



CONSULTING. ENGINEERING. CONSTRUCTION.

October 6, 2021

El Paso County – Department of Public Works, Stormwater
3275 Akers Drive
Colorado Springs, CO 80922
Phone: 719.520.6460

Drainage Letter
Re: Sunset Village Filing 4 (1st Submittal)

Dear Sir or Madam,

This Drainage Letter is provided to address the development of Sunset Village Filing 4 located in El Paso County, Colorado as it relates to stormwater drainage to the existing regional pond dedicated to the Sunset Village subdivisions for water quality treatment and detention. The historic and developed conditions drainage patterns, flow rates, and volumes for stormwater runoff have been analyzed as well as the condition of the existing Pond facility. Within this letter are assessments of the existing and developed conditions and a comparison to the County-approved Final Drainage Report for Sunset Village Filing #4 developed by JPS Engineering, latest revision October 15, 2001. The Construction Documents for Sunset Village Filing 4 were developed by JPS Engineering and were approved by the County on December 19, 2001. An assessment of the predicted developed drainage conditions and the new developed conditions with the additional impervious area for sidewalk and the impact to the regional Pond is included in this letter.

General Description

Sunset Village Filing 4 is a 47-lot single-family residential modular home subdivision located in El Paso County, Colorado south of Enoch Road and west of South Ellicott Highway. The subdivision is located in the northeast corner of Section 12, Township 15 South, Range 63 West of the 6th PM. The site is bordered by the other developed Sunset Village filings, future Filing 5 to the northwest, and undeveloped agricultural areas beyond the Sunset Village subdivision. The site is located at an elevation of approximately 5,790 feet above mean sea level and is accessible via Jayhawk Avenue, Pipestem Avenue, and Enoch Road which connect to Ellicott Highway to the west.

The subdivision is partially built out with six existing single-family residences, utilities including water, wastewater, storm sewer, gas, and electric, and partially paved roadways. The subdivision stalled during construction and was not completed; particular items that were not completed were the asphalt mat within the roadways (not completed to depth), signage, and pond infrastructure.

Please add PCD File No. CDR-218 and provide a cover page for the report.

Add the County Standard Signature Block for drainage reports (attached)



Existing Drainage Conditions

While the site is partially built out at present day, the existing drainage conditions are considered the fully undeveloped condition of Filing 4 for the purposes of this analysis, in order to be consistent with the County approved Final Drainage Report (FDR) developed by JPS in 2001. The FDR describes the existing drainage conditions as such:

The major channel of Black Squirrel Creek is located east of the site, across Ellicott Highway. The intermittent streams throughout this area drain into the Black Squirrel Creek Basin which ultimately outfalls into the Arkansas River. The terrain is generally flat with gentle northwest to southeast slopes ranging from 1 percent to 4 percent. The native vegetation is mainly reedgrass, bluestem, and blue gramma.

An excerpt from the FDR describes the existing soil conditions:

According to the Soil Survey of El Paso County prepared by the Soil Conservation Service, on-site soils are comprised of "Valent series (102) sands" ...characterized as excessively drained sandy eolian material. These soils are classified as hydrologic soils group "A".

The Floodplain Impacts section of the report reads:

Sunset Village is located north of the delineated floodplain limits for the Telephone Exchange drainage basin, tributary to Black Squirrel Creek. The project site is located approximately one mile west of the main channel of Black Squirrel Creek, beyond the limits of the 100-year floodplain delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in the Flood Insurance Rate Map (FIRM) Number 08041C0825-F, dated March 17, 1997.

The FDR by JPS Engineering includes an Existing Drainage Plan which shows the sub-basin delineations for the Site including off-site drainage. Corresponding Rational Method calculations are included within the report appendix. The existing drainage pattern consists of overland flow across undeveloped agricultural land from the northwest to the southeast, with stormwater flow directed into the Telephone Exchange Drainage Channel.

The delineations and hydrology calculation presented in the FDR have been verified and no changes are proposed within this letter.

Developed Drainage Conditions

The developed conditions for Sunset Village Filing 4 include the fully built out single-family residential subdivision filing including modular homes, and right-of-way corridor development with asphalt paving and concrete curb and gutter. The 2001 design plans and FDR, however, showed the typical section for the residential rights-of-way with 4' attached sidewalks throughout the Filing. The County has requested that the section be updated to current standards with 5' width

Detention Pond B is not previously discussed in the report text. Please provide some context as to where this pond is located, the FDR it was designed/approved with, etc.

concrete pedestrian attached sidewalks. As such, the 2001 FDR hydrology maps and calculations are assessed as approved and with this increase in impervious area as it relates to the design for Detention Pond #2.

Existing Water Quality and Detention Facility

Detention Pond #2 is located southwest of Filing 4 and is the design point for water quality capture and treatment and detention of the 100-year storm event for Filing 4 and future Filing 5. The pond is located in the area designated for the future Regional Detention Pond C as described in the Sunset Village Master Drainage Design Plan which is to account for future development of Filing 5.

The 2001 FDR includes hydrologic and hydraulic calculations for the developed conditions sub-basins throughout the filing and off-site. These sub-basin delineations have been verified as a part of this drainage letter. To be assessed is the impact of the increase in percent imperviousness for the tributary area for Detention Pond #2 in order to retrofit the pond for current El Paso County and Mile High Flood District standards. With the exception of curb ramps, signage, and pond retrofits, no other deviations from the 2001 FDR drawings are proposed.

Update the narrative based on comments to the design calculations

The 2001 FDR designates Detention Pond #2 as Design Point B. The Pond has a 5-year storm event flow rate of 27.8 cfs and a 100-year storm event flow rate of 57.4 cfs as presented in the report's calculations in the appendix. Detention Pond B design calculations are also presented in the appendix with 5-year and 100-year stage-storage tables. Detention Pond B has a 4-foot pond depth ranging from elevation 5,784' to 5,788' with a 5-year stage elevation of 5,786' and a 100-year stage elevation of 5,787'. The volume of the facility is 60,871.5 cubic feet or 1.40 acre-feet for the 100-year stage. The total volume is 84,775 cubic feet. The freeboard elevation to the top of the pond bank at elevation 5,788'.

Update the existing and/or developed detention facility to describe the spillway design/condition. What is the existing condition and does the spillway need to be retrofitted? Explain the work needed if it needs to be retrofitted to meet current criteria.

The hydrologic criteria used to calculate storm water flows are presented in the report. Rational method procedures were utilized for calculation of storm water flows from small on-site drainage basins, all of which are below 100-acres. The calculations were verified.

Developed Water Quality and Detention Facility

The new developed condition matches that of the original 2001 drawings with the exception of attached 5' width concrete pedestrian sidewalks throughout the filing instead of 4' width sidewalks for the approximate increase of impervious area of 4,815 square feet. The increase in percent imperviousness of the 22.23 acres is 0.47 percent.

Add a narrative explaining the pond outfall condition. Does it appear hydraulically stable? Are there proposed improvements needed?

While the sidewalk width increase results in percent imperviousness increase, the hydrology calculations for stormwater runoff yield the same results presented in the 2001 FDR because standard ¼-acre lot coefficient values were used for the 5-year and 100-year storm events; 0.50 and 0.60, respectively. Similarly, a standard ¼-lot percent imperviousness of 40 percent was used. These values are unchanged in the County’s Table 5-1 Recommended Average Runoff Coefficients and Percent Impervious in the El Paso County Drainage Criteria Manual Section II – Hydrology, version dated October 31, 2018.

While the County has changed the typical right-of-way section for the minor residential roadways within the Filing to increase the sidewalk width from 4’ to 5’, the storm water runoff and pond water quality capture, EURV, and 100-year detention volumes remain unchanged when using current standards as percent imperviousness and coefficients remain unchanged from the 2001 FDR. For this reason, no hydrology or hydraulic calculations are needed for the new developed drainage conditions with the exception of pond infrastructure calculations for design.

Pond Infrastructure

The 2001 Construction Drawings include a Detention Pond Plan & Details sheet (D3) for the pond outlet structure and wall section design. The existing outlet structure was constructed according to this plan, however, current standards require that additional pond infrastructure be constructed in order for the Filing to be in compliance with El Paso County. The following is to be designed as supplemental plan set sheets within the original Construction Drawings:

- Any required forebay(s) or rip-rap at inlet locations
- Concrete trickle channel
- Micropool
- Retrofit to the existing CDOT Type C Catch Basin Outlet Structure including the following:
 - Well screen installation
 - Orifice Plate (new design from 2001 FDR)

Storm Sewer Infrastructure

The 2001 FDR includes hydraulic calculations and model results for the public storm sewer system for Filing 4 within the appendix. There exist three storm mains within the filing, pipes P-1, P-2, and P-3 which were calculated to have developed condition full-capacities of 5.87 percent, 21.83 percent, and 29.31 percent, respectively. These percent-full figures are considered low and are not anticipated to reach the 80 percent full standard as the hydrology and hydraulic calculations remain unchanged from the 2001 FDR. Hydraulic grade lines are also presented within the 2001 FDR and are not anticipated to change.

Pipe P-3 is the inlet pipe to Detention Pond #2 which has a full capacity discharge potential of 29.31 cfs and average velocity of 5.29 ft/s. These figures are used to size the rip-rap forebay of the pond.

Show the "Four-Step Process" for selecting structural BMPs
(ECM Section I.7.2 BMP Selection)

Engineer must confirm in the Drainage Report that the existing
pond is functioning as intended (ie: does not have reduced capacity
due to sediment deposits, for example).

Summary

In order to meet compliance, the Pond is to be retrofitted to include the required storm infrastructure which includes a concrete trickle channel, micropool, and an outlet structure with an engineered orifice plate, well screen, and trash rack. The Construction Drawings already included the outlet structure design as a CDOT Type C Catch Basin with a trash rack. As long as the as-built conditions of Detention Pond #2 match the Construction Drawings, water quality treatment and 100-year detention volumes will be met. The Developer is to implement the pond retrofits in order to be in compliance with the County. There will be no negative impacts to downstream development or surrounding areas due to the construction of Sunset Village Filing 4 once the pond is retrofitted as designed.

This letter has been prepared in accordance with El Paso County and the Mile High Flood District (MHFD). A Vicinity Map, USGS Soil Maps, FEMA Floodplain Map, Stormwater Detention and Infiltration Calculations (with Orifice Plate design calculations), and the 2001 Final Drainage Report are provided within the Appendix of this letter.

Please feel free to contact us with any questions or if any additional information is needed.

Respectfully,
ATWELL, LLC



Richard Lyon
Registered Professional Engineer
State of Colorado No. 0053921

APPENDIX A – VICINITY MAP
APPENDIX B – USGS SOIL MAPS
APPENDIX C – FEMA FLOODPLAIN MAP
APPENDIX D – STORMWATER DETENTION AND INFILTRATION CALCULATIONS
APPENDIX E – PHOTOGRAPHS OF EXISTING POND
APPENDIX F – FINAL DRAINAGE REPORT FOR SUNSET VILLAGE FILING 4 DEVELOPED BY
JPS ENGINEERING, DATED OCTOBER 15, 2001

Appendix A: Vicinity Map

SUNSET VILLAGE FILING 4

A PART OF SECTION 12, TOWNSHIP 15 SOUTH, RANGE 63 WEST
OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO,
STATE OF COLORADO



SCALE: 1" = 3,000'

PROJECT NO.: 21004166
DATE: 10/6/21



ATWELL

866.850.4200 www.atwell-group.com

6200 S. SYRACUSE WAY, SUITE 470
GREENWOOD VILLAGE, CO 80111
303.825.7100

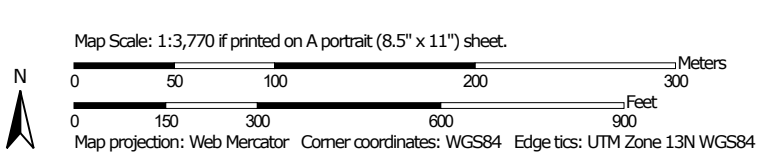
CONTACT: RICHARD LYON
RLYON@ATWELL-GROUP.COM

Appendix B: USGS Soil Maps

Soil Map—El Paso County Area, Colorado
(Sunset Village Fil 4 - Soils Map)



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

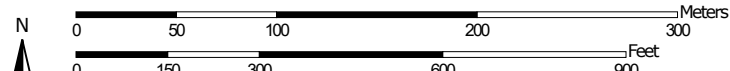
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	6.3	9.4%
106	Wigton loamy sand, 1 to 8 percent slopes	60.2	90.6%
Totals for Area of Interest		66.4	100.0%

Hydrologic Soil Group—El Paso County Area, Colorado
(Sunset Village Fil 4 - Hydrologic Soils Group Map)



Soil Map may not be valid at this scale.

Map Scale: 1:3,770 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	6.3	9.4%
106	Wigton loamy sand, 1 to 8 percent slopes	A	60.2	90.6%
Totals for Area of Interest			66.4	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C: FEMA Floodplain Map

National Flood Hazard Layer FIRMette



104°23'36"W 38°46'5"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

104°22'58"W 38°45'37"N

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 |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard Zone D |
| | | Channel, Culvert, or Storm Sewer |
| OTHER FEATURES | | Levee, Dike, or Floodwall |
| | | 20.2 Cross Sections with 1% Annual Chance |
| MAP PANELS | | 17.5 Water Surface Elevation |
| | | 8 Coastal Transect |
| OTHER FEATURES | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| OTHER FEATURES | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| OTHER FEATURES | | Profile Baseline |
| | | Hydrographic Feature |
| MAP PANELS | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |
| | | 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 **10/1/2021 at 11:18 AM** 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.

Appendix D: Stormwater Detention and Infiltration Calculations

Remove the SDI worksheet from the drainage letter

Stormwater Detention

SDI-Des

Stormwater Facility Name: **Detention Pond #2**

Facility Location & Jurisdiction: **Sunset Village Subdivision - El Paso County**

User Input: Watershed Characteristics

Extended Detention Basin (EDB) ▼		EDB
Watershed Area =	22.23	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	400	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	34.0%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths (use dropdown):

User Input ▼

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Once CUHP has been run and the Stage-Area-Discharge information has been provided, click 'Process Data' to interpolate the Stage-Area-Volume-Discharge data and generate summary results in the table below. Once this is complete, click 'Print to PDF'.

User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	120	0.00	0.00
0.33	120	0.33	0.01
0.50	120	0.50	0.01
1.00	1,355	1.00	0.02
1.50	12,051	1.50	0.10
2.00	33,289	2.00	0.16
2.50	48,613	2.50	0.20
3.00	50,129	3.00	9.35
4.00	53,216	4.00	11.17

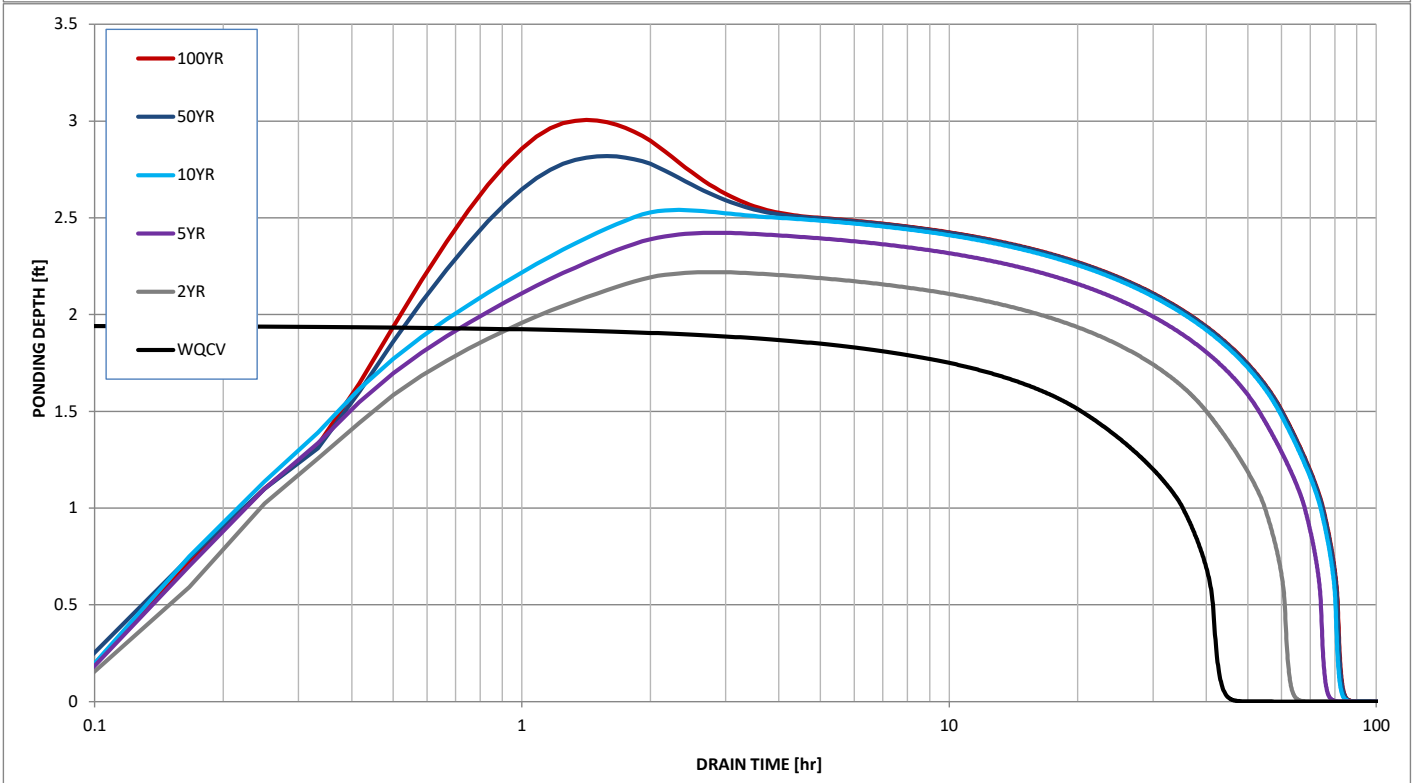
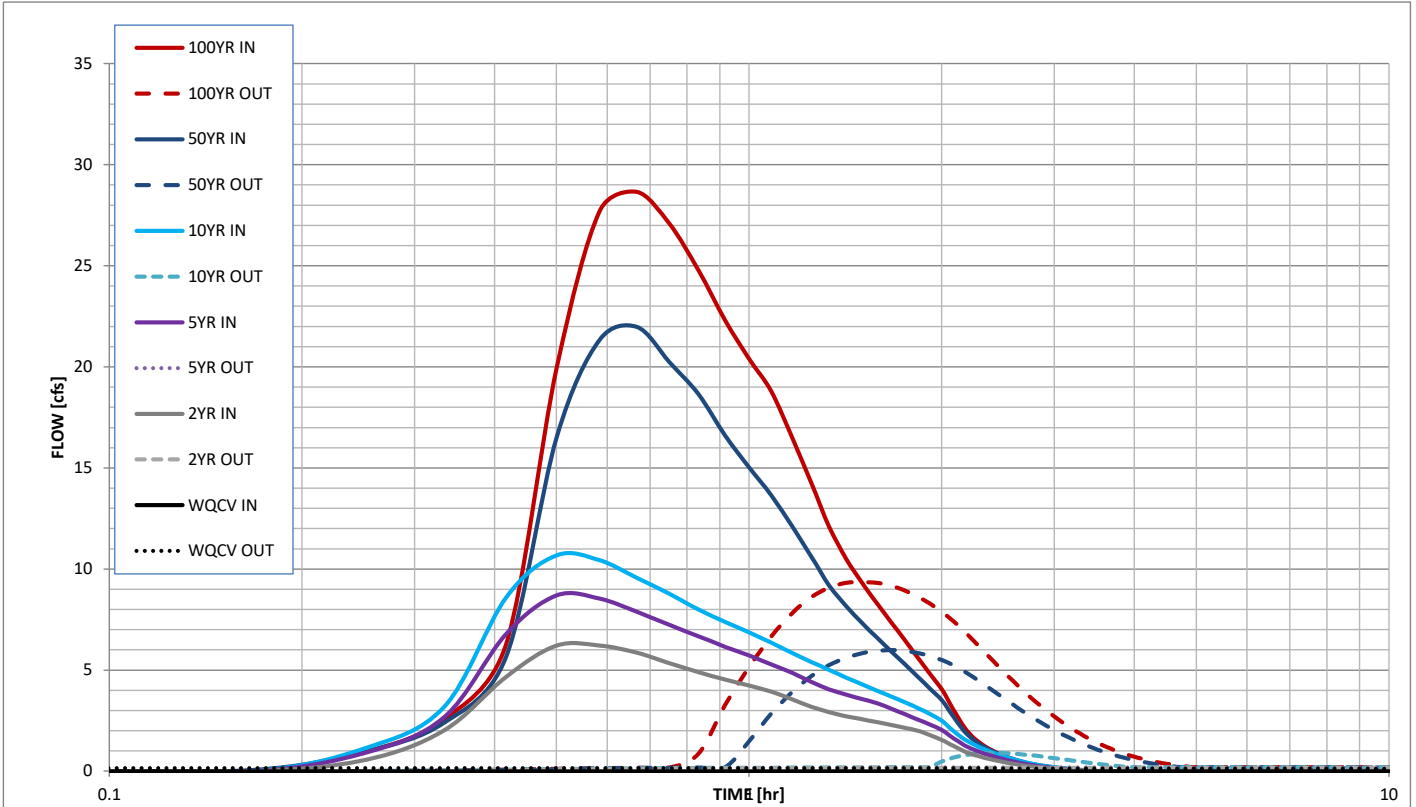
After completing and printing this worksheet to a pdf, go to: <https://maperture.digitaldataservices.com/gvh/?viewer=cswdif>

