

**MASTER DEVELOPMENT DRAINAGE PLAN
UPDATE FOR THE WOODMEN HEIGHTS
COMMERCIAL CENTER
AND
PRELIMINARY/FINAL DRAINAGE REPORT
FOR
WOODMEN HEIGHTS
COMMERCIAL CENTER FILING NO. 1**

MARCH 2012

Prepared for:

**International Development Company
Randle W. Case II
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Prepared by:



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Project #42-003

MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR THE WOODMEN HEIGHTS
COMMERCIAL CENTER AND PRELIMINARY/FINAL DRAINAGE REPORT FOR
WOODMEN HEIGHTS COMMERCIAL CENTER FILING NO. 1

DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria acceptable to the City of Colorado Springs. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.


Virgil A. Sanchez 3-9-12
Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc.

DEVELOPER'S STATEMENT

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

International Development Company

BY: Randle W. Case II DATE: 3/9/12

TITLE: President

ADDRESS: 102 E. Pikes Peak Ave, Ste. 201
Colorado Springs, 80903
(719) 633-2700

CITY OF COLORADO SPRINGS

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

BY: Timothy R. Matro DATE: March 9, 2012
For The City Engineer

CONDITIONS:

**MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR THE
WOODMEN HEIGHTS COMMERCIAL CENTER AND
PRELIMINARY/FINAL DRAINAGE REPORT FOR
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MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR THE WOODMEN HEIGHTS COMMERCIAL CENTER AND PRELIMINARY/FINAL DRAINAGE REPORT FOR WOODMEN HEIGHTS COMMERCIAL CENTER FILING NO. 1

PURPOSE

This document is the MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR THE WOODMEN HEIGHTS COMMERCIAL CENTER AND PRELIMINARY/FINAL DRAINAGE REPORT FOR WOODMEN HEIGHTS COMMERCIAL CENTER FILING NO. 1. The purpose of this report is to identify the existing and proposed runoff patterns and peak rates of runoff and identify any drainage improvements needed to safely route stormwater to adequate outfall facilities per the current City of Colorado Springs Drainage Criteria.

GENERAL LOCATION AND DESCRIPTION

Woodmen Heights Commercial Center Filing No. 1 is located in Section 4, Township 13 South, Range 65 West of the 6th P.M. in the City of Colorado Springs, El Paso County, Colorado, at the northwest corner of Marksheffel Road and Woodmen Road. The site is bounded on the south by Woodmen Road, on the north by unplatted property within the Woodmen Heights Master Plan, on the west by the Sand Creek Channel and on the east by Marksheffel Road. The site lies within the Sand Creek Drainage Basin.

The existing site terrain generally slopes from south to north at grades of approximately 2.0% to 2.5%. Vegetation consists of predominately native grasses.

The proposed site consists of approximately 1.635 acres and is currently zoned "PUD", Planned Unit Development. The site lies within the previously approved Concept Plan, and MDDP for Woodmen Heights Commercial Center.

SOILS

According to the Soil Survey of El Paso County, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the underlying soil is classified as Pring Course Sandy Loam, which has a hydrological soils classification "B". (See Appendix)

CLIMATE

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM)

Panel No.'s 08041C0535 F, effective dates March 17, 1997, no portion of the of the site lies within a designated 100-year floodplain.

DRAINAGE CRITERIA

The drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual. Calculations were performed to determine runoff quantities during the 5-year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having less than 100 acres.

The final drainage report for Woodmen Heights Commercial Center Filing No. 1 confirms with the Master Development Drainage Report for Woodmen Heights Commercial Center, prepared by Matrix Design Group. (see references, and appendix)

EROSION CONTROL PLAN

The City of Colorado Springs Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate be submitted with the Final Drainage Report. M&S Civil Consultants, Inc. respectfully requests that the Erosion Control Plan and estimate be submitted separately and that erosion control assurances be posted prior to obtaining a grading permit.

DEVELOPMENT IMPROVEMENTS

The proposed site contains an existing right-in/right-out access intersection off of Woodmen Road. This access point was constructed in the Spring of 2011. The access point will be extended northerly as a public street to be known as Kenosha Drive, with a 60' right-of-way. The other interior streets to the Woodmen Heights Commercial Center will be private with a minimum of a 28-foot width, curb to curb.

HISTORIC DRAINAGE CHARACTERISTICS

The site historically drains from a north to south at a general slope of 2.0%. The flows drain to the south end of the property and are conveyed via (3) public - 48" RCP culvert under Woodmen Road to the south. The flows then drain overland across an existing wetland area to Sand Creek. Additional flows are conveyed onto the site from Shiloh Mesa in two locations. A temporary diversion of flows are proposed to be conveyed in a channel on the north side of a future intersection to Marksheffel Road, from Shiloh Mesa. These flows are from upstream historic basins, and will be ultimately routed in a storm sewer system to Sand Creek. In the interim, the flows will be discharged overland, and conveyed southerly to the (3) 48" culverts under Woodmen Road. The second conveyance from Shiloh Mesa currently is discharged in an overland swale along the southerly boundary of this development. The storm water flows will ultimately be carried in a 60" RCP to discharge into the (3) 48" culverts under Woodmen Road. The flows south of Woodmen Road are ultimately carried in the Sand Creek Channel downstream to Fountain Creek. (See Appendix for Historic Drainage Map).

The (3) 48" RCP culverts were sized in the Woodmen Road, Safety Improvement Project B, Final Drainage Report, June 2003, by ECI Engineering. The culverts are identified as Culvert C1, with a contributing area of 326 Acres. The existing condition calculates $Q_5=56\text{cfs}$, $Q_{100}=276\text{cfs}$ to pass under Woodmen Road with three (3) 48" culverts. The future condition calculates $Q_5=134\text{cfs}$, $Q_{100}=439\text{ cfs}$, to pass under

Woodmen Road with five (5) public - 48" culverts. Refer to Appendix in this report for supporting information.

Woodmen Road Culverts

Existing 2012	3-48"	326 Acres	Q5=56 cfs	Q100=276 cfs	Wd Rd Report
Future	5-48"	326 Acres	Q5=134 cfs	Q100=439 cfs	Wd Rd Report
Prop. w/ Historic	3-48"	406.98 Acres	Q5=294 cfs	Q100=620 cfs	WHCC FDR
Prop. Ultimate	3-48"	63.23 Acres	Q5=135.4 cfs	Q100=240 cfs	WHCC FDR

The outfall condition on the south side of Woodmen Road consists of a 12" Rip Rap splash pad per the Woodmen Road Construction Drawings (See Appendix). The proposed condition will condition will consist of an enlarged rip rap pad to provide energy dissipation and to prevent erosion. The existing wetland area south of the outfall was proposed to receive 134 cfs/439 cfs in the Future condition per the Woodmen Road Drainage Report. The proposed ultimate condition delivers 135 cfs / 240 cfs. The initial storm events are essentially the same to provide hydrology to the wetlands. The major storm event is considered irrelevant for the wetland hydrology.

PROPOSED DRAINAGE CHARACTERISTICS

BASIN A1 Runoff Description:

Surface Routing

Basin A1 contains 3.74 acres, Q5=14.5cfs, Q100=27.5cfs of asphalt parking, landscaping and the proposed buildings within a planned commercial center. For the purpose of this report, the flows are conveyed via sheet flow and concentrated curb and gutter flow to a proposed 36" RCP Stub-out from the proposed 60" RCP from Shiloh Mesa. *However, with more knowledge of this basins development and the extension of the private roadway on the west side of this basin, the proposed 36" RCP Storm Sewer Pipe could be extended to a more appropriate location and/or into a divided storm sewer system to collect the flows in Basin A1.*

Pipe Routing/Pipe Capacity

The flows are then conveyed via a 36" RCP (pipe P9A – Q5=14.5cfs, Q100=27.5cfs) to the south to combine with flows in pipe P9 from Shiloh Mesa.

The flows in the proposed pipe P9, public - 60" RCP, (Q5=92.17cfs, Q100=157.90cfs), Shiloh Mesa Outfall, were taken from the Master Development Drainage Plan for Shiloh Mesa at Woodmen Heights, by Matrix Design Group, as approved, November 2009. This public 60" RCP pipe, collects storm water from east of Shiloh Mesa, the Shiloh Mesa Development, and Marksheffel Road. The public pipe is proposed to be installed in the summer of 2012, along with the site grading adjacent to Woodmen Road. The 36" stub for Basin A1, can be installed at a specific location with the development of Basin A1. (See Appendix)

BASIN A2 Runoff Description:

Surface Routing

Basin A2 contains 2.51 acres, Q5=10.8cfs, Q100=20.3cfs of asphalt parking, landscaping and the proposed buildings within a planned commercial center. For the purpose of this report, the flows are conveyed via sheet flow and concentrated curb and gutter flow to a proposed 24" RCP Stub-out, Pipe P1. *However, with more knowledge of this basins development and the extension of the private roadway, the proposed inlets and Storm Sewer System could be amended to suite the future development layout. It is possible that the inlets at Design Point 2, may need to be enlarged and the storm sewer system be extended and divided into the future development in Basins A1 and A2.*

Pipe Routing/Pipe Capacity

The flows are then conveyed via a 30" RCP (pipe P1 – Q5=10.8cfs, Q100=20.3cfs) to the south to combine with flows in pipe P2 from the 4' inlet in the private roadway.

BASIN A3 Runoff Description:

Surface Routing

Basin A3 contains 1.22 acres, Q5=5.4cfs, Q100=10.2cfs of landscaping and asphalt driveway in the Private Road. The flows conveyed via sheet flow and concentrated curb and gutter flow and are assumed to be split evenly, and collected by two (2) 4' D-10-R sump inlets (DP2, Q5=5.4cfs, Q100=10.2cfs). *However, with more knowledge of this basins development and the extension of the private roadway, the proposed inlets and Storm Sewer System could be amended to suite the future development layout. It is possible that the inlets at Design Point 2 may need to be enlarged and the storm sewer system be extended and divided into the future development in Basins A1 and A2.*

Pipe Routing/Pipe Capacity

The flows are then conveyed via a 30" RCP (pipe P2 – Q5=13.4cfs, Q100=25.2cfs) to the north to combine with flows from a 18" RCP pipe (pipe P3 – Q5=2.6cfs, Q100=4.9cfs) from the opposite 4' D-10-R sump inlet.

BASIN A4 Runoff Description:

Surface Routing

Basin A4 contains 2.76 acres, Q5=12.2cfs, Q100=23.1cfs of asphalt parking, landscaping and the proposed buildings within a planned commercial center. For the purpose of this report, the flows are conveyed via sheet flow and concentrated curb and gutter flow to a proposed 60" RCP. The 60" RCP is over sized to handle the historic upstream flows diverted from the north. BASIN EXB contains 406.98 acres, (Q5=152.3cfs, Q100=369.4cfs) of upstream native, historic development, including the temporary diversion from Shiloh Mesa. The historic flow carried in the 60" RCP (pipe P5H – Q5=152.3cfs, Q100=369.4cfs) will remain until the future storm sewer system is constructed from Shiloh Mesa on the north side of the project. The proposed future system will convey flows from Shiloh Mesa and flows from the Woodmen Heights Commercial Center and outfall into Sand Creek. See MDDP's for the aforementioned developments.

Pipe Routing/Pipe Capacity

The flows are then conveyed via a private 60" RCP (pipe P5H – Q5=152.3cfs, Q100=369.4cfs) to the south to combine with flows from pipe P9 (Southerly flows from Shilo Mesa) and discharge into the (3) 48" culverts under Woodmen Road.

BASIN B Runoff Description:

Surface Routing

Basin B contains 1.27 acres, Q5=5.6cfs, Q100=10.6cfs of asphalt parking, landscaping, the proposed development of Filing No. 1, and the future adjacent developed lot to the east. The flows conveyed via sheet flow and concentrated curb and gutter flow and are assumed to be split evenly, and collected by two (2) 4' D-10-R sump inlets (DP3, Q5=8.6cfs, Q100=16.2cfs).

Clogging Statement

In the event of clogging or inlet failure, the runoff will overtop the curb and gutter and into Kenosha Drive. The flows will be discharged to the west and eventually into the Sand Creek Channel.

Pipe Routing/Pipe Capacity

The flows are then conveyed via a public 18" RCP (pipe P6 – Q5=4.3cfs, Q100=8.1cfs, and a public 30" RCP pipe P7 – Q5=12.6cfs, Q100=23.8cfs) into the larger public 36" storm sewer trunk line in the Private Drive. The flows are combined and discharged into a Temporary Water Quality Pond on the west side of Kenosha Drive.

BASIN C Runoff Description:

Surface Routing

Basin C contains 1.94 acres, Q5=8.2cfs, Q100=15.6cfs of asphalt parking, landscaping and the proposed buildings within a planned commercial center. For the purpose of this report, the flows are conveyed via sheet flow and concentrated curb and gutter flow to a proposed 24" RCP FES Stub into the basin. *However, with more knowledge of this basins development, the proposed 24" RCP Storm Sewer Pipe could be extended to a more appropriate location and/or into a divided storm sewer system to collect the flows in Basin C. The 24" FES stub will collect the interim/historic flows.*

Clogging Statement

In the event of clogging or inlet failure, the runoff will overtop the high point in the Private Drive and conveyed to Design Point 3. The flows will then be conveyed to the west and eventually into the Sand Creek Channel.

Pipe Routing/Pipe Capacity

The flows are then conveyed via a 24" RCP's (pipe P7A – Q5=8.2cfs, Q100=15.6cfs into the larger 36" storm sewer trunk line in the Private Drive.

BASIN D Runoff Description:

Surface Routing

Basin D contains 0.65 acres, Q5=3.0cfs, Q100=5.6cfs of landscaping and asphalt driveway in the Private Road. The flows are conveyed via sheet flow and concentrated curb and gutter flow, combined with Basin B, and collected by two (2) 4' D-10-R sump inlets at Design Point 3. The clogging statement and Pipe Routing/Pipe Capacity was previously described above for Basin B.

BASIN E Runoff Description:

Surface Routing

Basin E contains 1.09 acres, Q5=4.8cfs, Q100=9.1cfs of the asphalt in Woodmen Road, and the landscaping area southwest of the proposed development of Lot 1, Woodmen Heights Commercial Center Filing No. 1. The flows are conveyed to a proposed curb opening on the west side of Kenosha Drive. The concentrated flows will then be directed down a 4' concrete swale into the Sand Creek channel.

The flows in Basin E are not collected by standard curb inlets due to a physical conflict with two existing petroleum gas lines under the proposed Kenosha Drive. The existing petroleum gas lines prohibit a normal two inlet and pipe crossing the roadway. The conflict is due to the shallow depth and horizontal location of the petroleum lines.

BASIN F Runoff Description:

Surface Routing

Basin F contains 1.31 acres, Q5=3.8cfs, Q100=7.0cfs of the asphalt in Woodmen Road, and the landscaping

area southeast of the proposed development of Lot 1, Woodmen Heights Commercial Center Filing No. 1. The flows are conveyed in the Woodmen Road roadside swale. The concentrated flows will then be collected in a quadruple public 4'x4' CDOT grate inlet. In the interim, flows from Basins A1, A2 and F, Design Point 7H, Q5=28.2cfs, Q100=53.3cfs will continue in the historic flow path to the proposed CDOT grate inlet. The flows will be collected and passed under Woodmen Road in the existing (3) 48" culverts. The historic condition will exist until the storm sewer system within the development is constructed at Design Points, D1, and D2.

Clogging Statement

In the event of clogging or inlet failure, the runoff will overtop the high point in the roadside ditch south of the proposed building in Lot 1, of Woodmen Heights Commercial Center Filing No. 1. The flows will then be conveyed to the west and eventually into the Sand Creek Channel. The elevation of the high point in the roadside swale is lower than the finish floor elevation of the proposed building. No flooding shall occur in the case of total inlet failure.

REGIONAL DETENTION POND (Referenced from MDDP for Woodmen Heights)

General

Drainage Basin Planning Study Requirements

Sand Creek Drainage Basin Planning Study, Kiowa Engineering Corporation, March 1996 the proposed construction of the two ponds (No. 3 and No. 6) as shown with option "Detention Site Alternative 'A'" is required. This option would replace the detention facilities no's 4 and 5, thus routing upstream flows into the expanded facilities on this site.

