MASTER DEVELOPMENT DRAINAGE PLAN

For

SHILOH MESA
AT
WOODMEN HEIGHTS

SAND CREEK DRAINAGE BASIN

Prepared for:
City of Colorado Springs Subdivision
30 North Nevada Avenue, Suite 702
Colorado Springs, CO 80903

On Behalf of:
Center for Strategic Ministry
8292 Woodmen Valley View
Colorado Springs, CO 80908

Prepared by:

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NOVEMBER 2009

08.346.005

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 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.

Brady A. Shyrock, PE
Registered Professional Engineer
State of Colorado
No. 38164

SEAL

Developer's Statement:

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

Center for Strategic Ministry
Business Name

By: _____
Les Krohnfeldt

Title: _____
Address: 8292 Woodmen Valley View
Colorado Springs, CO 80908

City of Colorado Springs:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____
For the City Engineer Date 11/19/09

Conditions:

TABLE OF CONTENTS

APPENDIX TABLE OF CONTENTS

I. INTRODUCTION

Shiloh Mesa at Woodmen Heights is a 112.88-acre mixed-use development consisting of residential, commercial, public assembly, open space, and public right-of-way uses. The site was annexed into the City of Colorado Springs (City) in August of 2004, as part of the Woodmen Heights Metropolitan District, located in northeastern Colorado Springs, Colorado. This site was previously platted as Woodmen Heights No. 3. The objective of the Shiloh Mesa Master Development Drainage Plan (Shiloh Mesa MDDP) is to identify the major drainageways, ponding and detention areas, locations of culverts, bridges, open channels and drainage areas which are tributary to this development. This project is located within the Sand Creek Drainage Basin. Other drainage analysis for adjacent property being submitted for concurrent review include ***The Master Development Drainage Plan for the Woodmen Heights Commercial Center***, prepared by Matrix Design Group, Inc (WHCC MDDP) and the ***Drainage Letter for Marksheffel Road Interim Design at Woodmen Heights*** prepared by Matrix Design Group, Inc (Marksheffel Drainage Letter). All analyses were completed in accordance with the City of Colorado Springs / El Paso County Drainage Criteria Manual.

Woodmen Road from Powers Boulevard to US Highway 24 is currently in the process of being expanded from a two-lane, 34-foot wide asphalt-surface roadway to a four-lane divided highway with varied right-of-way (ROW).

A. Project Location

The site area for construction is located in eastern Colorado Springs, Colorado northeast of the intersection of East Woodmen Road (Woodmen, or Woodmen Road) and North Marksheffel Road (Marksheffel or Marksheffel Road). See Vicinity Map, Appendix A.

1. General Location. Southwest ¼ of Section 4 of Township 13 South, Range 65 West of the Sixth Principal Meridian, El Paso County, State of Colorado.

2. Surrounding Streets. Existing Woodmen Road borders the site to the south, Mustang Road borders the project to the east, and the proposed Marksheffel Road borders the project to the west.

3. Drainageway. The site is located within the Sand Creek Drainage Basin and is bound by Sand Creek on the northwest. A portion of the topography drains to the west directly into Sand Creek Channel. The majority of the runoff from the site flows southwest towards the intersection of Woodmen Road and Marksheffel Road. Woodmen Road, located directly to the south of the property is higher in elevation than the surrounding land. The runoff is routed to the adjacent undeveloped property to the west (known as the Woodmen Heights Commercial Center) where it enters culverts which convey the runoff under Woodmen Road and ultimately into the Sand Creek Channel.

4. Surrounding Developments. The following developments are located adjacent to the site.

North:	Pawnee Rancheros Filing No. 2 is an existing single family residential development with lots greater than one acre in size.
West / Southwest:	The area to the southwest is currently unplatted and undeveloped, and known as the Woodmen Heights Commercial Center as previously mentioned. The Woodmen Heights Commercial Center is currently under conceptual review for a commercial development.
East:	East of Mustang Road is an existing single family residential development known as the Bar J-B Acres with lots greater than one acre in size.

B. Property Description

1. Project Area. The Shiloh Mesa at Woodmen Heights property encompasses 112.88 acres of land. Currently, there is an existing multiuse community center, temporary modular classroom units, and parking lot on the site. Future developments consist of residential, mixed use, and commercial land use. Refer to the Existing Conditions Drainage Map located in Appendix E.

2. Ground Cover. The majority of the site is covered with sparse vegetation including natural grasses and some shrubs.

3. General Soil Conditions. The Web Soil Survey, created by the Natural Resources Conservation Service, was utilized to investigate the existing general soil types within and tributary to the area impacting the site. See Soils Map; Appendix A. The following soil types are present in the development area.

Table 1.1 - NRCS Soil Survey for El Paso County

Soil ID No.	*Soil*	*Hydrologic Classification*	*Permeability*
8	Blakeland loamy sand	A	Rapid
9	Blakeland-Fluvaquentic Haplaquolls	A	Rapid
19	Columbine gravelly sandy loam	A	Rapid
71	Pring coarse sandy loam	B	Moderately Rapid

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high

runoff potential. For the analysis in this report, hydrologic group "B" soil classification was assumed across the entire site. Predominantly, Type "B" soils (sandy loam) exist on the site and the remaining Type "A" soils will exhibit Type "B" properties after grading and compaction have occurred.

4. Major Drainageways. The Shiloh Mesa at Woodmen Heights development lies within the Sand Creek Drainage Basin. The northwest portion of the site is located along the Sand Creek Channel

5. Irrigation Facilities. No existing irrigation facilities can be found on or around the site.

6. Existing Utilities. Existing infrastructure within the Shiloh Mesa site is limited to the utility currently servicing the existing chapel. Additionally, there is an existing 24-inch water main located within an existing utility easement, which is identified as proposed Marksheffel Road ROW. The water main crosses Sand Creek Channel and continues in a general northwest direction.

II. HYDROLOGIC AND HYDRAULIC ANALYSIS

A. Major Basin Description

The Sand Creek Drainage Basin is a tributary to the Fountain Creek. The Sand Creek Drainage Basin area is approximately 54 square miles, and is located in the east central portion of El Paso County. Shiloh Mesa at Woodmen Heights is located in the upper western sub-basin of Sand Creek. Shiloh Mesa accepts offsite runoff from the adjacent properties to the north and east.

According to ***The Sand Creek Drainage Basin Planning Study*** (SCDBPS), by Kiowa Engineering dated March 1996, select channel improvements as well as the construction of a regional detention pond will be necessary for this development. The recommended channel improvements per the SCDBPS will consist of selective riprap lining of the channel with grade control structures. Runoff from the proposed development drains to an area defined as reach SC-8 in the SCDBPS. (See Appendix D)

B. Floodplain Statement

Review of the ***Flood Insurance Rate Map Panel 535 (08041CO535 F)***, effective date March 17, 1997, published by the Federal Emergency Management Agency (FEMA), shows the Sand Creek Floodway and Floodplain for Sand Creek. A Letter of Map Revision (LOMR), dated December 7, 2005, exists for the channel in this region. The 100-year and 500-year floodplains are defined within the LOMR. (See Appendix A)

Channel Improvements, as specified in the SCDBPS, will be required with the development of Shiloh Mesa. It is anticipated that a 404 Permit will be required prior to construction of the channel improvements, and a LOMR will be required after channel improvements are completed to delineate the new floodplains.

C. Drainage Regulations

This report has been prepared in accordance to the criteria set forth in the ***City of Colorado Springs and El Paso County Drainage Criteria Manual*** (Drainage Criteria Manual), dated November 1991 and ***Volume 2*** of the City Drainage Criteria Manual, dated November 1, 2002. In addition to the City Criteria Manual, the ***Urban Storm Drainage Criteria Manuals, Volumes 1-3***, published by the Urban Drainage and Flood Control District, latest update, have been used to supplement the Drainage Criteria Manual.

D. Design Frequency

The design frequency is based on the Drainage Criteria Manual. The 100-year storm event was used as the major storm for the project, and the 5-year storm event was used as the minor storm.

E. Design Discharge

1. Method of Analysis

The hydrology for this project uses the Rational Method as recommended by the Drainage Criteria Manual for the minor and major storms. The Rational Method is used for drainage basins less than 100-acres in size.

The Rational Method uses the following equation: Q=C*I*A
Where:

Q = Maximum runoff rate in cubic feet per second (cfs)
C = Runoff coefficient
I = Average rainfall intensity in inches per hour
A = Area of drainage sub-basin in acres

2. Runoff Coefficient

Rational Method coefficients are from Table 5-1 of the Drainage Criteria Manual for developed land use such as roadway and commercial areas, as well as undeveloped areas. See Appendix C for more information.

3. Time of Concentration

The time of concentration for the Rational Method was taken from the Drainage Criteria Manual. The time of concentration consists of the initial time of overland flow and the travel time in a channel to the inlet or point of interest. A minimum time of concentrations of 5 minutes was used for the final calculations.

4. Rainfall Intensity

The hypothetical rainfall depths for the 24-hour storm duration were estimated from the NOAA Atlas 2, Volume III-Colorado Isopluvial Figures 27 and 31. Table 2.1 lists the rainfall depth for each of the 24-hour storm events.

Table 2.1 - Rainfall Depth in Colorado Springs in the 24 Hour Storm Event

Storm Recurrence Interval	Rainfall Depth (inches)
5-year	2.6
100-year	4.4

The rainfall intensity equation for the Rational Method was taken from Drainage Criteria Manual updated Storm Intensity Curves Memo.

Intensity Equation: $$I = 26.65 * \frac{P_1}{(10 + T_d)^{0.76}}$$

F. Hydraulic Criteria

Storm sewer infrastructure was sized using *Bentley's* StormCAD computer program. A minimum slope of one-half percent throughout the proposed pipe network was assumed as well as a roughness coefficient that corresponds to a pipe material of concrete. The losses in junctions, pipes and manholes were calculated using the Federal Highway Administration (FHWA) HEC-22 methods.

III. EXISTING FACILITIES

A. Previous Analysis of Existing Facilities

The SCDBPS outlines the drainage improvements required by the City, prior to development in this area. The SCDBPS proposed numerous regional detention ponds throughout the development area of Woodmen Heights Metropolitan District. Other studies of the Shiloh Mesa development area include ***The Master Development Drainage Plan for Woodmen Heights*** (Classic MDDP), by Classic Consulting Engineers and Surveyors, dated June 2004, and more recently ***The Master Development Drainage Plan Update for Woodmen Heights and Final Drainage Report for Forest Meadows Filing No. 1 and No. 4*** (ESI MDDP), by Engineering and Surveying Inc (ESI), dated February of 2006. The Classic MDDP proposed eliminating Detention Facilities No. 4 and 5, as outlined in the SCDBPS, and enlarging Facilities No. 3 and 6 to compensate for the loss of detention area.

Detention Facility No. 3 (Pond #3), is located inline with the main reach of the Sand Creek Channel just west of the proposed Marksheffel Road alignment and north of Woodmen Road. This detention pond was sized to accommodate the developed stormwater runoff from the eastern portion of the Woodmen Heights Metropolitan District. According to the Classic MDDP, Pond #3 is a 224 acre-foot facility with a total developed inflow of Q_{100}=2883 cubic feet per second (cfs) and a release rate of **Q_{100}=2242 cfs**. It was anticipated that this facility would be combined with a neighborhood park area. In addition to Pond #3, the Woodmen Heights Metropolitan District is responsible to complete the construction of Regional Pond #2, located adjacent to Security Service Field, approximately 3 miles downstream. Construction is underway to complete the interim condition of Pond #2.

The ESI MDDP was approved by the City in February of 2006, and functions as an amendment/update to the Classic MDDP. The ESI MDDP evaluated the previous analysis performed in the Classic MDDP and resized Pond #3 to a 209 acre-foot facility. The reason for the decrease in size of Pond #3 can be attributed to the rerouting of runoff from 18.7 acres, known as Parcel 11 in the Classic MDDP, to Detention Facility No. 6. Minor changes were also made with respect to drainage analysis, such as an increased inflow of Q_{100}=3207 cfs to Pond #3 and a release rate of **Q_{100}=2240 cfs**. Both the Classic MDDP and the ESI MDDP, assumed that Pond #3 would accept developed flows from the Shiloh Mesa development and would treat the runoff for water quality.

B. Offsite Analysis of Existing Facilities

The Classic MDDP and the ESI MDDP utilized the SCS method for computing the hydrologic analysis. The impervious area of each basin was analyzed to compare the results from the ESI MDDP to those calculated using the Rational Method in this report (which will yield more conservative results). It was assumed that the time of concentration would remain the same for each analysis, and therefore the impervious area is the controlling factor for evaluating the peak runoff rates. For the proposed site, the ESI MDDP employed a curve number of 92. According to **Table 5-5** of the Drainage Criteria Manual, *Runoff Curve Numbers for Hydrologic Soil*, a commercial area with a curve number of 92 corresponded to an 85 percent impervious area. Conversely, **Table 5-1** of the Drainage Criteria Manual, *Recommended Average Runoff*

Coefficients and Percent Impervious, lists the runoff coefficients associated with the Rational Method for residential areas to be 65 percent impervious and 95 percent impervious for commercial areas. Comparing the acreage of impervious area from each analysis yielded similar results, and therefore the assumptions made for this analysis are valid. Refer to the Impervious Area Comparison Table in Appendix B.

Another assumption was made for the runoff pertaining to the property to the east, known as Basin OS-5. Per the ESI MDDP, the proposed development is designated to accept significant flow from Basin OS-5 and convey it through the proposed development to the site to the west. Basin OS-5 is composed of residential lots greater than one acre in size, and is covered with native grasses. It appears that no comprehensive overlot grading activities have occurred; only minor grading for the footprint of the home. To account for this flow using the Rational Method, it was assumed that the time of concentration from the ESI MDDP would remain the same. The time of concentration was combined with the basin area to arrive at an average runoff coefficient, C(100)=0.27. Table 5-1 from the Colorado Springs Drainage Criteria Manual verified that the calculated average runoff coefficient was reasonable for land that is a mixture of undeveloped historic flow, pasture/meadow, and residential development with lots greater than one-acre in size. Refer to the Existing Conditions Drainage Map located in Appendix E.

Sub-Basin OS-5 (323.00 acres, Q(5) = 201.70 cfs, Q(100) = 404.00 cfs) accounts for the runoff from the Bar J-B Acres Subdivision, and is collected in a swale prior to entering the site. The swale appears to be well vegetated with no erosion issues. Two existing 42-inch Corrugated Metal Pipes (CMP) convey the runoff under Mustang Road onto the Shiloh Mesa property at Design Point 2 on the existing conditions drainage map (323.00 acres, Q(5) = 201.70 cfs, Q(100) = 404.00 cfs). The peak flow from Sub-Basin OS-5 is comparable to the results of the ESI MDDP Q(100)=386.63 cfs. The peak flow used in this report was derived from the use of the Rational Method whereas the ESI MDDP utilized the Soil Conservation Service Method (SCS Method). Any developed runoff from sub-basin OS-5 that exceeds the flow identified at Design Point 2 (as documented on the Existing Conditions Drainage Map) will require detention and water quality to be provided prior to entering the Shiloh Mesa development.

The portion of the Pawnee Rancheros Subdivision, located to the north of the site, is delineated as Sub-Basin OS-1 (4.26 acres, Q(5) = 3.0 cfs, Q(100) = 7.5 cfs). This area is undeveloped and covered with native grasses and shrubs. Runoff from this basin sheetflows onto the Shiloh Mesa property at Design Point 1 (4.26 acres, Q(5) = 3.0 cfs, Q(100) = 7.5 cfs). Refer to Table 3.1 and the Existing Conditions Drainage Map located in Appendix E.

According to the ***Final Hydrology and Hydraulics Report for Woodmen Road Powers to US 24*** (Woodmen Road FDR), by DMJM Harris, dated October 15, 2007, the runoff from Woodmen Road is contained and routed within the Woodmen ROW. Curb inlets and bio-swales, as defined in the Woodmen Road FDR, are being used to convey and treat runoff. Runoff will be directed to the south of Woodmen Road and then to the west of Marksheffel Road. According to the Woodmen Road FDR, runoff from basin N14 (17.6 acres) is conveyed to the south via an 18-inch RCP within Woodmen Road. Sub-Basin N14 is area draining to the northeast corner of the intersection of Marksheffel Road and Woodmen Road. This basin corresponds to Sub-Basin J as described within the onsite analysis of existing facilities.

Located adjacent to the eastern boundary of the development is Mustang Road. Runoff from Mustang Road is routed south via roadside ditches. As previously described, Sub-Basin OS-5 consists of a significant drainage area that outlets across the Shiloh Mesa property. Runoff from the northern portion Mustang Road is included within this drainage area.

Sub-Basin OS-6 (1.13 acres, Q(5) = 3.9 cfs, Q(100) = 7.4 cfs) accounts for runoff generated by Mustang Road south of Design Point 2 (refer to the Existing Conditions Drainage Map). Runoff generated within OS-6 drains to the south and enters the existing roadside swale within the north side of the Woodmen Road ROW and is directed to the east (Woodmen Road FDR Basin B9). The stormwater runoff from Sub-Basin OS-6 does not impact the Shiloh Mesa development.

C. Onsite Analysis of Existing Facilities

As previously mentioned, Shiloh Mesa accepts runoff from offsite drainage basins at two locations. The northern location, designated as Sub-Basin OS-1, sheetflows onto Sub-Basin A (2.1 acres, Q(5) = 2.3 cfs, Q(100) = 5.6 cfs). Sub-Basin A, located at the northeast corner of the site, is undeveloped and covered with native grasses and shrubs. Stormwater from Sub-Basins OS-1 and A, combine at Design Point 1-A, and drain southerly across Sub-Basin E towards Design Point 4. Refer to Table 3.1 for peak flowrates at respective design points.

Sub-Basins B (3.5 acres, Q(5) = 2.4 cfs, Q(100) = 6.1 cfs) and M (12.8 acres, Q(5) = 4.2 cfs, Q(100) = 7.9 cfs) are located along the eastern edge of the Sand Creek Channel. The runoff generated in Sub-Basin B sheet flows into Sub-Basin M which discharges directly into Sand Creek. The basins consist of small shrubs and native grasses and some minor erosion has occurred where runoff concentrates before entering the channel.

Sub-Basin D (6. 6 acres, Q(5) = 3.6 cfs, Q(100) = 9.1 cfs) is located along the eastern property line of the site. It is undeveloped and vegetation consists of native grasses and shrubs. Runoff in this basin flows to the south to combine with offsite flows from Sub-Basin OS-5 at Design Point 3, which then flows in a southwest direction across the site to Design Point 4 (please refer to Table 3.1).

Sub-Basins C (19.6 acres, Q(5) = 7.1 cfs, Q(100) = 17.7 cfs) and E (18.1 acres, Q(5) = 9.0 cfs, Q(100) = 22.5 cfs) are located in the north central region of the site. Native grasses and shrubs constitute the sparse vegetation in these basins. Stormwater from Sub-Basins A and OS-1 combine with runoff from Sub-Basin E at Design Point 4. Runoff from Sub-Basins C and E flow in a southerly direction to Design Point 4. Design Point 4 marks the amalgamation of runoff from Sub-Basins OS-1, A, C, E, D, and OS-5 (please refer to Table 3.1). The swale then routes the flows in a southwesterly direction towards the proposed Marksheffel Road.

The westside of the proposed development which does not drain directly into Sand Creek is delineated into Sub-Basins F (7.0 acres, Q(5) = 4.0 cfs, Q(100) = 9.9 cfs) and G (3.8 acres, Q(5) = 2.2 cfs, Q(100) = 5.4 cfs). Grasses and shrubs sparsely cover the ground with vegetation. Stormwater from Sub-Basin G flows in a southward direction to Design Point 5. Design Point 5 is the location where stormwater enters the swale from Design Point 4. Runoff generated in Sub-Basin F moves in a southwestly direction toward the proposed Marksheffel Road. Runoff accumulates at Marksheffel Road and drains to the south joining flows from Sub-Basin G and

Design Point 5 at Design Point 6. Please refer to Table 3.1 for peak runoff flowrates at respective design points

Sub-Basins H (7.7 acres, Q(5) = 4.1 cfs, Q(100) = 10.3 cfs) and I (8.1 acres, Q(5) = 4.1 cfs, Q(100) = 13.1 cfs) are located in the central portion of the site and drain in northeast to southwest fashion. Sub-Basin H is undeveloped and covered with a slight amount of vegetation consisting of grasses and shrubs. Sub-Basin I contains a portion of the existing community center and parking lot, however the majority of the basin is undeveloped land similar to Sub-Basin H. Runoff generated by Sub-Basins H and I combine at Design Point 7, located along the western edge of the site. Please refer to Table 3.1 for historic peak runoff flowrates.

Sub-Basin K (6.5 acres, Q(5) = 3.8 cfs, Q(100) = 9.4 cfs) is located in the southern portion of the proposed development. While the majority of this basin is undeveloped, a portion of the community center, existing parking lot, temporary modular units, as well as the access road are all located along the eastern side of the basin. Runoff generated in this basin drains in a south southwesterly direction to Design Point 8. Sub-Basin K is undeveloped and contains native grasses and shrubs. Refer to Table 3.1 for design point peak runoff information.

Sub-Basin J (14.1 acres, Q(5) = 8.5 cfs, Q(100) = 21.1 cfs) currently drains to Woodmen Road. As previously mentioned, the Woodmen Road FDR accounted for this drainage area within Basin N14 (17.55 acres, Q(5) = 10.1 cfs, Q(100) = 20 cfs). According to the Woodmen Road FDR, existing storm sewer infrastructure captures runoff from this basin and routes it south then west toward Sand Creek.

The ultimate plan for Marksheffel Road a six lane principal arterial, however the initial construction will be a four lane road in a 160-foot ROW. Sub-Basin L (3.2 acres, Q(5) = 5.4 cfs, Q(100) = 11.2 cfs) accounts for the peak historic runoff generated along the eastern portion of the roadway. Stormwater is routed to the south where it joins the flow from Sub-Basin K as well as flows from Design Points 6 and 7 at Design Point 8 (please refer to Table 3.1). Runoff exits the site flowing west into the adjacent undeveloped property (known as Woodmen Heights Commercial Center). Stormwater flows in a westward direction to three existing 48-inch culverts which route the flow south under Woodmen Road into an existing swale and ultimately into Sand Creek.

Table 3.1 – Existing Design Point Peak Runoff Rates

Design Point	*Sub-Basins*	*Total Area (ac.)*	*Q(5) (cfs)*	*Q(100) (cfs)*
1	OS-1, A	6.3	**4.0**	**9.8**
1-A	DP1, E	24.5	**11.5**	**28.6**
2	OS-5	323.0	**201.7**	**404.0**
3	DP2, D	329.6	**144.5**	**347.4**
4	1-A, DP3, C,	373.60	**145.0**	**350.5**
5	DP4, G	377.4	**146.8**	**354.9**
6	DP5, F	384.3	**150.0**	**363.0**
7	H, I	15.8	**7.4**	**21.2**
8	DP6, DP7, K, L	409.8	**164.1**	**399.2**

IV. DRAINAGE FACILITY DESIGN

A. Proposed Conditions

Previous analysis of the proposed Woodmen Heights Metropolitan District development proposed four outfall locations for the Shiloh Mesa site. The outfall locations proposed in the ESI MDDP are designated as Pipe 20, Pipe 21, Pipe 36, and Pipe 39. The Shiloh Mesa at Woodmen Heights development will utilize four discharge points as well; Design Point 11, Design Point 31, Design Point 21, and Design Point 30 (refer to the Proposed Conditions Drainage Map located in Appendix E). One key difference from the ESI MDDP proposed in the Shiloh Mesa development is the routing of offsite runoff. The ESI MDDP recommended routing flows from Sub-Basin OS-5 through Pipe 36 and the adjacent development known as Woodmen Heights Commercial Center. Instead, the Shiloh Mesa development proposes routing the offsite flow to Design Point 31, located north of the Marksheffel Road and Sand Creek Channel crossing. Please refer to Table 4.1 and the Proposed Conditions Drainage Plan located in Appendix E.

Table 4.1 – Summary of Design Points

Design Point	*Contributing Area*	*Total Peak Discharge Q(100)*
11	31.71	107.53
Pipe 20	11.67	56.54
21	29.80	184.26
Pipe 36	380.31	586.96
30	27.03	157.90
Pipe 39	25.18	116.93
31	348.38	568.12
Pipe 21	12.90	62.73

1. DESIGN POINT 11

Design Point 11 is the northern outfall to Sand Creek from the Shiloh Mesa development. Specifically, Sub-Basins A, B, C, D, E, F, G, H, I, J, K, and OS-1 are routed to Design Point 11. The tributary area draining to this outfall is approximately 31.71 acres, and composed of commercial, residential, and open space land uses. The location of Design Point 11 is similar to the proposed location of Pipe 20 from the Classic MDDP and ESI MDDP reports. The sub-basins that compose the tributary area are described below followed by Table 4.2 which summarizes the design points and the 5-year and 100- year routed peak flowrates.

Sub-Basin OS-1, as described in existing conditions, is an off-site basin that flows onto the site near the northeastern boundary of the project. It is currently an undeveloped area considered to be a pasture/meadow land use. Runoff generated by OS-1 will be collected by a 36-inch Reinforced Concrete Pipe (RCP) at Design Point 1. Flows will be routed through the trunk alignment in Olive Wood to the outfall at Design Point 11.

Sub-Basin A (2.8 acres, Q(5) = 3.1 cfs, Q(100) = 7.6 cfs) will be a mixture of park land and single family residential. A drainage swale located at the northeastern portion of the basin will route the stormwater northwesterly to a sump inlet. The runoff will be routed to the trunk line in Olive Wood at Design Point 2 via a 36-inch RCP.

Sub-Basin D (5.9 acres, Q(5) = 22.3 cfs, Q(100) = 41.0 cfs) will be primarily commercial land use with park and open space. Runoff will be collected by a storm drain system located in the proposed parking lot. A 36-inch RCP will convey the flow at Design Point 3.

Sub-Basins B, C, E, F, G, and H are all multi-family residential land use. Sub-Basins B (3.2 acres, Q(5) = 8.6 cfs, Q(100) = 17.8 cfs), and E (2.3 acres, Q(5) = 6.4 cfs, Q(100) = 13.3 cfs) will sheet flow to adjacent alleys on the south and west sides of the basins where the flow will be intercepted by curb inlets and directed west to Design Points 4, 5, and 6 of the trunk storm sewer. Similarly, Sub-Basins C (1.6 acres, Q(5) = 5.0 cfs, Q(100) = 9.8 cfs), F (0.8 acres, Q(5) = 2.8 cfs, Q(100) = 5.6 cfs), and G (2.5 acres, Q(5) = 6.8 cfs, Q(100) = 14.0 cfs) will also sheet flow to the front of the lots and into Olive Wood where the flow will be intercepted by curb inlets and directed into the main storm line at Design Points 5, 6, and 7 respectively.

Located along the eastern side of the property are Sub-Basins I (2.8 acres, Q(5) = 4.5 cfs, Q(100) = 10.0 cfs) and J (3.9 acres, Q(5) = 10.2 cfs, Q(100) = 21.2 cfs). These basins are open space and will function as a transition from the existing development along Mustang Road to the proposed multi-family residential. Runoff will be collected by curb inlets within Olive Wood at Design Points 8 and 9 and conveyed via a 30-inch RCP.

The land use for Sub-Basin H is multi-family residential. Stormwater generated within Sub-Basin H will be directed south towards the street. The runoff will be collected by curb inlets and conveyed via a 36-inch RCP trunk line to a confluence at Design Point 7 within Olive Wood.

Runoff generated within Sub-Basins OS-1, A, B, C, D, E, F, and, G combine at Design Point 7 with the stormwater from Sub-Basins I, J, and H. A 42-inch RCP will convey the flow to Design Point 10.

Sub-Basin K (2.8 acres, Q(5) = 4.5 cfs, Q(100) = 10.0 cfs) is located along the western side of the site adjacent to Sand Creek. This basin is anticipated to maintain open space land use and may be routed directly into Sand Creek. This basin will be included in the peak flowrate at Design Point 10 in this analysis.