Create a new stormwater facility, and attach the PDF of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	N/A	1.19	1.50	1.75	2.25	2.52	in
CUHP Runoff Volume =	0.303	0.566	0.771	0.938	1.671	2.144	acre-ft
Inflow Hydrograph Volume =	N/A	0.566	0.771	0.938	1.671	2.144	acre-ft
Time to Drain 97% of Inflow Volume =	35.7	51.9	63.3	68.3	65.0	63.1	hours
Time to Drain 99% of Inflow Volume =	39.9	57.6	69.3	74.3	72.0	70.8	hours
Maximum Ponding Depth =	1.95	2.22	2.42	2.54	2.82	3.01	ft
Maximum Poned Area =	0.71	0.92	1.06	1.12	1.14	1.15	acres
Maximum Volume Stored =	0.305	0.528	0.727	0.858	1.174	1.385	acre-ft

Stormwater Detention and Infiltration Design Data Sheet

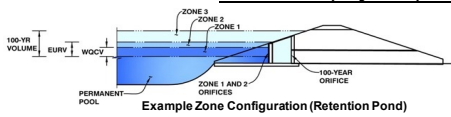


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD- Detention, Version 4.04 (February 2021)

Project: **21004166 - Sunset Village Filing 4**

Basin ID: **Detention Pond #2 (Design Point B)**



Watershed Information

Selected BMP Type =	EDB
Watershed Area =	22.23 acres
Watershed Length =	2,000 ft
Watershed Length to Centroid =	400 ft
Watershed Slope =	0.010 ft/ft
Watershed Imperviousness =	34.00% percent
Percentage Hydrologic Soil Group A =	100.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input

After providing required inputs above including 1-hour rainfall depths, click "Run CUHP" to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Water Quality Capture Volume (WQCV) =	0.303 acre-feet
Excess Urban Runoff Volume (EURV) =	0.782 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.566 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.771 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.938 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.315 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	1.671 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.144 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	3.163 acre-feet
Approximate 2-yr Detention Volume =	0.495 acre-feet
Approximate 5-yr Detention Volume =	0.658 acre-feet
Approximate 10-yr Detention Volume =	0.817 acre-feet
Approximate 25-yr Detention Volume =	1.024 acre-feet
Approximate 50-yr Detention Volume =	1.172 acre-feet
Approximate 100-yr Detention Volume =	1.397 acre-feet

Optional User Overrides

	acre-feet
	acre-feet
	inches
	inches
	inches
	inches
	inches
	inches
	inches
	inches
	inches

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.303 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.480 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.614 acre-feet
Total Detention Basin Volume =	1.397 acre-feet
Initial Surcharge Volume (ISV) =	40 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	3.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.004 ft/ft
Slopes of Main Basin Sides (S _{main}) =	3 H:V
Basin Length-to-Width Ratio (R _{L/W}) =	3

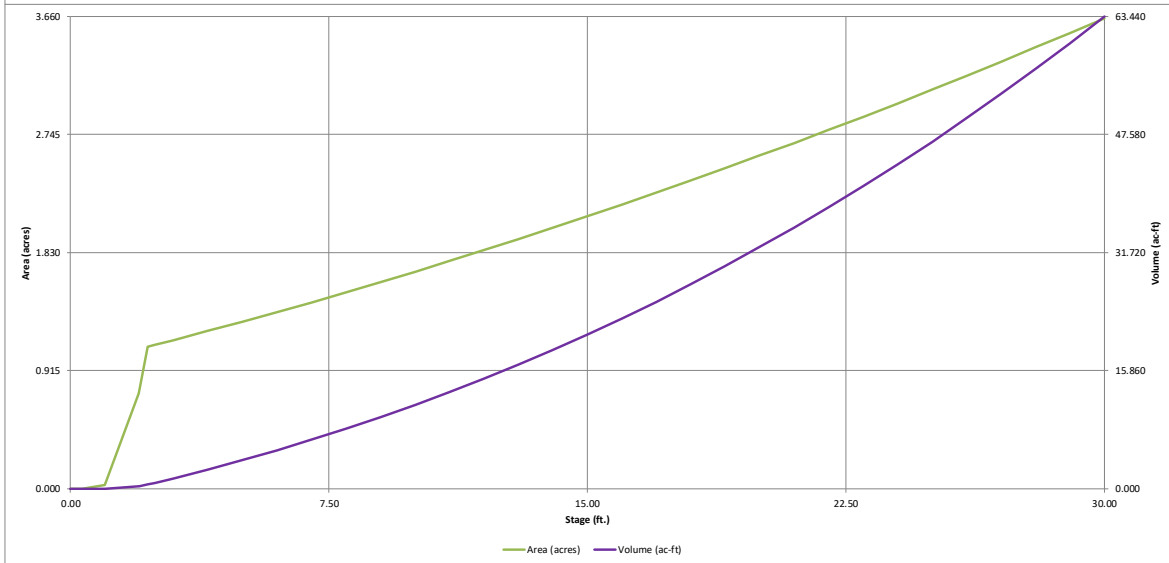
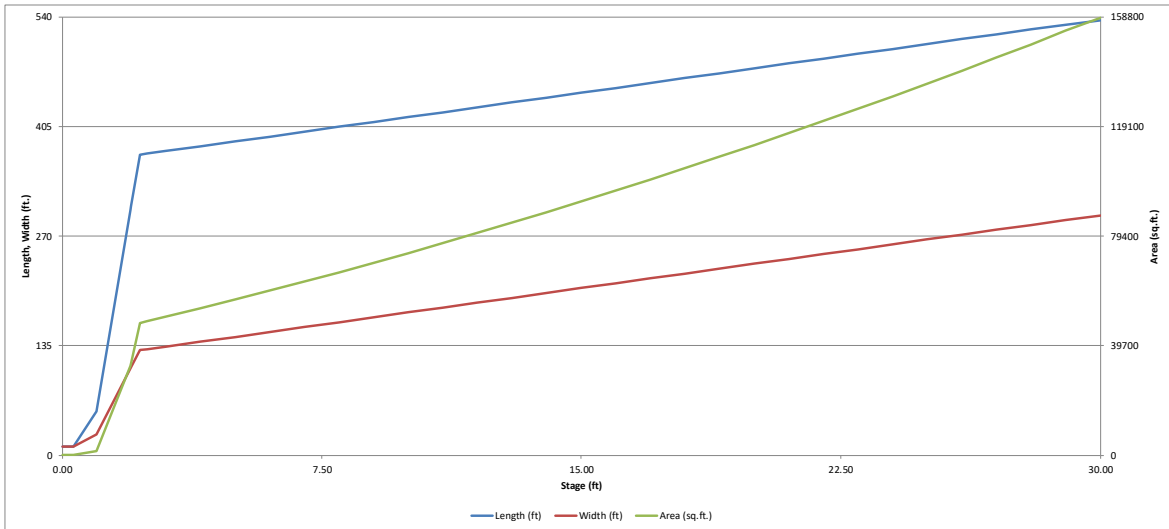
Initial Surcharge Area (A _{ISV}) =	120 ft ²
Surcharge Volume Length (L _{ISV}) =	10.9 ft
Surcharge Volume Width (W _{ISV}) =	10.9 ft
Depth of Basin Floor (H _{FLOOR}) =	1.42 ft
Length of Basin Floor (L _{FLOOR}) =	370.2 ft
Width of Basin Floor (W _{FLOOR}) =	129.3 ft
Area of Basin Floor (A _{FLOOR}) =	47,861 ft ²
Volume of Basin Floor (V _{FLOOR}) =	23,845 ft ³
Depth of Main Basin (H _{MAIN}) =	0.75 ft
Length of Main Basin (L _{MAIN}) =	374.7 ft
Width of Main Basin (W _{MAIN}) =	133.8 ft
Area of Main Basin (A _{MAIN}) =	50,129 ft ²
Volume of Main Basin (V _{MAIN}) =	36,743 ft ³
Calculated Total Basin Volume (V _{total}) =	1.393 acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00	578.000	10.9	10.9	120		0.003		
ISV	0.33		10.9	10.9	120		0.003	40	0.001
	1.00		54.0	25.1	1,315		0.031	208	0.005
Zone 1 (WQCV)	1.98	5785.98	301.9	106.8	32,237		0.744	13,361	0.307
	2.00		307.0	108.4	33,289		0.764	14,016	0.321
Floor	2.25		370.2	129.3	47,861		1.099	24,105	0.573
Zone 2 (EURV)	2.46	5786.46	371.5	130.5	48,492		1.113	34,222	0.766
Zone 3 (100-year)	3.00	5787.00	374.7	133.8	50,129		1.151	60,849	1.397
FREEBOARD	4.00	5788.00	380.7	139.8	53,216		1.222	112,515	2.583
	5.00		386.7	145.8	56,375		1.294	167,305	3.841
	6.00		392.7	151.8	59,606		1.368	225,290	5.172
	7.00		398.7	157.8	62,909		1.444	286,541	6.578
	8.00		404.7	163.8	66,284		1.522	351,132	8.061
	9.00		410.7	169.8	69,731		1.601	419,133	9.622
	10.00		416.7	175.8	73,250		1.682	490,617	11.263
	11.00		422.7	181.8	76,841		1.764	565,657	12.986
	12.00		428.7	187.8	80,504		1.848	644,258	14.792
	13.00		434.7	193.8	84,239		1.934	726,638	16.682
	14.00		440.7	199.8	88,046		2.021	812,891	18.660
	15.00		446.7	205.8	91,925		2.110	903,200	20.726
	16.00		452.7	211.8	95,875		2.201	997,697	22.881
	17.00		458.7	217.8	99,898		2.293	1,094,578	25.128
	18.00		464.7	223.8	103,993		2.387	1,194,518	27.468
	19.00		470.7	229.8	108,160		2.483	1,302,589	29.903
	20.00		476.7	235.8	112,399		2.580	1,412,862	32.435
	21.00		482.7	241.8	116,710		2.679	1,527,411	35.065
	22.00		488.7	247.8	121,093		2.780	1,646,307	37.794
	23.00		494.7	253.8	125,548		2.882	1,769,621	40.625
	24.00		500.7	259.8	130,075		2.986	1,897,427	43.559
	25.00		506.7	265.8	134,674		3.092	2,029,795	46.598
	26.00		512.7	271.8	139,345		3.199	2,166,799	49.743
	27.00		518.7	277.8	144,088		3.308	2,308,509	52.996
	28.00		524.7	283.8	148,903		3.418	2,454,998	56.359
	29.00		530.7	289.8	153,790		3.531	2,606,339	59.833
	30.00		536.7	295.8	158,749		3.644	2,762,602	63.421

Input the existing (surveyed) pond stage-area information in the optional columns. If the existing pond does not have sufficient capacity then update the construction drawings to include a pond grading plan.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Depotion, Version 4.04 (February 2021)



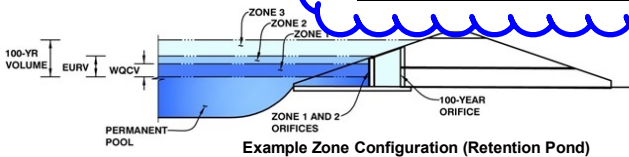
Update information

Will be reviewed once the pond stage-storage is updated to reflect the existing pond geometry.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: 21002365 - North 30th Street Apartment Building
 Basin ID: ADS Underground Detention Chambers - Concept 1



	Estimated Stage (ft)	Estimated Volume (ac-ft)	
Zone 1 (WQCV)	1.98	0.303	Orifice Plate
Zone 2 (EURV)	2.46	0.480	Orifice Plate
Zone 3 (100-year)	3.00	0.614	Weir&Pipe (Restrict)
Total (all zones)		1.397	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft ²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft ²
Depth at top of Zone using Orifice Plate =	3.05	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft ²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.25	1.25				
Orifice Area (sq. inches)	0.31	0.31	2.25	2.25				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice =	Not Selected	Not Selected	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	Not Selected	Not Selected
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A
Vertical Orifice Diameter =	N/A	N/A	inches			

User Input: Overflow Weir (Dropdown with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

Calculated Parameters for Overflow Weir

Overflow Weir Front Edge Height, H _o =	Zone 3 Weir: 2.50	Not Selected: N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H _t =	Zone 3 Weir: 2.50	Not Selected: N/A
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.90	N/A
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.14	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.57	N/A
Debris Clogging % =	50%	N/A	%			

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Depth to Invert of Outlet Pipe =	Zone 3 Restrictor: 0.00	Not Selected: N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	Zone 3 Restrictor: 1.25	Not Selected: N/A
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.56	N/A
Restrictor Plate Height Above Pipe Invert =	12.00	N/A	inches	Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

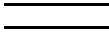
Spillway Invert Stage =	6.00	ft (relative to basin bottom)	Spillway Design Flow Depth =	0.85	feet
Spillway Crest Length =	10.00	feet	Stage at Top of Freeboard =	7.85	feet
Spillway End Slope =	3.00	H:V	Area at Top of Freeboard =	1.51	acres
Freeboard above Max Water Surface =	1.00	feet	Volume at Top of Freeboard =	7.83	acre-ft

Update the narrative to discuss if this is existing condition or to be constructed.

Routed Hydrograph Results

The user can override the default CUHP hydrographs in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
One-Hour Rainfall Depth (in) =	N/A	N/A	0.303	0.566	0.771	0.938	1.315	1.671
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.566	0.771	0.938	1.315	1.671	2.144
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.566	0.771	0.938	1.315	1.671	2.144
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.3	0.4	3.8	7.6	12.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.17	0.34	0.56
Peak Inflow Q (cfs) =	N/A	N/A	6.2	8.7	10.7	16.7	22.0	28.7
Peak Outflow Q (cfs) =	0.2	0.2	0.2	0.2	0.5	3.0	5.6	9.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	1.1	0.8	0.7	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.3	0.5	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	62	53	62	69	68	67	65
Time to Drain 99% of Inflow Volume (hours) =	42	72	60	72	79	78	76	73
Maximum Ponding Depth (ft) =	1.98	2.46	2.23	2.41	2.55	2.73	2.85	3.01
Area at Maximum Ponding Depth (acres) =	0.74	1.11	1.06	1.12	1.12	1.13	1.14	1.15
Maximum Volume Stored (acre-ft) =	0.307	0.786	0.521	0.719	0.875	1.077	1.225	1.408



fix page layout. This is a part of the previous sheet.

ft²

ft²
feet

ft

feet
feet

ft²
ft²

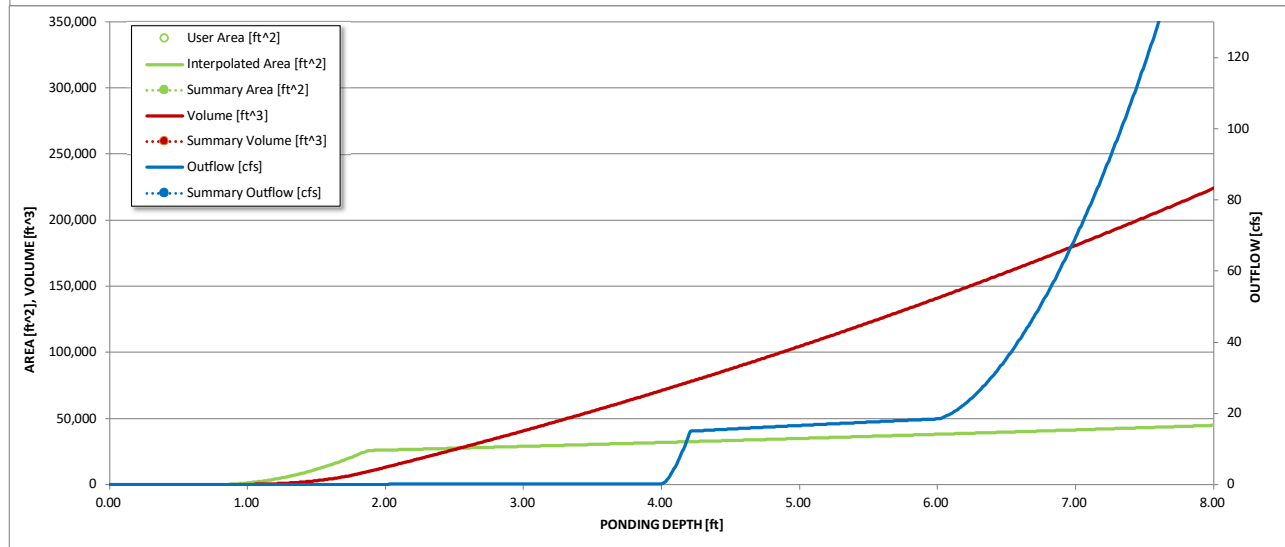
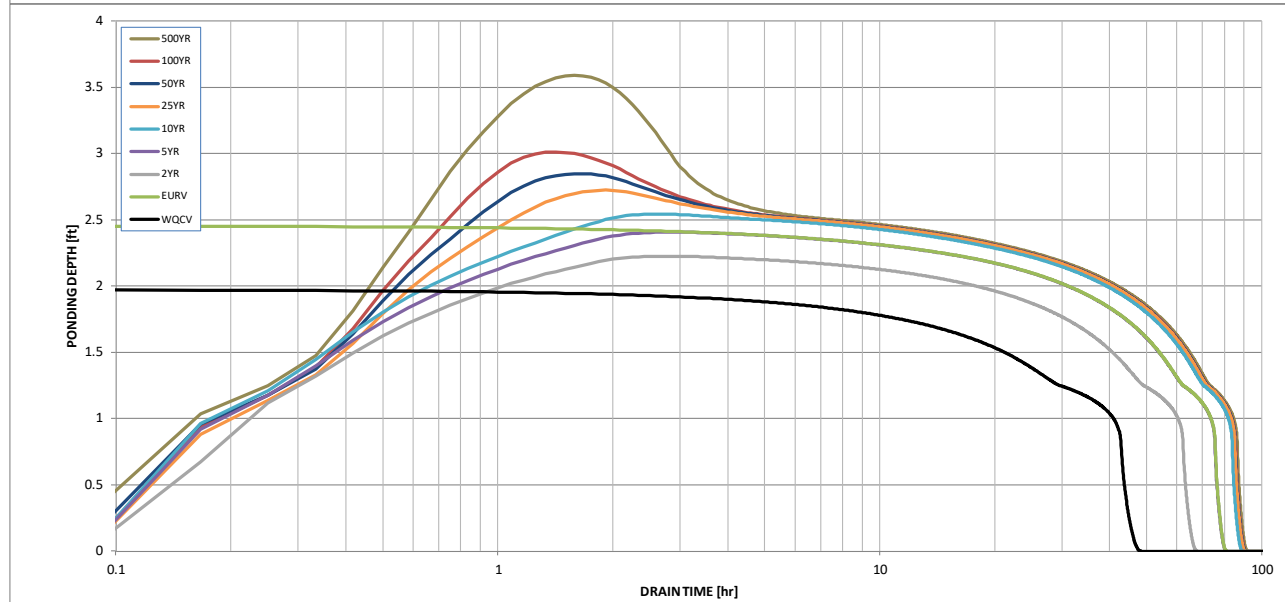
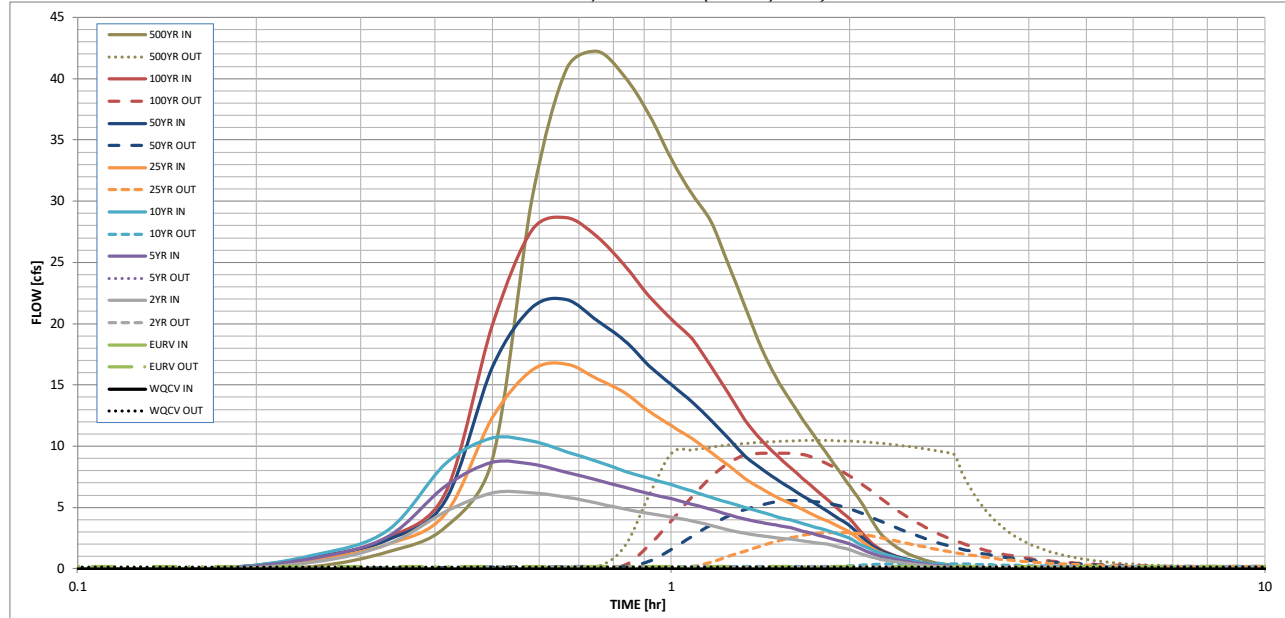
ft

