,000/EA	\$ 10,000.00
3. Outlet/Dissipator	1 EA @ \$15,000/EA	\$ 15,000.00
4. Rip-Rap Low Flow	1 EA @ \$10,000/EA	<u>\$ 10,000.00</u>
	Sub-total:	\$ 50,000.00
	15% Engineering & Contingency:	<u>\$ 7,500.00</u>
	TOTAL:	\$ 57,500.00

Future Street Systems (Public Non-reimbursable):

1. 4' D-10-R Inlet	1Ea. @ \$2,850.00/Ea.	\$ 2,850.00
2. 10' D-10-R Inlet	19 Ea. @ \$3,750.00/Ea.	\$ 17,250.00
3. 16' D-10-R Inlet	6 Ea. @ \$5,600.00/Ea.	\$ 33,600.00
4. 20' D-10-R Inlet	5 Ea. @ \$6,100.00/Ea.	\$ 30,500.00
5. 18" RCP	900 L.F. @ \$26.00/L.F.	\$ 23,400.00
6. 24" RCP	1000 L.F. @ \$32.00/L.F.	\$ 32,000.00
7. 27" RCP	800 L.F. @ \$38.00/L.F.	\$ 30,400.00
8. 30" RCP	700 L.F. @ \$40.00/L.F.	\$ 28,000.00
9. 36" RCP	800 L.F. @ \$51.00/L.F.	\$ 40,800.00
10. 42" RCP	2000 L.F. @ \$61.00/L.F.	\$ 122,000.00
11. 60" RCP	850 L.F. @ \$127.00/L.F.	\$ 127,950.00
12. 72" RCP	500 L.F. @ \$164.00/L.F.	\$ 82,000.00
13. Type I MH	9 Ea. @ \$5,000.00/Ea.	\$ 45,000.00
14. Type II MH	3 Ea. @ \$2,000.00/Ea.	<u>\$ 6,000.00</u>
	Sub-total:	\$ 621,750.00
	15% Engineering & Contingency:	<u>\$ 93,262.50</u>
	TOTAL:	\$ 715,012.50

DRAINAGE FEES

North Range at Springs Ranch Development is located within the Sand Creek Drainage Basin. The total area of the development is approximately 75 acres. North Range at Springs Ranch Filing No. 1 contains 12.859 acres and Filing No. 2 contains 10.599 acres.

The remainder of the site will be platted with multiple plats as required for build-out. Drainage Reports will be completed for each additional filing at that time, with Fees calculated in individual reports. The 2001 Drainage, Bridge and Pond Fees are as follows:

Filing No. 1:

Drainage Fee:	\$ 6,714.00/ac.x12.859ac	=	\$ 86,335.33
Bridge Fee:	\$ 400.00/ac.x12.859ac	=	\$ 5,143.60
Pond Fee (Land):	\$ 427.00/ac.x12.859ac	=	\$ 5,490.79
Pond Fee (Facilities):	\$ 1,498.00/ac.x12.859ac	=	\$ 19,262.78
Pond Fee (Surcharge):	\$ 988.00/ac.x12.859ac	=	\$ 12,704.69
		Total: =	\$128,937.19

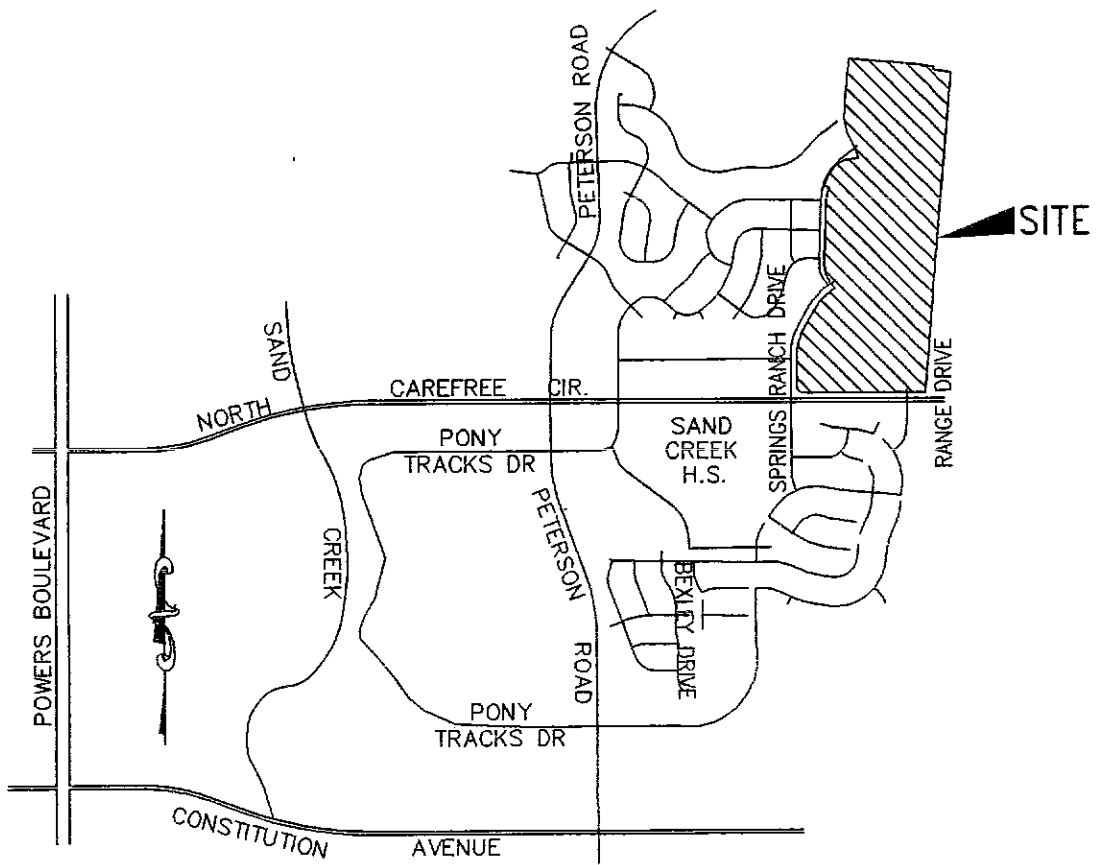
Filing No. 2:

Drainage Fee:	\$ 6,714.00/ac.x10.599ac	=	\$ 71,161.69
Bridge Fee:	\$ 400.00/ac.x10.599ac	=	\$ 4,239.60
Pond Fee (Land):	\$ 427.00/ac.x10.599ac	=	\$ 4,525.77
Pond Fee (Facilities):	\$ 1,498.00/ac.x10.599ac	=	\$ 15,877.30
Pond Fee (Surcharge):	\$ 988.00/ac.x10.599ac	=	\$ 10,471.81
		Total: =	\$106,276.17

Drainage Credits will be utilized to cover the cost of the Drainage Fees.

Bridge and Pond Fees will be paid at time of platting.

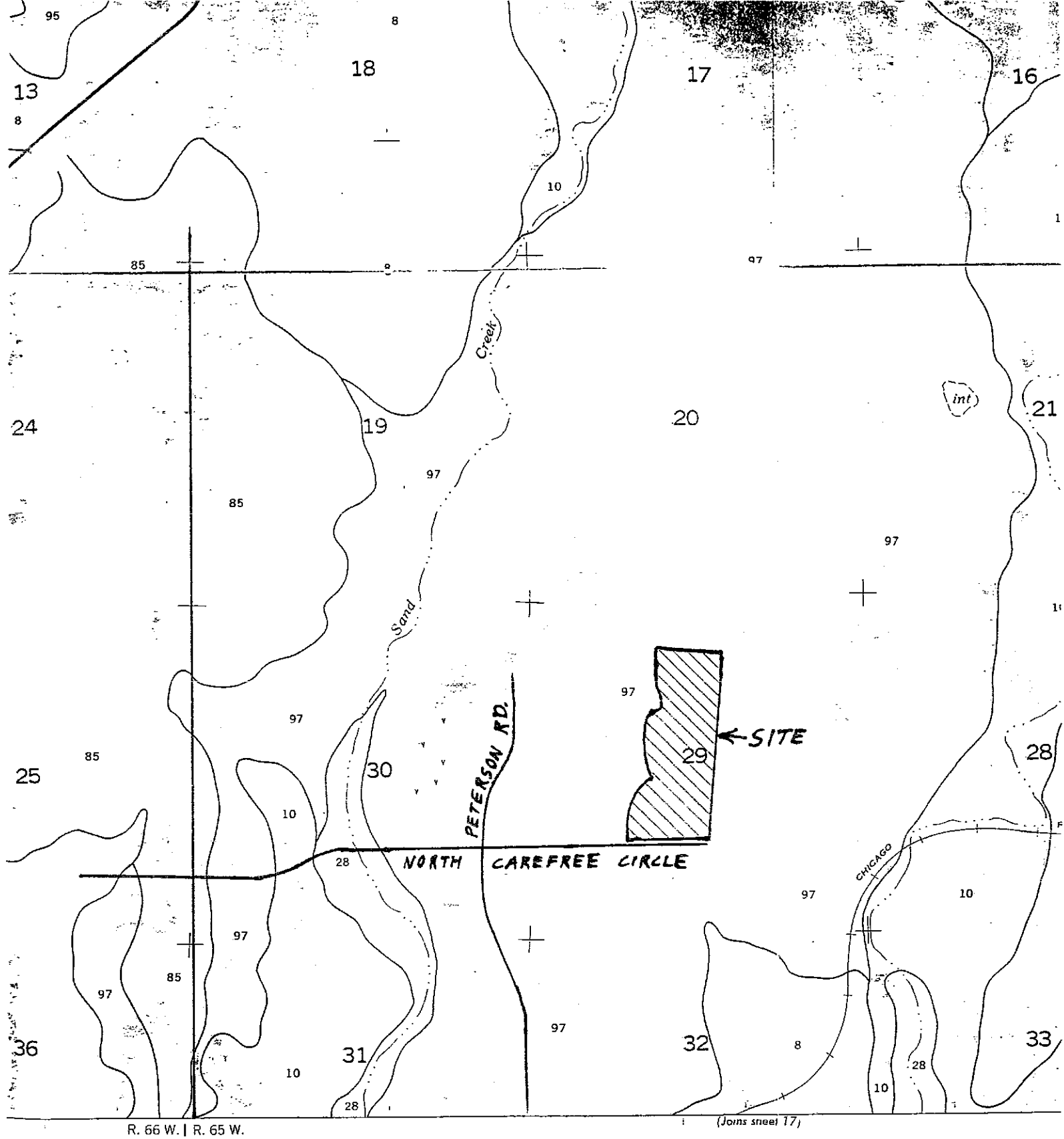
APPENDIX



VICINITY MAP

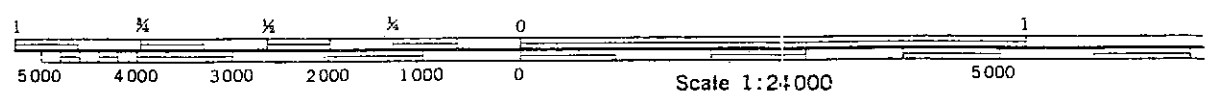
NOT TO SCALE

FIGURE 1



1" = 2000'

