Submit an updated drainage report meeting current criteria

NEW DOC

Reevaluating the previously approved report made me realize how much has changed in the last 15 years. The report has been redone with today's standards used. Most of the culverts needed to be doubled in capacity. The retention areas were found to be oversized. However, I kept the drainage easements the same for a large factor of safety.

FINAL DRAINAGE REPORT

for

FALCON ACRES SUBDIVISION

Prepared for:

United Planning & Engineering
4575 Galley Road, Suite 200
Colorado Springs, CO 80915

June 25, 2007
Revised September 4, 2007
Revised October 31, 2007
Revised February 7, 2008

Prepared by:

JPS ENGINEERING

19 E. Willamette Avenue
Colorado Springs, CO 80903
(719)-477-9429
(719)-471-0766 FAX

JPS Project No. 020506

Add PCD File No. SF223

Added.

FALCON ACRES SUBDIVISION
FINAL DRAINAGE REPORT
TABLE OF CONTENTS

APPENDICES

DRAINAGE STATEMENT

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.

3/28/08

John P. Schwab, P.E. #29891

Developer's Statement:

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

By: _____ 3/28/08

Printed Name: LOIS ELLIOTT Date

Title: OWNER

El Paso County's Statement

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

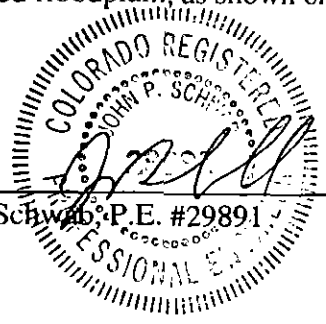
for _____ 4-15-08

John A. McCarty, P.E., Director / County Engineer Date

Conditions:

FLOODPLAIN STATEMENT

To the best of my knowledge and belief, Falcon Acres Subdivision is not located in a FEMA designated floodplain, as shown on FIRM panel No. 08041C0800F, dated March 17, 1997.



3/28/08

John P. Schwab, P.E. #29891

I. GENERAL LOCATION AND DESCRIPTION

A. Background

Falcon Acres is a proposed residential subdivision located in northeastern El Paso County, Colorado. The Falcon Acres parcel (El Paso County Assessor's Number 44040-00-014) is located at the southwest corner of Curtis Road and Davis Road, as shown in Figure A1 (Appendix A). Falcon Acres Subdivision will consist of 8 rural residential lots (5-acre lot sizes) on a 47.6-acre parcel.

B. Scope

This report is intended to fulfill the El Paso County requirements for a "Final Drainage Report" in support of the final subdivision plat approval process. This report will provide a summary of site drainage issues impacting the proposed residential development. The report will analyze impacts from upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the El Paso County Drainage Criteria Manual.

C. Site Location and Description

The Falcon Acres parcel is located in the northeast quarter of the northeast quarter (NE1/4), and the east half of the east half of the northwest quarter of the northeast quarter (NE1/4) of Section 4, Township 14 South, Range 64 West of the 6th Principal Meridian. The site is currently inhabited by an existing ranch and pasture/meadow areas. The parcel is zoned RR-3 (rural residential), allowing for 5–acre minimum lot sizes. A new public road (Peaceful Prairie Road) extending south from Davis Road will provide access to the subdivision. Associated site improvements will include grading, driveway paving, and utility service improvements for the eight residential lots.

The parcel is bordered by existing rural residential lots on all sides, typically consisting of 5-acre lots. Davis Road borders the north boundary of the parcel, and Curtis Road borders the east boundary of the parcel. Ground elevations within the site range from approximately 6,530 to 6,550 feet above mean sea level.

The site is located near the upstream end of the Livestock Company Drainage Basin, which is tributary to the West Fork of Black Squirrel Creek. The terrain is gently rolling with average grades ranging from 1to 5 percent. The existing site is a rural ranch parcel and pasture / meadow area.

Added.

D. General Soil Conditions

Add Chapter 6 of the City DCM, May 2014

Add MHFD DCM

According to the Soil Survey of El Paso[illegible]), on-site soils are comprised of Type 97, [illegible]re classified as hydrologic soils group "B," with moderately rapid permeability, slow to medium surface runoff characteristics, and moderate hazard of erosion.

E. References

City of Colorado Springs & El Paso County "Drainage Criteria Manual," revised October 12, 1994.

CDOT, "CDOT Drainage Design Manual," July, 1995.

Update all reference to the latest version.

El Paso County "Engineering Criteria Manual," December, 2004.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C0800F, March 17, 1997.

Removed or updated as needed.

JPS Engineering, Inc., "Preliminary Drainage Report for Falcon Acres Subdivision," August 29, 2006 (approved by El Paso County 9/18/06).

Kiowa Engineering Corporation, "Final Drainage Report, Davis Ranch Subdivision Filing Nos. 3, 4, and 5," August 9, 2005.

USDA Natural Resources Conservation Service, "Soil Survey of El Paso County Area, Colorado," June, 1981.

Removed.

WRC Engineering, Inc., "Adams County Storm Drainage Design and Technical Criteria," February, 1989.

Remove.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The proposed development lies completely within the Livestock Company Drainage Basin (CHWS 0400) as classified by El Paso County. Drainage from this site parcel flows southeasterly to a downstream confluence with the West Fork of Black Squirrel Creek.

B. Floodplain Impacts

The project site is located beyond the limits of any 100-year floodplain delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Number 08041C0800-F, dated March 17, 1997, as shown in Figure A2 (Appendix A).

Update to the current effective FIRM

Updated.

C. Sub-Basin Description

The existing drainage basins lying in and around the proposed development are depicted in Figure EX1 (Appendix A). The site is impacted by off-site drainage basins to the west, northwest, and southwest, which generally drain in an easterly direction across the site. Two existing sub-basins have been delineated within the site, each characterized by an existing depression as indicated by the hatched areas on Figure EX2 (Appendix A). Overflows from the existing depressions within the site would tend to drain northeasterly towards the intersection of Davis Road and Curtis Road, where no culvert currently exists. The natural drainage patterns within the site will be impacted through development by site grading and concentration of runoff in subdivision streets. Developed runoff will generally continue to follow historic paths.

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

No Drainage Basin Planning Study (DBPS) has been completed for the Livestock Company Drainage Basin. No Master Development Drainage Plans (MDDP) were found for any adjacent subdivisions.

B. Hydrologic Criteria

SCS procedures were utilized for analysis of the major off-site basin flows impacting the site. In accordance with El Paso County drainage criteria, SCS hydrologic calculations were based on the following assumptions:

• Design storm (minor)	5-year
• Design storm (major)	100-year
• Storm distribution	SCS Type IIA (eastern Colorado)
• 100-year, 24-hour rainfall	4.4 inches per hour (NOAA isopluvial map)
• 5-year, 24-hour rainfall	2.6 inches per hour (NOAA isopluvial map)
• Hydrologic soil type	B
• SCS curve number - undeveloped conditions	61 (pasture / range)
• SCS curve number - undeveloped conditions	50 (range with upstream retention ponds)
• SCS curve number - developed conditions	98 (paved areas)
• SCS curve number - developed 5-acre lots	63 (composite calculation)

A curve number of 50 has been selected for hydrologic modeling of upstream areas with existing retention ponds. This approach is consistent with the approved Final Drainage Report for Davis Ranch Subdivision, which is located a few miles east of this site.

Verify and update as necessary per the adopted City DCM (May 2014)

These have all been revised per City DCM.

Revise to current criteria (City 2014 DCM Chapter 6)

All revised.

Rational Method procedures were utilized for calculation of peak flows within the on-site drainage basins. Rational Method hydrologic calculations were based on the following assumptions:

- Design storm (minor) — 5-year
- Design storm (major) — 100-year
- Time of Concentration – Overland Flow — "Airport" equation (300' max. developed)
- Time of Concentration – Gutter/Ditch Flow — "SCS Upland" equation
- Rainfall Intensities — El Paso County I-D-F Curve
- Hydrologic soil type — B

	C5	C100
• Runoff Coefficients - undeveloped: Existing pasture/range areas	0.25	0.35
• Runoff Coefficients - developed: Proposed lot areas (5-acre lots)	0.29	0.38 (composite calculation)

Update.

Updated.

Hydrologic calculations are enclosed in Appendix B, and peak design flows are identified on the in drawings.

Update per City 2014 DCM Table 6-6 for existing pasture

Update. value seems high. 5 ac lot typically has 7% impervousness so C5 value should be around 0.12

INAGE FACILITY DESIGN

A. General Concept

Development of the proposed subdivision will require site grading and paving work within 8 proposed rural residential lots, resulting in a limited amount of additional impervious area within

Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59

Historic drainage conditions are depicted in Figures EX1 and EX2. There are no existing drainage facilities within or adjacent to the site. The existing site is characterized by two large drainage retention areas within the site, represented by the hatch patterns on Sheet EX2. Off-site flows from Basins OA1-OA3 combine with on-site drainage from Basin A, draining to the existing depression within Basin A on the west side of the parcel. As shown on Sheet EX1, the existing upstream basins have several stock ponds and retention areas. There is currently no culvert for drainage to cross the low point in Davis Road at the north boundary of the Falcon Acres site. Based on the topography, overflows from Basin OA1 would overtop Davis Road and flow south into Basin A.

This sentence seems to contradict the subsequent sentence. Revise to clarify.

Revised for clarification.

Off-site flows from Basins OA1, OA2.1, OA2.2, and OA3 combine with on-site flows at the existing retention area within Basin A, with calculated historic peak flows of Q_5 = 2.0 cfs and Q_{100} = 78.8 cfs at Design Point A.

The westerly retention area (Retention Area A) within the Falcon Acres site currently has a storage volume of approximately 91.6 acre-feet between the 6528 and 6536 contours. Overflows from this retention area would drain northeasterly to Basin B.

Off-site flows from Basin OB1 combine with on-site drainage from Basin B, draining to the existing depression within Basin B on the east side of the parcel.

Off-site flows from Basin OB1 combine with on-site flows at the existing retention area within Basin B, with calculated historic peak flows of Q_5 = 0.04 cfs and Q_{100} = 2.8 cfs at Design Point B.

The easterly retention area (Retention Area B) has a storage volume of approximately 6.9 acre-feet between the 6528 and 6530 contours. Overflows from Retention Area B would drain northeasterly towards the intersection of Curtis Road and Davis Road.

Based on the substantial retention volume within the site, no 100-year flows would be expected to reach Design Point #1 at the northeast corner of the site. In the unlikely event the existing retention ponds were completely full, overflows from Basin A would flow northeasterly, combining with flows from Basin B at Design Point #1, with calculated historic peak flows (SCS Method) of Q_5 = 1.9 cfs and Q_{100} = 68.6 cfs. As noted in Appendix B, the calculated flows for off-site basins with retention ponds have incorporated an SCS runoff curve number of 50 based on the existence of numerous upstream retention areas. Historic overflows from the Falcon Acres parcel would tend to overtop Curtis Road and flow to an existing depression on the parcel at the southeast corner of Curtis Road and Davis Road.

2. Developed Drainage Conditions

The developed drainage basins and projected flows are shown in the Developed Drainage and Erosion Control Plan (Figure D1, Appendix A). In the developed condition, Basin A has been divided into sub-basins A1 and A2 by the proposed public road within the site. Off-site flows from Basin OA2.1 and OA2.2 will combine with on-site drainage from Sub-Basins A1 and A2, draining to a new culvert crossing at the low point of the proposed roadway profile. Developed peak flows at Design Point A1 are projected to be Q_5 = 1.4 cfs and Q_{100} = 54.6 cfs. A proposed culvert (36-inch RCP) will cross the new public road at Design Point A1.

Given the lack of any existing drainage facility crossing the low point in Davis Road, a future 24-inch culvert is recommended at Design Point OA1 prior to paving this off-site roadway. An 18-inch private driveway culvert will be installed across the private shared

driveway (Satellite View) south of Design Point OA1. Another 21-inch private driveway culvert will be constructed across Moonglow Heights at Design Point A3.1 to convey drainage across the retention area split by the new shared driveway.

Off-site flows from Basins OA1-OA3 will continue to combine with flows from Basins A1-A3 in the existing "Retention Area A" on the west side of the site. Off-site flows from Basins OA1, OA2.1, OA2.2, and OA3 will continue to combine with on-site flows from Basins A1-A3.2 at the existing retention area within Basin A, with calculated developed peak flows of Q_5 = 2.3 cfs and Q_{100} = 89.8 cfs at Design Point A.

This retention area has a bottom elevation of 6528.0 and the existing saddle northeast of this area has an elevation of approximately 6536.0, which would be the natural overflow point annel A3 is proposed to provide an overflow swale northeasterly from Retention Area B. This channel will be excavated to an elevation of ge easement will encompass ground elevations within Area A up to the *reclude building anywhere within the retention area.*

Verify if the current MHFD criteria still has the same requirements. UPdate per current criteria.

Drainage and Flood Control District (UDFCD) has adopted criteria requiring stormwater retention ponds to have a storage volume of 1.5 times the 24-hour, 100-year volume. As detailed in Appendix C, the calculated 100-year, 24-hour retention volume for Design Point A is 64.8 acre-feet. The available retention storage volume up to the 6533.5 contour level within Basin A is 47.3 acre-feet, which is approximately equal to the calculated 100-year storage volume requirement of 48.3 acre-feet (based on a 24-hour retention volume with safety factor of 1.5 per UDFCD criteria). Overflow channels will be provided to safely convey overflows or back-to-back storm events to existing downstream swales.

Recommendation is now 2 times 24-hour, 100-year volume per MHFD criteria. However, the 24-hour, 100-year detention volume is now lower using the MHFD spreadsheet so the storage needed is actually less than in the previous report. For safety, I kept the drainage easement/no-build area the same.

Off-site flows from Basin OB1 will continue to combine with on-site drainage from Basin B, draining to the existing "Retention Area B" on the east side of the site. Off-site flows from Basin OB1 will continue to combine with on-site flows at the existing retention area within Basin B, with calculated developed peak flows of Q_5 = 1.7 cfs and Q_{100} = 11.7 cfs at Design Point B.

This retention area has a bottom elevation of 6528.0 and the existing overflow swale northeast has an elevation of approximately 6530.0. A drainage easement will encompass ground elevations within Area B up to the grade of 6530 to preclude building within the retention area.

As detailed in Appendix C, the calculated 100-year, 24-hour retention volume for Design Point B is 2.3 acre-feet, which is below the available retention storage volume of 2.8 acre-feet.

As with the historic conditions, no 100-year flows would be expected to reach Design Point #1 based on the substantial retention volume within the site. In the unlikely event the

existing retention ponds were completely full, overflows from off-site Basins OA1-OA3 and OB1 will combine with flows from on-site Basins A and B at Design Point #1, with developed peak flows (SCS Method) of Q_5 = 2.4 cfs and Q_{100} = 81.1 cfs.

The proposed rural residential lot layout has been designed to maintain the two existing drainage retention areas, while providing an overflow channel to the northeast. Given the lack of any existing drainage facility crossing the low point on the south side of Davis Road at the Curtis Road intersection, a culvert is recommended at this location. The proposed culvert will be a 14'x23" elliptical (HERCP) culvert sized to convey overflows only from the on-site retention areas (beyond 100-year flows).

As depicted on Sheet EX1, the off-site parcel to the east also has an existing depression which serves as a drainage retention area. The proposed drainage approach of maintaining the existing drainage retention areas within the Falcon Acres parcel should maintain conditions that mimic pre-development hydrology downstream of the site.

C. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix B, the total developed flow from the site will remain unchanged based on the existing retention volumes. If the existing retention volume were excluded from the analysis, the total developed flow would exceed historic flow from the site by a negligible amount. The increase in developed flow will be mitigated by maintaining the existing on-site drainage retention areas. The comparison of developed to historic discharges at key design points is summarized as follows:

Design Point	Historic Flow			Developed Flow			Comparison of Developed to Historic Flow (Q_5%/Q_{100}%)
	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	
1 (with Retention)	766.2	0	0	766.2	0	0	(no change)
1 (w/o Retention)	766.2	1.9	68.6	766.2	2.4	81.1	126% / 118% (increase)

The total developed storm runoff downstream of the proposed subdivision will be maintained at historic levels by routing flows through two existing retention ponds within the site. The retention volume has been sized to retain the calculated 24-hour, 100-year storm discharge from the developed basins within the site, as detailed in Appendix D. Overflow swales will be provided to convey major storm discharges downstream following historic drainage patterns. Based on the drainage concept of protecting the existing on-site retention areas, the proposed development will have a negligible downstream drainage impact.

D. On-Site Drainage Facility Design

Developed sub-basins and proposed drainage improvements are depicted in the enclosed Drainage Plan (Sheet D1). In accordance with El Paso County standards, new roadways will be graded with a minimum longitudinal slope of 1.0 percent.

On-site drainage facilities will consist of roadside ditches, grass-lined channels, and culverts. Hydraulic calculations for sizing of drainage facilities are enclosed in Appendix C and design criteria are summarized as follows:

1. Culverts

The internal road system will be graded to drain roadside ditches to low points along the road profile, where cross-culverts will convey developed flows into grass-lined channels following historic drainage paths. Culvert pipes have been specified as reinforced concrete pipe (RCP) with a minimum diameter of 18-inches. Culvert sizes have been identified based on a maximum headwater-to-depth ratio (HW/D) of 1.0 for the minor (5-year) design storm. Final culvert design has been performed utilizing the FHWA HY-8 software package to perform a detailed analysis of inlet and outlet control conditions, meeting El Paso County criteria for allowable overtopping. Riprap outlet protection will be provided at all culverts. Culvert sizing parameters are summarized in Appendix C.

2. Open Channels

Drainage easements have been dedicated along major drainage channels and existing depressions within the site, following historic drainage paths through the subdivision. Proposed channels will generally be grass-lined channels designed to convey 100-year flows, with a trapezoidal cross-section, variable bottom width and depth, 4:1 maximum side slopes, 1-foot minimum freeboard, and a minimum slope of 0.5 percent.

The proposed drainage channels have been sized utilizing Manning's equation for open channel flow, assuming a friction factor ("n") of 0.030 for dry-land grass channels. Maximum allowable velocities have been evaluated based on El Paso County drainage criteria, typically allowing for a maximum 100-year velocity of 5 feet per second. The proposed channels will be seeded with native grasses for erosion control. Ditch flows will be diverted to drainage channels at the nearest practical location to minimize excessive roadside ditch sizes. Detailed channel hydraulic calculations are provided in Appendix C.

Drainage swales crossing proposed lots and existing drainage retention areas within the site have been placed in drainage easements, with variable widths based on the calculated 100-year water surface elevations and retention area configuration. Based on the proposed channel section (4' bottom, 2' deep, 4:1 side slopes) and calculations in Appendix C, a minimum drainage easement width of 30 feet is required for the overflow swales from each of the retention ponds.

Add a section for the 4-step process (ECM Appendix I Section I.7.2.A)
Under each step, summarize how the step was considered or implemented.

E. Anticipated Drainage Problems and Solutions

Added.

The drainage plan for this subdivision includes a system of roadside ditches, channels, and culverts to convey developed flows through the site. The primary drainage problems anticipated within this development will consist of maintenance of these drainage channels and culverts. Care will need to be taken to implement proper erosion control measures in the proposed roadside ditches, channels, and swales. Ditches have been designed to meet allowable velocity criteria. Seeding will be the primary erosion control method within the on-site ditches and channels. Erosion control blankets have been specified where necessary. Proposed drainage facilities outside the public right-of-way will be owned and maintained by the subdivision HOA or individual lot owners.

V. EROSION CONTROL / SEDIMENT CONTROL

Best management practices (BMP's) will be implemented for erosion control during construction. Erosion c
disturbed slopes, straw
access points, and rev
excavation as necessary
of the graded areas. T
BMP's, minimizing adverse drainage i

Drainage Basins:			
Chico Creek	Book Ranch	$19,830	$2,871
Chico Creek	Upper East Chico	$10,803	$313
Chico Creek	Telephone Exchange	$11,870	$278
Chico Creek	Livestock Company	$19,552	$233
Chico Creek	West Squirrel	$10,192	$4,229
Chico Creek	Solberg Ranch	$21,134	$0

Update per current 2022 drainage fees.

VI. COST ESTIMATE AND DRA

The estimated cost for drainage improvements serving the Falcon Acres Subdivision is approximately $36,800, as detailed in Appendix D.

Updated.

The site lies completely within the Livestock Company Drainage Basin (CHWS 0400), which has a 2007 basin fee of $11,842 per impervious acre and a bridge fee of $141 per impervious acre. The calculation of applicable drainage basin fees is summarized as follows:

Average residential lot size = 5 acre/lot (gross density)
Residential Area = 47.577 acres
Percent impervious = 7% (per El Paso County guidelines, Table 3-1)
Total Impervious area = (7% * 47.577) = 3.33 ac.
Adjusted Impervious area = (3.33 ac) * 75% = 2.50 ac.
(Includes 25% reduction on drainage fees for 5-acre lots)

Drainage Basin Fee = (2.5 ac.) @ $11,842/ac. = $29,605.00
Bridge Fee = (3.33 ac.) @ $141/ac. = $ 469.53
Total Calculated Fee = $30,074.53

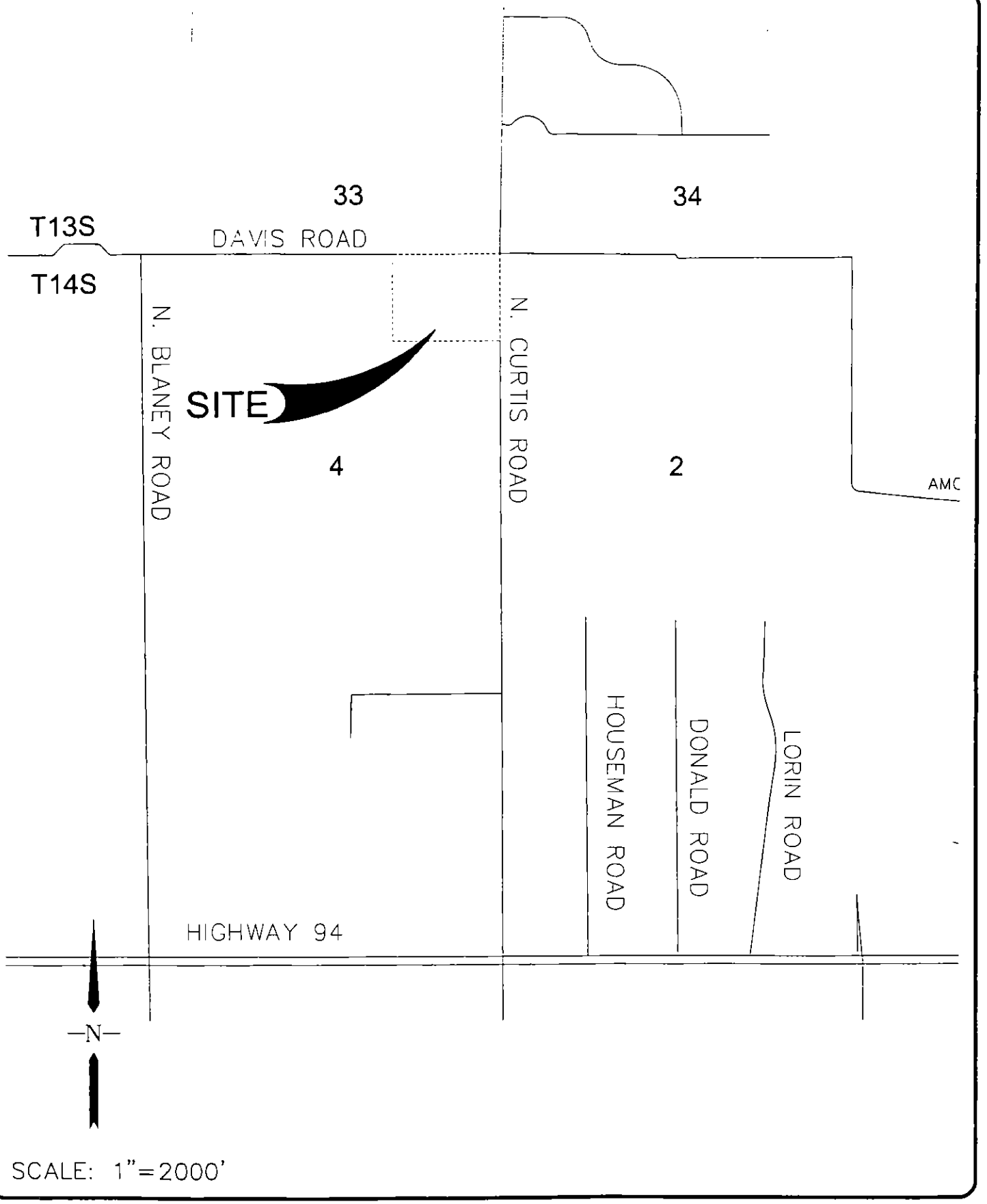
VI. SUMMARY

Falcon Acres is a proposed subdivision consisting of 8 rural residential lots located south of Falcon in El Paso County, Colorado. Development of the proposed 47.6-acre Falcon Acres Subdivision will result in a negligible increase in undetained developed runoff from the site, which will be mitigated by maintaining two existing drainage retention areas within the site.