Detention Pond No. 3

General Site Information

In the ultimate condition, inflow comes from six sources (refer to study prepared by Classic Consulting Engineers and Surveyors titled "Master Development Drainage Plan for Woodmen Heights Master Plan" dated June 2004 for inflow source locations); northwest from Area 4 single-family development, northwest from Forest Meadows Avenue, north from the adjacent park site, northeast from the Sand Creek channel, east from a commercial/multi-family development and southeast from a commercial/office development. Outflow will be routed via an outlet structure in the southeast corner and beneath Woodmen Road via a multi-cell box culvert structure, or bridge. Per the MDDP, this facility will be combined with a neighborhood park area that will exist, at a minimum, above the 10-year storm event elevation. Coordination with the City of Colorado Springs Park and Recreation Department will be required with the final design construction document preparation phase for this facility. Channel improvements associated with the construction of this facility and upstream improvements are summarized in the aforementioned MDDP for the Woodmen Heights Master plan. It should be noted that the downstream facilities will need to be constructed prior to releasing the total developed flows. The release of developed flows shall not adversely affect adjacent or downstream property.

The size and geometry of the outfall structure will be determined during the final design phase of pond construction document preparation. The basic geometric configuration of this pond will be a rectangular facility with the major axis running north and south. The pond's eastern edge will be located within the existing Sand Creek Channel drainageway. The south edge of the pond will be against the proposed fill embankment of Woodmen Road.

Preliminary Design Results - Interim

In the interim condition, a few adjacent parcel areas will become developed and ultimately discharge into this facility. These parcels have been delineated to correlate with the MDDP study. These are: parcels 12,

17, 18, 19 and 25. Development of these parcels corresponds to a required storage pond volume of approximately 10 acre-ft with a developed ($Q_{100}=376\text{cfs}$) peak inflow and a (Historic release, $Q_5=58\text{cfs}$, $Q_{100}=144\text{cfs}$) outflow. During the final design phase, the interim pond will be designed to release the 2-year, 5-year, 10-year, 50-year and 100-year developed flow at rates determined by the SCDBPS. The interim pond will release the flow upstream of the proposed Woodmen Road bridge. Refer to Pond Calculations in the appendix for Pondpack input and output data.

Preliminary Design Results - Ultimate

In the ultimate condition, numerous parcel areas within the Woodmen Heights and outside of it will become developed and ultimately discharge into this facility. These parcels have been delineated to correlate with the MDDP study. These are: on-site parcels 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25, and off-site parcels 2, 3, 4, & 5. Development of these parcels corresponds to a required storage pond volume of approximately 209 acre-ft with a ($Q_{100}=3207\text{cfs}$) peak inflow and a ($Q_{100}=2240\text{cfs}$) outflow. Refer to Pond Calculations in the appendix for Pondpack input and output data.

Water Quality

In the ultimate condition, the water quality capture volume (WQCV) computed using the Colorado Springs/El Paso County Drainage Criteria Manual – Volume 2 for Extended Detention Basins was approximately 28 acre-ft. This volume will be added to the peak developed required storage volume.

Prior Study Comparison – Ultimate Conditions

The “Sand Creek Drainage Basin Planning Study”, Kiowa Engineering Corporation, March 1996 states that the required storage volume is 140 acre-ft with a ($Q_{100}=3230\text{cfs}$) peak inflow and a ($Q_{100}=2240\text{cfs}$) outflow. The 69 acre-ft storage and ($Q_{100}=23\text{cfs}$) peak inflow differences can be attributed to the fact that we are combining DBPS detention facilities 3, 4 and 5. The “Master Development Drainage Plan for Woodmen Heights Master Plan”, Classic Consulting Engineers and Surveyors, June 2004 states that the required storage volume is 224 acre-ft with a ($Q_{100}=2883\text{cfs}$) peak inflow and a ($Q_{100}=2242\text{cfs}$) outflow. The 15 acre-ft storage and ($Q_{100}=324\text{cfs}$) peak inflow differences can be attributed to minor basin time of concentration, area and curve number model values based on the latest information available.

WATER QUALITY / DETENTION REQUIREMENTS

This project is a part of the Woodmen Heights Metropolitan District and Woodmen Heights Master Plan. Per the previously updated and approved MDDP's for Woodmen Heights Commercial Center. Sand Creek Detention Basin No. 3 will provide water quality and detention storage for this site. No detention is required at this time due to the minimal amount of flows being proposed into the Sand Creek Channel. ($Q_{100}=47.4\text{cfs}$) The interim proposed water quality facility will be designed and located at the 36" RCP outfall location in the Sand Creek channel. A floodplain development permit will be required prior to construction.

DRAINAGE, BRIDGE AND POND FEES

Woodmen Heights Commercial Center Filing No. 1 is located within the Sand Creek Drainage Basin and consists of 1.635 Acres. The 2012 Drainage, Bridge and Pond Fees per the City of Colorado Springs for the site is listed below:

Woodmen Heights Commercial Center Filing No. 1

Drainage Fee:	\$ 9,632/acre x 1.635 acres	\$ 15,748.32
Bridge Fee:	\$ 596/acre x 1.635 acres	\$ 974.46
Pond Fee (Land):	\$ 1,070/acre x 1.635 acres	\$ 1,749.45
Pond Fee (Facilities):	\$ 2,881/acre x 1.635 acres	\$ <u>4,710.44</u>
Total		\$ 23,182.67

The Woodmen Heights Metropolitan District possesses credits for Drainage, Pond Land, and Pond Facility fees. It is the intention for this development to acquire the credits from the Woodmen Heights District to apply to this developments fee obligation. However, This development will pay the Bridge Fee obligation to be credited to the Woodmen Heights District’s obligation for the Marksheffel Road bridge over Sand Creek.

CONSTRUCTION COST OPINION

**PUBLIC REIMBURSABLE FACILITIES;
(In Liu of Sand Creek Detention Basin No. 4 – See Appendix)**

Item:	Quantity	Cost/Unit	Amount
36” RCP	320 LF	\$ 45 / LF	\$ 14,400.00
36” RCP FES	1 EA.	\$ 3,500 / EA	\$ 3,500.00
60” RCP (Shiloh Mesa)	675 LF	\$ 350 / LF	\$ 236,250.00
WQ Pond	1 EA.	\$ 5,500 / EA	\$ <u>5,500.00</u>
TOTAL			\$<u>259,650.00</u>

PRIVATE NON-REIMBURSABLE FACILITIES;

Item:	Quantity	Cost/Unit	Amount
18” RCP	28 LF.	\$ 25 / LF	\$ 700.00
60” RCP (Historic)	255 LF	\$ 350 / LF	\$ 89,250.00
Custom Manhole	1 EA	\$ 6,000 / EA	\$ 6,000.00
Custom Manhole Tie to 48”	1 EA	\$ 10,000 / EA	\$ 10,000.00
4’ D-10-R INLET	2 EA.	\$ 3,000 / EA	\$ <u>6,000.00</u>
TOTAL			\$ <u>111,950.00</u>

DRAINAGE COST COMPARISON AND CREDIT SUMMARY

Woodmen Heights Commercial Center Filing No. 1

Public Facilities:

Total public, on-site drainage facility estimate	\$259,650.00
Total public, <u>reimbursable</u> on-site drainage facility portion is	\$259,650.00
Total public, <u>non-reimbursable</u> on-site drainage facility portion is	\$111,950.00

M&S Civil Consultants, Inc. cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2012.

SUMMARY

Woodmen Heights Commercial Center Filing No. 1, contains 1.635 acres of commercial development within the Sand Creek Drainage Basin. The proposed drainage facilities will adequately convey, and outfall runoff from the site to be detained by Sand Creek Detention Pond No.3 or at an alternate site.. All drainage facilities described herein are subject to change due to final design considerations. This report is in conformance with the "Master Development Drainage Plan for Woodmen Heights Commercial Center". The development of Woodmen Heights Commercial Center Filing No. 1 shall not adversely affect adjacent or downstream property and is located outside of the 100 year floodplain.

REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs and El Paso County "Drainage Criteria Manual", October 1987, revised November 1991.
2. Soil Survey for El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.
3. Master Development Drainage Plan for Woodmen Heights Master Plan, Classic Consulting Engineers and Surveyors, LLC, June 2004.
4. Sand Creek Drainage Basin Planning Study, Kiowa Engineering Corporation, March 1996
5. Master Development Drainage Plan Update for Woodmen Heights and Final Drainage Report for Forest Meadows Filing No. 1 and No. 4., Engineering and Surveying, Inc., February 2006.
6. Master Development Drainage Plan for The Woodmen Heights Commercial Center, Matrix Design Group, November 2009.
7. Master Development Drainage Plan for Shiloh Mesa at Woodmen Heights, Matrix Design Group, November 2009.
8. El Paso County Colorado, Woodmen Road, Safety Improvement Project B, Final Drainage Report, June 2003, by ECI Engineering.
9. Drainage Letter for Marksheffel Road Interim Design at Woodmen Heights, (Located Adjacent to Shiloh Mesa & Woodmen Heights Commercial Center Developments North of Woodmen Road, & South of Main Street), by Matrix Design Group, Inc., February 2009.
10. Construction Drawings for El Paso County, Department of Transportation, Woodmen Road – Powers to US24, Project No. STU M240-062, by DMJM Hariss/AECOM, February 21, 2007.

**See Following Pages for Excerpts from Various Reports, and Construction Plans

MASTER DEVELOPMENT DRAINAGE PLAN

For

THE WOODMEN HEIGHTS COMMERCIAL CENTER

SAND CREEK DRAINAGE BASIN

Prepared for:

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

On Behalf of:

Marksheffel- Woodmen Investments, LLC
102 East Pikes Peak Ave., Suite 200
Colorado Springs, CO 80903

Prepared by:



Matrix Design Group, Inc.

An Employee Owned Company
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NOVEMBER 2009

06.052.018

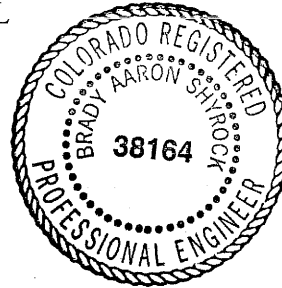
Engineer's Statement:

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.

 11/18/2009

SEAL

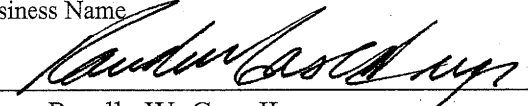
Brady A. Shyrock
Registered Professional Engineer
State of Colorado
No. 38164



Developer's Statement:

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

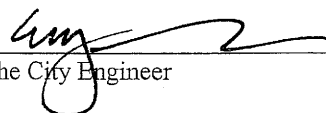
Marksheffel- Woodmen Investments, LLC
Business Name

By: 
Randle W. Case II

Title: Manager
Address: 102 East Pikes Peak Ave., Suite 200
Colorado Springs, CO 80903

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

12.2.09
Date

Conditions:

Table 4.2 - Summary of Routed Developed Runoff

<i>Design Point</i>	<i>Area (ac)</i>	<i>Q(5) (cfs)</i>	<i>Q(100) (cfs)</i>	<i>Description</i>
1	8.75	21.57	38.65	Sub-basins OS-10 & B
1-A	2.61	8.23	14.66	Sub-basin OS-10
2	34.12	102.78	184.26	Shiloh Mesa MDDP DP 21
3	38.44	114.63	205.86	Sub-basin C & DP2
4	11.09	27.46	49.23	Sub-basin F & DP1
5	49.53	121.44	216.6	DP3 & DP4
6	27.03	92.17	157.9	Shiloh Mesa MDDP DP 30
7	36.41	100.51	178.95	Sub-basin E & DP6
8	13.09	40.83	72.7	Sub-basins J & D
9	49.5	137.94	245.67	DP7 & DP8

As previously noted, the Woodmen Heights Commercial Center will utilize two locations for outlets within Sand Creek (peak flowrates are Design Points 5 and 9). Design Point 9 is comparable to the previous analysis presented within the ESI MDDP for Pipe 41. The ESI MDDP estimated a drainage area of 49.51 acres would be routed to Sand Creek by Pipe 41. Pipe 41 is a 60-inch diameter pipe conveying a peak flowrate for the major storm of $Q(100) = 234.99$ cfs. The proposed area draining to Design Point 9 is 49.5 acres with a peak flow rate of $Q(100) = 245.67$ cfs. Since the land use of the property remains consistent with the assumption in the ESI MDDP, the volume of runoff routed to Sand Creek is the same as well. The minor difference in peak flowrates can be attributed to the different methods of analysis.

Design Point 5, however, is conveying a decrease in the stormwater volume from the rate estimated within the ESI MDDP for Pipe 38. Pipe 38 was modeled as an 84-inch RCP, with an estimated peak flowrate of $Q(100) = 648.71$ cfs. Design Point 5, on the other hand, has a peak flowrate of $Q(100) = 216.60$ cfs which is conveyed by a 66-inch RCP. The difference in runoff is attributed to the decrease in drainage area. Runoff from the area east of Shiloh Mesa will be routed to Sand Creek upstream of the Marksheffel Road crossing. This difference is an approximate decrease of 350 acres of drainage area.

C. Comparison of Studied Onsite Runoff

Sub-Basin Parcel 22, defined in the ESI MDDP, is located in the northern portion of the site. Parcel 22 contains 16.68 acres which have a land use characterization of neighborhood commercial / multi family. Runoff is collected in Pipe 37, which then joins the flow in Pipe 36 at Pipe 38. Pipe 38 outlets into Sand Creek. Pipes 36, 37, and 38 were sized in the ESI MDDP as 78-inch, 42-inch, and 84-inch diameter RCP respectively with a one percent slope. Refer to Table 4.3 for a comparison of peak flow rates at each outlet to Sand Creek.

Sub-basin Parcel 23 is situated in the southern half of the site. It is approximately 24.38 acres in size and the land use is community commercial. Runoff from Parcel 23 is collected by Pipe 40,

DRAINAGE LETTER

for

MARKSHEFFEL ROAD INTERIM DESIGN AT WOODMEN HEIGHTS

**(LOCATED ADJACENT TO SHILOH MESA & WOODMEN HEIGHTS
COMMERCIAL CENTER DEVELOPMENTS
NORTH OF WOODMEN ROAD, & SOUTH OF MAIN STREET)**

located within

SAND CREEK DRAINAGE BASIN

Prepared for:

**City of Colorado Springs
Subdivision Review Team**
30 North Nevada Avenue, Suite 702
Colorado Springs, CO 80903

On Behalf of:

Woodmen Heights Metropolitan District
455 East Pikes Peak, Suite #100
Colorado Springs, CO 80903



Matrix Design Group, Inc.
An Employee Owned Company

2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
(719) 575-0100
fax (719) 572-0208

FEBRUARY 2009

04.030.037

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.



SEAL

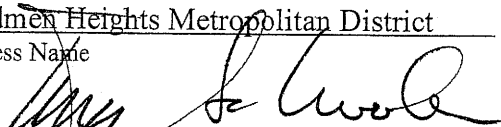
Brady A. Shyrock
Registered Professional Engineer
State of Colorado
No. 38164



Developer's Statement:

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

Woodmen Heights Metropolitan District
Business Name

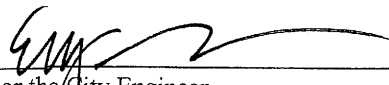
By: 

Mr. Terry Schooler

Title: Manager
Address: 455 East Pikes Peak Avenue, Suite # 100
Colorado Springs, CO 80903

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

4/6/09

Date

Conditions:

intersection of Woodmen Road & Marksheffel Road northward to the intersection of Main Street and Marksheffel Road, composing an area of 2.05 acres (in comparison, the ultimate condition of OS-3 within the Shiloh Mesa MDDP was analyzed using an area of 1.43 acres). Similarly, Basin OS-2 consists of 2.70 acres in the interim condition (in comparison, the ultimate condition of OS-2 within the Shiloh Mesa MDDP was analyzed using an area of 1.27 acres). The basin is defined by an area from the centerline of Marksheffel Road and extends in eastward direction a distance of 55 feet beyond the Marksheffel Road ROW. The intersection of Marksheffel Road and the existing private drive to the Woodmen Valley Church Community Center will create a basin boundary to the north such that interim grading will route runoff from the north away from the proposed roadway improvements. The Marksheffel Road and Woodmen Road intersection denotes the southern boundary of the drainage basins. Refer to the Appendix A for the Interim Conditions Drainage Basin Map.