ft²
feet
radians

500 Year
3.14
3.163
3.163
22.5
1.01
42.2
10.5
0.5
Outlet Plate 1
0.9
N/A
62
71
3.59
1.19
2.088

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.21
	0:15:00	0.00	0.00	0.55	0.90	1.12	0.76	0.97	0.95	1.39
	0:20:00	0.00	0.00	2.02	2.66	3.18	2.03	2.40	2.57	3.42
	0:25:00	0.00	0.00	4.67	6.80	8.60	4.53	5.66	6.29	8.97
	0:30:00	0.00	0.00	6.22	8.70	10.68	12.38	16.52	19.96	30.28
	0:35:00	0.00	0.00	6.22	8.54	10.44	16.26	21.34	27.70	40.86
	0:40:00	0.00	0.00	5.87	7.90	9.58	16.73	21.99	28.66	42.24
	0:45:00	0.00	0.00	5.35	7.24	8.78	15.51	20.25	27.09	40.20
	0:50:00	0.00	0.00	4.91	6.68	8.00	14.40	18.65	24.79	37.15
	0:55:00	0.00	0.00	4.54	6.16	7.40	12.89	16.61	22.32	33.41
	1:00:00	0.00	0.00	4.23	5.72	6.87	11.67	15.02	20.39	30.60
	1:05:00	0.00	0.00	3.94	5.29	6.35	10.64	13.64	18.79	28.32
	1:10:00	0.00	0.00	3.56	4.87	5.85	9.52	12.12	16.51	24.80
	1:15:00	0.00	0.00	3.20	4.43	5.42	8.43	10.64	14.29	21.36
	1:20:00	0.00	0.00	2.92	4.05	5.02	7.36	9.20	12.10	18.06
	1:25:00	0.00	0.00	2.73	3.79	4.64	6.57	8.19	10.53	15.66
	1:30:00	0.00	0.00	2.57	3.57	4.31	5.91	7.34	9.33	13.78
	1:35:00	0.00	0.00	2.43	3.37	3.99	5.35	6.62	8.31	12.16
	1:40:00	0.00	0.00	2.29	3.10	3.70	4.83	5.94	7.38	10.69
	1:45:00	0.00	0.00	2.15	2.82	3.42	4.35	5.31	6.49	9.30
	1:50:00	0.00	0.00	2.01	2.56	3.14	3.89	4.69	5.64	7.97
	1:55:00	0.00	0.00	1.78	2.31	2.84	3.43	4.09	4.82	6.71
	2:00:00	0.00	0.00	1.56	2.04	2.49	3.00	3.52	4.05	5.53
	2:05:00	0.00	0.00	1.26	1.65	2.00	2.37	2.72	3.07	4.11
	2:10:00	0.00	0.00	1.00	1.30	1.60	1.78	2.00	2.19	2.93
	2:15:00	0.00	0.00	0.80	1.05	1.31	1.35	1.51	1.62	2.17
	2:20:00	0.00	0.00	0.67	0.87	1.09	1.06	1.19	1.25	1.66
	2:25:00	0.00	0.00	0.55	0.72	0.90	0.85	0.95	0.97	1.27
	2:30:00	0.00	0.00	0.45	0.60	0.74	0.69	0.77	0.76	0.98
	2:35:00	0.00	0.00	0.37	0.49	0.61	0.55	0.61	0.59	0.74
	2:40:00	0.00	0.00	0.30	0.40	0.49	0.44	0.49	0.45	0.56
	2:45:00	0.00	0.00	0.25	0.32	0.39	0.35	0.38	0.35	0.43
	2:50:00	0.00	0.00	0.20	0.26	0.31	0.28	0.30	0.28	0.34
	2:55:00	0.00	0.00	0.16	0.20	0.25	0.22	0.24	0.22	0.27
	3:00:00	0.00	0.00	0.13	0.16	0.20	0.18	0.19	0.18	0.21
	3:05:00	0.00	0.00	0.10	0.13	0.15	0.14	0.15	0.14	0.17
	3:10:00	0.00	0.00	0.08	0.10	0.12	0.10	0.11	0.10	0.12
	3:15:00	0.00	0.00	0.05	0.07	0.08	0.08	0.08	0.07	0.09
	3:20:00	0.00	0.00	0.04	0.05	0.06	0.05	0.05	0.05	0.06
	3:25:00	0.00	0.00	0.02	0.03	0.04	0.03	0.03	0.03	0.03
	3:30:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.01	0.02
	3:35:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Appendix E: Photographs of Existing Pond



Figure 1: Existing Pond appears to have been constructed as designed in terms of topography. There is much debris to be disposed of as a part of this project.



Figure 2: Existing Outlet Structure is in sufficient condition. Dimensions match the Construction Drawings.



Figure 3: Measurements were taken to ensure that the outlet structure was constructed according to the Construction Drawings. A trash rack was installed per the detail.



Figure 4: Outlets of pipes into the pond have built up with sediment over time and there is no energy dissipation installed. Type VL rip-rap is to be installed.



Figure 5: Outlets of pipes into the pond have built up with sediment over time and there is no energy dissipation installed. Type VL rip-rap is to be installed.

Appendix F: Final Drainage Report for Sunset Village Filing 4

Prepared by JPS Engineering dated October 15, 2021

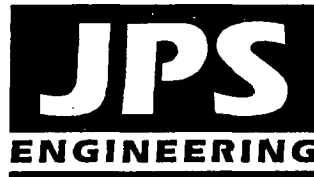
**FINAL DRAINAGE REPORT
FOR
SUNSET VILLAGE FILING #4**

Prepared for:

Ellicott Springs Development
90 S. Cascade Avenue, Suite 950
Colorado Springs, CO 80903

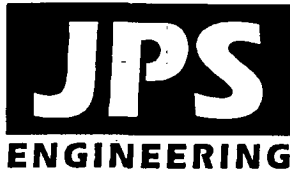
March 6, 2001
Revised July 20, 2001
Revised September 10, 2001
Revised October 15, 2001

Prepared by:



518 North Nevada Ave., Suite 303
Colorado Springs, CO 80903
(719)-477-9429
(719)-471-0766 FAX

JPS Project No. 090006



518 N. Nevada Ave., Suite 303
Colorado Springs, CO 80903
(719)-477-9429
(719)-471-0766 fax

October 15, 2001

El Paso County Department of Transportation
Attn: Colleen Dawson
3460 N. Marksheffel Road
Colorado Springs, CO 80922

**SUBJECT: Sunset Village Filing #4
Final Drainage Report**

Dear Colleen:

We have enclosed a "draft" revision of the final drainage report for Sunset Village Filing No. 4 for your final review and approval. Based on recent discussions with the County, the proposed regional park and regional detention facility in Section 12 has been eliminated from the plan. In this submittal, we have attempted to address all remaining review comments from the El Paso County review memorandum dated October 3, 2001. These review comments are specifically addressed as follows:

1. Detention Pond #2 has been relocated to the northeast side of the Telephone Exchange main channel.
2. Sheets D2 and D3 are included in the report as half-size drawings, and full-size copies are included in the construction drawings.
3. The inlet size for design point B2 has been corrected (10-foot).
4. Drainage fee calculations have been updated in accordance with County comments.
5. Erosion Control measures have been identified for the proposed detention pond.
6. The "SWMP" erosion control note has been added to the plan.

Please call me if you have any questions or need any additional information.

Sincerely,
JPS ENGINEERING

John P. Schwab, P.E.

cc: Rodney Preisser, Ellicott Springs Development
Tom Keith, United Planning & Engineering

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APPENDICES

APPENDIX A Figures

FIGURE A1:	Vicinity Map
FIGURE A2:	FEMA Flood Insurance Rate Map
FIGURE A3:	NRCS Soils Map
FIGURE EX1:	Historic Drainage Plan
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SHEET D2:	Storm Drain Plan & Profile
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APPENDIX B Hydrologic Calculations

APPENDIX C Hydraulic Calculations

APPENDIX D Cost Estimate

APPENDIX E Correspondence

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.

John P. Cowab, P.E.



9/11/01

Developer's Statement:

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

By: _____

Printed Name:

Title:

My Hussin

9-12-01

Date

Ellicott Springs Development
90 S. Cascade Avenue, Suite 950
Colorado Springs, CO 80903

El Paso County's Statement

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

John A. McCarty, P.E., Director of Public Works

John A. McCarty


12-19-01

Date

Conditions:

FLOODPLAIN STATEMENT

To the best of my knowledge and belief, Sunset Village Filing #4 is not located in a FEMA designated floodplain, as shown on FIRM panel No. 08041C0825F, dated March 17, 1997.



John P. Schwab, P.E. #29891

I. GENERAL LOCATION AND DESCRIPTION

A. Background

The Ellicott Springs development is located approximately 4 miles south of Ellicott, Colorado in eastern El Paso County. Initial phases of the development included Filings No. 1, 2, and 3 of Sunset Village. The development is located on the west side of Ellicott Highway between Enoch Road and Henderson Road. Ultimately, the proposed mixed-use development will consist of over 5,000 single-family homes with related multifamily and commercial development within the 2,000-acre parcel. Sunset Village Filing No. 4 consists of 47 lots on a 14.25-acre parcel located at the northeast corner of the Ellicott Springs Master Plan area, as shown in Figure A1.

B. Scope

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. The previously approved March 2000 "Preliminary Drainage Report for Sunset Village Filing No. 3" prepared by Leigh Whitehead and Associates, Inc. is the PDR for Sunset Village Filings No. 3, 4, and 5. The Final Drainage Report for Sunset Village Filing No. 3, prepared by JPS Engineering, was approved by El Paso County in August, 2000. This report updates and supersedes the approved MDDP and Preliminary Drainage Reports for the Sunset Village Filing No. 4 parcel.

C. Site Location and Description

Sunset Village Filing No. 4 is located in the northeast corner of Section 12, Township 15 South, Range 63 West of the 6th P.M. The site has historically been used as an agricultural field. The proposed Filing No. 4 will consist of 47 single family residential lots planned for modular home units. Associated site improvements will include site grading and utilities and asphalt paving of the roads within the site. The south half of Enoch Road will be constructed within a 40-foot right-of-way adjacent to and south of the north boundary of the site.

The parcel is bordered by agricultural properties and undeveloped areas on the north and west sides. Sunset Village Filings No. 2 and 3 border the Filing No. 4 parcel to the east, and Ellicott Highway runs along the easterly boundary of the overall Sunset Village site. The site is located at an elevation of approximately 5,790 feet above mean sea level, and is accessible via Jayhawk Avenue, Pipestem Avenue, and Enoch Road, which connect to Ellicott Highway.

The major drainage channel of Black Squirrel Creek is located east of the site, across Ellicott Highway. The intermittent streams throughout this area drain into the Black Squirrel Creek Basin which ultimately outfalls into the Arkansas River. The terrain is generally flat with gentle northwest to southeast slopes ranging from 1% to 4%. The native vegetation is mainly reedgrass, bluestem, and blue gramma.

A major tributary of the Telephone Exchange Drainage Basin lies adjacent to the southerly boundary of the Sunset Village Filing No. 4 parcel. Historic drainage patterns from the site are conveyed overland to the south and west into the adjacent drainage channel.

D. General Soil Conditions

According to the Soil Survey of El Paso County prepared by the Soil Conservation Service, on-site soils are comprised of "Valent series (102)" sands" (see Figure A3), characterized as excessively drained sandy eolian material. These soils are classified as hydrologic soils group "A," this report will consider these soils as hydrologic group "B" in accordance with El Paso County drainage criteria.

E. References

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

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

El Paso County "Subdivision Criteria Manual," June, 1981.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C1025-F, March 17, 1997.

JPS Engineering, "Final Drainage Report for Sunset Village Filing No. 3," August 15, 2000.

Leigh Whitehead & Associates, Inc., "Master Development Drainage Plan for Sunset Village," May, 2000.

Leigh, Whitehead & Associates, Inc., "Preliminary Drainage Report and Plan for Sunset Village Filing No. 3," March, 2000.

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

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The proposed development lies entirely within the Telephone Exchange Drainage Basin (CHWS0200) as classified by El Paso County. No drainage planning studies have been completed for this tributary area of the Black Squirrel Creek basin. However, the March 2000 "Sunset Village Master Development Drainage Plan (MDDP)," prepared by Leigh Whitehead & Associates, Inc., has been approved by El Paso County.

B. Floodplain Impacts

Sunset Village is located north of the delineated floodplain limits for the Telephone Exchange drainage basin, tributary to Black Squirrel Creek. The project site is located approximately one mile west of the main channel of Black Squirrel Creek, beyond the limits of the 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 08041C0825-F, dated March 17, 1997 (see Figure A2).

C. Sub-Basin Description

The existing drainage basins lying in and around the proposed development are illustrated in Figure EX1 (Appendix A). The proposed Sunset Village Filing No. 4 parcel is impacted by two historic drainage basins. Basin EX-B covers the majority of the Filing No. 4 parcel, draining southeasterly to the existing Telephone Exchange drainage channel. Basin EX-C covers the southwesterly fringe of the parcel, also draining to the adjacent channel. The natural drainage patterns will be impacted through development by site grading and concentration of runoff to an extent in subdivision street gutters and storm drains. Developed runoff will generally continue to follow historic paths.

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

The "Sunset Village MDDP" prepared by Leigh Whitehead generally recommends mitigation of developed runoff flows through regional on-site detention ponds to maintain historic runoff flows leaving the developed site.

Sunset Village Filing No. 4 is located in Basin A30 as identified in the MDDP. According to the MDDP, this basin consists of a 10.66 square mile drainage area with developed peak flows of $Q_5 = 316$ cfs and $Q_{100} = 1,570$ cfs.

B. Hydrologic Criteria

In accordance with El Paso County drainage criteria, 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 | |
| | <u>C5</u> | <u>C100</u> |
| • Runoff Coefficients – undeveloped areas: | | |
| Pasture / meadow | 0.25 | 0.35 |
| • Runoff Coefficients - developed: | | |
| ¼-acre residential lots | 0.50 | 0.60 |

Rational method procedures were utilized for calculation of peak flows within the relatively small on-site drainage basins, all of which are well below 100-acres. Hydrologic calculations are enclosed in Appendix B, and peak design flows are identified on the drainage basin drawings.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

Development of the proposed subdivision will require site grading and paving work, resulting in additional impervious areas across the site. The general concept for management of developed storm runoff is to grade the home sites to curb and gutter along the internal roads within the subdivision, conveying runoff flows through the site. Access to Sunset Village Filing No. 4 will be provided by extensions of Pipestem Avenue, Wheat Drive, Fleet Street, and Jayhawk Avenue from the east, and construction of Redtail Drive and Black Elk Drive. The street system has been designed to convey runoff through the site by street gutter to a low point at the intersection of Jayhawk Avenue and Redtail Drive. Curb inlets at this low point will convey runoff into storm drains flowing to a detention pond along the bank of the major drainage channel southwest of Filing No. 4. Overlot grading will be minimized on lots adjacent to the major channel floodplain to ensure that these lots remain above the adjacent high water (100-year) surface elevation.

The following is a description of the basin characteristics and flow patterns for historic and developed conditions:

B. Specific Details

1. Existing Drainage Conditions

Historic drainage conditions are depicted in Figure EX1. The site is covered primarily by one existing drainage basin (EX-B, 21.4 acres), which sheet flows southeast to the existing Telephone Exchange drainage channel. Historic peak flows from Basin EX-B are $Q_5 = 8.6$ cfs and $Q_{100} = 22.5$ cfs.

2. Developed Drainage Conditions

The developed drainage basins and projected flows are shown in the Developed Drainage and Erosion Control Plan (Sheet D1, in pocket at back of report). The developed site has been divided into eight sub-basins (B1-B8) and four design points, as shown on the enclosed Drainage Plan. Hydrologic calculations are enclosed in Appendix B. Developed runoff from the site will be conveyed by street gutters to curb inlets at the intersection of Jayhawk Avenue and Redtail Drive. Developed peak flows from Basin B are projected to be $Q_5 = 27.8$ cfs and $Q_{100} = 57.4$ cfs. A storm drain will convey these flows to a detention pond to be constructed in the Telephone Exchange tributary channel south of the Filing No. 4 parcel. Developed on-site runoff combines with the main channel flow from the off-site drainage basin to the north (A30), which has peak flows of $Q_5 = 316$ cfs and $Q_{100} = 1,570$ cfs.

Developed flows from Sub-basins A2 and A3 have been considered in sizing of existing storm inlets southeast on Pipestem Avenue as described in the final drainage report for Sunset Village Filing No. 3. Development of Basin C along the westerly fringe of Filing No. 4 is assumed to consist only of rear yards, resulting in no significant change from historic drainage conditions. The overall developed flows from Filing No. 4 will remain negligible (less than 4 percent) in comparison to the off-site flows in the Telephone Exchange tributary (Basin A30) south of the site.

3. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix B, the total developed flow from the site will exceed historic flow from the site. The comparison of developed to historic discharges at the key design point (B) 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)	
B	21.37	8.6	22.5	22.23	27.79	57.35	323% / 255% (increase)

4. Detention Ponds

The total developed storm runoff downstream of Design Point B will be maintained at historic levels by constructing a stormwater detention pond (Detention Pond #2) adjacent to the Telephone Exchange drainage channel southwest of Lots 6 and 7. The proposed pond will be located within the area designated for the future Regional Detention Pond C as described in the Sunset Village MDDP. Given the uncertainty in timing of the future regional detention pond, the proposed temporary detention pond will be sized to mitigate the impacts of developed flows from Sunset Village Filings No. 4 and No. 5 (future).

The proposed detention facility will be sized to maintain the pond outflow to a level below historic discharges from Design Point B. In accordance with El Paso County drainage criteria, the proposed pond has been sized utilizing the Rational Stored Rate method (see Appendix C), resulting in a pond volume of 1.4 acre-feet. Details of the proposed detention pond are shown in the enclosed Sheet D3.