FIGURE 2



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WESTERRA DEVELOPMENT COMPANY • 2 NORTH CASCADE AVE., SUITE 1100 • COLORADO SPRINGS, CO 80903 • PHONE 719-636-0083 • FAX 719-630-0676

October 12, 2000

Mr. Brian Kelley
Senior Civil Engineer
City of Colorado Springs Engineering Unit
101 West Costilla St., Room 113
Colorado Springs, CO 80903

RE: North Range at Springs Ranch

Mr. Kelley,

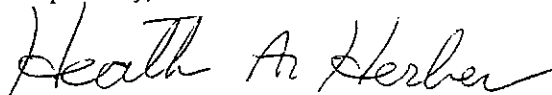
It is our understanding that Rockwell-Minchow Consultants, Inc. has prepared a Grading Plan and Drainage Plan & Report for the above referenced proposed development. We have reviewed the Grading Plan and have no objection to the off-site grading shown on property to the east held by Pronghorn Meadows LLC. We request that the grading comply with the Grading/Erosion Control Plan upon approval, and that the existing barbed wire/livestock fence on the common property line be replaced in kind upon completion of the grading.

Per the Drainage Plan and Report, we understand that runoff released from the proposed Detention Pond in the North Range will be limited to at or below historic release rates onto Pronghorn property to the east. It is also understood that runoff from Pronghorn property to the north draining onto the proposed North Range Development also be limited to at or below historic levels.

URS Greiner Woodward Clyde has been retained by Pronghorn Meadows LLC to perform engineering analysis and site design on our site to the east and will be working closely with Rockwell-Minchow Consultants, Inc. to ensure that all design issues are handled properly in keeping with City of Colorado Springs and El Paso County requirements for the benefit of Pronghorn Meadows LLC and BRE/Springs Ranch LLC.

If you have any questions or concerns regarding this development, please call me at 636-0083

Respectfully,



Heath A. Herber, Manager
Pronghorn Meadows LLC
c/o Westerra Development Co.

cc: BRE\Springs Ranch LLC
Rockwell-Minchow Consultants, Inc.
Nass Design Associates
URS Greiner Woodward Clyde
El Paso County DOT

cc: [unclear]
[unclear]



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

**EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS**

PANEL 539 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>
COLORADO SPRINGS, CITY OF	080060	0539	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0539	F

**MAP NUMBER
08041C0539 F**

**EFFECTIVE DATE:
MARCH 17, 1997**



Federal Emergency Management Agency

DRIVE
LASATER TRAIL
DRIVE

ZONE X

DRIVE

PETERSON RD.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN
TOWNSHIP 13 SOUTH, RANGE 65 WEST.

ZONE X

29 SITE

CITY OF COLORADO SPRINGS
080060

N. CAREFREE CIRCLE

CITY OF COLORADO SPRINGS
EL PASO COUNTY

**Detention Basin No. 46
North Range at Springs Ranch
Earthwork Calculation**

Elevation	Area	Avg. Area	Volume	Basin Depth	Cumulative Basin Volume	Elevation	
6566	0 sf						
		19,875 sf	39,750 cf	2.0 ft	39,750 cf	0.91 ac-ft	6568
6568	39,750 sf						
		60,905 sf	121,810 cf	4.0 ft	161,560 cf	3.71 ac-ft	6570
6570	82,060 sf						
		85,793 sf	171,585 cf	6.0 ft	333,145 cf	7.65 ac-ft	6572
6572	89,525 sf						
		93,376 sf	186,751 cf	8.0 ft	519,896 cf	11.94 ac-ft	6574
6574	97,226 sf						
		99,178 sf	99,178 cf	9.0 ft	619,074 cf	14.21 ac-ft	6575
6575	101,130 sf						
		50,565 sf	50,565 cf	10.0 ft	669,639 cf	15.37 ac-ft	6576
6576	105,155 sf						

**Detention Basin No. 46
North Range at Springs Ranch
Outlet Structure Sizing**

Broad Crested Weir Calculation

Weir Coefficient	2.6
Crest Elevation	6566.50
Crest Length	3.5
Top of Weir	6569.50

Water Elevation	Flow Depth	Weir Flow
6567.00	0.50 ft	3.2 cfs
6567.50	1.00 ft	9.1 cfs
6568.00	1.50 ft	16.7 cfs
6568.50	2.00 ft	25.7 cfs
6569.00	2.50 ft	36.0 cfs
6569.50	3.00 ft	47.3 cfs
6570.00	3.50 ft	59.6 cfs
6570.50	4.00 ft	72.8 cfs

Weir Equation:

$$Q = CLH^{1.5}$$

C = Weir coefficient (dimensionless)

L = Length of weir, in ft

H = Depth of flow over the crest, in ft

Orifice Calculation associated with Outlet Structure

Orifice Coefficient		0.6
Opening Size	Width	3.5 ft
	Length	3.5 ft
Opening Area		12.25 sf
Opening Area w/Blockage		8.58 sf
Opening Flowline Elevation		6569.50
Opening Centerline Elevation		6570.25
Opening Top Elevation		6571.00

Water Elevation	Head/Flow Depth	Orifice Flow	Weir Flow	Total Flow
6571.00	0.75 ft	35.8 cfs	72.8 cfs	108.6 cfs
6571.50	1.25 ft	46.2 cfs	72.8 cfs	119.0 cfs
6572.00	1.75 ft	54.6 cfs	72.8 cfs	127.4 cfs
6572.50	2.25 ft	61.9 cfs	72.8 cfs	134.7 cfs
6573.00	2.75 ft	68.5 cfs	72.8 cfs	141.3 cfs
6573.50	3.25 ft	74.4 cfs	72.8 cfs	147.2 cfs
6574.00	3.75 ft	80.0 cfs	72.8 cfs	152.8 cfs
6574.50	4.25 ft	85.1 cfs	72.8 cfs	157.9 cfs
6575.00	4.75 ft	90.0 cfs	72.8 cfs	162.8 cfs
6575.50	5.25 ft	94.6 cfs	72.8 cfs	167.4 cfs
6576.00	5.75 ft	99.0 cfs	72.8 cfs	171.8 cfs

Note: The Orifice Plate controls the flow rate out of the detention basin when the water surface elevation is above 6572. See Orifice Plate Sizing calculation.

Orifice Equation:

$$Q = CA(2gH)^{0.5}$$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

Use a 30% blockage for area

g = Gravitational acceleration constant, 32.2 ft/sec²

H = Head above the centerline of the pipe, in ft

Detention Basin No. 46
North Range at Springs Ranch
Orifice Plate Sizing

Orifice Plate is located on the 48-inch RCP outfalling from the Outlet Structure.

Orifice Coefficient 0.6
 Opening Size Width 3.1 ft
 Height 4.0 ft
 Opening Area 11.01 sf
 Opening Flowline Elevation 6564.20
 Opening Centerline Elevation 6566.20

Orifice Equation:

$$Q = CA(2gH)^{0.5}$$

C = Orifice coefficient (dimensionless)

0.6 for a square-edged entrance

1.0 for a well-rounded entrance

A = Cross-sectional area of opening, in sf

g = Gravitational acceleration constant, 32.2 ft/sec²

H = Head above the centerline of the pipe, in ft

Water Elevation	Head / Flow Depth	Orifice Flow
6568.00	1.80 ft	71.1 cfs
6568.50	2.30 ft	80.4 cfs
6569.00	2.80 ft	88.7 cfs
6569.50	3.30 ft	96.3 cfs
6570.00	3.80 ft	103.3 cfs
6570.50	4.30 ft	109.9 cfs
6571.00	4.80 ft	116.1 cfs
6571.50	5.30 ft	122.0 cfs
6572.00	5.80 ft	127.7 cfs
6572.50	6.30 ft	133.1 cfs
6573.00	6.80 ft	138.2 cfs
6573.50	7.30 ft	143.2 cfs
6574.00	7.80 ft	148.1 cfs
6574.10	7.90 ft	149.0 cfs
6574.20	8.00 ft	149.9 cfs
6574.50	8.30 ft	152.7 cfs
6575.00	8.80 ft	157.3 cfs

7 COMPUT 7 50 99 0.0 4.4 1.01 2 01 01 100-YR
ENDCMP 1
7 COMPUT 7 50 99 0.0 3.0 1.01 2 01 02 10-YR

1

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

ENDCMP 1
ENDJOB 2

0*****END OF 80-80 LIST*****

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION JOB 1 PASS 1
REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2) PAGE 1

FILE NO. 1

0

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:

CHESTER, PA (NORTHEAST) -- 215-499-3933, FORT WORTH, TX (SOUTH) -- 334-5242 (FTS)

7 COMPUT 7 50 99 0.0 4.4 1.01 2 01 01 100-YR
ENDCMP 1
7 COMPUT 7 50 99 0.0 3.0 1.01 2 01 02 10-YR

1

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

ENDCMP 1
ENDJOB 2

0*****END OF 80-80 LIST*****

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION JOB 1 PASS 1
REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2) PAGE 1

FILE NO. 1

0

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CHESTER, PA (NORTHEAST) -- 215-499-3933, FORT WORTH, TX (SOUTH) -- 334-5242 (FTS)

LINCOLN, NB (MIDWEST) -- 541-5318 (FTS), PORTLAND, OR (WEST) -- 423-4099 (FTS)
 OR HYDROLOGY UNIT, ENGINEERING DIVISION, LANHAM, MD -- 436-7383 (FTS).