The proposed drainage patterns will remain consistent with historic conditions, and new drainage facilities will be constructed on-site to El Paso County standards to safely convey runoff to adequate outfalls. Maintenance of the existing drainage retention areas, in conjunction with proper erosion control measures, will ensure that there will be no adverse drainage impacts from this development to downstream landowners or parcels.

APPENDIX A

FIGURES



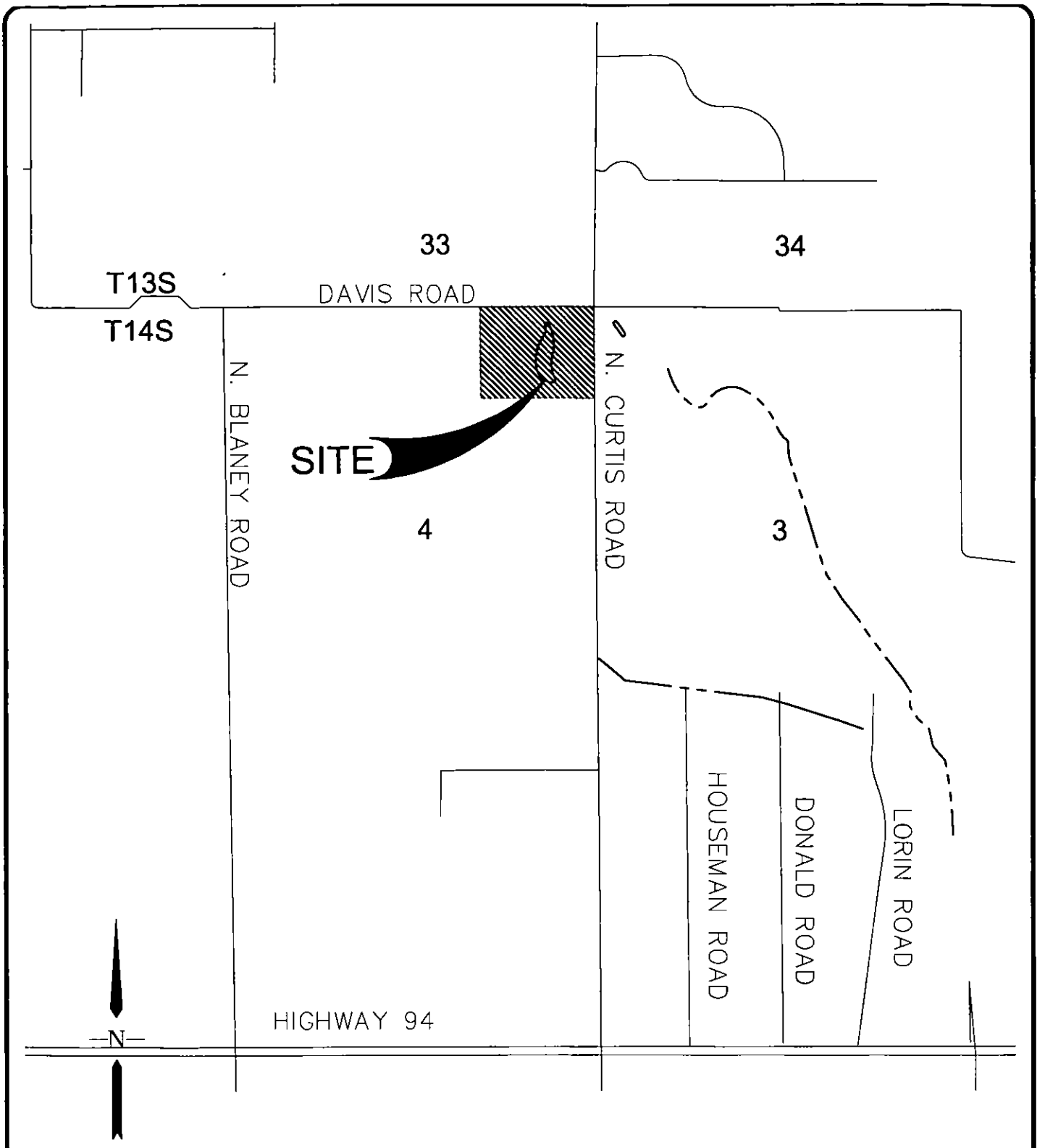
VICINITY MAP

JPS ENGINEERING

FALCON ACRES SUBDIVISION

FIGURE A1

JPS PROJ NO. 020506



SCALE: 1"=1000'

FIRM PANEL 07041C0800F (MARCH 17,1997)

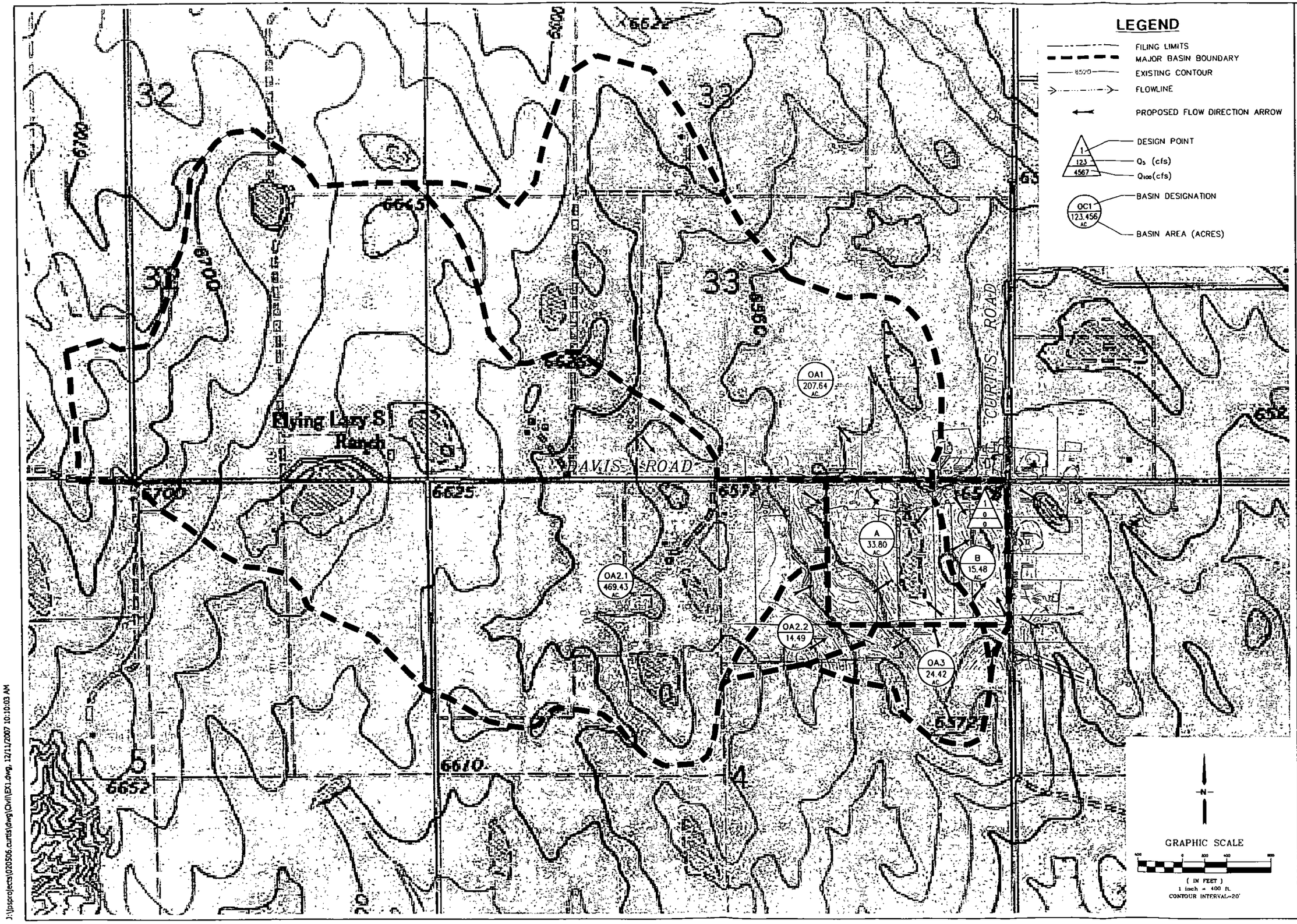
FLOODPLAIN MAP

JPS ENGINEERING

FALCON ACRES SUBDIVISION

FIGURE A2

JPS PROJ NO. 020506



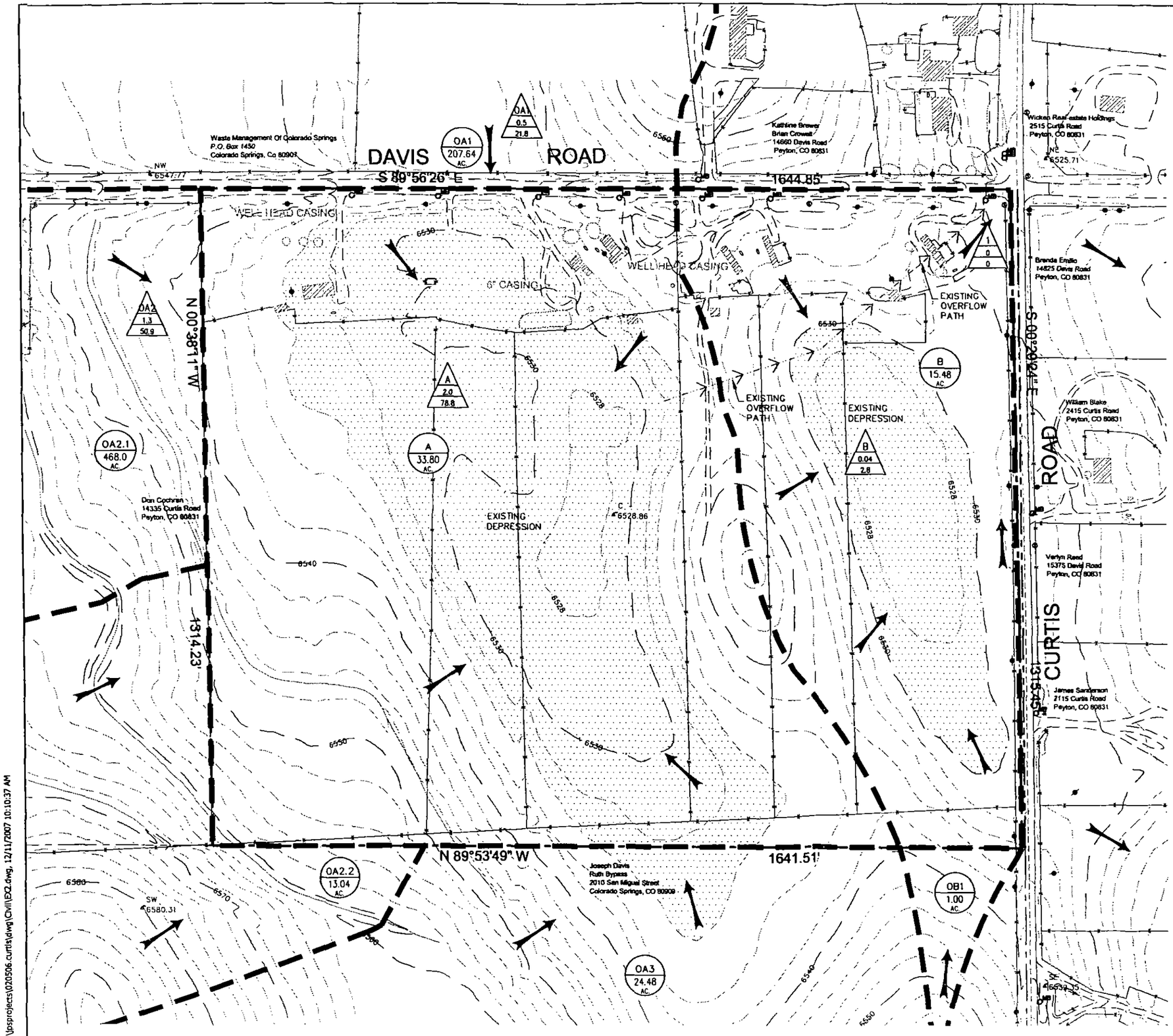
FALCON ACRES

MAJOR BASIN / HISTORIC DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766

No.	REVISION	BY	DATE

HORZ. SCALE:	1"=400'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:		CHECKED:	JPS
CREATED:	4/21/05	LAST MODIFIED:	9/04/07
PROJECT NO:	020506	MODIFIED BY:	BJJ
SHEET:	EX1		



LEGEND

- FILING LIMITS
- MAJOR BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- FLOWLINE
- PROPOSED FLOW DIRECTION ARROW
- DESIGN POINT
- Q_5 (cfs)
- Q_{100} (cfs)
- BASIN DESIGNATION
- BASIN AREA (ACRES)

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.
Contour Interval = 2'

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

FALCON ACRES

HISTORIC DRAINAGE PLAN

NO.	REVISION	BY	DATE

HORZ. SCALE: 1"=100'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED:	CHECKED: JPS
CREATED: 4/21/05	LAST MODIFIED: 9/04/07
PROJECT NO. 020506	MODIFIED BY: BJJ
SHEET: EX2	

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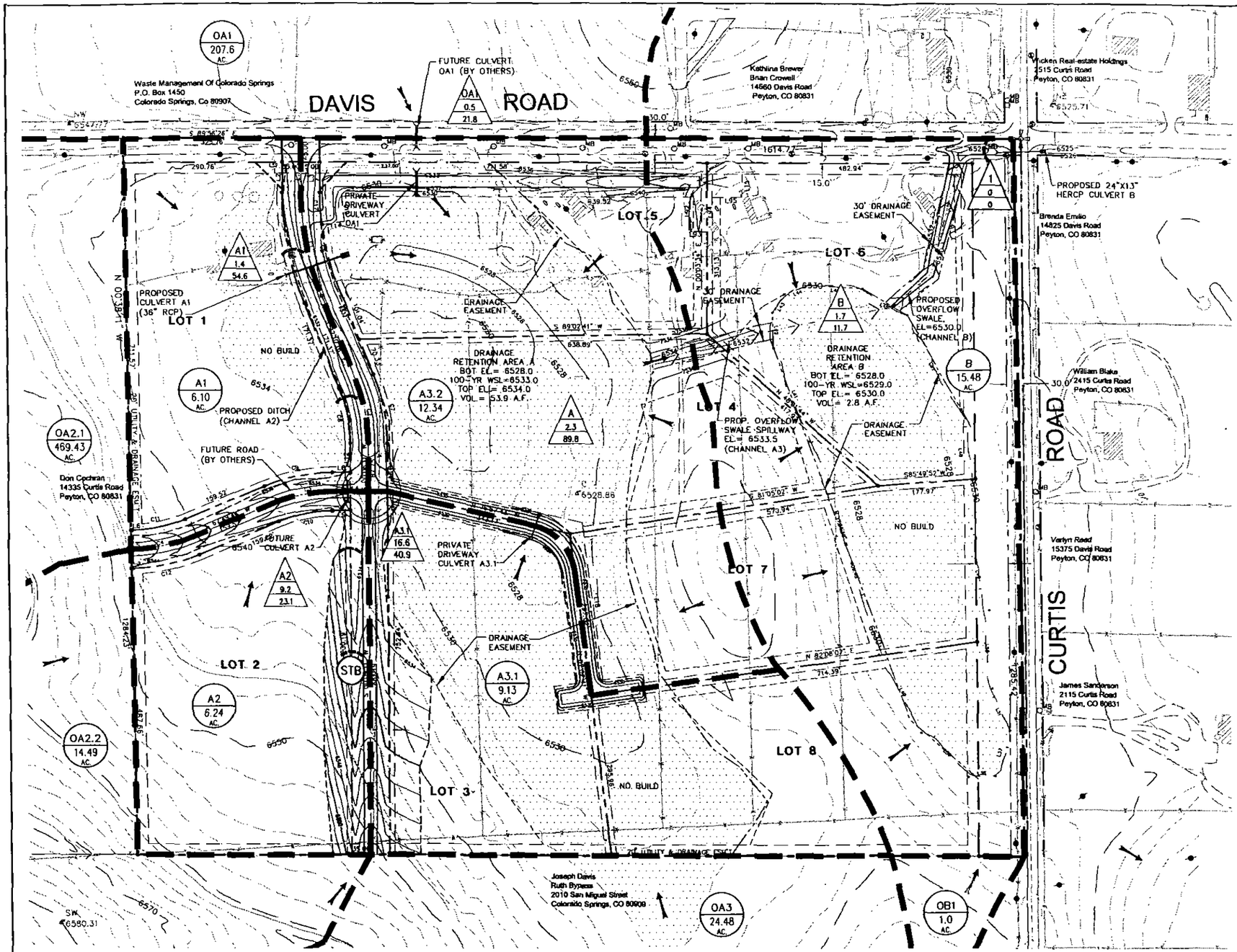

FALCON ACRES SUBDIVISION

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

No.	REVISION	BY	DATE
1	COUNTY COMMENTS	JPS	2/06/05

HORZ. SCALE: 1"=100'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: UP&E	CHECKED: JPS
CREATED: 3/29/06	LAST MODIFIED: 2/07/05
PROJECT NO. 020506	MODIFIED BY: BJJ
SHEET: D1	

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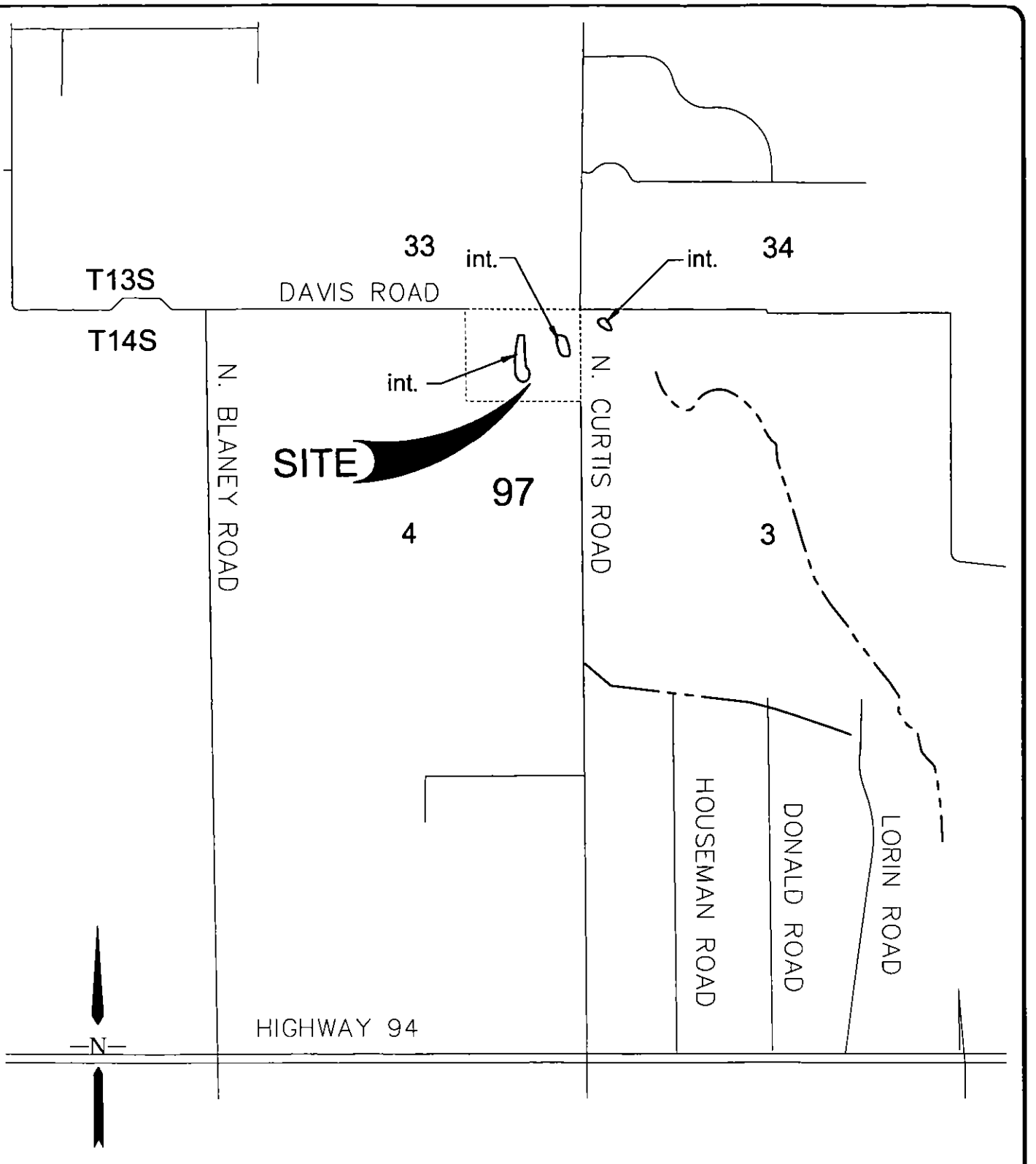
APPENDIX B

HYDROLOGIC CALCULATIONS



SCALE: 1"=1000'

(EL PASO COUNTY SOILS MAP NO. 18)

SCS SOILS MAP

JPS ENGINEERING

FALCON ACRES SUBDIVISION

FIGURE B

JPS PROJ NO. 020506

Almost all areas of this soil are used as rangeland. A few areas of crops such as alfalfa and corn are grown under sprinkler irrigation.

This soil is well suited to the production of native vegetation suitable for grazing. It is best suited to deep-rooted grasses. The native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, sideoats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover. Interseeding is used to improve the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand is the main limitation for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to openland and rangeland wildlife habitat. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitation of this soil for roads and streets is frost action potential. Special designs for roads are needed to minimize this limitation. Practices are needed to control soil blowing and water erosion on construction sites where the plant cover has been removed. Capability subclass VIe, nonirrigated.

96—Truckton sandy loam, 0 to 3 percent slopes. This deep, well drained soil formed in alluvium and residuum derived from arkosic sedimentary rock on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperatue is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is brown sandy loam about 16 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Blakeland loamy sand, 1 to 9 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; Ellicott loamy coarse sand, 0 to 5 percent slopes; and Ustic Torrifluvents, loamy.

Permeability of this Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazards of erosion and soil blowing are moderate.

This soil is used mainly for cultivated crops. It is also used for livestock grazing, for wildlife habitat, and as homesites.

Crops are commonly grown in combination with summer fallow because moisture is insufficient for annual cropping. Alfalfa can also be grown on this soil. When this soil is used as cropland, crop residue management and minimum tillage are necessary conservation practices.

This soil is well suited to the production of native vegetation suitable for grazing (fig. 7). It favors deep-rooted grasses. The native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, sideoats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover. Interseeding is used to improve the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitation of this soil for roads and streets is frost-action potential. Special designs for roads are needed to overcome this limitation. Capability subclasses IIIe, nonirrigated, and IIe, irrigated.