Currently, runoff flows in a southwest direction and crosses the future Marksheffel Road at the location of the future sump inlets. For the interim condition, construction of Marksheffel Road will incorporate a 48-inch RCP stub at Design Point 9 to accommodate the flows from this area. Additionally, a swale will be constructed north of the Marksheffel Road Improvements to route the offsite flows away from the roadway at Design Point 8. Refer to Table 1 for a design point peak runoff summary and Appendix B for swale recommendations.

Table 1 - Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
1	OS-1	4.26	2.7	6.7
2	OS-5	323.00	201.7	404.0
3	DP2, D	329.56	145.7	349.1
4	DP3, C, E	367.28	143.8	338.9
5	DP4, G	371.03	145.6	343.2
6	DP5, F	377.98	148.9	351.3
7	H, I	11.23	6.7	18.9
8	DP6, DP7, L	389.21	163.3	401.3
9	K	9.71	5.6	13.9
10	DP9, OS-2, OS-3	14.46	34.2	72.1

A sump location within Marksheffel Road is proposed approximately 250 feet north of the Woodmen Road intersection. Two curb inlets are proposed at this location to capture 100% of the flows from sub-basins OS-2 and OS-3. StormCAD calculations show an intercepted flow at the east inlet (Basin OS-2) to be $Q(5) = 12.4$ cfs and $Q(100) = 23.4$ cfs. StormCAD calculations also show an intercepted flow at the west inlet (Basin OS-3) to be $Q(5) = 9.4$ cfs and $Q(100) = 17.7$ cfs. In the interim condition, the total routed flow at Design point 10 was determined to be $Q(5) = 34.2$ cfs and $Q(100) = 72.1$ cfs. This runoff will outfall to a temporary swale that conveys flows to Sand Creek Channel where Pond # 3 is to be located. In comparison, the total routed flow in the ultimate condition at this same location (designated as Design Point 30 within the

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:



Matrix Design Group, Inc.

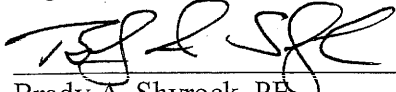
An Employee Owned Company
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
(719) 575-0100
fax (719) 572-0208

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: 

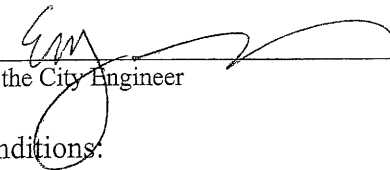
Les Krohnfeldt

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: _____

EL PASO COUNTY, COLORADO

WOODMEN ROAD

SAFETY IMPROVEMENT PROJECT B

FINAL DRAINAGE REPORT

JUNE 2003

Prepared by



An AECOM Company

In Association with
DMJM ■ HARRIS

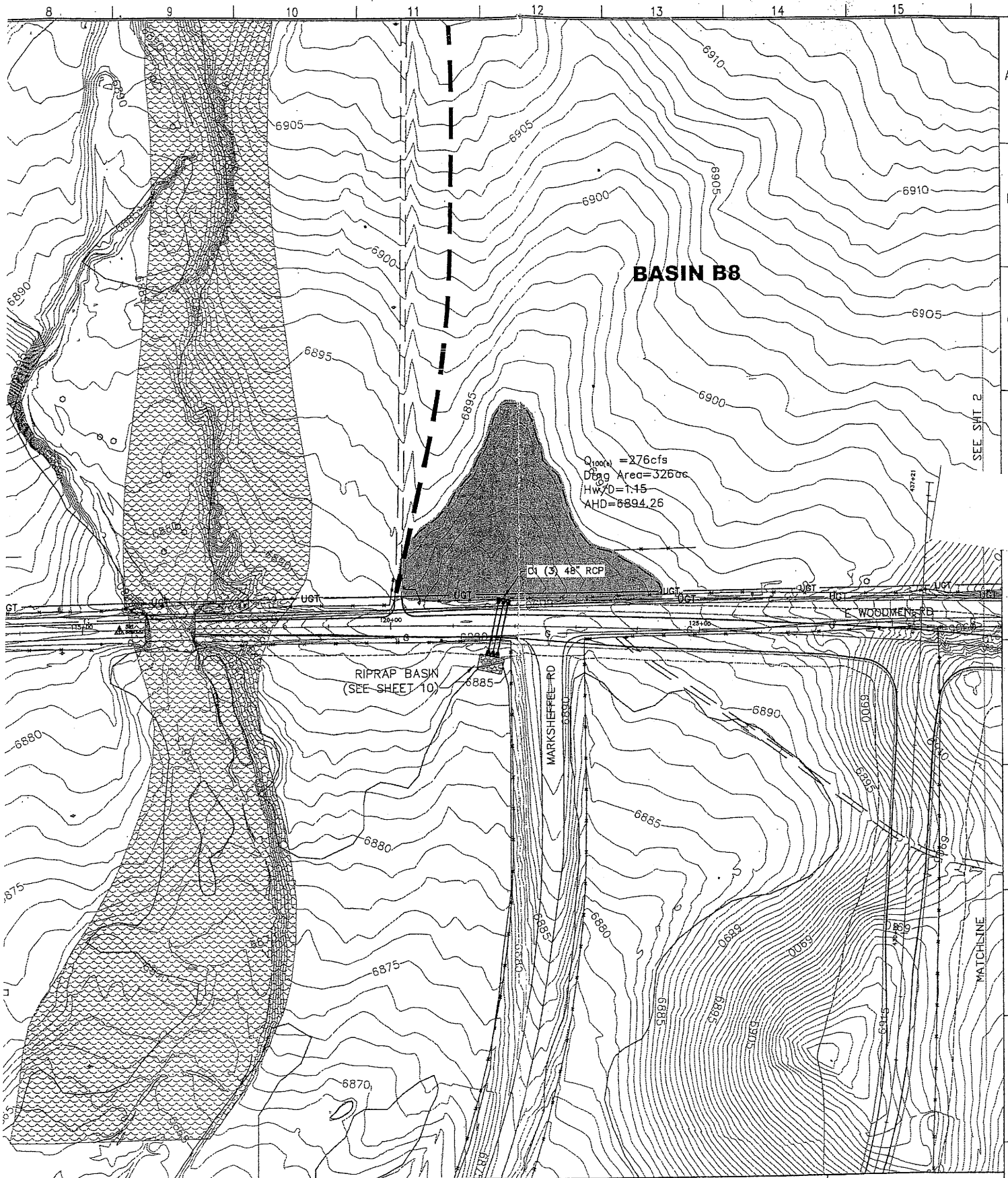
Table D9 Existing and Future Culvert Peak Discharge

CULVERT ID	LOCATION	STATION	SOURCE OF RUNOFF	AREA (ACRE)	EXISTING CONDITIONS		FUTURE CONDITIONS	
					Q5 (CFS)	Q100 (CFS)	Q5 (CFS)	Q100 (CFS)
C1	At old Marksheffel Intersection	121+69.42	Basin B8	326	56	276	134	439
C2	Between Maverick and Ponca Roads	150+85.73	Basin B10	107	16	94	16	94
C3	E. Corner of Ponca Rd	157+78.66	Basin B11	154	28	137	47	180
C4	W. Side of Mohawk Rd	168+03.78	Culverts C17, C18 & C19	236	52	219	105	334
C5	S. of Stock Dam at draft horse farm	193+39.62	Basin B14	635	92	444	114	496
C6	E. of draft horse farm	206+57.00	Basin B15	624	89	436	330	903
C7	E. of draft horse farm	215+39.01	Split flow from Basin B15		30	145	110	301
C8	S. of Falcon Meadows Subdivision	230+36.80	Basin B16	954	108	646	159	776
C9	Lizard Head Intersection	258+61.15	Culverts C20, C21 & C22	369	44	264	44	264
C10	Under OHHV, W. of Falcon Sch Adm	275+03.67	Basin B18	119	27	131	30	139
C11	W. of Electric Co Entrance (Bike Path)	294+46.31	Basin B19	2035	241	1,480	288	1607
C12	E. of Electric Co	304+01.73	Basin B20	182	23	139	34	167
C13	1000' W. of Meridian Rd	322+09.45	Parts of Basin B21 & B22	394	43	251	79	320
C14	400' W. of Meridian Rd	327+45.22	Parts of Basin B21 & B22	393	43	251	79	320
C15	New Marksheffel Alignment	412+50	Split flow	20	20	46	51	99
C16	New Marksheffel Alignment	422+00	Split flow	5	5	10	10	20
C17	Mohawk Intersection	507+07.45	5 acres between roads	5	5	10	10	20
C18	Mohawk	508+11.05	Basin B13	223	40	193	93	308
C19	Mohawk	8+98.94	Basins B12	8	30	16	7	16
C20	Lizard Head split flow of 225ex and Fut	701+76.70	Culvert C22		44	60	30	60
C21	Lizard Head Intersection	94+03.76	Basin B17	369		264	44	264
C22	Lizard Head same as 701+76.70	105+78.19	Split flow		30	60	30	60

Table D10 Culvert Design

NO.	LOCATION	STATION	LENGTH A. (FT)	U/S INVERT ELEV. (FT)	SHOULDER ELEV. (FT)	D/S INVERT ELEV. (FT)	CULVERT DESIGN FOR EXISTING Q ₁₀₀	CULVERT DESIGN FOR FUTURE Q ₁₀₀	MAX. HEADWT FOR EXIST COND. (FT)	MAX. HEADWT FOR FUTURE COND. (FT)	EXIT VELOCITY (FUTURE) (FT/SEC)	MAX. DEPTH OF D/S WATER (FUTURE) (FT)
C1	At old Marksheffel Intersection	121 + 69.42	166.51	6887.94	6894.26	6885.88	(3) 48"	(5) 48"	6892.55	6892.45	12.59	2.17
C2	Between Maverick and Ponca Roads	150 + 85.73	156.44	6903.50	6909.25	6902.71	(1) 48"	(1) 48"	6908.17	6908.17	9.5	2.94
C3	E. Corner of Ponca Rd	157 + 78.66	190.83	6901.46	6908.34	6900.50	(1) 48"	(2) 48"	6908.19	6906.04	9.29	2.88
C4	W. Side of Mohawk Rd	168 + 03.78	195.36	6898.50	6908.43	6896.64	(2) 48"	(3) 48"	6903.66	6903.73	12.26	2.71
C5	S. of Stock Dam at draft horse farm	193 + 39.62	224.71	6887.00	6894.93	6885.20	(3) 60"	(3) 60"	6892.5	6892.85	12.73	3.14
C6	E. of draft horse farm	206 + 57.00	226.88	6879.67	6887.40	6878.53	(2) 60"	(5) 60"	6886.96	6885.83	11.13	3.85
C7	E. of draft horse farm	215 + 39.01	214.50	6886.00	6893.61	6885.50	(2) 48"	(3) 48"	6890.02	6891.19	9.79	3.04
C8	S. of Falcon Meadows Subdivision	230 + 36.80	204.45	6884.27	6891.48	6883.24	(4) 60"	(4) 60"	6890.06	6890.81	11.57	3.98
C9	Lizard Head Intersection	258 + 61.15	189.84	6896.50	6904.96	6894.0	(2) 48"	(2) 48"	6902.66	6902.66	14.19	2.77
C10	Under OHHV, W. of Falcon Sch Adm	275 + 03.67	206.50	6895.39	6901.52	6894.36	(2) 48"	(2) 48"	6899.07	6899.22	8.69	2.43
C11	W. of Electric Co Entrance (Bike Path)	294 + 46.31	210.51	6881.70	6895.06	6880.70	19x9 RCB	19x9 RCB	6891.40	6891.07	16.17	4.97
C12	E. of Electric Co	304 + 01.73	210.49	6880.13	6886.74	6879.08	(2) 48"	(2) 48"	6883.96	6884.49	9.01	2.76
C13	1000' W. of Meridian Rd	322 + 09.45	139.70	6868.50	6878.06	6868.00	(2) 48"	(3) 48"	6874.69	6873.71	9.13	3.51
C14	400' W. of Meridian Rd	327 + 45.22	160.12	6867.74	6874.00	6866.90	(2) 48"	(3) 48"	6873.60	6872.79	10.13	3.13
C15	New Marksheffel Alignment	412 + 50.00		6880.00	6885.00	6878.00	30"	30"	6884.39	6884.79	12.77	1.84
C16	New Marksheffel Alignment	422 + 00.00		6882.00	6886.00	6880.00	24"	24"	6883.83	6884.93	10.53	1.16
C17	Mohawk Intersection	507 + 07.45	93.68	6903.45	6910.40	6902.99	24"	24"	6905.13	6906.24	7.38	1.61
C18	Mohawk	508 + 11.05	119.72	6903.10	6908.00	6902.50	(2) 48"	(3) 48"	6907.83	6908.00	9.92	3.07
C19	Mohawk	008 + 98.94	57.83	6902.25	6907.30	6901.75	24"	24"	6904.54	6904.54	7.35	1.31
C20	Lizard Head split flow of 225x and Fut	701 + 76.70	73.63	6899.44	6905.80	6899.07	(1) 48"	(1) 48"	6902.93	6902.93	8.42	2.21
C21	Lizard Head Intersection	094 + 03.76	80.60	6899.13	6905.60	6898.73	(2) 48"	(2) 48"	6905.30	6905.30	11.5	3.43
C22	Lizard Head as C20	105 + 78.19	85.22	6900.48	6907.00	6900.06	(1) 48"	(1) 48"	6903.97	6903.97	8.37	2.22

Note: (2) 48" means 2-48 inch diameter RCP culverts will be used. Maximum headwater elevation for both existing and future conditions is limited by the shoulder elevation.

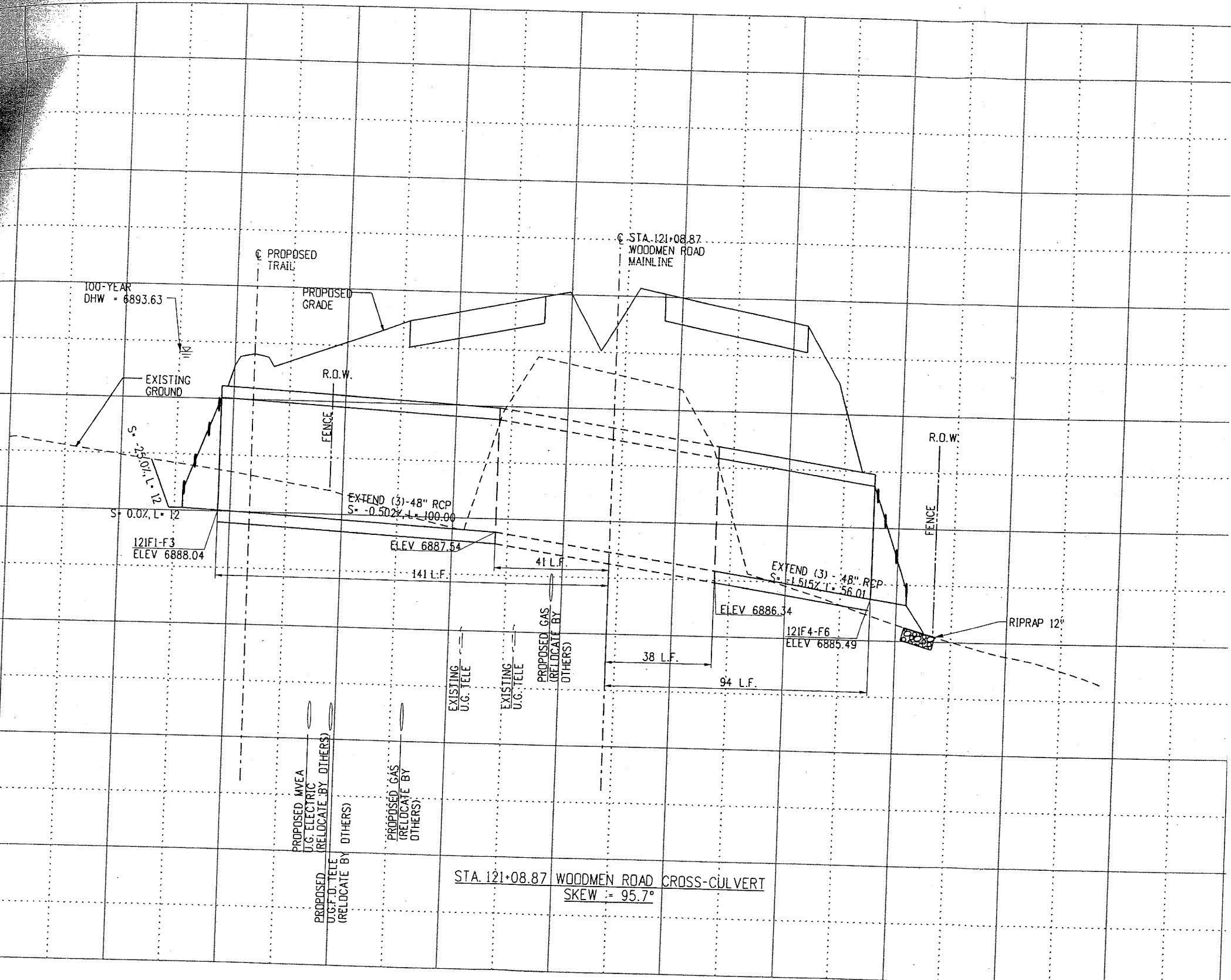


ARRIS
 80904
 (719) 386-8338



As Constructed		WOODMEN DRAINAGE		Project No./Code	
No Revisions: -		PROJECT B - PLAN			
Revised:	-	Designer:	MAL	Structure Numbers	
Void:	-	Detailer:		Sheet Number	1
		Sheet Subset:	Drainage	Subset Sheets:	of