C. On-Site Drainage Facility Design

Developed sub-basins and proposed drainage improvements are depicted in the enclosed Drainage Plan and Storm Sewer Plan (Sheets D1 and D2, in pocket). The proposed drainage facilities are described as follows:

The internal road gutters within Filing No. 4 will be graded to drain to the low point on Jayhawk Avenue at the Redtail Drive intersection. According to the El Paso County Drainage Criteria Manual, the minor storm street capacity of residential streets at the minimum grade of 0.5 percent is 8 cfs ($Q_{all} = 112.6 * S^{1/2}$). The street capacity of Jayhawk Avenue at key road intersections is summarized as follows:

Location	Design Point	Street Grade	Allowable Capacity (cfs)	Peak Flow (Q_5 , cfs)
Jayhawk Ave. @ Jayhawk Drive	B3	1.0%	11.3	4.2
Jayhawk Ave. @ Black Elk Drive	B5	1.1%	11.8	11.7

Three CDOT "Type R" curb-opening inlets will be installed in a sump condition at this intersection (see Appendix C). Inlet sizes were determined based on a maximum allowable ponding depth of 12 inches for the major (100-year) storm, including a 20 percent clogging factor. A storm sewer system will be constructed from the proposed inlets to the proposed detention pond southwest of Filing No. 4. Storm sewer pipe slopes were set based on proposed street grades and detention pond grades at the outfall. Storm sewer pipe sizes were determined based on full-pipe capacity for the 5-year storm event (see Appendix C). A 36-inch RCP storm drain will convey developed flows to an outfall in the proposed detention pond, which will discharge to the existing Telephone Exchange channel. Riprap outlet protection sized for the 100-year storm event will be provided for erosion control at the storm sewer pipe outlet. Characteristics of the proposed sump inlets and storm sewer system are summarized as follows:

Design Point	Proposed Inlet Size	Inlet Flow		Inlet Ponding Depth		Storm Sewer Flow	Storm Sewer Pipe Size
		(Q ₅ , cfs)	(Q ₁₀₀ , cfs)	(d ₅ , ft)	(d ₁₀₀ , ft)	(Q ₅ , cfs)	
B8	5-foot	3.5	7.2	0.49	0.72	3.5	18-inch
B7	25-foot	19.1	39.5	0.64	0.95	21.4	30-inch
B2	10-foot	7.7	15.8	0.58	0.86	27.8	36-inch

As shown above, the proposed storm inlets provide sufficient capacity to intercept 5-year flows without overtopping the curb (9-inch depth) and intercept 100-year flows with a maximum ponding depth of 12-inches.

A grass-lined temporary diversion channel will be graded along the northwest boundary of Sunset Village Filing No. 4 to divert off-site drainage from the proposed subdivision until future street improvements are constructed in Sunset Village Filing No. 5.

V. EROSION CONTROL

Best management practices (BMP's) will be implemented for erosion control during construction. The erosion control plan for Sunset Village Filing No. 4 is enclosed in the pocket in back of this report. Erosion control measures will include installation of silt fence at the toe of disturbed slopes, vehicle tracking pads at access points, and revegetation of disturbed areas. Cut slopes will be stabilized during excavation if necessary and vegetation will be established for stabilization of the graded areas.

VI. COST ESTIMATE AND DRAINAGE FEES

The cost estimate for proposed temporary and permanent drainage improvements is detailed in Appendix D. The total estimated cost of improvements required for Sunset Village Filing No. 4 is approximately \$55,000. The proposed development does not include any reimbursable stormwater facilities. This parcel is located in the Telephone Exchange drainage basin, which currently has a basin fee structure of \$5,267 per impervious acre and a bridge fee of \$123 per impervious acre. Applicable drainage and bridge fees are calculated as follows:

Total platted acreage = 14.25
 Total lot area – 9.734 acres (from plat)
 Average lot size = (9.734 acres / 47 lots) = 0.207 acres per lot
 Percent impervious = 43% (from El Paso County criteria for 0.20 ac/lot)
 Total impervious area = (0.43 * 14.25 ac.) = 6.13 acres
 Drainage Fee = (6.13 ac. @ \$5,267/ac.) = \$32,274
 Bridge Fee = (6.13 ac. @ \$123/ac.) = \$754
Total Drainage and Bridge Fee = \$33,028

VII. SUMMARY

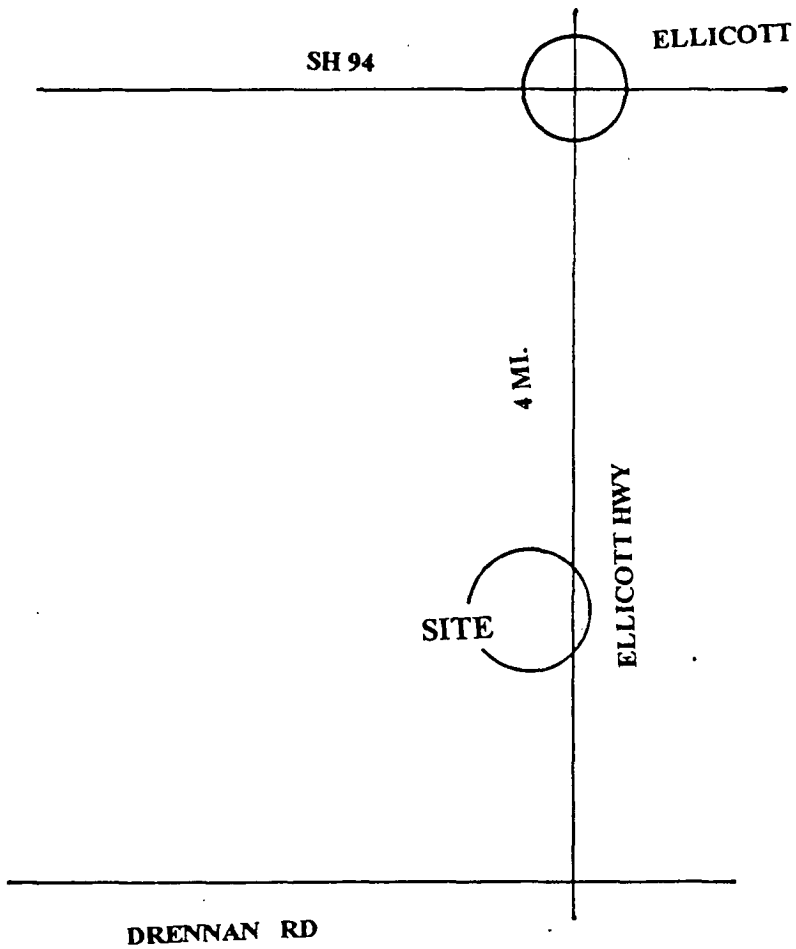
The proposed Sunset Village Filing No. 4 will result in an increase in undetained developed runoff from the site. To mitigate the increase in developed runoff and concentration of flows, an on-site stormwater detention pond (Detention Pond #2) will be constructed southwest of this filing adjacent to the Telephone Exchange drainage channel. Detention Pond #2 will be located within the area designated for a future regional detention pond in the Sunset Village MDDP, allowing for integration into a larger pond when the future regional detention facility is constructed.

The total developed flow from Filing No. 4 will remain minimal (less than 4 percent) in comparison to historic off-site flows in the Telephone Exchange channel running along the southwesterly boundary of the site. Construction of the proposed Detention Pond #2 will ensure that developed flows from Sunset Village Filings No. 4 and 5 remain below historic levels.

The proposed drainage patterns from development of Sunset Village Filing No. 4 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. Construction of the proposed drainage and detention facilities, in conjunction with proper erosion control measures, will ensure that this subdivision will not adversely affect downstream or surrounding areas.

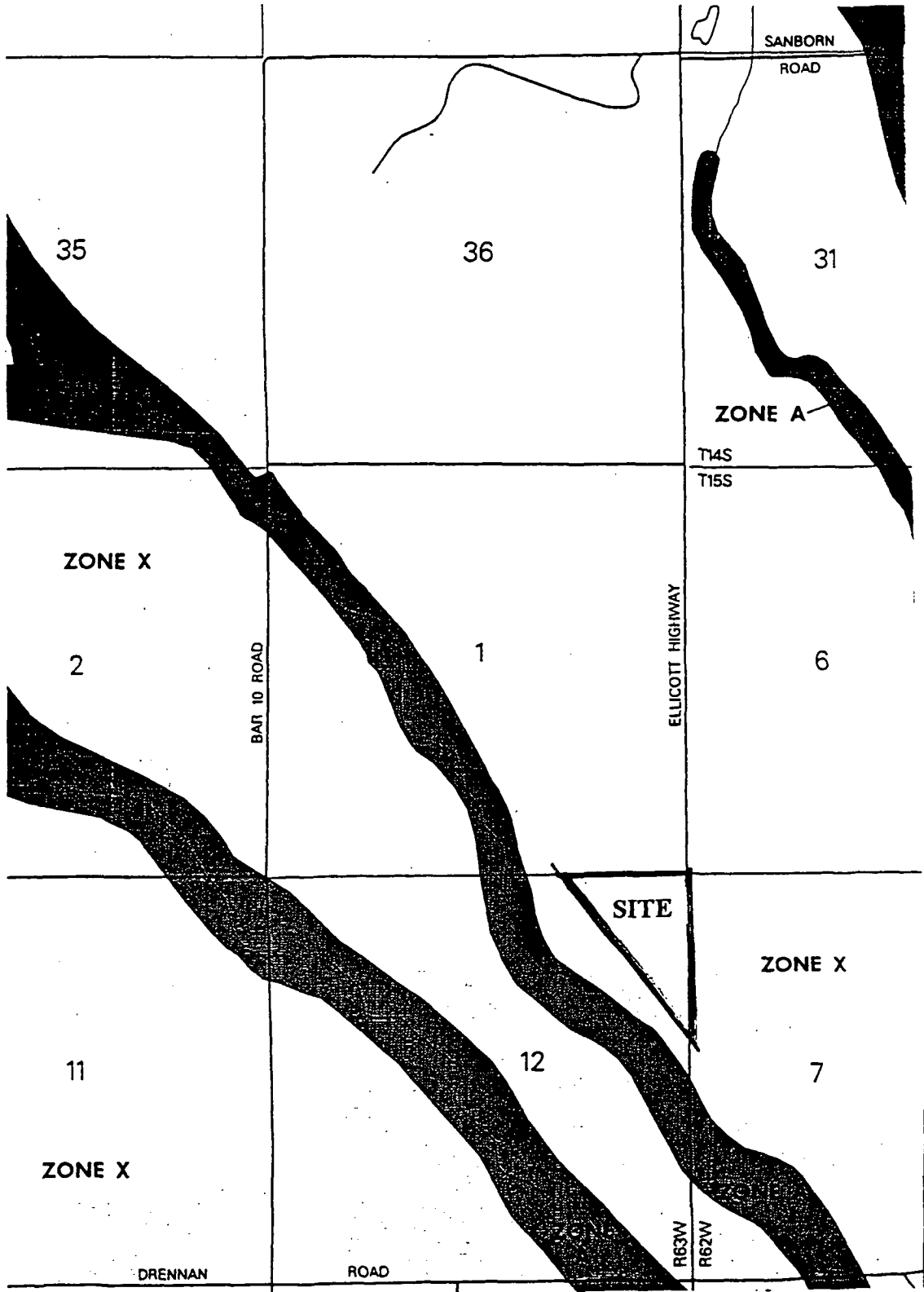
APPENDIX A

FIGURES



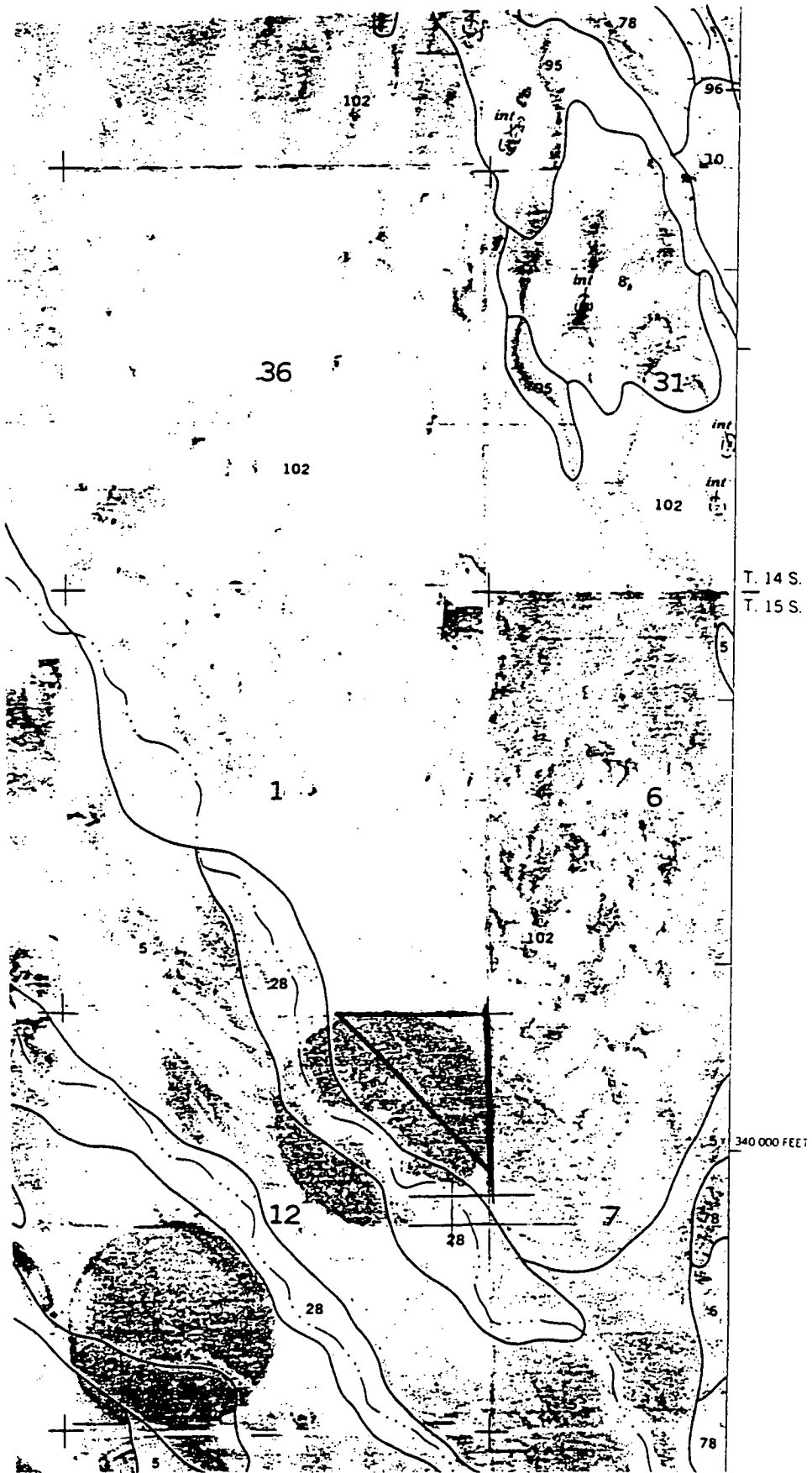
VICINITY MAP

NTS



FIRM PANEL

08041 C 0825 F, Revised March 17, 1997



SOILS MAP

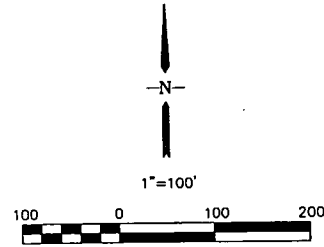
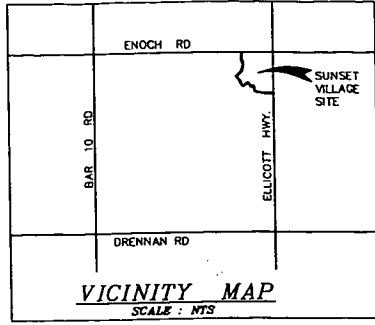
SUNSET VILLAGE - FILING NO. 4

EXISTING DRAINAGE PLAN

NO.	REVISION	BY	DATE	SURVEY INFO	DATE

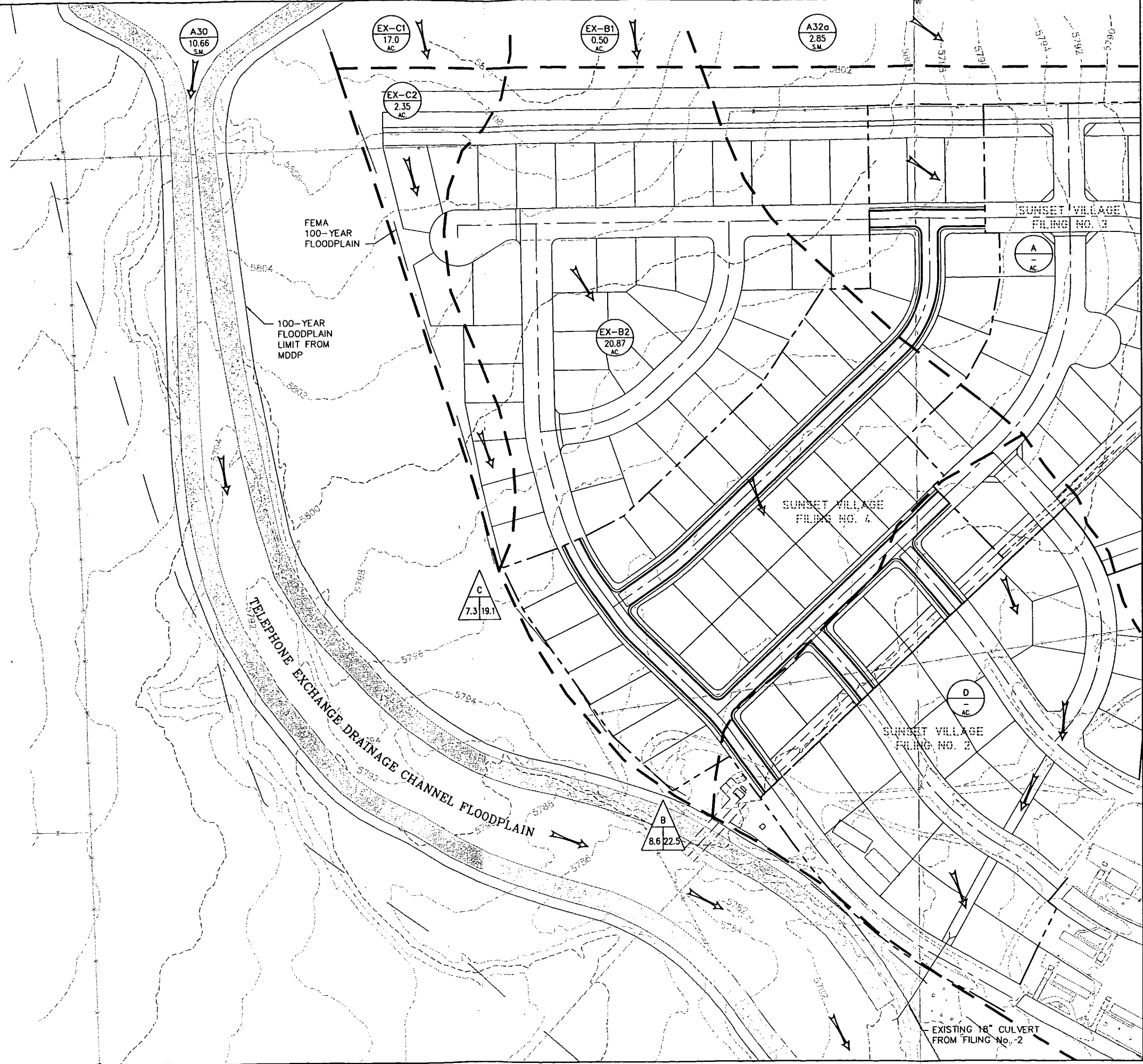
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VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: UP&E	CHECKED: JPS
CREATED: 11/18/00	LAST MODIFIED: 3/6/01
PROJECT NO: 090006	MODIFIED BY: JPS
SHEET:	

EX1



LEGEND

- FILING LIMITS
- MAJOR DRAINAGE BASIN BOUNDARY
- DRAINAGE SUB-BASIN BOUNDARY
- 6520 --- EXISTING CONTOUR
- FLOW DIRECTION ARROW
- FLOWLINE
- ▲ DESIGN POINT
- ▲ 46.8/164 Q₁₀₀(cfs)
- ▲ Q₅ (cfs)
- DEVELOPED BASIN DESIGNATION
- C14 23.21 AC BASIN AREA (ACRES)



EROSION CONTROL NOTES:

1. DISTURBED AREAS, NOT LANDSCAPED WITH APPROVED GROUND COVER, SHALL BE SEEDED WITH NATIVE GRASSES. SEE NOTE ON SHEET 2 FOR SEEDING/FERTILIZER SPECIFICATIONS. THE TOTAL SEEDING COMBINATION SHALL BE CERTIFIED FREE FROM NOXIOUS WEEDS.