97—Truckton sandy loam, 3 to 9 percent slopes. This deep, well drained soil formed in alluvium and residuum derived from arkosic sedimentary rock on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is brown sandy loam about 16 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Blakeland loamy sand, 1 to 9 percent slopes; Bresser sandy loam, 3 to 5 percent slopes; and Truckton sandy loam, 0 to 3 percent slopes. Also included are small areas of soils that have arkosic sandstone or shale at a depth of less than 40 inches.

Permeability of this Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow to medium, and the hazards of erosion and soil blowing are moderate.

More than half of this soil is used as rangeland, for wildlife habitat, and as homesites. The rest, consisting of the less sloping areas, is used for wheat and sorghum. Rangeland or pastureland is the most suitable use because the permanent plant cover protects the soil.

This soil is well suited to the production of native vegetation suitable for grazing. Native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover from this soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are well suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of this soil for construction is frost-action potential. Special designs for roads are needed to overcome this limitation. Because of the sandy nature of the soil, practices must be provided to minimize surface runoff and thus keep erosion to a minimum. Access roads must have adequate cut-slope grade and be provided with drains to control surface runoff. Capability subclasses IVe, nonirrigated, and IVe, irrigated.

18—Truckton-Blakeland complex, 9 to 20 percent slopes. These strongly sloping to moderately steep soils are on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

The Truckton soil makes up about 60 percent of the complex, the Blakeland soil about 25 percent, and other soils about 15 percent.

Included with these soils in mapping are areas of Bresser sandy loam, 5 to 9 percent slopes, and Yoder gravelly sandy loam, 8 to 25 percent slopes.

The Truckton soil is deep and well drained. It formed in alluvium and residuum weathered from arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 5 inches thick. The next layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is brown sandy loam about 16 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Permeability of the Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high. Soil slippage is common on the upper part of slopes.

The Blakeland soil is deep and somewhat excessively drained. It formed in arkosic sandy alluvium and eolian sediment derived from arkosic sedimentary rock. Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The underlying material is brown loamy sand about 16 inches thick; it grades to pale brown sand that extends to a depth of 60 inches or more.

Permeability of the Blakeland soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is medium, and the hazard of erosion is moderate to high, and the hazard of soil blowing is high. Soil slippage is common on the upper part of slopes.

The soils in this complex are used for grazing livestock and wildlife habitat.

These soils are suited to the production of native vegetation suitable for grazing. The native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover from these soils. Interseeding improves the existing vegetation. Deferment of grazing in spring improves plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Soil blowing is the main limitation for the establishment of trees and shrubs on these soils. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Trees need to be planted in shallow furrows on the Blakeland soil because of its loose, sandy surface layer. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Tomah: [1]92, [1]93:							
Tomah part	B	None	---	---	>60	---	Moderate.
Crowfoot part	B	None	---	---	>60	---	Moderate.
Travessilla: [1]94:							
Travessilla part	D	None	---	---	6-20	Hard	Low.
Rock outcrop part	D	---	---	---	---	---	---
Truckton: 95, 96, 97	B	None	---	---	>60	---	Moderate.
[1]98:							
Truckton part	B	None	---	---	>60	---	Moderate.
Blakeland part	A	None	---	---	>60	---	Low.
[1]99, [1]100:							
Truckton part	B	None	---	---	>60	---	Moderate.
Bresser part	B	None	---	---	>60	---	Low.
Ustic Torrifluvents: 101	B	Occasional	Very brief	Mar-Aug	>60	---	Moderate.
Valent: 102, 103	A	None	---	---	>60	---	Low.
Vona: 104, 105	B	None	---	---	>60	---	Moderate.
Wigton: 106	A	None	---	---	>60	---	Low.
Wiley: 107, 108	B	None	---	---	>60	---	Low.
Yoder: 109, 110	B	None	---	---	>60	---	Low.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

Replaced with updated numbers.

Replace with Table 6-6 from City DCM (May 2014)

TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90

Replaced with criteria from EPC DCM.

Replace with current criteria

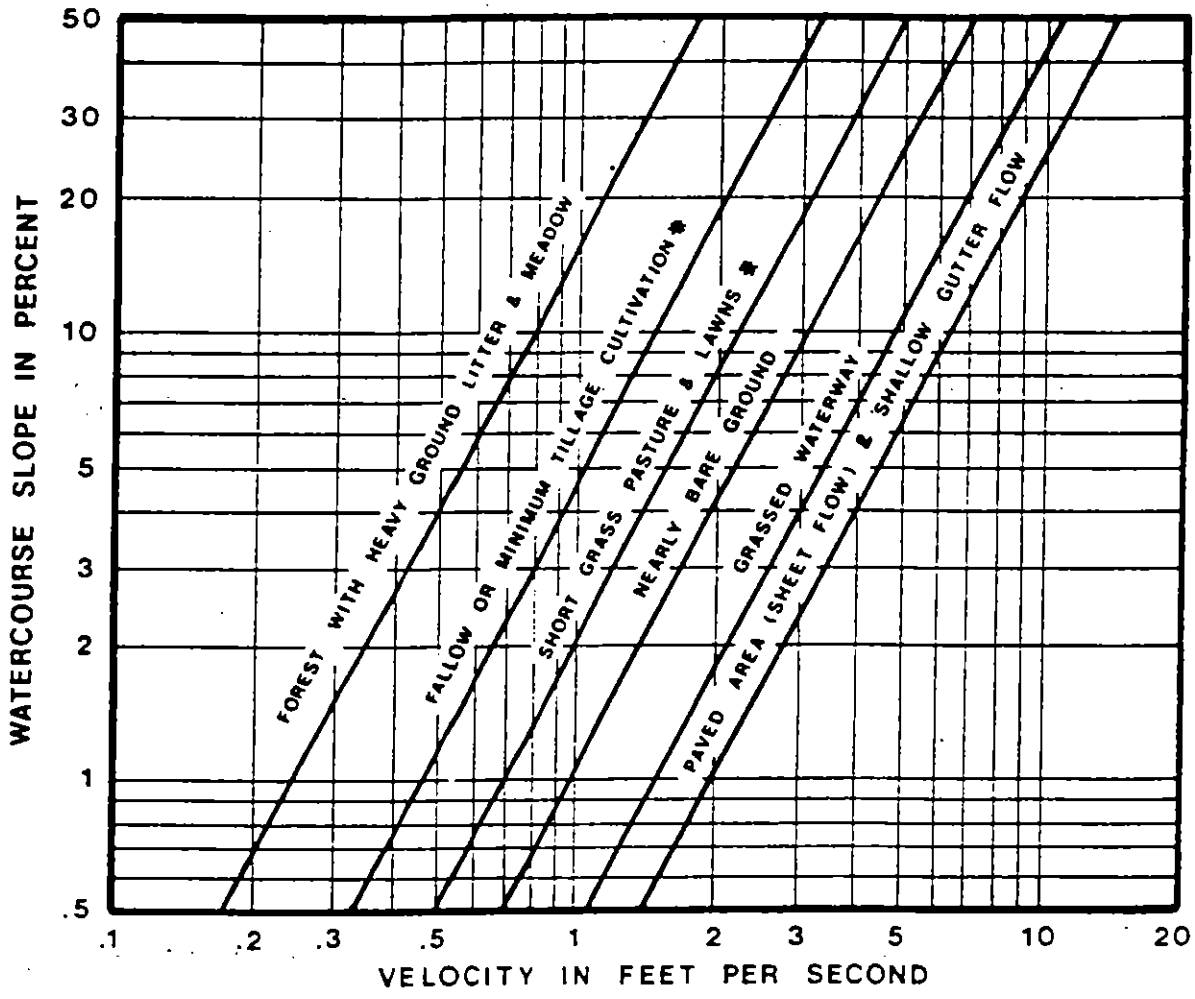


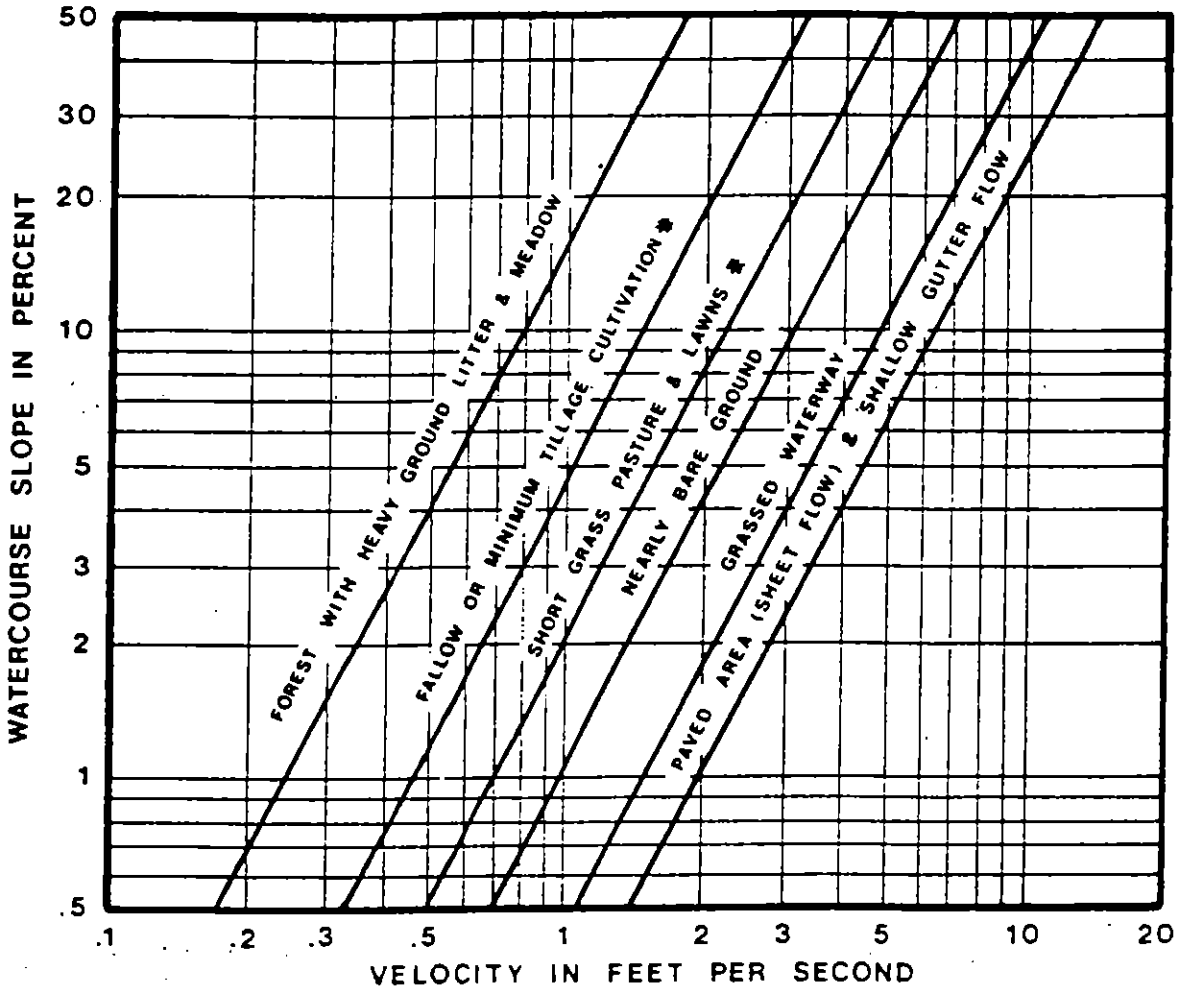
FIGURE 3-2. ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

* MOST FREQUENTLY OCCURRING "UNDEVELOPED" LAND SURFACES IN THE DENVER REGION.

REFERENCE: "Urban Hydrology For Small Watersheds" Technical Release No. 55, USDA, SCS Jan. 1975.

Replaced with criteria from EPC DCM.

Replace with current criteria



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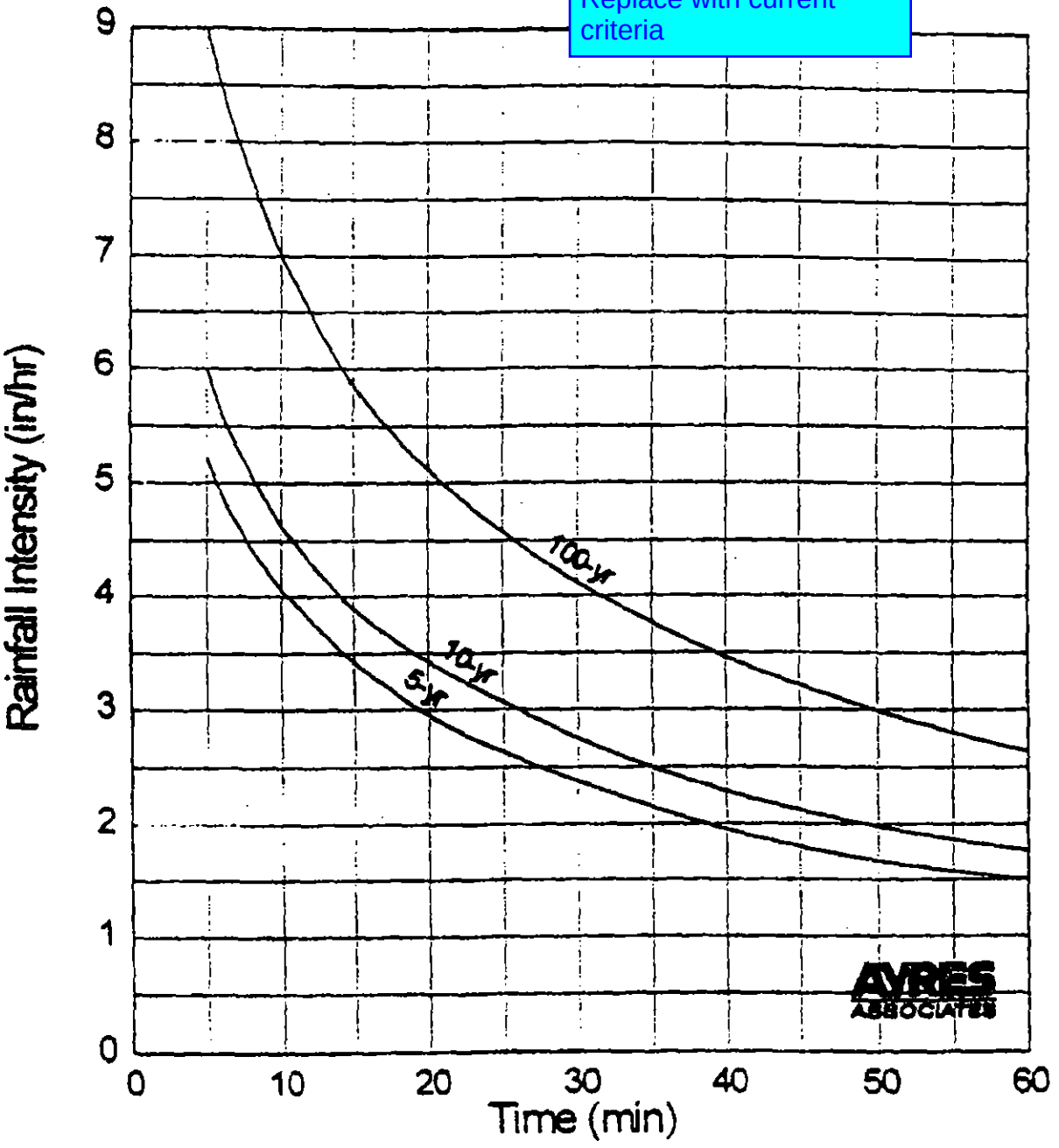
Replaced with criteria from EPC DCM.

Replace with current criteria



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

Updated data is now included with new submittal. Most of the sheets from previous report have been removed.

Hydrologic/hydraulic calculations will be reviewed on the resubmittal once all the input variables/criteria identified in the narrative have been updated to current standards.

FALCON ACRES SUBDIVISION

COMPOSITE RUNOFF COEFFICIENTS - TYPICAL 5-ACRE DEVELOPED RURAL RESIDENTIAL AREA

DEVELOPED CONDITIONS

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
5-ACRE LOTS	5.00	B	5.50	BLDG/DRIVEWAY	0.9	94.50	LAWN/MEADOW	0.25				0.286

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
5-ACRE LOTS	5.00	B	5.50	BLDG/DRIVEWAY	0.95	94.50	LAWN/MEADOW	0.35				0.383

Replaced with criteria from EPC DCM.

Max overland flow is 300 ft for non-urban land uses

FALCON ACRES
RATIONAL METHOD

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	OVERLAND LENGTH (FT)	SLOPE (%)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT K	SLOPE (%)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5]	PEAK FLOW
OA1	OA1	207.64	0.250	0.350	1000	1.0	48.4	4000	1.50	1.5	1.84	36.3	84.7		
OA2	OA2	483.90	0.250	0.350	1000	2.0	38.4	6400	1.50	2.5	2.37	45.0	83.4		
OA3		24.40	0.250	0.350	1000	3.8	31.0	200	1.50	1	1.50	2.2	33.2		
A		33.80	0.250	0.350	0		0.0	700	1.50	1.14	1.60	7.3	7.3		
OA1-OA3,A	A	749.74	0.250	0.350									92.0		
OB1		1.00	0.250	0.350	380	5.3	17.1					0.0	17.1		
B		15.48	0.250	0.350	0		0.0	700	1.50	0.5	1.06	11.0	11.0		
OB1,B	B	16.48	0.250	0.350									28.1		
Tc from A TO DP1								900	1.50	0.9	1.42	10.5	10.5		
OA1-OA3,OB1,A,B	1	766.22	0.250	0.350									102.5		

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	OVERLAND LENGTH (FT)	SLOPE (%)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT K	SLOPE (%)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	(IN/HR)	(IN/HR)	(CFS)	(CFS)
OA2.2		14.50	0.250	0.350	1000	2.0	38.4	300	1.50	5	3.35	1.5	39.9	1.95	3.50	7.07	17.76
A2		6.24	0.286	0.383	0		0.0	700	1.50	1.14	1.60	7.3	7.3				
OA2.2,A2	A2	20.74	0.261	0.360									47.2	1.70	3.10	9.20	23.14
OA2.1		469.40	0.250	0.350	1000	2.0	38.4	6400	1.50	2.5	2.37	45.0	83.4	1.50	2.65	176.03	435.37
A1		6.10	0.286	0.383	0		0.0	700	1.50	1.14	1.60	7.3	7.3				
OA2.1-OA2.2,A1-A2	A1	496.24	0.251	0.351									90.7	1.50	2.65	186.76	461.34
OA1	OA1	207.64	0.250	0.350	1000	1.0	48.4	4000	1.50	1.5	1.84	36.3	84.7	1.50	2.65	77.87	192.59
OA3		24.40	0.250	0.350	1000	3.8	31.0	200	1.50	1	1.50	2.2	33.2	2.20	3.85	13.42	32.88
A3.1		9.13	0.286	0.383	0		0.0	580	1.50	0.69	1.25	7.8	7.8				
OA3,A3.1	A3.1	33.53	0.260	0.359									41.0	1.90	3.40	16.55	40.93
A3.2		12.34	0.286	0.383	0		0.0	700	1.50	1.14	1.60	7.3	7.3				
OA1-OA3,A1-A3	A	749.75	0.252	0.351									98.0	1.50	2.65	282.98	698.35
OB1		1.00	0.250	0.350	380	5.3	17.1					0.0	17.1				
B		15.49	0.286	0.383	0		0.0	700	1.50	0.5	1.06	11.0	11.0				
OB1,B	B	16.48	0.284	0.381									28.1	2.50	4.20	11.69	26.37
Tc from A TO DP1								900	1.50	0.9	1.42	10.5	10.5				
OA1-OA3,OB1,A,B	1	766.23	0.252	0.352									108.5	1.50	2.65	290.00	714.99

1) OVERLAND FLOW Tco = (1.87*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = K * ((SLOPE(%))^0.5)
K = 0.25 FOR MEADOW
K = 1.0 FOR BARE SOIL
K = 1.5 FOR GRASS CHANNEL
K = 2.0 FOR PAVEMENT
3) GUTTER/SWALE FLOW, Tt = (GUTTER LENGTH/ SCS VELOCITY) / 60 SEC
4) Tc = Tco + Tt
5) IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
6) INTENSITY BASED ON I-D-F CURVE IN EL PASO COUNTY DRAINAGE CRITERIA MANUAL
7) Q = CIA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Replaced with criteria from EPC DCM.

TABLE 5-4
RUNOFF CURVE NUMBERS FOR HYDROL
COVER COMPLEXES - RURAL COND
(Antecedent Moisture Condition II, a
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

Replace with current criteria

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

< 50

CN 50 Used For Off-Site Existing w/Retention Storage

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

Replaced with criteria from EPC DCM.

Replace with current criteria

TABLE 5-5
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - URBAN AND SUBURBAN CONDITIONS 1/
(Antecedent Moisture Condition II)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

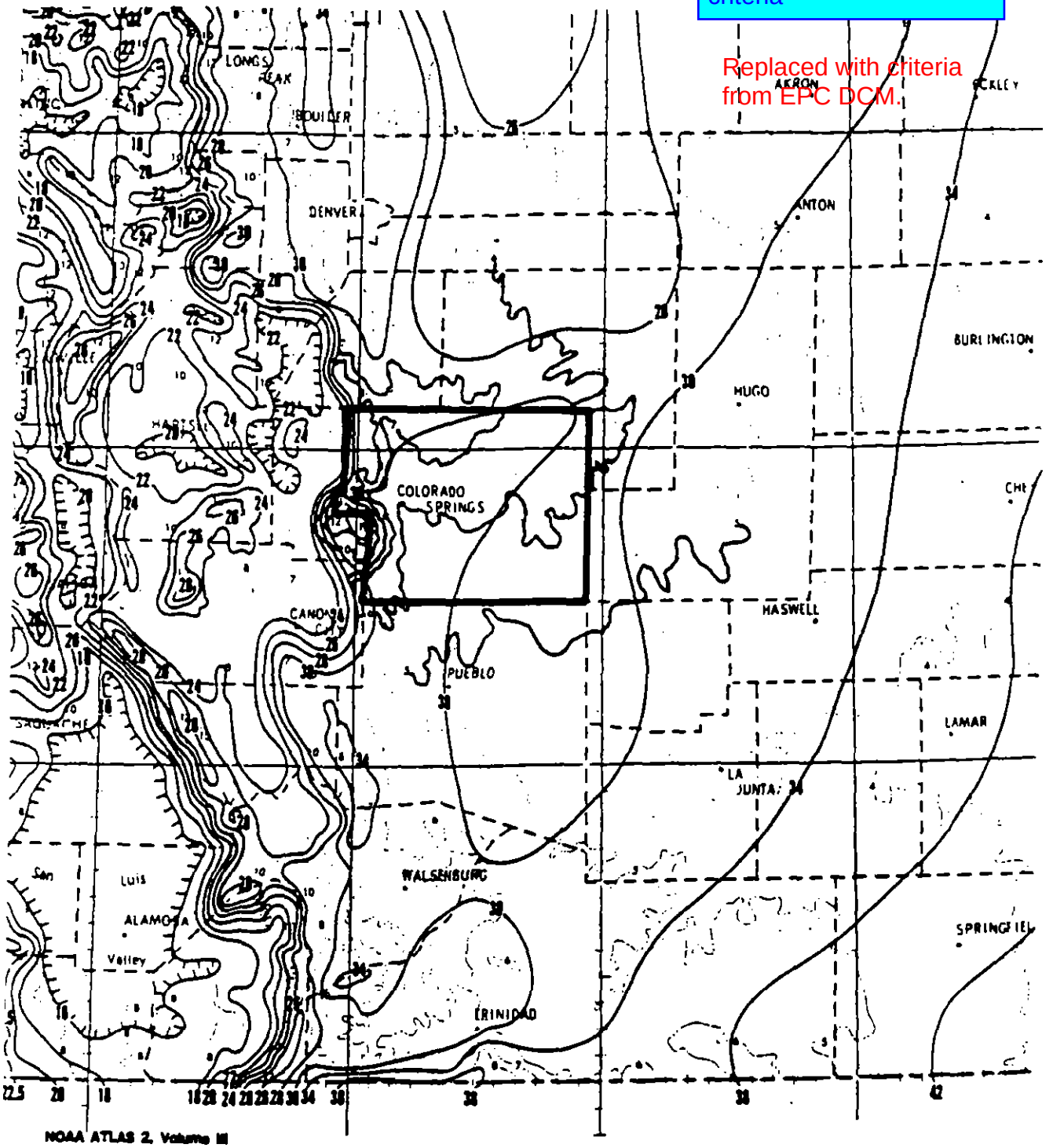
Land Use		Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition:	grass cover on 75% or more of the area	39*	61	74	80
Fair condition:	grass cover on 50% to 75% of the area	49*	69	79	84
Commercial and Business areas (85% Impervious)		89*	92	94	95
Industrial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

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

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

Replace with current criteria

Replaced with criteria from EPC DCM.