PROGRAM CHANGES SINCE MAY 1982:

- 12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD
 CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION
- 5/02/83 - CORRECT COMPUTATIONS FOR ---
 - 1. DIVISION OF BASEFLOW IN DIVERT OPERATION
 - 2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
 - 3. CROSS SECTION DATA PLOTTING POSITION
 - 4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
 - 5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTYPEAK HYDROGRAPH
 - 6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
 - 7. BASEFLOW ENTERED WITH READHYD
 - 8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS
- ENHANCEMENTS ---
 - 1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
 - 2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S
- 09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS
 CORRECT COMBINATION OF RATING TABLES FOR DIVERT
 CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS
 ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

1

TR20 XEQ 11/ 8/ 0	11:47	SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION	JOB 1	PASS 1
REV PC/09/83		24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)		PAGE 2

EXECUTIVE CONTROL OPERATION LIST

RECORD ID

LISTING OF CURRENT DATA

	STRUCT NO.	ELEVATION	DISCHARGE	STORAGE
3	STRUCT 99			
8		6566.00	.00	.00
8		6568.00	16.70	.90
8		6570.00	59.60	3.70
8		6572.00	127.70	7.70
8		6574.00	148.10	11.90

8	6575.00	157.30	14.20
8	6576.00	496.00	15.40

9 ENDTBL

TIME INCREMENT

4 DIMHYD	.0200				
8	.0000	.0300	.1000	.1900	.3100
8	.4700	.6600	.8200	.9300	.9900
8	1.0000	.9900	.9300	.8600	.7800
8	.6800	.5600	.4600	.3900	.3300
8	.2800	.2410	.2070	.1740	.1470
8	.1260	.1070	.0910	.0770	.0660
8	.0550	.0470	.0400	.0340	.0290
8	.0250	.0210	.0180	.0150	.0130
8	.0110	.0090	.0080	.0070	.0060
8	.0050	.0040	.0030	.0020	.0010
8	.0000	.0000	.0000	.0000	.0000

9 ENDTBL

COMPUTED PEAK RATE FACTOR = 484.00

TABLE NO.

TIME INCREMENT

5 RAINFL 1	.5000				
8	.0000	.0015	.0050	.0080	.0120
8	.0170	.0210	.0260	.0320	.0460
8	.0600	.1000	.7000	.7500	.7800
8	.8000	.8200	.8300	.8400	.8500

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
 REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 PASS 1
 PAGE 3

8	.8600	.8700	.8750	.8830	.8900
8	.8980	.9050	.9120	.9180	.9240
8	.9300	.9350	.9400	.9450	.9500
8	.9550	.9600	.9650	.9700	.9750
8	.9800	.9830	.9850	.9880	.9900
8	.9930	.9950	.9980	1.0000	1.0000

9 ENDTBL

TABLE NO.

TIME INCREMENT

5 RAINFL 2	.2500
------------	-------

8	.0000	.0020	.0050	.0080	.0110
8	.0140	.0170	.0200	.0230	.0260
8	.0290	.0320	.0350	.0380	.0410
8	.0440	.0480	.0520	.0560	.0600
8	.0640	.0680	.0720	.0760	.0800
8	.0850	.0900	.0950	.1000	.1050
8	.1100	.1150	.1200	.1260	.1330
8	.1400	.1470	.1550	.1630	.1720
8	.1810	.1910	.2030	.2180	.2360
8	.2570	.2830	.3870	.6630	.7070
8	.7350	.7580	.7760	.7910	.8040
8	.8150	.8250	.8340	.8420	.8490
8	.8560	.8630	.8690	.8750	.8810
8	.8870	.8930	.8980	.9030	.9080
8	.9130	.9180	.9220	.9260	.9300
8	.9340	.9380	.9420	.9460	.9500
8	.9530	.9560	.9590	.9620	.9650
8	.9680	.9710	.9740	.9770	.9800
8	.9830	.9860	.9890	.9920	.9950
8	.9980	1.0000	1.0000	1.0000	1.0000

9 ENDTBL

TABLE NO. TIME INCREMENT
5 RAINFL 3 .5000

8	.0000	.0100	.0220	.0360	.0510
8	.0670	.0830	.0990	.1160	.1350
8	.1560	.1790	.2040	.2330	.2680
8	.3100	.4250	.4800	.5200	.5500
8	.5770	.6010	.6230	.6440	.6640
8	.6830	.7010	.7190	.7360	.7530
8	.7690	.7850	.8000	.8150	.8300
8	.8440	.8580	.8710	.8840	.8960
8	.9080	.9200	.9320	.9440	.9560
8	.9670	.9780	.9890	1.0000	1.0000

9 ENDTBL

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 PASS 1
PAGE 4

TABLE NO. TIME INCREMENT
5 RAINFL 4 .5000

8	.0000	.0040	.0080	.0120	.0160
---	-------	-------	-------	-------	-------

8	.0200	.0250	.0300	.0350	.0400
8	.0450	.0500	.0550	.0600	.0650
8	.0700	.0750	.0810	.0870	.0930
8	.0990	.1050	.1110	.1180	.1250
8	.1320	.1400	.1480	.1560	.1650
8	.1740	.1840	.1950	.2070	.2200
8	.2360	.2550	.2770	.3030	.4090
8	.5150	.5490	.5830	.6050	.6240
8	.6400	.6550	.6690	.6820	.6940
8	.7050	.7160	.7270	.7380	.7480
8	.7580	.7670	.7760	.7840	.7920
8	.8000	.8080	.8160	.8230	.8300
8	.8370	.8440	.8510	.8580	.8640
8	.8700	.8760	.8820	.8880	.8940
8	.9000	.9060	.9110	.9160	.9210
8	.9260	.9310	.9360	.9410	.9460
8	.9510	.9560	.9610	.9660	.9710
8	.9760	.9800	.9840	.9880	.9920
8	.9960	1.0000	1.0000	1.0000	1.0000
9	ENDTBL				

TABLE NO. TIME INCREMENT
5 RAINFL 5 .5000

8	.0000	.0020	.0050	.0080	.0110
8	.0140	.0170	.0200	.0230	.0260
8	.0290	.0320	.0350	.0380	.0410
8	.0440	.0470	.0510	.0550	.0590
8	.0630	.0670	.0710	.0750	.0790
8	.0840	.0890	.0940	.0990	.1040
8	.1090	.1140	.1200	.1260	.1330
8	.1400	.1470	.1540	.1620	.1710
8	.1810	.1920	.2040	.2170	.2330
8	.2520	.2770	.3180	.6380	.6980
8	.7290	.7520	.7700	.7850	.7980
8	.8090	.8190	.8290	.8380	.8460
8	.8540	.8610	.8680	.8740	.8800
8	.8860	.8920	.8970	.9020	.9070
8	.9120	.9170	.9210	.9250	.9290
8	.9330	.9370	.9410	.9450	.9490
8	.9530	.9570	.9600	.9630	.9660
8	.9690	.9720	.9750	.9780	.9810

1

TR20 XEQ 11/ 8/ 0 11:47
REV PC/09/83

SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 PASS 1
PAGE 5

8	.9840	.9870	.9900	.9930	.9960
8	.9980	1.0000	1.0000	1.0000	1.0000

9 ENDTBL

TABLE NO.	TIME INCREMENT				
5 RAINFL 6	.0200				

8	.0000	.0080	.0162	.0246	.0333
8	.0425	.0524	.0630	.0743	.0863
8	.0990	.1124	.1265	.1420	.1595
8	.1800	.2050	.2550	.3450	.4370
8	.5300	.6030	.6330	.6600	.6840
8	.7050	.7240	.7420	.7590	.7750
8	.7900	.8043	.8180	.8312	.8439
8	.8561	.8678	.8790	.8898	.9002
8	.9103	.9201	.9297	.9391	.9483
8	.9573	.9661	.9747	.9832	.9916
8	1.0000	1.0000	1.0000	1.0000	1.0000

9 ENDTBL

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
 REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 PASS 1
 PAGE 6

0 STANDARD CONTROL INSTRUCTIONS

6 RUNOFF 1 50 1	.0830	78.0000	.32000	0 0 0 0 1
6 REACH 3 150 1 2	1370.0000	1.3000	1.52000	0 0 0 0 1
6 RUNOFF 1 49 1	.0540	78.0000	.21000	0 0 0 0 1
6 ADDHYD 4 49 2 1 3			0 0 0 0 0 1	
6 REACH 3 149 3 1	830.0000	1.3000	1.52000	0 0 0 0 1
6 RUNOFF 1 47 2	.0250	78.0000	.25000	0 0 0 0 1
6 ADDHYD 4 47 1 2 3			0 0 0 0 0 1	
6 RUNOFF 1 48 1	.0680	72.0000	.32000	0 0 0 0 1
6 REACH 3 148 1 2	1205.0000	1.3000	1.52000	0 0 0 0 1
6 ADDHYD 4 47 3 2 1			0 0 0 0 0 1	
6 REACH 3 147 1 2	525.0000	1.3000	1.52000	0 0 0 0 1
6 RUNOFF 1 46 1	.0340	75.0000	.25000	0 0 0 0 1
6 ADDHYD 4 46 2 1 3			0 0 0 0 0 1	
6 RUNOFF 1 52 1	.0520	69.0000	.32000	0 0 0 0 1
6 ADDHYD 4 46 3 1 2			1 1 0 1 0 1	
6 RESVOR 2 99 2 1	.0000		0 0 0 0 0 1	

ENDATA

END OF LISTING

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 PASS 1
PAGE 7

EXECUTIVE CONTROL OPERATION INCREM

RECORD ID MIN

+ MAIN TIME INCREMENT = .03 HOURS

EXECUTIVE CONTROL OPERATION COMPUT

RECORD ID 100-YR

+ FROM XSECTION 50 TO STRUCTURE 99

STARTING TIME = .00 RAIN DEPTH = 4.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .03 HOURS

*** WARNING REACH 149 ANT-KIN COEFF. (C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

*** WARNING REACH 147 ANT-KIN COEFF. (C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION ADDHYD STRUCTURE 46

PEAK TIME(HRS) PEAK DISCHARGE(CFS) PEAK ELEVATION(FEET)
6.09 486.73 (NULL)
7.98 25.48 (NULL)

