

**JR Engineering, Ltd.**

4935 North 30th Street
Colorado Springs, Colorado 80919
(719) 593-2593 • FAX (719) 528-6613
www.jreng.com

FINAL DRAINAGE REPORT

FOR

COLORADO CENTRE RESIDENTIAL

FILING NO. 5

May 1997
Revised February 1998

Prepared For:
RICHMOND AMERICAN HOMES OF COLORADO, INC.
4600 South Ulster Street, Suite 400
Denver, CO 80237
(303) 773-2727

Prepared By:
JR ENGINEERING, LTD.
4935 North 30th Street
Colorado Springs, CO 80919
(719) 593-2593

Job No. 8132.51

JRE Engineering, Ltd.

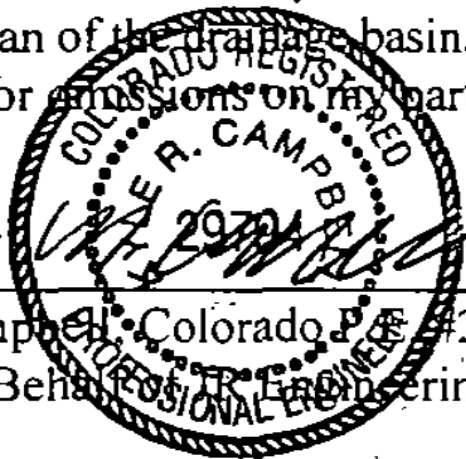
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DRAINAGE REPORT STATEMENT

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 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.



[Signature]
Kyle R. Campbell, Colorado P.E. #29794
For and On Behalf of JRE Engineering, Ltd.

7-13-98
Date

DEVELOPER'S STATEMENT:

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

Business Name: Richmond American Homes of Colorado, Inc.

By: [Signature]
N. JERREY RAINEN
Title: EXECUTIVE VICE PRESIDENT

Address: 4600 South Ulster Street, Suite 400
Denver, CO 80237

EL PASO COUNTY ONLY:

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

[Signature]
John A. McCarty Manager/County Engineer

8-10-98
Date

Conditions:

COLORADO CENTRE METROPOLITAN DISTRICT

[Signature]
Alvaro J. Testa, Ph.D., P.E., District Manager

7-13-98
Date

**FINAL DRAINAGE REPORT
FOR COLORADO CENTRE RESIDENTIAL FILING NO. 5**

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FINAL DRAINAGE REPORT FOR COLORADO CENTRE RESIDENTIAL FILING NO. 5

PURPOSE

This document is the Final Drainage Report for Colorado Centre Residential Filing No. 5. The purpose of this report is to estimate anticipated storm water runoff quantities, recommend specific solutions for on-site and off-site drainage impacts resulting from development, and identify necessary improvements to safely route storm water runoff to adequate outfall facilities.

GENERAL DESCRIPTION

Colorado Centre Residential Filing No. 5 is located in Sections 3 and 10, Township 15 South, Range 65 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso. The site is bounded to the north by a proposed middle school site, to the west and south by Horizonview Drive and Colorado Centre Filing No. 4 and to the east by a elementary school site. More specifically, Colorado Centre Residential Filing No. 5 is approximately 2200 feet north of Bradley Road and approximately 600 feet northwest of Jimmy Camp Creek. Proposed use of this filing is a Planned Unit Development (PUD) with 73 single family homes. The existing site drains predominantly to the southeast to Jimmy Camp Creek.

Existing zoning of this property is R-4 Residential and the site acreage is 17.4 acres. The site is currently PUD (Planned Unit Development).

EXISTING DRAINAGE CONDITIONS

The existing topography is a stabilized site graded in accordance to Colorado Centre Residential Filing No. 4 Overlot Grading Plan, dated July 1993, by JR Engineering, Ltd. Slopes range from 25% to 1%. The average soil condition reflects Hydrologic Group "B" (Loamy Ustic Torrfluvents) in

the land west of Jimmy Camp Creek and Group "A" (Ellicott loamy coarse sand) in Jimmy Camp Creek as determined by the "Soil Survey of El Paso County Area," prepared by S.C.S. Colorado Centre Residential Filing No. 5 is adjacent to existing Horizonview Drive (Residential Collector with 80-foot right-of-way). Per the MDDP, prepared by JR Engineering, Ltd., approved on April 19, 1996, all existing flows from Colorado Centre Filings No. 1, 2, and 3 are contained within the westerly half of Horizonview Drive, and a portion of the flows from northern Horizonview Drive are intercepted by the existing pair of 15-foot Type R inlets that discharge into the existing grass-lined channel. These flows are detailed in References 3, 4, 5, 6, and 7. Channel flows are $Q_5 = 156$ cfs and $Q_{100} = 344$ cfs.

Four off-site basins (OS-K, OS-L, OS-3, and OS-4) are located north of the existing channel. These undeveloped basins consist of future single family residential and a portion of a middle school site. The basins currently sheet flow to the existing channel that outfalls to Jimmy Camp Creek (Design Point 5). All existing on-site flows travel overland in a southeasterly direction to Jimmy Camp Creek. These flows are detailed in Reference 3, which constructed the channel parallel with Flagstone Street.

PROPOSED DRAINAGE CHARACTERISTICS

The drainage flows and patterns for Colorado Centre Residential Filing No. 5 are unchanged from those described in the approved MDDP for Colorado Centre Residential Phase II. The MDDP specified two 15-foot sump inlets at the intersection of Anvil Drive and the existing channel. The two 66-foot CMP's will be changed to three 47" x 71" CM arch pipes. Basin identifiers and calculations will remain unchanged from the MDDP. This allows Anvil Drive to be constructed at a lower elevation (47" height vs. 66" height). Also, this will permit the emergency overflow path to directly cross over Anvil Drive within the easement and not cross into or through the subdivision.

Flows from Basin B-1 ($Q_5 = 4$ cfs, $Q_{100} = 8$ cfs) and B-2 ($Q_5 = 3$ cfs, $Q_{100} = 5$ cfs) travel southwesterly down Gunbarrel Drive to Colorado Centre Residential Filing No. 4 and continues as

described in the Colorado Centre Residential Filing 4 Final Drainage Report. The capacity of Gunbarrel Drive with ramp carry curb at 0.75% grade is $Q_5 = 7$ cfs and $Q_{100} = 73$ cfs. All 5-year flow capacities are calculated to a depth of the street crownline or 20 cfs/side, whichever is the most limiting, and the 100-year flows are calculated to a depth equal to the right-of-way elevation assuming a 2% grade from the top of curb to right-of-way.

Basin J-1 ($Q_5 = 4$ cfs, $Q_{100} = 7$ cfs) and J-2 ($Q_5 = 8$ cfs, $Q_{100} = 16$ cfs) will flow in the half street sections of Settlement Way and Yukon Way, respectively. The runoff will discharge into Colorado Centre Residential Filing No. 4 and continues as described in the Filing No. 4 Final Drainage Report. The street capacity of Settlement Way at 1.46% with ramp curb is $Q_5 = 9$ cfs/side and $Q_{100} = 130$ cfs/side.

Basin K-1 ($Q_5 = 6$ cfs, $Q_{100} = 11$ cfs) will discharge onto Colorado Centre Residential Filing No. 4 via Settlement Drive.

Basin L-1 ($Q_5 = 4$ cfs, $Q_{100} = 8$ cfs) generates flows that travel easterly down Gunbarrel Drive. The street capacity of Gunbarrel Drive at 0.75% is $Q_5 = 7$ cfs and $Q_{100} = 73$ cfs. This flow combines with Basin L-2 ($Q_{10} = 11$ cfs, $Q_{100} = 22$ cfs) then travels southwesterly down Anvil Drive to Colorado Centre Residential Filing No. 4 and continues as described in the Colorado Centre Residential Filing No. 4 Final Drainage Report. Anvil Drive has a street Capacity of $Q_5 = 16$ cfs and $Q_{100} = 226$ cfs at 1.37% with 8-inch vertical curb.

Basin M ($Q_5 = 8$ cfs, $Q_{100} = 14$ cfs) also travels down Anvil Drive to Colorado Centre Residential Filing No. 4.

Basin A ($Q_5 = 1$ cfs, $Q_{100} = 2$ cfs) sheet flows onto northerly Horizonview Drive as described in the Filing No. 4 Final Drainage Report.

Basin H ($Q_5 = 4$ cfs, $Q_{100} = 6$ cfs) sheet flows into the Flagstone Channel as described in Reference 3.

Basin I ($Q_5 = 19$ cfs, $Q_{100} = 35$ cfs) sheet flows into Jimmy Camp Creek as described in the Colorado Centre Residential Filing No. 4 Final Drainage Report.

Flows at discharge points from Colorado Centre Residence Filing No. 5 are as follows:

| Design Point | Q_5 | Q_{100} |
|---------------------|-------------------------|-----------------------------|
| 5 | 156 | 344 |
| 19 | 7 | 12 |
| 20 | 4 | 7 |
| 21 | 6 | 14 |
| 22 | 18 | 30 |

DRAINAGE DESIGN CRITERIA

This report has been prepared in accordance with the County Drainage Criteria Manual. The modified Rational Method was used to calculate basin flows.