NOAA ATLAS 2, Volume III

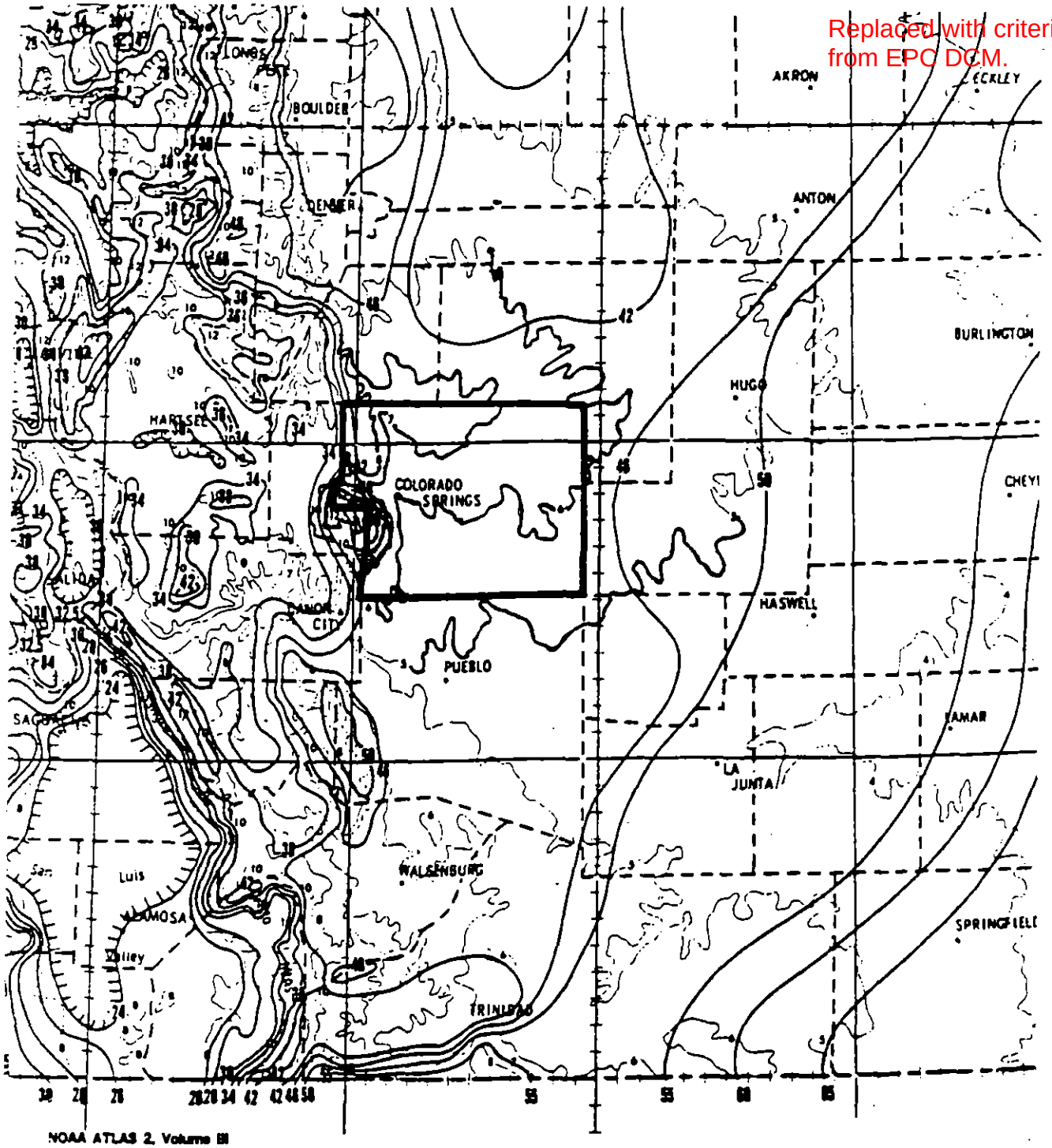
Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

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

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

Replace with current criteria

Replaced with criteria from EPC DCM.



NOAA ATLAS 2, Volume III

Prepared by U.S. Department of Commerce
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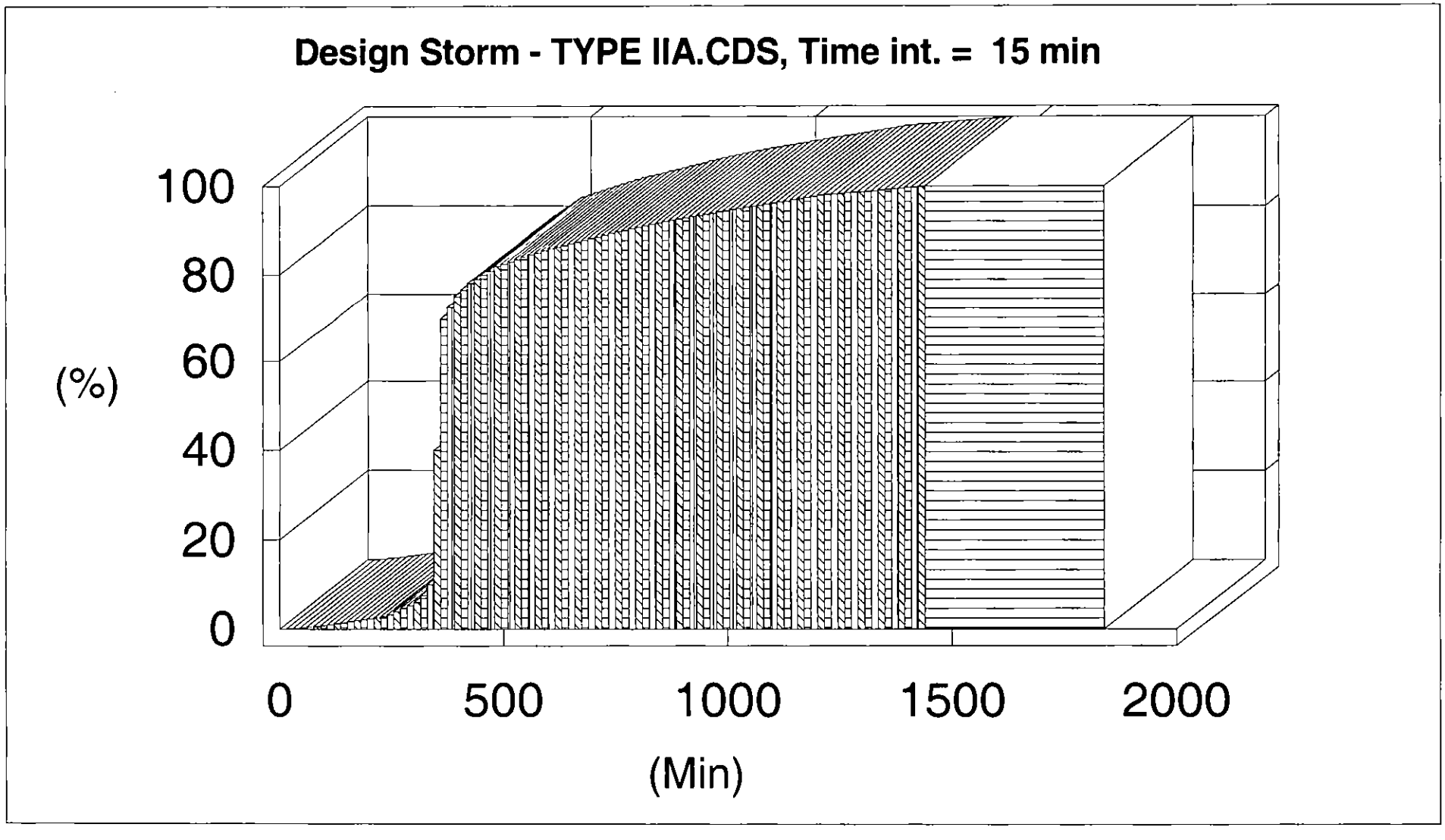
ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH


Design Storm - TYPE IIA.CDS, Time int. = 15 min
100
80
60
40
20
0
(%)
0
500
1000
1500
2000
(Min)

Hydrograph Plot

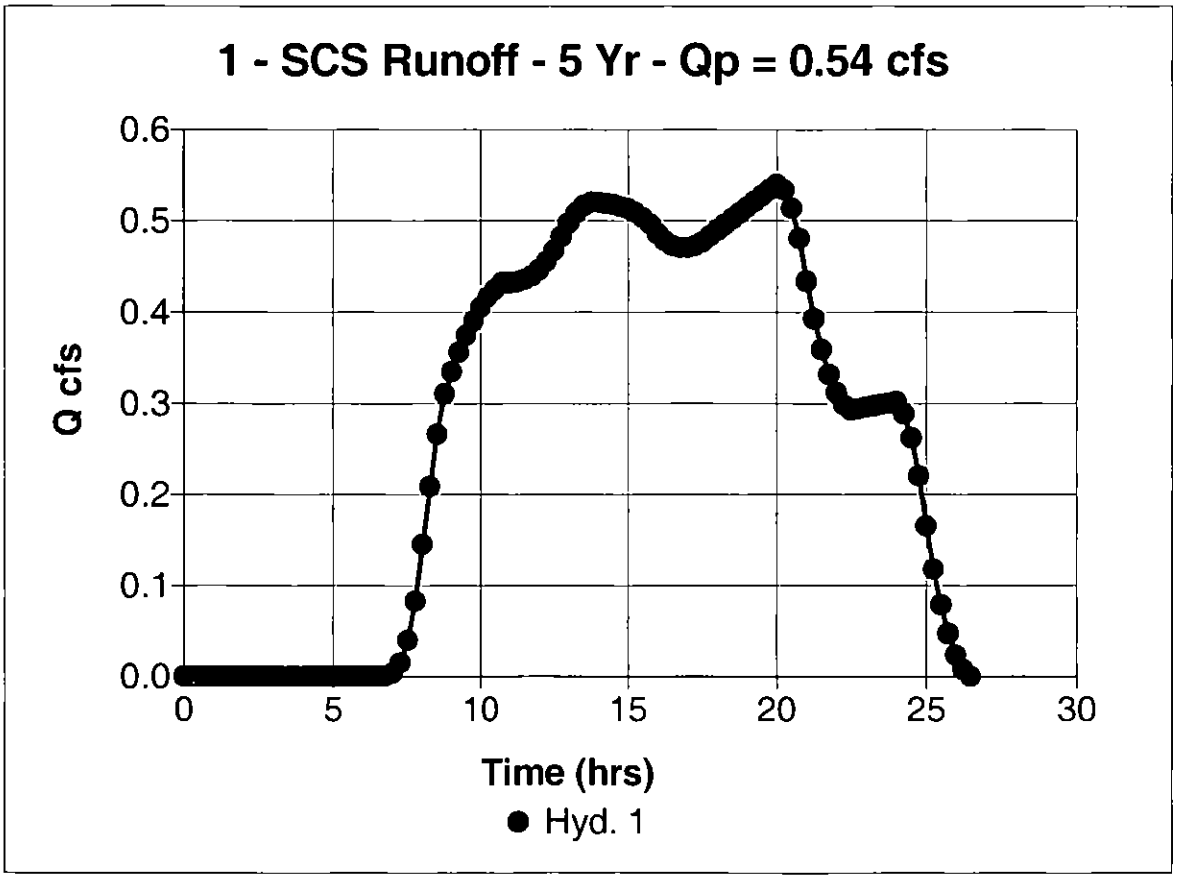
English

Hyd. No. 1

OA1-H

Hydrograph type	= SCS Runoff	Peak discharge	= 0.54 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 207.64 ac	Curve number	= 50
Basin Slope	= 1.4 %	Hydraulic length	= 6530 ft
Tc method	= USER	Time of conc. (Tc)	= 84.7 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 0.606 acft



Hydrograph Plot

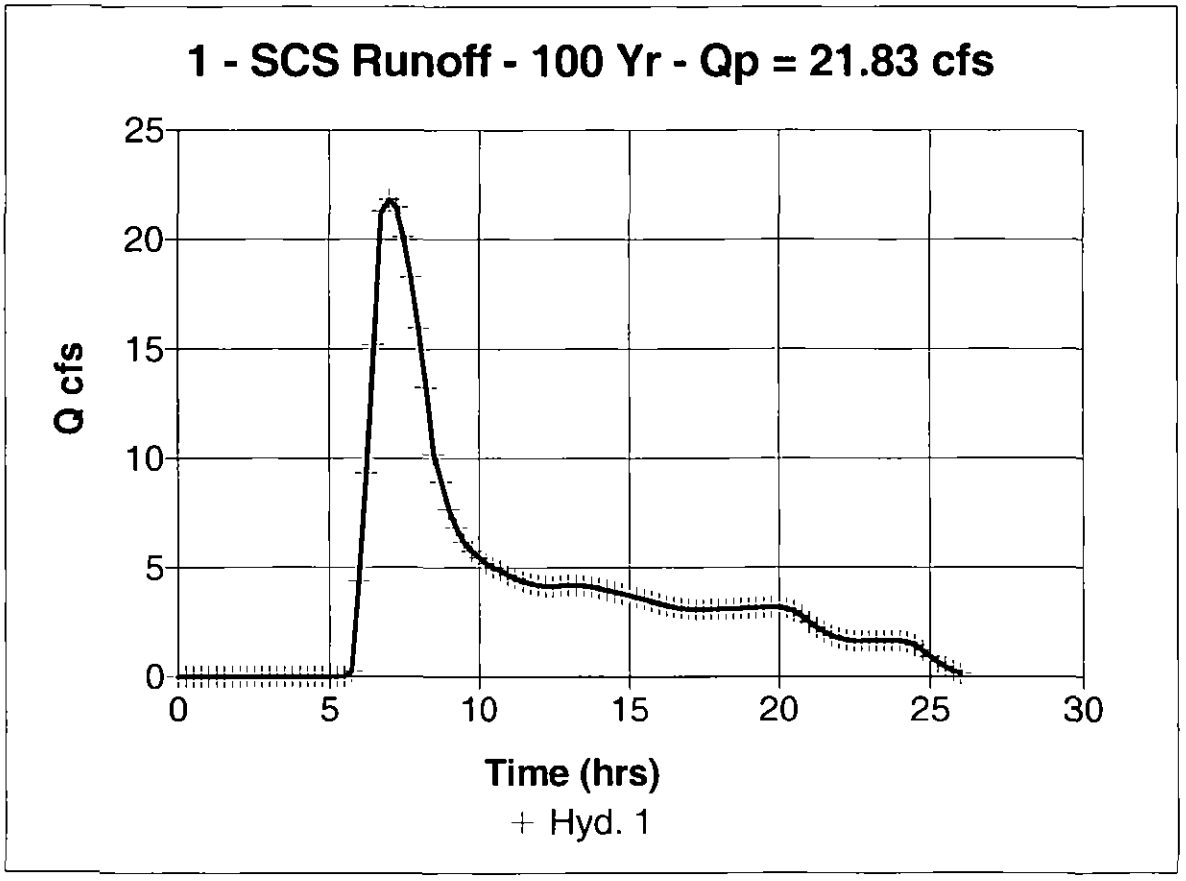
English

Hyd. No. 1

OA1-H

Hydrograph type	= SCS Runoff	Peak discharge	= 21.83 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 207.64 ac	Curve number	= 50
Basin Slope	= 1.4 %	Hydraulic length	= 6530 ft
Tc method	= USER	Time of conc. (Tc)	= 84.7 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 8.289 acft



Hydrograph Plot

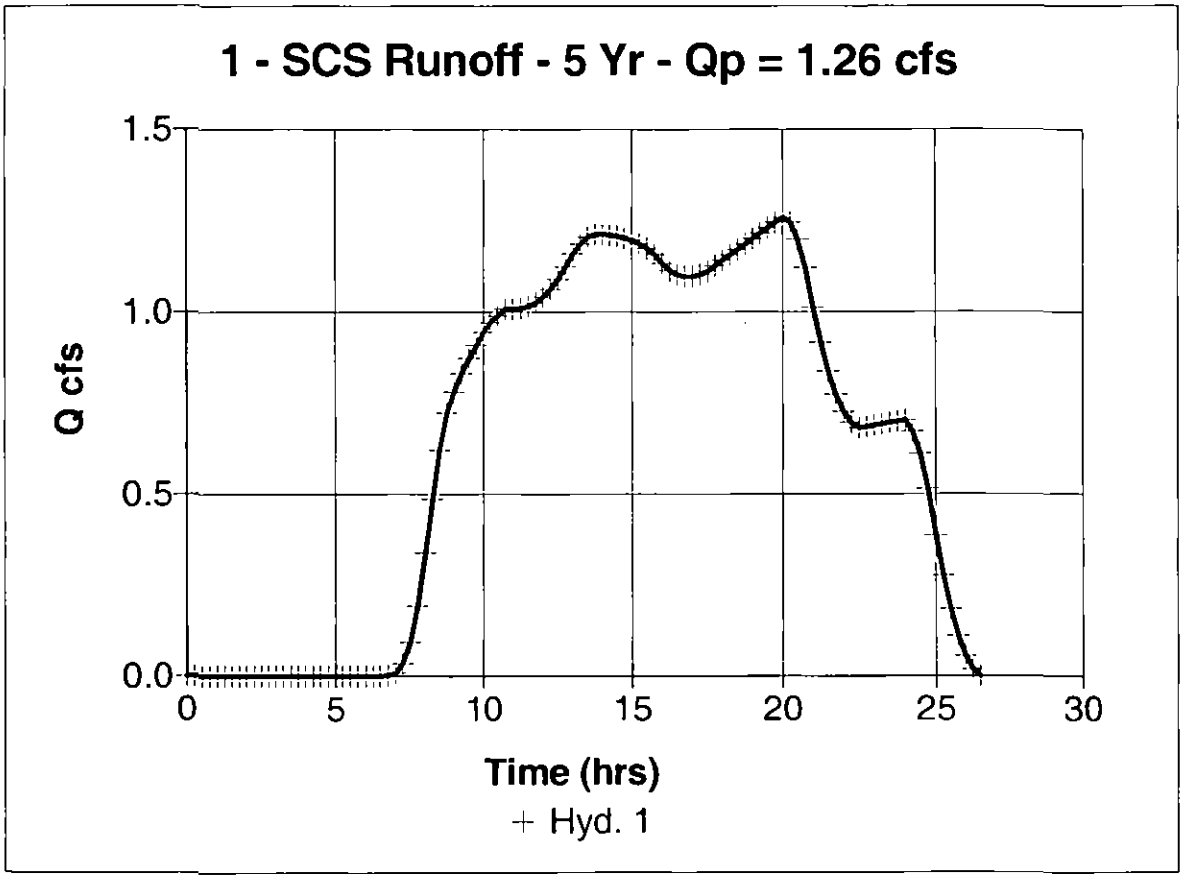
English

Hyd. No. 1

OA2-H

Hydrograph type	= SCS Runoff	Peak discharge	= 1.26 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 483.90 ac	Curve number	= 50
Basin Slope	= 2.4 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 92 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 1.412 acft



Hydrograph Plot

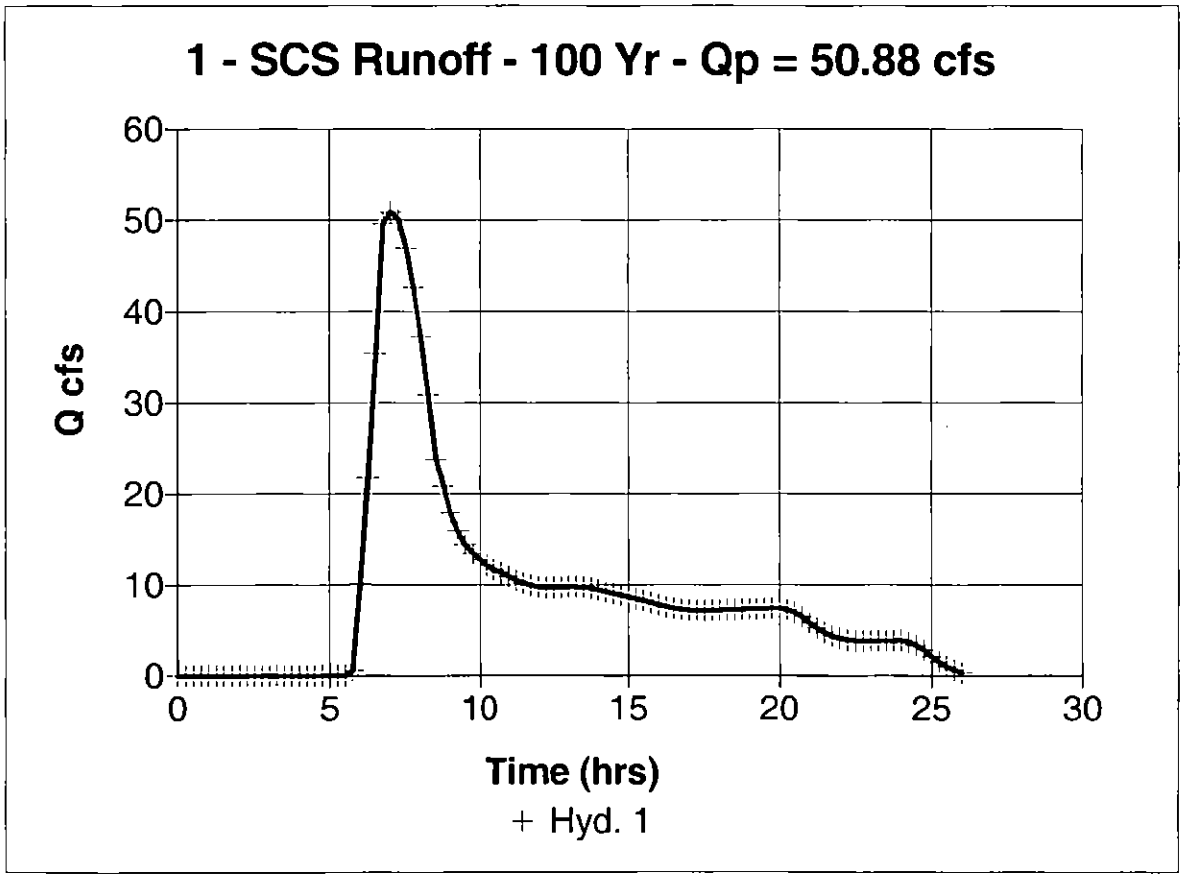
English

Hyd. No. 1

OA2-H

Hydrograph type	= SCS Runoff	Peak discharge	= 50.88 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 483.90 ac	Curve number	= 50
Basin Slope	= 2.4 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 83.4 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 19.317 acft



