MASTER DEVELOPMENT DRAINAGE PLAN FOR THE EAST HALF OF MOUNTAIN VISTA RANCH AND THE FINAL DRAINAGE REPORT FOR MOUNTAIN VISTA RANCH FILING NO. 1 & NO. 2

March 2008

Prepared for:

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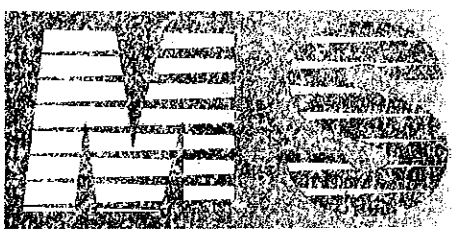

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Project #29-001

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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, 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.

M3 Land, LLC

BY: _____ DATE: 4/29/08
James F. Morley

TITLE: Owner

ADDRESS: 20 Boulder Crescent, 2nd Floor
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.

BY: _____ DATE: 5/1/08
For The City Engineer

CONDITIONS:

No grading or drainage construction shall occur for this development until approval of off-site grading and drainage is obtained from the adjacent land owner (Banning Lewis Ranch Companies, LLC).

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PURPOSE

This document is the Master Development Drainage Plan for the East half of Mountain Vista Ranch and the Final Drainage Report (FDR) for Mountain Vista Ranch Filing No. 1 and No. 2. 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

Mountain Vista Ranch is located in Sections 21, 22, 27, & 28, Township 13 South, Range 65 West of the 6th P.M., in the City of Colorado Springs, El Paso County, Colorado. The project is located within the Banning Lewis Master Plan, located approximately one mile southeast of the intersection of Barnes Road and Marksheffel Road.

The development is proposed to be zoned "PUD", Planned Unit Development, for the construction of single-family. Construction of Mountain Vista Ranch is anticipated to be completed in several phases. Filing No. 1 is considered to be the phase I development and Filing No. 2 is considered to be phase II development for the purpose of this report.

SOILS

The site and surrounding areas consist of well drained soils that average an annual precipitation of 15 inches and the average frost-free period of about 135 days. The site contains four types of soils derived from arkosic sedimentary rock on alluvial fans, uplands and terraces. Typically, the surface layer for these four soil series is a dark grayish brown sandy loam.

To the east of the East Fork of Sand Creek drainage channel, the site is underlain by the Blakeland-8 loamy sand soil series, Hydrologic Group A. The middle of the site is underlain by the Bresser-12 sandy loam soil series, Hydrologic Group B. The east side of the site is underlain by the Truckton-97 sandy loam soil series, Hydrologic Group B.

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 15 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. 08041C0543 F, effective date March 17, 1997. The majority of the site is defined as Zone X with the exception of the Sand Creek East Fork Sub-tributary which is defined as a Zone AE.

In the proposed condition, the physical floodplain on the site will be confined within the banks of the proposed Detention Facility 96 and the inner banks of the proposed channel improvements to Sand Creek East Fork Sub-Tributary.

The process to prepare and submit a Conditional Letter of Map Revision (CLOMR) is underway at this time. A CLOMR/LOMR is required due to the proposed channel to be relocated outside the limits of the existing floodplain and the overall limits of the floodplain are proposed to be amended. It is anticipated the CLOMR will be approved in the next 6 months. No construction will occur in the existing floodplain until the CLOMR is approved by FEMA. A Letter of Map Revision (LOMR) will be required once the proposed improvements to modify the physical floodplain have been completed.

DRAINAGE CRITERIA

The drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual. The hydrologic and hydraulic calculations were performed to determine runoff quantities during the 5- year and 100-year frequency storms for developed conditions using the Rational Method. All facilities proposed in this report are planned to accept 100-year flows.

EXISTING DRAINAGE CHARACTERISTICS

This site is located in the Sand Creek Major Drainage Basin. This portion was included in the Sand Creek Drainage Basin Planning Study that was prepared by Kiowa Engineering. The runoff from the western portion of the site that is adjacent to Marksheffel Rd. was previously studied in the Master Development Drainage Plan for Hilltop Subdivision and the Final Drainage Report and Erosion Control for Chateau at Antelope Ridge which were prepared by URS. The area directly north of the site was previously studied in the Master Development Drainage Plan for Banning Lewis Ranch Phase I and II and in the Final Drainage Report for Banning Lewis Ranch Filing No. 2, and they were both prepared by Turner Collie and Braden, Inc.

The existing conditions for the site consist of native prairie grasses with gradual sloping terrain. The east and west portions of the site receive flows that are conveyed from the Banning Lewis Ranch site which is located directly to the north of Mountain Vista Ranch. The flows from the central portion of the site are conveyed directly to Sand Creek East Tributary which bisects the site in a north south direction and is centrally located east to west in the site. Additional flows are conveyed directly through the site in Sand Creek from the upstream areas of Banning Lewis Ranch and Toy Ranch.

Basin OS-1B is equivalent to basin to O-3 from the MDDP for Hilltop Subdivision and the FDR and Erosion Control for Chateau at Antelope Ridge. The flows in this basin which include the eastern half of Marksheffel Rd. drain to an existing 18"cmp that crosses under Marksheffel Rd. to the existing drainage channel located to the west of Marksheffel Rd. The existing flow rates for the historic condition are Q5= 19cfs and Q100=56cfs with an anticipated developed condition flow rate of Q5=24cfs and Q100=62cfs.

Basin EX-4 (Q5=32.7cfs, Q100=81.5cfs) is an 81.5 acre watershed that outfalls to a broad natural swale at the southern boundary of the site at DP EX-4.
Basin EX-5 (Q5=33.9cfs, Q100=84.5cfs) is a 69.1 acre watershed that outfalls to a natural channel at the southern boundary of the site at DP EX-5.

Basin EX-6 (Q5=18.1cfs, Q100=45.0cfs) is a 28.0 acre watershed that outfalls to a natural channel at the southern boundary of the site at DP EX-6.

Basins EX-4, EX-5 and EX-6 were established in the preliminary MDDP for Mountain Vista Ranch by JR Engineering and can be seen on the existing conditions sheet in that report.

The existing Sand Creek is a wide, natural swale that consists of native grasses. The width of the existing channel taken from the FEMA FIRM Panel 543 can be seen ranging from 160-550 feet and the 100-year flood plain is shown on the Drainage Maps contained in this report. The existing flow rates for Sand Creek were found to be Q5=151cfs, and Q100=869cfs and these were taken from the preliminary MDDP for Mountain Vista Ranch by JR Engineering.

PROPOSED DRAINAGE CHARACTERISTICS

General Description of Proposed Drainage Characteristics

A majority of the flows developed along the proposed Barnes Rd. corridor and a portion of the development adjacent to proposed Barnes Rd. will be collected in storm sewer systems and conveyed to the regional detention facility, Pond 96, which lies directly to the north of proposed Barnes Rd. These flows will then be routed through the detention facility into the proposed stabilized, trapezoidal channel of the Sand Creek East Tributary.

A large amount of the developed flows from the site will be collected and conveyed in proposed streets, captured in storm sewer inlets, and conveyed in a storm sewer pipe network to be discharged directly into the proposed, trapezoidal channel of the Sand Creek East Tributary. Therefore, not all the developed flows generated in the east half of Mountain Vista Ranch will be detained.

Flows from the development that are not routed through Pond 96 or discharged into Sand Creek will be collected in the proposed streets and channelized to a detention/water quality pond south of the property or will be captured by the storm sewer system and will be delivered to a detention/water quality pond adjacent to the southern property boundary. The detention/water quality ponds are temporary and will be in service until such a time as the adjacent property directly south of the proposed development is improved and the flows are routed through the future development.

Detailed Description of Proposed Drainage Characteristics

A brief description of each developed drainage basin including historic and developed runoff rates, drainage patterns as well as existing and proposed drainage facilities for each basin is provided in this section of the report. A summary of peak developed runoff for the basins and designated design points are depicted on the Drainage Maps in the appendix. The historic flow drainage map can be seen in the MDDP for Mountain Vista Ranch. It should be noted that the pipe sizes designed herein were designed to be 60% full. It is from prior experience that this value will adequately account for head losses in the system. During the final design phase of construction document preparation, the pipe sizes may be adjusted per the hydraulic grade line calculations.

Design Point 1 (DP 1) flows (Q5=9.5cfs, Q100=19.9cfs) are generated by basin C (Q5=2.2cfs, Q100=4.6cfs), basin D (Q5=5.0cfs, Q100=10.6cfs), basin E (Q5=2.4cfs, Q100=5.0cfs).

Basin Runoff Description
Basin C-E will consist of single-family residential development and streets.

Surface Routing
Basin C flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flint Lane and Flintstone Way. Basin D flows consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Shale Court. The flows from basins C & D will combine and will be carried through a cross pan at the intersection of Flintstone Way and Shale Court. At this point the flows from basin C & D will combine with the flows from basin E. Basin E flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Shale Court. The collective flows of basins C, D & E will be conveyed to DP1 via Flintstone Way curb and gutter. DP 1's 12' D-10-R at-grade inlet will intercept Q5=4.4cfs, Q100=7.2cfs with a flowby of Q5=5.0cfs, Q100=12.7cfs to DP1A.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP1A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 101) will convey flows collected in the 12' at-grade inlet westerly in Flintstone Way to the proposed manhole where it will combine with flows from DP 1A. The flow in pipe 101 (Q5=4.4cfs and Q100=7.2cfs) has a full flow capacity of 17.9cfs assuming a 2.9% slope.

Design Point 1A (DP 1A) flows (Q5=18.1cfs, Q100=39.9cfs) are generated by basin A (Q5=5.4cfs, Q100=11.2cfs), basin B (Q5=1.8cfs, Q100=3.7cfs), basin F (Q5=6.4cfs, Q100=13.5cfs), and flowby from DP 1 (Q5=5.0cfs, Q100=12.7cfs)

Basin Runoff Description
Basins A, B and F will consist of single-family residential development and streets.

Surface Routing
Basin A flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path. Basin B flows consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path. Basin F flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path. The flows from basins A, B and F will combine and will be carried through a cross pan at the intersection of Flintstone Way and Thunder Egg Path. The collective flows of basins A, B and F will be conveyed to DP1A via Flintstone Way curb and gutter. DP 1A's 14' D-10-R at-grade inlet will intercept Q5=5.9cfs, Q100=13.2cfs with a flowby of Q5=11.8cfs, Q100=26.7cfs to DP2.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP2.

Pipe Routing/Pipe Capacity
A 24" RCP (pipe 102) will convey flows collected in the 14' at-grade inlet in Flintstone Way and proceed to

a proposed manhole where it will combine with flows from DP 1. The flow in pipe 102 (Q5=5.9cfs and Q100=13.2cfs) has a full flow capacity of 22.6cfs assuming a 1.0% slope. The combined flows in pipes 101 and 102 will proceed westerly via pipe 103 towards design points 2 and 2A. The flow in pipe 103 is Q5=10.2cfs and Q100=20.1cfs.

Design Point 2 (DP 2) flows (Q5=18.9cfs, Q100=42.0cfs) are generated by DP6 flowby (Q5=7.4cfs, Q100=15.7cfs), and DP1A flowby (Q5=11.8cfs, Q100=26.7cfs).

Basin Runoff Description
DP6 and DP1 flowby will consist of single-family residential development and streets (including Vista Del Tierra Drive and Barnes Road).

Surface Routing
Basin A flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path. Basin F flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path. The collective flows of basins F and flowby from DP 1 will be conveyed through the intersection of Thunder Egg Path and Flintstone Way via a cross pan and be combined with the flows from basins B. The combined flows will continue along the northern curb and gutter of Flintstone Way until it is intercepted by DP 2 combining with DP 6 flowby. DP 2's 14' D-10-R sump inlet will intercept Q5=18.9cfs, Q100=42.0cfs.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP5.

Pipe Routing/Pipe Capacity
A 36" RCP (pipe 104) will convey flows from the 12' sump inlet from north side of Flintstone Way to the manhole in Flintstone Way. The flow in pipe 104 (Q5=18.9cfs and Q100=42.0cfs) and has a full flow capacity of 66.7cfs assuming a 1.1% slope. The flows combine with the flows from pipes 103 and 105 and continue westerly in pipe 106 to a manhole in Vista Del Tierra Drive. The flow in pipe 106 (Q5=29.4cfs and Q100=62.9cfs) has a full flow capacity of 94.3cfs assuming a 2.0% slope.

Design Point 2A (DP 2A) flows (Q5=0.8cfs, Q100=1.7cfs) are generated by basin R10A (Q5=0.8cfs, Q100=1.7cfs).

Basin Runoff Description
Basin R10A will consist of single-family residential development and streets.

Surface Routing
Basin R10A flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flintstone Way by DP 2. DP 2's 4' D-10-R sump inlets will intercept Q5=0.8cfs, Q100=1.7cfs.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP5.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 105) will convey flows from the 4' sump inlet on the south side of Flintstone Way to the manhole in Flintstone Way. The flow in pipe 105 (Q5=0.8cfs and Q100=1.7cfs) has a full flow capacity of

12.9cfs assuming a 1.5% slope. The flows combine with the flows from pipe 101 and pipe 104 and continue westerly in pipe 106 to the proposed Sand Creek channel. The flow in pipe 106 (Q5=23.1cfs and Q100=48.3cfs) has a full flow capacity of 144.6cfs assuming a 4.7% slope.