EROSION CONTROL PLAN

The County of El Paso Drainage Criteria Manual specifies that an Erosion Control Plan and associated cost estimate be submitted in conjunction with the Final Drainage Report. This site has an approved Erosion Control Plan as submitted with the Colorado Centre Residential Filing No. 4 Drainage Report. Therefore, all necessary approvals and assurances have been taken care of previously.

FLOODPLAIN STATEMENT

This site, Colorado Centre Residential Filing No. 5, is not within a designated F.E.M.A. Floodplain as determined by the Flood Insurance Rate Map, Community Panel Number 08041C0769F, effective date March 17, 1997.

CONSTRUCTION COST ESTIMATE (On-site)

Public Drainage Facilities

| <u>ITEM</u> | <u>DESCRIPTION</u> | <u>QUANTITY</u> | <u>UNIT COST</u> | <u>COST</u> |
|-------------|--------------------------------|-----------------|-----------------------------|----------------------------|
| 1. | 15' Type R Modified Curb Inlet | 2 EACH | \$4,000/EA | \$ 8,000.00 |
| 2. | 47" x 71" CM Arch Pipe | 225 L.F. | \$95/L.F. | <u>\$ 21,375.00</u> |
| | | | SUBTOTAL | \$ 29,375.00 |
| | | | 5% CONSTRUCTION CONTINGENCY | \$ 1,468.75 |
| | | | 10% ENGINEERING | <u>\$ 2,937.50</u> |
| | | | TOTAL | <u>\$ 33,781.25</u> |

JR Engineering, Ltd. cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. The opinions represent our best judgement as design professionals familiar with the construction industry and this development.

DRAINAGE AND BRIDGE FEES:

The Jimmy Camp Creek Drainage Basin (miscellaneous basin) Fees are as follows:

| | | | |
|----|------------------------------|---|----------------------------|
| A. | Drainage Fees | | |
| | 17.419 Acres x \$5,256/Acre | = | \$ 91,554.26 |
| B. | Bridge Fees (no Bridge fees) | = | <u>\$ 00.0</u> |
| | TOTAL | = | <u>\$ 91,554.26</u> |

JR Engineering, Ltd. cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. The opinions represent our best judgement as design professionals familiar with the construction industry and this development.

SUMMARY

The flows generated by this development will not adversely affect the downstream property owners. The existing and proposed street system and storm sewer facilities are able to handle the flows from this site. Jimmy Camp Creek will be stabilized prior to the development of Filing No. 6 taking place. All streets were analyzed using the current drainage criteria. Horizonview Drive flows are restricted to a spread of no greater than 20 feet from the flowline of the existing curb and gutter for 5-year flows. All other streets are limited to a depth of either the crownline or top of curb, whichever is the most limiting for 5-year flows. All 100-year flows are restricted to a curb flowline depth not to exceed the right-of-way elevation assuming a 2% grade. All flows generated by Filing No. 5 will be safely discharged to Jimmy Camp Creek. At the time of home construction, the home builder will be responsible for maintaining the proper lot drainage patterns as detailed in this report.

PREPARED BY:

A handwritten signature in black ink, appearing to read "Clyde D. Spencer". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

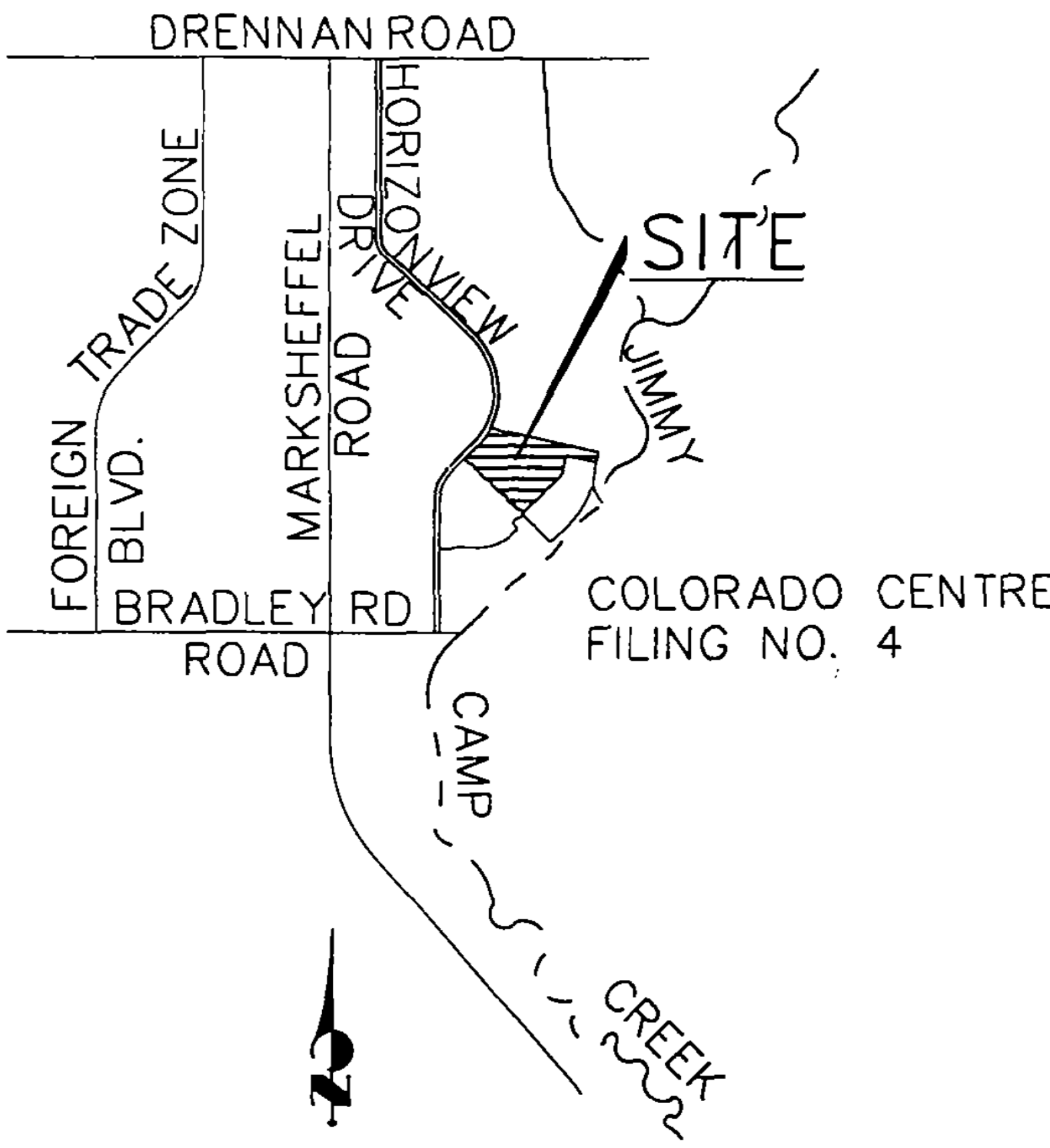
Clyde D. Spencer, P.E.
Project Engineer
Land Development
For and On Behalf of JR Engineering, Ltd.

REFERENCES:

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated October 1987, revised October 1994.
2. "Master Development Drainage Plan for Colorado Centre Residential Phase II," JR Engineering, Ltd., July 22, 1993.
3. "Drainage Study for Horizonview Drive," JR Engineering, Ltd., April 1, 1986.
4. "Colorado Centre Residential Filing No. 1," JR Engineering, Ltd., March 22, 1985.
5. "Colorado Centre Residential Filing No. 2," JR Engineering, Ltd., April 19, 1985.
6. "Colorado Centre Residential Filing No. 3," JR Engineering, Ltd., July 23, 1985.
7. "Final Drainage Report and Erosion Control Plan for Colorado Centre Residential Filing No. 4," prepared by JR Engineering, Ltd.
8. Flood Insurance Rate Map, Community Panel Number 08041C0769F, effective date March 17, 1998.