Table 4.2 – Summary of Design Points That Outfall to Design Point 11

Design Point	*Contributing Area*	*Total Peak Discharge Q(5)*	*Total Peak Discharge Q(100)*	*Pipe Diameter*	*Contributing Basins*
		cfs	**cfs**	**inch**	
1	4.3	5.13	9.12	36	OS-1
2	7.0	8.15	14.56	36	DP-1, A
3	12.9	22.69	40.66	36	DP-2, D
4	4.7	14.97	26.67	36	B,C
5	17.7	33.61	60.34	36	DP-3, DP-4
6	20.8	40.28	72.43	42	E, F, DP-5
7	31.2	59.61	107.36	42	G, H, DP-6, DP-9
8	7.1	5.69	10.13	30	I
9	11.0	15.30	27.53	36	DP-8, J
10	31.7	59.70	107.53	42	DP-7, K
11	31.7	59.70	107.53	42	DP-10

Design Point 11 is the outfall to Sand Creek. Runoff at Design Point 11 can be compared to Pipe 20 of the ESI MDDP. Pipe 20 was estimated to be a 36-inch diameter pipe with a drainage area of 11.67 acres and a peak flowrate of $Q_{DEVELOPED}(100) = 56.54$ cfs. Conversely, the Shiloh Mesa development proposes to route a significantly larger drainage basin boundary (31.7 acres) to Design Point 11 resulting in a peak flowrate for the major storm of $Q_{DEVELOPED}(100) = 107.53$ cfs with a pipe diameter of 42-inch (The benefits to offsite downstream facilities are discussed in the Design Point 31 section in greater detail).

2. DESIGN POINT 31

The commercial area north of Kenosha Drive will be collected in a trunk storm sewer system which outfalls north of the Marksheffel Road crossing of Sand Creek at Design Point 31. The on-site drainage area consists of Sub-Basins L, M, N, O, P, Q, and EE and encompasses approximately 21.26 acres of the proposed site. The majority of this drainage area is composed of impervious land use such as parking lots and streets. Additionally several offsite sub-basins are routed to Design Point 31. The sub-basins are described below, followed by Table 4.3 which summarizes the design points and the 5-year and 100- year routed peak flowrates.

The parking lot for the main chapel of the development is delineated Sub-Basin L (6.5 acres, Q(5) = 28.8 cfs, Q(100) = 54.1 cfs). Runoff from Sub-Basin L will sheet flow southeast to sump inlets located in the southeast corner of the basin known as Design Point 12. A 36-inch RCP will route runoff within Tamarisk Wood to the west.

The runoff generated by Tamarisk Wood is defined as Sub-Basin M (0.9 acres, Q(5) = 4.2 cfs, Q(100) = 7.9 cfs). Stormwater will flow to the curb and gutter where it will be routed in a southwest direction. Curb inlets at Design Point 13 will combine the runoff with flow from Sub-Basin L in a 42-inch RCP and route the stormwater to the southwest toward Design Point 14.

Sub-Basin N (4.8 acres, Q(5) = 20.1 cfs, Q(100) = 37.8 cfs) is composed of commercial development with the majority of the basin being composed of the impervious parking lot. Runoff generated by Sub-Basin N will sheet flow southwest to sump inlets within the parking lot. Stormwater will enter the trunk storm sewer system in Tamarisk Wood at Design Point 14 where a 54-inch RCP conveys the flow to DP15. Please refer to Table 4.3 for Design Point Peak Runoff information.

Sub-Basins Q (2.8 acres, Q(5) = 12.8 cfs, Q(100) = 24.1 cfs) and P (1.5 acres, Q(5) = 6.4 cfs, Q(100) = 12.0 cfs) consist of impervious roadway. Runoff generated within Sub-Basins Q and P is routed via curb and gutter to sump inlets at Design Point 16. Runoff from these basins will be combined with the runoff from Sub-Basin OS-5 (as described later in this section) within the trunk 72-inch RCP east from Design Point 16 to Design Point 17 (Please refer to Table 4.3).

The northern portion of Marksheffel Road, adjacent to the project, is designed at Sub-Basins OS-7 (1.3 acres, Q(5) = 4.9 cfs, Q(100) = 9.3 cfs) and OS-10 (2.6 acres, Q(5) = 7.8 cfs, Q(100) = 14.66 cfs). Runoff generated within Sub-Basins OS-7 and OS-10 will be routed south via curb and gutter to curb inlets within the roadway. Stormwater from Sub-Basin OS-7 will be routed to Design Point 33 within Kenosha Drive then outlet to the Sand Creek Channel at Design Point 31. Runoff generated within OS-10 will be conveyed to the south to Design Point 30, and then west through the Woodmen Heights Commercial Center to the Sand Creek Channel. Table 4.3 contains peak runoff rates at the respective Design Points.

Sub-Basin O (3.0 acres, Q(5) = 13.5 cfs, Q(100) = 25.3 cfs) is located along the eastern property line adjacent to Marksheffel Road. The land use of Sub-Basin O is primarily parking lot and commercial development. Stormwater within Sub-Basin O will be collected via sump inlets in the parking lot and routed to Design Point 15 (please refer to Table 4.3). Design Point 15 is the location where the offsite flow from Sub-Basin OS-5, runoff generated by Kenosha Drive and Marksheffel Road, as well as the parking lot and commercial areas adjacent to the proposed chapel combine before they outlet to the Sand Creek Channel. An existing 24-inch water main crosses the property in this basin as described in the onsite analysis of the existing facilities. It is unknown at this time when the Shiloh Mesa development of this area will take place in relation to the proposed crossing of Sand Creek with Marksheffel Road. In the event that this area develops prior to the crossing of Sand Creek, the design of any facilities will need to take into account the existing waterline, and may require the approval of Colorado Springs Utilities (CSU).

Sub-Basin EE (4.6 acres, Q(5) = 11.5 cfs, Q(100) = 21.7 cfs) consists of an amphitheater, landscaped park space, and the future chapel of the development. The runoff coefficient has been given a conservative, commercial land use for the purpose of

this report. Runoff will be routed to the southwest corner of the basin. After the flow is collected in an inlet, it will be directed via 24-inch RCP to Design Point 31.

As previously described, the area to the east of the development has been labeled Sub-Basin OS-5. Conforming to previous analysis, the Shiloh Mesa will accept historic flows that are currently crossing the property. Specifically, this development will accept stormwater from the basin OS-5 and convey it to Sand Creek (refer to the Existing Conditions Drainage Map, Design Point 2). The utilization of a headwall structure at Design Point 32 (identified as Design Point 2 in the Existing Conditions Drainage Map) is recommended to intercept flows coming from the Sub-Basin OS-5. The installation of the all structures within Mustang Road will require coordination with El Paso County and adjacent property owners to obtain necessary easements and ownership / maintenance obligations. Runoff is limited to historic rates, as it is today, and will be routed directly to Sand Creek. It is assumed that the historic flow will not require water quality treatment by the Shiloh Mesa development, before the runoff is placed in Sand Creek. Basin OS-5 accounts for 323-acres and consists of a large lot residential development. Runoff coefficients were assumed to be C(5) = 0.24 and C(100) = 0.27, which yields peak developed runoff rates of Q(5) = 201.70 cfs and Q(100) = 404.0 cfs. As previously noted, the peak flow from Sub-Basin OS-5 is comparable to the results of the ESI MDDP Q(100)=386.63 cfs. Basin OS-5 drains to the development via two existing 42-inch CMPs under Mustang Road. The SCDBPS calls for replacement of the existing 42-inch CMPs with a 60-inch CMP and a rip-rap channel to convey the flow across the Shiloh Mesa site. The Classic MDDP recommends an alternative of a 72-inch trunk storm sewer system to convey the flow. This trunk storm sewer system is labeled Pipe 30 within the Classic MDDP, and would replace both the rip-rap channel and the 60-inch diameter pipe. Subsequent analysis in the ESI MDDP, assumed the 72-inch storm sewer will be implemented as the preferred alternative for development on this property. The runoff conveyed by Pipe 30 was proposed to be routed through the property to the southwest, known as the Woodmen Heights Commercial Center, to Sand Creek per the ESI MDDP.

As an alternative to the alignment described in the above paragraph, this report recommends routing the flow from basin OS-5 across the Shiloh Mesa property into the Sand Creek Channel at Design Point 31. Design point 31 is located immediately upstream of the proposed Marksheffel Road crossing at Sand Creek. This will have an impact in three ways. First, rerouting of the runoff generated within OS-5 will provide a cost savings to the proposed infrastructure across the Shiloh Mesa Development as well as the proposed development to the southwest known as Woodmen Heights Commercial Center. Second, it will move the offsite runoff approximately 1600 feet upstream of the Classic MDDP outlet location by moving the point of discharge. Finally, it will increase the volume of flow for the same 1600 feet of the channel. It is anticipated that extra armoring of the channel will provide stabilization to compensate for the added volume of runoff. Furthermore, the drainage analysis associated with the design of the Sand Creek crossing for Marksheffel Road will need to account for this additional flow for this connection to be viable. A detailed channel analysis providing design recommendations for armoring, drop structures, as well as the bridge hydraulics (if applicable) will be required to be approved by the City prior to the acceptance of any development plan submittal which incorporates this alternative. Coordination of the hydraulics associated

with the channel and the structure for the Sand Creek crossing will be necessitated by the demand of either the development of Shiloh Mesa or the connection of Marksheffel Road to the west side of Sand Creek. Ultimately, this alternative would discharge the same volume of runoff to Sand Creek. Peak flowrates entering the channel at Design Point 31 were calculated to be Q(5) = 344.82 cfs and Q(100) = 568.12 cfs. The Sand Creek Channel Improvements drainage report as well as the preliminary drainage report for Shiloh Mesa will outline the timing and any interim design required for routing the offsite flows.

Table 4.3 - Summary of Design Points that Outfall to Design Point 31

Design Point	*Contributing Area*	*Total Peak Discharge Q(5)*	*Total Peak Discharge Q(100)*	*Pipe Diameter*	*Contributing Basins*
		cfs	**cfs**	**inch**	
12	6.5	30.69	54.63	36	L
13	7.4	34.50	61.44	42	DP-12, M
14	12.2	54.35	96.87	42	DP-13, N
15	15.2	65.23	116.52	54	DP-14, O
16	324.5	205.38	410.56	72	DP-32, P
17	328.6	215.39	428.44	72	DP-16, DP-33
31	348.4	344.82	568.12	84	DP-17, DP-15, EE
32	323.0	201.70	404.00	72	OS-5
33	4.1	15.22	27.39	30	OS-7, Q

Peak runoff at Design Point 31 can be compared to Pipe 21 of the ESI MDDP. The ESI MDDP estimated a drainage area of 12.90 acres would be routed to Sand Creek by Pipe 21. Pipe 21 is a 36-inch diameter pipe conveying a peak flowrate for the major storm of Q(100) = 62.73 cfs. Routing the runoff generated in the offsite basins east of the property significantly increases the drainage basin area. This volume of flow is expected to have a major impact on Sand Creek, and as previously mentioned a detailed analysis of channel hydraulics will be required. The proposed area draining to Design Point 31 is 348.4 acres with a peak flow rate of Q(100) = 568.12 cfs.

3. DESIGN POINTS 20 / 21

Approximately 29.8 acres drain to the storm sewer system Design Point 21, located at the intersection of Marksheffel Road and Main Street. The onsite drainage area is composed of Sub-Basins S, T, U, and V. These basins consist of commercial and roadway land use. The peak runoff from Shiloh Mesa collects at Design Point 20. Immediately downstream is Design Point 21. At this location, the stormwater from Shiloh Mesa combines with the runoff generated from a portion of Marksheffel Road designated as offsite Sub-Basins OS-4 and OS-9. The runoff is then routed west through the Woodmen Heights Commercial Center to ultimately discharge into Sand Creek. The sub-basins are described below, followed by Table 4.4 which summarizes the design points and the 5-year and 100- year routed peak flowrates.

Sub-Basin S (4.9 acres, Q(5) = 17.7 cfs, Q(100) = 31.9 cfs) is primarily a parking lot bordered by the Bar J-B Acres Subdivision to the east. Runoff from Sub-Basin S will sheet flow to sump inlets located in the southwest corner of the basin. Runoff enters the southern trunk storm sewer at Design Point 18 where it is conveyed to the west within Main Street via a 30-inch RCP to Design Point 19.

Sub-Basin T (5.0 acres, Q(5) = 19.8 cfs, Q(100) = 36.7 cfs) is commercial land use bordered by the Bar J-B Acres Subdivision to the east. Stormwater from Sub-Basin T will sheet flow south to sump inlets in the southwest corner of the basin at Design Point 19. The southern trunk storm sewer will route the flow to Design Point 20 via 42-inch RCP within Main Street.

Sub-Basin U (13.4 acres, Q(5) = 53.4 cfs, Q(100) = 95.1 cfs) is entirely commercial land use. Runoff generated by this basin will be routed in a southwest direction. Due to the size, it is anticipated that additional minor drainage infrastructure will be required for this basin with the final drainage report. This minor storm sewer infrastructure will connect to the southern trunk storm sewer at Design Point 20, where the runoff will be conveyed to the west via 54-inch RCP. Please refer to Table 4.4 for Design Point Peak Runoff information.

Sub-Basin V (3.9 acres, Q(5) = 16.2 cfs, Q(100) = 29.8 cfs) is a combination of commercial and roadway land use. Runoff from Sub-Basin V will be conveyed by Main Street in a southwest direction to curb inlets at Design Point 20. A 54-inch RCP will route the flow to the west to Design Point 21.

Sub-Basins OS-4 (1.5 acres, Q(5) = 6.7 cfs, Q(100) = 12.6 cfs) and OS-9 (1.2 acres, Q(5) = 4.2 cfs, Q(100) = 7.9 cfs) are portion of Marksheffel Road between Kensoha Drive and Main Street.. Runoff generated within Sub-Basins OS-4 and OS-9 will be routed south via curb and gutter to curb inlets within the roadway. Runoff generated by Sub-Basins OS-4 and OS-9 is combined with stormwater conveyed within the trunk 54-inch RCP storm sewer system within Main Street (at Design Point 21). The stormwater is routed to the west through the Woodmen Heights Commercial Center to Sand Creek.

Table 4.4 - Summary of Design Points That Outfall to Design Point 21

Design Point	*Contributing Area*	*Total Peak Discharge Q(5)*	*Total Peak Discharge Q(100)*	*Pipe Diameter*	*Contributing Basins*
		cfs	**cfs**	**inch**	
18	4.9	18.03	32.10	30	S
19	9.8	35.07	62.66	42	DP-18, T
20	27.1	94.44	169.01	54	DP-19, U, V
21	29.8	102.78	184.26	54	DP-20, OS-4, OS-9

Located at the intersection of the Marksheffel Road and Main Street is Design Point 21. Design Point 21 can be compared to Pipe 36 of the ESI MDDP. Pipe 36 was estimated to be a 78-inch RCP conveying a peak flow of Q(100) = 586.96 cfs. The ESI MDDP

estimated the runoff from 380.31 acres would be routed through Pipe 36. Rerouting the offsite flow as presented in the Design Point 31 outfall reduces the drainage area at Design Point 21 to 29.8 acres. The result is a decrease in RCP diameter to 54-inch and a decrease in the peak flowrate Q(100) = 184.26 cfs.

4. DESIGN POINTS 29 / 30

Sub-Basins W, X, Y, Z, AA, BB, and CC, as well as offsite basins OS-2 and OS-3, account for approximately 27.03 acres of the southern portion of the proposed site. The land use of these basins consists of commercial, multi-family residential, open space, and roadway. Runoff generated will be routed through a southern trunk storm sewer to the Woodmen Heights Commercial Center at Design Point 30. Ultimately, the stormwater will outfall into Pond #3 inline with Sand Creek. The sub-basins are described below, followed by Table 4.5 which summarizes the design points and the 5-year and 100- year routed peak flowrates.

Sub-Basin W (3.3 acres, Q(5) = 15.2 cfs, Q(100) = 27.1 cfs) is entirely commercial land use. Runoff generated by this sub-basin will sheet flow in a general southwest direction and will be collected by a series of inlets at Design Point 22. The runoff is routed via a 30-inch RCP southern trunk storm sewer system towards Design Point 24. Please refer to Table 4.5 for Design Point peak runoff rates

Sub-Basins X (3.0 acres, Q(5) = 9.2 cfs, Q(100) = 16.7 cfs), and Y (3.6 acres, Q(5) = 9.5 cfs, Q(100) = 19.7 cfs) are multi-family residential land uses. Runoff generated within each basin will sheet flow to Sycamore Wood. Curb and gutter will route the stormwater within Sycamore Wood to Design Point 23. Sump curb inlets will capture the flow and a 42-inch RCP will convey the runoff west to the trunk storm sewer toward Design Point 24.

The commercial development along the southern portion of the property is delineated as Sub-Basin Z (1.0 acres, Q(5) = 4.4 cfs, Q(100) = 7.8 cfs). A series of inlets will capture the runoff generated within this basin at Design Point 25, and route the stormwater to the trunk system within Sycamore Wood towards Design Point 24.

Similar to Sub-basins X and Y, Sub-Basin AA (1.4 acres, Q(5) = 6.4 cfs, Q(100) = 11.4 cfs) is multi-family residential. Runoff generated by this sub-basin will sheet flow to the southwest corner of the basin where it will be collected by a storm sewer system that will route the stormwater to Design Point 26. A 48-inch RCP trunk storm sewer will route the flow to the west towards Design Point 28.

Located along the southern border of the development is Sub-Basin BB (3.1 acres, Q(5) = 2.7 cfs, Q(100) = 6.8 cfs). Sub-Basin BB is primarily open space. Runoff generated within this basin is routed to a sump inlet at Design Point 27. From Design Point 27, the runoff will be routed to the west via an 18-inch RCP to the trunk storm sewer system at Design Point 28.

The commercial development located in the southwest corner of the site is delineated as Sub-Basin CC (8.91 acres, Q(5) = 39.9 cfs, Q(100) = 71.0 cfs). Runoff generated by this basin will be routed towards the south side of the basin. An internal storm sewer system might be required at the final drainage report. The stormwater will be routed via a 48-inch RCP to the trunk line to combine with flows from Design Points 26 and 27 at Design Point 28. A 48-inch RCP will convey the flow to the west towards Design Point 29.

The portion of Marksheffel Road between Woodmen Road and Main Street is designated as Sub-Basins OS-2 (1.3 acres, Q(5) = 5.8 cfs, Q(100) = 11.0 cfs) and OS-3 (1.4 acres, Q(5) = 4.9 cfs, Q(100) = 9.2 cfs). Runoff generated within Sub-Basins OS-2 and OS-3 is routed south by curb and gutter to sump inlets within the roadway. Stormwater from Design Point 29 combines with runoff from Marksheffel Road (Sub-Basins OS-2 and OS-3) at Design Point 30, and is routed to the west into the Woodmen Heights Commercial Center development via 60" RCP.

Table 4.5 - Summary of Design Points That Outfall to Design Point 30

Design Point	*Contributing Area*	*Total Peak Discharge Q(5)*	*Total Peak Discharge Q(100)*	*Pipe Diameter*	*Contributing Basins*
		cfs	**cfs**	**inch**	
22	3.3	15.37	27.37	30	W
23	6.6	21.40	38.09	42	X, Y
24	11.0	39.40	67.03	42	DP-22, DP-23, DP-25
25	1.0	4.40	7.83	18	Z
26	12.3	44.50	75.69	48	DP-24, AA
27	3.1	5.03	8.96	18	BB
28	21.2	80.95	136.95	48	DP-26, CC
29	24.3	84.67	144.53	48	DP-28, DP-27
30	27.0	92.17	157.90	60	DP-29, OS-2, OS-3

Design Point 29 is located in the southwestern corner of the proposed development, and denotes the southern outfall of the site. Runoff from the southern portion of Marksheffel Road combines with stormwater from Design Point 29 at Design Point 30. Runoff is routed to the west through the adjacent property; Woodmen Heights Commercial Center. Design Point 30 can be compared to Pipe 39 of the ESI MDDP. The ESI MDDP estimated Pipe 39 to be a 42-inch RCP conveying a peak flow of Q(100) = 116.93 cfs. The drainage area routed to Pipe 39 is 25.18 acres. Similarly, the drainage area routed to Design Point 30 is 27.0 acres with a peak flowrate of Q(100) = 157.90 cfs. An existing elliptical 38 x 60-inch RCP has been installed by others within the proposed Marksheffel Road ROW. The elliptical pipe will convey the proposed flow from Shiloh Mesa (Design Point 29) to Design Point 30 within the Woodmen Heights Commercial Center.

5. MUSTANG ROAD CULVERTS

Presently, there are roadside swales located adjacent to Mustang Road. The development of Shiloh Mesa will require the installation of two proposed 18-inch RCP culverts. The northern culvert has been designed for a peak flowrate of Q(100) = 7.90 cfs, as delineated

by Sub-Basin OS-8. This culvert crosses Kenosha Drive and routes the runoff from OS-8 to Design Point 32 (or Design Point 2 of the existing conditions drainage map) via the existing roadside swale. This flowrate is included within Sub-Basin OS-5.

The southern culvert was designed to convey the peak flowrate from Sub-Basin OS-6 (Q(100) = 7.40 cfs). Flow passing though the southern culvert enters the roadside swale within the Woodmen Road ROW and is directed to the east (per the Woodmen Road FDR as previously mentioned in Section III-B of this report). No flow from this basin will be accepted by the Shiloh Mesa development.

6. MAINTENANCE

Maintenance access for all proposed public drainage systems will be provided within any ROW or through means of an easement. The internal storm sewer infrastructure will be public and dedicated to the City. Once the channel improvements are completed, and approved by the City, the City will take over the maintenance responsibilities of the channel. The Sand Creek Channel Improvements will be dedicated to the City by means of a tract

B. Phasing of Improvements

For all scenarios associated with releasing runoff at greater than historic rates into the Sand Creek Channel, the downstream infrastructure must be installed prior to releasing runoff. Per the annexation agreement for Woodmen Heights No. 3, "Owners shall be responsible for conformance with the SCDBPS except that no storm drainage flows shall exit the property (Woodmen Heights No. 3) in excess of historic flow rates until the downstream drainage facilities on the main channel of Sand Creek between Woodmen Road and Constitution Avenue (to include Detention Pond No. 2 which is south of Barnes Road) are either in place in accord with the SCDBPS (as well as Classic and ESI MDDPs) or the facilities that are in place are adequate to accept flows in excess of historic that Owner(s) desire to release."

The first option of downstream infrastructure to be completed is the construction of Pond #2, which is located adjacent to Security Service Field, approximately three miles downstream of Woodmen Road. The owners of Shiloh Mesa could agree to participate on an equitable basis in exchange for the approval to release storm flows at the flow rates specified in the Classic and ESI MDDPs (**Q_{100}=2242 cfs**; refer to Section III-A of this report). Construction activities are underway to complete the interim plans for this pond.

As provided for within the annexation agreement for Woodmen Heights No. 3, the second option the Owner(s) of the developable parcels adjacent to Sand Creek Channel have is to construct their own detention and water quality facilities and release at historic flow rates (**Q_{100}=401.3 cfs** from the Shiloh Mesa Site corresponding to Design Point 8 of the historical analysis calculations in Appendix B) and in accord with the Classic and ESI MDDPs (**Q_{100}=2242 cfs**; refer to Section III-A of this report).

A potentially third viable option for this development is the planned regional Pond #3, located inline with the Sand Creek Channel immediately north of Woodmen Road. This pond was designed to detain developed flows from the eastern portion of the Woodmen Heights Master Plan development and was previously sized by both the Classic and ESI MDDPs. Pond #3 will

contain a hydraulic outlet structure which controls the release of stormwater south of Woodmen Road to release rates as outlined in the Classic and ESI MDDPs (Q_{100}=**2242 cfs**; refer to Section III-A of this report). In our professional opinion, the construction of Pond #3 and all associated channel improvements between Pond #3 and the most upstream point of discharge associated with the Shiloh Mesa development, will minimize downstream impacts resulting from increased peak flow to the extent practicable in accordance with the Colorado Springs Drainage Criteria Manual.

Shiloh Mesa can be broken into four major areas (zones) for the purpose of phasing. Construction within each of these zones would require onsite and offsite infrastructure to ensure downstream facilities are not adversely impacted. Development in one zone does not require any storm water improvements in any other zone, as long as local grading, drainage, and erosion issues are consistent with the concept plan. A zoning map is included within Appendix E.

Zone 1 is the southern quarter of the Shiloh Mesa development and includes onsite Sub-Basins W, X, Y, Z, AA, BB, and CC. Sub-Basins OS-2 and OS-3 (Marksheffel Road) has been considered, as part of the interim design. All eight of these basins are routed toward Design Point 30. For offsite flows generated adjacent to Mustang Road, a culvert will need to be installed once the connection to Mustang Road is made. The existing swale along the eastern boundary is already diverting offsite flows in a southward direction to the ditch running along the north side of Woodmen Road then heads in an eastward direction before conveying runoff to the south across Woodmen Road within an existing culvert, so no other improvements are needed. No runoff will be accepted in this zone from the east. The trunk line shown on the Drainage Plan within Zone 1 would need to be installed to convey the drainage accordingly. Stub outs for future lines, along with temporary accommodations, should be made if only a portion of Zone 1 is built. The trunk line will connect at Marksheffel Road (Design Point 29). As described at Design Points 29 / 30, an elliptical 38 x 60-inch RCP has been installed within the proposed Marsheffel Road ROW to convey the runoff in a westward direction through the Woodmen Heights Commercial Center and ultimately to Sand Creek.

In general, in order to discharge into Sand Creek, Regional Detention Pond #3 must be built to accommodate developed runoff, or it must be shown that the developed release from Zone 1, along with any other releases, will not exceed historic flowrates. This may be accomplished through onsite detention. This detention could be considered temporary until the construction of Pond #3 is complete.

Table 4.6 - Zone 1 Non-Reimbursable Public Facilities

Item	Unit	Quantity	Unit Cost	Extension
Type I Manhole	EA	13	$3,770.00	$49,010.00
18" RCP	LF	357	$53.00	$18,921.00
24" RCP	LF	171	$65.00	$11,115.00
30" RCP	LF	871	$72.00	$62,712.00
36" RCP	LF	441	$90.00	$39,690.00
48" RCP	LF	642	$120.00	$77,040.00
D10R Inlet	EA	12	$6,000.00	$72,000.00
			Sub-Total	$330,488.00
			15% Contingencies & Engineering	$49,573.20
			Grand Total	***$380,061.20***

Zone 2 is north of Zone 1 and includes Sub-Basins Q, S, T, U, and V. Sub-Basins OS-4 and OS-9 (Marksheffel Road) will also need to be considered, depending on the timing of construction. All seven of these basins drain toward Design Points 20 / 21. The major trunk line within Kenosha Drive (Zone 3) or some temporary swale will need to be constructed to divert the flow from offsite Sub-Basin OS-5 to Design Point 31. The trunk line shown on the Drainage Plan within Main Street (Zone 2) would need to be installed to facilitate the drainage needs within Zone 2 accordingly. Stub outs for future lines and coordination with the Woodmen Heights Commercial Center should be taken into account if only a portion of Zone 2 is built. The trunk line will connect at Marksheffel Road to the storm drain at Design Point 21. It is assumed that this storm drain will be installed by the Woodmen Heights Metropolitan District. If this assumption is not valid, coordination with the Woodmen Heights Commercial Center to install a temporary swale to discharge west to Sand Creek will be required.

In general, Pond # 3 and channel improvements must be built prior to discharging into Sand Creek, or it must be shown that the developed release from Zone 2, along with any other releases, does not exceed historic flowrates. This may be accomplished through temporary onsite detention.

Table 4.7 - Zone 2 Non-Reimbursable Public Facilities

Item	Unit	Quantity	Unit Cost	Extension
Type I Manhole	EA	6	$2,600.00	$15,600.00
18" RCP	LF	168	$53.00	$8,904.00
30" RCP	LF	754	$72.00	$54,288.00
42" RCP	LF	862	$100.00	$86,200.00
54" RCP	LF	132	$180.00	$23,760.00
D10R Inlet	EA	8	$6,000.00	$48,000.00
			Sub-Total	$236,752.00
		15% Contingencies & Engineering		$35,512.80
			Grand Total	***$272,264.80***

Zone 3 is north of Zone 2 and includes Sub-Basins P, L, M, N, O, EE, OS-5, and OS-7. All eight of these basins drain towards Design Point 31. The headwall structure at Mustang Road and all trunk storm drain infrastructure within the Kenosha Drive ROW must be installed when Kenosha Drive improvements are constructed, except for Kenosha Drive improvements located within 250 feet of Marksheffel Road. The storm sewer trunk line within Kenosha Drive ROW will discharge into Sand Creek at Design Point 31.