Design Point 3 (DP 3) flows (Q5=0.7cfs, Q100=1.4cfs) are generated by basin L1 (Q5=0.7cfs, Q100=1.4cfs).

Basin Runoff Description
Basin L1 will consist of single-family residential development and streets.

Surface Routing
Basin L1 flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flint Lane and conveyed to the DP 3. DP 3's 4' D-10-R sump inlet will intercept Q5=0.7cfs, Q100=1.4cfs.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP4.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 202) will convey flows from the 4' sump inlet on the west side of Flint Lane to the manhole in Flint Lane. The flow pipe 202 (Q5=0.7cfs, Q100=1.4cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope.

Design Point 3A (DP 3A) flows (Q5=16.2cfs, Q100=35.9cfs) are generated by basin G (Q5=2.3cfs, Q100=4.7cfs), basin H (Q5=2.8cfs, Q100=5.8cfs), basin I (Q5=6.2cfs, Q100=18.9cfs), basin J (Q5=2.0 cfs, Q100=4.1cfs) and basin K (Q5=4.4cfs, Q100=9.4cfs).

Basin Runoff Description
Basin G, H, J & K will consist of single-family residential development and streets. Basin I will consist of a park and residential streets.

Surface Routing
Basin G flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path and Flint Lane. Basin H flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Star Garnet Place, Aquamarine Trail and Flint Lane. Flows from basin G and H will combine and continue through the intersection of Flint Lane and Aquamarine Trail via a cross pan. The flows from basins G & H will then combine with the flow from basin I. Basin I consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flint Lane and Iolite Trail. The collective flows of basins G, H & I will be conveyed through the intersection of Flint Lane and Iolite Trail via a cross pan. Basin J flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Iolite Trail. The flows from basins G, H, & I will combine with flow from basin J and continue in the curb and gutter of Flint Lane. Basin K flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flint Lane and Iolite Trail. The combined flows of G,H,I & J will combine with the flows from basin K and continue along the vertical curb and gutter of Flint Lane to DP 3A. *Refer to the Street Capacity Summary in the Hydraulics Calculations of the appendix for street capacity information.* DP 3A's 12' D-10-R sump inlet will intercept Q5=16.2cfs, Q100=35.9cfs.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP4.

Pipe Routing/Pipe Capacity
A 36" RCP (pipe 201) will convey flows from the 12' sump inlet from the east side of Flint Lane to the manhole in Flint Lane. The flows in pipe 201 (Q5=16.2cfs, Q100=35.9cfs). The flows combine with the flow from pipe 202 in the proposed manhole in Flint Lane where it will be conveyed to a 36" RCP (pipe 203). The flow in pipe 203 (Q5=16.8cfs, Q100=37.2cfs) has a full flow capacity of 78.9cfs assuming a 1.4% slope and will flow to DP4.

Design Point 4 (DP 4) flows (Q5=10.3cfs, Q100=21.5cfs) are generated by basin L (Q5=2.7cfs, Q100=5.5cfs), basin M (Q5=2.0cfs, Q100=4.2cfs), basin N (Q5=5.5cfs, Q100=11.6cfs).

Basin Runoff Description
Basin L-M will consist of single-family residential development and streets.

Surface Routing
Basin L flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flint Lane and Prairie Agate Lane. Basin M flows consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Iolite Trail and Prairie Agate Lane. The flows from basins L & M will combine and conveyed through a cross pan at the intersection of Iolite Trail and Prairie Agate Lane. At this point the flows from basin L & M will combine with the flows from basin N. Basin N flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flint Lane, Iolite Trail and Prairie Agate Lane. The collective flows of basins L, M & N will be conveyed to DP 4 via Prairie Agate Lane curb and gutter. DP 4's 12' D-10-R at-grade inlet will intercept Q5=4.6cfs, Q100=7.8cfs with a flowby of Q5=5.7cfs, Q100=13.7cfs continuing to DP5.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP5.

Pipe Routing/Pipe Capacity
A 24" RCP (pipe 204) will convey flows from the 12' at-grade inlet in Prairie Agate Lane to the manhole in Prairie Agate Lane. The flows in pipe 204 (Q5=4.6cfs, Q100=7.8cfs) has a full flow capacity of 22.6cfs assuming a 1.0% slope. At that point the flow from pipe 203 will combine with the flow from pipe 204 in the manhole in Prairie Agate Lane and will be conveyed to a 36" RCP (pipe 205). The flow in pipe 205 (Q5=21.1cfs, Q100=44.5cfs) has a full flow capacity of 78.9cfs assuming a 1.4% slope. Flow in pipe 205 will continue to DP 5.

Design Point 5 (DP 5) flows (Q5=15.6cfs, Q100=34.3cfs) are generated by basin O (Q5=1.5cfs, Q100=3.2cfs), basin P (Q5=3.4cfs, Q100=7.0cfs), basin Q (Q5=1.8cfs, Q100=3.7cfs), basin R10 (Q5=3.1cfs, Q100=6.4cfs) and DP 4 flowby (Q5=5.7cfs, Q100=13.7cfs).

Basin Runoff Description
Basin O-Q & R10 will consist of single-family residential development and streets.

Surface Routing
Basin O flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be

intercepted by street curb and gutter in Flintstone Way and Thunder Egg Path. The flow from basin O will combine with the flow from basin P. Basin P flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Flintstone Way and Prairie Agate Lane. The flows from basins O & P will combine with the flowby from DP 4 and will be carried through a cross pan at the intersection of Thunder Egg Path and Prairie Agate Lane. At this point the flows from basin O, P and DP 4 will combine with the flows from basin Q. Basin Q flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Thunder Egg Path and Prairie Agate Lane and conveyed to DP 5 in the north side of Prairie Agate Lane. Basin R10 flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Vista Del Tierra Drive and conveyed to DP 5 in the north side of Prairie Agate Lane. The collective flows of basins DP 4, O, P, Q & R10 will be conveyed to DP 5 via Prairie Agate Lane curb and gutter. *Refer to the Street Capacity Summary in the Hydraulics Calculations of the appendix for street capacity information.* DP 5's 10' D-10-R sump inlet will intercept Q5=15.6cfs, Q100=34.3cfs.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed down Vista Del Tierra Drive, through the southern boundary of the property and past the improved road section into the existing Sand Creek channel.

Pipe Routing/Pipe Capacity
A 36" RCP (pipe 206) will convey flows from the 10' sump inlets in Prairie Agate Lane to the manhole in Prairie Agate Lane. The flow in pipe 206 (Q5=15.6cfs, Q100=34.3cfs) has a full flow capacity of 66.7cfs assuming a 1.0% slope.

Design Point 5A (DP 5) flows (Q5=11.3cfs, Q100=24.0cfs) are generated by basin K-1 (Q5=11.3cfs, Q100=24.0cfs).

Basin Runoff Description
Basin K-1 will consist of single-family residential development and streets.

Surface Routing
Basin K-1 flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane and conveyed to DP 5A

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed down Vista Del Tierra Drive, through the southern boundary of the property and past the improved road section into the existing Sand Creek channel.

Pipe Routing/Pipe Capacity
A 30" RCP (pipe 207) will convey flows from the 6' sump inlets in Prairie Agate Lane to the manhole in Prairie Agate Lane. The flow in pipe 207 (Q5=11.3cfs, Q100=24.0cfs) has a full flow capacity of 41.0cfs assuming a 1.0% slope. At that point the flow from pipe 207 will combine with the flow from pipe 205 and pipe 206 in the manhole in Prairie Agate Lane and will be conveyed to a 36" RCP (pipe 208). The flow in pipe 208 (Q5=44.8cfs, Q100=95.9cfs) has a full flow capacity of 133.4cfs assuming a 4.0% slope. Flow in pipe 208 will discharge directly into the improved Sand Creek channel.

Design Point 6 (DP 6) flows (Q5=16.8cfs, Q100=33.9cfs) are generated by basin PP (Q5=1.4cfs, Q100=2.9cfs), basin R6 (Q5=5.8cfs, Q100=10.9cfs), basin R8 (Q5=5.5cfs, Q100=11.5cfs) and basin R9 (Q5=5.9cfs, Q100=12.2cfs).

Basin Runoff Description
Basin PP, R6, R8 & R9 will consist of single-family residential development and streets.

Surface Routing
Basin PP flows consists of unconcentrated sheet flow. The flow will be intercepted by street curb and gutter in Barnes Road. Basin R6 flows consist of unconcentrated sheet flow and street curb and gutter flow. The flow will be intercepted by street curb and gutter in Barnes Road combining with bas PP flows. Basins R8 and R9 flows consist of unconcentrated sheet flow and street curb and gutter flows. These are intercepted by street curb and gutter in Vista Del Tierra Drive combining with said flows from basins R6 and PP. The combined flows will proceed southerly in Vista Del Tierra Drive to DP 6, a 14' at-grade inlet (Q5=16.8cfs, Q100=33.9cfs). Flowby (Q5=7.4cfs, Q100=15.7cfs) proceeds south to DP 2 in 3rd Street.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed south along the curb and gutter of Vista Del Tierra Drive to DP 2.

Pipe Routing/Pipe Capacity
A 30" RCP (pipes 107) will convey flows from the 14'D-10-R at grade inlet in Vista Del Tierra Drive to a manhole in Vista Del Tierra Drive combining with flows from pipe 106. The flow in pipe 107 (Q5=9.4cfs, Q10=18.2cfs) has a full flow capacity of 43.0cfs assuming a 1.1% slope. Pipe 107 and 108 flows combine in a manhole and proceed westerly to Sand Creek via pipe 108, a 42" RCP (Q5=38.1cfs, Q10=82.8cfs).

Design Point 6A - NOT USED

Design Point 7 (DP 7) flows (Q5=7.2cfs, Q100=15.1cfs) are generated by basin FF (Q5=2.4cfs, Q100=4.9cfs), basin GG (Q5=4.9cfs, Q100=10.3cfs).

Basin Runoff Description
Basin FF & GG will consist of single-family residential development and streets.

Surface Routing
Basin FF flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The flow from basin FF will combine with the flow from basin GG in Chert Path. Basin GG flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Aquamarine Lane and Chert Path. The flows from basins FF & GG will be carried through a cross pan at the intersection of Prairie Agate Lane and Chert Path. The collective flows of basins FF & GG will be conveyed to DP 7 via Aquamarine Lane curb and gutter. DP 7's 12' D-10-R at-grade inlet will intercept Q5=3.2cfs, Q100=4.8cfs with a flowby of Q5=4.0cfs, Q100=10.4cfs continuing to DP7A.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed down Aquamarine Lane to DP 7A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 301) will convey flows from the 12' at-grade inlet in Aquamarine Lane to DP 7. The flows in pipe 301 (Q5=3.2cfs, Q100=4.8cfs) has a full flow capacity of 13.7cfs assuming a 1.7% slope.

Design Point 7A (DP 7A) flows (Q5=8.5cfs, Q100=20.0cfs) are generated by basin HH (Q5=4.5cfs, Q100=9.5cfs) and the flowby from DP 7 (Q5=4.0cfs, Q100=10.4cfs).

Basin Runoff Description
Basin HH will consist of single-family residential development and streets.

Surface Routing
Basin HH flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Aquamarine Lane. The flow from basin HH will combine with the flowby from DP 7. The collective flows of basins HH and the flowby from DP 7 will be conveyed to DP 7A via Aquamarine Lane curb and gutter. DP 7A's 12' D-10-R at-grade inlet will intercept Q5=3.5cfs, Q100=6.1cfs with a flowby of Q5=5.1cfs, Q100=14.0cfs continuing to DP 8.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP 8.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 302) will convey flows from the 12' at-grade inlet in Aquamarine Lane to the manhole in Aquamarine Lane. The flow in pipe 302 (Q5=3.5cfs, Q100=6.1cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope. At that point the flow from pipe 302 will combine with the flow from pipe 301 in the manhole in Aquamarine Lane and will be conveyed to DP 8 in a 24" RCP (pipe 303). The flow in pipe 303 (Q5=6.7cfs, Q100=10.9cfs) has a full flow capacity of 25.8cfs assuming a 1.3% slope.

Design Point 8 (DP 8) flows (Q5=10.8cfs, Q100=25.9cfs) are generated by basin II (Q5=2.2cfs, Q100=4.6cfs), basin JJ (Q5=3.4cfs, Q100=7.0cfs) and the flowby from DP 7A (Q5=5.1cfs, Q100=14.0cfs).

Basin Runoff Description
Basin II & JJ will consist of single-family residential development and streets.

Surface Routing
Basin II flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The flow from basin II will combine with the flow from flowby from DP 7. The collective flows of basins II and the flowby from DP 7A will be conveyed through the intersection of Prairie Agate Lane and Aquamarine Lane via a cross pan. At this point, these flows will combine with the flows from basin JJ. Basin JJ flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The combined flows will be intercepted by DP 8's 12' D-10-R at-grade inlet which will intercept a flow of Q5=3.9cfs, Q100=7.8cfs with a flowby of Q5=6.8cfs, Q100=18.1cfs continuing to DP 9.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to DP 9.