Figure D11 Plan; Sheet 1 of 10



SCALE:
 1" = 40' HORIZONTAL
 1" = 4' VERTICAL

Computer File Information	
Creation Date:	02/20/06 Initials: LPS
Last Modification Date:	2/14/2007 Initials: LPS
Full Path:	I:\4954\4954_0604\cadd\drainage\54PRSTR19.dgn
Drawing Scale:	1"=20'
VB Ver:	08.00.01.19 Units: ENGLISH

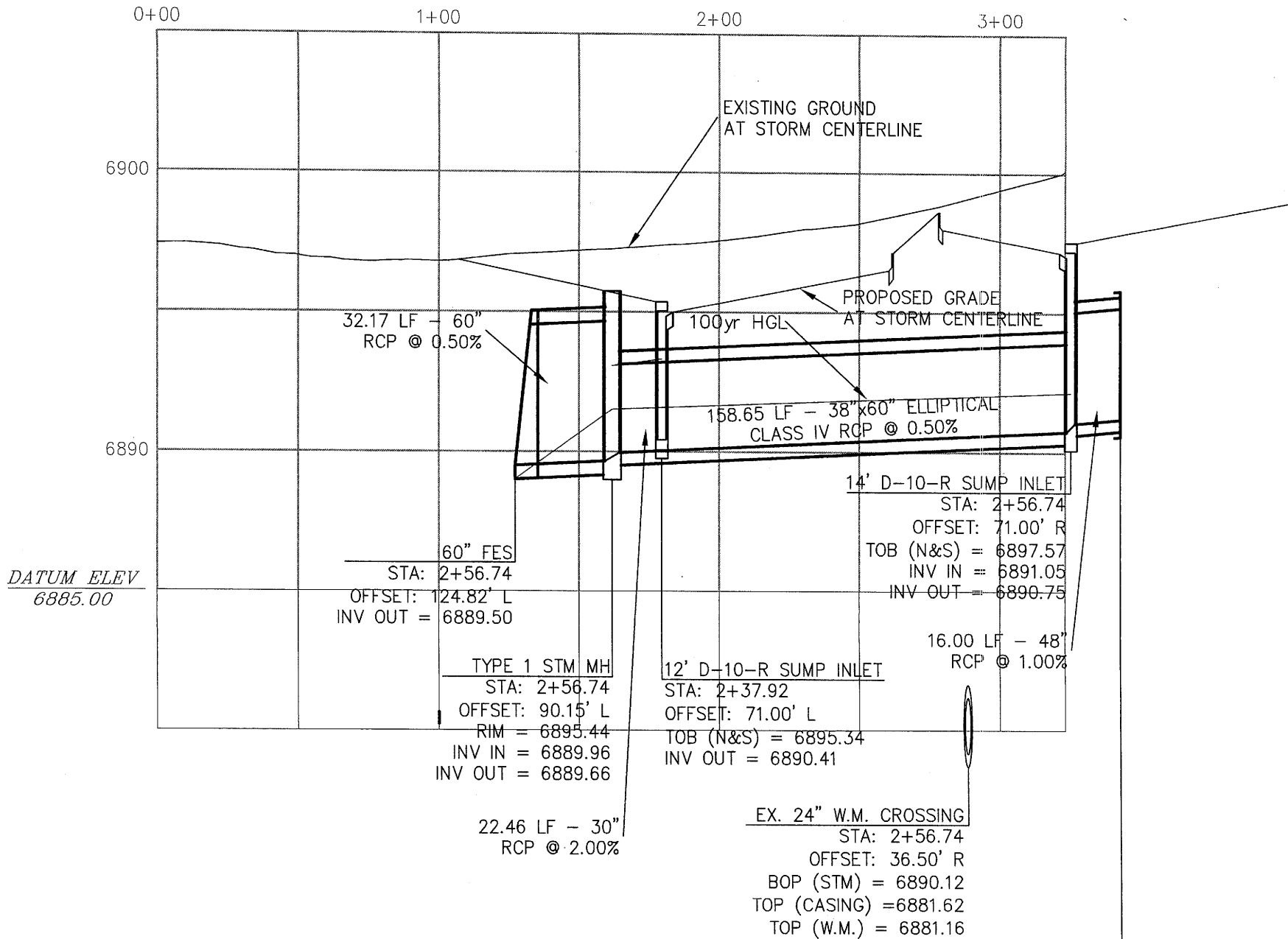
Sheet Revisions	

DMJM HARRIS | AECOM
 2950 Professional Place
 Colorado Springs, Colorado 80904
 Phone: (719) 386-8300 Fax: (719) 386-8338



As Constructed
 No Revisions:
 Revised:
 Void:

WOODMEN ROAD STORM SEWER PROFILE - WOODMEN RD. STA. 121+08.87	
Designer:	CLK Structure Numbers
Detailer:	LPS
Sheet Subset:	DRANAGE Subset Sheets: DR19 of 4.



MARKSHEFFEL ROAD - STORM SEWER

SCALE: 1" = 50'

48" CONC. PLUG
 STA: 2+56.74
 OFFSET: 90.00' R
 INV = 6891.21

FOR PROFILE SEE SHEET P-13

ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

CHANNEL IMPROVEMENTS

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

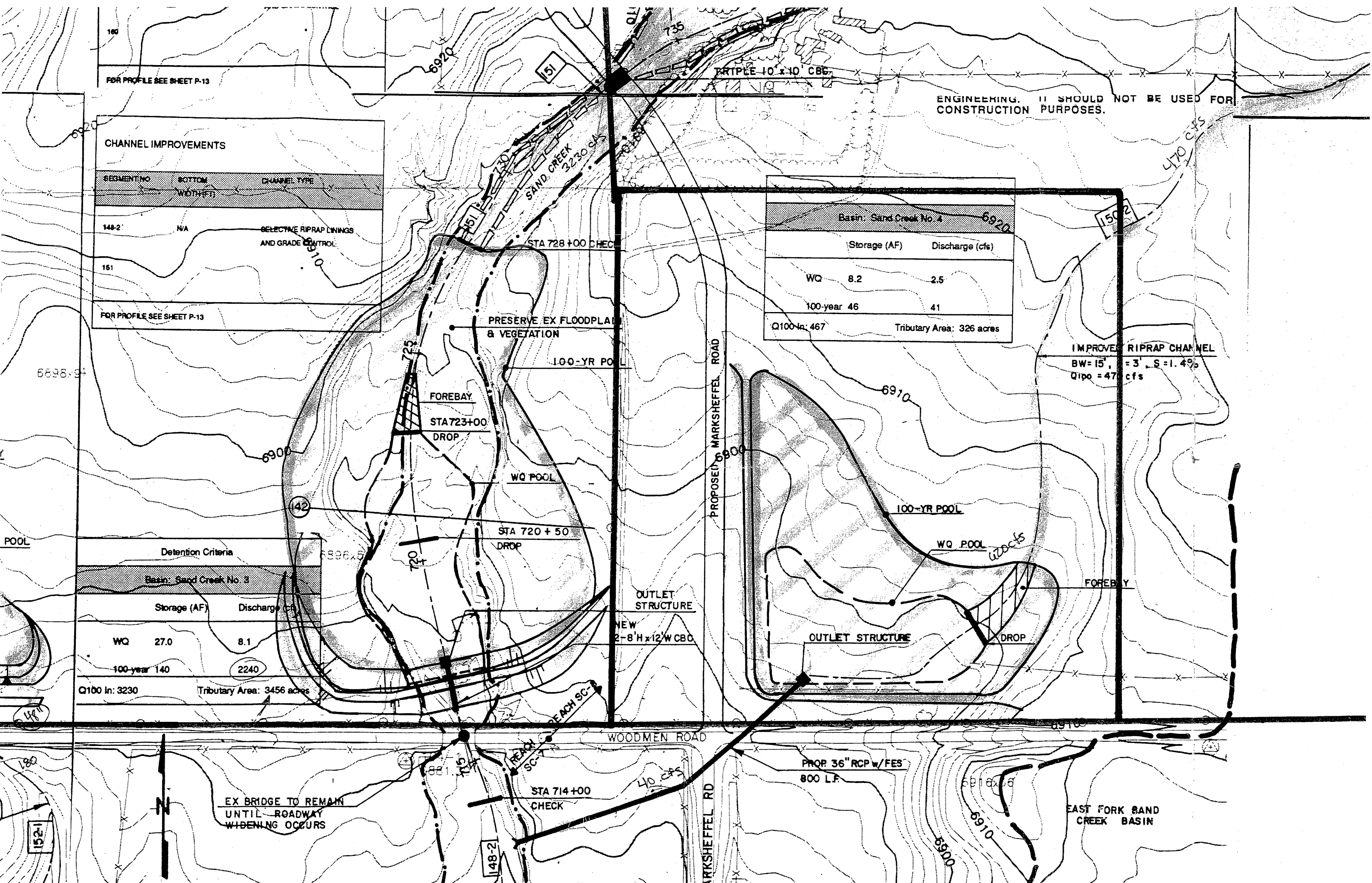
FOR PROFILE SEE SHEET P-13

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

IMPROVE RIPRAP CHANNEL
 BW=15', = 3' S=1.4%
 Q100 = 47 cfs

POOL

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



EX BRIDGE TO REMAIN
 UNTIL ROADWAY
 WIDENING OCCURS

EAST FORK SAND
 CREEK BASIN

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

WOODMEN ROAD

PROPOSED MARKSHEFFEL ROAD

STA 714+00
 CHECK

REACH SC-1

REACH SC-2

120'

FOREBAY
 STA 723+00
 DROP

WQ POOL

PRESERVE EX FLOODPLAIN
 & VEGETATION

100-YR POOL

STA 728+00 CHECK

SAND CREEK
 32.30 cfs

MARKSHEFFEL RD

148-2

142

151

151

150-2

6920

735

160

6898.5'

6900

6910

470 cfs

6910

6910

6900

180

152-1





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				Intensity		Peak Runoff		
						C(5)	C(100)	CA(5)	CA(100)	Overland Length (ft)	Overland Slope (%)	T(initial) (min.)	Travel Length (ft)	Weighted Slope (%)	Velocity (fps)	T(travel) (min.)	Final T(c)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
EX-A					2.06	0.25	0.35	0.52	0.72	20	2.0%	5.7	390	2.5%	2.5	2.6	8.3	4.4	7.8	2.3	5.6
EX-B					3.54	0.25	0.35	0.89	1.24	300	2.0%	21.9	250	3.0%	2.5	1.7	23.6	2.8	4.9	2.4	6.1
EX-C					19.58	0.25	0.35	4.90	6.85	500	2.0%	28.3	2409	1.7%	1.0	40.2	68.4	1.5	2.6	7.1	17.7
EX-D					6.56	0.25	0.35	1.64	2.30	500	2.2%	27.4	1279	2.4%	2.9	7.4	34.8	2.2	4.0	3.6	9.1
EX-E					18.14	0.25	0.35	4.54	6.35	500	2.4%	26.6	2652	1.9%	2.9	15.2	41.9	2.0	3.5	9.0	22.5
EX-F					6.95	0.25	0.35	1.74	2.43	500	2.2%	27.4	1017	1.9%	2.9	5.8	33.2	2.3	4.1	4.0	9.9
EX-G					3.75	0.25	0.35	0.94	1.31	500	2.0%	28.3	699	2.0%	2.9	4.0	32.3	2.3	4.1	2.2	5.4
EX-H					5.76	0.25	0.35	1.44	2.01	500	1.8%	29.3	1212	2.0%	2.9	7.0	36.2	2.2	3.9	3.1	7.8
EX-I					4.30	0.25	0.45	1.08	1.94	500	1.2%	33.5	710	2.2%	2.9	4.1	37.5	2.1	3.8	2.3	7.3
EX-J					14.06	0.25	0.35	3.52	4.92	500	2.2%	27.4	514	2.0%	2.9	3.0	30.4	2.4	4.3	8.5	21.1
EX-K					9.41	0.25	0.35	2.35	3.29	500	2.0%	28.3	730	2.6%	2.9	4.2	32.5	2.3	4.1	5.4	13.6
EX-L					1.85	0.25	0.35	0.46	0.65	125	3.2%	12.1	986	1.7%	2.9	5.7	17.8	3.2	5.7	1.5	3.7
OS-1					4.26	0.25	0.35	1.07	1.49	495	2.2%	27.2	207	5.8%	2.9	1.2	28.4	2.5	4.5	2.7	6.6
OS-2					2.70	0.90	0.95	2.43	2.57							5.0	5.1	9.1	12.4	23.4	
OS-3					2.05	0.90	0.95	1.85	1.95							5.0	5.1	9.1	9.4	17.7	
OS-5					323.00	0.20	0.27	64.60	87.20							26.4			201.7	404.0	
PP-O					0.78	0.90	0.95	0.71	0.74	42	2.0%	8.2	636	2.1%	4.1	2.6	10.8	4.0	7.1	2.8	5.3
PP-N					0.09	0.90	0.95	0.62	0.65	42	2.0%	8.2	548	2.1%	4.0	2.3	10.5	4.0	7.2	2.5	4.7
1			OS-1, EX-A		6.32	0.25	0.35	1.59	2.21	495	2.2%	27.20	207	0.06	2.90	1.19	28.4	2.5	4.4	4.0	9.8
1-A			DP1, E		24.46	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	28.8
2			OS-5		323.00	0.20	0.27	64.60	87.20							26.4	2.60	4.63	168.1	403.9	
3			DP2, EX-D	Tc From OS-5 is considered negligible	329.56	0.20	0.27	66.24	89.50	500	2.2%	27.40	1279	0.02	2.50	8.53	35.9			201.7	404.0
4			1-A, DP3, EX-C		373.60	0.21	0.28	77.27	104.91	500	2.0%	28.28	2652	0.02	2.50	17.68	46.0	1.88	3.34	145.0	350.5
5			DP4, EX-G, PP-O, PP-N		378.82	0.21	0.28	79.53	107.62	500	2.0%	28.28	2652	0.02	2.50	17.68	46.0	1.88	3.34	149.3	359.5
6			DP5, EX-F		385.77	0.21	0.29	81.27	110.05	500	2.0%	28.28	2652	0.02	2.50	17.68	46.0	1.88	3.34	152.5	367.6
7			EX-H, EX-I		10.06	0.25	0.39	2.52	3.95	500	2.0%	28.28	273	2.2%	2.5	1.8	30.1	2.42	4.30	6.1	17.0
8			DP6, DP7, L		397.68	0.21	0.29	84.25	114.65	500	2.0%	28.28	2652	2.2%	3.5	12.6	40.9	2.02	3.59	169.9	411.6
9			EX-K		9.41			2.35	3.29							32.5	2.31	4.12	5.4	13.6	

Rational Calculations



Project Name: Shiloh Mesa Street
 Project Location: Northeast Colorado Springs
 Designer: BAS
 Notes:

Average Channel Velocity: ft/s (If specific channel vel is used, this will be ignored)
 Average Slope for Initial Flow: ft/ft (If Elevations are used, this will be ignored)
 Note:
 Q2, Q5 & Q10 are based on C10;
 Q25, Q50 & Q100 are based on C100