In general, Pond #3, the Sand Creek crossing, and downstream channel improvements must be completed prior to discharging into Sand Creek, or it must be shown that the developed release from Zone 3, along with any other releases, does not exceed historic flowrates. This may be accomplished through temporary onsite detention.

Table 4.8 - Zone 3 Non-Reimbursable Public Facilities

Item	Unit	Quantity	Unit Cost	Extension
Type I Manhole	EA	4	$3,770.00	$15,080.00
18" RCP	LF	304	$53.00	$16,112.00
30" RCP	LF	320	$72.00	$23,040.00
36" RCP	LF	174	$90.00	$15,660.00
54" RCP	LF	531	$180.00	$95,580.00
D10R Inlet	EA	10	$6,000.00	$60,000.00
			Sub-Total	$225,472.00
			15% Contingencies & Engineering	$33,820.80
			Grand Total	***$259,292.80***

Table 4.9 - Zone 3 Reimbursable Public Facilities

Item	Unit	Quantity	Unit Cost	Extension
Type I Manhole Special	EA	7	$7,000.00	$49,000.00
72" RCP	LF	1224	$230.00	$281,520.00
84" RCP	LF	453	$250.00	$113,250.00
84" Outlet Structure	EA	1	$5,000.00	$5,000.00
			Sub-Total	$448,770.00
			15% Contingencies & Engineering	$67,315.50
			Grand Total	***$516,085.50***

Zone 4 is the northern quarter of the development and includes Sub-Basins A, B, C, D, E, F, G, H, I, J, and K. All of these 11 basins drain towards Design Point 11. For offsite flows upstream (Basin OS-1), the major trunk line or some temporary swale will need to be constructed to handle the flow to Design Point 11 and away from Zone 4. The trunk line shown on the drainage plan within Zone 4 would need to be installed to route the drainage accordingly. Stub outs for future lines, along with temporary accommodations, should be made if only a portion of Zone 4 is built. The trunk line will discharge into Sand Creek at Design Point 11.

In general, Pond #3, the crossing of Sand Creek, and downstream channel improvements must be built prior to discharging into Sand Creek, or it must be shown that the developed release from Zone 4, along with any other releases, does not exceed historic flowrates. This may be accomplished through temporary onsite detention.

Table 4.10 - Zone 4 Non-Reimbursable Public Facilities

Item	Unit	Quantity	Unit Cost	Extension
Type I Manhole	EA	13	$3,770.00	$49,010.00
18" RCP	LF	183	$53.00	$9,699.00
30" RCP	LF	805	$72.00	$57,960.00
36" RCP	LF	2175	$90.00	$195,750.00
42" RCP	LF	790	$100.00	$79,000.00
D10R Inlet	EA	14	$6,000.00	$84,000.00
42" Outlet Structure	EA	1	$1,500.00	$1,500.00
			Sub-Total	$476,919.00
			15% Contingencies & Engineering	$71,537.85
			Grand Total	***$548,456.85***

C. Improvements to Sand Creek Channel

Detailed hydraulic analysis of the Sand Creek Channel will need to be completed for the reach located to the northwest and adjacent to the project site at the time of development. The channel improvements must be installed when any one of the following occur:

- Any undetained stormwater flows generated within the Shiloh Mesa development are released directly to Sand Creek
- Any development located adjacent to the Sand Creek Channel floodplain north and west of Tamarisk Wood and west of the western loop of Olive Wood
- The routing of runoff from offsite Sub-Basin OS-5 to the channel

Future development of Shiloh Mesa must conform with the SCDBPS, with the exception that no runoff shall leave the property in excess of historic flowrates until the downstream drainage facilities on the main channel of Sand Creek between Woodmen Road and Constitution Avenue (to include Detention Pond #2, located south of Barnes Road) are either in place in accordance with the SCDBPS, or the facilities that are in place are capable of accepting runoff in excess of the historic flowrates. According to the SCDBPS, the Sand Creek Channel Improvements associated with this development consist of two drop structures/grade control structures along with channel stabilization improvements. Subsequent analysis will be required for the design of the channel improvements to verify how they will connect to the regional detention facility known as Pond #3. The owner / developer has the option to construct the required channel improvements and regional detention facility adjacent to this development in lieu of paying drainage fees to the City. The drainage analysis and design are an owner / developer obligation and will be required with the submittal of a development plan. It must be demonstrated that the developed release does not exceed historic flowrates until the downstream facilities can accommodate the additional flow. Installation of the channel improvements is to take place concurrent to development of adjacent properties. The improvements shall adhere to the timing as outlined in the subsequent preliminary and/or final drainage reports.

D. Water Quality

According to the ESI MDDP, the water quality capture volume required for the Shiloh Mesa development is included in the volume of the proposed regional detention pond, known as Pond #3. The ESI MDDP specified that an extended detention basin within Pond #3 will serve as the best management practice (BMP) structure for providing water quality.

Pond #3 will be dedicated to the City of Colorado Springs, who will own and maintain it. The pond has been sized to handle the developed flows for the Woodmen Heights Master Planned areas per the Classic and ESI MDDPs. Until the installation of Pond #3 is completed, runoff must be detained to historic rates and treated for water quality prior to leaving the development area.

E. Drainage, Bridge, and Pond Fees

Shiloh Mesa at Woodmen Heights is located within the Sand Creek Drainage Basin. The WHMD was established by the property owners within Woodmen Heights to finance and construct certain infrastructure improvements within the District including all reimbursable public drainage improvements. Once the improvements have been installed, the City will take

ownership and maintenance of all facilities through the dedication of ROW and/or the platting of land. The WHMD acknowledges their obligation to install the capital improvements listed in this report per City requirements for the development. Financial assurances may be required by the City prior to issuing building permits. The table below outlines the platting fees applicable to the Shiloh Mesa development.

In order to reduce developed flows to historic levels in the Sand Creek Channel and the corresponding magnitude of infrastructure required downstream of this development, the need for regional detention in the upper portion of the Sand Creek basin has been identified in the Classic MDDP. This will result in a ~~unit~~ drainage fee increase of $3,691,140.35 (2004 dollars) within the Sand Creek Drainage Basin for unplatted acreage. No final drainage reports within the study area for the Woodmen Heights Commercial Center will be approved until such time as the proposed fee increase for the Sand Creek Drainage Basin has been addressed by the City Drainage Board.

Table 4.11 - Sand Creek Drainage Basin Fees

BASIN	AREA	DRAINAGE	BRIDGE	POND		TOTAL
	ACRE	FEE/ACRE	FEE/ACRE	LAND	FACILITIES	
SAND CREEK	112.88	$9,493	$596	$1,070	$2,881	***$1,584,835.20***

Total fees owed to the City are ***$1,584,835.20 at the time of platting***

Based on the approved Classic MDDP for the Woodmen Heights Master Plan (June 2004), the costs to install reimbursable public drainage improvements within the Sand Creek Basin for the Woodmen Heights Master Plan exceed the fees that would be collected by the City. Therefore, the fees associated with the Shiloh Mesa development are fully offset by public drainage improvements constructed by the owner / developer or the WHMD.

GW 11/19/09

V. CONCLUSION

The proposed Shiloh Mesa at Woodmen Heights development is in compliance with Volume I and II of the City Drainage Criteria Manual, dated November 1991, and the DBPS for Sand Creek. The overall design concept does not negatively impact downstream storm sewer infrastructure, and coincides with the previously approved drainage studies of this area and the surrounding properties.

Redirecting the offsite flow from the east of Shiloh Mesa to upstream of the proposed crossing of Sand Creek with Marksheffel Road will have an economic benefit of decreasing the cost of storm sewer infrastructure to this development and other developments downstream. However, this cost must be weighed against the added cost for improvements to the Sand Creek Channel. The Classic MDDP specified that the Woodmen Heights Commercial Center, will accept flows from Shiloh Mesa containing runoff from the off-site basin OS-5, and convey that flow to Sand Creek. The cost distribution for the added channel improvements will need to be coordinated between the Shiloh Mesa development, the Woodmen Heights Commercial Center development, and the Woodmen Heights Metropolitan District.

VI. REFERENCES

1. ***Preliminary Design of Selected Alternative, Sand Creek Drainage Basin Planning Study***, Kiowa Engineering, revised March 1996.

2. ***City of Colorado Springs & El Paso County Drainage Criteria Manual***, Vol. I and II, dated November 1991.

3. ***FEMA Flood Insurance Rate Map***, El Paso County Colorado and Incorporated Areas, Panels 535 of 1300. March 17, 1997.

4. ***Soil Survey of El Paso County Area, Colorado,*** Natural Resources Conservation Service, Issued June 1981.

5. ***Urban Storm Drainage Criteria Manual, Volumes 1-3***, Urban Drainage and Flood Control District, June 2001 and subsequent updates.

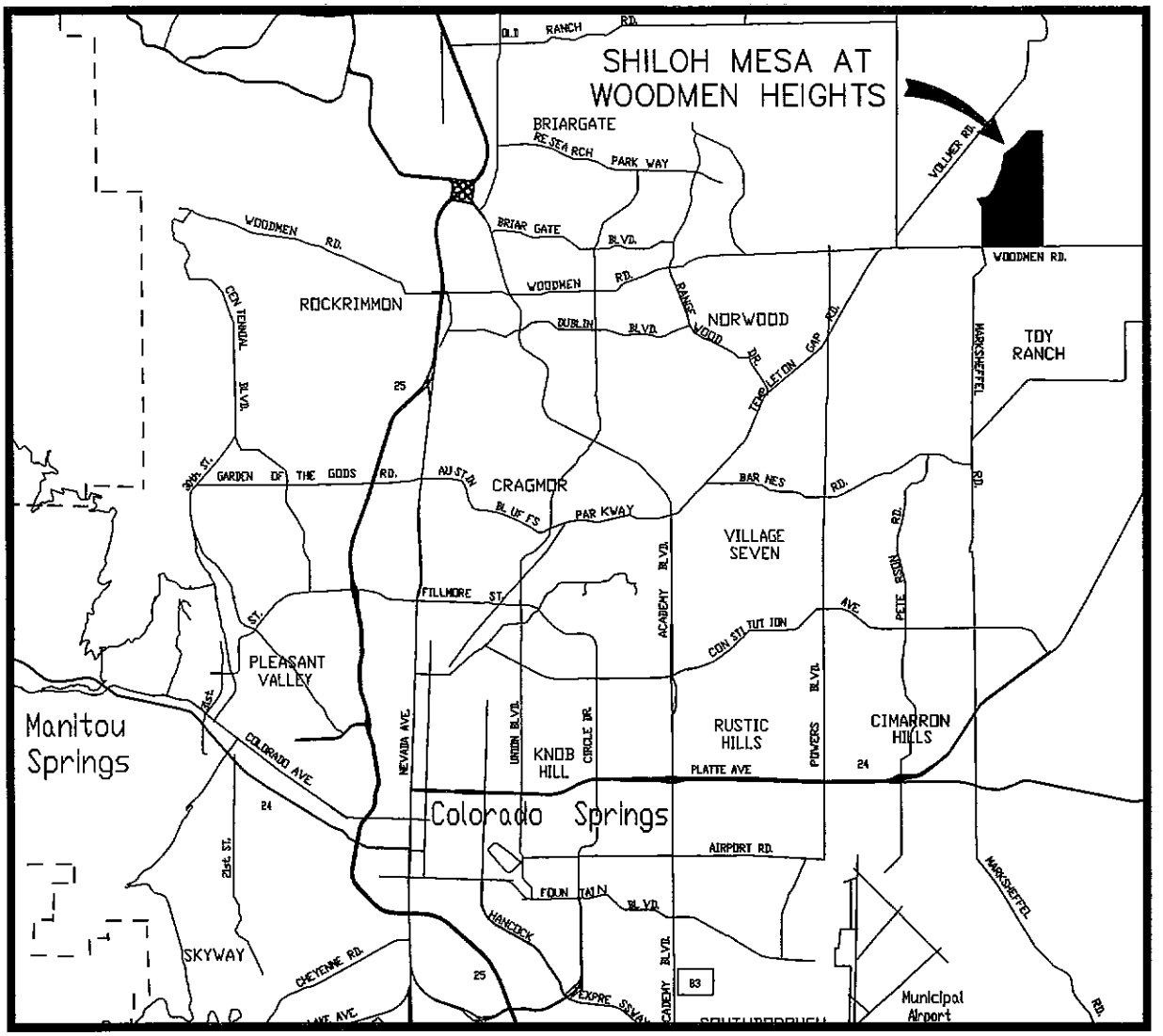
6. ***Final Hydrology and Hydraulics Report for Woodmen Road Powers to US 24***, by DMJM Harris, dated October 15, 2007

7. ***Master Development Drainage Plan for Woodmen Heights Master Plan***, Classic Consulting Engineers and Surveyors, dated June 2004.

8. ***Master Development Drainage Plan for Woodmen Heights Master Plan Update for Woodmen Heights and Final Drainage Report for Forrest Meadows Filing No. 1 and No. 4***, Engineer and Surveying, Inc., dated February 2006.

APPENDIX A

MAPS



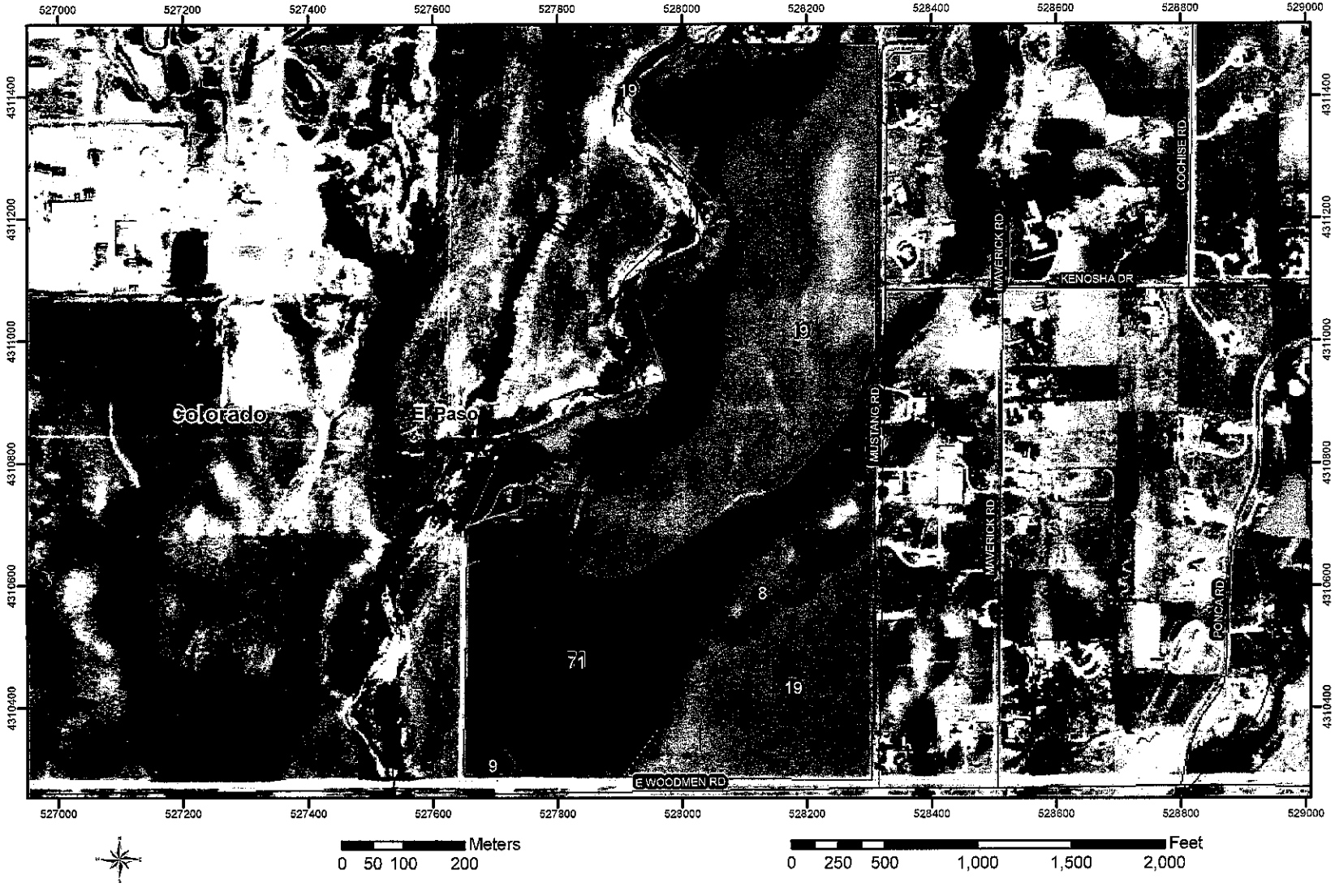
VICINITY MAP

NORTH
N.T.S.

Matrix Design Group,
Integrated Design Solutions
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

HYDROLOGIC SOIL GROUP RATING FOR EL PASO COUNTY AREA, COLORADO

The Woodmen Valley Community



HYDROLOGIC SOIL GROUP RATING FOR EL PASO COUNTY AREA, COLORADO

The Woodmen Valley Community

MAP LEGEND

Hydrologic Soil Group
{Dominant Condition, <}

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

Soil Map Units

- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 13

Soil Survey Area: El Paso County Area, Colorado
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

Map comprised of aerial images photographed on these dates:
1999

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.

Tables - Hydrologic Soil Group

Summary by Map Unit - El Paso County Area, Colorado

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Total Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	11.5	7.8
9	Blakeland-Fluvaquentic Haplaquolls	A	0.7	0.5
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	65.0	43.8
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	71.1	47.9

Description - Hydrologic Soil Group

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.

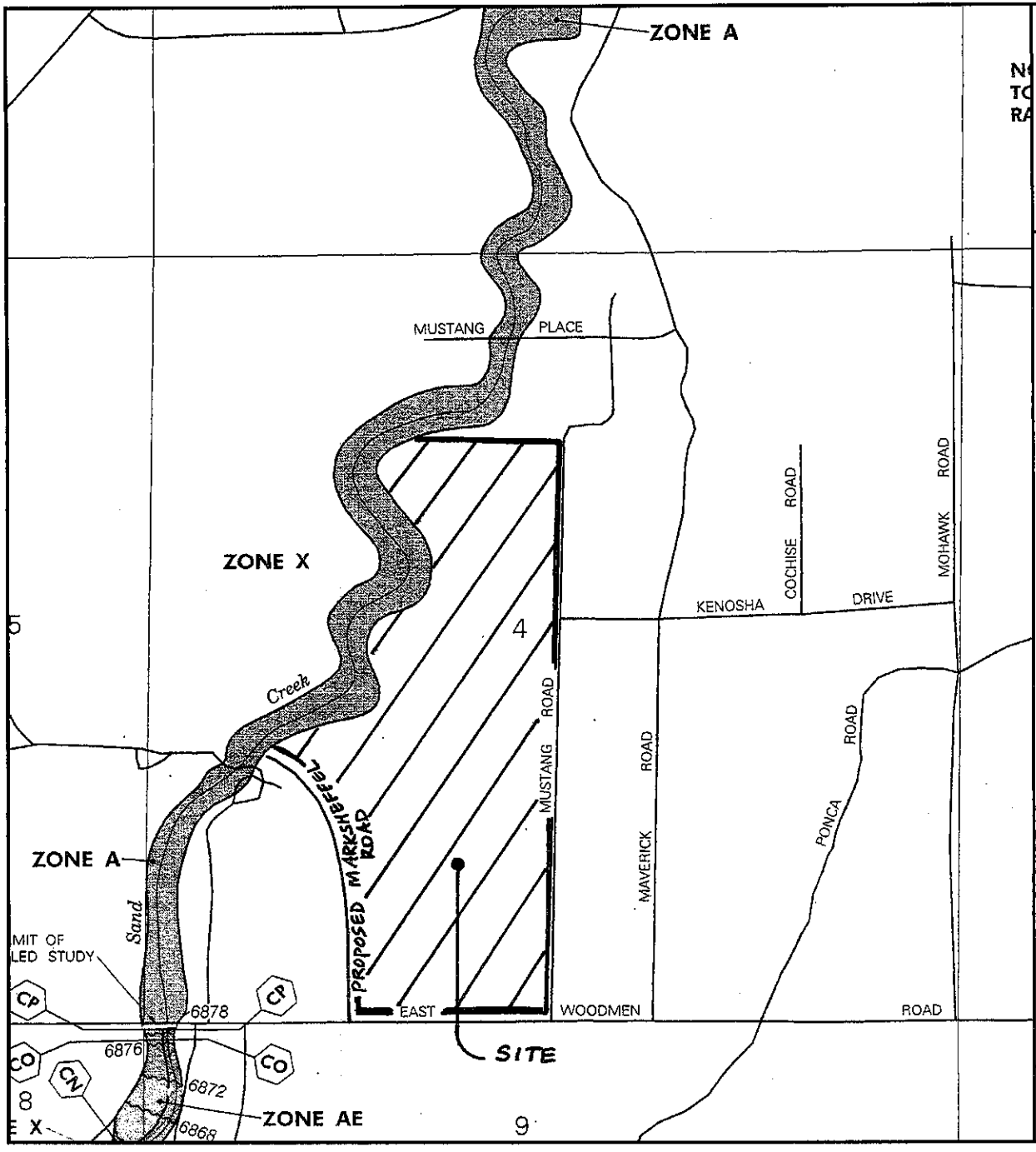
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Parameter Summary - Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Lower



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 535 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0535	F

MAP NUMBER
08041C0535 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

Federal Emergency Management Agency

Washington, D.C. 20472

AUG 15 2005

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Jim Bensberg
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

IN REPLY REFER TO:
Case No.: 04-08-0779P
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of This Revision: **DEC 07 2005**

Dear Mr. Bensberg:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

BY
Kelly A Brunswick

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

For: Doug Bellomo, P.E., Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

List of Enclosures:
Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map
Annotated Flood Insurance Study Report

cc: Mr. Kevin Stilson, P.E., CFM
Regional Floodplain Administrator
Pikes Peak Regional Building Department

[redacted]
Kiowa Engineering Corporation

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	NO PROJECT	HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	East Woodmen Road to Mustang Place	APPROXIMATE LATITUDE & LONGITUDE: 38.946, -104.681 SOURCE: USGS QUADRANGLE DATUM: NAD 83	
FLOODING SOURCE(S) & REVISED REACH(ES)	Sand Creek - from approximately 2,200 feet downstream of East Woodmen Road to Mustang Place		

SUMMARY OF REVISIONS

Effective Flooding:	Zone A	No BFEs*	No Floodway	BFEs*	Floodway	Zone AE
Revised Flooding:	Zone AE	BFEs	Floodway	BFEs	Floodway	Zone AE
Increases:	YES	YES	YES	YES	YES	YES
Decreases:	NONE	NONE	NONE	YES	NONE	YES

* BFEs – Base Flood Elevations

ANNOTATED MAPPING ENCLOSURES			ANNOTATED STUDY ENCLOSURES
TYPE: FIRM*	NO.: 08041C0535 F	Date: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 FLOODWAY DATA TABLE: 5 PROFILES: 204P and 204P(a)
TYPE: FIRM	NO.: 08041C0545 F	Date: March 17, 1997	

* FIRM – Flood Insurance Rate Map; ** FBFM – Flood Boundary and Floodway Map; *** FHBM – Flood Hazard Boundary Map

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate 105634 10.3.1.04080779P 102IAC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson
Director, Federal Insurance and Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panels and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below.

LOCAL NEWSPAPER
Name: *El Paso County News*
Dates: 08/31/2005 09/07/2005

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Sand Creek	Approximately 2,100 feet downstream of East Woodmen Road	6,847	6,849	08041C0535 F
	Immediately downstream of Mustang Place	None	6,976	08041C0535 F

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate 105634 10.3.1.04080779P 102IAC

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate new topographic information along Sand Creek from approximately 2,200 feet downstream of East Woodmen Road to Mustang Place and has resulted in a revised delineation of the regulatory floodway, increases and decreases in SFHA width, and increased and decreased BFEs for Sand Creek. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Approximately 2,100 feet downstream of East Woodmen Road	6,847	6,849
Immediately downstream of Mustang Place	None	6,976

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Jim Bensberg
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Sand Creek (cont'd)		Revised Data						
BA	41,708	131	421	10.5	6,420.6	6,420.6	6,420.6	0.0
BB	42,116	300	544	8.0	6,426.3	6,426.3	6,426.3	0.0
BC	42,766	299	613	7.2	6,431.8	6,431.8	6,432.5	0.7
BD	44,396	74	353	12.4	6,453.6	6,453.6	6,453.6	0.0
BE	44,866	64	341	13.2	6,460.9	6,460.9	6,460.9	0.0
BF	45,876	106	403	11.2	6,473.1	6,473.1	6,473.1	0.0
BG	46,456	74	360	12.5	6,480.0	6,480.0	6,480.0	0.0
BH	47,091	140	442	10.2	6,495.4	6,495.4	6,495.8	0.4
BI	48,471	230	525	8.6	6,513.8	6,513.8	6,513.8	0.0
BJ	48,895	147	451	10.0	6,519.2	6,519.2	6,519.2	0.0
BK	49,550	140	390	10.8	6,526.7	6,526.7	6,526.7	0.0
BL	51,485	125	466	9.2	6,541.3	6,541.3	6,541.3	0.0
BM	52,380	60	324	13.3	6,554.7	6,554.7	6,554.9	0.2
BN	52,580	107	489	8.8	6,557.4	6,557.4	6,557.4	0.0
BO	53,095	120	426	10.1	6,566.7	6,566.7	6,566.7	0.0
BP	53,550	50	305	14.1	6,574.9	6,574.9	6,575.4	0.5
BQ	54,590	99	378	11.1	6,587.9	6,587.9	6,587.9	0.0
BR	55,645	39	308	13.6	6,608.5	6,608.5	6,608.5	0.0
BS	56,500	80	393	9.9	6,618.4	6,618.4	6,619.0	0.6
BT	57,495	170	490	8.0	6,633.5	6,633.5	6,634.1	0.6
BU	58,645	65	296	12.2	6,650.3	6,650.3	6,651.0	0.7
BV	59,485	150	390	9.2	6,664.7	6,664.7	6,664.7	0.0
BW	60,685	130	350	9.4	6,680.1	6,680.1	6,680.6	0.5
BX	62,275	60	255	11.8	6,706.9	6,706.9	6,707.5	0.6
BY	62,667	100	427	7.0	6,711.9	6,711.9	6,712.6	0.7
BZ	64,822	90	264	9.9	6,744.7	6,744.7	6,744.8	0.1

1Feet Above Confluence With Fountain Creek

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK

REVISED TO REFLECT LOMR DATED DEC 07 2005

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Sand Creek (cont'd)								
CA	65,292	164	427	6.1	6,748.7	6,748.7	6,749.4	0.7
CB	66,092	41	223	11.7	6,761.2	6,761.2	6,762.2	1.0
CC	66,247	90	270	9.6	6,773.6	6,773.6	6,773.7	0.1
CD	67,647	50	218	11.9	6,782.6	6,782.6	6,783.3	0.7
CE	68,297	65	284	8.8	6,793.9	6,793.9	6,794.4	0.5
CF	69,147	50	213	11.7	6,804.5	6,804.5	6,804.5	0.0
CG	70,157	50	213	11.7	6,815.1	6,815.1	6,815.3	0.2
CH	70,577	205	347	7.2	6,823.9	6,823.9	6,824.5	0.6
CI	70,627	180	267	9.4	6,826.7	6,826.7	6,827.7	1.0
CJ	70,727	210	340	7.3	6,831.1	6,831.1	6,831.1	0.0
CK	70,807	195	334	7.5	6,832.5	6,832.5	6,832.5	0.0
CL	71,162	90	255	9.8	6,838.0	6,838.0	6,839.0	1.0
CM	71,977	226	503	5.2	6,847.4	6,847.4	6,848.3	0.9
CN	73,052	174	328	7.9	6,861.1	6,861.1	6,861.2	0.1
CO	73,644	237	364	7.1	6,870.2	6,870.2	6,870.2	0.0
CP	75,142	172	324	8.0	6,888.5	6,888.5	6888.7	0.2
CQ	76,161	109	283	9.2	6,903.5	6,903.5	6,903.7	0.2
CR	77,846	100	272	9.6	6,926.1	6,926.1	6,926.7	0.6
CS	79,187	117	287	9.1	6,944.1	6,944.1	6,944.1	0.0
CT	80,808	102	277	9.4	6,969.2	6,969.2	6,969.4	0.2