Pipe Routing/Pipe Capacity
A 24" RCP (pipe 305) will convey flows from the 12' at-grade inlet in Prairie Agate Lane to the manhole in Prairie Agate Lane. The flow in pipe 305 (Q5=3.9cfs, Q100=7.8cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope. At that point the flow from pipe 305 will combine with the flow from pipe 303 in the proposed manhole in Prairie Agate Lane to be conveyed to a 24" RCP (pipe 306). The flow in pipe 306 (Q5=10.7cfs, Q100=18.7cfs) has a full flow capacity of 25.8cfs assuming a 1.3% slope. Flow in pipe 306 will continue to DP 9.

Design Point 9 (DP 9) flows (Q5=13.5cfs, Q100=31.8cfs) are generated by basin KK (Q5=5.0cfs, Q100=10.4cfs), basin MM (Q5=2.8cfs, Q100=6.0cfs) and the flowby from DP 8 (Q5=6.8cfs,

Q100=18.1cfs).

Basin Runoff Description
Basin KK & MM will consist of single-family residential development and streets.

Surface Routing
Basin KK flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Zircon Terrace and Prairie Agate Lane. The flows from basin KK will combine with the flowby from DP 8 and enter the 10' D-10-R sump inlet (Q5=13.5cfs, Q100=31.8cfs) on the north side of Prairie Agate Lane at DP 9. Basin MM flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Zircon Terrace and Prairie Agate Lane. The flows from basin MM will be carried through a cross pan at the intersection of Prairie Agate Lane and Zircon Terrace to the 10' D-10-R sump inlet on the north side of Prairie Agate Lane to DP 9.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed directly south through a channel in a drainage tract into the adjacent undeveloped property.

Pipe Routing/Pipe Capacity
A 36" RCP (pipe 307) will convey flows from the 10'D-10-R sump inlet in the north side of Prairie Agate Lane to the manhole in Prairie Agate Lane. The flow in pipe 307 (Q5=13.5cfs, Q100=31.8cfs) has a full flow capacity of 47.2cfs assuming a 0.5% slope. At that point the flow from pipe 307 will combine with the flow from pipe 306 in the manhole in Prairie Agate Lane and will be conveyed in a 42" RCP (pipe 308). The flow in pipe 308 (Q5=23.2cfs, Q100=48.8cfs) has a full flow capacity of 71.1cfs assuming a 0.5% slope. The flow is then conveyed to DP 9A's 6' D-10-R sump inlet on the south side of Prairie Agate Lane.

Design Point 9A (DP 9A) flows (Q5=12.3cfs, Q100=25.7cfs) are generated by basin EE (Q5=8.3cfs, Q100=17.3cfs) and basin LL (Q5=2.9cfs, Q100=5.9cfs).

Basin Runoff Description
Basin EE & LL will consist of single-family residential development and streets.

Surface Routing
Basin EE flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The flow from basin EE will combine with the flow from basin LL Basin LL flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The combined flows will be conveyed to the 6' D-10-R sump inlet (Q5=12.3cfs, Q100=25.7cfs) on the south side of Prairie Agate Lane at DP 9. *Refer to the Street Capacity Summary in the Hydraulics Calculations of the appendix for street capacity information.*

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed directly south through a channel in a drainage tract into the adjacent undeveloped property.

Pipe Routing/Pipe Capacity
A 54" RCP (pipe 309) will convey flows from the 6' D-10-R sump inlet box and flows from pipe 308 to the south where it will discharge into a temporary detention/water quality pond. The flows in pipe 309

(Q5=37.9cfs, Q100=79.3cfs) has a full flow capacity of 139.1cfs assuming a 0.5% slope.

Design Point 10 (DP 10) flows (Q5=2.8cfs, Q100=6.5cfs) are generated by basin V (Q5=2.0cfs, Q100=4.9cfs), basin W (Q5=0.2cfs, Q100=0.5cfs) and basin X (Q5=1.1cfs, Q100=2.3cfs)

Basin Runoff Description
Basin V, W & X consists of single-family residential development and streets.

Surface Routing
Basin V flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Mesolite Lane. Flows from basin V will be conveyed through the intersection of Mesolite Lane and Iolite Trail via a cross pan. Basin W flows consist of unconcentrated sheet and concentrated gutter flow. The flows will be intercepted by street curb and gutter in Iolite Trail and combine with the flow from basin V. Basin X flows consist of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Mesolite Lane. The flows that are collected north of Prairie Agate Lane in basin X will be combined with the flows from basin W and be conveyed through the intersection of Mesolite Lane and Prairie Agate Lane via a cross pan where it will be combined with the flow from basin X south of Prairie Agate Lane. The flows will continue to be conveyed through the gutter of Mesolite Lane and exit out the southern end of the property to a temporary water quality pond (DP P1).

Design Point 10A (DP 10A) flows (Q5=9.7cfs, Q100=20.2cfs) are generated by basin Z (Q5=0.7cfs, Q100=1.4cfs), basin AA (Q5=2.1cfs, Q100=4.4cfs), basin BB (Q5=3.7cfs, Q100=7.7cfs), basin CC (Q5=2.1cfs, Q100=4.4cfs) and basin DD (Q5=1.4cfs, Q100=2.8cfs).

Basin Runoff Description
Basin Z, AA, BB, CC & DD consists of single-family residential development and streets.

Surface Routing
Basin Z flows consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Mesolite Lane. Basin AA flows consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Zircon Terrace. Flows from basin Z will combine with flows from basin A and continue through the intersection of Zircon Terrace and Mesolite Lane via a cross pan and will then be combined with the flow from basin BB. Basin BB consists of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Zircon Terrace and Mesolite Lane. The collective flows of basins Z, AA & BB will be conveyed through the intersection of Mesolite Lane and Zircon Terrace via a cross pan and combined with the flow from basin DD. Basin DD flows consist of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The flows that enter and are generated by basin DD will be conveyed through the gutter of Mesolite Lane and exit out the southern end of the property to a temporary water quality pond (DP P1). *Refer to the Street Capacity Summary in the Hydraulics Calculations of the appendix for street capacity information.*

Design Point 11 (DP 11) flows (Q5=4.3cfs, Q100=9.2cfs) are generated by basin T (Q5=4.3cfs, Q100=9.2cfs).

Basin Runoff Description
Basin T will consist of single-family residential development and streets.

Surface Routing
Basin T flows consists of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Palmwood Path, Star Garnet Place and Aquamarine Lane. The flows from basin T will be conveyed to the 4' D-10-R sump inlet (Q5=4.3cfs, Q100=9.2cfs) on the north side on Aquamarine Lane.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed directly south through the park site into Iolite Trail where it will be conveyed to DP 3A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipes 402) will convey flows from the 4'D-10-R sump inlets in Aquamarine Lane to the manhole in Aquamarine Lane. The flow in pipe 402 (Q5=4.3cfs, Q100=9.2cfs) has a full flow capacity of 12.9cfs assuming a 1.5% slope.

Design Point 11A (DP 11A) flows (Q5=1.9cfs, Q100=3.9cfs) are generated by basin U (Q5=0.8cfs, Q100=1.6cfs) and basin Y (Q5=0.9cfs, Q100=1.9cfs).

Basin Runoff Description
Basin U & Y will consist of single-family residential development and streets.

Surface Routing
Basin U flows consists of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Aquamarine Lane. The flows from basin U will be conveyed to the 4' D-10-R sump inlet on the south side on Aquamarine Lane. Basin Y flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Aquamarine Lane. The flows from basin Y will be conveyed to the 4' D-10-R sump inlet on the south side on Aquamarine Lane.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed directly south through the park site into 6th St. where it will be conveyed to DP 3A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipes 401) will convey flows from the 4'D-10-R sump inlet in Aquamarine Lane to the manhole in Aquamarine Lane. The flow in pipe 401(Q5=1.9cfs, Q100=3.9cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope. A 24" RCP (pipe 403) will convey flows from the manhole in Aquamarine Lane in a northerly direction to a manhole in Star Garnet Place. The flow in pipe 403(Q5=5.7cfs, Q100=12.1cfs) has a full flow capacity of 16.0cfs assuming a 1.0% slope

Design Point 11B (DP 11B) flows (Q5=3.3cfs, Q100=7.0cfs) are generated by basin R (Q5=1.6cfs, Q100=3.2cfs) and basin S (Q5=1.8cfs, Q100=3.7cfs).

Basin Runoff Description
Basin R & S will consist of single-family residential development and streets.

Surface Routing
Basin R flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. Basin S flows consists of unconcentrated sheet

flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Prairie Agate Lane. The flows from basins R and S will be conveyed to the 4' D-10-R sump inlet (DP 11B) on the west side on the cul-de-sac on Prairie Agate Lane.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed directly west through a channel in a drainage tract where it will be conveyed to DP 12A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 404) will convey flows from the 4'D-10-R sump inlet in Prairie Agate Lane to the manhole in Star Garnet Place. The flows in pipe 404 (Q5=3.3cfs, Q100=7.0cfs) has a full flow capacity of 25.7cfs assuming a 6.0% slope. A 30" RCP (pipe 405) will convey flows from pipes 403 & 404 that were combined in the manhole in Star Garnet Place directly north to DP 12A. The flow in pipe 405 (Q5=9.5cfs, Q100=19.8cfs) has a full flow capacity of 29.0cfs assuming a 0.5% slope.

Design Point 12 (DP 12) flows (Q5=1.7cfs, Q100=3.5cfs) is generated by basin OO (Q5=1.7cfs, Q100=3.5cfs).

Basin Runoff Description
Basin OO will consist of single-family residential development and streets.

Surface Routing
Basin OO flows consists of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Star Garnet Place. The flows from basin OO will be conveyed to the 4' D-10-R sump inlet (Q5=1.7cfs, Q100=3.5cfs) in the west side of Star Garnet Place.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west on Barnes Rd. and then proceed south in the gutter of Vista Del Tierra Drive where it will be conveyed to DP 6.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 406) will convey flows from the 4'D-10-R sump inlet on the west side of Star Garnet Place to the manhole in 15th St. The flow in pipe 406 (Q5=1.7cfs, Q100=3.5cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope.

Design Point 12A (DP 12A) flows (Q5=1.5cfs, Q100=3.1cfs) are generated by basin NN (Q5=1.5cfs, Q100=3.1cfs).

Basin Runoff Description
Basin NN will consist of single-family residential development and streets.

Surface Routing
Basin NN flows consists of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Star Garnet Place. The flows from basin NN will be conveyed to the 4' D-10-R sump inlet (Q5=1.5cfs, Q100=3.1cfs) in the east side of Star Garnet Place.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west on Barnes Rd. and then proceed south in the gutter of Vista Del Tierra Drive where it will be conveyed to DP 6.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 407) will convey flows from the 4'D-10-R sump inlet on the east side of Star Garnet Place to the manhole in Star Garnet Place. The flow in pipe 407 (Q5=1.5cfs, Q100=3.1cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope. A 36" RCP (pipe 408) will convey flows from pipes 405, 406 & 407 that will combine in the manhole in Star Garnet Place directly north to the manhole in Barnes Rd. The flow in pipe 408 (Q5=12.4cfs, Q100=25.9cfs) has a full flow capacity of 47.2cfs assuming a 0.5% slope.

Design Point 13 (DP 13) flows (Q5=4.1cfs, Q100=9.8cfs) are generated by one half of the existing flow from basin OS-5 (Q5=4.1cfs, Q100=9.8cfs).

Basin Runoff Description
Basin OS-5 will consist of single-family residential development and streets.

Surface Routing
Basin OS-5 existing flows consists of unconcentrated sheet flow and concentrated ditch flow. These will be conveyed to the east to basin OS-6 by means of a diversion swale. In order to size the inlets that will convey the future developed flows, an estimate of one half of the existing flow from basin OS-5 (Q5=4.1cfs, Q100=9.8cfs) was used and the derived valued for surface flow to the inlet shall not be exceeded for the future development.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west on Barnes Rd. and then proceed north in the gutter of Vista Del Tierra Drive where it will be conveyed to DP 15A.

Pipe Routing/Pipe Capacity
A 24" RCP (pipes 411) will convey flows from the 4'D-10-R sump inlet in the west side of Star Garnet Place north of Barnes Rd. to the manhole in Star Garnet Place to the north of Barnes Rd. The flow in pipe 411 (Q5=4.1cfs, Q100=9.8cfs) has a full flow capacity of 22.6cfs assuming a 1.0% slope.

Design Point 13A (DP 13A) flows (Q5=12.3cfs, Q100=27.8cfs) are generated by half of the existing flow from basin OS-5 (Q5=6.5cfs, Q100=12.3cfs) and basin R5-A (Q5=4.9cfs, Q100=10.1cfs).

Basin Runoff Description
Basin OS-5 and R5-A will consist of single-family residential development and roadway corridor.

Surface Routing
Basin OS-5 existing flows consists of unconcentrated sheet flow and concentrated ditch flow. These will be conveyed to the east to basin OS-6 by means of a diversion swale. In order to size the inlets that will convey the future developed flows, an estimate of one half of the existing flow from basin OS-5 (Q5=4.1cfs, Q100=9.8cfs) combined with the flows from basin R5-A was used and the derived valued for surface flow to the inlet shall not be exceeded for the future development. Basin R5-A flows consists of unconcentrated sheet flow and concentrated gutter flow. These will be intercepted by street curb and gutter in Barnes Rd and be conveyed to the 8' D-10-R sump inlet (Q5=12.3cfs, Q100=27.8cfs) in the east side of Star Garnet Place and north of Barnes Rd.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west on Barnes Rd. and then proceed north in the gutter of Vista Del Tierra Drive where it will be conveyed to DP 15A.