TIME(HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =	.03 HOURS	DRAINAGE AREA =	.32 SQ.MI.
5.28	DISCHG	.00	.00	.00	.00	.06
5.61	DISCHG	2.50	8.14	19.70	38.63	65.35
5.94	DISCHG	326.52	373.54	418.02	456.09	481.31
6.27	DISCHG	285.18	241.97	204.07	172.24	146.67
6.60	DISCHG	77.12	71.24	65.75	60.73	56.26
6.93	DISCHG	41.33	40.30	39.52	38.89	38.28
7.26	DISCHG	30.96	29.82	28.84	28.02	27.37
7.59	DISCHG	25.69	25.61	25.54	25.50	25.47
7.92	DISCHG	25.46	25.47	25.48	25.46	25.33
8.25	DISCHG	19.07	17.87	16.84	15.96	15.26
8.58	DISCHG	13.36	13.25	13.16	13.10	13.05
8.91	DISCHG	12.93	12.93	12.93	12.93	12.93
9.24	DISCHG	12.95	12.96	12.96	12.96	12.97
9.57	DISCHG	12.99	13.00	13.00	13.01	13.01

RUNOFF VOLUME ABOVE BASEFLOW = 1.48 WATERSHED INCHES, 302.33 CFS-HRS, 24.98 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP

RECORD ID

+ COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL OPERATION COMPUT

RECORD ID 10-YR

+ FROM XSECTION 50 TO STRUCTURE 99

STARTING TIME = .00 RAIN DEPTH = 3.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 ANT. MOIST. COND= 2
ALTERNATE NO.= 1 STORM NO.= 2 MAIN TIME INCREMENT = .03 HOURS

*** WARNING REACH 149 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 PASS 2
PAGE 8

*** WARNING REACH 147 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION ADDHYD STRUCTURE 46

PEAK TIME(HRS) PEAK DISCHARGE(CFS) PEAK ELEVATION(FEET)
6.11 221.00 (NULL)
7.99 13.94 (NULL)

TIME(HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =	.03 HOURS	DRAINAGE AREA =	.32 SQ.MI.
5.28	DISCHG	.00 .00 .00 .00 .00 .00 .00 .00 .00 .00 .00 .01				
5.61	DISCHG	.08 .51 1.94 5.41 11.86 21.90 35.66 52.84 72.97 95.48				
5.94	DISCHG	119.81 145.30 171.07 194.76 212.82 220.80 217.11 204.14 185.45 164.29				
6.27	DISCHG	143.50 124.04 106.39 91.05 78.29 68.04 59.99 53.74 48.86 44.91				
6.60	DISCHG	41.50 38.37 35.47 32.84 30.50 28.49 26.79 25.37 24.20 23.25				
6.93	DISCHG	22.51 21.93 21.48 21.12 20.78 20.35 19.78 19.09 18.35 17.61				
7.26	DISCHG	16.93 16.33 15.80 15.35 14.99 14.70 14.48 14.31 14.18 14.09				
7.59	DISCHG	14.02 13.97 13.93 13.91 13.90 13.89 13.89 13.89 13.90 13.91				
7.92	DISCHG	13.91 13.93 13.94 13.93 13.87 13.67 13.29 12.72 12.03 11.31				
8.25	DISCHG	10.61 9.97 9.41 8.92 8.52 8.20 7.94 7.75 7.59 7.48				
8.58	DISCHG	7.39 7.32 7.26 7.22 7.19 7.17 7.16 7.15 7.14 7.13				
8.91	DISCHG	7.13 7.13 7.13 7.13 7.13 7.13 7.13 7.14 7.14 7.15				
9.24	DISCHG	7.15 7.15 7.16 7.16 7.16 7.17 7.17 7.18 7.18 7.18				

9.57 DISCHG 7.19 7.19 7.20 7.20 7.20 7.21 7.21 7.21 7.22 7.22

RUNOFF VOLUME ABOVE BASEFLOW = .69 WATERSHED INCHES, 140.44 CFS-HRS, 11.61 ACRE-FEET; BASEFLOW = .00 CFS

EXECUTIVE CONTROL OPERATION ENDCMP

RECORD ID

COMPUTATIONS COMPLETED FOR PASS 2

EXECUTIVE CONTROL OPERATION ENDJOB

RECORD ID

TR20 XEQ 11/ 8/ 0 11:17 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION
 REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2)

JOB 1 SUMMARY
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SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
 (A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
 A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE	1	STORM	1											
XSECTION	50	RUNOFF	.08	1	2	.03	.0	4.40	24.00	1.69	---	6.08	146.52	1765.3
XSECTION	150	REACH	.08	1	2	.03	.0	4.40	24.00	1.68	---	6.13	143.84	1733.0
XSECTION	49	RUNOFF	.05	1	2	.03	.0	4.40	24.00	1.69	---	6.03	109.51	2028.0
STRUCTURE	49	ADDHYD	.14	1	2	.03	.0	4.40	24.00	1.69	---	6.07	239.59	1748.9
XSECTION	149	REACH	.14	1	2	.03	.0	4.40	24.00	1.69	---	6.10	239.02	1744.7
XSECTION	47	RUNOFF	.03	1	2	.03	.0	4.40	24.00	1.69	---	6.05	48.45	1937.9
STRUCTURE	47	ADDHYD	.16	1	2	.03	.0	4.40	24.00	1.69	---	6.09	284.14	1753.9
XSECTION	48	RUNOFF	.07	1	2	.03	.0	4.40	24.00	1.29	---	6.09	92.48	1360.0
XSECTION	148	REACH	.07	1	2	.03	.0	4.40	24.00	1.28	---	6.14	90.31	1328.1
STRUCTURE	47	ADDHYD	.23	1	2	.03	.0	4.40	24.00	1.57	---	6.10	370.86	1612.5
XSECTION	147	REACH	.23	1	2	.03	.0	4.40	24.00	1.57	---	6.10	370.86	1612.5
XSECTION	46	RUNOFF	.03	1	2	.03	.0	4.40	24.00	1.48	---	6.05	58.58	1722.9
STRUCTURE	46	ADDHYD	.26	1	2	.03	.0	4.40	24.00	1.56	---	6.09	425.83	1613.0
XSECTION	52	RUNOFF	.05	1	2	.03	.0	4.40	24.00	1.11	---	6.10	60.90	1171.1

STRUCTURE 46	ADDHYD	.32	1	2	.03	.0	4.40	24.00	1.48	---	6.09	486.73	1540.3
STRUCTURE 99	RESVOR	.32	1	2	.03	.0	4.40	24.00	1.43	6573.99	6.40	147.97	468.3
ALTERNATE 1 STORM 2													
+													
XSECTION 50	RUNOFF	.08	1	2	.03	.0	3.00	24.00	.82	---	6.09	72.40	872.3
XSECTION 150	REACH	.08	1	2	.03	.0	3.00	24.00	.82	---	6.15	69.70	839.7
XSECTION 49	RUNOFF	.05	1	2	.03	.0	3.00	24.00	.83	---	6.04	55.67	1030.9
STRUCTURE 49	ADDHYD	.14	1	2	.03	.0	3.00	24.00	.82	---	6.08	115.40	842.3
XSECTION 149	REACH	.14	1	2	.03	.0	3.00	24.00	.82	---	6.12	114.30	834.3
XSECTION 47	RUNOFF	.03	1	2	.03	.0	3.00	24.00	.83	---	6.06	24.44	977.6
STRUCTURE 47	ADDHYD	.16	1	2	.03	.0	3.00	24.00	.82	---	6.11	136.34	841.6
XSECTION 48	RUNOFF	.07	1	2	.03	.0	3.00	24.00	.56	---	6.11	39.90	586.8
XSECTION 148	REACH	.07	1	2	.03	.0	3.00	24.00	.56	---	6.17	37.88	557.1
STRUCTURE 47	ADDHYD	.23	1	2	.03	.0	3.00	24.00	.74	---	6.12	171.63	746.2
XSECTION 147	REACH	.23	1	2	.03	.0	3.00	24.00	.74	---	6.12	171.63	746.2
XSECTION 46	RUNOFF	.03	1	2	.03	.0	3.00	24.00	.69	---	6.06	27.83	818.5
STRUCTURE 46	ADDHYD	.26	1	2	.03	.0	3.00	24.00	.74	---	6.11	196.92	745.9
XSECTION 52	RUNOFF	.05	1	2	.03	.0	3.00	24.00	.45	---	6.11	24.08	463.2
STRUCTURE 46	ADDHYD	.32	1	2	.03	.0	3.00	24.00	.69	---	6.11	221.00	699.4

1

TR20 XEQ 11/ 8/ 0 11:47 SPRINGS RANCH EAST FORK BASINS -FUTURE CONDITION W/DETENTION JOB 1 SUMMARY
 REV PC/09/83 24 HR TYPE IIA STORM (100- AND 10-YR, AMC=2) PAGE 10

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
 (A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
 A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE			
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)
ALTERNATE 1 STORM 2													
+													
STRUCTURE 99	RESVOR	.32	1	2	.03	.0	3.00	24.00	.66	6570.63	6.40	80.92	256.1

1

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS
 (A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK
 A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

HYDROGRAPH INFORMATION										ROUTING PARAMETERS					PEAK				
		OUTFLOW+				VOLUME		MAIN	ITER-	Q AND A	PEAK	S/Q	ATT-	TRAVEL TIME					
XSEC	REACH	INFLOW		OUTFLOW		INTERV.	AREA	BASE-	ABOVE	TIME	ATION	EQUATION	LENGTH	RATIO	@PEAK	KIN	STOR-	KINE-	
ID	LENGTH (FT)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	FLOW (CFS)	BASE (IN)	INCR (HR)	#	COEFF (X)	POWER (M)	FACTOR (K*)	O/I (Q*)	(K) (SEC)	COEFF (C)	AGE (HR)	MATIC (HR)
ALTERNATE		1	STORM	1															
+150	1370	146	6.1	144	6.1	---	---	0	1.69	.03	1	1.30	1.52	.028	.982	138	.60	.07	.04
+149	830	240	6.1	239	6.1	---	---	0	1.69	.03	1	1.30	1.52	.010	.998	71	.91?	.03	.02
+148	1205	92	6.1	90	6.1	---	---	0	1.29	.03	1	1.30	1.52	.029	.980	142	.59	.03	.04
+147	525	371	6.1	371	6.1	---	---	0	1.57	.03	0	1.30	1.52	.004	1.000	38	1.00?	.00	.00
ALTERNATE		1	STORM	2															
+150	1370	72	6.1	69	6.1	---	---	0	.82	.03	1	1.30	1.52	.040	.962	175	.51	.03	.05
+149	830	115	6.1	111	6.1	---	---	0	.82	.03	1	1.30	1.52	.014	.988	91	.79?	.07	.03
+148	1205	40	6.1	38	6.2	---	---	0	.56	.03	1	1.30	1.52	.045	.950	189	.48	.07	.05
+147	525	171	6.1	171	6.1	---	---	0	.74	.03	0	1.30	1.52	.006	1.000	50	1.00?	.00	.00