Basin	Total Area sf	Total Area acres	Rational 'C' Values												Flow Lengths					
			Surface Type 1			Surface Type 2			Surface Type 3			Surface Type 4			Composite C10	Composite C100	Initial Length ft	True Initial Length ft	Channel flow Length ft	True Channel Length ft
			C10	C100	Area (SF)	C10	C100	Area (SF)	C10	C100	Area	C10	C100	Area						
OS-1	174,004.9	4.000	0.25	0.35	174,005	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	495.00	300.00	207.00	402.00
EX-A	92,394.3	2.130	0.25	0.35	92,394	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	375.00	300.00	399.00	474.00
EX-B	154,150.3	3.540	0.25	0.35	154,150	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	300.00	300.00	700.00	700.00
EX-C	852,327.9	19.570	0.25	0.35	852,328	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	500.00	300.00	3055.00	3255.00
EX-D	285,762.2	6.570	0.25	0.35	285,762	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	500.00	300.00	360.00	560.00
EX-E	789,865.5	18.140	0.25	0.35	789,866	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	500.00	300.00	3002.00	3202.00
EX-F	302,905.2	6.960	0.25	0.35	302,905	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	500.00	300.00	1075.00	1275.00
EX-G	163,766.3	3.760	0.25	0.35	163,766	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	300.00	300.00	765.00	965.00
PP-H	284,718.3	6.540	0.25	0.35	284,718	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	500.00	300.00	1075.00	1275.00
PP-I	180,074.1	4.140	0.25	0.35	131,674	0.90	0.95	26,996	0.60	0.70	0	0.90	0.90	21,404	0.430	0.510	500.00	300.00	335.00	535.00
EX-J	612,382.8	14.060	0.25	0.35	518,471	0.90	0.95	73,662	0.60	0.70	0	0.90	0.90	20,250	0.350	0.450	500.00	300.00	1655.00	1755.00
PP-K	402,460.2	9.240	0.25	0.35	389,330	0.90	0.95	13,131	0.60	0.70	0	0.90	0.90	0	0.250	0.370	500.00	300.00	1186.00	1386.00
EX-L	65,340.3	1.510	0.25	0.35	65,340	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	125.00	125.00	760.00	750.00
PP-N	19,143.8	0.440	0.25	0.35	0	0.90	0.95	19,144	0.60	0.70	0	0.90	0.90	0	0.900	0.950	42.00	42.00	337.79	337.79
PP-O	20,449.2	0.470	0.25	0.35	0	0.90	0.95	20,449	0.60	0.70	0	0.90	0.90	0	0.900	0.950	42.00	42.00	361.21	361.21
PP-R	10,807.5	0.250	0.25	0.35	0	0.90	0.95	10,808	0.60	0.70	0	0.90	0.90	0	0.900	0.950	42.00	42.00	169.05	169.05
PP-S	13,673.0	0.320	0.25	0.35	0	0.90	0.95	13,673	0.60	0.70	0	0.90	0.90	0	0.900	0.950	42.00	42.00	233.13	233.13
FUT-P	14,533.9	0.340	0.25	0.35	0	0.90	0.95	14,534	0.60	0.70	0	0.90	0.90	0	0.900	0.950	42.00	42.00	475.00	475.00
FUT-Q	15,033.6	0.350	0.25	0.35	0	0.90	0.95	15,034	0.60	0.70	0	0.90	0.90	0	0.900	0.950	42.00	42.00	485.00	485.00
OS-2	113,200.0	2.600	0.25	0.35	52,471	0.90	0.95	60,729	0.60	0.70	0	0.90	0.90	0	0.600	0.680	115.00	115.00	641.00	641.00
OS-3	89,204.3	2.050	0.25	0.35	64,826	0.90	0.95	24,378	0.60	0.70	0	0.90	0.90	0	0.430	0.620	115.00	115.00	659.00	659.00
OS-5	14,069,936.3	323.010	0.25	0.35	13,069,936	0.90	0.95	500,000	0.60	0.70	500,000	0.90	0.90	0	0.290	0.390	500.00	300.00	5000.00	5685.00
DP1	266,399.2	6.120	0.25	0.35	266,399	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	495.00	300.00	606.00	801.00
DP2	14,069,936.3	323.010	0.25	0.35	13,069,936	0.90	0.95	500,000	0.60	0.70	500,000	0.90	0.90	0	0.290	0.390	500.00	300.00	5000.00	5200.00
DP3	14,355,698.5	329.570	0.25	0.35	13,355,698	0.90	0.95	500,000	0.60	0.70	500,000	0.90	0.90	0	0.290	0.390	500.00	300.00	5560.00	5560.00
DP4	16,264,291.1	373.380	0.25	0.35	15,264,291	0.90	0.95	500,000	0.60	0.70	500,000	0.90	0.90	0	0.290	0.380	500.00	300.00	11417.00	11617.00
DP5	16,549,009.4	379.920	0.25	0.35	15,549,009	0.90	0.95	500,000	0.60	0.70	500,000	0.90	0.90	0	0.290	0.390	500.00	300.00	12492.00	12692.00
DP6	368,245.4	8.460	0.25	0.35	368,245	0.90	0.95	0	0.60	0.70	0	0.90	0.90	0	0.250	0.350	500.00	300.00	1825.00	2025.00
DP7	18,917,254.8	388.370	0.25	0.35	17,917,255	0.90	0.95	500,000	0.60	0.70	500,000	0.90	0.90	0	0.280	0.380	500.00	300.00	14317.00	14517.00
DP8	1,194,917.0	27.440	0.25	0.35	1,039,474	0.90	0.95	113,789	0.60	0.70	0	0.90	0.90	41,654	0.340	0.430	500.00	300.00	3076.00	3276.00
DP9	1,461,394.9	33.550	0.25	0.35	1,156,772	0.90	0.95	262,969	0.60	0.70	0	0.90	0.90	41,654	0.390	0.480	500.00	300.00	4978.72	5178.72
DP10	64,073.5	1.480	0.25	0.35	0	0.90	0.95	64,074	0.60	0.70	0	0.90	0.90	0	0.900	0.950	25.00	25.00	602.72	602.72

Project Name:
 Project Location:
 Designer:
 Notes:

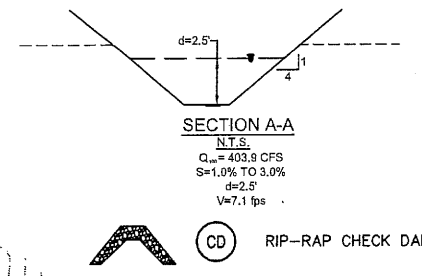
Average Channel Velocity
 Average Slope for Initial Flow
 Note:
 Q2, Q5 & Q10 are based on C10;
 Q25, Q50 & Q100 are based on C100

Rational Calculations

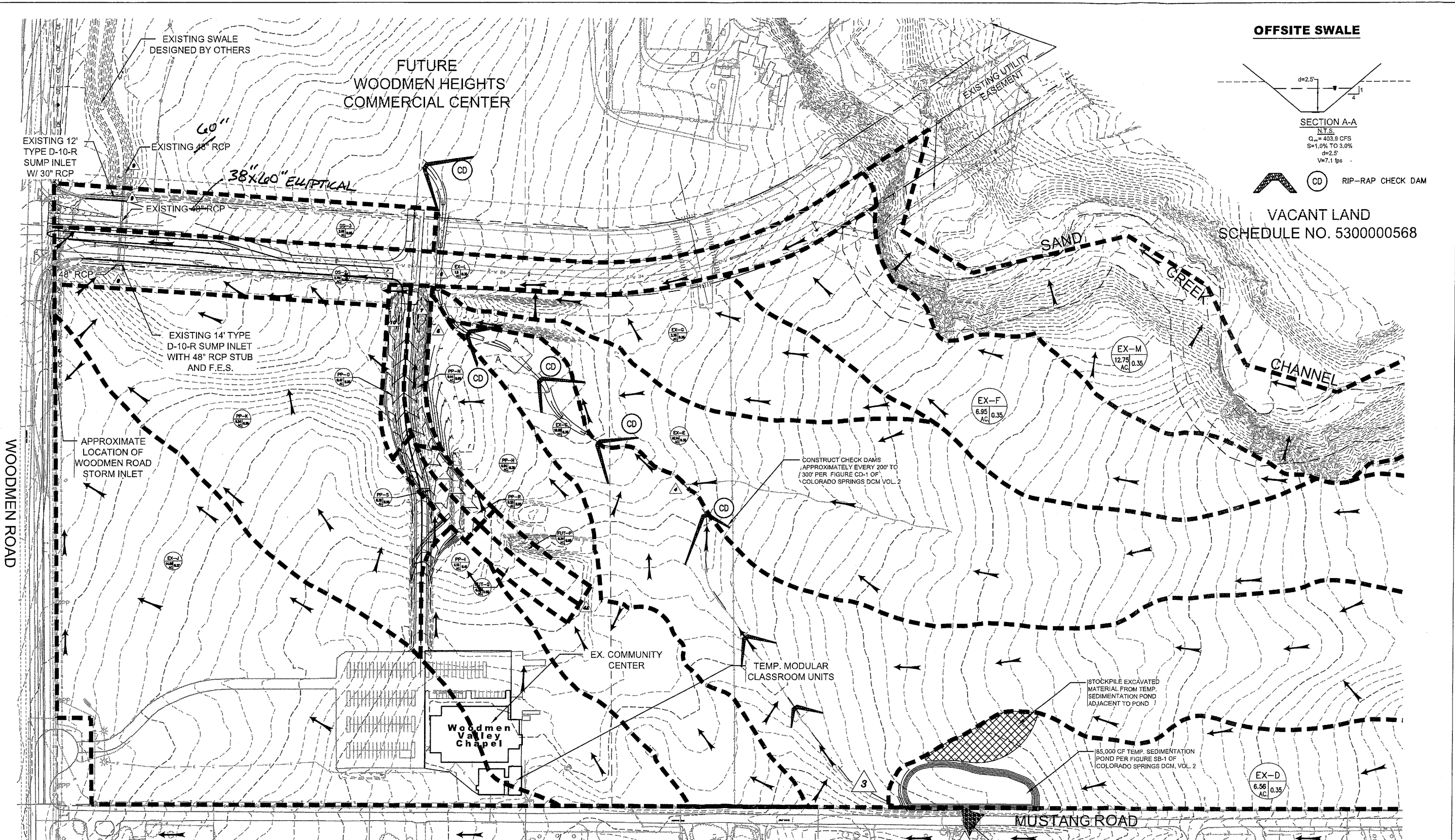


Basin	Initial Flow			Channel Flow				Rainfall Intensity and Rational Flow Rate														
	High Point Elevation	Low Point Elevation	Average Slope	Initial Tc (min)	High Point Elevation	Low Point Elevation	Average Slope	Flow Master Velocity (ft/s)	Channel Tc (min)	Total I/c (min)	i2 in/hr	Q2 cfs	i5 in/hr	Q5 cfs	i10 in/hr	Q10 cfs	i25 in/hr	Q25 cfs	i50 in/hr	Q50 cfs	i100 in/hr	Q100 cfs
OS-1	6997.00	6996.00	0.022	21.10	6966.00	6973.50	0.060	2.37	2.83	23.92	2.00	2.0	2.75	2.8	3.20	3.2	4.12	5.8	4.67	6.6	4.8872	6.9
EX-A	6964.25	6977.00	0.019	22.10	6977.00	6967.00	0.025	1.37	5.77	27.86	1.84	1.0	2.53	1.4	2.95	1.6	3.79	2.8	4.29	3.2	4.956	3.4
EX-B	6979.00	6973.00	0.020	21.85	6973.00	6962.00	0.016	0.97	12.03	39.87	1.64	1.5	2.26	2.0	2.63	2.4	3.39	4.2	3.84	4.8	4.0194	5.0
EX-C	6984.25	6973.00	0.023	21.01	6973.00	6918.00	0.018	1.68	32.29	53.30	1.24	6.1	1.71	8.4	1.99	9.8	2.56	17.7	2.91	20.1	3.0419	21.0
EX-D	6982.00	6973.00	0.018	22.63	6973.00	6938.50	0.096	3.78	2.47	25.10	1.94	3.2	2.68	4.4	3.12	5.2	4.01	9.3	4.55	10.5	4.7618	11.0
EX-E	6979.00	6968.00	0.022	21.17	6968.00	6918.00	0.017	2.45	21.78	42.95	1.42	6.5	1.96	8.9	2.28	10.4	2.94	18.8	3.33	21.3	3.4839	22.3
EX-F	6960.00	6950.00	0.020	21.85	6950.00	6930.00	0.019	1.16	18.32	40.17	1.48	2.6	2.04	3.8	2.38	4.2	3.06	7.5	3.47	8.5	3.6297	8.9
EX-G	6941.50	6931.00	0.021	21.50	6931.00	6915.00	0.021	1.80	8.94	30.43	1.75	1.7	2.40	2.3	2.80	2.7	3.60	4.8	4.08	5.4	4.2767	5.7
PP-H	6943.00	6933.50	0.019	22.23	6933.50	6916.00	0.016	1.44	14.76	36.98	1.56	2.6	2.14	3.5	2.50	4.1	3.22	7.4	3.64	8.4	3.8155	8.8
PP-I	6938.00	6931.00	0.014	19.40	6931.00	6924.00	0.021	2.78	3.21	22.60	2.06	3.7	2.83	5.1	3.30	5.9	4.24	9.0	4.81	10.2	5.0369	10.7
EX-J	6939.00	6929.00	0.020	19.28	6929.00	6912.00	0.011	1.86	15.73	35.00	1.61	8.0	2.21	11.0	2.58	12.8	3.32	21.2	3.77	24.0	3.9425	25.1
PP-K	6930.00	6917.00	0.026	19.31	6917.00	6902.00	0.013	1.12	20.63	39.93	1.49	3.9	2.05	5.3	2.39	6.2	3.07	10.6	3.48	12.0	3.6430	12.6
EX-L	6936.00	6932.00	0.032	12.06	6932.00	6913.00	0.025	1.71	7.31	19.36	2.23	0.8	3.06	1.2	3.57	1.4	4.60	2.4	5.21	2.8	5.4540	2.9
PP-N	6919.00	6918.00	0.024	1.82	6918.00	6911.00	0.021	4.38	1.29	5.00	3.71	1.5	5.10	2.0	5.96	2.4	7.66	3.2	8.68	3.7	9.0861	3.8
PP-O	6918.50	6917.50	0.024	1.82	6917.50	6911.00	0.018	4.43	1.36	5.00	3.71	1.6	5.10	2.2	5.96	2.5	7.66	3.4	8.68	3.9	9.0861	4.1
PP-R	6924.00	6923.00	0.024	1.82	6923.00	6919.00	0.024	3.33	0.72	5.00	3.71	0.8	5.10	1.2	5.96	1.4	7.66	1.8	8.68	2.1	9.0861	2.2
PP-S	6924.00	6923.00	0.024	1.82	6923.00	6919.00	0.017	4.11	0.95	5.00	3.71	1.1	5.10	1.5	5.96	1.7	7.66	2.3	8.68	2.7	9.0861	2.8
FUT-P	6932.00	6919.50	0.298	0.78	6919.50	6911.00	0.018	3.93	2.01	5.00	3.71	1.1	5.10	1.5	5.96	1.7	7.66	2.5	8.68	2.8	9.0861	3.0
FUT-Q	6932.00	6919.50	0.321	0.76	6919.50	6911.00	0.015	4.18	1.93	5.00	3.71	1.2	5.10	1.6	5.96	1.9	7.66	2.6	8.68	2.9	9.0861	3.0
OS-2	6913.00	6911.00	0.017	8.34	6911.00	6896.00	0.023	5.97	1.79	10.12	2.97	4.7	4.08	6.4	4.76	7.5	6.13	10.9	6.94	12.4	7.2686	13.0
OS-3	6913.00	6911.00	0.017	11.17	6911.00	6896.00	0.023	2.69	4.10	15.27	2.50	2.2	3.43	3.1	4.01	3.6	5.15	5.5	5.84	6.3	6.1126	6.8
OS-5	7045.00	7030.00	0.030	18.19	7030.00	6942.00	0.018	3.00	31.47	49.66	1.30	122.7	1.79	168.8	2.09	196.9	2.68	340.5	3.04	385.9	3.1819	404.0
DP1	6997.00	6986.00	0.022	21.10	6986.00	6967.00	0.031	1.37	9.74	30.94	1.73	2.7	2.38	3.7	2.78	4.3	3.58	7.7	4.05	8.8	4.2441	9.2
DP2	7045.00	7030.00	0.030	18.19	7030.00	6942.00	0.018	7.65	11.33	29.51	1.78	167.8	2.45	230.9	2.85	269.3	3.67	465.7	4.16	527.8	4.3522	552.7
DP3	7045.00	7030.00	0.030	18.19	7030.00	6938.50	0.017	7.65	12.11	30.30	1.75	168.6	2.41	232.0	2.81	270.7	3.61	468.1	4.09	530.5	4.2872	555.5
DP4	7045.00	7030.00	0.030	18.19	7030.00	6918.00	0.010	7.65	25.31	43.49	1.41	154.0	1.94	212.0	2.27	247.3	2.91	416.7	3.30	472.2	3.4572	494.4
DP5	7045.00	7030.00	0.030	18.19	7030.00	6916.00	0.009	7.65	27.85	45.84	1.37	151.7	1.88	208.8	2.19	243.6	2.82	410.3	3.20	465.0	3.3460	486.9
DP6	7045.00	7030.00	0.030	19.09	7030.00	6915.00	0.063	7.65	4.41	23.50	2.01	4.3	2.77	5.9	3.23	6.9	4.16	12.4	4.71	14.1	4.9337	14.7
DP7	7045.00	7030.00	0.030	18.42	7030.00	6913.00	0.008	7.65	31.63	50.04	1.29	141.7	1.78	195.0	2.08	227.5	2.67	397.0	3.02	449.9	3.1666	471.1
DP8	6939.00	6929.00	0.020	19.54	6929.00	6912.00	0.006	2.78	19.64	39.17	1.50	14.1	2.07	19.5	2.42	22.7	3.11	36.9	3.52	41.9	3.6857	43.8
DP9	6939.00	6929.00	0.020	18.25	6929.00	6896.00	0.007	5.97	14.46	32.70	1.67	22.1	2.30	30.4	2.69	35.5	3.46	56.1	3.92	63.6	4.1028	66.8
DP10	6924.00	6923.00	0.040	1.18	6923.00	6911.00	0.020	7.65	1.31	5.00	3.71	5.0	5.10	6.9	5.96	8.0	7.66	10.9	8.68	12.3	9.0861	12.9