Pipe Routing/Pipe Capacity
A 30" RCP (pipes 410) will convey flows from the 8'D-10-R sump inlet in the east side of Star Garnet Place north of Barnes Rd. to the manhole in Star Garnet Place to the north of Barnes Rd. The flow in pipe 410 (Q5=12.3cfs, Q100=27.8cfs) has a full flow capacity of 41.0cfs assuming a 1.0% slope. A 42" RCP (pipe 410A) will extend from the manhole in Star Garnet Place to the north and be buried and plugged. When basin OS-5 develops the plug will be removed and pipe 410A will convey the developed flows from basin OS-5. The flow in pipe 410A (Q5=38.8cfs, Q100=80.5cfs) has a full flow capacity of 142.3cfs assuming a 2.0% slope. A 42" RCP (pipe 412) will convey flows from the manhole in Star Garnet Place south to the manhole in Barnes Rd. The flow in pipe 412 (Q5=51.6cfs, Q100=110.0cfs) has a full flow capacity of 244.4cfs assuming a 5.9% slope.

Design Point 14 (DP 14) flows (Q5=2.1cfs, Q100=4.3cfs) are generated by basin R6-A (Q5=2.1cfs, 100=4.3cfs).

Basin Runoff Description
Basin R6-A will consist of a roadway corridor with landscaped areas.

Surface Routing
Basin R6-A flows consists of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Barnes Rd and be conveyed to the 12' D-10-R at-grade inlet in the median curb in the east bound lane in Barnes Rd. DP 14's 12' D-10-R at-grade inlet will intercept Q5=0.9cfs, Q100=1.3cfs with a flowby of Q5=1.2cfs, Q100=3.0cfs continuing to DP 15A.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west bound curb and gutter in Barnes Rd. and then proceed north in the gutter of Vista Del Tierra Drive where it will be conveyed to DP 15A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipes 409) will convey flows from the 12'D-10-R at-grade inlet in eastbound Barnes Rd. to the manhole in Barnes Rd. The flow in pipe 409 (Q5=1.2cfs, Q100=2.1cfs) has a full flow capacity of 36.8cfs assuming a 12.3% slope. The flows from pipes 408, 409 & 412 will be conveyed west in a 54" RCP (pipe 413) to the manhole in the intersection of Barnes Rd. and Vista Del Tierra Drive. The flow in pipe 413 (Q5=60.0cfs, Q100=127.2cfs) has a full flow capacity of 196.7cfs assuming a 1.0% slope.

Design Point 15 (DP 15) flows (Q5=3.9cfs, Q100=8.1cfs) are generated by basin R4 (Q5=3.9cfs, 100=8.1cfs). *See DP-20 for the interim flow condition for basin R4.*

Basin Runoff Description
Basin R4 will consist of single-family residential development and roadway corridor.

Surface Routing
Basin R4 future developed flows consist of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter and conveyed to the 4' D-10-R sump inlet (Q5=3.9cfs, Q100=8.1cfs) in Vista Del Tierra Drive.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west in the gutter of Barnes Rd. where it will be conveyed to DP 18A.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 415) will convey flows from the 4'D-10-R sump inlet in the west side curb and gutter to the manhole in Vista Del Tierra Drive. The flow in pipe 415 (Q5=3.9cfs, Q100=8.1cfs) has a full flow capacity of 10.5cfs assuming a 1.0% slope. The flow from pipe 415 will be conveyed to the manhole in Vista Del Tierra Drive.

Design Point 15A (DP 15A) flows (Q5=20.4cfs, Q100=45.0cfs) are generated by the flowby from DP 14 (Q5=1.2cfs, 100=3.0cfs), basin R4A (Q5=7.0cfs, 100=14.5cfs), basin R5 (Q5=8.0cfs, 100=16.5cfs) and basin OS-3(EX) (Q5=7.7cfs, 100=18.2cfs). *See DP-20 for the interim flow condition for basin R4A.*

Basin Runoff Description
Basin R4 & R5 will consist of single-family residential development and roadway corridor. Basin OS-3 consists of gradual sloping terrain with native prairie vegetation.

Surface Routing
Basin R4 future developed flows consist of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter and conveyed to the 16' D-10-R sump inlet (Q5=20.4cfs, Q100=45.0cfs) in the east side of Vista Del Tierra Drive. Basin R5 flows consist of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter in Barnes Rd. and then conveyed north to the 16' D-10-R sump inlet (Q5=20.4cfs, Q100=45.0cfs) in the east side of Vista Del Tierra Drive.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed to the west in the gutter of Barnes Rd. where it will be conveyed to DP 18A.

Pipe Routing/Pipe Capacity
A 36" RCP (pipes 414A) will be extended from the back of the sump inlet box on the east side of Vista Del Tierra Drive and plugged to convey the future developed flows from OS-3. The flows in pipe 414A (Q5=28.9cfs, Q100=60.1cfs) has a full flow capacity of 94.3cfs assuming a 2.0% slope. When OS-3 develops, the plug in pipe 414A will be removed and assume flows from the developed area. A 48" RCP (pipe 414) will convey the flows from the 16' D-10-R sump inlet (Q5=20.4cfs, Q100=45.0cfs) on the east side of Vista Del Tierra Drive and from pipe 414A to the manhole in Vista Del Tierra Drive. The flows in pipe 414 (Q5=48.1cfs, Q100=102.3cfs) has a full flow capacity of 143.6cfs assuming a 1.0% slope. A 48" RCP (pipe 416) will convey flows from pipe 414 and pipe 415 to the manhole in the intersection of Barnes Rd. and Vista Del Tierra Drive. The flow in pipe 416 (Q5=50.9 cfs, Q100=108.1cfs) has a full flow capacity of 231.6cfs assuming a 2.6% slope. At this point the flows from pipe 416 will combine with the flows from pipe 413 and then be conveyed west to the manhole in Barnes Rd. via a 60" RCP (pipe 417). The flow in pipe 417 (Q5=110.0cfs, Q100=233.6cfs) has a full flow capacity of 329.4cfs assuming a 1.6% slope. A 60" RCP (pipe 420) will extend northwest from the manhole and will convey flows from pipes 417 and discharge them into Pond 96. The flows in pipe 420 (Q5=109.5cfs, Q100=232.4cfs) has a full flow capacity of 368.3cfs assuming a 2.0% slope.

Design Point 16 (DP 16) flows (Q5=9.4cfs, Q100=17.6cfs) are generated by basin R1 (Q5=9.4cfs, Q100=17.6cfs).

Basin Runoff Description
Basin R1 will consist of roadway corridor and landscaping areas.

Surface Routing
Basin R1 flows consist of unconcentrated sheet flow and concentrated gutter flow. The flows from basin R1 will be intercepted by street curb and gutter in Barnes Rd., and conveyed to the 4' D-10-R sump inlet (Q5=9.4cfs, Q100=17.6cfs) in the south side of Barnes rd.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed south along Marksheffel Rd. to EX-1.

Pipe Routing/Pipe Capacity
A 36" RCP (pipe 603) will convey flow from the 4' D-10-R sump inlet (Q5=9.4cfs, Q100=17.6cfs) and pipe 602 and discharge it to the south in the existing roadside ditch. The flow in pipe 603 (Q5=22.8cfs, Q100=44.8cfs) has a full flow capacity of 66.7cfs assuming a 1.0% slope.

For this report the peak flow rates calculated for DP EX-1 are Q5=37.5cfs and Q100=71.4cfs. According to the "MDDP for the Hilltop Subdivision" at DP EX-1 the historic flow rates were calculated to be Q5=19.0cfs, Q100=56.0cfs and the developed flows were anticipated to be Q5=24cfs and Q100=62cfs. The developed flow rates for this report compare very well with these anticipated flow rates. Due to a very insignificant increase in flow rates no detention will be needed at this time, but the existing 18" culvert, that conveys flows from the east side of Marksheffel to the drainage channel west of Marksheffel, shall be upgraded to a 36" RCP (pipe EX-1). It was found the existing 18" cmp does not have enough capacity to convey the 100-year flows in the historic condition. The flow in the proposed pipe EX-1 (Q5=37.5cfs, Q100=71.4cfs) has a full flow capacity of 133.4cfs assuming a 4.0% slope.

When development occurs to the property south of Barnes Rd. and directly east of Marksheffel Rd. it is recommended that developed flows be detained and released at a rate equal to or less than the rates calculated for this report at design point EX-1.

Design Point 16A & 16A(EX) (DP 16A & 16A(EX)) flows (Q5=11.0cfs, Q100=21.0cfs) are generated by basin R1A (Q5=9.4cfs, Q100=17.6cfs), 10% of the future developed basin OS-1 (Q5=1.1cfs, Q100=2.1cfs) and basin OS-1(EX) (Q5=2.6cfs, Q100=6.2cfs).

Basin Runoff Description
Basin R1 will consist of roadway corridor and landscaping areas, and basin OS-1 will consist of native prairie in the existing condition and single family residential in the future developed condition.

Surface Routing
Basin OS-1 flow consists of unconcentrated sheet flow. The flow will be conveyed to basin R1 via sheet flow. In the existing condition, flow from the entire basin OS-1 will be accepted into basin 01 and conveyed the 8' D-10-R sump inlet (Q5=13.4cfs, Q100=27.1cfs) at to DP 16A(EX) via the curb and gutter of Barnes Rd., and in the future developed condition only the flows from the adjacent developed back of lots will be accepted into basin R1 and conveyed to DP 16A via the curb and gutter of Barnes Rd. It is proposed that the additional future developed flows from basin OS-1 will be collected and conveyed in a storm sewer system to the drainage channel west of Marksheffel Rd. in an across road culvert north of the intersection of Barnes Rd. and Marksheffel Rd. The existing flows from basin OS-1 were used to determine the inlet size at DP 16A due to the fact that larger flows will be accepted into basin R1 in the existing condition.

Clogging Statement
In the event of clogging or inlet failure, the runoff will proceed south along Marksheffel Rd. to EX-1.

Pipe Routing/Pipe Capacity
A 30" RCP (pipe 602) will convey flows from the 8' D-10-R sump inlet on the north side of Barnes Rd. to the 4' D-10-R sump inlet box on the south side of Barnes Rd. The flow in pipe 602 (Q5=13.4cfs, Q100=27.1cfs) has a full flow capacity of 41.0cfs assuming a 1.0% slope.

Design Point 17 (DP 17) flows (Q5=6.9cfs, Q100=13.0cfs) are generated by basin R2A (Q5=6.9cfs, 100=13.0cfs).

Basin Runoff Description
Basin R2A will consist of roadway corridor.

Surface Routing
Basin 02 flows consist of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter and conveyed to the 12' D-10-R at-grade inlet in Barnes Rd directly west of Collector A. DP 17's 12' D-10-R at-grade inlet will intercept Q5=3.8cfs, Q100=5.3cfs with a flowby of Q5=3.1cfs, Q100=7.7cfs continuing to DP18 via the curb and gutter of Barnes Rd.

Clogging Statement
In the event of clogging or inlet failure, the runoff will continue in the curb and gutter of Barnes Rd. to DP 18.

Pipe Routing/Pipe Capacity
An 18" RCP (pipe 501) will convey flow from the 12' at-grade inlet on the south side of Barnes Rd. to the manhole in the eastbound lanes of Barnes Rd. The flow in pipe 501 (Q5=3.8cfs, Q100=5.3cfs) has a full flow capacity of 12.0cfs assuming a 1.3% slope.

Design Point 17A (DP 17A) flows (Q5=25.3cfs, Q100=52.5cfs) are generated by OS-1A (Q5=25.3cfs, 100=52.5cfs).

Basin Runoff Description
Basin OS-1-A will consist of native prairie in the existing condition and single-family residential development and streets in the future development.

Surface Routing
Basin OS-1A flow consists of unconcentrated sheet flow and concentrated ditch flow. These flows will be intercepted by a temporary diversion channel (Q5=6.5cfs, Q100=15.4cfs) that will convey flows to a 42"RCP flared end section that will be located west of Collector A. When development occurs to basin OS-1A the diversion channel will be eliminated and the developed flows will be routed to the 42" RCP FES.

Clogging Statement
In the event of clogging or inlet failure, the runoff will continue in the curb and gutter of Barnes Rd. to DP 18A.

Pipe Routing/Pipe Capacity
In the interim condition, a 42" RCP flared end section will collect flows from basin OS-1-A and convey it to a 42" RCP (pipe 500) which will convey flows to the 12'D-10-R at-grade inlet box on the north side of Barnes Rd. The interim flow in pipe 500 (Q5=6.5cfs, Q100=15.4cfs) has a full flow capacity of 100.6cfs assuming a 1.0% slope. 90% of the future developed flows from basin OS-1-A will be collected and conveyed in storm sewer system and then routed to a 42" RCP (pipe 500) which will convey flows to the

manhole in Barnes Rd. The ultimate flow in pipe 500 (Q5=25.3cfs, Q100=52.5cfs) has a full flow capacity of 100.6cfs assuming a 1.0% slope.