Hydrograph Plot

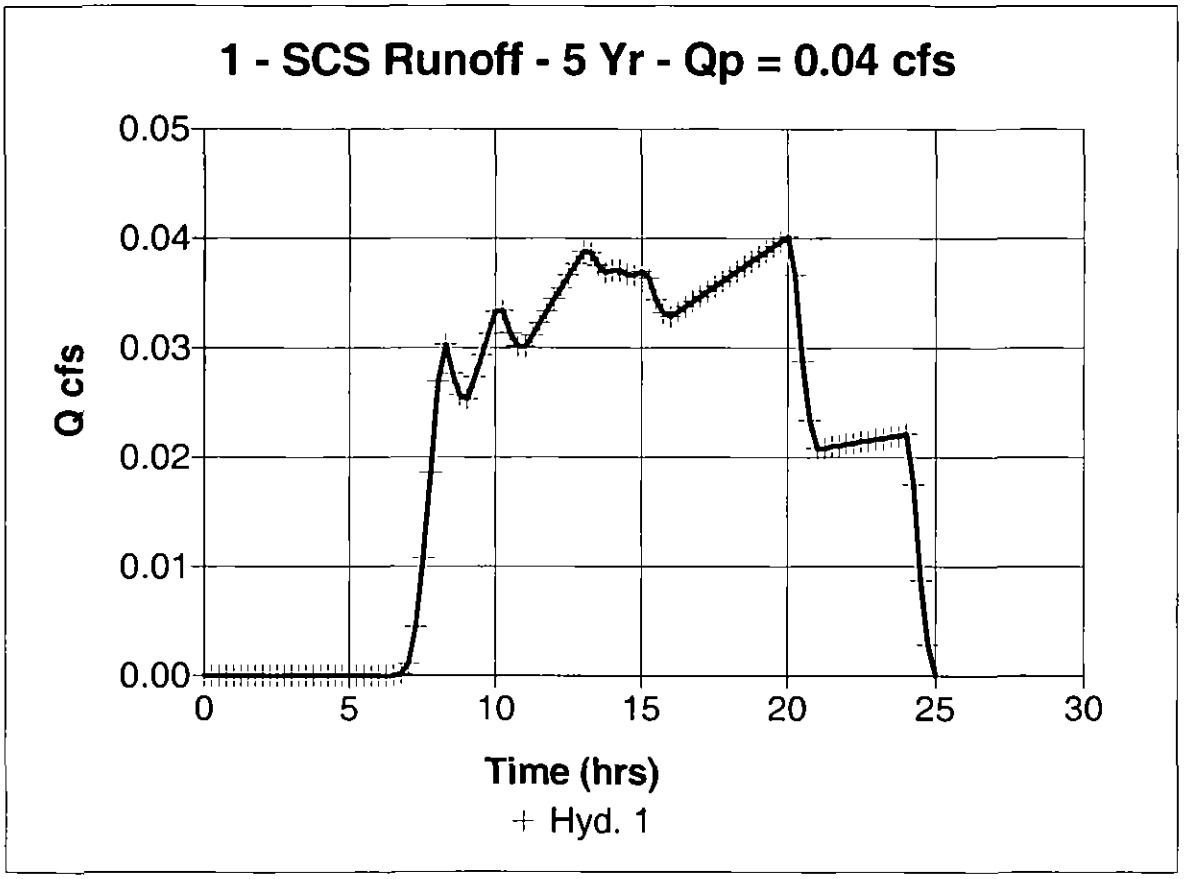
English

Hyd. No. 1

B-H

Hydrograph type	= SCS Runoff	Peak discharge	= 0.04 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 16.48 ac	Curve number	= 50
Basin Slope	= 2.6 %	Hydraulic length	= 1080 ft
Tc method	= USER	Time of conc. (Tc)	= 28.1 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 0.044 acft



Hydrograph Plot

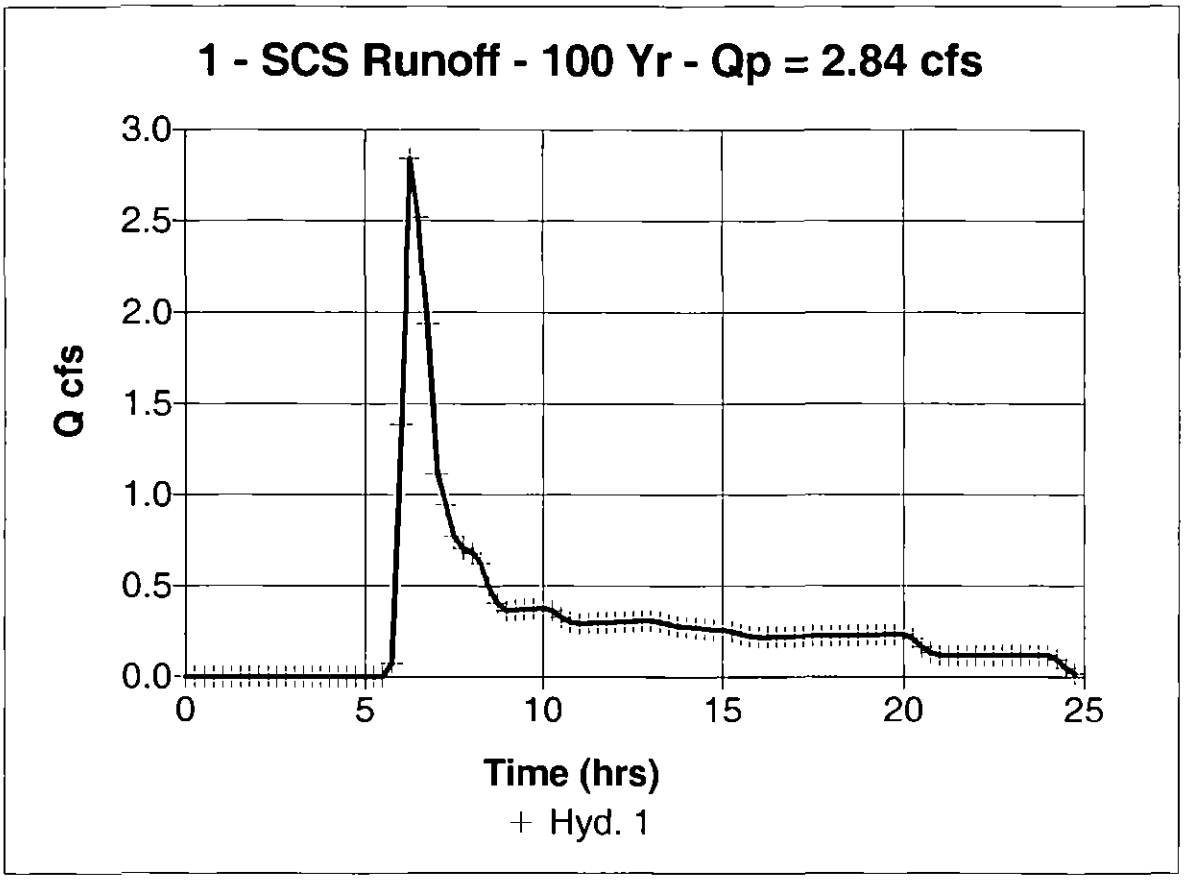
English

Hyd. No. 1

B-H

Hydrograph type	= SCS Runoff	Peak discharge	= 2.84 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 16.48 ac	Curve number	= 50
Basin Slope	= 2.6 %	Hydraulic length	= 1080 ft
Tc method	= USER	Time of conc. (Tc)	= 28.1 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 0.598 acft



Hydrograph Plot

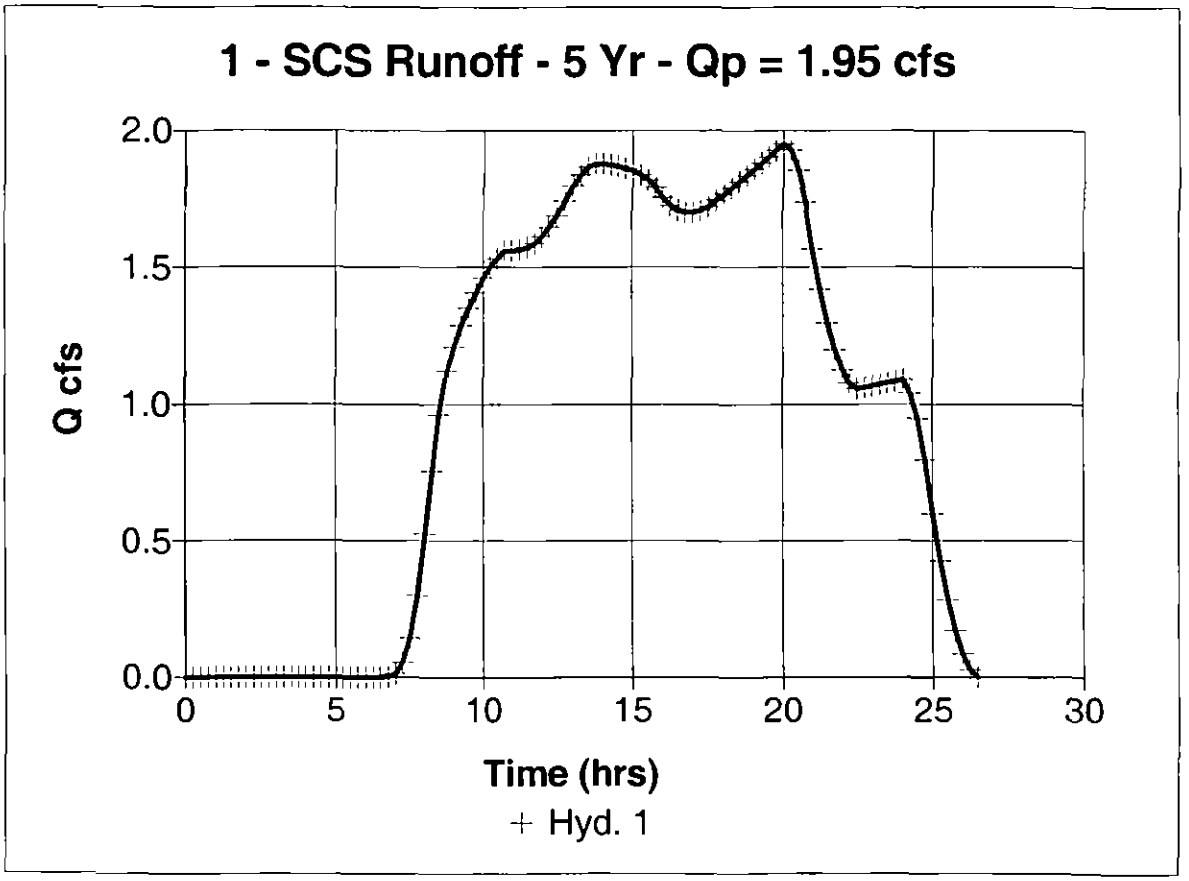
English

Hyd. No. 1

A-H

Hydrograph type	= SCS Runoff	Peak discharge	= 1.95 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 749.70 ac	Curve number	= 50
Basin Slope	= 1.3 %	Hydraulic length	= 5700 ft
Tc method	= USER	Time of conc. (Tc)	= 92 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 2.188 acft



Hydrograph Plot

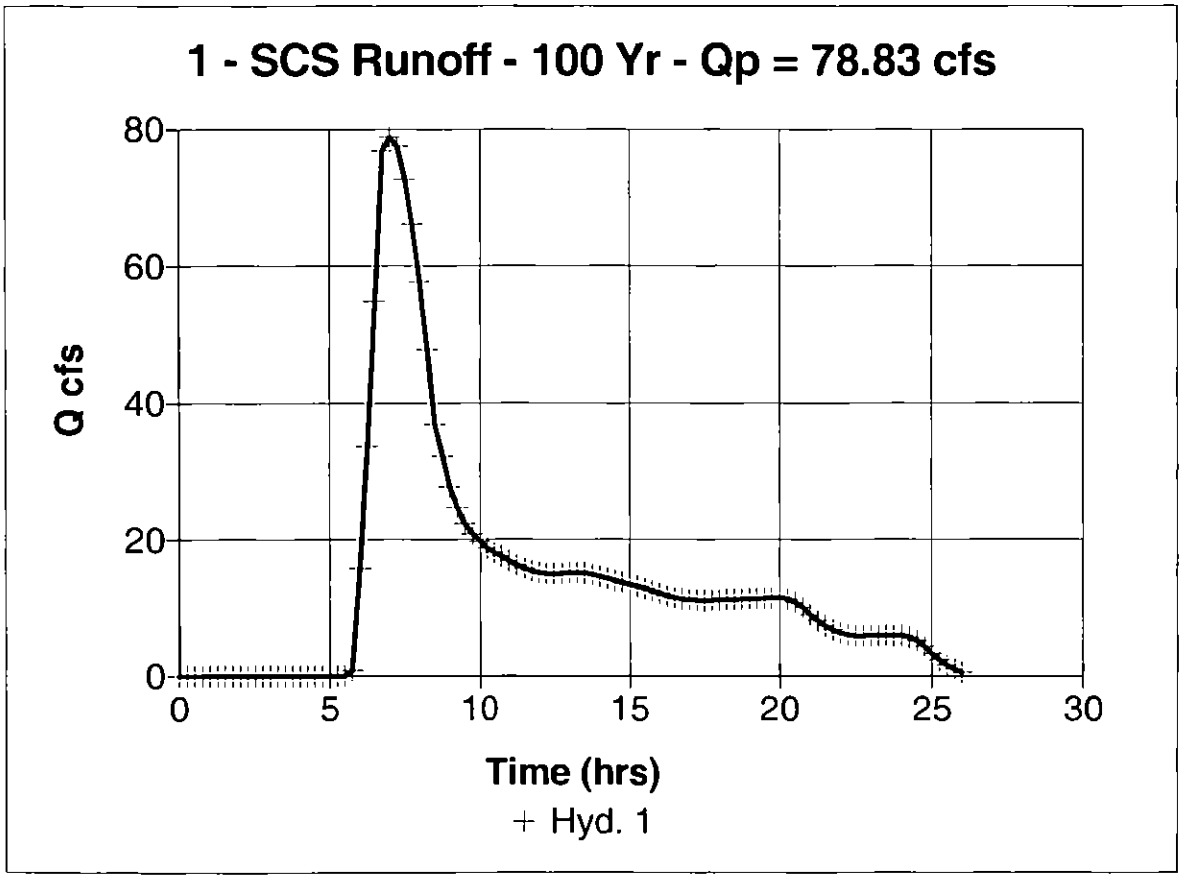
English

Hyd. No. 1

A-H

Hydrograph type	= SCS Runoff	Peak discharge	= 78.83 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 749.70 ac	Curve number	= 50
Basin Slope	= 1.3 %	Hydraulic length	= 5700 ft
Tc method	= USER	Time of conc. (Tc)	= 92 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 29.928 acft



Hydrograph Plot

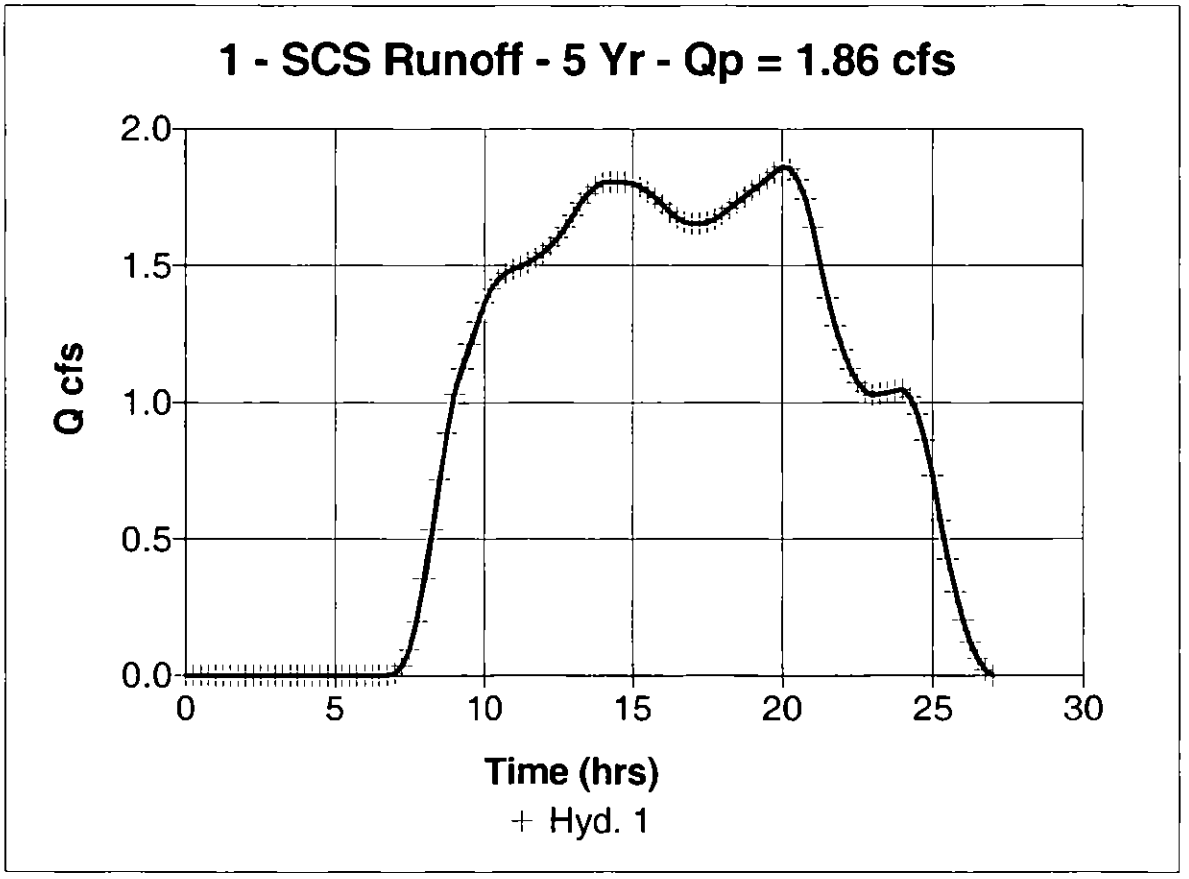
English

Hyd. No. 1

DP1-H

Hydrograph type	= SCS Runoff	Peak discharge	= 1.86 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 766.20 ac	Curve number	= 50
Basin Slope	= 2.1 %	Hydraulic length	= 9070 ft
Tc method	= USER	Time of conc. (Tc)	= 102.5 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 2.114 acft



Hydrograph Plot

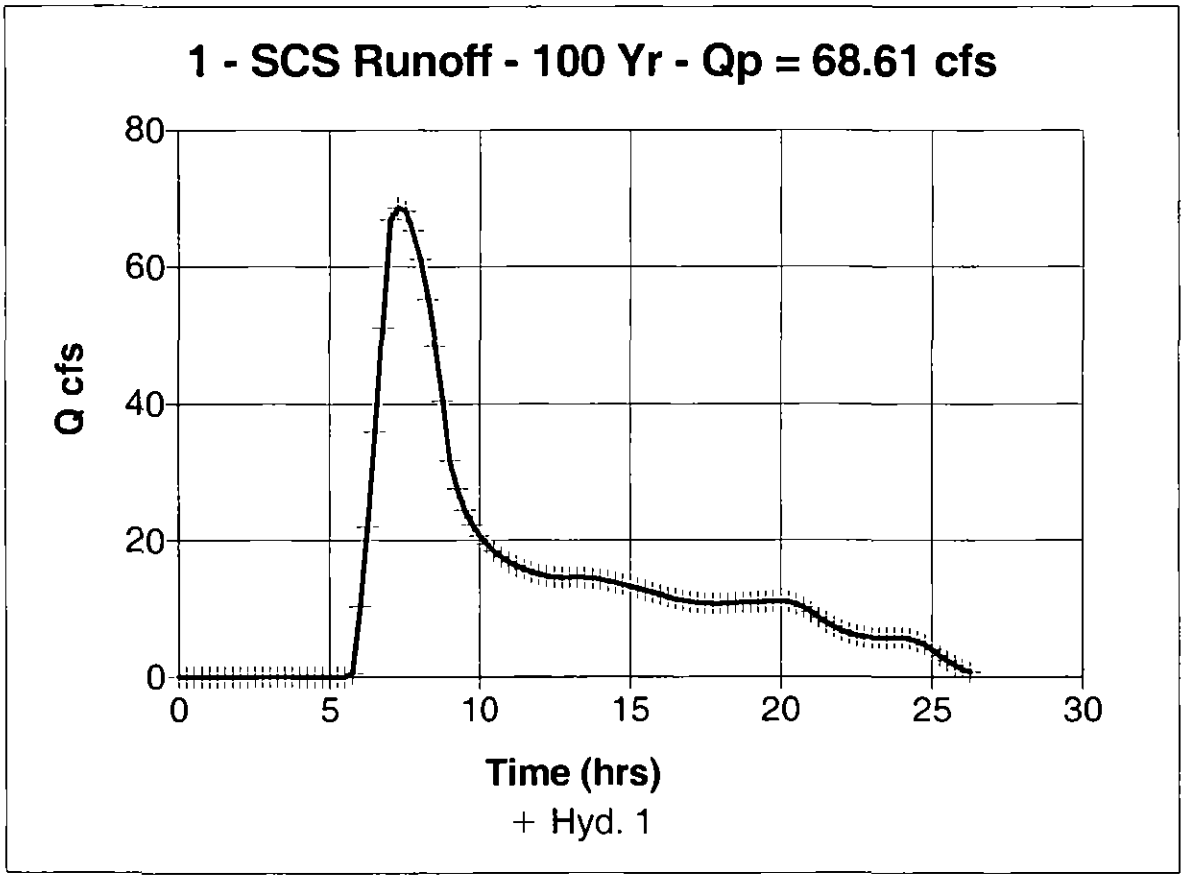
English

Hyd. No. 1

DP1-H

Hydrograph type	= SCS Runoff	Peak discharge	= 68.61 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 766.20 ac	Curve number	= 50
Basin Slope	= 2.1 %	Hydraulic length	= 9070 ft
Tc method	= USER	Time of conc. (Tc)	= 102.5 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 28.918 acft



Hydrograph Plot

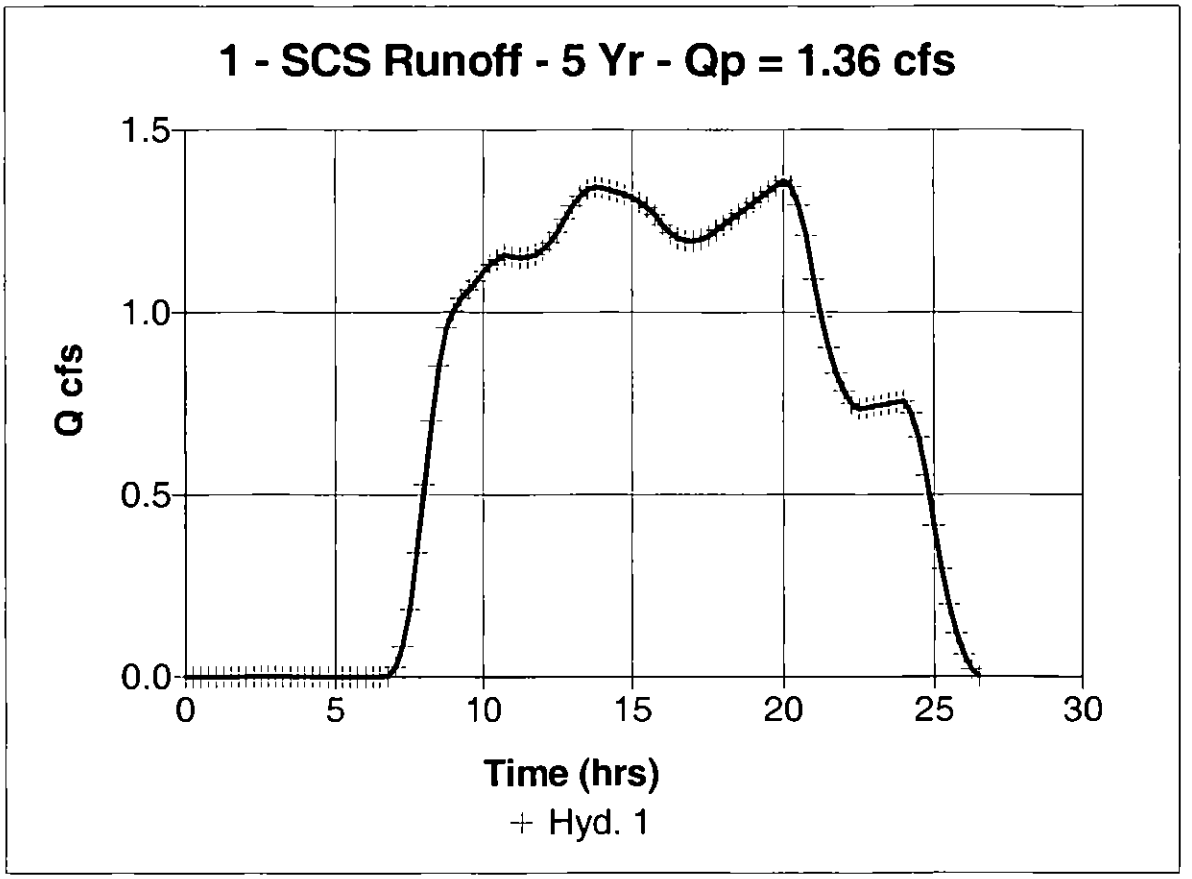
English

Hyd. No. 1

A1-D

Hydrograph type	= SCS Runoff	Peak discharge	= 1.36 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 496.20 ac	Curve number	= 50.3
Basin Slope	= 1.4 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 83.4 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 1.580 acft