Revised Data

[1]Feet Above Confluence With Fountain Creek

TABLE 5

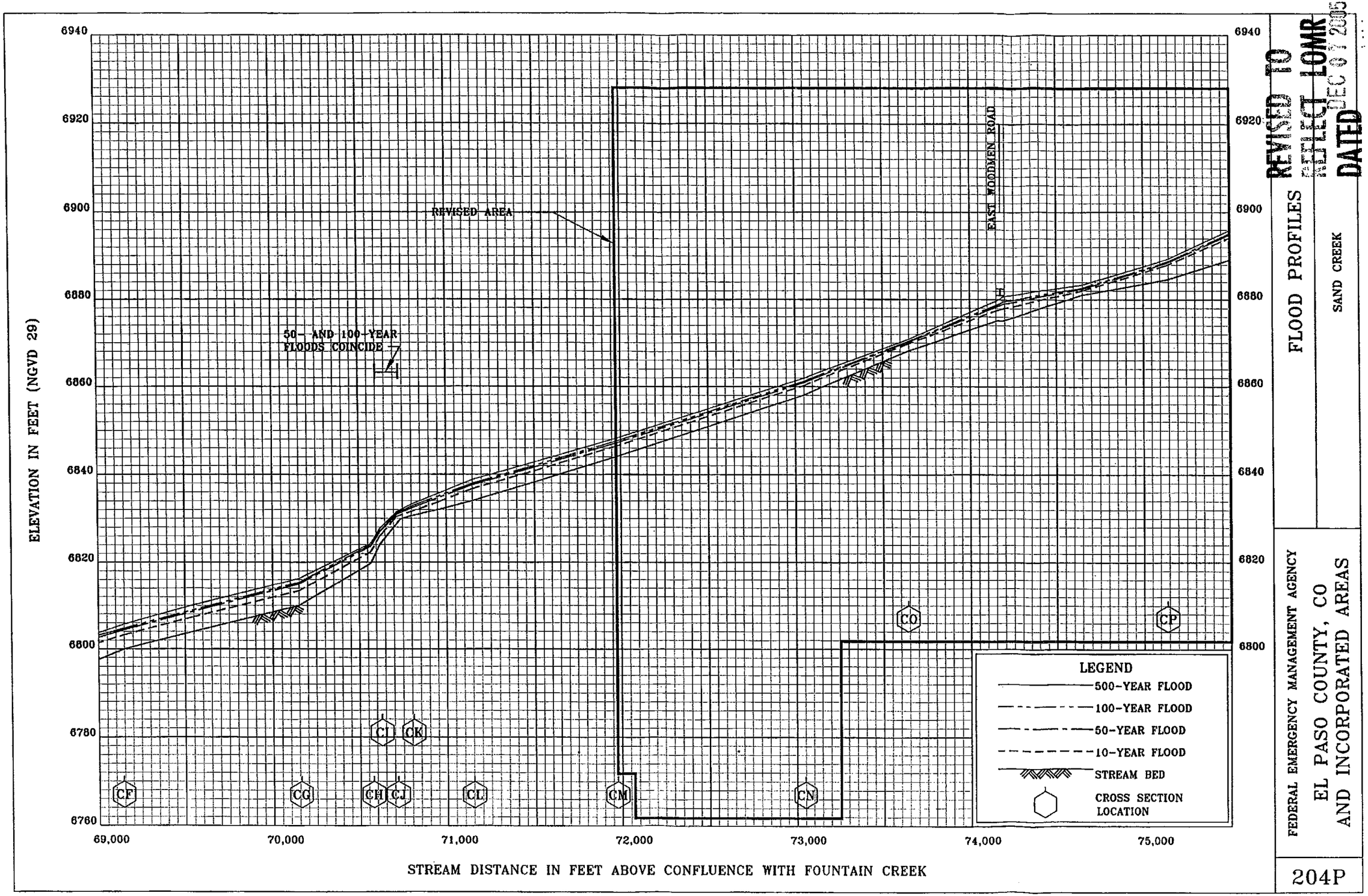
FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK

REVISED TO REFLECT LOMR DATED DEC 07 2005



REVISED TO REFLECT LOMR DATED DEC 8 2005

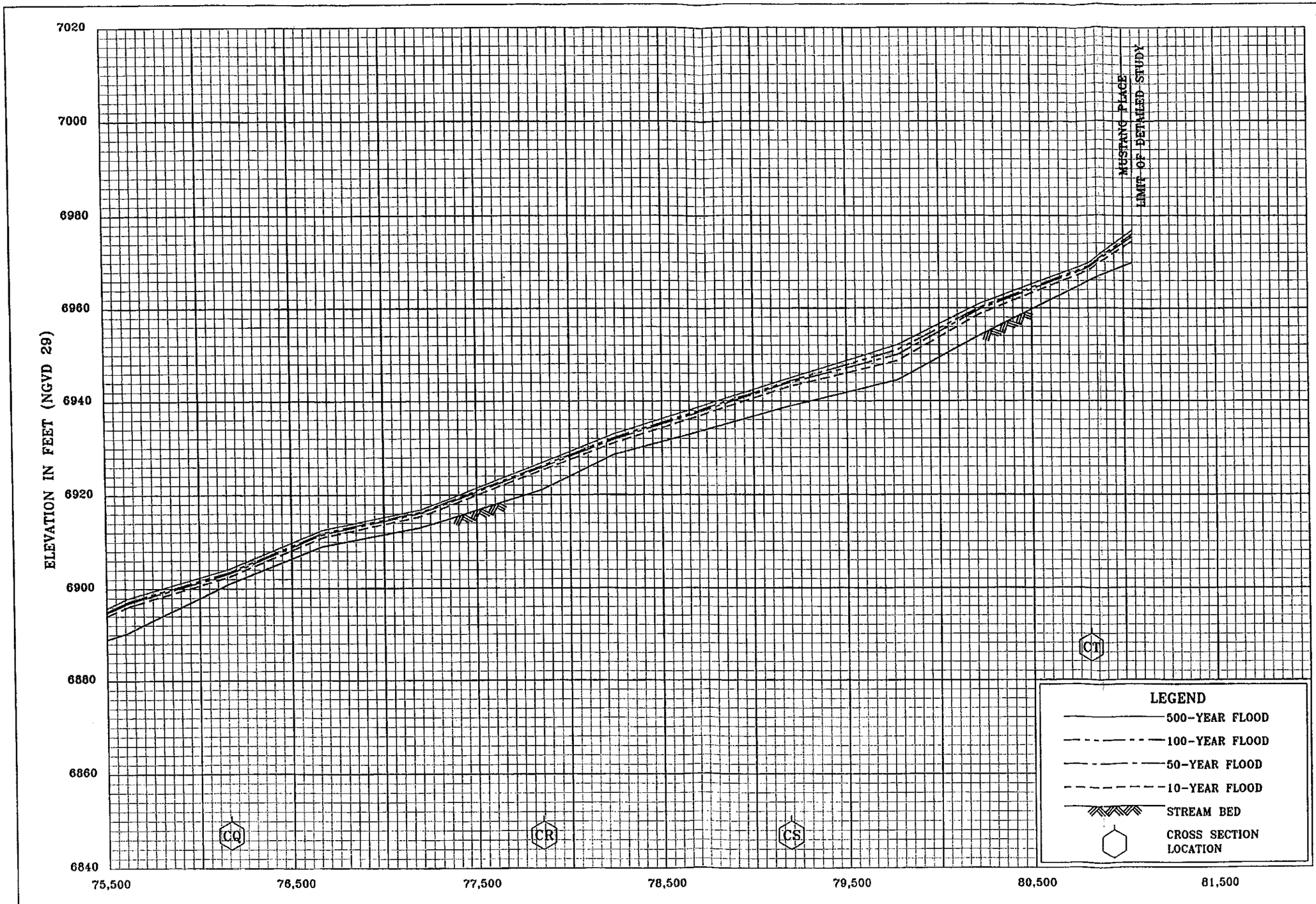
FLOOD PROFILES

SAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

204P



REVISED TO REFLECT LOMR DATED DEC 07 2005

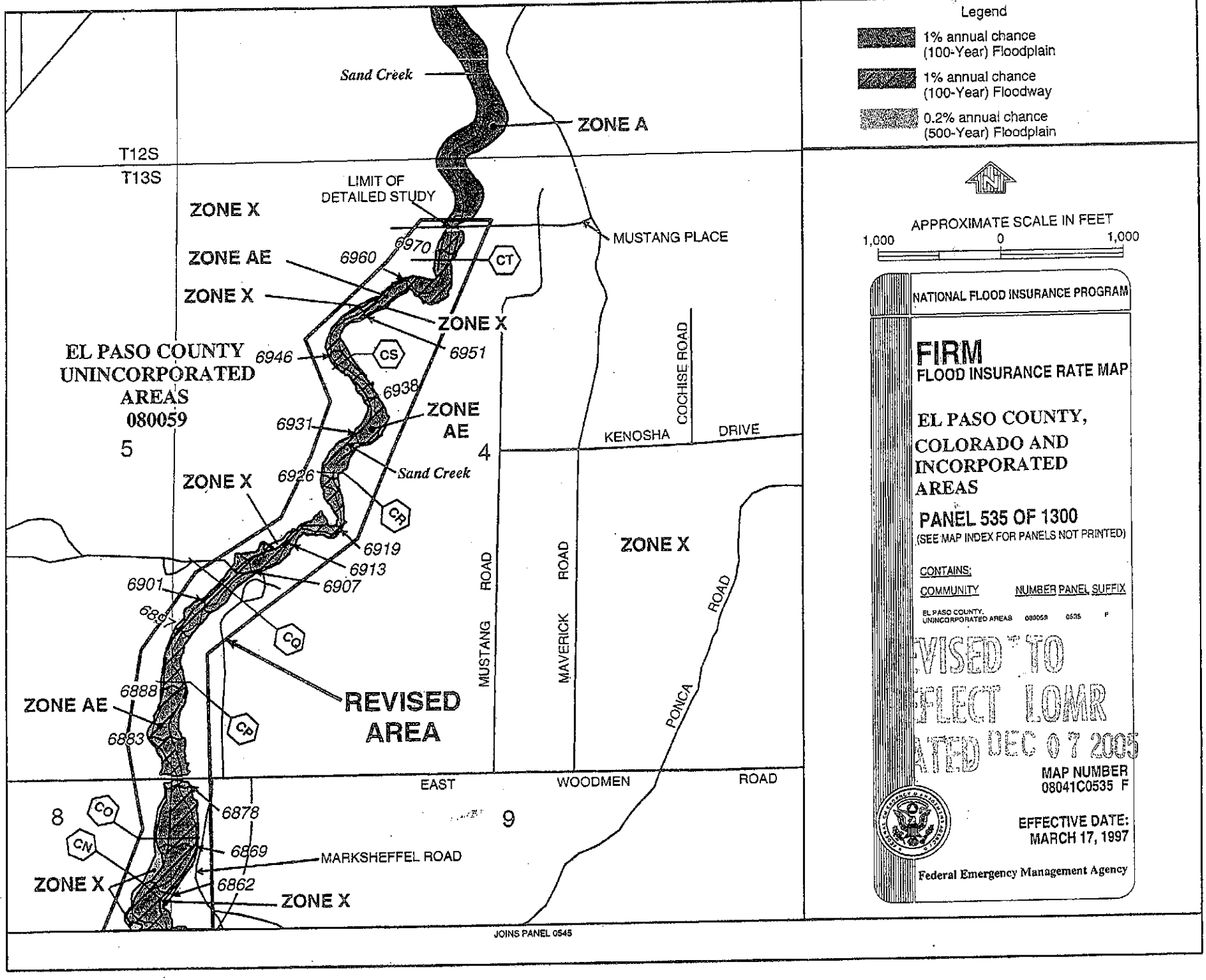
FLOOD PROFILES

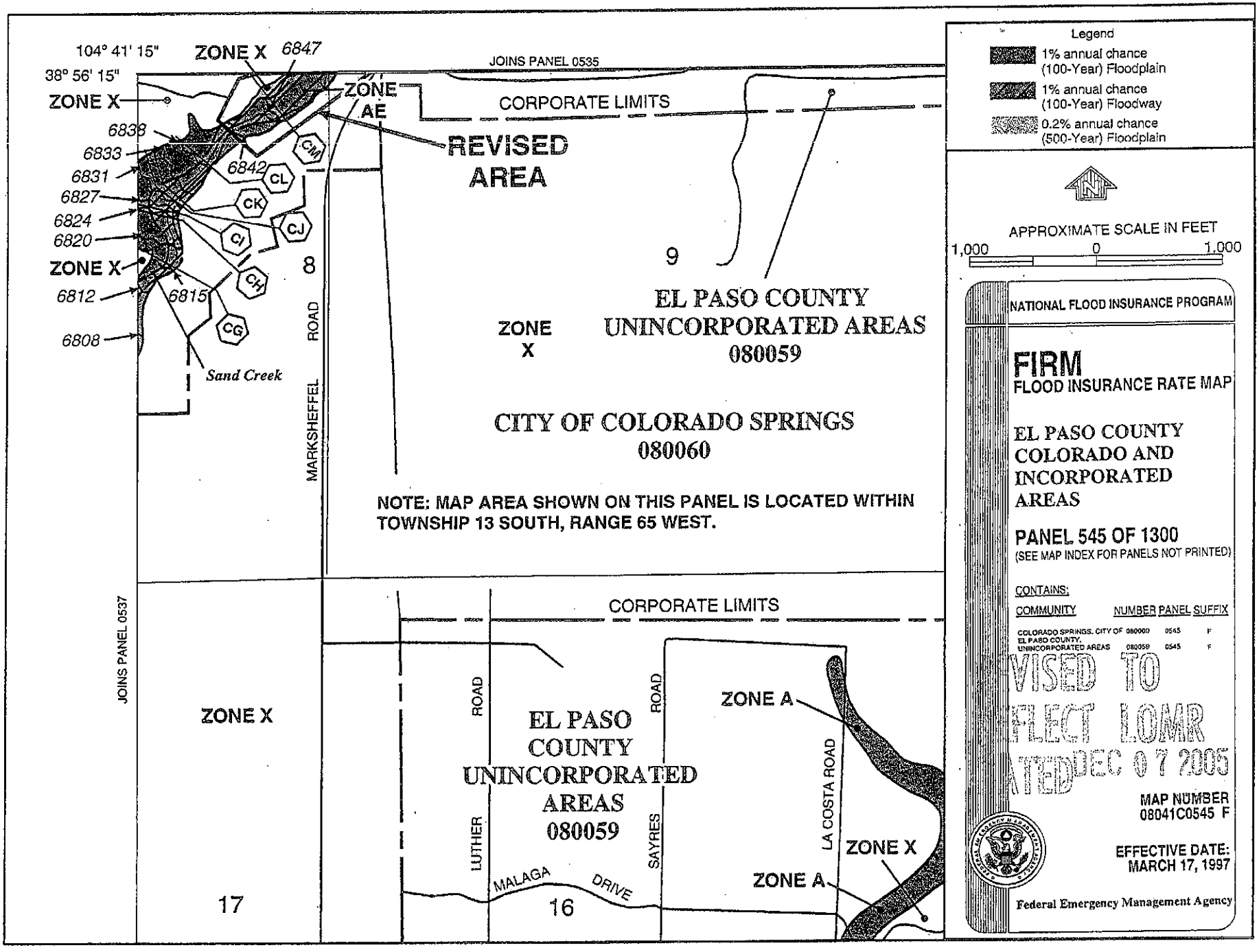
SAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

204P(a)


Sand Creek
ZONE A
T12S
T13S
LIMIT OF DETAILED STUDY
ZONE X
ZONE AE
ZONE X
ZONE X
6970
6960
CT
MUSTANG PLACE
EL PASO COUNTY UNINCORPORATED AREAS 080059
6946
CS
6951
6938
6931
ZONE AE
5
4
COCHISE ROAD
KENOSHA
DRIVE
ZONE X
6926
Sand Creek
CR
6919
6913
6907
6901
6897
CQ
ZONE X
MUSTANG ROAD
MAVERICK ROAD
PONCA ROAD
REVISED AREA
6888
ZONE AE
CP
6883
EAST
WOODMEN
ROAD
8
CO
CN
6878
6869
MARKSHEFFEL ROAD
ZONE X
6862
ZONE X
9
JOINS PANEL 0545
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
1,000
0
1,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 535 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY
NUMBER
PANEL
SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS
080059
0535
F
REVISED TO REFLECT LOMR DATED DEC 07 2005
MAP NUMBER 08041C0535 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency


104° 41' 15"
38° 56' 15"
ZONE X
6847
ZONE X
ZONE AE
JOINS PANEL 0535
CORPORATE LIMITS
REVISED AREA
6838
6833
6831
6827
6824
6820
ZONE X
6812
6808
6842
6815
CM
CL
CK
CJ
CI
CH
CG
Sand Creek
8
9
MARKSHEFFEL ROAD
ZONE X
EL PASO COUNTY
UNINCORPORATED AREAS
080059
CITY OF COLORADO SPRINGS
080060
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST.
JOINS PANEL 0537
ZONE X
CORPORATE LIMITS
LUTHER ROAD
EL PASO COUNTY
UNINCORPORATED
AREAS
080059
SAYRES ROAD
ZONE A
LA COSTA ROAD
ZONE X
ZONE A
MALAGA DRIVE
17
16
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
1,000 0 1,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY COLORADO AND INCORPORATED AREAS
PANEL 545 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0545 F
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0545 F
VISED TO
FLECT LOMR
ATED DEC 07 2005
MAP NUMBER
08041C0545 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency

APPENDIX B

HYDROLOGIC AND HYDRAULIC CALCULATIONS

Matrix Design Group, Inc.
Integrated Design Solutions
Infrastructure Engineering
Community Development
Program Management

Shiloh Mesa at Woodmen Heights
Historic Runoff Calculations

Sub-Basin Designation	Design Point	Sewer or Road	Sub-Basins	Comments	Total Area (ac.)	Weighted Coefficients		CA		Overland Time			Travel Time					*4 Intensity		Peak Runoff	
						C(5)	C(100)	CA(5)	CA(100)	Overland Length (ft)	Overland Slope (%)	* T(initial) (min.)	Travel Length (ft)	Weighted Slope (%)	*3 Velocity (fps)	*2 T(travel) (min.)	Final T(c)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
A					2.1	0.25	0.35	0.52	0.72	20	2.0%	5.7	390	2.5%	2.5	2.6	8.3	4.40	7.83	2.3	5.6
B					3.5	0.25	0.35	0.89	1.24	300	2.0%	21.9	250	3.0%	2.5	1.7	23.6	2.77	4.93	2.4	6.1
C					19.6	0.25	0.35	4.90	6.85	500	2.0%	28.3	2409	1.7%	1.0	40.2	68.4	1.45	2.58	7.1	17.7
D					6.6	0.25	0.35	1.64	2.30	500	2.2%	27.4	1279	2.4%	2.9	7.4	34.8	2.22	3.96	3.6	9.1
E					18.1	0.25	0.35	4.54	6.35	500	2.4%	26.6	2652	1.9%	2.9	15.2	41.9	1.99	3.54	9.0	22.5
F					7.0	0.25	0.35	1.74	2.43	500	2.2%	27.4	1017	1.9%	2.9	5.8	33.2	2.28	4.06	4.0	9.9
G					3.8	0.25	0.35	0.94	1.31	500	2.0%	28.3	699	2.0%	2.9	4.0	32.3	2.32	4.13	2.2	5.4
H					7.7	0.25	0.35	1.92	2.69	500	1.8%	29.3	1212	2.0%	2.9	7.0	36.2	2.17	3.86	4.2	10.4
I					8.1	0.25	0.45	2.03	3.65	500	1.2%	33.5	710	2.2%	2.9	4.1	37.5	2.12	3.78	4.3	13.8
J					14.1	0.25	0.35	3.52	4.92	500	2.2%	27.4	514	2.0%	2.9	3.0	30.4	2.41	4.28	8.5	21.1
K					6.5	0.25	0.35	1.63	2.28	500	2.0%	28.3	730	2.6%	2.9	4.2	32.5	2.31	4.12	3.8	9.4
L					3.2	0.60	0.70	1.90	2.22	125	3.2%	12.1	986	1.7%	2.9	5.7	17.8	3.20	5.69	6.1	12.6
OS-1					4.3	0.25	0.35	1.07	1.49	495	2.2%	27.2	207	5.8%	2.9	1.2	28.4	2.50	4.45	2.7	6.6
OS-5					323.0	0.20	0.27	64.60	87.20								26.4			201.7	404.0
	1		OS-1, A		6.3	0.25	0.35	1.59	2.21	495	2.2%	27.2	207	5.8%	2.9	1.2	28.4	2.50	4.45	4.0	9.8
	1-A		DP1, E		24.5	0.25	0.35	6.13	8.56	500	2.0%	28.3	2652	2.0%	2.5	17.7	46.0	1.88	3.34	11.5	28.6
	2		OS-5		323.0	0.20	0.27	64.60	87.20								26.4			201.7	404.0
	3		DP2, D	Tc From OS-5 is considered negligible	329.6	0.20	0.27	66.24	89.50	500	2.2%	27.4	1279	2.4%	2.5	8.5	35.9	2.18	3.88	144.5	347.4
	4		1-A, DP3, C,		373.6	0.21	0.28	77.27	104.91	500	2.0%	28.3	2652	1.9%	2.5	17.7	46.0	1.88	3.34	145.0	350.5
	5		DP4, G		377.4	0.21	0.28	78.20	106.22	500	2.0%	28.3	2652	2.0%	2.5	17.7	46.0	1.88	3.34	146.8	354.9
	6		DP5, F		384.3	0.21	0.28	79.94	108.65	500	2.0%	28.3	2652	2.0%	2.5	17.7	46.0	1.88	3.34	150.0	363.0
	7		H, I		15.8	0.25	0.40	3.95	6.34	500	2.0%	28.3	2652	2.0%	2.5	17.7	46.0	1.88	3.34	7.4	21.2
	8		DP6, DP7, K, L		409.8	0.21	0.29	87.42	119.49	500	2.0%	28.3	2652	2.0%	2.5	17.7	46.0	1.88	3.34	164.1	399.2

Matrix Design Group, Inc.
Integrated Design Solutions
Infrastructure Engineering
Community Development
Program Management

Shiloh Mesa at Woodmen Heights
Developed C Value Calculations

Global Parameters1

Land Use	% Imp.	C_5	C_{100}
High Density Residential (Town Homes)	65%	0.60	0.70
High Density Residential (Courtyard Homes)	65%	0.60	0.70
High Density Residential (Senior Villas)	65%	0.60	0.70
Low Density Residential (Single Family)	45%	0.35	0.45
Open Space	2%	0.25	0.35
Commercial	90%	0.90	0.90
Roadway	95%	0.90	0.95

Subbasin	Total Area (sq ft.)	Total Area (acres)	Land Use Area per Sub-Basin															
			Residential				Open Space		Imp. Area (ac)	Roadway		Imp. Area (ac)	Commercial		Imp. Area (ac)	% Check	Composite Imp.	
			SR VILLAS	HIGH														
			Area (AC)	Area (AC)	%	Imp. Area (ac)	Area (AC)	%		Area (AC)	%		Area (AC)	%				5-year / 100-year
A	119,982.10	2.8	2.75	-	99.8%	1.79	0.00	0.2%	0.00	-	0.0%	-	-	-	-	100.0%	64.9%	0.60 / 0.70
B	137,745.48	3.2	-	2.70	85.4%	1.76	0.21	6.7%	0.00	0.25	7.9%	0.24	-	-	-	100.0%	63.1%	0.60 / 0.70
C	68,207.73	1.6	-	0.80	51.1%	0.52	-	0.0%	-	0.77	48.9%	0.73	-	-	-	100.0%	79.7%	0.75 / 0.82
D	257,862.81	5.9	-		0.0%	-	1.48	25.0%	0.03		0.0%	-	4.44	0.75	4.00	100.0%	68.0%	0.74 / 0.76
E	101,988.32	2.3	-	2.34	100.0%	1.52	-	0.0%	-	-	0.0%	-	-	-	-	100.0%	65.0%	0.60 / 0.70
F	35,755.30	0.8	-	0.63	76.8%	0.41	-	0.0%	-	0.19	23.2%	0.18	-	-	-	100.0%	72.0%	0.67 / 0.76
G	107,611.03	2.5	-	2.47	100.0%	1.61	-	0.0%	-	-	0.0%	-	-	-	-	100.0%	65.0%	0.60 / 0.70
H	52,518.90	1.2	-	1.09	90.0%	0.71	-	0.0%	-	0.12	10.0%	0.11	-	-	-	100.0%	68.0%	0.63 / 0.73
I	122,983.31	2.8	-	-	0.0%	-	2.32	82.3%	0.05	0.50	17.7%	0.48	-	-	-	100.0%	18.5%	0.37 / 0.46
J	169,803.76	3.9	2.00	-	51.3%	1.30	1.28	32.8%	0.03	0.62	15.9%	0.59	-	-	-	100.0%	49.1%	0.53 / 0.63
K	21,322.59	0.5	-	-	0.0%	-	0.49	100.0%	0.01	-	0.0%	-	-	-	-	100.0%	2.0%	0.25 / 0.35
L	283,091.49	6.5	-	-	0.0%	-	-	0.0%	-	6.50	100.0%	6.17	-	-	-	100.0%	95.0%	0.90 / 0.95
M	40,278.63	0.9	-	-	0.0%	-	-	0.0%	-	0.92	100.0%	0.88	-	-	-	100.0%	95.0%	0.90 / 0.95
N	208,583.60	4.8	-	-	0.0%	-	-	0.0%	-	4.79	100.0%	4.55	-	-	-	100.0%	95.0%	0.90 / 0.95
O	129,400.87	3.0	-	-	0.0%	-	0.45	15.0%	0.01	2.53	85.0%	2.40	-	-	-	100.0%	81.1%	0.80 / 0.86
P	65,507.91	1.5	-	-	0.0%	-	-	0.0%	-	1.50	100.0%	1.43	-	-	-	100.0%	95.0%	0.90 / 0.95
Q	122,497.92	2.8	-	-	0.0%	-	-	0.0%	-	2.81	100.0%	2.67	-	-	-	100.0%	95.0%	0.90 / 0.95
OS-4	64,163.09	1.5	-	-	0.0%	-	-	0.0%	-	1.47	100.0%	1.40	-	-	-	100.0%	95.0%	0.90 / 0.95
S	211,229.98	4.8	-	-	0.0%	-	0.60	12.4%	0.01	-	0.0%	-	4.25	0.88	3.83	100.0%	79.1%	0.82 / 0.83
T	217,164.43	5.0	-	-	0.0%	-	0.66	13.1%	0.01	2.33	46.7%	2.21	2.00	0.40	1.80	100.0%	80.8%	0.81 / 0.85
U	584,936.72	13.4	-	-	0.0%	-	-	0.0%	-	-	0.0%	-	13.43	1.00	12.09	100.0%	90.0%	0.90 / 0.90
V	168,769.15	3.9	-	-	0.0%	-	0.42	11.0%	0.01	1.25	32.3%	1.19	2.20	0.57	1.98	100.0%	82.0%	0.83 / 0.86
W	144,544.57	3.3	-	-	0.0%	-	-	0.0%	-	-	0.0%	-	3.32	1.00	2.99	100.0%	90.0%	0.90 / 0.90
X	132,490.92	3.0	-	2.00	65.8%	1.30	0.36	11.9%	0.01	0.68	22.4%	0.65	-	-	-	100.0%	64.2%	0.63 / 0.71
Y	156,206.82	3.6	-	2.35	65.5%	1.53	0.79	21.9%	0.02	0.45	12.5%	0.43	-	-	-	100.0%	55.0%	0.56 / 0.65
Z	41,460.43	1.0	-	-	0.0%	-	-	0.0%	-	-	0.0%	-	0.95	1.00	0.86	100.0%	90.0%	0.90 / 0.90
AA	60,994.91	1.4	-	-	0.0%	-	0.01	0.7%	0.00	0.07	5.0%	0.07	1.32	0.94	1.19	100.0%	89.6%	0.90 / 0.90
BB	136,214.18	3.1	-	-	0.0%	-	3.13	100.0%	0.06	-	0.0%	-	-	-	-	100.0%	2.0%	0.25 / 0.35
CC	387,908.12	8.9	-	-	0.0%	-	0.06	0.6%	0.00		0.0%	-	8.85	0.99	7.97	100.0%	89.5%	0.90 / 0.90
OS-2	55,320.10	1.3	-	-	0.0%	-	-	0.0%	-	1.27	100.0%	1.21	-	-	-	100.0%	95.0%	0.90 / 0.95
EE	199,052.11	4.6	-	-	0.0%	-	0.69	15.0%	0.01	-	0.0%	-	3.88	0.85	3.50	100.0%	76.8%	0.80 / 0.82
FF	311,454.00	7.2	-	-	0.0%	-	7.15	100.0%	0.14	-	0.0%	-	-	-	-	100.0%	2.0%	0.25 / 0.35
TOTAL ONSITE		**112.88**	**4.75**	**14.38**	**16.9%**	12.43	**12.94**	**11.5%**	**0.26**	**29.02**	**25.7%**	**27.57**	**44.64**	**0.40**	40.18	93.7%	71.3%	0.72 / 0.76
OS1		4.26	-	-	0.0%	-	4.26	100.0%	0.09	-	0.0%	-	-	0%	-	100.0%	2.0%	0.25 / 0.35
OS-5		323.00	-	-	0.0%	-	323.00	100.0%	6.46	-	0.0%	-	-	0%	-	100.0%	2.0%	0.22 / 0.28
OS-6		1.13	-	-	0.0%	-	-	0.0%	-	1.13	100.0%	1.07	-	0%	-	100.0%	95.0%	0.90 / 0.95
OS-7		1.32	-	-	0.0%	-	-	0.0%	-	1.32	100.0%	1.25	-	0%	-	100.0%	95.0%	0.90 / 0.95
OS-8		1.07	-	-	0.0%	-	-	0.0%	-	1.07	100.0%	1.02	-	0%	-	100.0%	95.0%	0.90 / 0.95
TOTAL OFFSITE		**330.78**	-	-	**0.0%**	-	**327.26**	**98.9%**	**6.55**	**2.45**	**0.7%**	**2.33**	**0.00**	**0.0%**	0.00	99.7%	2.7%	0.25 / 0.35