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
0 STRUCTURE 99	.32		
+			
ALTERNATE 1		147.97	80.92
0 STRUCTURE 49	.14		
+			
ALTERNATE 1		239.59	115.40
0 STRUCTURE 47	.23		
+			
ALTERNATE 1		370.86	171.63
0 STRUCTURE 46	.32		
+			
ALTERNATE 1		486.73	221.00
0 XSECTION 46	.03		
+			
ALTERNATE 1		58.58	27.83
0 XSECTION 47	.03		
+			
ALTERNATE 1		48.45	24.44
0 XSECTION 48	.07		
+			
ALTERNATE 1		92.48	39.90
0 XSECTION 49	.05		
+			
ALTERNATE 1		109.51	55.67
0 XSECTION 50	.08		
+			
ALTERNATE 1		146.52	72.40
0 XSECTION 52	.05		
+			
ALTERNATE 1		60.90	24.08
0 XSECTION 147	.23		
+			
ALTERNATE 1		370.86	171.63
0 XSECTION 148	.07		
+			

ALTERNATE	1	90.31	37.88
0 XSECTION 149	.14		
+			
ALTERNATE	1	239.02	114.30
0 XSECTION 150	.08		
+			
ALTERNATE	1	143.84	69.70
1END OF 1 JOBS IN THIS RUN			

MAJOR BASIN	JB BASIN	AREA		BASIN		To Min.	I	SOIL GROUP	DEV. TYPE	C	BASIN		RETURN PERIOD
		PLANIMETER READING	Ac.	LENGTH	HEIGHT						Q	Q _p	
I			16.3	Over land 200' Street 1600'	4' ⇒ 8.4 2 fps ⇒ 13.3	21.7	2.8 4.9	"B" "B"		0.60 0.70	27.4 55.9		
II			7.4	Over land 100' Street 1100'	2' ⇒ 7.6 3 fps ⇒ 6.1	13.7	3.5 6.1			0.60 0.70	15.5 31.6		
III			10.7	Over land 200' Street 900'	3' ⇒ 9.2 3 fps ⇒ 5.0	14.2	3.5 6.0			0.60 0.70	22.5 44.9		
IV			7.6	Over land 200' Street 1000'	1' ⇒ 8.4 3 fps ⇒ 5.6	14.0	3.5 6.0			0.60 0.70	16.0 31.9		
V			6.3	Over land 100' Street 1600'	2' ⇒ 8.5 4 fps ⇒ 6.7	15.2	3.4 5.8			0.60 0.70	12.8 25.6		
VI			7.5	Over land 100' Street 1000'	2' ⇒ 7.4 3 fps ⇒ 5.6	13.0	3.6 6.2			0.60 0.70	16.2 32.5		
VII			9.1	Over land 200' Street 1600'	3' ⇒ 9.2 3 fps ⇒ 8.9	18.1	3.1 5.4			0.60 0.70	16.9 34.4		
VIII			4.6	Over land 200' Street 1000'	4' ⇒ 8.4 3 fps ⇒ 5.6	14.0	3.5 6.0			0.60 0.70	9.7 19.3		

HYDROLOGIC COMPUTATION BASIC DATA
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MAJOR BASIN	B. SIN	AREA		BASIN		Tc Min.	I	SOIL GROUP	DEV. TYPE	C	BASIN		RETURN PERIOD
		PLATHMETER READING	Ac.	LENGTH	HEIGHT						a	ap	
IX			8.4	Overland 150' Street 1500'	2% ⇒ 7.4 3% ⇒ 10.8	18.2	3.1 5.4	"B" "B"		0.60 0.70	15.6 31.7		
X			2.1	Overland 150' Street 700'	2% ⇒ 9.1 3% ⇒ 2.8	11.9	3.8 6.5			0.60 0.70	4.8 9.5		
XI			8.0	Overland 150' Street 1400'	2% ⇒ 7.2 3% ⇒ 7.8	15.0	3.4 5.8			0.60 0.70	16.3 32.5		
XII			7.8	Overland 100' Street 800'	2% ⇒ 7.4 3% ⇒ 6.7	14.1	3.5 6.0			0.60 0.70	16.4 32.7		
XIII			5.4	Overland 150' Street 800'	2% ⇒ 9.1 3% ⇒ 4.4	13.5	3.6 6.1			0.60 0.70	11.6 23.0		
XIV			26.3	Overland 300' Street 1100'	2% ⇒ 12.9 3% ⇒ 6.1	19.0	3.0 5.2			0.60 0.70	47.3 95.7		
XV			2.7	Overland 100' Street 500'	2% ⇒ 7.4 3% ⇒ 4.2	11.6	3.8 6.6			0.60 0.70	6.1 12.5		
XVI			7.4	Overland 150' Street 900'	2% ⇒ 9.1 3% ⇒ 5.0	14.1	3.5 6.0			0.60 0.70	15.5 31.1		

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MAJOR BASIN	IB BASIN	AREA		BASIN		Tc Min.	I	SOIL GROUP	DEV. TYPE	C	BASIN		RETURN PERIOD
		PLANIMETER HEADING	Ac.	LENGTH	HEIGHT						a	ap	
<u>XVII</u>			7.2	Overland 150' Street 1200'	2% ⇒ 9.1 3fps ⇒ 6.7	15.8	3.3 5.7	"B" "B"		0.60 0.70	14.3 28.7		
<u>XVIII</u>			16.6	Frost H=2		22.1	2.8 4.9			0.25 0.35	11.6 24.5		
<u>XIX</u>			3.9	Overland 120' Street 1000'	2% ⇒ 8.1 3fps ⇒ 5.6	13.7	3.6 6.1			0.60 0.70	8.4 16.6		
<u>XX</u>			10.1	Overland 200' Street 500'	2% ⇒ 10.5 2fps ⇒ 4.2	14.7	3.5 5.9			0.60 0.70	21.2 41.7		
<u>XXI</u>			4.0	Overland 150' Street 500'	2% ⇒ 9.1 2fps ⇒ 4.2	13.3	3.6 6.1			0.60 0.70	8.6 17.1		
<u>XXII</u>			4.0	Overland 200' Street 600'	2% ⇒ 7.4 2fps ⇒ 3.3	10.7	4.0 6.9			0.60 0.70	9.6 19.3		
<u>XXIII</u>			5.8	Overland 150' Street 1600'	2% ⇒ 5.3 3fps ⇒ 8.9	14.2	3.5 6.0			0.60 0.70	12.2 24.5		
<u>XXIV</u>			9.2	Overland 1000' Street 600'	2% ⇒ 7.4 3fps ⇒ 3.3	10.7	4.0 6.9			0.60 0.70	22.1 44.4		

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MAJOR BASIN	IB BASIN	AREA		BASIN		Tc Min.	I	SOIL GROUP	DEV. TYPE	C _r	BASIN		RETURN PERIOD
		PLAINTMETER READING	AG.	LENGTH	HEIGHT						Q ₁	Q ₂	
XXV			4.1	Ovaloid 130' 5 ft. at 80'	2 ft. ⇒ 8.5 3 ft. ⇒ 4.4	12.9	3.7 6.3	"B" "B"		0.60 0.70	9.1 18.1		
XXVI			16.0	Front 11-2		22.1	2.8 4.9			0.25 0.35	11.2 27.4		
XXVII	(Pond)		4.6	Ovaloid 300' x 6'		14.3	3.5 6.0			0.30 0.40	4.8 11.0		
XXVIII			2.3	Ovaloid 300' x 8'		8.2	4.4 7.6			0.60 0.70	6.1 12.2		
XXIX			3.3	Ovaloid 200' x 5'		7.8	4.5 7.8			0.60 0.70	8.9 18.0		
XXX			6.5	Ovaloid 110' x 70'	2 ft. ⇒ 7.4 2 ft. ⇒ 5.8	13.2	3.6 6.2			0.60 0.70	14.0 28.2		
XXXI			7.5	Ovaloid 200' x 90'	2 ft. ⇒ 10.5 3 ft. ⇒ 5.0	15.5	3.3 5.8			0.60 0.70	14.8 30.4		

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD $Q=CIA$

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MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc Min.	I	SOIL GROUP	DEV. TYPE	C.	BASIN		RETURN PERIOD
		PLANIMETER READING	Ac.	LENGTH	HEIGHT						a	b	
H-1			4.3	Overland 100' @ 5% Street 100' @ 3% ⇒ 4.2	2% ⇒ 7.4 ⇒ 4.2	11.6	3.8 6.7		1/8 ac. Res.	0.60 0.70	9.8 20.2		
H-2			33.4	Overland 700' @	7% ⇒ 22.1	22.1	2.8 4.8		Pasture	0.25 0.35	23.4 56.1		
H-3			162.3	Overland 1000' @ Swale 3600' @	8% ⇒ 25.3 2% ⇒ 3 for ⇒ 20.0	45.3	1.8 3.2		Pasture	0.25 0.35	73.0 181.8		
H-4			14.5	Overland 800' @	6% ⇒ 24.9	24.9	2.7 4.6		Pasture	0.25 0.35	9.8 23.3		
Historic DP #1	H-1, H-2 & H-3		200.0	From H-3		45.3	1.8 3.2		Pasture	0.25 0.35	90.0 224.0		