APPENDIX

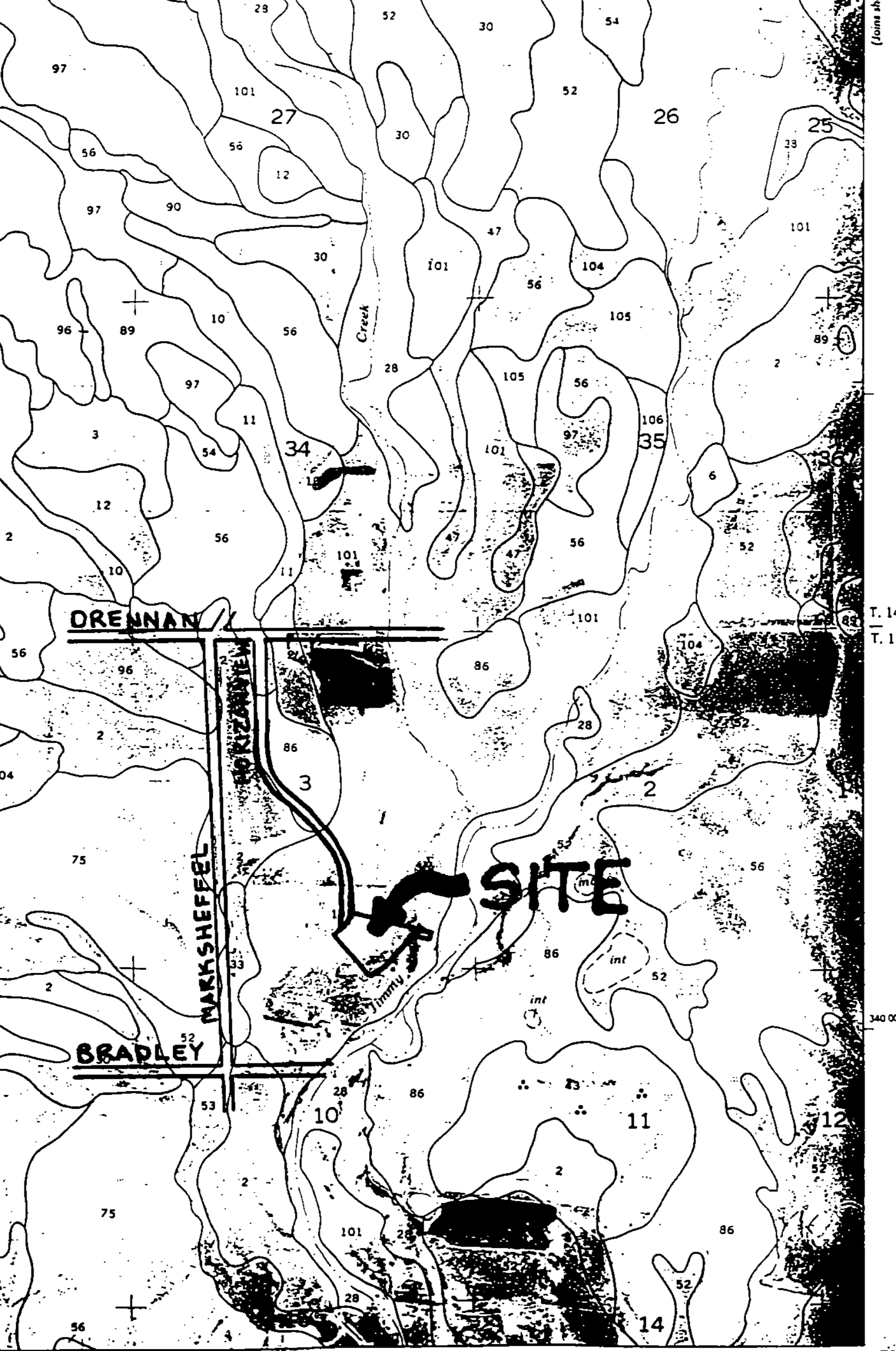
VICINITY MAP



VICINITY MAP

N.T.S.

**SOILS MAP
(S.C.S. SURVEY)**



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T. 1

340 00

F.E.M.A. MAP



FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

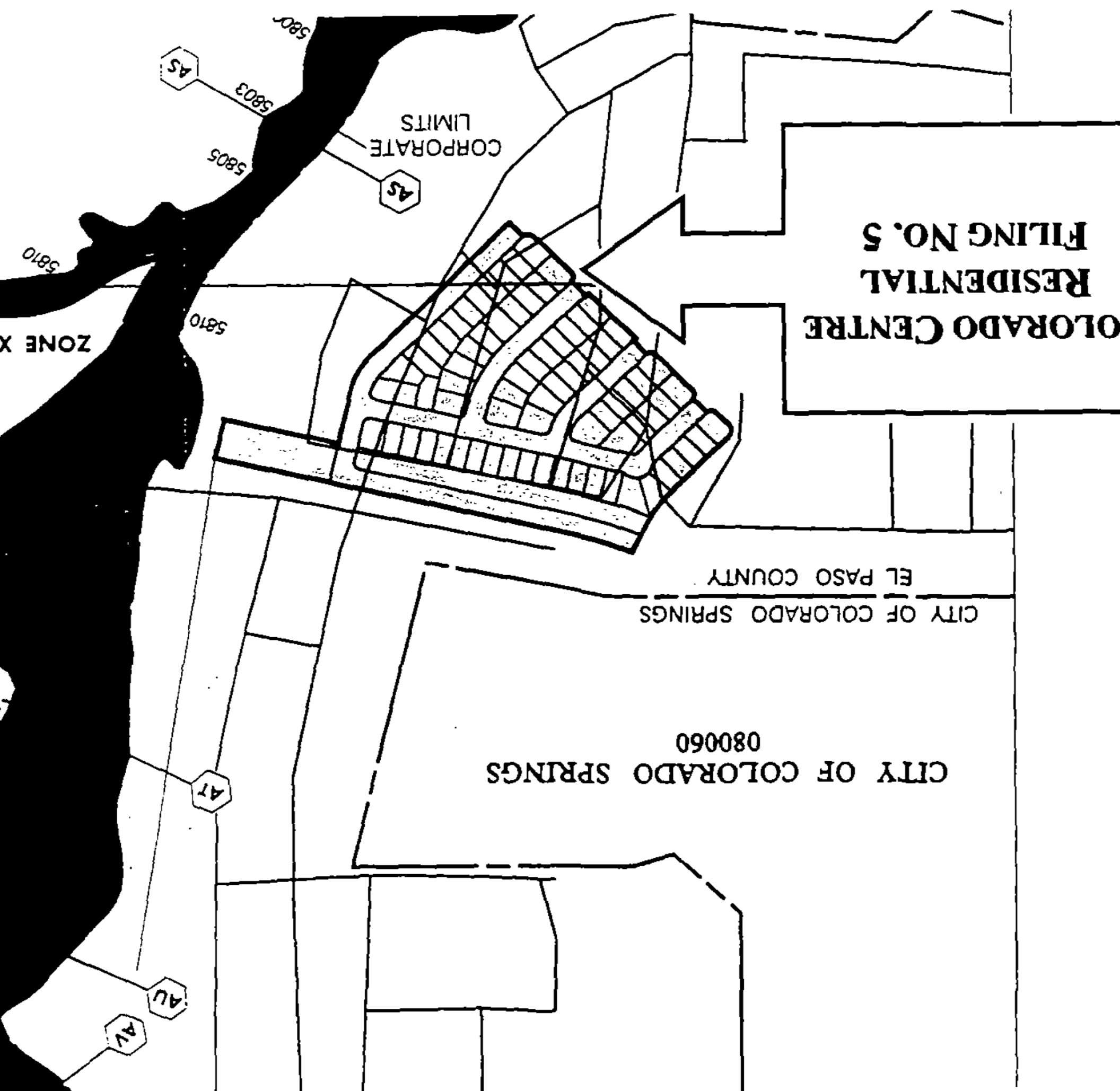
PANEL 769 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

| CONTAINS: COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|--------|-------|--------|
| COLORADO SPRINGS, CITY OF | 080060 | 0769 | F |
| EL PASO COUNTY, UNINCORPORATED AREAS | 080059 | 0769 | F |

MAP NUMBER
08041C0769 F

EFFECTIVE DATE:
MARCH 17, 1997



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- ZONE A** No base flood elevations determined.
- ZONE AE** Base flood elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

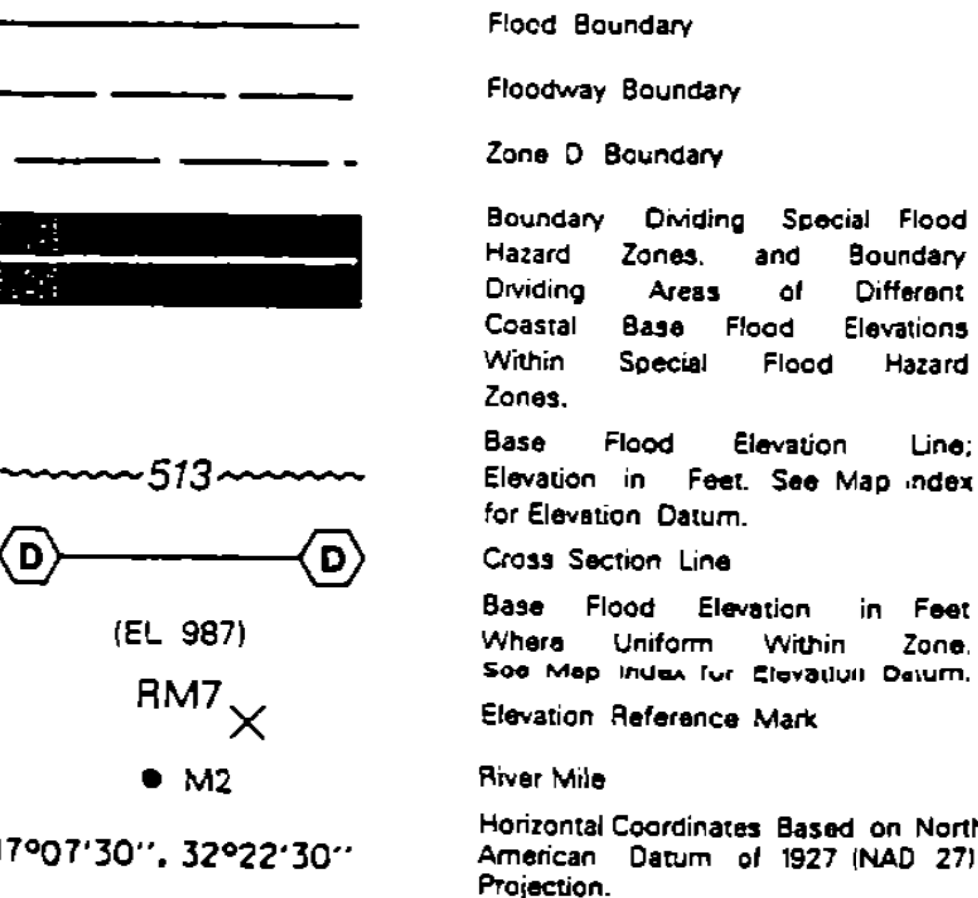
OTHER AREAS

- ZONE X** Areas determined to be outside 500-year floodplain.
- ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS



Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.