Matrix Design Group, Inc.
Integrated Design Solutions
Infrastructure Engineering
Community Development
Program Management

SHILOH MESA AT WOODMEN HEIGHTS
Rational Method Hydrology
PROPOSED INDIVIDUAL BASINS

SubBasin Data							Time ofConcentration											Runof				
							Overland Time (ti)				Travel Time (tt)				Tc	ti Check						
	Sb-Basin ID	Area	Area	C 5-year	C 100-year	CA (5)	CA (100)	Length (500'maxnon-urban, 300' max urban)	Slope	ti	Cv	Length	Slope	Velocity	tt	tc/ttk	Total length	ti =(1.8040)	Minimum Tc	Final Tc (ti min =tt)	Intensity(5)* [4]	Intensity(100)* [4]	Total PeakDischarge (Q5)	Total PeakDischarge (Q100)
		sq feet	acres					ft	%	min.		ft	%	fps	min	min	ft	min	min	min	in/hr	in/hr	cfs	cfs
	OS1		4.26	0.25	0.35	1.07	1.49	250	2.0%	19.9	5.0	737	3.2%	0.9	13.7	33.7	987	15.5	15.5	15.5	3.41	6.07	3.6	9.1
	A		2.75	0.60	0.70	1.65	1.93	20	2.0%	3.3	20.0	390	2.0%	2.8	2.3	5.6	410	12.3	5.6	5.6	4.95	8.81	8.2	17.0
	B		3.16	0.60	0.70	1.90	2.20	20	2.0%	3.3	20.0	700	2.0%	2.8	4.1	7.4	720	14.0	7.4	7.4	4.55	8.10	8.6	17.8
	C		1.57	0.75	0.82	1.17	1.29	20	2.0%	2.3	20.0	800	1.0%	2.0	6.7	9.0	820	14.6	9.0	9.0	4.26	7.59	5.0	9.8
	D		5.92	0.74	0.76	4.37	4.51	20	2.0%	2.4	20.0	360	2.0%	2.8	2.1	4.5	380	12.1	4.5	5.0	5.10	9.09	22.3	41.0
	E		2.34	0.60	0.70	1.40	1.64	20	2.0%	3.3	20.0	680	2.0%	2.8	4.0	7.3	700	13.9	7.3	7.3	4.57	8.14	6.4	13.3
	F		0.82	0.67	0.76	0.55	0.62	20	2.0%	2.9	20.0	390	2.0%	2.8	2.3	5.2	410	12.3	5.2	5.2	5.07	9.02	2.8	5.6
	G		2.47	0.60	0.70	1.48	1.73	20	2.0%	3.3	20.0	690	2.0%	2.8	4.1	7.4	710	13.9	7.4	7.4	4.56	8.12	6.8	14.0
	H		1.21	0.63	0.73	0.76	0.87	20	2.0%	3.1	20.0	360	2.0%	2.8	2.1	5.2	380	12.1	5.2	5.2	5.04	8.98	3.8	7.8
	I		2.82	0.37	0.46	1.03	1.29	20	2.0%	4.9	20.0	610	2.0%	2.8	3.6	8.5	630	13.5	8.5	8.5	4.36	7.76	4.5	10.0
	J		3.90	0.53	0.63	2.08	2.44	20	2.0%	3.8	20.0	360	2.0%	2.8	2.1	5.9	380	12.1	5.9	5.9	4.89	8.70	10.2	21.2
	K		0.49	0.25	0.35	0.12	0.17	20	2.0%	5.6	20.0	585	2.0%	2.8	3.4	9.1	605	13.4	9.1	9.1	4.25	7.57	0.5	1.3
	OS-8		1.07	0.90	0.95	0.96	1.02	20	2.0%	1.3	20.0	1254	2.2%	3.0	7.0	8.4	1274	17.1	8.4	8.4	4.38	7.79	4.2	7.9
	L	267715	6.50	0.90	0.95	5.85	6.17	20	2.0%	1.3	20.0	750	2.0%	2.8	4.4	5.7	770	14.3	5.7	5.7	4.92	8.76	28.8	54.1
	M	40278	0.92	0.90	0.95	0.83	0.88	20	2.0%	1.3	20.0	640	2.0%	2.8	3.8	5.1	660	13.7	5.1	5.1	5.08	9.04	4.2	7.9
	N	208583	4.79	0.90	0.95	4.31	4.55	20	2.0%	1.3	20.0	665	1.0%	2.0	5.5	6.9	685	13.8	6.9	6.9	4.67	8.31	20.1	37.8
	O	129400	2.97	0.90	0.95	2.67	2.82	20	2.0%	1.3	20.0	665	2.0%	2.8	3.9	5.2	685	13.8	5.2	5.2	5.04	8.97	13.5	25.3
	P	65507	1.50	0.90	0.95	1.35	1.43	20	3.0%	1.2	20.0	1130	3.0%	3.5	5.4	6.6	1150	16.4	6.6	6.6	4.73	8.41	6.4	12.0
	Q	122497	2.81	0.90	0.95	2.53	2.67	20	2.0%	1.3	20.0	650	2.0%	2.8	3.8	5.2	670	13.7	5.2	5.2	5.06	9.01	12.8	24.1
	OS-4	64163	1.47	0.90	0.95	1.33	1.40	20	2.0%	1.3	20.0	600	1.7%	2.6	3.8	5.2	620	13.4	5.2	5.2	5.06	9.01	6.7	12.6
	S	211229	4.85	0.82	0.83	3.97	4.03	20	2.0%	1.9	20.0	1045	2.0%	2.8	6.2	8.0	1065	15.9	8.0	8.0	4.44	7.90	17.7	31.9
	T	217164	4.99	0.81	0.85	4.06	4.24	20	2.0%	1.9	20.0	640	1.7%	2.6	4.1	6.0	660	13.7	6.0	6.0	4.86	8.66	19.8	36.7
	U	584936	13.43	0.90	0.90	12.09	12.09	20	2.0%	1.3	20.0	1155	2.0%	2.8	6.8	8.1	1175	16.5	8.1	8.1	4.42	7.87	53.4	95.1
	V	166769	3.87	0.83	0.86	3.21	3.32	20	2.0%	1.8	20.0	575	2.0%	2.8	3.4	5.2	595	13.3	5.2	5.2	5.08	9.00	16.2	29.8
	OS-9		1.19	0.90	0.95	1.07	1.13	20	2.0%	1.3	20.0	600	2.0%	2.8	3.5	4.9	620	13.4	4.9	5.0	5.10	9.09	5.5	10.3
	OS-7	57499	1.32	0.90	0.95	1.19	1.25	20	2.0%	1.3	20.0	1420	2.0%	2.8	8.4	9.7	1440	18.0	9.7	9.7	4.15	7.39	4.9	9.3
	OS-10		2.61	0.90	0.95	2.35	2.48	20	2.0%	1.3	20.0	1900	2.0%	2.8	11.2	12.5	1920	20.7	12.5	12.5	3.75	6.67	8.8	16.5
	W	144544	3.32	0.90	0.90	2.99	2.99	20	2.0%	1.3	20.0	363	2.0%	2.8	2.1	3.5	383	12.1	3.5	5.0	5.10	9.09	15.2	27.1
	X	132532	3.04	0.63	0.71	1.90	2.17	20	2.0%	3.1	20.0	500	2.0%	2.8	2.9	6.1	520	12.9	6.1	6.1	4.84	8.61	9.2	18.7
	Y	156206	3.59	0.55	0.65	2.01	2.35	20	2.0%	3.6	20.0	515	2.0%	2.8	3.0	6.6	535	13.0	6.6	6.6	4.72	8.41	9.5	19.7
	Z	41460	0.95	0.90	0.90	0.86	0.86	20	2.0%	1.3	20.0	300	2.0%	2.8	1.8	3.1	320	11.8	3.1	5.0	5.10	9.09	4.4	7.8
	AA	60994	1.40	0.90	0.90	1.25	1.26	20	2.0%	1.4	20.0	370	2.0%	2.8	2.2	3.5	390	12.2	3.5	5.0	5.10	9.09	6.4	11.4
	BB	136214	3.13	0.25	0.35	0.78	1.09	20	2.0%	5.6	10.0	807	2.0%	1.4	9.5	15.2	827	14.6	14.6	14.6	3.51	6.24	2.7	6.8
	CC	387908	8.91	0.90	0.90	7.98	7.98	20	2.0%	1.4	20.0	690	2.0%	2.8	4.1	5.4	710	13.9	5.4	5.4	5.00	8.90	39.9	71.0
	OS-2	55320	1.27	0.90	0.95	1.14	1.21	20	2.0%	1.3	20.0	510	2.0%	2.8	3.0	4.3	530	12.9	4.3	5.0	5.10	9.09	5.8	11.0
	OS-6	49223	1.13	0.90	0.95	1.02	1.07	20	2.0%	1.3	20.0	1763	2.0%	2.8	10.4	11.7	1783	19.9	11.7	11.7	3.85	6.86	3.9	7.4
	OS-3		1.43	0.90	0.95	1.29	1.36	20	2.0%	1.3	20.0	510	2.0%	2.8	3.0	4.3	530	12.9	4.3	5.0	5.10	9.09	6.6	12.3
	EE		4.57	0.72	0.76	3.28	3.47	300	10.0%	5.7	20.0	500	0.5%	0.5	16.7	22.4	800	14.4	14.4	14.4	3.52	6.27	11.5	21.7
	OS-5		323.00	0.24	0.27	77.52	87.21													25.4	2.60	4.63	201.7	404.0

*[1] - Colorado Springs Drainage Criteria Manual Tc = [1.87(1.1-C)√L] / S^0.33

*[2] - Tt = Length/Velocity

*[3] - Urbn Drainage Figure RO-1

*[4] - Colorado Springs Drianage Criteria Manual

I(5) = (28.651.5) / (10 + Tc)^0.76

I(100) = (28.652.67) / (10 + Tc)^0.76

Shiloh Mesa at Woodmen Heights
Rational Method Routed Peak Flowrates

Outfall 11

Design Point	Contributing Area	Total Peak Discharge Q(5)	Total Peak Discharge Q(100)	Pipe Diameter	Contributing Basins
		cfs	cfs	inch	
1	4.3	5.13	9.12	36	OS-1
2	7.0	8.15	14.56	36	DP-1, A
3	12.9	22.69	40.66	36	DP-2, D
4	4.7	14.97	26.67	36	B,C
5	17.7	33.61	60.34	36	DP-3, DP-4
6	20.8	40.28	72.43	42	E, F, DP-5
7	31.2	59.61	107.36	42	G, H, DP-6, DP-9
8	7.1	5.69	10.13	30	I
9	11.0	15.30	27.53	36	DP-8, J
10	31.7	59.70	107.53	42	DP-7, K
11	31.7	59.70	107.53	42	DP-10

Outfall 31

Design Point	Contributing Area	Total Peak Discharge Q(5)	Total Peak Discharge Q(100)	Pipe Diameter	Contributing Basins
		cfs	cfs	inch	
12	6.5	30.69	54.63	36	L
13	7.4	34.50	61.44	42	DP-12, M
14	12.2	54.35	96.87	42	DP-13, N
15	15.2	65.23	116.52	54	DP-14, O
16	324.5	205.38	410.56	72	DP-32, P
17	328.6	215.39	428.44	72	DP-16, DP-33
31	348.4	344.82	568.12	84	DP-17, DP-15, EE
32	323.0	201.70	404.00	72	OS-5
33	4.1	15.22	27.39	30	OS-7, Q

Outfall 21

Design Point	Contributing Area	Total Peak Discharge Q(5)	Total Peak Discharge Q(100)	Pipe Diameter	Contributing Basins
		cfs	cfs	inch	
18	4.9	18.03	32.10	54	S
19	9.8	35.07	62.66	54	DP-18, T
20	27.1	94.44	169.01	54	DP-19, U, V
21	29.8	102.78	184.26	54	DP-20, OS-4, OS-9

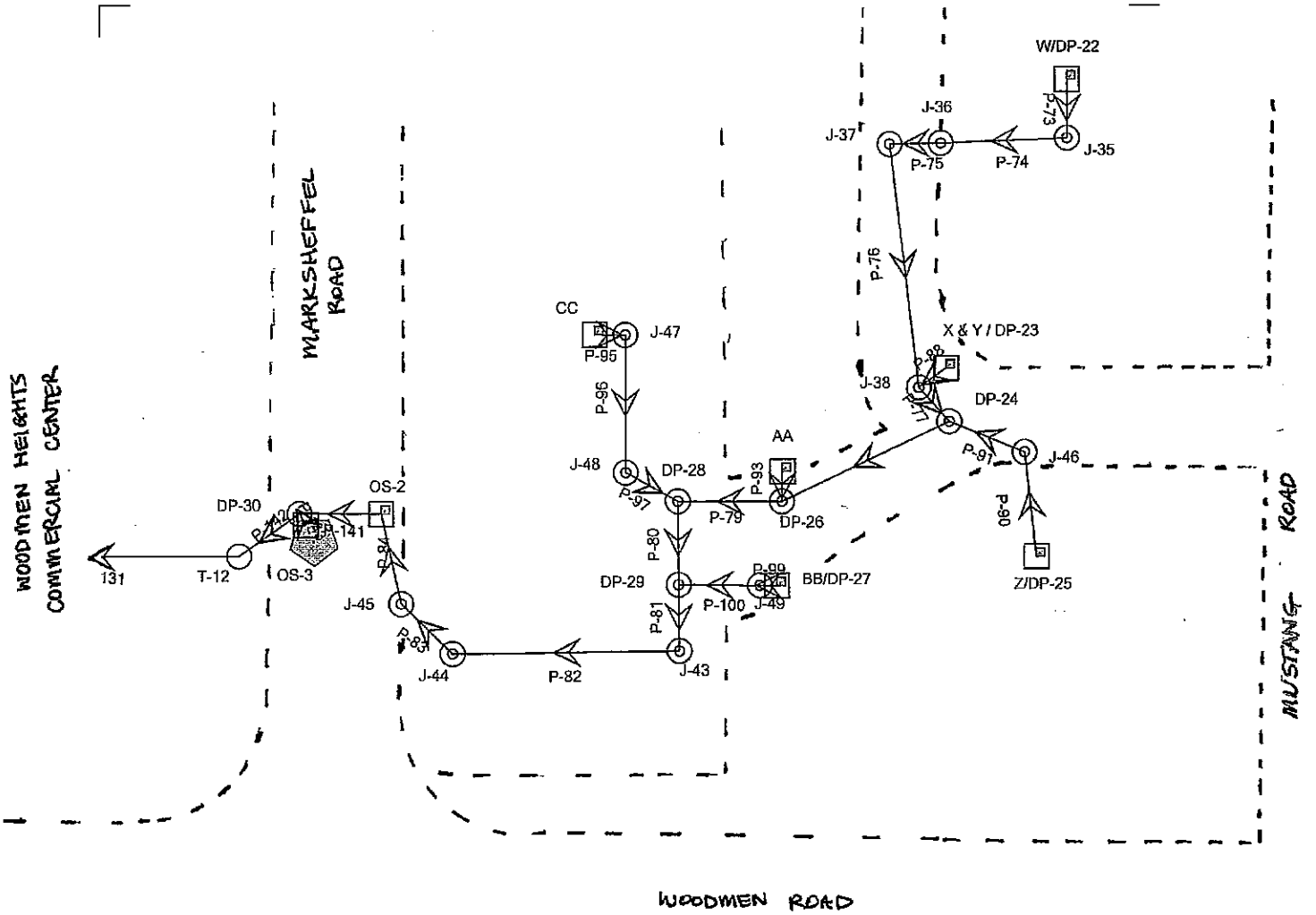
Outfall 30

Design Point	Contributing Area	Total Peak Discharge Q(5)	Total Peak Discharge Q(100)	Pipe Diameter	Contributing Basins
		cfs	cfs	inch	
22	3.3	15.37	27.37	30	W
23	6.6	21.40	38.09	30	X, Y
24	10.9	39.40	67.03	36	DP-22, DP-23, DP-25
25	1.0	4.40	7.83	18	Z
26	12.3	44.50	75.69	48	DP-24, AA
27	3.1	5.03	8.96	18	BB
28	21.2	80.95	136.95	48	DP-26, CC
29	24.3	84.67	144.53	48	DP-28, DP-27
30	27.0	92.17	157.90	60	DP-29, OS-2, OS-3

BENTLEY STORMCAD ANALYSIS

PHASING ZONE 1

Title: Print Preview



SHILOH MESA

Title: ~~Woodmen Heights Commercial Center~~

WHCC 11-14-08.stc

1/29/2009

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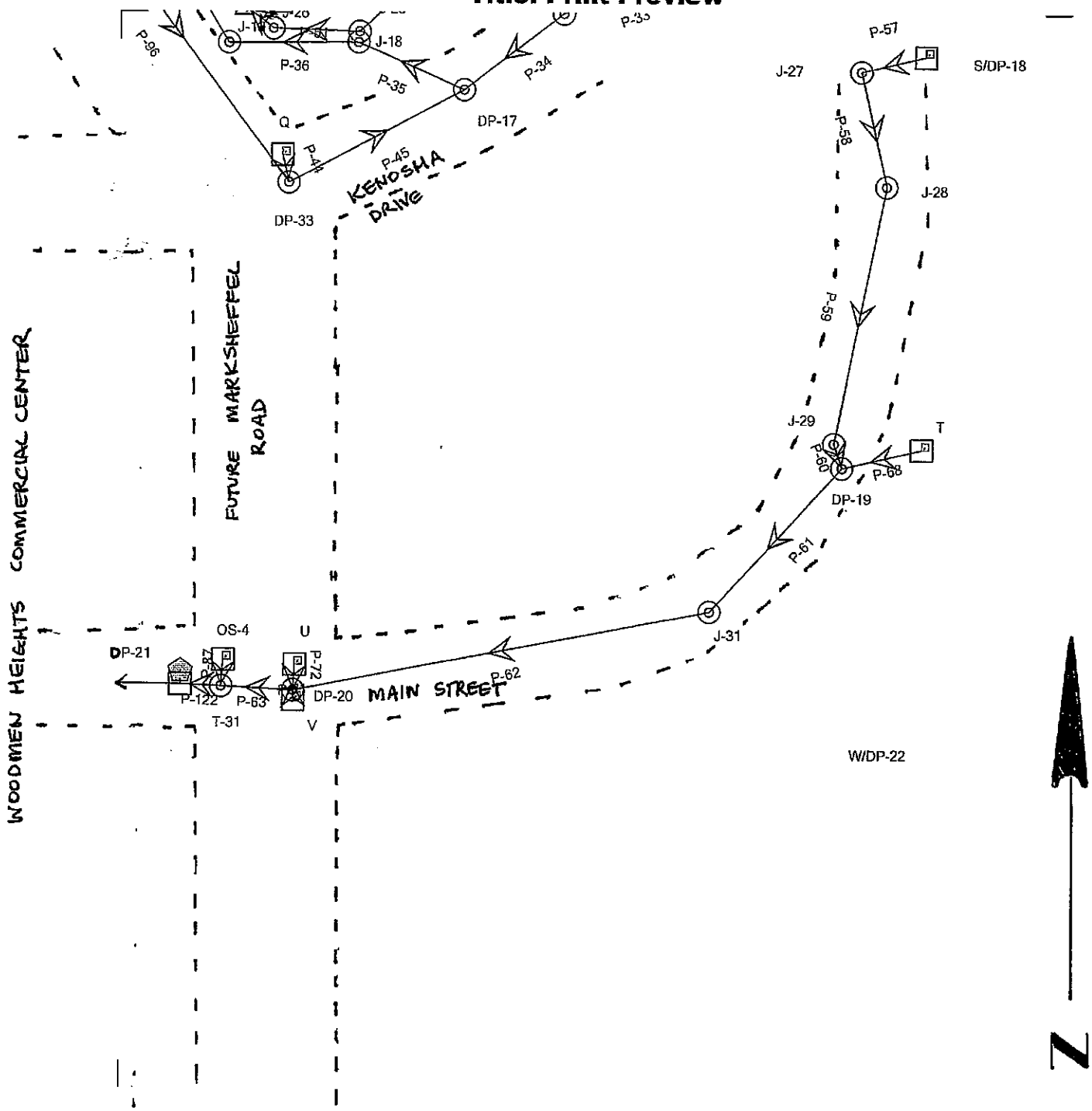
Project Engineer: Rich Eastland
Bentley StormCAD V8 XM Edition
[08.09.081.00]

PHASING ZONE 2

Title: Print Preview



SHILOH MESA

Title: ~~Woodmen Heights Commercial Center~~

WHCC 11-14-08.stc

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Bentley StormCAD V8 XM Edition
[08.09.081.00]

PHASING ZONE 3

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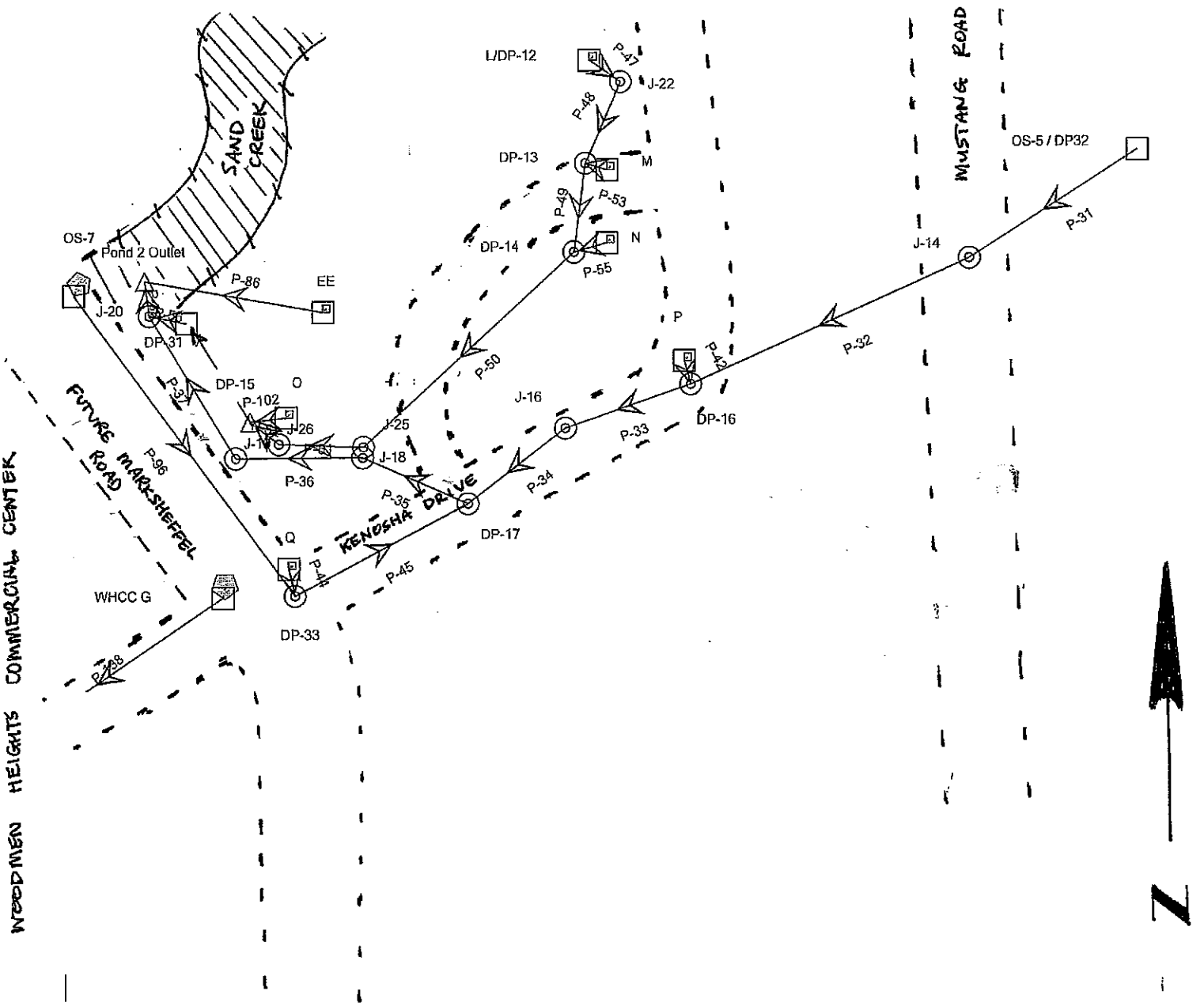

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Title: ~~Woodmen Heights Commercial Center~~