HYDROLOGIC COMPUTATION BASIC DATA
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MAJOR BASIN	SUB BASIN	AREA		BASIN		To Min.	I	SOIL GROUP	DEV. TYPE	C.	BASIN		RETURN PERIOD
		PLANIMETER READING	Ac.	LENGTH	HEIGHT						a	b	
DP#1		VI + VII	18.1	II = + Street 650' @ # _p = 2.7	13.7	16.4	3.2 5.6	B B		0.60 0.70	34.7 70.9		
DP#2		XI + XII	16.6	From XVII		18.1	3.1 5.4			0.60 0.70	30.9 62.7		
DP#3		DP#1 + I + II + III + IV + V + VIII	53.2	DP#3 + Street 650' @ # _p = 2.5	18.1	20.6	2.9 5.0			0.60 0.70	92.6 186.2		
DP#4		DP#3 + IX + X	63.7	DP#3 + Street 650' @ # _p = 1.0	20.6	21.6	2.8 4.9			0.60 0.70	107.0 218.5		
DP#5		DP#4 + XII + XIII + XIV + XV	101.5	DP#4 + Street 1000' @ 15' # _p = 1.1	21.6	22.7	2.8 4.8			0.60 0.70	170.5 341.0		
DP#6		XII + XIII	13.2	XII + Street 200' @ # _p = 2.5	14.1	16.6	3.2 5.6			0.60 0.70	25.3 51.7		
DP#7		DP#6 + XIV	39.5	From XIV		19.0	3.0 5.2			0.60 0.70	71.1 143.8		
DP#8		DP#7 + XV	45.2	DP#7 + Street 900' @ 10' # _p = 1.5	19.0	20.5	2.9 5.1			0.60 0.70	78.6 161.4		

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD Q=CIA

PAGE ___ OF ___



PROJECT: _____
BY: _____ DATE: _____

- EX 6'	Sump Inlet @ Basin XXIX
	$Q_s = 8.9 \text{ cfs}$ $Q_{100} = 18.9 \text{ cfs}$
	$Q = 1.47(L_i + 1.8(W)) (d_{max} + W/12)^{1.85}$
	$d_{max_{100}} = 0.71' \text{ ok}$
- EX 12'	Sump Inlet @ Basin XXXI
	$Q_s = 14.4 \text{ cfs}$, $Q_{100} = 29.6 \text{ cfs}$
	$d_{max_{100}} = 0.75' \text{ ok}$
- PROPOSED	Sump Inlets @ Basin XXX
	$Q_s = 14.0 \text{ cfs}$, $Q_{100} = 28.2 \text{ cfs}$ (Split Evenly, Both Sides of Street)
	$d_{max} = 1.0'$ $Q = 14.1 \text{ cfs}$
	$L_i = 1.95' \Rightarrow$ USE 4' Inlet each side of street
	24" RCP OUT

Design Point #4 $Q_5 = 107.0$, $Q_{100} = 218.5$

Street $S = 3\%$ $Q_{5 exp} = 20.0 cfs (1/2) = 40.0 cfs (1/2)$

$Q_{100 exp} = 60.0 cfs (1/2) = 120 cfs (1/2)$

$Q_{pipe (upstream) min 5} = 107 - 40 = 67 cfs$

$Q_{pipe (upstream) min 100} = 218.5 - 120 = 98.5 cfs$

Need 36" RCP Upstream

$S = 3\%$, $Q_{100} = 60 cfs (1/2 street)$

$T_{100} = 3.04 \sqrt{\frac{60}{(0.03)^{1/2}}} 0.375 = 27.2$

$F_w = 16.4 \left[\frac{(27.2 - 2)(0.03)^{1/6}}{(0.03)^{1/2}} \right] = 2.53$

$L_1 = 2.49 (0.02)^{0.3} (27.2)(2.53) = 53.0$

$L_2 = 3.27 (0.02)^{0.15} (27.2)(2.53) = 31.8$

$L_3 = 1.65 \left(\frac{2.53}{27.2} \right) = 113.5$

Try $L_x = 20' < L_2 \Rightarrow Q_x = Q \left(\frac{L_x}{L_1} \right)$

$Q_x = 40.0 \left(\frac{20}{53.0} \right) = 15.1 cfs$

$Q_{by} = 24.9 cfs$

$Q_{out} = 98.5 - 15.1 - 15.1 = 128.7 cfs$

USE 42" RCP OUT

Design Point #5 $Q_5 = 170.5$, $Q_{100} = 341.0$

Street @ 1/2 $Q_{5\text{ cap}} = 12 \text{ cfs } (1/2) = 24 \text{ cfs (full)}$

$Q_{100\text{ cap}} = 34.7 \text{ cfs } (1/2) = 69.4 \text{ cfs (full)}$

$Q_{\text{pipe (upstream) min}_5} = 170.5 - 24 = 146.5 \text{ cfs}$

$Q_{\text{pipe (upstream) min}_{100}} = 341.0 - 69.4 = 271.6 \text{ cfs}$

USE 1/2 100yr capacity (street)

$341.0 - 34.7 = 306.3 \text{ cfs pipe}$

Need 60" RCP OUT

Design Point #7 $Q_5 = 71.1$, $Q_{100} = 143.8$

Street @ 2/3 $Q_{5\text{ cap}} = 16 \text{ cfs } (2/3) = 32 \text{ cfs (full)}$

$Q_{100\text{ cap}} = 49.0 \text{ cfs } (2/3) = 98 \text{ cfs (full)}$

USE 2/3 100yr capacity (street)

$143.8 - 49.0 = 94.8 \text{ cfs pipe}$

Need 36" RCP OUT

Design Point #9 $Q_5 = 276.5$, $Q_{100} = 561.6$

Street @ 1% $Q_{100cap} = 34.7 \left(\frac{1}{2}\right) = 69.4 \text{ cfs (5\%!!)}$

$Q_{pipe \text{ (upstream) } min_{100}} = 561.6 - 69.4 = 492.2 \text{ cfs}$

USE $\frac{1}{2}$ 100yr capacity (street)

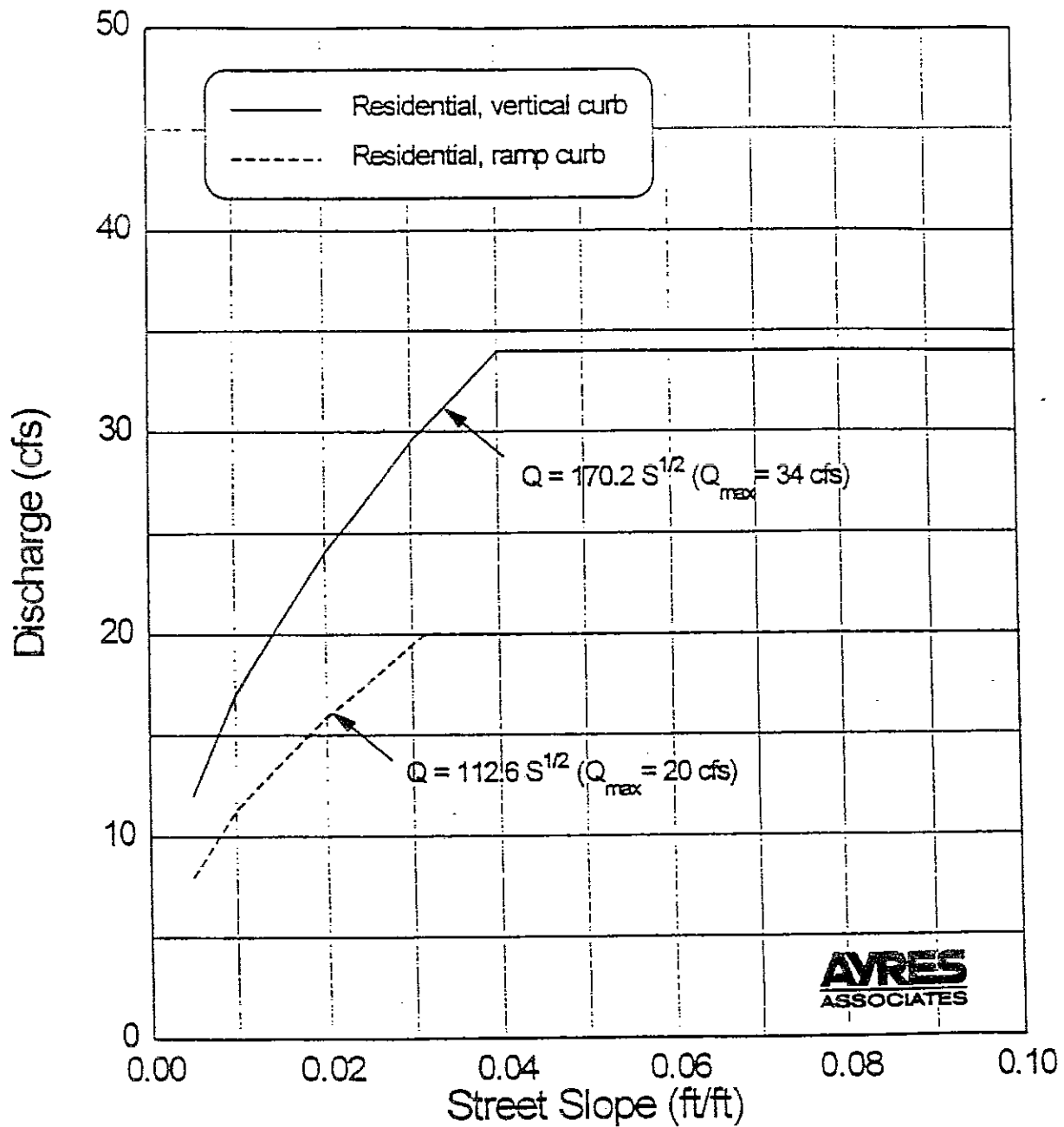
$561.6 - 34.7 = 526.9 \text{ cfs pipe}$

USE 72" RCP OUT

Design Point #10 $Q_5 = 303.3 \text{ cfs}$ $Q_{100} = 602.8 \text{ cfs}$

$602.8 \text{ cfs} / 187.2 \text{ acres} = 3.2 \text{ cfs/acre}$

RESIDENTIAL STREET (34' Flowline to flowline)

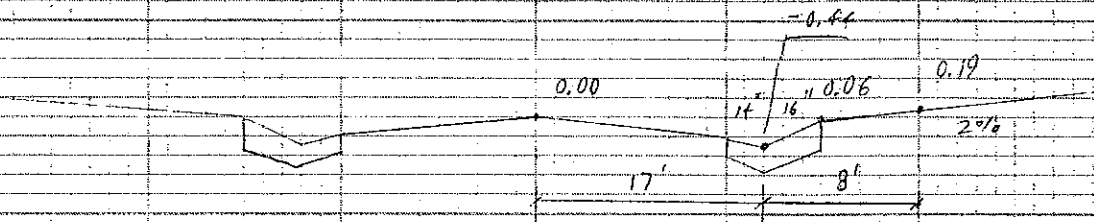


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Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown.