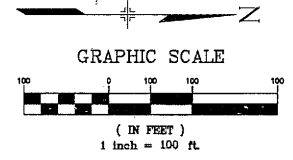
OFFSITE SWALE



VACANT LAND
SCHEDULE NO. 530000568



NOTE: FOR PLAN & PROFILE OF MARKSHEFFEL ROAD & STORM SEWER SHOWN SCHEMATICALLY ON THIS PLAN, SEE WOODMEN HEIGHTS-ROADWAY INFRASTRUCTURE MARKSHEFFEL ROAD- INTERIM ROADWAY PLANS BY M & S CIVIL CONSULTANTS, OCT. 2008



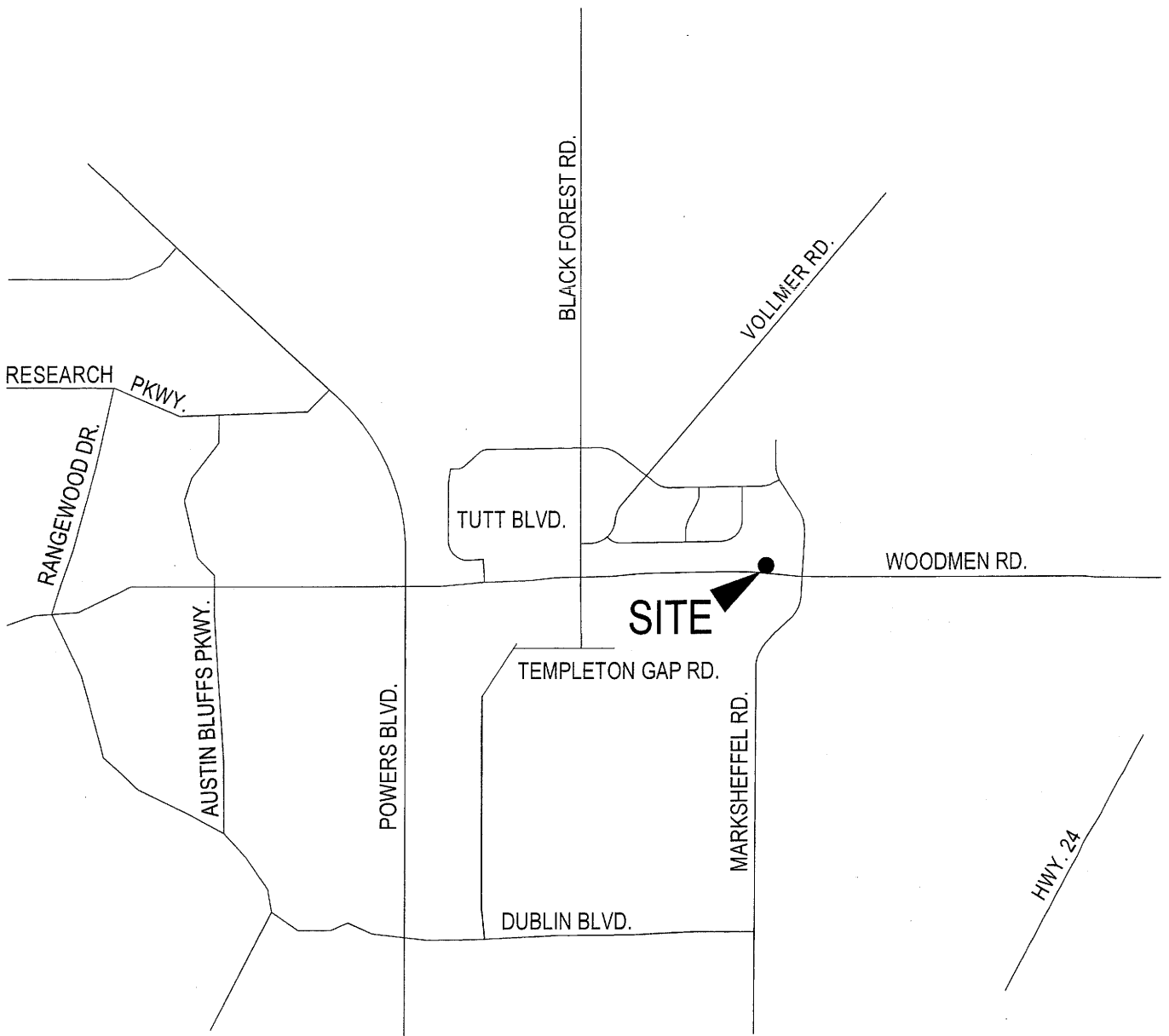
LEGEND

- DRAINAGE BASIN BOUNDARY
- - - EXISTING CONTOUR
- - - EXISTING STORM
- - - EXISTING FENCE
- EXISTING ELECTRIC
- - - EXISTING FIBER OPTIC
- EXISTING FLOW DIRECTION ARROW
- △ 10 DESIGN POINT
- A BASIN DESIGNATION
- "C" COEFFICIENT (100 YR)
- BASIN AREA (ACRES)



SHILOH MESA STREET EXISTING CONDITIONS AT WOODMEN HEIGHTS			
WITHIN SHILOH MESA DEVELOPMENT NORTH OF WOODMEN ROAD, SOUTH OF KENOSHA DRIVE			
DRAINAGE PLAN EXISTING CONDITIONS			
DESIGNED BY: BAS	SCALE:	DATE ISSUED: AUGUST, 2011	DR01
DRAWN BY: BAS	HORIZ: 1" = 100'	MDG PROJECT NO: 11.469.003	
CHECKED BY: EWS	VERT: N/A		

VICINITY MAP

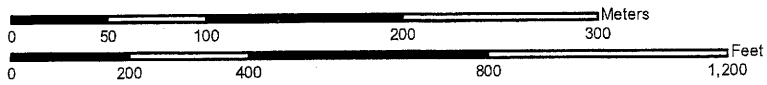


VICINITY MAP

N.T.S.


SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado
(Woodmen Heights Commercial Center)




MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Units

Soil Ratings

 A

 A/D

 B

 B/D

 C


 C/D


 D

 Not rated or not available

Political Features


Municipalities

 Cities

 Urban Areas

Water Features


 Oceans

 Streams and Canals

Transportation


 Rails


Roads

 Interstate Highways

 US Routes

 State Highways

 Local Roads

 Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 13N

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 4, Dec 20, 2006

Date(s) aerial images were photographed: 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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
9	Blakeland-Fluvaquentic Haplaquolls	A	5.2	11.1%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	1.5	3.3%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	40.3	85.6%
Totals for Area of Interest (AOI)			47.0	100.0%

Description

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

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

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

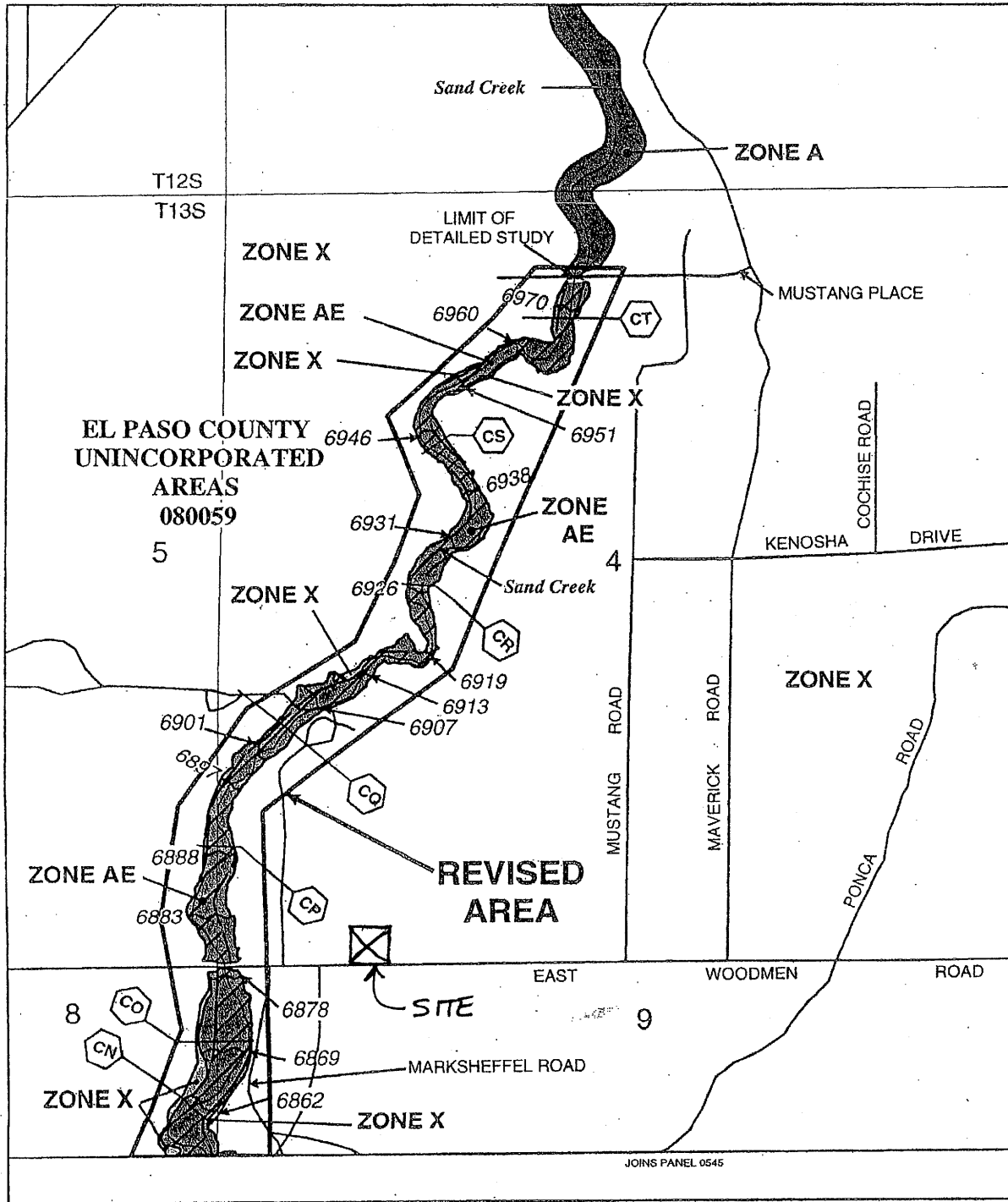
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.




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

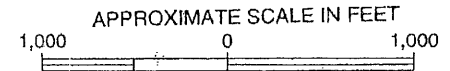
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over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

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

FLOODPLAIN MAP



- Legend
-  1% annual chance (100-Year) Floodplain
 -  1% annual chance (100-Year) Floodway
 -  0.2% annual chance (500-Year) Floodplain



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



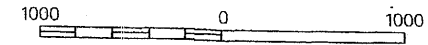
EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

ZONE A



APPROXIMATE SCALE IN FEET



N
TO
RA

MUSTANG PLACE

ZONE X

COCHISE ROAD

MOHAWK ROAD

KENOSHA

DRIVE

4

Creek

MUSTANG ROAD

MAVERICK ROAD

PONCA ROAD

ZONE A

MIT OF
LED STUDY

Sand

6878



EAST

WOODMEN

ROAD

6876

6872



SITE

6868

ZONE AE

9

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

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

HYDROLOGIC CALCULATIONS

WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Area Runoff Coefficient Summary)

BASIN	TOTAL AREA (Acres)	STREETS / DEVELOPED			OVERLAND / UNDEVELOPED			WEIGHTED	
		AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	C ₅	C ₁₀₀
<i>A1</i>	3.74	3.37	0.90	0.95	0.37	0.25	0.35	0.84	0.89
<i>A2</i>	2.51	2.38	0.90	0.95	0.13	0.25	0.35	0.87	0.92
<i>A3</i>	1.22	1.16	0.90	0.95	0.06	0.25	0.35	0.87	0.92
<i>A4</i>	2.76	2.62	0.90	0.95	0.14	0.25	0.35	0.87	0.92
<i>B</i>	1.27	1.21	0.90	0.95	0.06	0.25	0.35	0.87	0.92
<i>C</i>	1.94	1.75	0.90	0.95	0.19	0.25	0.35	0.84	0.89
<i>D</i>	0.65	0.64	0.90	0.95	0.01	0.25	0.35	0.89	0.94
<i>E</i>	1.09	1.04	0.90	0.95	0.05	0.25	0.35	0.87	0.92
<i>F</i>	1.31	0.79	0.90	0.90	0.52	0.15	0.20	0.60	0.62

Calculated by: VAS _____

Date: 3/5/2012 _____

Checked by: _____

**WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
HISTORIC DRAINAGE RUNNOFF**

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c	Length (ft)	Slope (%)	Velocity (fps)	T _t	TOTAL (min)	Location	I ₅	I ₁₀₀	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		From DCM Table 5-1					(min)				(min)			(in/hr)	(in/hr)		
A	3.50	0.25	0.35	0.25	100	2	12.6	1000	2.3%	5.3	3.1	15.8		3.4	6.0	3.0	7.4
B	29.00	0.25	0.35	0.25	100	2	12.6	1750	1.8%	4.7	6.2	18.9		3.1	5.5	22.5	56.1
C	4.00	0.25	0.35	0.25	100	2	12.6	1800	2.5%	5.5	5.4	18.1		3.2	5.6	3.2	7.9
SC	11.80	0.25	0.35	0.25	60	20	3.9	2350	1.4%	4.1	9.5	13.3		3.6	6.5	10.8	26.8

OFF-SITE FLOWS DIVERTED FROM SHILO MESA - SEE REPORT BY MATRIX DESIGN GROUP 2011 - PROJ. NO. 11.469.003

EX-C	19.58	0.25	0.35	0.25	500	10	28.3	2409	1.7%	4.6	8.8	37.1		2.1	3.8	10.5	26.1
EX-D	6.56	0.25	0.35	0.25	500	11	27.4	1279	2.4%	5.4	3.9	31.3		2.4	4.2	3.9	9.7
EX-E	18.14	0.25	0.35	0.25	500	12	26.6	2652	1.9%	4.8	9.2	35.8		2.2	3.9	9.9	24.7
EX-F	6.95	0.25	0.35	0.25	500	11	27.4	1017	1.9%	4.8	3.5	30.9		2.4	4.2	4.1	10.3
EX-G	3.75	0.25	0.35	0.25	500	10	28.3	699	2.0%	4.9	2.4	30.6		2.4	4.3	2.2	5.6
OS-5	323.00	0.20	0.27									26.4				201.7	404.0