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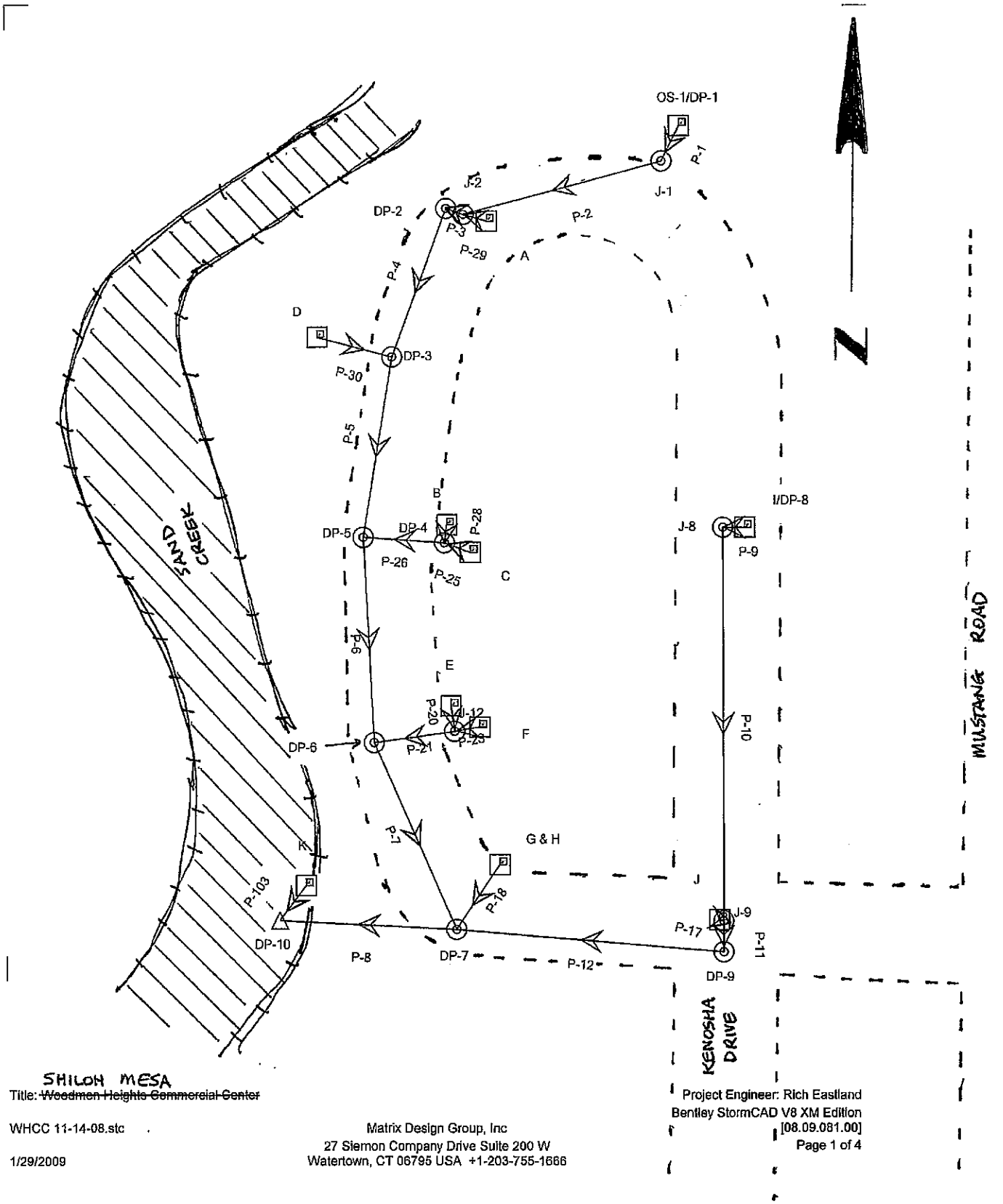
[08.09.081.00]

PHASING ZONE 4

Title: Print Preview



SHILOH MESA

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[08.09.081.00]

Shiloh Mesa
StormCAD 5-Year
Pipe Report

Label	Length (ft)	Section Size	Material	Upstream Node	Upstream Ground Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Downstream Invert Elevation (ft)	Downstream Node	Slope (ft/ft)	System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	55	36	Concrete	OS-1/DP-1	6,975.00	6,968.26	J-1	6,975.00	6,967.71	0.01	1.491	3.41	5.13	5.91	6,969.13	6,968.74
P-2	340	36	Concrete	J-1	6,975.00	6,967.71	J-2	6,970.00	6,964.31	0.01	1.491	3.395	5.1	5.9	6,968.58	6,965.28
P-3	25	36	Concrete	J-2	6,970.00	6,964.31	DP-2	6,970.00	6,964.06	0.01	2.454	3.301	8.16	6.4	6,965.21	6,965.08
P-4	240	36	Concrete	DP-2	6,970.00	6,964.06	DP-3	6,965.00	6,961.66	0.01	2.454	3.295	8.15	6.39	6,964.96	6,963.24
P-5	275	36	Concrete	DP-3	6,965.00	6,961.66	DP-5	6,965.00	6,958.91	0.01	6.953	3.238	22.69	8.53	6,963.19	6,960.85
P-6	309	36	Concrete	DP-5	6,965.00	6,958.91	DP-6	6,960.00	6,955.82	0.01	10.452	3.19	33.61	9.45	6,960.79	6,957.84
P-7	315	42	Concrete	DP-6	6,960.00	6,955.82	DP-7	6,955.00	6,952.67	0.01	12.713	3.143	40.28	9.88	6,957.79	6,955.00
P-8	267	42	Concrete	DP-7	6,955.00	6,952.67	DP-10	6,950.00	6,950.00	0.01	19.08	3.099	59.61	10.9	6,955.09	6,953.50
P-9	33	54	Concrete	I/DP-8	6,970.00	6,963.42	J-8	6,970.00	6,963.09	0.01	1.297	4.352	5.69	5.48	6,964.09	6,963.98
P-10	591	30	Concrete	J-8	6,970.00	6,963.09	J-9	6,960.00	6,957.18	0.01	1.297	4.335	5.67	5.87	6,963.88	6,958.43
P-11	46	36	Concrete	J-9	6,960.00	6,957.18	DP-9	6,960.00	6,956.72	0.01	3.754	4.059	15.36	7.66	6,958.43	6,958.17
P-12	405	36	Concrete	DP-9	6,960.00	6,956.72	DP-7	6,955.00	6,952.67	0.01	3.754	4.044	15.3	7.66	6,957.97	6,955.00
P-17	7	18	Concrete	J	6,960.00	6,957.25	J-9	6,960.00	6,957.18	0.01	2.457	4.883	12.09	6.84	6,958.64	6,958.50
P-18	117	36	Concrete	G & H	6,955.00	6,953.84	DP-7	6,955.00	6,952.67	0.01	2.612	4.56	12.01	7.15	6,954.94	6,955.00
P-20	39	30	Concrete	E	6,960.00	6,957.44	J-12	6,960.00	6,957.05	0.01	1.638	4.58	7.56	6.37	6,958.35	6,958.16
P-21	123	36	Concrete	J-12	6,960.00	6,957.05	DP-6	6,960.00	6,955.82	0.01	2.261	4.56	10.39	6.86	6,958.07	6,957.85
P-23	38	30	Concrete	F	6,960.00	6,957.43	J-12	6,960.00	6,957.05	0.01	0.623	5.053	3.17	4.96	6,958.01	6,958.09
P-25	43	30	Concrete	C	6,965.00	6,960.57	DP-4	6,965.00	6,960.14	0.01	1.287	4.265	5.53	5.83	6,961.35	6,961.40
P-26	123	36	Concrete	DP-4	6,965.00	6,960.14	DP-5	6,965.00	6,958.91	0.01	3.499	4.244	14.97	7.61	6,961.37	6,960.91
P-28	27	30	Concrete	B	6,965.00	6,960.41	DP-4	6,965.00	6,960.14	0.01	2.212	4.56	10.17	6.93	6,961.48	6,961.48
P-29	30	36	Concrete	A	6,970.00	6,964.61	J-2	6,970.00	6,964.31	0.01	0.962	4.463	4.33	5.55	6,965.34	6,965.23
P-30	82	36	Concrete	D	6,965.00	6,962.48	DP-3	6,965.00	6,961.66	0.01	4.499	5.105	23.15	8.58	6,964.03	6,963.35
P-103	66	18	Concrete	K	6,955.00	6,950.66	DP-10	6,950.00	6,950.00	0.01	0.171	4.248	0.73	3.42	6,951.50	6,951.50
P-31	277	72	Concrete	OS-5 / DP32	6,945.00	6,935.80	J-14	6,950.00	6,933.03	0.01	0	2.602	404	17.05	6,941.15	6,938.49
P-32	437	72	Concrete	J-14	6,950.00	6,933.03	DP-16	6,940.00	6,928.66	0.01	0	2.588	404	17.05	6,938.38	6,934.26
P-33	186	72	Concrete	DP-16	6,940.00	6,928.66	J-16	6,935.00	6,926.80	0.01	1.425	2.565	407.68	17.06	6,934.03	6,932.28
P-34	171	72	Concrete	J-16	6,935.00	6,926.80	DP-17	6,930.00	6,925.09	0.01	1.425	2.555	407.67	17.06	6,932.17	6,929.94
P-35	159	72	Concrete	DP-17	6,930.00	6,925.09	J-18	6,930.00	6,923.50	0.01	5.348	2.547	417.73	14.77	6,931.55	6,930.00
P-36	177	72	Concrete	J-18	6,930.00	6,923.50	J-19	6,930.00	6,921.73	0.01	5.348	2.538	417.68	14.77	6,931.72	6,930.00
P-37	225	72	Concrete	J-19	6,930.00	6,921.73	J-20	6,930.00	6,919.48	0.01	5.348	2.527	417.63	14.77	6,928.33	6,926.14
P-38	48	72	Concrete	J-20	6,930.00	6,919.48	DP-31	6,919.00	6,919.00	0.01	5.348	2.515	534.08	18.89	6,925.76	6,925.00
P-42	34	18	Concrete	P	6,940.00	6,929.00	DP-16	6,940.00	6,928.66	0.01	1.425	4.726	6.79	3.84	6,934.19	6,934.04
P-44	39	18	Concrete	Q	6,930.00	6,928.23	DP-33	6,930.00	6,927.84	0.01	2.67	5.053	13.6	7.69	6,930.65	6,930.00
P-45	275	30	Concrete	DP-33	6,930.00	6,927.84	DP-17	6,930.00	6,925.09	0.01	3.924	3.849	15.22	3.1	6,930.38	6,930.00
P-56	53	72	Concrete	Pond 2 Outlet	6,925.00	6,920.01	J-20	6,930.00	6,919.48	0.01	0	5.105	116.52	12.11	6,926.47	6,925.76
P-86	250	18	Concrete	EE	6,930.00	6,921.50	DP-31	6,919.00	6,919.00	0.01	3.747	3.527	13.32	7.54	6,924.52	6,920.50
P-47	53	36	Concrete	L/DP-12	6,950.00	6,933.65	J-22	6,950.00	6,933.12	0.01	6.175	4.931	30.69	9.24	6,935.45	6,935.31
P-48	123	36	Concrete	J-22	6,950.00	6,933.12	DP-13	6,950.00	6,931.89	0.01	6.175	4.908	30.55	9.23	6,934.91	6,933.74
P-49	124	42	Concrete	DP-13	6,950.00	6,931.89	DP-14	6,945.00	6,930.65	0.01	7.049	4.856	34.5	9.48	6,933.71	6,933.29
P-50	397	42	Concrete	DP-14	6,945.00	6,930.65	J-25	6,930.00	6,926.68	0.01	11.599	4.649	54.35	10.66	6,932.96	6,929.35
P-51	118	42	Concrete	J-25	6,930.00	6,926.68	J-26	6,930.00	6,925.50	0.01	11.599	4.523	52.89	10.59	6,928.96	6,928.80
P-52	50	42	Concrete	J-26	6,930.00	6,925.50	DP-15	6,925.00	6,925.00	0.01	11.599	4.487	52.47	10.57	6,928.54	6,928.50
P-53	31	18	Concrete	M	6,950.00	6,932.20	DP-13	6,950.00	6,931.89	0.01	0.874	5.079	4.47	2.53	6,933.80	6,933.74
P-55	47	18	Concrete	N	6,945.00	6,931.12	DP-14	6,945.00	6,930.65	0.01	4.55	4.662	21.39	12.1	6,934.98	6,933.03
P-102	50	18	Concrete	O	6,930.00	6,925.50	DP-15	6,925.00	6,925.00	0.01	2.554	5.053	13.01	7.36	6,927.27	6,926.50
P-104	166	36	Concrete	Pond 1 Outlet	6,955.00	6,936.66	DP-11	6,935.00	6,935.00	0.01	0	5.105	107.15	15.16	6,942.25	6,937.92
P-57	90	54	Concrete	S/DP-18	6,940.00	6,922.72	J-27	6,940.00	6,921.82	0.01	4.025	4.444	18.03	8.09	6,924.16	6,923.57
P-58	160	54	Concrete	J-27	6,940.00	6,921.82	J-28	6,940.00	6,920.22	0.01	4.025	4.41	17.89	8.07	6,923.25	6,921.68
P-59	362	54	Concrete	J-28	6,940.00	6,920.22	J-29	6,930.00	6,916.60	0.01	4.025	4.35	17.65	8.04	6,921.64	6,918.39
P-60	35	54	Concrete	J-29	6,930.00	6,916.60	DP-19	6,930.00	6,916.25	0.01	4.025	4.22	17.12	7.9	6,918.38	6,918.43
P-61	270	54	Concrete	DP-19	6,930.00	6,916.25	J-31	6,925.00	6,913.55	0.01	8.267	4.208	35.07	9.55	6,918.17	6,915.79
P-62	595	54	Concrete	J-31	6,925.00	6,913.55	DP-20	6,915.00	6,909.10	0.007	8.267	4.132	34.43	8.52	6,915.46	6,910.77
P-63	98	54	Concrete	DP-20	6,915.00	6,907.60	T-31	6,912.00	6,906.62	0.01	23.682	3.956	94.44	12.24	6,910.45	6,909.60
P-68	112	30	Concrete	T	6,930.00	6,917.37	DP-19	6,930.00	6,916.25	0.01	4.241	4.86	20.78	8.38	6,918.92	6,918.43
P-71	13	18	Concrete	V	6,915.00	6,907.73	DP-20	6,915.00	6,907.60	0.01	3.328	5.053	16.95	3.45	6,910.54	6,910.52
P-72	35	18	Concrete	U	6,915.00	6,907.95	DP-20	6,915.00	6,907.60	0.01	12.087	4.425	53.92	10.64	6,910.66	6,910.72

Shiloh Mesa
StormCAD 5-Year
Pipe Report

Label	Length (ft)	Section Size	Material	Upstream Node	Upstream Ground Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Downstream Invert Elevation (ft)	Downstream Node	Slope (ft/ft)	System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-87	36	18	Concrete	OS-4	6,916.00	6,911.00	T-31	6,912.00	6,906.62	0.122	1.396	5.053	7.11	15.58	6,911.95	6,909.58
P-73	71.1	30	Concrete	W/DP-22	6,925.00	6,911.07	J-35	6,925.00	6,910.36	0.01	2.988	5.105	15.37	7.66	6,912.32	6,911.35
P-74	154.8	30	Concrete	J-35	6,925.00	6,910.06	J-36	6,920.00	6,908.51	0.01	2.988	5.065	15.26	7.65	6,911.31	6,909.49
P-75	63.2	36	Concrete	J-36	6,920.00	6,908.01	J-37	6,920.00	6,907.38	0.01	2.988	4.981	15	7.5	6,909.19	6,908.31
P-76	304.1	36	Concrete	J-37	6,920.00	6,907.08	J-38	6,915.00	6,904.04	0.01	2.988	4.947	14.9	7.49	6,908.26	6,905.62
P-77	55.8	36	Concrete	J-38	6,915.00	6,903.74	DP-24	6,915.00	6,903.38	0.006	7.48	4.714	35.54	8.13	6,905.59	6,905.03
P-78	240.3	36	Concrete	DP-24	6,915.00	6,902.88	DP-26	6,910.00	6,900.68	0.009	8.335	4.69	39.4	9.44	6,904.75	6,902.15
P-79	126.8	36	Concrete	DP-26	6,910.00	6,900.18	DP-28	6,910.00	6,898.91	0.01	9.595	4.601	44.5	10.09	6,902.18	6,901.66
P-80	103.2	48	Concrete	DP-28	6,910.00	6,898.61	DP-29	6,910.00	6,897.58	0.01	17.614	4.559	80.95	11.76	6,901.34	6,899.81
P-81	79.8	48	Concrete	DP-29	6,910.00	6,897.38	J-43	6,910.00	6,896.58	0.01	18.709	4.49	84.67	11.91	6,900.17	6,899.82
P-82	278.9	48	Concrete	J-43	6,910.00	6,896.28	J-44	6,909.00	6,893.49	0.01	18.709	4.468	84.27	11.89	6,899.06	6,896.42
P-83	103.9	48	Concrete	J-44	6,909.00	6,893.19	J-45	6,907.00	6,892.15	0.01	18.709	4.396	82.9	11.84	6,895.95	6,895.14
P-84	79.8	48	Concrete	J-45	6,907.00	6,891.85	OS-2	6,897.55	6,891.05	0.01	18.709	4.369	82.4	11.84	6,894.60	6,894.30
P-88	41	18	Concrete	X & Y / DP-23	6,915.00	6,905.69	J-38	6,915.00	6,905.24	0.011	4.492	4.726	21.4	12.11	6,908.43	6,906.71
P-90	128	30	Concrete	Z/DP-25	6,920.00	6,907.00	J-46	6,915.00	6,905.70	0.01	0.855	5.105	4.4	5.48	6,907.69	6,906.25
P-91	100	30	Concrete	J-46	6,915.00	6,905.40	DP-24	6,915.00	6,904.38	0.01	0.855	5.006	4.31	5.46	6,906.08	6,904.92
P-93	37	21	Concrete	AA	6,915.00	6,901.55	DP-26	6,910.00	6,901.18	0.01	1.26	5.105	6.48	5.98	6,902.43	6,902.54
P-95	35.2	18	Concrete	CC	6,910.00	6,902.32	J-47	6,910.00	6,901.96	0.01	8.019	5.003	40.44	9.97	6,904.30	6,903.62
P-96	170.7	24	Concrete	J-47	6,910.00	6,901.66	J-48	6,910.00	6,899.65	0.012	8.019	4.989	40.33	10.41	6,903.56	6,901.82
P-97	73.5	36	Concrete	J-48	6,910.00	6,899.65	DP-28	6,910.00	6,898.91	0.01	8.019	4.923	39.79	9.8	6,901.53	6,901.67
P-99	21	18	Concrete	BB/DP-27	6,910.00	6,901.39	J-49	6,910.00	6,901.18	0.01	1.095	4.556	5.03	5.88	6,902.25	6,901.93
P-100	99	18	Concrete	J-49	6,910.00	6,900.88	DP-29	6,910.00	6,899.88	0.01	1.095	4.544	5.02	5.9	6,901.74	6,900.93
P-96	650	24	Concrete	OS-7	6,936.00	6,933.00	DP-33	6,930.00	6,927.84	0.008	1.254	4.149	5.25	5.29	6,933.76	6,930.00
P-122	250.6	48	Concrete	T-31	6,912.00	6,906.62	OS-9 / DP-21	6,910.00	6,904.11	0.01	25.079	3.937	99.53	12.41	6,909.55	6,906.39
P-141	157.4	12	Concrete	OS-2	6,897.55	6,890.75	DP-30	6,895.44	6,889.96	0.005	19.916	4.349	87.3	9.1	6,893.60	6,892.79
P-143	22.8	12	Concrete	OS-3	6,895.44	6,891.44	DP-30	6,895.44	6,891.66	-0.01	1.359	5.105	6.99	2.22	6,892.88	6,892.60

Shiloh Mesa
StormCAD 100-Year
Pipe Report

Label	Length (ft)	Section Size	Material	Upstream Node	Upstream Ground Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Downstream Invert Elevation (ft)	Downstream Node	Slope (ft/ft)	System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	55	36	Concrete	OS-1/DP-1	6,975.00	6,968.26	J-1	6,975.00	6,967.71	0.01	1.491	6.071	9.12	6.69	6,969.43	6,969.19
P-2	340	36	Concrete	J-1	6,975.00	6,967.71	J-2	6,970.00	6,964.31	0.01	1.491	6.046	9.09	6.69	6,968.88	6,965.64
P-3	25	36	Concrete	J-2	6,970.00	6,964.31	DP-2	6,970.00	6,964.06	0.01	2.454	5.899	14.59	7.56	6,965.53	6,965.47
P-4	240	36	Concrete	DP-2	6,970.00	6,964.06	DP-3	6,965.00	6,961.66	0.01	2.454	5.889	14.56	7.55	6,965.28	6,963.82
P-5	275	36	Concrete	DP-3	6,965.00	6,961.66	DP-5	6,965.00	6,958.91	0.01	6.953	5.801	40.66	9.9	6,963.74	6,961.54
P-6	309	36	Concrete	DP-5	6,965.00	6,958.91	DP-6	6,960.00	6,955.82	0.01	10.452	5.727	60.34	10.68	6,961.42	6,958.57
P-7	315	42	Concrete	DP-6	6,960.00	6,955.82	DP-7	6,955.00	6,952.67	0.01	12.713	5.652	72.43	11.38	6,958.49	6,954.87
P-8	267	42	Concrete	DP-7	6,955.00	6,952.67	DP-10	6,950.00	6,950.00	0.01	19.08	5.582	107.36	11.16	6,956.54	6,953.50
P-9	33	54	Concrete	I/DP-8	6,970.00	6,963.42	J-8	6,970.00	6,963.09	0.01	1.297	7.747	10.13	6.5	6,964.32	6,964.33
P-10	591	30	Concrete	J-8	6,970.00	6,963.09	J-9	6,960.00	6,957.18	0.01	1.297	7.721	10.1	6.92	6,964.15	6,958.88
P-11	46	36	Concrete	J-9	6,960.00	6,957.18	DP-9	6,960.00	6,956.72	0.01	3.754	7.299	27.62	8.99	6,958.88	6,958.78
P-12	405	36	Concrete	DP-9	6,960.00	6,956.72	DP-7	6,955.00	6,952.67	0.01	3.754	7.276	27.53	8.98	6,958.42	6,955.00
P-17	7	18	Concrete	J	6,960.00	6,957.25	J-9	6,960.00	6,957.18	0.01	2.457	8.693	21.53	12.18	6,959.17	6,958.88
P-18	117	36	Concrete	G & H	6,955.00	6,953.84	DP-7	6,955.00	6,952.67	0.01	2.612	8.117	21.37	8.4	6,955.33	6,955.00
P-20	39	30	Concrete	E	6,960.00	6,957.44	J-12	6,960.00	6,957.05	0.01	1.638	8.153	13.46	7.48	6,958.67	6,958.58
P-21	123	36	Concrete	J-12	6,960.00	6,957.05	DP-6	6,960.00	6,955.82	0.01	2.261	8.122	18.51	8.07	6,958.43	6,958.60
P-23	38	30	Concrete	F	6,960.00	6,957.43	J-12	6,960.00	6,957.05	0.01	0.623	8.995	5.65	5.86	6,958.41	6,958.47
P-25	43	30	Concrete	C	6,965.00	6,960.57	DP-4	6,965.00	6,960.14	0.01	1.287	7.592	9.85	6.87	6,961.76	6,961.86
P-26	123	36	Concrete	DP-4	6,965.00	6,960.14	DP-5	6,965.00	6,958.91	0.01	3.499	7.561	26.67	8.91	6,961.81	6,961.66
P-28	27	30	Concrete	B	6,965.00	6,960.41	DP-4	6,965.00	6,960.14	0.01	2.212	8.117	18.1	8.1	6,961.85	6,961.99
P-29	30	36	Concrete	A	6,970.00	6,964.61	J-2	6,970.00	6,964.31	0.01	0.962	7.944	7.71	6.52	6,965.60	6,965.56
P-30	82	36	Concrete	D	6,965.00	6,962.48	DP-3	6,965.00	6,961.66	0.01	4.499	9.086	41.21	9.93	6,964.57	6,964.04
P-103	66	18	Concrete	K	6,955.00	6,950.66	DP-10	6,950.00	6,950.00	0.01	0.171	7.562	1.31	4.05	6,951.50	6,951.50
P-31	277	72	Concrete	OS-5 / DP32	6,945.00	6,935.80	J-14	6,950.00	6,933.03	0.01	0	4.632	404	17.05	6,941.15	6,938.49
P-32	437	72	Concrete	J-14	6,950.00	6,933.03	DP-16	6,940.00	6,928.66	0.01	0	4.606	404	17.05	6,938.38	6,934.27
P-33	186	72	Concrete	DP-16	6,940.00	6,928.66	J-16	6,935.00	6,926.80	0.01	1.425	4.566	410.56	17.07	6,934.04	6,932.30
P-34	171	72	Concrete	J-16	6,935.00	6,926.80	DP-17	6,930.00	6,925.09	0.01	1.425	4.549	410.53	17.07	6,932.18	6,929.97
P-35	159	72	Concrete	DP-17	6,930.00	6,925.09	J-18	6,930.00	6,923.50	0.01	5.348	4.533	428.44	15.15	6,931.63	6,930.00
P-36	177	72	Concrete	J-18	6,930.00	6,923.50	J-19	6,930.00	6,921.73	0.01	5.348	4.517	428.35	15.15	6,931.81	6,930.00
P-37	225	72	Concrete	J-19	6,930.00	6,921.73	J-20	6,930.00	6,919.48	0.01	5.348	4.5	428.26	15.15	6,928.48	6,926.18
P-38	48	72	Concrete	J-20	6,930.00	6,919.48	DP-31	6,919.00	6,919.00	0.01	5.348	4.477	544.66	19.26	6,925.79	6,925.00
P-42	34	18	Concrete	P	6,940.00	6,929.00	DP-16	6,940.00	6,928.66	0.01	1.425	8.413	12.08	6.84	6,934.52	6,934.07
P-44	39	18	Concrete	Q	6,930.00	6,928.23	DP-33	6,930.00	6,927.84	0.01	2.67	8.995	24.2	13.7	6,932.07	6,930.00
P-45	275	30	Concrete	DP-33	6,930.00	6,927.84	DP-17	6,930.00	6,925.09	0.01	3.924	6.926	27.39	5.58	6,931.23	6,930.00
P-56	53	72	Concrete	Pond 2 Outlet	6,925.00	6,920.01	J-20	6,930.00	6,919.48	0.01	0	9.086	116.52	12.11	6,926.50	6,925.79
P-86	250	18	Concrete	EE	6,930.00	6,921.50	DP-31	6,919.00	6,919.00	0.01	3.747	6.278	23.71	13.42	6,933.24	6,920.50
P-47	53	36	Concrete	L/DP-12	6,950.00	6,933.65	J-22	6,950.00	6,933.12	0.01	6.175	8.777	54.63	7.73	6,936.67	6,936.31
P-48	123	36	Concrete	J-22	6,950.00	6,933.12	DP-13	6,950.00	6,931.89	0.01	6.175	8.728	54.33	10.52	6,935.51	6,934.45
P-49	124	42	Concrete	DP-13	6,950.00	6,931.89	DP-14	6,945.00	6,930.65	0.01	7.049	8.647	61.44	10.97	6,934.39	6,934.39
P-50	397	42	Concrete	DP-14	6,945.00	6,930.65	J-25	6,930.00	6,926.68	0.01	11.599	8.285	96.87	11.91	6,933.68	6,930.00
P-51	118	42	Concrete	J-25	6,930.00	6,926.68	J-26	6,930.00	6,925.50	0.01	11.599	8.085	94.53	9.82	6,930.68	6,929.64
P-52	50	42	Concrete	J-26	6,930.00	6,925.50	DP-15	6,925.00	6,925.00	0.01	11.599	8.015	93.71	11.88	6,928.87	6,928.50
P-53	31	18	Concrete	M	6,950.00	6,932.20	DP-13	6,950.00	6,931.89	0.01	0.874	9.04	7.96	4.51	6,934.63	6,934.45
P-55	47	18	Concrete	N	6,945.00	6,931.12	DP-14	6,945.00	6,930.65	0.01	4.55	8.299	38.07	21.54	6,940.02	6,933.85
P-102	50	18	Concrete	O	6,930.00	6,925.50	DP-15	6,925.00	6,925.00	0.01	2.554	8.995	23.16	13.11	6,928.93	6,926.50
P-104	166	36	Concrete	Pond 1 Outlet	6,955.00	6,936.66	DP-11	6,935.00	6,935.00	0.01	0	9.086	107.15	15.16	6,942.25	6,937.92
P-57	90	54	Concrete	S/DP-18	6,940.00	6,922.72	J-27	6,940.00	6,921.82	0.01	4.025	7.911	32.1	9.25	6,924.65	6,924.36
P-58	160	54	Concrete	J-27	6,940.00	6,921.82	J-28	6,940.00	6,920.22	0.01	4.025	7.857	31.88	9.23	6,923.74	6,922.20
P-59	362	54	Concrete	J-28	6,940.00	6,920.22	J-29	6,930.00	6,916.60	0.01	4.025	7.763	31.5	9.21	6,922.13	6,919.88
P-60	35	54	Concrete	J-29	6,930.00	6,916.60	DP-19	6,930.00	6,916.25	0.01	4.025	7.56	30.68	4.34	6,919.86	6,919.78
P-61	270	54	Concrete	DP-19	6,930.00	6,916.25	J-31	6,925.00	6,913.55	0.01	8.267	7.52	62.66	8.87	6,919.29	6,916.90
P-62	595	54	Concrete	J-31	6,925.00	6,913.55	DP-20	6,915.00	6,909.10	0.007	8.267	7.372	61.44	9.18	6,916.25	6,911.63
P-63	98	54	Concrete	DP-20	6,915.00	6,907.60	T-31	6,912.00	6,906.62	0.01	23.682	7.08	169.01	13.9	6,911.39	6,910.60
P-68	112	30	Concrete	T	6,930.00	6,917.37	DP-19	6,930.00	6,916.25	0.01	4.241	8.651	36.99	7.54	6,920.70	6,919.79
P-71	13	18	Concrete	V	6,915.00	6,907.73	DP-20	6,915.00	6,907.60	0.01	3.328	8.995	30.18	6.15	6,911.60	6,911.53
P-72	35	18	Concrete	U	6,915.00	6,907.95	DP-20	6,915.00	6,907.60	0.01	12.087	7.877	95.97	9.98	6,912.27	6,911.95