Design Point 17B (DP 17B) flows (Q5=12.0cfs, Q100=23.1cfs) are generated by basin R2 (Q5=8.7cfs, 100=16.3cfs) and 10% of basin OS-1A (FUT) (Q5=2.5cfs, 100=5.3cfs).

Basin Runoff Description
Basin R2 & OS-1A (FUT) will consist of single-family residential development and roadway corridor.

Surface Routing
Basin R2 flows consist of unconcentrated sheet flow and concentrated gutter flow. The flow will be intercepted by street curb and gutter and conveyed to the 12' D-10-R at-grade inlet on the north side of the median of Barnes Rd. DP 17B's 12' D-10-R at-grade inlet will intercept Q5=5.1cfs, Q100=8.6cfs with a flowby of Q5=6.9cfs, Q100=14.6cfs continuing to DP18 via the curb and gutter of Barnes Rd. In the event that the adjacent property north of basin 02 develops, the sheet flow from the back of the lots from the adjacent property, which is estimated at 10% of the total basin flow, will be conveyed and collected in the curb and gutter of Barnes Rd. and directed to DP 17B.

Clogging Statement
In the event of clogging or inlet failure, the runoff will continue in the curb and gutter of Barnes Rd. to DP 18.

Pipe Routing/Pipe Capacity
A 24" RCP (pipe 502) will convey flows from the 12'D-10-R at-grade inlet (Q5=5.1cfs, Q100=8.6cfs) and pipe 501 to the manhole in the westbound lanes of Barnes Rd. The flow in pipe 502 (Q5=5.1cfs, Q100=8.6cfs) has a full flow capacity of 119.0cfs assuming a 1.4% slope. A 24" RCP (pipe 503) will convey flows from pipes 500 & 502 to the manhole east of Collector A. The flow in pipe 503 (Q5=37.9cfs, Q100=76.8cfs) has a full flow capacity of 142.3cfs assuming a 2.0% slope. A 42" RCP (pipe 504) will convey flows from pipe 503 north and discharge into Pond 96. The flow in pipe 504 (Q5=36.6cfs, Q100=74.2cfs) has a full flow capacity of 211.0cfs assuming a 4.4% slope.

Design Point 18 (DP 18) flows (Q5=10.0cfs, Q100=20.5cfs) are generated by the south half of basin R3 (Q5=7.1cfs, 100=13.3cfs) and flowby from DP 17 sump inlet (Q5=3.1cfs, 100=7.7cfs).

Basin Runoff Description
Basin R3 will consist of roadway corridor.

Surface Routing
Basin R3 flows consist of unconcentrated sheet flow, concentrated gutter flow and the flowby (Q5=7.1cfs, Q100=13.3cfs) from DP 17. These will be intercepted by street curb and gutter in Barnes Rd. and then conveyed to the 4' D-10-R sump inlet (Q5=10.0cfs, Q100=20.5cfs) in the south side of Barnes Rd.

Clogging Statement
In the event of clogging or inlet failure, the runoff will overtop the curb and gutter and precede either to the north into Pond 96 or to the south to the improved Sand Creek channel.

Pipe Routing/Pipe Capacity
A 30" RCP (pipe 418) will convey flows from the 4'D-10-R sump inlet on the south side Barnes Rd. to the manhole in the median of Barnes Rd. The flow in pipe 418 (Q5=10.0cfs, Q100=20.5cfs) has a full flow

capacity of 65.1cfs assuming a 1.0% slope.

Design Point 18A (DP 18A) flows (Q5=13.5cfs, Q100=26.8cfs) are generated by the north half of basin R3 (Q5=7.1cfs, 100=13.3cfs) and flowby from DP 17B (Q5=6.9cfs, 100=14.6cfs).

Basin Runoff Description
Basin R3 will consist of roadway corridor.

Surface Routing
Basin R3 flows consist of unconcentrated sheet flow, concentrated gutter flow and the flowby from DP 17B (Q5=6.9cfs, Q100=14.6cfs). These will be intercepted by street curb and gutter in Barnes Rd. and then conveyed to the 8' D-10-R sump inlet (Q5=13.5cfs, Q100=26.8cfs) in Barnes Rd.

Clogging Statement
In the event of clogging or inlet failure, the runoff will overtop the curb and gutter and precede either to the north into Pond 96 or to the south to the improved Sand Creek channel.

Pipe Routing/Pipe Capacity
A 30" RCP (pipe 419) will convey flows from the 8' D-10-R sump inlet on the north side Barnes Rd. and pipe 418 to the manhole on the median of Barnes Rd.. The flow in pipe 419 (Q5=13.5cfs, Q100=26.8cfs) has a full flow capacity of 41.0cfs assuming a 1.0% slope. A 30" RCP (pipe 419A) will convey flows from pipes 418 & 419 and will extend from the manhole to the outfall pipe from Pond and discharge them into Pond 96. The flows in pipe 419A (Q5=23.4cfs, Q100=47.1cfs) has a full flow capacity of 71.0cfs assuming a 3.0% slope.

Offsite and Roadways

Design Point 20 (EX) (DP 20 (EX)) flows (Q5=14.3cfs, Q10=30.7cfs) are generated by basin OS-2 (EX) (Q5=3.0cfs, 100=7.2cfs), basin OS-3 (EX) (Q5=7.7cfs, 100=18.2cfs), basin R4 (Q5=3.9cfs, 100=8.1cfs) and basin R4A (Q5=7.0cfs, 100=14.5cfs).

Basin Runoff Description
Basin OS-2, basin OS-3, basin R4 and basin R4A consists of native prairie in the existing condition and will consist of single-family residential development and roadways in the developed condition.

Surface Routing
Basin OS-3 flow consists of unconcentrated sheet flow and concentrated ditch flow in the existing condition. The flow will be intercepted by a stable temporary diversion swale and conveyed to Pond 96. The developed flow from basin OS-2 will consist of unconcentrated sheet flow and concentrated gutter flow. The future developed flow from basin OS-2 (Q5=17.1cfs, Q100=35.6cfs) will be conveyed and collected in a future storm sewer system and discharged directly into Pond 96. For the developed flow conditions and routing for OS-3 see DP 15A, for R4 see DP 15 and for R4A see DP 15 A.

Design Point 21 (DP 21) flows are generated by basin OS-4 (EX) (Q5=12.0cfs, 100=28.6cfs).

Basin Runoff Description
Basin OS-4 consists of native prairie in the existing condition and will consist of single-family residential development, roadways and a park in the developed condition.

Surface Routing
Basin OS-4 flow consists of unconcentrated sheet flow and concentrated ditch flow in the existing condition. The flow will be intercepted by a stable temporary diversion swale and conveyed to Pond 96. The developed flow from basin OS-4 will consist of unconcentrated sheet flow and concentrated gutter flow. The future developed flow from basin OS-4 (Q5=56.1cfs, Q100=116.5cfs) will be conveyed and collected in a future storm sewer system and discharged directly into Pond 96.

Design Point 22 (DP 22) See "Detention and Channel Improvements" below.

Design Point 23 (DP 23) flows (Q5=17.9cfs, Q100=42.1cfs) are generated by basin OS-5(EX) (Q5=13.0cfs, 100=27.9cfs), basin OS-6 (Q5=14.4cfs, 100=30.7cfs) and basin LL1 (Q5=3.0cfs, 100=6.2cfs).

Basin Runoff Description
Basin OS-5 and OS-6 consists of native prairie in the existing condition and the future developed condition will be single family residential. Basin LL1 will consist of single-family residential development and streets.

Surface Routing
Basin OS-5 (EX) flows consists of unconcentrated sheet flow and concentrated ditch flow. In the existing condition the flow will be intercepted by a stable temporary diversion swale that will convey flows to the eastern property boundary where the flows will continue to be conveyed through basin OS-6. See DP 13 & 13A for explanation of the future developed flows for basin OS-5. Basin OS-6 (EX) is comprised of right-of-way for the future Banning Lewis Parkway and Barnes Rd. interchange. Basin LL1 will consist of the back of lots for the single family development (Q5=3.0cfs, Q100=6.2cfs). The developed flows will be diverted to the historic flow channel at the southeast corner of the site. The existing flow rates calculated for DP 24 are Q5=17.9cfs and Q100=42.1cfs. The rates compare very well at this location to the historic flow rates that were discussed in the preliminary "MDDP for Mountain Vista Ranch" (Q5=18.1cfs, Q100=45.0cfs) concluding that no detention will be needed at this point. The channel should be stabilized and constructed so that the energy will be dissipated and dispersed prior to being released to the natural watercourse. The development of the master planned interchange may trigger the need to replace or upgrade the means of conveyance from basin OS-6.

Design Point 24 (DP 24) flows (Q5=7.1cfs, Q100=13.3cfs) are generated by basin R7.

Basin Runoff Description
Basin 07 consists of a roadway corridor.

Surface Routing
Basin R7 flows consists of unconcentrated sheet flow and concentrated gutter flow. The flow (Q5=7.7cfs, Q100=14.5cfs) in the Vista Del Tierra Drive west gutter will exit the southern end of the site and it will be routed to a riprap pad that will dissipate the energy and disperse the flow before allowing it to follow the natural watercourse to Sand Creek channel.

Design Point P1 (DP P1) See "Detention and Channel Improvements" below.

Design Point P2 (DP P2) flows (Q5=7.1cfs, Q100=13.3cfs) are generated by basin LL2 and flows from DP P1 discharge.

Basin Runoff Description
Basin LL2 consists of single-family residential development.

Surface Routing
Basin LL2 flows consists of unconcentrated sheet flow and will be conveyed to adjacent property to the south (Q5=0.9cfs, Q100=1.8cfs). The flow from basin LL2 will combine with the discharge from the water quality at DP P1. The flows at DP P2 (Q5=34.7cfs, Q100=86.2cfs) compare very well to the historic flow (Q5=34.7cfs, Q100=86.2cfs) concluding that no detention will be needed at this point.

REGIONAL DETENTION FACILITY 96

Pond 96 is has been designed by JR Engineering and is approved. The detention facility has been designed to accept the developed flows that are contained in this report. As can be seen in the outflow hydrograph titled "Regional Pond 96 Routing" in the preliminary MDDP for Mountain Vista Ranch, the release of the flows in Pond 96 will be lagged such that it will allow ample availability for free flow discharge directly into the improved Sand Creek channel from the storm sewer outfalls proposed from the majority of the development. In the event that Pond 96 is not constructed prior to the development of Village 2, by Banning Lewis Ranch Companies, and developed flows are generated by Mountain Vista Ranch, a temporary detention pond(s) will be necessary to detain flows to historic levels from Mountain Vista Ranch prior to discharging into the proposed channel.

DETENTION & CHANNEL IMPROVEMENTS

The proposed channel improvements for the Sand Creek Channel East Fork Sub-Tributary in Mountain Vista Ranch were discussed in the preliminary MDDP for Mountain Vista Ranch, and will be restated in this report for clarity. The channel improvements proposed for the Mountain Vista Ranch portion of the Sand Creek East Fork Sub-Tributary will utilize various concepts from the sections approved in the Banning Lewis Ranch MDDP and the sections presented in the Sand Creek DBPS. Peak flow rates in the subject reach of the channel will be considerably less than assumed in the Sand Creek DBPS due to the mitigation of peak rates that will occur with the construction of proposed Detention Pond 96. This pond was not part of the preferred plan as proposed by the Sand Creek DBPS.

The proposed profile of the drainage channel includes bottom slopes of 0.5% with 4.0' grouted sloping drop structures spaced approximately 350 linear feet apart. The proposed section utilizes a 30' bottom width, 5 foot deep, trapezoidal section with 3:1 side slopes to convey the 100-year design flows of approximately 785 cfs. The 100-year design flow will be conveyed at a depth of approximately 4 feet at 6 feet per second. The bottom of the channel is proposed to be unlined. Side slopes are proposed to be lined with exposed riprap at the toe and to a depth of 1 foot above the invert. Above the 1 foot depth buried riprap is proposed extending to the 4 foot depth. The bottom of the buried riprap is also planned to be extended to four feet below the invert of the channel to armor against potential scour.

On the east side of the trapezoidal channel there are proposed gradual slopes to provide for maintenance access, potential utility corridors and additional conveyance in case overtopping of the proposed upstream detention pond occurs.

For the interim condition, this is defined as the constructed Pond 96 and the developed Filing No. 1 and Filing No. 2, a design point, DP 22 (EX), was used to compare the existing flow rates to the developed flow rates in Sand Creek Channel East Fork Sub-Tributary as it exits the Mountain Vista Ranch area. The existing flow rate at DP 22 (EX) is Q100=4683cfs, and the developed flow is considerably less and was found to be Q100=914.8cfs. The proposed flows generated at DP 22 (EX) were found by routing basin OS-

7 (EX) (Q100=27.4cfs), PIPE 108 (Q100=82.9cfs), and PIPE 208 (Q100=95.9cfs) along with the proposed discharge of the pond (Q100=784cfs). This discharge will be accounted for in the final channel design that is currently being prepared by M & S Civil Consultants, Inc.