Calculated by: VAS
Date: 3/5/2012
Checked by: _____

WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	Location	I ₅	I ₁₀₀	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		From DCM Table 5-1												(in/hr)	(in/hr)		
A1	3.74	0.84	0.89	0.25	25	2	4.0	1000	2.5%	5.5	3.0	7.0		4.6	8.3	14.5	27.5
A2	2.51	0.87	0.92	0.25	25	2	4.0	550	2.5%	5.5	1.7	5.7		4.9	8.8	10.8	20.3
A3	1.22	0.87	0.92	0.25	10	2	1.9	420	2.5%	5.5	1.3	5.0		5.1	9.1	5.4	10.2
A4	2.76	0.87	0.92	0.25	10	2	1.9	420	2.5%	5.5	1.3	5.0		5.1	9.1	12.2	23.1
B	1.27	0.87	0.92	0.25	10	2	1.9	300	1.5%	4.3	1.2	5.0		5.1	9.1	5.6	10.6
C	1.94	0.84	0.89	0.25	25	2	4.0	350	2.5%	5.5	1.1	5.1		5.1	9.1	8.2	15.6
D	0.65	0.89	0.94	0.25	10	2	1.9	200	2.0%	4.9	0.7	5.0		5.1	9.1	3.0	5.6
E	1.09	0.87	0.92	0.25	10	2	1.9	350	1.0%	3.5	1.7	5.0		5.1	9.1	4.8	9.1
F	1.31	0.60	0.62	0.25	25	4	3.2	600	1.0%	3.5	2.9	6.0		4.9	8.6	3.8	7.0

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: VAS
Date: 3/5/2012
Checked by: _____

WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Surface Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA ₅	Equivalent CA ₁₀₀	Maximum T _c	Intensity *		Flow	
					I ₅	I ₁₀₀	Q ₅	Q ₁₀₀
1	A2	2.18	2.31	5.7	4.9	8.8	10.8	20.3
2	A3	1.06	1.12	5.0	5.1	9.1	5.4	10.2
3	B & D	1.68	1.78	5.0	5.1	9.1	8.6	16.2
4	A4	2.39	2.54	5.0	5.1	9.1	12.2	23.1
4H	HISTORIC COLLECTED OFF-SITE	85.60	116.60	50.0	1.8	3.2	152.3	369.4
5	C	1.62	1.73	5.1	5.1	9.1	8.2	15.6
6	E	0.95	1.00	5.0	5.1	9.1	4.8	9.1
7	A1	3.12	3.33	7.0	4.6	8.3	14.5	27.5
7H	HISTORIC COLLECTED, A1, A2, F	6.09	6.45	7.0	4.6	8.3	28.2	53.3
8	F	0.79	0.81	6.0	4.9	8.6	3.8	7.0

EXISTING FLOWS - ONSITE AND OFFSITE

1*	C, DP8 (SHILO MESA)	88.40	120.86	47.7	1.8	3.3	162.2	394.6
2*	DP1, B	95.68	131.06	55.5	1.7	3.0	159.3	388.5
6**	EX-C, THRU EX-G, OS-5	78.35	106.45	46.0	1.9	3.3	147.0	355.4

* FROM MATRIX MDDP FOR THE WOODMEN HEIGHTS COMMERCIAL CENTER 2009

** FROM MATRIX MDDP FOR SHILO MESA EXISTING CONDITIONS 2011

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point

EX - Existing Design Point

FB- Flow By from Design Point

INT- Intercepted Flow from Design Point

Calculated by: VAS

Date: 3/5/2012

Checked by: _____

HYDRAULIC CALCULATIONS

WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Storm Sewer Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA ₅	Equivalent CA ₁₀₀	Maximum T _C	Intensity*		Flow		
					I ₅	I ₁₀₀	Q ₅	Q ₁₀₀	Pipe
P1	A2	2.18	2.31	5.7	4.9	8.8	10.8	20.3	24"
P2	1/2 A3, A2	2.71	2.87	5.7	4.9	8.8	13.4	25.2	30"
P3	1/2 A3	0.53	0.56	5.7	4.9	8.8	2.6	4.9	18"
P4	P2 & P3	3.24	3.43	5.7	4.9	8.8	16.0	30.2	30"
P5	A4	2.39	2.54	5.0	5.1	9.1	12.2	23.1	30"
P5H	HISTORIC COLL. DP D4H	85.60	116.60	50.0	1.8	3.2	152.3	369.4	60"
P5A	P4, P5	5.63	5.97	5.0	5.1	9.1	28.7	54.3	36"
P5AH	HISTORIC COLL. P5H, & P4	88.83	120.03	50.0	1.8	3.2	158.1	380.3	60"
P6	1/2 D, 1/2 B	0.84	0.89	5.0	5.1	9.1	4.3	8.1	18"
P7	1/2 D, 1/2 B, C	2.46	2.62	5.0	5.1	9.1	12.6	23.8	30"
P7A	C	1.62	1.73	5.1	5.1	9.1	8.2	15.6	24"
P8	P6, P7, P7A	4.92	5.23	5.1	5.1	9.1	25.0	47.4	36"
P9	SHILOH MESA OUTFALL, & A1						106.67*	185.4*	60"
P9A	A1	3.12	3.33	7.0	4.6	8.3	14.5	27.5	36"
P10	P5A, P9						135.4	239.7	3-48"
P10H	HISTORIC COLL. P5AH, & P10						293.5	619.9	3-48"

* FROM MATRIX MDDP FOR SHILO MESA AT WOODMEN HEIGHTS

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point

EX - Existing Design Point

FB- Flow By from Design Point

INT- Intercepted Flow from Design Point

Calculated by: VAS

Date: 3/5/2012

Checked by: _____

**WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)**

DP D2 - 1/2 BASIN C

Total Flow: $Q_5 = 4.1$ cfs
 $Q_{100} = 7.8$ cfs

Maximum allowable ponding depth at sump:

$D_{max_5} = 0.50'$
 $D_{max_{100}} = 0.67'$

$$Q_i = 1.7(L_i + 1.8(W))(D_{max} + w/12)^{1.85}$$

where: $W = 3$ feet
 $w = 4$ inches

Clogging Factor = 1.25
 $L_i (1.25) =$ Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

**(Install a Public 4' D-10-R inlet to accept both 5 yr. & 100 yr.
developed flows at this design point.)**

Calculated by: VAS

Date: 3/5/2012

Checked by: _____

WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP D2 - 1/2 BASIN C

Total Flow:

Q_5	=	4.1 cfs
Q_{100}	=	7.8 cfs

Maximum allowable ponding depth at sump:

D_{max_5}	=	0.50'
$D_{max_{100}}$	=	0.67'

$$Q_i = 1.7(L_i + 1.8(W))(D_{max} + w/12)^{1.85}$$

where: $W = 3$ feet
 $w = 4$ inches

Clogging Factor = 1.25
 $L_i (1.25) =$ Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

**(Install a Public 4' D-10-R inlet to accept both 5 yr. & 100 yr.
developed flows at this design point.)**

Calculated by: VAS _____

Date: 3/5/2012 _____

Checked by: _____

**WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)**

DP 3 -1/2 BASIN D & B

Total Flow:

Q_5	=	4.3 cfs
Q_{100}	=	8.1 cfs

Maximum allowable ponding depth at sump:

D_{max_5}	=	0.50'
$D_{max_{100}}$	=	0.67'

$$Q_i = 1.7(L_i + 1.8(W))(D_{max} + w/12)^{1.85}$$

where: $W = 3$ feet
 $w = 4$ inches

Clogging Factor = 1.25
 $L_i (1.25) =$ Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

**(Install a Public 4' D-10-R inlet to accept both 5 yr. & 100 yr.
developed flows at this design point.)**

Calculated by: VAS
Date: 3/5/2012
Checked by: _____

**WOODMEN HEIGHTS COMM. CENTER FIL. NO. 1
PRELIMINARY/FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)**

DP 3 -1/2 BASIN D & B

Total Flow: Q_5 = 4.3 cfs
 Q_{100} = 8.1 cfs

Maximum allowable ponding depth at sump:

D_{max_5} = 0.50'
 $D_{max_{100}}$ = 0.67'

$$Q_i = 1.7(L_i + 1.8(W))(D_{max} + w/12)^{1.85}$$

where: W = 3 feet
 w = 4 inches

Clogging Factor = 1.25
 $L_i (1.25)$ = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

**(Install a Public 4' D-10-R inlet to accept both 5 yr. & 100 yr.
developed flows at this design point.)**

Calculated by: VAS
Date: 3/5/2012
Checked by: _____

POND CALCUALATIONS

BASIN GEOMETRY:
 $\frac{\text{LENGTH (L)}}{\text{WIDTH (W)}} \geq 2$

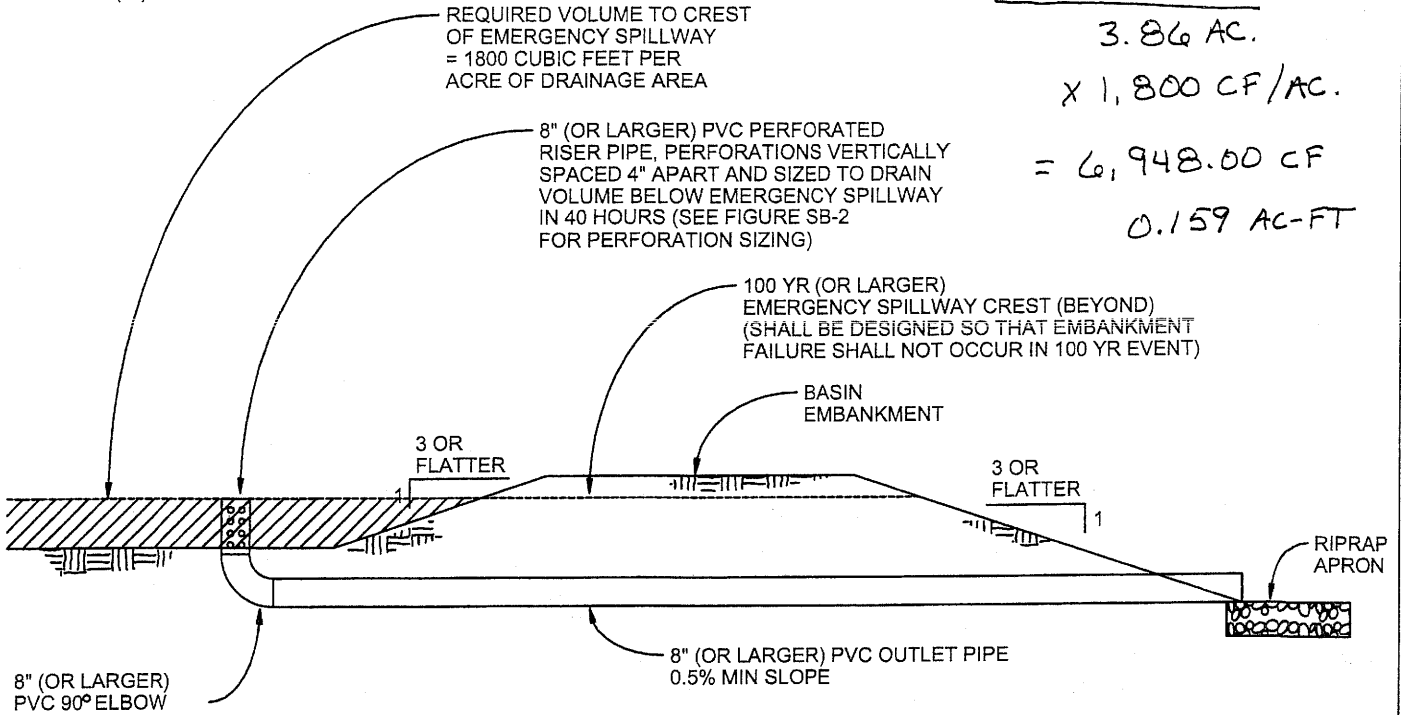
BASINS: B 1.27 AC.
 C 1.94 AC.
 D 0.65 AC.

3.86 AC.

$\times 1,800 \text{ CF/AC.}$

$= 6,948.00 \text{ CF}$

0.159 AC-FT



SEDIMENT BASIN

NTS

SEDIMENT BASIN NOTES

INSTALLATION REQUIREMENTS

1. SEDIMENT BASINS SHALL BE INSTALLED BEFORE ANY CLEARING AND/OR GRADING IS UNDERTAKEN.
2. THE AREA UNDER WHICH THE EMBANKMENT IS TO BE INSTALLED SHALL BE CLEARED, GRUBBED, AND STRIPPED OF ALL VEGETATION AND ROOT MAT.
3. THE OUTLET OF THE BASIN SHALL BE DESIGNED TO DRAIN ITS VOLUME IN 40 HOURS.
4. THE OUTLET IS TO BE LOCATED AT THE FURTHEST DISTANCE FROM THE INLET OF THE BASIN. BAFFLES MAY BE NEEDED TO INCREASE THE FLOW LENGTH AND SETTLING TIME.
5. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL WITH A MINIMUM OF 15% PASSING A #200 SIEVE. EXCAVATED SOIL CAN BE USED IF IT MEETS THIS REQUIREMENT.
6. EMBANKMENT IS TO BE COMPACTED TO AT LEAST 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D 698.
7. WHEN A BASIN IS INSTALLED NEAR A RESIDENTIAL AREA, FOR SAFETY REASONS, A SIGN SHALL BE POSTED AND THE AREA SECURED WITH A FENCE.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SEDIMENT BASINS AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.
2. SEDIMENT BASINS SHALL BE CLEANED OUT BEFORE SEDIMENT HAS FILLED HALF THE VOLUME OF THE BASIN.
3. SEDIMENT BASINS SHALL REMAIN OPERATIONAL AND PROPERLY MAINTAINED UNTIL THE SITE AREA IS PERMANENTLY STABILIZED WITH ADEQUATE VEGETATIVE COVER AND/OR OTHER PERMANENT STRUCTURE AS APPROVED BY THE CITY.

City of Colorado Springs
 Stormwater Quality

Figure SB-1
 Sediment Basin
 Construction Detail and Maintenance
 Requirements

Required Area per Row (in²)

		Depth at Outlet (ft)							
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Design Volume (acre-ft)	2	15.04	7.71	5.10	3.76	2.95	2.41	2.02	1.73
	1	7.52	3.86	2.55	1.88	1.48	1.21	1.01	0.87
	0.6	4.51	2.31	1.53	1.13	0.89	0.72	0.61	0.52
	0.4	3.01	1.54	1.02	0.75	0.59	0.48	0.40	0.35
	0.2	1.50	0.77	0.51	0.38	0.30	0.24	0.20	0.17
	0.1	0.75	0.39	0.26	0.19	0.15	0.12	0.10	0.09
	0.06	0.45	0.23	0.15	0.11	0.09	0.07	0.06	0.05
	0.04	0.30	0.15	0.10	0.08	0.06	0.05	0.04	0.03
	0.02	0.15	0.08	0.05	0.04	0.03	0.02	0.02	0.02
0.01	0.08	0.04	0.03	0.02	0.01	0.01	0.01	0.01	