2. EROSION CONTROL MEASURES SHALL BE INSPECTED PERIODICALLY AND REPAIRED TO MAINTAIN CONTROL.

3. AT LEAST TEN DAYS PRIOR TO THE ANTICIPATED START OF CONSTRUCTION, FOR PROJECTS THAT WILL DISTURB 5 ACRES OR MORE (ONE ACRE OR MORE AFTER JULY 1, 2002), THE OWNER OR OPERATOR OF THE CONSTRUCTION ACTIVITY SHALL SUBMIT A PERMIT APPLICATION FOR STORMWATER DISCHARGE TO THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WATER QUALITY CONTROL DIVISION. THE APPLICATION CONTAINS CERTIFICATION OF COMPLETION OF A STORMWATER MANAGEMENT PLAN (SWMP), OF WHICH THIS GRADING AND EROSION CONTROL PLAN MAY BE A PART. FOR INFORMATION OR APPLICATION MATERIALS CONTACT:

COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENT
 WATER QUALITY CONTROL DIVISION
 WQCD-PERMITS
 4300 CHERY CREEK DRIVE SOUTH
 DENVER, COLORADO 80246-1530
 ATTN: PERMITS UNIT

ENGINEER'S STATEMENT

IF SUCH WORK IS PERFORMED IN ACCORDANCE WITH THE DRAINAGE AND EROSION CONTROL PLAN, THE WORK WILL NOT BECOME A HAZARD TO LIFE OR LIMB, ENDANGER PROPERTY OR ADVERSELY AFFECT THE SAFETY, USE OR STABILITY OF A PUBLIC WAY, DRAINAGE CHANNEL OR OTHER PROPERTY.

PREPARED UNDER THE DIRECTION OF:

JOHN P. SCHWAB P.E. NO. 29891

OWNER'S STATEMENT:

THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE EROSION CONTROL PLAN.

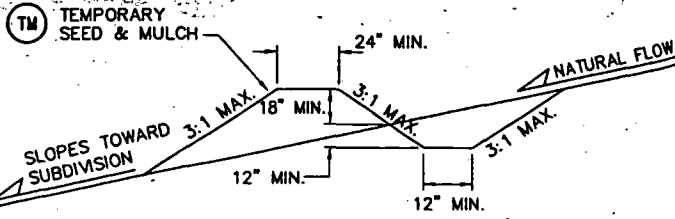
RODNEY PREISSER
 OWNER

DISCLAIMER:

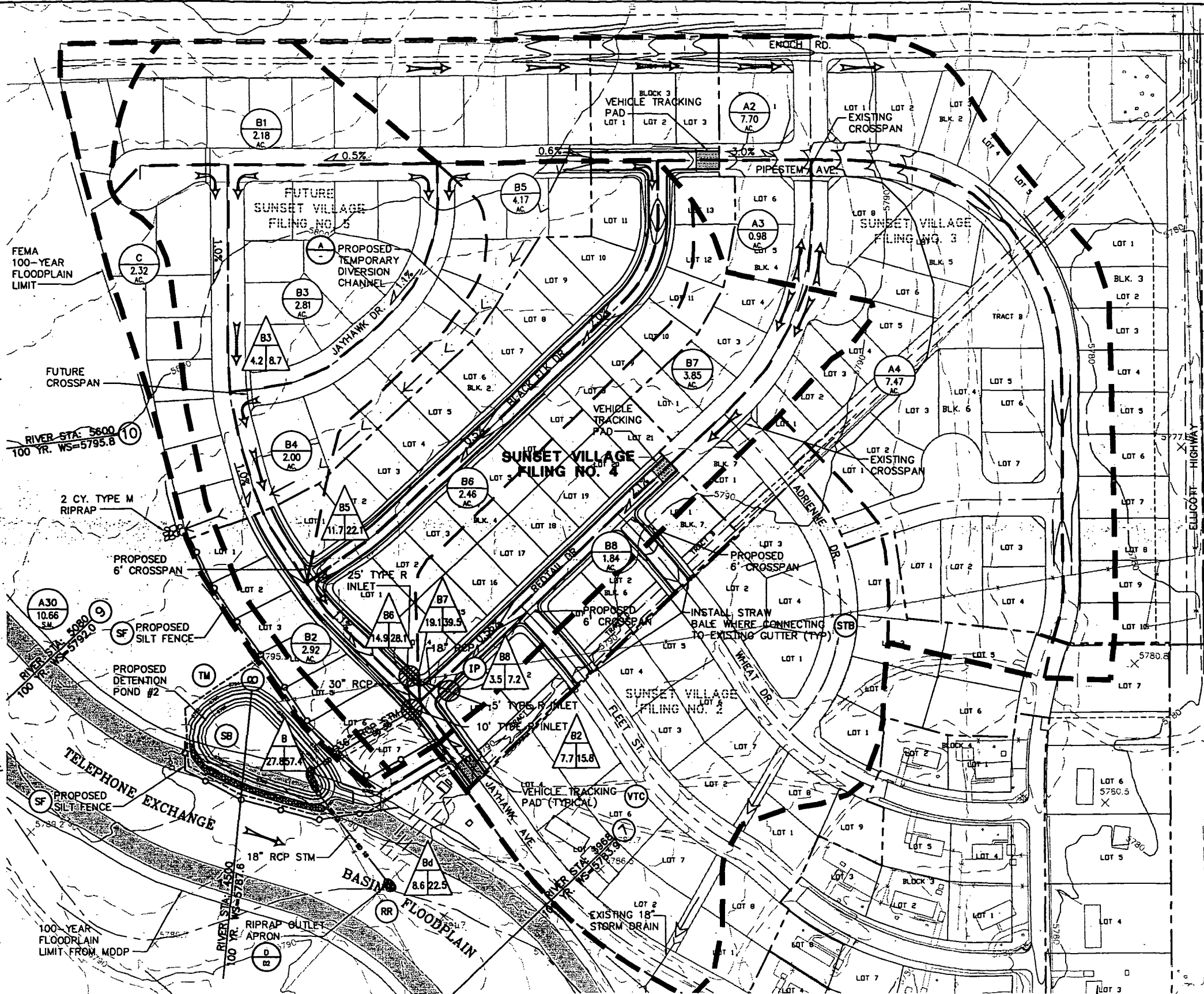
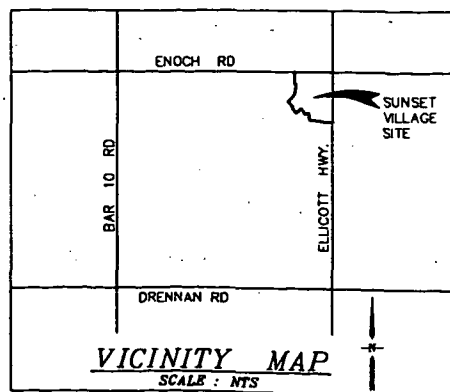
COUNTY PLAN REVIEW PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

ANTICIPATED PROJECT SCHEDULE:

START DATE: NOVEMBER 2001
 COMPLETION DATE: MARCH 2002
 DATE OF FINAL STABILIZATION: MARCH 2003



STORMWATER DIVERSION DITCH/BERM DETAIL (A)



LEGEND:

- FILING LIMITS
- DRAINAGE BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED FLOW DIRECTION ARROW
- SILT FENCE
- STRAW BALES
- RIPRAP
- DESIGN POINT
- Q_{100} (cfs)
- Q_5 (cfs)
- DEVELOPED BASIN DESIGNATION
- BASIN AREA (ACRES)
- INLET PROTECTION
- SILT FENCE
- VEHICLE TRACKING CONTROL
- STRAW BALE BARRIER

Scale: 1" = 100'

North arrow pointing up.

SUNSET VILLAGE - FILING NO. 4

JPS ENGINEERING

518 N. Nevada Ave.
 Suite 303
 Colorado Springs, CO 80903
 PH: 719-477-9429
 FAX: 719-471-0766

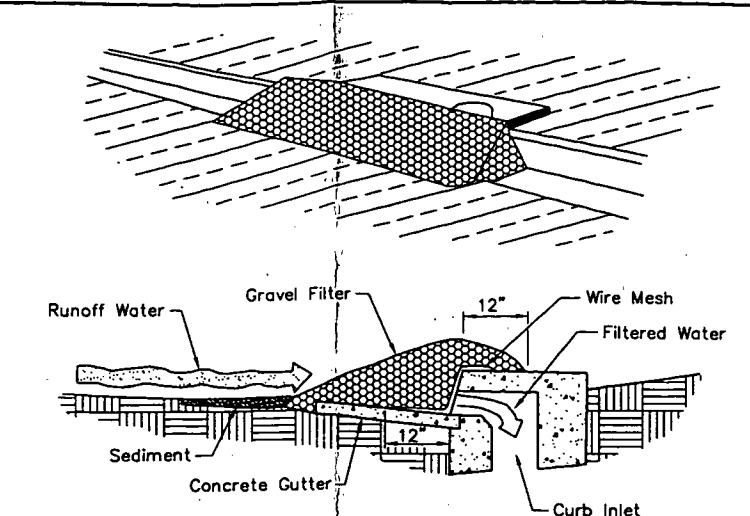
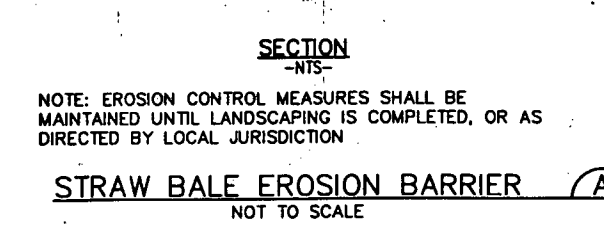
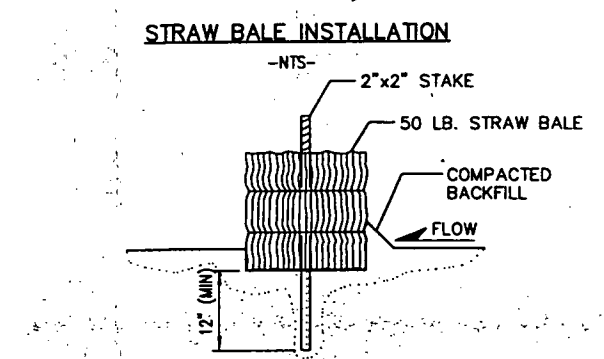
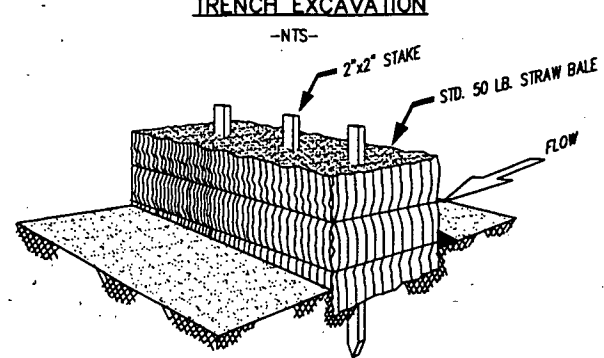
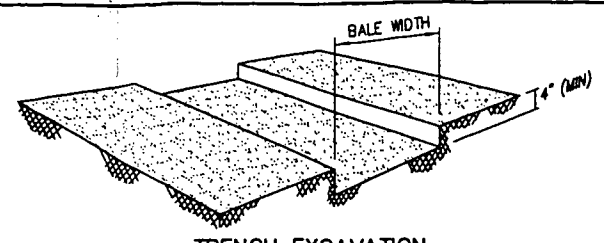
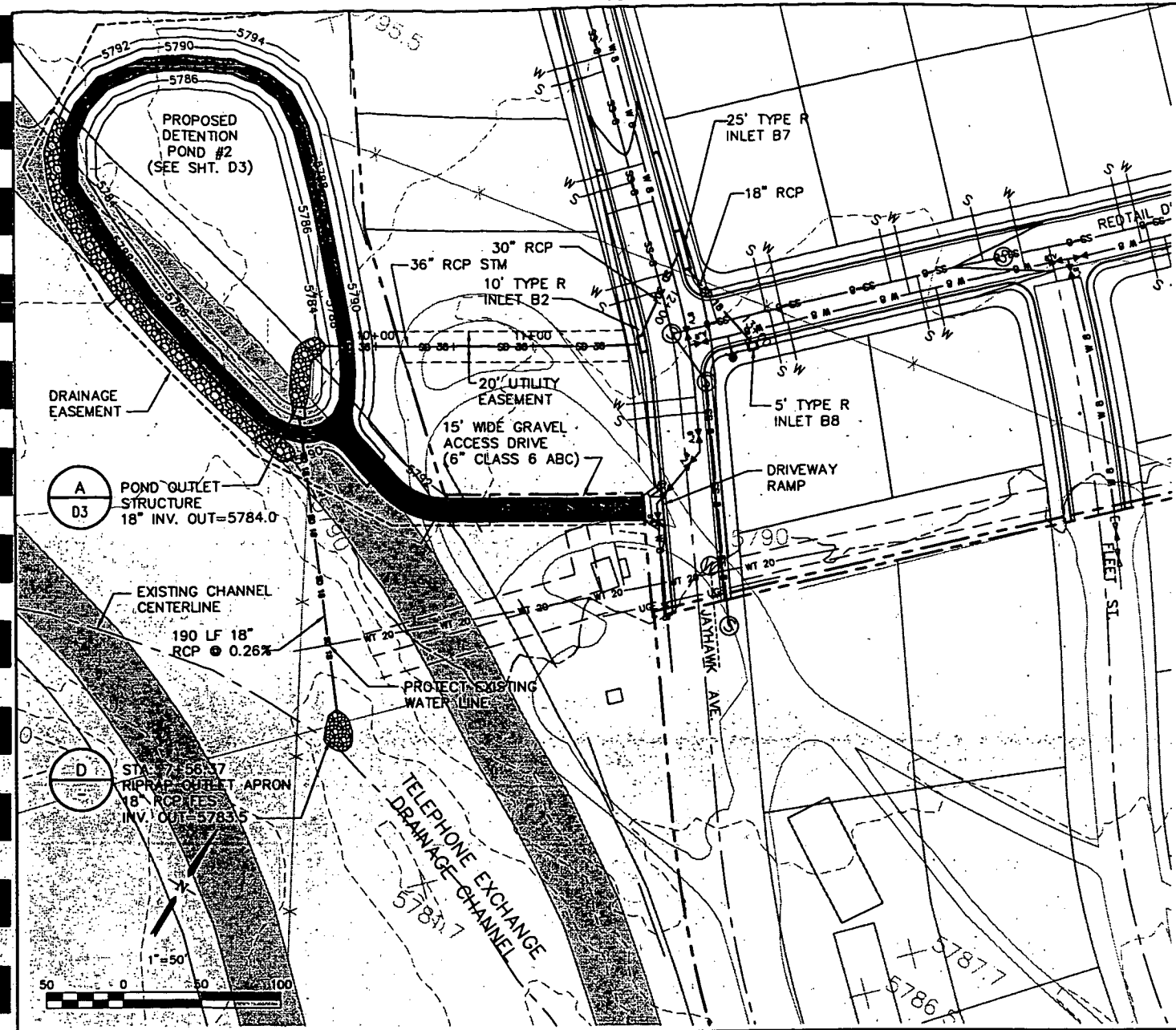
NO.	REVISION	BY	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE

DEVELOPED DRAINAGE & EROSION CONTROL PLAN

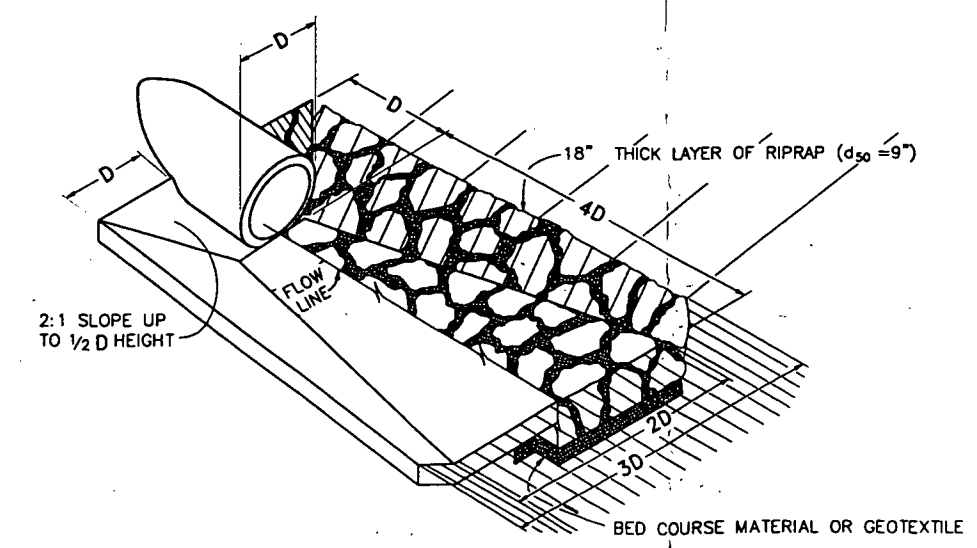
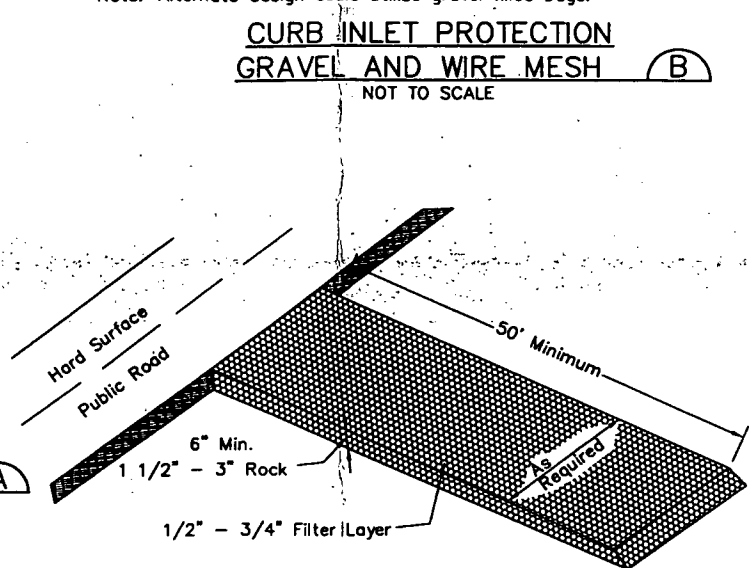
HORIZ. SCALE: 1"=100'
 VERT. SCALE: N/A
 SURVEYED: UP&E
 CREATED: 11/16/00
 PROJECT NO: 090008
 SHEET: D1