Hydrograph Plot

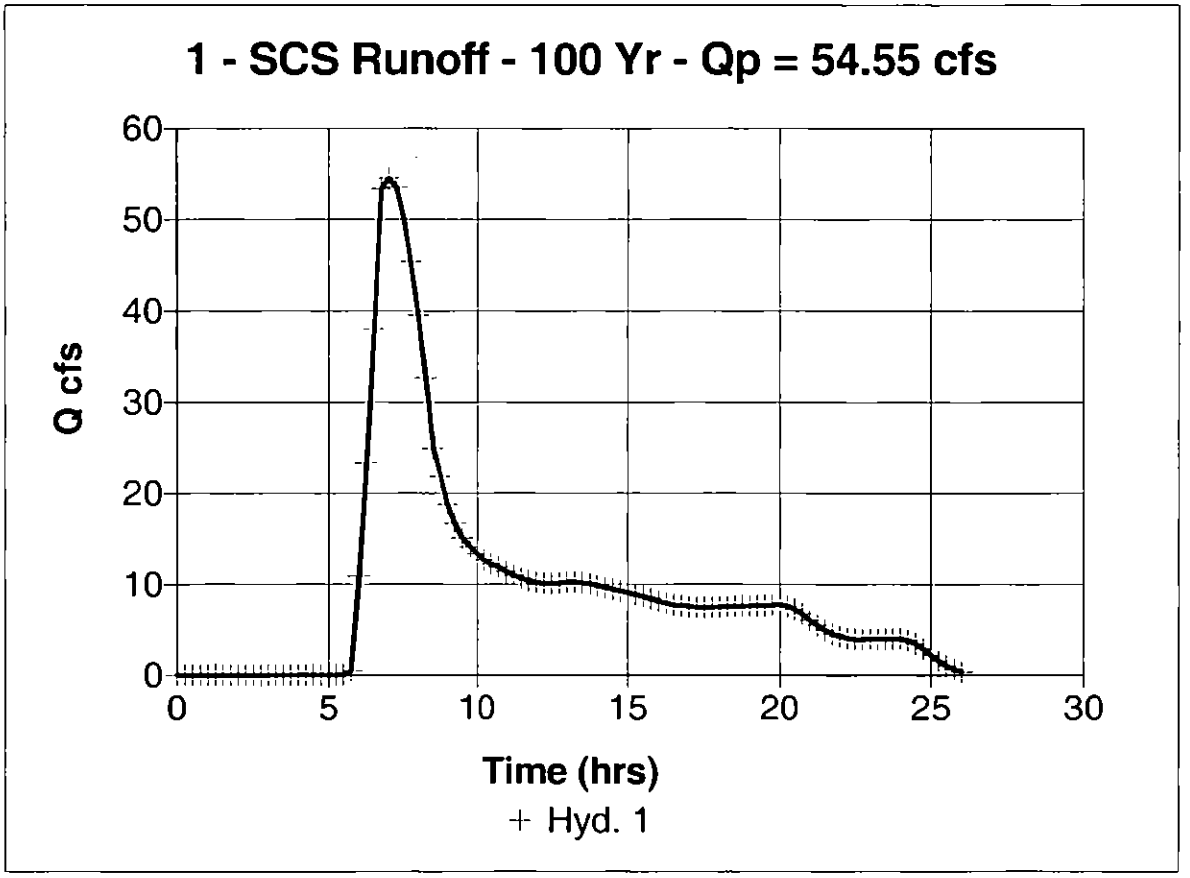
English

Hyd. No. 1

A1-D

Hydrograph type	= SCS Runoff	Peak discharge	= 54.55 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 496.20 ac	Curve number	= 50.3
Basin Slope	= 1.4 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 83.4 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 20.360 acft



Hydrograph Plot

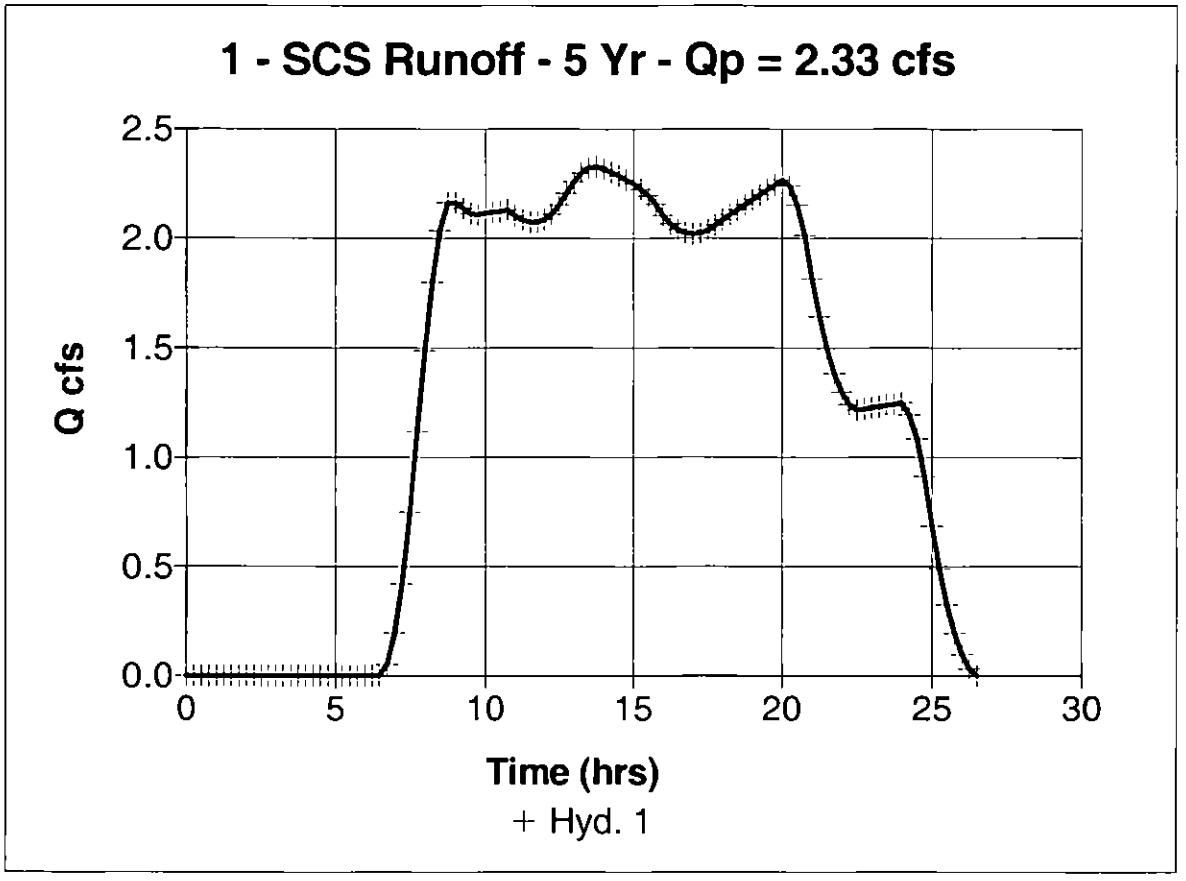
English

Hyd. No. 1

A-D

Hydrograph type	= SCS Runoff	Peak discharge	= 2.33 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 749.80 ac	Curve number	= 50.9
Basin Slope	= 1.1 %	Hydraulic length	= 5700 ft
Tc method	= USER	Time of conc. (Tc)	= 92 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 2.810 acft



Hydrograph Plot

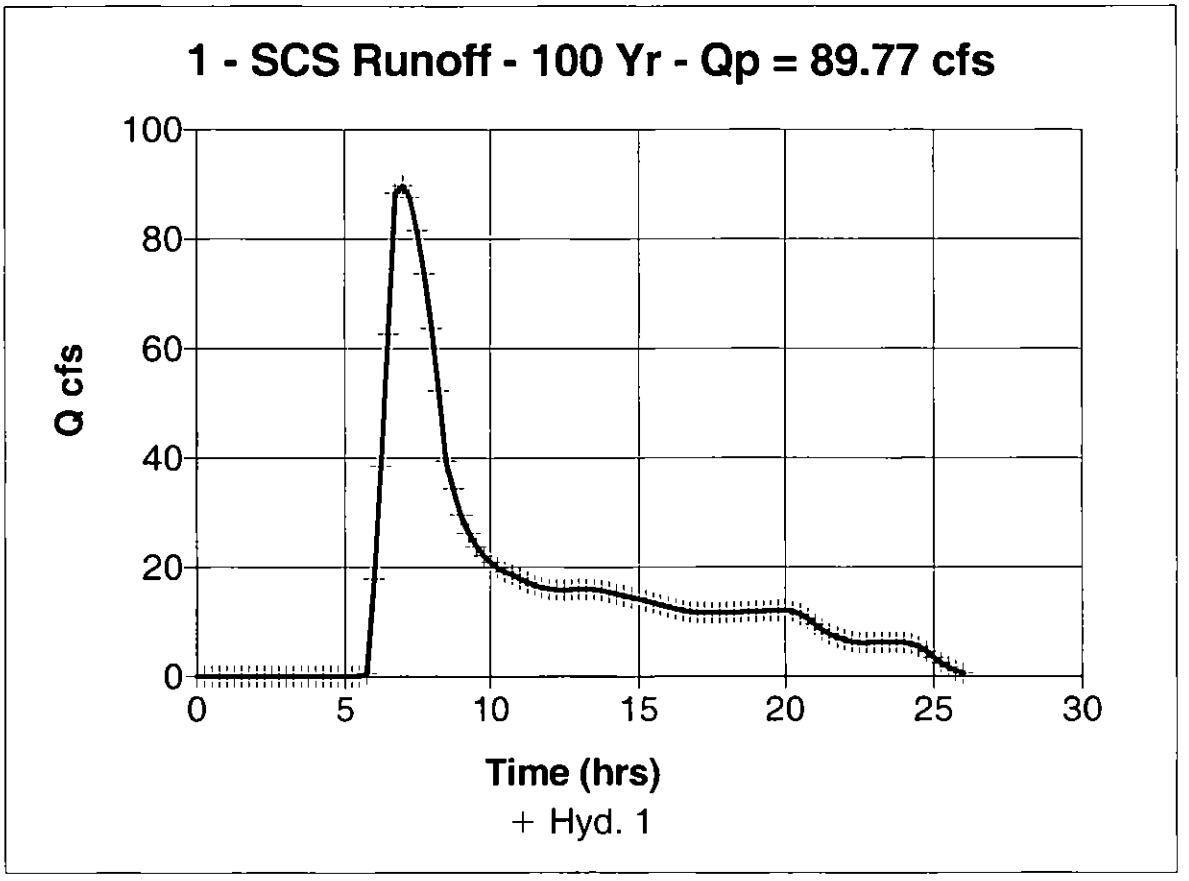
English

Hyd. No. 1

A-D

Hydrograph type	= SCS Runoff	Peak discharge	= 89.77 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 749.80 ac	Curve number	= 50.9
Basin Slope	= 1.1 %	Hydraulic length	= 5700 ft
Tc method	= USER	Time of conc. (Tc)	= 92 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 32.462 acft



Hydrograph Plot

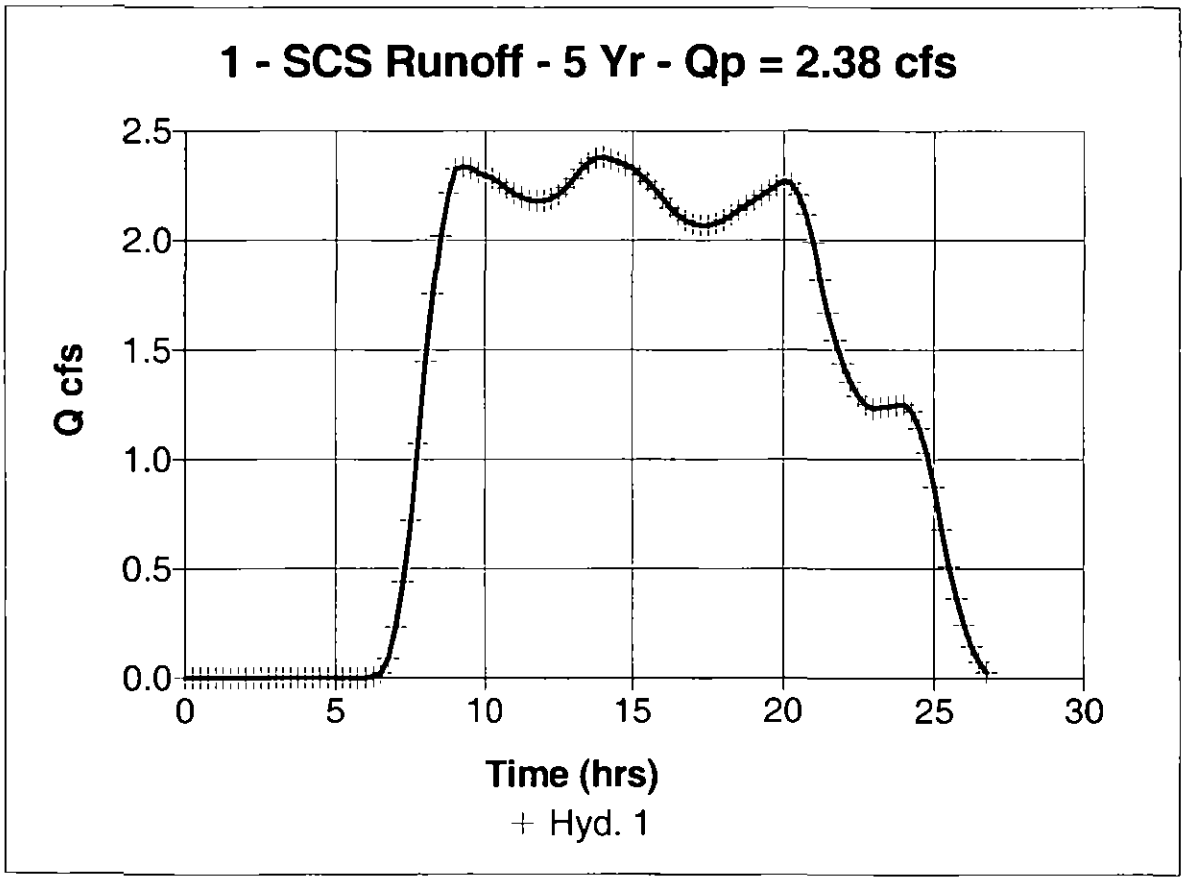
English

Hyd. No. 1

DP1-D

Hydrograph type	= SCS Runoff	Peak discharge	= 2.38 cfs
Storm frequency	= 5 yrs	Time interval	= 15 min
Drainage area	= 766.20 ac	Curve number	= 51.2
Basin Slope	= 2.1 %	Hydraulic length	= 1080 ft
Tc method	= USER	Time of conc. (Tc)	= 102.5 min
Total precip.	= 2.60 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 2.930 acft



Hydrograph Plot

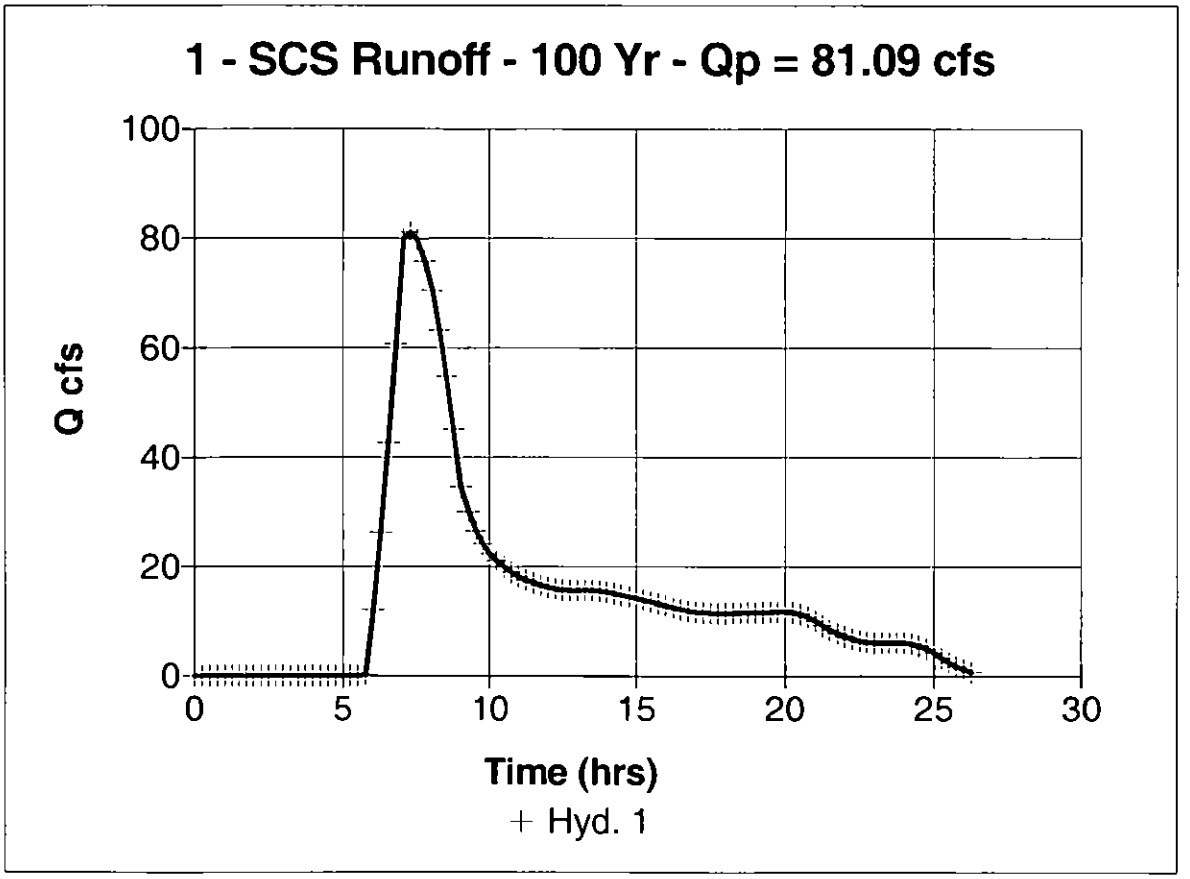
English

Hyd. No. 1

DP1-D

Hydrograph type	= SCS Runoff	Peak discharge	= 81.09 cfs
Storm frequency	= 100 yrs	Time interval	= 15 min
Drainage area	= 766.20 ac	Curve number	= 51.2
Basin Slope	= 2.1 %	Hydraulic length	= 1080 ft
Tc method	= USER	Time of conc. (Tc)	= 102.5 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= TYPE IIA.CDS	Shape factor	= 484

Total Volume = 32.195 acft



FALCON ACRES SUBDIVISION

COMPOSITE RUNOFF CURVE NUMBERS - TYPICAL 5-ACRE DEVELOPED RURAL RESIDENTIAL LOT

DEVELOPED CONDITIONS

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	CN	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	CN	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	CN	WEIGHTED C VALUE
5-ACRE LOTS	5.00	B	5.50	BLDG/DRIVEWAY	98	94.50	LAWN/MEADOW	61				63.035

FALCON ACRES
COMPOSITE RUNOFF CURVE NUMBERS

DEVELOPED CONDITIONS

BASIN	TOTAL AREA (AC)	SOIL TYPE	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	CN	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	CN	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	CN	WEIGHTED CN-VALUE
OA2.1,OA2.2	483.90	B	483.90	MEADOW	50							50.000
A1,A2	12.30	B	12.30	5-AC LOTS	63.035							63.035
OA2, A1	496.20	B										50.323
OA1	207.64	B	207.64	MEADOW	50							50.000
OA3	24.48	B	24.48	MEADOW	61							61.000
A3	21.50	B	21.50	5-AC LOTS	63.035							63.035
OA1-OA3,A1,A2	749.82	B										50.947
OB1	1.00	B	1.00	MEADOW	61							61.000
B	15.48	B	15.48	5-AC LOTS	63.035							63.035
OB1,B	16.48	B										62.912
OA1-OA3,OB1,A1,A2,B	766.30	B										51.204

FALCON ACRES SUBDIVISION
SCS METHOD - HYDROLOGY SUMMARY

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	AREA (SM)	CURVE NUMBER (CN)	HIGH ELEV. (FT)	LOW ELEV. (FT)	H (FT)	CHANNEL LENGTH (FT)	CHANNEL LENGTH (MI)	SLOPE (%)	Tc [1] (MIN)	PEAK FLOW Q5 [2] (CFS)	PEAK FLOW Q100 [2] (CFS)
OA1	OA1	207.64	0.32	50	6600	6530	70	5000	0.95	1.4%	84.70	0.5	21.8
OA2	OA2	483.9	0.76	50	6720	6540	180	7400	1.40	2.4%	83.40	1.3	50.9
OA1-OA3,A	A	749.74	1.17	50	6600	6528	72	5700	1.08	1.3%	92.00	2.0	78.8
OB1, B	B	16.48	0.03	50	6556	6528	28	1080	0.20	2.6%	28.10	0.04	2.8
OA1-OA3,OB1,A,B	1	766.2	1.20	50	6720	6528	192	9070	1.72	2.1%	102.50	1.9	68.6

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	AREA (SM)	CURVE NUMBER (CN)	HIGH ELEV. (FT)	LOW ELEV. (FT)	H (FT)	CHANNEL LENGTH (FT)	CHANNEL LENGTH (MI)	SLOPE (%)	Tt [1] (HR)	PEAK FLOW Q5 [3] (CFS)	PEAK FLOW Q100 [3] (CFS)
OA2.1-OA2.2,A1-A2	A1	496.24	0.78	50.323	6720	6540	180	7400	1.40	2.4%	83.40	1.4	54.6
OA1-OA3,A1-A3	A	749.78	1.17	50.947	6600	6528	72	5700	1.08	1.3%	92.00	2.3	89.8
OB1, B	B	16.48	0.03	62.91	6556	6528	28	1080	0.20	2.6%	28.10	1.7	11.7
OA1-OA3,OB1,A,B	1	766.2	1.20	51.204	6720	6528	192	9070	1.72	2.1%	102.50	2.4	81.1

* Refer to Rational Method Calculations for Developed Flows at Design Points A2 and A3.1

1) DESIGN RAINFALL: 5-YR, 24-HR = 2.6 IN; 100-YR, 24-HR = 4.4 IN
2) Tc FROM RATIONAL METHOD CALCULATION TABLE
3) PEAK FLOWS CALCULATED BY INTELISOLVE "HYDRAFLOW" PROGRAM

APPENDIX C

HYDRAULIC CALCULATIONS

FALCON ACRES SUBDIVISION
CHANNEL CALCULATIONS
DEVELOPED FLOWS

PROPOSED CHANNELS

CHANNEL	DESIGN POINT	PROPOSED SLOPE (%)	BOTTOM WIDTH (B, FT)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	Q100 FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	CHANNEL LINING
A2 (WEST DITCH)	A2	0.50	0	6:1/3:1	2.5	0.030	23.1	1.4	2.7	GRASS
A2 (WEST DITCH)	A2	3.71	0	6:1/3:1	2.5	0.030	23.1	1.0	5.7	**GRASS/ECB**
A3	A1	0.50	4	4:1	3.0	0.030	54.6	1.6	3.4	GRASS
A (OVERFLOW)	A	1.54	4	4:1	3.0	0.030	89.8	1.5	5.9	**GRASS/ECB**
B (OVERFLOW)	1	1.30	4	4:1	3.0	0.030	81.1	1.5	5.4	**GRASS/ECB**

1) Channel flow calculations based on Manning's Equation
2) Channel depth includes 1' minimum freeboard
3) n = 0.03 for grass-lined non-irrigated channels (minimum)
4) n = 0.035 for riprap-lined channels
5) Vmax = 5 fps per El Paso County criteria (p. 10-13) for fescue (dry land grass) for 100-year flows

Add the product specification in the drainage report.