0.25 in²

TABLE SB-1

Circular Perforation Sizing

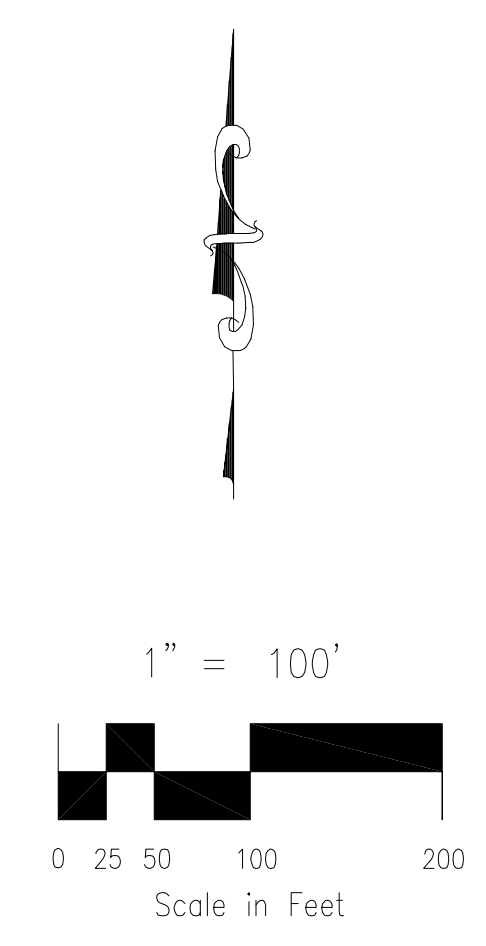
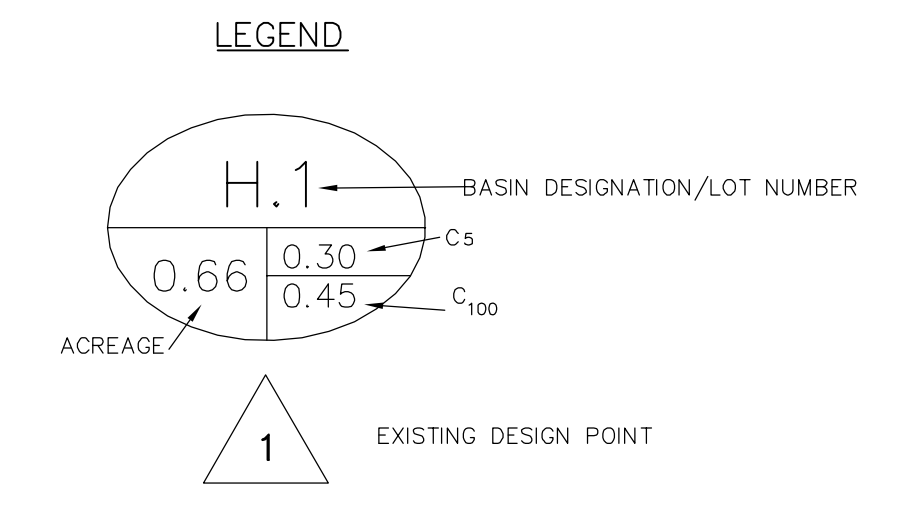
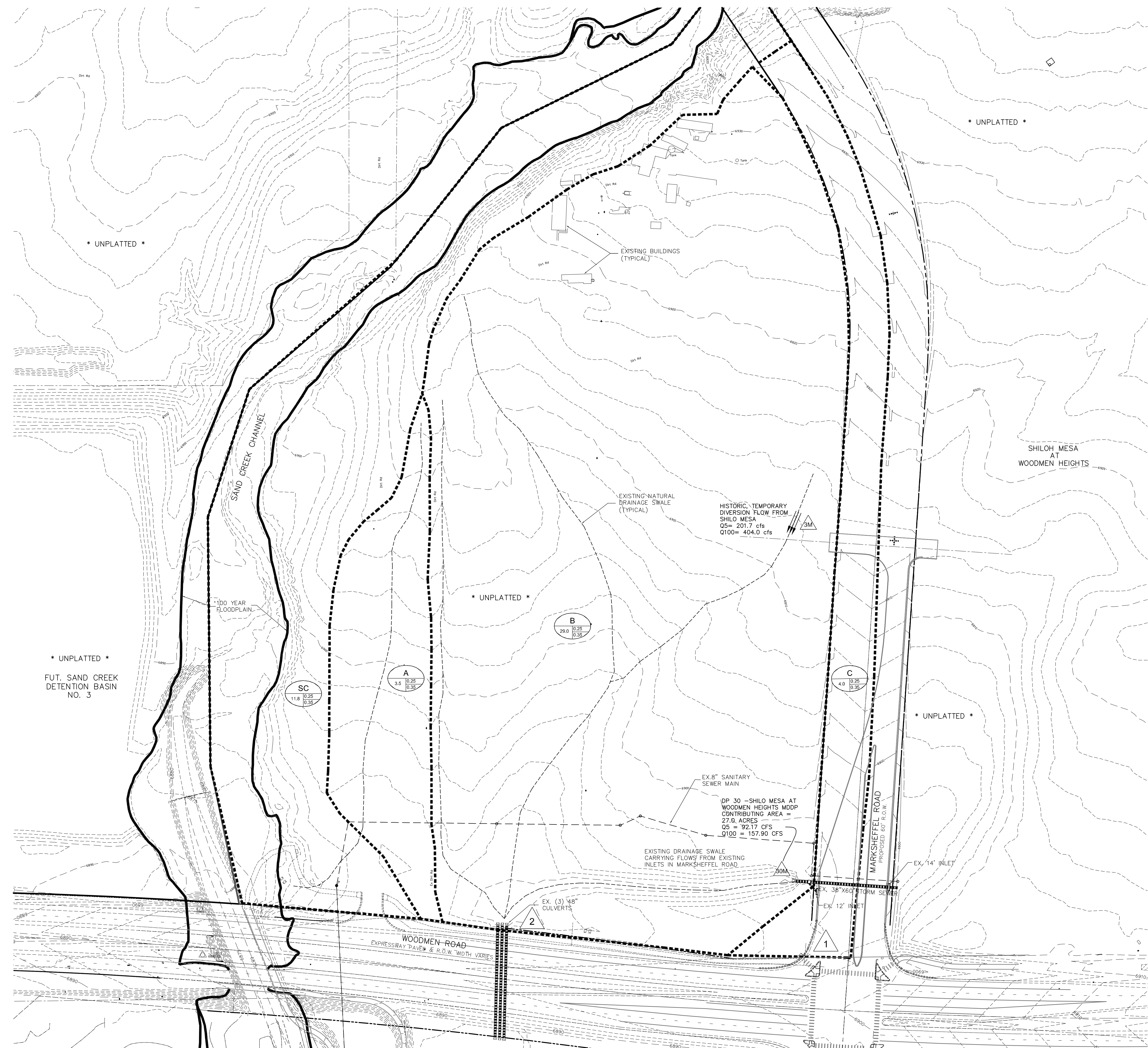
Hole Diameter (in)	Hole Diameter (in)	Area per Row (in ²)		
		n = 1	n = 2	n = 3
1/4	0.250	0.05	0.10	0.15
5/16	0.313	0.08	0.15	0.23
3/8	0.375	0.11	0.22	0.33
7/16	0.438	0.15	0.30	0.45
1/2	0.500	0.20	0.39	0.59
9/16	0.563	0.25	0.50	0.75
5/8	0.625	0.31	0.61	0.92
11/16	0.688	0.37	0.74	1.11
3/4	0.750	0.44	0.88	1.33
7/8	0.875	0.60	1.20	1.80
1	1.000	0.79	1.57	2.36
1 1/8	1.125	0.99	1.99	2.98
1 1/4	1.250	1.23	2.45	3.68
1 3/8	1.375	1.48	2.97	4.45
1 1/2	1.500	1.77	3.53	5.30
1 5/8	1.625	2.07	4.15	6.22
1 3/4	1.750	2.41	4.81	7.22
1 7/8	1.875	2.76	5.52	8.28
2	2.000	3.14	6.28	9.42
n = Number of columns of perforations				
Minimum steel plate thickness		1/4"	5/16"	3/8"

TABLE SB-2

DRAINAGE MAPS

WOODMEN HEIGHTS COMMERCIAL CENTER FILING NO. 1

EXISTING DRAINAGE PLAN



DRAINAGE BASIN SUMMARY EXISTING		
BASINS		
BASIN :	MINOR FLOW (cfs) (5 YR)	MAJOR FLOW (cfs) (100 YR)
A	3.0	7.4
B	22.5	56.1
C	3.2	7.9
SC	10.8	26.8
DESIGN POINTS		
DESIGN POINT:	MINOR FLOW (cfs)	MAJOR FLOW (cfs)
1	162.2	394.6
2*	159.3	388.5

2* WOODMEN ROAD FINAL DRAINAGE REPORT 2003
 CULVERT ID C1, BASIN B8
 CONTRIBUTING AREA = 326 AC.
 EXISTING CONDITIONS; Q5=56 CFS, Q100=276 CFS
 FUTURE CONDITIONS; Q5=134 CFS, Q100=439 CFS
 EXISTING (3) 48" CULVERTS
 FUTURE (5) 48" CULVERTS - NOT REQUIRED

WOODMEN HEIGHTS COMM. CNTR
 FILING NO. 1
 EXISTING DRAINAGE PLAN
 JOB NO. 08-017
 DATE PREPARED: DEC. 2, 2011
 DATE REVISED: MARCH 8, 2012



102 E. PIKES PEAK AVE., STE 306
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 f 719.444.8427

WOODMEN HEIGHTS COMMERCIAL CENTER FILING NO. 1

DEVELOPED DRAINAGE MAP

DRAINAGE BASIN SUMMARY

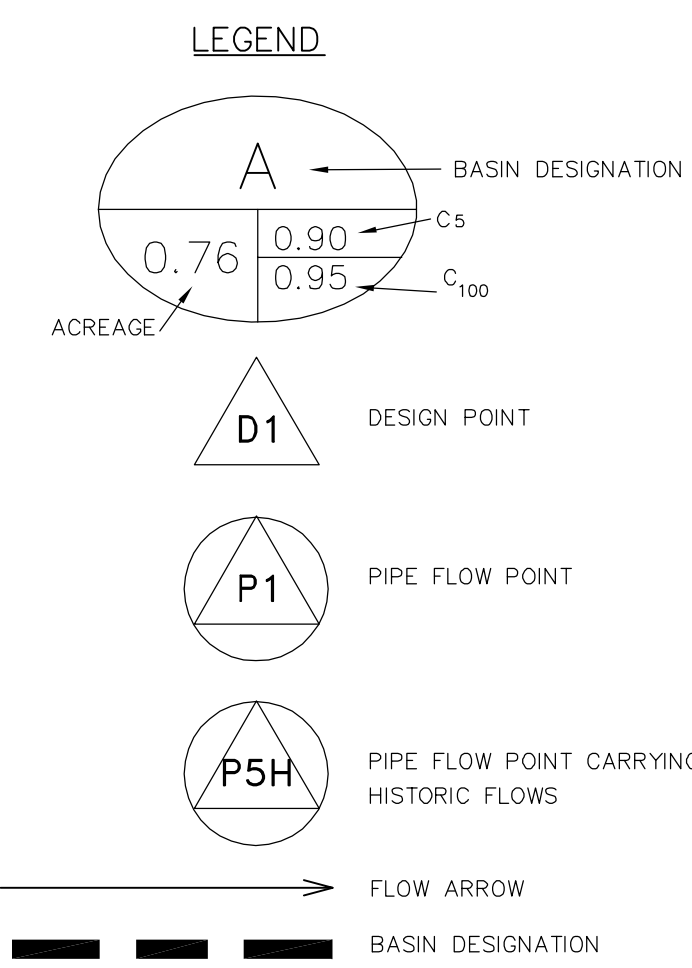
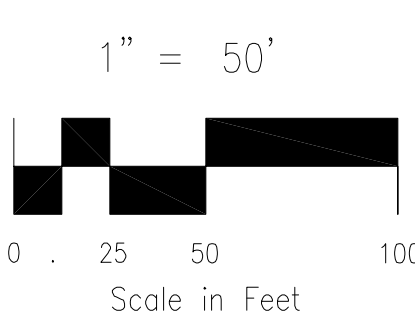
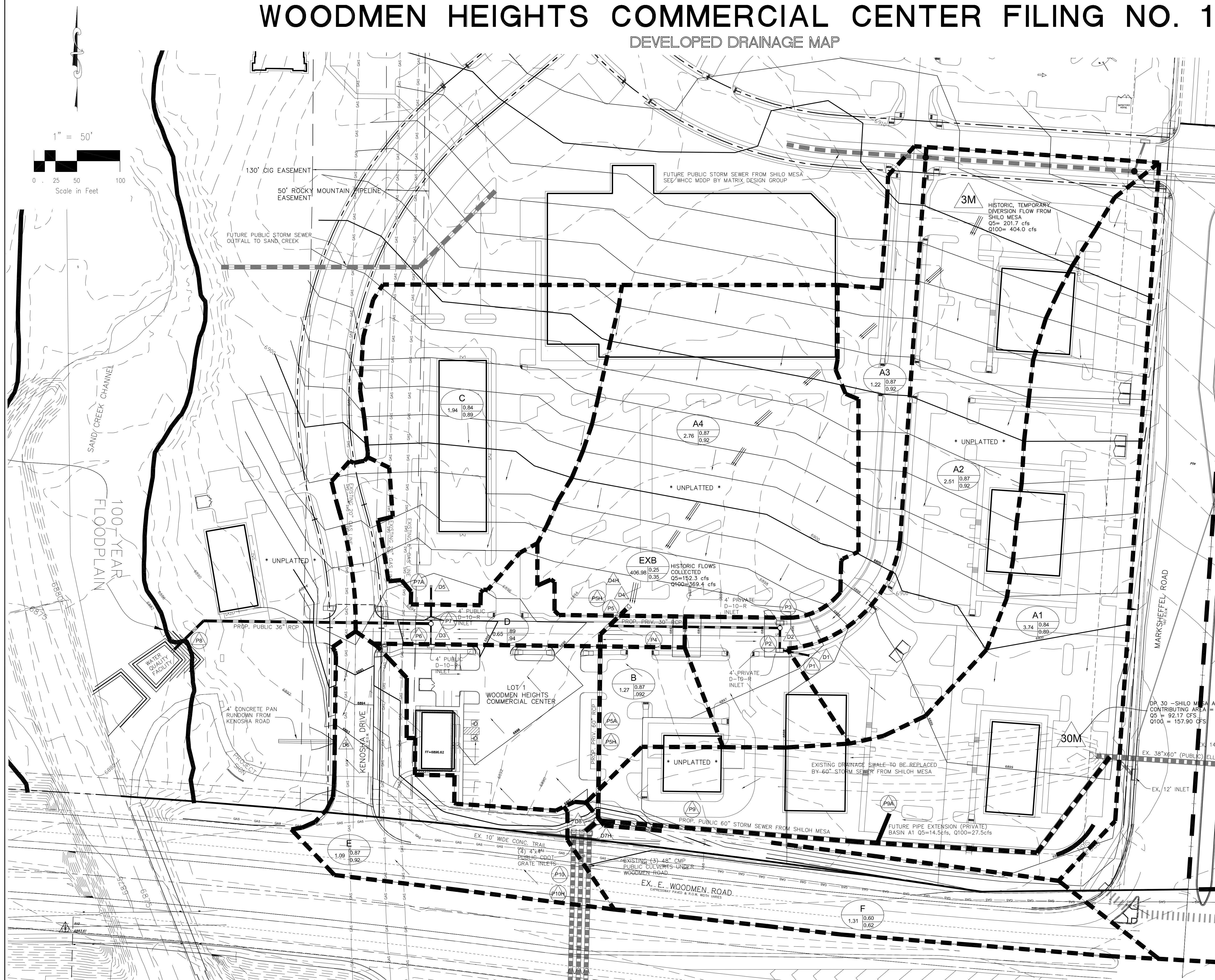
DEVELOPED BASINS		
BASIN :	MINOR FLOW (cfs): (5 YR)	MAJOR FLOW (cfs): (100 YR)
A1	14.5	27.5
A2	10.8	20.3
A3	5.4	10.2
A4	12.2	23.1
B	5.6	10.6
C	8.2	15.6
D	3.0	5.6
E	4.8	9.1
F	3.8	7.0

DESIGN POINTS

DESIGN POINT:	MINOR FLOW (cfs): (5 YR)	MAJOR FLOW (cfs): (100 YR)
1	10.8	20.3
2	5.4	10.2
3	8.6	16.2
4	12.2	23.1
4H	152.3	369.4
5	8.2	15.6
6	4.8	9.1
7	14.5	27.5
7H	28.2	53.3
8	3.8	7.0
3M	201.7	404.0
30M	92.17	157.90

PIPE FLOWS

PIPE:	MINOR FLOW (cfs): (5 YR)	MAJOR FLOW (cfs): (100 YR)	PROP. PIPE SIZE
1	10.8	20.3	24" RCP
2	13.4	25.2	30" RCP
3	2.6	4.9	18" RCP
4	16.0	30.2	30" RCP
5	12.2	23.1	30" RCP
5H	152.3	369.4	60" RCP
5A	28.7	54.3	30" RCP
5AH	158.1	380.3	60" RCP
6	4.3	8.1	18" RCP
7	12.6	23.8	30" RCP
7A	8.2	15.6	24" RCP
8	25.0	47.4	36" RCP
9	106.67	185.4	60" RCP
9A	14.5	27.5	36" RCP
10	135.4	239.7	(3) 48" RCP
10H	293.5	619.9	(3) 48" RCP



WOODMEN HEIGHTS COMMERCIAL CNTR FIL. 1 DEVELOPED DRAINAGE MAP
JOB NO. 42-003
DATE PREPARED: DECEMBER 1, 2011
DATE REVISED: MARCH 8, 2012



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