A temporary detention/water quality pond will be constructed adjacent to the south end of the site at DP P1, and it will detain the flows that exit the site from Mesolite Lane and the flows that are discharged from pipe 309. The aforementioned flows will be conveyed to the pond via temporary stabilized channels. The pond will have a volume of 1.1 acre-feet for detention and an additional 0.6 acre-feet for water quality bringing the total volume to 1.7 acre-feet. The Rational Volumetric Method developed by Urban Watershed Research Institute was used to determine the pond volume. The historic flow rates at DP P1, which are found in the preliminary "MDDP for Mountain Vista Ranch", are Q5=33.9cfs, Q100=84.5cfs. The release for the detention/water quality will be at the historic rate into the natural watercourse located below the pond. When the property adjacent to the southern boundary of Mountain Vista Ranch develops, the detention/water quality pond and the temporary channels will be removed and the flows will be conveyed through the future storm sewer system.

A temporary detention/water quality pond will also be constructed adjacent to the southeast corner of the site at DP 23, and it will detain the existing flows adjacent to the site from basins OS-5EX and OS-6EX that are discharged from a proposed diversion swale on the east perimeter of Filing No.6. The pond will have a volume of 1.5 acre-feet for detention and an additional 0.8 acre-feet for water quality bringing the total volume to 2.3 acre-feet. The Rational Volumetric Method developed by Urban Watershed Research Institute was used to determine the pond volume. The historic flow rates at DP 23, which are found in the preliminary "MDDP for Mountain Vista Ranch", are Q5=18.1cfs, Q100=45.0cfs. The release for the detention/water quality will be at the historic rate into the shallow swale located below the pond. When the property adjacent to the southern boundary of Mountain Vista Ranch develops, the detention/water quality pond and the temporary channels will be removed and the flows will be conveyed through the future storm sewer system.

FUTURE SCHOOL SITE

The future school site in the existing condition consists of native prairie with grades of 1.5%. The flows in this site will exit the site as sheet flow; therefore no collection system or detention of the flows will be necessary. In the event the site develops, a collection system will be needed at that time.

CONSTRUCTION COST OPINION

The proposed drainage facility Construction Cost Opinion for Mountain Vista Ranch Filing No. 1 and No. 2 is included in the Appendix. The costs have been broken out to show the differences from the approved Drainage Basin Planning Study. Some of these changes are due to the proposed drainage plan from the Banning Lewis Ranch Master Development Drainage Plan, approved August 2004, prepared by Turner, Collie, & Braden, Inc.

Public Facilities:

Filing NO. 1

The total public, 2008 MDDP estimate of DBPS reimbursable on-site drainage facilities:	$ 1,670,532.07
The total public, cost estimate to construct reimbursable on-site drainage facilities:	$ 1,516,759.00
The difference of public, reimbursable on-site drainage facilities:	$ 153,773.07

Filing NO. 2

The total public, 2008 MDDP estimate of DBPS reimbursable on-site drainage facilities:	$ 604,287.88
The total public, cost estimate to construct reimbursable on-site drainage facilities:	$ 27,335.00
The difference of public, reimbursable on-site drainage facilities:	$ 576,952.88

M & S Civil Consultants, Inc. (M&S) 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 2008. Upon completion of the aforementioned improvements, M&S shall submit the actual construction costs to the City of Colorado Springs/City Drainage Board for reimbursement.

DRAINAGE, BRIDGE AND POND FEES

Mountain Vista Ranch is located within the Sand Creek Drainage Basin. The 2008 Drainage, Bridge and Pond Fees per the City of Colorado Springs for this site are listed below:

Filing NO. 1

Drainage Fee:	$ 9,041/acre x 60.24 acres	$ 544,629.84
Bridge Fee:	$ 568/acre x 60.24 acres	$ 34,216.32
Pond Fee (Land):	$ 1,070/acre x 60.24 acres	$ 65,456.80
Pond Fee (Facilities):	$ 2,744/acre x 60.24 acres	$ 165,298.56
Total:		**$ 809,601.52**
Total fees for this site payable to the City of Colorado Springs:		**$ 0.00 ***

Filing NO. 2

Drainage Fee:	$ 9,041/acre x 41.34 acres	$ 373,754.94
Bridge Fee:	$ 568/acre x 41.34 acres	$ 23,481.12
Pond Fee (Land):	$ 1,070/acre x 41.34 acres	$ 44,233.80
Pond Fee (Facilities):	$ 2,744/acre x 41.34 acres	$ 113,436.96
Total:		**$ 554,906.82**
Total fees for this site payable to the City of Colorado Springs:		**$ 0.00 ***

*** The obligation for Mountain Vista Ranch Filing No. 1 and No. 2 improvements, to construct the necessary East Fork Sand Creek Channel Improvements and the necessary 100-yr Regional Facilities improvements, will exceed the Drainage fees for this site. Therefore, at the time of platting, no fees will be paid for Drainage prior to plat recordation.**

SUMMARY

Mountain Vista Ranch Filing No. 1 and No. 2 contains 101.58 acres within the Sand Creek Drainage Basin. The development of the site will require drainage and water quality facilities to accommodate developed flows and meet City of Colorado Springs Drainage Criteria. The proposed drainage facilities will adequately convey, detain and route runoff from the site to the East Fork of Sand Creek or existing off-site drainage swales. All drainage facilities described herein and shown on the included drainage map are subject to change due to final design considerations. The drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual. Supporting information and calculations are included in the Appendix.

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 Banning Lewis Ranch Phase I and II, November 2004, prepared by Turner, Collie, & Braden, approved January 25, 2005.

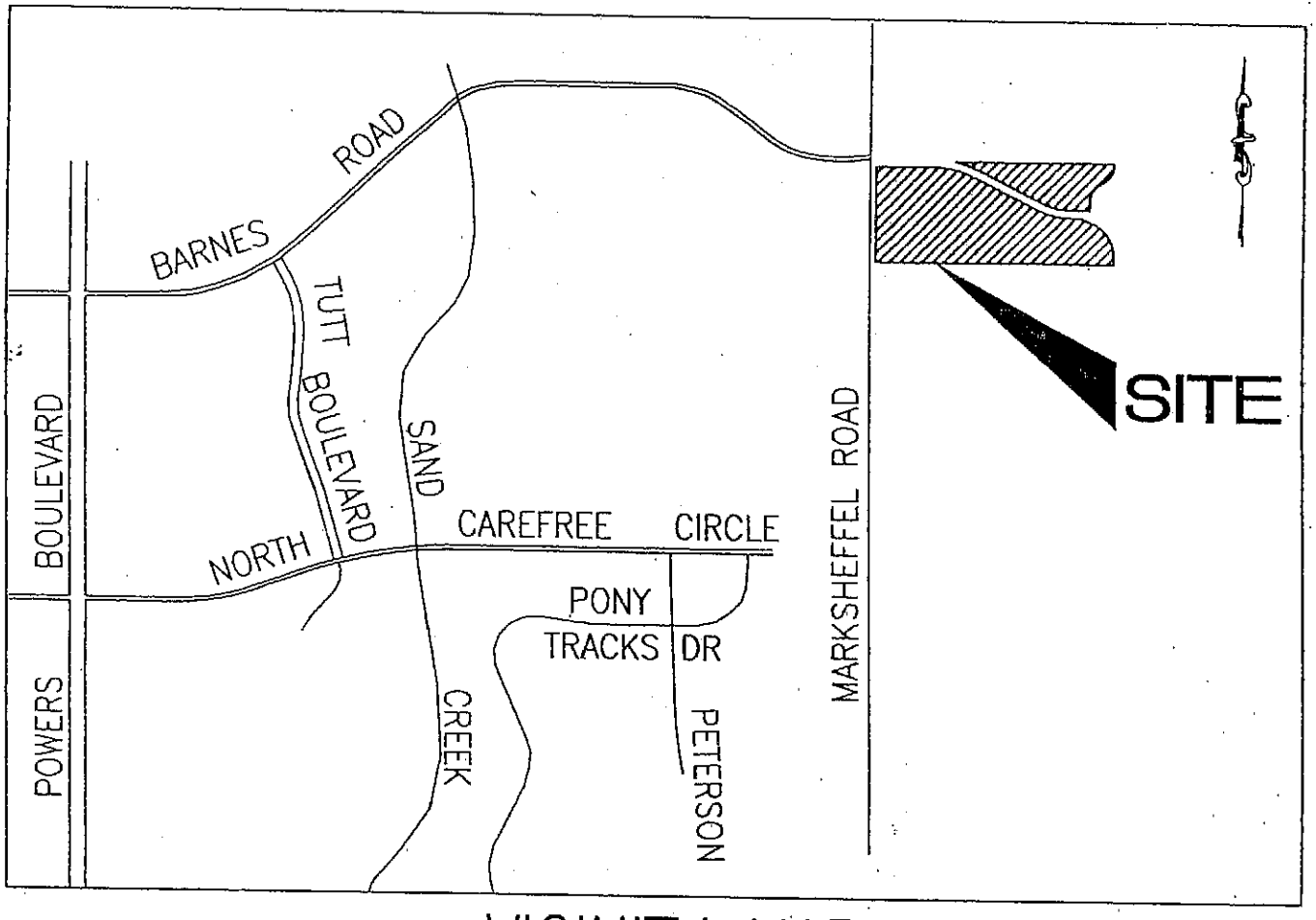
4. Master Development Drainage Plan for Hilltop Subdivision, November 1996 revised March 1997, prepared by URS Greiner, Inc.

5. Drainage Basin Planning Study for the Sand Creek Drainage Basin, Preliminary Design Report, January 1993, prepared by Kiowa Engineering Corporation, Revised March 1996.

6. Master Development Drainage Plan for Mountain Vista Ranch, March 2006, prepared by JR Engineering

APPENDIX

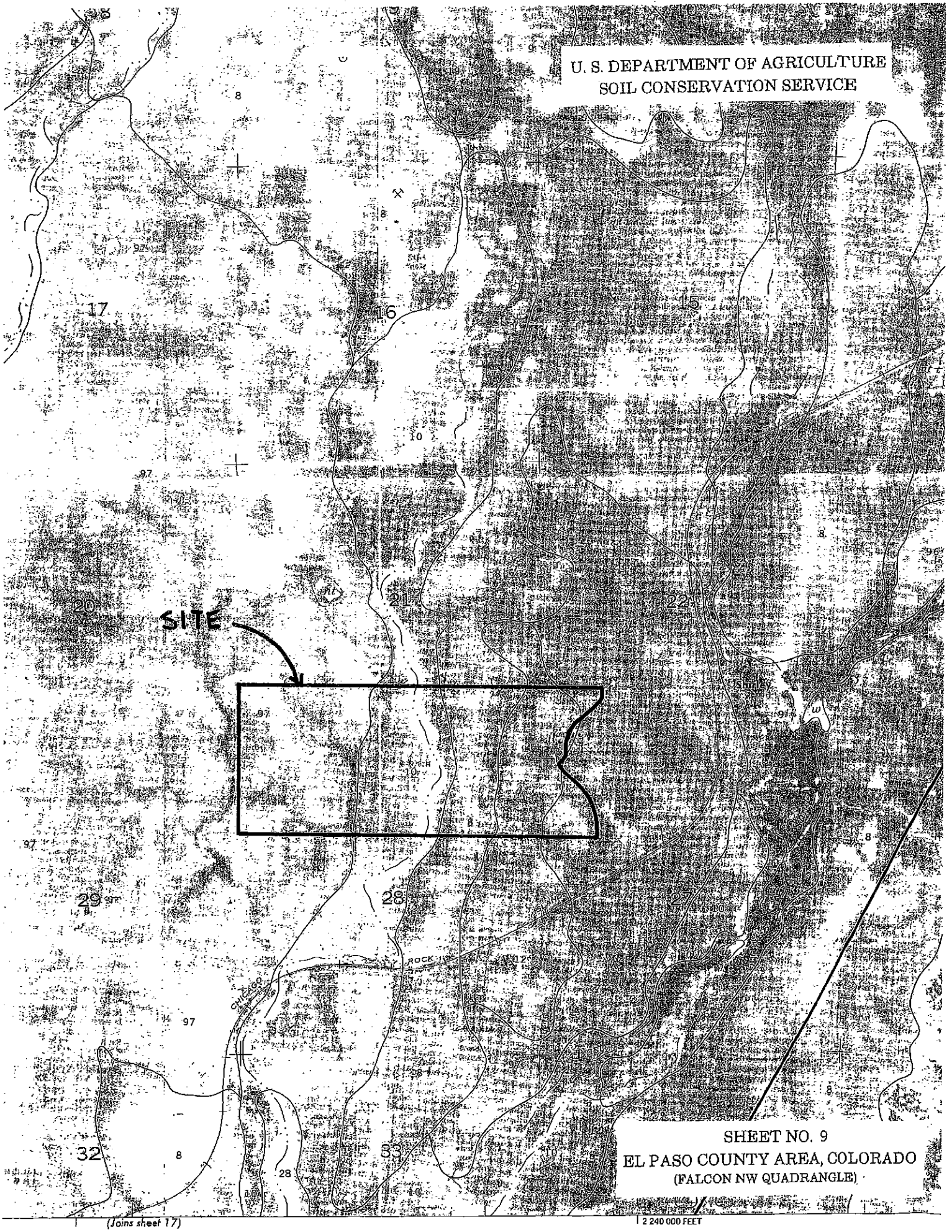
VICINITY MAP



VICINITY MAP

NTS

SOILS MAP


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SITE
SHEET NO. 9
EL PASO COUNTY AREA, COLORADO
(FALCON NW QUADRANGLE)
(Joins sheet 17)
2 240 000 FEET