NOTES

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly local drainage sources of small size, or all planimetric features within Special Flood Hazard Areas.

Coastal base flood elevations apply only landward of 0.0 NGVD, and do not include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

This map may incorporate approximate boundaries of Coastal Resource System Units and/or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-508).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, refer to Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately published Map Index.

MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE MAP on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.



APPROXIMATE SCALE IN FEET



HYDROLOGIC CALCULATIONS

| BASIN | AREA (acres) | L (ft) | H (ft) | S (%) | V (fps) | Tc (min) | I _s | I ₁₀₀ | SOIL GROUP | LAND USE | C _s | C ₁₀₀ | FLOW Q _s Q ₁₀₀ |
|-------|-----------------|-------------|-----------|----------|------------|-------------|----------------|------------------|---------------|-------------|----------------|------------------|---|
| D5-I | 0.4 | 200 | 2 | 1% | | 5 | 5.2 | 9.0 | B | | .61 | .68 | 1 2 |
| D5-1 | 7.4 | 300 | 10 | 3.3% | | 12 | 3.8 | 6.6 | B | | .60 | .70 | 1.1 3.4 |
| D5-2 | 10.9 | 100 1000 | 2 | 2% | 2.9 | 24 | 2.7 | 4.6 | B | | .65 | .75 | 1.9 3.1 |
| A | 0.4 | 25 350 | .5 | 2% | 3.4 | 8 | 4.5 | 7.8 | B | | .60 | .70 | 1 2 |
| B-1 | 1.5 | 125 300 | 2.5 | 2% | 3.3 | 16 | 3.3 | 5.7 | B | | .70 | .78 | 4 5 |
| B-2 | 0.9 | 50 300 | 1 | 2% | 3.3 | 10 | 4.1 | 7.0 | B | | .70 | .78 | 3 5 |
| C | 1.1 | 25 1000 | .5 | 2% | 4.3 | 10 | 4.1 | 7.0 | B | | .62 | .72 | 3 4 |
| D-1 | 1.8 | 50 1000 | 1 | 2% | 4.0 | 13 | 3.7 | 6.3 | B | | .69 | .77 | 3 4 |
| D-2 | 1.5 | 125 500 | 2.5 | 2% | 5.2 | 16 | 3.3 | 5.7 | B | | .69 | .77 | 3 4 |
| D-3 | 1.9 | 125 400 | 2.5 | 2% | 3.0 | 16 | 3.3 | 5.7 | B | | .69 | .77 | 4 5 |
| E | 1.3 | 25 1000 | .5 | 2% | 2.9 | 12 | 3.8 | 6.5 | B | | .64 | .73 | 3 4 |
| F | 5.4 | 125 820 | 2.5 | 2% | 3.3 | 18 | 3.1 | 5.4 | B | | .71 | .79 | 12 13 |
| G | 8.7 | 250 | 5 | 2% | | 20 | 2.9 | 5.2 | B | | .40 | .63 | 10 29 |
| H | 1.1 | 25 | .5 | 2% | | 6 | 5.0 | 8.1 | B | | .60 | .70 | 3 6 |
| I | 10.5 | 300 | 6 | 2% | | 22 | 2.8 | 4.8 | B | | .55 | .70 | 16 25 |
| J-1 | 1.3 | 25 970 | .5 | 2% | 4.3 | 10 | 4.1 | 7.0 | B | | .69 | .77 | 4 7 |

JR ENGINEERING, LTD

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PROJECT: Colorado Centre Residential 5

ENGINEER: _____ DATE: 4-25-91

JOB NO: 8132.51 PAGE: 1 of 2

| BASIN | AREA (acres) | L (ft) | H (ft) | S (%) | V (cfs) | Tc (min) | I _s | I _m | SOIL GROUP | LAND USE | C _s | C ₁₀₀ | FLOW Q _s Q ₁₀₀ |
|-------|-----------------|-------------|-----------|----------|------------|-------------|----------------|----------------|---------------|-------------|----------------|------------------|---|
| J-2 | 4.0 | 125 980 | 2.15 | 2% | 3.3 | 19 | 3.0 | 5.2 | B | | .69 | .77 | 8 14. |
| K-1 | 1.9 | 25 970 | .5 | 2% | 4.3 | 10 | 4.1 | 7.0 | B | | .72 | .80 | 6 11 |
| K-2 | 2.0 | 50 650 | 1 | 2% | 3.4 | 12 | 3.8 | 6.5 | B | | .72 | .80 | 5 10 |
| L-1 | 1.5 | 25 710 | .5 | 2% | 2.9 | 10 | 4.1 | 6.9 | B | | .69 | .78 | 4 8. |
| L-2 | 5.8 | 175 1050 | 3 | 1.7% | 8.9 | 22 | 2.8 | 4.8 | B | | .69 | .78 | 11 22. |
| M | 2.1 | 25 200 | .5 | 2% | 3.3 | 7 | 4.8 | 7.8 | B | | .79 | .85 | 8 14. |
| N | 3.4 | 125 400 | 2.15 | 2% | 2.7 | 17 | 3.2 | 5.6 | B | | .66 | .75 | 7 14 |
| O | 5.5 | 125 830 | 2.15 | 2% | 3.3 | 18 | 3.1 | 5.4 | B | | .73 | .80 | 17 24 |
| H1 | 1.4 | 1350 | . | | 4.0 | 5.6 | 5.0 | 8.5 | B | | .61 | .68 | 4 8 |
| H2 | 0.6 | 300 | | | 2.9 | 5 | 5.2 | 9.0 | B | | .61 | .68 | 2 4 |
| H3 | 1.8 | 800 | | | 3.2 | 5 | 5.2 | 9.0 | B | | .61 | .68 | 6 11 |
| | | | | | | | | | | | | | |
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PROJECT: Colorado Centre Residential Lot 5

ENGINEER: _____ DATE: 4-25-97

JOB NO: 8132.51 PAGE: 2 of 2

HYDRAULIC CALCULATIONS

Type R inlet @ Anvil and Existing Channel

$$Q_L = 1.7 (L_i + 1.8w) (d_{max} + \frac{w}{12})^{1.35}$$

$$Q_5 = 30 \text{ cfs total (15 cfs/side)}$$

$$1.7 (15 + 5.4) (.49 + .25)^{1.35} = 20 \text{ OK}$$

$$Q_{100} = 58 \text{ cfs total (29 cfs/side)}$$

$$1.7 (15 + 5.4) (.87 + .25)^{1.35} = 43 \text{ OK}$$

STREET CAPACITY SUMMARY

(1) Horizonview Drive (Residential Collector)

- 80' R.O.W.
- 45' Flowline to Flowline
- 8" Vertical Curb

5-year (flow cannot encroach more than 20' from curb flowline)

$$Q=(1.49 / 0.016) (A/R)- (A)(s)^{1/2}$$

$$\text{Area (A)} = 4.29$$

$$\text{Wetted Perimeter (R)} = 20.59$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q=139.68 (S)^{1/2}$$

Depth of flow at curb
flowline not to exceed
0.53'

100-year (flow depth not to exceed 1.0' at curb flowline)

$$Q=(1.49 / 0.016) (A/R)- (A)(S)^{1/2}$$

$$\text{Area (A)} = 37.55$$

$$\text{Wetted Perimeter (R)} = 81.34$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q=2083.34 (S)^{1/2}$$

STREET CAPACITY SUMMARY

(1) Anvil Drive (Residential)

- 60' R.O.W.
- 40' Flowline to Flowline
- 8" Vertical Curb

5-year (Top of curb or crownline, whichever is most limiting)

$$Q=(1.49 / 0.016) (A/R)- (A)(s)^{1/2}$$

$$\text{Area (A)} = 4.16$$

$$\text{Wetted Perimeter (R)} = 20.53$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q=133.74 (S)^{1/2} -$$

1/2 Street Section

Depth of flow at curb
flowline not to exceed
0.53'