North American Green calculations were used to choose specific product. Those products have been identified on Proposed Drainage Map and Construction Drawings.

Worksheet
Worksheet for Trapezoidal Channel

Ditch A2 (West Side of [redacted] Way) Peaceful Rain

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	005000	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	0.00	ft
Discharge	23.10	cfs

$= Q_{100}$

Results		
Depth	1.38	ft
Flow Area	8.6	ft²
Wetted Perim	12.77	ft
Top Width	12.44	ft
Critical Depth	1.10	ft
Critical Slope	0.016572	ft/ft
Velocity	2.69	ft/s
Velocity Head	0.11	ft
Specific Energ	1.49	ft
Froude Numb	0.57	
Flow Type	Subcritical	

< 5 fps ✓

Worksheet

Worksheet for Trapezoidal Channel

Ditch A2

Project Description	
Worksheet	Trapezoidal Chann
Flow Element	Trapezoidal Chann
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	037100	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	0.00	ft
Discharge	23.10	cfs = Q_{100}

Results		
Depth	0.95	ft
Flow Area	4.1	ft²
Wetted Perim	8.77	ft
Top Width	8.54	ft
Critical Depth	1.10	ft
Critical Slope	0.016572	ft/ft
Velocity	5.70	ft/s → Use ECB Lining
Velocity Head	0.51	ft
Specific Energ	1.45	ft
Froude Numb	1.46	
Flow Type	Supercritical	

Worksheet
Worksheet for Trapezoidal Channel

Channel A3 (Ref. A1)

Project Description	
Worksheet	Trapezoidal Chann
Flow Element	Trapezoidal Chann
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	005000	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	4.00	ft
Discharge	54.60	cfs

$= Q_{HW}$

Results		
Depth	1.57	ft
Flow Area	16.1	ft²
Wetted Perim	16.93	ft
Top Width	16.55	ft
Critical Depth	1.22	ft
Critical Slope	0.014615	ft/ft
Velocity	3.39	ft/s
Velocity Head	0.18	ft
Specific Ener	1.75	ft
Froude Numb	0.61	
Flow Type	Subcritical	

Worksheet
Worksheet for Trapezoidal Channel

Basin A
Overflow Channel

Project Description	
Worksheet	Trapezoidal Chann
Flow Element	Trapezoidal Chann
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	015400	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	4.00	ft
Discharge	89.80	cfs = Q_{100}

Results		
Depth	1.52	ft
Flow Area	15.4	ft²
Wetted Perim	16.55	ft
Top Width	16.18	ft
Critical Depth	1.57	ft
Critical Slope	0.013653	ft/ft
Velocity	5.85	ft/s → Use ECB Lining
Velocity Head	0.53	ft
Specific Energ	2.05	ft
Froude Numb	1.06	
Flow Type	Supercritical	

Worksheet
Worksheet for Trapezoidal Channel

Channel B

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	013000	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	4.00	ft
Discharge	81.10	cfs

= Q_{100}

Results		
Depth	1.51	ft
Flow Area	15.2	ft²
Wetted Perim	16.45	ft
Top Width	16.08	ft
Critical Depth	1.49	ft
Critical Slope	0.013843	ft/ft
Velocity	5.35	ft/s
Velocity Head	0.44	ft
Specific Energ	1.95	ft
Froude Numb	0.97	
Flow Type	Subcritical	

→ Use ECB Lining

JPS Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666
Project Engineer: John P. Schwab

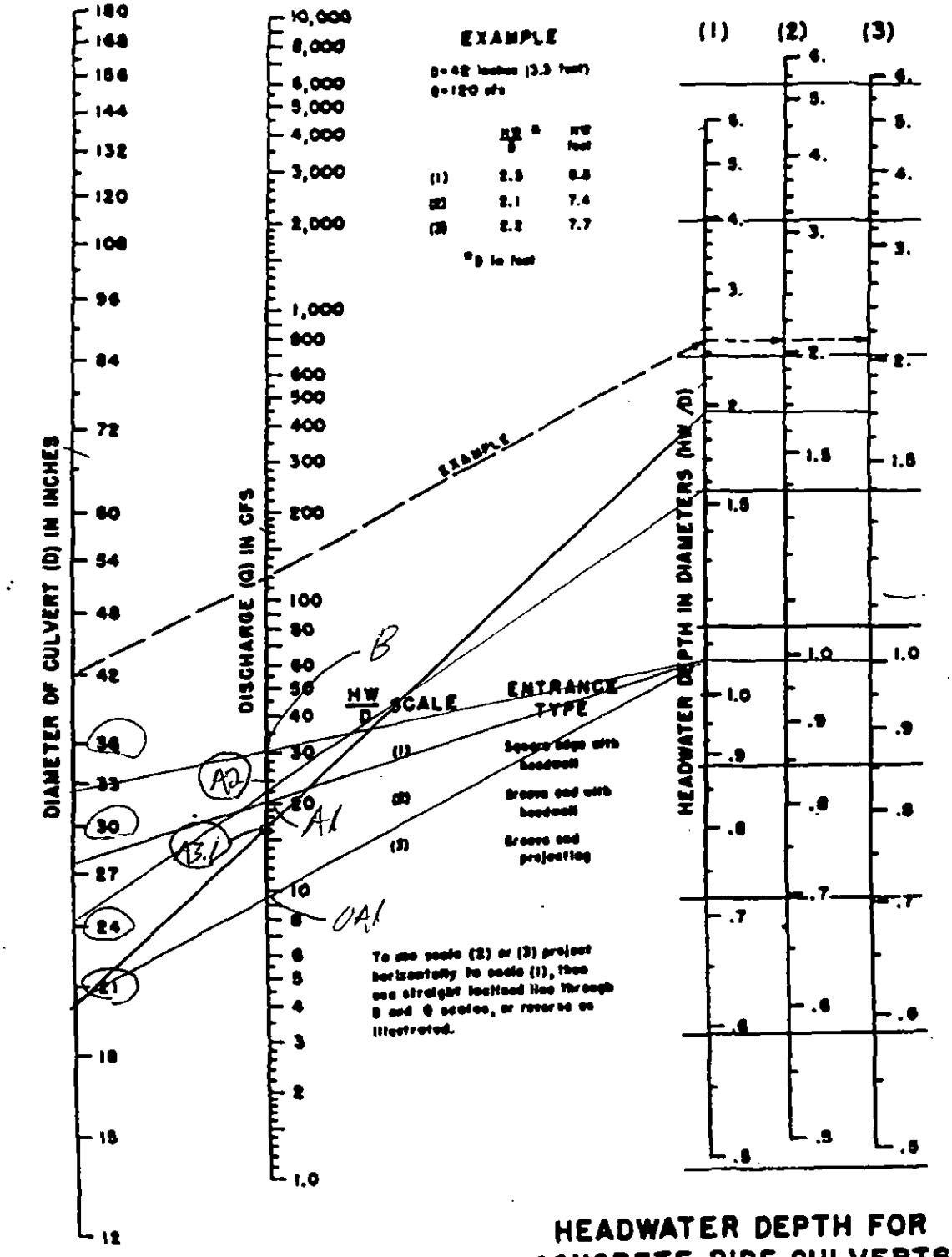
JPS ENGINEERING

FALCON ACRES
CULVERT SIZING SUMMARY

Design Point	Peak Flow (Q_5, cfs)	Maximum HW/D at Q_5	Peak Flow (Q_{100}, cfs)	Culvert Size (in)	Riprap Size
OA1	0.5	1.0	21.8	24" RCP	Type M
A1	1.4	1.0	54.6	36" RCP	Type M
A2	9.2	1.0	23.1	24" RCP	Type M
A3.1	16.6	1.7	40.9	21" RCP *	Type M
B	7.4	**	7.4	14"x23" HERCP *	Type M

* Culvert B is nominally sized for overflow of retention areas only

Falcon Acres



HEADWATER SCALES 2 & 3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

JPS ENGINEERING

FALCON ACRES
DRIVEWAY CULVERT SIZING SUMMARY

Design Point	Drainage Basin	Basin Peak Flow (Q_5, cfs)	% of Basin at Driveway Culvert	Driveway Peak Flow (Q_5, cfs)	Culvert Size (in)
Private Culverts:					
Lot 1	A1	1.4	10%	0.14	18"
Lot 2	A2	9.2	100%	9.2	18"
Lot 3	A3	2.3	100%	2.3	18"
Lot 4, 7, 8	A3.1	16.6	100%	16.6	21"
Lot 5, 6	OA1	0.5	100%	0.5	18"

- Culvert Capacity based on Inlet Control Nomographs (Fig. 9-32, assuming RCP or HDPE Culverts)

JPS ENGINEERING

FALCON ACRES
CULVERT SIZING SUMMARY (HY8 PROGRAM INPUT/OUTPUT SUMMARY)

Culvert	Selected Pipe Size	Road CL EL	Inv. In EL	Inv. Out EL	L (ft)	Q_5 (cfs)	Allowable [a] 5-Yr. HW	Calc. 5-Year HW	Q_{100} (cfs)	Allowable [b] 100-Yr. HW	Calc. 100-Yr. HW	Riprap Size D_{50} (in)
A1	36" RCP	6534.62	6529.00	6528.50	62	1.4	6530.50	6529.31	54.6	6534.44	6533.06	M (12")

[a] Maximum allowable 5-year HW/D = 1.0.
[b] Maximum allowable 100-year headwater depth is 6 inches above shoulder.

CURRENT DATE: 12-11-2007 FILE DATE: 12-11-2007
CURRENT TIME: 14:24:38 FILE NAME: CURT-A1

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS	SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	6529.31	6529.00	62.00	1	RCP	3.00	3.00	.013	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: CURT-A1 DATE: 12-11-2007

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
6529.31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6531.17	17.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6531.50	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6533.06	51.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6534.32	68.3	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6536.01	85.3	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6538.06	102.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6540.46	119.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6543.27	136.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6546.83	153.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
6551.80	170.7	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CURT-A1 DATE: 12-11-2007

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
6529.31	0.000	0.00	0.00	0.00
6531.17	0.000	17.07	0.00	0.00
6531.50	0.000	22.60	0.00	0.00
6533.06	0.000	51.21	0.00	0.00
6534.32	0.000	68.28	0.00	0.00
6536.01	0.000	85.35	0.00	0.00
6538.06	0.000	102.42	0.00	0.00
6540.46	0.000	119.49	0.00	0.00
6543.27	0.000	136.56	0.00	0.00
6546.83	0.000	153.63	0.00	0.00
6551.80	0.000	170.70	0.00	0.00

CURRENT DATE: 12-11-2007 FILE DATE: 12-11-2007
CURRENT TIME: 14:24:38 FILE NAME: CURT-A1

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	6529.31	0.00	0.00	0-NF	0.00	0.00	0.00	%-6529.00	0.00	0.00
17.07	6531.17	1.86	1.86	1-S2n	1.24	1.31	1.25	%-6529.00	6.13	0.00
22.60	6531.50	2.19	2.19	1-S2n	1.46	1.53	1.46	%-6529.00	6.63	0.00
51.21	6533.06	3.73	3.75	2-M2c	3.00	2.32	2.32	%-6529.00	8.74	0.00
68.28	6534.32	5.01	4.87	2-M2c	3.00	2.62	2.62	%-6529.00	10.46	0.00
85.35	6536.01	6.70	6.39	2-M2c	3.00	2.89	2.89	%-6529.00	12.30	0.00
102.42	6538.07	8.76	8.06	6-S2n	3.00	3.00	2.90	%-6529.00	14.75	0.00
119.49	6540.46	11.15	9.99	6-S2n	3.00	3.00	2.90	%-6529.00	17.20	0.00
136.56	6543.27	13.96	12.23	6-S2n	3.00	3.00	2.90	%-6529.00	19.66	0.00
153.63	6546.83	17.52	14.76	6-S2n	3.00	3.00	2.90	%-6529.00	22.12	0.00
170.70	6551.80	22.49	17.59	6-S2n	3.00	3.00	2.90	%-6529.00	24.58	0.00

El. inlet face invert 6529.31 ft El. outlet invert 6529.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	6529.31 ft
OUTLET STATION	62.00 ft
OUTLET ELEVATION	6529.00 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0050
CULVERT LENGTH ALONG SLOPE	62.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.013
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END PROJECTION
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-2007 FILE DATE: 12-11-2007
CURRENT TIME: 14:24:38 FILE NAME: CURT-A1

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ***********

BOTTOM WIDTH	0.00 ft
SIDE SLOPE H/V (X:1)	0.0
CHANNEL SLOPE V/H (ft/ft)	0.000
MANNING'S n (.01-0.1)	0.000
CHANNEL INVERT ELEVATION	0.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	6529.00 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	0.00	0.000	0.00	0.00	0.00
17.07	0.00	0.000	0.00	0.00	0.00
22.60	0.00	0.000	0.00	0.00	0.00
51.21	0.00	0.000	0.00	0.00	0.00
68.28	0.00	0.000	0.00	0.00	0.00
85.35	0.00	0.000	0.00	0.00	0.00
102.42	0.00	0.000	0.00	0.00	0.00
119.49	0.00	0.000	0.00	0.00	0.00
136.56	0.00	0.000	0.00	0.00	0.00
153.63	0.00	0.000	0.00	0.00	0.00
170.70	0.00	0.000	0.00	0.00	0.00

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	34.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	6533.13 ft

Culvert A1

$Q_{100} = 546$ cfs; $D = 3.0'$ (36" RCP)

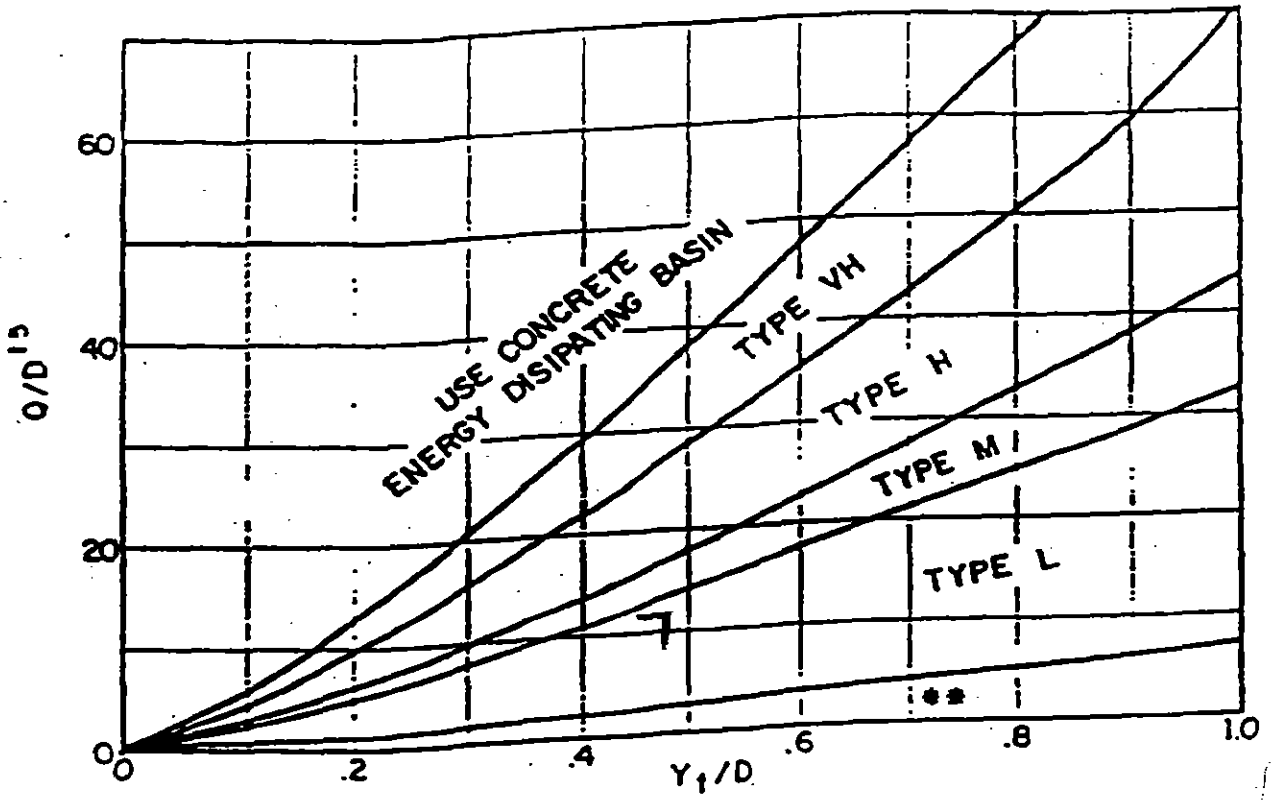
$$\frac{Q}{D^{1.5}} = \frac{546}{(3)^{1.5}} = 10.5$$

$Y_t = 1.44'$ (From HY-8)

$$\frac{Y_t}{D} = \frac{1.44}{3} = 0.47$$

Replace with current figure. typ all

Replaced with criteria from EPC DCM.



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

→ Use Type M

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

Culvert AQ
(Yellow Sun Lane)

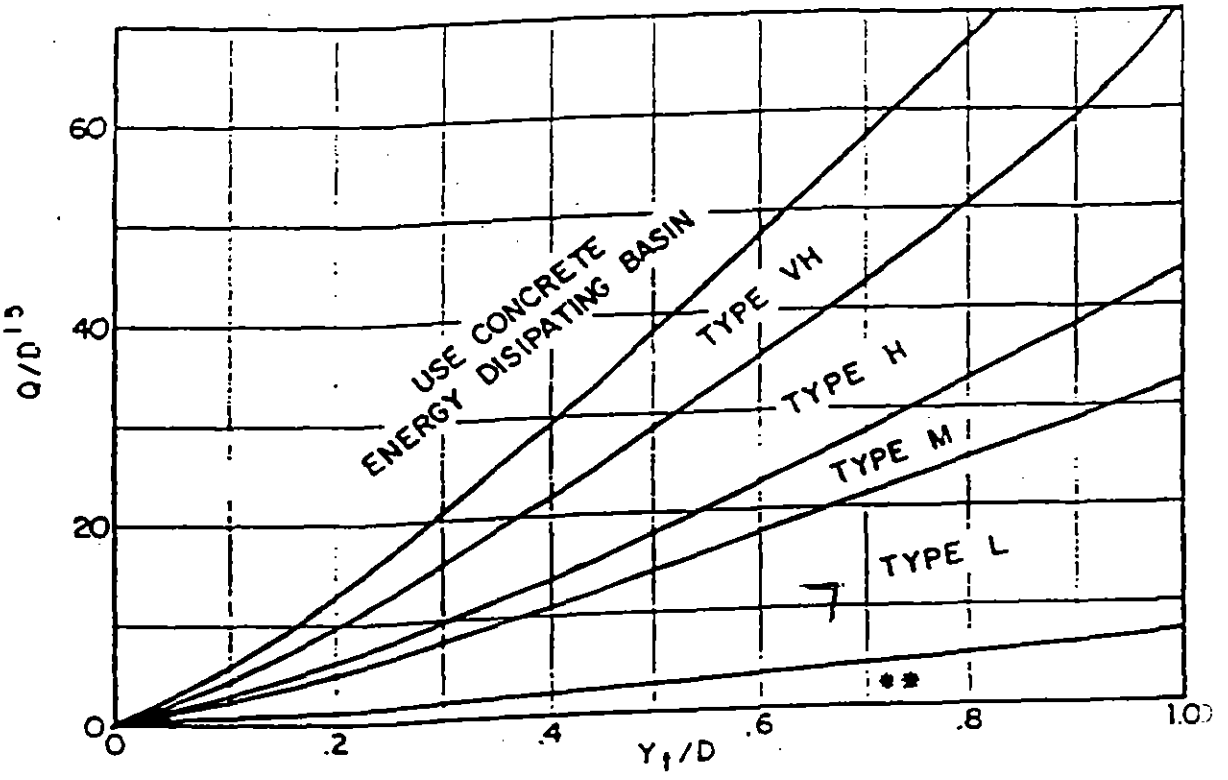
$Q_{100} = 23.1$ cfs (Basin AQ)

$D = 18" = 1.5'$

$$\frac{Q}{D^{1.5}} = \frac{23.1}{(1.5)^{1.5}} = 12.6$$

$Y_t = 1.0' \pm$

$$\frac{Y_t}{D} = \frac{1.0}{1.5} = 0.67$$



Use D_o instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

→ Use Type M

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

Culvert - Yellow Sun Court
(Basin A3)

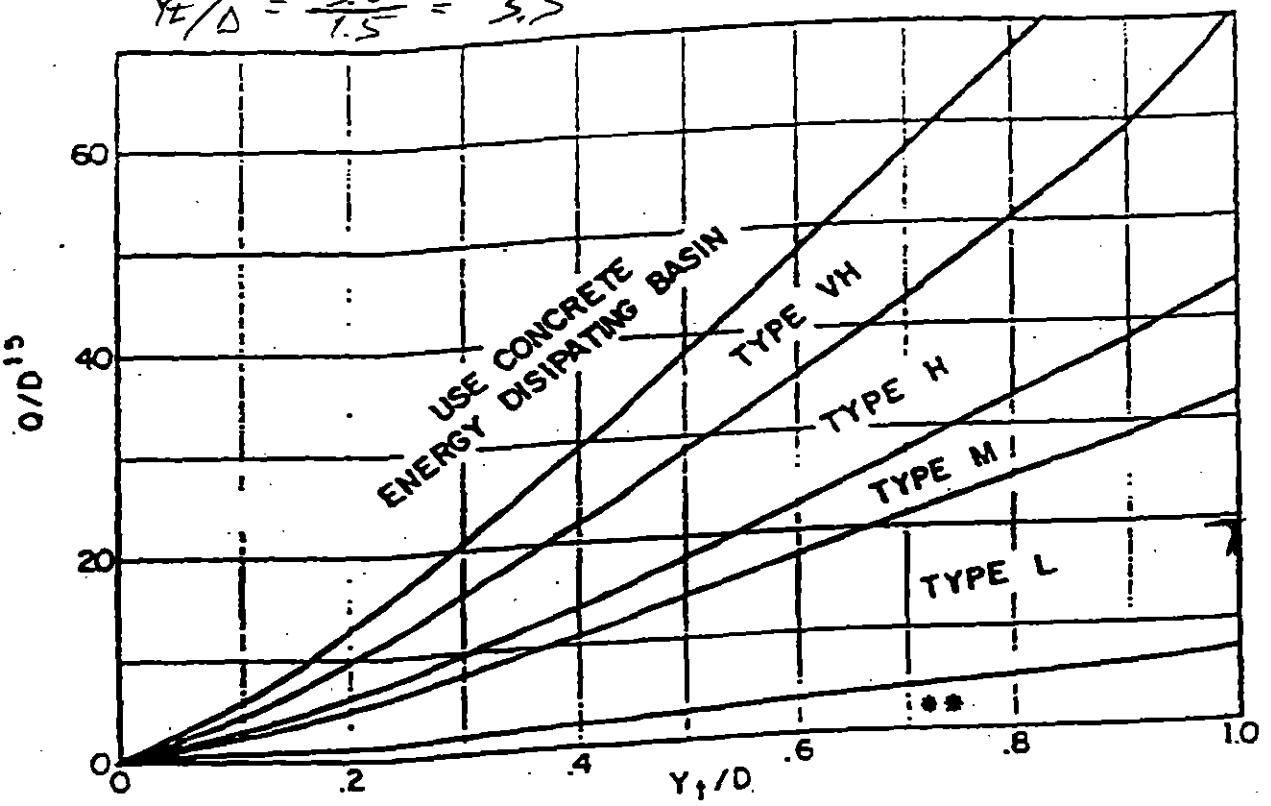
$Q_{100} = 32.9$ cfs (Basin OA3)