FLOODPLAIN MAP

ROAD

ROAD

MARKSHEFFEL

EL PASO COUNTY

CITY OF COLORADO SPRINGS

0

ZONE X

COUNTY
ATED AREAS
0059

CITY OF COLORADO SPRINGS
080060

21

6645

N

6639

N

Mountain
Vista
Ranch

6630

6625

6620

6616

6611

6606

ZONE X

M

6602

M

CITY OF COLORADO SPRINGS
080060

6598

6595

6590

Sand Creek East
Fork Subtributary

ZONE X

6586

6590

ZONE X

ZONE AE

6581

6586

6581

ZONE AE

L

6577

L

6573

29

28

ZONE X

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 543 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0543	F

MAP NUMBER
08041C0543 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

CITY OF COLORADO SPRINGS
080060

6645
N 6639 N
22
21
6630
6625
6620
6616
6611
6606
M 6602 M
6598
6595
6590
6586
6581
L

Mountain Vista Ranch

ZONE X

Sand Creek East Fork Subtributary

ZONE X

ZONE AE

CADILLAC AND LAKE CITY

COLORADO AND EASTERN

JOINS PANEL 0544

28

27

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 543 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0543	F

MAP NUMBER
08041C0543 F

EFFECTIVE DATE:
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Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
"C" Value Interpolation

Typical Lot			AREA			5 YEAR "C"		100 YEAR "C"		5 YEAR	100 YEAR
Width	Length	Basin	Low	Actual	High	High	Low	High	Low	Interp	Interp
50	120	A	0.125	0.138	0.250	0.60	0.50	0.70	0.60	0.59	0.69
60	50	B	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	C	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	190	D	0.125	0.218	0.250	0.60	0.50	0.70	0.60	0.53	0.63
50	50	E	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	170	F	0.125	0.195	0.250	0.60	0.50	0.70	0.60	0.54	0.64
60	75	G	0.125	0.103	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	150	H	1.125	0.207	0.250	0.60	0.50	0.70	0.60	0.60	0.70
Park		I				0.25		0.35		0.25	0.35
60	50	J	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	150	K	0.125	0.207	0.250	0.60	0.50	0.70	0.60	0.53	0.63
60	160	K1	0.125	0.220	0.250	0.60	0.50	0.70	0.60	0.52	0.62
65	150	L	1.125	0.224	0.250	0.60	0.50	0.70	0.60	0.60	0.70
70	50	L1	0.125	0.080	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	50	M	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
65	150	N	0.125	0.224	0.250	0.60	0.50	0.70	0.60	0.52	0.62
60	50	O	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	P	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	Q	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	R	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	S	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	190	T	0.125	0.262	0.250	0.60	0.50	0.70	0.60	0.49	0.59
Road		U				0.90		0.95		0.90	0.95
Park		V				0.25		0.35		0.25	0.35
50	50	W	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	X	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	50	X1	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	Y	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	Z	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	150	AA	0.125	0.207	0.250	0.60	0.50	0.70	0.60	0.53	0.63
50	150	BB	0.125	0.172	0.250	0.60	0.50	0.70	0.60	0.56	0.66
50	150	CC	0.125	0.172	0.250	0.60	0.50	0.70	0.60	0.56	0.66
65	50	DD	0.125	0.075	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	120	EE	0.125	0.138	0.250	0.60	0.50	0.70	0.60	0.59	0.69
60	50	FF	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	150	GG	0.125	0.207	0.250	0.60	0.50	0.70	0.60	0.53	0.63
70	150	HH	0.125	0.241	0.250	0.60	0.50	0.70	0.60	0.51	0.61
60	50	II	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
65	50	JJ	0.125	0.075	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	150	KK	0.125	0.172	0.250	0.60	0.50	0.70	0.60	0.56	0.66

60	50	LL	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	50	LL1	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	50	LL2	0.125	0.069	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	150	MM	0.125	0.207	0.250	0.60	0.50	0.70	0.60	0.53	0.63
50	70	NN	0.125	0.080	0.250	0.60	0.50	0.70	0.60	0.60	0.70
60	70	OO	0.125	0.096	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	PP	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
Road		R1				0.90		0.95		0.90	0.95
Road		R1A				0.90		0.95		0.90	0.95
Road		R2				0.90		0.95		0.90	0.95
Road		R2A				0.90		0.95		0.90	0.95
Road		R3				0.90		0.95		0.90	0.95
50	100	R4	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	R4A	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	R5	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	R5A	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
Road		R6				0.90		0.95		0.90	0.95
50	100	R6A	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
Road		R7				0.90		0.95		0.90	0.95
50	100	R8	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	R9	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	100	R10	0.125	0.115	0.250	0.60	0.50	0.70	0.60	0.60	0.70
50	50	R10A	0.125	0.057	0.250	0.60	0.50	0.70	0.60	0.60	0.70
Proposed Basin		OS-1				0.60		0.70		0.60	0.70
Proposed Basin		OS-1A				0.60		0.70		0.60	0.70
Proposed Basin		OS-1B				0.60		0.70		0.60	0.70
Proposed Basin		OS-2				0.60		0.70		0.60	0.70
Proposed Basin		OS-3				0.60		0.70		0.60	0.70
Proposed Basin		OS-4				0.60		0.70		0.60	0.70
Proposed Basin		OS-5				0.60		0.70		0.60	0.70
Proposed Basin		OS-6				0.60		0.70		0.60	0.70
Proposed Basin		OS-7				0.60		0.70		0.60	0.70
Proposed Basin		School				0.60		0.70		0.60	0.70
Existing Basin		OS-1				0.15		0.20		0.15	0.20
Existing Basin		OS-1A				0.15		0.20		0.15	0.20
Existing Basin		OS-1B				0.15		0.20		0.15	0.20
Existing Basin		OS-2				0.15		0.20		0.15	0.20
Existing Basin		OS-3				0.15		0.20		0.15	0.20
Existing Basin		OS-4				0.15		0.20		0.15	0.20
Existing Basin		OS-5				0.15		0.20		0.15	0.20
Existing Basin		OS-6				0.15		0.20		0.15	0.20
Existing Basin		OS-7				0.15		0.20		0.15	0.20
Existing Basin		School				0.15		0.20		0.15	0.20

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Area Drainage Summary)

From Composite Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)	INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL	C_5	C_{100}	C_5	Length	Height	T_C	Length	Slope	Velocity	T_t	TOTAL	I_5	I_{100}	Q_5	Q_{100}
	(Acres)	From DCM Table 5-1			(ft)	(ft)	(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
A	2.70	0.59	0.69	0.25	120	3	12.9	943	2.4%	5.4	2.9	15.8	3.4	6.0	5.4	11.2
B	0.80	0.60	0.70	0.25	50	0.5	11.2	450	2.4%	5.4	1.4	12.6	3.7	6.6	1.8	3.7
C	1.00	0.60	0.70	0.25	50	0.5	11.2	525	2.7%	5.8	1.5	12.8	3.7	6.6	2.2	4.6
D	2.70	0.53	0.63	0.25	170	8	12.4	575	2.2%	5.1	1.9	14.3	3.5	6.3	5.0	10.6
E	1.10	0.60	0.70	0.25	50	0.5	11.2	575	2.2%	5.2	1.8	13.1	3.7	6.5	2.4	5.0
F	3.40	0.54	0.64	0.25	170	7	13.0	650	2.4%	5.4	2.0	15.0	3.5	6.2	6.4	13.5
G	1.00	0.60	0.70	0.25	50	0.5	11.2	330	2.6%	5.6	1.0	12.2	3.8	6.7	2.3	4.7
H	1.30	0.60	0.70	0.25	120	3	12.9	380	2.6%	5.6	1.1	14.0	3.6	6.4	2.8	5.8
I	5.90	0.25	0.35	0.25	500	18	23.3	550	2.7%	5.8	1.6	24.9	2.7	4.8	4.0	9.9
J	0.90	0.60	0.70	0.25	50	0.5	11.2	750	2.7%	5.8	2.2	13.4	3.6	6.5	2.0	4.1
K	2.40	0.53	0.63	0.25	170	7	13.0	520	1.5%	4.3	2.0	15.0	3.5	6.2	4.4	9.4
K1	6.70	0.52	0.62	0.25	250	24	11.9	1377	1.4%	4.1	5.5	17.5	3.2	5.7	11.3	24.0
L	1.20	0.60	0.70	0.25	50	0.5	11.2	550	2.5%	5.5	1.7	12.9	3.7	6.6	2.7	5.5
L1	0.30	0.60	0.70	0.25	50	0.5	11.2	550	2.5%	5.5	1.7	12.9	3.7	6.6	0.7	1.4
M	0.90	0.60	0.70	0.25	50	0.5	11.2	550	2.5%	5.5	1.7	12.9	3.7	6.6	2.0	4.2
N	2.90	0.52	0.62	0.25	50	0.5	11.2	780	2.5%	5.5	2.3	13.6	3.6	6.4	5.5	11.6
O	0.70	0.60	0.70	0.25	50	0.5	11.2	750	2.6%	5.6	2.2	13.5	3.6	6.5	1.5	3.2
P	1.50	0.60	0.70	0.25	140	7	11.1	500	2.2%	5.2	1.6	12.7	3.7	6.6	3.4	7.0
Q	0.80	0.60	0.70	0.25	50	0.5	11.2	500	2.2%	5.2	1.6	12.8	3.7	6.6	1.8	3.7
R	0.70	0.60	0.70	0.25	50	0.5	11.2	400	1.6%	4.4	1.5	12.8	3.7	6.6	1.6	3.2
S	0.80	0.60	0.70	0.25	50	0.5	11.2	400	1.6%	4.4	1.5	12.7	3.7	6.6	1.8	3.7
T	2.50	0.49	0.59	0.25	180	7	13.6	380	2.5%	5.5	1.1	14.8	3.5	6.2	4.3	9.2
U	0.20	0.90	0.95	0.25	20	0.3	6.2	180	1.0%	3.5	0.9	7.1	4.6	8.2	0.8	1.6
V	1.70	0.25	0.35	0.25	20	0.3	6.2	350	4.9%	7.8	0.8	7.0	4.6	8.3	2.0	4.9
W	0.10	0.60	0.70	0.25	50	0.5	11.2	100	1.4%	4.1	0.4	11.6	3.9	6.9	0.2	0.5
X	0.40	0.60	0.70	0.25	20	0.3	6.2	350	2.9%	6.0	1.0	7.2	4.6	8.2	1.1	2.3
X1	0.60	0.60	0.70	0.25	50	2	7.1	1	3.0%	6.1	0.0	7.1	4.6	8.2	1.7	3.5
Y	0.40	0.60	0.70	0.25	50	0.5	11.2	220	2.4%	5.4	0.7	11.9	3.8	6.8	0.9	1.9
Z	0.30	0.60	0.70	0.25	50	0.5	11.2	170	4.9%	7.8	0.4	11.6	3.9	6.9	0.7	1.4
AA	1.10	0.53	0.63	0.25	160	5.5	13.4	320	1.5%	4.3	1.2	14.6	3.5	6.2	2.1	4.4
BB	1.90	0.56	0.66	0.25	210	14	12.3	850	2.2%	5.2	2.7	15.0	3.5	6.2	3.7	7.7
CC	1.10	0.56	0.66	0.25	220	10	14.3	300	2.0%	4.9	1.0	15.3	3.4	6.1	2.1	4.4
DD	0.60	0.60	0.70	0.25	50	0.5	11.2	350	2.0%	4.9	1.2	12.4	3.8	6.7	1.4	2.8
EE	4.40	0.59	0.69	0.25	120	3	12.9	1375	1.8%	4.7	4.9	17.7	3.2	5.7	8.3	17.3
FF	1.10	0.60	0.70	0.25	50	0.5	11.2	700	1.8%	4.7	2.5	13.7	3.6	6.4	2.4	4.9
GG	2.50	0.53	0.63	0.25	150	7	11.7	470	1.9%	4.8	1.6	13.3	3.6	6.5	4.9	10.3
HH	2.40	0.51	0.61	0.25	150	7	11.7	430	1.9%	4.8	1.5	13.2	3.7	6.5	4.5	9.5
II	1.00	0.60	0.70	0.25	50	0.5	11.2	550	1.8%	4.7	2.0	13.2	3.7	6.5	2.2	4.6
JJ	1.60	0.60	0.70	0.25	50	0.5	11.2	1000	1.9%	4.8	3.5	14.7	3.5	6.2	3.4	7.0
KK	2.40	0.56	0.66	0.25	150	7	11.7	470	2.8%	5.9	1.3	13.0	3.7	6.6	5.0	10.4
LL	1.30	0.60	0.70	0.25	50	0.5	11.2	500	1.4%	4.1	2.0	13.3	3.7	6.5	2.9	5.9
LL1	1.00	0.60	0.70	0.25	50	4	5.7	1	1.0%	3.5	0.0	5.7	4.9	8.8	3.0	6.2
LL2	0.30	0.60	0.70	0.25	50	4	5.7	1	3.0%	6.1	0.0	5.7	4.9	8.8	0.9	1.8