100-year (flow depth not to exceed R.O.W. depth - 0.87' at curb flowline)

$$Q=(1.49 / 0.016) (A/R)- (A)(S)^{1/2}$$

$$\text{Area (A)} = 23.46$$

$$\text{Wetted Perimeter (R)} = 61.34$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q=1147.43 (S)^{1/2} \quad \text{Total Street Capacity - Both Sides}$$

STREET CAPACITY SUMMARY

(1) Ramp Curb Streets (Residential)

- 60' R.O.W.
- 32' Flowline to Flowline
- Ramp Curb

5-year (top of curb or crownline, whichever is most limiting)

$$Q=(1.49 / 0.016) (A/R)- (A)(s)^{1/2}$$

$$\text{Area (A)} = 2.83$$

$$\text{Wetted Perimeter (R)} = 17.35$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q=78.73 (S)^{1/2} -$$

1/2 Street Section

Depth of flow at curb
flowline not to exceed
0.38'

100-year (flow depth not to exceed R.O.W. Depth - 0.69' at curb flowline)

$$Q=(1.49 / 0.016) (A/R)- (A)(S)^{1/2}$$

$$\text{Area (A)} = 19.40$$

$$\text{Wetted Perimeter (R)} = 60.13$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q=846.65 (S)^{1/2}$$

STREET CAPACITY SUMMARY

(1) Vertical Curb Streets (Residential)

- 60' R.O.W.
- 34' Flowline to Flowline
- 8" Vertical Curb

5-year (top of curb or crownline, whichever is most limiting)

$$Q = (1.49/0.016) (A/R)^{2/3} (S)^{1/2}$$

$$\text{Area (A)} = 2.98$$

$$\text{Wetted Perimeter (R)} = 17.43$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q = 85.39 (S)^{1/2}$$

Depth of flow at flowline not to exceed
0.47'

100-Year (flow depth not to exceed R.O.W. Depth - 0.93' at curb
flowline)

$$Q = (1.49/0.016)(A/R)^{2/3} (S)^{1/2}$$

$$\text{Area (A)} = 25.18$$

$$\text{Wetted Perimeter (R)} = 61.34$$

$$\text{Slope(S)} = \text{Variable}$$

$$Q = 1291.34 (S)^{1/2}$$

Culvert Designer/Analyzer Report Anvil Drive

Design Discharge Method: User-Specified

| | | | |
|------------------|------------|-----------------|------------|
| Design Discharge | 344.00 cfs | Check Discharge | 156.00 cfs |
|------------------|------------|-----------------|------------|

Design Model: Inverts

| | | | |
|-----------------|-------------|-------------------|----------------|
| Invert Upstream | 5,814.22 ft | Invert Downstream | 5,814.06 ft |
| Length | 77.72 ft | Slope | 0.002059 ft/ft |
| Depth | 0.16 ft | | |

Channel Properties: Trapezoidal Channel

| | | | |
|------------------|----------------|----------------------|----------|
| Slope | 0.002000 ft/ft | Mannings Coefficient | 0.025 |
| Depth | 3.37 ft | Left Side Slope | 4 H : V |
| Right Side Slope | 4 H : V | Bottom Width | 10.00 ft |

Channel Conditions for Design Storm.

| | | | |
|-----------|------------|------------------|-------------|
| Discharge | 344.00 cfs | Bottom Elevation | 5,814.06 ft |
| Depth | 3.37 ft | Velocity | 4.35 ft/s |

Channel Conditions for Check Storm.

| | | | |
|-----------|------------|------------------|-------------|
| Discharge | 156.00 cfs | Bottom Elevation | 5,814.06 ft |
| Depth | 2.30 ft | Velocity | 3.52 ft/s |

| Name | Desc | Discharge | HW Elev | Velocity |
|---------|---------------------|------------|-------------|-----------|
| Trial-1 | 3-71 x 47 inch Arch | 344.00 cfs | 5,819.03 ft | 6.76 ft/s |
| Trial-2 | 2-6 x 4 ft Box | 344.00 cfs | 5,819.10 ft | 8.51 ft/s |
| Trial-3 | 1-12 x 4 ft Box | 344.00 cfs | 5,819.10 ft | 8.51 ft/s |
| Trial-4 | 2-7 x 4 ft Box | 344.00 cfs | 5,818.59 ft | 7.29 ft/s |

Culvert Designer/Analyzer Report Anvil Drive

Project: Trial-1

For: Headwater Elevation

Event Summary

| | | | |
|------------------------------|-------------|---------------------|----------------|
| Available HW Elevation | N/A ft | Storm Event | Design |
| Computed Headwater Elevation | 5,819.03 ft | Discharge | 344.00 cfs |
| Headwater Depth/ Height | 1.23 | Tailwater Elevation | 5,817.43 ft |
| Control HW Elev | 5,818.23 ft | Control Type | Outlet Control |
| Outlet Control HW Elev | 5,819.03 ft | | |

Properties

| | | | |
|-----------------|-------------|-------------------|----------------|
| Upstream Invert | 5,814.22 ft | Downstream Invert | 5,814.06 ft |
| Length | 77.72 ft | Constructed Slope | 0.002059 ft/ft |

Hydraulic Profile

| | | | |
|---------------------|-------------|-------------------|----------------|
| Profile | M2 | Depth, Downstream | 3.37 ft |
| Profile Type | Mild | Normal Depth | N/A ft |
| Flow Regime | Subcritical | Critical Depth | 2.43 ft |
| Velocity Downstream | 6.76 ft/s | Critical Slope | 0.014123 ft/ft |

Construction

| | | | |
|------------------|---------------------------|----------------------|---------|
| Profile Shape | Arch | Mannings Coefficient | 0.024 |
| Profile Material | Steel and Aluminum Var CR | Span | 5.92 ft |
| Profile Size | 71 x 47 inch | Rise | 3.92 ft |
| Number Sections | 3 | | |

Outlet Control Properties

| | | | |
|------------------------|-------------|------------------------|---------|
| Outlet Control HW Elev | 5,819.03 ft | Upstream Velocity Head | 0.62 ft |
| | 0.50 | Entrance Loss | 0.31 ft |

Control Properties

| | | | |
|-----------------|---------------|---------------|----------------------|
| Control HW Elev | 5,818.23 ft | Flow Control | Unsubmerged |
| Control Type | 90 ° headwall | Area Full | 54.3 ft ² |
| | 0.00830 | HDS 5 Chart | 40 |
| | 2.00000 | HDS 5 Scale | 1 |
| | 0.03790 | Equation Form | 1 |
| | 0.69000 | | |

Culvert Designer/Analyzer Report

Anvil Drive

Design: Trial-2

For: Headwater Elevation

Culvert Summary

| | | | |
|------------------------------|-------------|---------------------|---------------|
| Designable HW Elevation | N/A ft | Storm Event | Design |
| Computed Headwater Elevation | 5,819.10 ft | Discharge | 344.00 cfs |
| Headwater Depth/ Height | 1.22 | Tailwater Elevation | 5,817.43 ft |
| Outlet Control HW Elev | 5,819.10 ft | Control Type | Inlet Control |
| Inlet Control HW Elev | 5,818.98 ft | | |

Geometrics

| | | | |
|-----------------|-------------|-------------------|----------------|
| Upstream Invert | 5,814.22 ft | Downstream Invert | 5,814.06 ft |
| Length | 77.72 ft | Constructed Slope | 0.002059 ft/ft |

Flow Profile

| | | | |
|---------------------|-------------|-------------------|----------------|
| Flow Profile | M2 | Depth, Downstream | 3.37 ft |
| Flow Type | Mild | Normal Depth | N/A ft |
| Flow Regime | Subcritical | Critical Depth | 2.94 ft |
| Velocity Downstream | 8.51 ft/s | Critical Slope | 0.004276 ft/ft |

Structure

| | | | |
|--------------------|----------|----------------------|---------|
| Structure Shape | Box | Mannings Coefficient | 0.013 |
| Structure Material | Concrete | Span | 6.00 ft |
| Structure Size | 6 x 4 ft | Rise | 4.00 ft |
| Number Sections | 2 | | |

Inlet Control Properties

| | | | |
|-----------------------|-------------|------------------------|---------|
| Inlet Control HW Elev | 5,818.98 ft | Upstream Velocity Head | 1.03 ft |
| | 0.20 | Entrance Loss | 0.21 ft |

Outlet Control Properties

| | | | |
|------------------------|-------------------------------|---------------|----------------------|
| Outlet Control HW Elev | 5,819.10 ft | Flow Control | Transition |
| Outlet Control Type | 90 ° headwall w 3/4" chamfers | Area Full | 48.0 ft ² |
| | 0.51500 | HDS 5 Chart | 10 |
| | 0.66700 | HDS 5 Scale | 1 |
| | 0.03750 | Equation Form | 2 |
| | 0.79000 | | |