$D = 18" = 1.5'$

$\frac{Q}{D^{1.5}} = \frac{32.9}{(1.5)^{1.5}} = 17.9$

$Y_t = 5.0'$ (Retention Pond A depth)

$Y_t/D = \frac{5.0}{1.5} = 3.3$



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

→ Use Type M

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

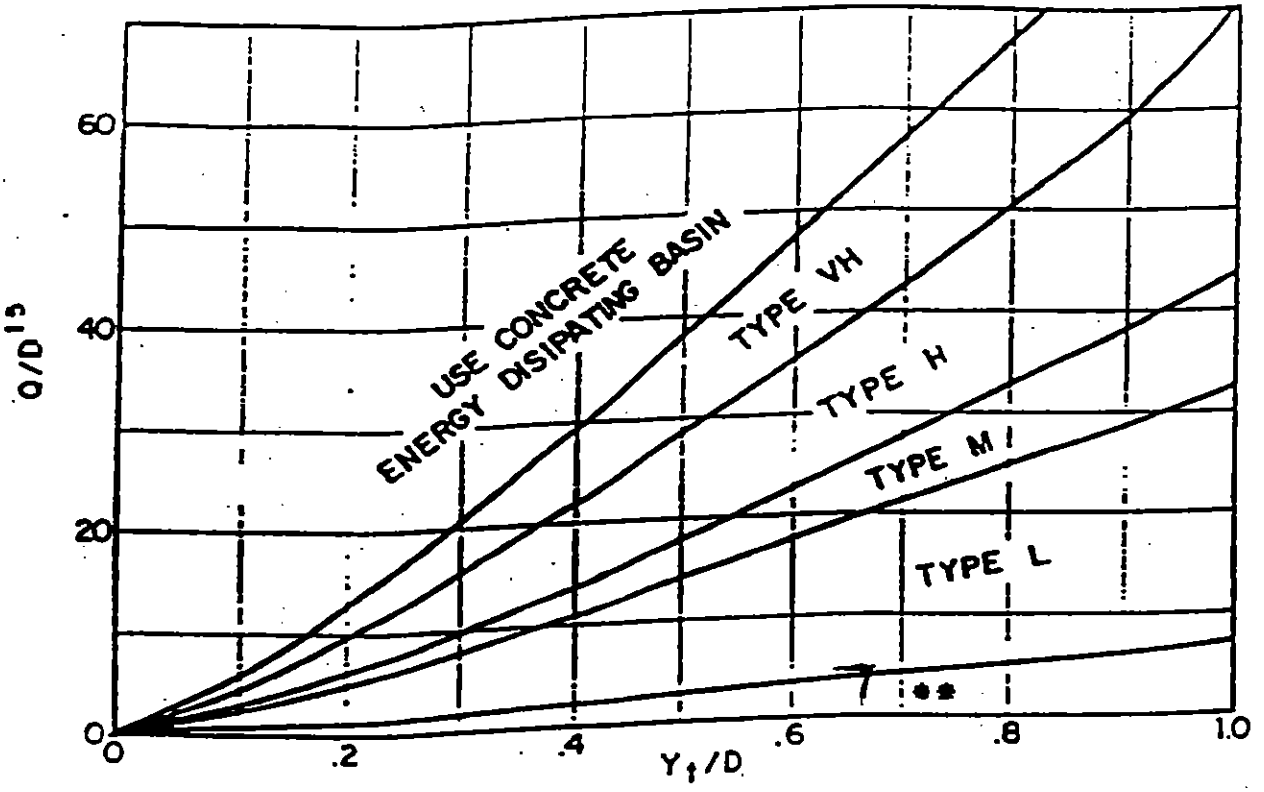
Culvert B (Curtis Road)

Q_{100} = (Nominally sized for overflow of Retention Pond B)
$\approx$ 7.0 cfs ($H_W/D = 1.0$)

$D = 18" = 1.5'$

$\frac{Q}{D^{1.5}} = \frac{7}{(1.5)^{1.5}} = 3.8$

$Y_t = 1.0'$ (assumed); $\frac{Y_t}{D} = \frac{1.0}{1.5} = 0.67$



Use D_o instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

→ Use Type M

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

FALCON ACRES
POND A STAGE-STORAGE TABLE

POND DEPTH (FT)	SURFACE AREA (SF)	INCREM. VOLUME (CF)	TOTAL VOLUME (CF)	TOTAL VOLUME (AF)
6528	45,179	0	0	0
6529	166,526	105852.5	105852.5	2.43
6530	287,872	227199	333051.5	7.65
6531	410178	349025	682076.5	15.66
6532	532,483	471330.5	1153407	26.48
6533	630062	581272.5	1734680	39.82
6533.5	678851	327228.3	2061908	47.33
6534	727640	654456.5	2716364	62.36

$\sim V_{100} = 48.3$ AF (Required Volume per UDFCD Criteria)

FALCON ACRES
POND B STAGE-STORAGE TABLE

POND DEPTH (FT)	SURFACE AREA (SF)	INCREM. VOLUME (CF)	TOTAL VOLUME (CF)	TOTAL VOLUME (AF)
6528	96,750	0	0	0
6529	149,445	123097.5	123097.5	2.83
6530	202,139	175792	298889.5	6.86

$> V_{100} = 2.34$ AF (Required)

FALCON ACRES
RETENTION POND SIZING

JPS ENGINEERING

DENVER URBAN DRAINAGE & FLOOD CONTROL DISTRICT CRITERIA:

RETENTION POND - BASIN A

REQUIRED 100-YEAR POND VOLUME, V:

V = Q * A * 1.5 (RETENTION POND VOLUME, ACRE-FEET)

= (100-YEAR; 24-HOUR RUNOFF) * (BASIN AREA) / (12 IN/FT) * 1.5

ASSUMPTIONS:

A =	755.6	AC	(DRAINAGE BASIN AREA, AC)
CN =	51.065		(WEIGHTED CURVE NUMBER FROM CN-SPREADSHEET)
P =	4.4	IN	(100-YEAR; 24-HOUR STORM RAINFALL PER EL PASO COUNTY)
S =	9.58		S = (1000/CN)-10
Q =	0.51	IN	Q = (P - 0.2S)^2 / (P + 0.8S) (100-YEAR; 24-HOUR STORM RUNOFF PER SCS TR-55)

CALCULATED 100-YEAR POND VOLUME, V:

V = 48.28 AC-FT

Replace with current criteria

Replaced with MHFD Detention Spreadsheet.

FALCON ACRES
RETENTION POND SIZING

JPS ENGINEERING

DENVER URBAN DRAINAGE & FLOOD CONTROL DISTRICT CRITERIA:

RETENTION POND - BASIN B

REQUIRED 100-YEAR POND VOLUME, V:

V = Q * A * 1.5 (RETENTION POND VOLUME, ACRE-FEET)

= (100-YEAR; 24-HOUR RUNOFF) * (BASIN AREA) / (12 IN/FT) * 1.5

ASSUMPTIONS:

A =	16.48	AC	(DRAINAGE BASIN AREA, AC)
CN =	62.91		(WEIGHTED CURVE NUMBER FROM CN-SPREADSHEET)
P =	4.4	IN	(100-YEAR; 24-HOUR STORM RAINFALL PER EL PASO COUNTY)
S =	5.90		S = (1000/CN)-10
Q =	1.14	IN	Q = (P - 0.2S)^2 / (P + 0.8S) (100-YEAR; 24-HOUR STORM RUNOFF PER SCS TR-55)

CALCULATED 100-YEAR POND VOLUME, V:

V = 2.34 AC-FT

Replace with current criteria

Replaced with MHFD Detention Spreadsheet.

APPENDIX D

COST ESTIMATE

FALCON ACRES
DRAINAGE IMPROVEMENTS COST ESTIMATE

Item No.	Description	Quantity	Unit	Unit Cost ($$$)	Total Cost ($$$)
	DRAINAGE IMPROVEMENTS				
203	Channel Grading	1050	LF	$5	$5,250
506	Riprap Aprons (d_{50} = 12")	17.5	CY	$40	$700
603	18" RCP Culvert w/ FES	28	LF	$50	$1,400
603	21" RCP Culvert w/ FES	41	LF	$55	$2,255
603	14"x23" HERCP Culvert w/ FES	34	LF	$60	$2,040
603	36" RCP Culvert w/ FES	62	LF	$65	$4,030
	SUBTOTAL				**$15,675**
	EROSION CONTROL IMPROVEMENTS				
208	Straw Bales	20	EA	$20	$400
208	Vehicle Tracking Pad (Erosion Control)	1	EA	$1,500	$1,500
208	Silt Fence	1,900	LF	$2	$3,800
208	Erosion Control Blankets	1,500	SY	$4	$6,000
210	Seeding (incl. 3" topsoil & mulching)	3.0	AC	$2,500	$7,500
	SUBTOTAL				**$19,200**
	Maintenance @ 10%				$1,920
	SUBTOTAL				**$21,120**
	TOTAL				**$36,795**

Update

Updated.

Replace with latest 2022 Fee Schedule

EXHIBIT A
Resolution No 07-57, F...

El Paso County Drainage Basin Fees Updated.

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2007 Drainage Fee	2007 Bridge Fee
Drainage Basins with DBPS's:					
CHWS1200	Chico Creek	2001	Bennett Ranch	$8,082	$570
FOFO2000	Chico Creek	2001	West Fork Jimmy Camp Creek	$8,764	$2,593
CHWS1400	Chico Creek	2000	Falcon	$8,925	$2,859
FOFO2600	Fountain Creek	1991*	Big Johnson / Crows Gulch	$15,000	$1,853
FOFO2800	Fountain Creek	1988*	Widefield	$14,083	$0
FOFO2900	Fountain Creek	1988*	Security	$14,071	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$15,000	$192
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$7,807	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$9,232	$700
FOFO3600	Fountain Creek	1981*	Fisher's Canyon	$15,000	$0
FOFO4000	*Fountain Creek*	*1988*	*Sand Creek*	*$15,000*	$1,653
FOFO4200	Fountain Creek	1977	Spring Creek	$6,639	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$12,998	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$15,000	$700
FOFO5400	Fountain Creek	1977	21st Street	$3,850	$0
FOFO5600	Fountain Creek	1984	19th Street	$2,520	$0
FOFO5800	Fountain Creek	1984	Camp Creek	$1,419	$0
FOMO0400	Monument Creek	1988*	Mesa	$8,695	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$8,049	$177
FOMO1200	Monument Creek	1977	Templeton Gap	$8,263	$192
FOMO1400	Monument Creek	1976	Pope's Bluff	$2,564	$437
FOMO1600	Monument Creek	1976	South Rockrimmon	$3,010	$0
FOMO1800	Monument Creek	1973	North Rockrimmon	$3,850	$0
FOMO2000	Monument Creek	1971	Pulpit Rock	$4,244	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$15,000	$700
FOMO2400	Monument Creek	1988	Dry Creek	$10,104	$366
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$5,810	$366
FOMO3700	Monument Creek	1987*	Middle Tributary	$10,682	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$15,000	$0
FOMO4000	Monument Creek	1998	Smith Creek	$5,216	$700
FOMO4200	Monument Creek	1989*	Black Forest	$15,000	$349
FOMO6200	Monument Creek	1993*	Dirty Woman Creek	$15,000	$700
FOMO6300	Fountain Creek	1993*	Crystal Creek	$15,000	$700
Miscellaneous Drainage Basins: [1]					
CHWS0600	Chico Creek		Book Ranch	$12,010	$1,736
CHEC0400	Chico Creek		Upper East Chico	$8,544	$190
CHWS0200	Chico Creek		Hoegler Ranch	$13,178	$0
CHWS0300	Chico Creek		Telephone Exchange	$7,189	$168
CHWS0400	Chico Creek		Livestock Company	$11,842	$141
CHWS0600	Chico Creek		West Squirrel	$6,173	$2,561
CHWS0800	Chico Creek		Solberg Ranch	$13,178	$0
FOFO1200	Chico Creek		Crooked Canyon	$3,864	$0
FOFO1400	Chico Creek		Calhan Reservoir	$3,226	$188
FOFO1600	Chico Creek		Sand Canyon	$2,331	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek	$15,000 [3]	$598
FOFO2200	Fountain Creek		Fort Carson	$10,104	$366
FOFO2700	Fountain Creek		West Little Johnson	$843	$0
FOFO3800	Fountain Creek		Stratton	$6,140	$275
FOFO6000	Fountain Creek		Midland	$10,104	$366
FOFO6000	Fountain Creek		Palmer Trail	$10,104	$366
FOFO6800	Fountain Creek		Black Canyon	$10,104	$366
FOFO7200	Fountain Creek		Williams Canyon	$10,104	$366
FOMO4600	Monument Creek		Beaver Creek	$7,652	$0
FOMO3000	Monument Creek		Kettle Creek	$6,911	$0
FOMO3400	Monument Creek		Elkhorn	$1,161	$0
FOMO5000	Monument Creek		Monument Rock	$5,548	$0
FOMO5400	Monument Creek		Palmer Lake	$6,871	$0
FOMO5600	Monument Creek		Raspberry Mountain	$2,984	$0
PLPL0200	Monument Creek		Bald Mountain	$6,359	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$1,637	$0
FOMO4400	Monument Creek		Jackson Creek	$5,066	$0
FOMO4800	Monument Creek		Tanchout Creek	$3,518	$529

1 The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee)

3 This is an interim fee and will be adjusted when a DBPS is completed In addition to the Drainage Fee of $15,000 a surety in the amount of $7,000 per impervious acre shall be provided to secure payment of additional fees in the event that the DBPS results in a fee greater than $15,000. Fees paid in excess of the future revised fee will be reimbursed See Resolution 06-325, September 14, 2006

EPC Stormwater Management _____ *Andre P. Brackin, P.E.*

Upload a clearer drainage map. The existing contours are difficult to read. Unable to tell what elevation the drainage easement follows.

Updated.

FALCON ACRES SUBDIVISION

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

LEGEND

- FILING LIMITS
- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- DRAINAGE CHANNEL
- CALCULATED 100-YEAR FLOODPLAIN LIMIT
- PRELIMINARY PRUDENT LINE SETBACK
- PROPOSED FLOW DIRECTION ARROW
- PROPOSED CULVERT (RCP OR HDPE) W/ FLARED END SECTIONS
- DESIGN POINT
- (cfs)
- (cfs)
- ASIN DESIGNATION
- ASIN AREA (ACRES)

These appears to be designated as wetlands per the US Fish & Wildlife Service National Wetlands Inventory website. Snippet on the right was obtained from the website.

Verify with the State Engineer's office if these are also considered Waters of the State. Update the narrative on the determination.

If it is considered water of the state then contact the stormwater reviewer regarding MS4 permit compliance. Typically stormwater runoff must be treated before discharging into waters of the state. Confirm with the stormwater team if it is applicable in this situation.

ECOSystems was hired to conduct a Wetland investigation and report. It is included with new submittal. Tjeu determined that no WOTUS was found on site including the areas identified by NWI mapping.

HIC SCALE

(IN FEET)
1 inch = 100 ft.
CONTOUR INTERVAL=2'

Update the channel calculation table (pg 57) to include these two roadside ditches

Channels added to drainage report along with ECB if needed.

Plat note 21 noted the develop is responsible for construction of driveways through no build easements.

Update the drainage report and construction plans to extend the private driveway for Lots 4, 7, & 8 past the no build easement and into the building envelope. Provide any additional culvert needed.

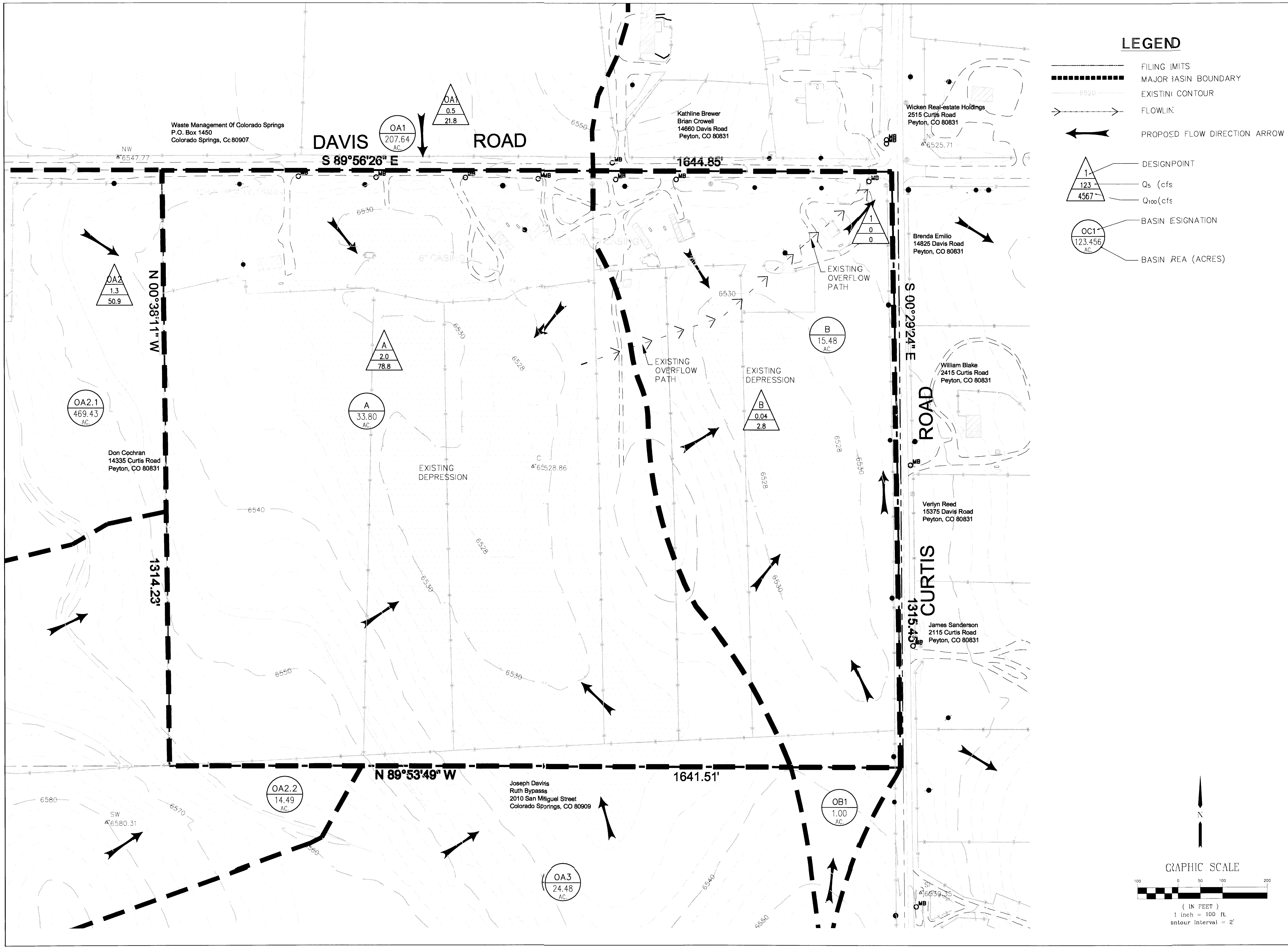
Driveway locations and culvert added for area within drainage easement.

HORZ. SCALE: 1"=100'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: UP&E	CHECKED: JPS
CREATED: 3/29/06	LAST MODIFIED: 12/11/07
PROJECT NO: 020506	MODIFIED BY: BJJ
SHEET: D1	

DATE
BY
REVISION
No.

Upload a clearer drainage map. Unable to see the minor contours.

Updated.



JPS ENGINEERING

19 E. Willamette Ave.
Colorado Springs, CO 80903

PH: 719-477-9429
FAX: 719-471-0766

FALCON ACRES

HISTORIC DRAINAGE PLAN

HORZ. SCALE:	1"=100'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:		CHECKED:	JPS
CREATED:	4/21/05	LAST MODIFIED:	12/11/07
PROJECT NO:	020506	MODIFIED BY:	BJJ
SHEET:	EX2		

FINAL DRAINAGE REPORT ADDENDUM #1 FOR FALCON ACRES EL PASO COUNTY, COLORADO

AUGUST 2021

Prepared For:

Thousand Hills Land & Cattle Co LLC
812 E Monument Street
Colorado Springs, Colorado 80903
(719) 238-4234
Contact: Richard Elliott

Prepared By:

TERRA NOVA ENGINEERING, INC.
721 S. 23rd Street
Colorado Springs, CO 80904
(719) 635-6422

Job No. 2142.00

FINAL DRAINAGE REPORT ADDENDUM #1 FOR FALCON ACRES EL PASO COUNTY, COLORADO

TABLE OF CONTENTS

REQUIRED MAPS AND DRAWINGS

DRAINAGE REPORT STATEMENT

Design Engineer's Statement

This 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 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.

_____

L DUCETT, P.E. 32339 Seal

Developers Statement

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

_____

Business Name

By: _____

Title: _____

Address: _____

_____

El Paso County Approval:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 & 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____

Jennifer Irvine, Date

County Engineer / ECM Administrator

Conditions:

The extent of criteria change is significant therefore the provided addendum is insufficient. Provide an updated Final Drainage Report meeting current criteria.

FINAL DRAINAGE REPORT ADDENDUM #1 FOR FALCON ACRES EL PASO COUNTY, COLORADO

Agreed, the report has been redone.

PURPOSE AND JUSTIFICATION

The purpose of this Final Drainage Report Addendum #1 is to update the construction cost opinion, drainage & bridge fees, and FEMA floodplain statement for the previously approved drainage report titled "Final Drainage Report for Falcon Acres Subdivision" dated June 25, 2007 prepared by JPS Engineering.

UPDATED CONSTRUCTION COST OPINION

	DRAINAGE IMPROVEMENTS	Quantity	Units	Unit Cost	**Total Cost**
506	Riprap Aprons (d_{50} = 12")	25	Tons	$83	$2,075
603	23"x14" HERCP Culvert w/ FES	88	LF	$81	$7,128
603	36" RCP Culvert w/ FES	62	LF	$124	$7,688
	SUBTOTAL				**$16,891**

UPDATED DRAINAGE & BRIDGE FEES

This currently unplatted site is in the Livestock Company Drainage Basin. The site is 49.23 acres. Appendix L of the Drainage Criteria Manual 1 Addendum states that for single-family 5 acre lots, an impervious percentage of 7% can be used. The combined Drainage Fees (2021) are due prior to final plat recordation.

Fee Type	% Imp.	Parcel Area (acre)	Imp. Area (acre)	Fee per Imp Acre	Mod %	Fee Cost
Drainage	7	49.23	3.45	$18,273	100	$63,042
Bridge	7	49.23	3.45	$217	100	$749
				Total		$114,165

UPDATED FLOODPLAIN STATEMENT

According to FEMA's FIRM No. 08041CO785G (eff. 12/7/2018), the proposed development is within an area designated as Zone X, having minimal flood hazard.

FEMA MAP

National Flood Hazard Layer FIRMette

FEMA

104°33'38"W 38°52'7"N

104°33'1"W 38°51'39"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/1/2021 at 4:25 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.