DRAWN: MJP
 DESIGNED: JPS
 CHECKED: JPS
 LAST MODIFIED: 10/11/01
 MODIFIED BY: JPS

DATE	BY	DATE	NO.	REVISION

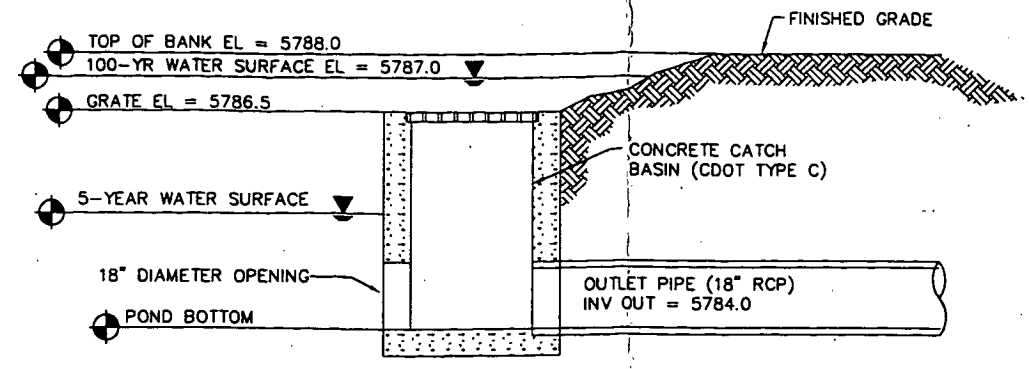
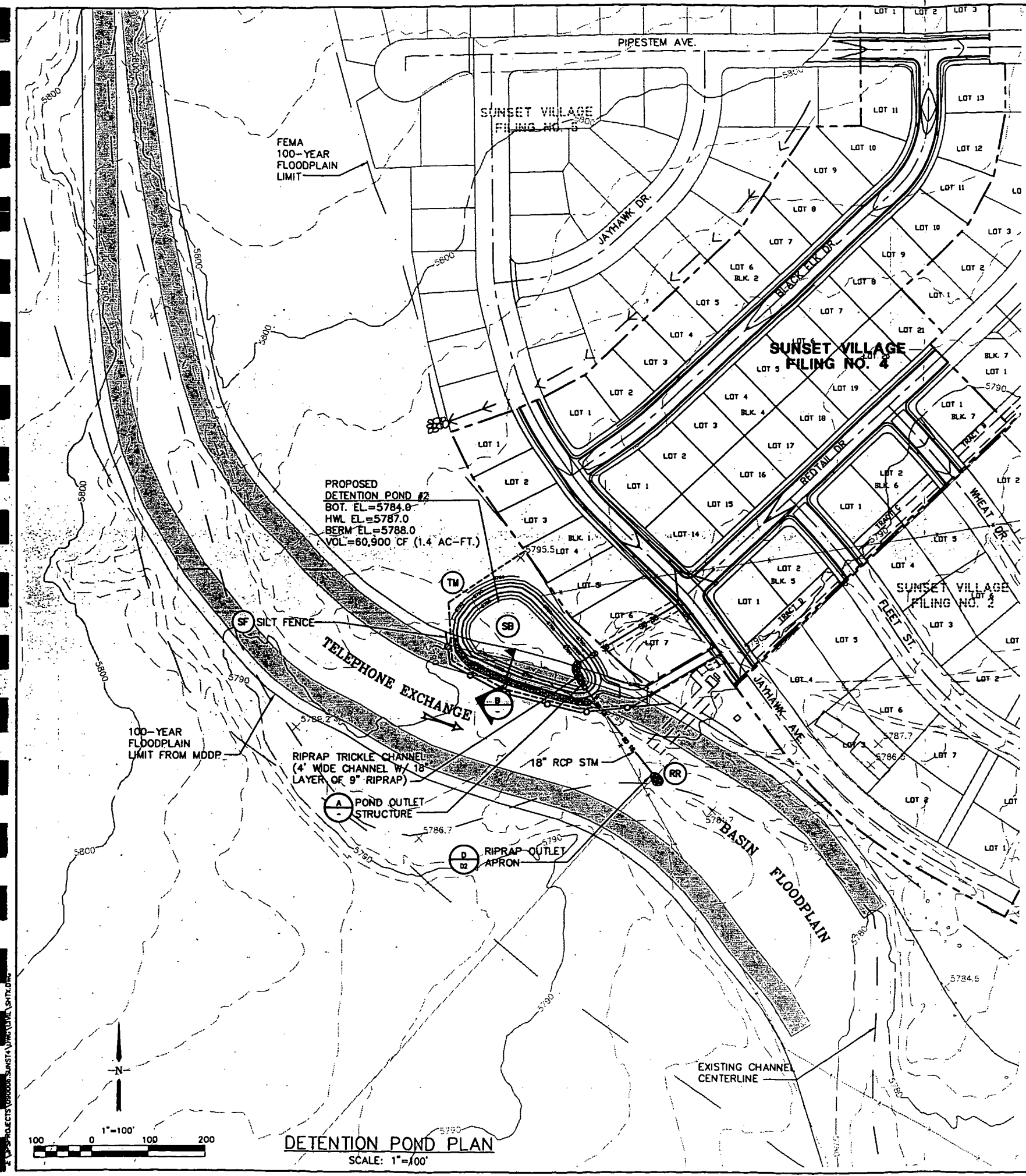


Specific Application
This method of inlet protection is applicable at curb inlets where ponding in front of the structure is not likely to cause inconvenience or damage to adjacent structures and unprotected areas.
Note: Alternate design could utilize gravel filled bags.

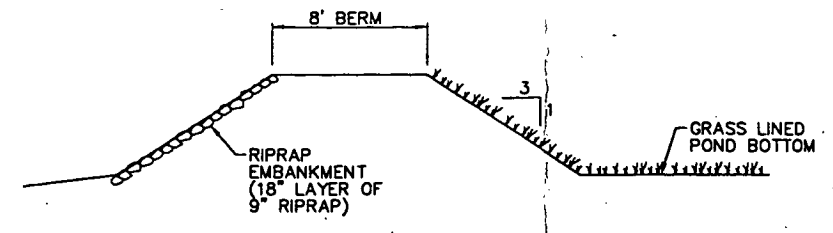


Station	Structure	Length	Slope	Notes
9+56.37	RIPRAP OUTLET APRON	-	-	18" RCP PIPES
9+56.37	POND OUTLET STRUCTURE	-	-	18" INV. OUT=5784.0
9+56.37	Channel	190 LF	0.26%	18" RCP
10+00	Channel	202 LF	0.19%	36" RCP
11+00	Channel	60 LF	0.28%	30" RCP
11+00	Channel	64 LF	0.31%	18" RCP
12+00	Inlet B2	-	-	10" TYPE R INLET B2 FL=5786.53 INV. IN=5784.49 INV. OUT=5784.39
12+00	Inlet B7	-	-	25' TYPE R INLET B7 FL=5788.50 INV. IN=5784.76 INV. OUT=5784.66
13+00	Inlet B8	-	-	5' TYPE R INLET B8 FL=5788.30 INV. OUT=5784.95

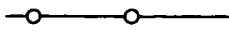









NOTE: WATER LINES SHALL BE LOWERED AS REQUIRED TO PROVIDE MINIMUM 18" CLEARANCE BELOW STORM SEWER



DETENTION POND OUTLET STRUCTURE A
NOT TO SCALE



TYPICAL POND WALL SECTION B
NOT TO SCALE

- LEGEND**
-  SILT FENCE
 -  STRAW BALES
 -  RIPRAP
 -  EXISTING CONTOURS
 -  PROPOSED CONTOURS
 -  INLET PROTECTION (GRAVEL FILTER)
 -  SILT FENCE
 -  VEHICLE TRACKING PAD
 -  TEMPORARY SEED AND MULCH ON DISTURBED SLOPES
 -  STRAW BALE BARRIER

SUNSET VILLAGE - FILING NO. 4

JPS ENGINEERING
 518 N. Nevada Ave.
 Suite 303
 Colorado Springs, CO 80903
 PH: 719-477-9429
 FAX: 719-471-0766

No.	REVISION	BY	DATE	DATE	SURVEY INFO

DETENTION POND PLAN & DETAILS

HORIZ. SCALE: 1"=100'	DRAWN: MJP
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: UP&E	CHECKED: JPS
CREATED: 8/29/01	LAST MODIFIED: 10/11/01
PROJECT NO: 090006	MODIFIED BY: JPS
SHEET:	

D3

DETENTION POND PLAN
SCALE: 1"=100'

APPENDIX B
HYDROLOGIC CALCULATIONS

SUNSET VILLAGE FILING NO. 4
RATIONAL METHOD - DRAINAGE CALCULATIONS

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C		OVERLAND LENGTH (FT)	SLOPE (%)	T _{co} ⁽¹⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT K	SLOPE (%)	SCS ⁽²⁾ VELOCITY (FT/S)	T _t ⁽³⁾ (MIN)	TOTAL T _c ⁽⁴⁾ (MIN)	INTENSITY ⁽⁵⁾		PEAK FLOW	
			5-YEAR ⁽⁷⁾	100-YEAR ⁽⁷⁾										5-YR (IN/HR)	100-YR (IN/HR)	Q ₅ ⁽⁶⁾ (CFS)	Q ₁₀₀ ⁽⁶⁾ (CFS)
B1		2.18	0.50	0.60	220	2.7	11.5	0				0.0	11.5	3.90	6.80	4.25	8.89
B2		2.92	0.50	0.60			0.0	1100	2.00	1.4	2.37	7.7	7.7	4.40	7.50	6.42	13.14
B1-B2	B2	5.1	0.50	0.60									19.2	3.00	5.15	7.65	15.76
B3	B3	2.81	0.50	0.60	300	1.3	17.0	230	2.00	0.5	1.41	2.7	19.7	3.00	5.15	4.22	8.68
B4		2.00	0.50	0.60			0.0	360	2.00	1.11	2.11	2.8	5.0	5.10	9.00	5.10	10.80
B5		4.17	0.50	0.60	300	1.7	15.8	670	2.00	0.5	1.41	7.9	23.7	2.60	4.10	5.42	10.26
B3-B5	B5	8.98	0.50	0.60									23.7	2.60	4.10	11.67	22.09
B6		2.46	0.50	0.60			0.0	250	2.00	2.16	2.94	1.4	5.0	5.10	9.00	6.27	13.28
B3-B6	B6	11.44	0.50	0.60									25.1	2.60	4.10	14.87	28.14
B7		3.85	0.50	0.60	300	1.0	18.7	790	2.00	0.68	1.65	8.0	26.7	2.50	4.30	4.81	9.93
B3-B7	B7	15.29	0.50	0.60									26.7	2.50	4.30	19.11	39.45
B8	B8	1.84	0.50	0.60			0.0	1020	2.00	0.5	1.41	12.0	12.0	3.75	6.50	3.45	7.18
B7-B8		5.69	0.50	0.60									26.7	2.50	4.30	7.11	14.68
B3-B8		17.13	0.50	0.60									26.7	2.50	4.30	21.41	44.20
B1-B8	B	22.23	0.50	0.60									26.7	2.50	4.30	27.79	57.35

1) OVERLAND FLOW T_{co} = (1.87 * (1.1 - RUNOFF COEFFICIENT) * (OVERLAND FLOW LENGTH^{0.5}) / (SLOPE^{0.333}))

2) SCS VELOCITY = K * ((SLOPE(%))^{0.5})

K = 0.70 FOR MEADOW / FOREST

K = 1.0 FOR BARE SOIL

K = 1.5 FOR GRASS CHANNEL

K = 2.0 FOR PAVEMENT

3) GUTTER/SWALE FLOW, TRAVEL TIME, T_t = (CHANNEL LENGTH / SCS VELOCITY) / 60 SEC

4) T_c = T_{co} + T_t

*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED

5) INTENSITY BASED ON I-D-F CURVE IN EL PASO COUNTY DRAINAGE CRITERIA MANUAL

6) Q = C_iA

7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY			
		10		100	
		A&B*	C&D*	A&B*	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-	2	0.15	0.25	0.20	0.30
Greenbelts, Agricultural					
→ 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

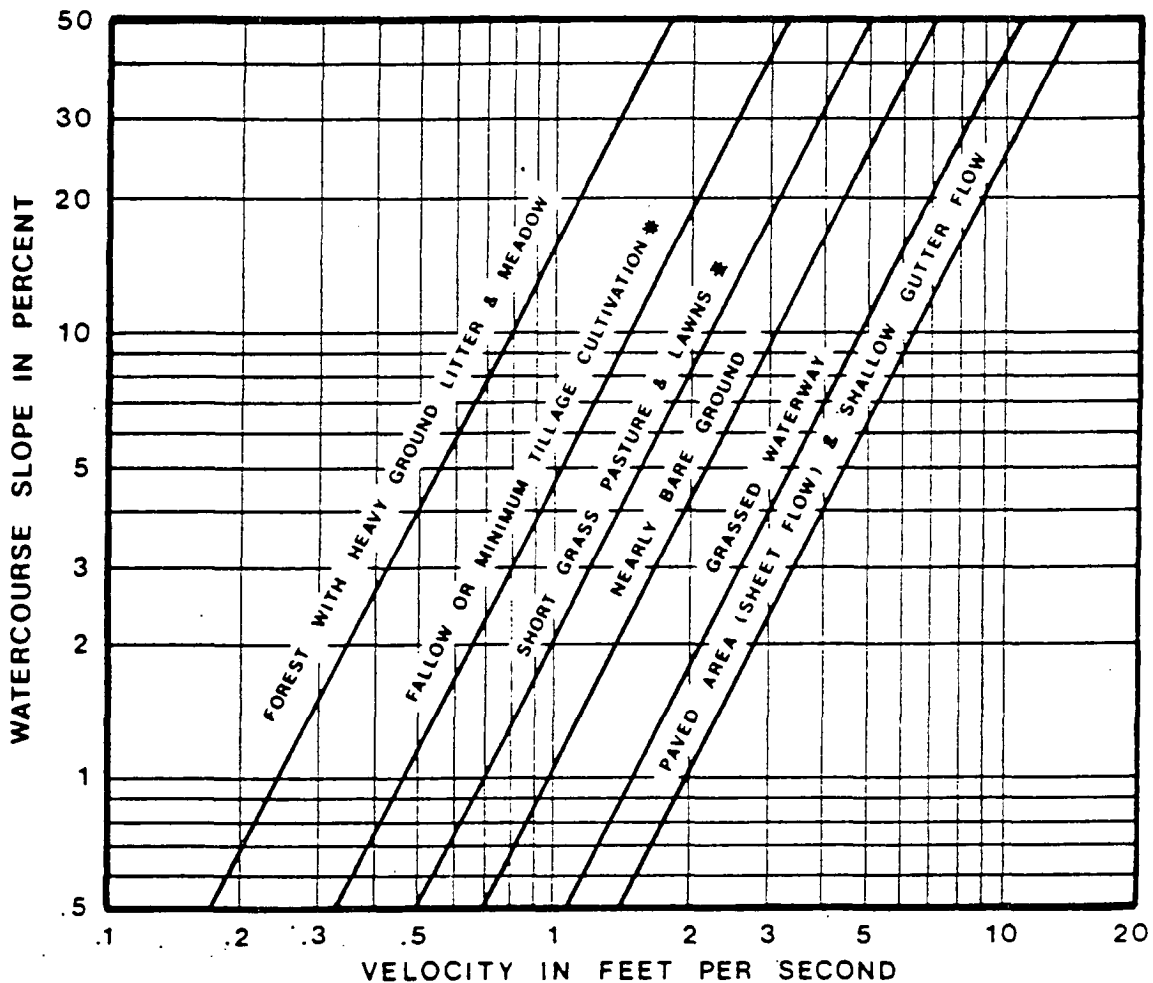
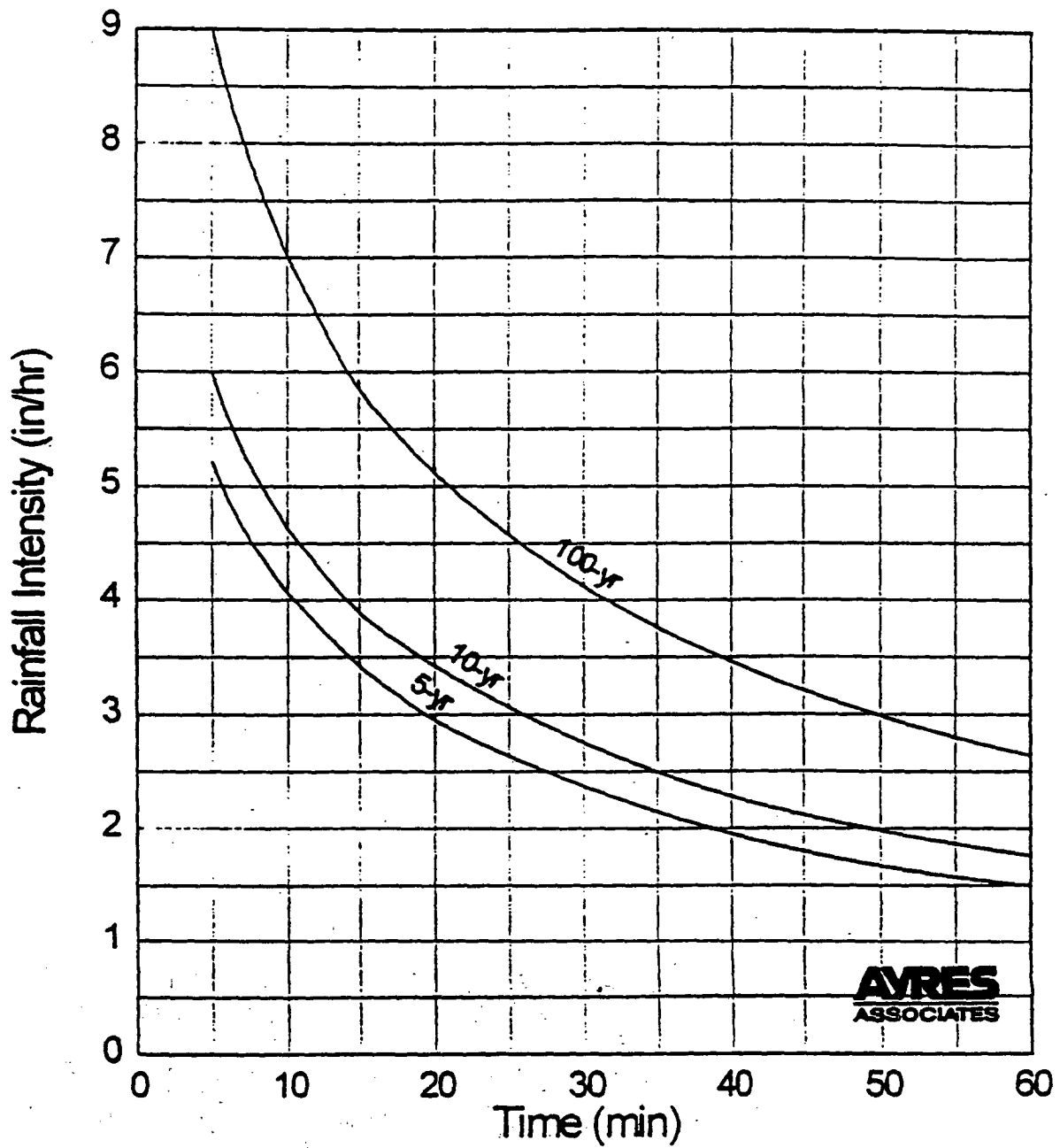


FIGURE 3-2. ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

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

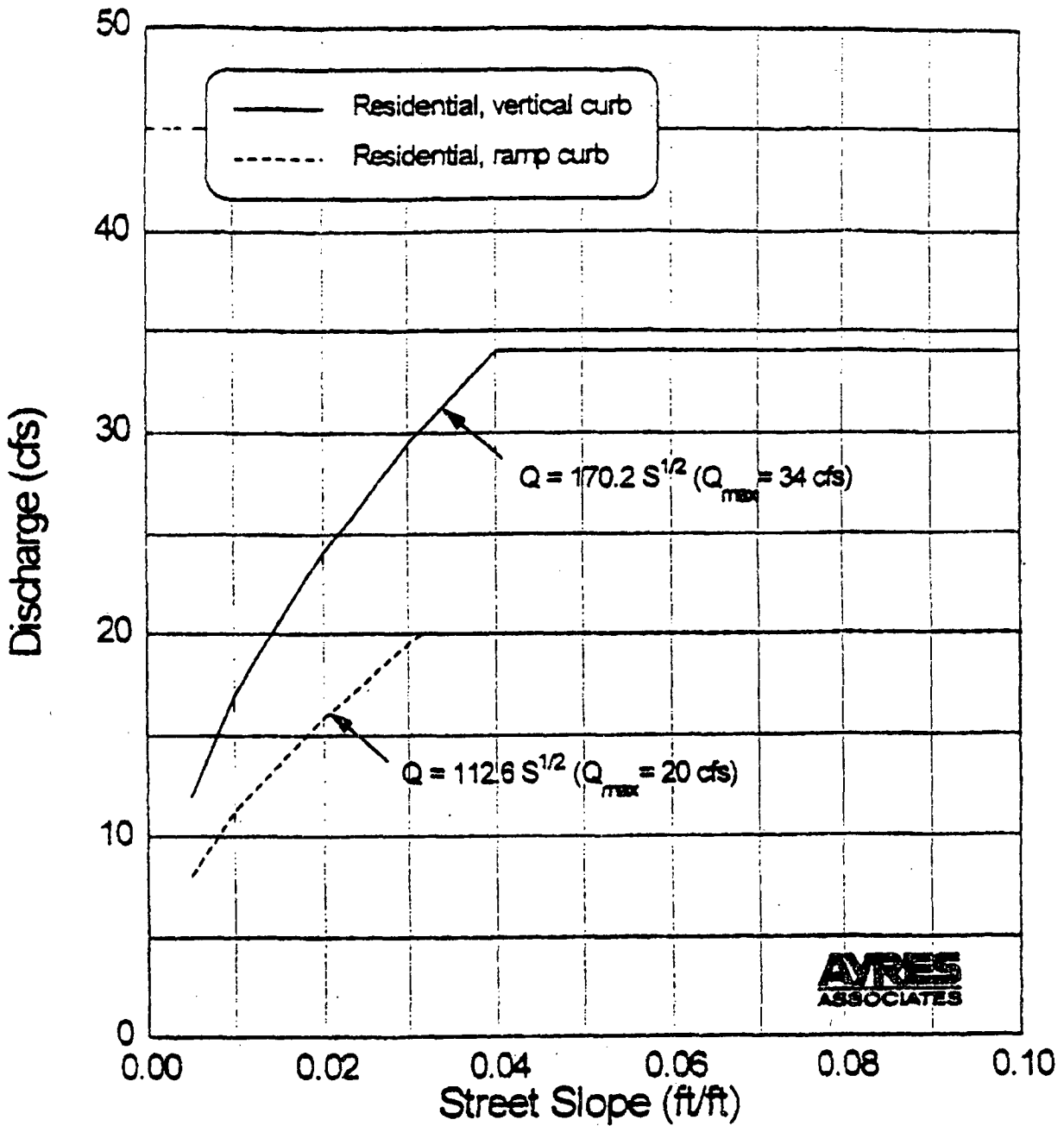
REFERENCE: "Urban Hydrology For Small Watersheds" Technical Release No. 55, USDA, SCS Jan. 1975.