100 year street capacity -

- Residential Ramp Curb



$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{0.5}$$

$$n = 0.016$$

$$A = 3.74 + 3.23 + 0.43 + 0.33 + 0.25 = 7.98$$

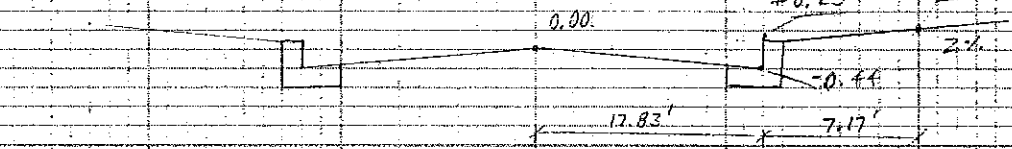
$$Q = \frac{376.7}{S^{0.5}}$$

$$R = \frac{7.98}{2.5} = 0.32$$

(1/2 street)

- 1% = 34.7
- 2% = 49.0
- 3% = 60.0
- 4% = 69.3

- Residential Vertical Curb



$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{0.5}$$

$$n = 0.016$$

$$A = 5.87 + 0.87 + 2.32 = 9.06$$

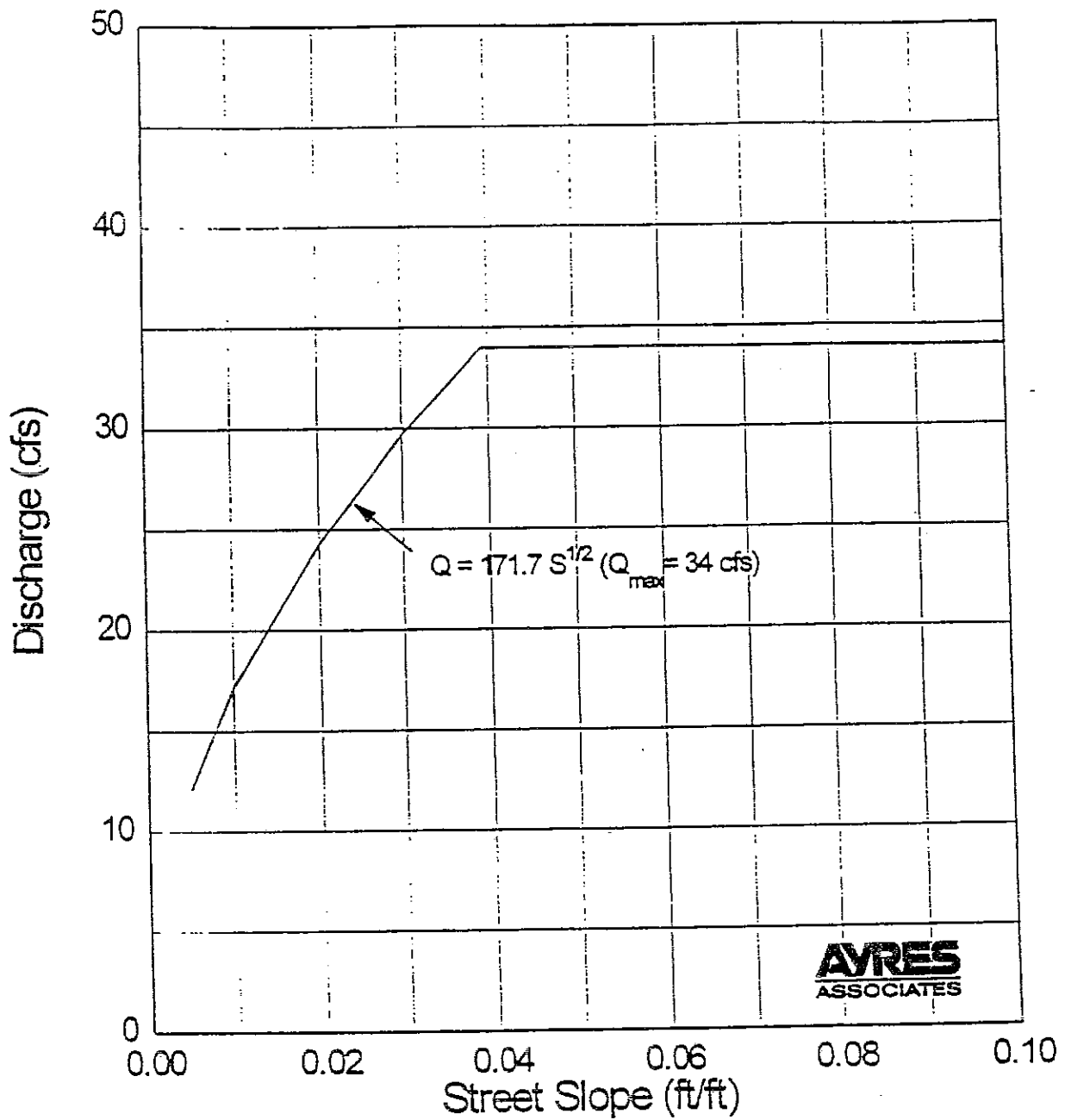
$$Q = \frac{396.3}{S^{0.5}}$$

$$R = \frac{9.06}{25.67} = 0.35$$

(1/2 street)

- 1% = 39.6
- 2% = 56.0
- 3% = 68.6
- 4% = 79.3

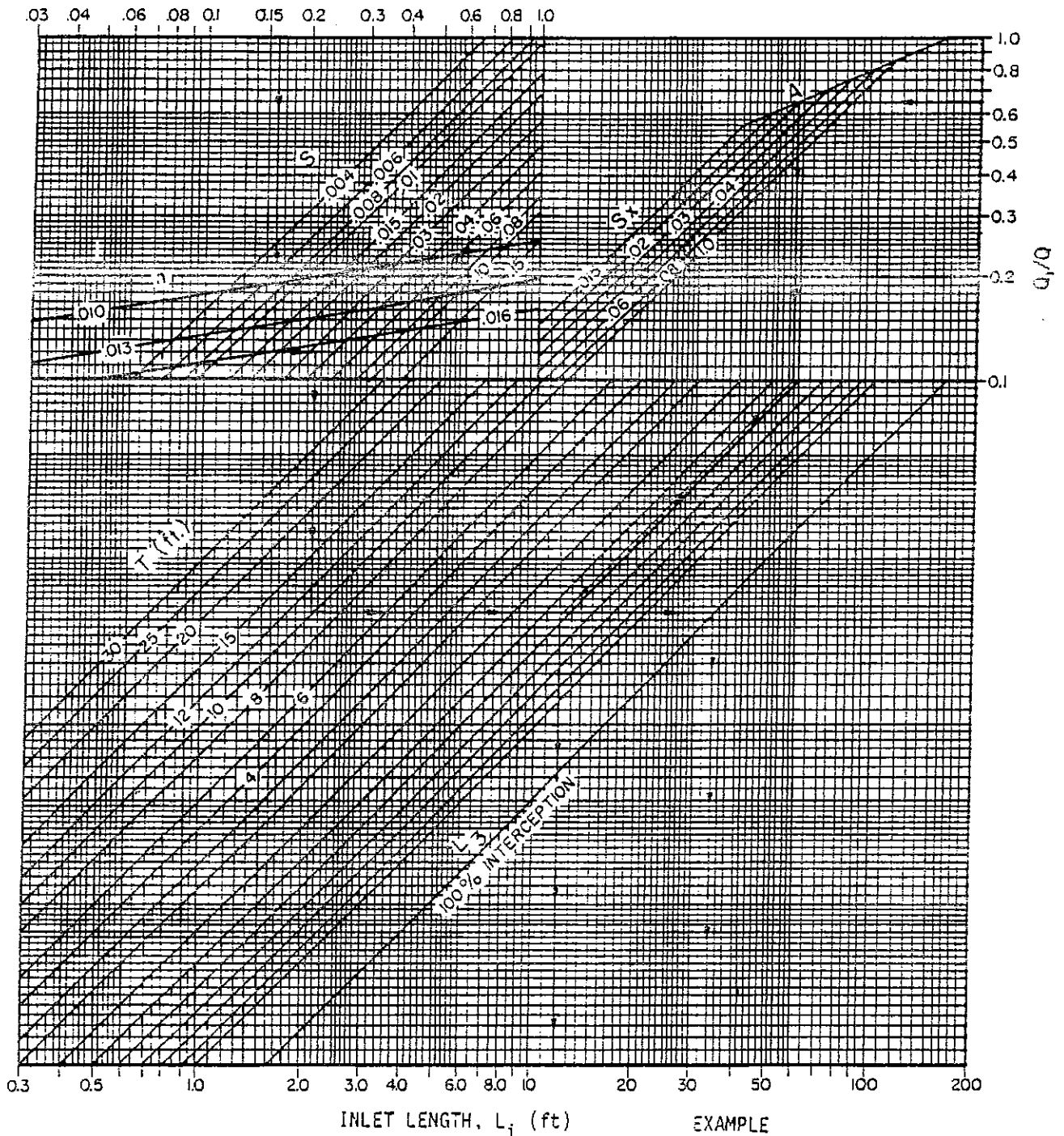
COLLECTOR STREETS (Major and Minor)



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Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown. No flow may cross the crown.

$$S_x (T-2) = d_w$$



This chart assumes, $w=2$ ft., $a=2$ " and $h=6$ in.