Culvert Designer/Analyzer Report

Anvil Drive

gn: Trial-3

e For: Headwater Elevation

| Culvert Summary | | | |
|------------------------------|-------------|---------------------|---------------|
| Designable HW Elevation | N/A ft | Storm Event | Design |
| Computed Headwater Elevation | 5,819.10 ft | Discharge | 344.00 cfs |
| Headwater Depth/ Height | 1.22 | Tailwater Elevation | 5,817.43 ft |
| Outlet Control HW Elev | 5,819.10 ft | Control Type | Inlet Control |
| Inlet Control HW Elev | 5,818.94 ft | | |

| Geometrics | | | |
|-----------------|-------------|-------------------|----------------|
| Upstream Invert | 5,814.22 ft | Downstream Invert | 5,814.06 ft |
| Length | 77.72 ft | Constructed Slope | 0.002059 ft/ft |

| Hydraulic Profile | | | |
|---------------------|-------------|-------------------|----------------|
| Profile | M2 | Depth, Downstream | 3.37 ft |
| Flow Type | Mild | Normal Depth | N/A ft |
| Flow Regime | Subcritical | Critical Depth | 2.94 ft |
| Velocity Downstream | 8.51 ft/s | Critical Slope | 0.002926 ft/ft |

| Culvert Description | | | |
|---------------------|-----------|----------------------|----------|
| Structure Shape | Box | Mannings Coefficient | 0.013 |
| Structure Material | Concrete | Span | 12.00 ft |
| Structure Size | 12 x 4 ft | Rise | 4.00 ft |
| Number Sections | 1 | | |

| Inlet Control Properties | | | |
|--------------------------|-------------|------------------------|---------|
| Inlet Control HW Elev | 5,818.94 ft | Upstream Velocity Head | 1.11 ft |
| | 0.20 | Entrance Loss | 0.22 ft |

| Outlet Control Properties | | | |
|---------------------------|-------------------------------|---------------|----------------------|
| Outlet Control HW Elev | 5,819.10 ft | Flow Control | Transition |
| Outlet Type | 90 ° headwall w 3/4" chamfers | Area Full | 48.0 ft ² |
| | 0.51500 | HDS 5 Chart | 10 |
| | 0.66700 | HDS 5 Scale | 1 |
| | 0.03750 | Equation Form | 2 |
| | 0.79000 | | |

Culvert Designer/Analyzer Report Anvil Drive

Design: Trial-4

Design For: Headwater Elevation

| Culvert Summary | | | |
|------------------------------|-------------|---------------------|----------------|
| Designable HW Elevation | N/A ft | Storm Event | Design |
| Inputted Headwater Elevation | 5,818.59 ft | Discharge | 344.00 cfs |
| Headwater Depth/ Height | 1.09 | Tailwater Elevation | 5,817.43 ft |
| Outlet Control HW Elev | 5,818.57 ft | Control Type | Outlet Control |
| Design Control HW Elev | 5,818.59 ft | | |

| Geometric Data | | | |
|-----------------|-------------|-------------------|----------------|
| Upstream Invert | 5,814.22 ft | Downstream Invert | 5,814.06 ft |
| Length | 77.72 ft | Constructed Slope | 0.002059 ft/ft |

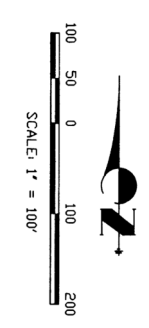
| Hydraulic Profile | | | |
|---------------------|-------------|-------------------|----------------|
| Profile | M2 | Depth, Downstream | 3.37 ft |
| Profile Type | Mild | Normal Depth | N/A ft |
| Flow Regime | Subcritical | Critical Depth | 2.66 ft |
| Velocity Downstream | 7.29 ft/s | Critical Slope | 0.003776 ft/ft |

| Culvert Information | | | |
|---------------------|----------|----------------------|---------|
| Culvert Shape | Box | Mannings Coefficient | 0.013 |
| Culvert Material | Concrete | Span | 7.00 ft |
| Culvert Size | 7 x 4 ft | Rise | 4.00 ft |
| Number Sections | 2 | | |

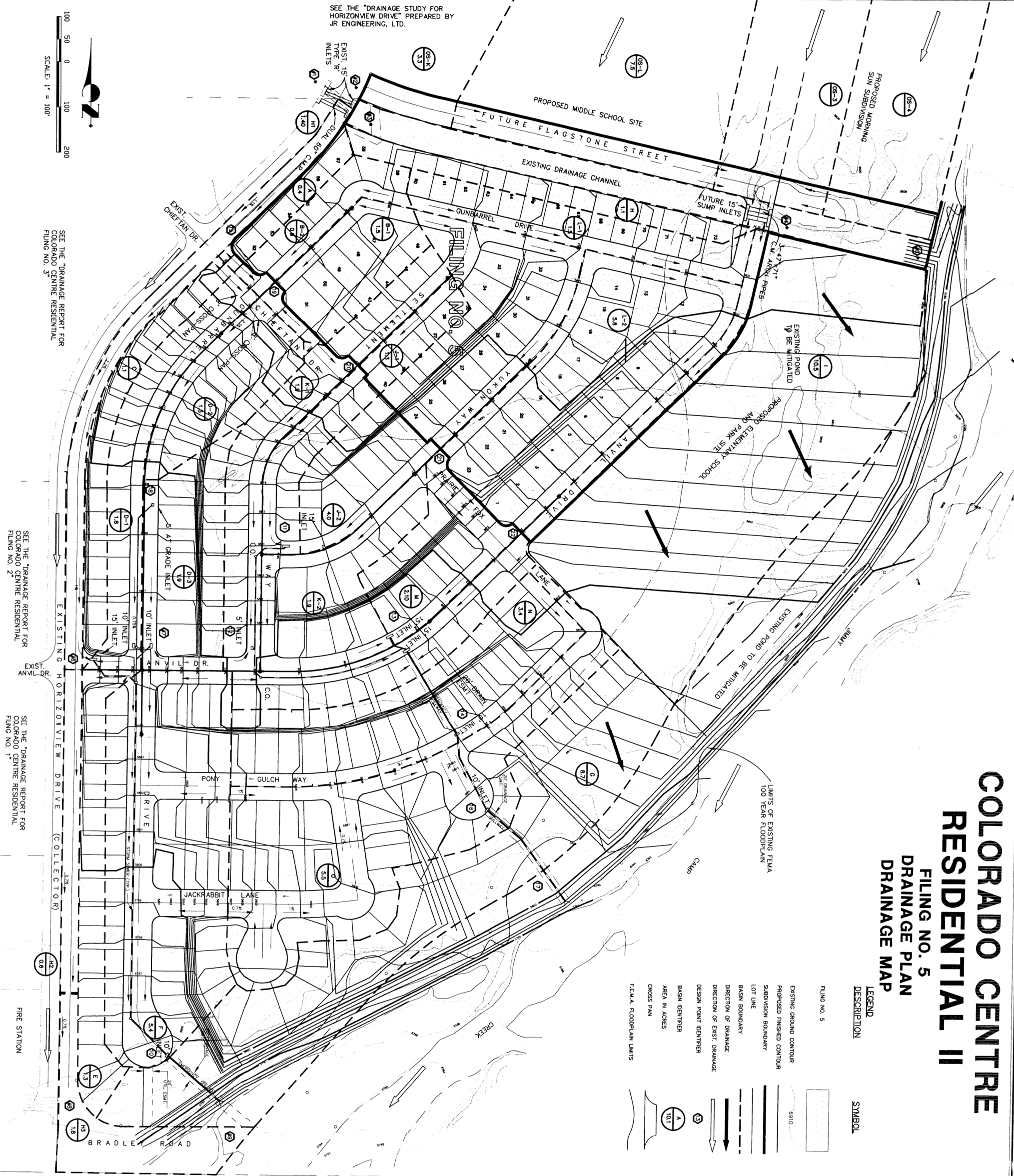
| Outlet Control Properties | | | |
|---------------------------|-------------|------------------------|---------|
| Outlet Control HW Elev | 5,818.59 ft | Upstream Velocity Head | 0.82 ft |
| | 0.20 | Entrance Loss | 0.16 ft |

| Control Properties | | | |
|------------------------|-------------------------------|---------------|----------------------|
| Outlet Control HW Elev | 5,818.57 ft | Flow Control | Unsubmerged |
| Control Type | 90 ° headwall w 3/4" chamfers | Area Full | 56.0 ft ² |
| | 0.51500 | HDS 5 Chart | 10 |
| | 0.66700 | HDS 5 Scale | 1 |
| | 0.03750 | Equation Form | 2 |
| | 0.79000 | | |

DRAINAGE MAP



SEE THE "DRAINAGE STUDY FOR HORIZONVIEW DRIVE" PREPARED BY JR ENGINEERING, LTD.