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

APPENDIX C
HYDRAULIC CALCULATIONS

RESIDENTIAL STREET (34' Flowline to flowline)



Interim Release October 12, 1994
City of Colorado Springs

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

INLET B2
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - B2
Type	Curb Inlet In Sag
Solve For	Spread

Input Data	
Discharge	9.56 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.083300 ft/ft
Road Cross Slope	0.020000 ft/ft
Curb Opening Length	10.00 ft
Opening Height	0.50 ft
Curb Throat Type	Inclined
Local Depression	3.0 in
Local Depression Width	2.00 ft
Throat Incline Angle	63.42 degrees

$Q_s * 1.25 = (7.65 * 1.25)$
 ↑ Clogging Factor

Results	
Spread	22.69 ft
Depth	0.58 ft
Gutter Depression	1.5 in
Total Depression	4.5 in

$= 7.0" < 9" \text{ to Top-of-Curb } \underline{\underline{OK}}$

Worksheet

Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - 1 B2
Type	Curb Inlet In Sag
Solve For	Spread

Input Data	
Discharge	19.70 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.083300 ft/ft
Road Cross Slope	0.020000 ft/ft
Curb Opening Length	<u>10.00 ft</u>
Opening Height	0.50 ft
Curb Throat Type	Inclined
Local Depression	3.0 in
Local Depression Width	2.00 ft
Throat Incline Angle	63.42 degrees

$= Q_{inlet} * 1.25 = (15.76 * 1.25)$
Logging Factor

Results	
Spread	36.74 ft
Depth	0.86 ft
Gutter Depression	1.5 in
Total Depression	4.5 in

< 1.0 ft. OK

INLET B7
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - B7
Type	Curb Inlet In Sag
Solve For	Spread

Input Data	
Discharge	23.90 cfs = $Q_s * 1.25 = (19.1 * 1.25)$
Gutter Width	2.00 ft
Gutter Cross Slope	0.083300 ft/ft
Road Cross Slope	0.020000 ft/ft
Curb Opening Length	<u>25.00 ft</u>
Opening Height	0.50 ft
Curb Throat Type	Inclined
Local Depression	3.0 in
Local Depression Width	2.00 ft
Throat Incline Angle	63.42 degrees

Results	
Spread	25.46 ft
Depth	0.64 ft = 7.7" < 9" to Top of Curb <u>OK</u>
Gutter Depression	1.5 in
Total Depression	4.5 in

INLET B7

Worksheet for Curb Inlet In Sag

Project Description

Worksheet	Curb Inlet - B7
Type	Curb Inlet In Sag
Solve For	Spread

Input Data

Discharge	49.40 cfs	= $Q_{avg} * 1.25 = 139.5 * 1.25$
Gutter Width	2.00 ft	
Gutter Cross Slope	0.083300 ft/ft	
Road Cross Slope	0.020000 ft/ft	
Curb Opening Length	<u>25.00 ft</u>	
Opening Height	0.50 ft	
Curb Throat Type	Inclined	
Local Depression	3.0 in	
Local Depression Width	2.00 ft	
Throat Incline Angle	63.42 degrees	

Results

Spread	41.31 ft	
Depth	0.95 ft	< 1.0 Ft <u>OK</u>
Gutter Depression	1.5 in	
Total Depression	4.5 in	

INLET B8

Worksheet for Curb Inlet In Sag

Project Description

Worksheet	Curb Inlet - B8
Type	Curb Inlet In Sag
Solve For	Spread

Input Data

Discharge	4.38 cfs	= $Q_s * 1.25 = (3.5 * 1.25)$
Gutter Width	2.00 ft	
Gutter Cross Slope	0.083300 ft/ft	
Road Cross Slope	0.020000 ft/ft	
Curb Opening Length	<u>5.00 ft</u>	
Opening Height	0.50 ft	
Curb Throat Type	Inclined	
Local Depression	3.0 in	
Local Depression Width	2.00 ft	
Throat Incline Angle	63.42 degrees	

Results

Spread	18.30 ft
Depth	0.49 ft
Gutter Depression	1.5 in
Total Depression	4.5 in

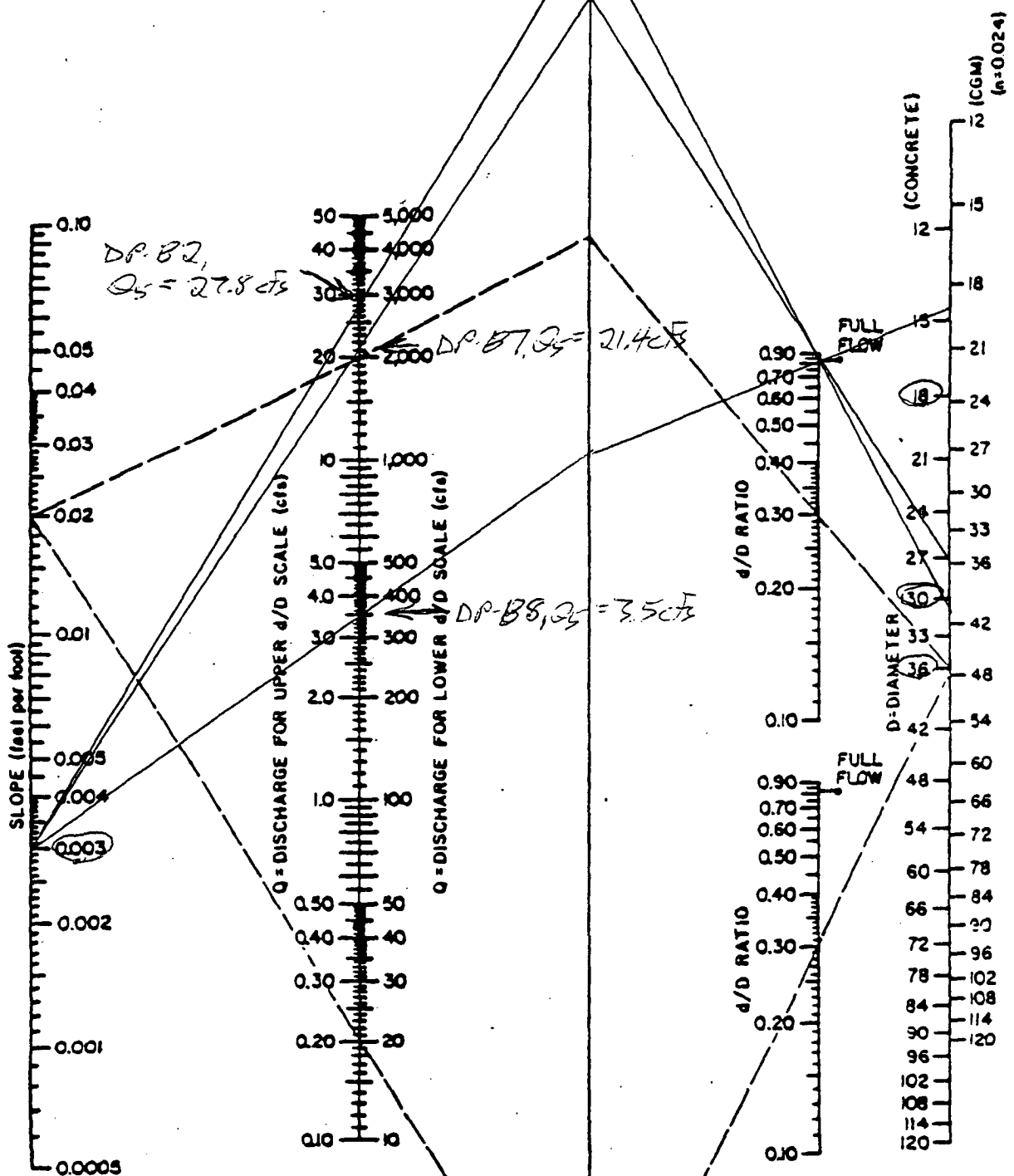
= 5.9" < 9" to Top of Curb: OK

INLET B8
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - B8
Type	Curb Inlet In Sag
Solve For	Spread

Input Data	
Discharge	9.00 cfs = $Q_{100} * 1.25 = (7.2 * 1.25)$
Gutter Width	2.00 ft
Gutter Cross Slope	0.083300 ft/ft
Road Cross Slope	0.020000 ft/ft
Curb Opening Length	<u>5.00 ft</u>
Opening Height	0.50 ft
Curb Throat Type	Inclined
Local Depression	3.0 in
Local Depression Width	2.00 ft
Throat Incline Angle	63.42 degrees

Results	
Spread	29.58 ft
Depth	0.72 ft < 1.0 Ft <u>OK</u>
Gutter Depression	1.5 in
Total Depression	4.5 in



EXAMPLE
 GIVEN: $S = 0.02$ FIND: $d/D =$
 $Q = 20$ cfs $d =$
 $D = 36"$ (CONCRETE)

SOLUTION
 $d/D = 0.30$
 $d = 0.30 \times 3' = 0.9'$



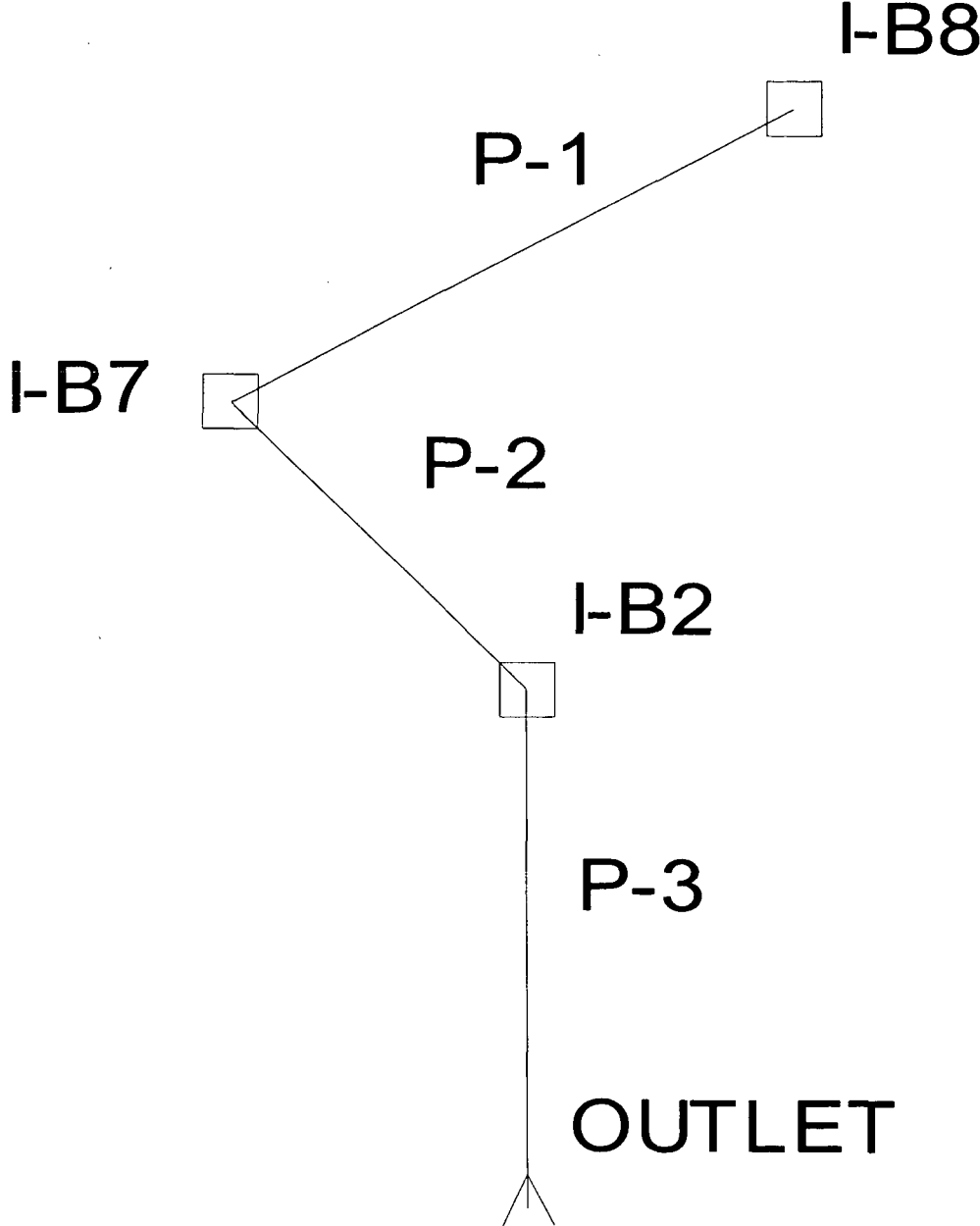
The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Uniform Flow for Pipe Culverts

Date
 OCT. 1987

Figure
 8 - 1

Scenario: Base



Scenario: Base

>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

Gravity subnetwork discharging at: OUTLET

>>>> Info: Loading and hydraulic computations completed successfully.
>>>> Warning: OUTLET Pipe crown is above structure.
>>>> Warning: P-1 Pipe fails minimum cover constraint.
>>>> Warning: P-1 Pipe fails minimum velocity constraint.
>>>> Warning: P-2 Pipe fails minimum cover constraint.
>>>> Warning: P-3 Pipe fails minimum cover constraint.
>>>> Warning: P-3 Pipe fails minimum slope constraint.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
I-B2	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
I-B7	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
I-B8	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: OUTLET

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-3	1	36 inch	Circular	202.00	27.80	5.29	5,786.58	5,786.00
P-2	1	30 inch	Circular	60.00	21.40	4.57	5,786.91	5,786.78
P-1	1	18 inch	Circular	64.00	3.50	1.98	5,787.15	5,787.08

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
OUTLET	27.80	5,784.00	5,786.00	5,786.00
I-B2	27.80	5,788.53	5,786.78	5,786.58
I-B7	21.40	5,788.50	5,787.08	5,786.91
I-B8	3.50	5,788.30	5,787.18	5,787.15

Completed: 09/10/2001 05:22:35 PM

Scenario: Base

DOT Report

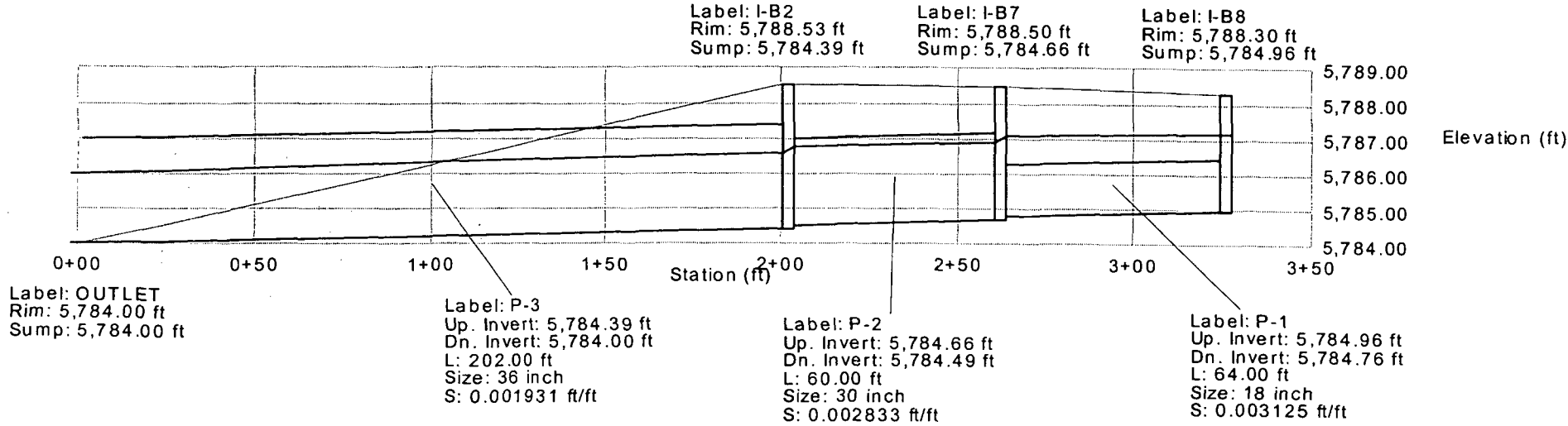
Label	-Node- Upstream Downstream	Upstream Inlet Area (acres)	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	Section Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Description
P-1	I-B8	0.00	0.00	0.00	5,788.30	5,787.15	0.001110	3.50	Circular	64.00	1.98	
	I-B7				5,788.50	5,787.08	0.003125	5.87	18 inch			
P-2	I-B7	0.00	0.00	0.00	5,788.50	5,786.91	0.002381	21.40	Circular	60.00	4.57	
	I-B2				5,788.53	5,786.78	0.002833	21.83	30 inch			
P-3	I-B2	0.00	0.00	0.00	5,788.53	5,786.58	0.002447	27.80	Circular	202.00	5.29	
	OUTLET				5,784.00	5,786.00	0.001931	29.31	36 inch			

Scenario: Base

Combined Pipe\Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	Upstream Inlet Rational Flow (cfs)	Section Size	Full Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)
P-1	I-B8	I-B7	64.00	0.00	0.00	0.00	0.00	0.00	18 inch	5.87	1.98	5,784.96	5,784.76	0.003125
P-2	I-B7	I-B2	60.00	0.00	0.00	0.00	0.00	0.00	30 inch	21.83	4.57	5,784.66	5,784.49	0.002833
P-3	I-B2	OUTLET	202.00	0.00	0.00	0.00	0.00	0.00	36 inch	29.31	5.29	5,784.39	5,784.00	0.001931

Profile
Scenario: Base



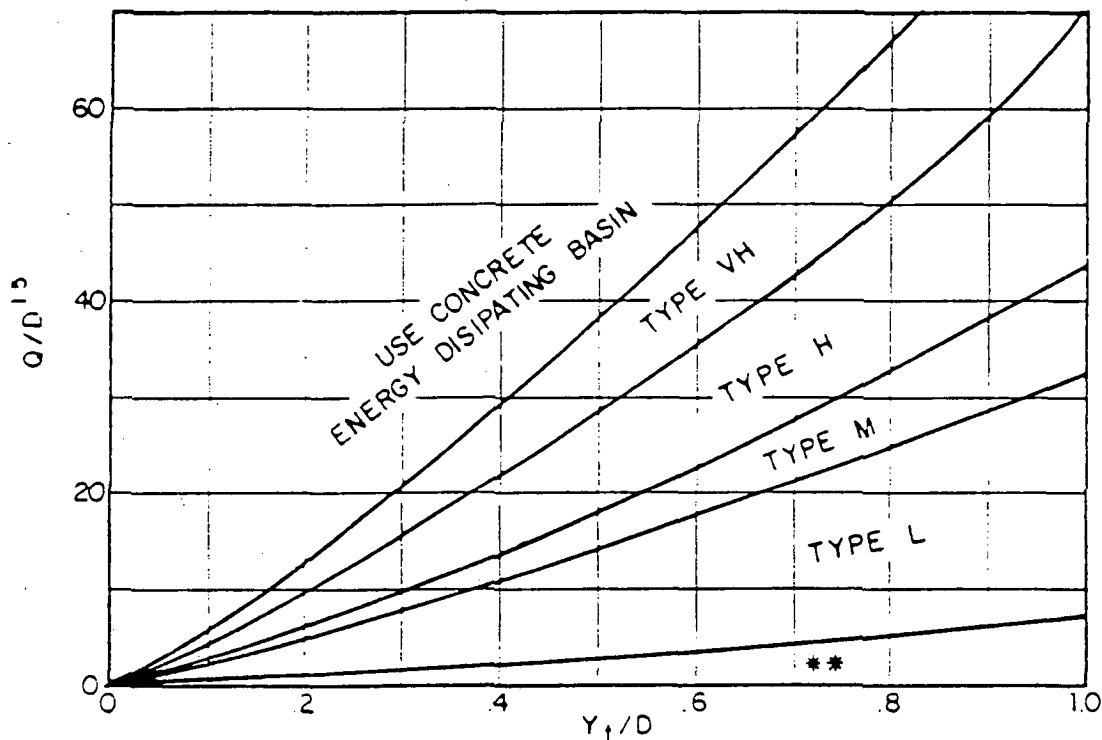
Storm Sewer Outlet

$$D = 3'; Q_{100} = 57.4 \text{ cfs}$$

$$\left(\frac{Q}{\Delta^{1.48}}\right) = \frac{57.4}{(3)^{1.48}} = 11.05$$

$$Y_{\pm} = 1.43' \text{ (From HEC-RAS)}$$

$$\left(\frac{Y_{\pm}}{D}\right) = \frac{1.43}{3} = 0.48$$



Use D_0 instead of D whenever flow is supercritical in the barrel.