REFERENCE :

Izzard, Carl. f., Report presented at the Annual Meeting of the National Transportation Board, January 1977; Simplified Method For Design of Curb-opening Inlets

EXAMPLE

Given	$S_x = 0.02$ ft/ft
	$T = 10$ ft.
	$S = 0.03$ ft/ft
Find	$L_i = 11.8$ ft $L_i = 34$ ft.
	$Q_i/Q = 0.65$ $Q_i/Q = 1.0$

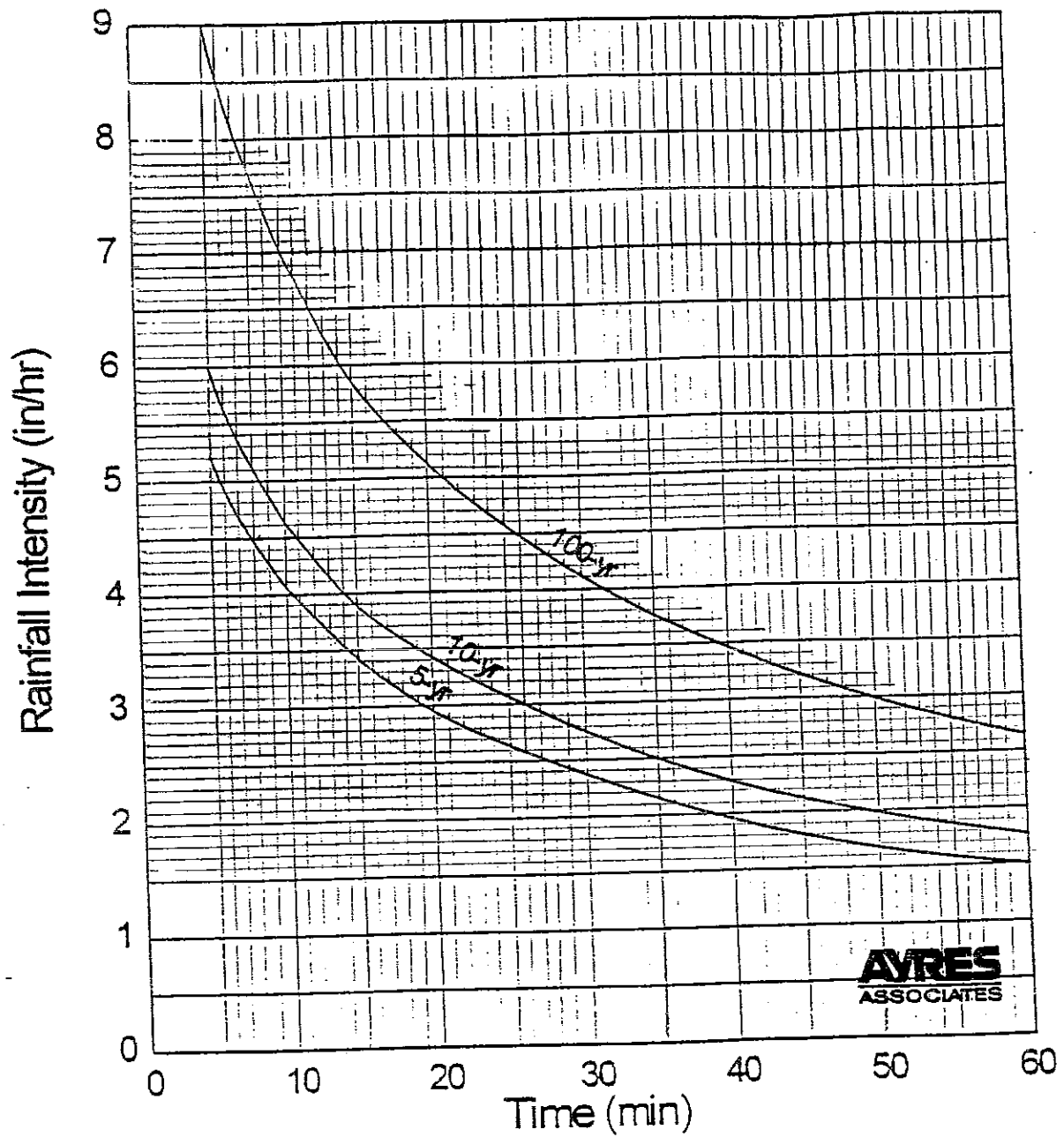


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Drainage Criteria Manual

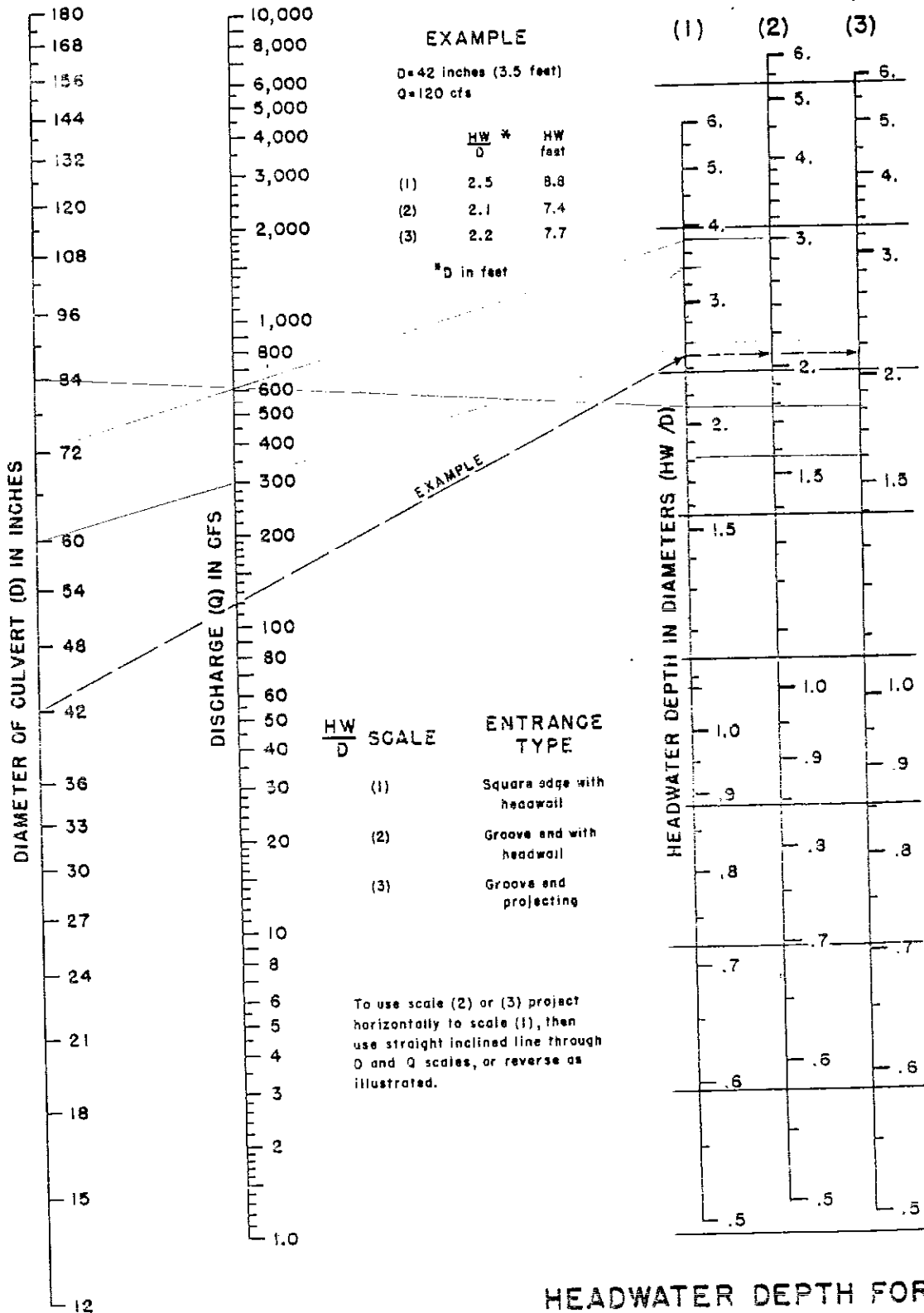
CONTINUOUS GRADE
Standard Curb-Opening Inlet Chart

Date	OCT. 1987
Figure	7-9



Interim Release October 12, 1994 , Rainfall Intensity Curves
 City Of Colorado Springs Drainage Criteria Manual

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

CONCRETE PIPE
Capacity (Velocity)

		1%	2%	3%	4%	5%	6%	7%	8%
0.57-									
5.0	18"	11.3 (6.6)	16.0 (9.3)	19.6 (11.4)	22.6 (13.2)	25.3 (14.7)	27.7 (16.1)	29.9 (17.4)	32.0 (18.6)
17.2	24"	24.3 (8.1)	34.4 (11.2)	42.2 (13.7)	48.7 (15.8)	54.4 (17.6)	59.6 (19.3)	64.4 (20.9)	68.8 (22.3)
31.2	30"	44.1 (9.5)	62.4 (13.4)	76.4 (16.4)	88.2 (19.0)	98.7 (21.2)	108.1 (23.2)	116.8 (25.1)	124.8 (26.8)
50.7	36"	71.8 (10.3)	101.5 (14.6)	124.3 (17.8)	143.5 (20.6)	160.4 (23.0)	175.8 (25.2)	189.8 (27.2)	202.9 (29.1)
76.5	42"	108.2 (10.8)	153.1 (15.3)	187.5 (18.7)	216.5 (21.6)	242.0 (24.2)	265.1 (26.5)	286.3 (28.6)	306.1 (30.6)
109.3	48"	154.5 (11.2)	218.5 (15.8)	267.6 (19.4)	309.0 (22.4)	345.5 (25.0)	378.5 (27.4)	408.8 (29.6)	437.0 (31.6)
149.6	54"	211.5 (11.5)	299.2 (16.2)	366.4 (19.8)	423.1 (22.9)	473.0 (25.6)	518.2 (28.1)	559.7 (30.3)	598.3 (32.4)
198.1	60"	280.2 (11.7)	396.2 (16.5)	485.3 (20.2)	560.3 (23.3)	626.5 (26.1)	686.3 (28.6)	741.2 (30.9)	792.4 (33.0)
255.4	66"	361.2 (11.8)	510.9 (16.7)	625.7 (20.5)	722.5 (23.7)	807.8 (26.5)	884.8 (29.0)	955.7 (31.3)	1021.7 (33.5)
322.1	72"	455.6 (12.0)	644.3 (17.0)	789.1 (20.8)	911.1 (24.0)	1018.7 (26.8)	1115.9 (29.3)	1205.3 (31.7)	1288.6 (33.9)
485.9	84"	687.2	971.4	1190.3	1374.4				