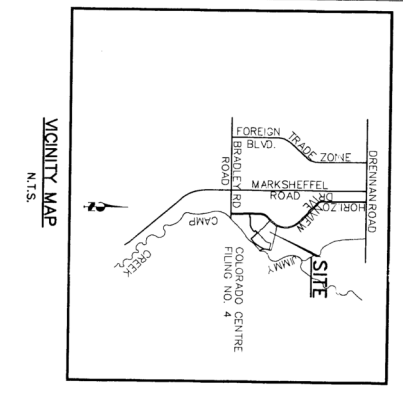


COLORADO CENTRE RESIDENTIAL II

FILING NO. 5 DRAINAGE PLAN DRAINAGE MAP

LEGEND

| DESCRIPTION | SYMBOL |
|------------------------------|----------|
| FILING NO. 5 | [Symbol] |
| EXISTING GROUND CONTOUR | 6910 |
| PROPOSED FINISHED CONTOUR | [Symbol] |
| SUBDIVISION BOUNDARY | [Symbol] |
| LOT LINE | [Symbol] |
| BASIN BOUNDARY | [Symbol] |
| DIRECTION OF EXIST. DRAINAGE | [Symbol] |
| DESIGN POINT IDENTIFIER | [Symbol] |
| BASIN IDENTIFIER | [Symbol] |
| AREA IN ACRES | [Symbol] |
| GROSS PAN | [Symbol] |
| FEMA FLOODPLAIN LIMITS | [Symbol] |



DESIGN POINT

| DESIGN POINT | FLOW (CFS) |
|--------------|------------------|
| 1 | Q(5) = 109 CFS |
| 2 | Q(100) = 245 CFS |
| 3 | Q(5) = 20 CFS |
| 4 | Q(100) = 60 CFS |
| 5 | Q(5) = 124 CFS |
| 6 | Q(100) = 270 CFS |
| 7 | Q(5) = 156 CFS |
| 8 | Q(100) = 344 CFS |
| 9 | Q(5) = 12 CFS |
| 10 | Q(100) = 24 CFS |
| 11 | Q(5) = 7 CFS |
| 12 | Q(100) = 13 CFS |
| 13 | Q(5) = 3 CFS |
| 14 | Q(100) = 20 CFS |
| 15 | Q(5) = 6 CFS |
| 16 | Q(100) = 23 CFS |
| 17 | Q(5) = 11 CFS |
| 18 | Q(100) = 21 CFS |
| 19 | Q(5) = 6 CFS |
| 20 | Q(100) = 11 CFS |
| 21 | Q(5) = 27 CFS |
| 22 | Q(100) = 58 CFS |
| 23 | Q(5) = 8 CFS |
| 24 | Q(100) = 14 CFS |
| 25 | Q(5) = 8 CFS |
| 26 | Q(100) = 15 CFS |
| 27 | Q(5) = 11 CFS |
| 28 | Q(100) = 24 CFS |
| 29 | Q(5) = 62 CFS |
| 30 | Q(100) = 105 CFS |
| 31 | Q(5) = 7 CFS |
| 32 | Q(100) = 13 CFS |
| 33 | Q(5) = 7 CFS |
| 34 | Q(100) = 12 CFS |
| 35 | Q(5) = 4 CFS |
| 36 | Q(100) = 7 CFS |
| 37 | Q(5) = 6 CFS |
| 38 | Q(100) = 14 CFS |
| 39 | Q(5) = 18 CFS |
| 40 | Q(100) = 30 CFS |

NOTES:
 * PER "DRAINAGE STUDY FOR HORIZONVIEW DRIVE" PREPARED BY JR ENGINEERING, LTD.
 THIS MAP IS TO BE USED FOR DRAINAGE PURPOSES ONLY. SEE OVERLIFT GRADING PLAN FOR APPROPRIATE GRADING INFORMATION.

BASIN SUMMARY:

| BASIN | Q(5)-CFS | Q(100)-CFS |
|--------|----------|------------|
| (05-4) | 10 | 12 |
| (05-1) | 17 | 34 |
| (05-3) | 15 | 31 |
| (05-4) | 4 | 7 |
| B-1 | 3 | 5 |
| B-2 | 3 | 5 |
| D-1 | 3 | 5 |
| D-2 | 4 | 6 |
| D-3 | 4 | 6 |
| E | 4 | 6 |
| F | 4 | 6 |
| G | 4 | 6 |
| H | 4 | 6 |
| I-1 | 9 | 11 |
| I-2 | 6 | 8 |
| J-1 | 6 | 8 |
| J-2 | 6 | 8 |
| K-1 | 6 | 8 |
| K-2 | 6 | 8 |
| L-1 | 13 | 22 |
| L-2 | 10 | 16 |
| M | 8 | 14 |
| N | 8 | 14 |
| O | 8 | 14 |
| P | 4 | 8 |
| Q | 4 | 8 |
| R | 4 | 8 |
| S | 2 | 4 |

| NO. | REVISION | BY | DATE |
|-----|----------|----|------|
| | | | |
| | | | |
| | | | |

| | |
|--------------------------------|-------------------------------|
| COLORADO CENTRE RESIDENTIAL II | SCALE: V=1"=100' H=1"=100' |
| FILING NO. 5 | DATE: 4/19/97 |
| DRAINAGE PLAN DRAINAGE MAP | DES. BY: KRC |
| | CHK. BY: |
| | DWN. BY: BJJ |

JR Engineering, Ltd.
 6455 N. Union Blvd, Suite 202
 Colorado Springs, Colorado 80918
 (719) 593-2593 • FAX (719) 528-6613

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EROSION CONTROL PLAN

FINAL DRAINAGE REPORT ADDENDUM
FOR
COLORADO CENTRE RESIDENTIAL
FILING NO. 4

August 6, 1993

Job No. 8132.40

Prepared For:

RICHMOND HOMES
4600 S. ULSTER ST. STE 400
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(303) 773-2727

Prepared By:

JR ENGINEERING, LTD.
6455 North Union Boulevard, Suite 202
Colorado Springs, CO 80918
(719) 593-2593

**FINAL DRAINAGE REPORT FOR
COLORADO CENTRE FILING NO. 4**

DRAINAGE REPORT 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 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.

_____ Joseph W. DesJardin,
Colorado P.E. #24207 Date
For and On Behalf of JR Engineering, Ltd.

DEVELOPER'S 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 ONLY:

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

_____ Director of Public Works
Date

Conditions:

COLORADO CENTRE METROPOLITAN DISTRICT

_____ Date
Alvaro J. Testa, Ph.D., P.E.

FINAL DRAINAGE REPORT ADDENDUM FOR COLORADO CENTRE RESIDENTIAL NO. 4

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APPENDIX

VICINITY MAP

SOILS MAP (S.C.S. FEMA MAP SURVEY)

HYDROLOGIC CALCULATIONS

EROSION CONTROL PLAN

DRAINAGE MAP

FINAL DRAINAGE REPORT FOR COLORADO CENTRE RESIDENTIAL FILING NO. 4

PURPOSE:

This document is the Final Drainage Report for Colorado Centre Residential Filing No. 4. The purpose of this report is to estimate anticipated storm water runoff quantities, recommend specific solutions for on-site and off-site drainage problems resulting from development, and identify necessary improvements to safely route storm water runoff to adequate outfall facilities.

GENERAL DESCRIPTION:

Colorado Centre Residential II Filing No. 4 is located in Section 3, Township 15 South, Range 65 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso. The site is bounded to the north, east, and south by future filings and to the west by Horizonview Drive. More specifically, Filing No. 4 is approximately 1000 feet north of New Drennan Road and approximately 500 feet west of Jimmy Camp Creek. Proposed use of this Filing is a planned unit development (P.U.D.) with 87 single family homes. The existing site drains predominantly to the southeast to Jimmy Camp Creek.

Existing zoning of this property is R-4 Residential and the site acreage is 16.6765 acres. The site is currently under review for zone change from R-4 to P.U.D. The average soil condition reflects Hydrologic Group "B" (Loamy Ustic Torrfluvents) in the land west of Jimmy Camp Creek and Group "D" (Ellicott loamy coarse sand) in Jimmy Camp Creek as determined by the "Soil Survey of El Paso County Area" prepared by SCS.

EXISTING DRAINAGE CONDITIONS:

Colorado Centre Residential Filing No. 4 is adjacent to existing Horizonview Drive (Residential Collector with 80 foot right-of-way). Per the M.D.D.P. (prepared by JR Engineering, Ltd. and submitted concurrently), all existing flows from Colorado Centre Filing No's. 1, 2, and 3 are contained within the westerly half of Horizonview Drive, and all flows from northern Horizonview Drive are totally intercepted by the existing pair of 15 foot type "R" inlets that discharge into the existing grass-lined channel.

All existing on-site flows travel overland in a southeasterly direction to Jimmy Camp Creek.

PROPOSED DRAINAGE CHARACTERISTICS:

After construction of this project, drainage from on-site will be split into several areas (see drainage map). At the intersection of Anvil Drive and Horizonview Drive (Design Point 6), flow from off-site Basins A, B & H1 combine with Basing C for a resultant flow of $Q_{10}=12$ cfs and $Q_{100}=20$)

A proposed 5 foot type "R" at-grade inlet at the northeast corner of the intersection will intercept $Q_{10}=5$ cfs and $Q_{100}=8$ cfs with $Q_{10}=7$ cfs and $Q_{100}=12$ cfs flowby. Basin D generates flow ($Q_{10}=12$ cfs and $Q_{100}=20$ cfs) that travels southerly along Gunbarrel Drive.

The ramp curb on both sides of Gunbarrel Drive has a capacity of $Q_{10}=14$ cfs and $Q_{100}=66$ cfs at 0.75%. A portion of this Basin D flow ($Q_{10}=10$ cfs and $Q_{100}=10$ cfs) is intercepted by a pair of 5 foot at-grade inlets at the corner of Anvil Drive and Gunbarrel.