** Use Type L for a distance of 3D downstream.

→ Use Type L Riprap ($d_{50} = 9"$)
 For length of $4\Delta = 4(3) = 12'$
 per CDOT M-601-12

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

**SUNSET VILLAGE FILING NO. 4
DETENTION POND DESIGN - DESIGN POINT B**

	5-YEAR	100-YEAR	
DRAINAGE AREA	22.23	22.23	AC
RUNOFF COEFF	0.5	0.6	
DISCHARGE RATE	8.6	22.5	CFS

ALLOWABLE RELEASE RATE

5-YEAR DETENTION STORAGE REQUIRED (RATIONAL STORED RATE METHOD)

Tc (MIN)	Tc (SEC)	INTENSITY (IN/HR)	INFLOW (CFS)	VOLUME (IN)	VOLUME (OUT)	STORAGE VOLUME (CF)	STORAGE VOLUME (AF)
5	300	5.2	57.8	17339.4	2580	14759.4	0.34
10	600	4.6	51.1	30677.4	5160	25517.4	0.59
15	900	3.4	37.8	34011.9	7740	26271.9	0.60
20	1200	3.0	33.3	40014.0	10320	29694.0	0.68
25	1500	2.7	30.0	45015.8	12900	32115.8	0.74
30	1800	2.3	25.6	46016.1	15480	30536.1	0.70
35	2100	2.1	23.3	49017.2	18060	30957.2	0.71
40	2400	1.9	21.1	50684.4	20640	30044.4	0.69
45	2700	1.8	20.0	54018.9	23220	30798.9	0.71
50	3000	1.7	18.9	56686.5	25800	30886.5	0.71
55	3300	1.6	17.8	58687.2	28380	30307.2	0.70
60	3600	1.5	16.7	60021.0	30960	29061.0	0.67

100-YEAR DETENTION STORAGE REQUIRED (RATIONAL STORED RATE METHOD)

Tc (MIN)	Tc (SEC)	INTENSITY (IN/HR)	INFLOW (CFS)	VOLUME (IN)	VOLUME (OUT)	STORAGE VOLUME (CF)	STORAGE VOLUME (AF)
5	300	9.0	120.0	36012.6	6750	29262.6	0.67
10	600	7.0	93.4	56019.6	13500	42519.6	0.98
15	900	5.8	77.4	69624.4	20250	49374.4	1.13
20	1200	5.2	69.4	83229.1	27000	56229.1	1.29
25	1500	4.6	61.4	92032.2	33750	58282.2	1.34
30	1800	4.2	56.0	100835.3	40500	60335.3	1.39
35	2100	3.8	50.7	106437.2	47250	59187.2	1.36
40	2400	3.5	46.7	112039.2	54000	58039.2	1.33
45	2700	3.2	42.7	115240.3	60750	54490.3	1.25
50	3000	3.0	40.0	120042.0	67500	52542.0	1.21
55	3300	2.8	37.3	123243.1	74250	48993.1	1.12
60	3600	2.6	34.7	124843.7	81000	43843.7	1.01

DETENTION POND B STAGE-STORAGE TABLE

POND DEPTH (FT)	SURFACE AREA (SF)	INCREM. VOLUME (CF)	TOTAL VOLUME (CF)	TOTAL VOLUME (AF)	
5784	17690				
5785	19392	18541	18541	0.43	
5786	21151	20271.5	38812.5	0.89	5-YEAR STAGE
5787	22967	22059	60871.5	1.40	100-YEAR STAGE
5788	24840	23903.5	84775	1.95	TOP OF BANK

DETENTION OUTLET STRUCTURE DESIGN - POND B

Q _o (100-YEAR) =	22.5 CFS	
Q _o (5-YEAR) =	8.6 CFS	
POND BOTTOM EL =	5784	
100-YEAR WSL =	5787	
5-YEAR WSL =	5786 (APPROX.)	
100-YEAR OUTLET INV =	5784	
5-YEAR OUTLET ORIFICE INV =	5784	
OUTLET PIPE DIAMETER =	18 IN	
1. DETERMINE 5-YEAR ORIFICE OPENING SIZE:		
DEPTH TO CENTERLINE OF ORIFICE =	1.25 FEET	
A = Q / (Cd * (2gh) ^{0.5}) =	1.47 SF	
Cd = 0.65 (ORIFICE COEFFICIENT FOR SQUARE-EDGED OPENINGS)		
2. DETERMINE 5-YEAR ORIFICE DIAMETER:		
D = (4A/(PI)) ^{0.5} =	1.37 FT	
SELECTED ORIFICE DIAMETER =	18 INCHES	
3. DETERMINE DISCHARGE THROUGH 5-YEAR OUTLET FOR 100-YEAR HEADWATER:		
100-YEAR HEADWATER =	2.25 FT	
ORIFICE AREA =	1.77 FT	
Q = CdA * (2gh) ^{0.5} =	13.83 CFS	
4. DETERMINE DISCHARGE FOR SIZING 100-YEAR WEIR:		
Q _{weir} = Q ₁₀₀ - Q _{orifice} =	8.67 CFS	
5. SIZE ORIFICE PLATE FOR 100-YEAR OUTLET:		
HEADWATER DEPTH =	1.75 FT	
A = Q / (Cd * (2gh) ^{0.5}) =	1.26 SF	
6. DETERMINE 100-YEAR ORIFICE DIAMETER:		
D = (4A/(PI)) ^{0.5} =	1.27 FT	(USE 18")
7. DETERMINE MINIMUM BOX DIMENSIONS:		
100-YEAR DEPTH TO WEIR =	0.5 FT	
L = Q _{weir} / (CH ^{1.5}) =	7.22 FT	USE TYPE C INLET
C = 3.4 (TABLE 1401)		L=12' OK

REF: ADAMS COUNTY STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

APPENDIX D
COST ESTIMATE

**SUNSET VILLAGE - FILING NO. 4
ENGINEER'S COST ESTIMATE
DRAINAGE IMPROVEMENTS**

Item No.	Description	Quantity	Unit	Unit Cost (\$\$)	Total Cost (\$\$)
PERMANENT FACILITIES					
203	Excavation (Detention Pond)	5,000	CY	\$3	\$15,000
203	Grass-lined Drainage Ditch	900	LF	\$3	\$2,700
212	Seeding	1	AC	\$800	\$800
506	Riprap (d50 = 9")	75	CY	\$40	\$3,000
603	36" RCP Storm Drain	202	LF	\$50	\$10,100
603	36" RCP FES	1	EA	\$700	\$700
603	30" RCP Storm Drain	60	LF	\$40	\$2,400
603	18" RCP Storm Drain	254	LF	\$30	\$7,620
604	25-foot Type R Inlet	1	EA	\$3,800	\$3,800
604	10-foot Type R Inlet	1	EA	\$3,200	\$3,200
604	5-foot Type R Inlet	1	EA	\$2,800	\$2,800
	SUBTOTAL				\$52,120
TEMPORARY FACILITIES					
212	Silt Fence	1,100	LF	\$2	\$2,200
212	Vehicle Tracking Pad	3	EA	\$300	\$900
212	Straw Bales	4	EA	\$40	\$160
	SUBTOTAL				\$3,260
	TOTAL				\$55,380
Note: This estimate does not include costs for street improvements (curb & gutter, crosspans, etc.)					

The cost estimate submitted herein is based on time-honored practices within the construction industry. As such the engineer does not control the cost of labor, materials, equipment or a contractor's method of determining prices and competitive bidding practices or market conditions. The estimate represents our best judgement as design professionals using current information available at the time of the preparation. The engineer cannot guarantee that proposals, bids and/or construction costs will not vary from this cost estimate.

APPENDIX E
CORRESPONDENCE

El Paso County Department OF Transportation

John A. McCarty, P.E., Director

3460 N. Marksheffel Road

Colorado Springs, CO 80922

MEMORANDUM

TO: John Schwab, JPS Engineering
CC: Mark Gebhart, Planning Department
Tom Keith, United Planning & Engineering
FROM: Colleen Dawson, Engineer I, Development Review
DATE: October 3, 2001
RE: Sunset Village Filing 4 (SF-01-005)

The Final Drainage Report and Final Construction Plans are not ready for Final Approvals. The multiple copies of each and Mylar's can be picked up at the El Paso County DOT office. Prior to sending signed copies, forward an additional review set.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Final Drainage Report:**

1. The Temporary Detention Facilities will need to be relocated so that they are not located in the main channel.
2. Sheets D2 & D3 are referenced in the text, but not included in the pocket.
3. Correct the "Proposed Inlet Size" for design point B2 in the table to match the calculations for a 10-foot inlet in the appendix.
4. The percent impervious value to be used in the drainage calculations should be 43% for the 0.20-acre lots per the "Revised Drainage Basin Fees Based on Impervious Area For Unincorporated El Paso County Only" Addendum which was approved by the BOCC October 1, 2001 (attached). Lot sizes should be based on the actual average size of lots, not the total area divided by the number of lots.
5. See FDR markups for further clarification.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Construction Plans:**

1. Correct the note that reads "SEE GENERAL NOTES & DETAILS SHEET 2 OF 12" everywhere it appears to represent the correct sheet numbers.
2. Correct the notes on the Redtail Drive profile (sheet 4 of 14) for the centerlines of Fleet and Wheat Streets to represent the correct sheet numbers.
3. The centerline elevation at 0+00 Wheat Street (sheet 7 of 14) does not match the elevation at 9+55.90 on the Redtail Drive profile (sheet 4 of 14).
4. Correct the notes on sheets 7 of 14 and 8 of 14 to represent the correct sheet number for Redtail Drive.
5. Provide erosion control measures and notes for the construction of the detention pond.

6. Add a note to the erosion control plan that reads: "At least ten days prior to the anticipated start of construction, for projects that will disturb 5 acres or more (one acre or more after July 1, 2002), the owner or operator of the construction activity shall submit a permit application for stormwater discharge to the Colorado Department of Public Health and Environment, Water Quality Control Division. The application contains certification of completion of a Stormwater Management Plan (SWMP), of which this grading and erosion control plan may be a part. For information or application materials contact:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD-Permits
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Attn: Permits Unit"

7. The following general construction note needs to be added to the page: "Core samples will be taken on an undisturbed section of Ellicott Highway to determine existing asphalt and gravel base thickness".
8. See Plan markups for clarification of comments:

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Estimate of Guaranteed Funds:**

1. Include the rip rap for the Trickle Channel through the detention pond in the estimate.

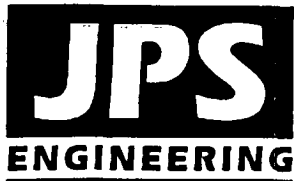
The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Final Plat:**

1. The additional land and a maintenance agreement for the Temporary Detention Facility need to be addressed.

CMD

file # 2645

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518 N. Nevada Ave., Suite 303
Colorado Springs, CO 80903
(719)-477-9429
(719)-471-0766 fax

September 10, 2001

El Paso County Department of Transportation
Attn: Colleen Dawson
3460 N. Marksheffel Road
Colorado Springs, CO 80922

**SUBJECT: Sunset Village Filing #4
Final Drainage Report**

Dear Colleen:

We have enclosed 7 copies of the revised final drainage report for Sunset Village Filing No. 4 for your approval. In this submittal, we have attempted to address all remaining review comments from the El Paso County review memorandum dated August 16, 2001. These review comments are specifically addressed as follows:

1. A temporary detention pond has been incorporated in the plan southwest of Design Point B, within the area designated for the future regional detention facility. The temporary pond has been sized to mitigate developed flows from Sunset Village Filings No. 4 and No. 5 (future).
2. The drainage fee calculation has been revised in accordance with the most recent County comments.

Please call me if you have any questions or need any additional information.

Sincerely,
JPS ENGINEERING

A handwritten signature in black ink, appearing to read "John P. Schwab".

John P. Schwab, P.E.

cc: Rodney Preisser, Ellicott Springs Development
Tom Keith, United Planning & Engineering

El Paso County Department Of Transportation

John A. McCarty, P.E., Director

3460 N. Marksheffel Road

Colorado Springs, CO 80922

MEMORANDUM

TO: John Schwab, JPS Engineering
CC: Mark Gebhart, Planning Department
Tom Keith, United Planning & Engineering
FROM: Colleen Dawson, Engineer I, Development Review
DATE: August 16, 2001
RE: Sunset Village Filing 4 (SF-01-005)

The El Paso County DOT has the following general comments for Sunset Village, Filing Four, **Highway Improvements Plan**:

1. This document needs to be made a part of the Construction Plans.
2. General construction notes need to be added to the page including:
 - a) Roadside ditches shall be restored to the original condition. Ditch restoration shall be the responsibility of the Contractor.
 - b) Paving of Ellicott Highway will not begin until a soils report and pavement design is accepted by the El Paso County Department of Transportation and subgrade compaction tests are taken and accepted by an inspector for El Paso County.
 - c) Core samples will be taken on an undisturbed section of Ellicott Highway to determine existing asphalt and gravel base thickness.
 - d) New pavement on Ellicott Highway shall be tapered into existing pavement with fine mix asphalt.
3. Change scarify depth on Typical Section to 18".
4. Change asphalt depth note to read "Asphalt depth to match existing".

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Final Drainage Report**:

1. Temporary Detention Facilities will be required until such time that permanent, Regional Improvements are constructed. Provide sizing calculations in the FDR and include the facilities in the Construction Plans.
2. Contact this Department for minor corrections to the drainage fee calculations.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Construction Plans**:

1. The applicant will be required to formally request a waiver of the criteria for minimum radius of a road for Black Elk Drive.
2. A Drainage easement of approximately 35' total width is required between Lots 6&7 of Block 1 for the 36" Storm Sewer line running along the lot line. This easement will

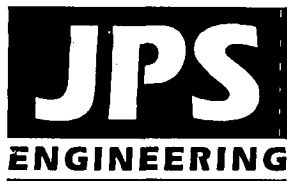
need to be continued along the Storm Sewer line until it terminates in the Telephone Exchange Drainage Channel.

3. Show the Storm Sewer and Water Line crossings on the Sanitary Sewer profile of Redtail Drive (14+00 to end).
4. The crown of the through street should be continued through intersections and indicated on the profiles. Adjust the profiles of Black Elk Drive, Wheat Drive, and Fleet Street to show the cross-pans and the crown of the intersected street.
5. The centerline elevation at 0+00 Fleet Street (page 9 of 12) does not match the elevation shown at 11+95.91 on the Redtail Drive profile (page 5 of 12).
6. Show the Drainage Easement along Lots 6&7 of Block 1.
7. See Plan markups for clarification of comments.

CMD

file # 2645

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518 N. Nevada Ave., Suite 303
Colorado Springs, CO 80903
(719)-477-9429
(719)-471-0766 fax

July 20, 2001

El Paso County Department of Transportation
Attn: Paul Danley, P.E.
3460 N. Marksheffel Road
Colorado Springs, CO 80922

**SUBJECT: Sunset Village Filing #4
Final Drainage Report**

Dear Paul:

We have enclosed 7 copies of the final drainage report for Sunset Village Filing No. 4 for your approval. This report presents the final drainage design for Filing No. 4, in accordance with previously approved drainage studies for this area. In this submittal, we have attempted to address all of the review comments in the El Paso County review letter dated April 5, 2001. These review comments are specifically addressed as follows:

1. Land Resource Solutions is currently negotiating with the El Paso County Parks Department regarding dedication of the 237-acre park tract southwest of this site, which will include the future regional Detention Pond C identified in the Sunset Village MDDP. The impact of developed flows from this filing will be negligible relative to off-site peak flows in the adjacent Telephone Exchange major drainage channel.
2. Design points B3, B6, and B8 have been labeled on the Drainage Plan.
3. The drainage fee calculation has been revised in accordance with previous comments.
4. Riprap sizing has been re-calculated based on the 100-year event (no impact to size).
5. The 18-inch storm sewer has a calculated velocity of 2.0 fps, which is slightly below the desired 2.5 fps, but is constrained by the 18-inch minimum pipe diameter and limited available slope (0.3 percent).
6. The storm sewer profile drawing (Sheet 11) includes a depiction of the design HGL, which remains at least one foot below grade.
7. 100-year ponding depths have been addressed at the proposed storm inlets.

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

John A. McCarty, P. E., Director
3460 North Marksheffel Road
Colorado Springs, Colorado 80922

TO: Mark Gebhart, Planning Department
FROM: Stuart Coston, Engineer I, Development Review
SUBJECT: Sunset Village Filing 4 (SF-01-005)
DATE: April 5, 2001

The El Paso County DOT has the following general comments for Sunset Village, Filing Four:

1. Please note that the connection of Enoch Road to Ellicott Highway is currently being constructed as part of Filing Three. Filing Four also connects to Enoch Road. The connection of Enoch at Ellicott Highway has inadequate sight distance. The developer will be required to correct this deficiency prior to Filing Three acceptance of improvements.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Final Drainage Report**:

1. Submittals indicate that the developer will not construct Detention Pond C (reference the MDDP for Sunset Village, Leigh Whitehead and Associates, February 2001) in conjunction with Filing Four. The applicant should provide a discussion in the Final Drainage Report that details when the pond will be constructed. The developer will bear responsibility for the design and all costs associated with the detention pond.
2. The applicant should label Design Points B3, B6, and B8 on the Drainage Plan.
3. The applicant should revise the Drainage Fees associated with this filing. Drainage fees for the Telephone Exchange Drainage Basin are \$5,267 per impervious acre. In addition, the applicant should account for the impervious area along the proposed streets. Comments are provided in the Drainage Report for clarification.
4. The applicant is required to calculate riprap sizing based on the 100-year storm event, as opposed to the five-year storm event.
5. The applicant is required to design the 18-inch storm sewer so that storm water velocities are at least 2.5 fps.

6. The applicant should depict the HGL on the storm drain plan and profile. The HGL should be no closer than one foot to the proposed ground elevation.
7. The applicant has sized all storm sewers using the five-year storm event. As a result, the applicant is required to address impacts to the area that would occur during the 100-year storm event. Specifically, address ponding depths at the intersection of Jayhawk Avenue and Redtail Drive.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Erosion Control Plan**:

1. The Erosion Control Plan should include the anticipated start date, completion date, and date of final stabilization.
2. The Plan should include the existing and proposed contour lines.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Final Plat**:

1. The applicant should depict easements around the two temporary turnaround locations.
2. The applicant should depict the location and dimensions of the floodplain on the final plat.

The El Paso County DOT has the following comments for Sunset Village, Filing Four, **Construction Plans**:

1. Remove the pavement thickness from the typical road section. Add a note that reads, "pavement and required base per the approved pavement design report."
2. In accordance with the El Paso County Subdivision Criteria Manual, Section D, the minimum radius for a subdivision road is 300 feet. The applicant should design the curvature along Black Elk Drive to meet this standard, or formally request a waiver for this criteria.
3. Table D2-2 of the El Paso County Subdivision Criteria Manual lists minimum acceptable K-values for vertical curves. The applicant should design the vertical curves along Wheat Drive and Fleet Street to meet these requirements.
4. The storm drain plan and profile on sheet 11 should be revised to represent accurate station locations.

5. Add a note that reads, "paving will not begin until a soils report and pavement design is accepted by the El Paso County Department of Transportation and subgrade compaction tests are taken and accepted by an inspector for El Paso County."

SRC

file # 2645

Sunset Village 4_SF.doc