Shiloh Mesa
StormCAD 100-Year
Pipe Report

Label	Length (ft)	Section Size	Material	Upstream Node	Upstream Ground Elevation (ft)	Upstream Invert Elevation (ft)	Downstream Ground Elevation (ft)	Downstream Invert Elevation (ft)	Downstream Node	Slope (ft/ft)	System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-87	36	18	Concrete	OS-4	6,916.00	6,911.00	T-31	6,912.00	6,906.62	0.122	1.396	8.995	12.66	18.42	6,912.28	6,910.55
P-73	71.1	30	Concrete	W/DP-22	6,925.00	6,911.07	J-35	6,925.00	6,910.36	0.01	2.988	9.086	27.37	8.97	6,912.76	6,912.10
P-74	154.8	30	Concrete	J-35	6,925.00	6,910.06	J-36	6,920.00	6,908.51	0.01	2.988	9.026	27.18	8.96	6,911.75	6,911.63
P-75	63.2	36	Concrete	J-36	6,920.00	6,908.01	J-37	6,920.00	6,907.38	0.01	2.988	8.897	26.8	2.79	6,911.62	6,911.58
P-76	304.1	36	Concrete	J-37	6,920.00	6,907.08	J-38	6,915.00	6,904.04	0.01	2.988	8.735	26.64	2.73	6,911.48	6,911.27
P-77	55.8	36	Concrete	J-38	6,915.00	6,903.74	DP-24	6,915.00	6,903.38	0.006	7.48	8.029	61.28	6.29	6,911.21	6,911.00
P-78	240.3	36	Concrete	DP-24	6,915.00	6,902.88	DP-26	6,910.00	6,900.68	0.009	8.335	7.978	67.85	5.33	6,910.54	6,910.00
P-79	126.8	36	Concrete	DP-26	6,910.00	6,900.18	DP-28	6,910.00	6,898.91	0.01	9.595	7.731	75.69	5.95	6,909.98	6,909.63
P-80	103.2	48	Concrete	DP-28	6,910.00	6,898.61	DP-29	6,910.00	6,897.58	0.01	17.614	7.621	136.95	10.77	6,908.57	6,907.63
P-81	79.8	48	Concrete	DP-29	6,910.00	6,897.38	J-43	6,910.00	6,896.58	0.01	18.709	7.572	144.53	11.36	6,907.37	6,906.56
P-82	278.9	48	Concrete	J-43	6,910.00	6,896.28	J-44	6,909.00	6,893.49	0.01	18.709	7.537	143.86	11.31	6,904.26	6,901.47
P-83	103.9	48	Concrete	J-44	6,909.00	6,893.19	J-45	6,907.00	6,892.15	0.01	18.709	7.417	141.55	11.13	6,900.18	6,899.17
P-84	79.8	48	Concrete	J-45	6,907.00	6,891.85	OS-2	6,897.55	6,891.05	0.01	18.709	7.372	140.7	11.06	6,897.83	6,897.06
P-88	41	18	Concrete	X & Y / DP-23	6,915.00	6,905.69	J-38	6,915.00	6,905.24	0.011	4.492	8.413	38.09	21.55	6,917.31	6,911.92
P-90	128	30	Concrete	Z/DP-25	6,920.00	6,907.00	J-46	6,915.00	6,905.70	0.01	0.855	9.086	7.83	1.6	6,910.99	6,910.94
P-91	100	30	Concrete	J-46	6,915.00	6,905.40	DP-24	6,915.00	6,904.38	0.01	0.855	8.515	7.34	1.5	6,910.91	6,910.88
P-93	37	21	Concrete	AA	6,915.00	6,901.55	DP-26	6,910.00	6,901.18	0.01	1.26	9.086	11.54	1.63	6,910.01	6,910.00
P-95	35.2	18	Concrete	CC	6,910.00	6,902.32	J-47	6,910.00	6,901.96	0.01	8.019	8.906	71.99	7.48	6,910.18	6,910.00
P-96	170.7	24	Concrete	J-47	6,910.00	6,901.66	J-48	6,910.00	6,899.65	0.012	8.019	8.872	71.71	5.71	6,910.43	6,910.00
P-97	73.5	36	Concrete	J-48	6,910.00	6,899.65	DP-28	6,910.00	6,898.91	0.01	8.019	8.661	70.01	5.57	6,909.83	6,909.65
P-99	21	18	Concrete	BB/DP-27	6,910.00	6,901.39	J-49	6,910.00	6,901.18	0.01	1.095	8.11	8.96	5.07	6,910.15	6,910.00
P-100	99	18	Concrete	J-49	6,910.00	6,900.88	DP-29	6,910.00	6,899.88	0.01	1.095	8.086	8.93	5.05	6,910.72	6,910.00
P-96	650	24	Concrete	OS-7	6,936.00	6,933.00	DP-33	6,930.00	6,927.84	0.008	1.254	7.386	9.34	6.23	6,934.02	6,930.00
P-122	250.6	48	Concrete	T-31	6,912.00	6,906.62	OS-9 / DP-21	6,910.00	6,904.11	0.01	25.079	7.05	178.21	14.01	6,910.49	6,907.49
P-141	157.4	12	Concrete	OS-2	6,897.55	6,890.75	DP-30	6,895.44	6,889.96	0.005	19.916	7.338	149.08	11.72	6,895.47	6,893.55
P-143	22.8	12	Concrete	OS-3	6,895.44	6,891.44	DP-30	6,895.44	6,891.66	-0.01	1.359	9.086	12.44	3.96	6,893.41	6,893.26

Shiloh Mesa
StormCAD 5-Year
Catchment Report

Catchment Node	Area (acres)	Rational C	Catchment CA	Time of Concentration (min)	Outflow Node	Catchment Intensity	5-year Peak Discharge (cfs)
L/DP-12 Catchment	6.5	0.95	6.175	5.7	L/DP-12	4.931	30.69
M Catchment	0.92	0.95	0.874	5.1	M	5.079	4.47
N Catchment	4.79	0.95	4.55	6.9	N	4.662	21.39
O Catchment	2.97	0.86	2.554	5.2	O	5.053	13.01
OS-1/DP-1 Catchment	4.26	0.35	1.491	15.5	OS-1/DP-1	3.41	5.13
I/DP-8 Catchment	2.82	0.46	1.297	8.5	I/DP-8	4.352	5.69
S/DP-18 Catchment	4.85	0.83	4.025	8	S/DP-18	4.444	18.03
J Catchment	3.9	0.63	2.457	5.9	J	4.883	12.09
G & H Catchment	3.68	0.71	2.612	7.4	G & H	4.56	12.01
T Catchment	4.99	0.85	4.241	6	T	4.86	20.78
E Catchment	2.34	0.7	1.638	7.3	E	4.58	7.56
F Catchment	0.82	0.76	0.623	5.2	F	5.053	3.17
V Catchment	3.87	0.86	3.328	5.2	V	5.053	16.95
C Catchment	1.57	0.82	1.287	9	C	4.265	5.53
B Catchment	3.16	0.7	2.212	7.4	B	4.56	10.17
A Catchment	2.75	0.35	0.962	7.9	A	4.463	4.33
D Catchment	5.92	0.76	4.499	5	D	5.105	23.15
K Catchment	0.49	0.35	0.171	9.1	K	4.248	0.73
U Catchment	13.43	0.9	12.087	8.1	U	4.425	53.92
OS-4 Catchment	1.47	0.95	1.396	5.2	OS-4	5.053	7.11
OS-2 Catchment	1.27	0.95	1.207	5	OS-2	5.105	6.21
W/DP-23 Catchment	3.32	0.9	2.988	5	W/DP-22	5.105	15.37
X & Y/ DP-23 Catchment	6.63	0.678	4.492	6.6	X & Y / DP-23	4.726	21.4
Z/DP-25 Catchment	0.95	0.9	0.855	5	Z/DP-25	5.105	4.4
AA Catchment	1.4	0.9	1.26	5	AA	5.105	6.48
P Catchment	1.5	0.95	1.425	6.6	P	4.726	6.79
Q Catchment	2.81	0.95	2.67	5.2	Q	5.053	13.6
CC Catchment	8.91	0.9	8.019	5.4	CC	5.003	40.44
BB/DP-27 Catchment	3.13	0.35	1.095	7.42	BB/DP-27	4.556	5.03
EE Catchment	4.57	0.82	3.747	14.4	EE	3.527	13.32
CATCHMENT OS-7	1.32	0.95	1.254	9.7	OS-7	4.149	5.25
OS-9 Catchment	1.19	0.95	1.13	11.2	OS-9 / DP-21	3.924	4.47
OS-3 Catchment	1.43	0.95	1.359	5	OS-3	5.105	6.99

Shiloh Mesa
StormCAD 100-Year
Catchment Report

Catchment Node	Area (acres)	Rational C	Catchment CA	Time of Concentration (min)	Outflow Node	Catchment Intensity	100-year Peak Discharge (cfs)
L/DP-12 Catchment	6.5	0.95	6.175	5.7	L/DP-12	8.777	54.63
M Catchment	0.92	0.95	0.874	5.1	M	9.04	7.96
N Catchment	4.79	0.95	4.55	6.9	N	8.299	38.07
O Catchment	2.97	0.86	2.554	5.2	O	8.995	23.16
OS-1/DP-1 Catchment	4.26	0.35	1.491	15.5	OS-1/DP-1	6.071	9.12
I/DP-8 Catchment	2.82	0.46	1.297	8.5	I/DP-8	7.747	10.13
S/DP-18 Catchment	4.85	0.83	4.025	8	S/DP-18	7.911	32.1
J Catchment	3.9	0.63	2.457	5.9	J	8.693	21.53
G & H Catchment	3.68	0.71	2.612	7.4	G & H	8.117	21.37
T Catchment	4.99	0.85	4.241	6	T	8.651	36.99
E Catchment	2.34	0.7	1.638	7.3	E	8.153	13.46
F Catchment	0.82	0.76	0.623	5.2	F	8.995	5.65
V Catchment	3.87	0.86	3.328	5.2	V	8.995	30.18
C Catchment	1.57	0.82	1.287	9	C	7.592	9.85
B Catchment	3.16	0.7	2.212	7.4	B	8.117	18.1
A Catchment	2.75	0.35	0.962	7.9	A	7.944	7.71
D Catchment	5.92	0.76	4.499	5	D	9.086	41.21
K Catchment	0.49	0.35	0.171	9.1	K	7.562	1.31
U Catchment	13.43	0.9	12.087	8.1	U	7.877	95.97
OS-4 Catchment	1.47	0.95	1.396	5.2	OS-4	8.995	12.66
OS-2 Catchment	1.27	0.95	1.207	5	OS-2	9.086	11.05
W/DP-23 Catchment	3.32	0.9	2.988	5	W/DP-22	9.086	27.37
X & Y/ DP-23 Catchment	6.63	0.678	4.492	6.6	X & Y / DP-23	8.413	38.09
Z/DP-25 Catchment	0.95	0.9	0.855	5	Z/DP-25	9.086	7.83
AA Catchment	1.4	0.9	1.26	5	AA	9.086	11.54
P Catchment	1.5	0.95	1.425	6.6	P	8.413	12.08
Q Catchment	2.81	0.95	2.67	5.2	Q	8.995	24.2
CC Catchment	8.91	0.9	8.019	5.4	CC	8.906	71.99
BB/DP-27 Catchment	3.13	0.35	1.095	7.42	BB/DP-27	8.11	8.96
EE Catchment	4.57	0.82	3.747	14.4	EE	6.278	23.71
OS-10 Catchment	2.61	0.95	2.48	16.4	OS-10	5.913	14.78
CATCHMENT OS-7	1.32	0.95	1.254	9.7	OS-7	7.386	9.34
OS-9 Catchment	1.19	0.95	1.13	11.2	OS-9 / DP-21	6.985	7.96
OS-3 Catchment	1.43	0.95	1.359	5	OS-3	9.086	12.44

APPENDIX C

STANDARD DESIGN CHARTS AND TABLES

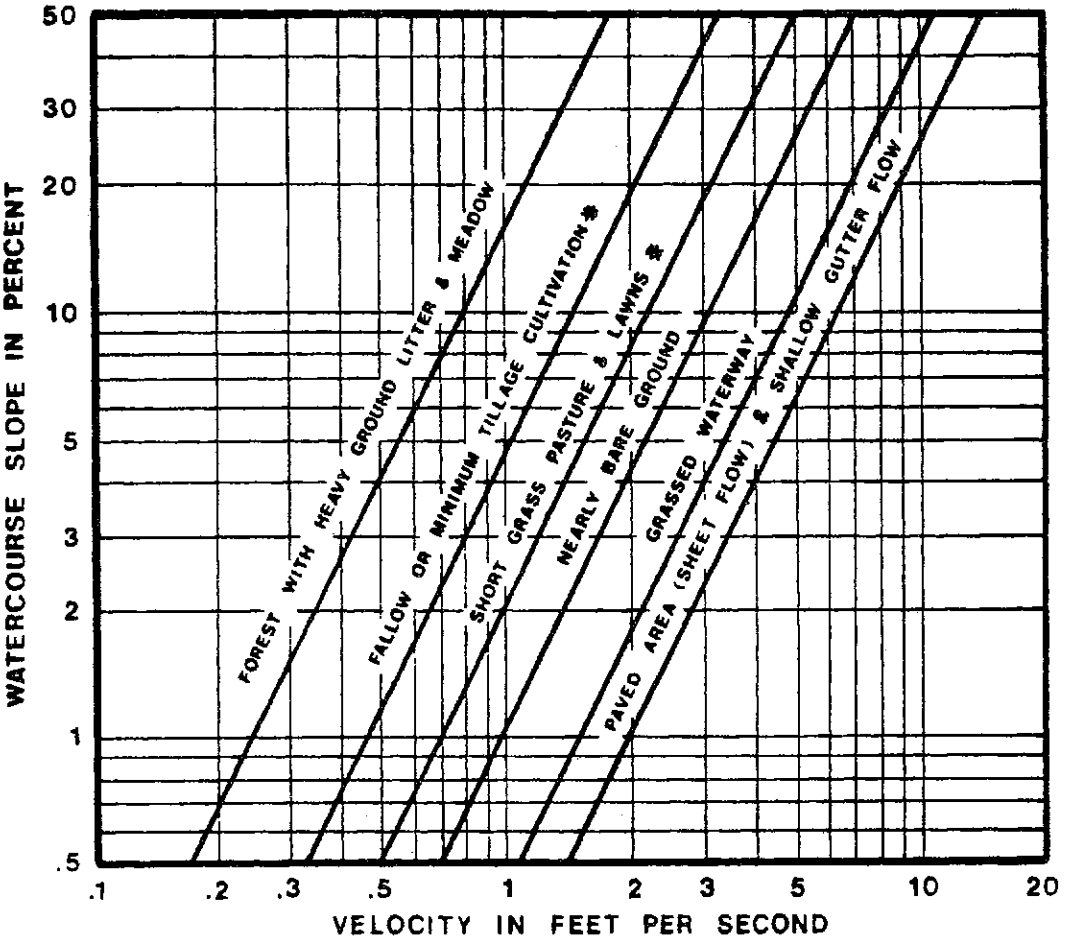

Figure RO-1—Estimate of Average Overland Flow Velocity for Use With the Rational Formula

TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

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

* Hydrologic Soil Group

9/30/90

APPENDIX D

ESI MDDP ANALYSIS

MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR WOODMEN HEIGHTS AND FINAL DRAINAGE REPORT FOR FOREST MEADOWS FILING NO. 1 AND NO. 4

February 2006

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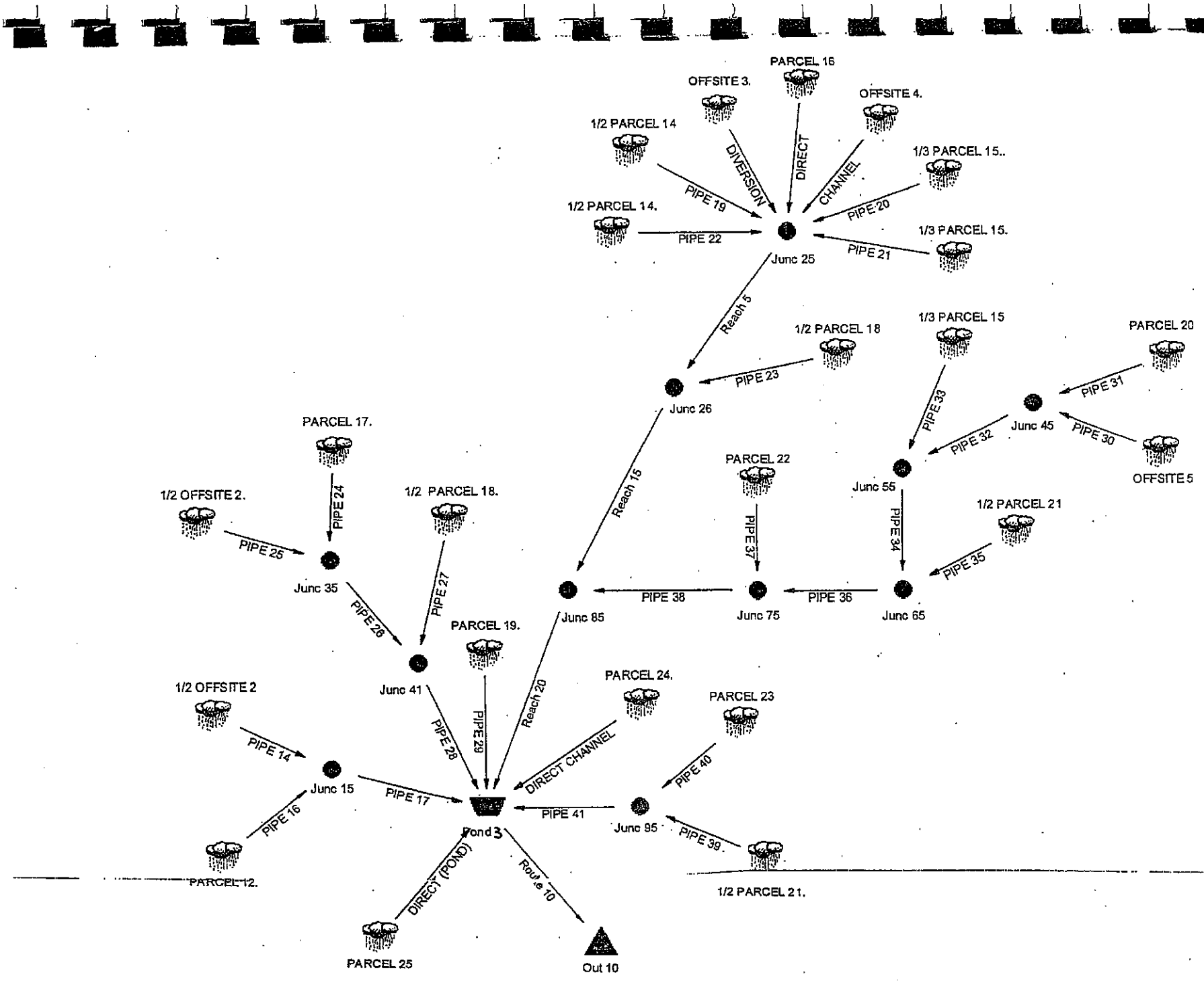

PARCEL 16
OFFSITE 3.
OFFSITE 4.
1/2 PARCEL 14
1/3 PARCEL 15..
DIVERSION
DIRECT
CHANNEL
PIPE 19
PIPE 20
1/2 PARCEL 14.
PIPE 22
1/3 PARCEL 15.
PIPE 21
Junc 25
Reach 5
1/2 PARCEL 18
1/3 PARCEL 15
PARCEL 20
PIPE 23
PIPE 31
Junc 26
PIPE 33
Junc 45
PIPE 32
PIPE 30
PARCEL 17.
PARCEL 22
OFFSITE 5
Junc 55
1/2 OFFSITE 2.
1/2 PARCEL 18.
PIPE 24
1/2 PARCEL 21
Reach 15
PIPE 37
PIPE 34
PIPE 25
PIPE 35
Junc 35
PIPE 38
PIPE 36
Junc 85
Junc 75
Junc 65
PIPE 27
PIPE 28
PARCEL 19.
Junc 41
PARCEL 24.
1/2 OFFSITE 2
PARCEL 23
Reach 20
PIPE 28
PIPE 29
DIRECT CHANNEL
PIPE 40
PIPE 14
Junc 15
PIPE 17
PIPE 41
Junc 95
PIPE 16
Pond 3
PIPE 39
PARCEL 12.
1/2 PARCEL 21.
DIRECT (POND)
Route 10
PARCEL 25
Out 10

NETWORK SUMMARY -- LINKS

(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = El Paso County

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm TypeIIA 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 4.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .5000 hrs End= 24.0000 hrs

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points	
CHANNEL	ADD	UN	624.572		7.2000	2457.30	OFFSITE 4.	
		DL	624.572		7.2000	2457.30		
		DN	738.691		6.9500	2781.53	JUNC 25	
DIRECT	ADD	UN	.340		6.1250	2.18	PARCEL 16	
		DL	.340		6.1250	2.18		
		DN	738.691		6.9500	2781.53	JUNC 25	
DIRECT (POND)	ADD	UN	3.195		6.2000	35.54	PARCEL 25	
		DL	3.195		6.2000	35.54		
		DN	935.626		7.0500	3206.52	POND 20	IN
DIRECT CHANNEL	ADD	UN	.322		6.1250	2.07	PARCEL 24.	
		DL	.322		6.1250	2.07		
		DN	935.626		7.0500	3206.52	POND 20	IN
DIVERSION	ADD	UN	98.617		6.5250	687.59	OFFSITE 3.	
		DL	98.617		6.5250	687.59		
		DN	738.691		6.9500	2781.53	JUNC 25	
PIPE 14	ADD	UN	49.309		6.5250	343.80	1/2 OFFSITE 2	
		DL	49.309		6.5250	343.80		
		DN	63.634		6.2500	404.64	JUNC 15	
PIPE 16	ADD	UN	14.325		6.0750	214.80	PARCEL 12.	
		DL	14.325		6.0750	214.80		
		DN	63.634		6.2500	404.64	JUNC 15	

NETWORK SUMMARY -- LINKS
(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = El Paso County

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm TypeIIA 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 4.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .5000 hrs End= 24.0000 hrs

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points	
CHANNEL	ADD	UN	624.572		7.2000	2457.30	OFFSITE 4.	
		DL	624.572		7.2000	2457.30		
		DN	738.691		6.9500	2781.53	JUNC 25	
DIRECT	ADD	UN	.340		6.1250	2.18	PARCEL 16	
		DL	.340		6.1250	2.18		
		DN	738.691		6.9500	2781.53	JUNC 25	
DIRECT (POND)	ADD	UN	3.195		6.2000	35.54	PARCEL 25	
		DL	3.195		6.2000	35.54		
		DN	935.626		7.0500	3206.52	POND 20	IN
DIRECT CHANNEL	ADD	UN	.322		6.1250	2.07	PARCEL 24.	
		DL	.322		6.1250	2.07		
		DN	935.626		7.0500	3206.52	POND 20	IN
DIVERSION	ADD	UN	98.617		6.5250	687.59	OFFSITE 3.	
		DL	98.617		6.5250	687.59		
		DN	738.691		6.9500	2781.53	JUNC 25	
PIPE 14	ADD	UN	49.309		6.5250	343.80	1/2 OFFSITE 2	
		DL	49.309		6.5250	343.80		
		DN	63.634		6.2500	404.64	JUNC 15	
PIPE 16	ADD	UN	14.325		6.0750	214.80	PARCEL 12.	
		DL	14.325		6.0750	214.80		
		DN	63.634		6.2500	404.64	JUNC 15	

Type.... Executive Summary (Links) Event: 100 yr
Name.... Watershed
File.... G:\Projects\08001\Woodmen Heights\Pondpack\ESI\POND 3 ULT DEV ESI.PPW
Storm... TypeIIA 24hr Tag: Dev100

NETWORK SUMMARY -- LINKS

(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points
PIPE 17	ADD	UN	63.634		6.2500	404.64	JUNC 15
		DL	63.634		6.2500	404.64	
		DN	935.626		7.0500	3206.52	POND 20 IN
PIPE 19	ADD	UN	3.993		6.0250	65.19	1/2 PARCEL 14
		DL	3.993		6.0250	65.19	
		DN	738.691		6.9500	2781.53	JUNC 25
PIPE 20	ADD	UN	3.409		6.0000	56.54	1/3 PARCEL 15..
		DL	3.409		6.0000	56.54	
		DN	738.691		6.9500	2781.53	JUNC 25
PIPE 21	ADD	UN	3.768		6.0000	62.73	1/3 PARCEL 15.
		DL	3.768		6.0000	62.73	
		DN	738.691		6.9500	2781.53	JUNC 25
PIPE 22	ADD	UN	3.993		6.0250	65.19	1/2 PARCEL 14.
		DL	3.993		6.0250	65.19	
		DN	738.691		6.9500	2781.53	JUNC 25
PIPE 23	ADD	UN	3.689		6.0000	61.42	1/2 PARCEL 18
		DL	3.689		6.0000	61.42	
		DN	742.381		7.0000	2779.84	JUNC 26
PIPE 24	ADD	UN	3.222		6.0250	52.61	PARCEL 17.
		DL	3.222		6.0250	52.61	
		DN	52.531		6.4000	350.09	JUNC 35
PIPE 25	ADD	UN	49.309		6.5250	343.80	1/2 OFFSITE 2.
		DL	49.309		6.5250	343.80	
		DN	52.531		6.4000	350.09	JUNC 35
PIPE 26	ADD	UN	52.531		6.4000	350.09	JUNC 35
		DL	52.531		6.4000	350.09	
		DN	55.452		6.4000	354.63	JUNC 41
PIPE 27	ADD	UN	2.921		6.0000	48.63	1/2 PARCEL 18.
		DL	2.921		6.0000	48.63	
		DN	55.452		6.4000	354.63	JUNC 41

Type.... Executive Summary (Links) Event: 100 yr
Name.... Watershed
File.... G:\Projects\08001\Woodmen Heights\Pondpack\ESI\POND 3 ULT DEV ESI.PPW
Storm... TypeIIA 24hr Tag: Dev100