The Basin D flowby ($Q_{10}=2$ cfs and $Q_{100}=11$ cfs) combines with the Design Point 6 flowby for a resultant flow of $Q_{10}=9$ cfs and $Q_{100}=25$ cfs. The depth of flow in the 6 foot cross pan at Design Point 6, is 5.2 inches for 100-year flows. The street capacity of Horizonview Drive at 0.7% grade is $Q_{10}=12$ cfs and $Q_{100}=175$ cfs.

This flowby continuous southerly down Horizonview Drive to Design Point 8 where Basin H2 ($Q_{10}=2$ cfs and $Q_{100}=4$ cfs) and Basin E ($Q_{10}=4$ cfs and $Q_{100}=6$ cfs) are added

for a resultant flow of $Q_{10}=12$ cfs and $Q_{100}=27$ cfs which is still within criteria. This flow will then travel easterly along future New Drennan Road to Design Point 9 where Basin H3 ($Q_{10}=7$ cfs and $Q_{100}=11$ cfs) is added for a resultant outfall flow of $Q_{10}=13$ cfs and $Q_{100}=32$ cfs. This flow will outfall to Jimmy Camp Creek in a ditch until New Drennan Road is extended.

The flows intercepted by the proposed 5 foot curb inlet at Design Point 6 will travel in 24" R.C.P. at 0.3% grade to a cleanout at the intersection on Anvil Drive and Gunbarrel Drive. The Basin D flows intercepted at Design Point 7 by the pair of 5 foot curb inlets will also travel to the same cleanout in 18" R.C.P. at 0.5% grade and 18" R.C.P. at 4.8% grade. The combined flows ($Q_{10}=14$ and $Q_{100}=17$ cfs) then travel southerly down Gunbarrel Drive in a 24" R.C.P. at 1.0% grade. For this filing, the 24" R.C.P. will be extended beyond the boundary and a temporary outfall ditch will transfer the pipe flows to Jimmy Camp Creek.

Basin J ($Q_{10}=16$ cfs and $Q_{100}=27$ cfs) generates flows that travel southwesterly down Granger Lane to two proposed 5 foot type "R" at-grade curb inlets (Design Point 11) at the intersection of Granger Lane and Settlement Way. A portion of the flow ($Q_{10}=10$ cfs and $Q_{100}=13$ cfs) is intercepted. The flowby ($Q_{10}=6$ cfs and $Q_{100}=15$ cfs) is within the street capacity of Granger Lane at 0.75% (Q_{10} (cap)=7 cfs and Q_{100} (cap)=66 cfs)

Basin K ($Q_{10}=15$ cfs and $Q_{100}=25$ cfs) then combines with the Basin J flowby for a resultant flow of $Q_{10}=18$ cfs and $Q_{100}=36$ cfs. This flow is then partially intercepted by a proposed 5 foot at-grade curb inlet (Design Point 12) at the intersection of Settlement Way and Anvil Drive. The flows intercepted by the inlet ($Q_{10}=6$ cfs and $Q_{100}=8$ cfs) generate flowby of $Q_{10}=12$ cfs and $Q_{100}=28$ cfs.

The capacity of Anvil Drive is $Q_{10}=15$ cfs and $Q_{100}=249$ cfs. This flow then travels to a proposed 15 foot type "R" sump inlet (Design Point 13) that accepts all 10-year and 100-year flows.

The flows intercepted by the proposed pair of 5 foot curb inlets at Design Point 11 ($Q_{10}=10$ cfs and $Q_{100}=13$ cfs) is transferred to the intersection of Settlement Way and Anvil Drive through 18" R.C.P. at 0.5% and 2.1% grade and 24" R.C.P. at 1.5% grade. This flow then travels easterly along Anvil Drive to where the intercepted flows from Design Point 12 ($Q_{10}=6$ cfs and $Q_{100}=8$ cfs) are added for a combined flow of $Q_{10}=16$ cfs and $Q_{100}=20$ cfs. This flow continues down Anvil Drive in a 24 inch R.C.P. at 1.2% grade to a proposed cleanout at Design Point 13.

Basin L ($Q_{10}=16$ cfs and $Q_{100}=27$ cfs) generates flows that travel southwesterly down Anvil Drive to the proposed 15 foot sump inlet (Design Point 13). Basin M ($Q_{10}=8$ cfs and $Q_{100}=14$ cfs) also travels down Anvil Drive to a proposed 15 foot sump inlet (Design Point 13) on the south side of the street. All 10-year and 100-year flows at the Anvil Drive sump ($Q_{10}=33$ cfs and $Q_{100}=67$ cfs) can be intercepted by two 15 foot type "R" sump inlets with a 1.25 clogging factor.

The flows from the northerly 15 foot inlet travel to the Design Point 13 cleanout in a 36 inch R.C.P. at 2.0% grade. The combined flows at the cleanout then travel in a 36 inch R.C.P. at 2.0% to the southerly 15 foot curb inlet. The combined flow exiting this inlet ($Q_{10}=47$ cfs and $Q_{100}=87$ cfs) is discharged in a 42" R.C.P. at 1% grade. This 42" R.C.P. will be extended beyond the Filing No. 7 boundary to a temporary ditch that will outfall to Jimmy Camp Creek.

DRAINAGE DESIGN CRITERIA:

This report has been prepared in accordance with the 1991 County Drainage Criteria Manual. The modified Rational Method was used to calculate basin flows.

EROSION CONTROL PLAN:

The County of El Paso Drainage Criteria Manual specifies that an Erosion Control Plan and associated cost estimate be submitted in conjunction with the Final Drainage Report.

FLOODPLAIN STATEMENT:

This site, Colorado Centre Residential Filing No. 4, is not within a designated F.E.M.A. Floodplain as determined by the Flood Insurance Rate Map, Community Panel Number 080059 0295B, effective date December 18, 1986.

CONSTRUCTION COST ESTIMATE

Public Drainage Facilities

| ITEM | QTY | UNIT COST | COST |
|------------------------|------------|--|---------------------------|
| 5' Type "R" Curb Inlet | 6 | \$2,000/EA | \$12,000.00 |
| Manhole/Cleanout | 6 | \$2,000/Ea | \$12,000.00 |
| 18" RCP | 227 LF | \$22/LF | \$ 4,994.00 |
| 24" RCP | 687 LF | \$30/LF | \$20,610.00 |
| 36" RCP | 43 LF | \$42/LF | \$ 1,806.00 |
| 42" RCP | 106 LF | \$50/LF | \$ 5,300.00 |
| | | Subtotal | \$56,710.00 |
| | | 15% Engineering & Contingencies | \$ 8,790.00 |
| | | Total | <u>\$65,500.00</u> |

JR Engineering, Ltd. cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. The opinions represent our best judgement as design professionals familiar with the construction industry and this development.

EROSION AND SEDIMENT CONTROL:

| ITEM | QTY | UNIT COST | COST |
|--|--------------|------------------|--------------------|
| Strawbale Check Dam (w/ 25% Maintenance and Replacement) | 25 | \$15/EA | \$ 375.00 |
| MIRAFI 100 x silt fence or equal | 2700 LF | \$1/LF | \$ 2,700.00 |
| Reseeding | 16.6765 Acre | \$500/AC | \$ 8,338.25 |
| | | Total | <u>\$11,413.25</u> |

DRAINAGE AND BRIDGE FEES:

The Jimmy Camp Creek Drainage Basin (miscellaneous basin) Fees are as follows:

| | | |
|----|---|--------------------|
| A. | Drainage Fees 16.6765 Acres x \$3,794/Acre = | \$63,270.64 |
| B. | Bridge Fees (no Bridge fees)= | \$ 0.00 |
| | Total | <u>\$63,270.64</u> |

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SUMMARY:

The flows generated by this development will not adversely affect the surrounding developments. The existing and proposed street system and storm sewer facilities are able to handle the flows from this site. Jimmy Camp Creek will be stabilized prior to any development other than Filing No. 4 taking place. All streets were analyzed using the current drainage criteria. Horizonview Drive flows are restricted to a spread of no greater than 20 feet from the flowline of the existing curb and gutter for 10-year flows. All other streets are limited to a depth of either the crownline or top of curb, whichever is the most limiting for 10-year flows. All 100-year flows are restricted to a curb flowline depth of 1 foot. All flows generated by Filing No. 4 will be safely channeled to Jimmy Camp Creek through temporary graded ditches.

REFERENCES:

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated October, 1991.
2. Master Development Drainage Plan for Colorado Centre Residential Phase II, JR Engineering, Ltd., July 22, 1993.
3. Drainage Study for Horizonview Drive, JR Engineering, Ltd., April 1, 1986.
4. Colorado Centre Residential Filing No. 1, JR Engineering, Ltd., March 22, 1985.
5. Colorado Centre Residential Filing No. 2, JR Engineering, Ltd., April 19, 1985.
6. Colorado Centre Residential Filing No. 3, JR Engineering, Ltd., July 23, 1985.