NETWORK SUMMARY -- LINKS

(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points	
PIPE 28	ADD	UN	55.452		6.4000	354.63	JUNC 41	
		DL	55.452		6.4000	354.63		
		DN	935.626		7.0500	3206.52	POND 20	IN
PIPE 29	ADD	UN	.427		6.0000	8.91	PARCEL 19.	
		DL	.427		6.0000	8.91		
		DN	935.626		7.0500	3206.52	POND 20	IN
PIPE 30	ADD	UN	34.135		6.1500	386.63	OFFSITE 5	
		DL	34.135		6.1500	386.63		
		DN	39.173		6.1500	441.75	JUNC 45	
PIPE 31	ADD	UN	5.038		6.0250	80.10	PARCEL 20.	
		DL	5.038		6.0250	80.10		
		DN	39.173		6.1500	441.75	JUNC 45	
PIPE 32	ADD	UN	39.173		6.1500	441.75	JUNC 45	
		DL	39.173		6.1500	441.75		
		DN	43.518		6.1000	483.28	JUNC 55	
PIPE 33	ADD	UN	4.345		6.0000	72.31	1/3 PARCEL 15	
		DL	4.345		6.0000	72.31		
		DN	43.518		6.1000	483.28	JUNC 55	
PIPE 34	ADD	UN	43.518		6.1000	483.28	JUNC 55	
		DL	43.518		6.1000	483.28		
		DN	50.872		6.1000	586.96	JUNC 65	
PIPE 35	ADD	UN	7.355		6.0250	116.93	1/2 PARCEL 21	
		DL	7.355		6.0250	116.93		
		DN	50.872		6.1000	586.96	JUNC 65	
PIPE 36	ADD	UN	50.872		6.1000	586.96	JUNC 65	
		DL	50.872		6.1000	586.96		
		DN	55.742		6.0750	648.71	JUNC 75	
PIPE 37	ADD	UN	4.870		6.0000	81.06	PARCEL 22	
		DL	4.870		6.0000	81.06		
		DN	55.742		6.0750	648.71	JUNC 75	

Type.... Executive Summary (Links)
Event: 100 yr
Name.... Watershed
File.... G:\Projects\08001\Woodmen Heights\Pondpack\ESI\POND 3 ULT DEV ESI.PPW
Storm... TypeIIA 24hr Tag: Dev100

NETWORK SUMMARY -- LINKS

(UN=Upstream Node; DL=DNstream End of Link; DN=DNstream Node)
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

Link ID	Type		HYG Vol ac-ft	Trun.	Peak Time hrs	Peak Q cfs	End Points	
PIPE 38	ADD	UN	55.742		6.0750	648.71	JUNC 75	
		DL	55.742		6.0750	648.71		
		DN	798.123		7.0500	2845.28	JUNC 85	
PIPE 39	ADD	UN	7.355		6.0250	116.93	1/2 PARCEL 21.	
		DL	7.355		6.0250	116.93		
		DN	14.474		6.0000	234.99	JUNC 95	
PIPE 40	ADD	UN	7.119		6.0000	118.54	PARCEL 23	
		DL	7.119		6.0000	118.54		
		DN	14.474		6.0000	234.99	JUNC 95	
PIPE 41	ADD	UN	14.474		6.0000	234.99	JUNC 95	
		DL	14.474		6.0000	234.99		
		DN	935.626		7.0500	3206.52	POND 20	IN
REACH 15	REACH	UN	742.381		7.0000	2779.84	JUNC 26	
		DL	742.381		7.0500	2776.02		
		DN	798.123		7.0500	2845.28	JUNC 85	
REACH 20	REACH	UN	798.123		7.0500	2845.28	JUNC 85	
		DL	798.123		7.1000	2841.97		
		DN	935.626		7.0500	3206.52	POND 20	IN
REACH 5	REACH	UN	738.691		6.9500	2781.53	JUNC 25	
		DL	738.691		7.0000	2776.63		
		DN	742.381		7.0000	2779.84	JUNC 26	
ROUTE 10	PONDrt	UN	935.626		7.0500	3206.52	POND 20	IN
ROUTE 10			935.622		7.9000	2242.32	POND 20	OUT
		DL	935.622		7.9000	2242.32		
		DN	935.622		7.9000	2242.32	OUT 10	

Type.... Unit Hyd. Summary
Name.... OFFSITE 5 Tag: Dev100 Event: 100 yr
File.... G:\Projects\08001\Woodmen Heights\Pondpack\ESI\POND 3 ULT DEV ESI.PPW
Storm... TypeIIA 24hr Tag: Dev100

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 4.4000 in
Rain Dir = G:\Projects\08001\Woodmen Heights\Pondpack\ESI\
Rain File -ID = - TypeIIA 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = G:\Projects\08001\Woodmen Heights\Pondpack\ESI\
HYG File - ID = work_pad.hyg - OFFSITE 5 Dev100
Tc = .4400 hrs
Drainage Area = 323.000 acres Runoff CN= 65

==========
Computational Time Increment = .05867 hrs
Computed Peak Time = 6.1600 hrs
Computed Peak Flow = 391.01 cfs

Time Increment for HYG File = .0250 hrs
Peak Time, Interpolated Output = 6.1500 hrs
Peak Flow, Interpolated Output = 386.63 cfs
==========

DRAINAGE AREA

ID:OFFSITE 5
CN = 65
Area = 323.000 acres
S = 5.3846 in
0.2S = 1.0769 in

Cumulative Runoff

1.2682 in
34.135 ac-ft

HYG Volume... 34.135 ac-ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .44000 hrs (ID: OFFSITE 5)
Computational Incr, Tm = .05867 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 831.76 cfs
Unit peak time Tp = .29333 hrs
Unit receding limb, Tr = 1.17333 hrs
Total unit time, Tb = 1.46667 hrs

CLASSIC MDDP DRAINAGE BASIN MAP

DEVELOPED CONDITIONS
WOODMEN HEIGHTS
MASTER DEVELOPMENT DRAINAGE PLAN
JUNE, 2004

VICINITY MAP
N.T.S.

PIPE RUN SUMMARY

PARCEL RUNOFF SUMMARY

OFFSITE RUNOFF SUMMARY

PER DBPS, ALTERNATIVE REGIONAL DETENTION POND. NECESSARY FOR INCREASE OF DEVELOPED FLOWS TRIBUTARY TO SAND CREEK NORTH OF WOODMEN HEIGHTS.

DET. SITE ALT. 'C'

PREVIOUSLY COTTONWOOD DRAINAGE BASIN (2.08 AC.)

COTTONWOOD CREEK

MAIN STEM SAND CREEK BASIN BOUNDARY

OS-A 100.9

EXISTING 18" RCP AND 36" CMP CULVERTS TO REMAIN UNTIL REPLACED OR EXTENDED WITH BLACK FOREST ROAD IMPROVEMENTS

RUNOFF DISCHARGED FROM OS-A NOT TO EXCEED HISTORIC RATES Qs= 41 Q100= 95

EXIST. 60" RCP CULVERT TO BE RELOCATED. AN ADDITIONAL 60" RCP IS REQUIRED TO CONVEY RUNOFF.

EXIST. 48" RCP CULVERT CONSTRUCTED WITH EL PASO COUNTY WOODMEN SAFETY PROJECT 'A'

OS-B 54.9

REEL ANNEX.

RUNOFF DISCHARGED FROM OS-B NOT TO EXCEED HISTORIC RATES Qs= 20.5 Q100= 52.5

BLACK FOREST ROAD

WOODMEN ROAD

OS-1 109

OS-2 500

OS-3 600

OS-4 CHAN

OS-5 323

3.5-7.99 DU/AC 53.7 ACRES

3.5-7.99 DU/AC 30.9 ACRES

3.5-7.99 DU/AC 33.7 ACRES

3.5-7.99 DU/AC 39.2 ACRES

3.5-7.99 DU/AC 67.1 ACRES

3.5-7.99 DU/AC 62.4 ACRES

SCHOOL 20.0 ACRES

PARK 50.0 AC.

8-11.99 DU/AC 18.7 ACRES

12-15.99 DU/AC 18.7 ACRES

REMOVE EXISTING 30" CMP'S REDIRECT FLOW INTO PIPE

OPEN CHANNEL OR 72" RCP

NEIGHBORHOOD COMMERCIAL/ OFFICE 21.2 ACRES

REGIONAL DETENTION FACILITY NO. 6 6.3 ACRES

NEIGHBORHOOD COMMERCIAL/ OFFICE 26.6 ACRES

NEIGHBORHOOD COMMERCIAL/ OFFICE 21.7 ACRES

REGIONAL DETENTION FACILITY NO. 3 25.5 ACRES

COMMUNITY COMMERCIAL/ OFFICE 24.3 ACRES

COMMUNITY COMMERCIAL/ OFFICE 32.8 ACRES

OFFICE 9.8 ACRES

71 ACRE-FT FACILITY SAND CREEK DETENTION BASIN #6

APPROXIMATE LOCATION OF RELOCATED ELECTRIC LINE/POLES AND CORRESPONDING PROPOSED UTILITY EASEMENT

NEIGHBORHOOD COMMERCIAL/ OFFICE/ MULTI-FAMILY 22.9 ACRES

8-11.99 DU/AC 13.8 ACRES

224 ACRE-FT FACILITY SAND CREEK DETENTION BASIN #3

OPEN SPACE 7.4 ACRES

MAJOR PUBLIC ASSEMBLY 24.9 ACRES

MAJOR PUBLIC ASSEMBLY 14.9 ACRES

SECONDARY SCHOOL 22.6 ACRES

MAJOR PUBLIC ASSEMBLY 17.3 ACRES

PARK 6.7 ACRES

NEIGHBORHOOD COMMERCIAL/ MULTI-FAMILY 18.7 ACRES

MAJOR PUBLIC ASSEMBLY 50.4 ACRES

COMMUNITY COMMERCIAL/ OFFICE 37.7 ACRES

EAST FORK SAND CREEK BASIN

IMPROVED RIPRAP CHANNEL BW=25', d=3', S=1.2% -3' DROPS @270' INTERVALS Q100=600 cfs CHANNEL DIVERSION

Q100=2630 cfs Q10 = 770 cfs

SAND CREEK CHANNEL IMPROVEMENTS PER SAND CREEK DBPS:
(2) CHECK STRUCTURES
(2) DROP STRUCTURES
TRIPLE 10X10 BOX CULVERT AT MARKSHEFFEL ROAD CROSSING

REMOVE EXISTING 42" CMP'S REPLACE W/ 2-60" CMP W/ FES

MAIN STEM SAND CREEK BASIN BOUNDARY

IMPROVED GRASSLINED CHANNEL BW=20', d=3', S=1.3% Q100=370 cfs ALTERNATIVE TO PIPE SYSTEM

EAST FORK SAND CREEK BASIN

MARKSHEFFEL ROAD (80' R.O.W.)

FUTURE REALIGNMENT

MARKSHEFFEL ROAD (80' R.O.W.)

BANNING LEWIS RANCH PHASE I

PROPOSED INDEX CONTOUR — EXIST. INDEX CONTOUR — PARCEL DESIGNATION — PIPE ROUTING — STORM SEWER PIPE — NATURAL CHANNEL — PROPOSED LAND USE — OFFSITE DRAINAGE BASIN — PROPOSED POND — PROPOSED WATER QUALITY POND — BASIN/PARCEL BOUNDARY

N

SCALE: 1" = 300'

DEVELOPED CONDITIONS
WOODMEN HEIGHTS
2077.00
8/03/04
SHEET 1 OF 1

CLASSIC CONSULTING ENGINEERS & SURVEYORS

FINAL
HYDROLOGY AND HYDRAULICS REPORT

FOR

WOODMEN ROAD
POWERS
TO
US 24
EL PASO COUNTY, COLORADO

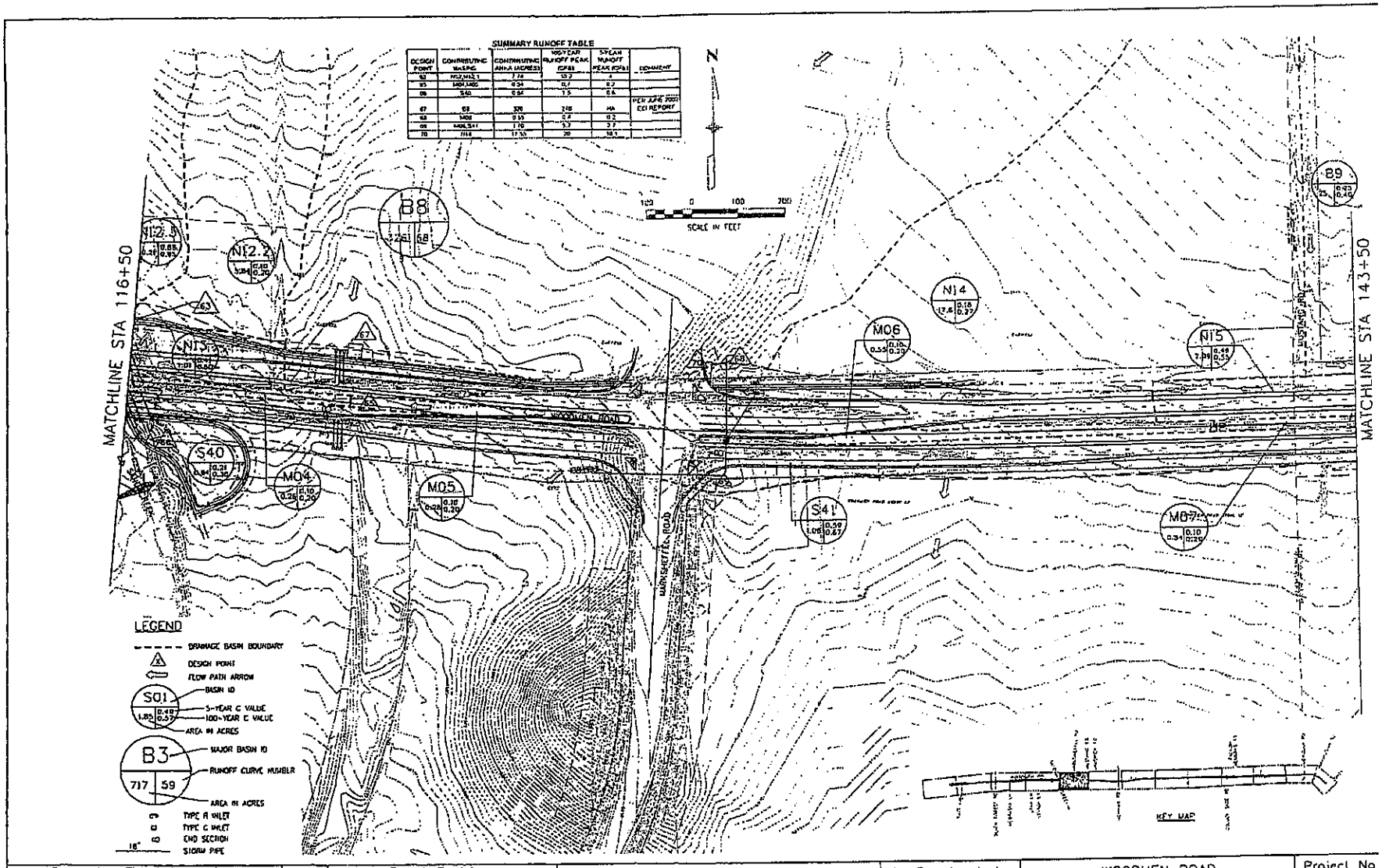
September 22, 2006
REVISED: October 4, 2007

PREPARED FOR:

EL PASO COUNTY
DEPARTMENT OF TRANSPORTATION
3275 AKERS DRIVE
PROJECT NUMBER STU M240-062

PREPARED BY:

DMJM HARRIS – AECOM
717 SEVENTEENTH STREET, SUITE 500
DENVER. COLORADO 80202



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Creation Date:	8/04/05	Initials:	LPS
Last Modification Date:	10/5/2007	Initials:	LPS
Full Pathnl:	\495\4954_0604\cadd\drainage report\54drdsn05.dgn		
Drawing Scale:	1"=200'		
V8 Ver.	08.00.01.19	Units:	ENGLISH

Sheet Revisions			

DM|M HARRIS | AECOM
2950 Professional Place
Colorado Springs, Colorado 80904
Phone: (719) 386-8500 Fax: (719) 386-8538

As Constructed	
No Revisions:	-
Revised:	-
Void:	-

WOODMEN ROAD
SUB-BASIN PLAN – WOODMEN ROAD

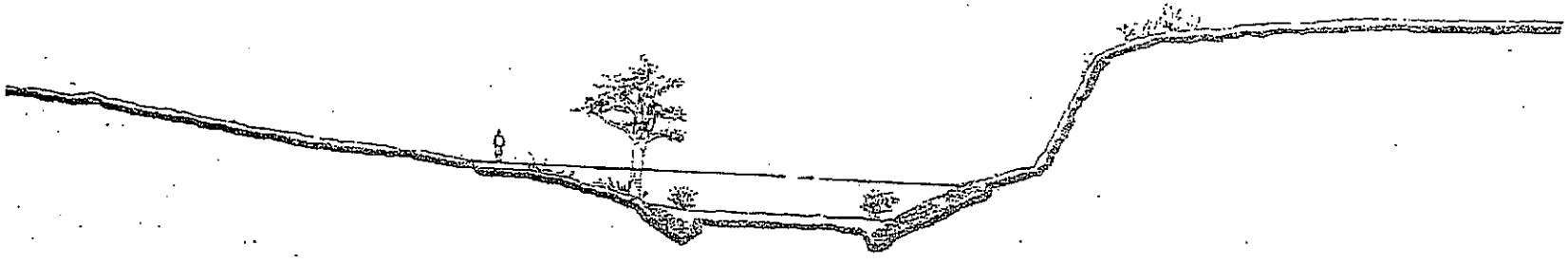
Designer:	DLK	Structure Numbers	
Detailer:	LPS		
Sheet Subset:	ROADWAY	Subset Sheets: DRNDSN 5 of 13	

Project No
STU M240
1326
Sheet Number

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

PREPARED BY:

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

100-year peak discharge to levels. This will allow for the channel improvements to be constructed within the existing right-of way.

Reaches SC-5 and SC-6: A selective channel improvement concept has been recommended for these reaches. Detention in Reach SC-8 of the basin will maintain flows to historic peak discharge levels, however the low flows will increase in frequency and volume. For this reason it has been recommended to provide riprap channel linings at selective locations to at least the 10-year water surface and install grade controls. This will prevent the long-term degradation of the invert. A residual 100-year floodplain will remain and will offer opportunities for habitat replacement and open space preservation. Land adjacent to the drainageway is currently undeveloped or unplatted at this time which makes the feasibility of implementing this concept greater in comparison to the urbanized reaches of the creek.

Reaches SC-7 and SC-8: A selective improvement concept involving the localized lining of channel banks and grade control construction has been recommended for these reaches. The feasibility of this concept stems from the fact that flows will be reduced because of detention. Numerous individual rural ownerships cross the drainageway, however no habitable structures lie within the 100-year floodplain. Because of this, the economic feasibility of channelization concepts is low. Non-structural measures can be used to limit encroachments into floodprone areas. Additionally, the City of Colorado Springs Comprehensive plan recommends that the floodplains be maintained as open space. Potential habitat disturbances can be avoided with a selective plan, or simply replaced as part of the particular construction activity which caused the disturbance.

Reach SC-9: A floodplain preservation concept has been recommended for this reach. Little increase in urbanization is anticipated in this reach, and for this reason the existing drainageway is expected to remain stable. Localized improvements may be necessary to limit erosion caused by flow concentrations at culverts or storm sewers. Private ownership of the drainageway is anticipated to continue which lower the feasibility of channel concepts which require permanent right-of-ways or easements for construction and maintenance.

Reaches WF-1 through WF-3: A 100-year channel concept has been recommended for these reaches primarily because of the potential for flooding damages. Several roadway crossings are in need of replacement because of the flood hazard the constrictions create. Some open space enhancement potential exists for this concept since these reaches have been degraded visually by debris accumulation, bank sloughing and sedimentation. Little opportunity exists for widening the drainageway because the

SAND CREEK DRAINAGE BASIN PLANNING STUDY

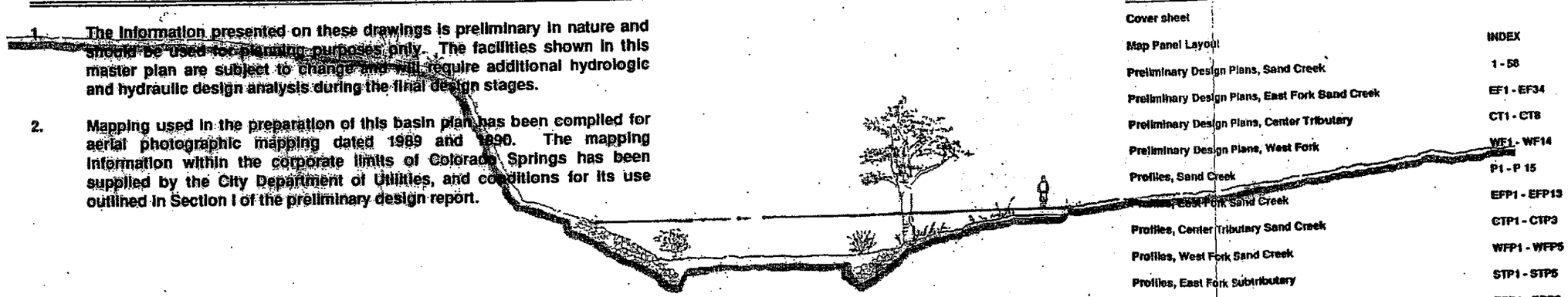
PRELIMINARY DESIGN OF SELECTED ALTERNATIVE

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO

GENERAL NOTES

1. The information presented on these drawings is preliminary in nature and should be used for planning purposes only. The facilities shown in this master plan are subject to change and will require additional hydrologic and hydraulic design analysis during the final design stages.

2. Mapping used in the preparation of this basin plan has been compiled for aerial photographic mapping dated 1989 and 1990. The mapping information within the corporate limits of Colorado Springs has been supplied by the City Department of Utilities, and conditions for its use outlined in Section I of the preliminary design report.



INDEX OF DRAWINGS	Panel No.
Cover sheet	
Map Panel Layout	INDEX
Preliminary Design Plans, Sand Creek	1 - 58
Preliminary Design Plans, East Fork Sand Creek	EF1 - EF34
Preliminary Design Plans, Center Tributary	CT1 - CT8
Preliminary Design Plans, West Fork	WF1 - WF14
Profiles, Sand Creek	P1 - P 15
Profiles, East Fork Sand Creek	EFP1 - EFP13
Profiles, Center Tributary Sand Creek	CTP1 - CTP3
Profiles, West Fork Sand Creek	WFP1 - WFP5
Profiles, East Fork Subtributary	STP1 - STP5
Profiles, East Bierstadt Creek	EBP1 - EBP3
Profiles, West Bierstadt Creek	WBP1 - WBP4
Typical Channel Sections and Details	CS1 - CS7
Typical Detention Basin Detail	CS8

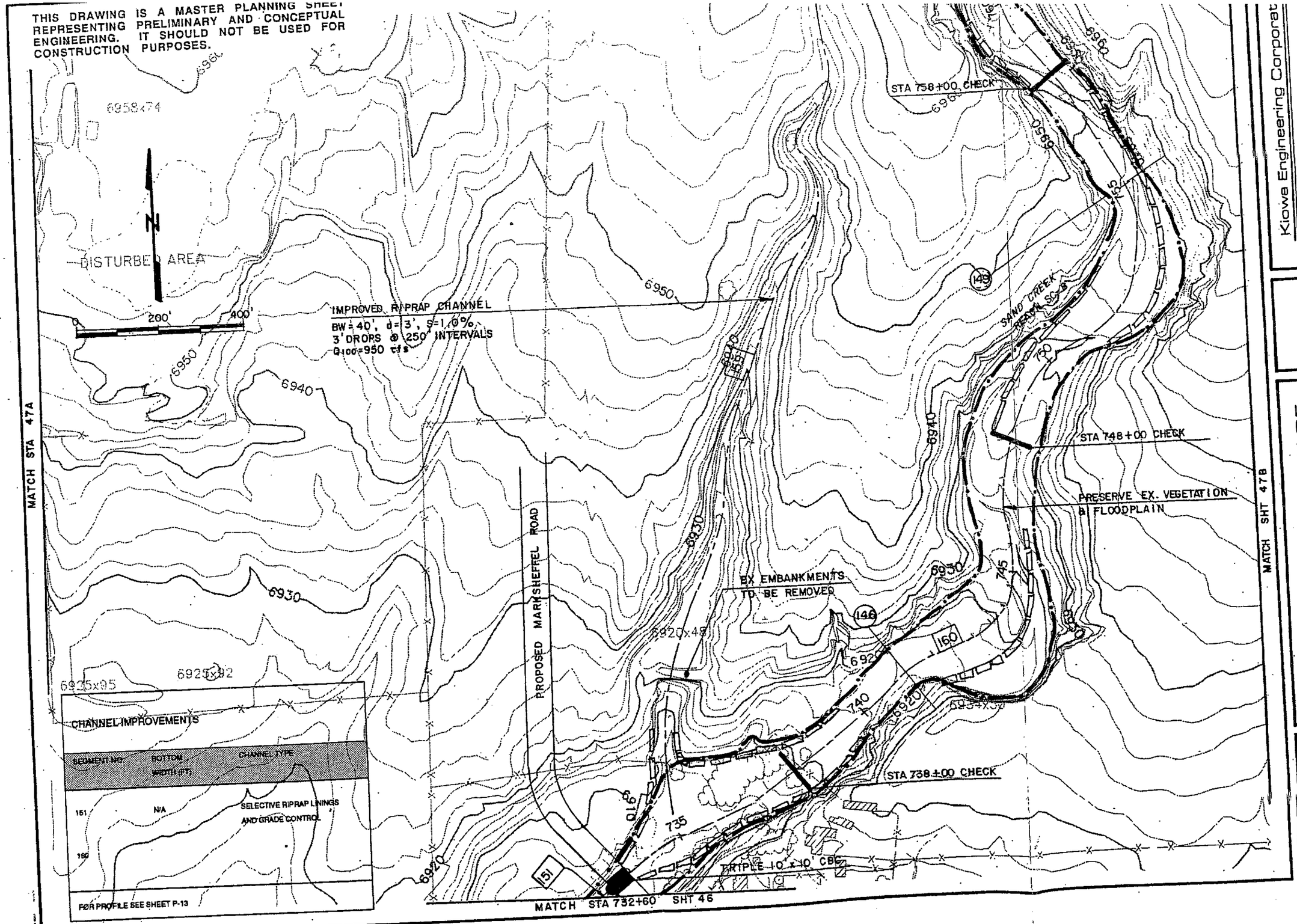
PREPARED FOR:

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

Prepared by:

Kiowa Engineering Corporation
1011 North Weber #200
Colorado Springs, CO 80903

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.



CHANNEL IMPROVEMENTS

SEGMENT NO.	BOTTOM WIDTH (FT)	CHANNEL TYPE
151	N/A	SELECTIVE RIPRAP LININGS AND GRADE CONTROL
160		

FOR PROFILE SEE SHEET P-13

Kiowa Engineering Corporat
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

Project No	90-040
Date:	9-92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	

THIS DRAWING IS A MASTER PLAN REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

MATCH STA 732+60 SHT 47

MATCH SHT 46B

CHANNEL IMPROVEMENTS

SEGMENT NO	BOTTOM WIDTH (FT)	CHANNEL TYPE
148-2	N/A	SELECTIVE RIPRAP LININGS AND GRADE CONTROL
151		

FOR PROFILE SEE SHEET P-13

Detention Criteria		
Basin: Sand Creek No. 4		
	Storage (AF)	Discharge (cfs)
WQ	8.2	2.5
100-year	46	41
Q100 In: 467	Tributary Area: 326 acres	

Detention Criteria		
Basin: Sand Creek No. 3		
	Storage (AF)	Discharge (cfs)
WQ	27.0	8.1
100-year	140	2240
Q100 In: 3230	Tributary Area: 3456 acres	

SAND CREEK

STA 728+00 CHECK

PRESERVE EX FLOODPLAIN & VEGETATION

100-YR POOL

FOREBAY

STA 723+00 DROP

WQ POOL

STA 720+50 DROP

OUTLET STRUCTURE NEW 2-8'H x 12'W CBC

REACH SC-3

REACH SC-2

WOODMEN ROAD

STA 714+00 CHECK

EX BRIDGE TO REMAIN UNTIL ROADWAY WIDENING OCCURS

PROPOSED MARKSHEFFEL ROAD

IMPROVED RIPRAP CHANNEL
BW= 15', d = 3', S = 1.4%
Qipo = 470 cfs

100-YR POOL

WQ POOL

FOREBAY

DROP

OUTLET STRUCTURE

PROP. 36" RCP w/ FES
800 L.F.

EAST FORK SAND CREEK BASIN

MARKSHEFFEL RD

6910

6900

6896x5

6896x6

0' 200' 400'

MATCH STA 711+20 SHT 46

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

Project No	90-04
Date:	9-92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	

46

APPENDIX E

DRAINAGE MAPS