From *Composite Runoff Coefficient Summary*				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
BASIN	AREA TOTAL	C_5	C_{100}	C_5	Length	Height	T_C	Length	Slope	Velocity	T_t	TOTAL	I_5	I_{100}	Q_5	Q_{100}
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
MM	1.60	0.55	0.63	0.25	250	12	15.0	515	3.3%	6.4	1.3	16.3	3.3	5.9	*2.8*	*6.0*
NN	0.60	0.60	0.70	0.25	100	6	8.8	200	2.5%	5.5	0.6	9.4	4.2	7.5	*1.5*	*3.1*
OO	0.70	0.60	0.70	0.25	100	4	10.1	100	1.7%	4.6	0.4	10.4	4.0	7.2	*1.7*	*3.5*
PP	0.60	0.60	0.70	0.25	100	4	10.1	700	6.0%	8.6	1.4	11.4	3.9	6.9	*1.4*	*2.9*
R1	2.20	0.90	0.95	0.25	50	10	4.2	850	3.0%	6.1	2.3	6.5	4.7	8.4	*9.4*	*17.6*
R1A	2.20	0.90	0.95	0.25	50	10	4.2	850	3.0%	6.1	2.3	6.5	4.7	8.4	*9.4*	*17.6*
R2	2.50	0.90	0.95	0.25	50	1	8.9	1150	4.0%	7.0	2.7	11.7	3.9	6.9	*8.7*	*16.3*
R2A	2.00	0.90	0.95	0.25	50	1	8.9	1150	4.0%	7.0	2.7	11.7	3.9	6.9	*6.9*	*13.0*
R3	4.40	0.90	0.95	0.25	50	1	8.9	1500	2.0%	4.9	5.1	14.0	3.6	6.4	*14.1*	*26.6*
R4	1.90	0.60	0.70	0.25	100	2	12.6	840	2.0%	4.9	2.8	15.5	3.4	6.1	*3.9*	*8.1*
R4A	3.40	0.60	0.70	0.25	100	2	12.6	840	2.0%	4.9	2.8	15.5	3.4	6.1	*7.0*	*14.5*
R5	3.40	0.60	0.70	0.25	100	8	8.0	1000	2.0%	4.9	3.4	11.4	3.9	6.9	*8.0*	*16.5*
R5A	2.00	0.60	0.70	0.25	100	8	8.0	500	1.0%	3.5	2.4	10.4	4.0	7.2	*4.9*	*10.1*
R6	1.60	0.90	0.95	0.25	50	2	7.1	1000	2.0%	4.9	3.4	10.5	4.0	7.2	*5.8*	*10.9*
R6A	1.00	0.60	0.70	0.25	100	2	12.6	500	1.0%	3.5	2.4	15.0	3.5	6.2	*2.1*	*4.3*
R7	2.20	0.90	0.95	0.25	30	1	5.9	1650	2.0%	4.9	5.6	11.4	3.9	6.9	*7.7*	*14.5*
R8	2.80	0.60	0.70	0.25	150	4	14.1	550	1.0%	3.5	2.6	16.7	3.3	5.9	*5.5*	*11.5*
R9	2.90	0.60	0.70	0.25	150	8	11.2	500	1.0%	3.5	2.4	13.6	3.6	6.4	*6.3*	*13.1*
R10	1.60	0.60	0.70	0.25	150	3	15.5	500	1.0%	3.5	2.4	17.9	3.2	5.7	*3.1*	*6.4*
R10A	0.30	0.60	0.70	0.25	30	2	4.7	500	1.0%	3.5	2.4	7.0	4.6	8.2	*0.8*	*1.7*
OS-1	5.60	0.60	0.70	0.25	200	4	17.9	850	3.3%	6.4	2.2	20.1	3.0	5.4	*10.1*	*21.0*
OS-1A	14.20	0.60	0.70	0.25	200	4	17.9	1000	3.0%	6.1	2.7	20.6	3.0	5.3	*25.3*	*52.5*
OS-1B	9.70	0.60	0.70	0.25	50	2	7.1	800	2.0%	4.9	2.7	9.8	4.1	7.4	*24.1*	*49.9*
OS-2	6.70	0.60	0.70	0.25	50	2	7.1	700	3.0%	6.1	1.9	9.0	4.3	7.6	*17.1*	*35.6*
OS-3	17.40	0.60	0.70	0.25	200	4	17.9	1500	1.6%	4.4	5.6	23.5	2.8	4.9	*28.9*	*60.1*
OS-4	40.70	0.60	0.70	0.25	800	25	30.9	600	2.0%	4.9	2.0	32.9	2.3	4.1	*56.1*	*116.5*
OS-5	24.60	0.60	0.70	0.25	200	4	17.9	2400	2.0%	4.9	8.1	26.0	2.6	4.7	*38.8*	*80.5*
OS-6	28.80	0.60	0.70	0.25	1000	38	32.4	2400	3.0%	6.1	6.6	39.0	2.1	3.7	*35.9*	*74.6*
OS-7	28.80	0.60	0.70	0.25	200	4	17.9	2150	2.0%	4.9	7.2	25.1	2.7	4.8	*46.2*	*96.0*
School	9.60	0.60	0.70	0.25	100	4	10.1	600	2.0%	4.9	2.0	12.1	3.8	6.8	*21.9*	*45.5*
OS-1(EX)	5.60	0.15	0.20	0.25	400	28	16.7	850	3.3%	6.4	2.2	19.0	3.1	5.5	*2.6*	*6.2*
OS-1A(EX)	14.20	0.15	0.20	0.25	500	35	18.7	500	7.0%	9.3	0.9	19.6	3.0	5.4	*6.5*	*15.4*
OS-1B(EX)	9.70	0.15	0.20	0.25	500	50	16.6	500	10.0%	11.1	0.8	17.4	3.2	5.8	*4.7*	*11.2*
OS-2(EX)	6.70	0.15	0.20	0.25	700	70	19.7	200	10.0%	11.1	0.3	20.0	3.0	5.4	*3.0*	*7.2*
OS-3(EX)	17.40	0.15	0.20	0.25	400	18	19.4	700	4.0%	7.0	1.7	21.0	2.9	5.2	*7.7*	*18.2*
OS-4(EX)	40.70	0.15	0.20	0.25	1200	42	36.4	1800	2.0%	4.9	6.1	42.5	2.0	3.5	*12.0*	*28.6*
OS-5(EX)	24.60	0.15	0.20	0.25	800	20	33.2	600	4.0%	7.0	1.4	34.7	2.2	4.0	*8.2*	*19.5*
OS-6(EX)	28.80	0.15	0.20	0.25	1000	38	32.4	2400	5.0%	6.1	6.6	39.0	2.1	3.7	*9.0*	*21.3*
OS-7(EX)	28.80	0.15	0.20	0.25	200	4	17.9	2150	2.0%	4.9	7.2	25.1	2.7	4.8	*11.6*	*27.4*
School	9.60	0.15	0.20	0.25	600	8	35.4	100	1.0%	3.5	0.5	35.9	2.2	3.9	*3.1*	*7.5*

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

Calculated by: SM

Date: 4/13/2007

Checked by: _____

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Surface Routing Summary)

Design Points	Contributing Basins/ Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity *		Flow		Comments
					I_5	I_{100}	Q_5	Q_{100}	
1	C,D,E	2.68	3.16	14.3	3.5	6.3	9.5	19.9	12' At Grade Inlet
1A	A, B, F, FB1	5.35	6.63	15.8	3.4	6.0	18.1	39.9	12' At Grade Inlet
2	FB1A, FB6	5.75	7.17	16.7	3.3	5.9	18.9	42.0	14' Sump Inlet
2A	R10A	0.18	0.21	7.0	4.6	8.2	0.8	1.7	4' Sump Inlet
3	L1	0.18	0.21	12.9	3.7	6.6	0.7	1.4	4' Sump Inlet
3A	G,H,I,J,K	4.68	5.83	15.0	3.5	6.2	16.2	35.9	12' Sump Inlet
4	L,M,N	2.77	3.27	12.9	3.7	6.6	10.3	21.5	12' At Grade Inlet
5	R10, Q, P, O, FB4	4.29	5.30	13.5	3.6	6.5	15.6	34.3	10' Sump Inlet
5A	K1	3.51	4.18	17.5	3.2	5.7	11.3	24.0	6' Sump Inlet
6	PP, R6, R8, R9	5.22	5.93	16.7	3.3	5.9	17.2	34.8	14' At Grade Inlet
6A	(NOT USED)								
7	FF,GG	2.00	2.36	13.7	3.6	6.4	7.2	15.1	10' At Grade Inlet
7A	HH, FB7	2.33	3.07	13.2	3.7	6.5	8.5	20.0	10' At Grade Inlet
8	II,JJ, FB7A	2.94	3.96	13.2	3.7	6.5	10.8	25.9	10' At Grade Inlet
9	MM,KK, FB8	4.07	5.37	16.3	3.3	5.9	13.5	31.8	10' Sump Inlet
9A	LL,EE	3.38	3.95	13.3	3.7	6.5	12.3	25.7	6' Sump Inlet
10	V,W,X	0.73	0.95	11.6	3.9	6.9	2.8	6.5	Pond
10A	Z,AA,BB,CC,DD	2.81	3.31	15.3	3.4	6.1	9.7	20.2	Pond
11	T	1.23	1.48	14.8	3.5	6.2	4.3	9.2	4' Sump Inlet
11A	U,Y	0.42	0.47	7.1	4.6	8.2	1.9	3.9	4' Sump Inlet
11B	R,S	0.90	1.05	12.7	3.7	6.6	3.3	7.0	4' Sump Inlet
12	OO	0.42	0.49	10.4	4.0	7.2	1.7	3.5	4' Sump Inlet
12A	NN	0.36	0.42	9.4	4.2	7.5	1.5	3.1	4' Sump Inlet
13	1/2 OS-5 (EX)	1.85	2.46	34.7	2.2	4.0	4.1	9.8	4' Sump Inlet
13A	R5A, 1/2 OS-5 (EX)	3.05	3.86	10.4	4.0	7.2	12.3	27.8	8' Sump Inlet
14	R6A	0.60	0.70	15.0	3.5	6.2	2.1	4.3	4' At Grade Inlet
15	R4	1.14	1.33	15.5	3.4	6.1	3.9	8.1	4' Sump Inlet
15A	R4A, R5, OS-3(EX), FB14	6.94	8.59	21.0	2.9	5.2	20.4	45.0	16' Sump Inlet
16	R1	1.98	2.09	6.5	4.7	8.4	9.4	17.6	4' Sump Inlet
16A	10% OS-1(FUT), R1A	2.32	2.48	6.5	4.7	8.4	11.0	21.0	N/A
16A(EX)	OS-1(EX), R1A	2.82	3.21	6.5	4.7	8.4	13.4	27.1	8' Sump Inlet - Higher than 16A
17	R2A	1.80	1.90	11.7	3.9	6.9	6.9	13.0	12' At Grade Inlet
17A	OS-1A (FUT)	8.52	9.94	20.6	3.0	5.3	25.3	52.5	FES

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Surface Routing Summary)

17A(EX)	OS-1A(EX)	2.13	2.84	19.6	3.0	5.4	***6.5***	***15.4***	***FES***
17B	R2, 10% OF OS-1A (FUT)	3.10	3.37	11.7	3.9	6.9	***12.0***	***23.1***	***12' At Grade Inlet***
17B (EX)	R2, 10% OF OS-1A (EX)	2.46	2.66	19.6	3.0	5.4	***7.5***	***14.4***	***N/A***
18	1/2 R3, FB DP 17	2.79	3.22	14.0	3.6	6.4	***10.0***	***20.5***	***4' Sump Inlet***
18A	1/2 R3, FB DP17B	3.77	4.21	14.0	3.6	6.4	***13.5***	***26.8***	***8' Sump Inlet***
20 (EX)	OS-2(EX), R4, R4A	4.19	5.05	15.5	3.4	6.1	***14.3***	***30.7***	***SWALE***
21 (EX)	OS-4(EX)	6.11	8.14	42.5	2.0	3.5	***12.0***	***28.6***	***SWALE***
22	POND, DP2, DP2A, DOS-7, DP5, DP5A								***CHANNEL***
22 (EX)	DP2, DP2A, OS-7(EX), DP5, DP5A	18.05	22.62	17.5	3.2	5.7	***58.2***	***129.8***	***CHANNEL***
23	OS-5 (EX), OS-6 (EX), LL1	8.61	11.38	39.0	2.1	3.7	***17.9***	***42.1***	***OFF-SITE***
24	R7	1.98	2.09	11.4	3.9	6.9	***7.7***	***14.5***	***OFF-SITE***
P1	DP10, DP10A, X1	3.90	4.68	15.3	3.4	6.1	***13.4***	***28.6***	***WQ/DETENTION POND***
P2	DP P1 Discharge, LL2	17.48	24.40	42.0	2.0	3.5	***34.7***	***86.2***	***OFF-SITE***
EX1	DP16, DP16A, OS-1B(EX)	5.75	6.51	6.5	4.7	8.4	***27.3***	***55.0***	***EXIST. CULVERT***

Calculated by: ***SM***
Date: 4/13/2007
Checked by: _____

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - At-Grade)

Proposed 12' Inlet at DP 1

5-YR FLOW

Q(5)	9.5 cfs	I(5)	3.5	Inlet size (Li) = 12 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 4.4 cfs
Depth	0.34 '	Fw	2.11	Qi- CA(eqv.) = 1.25
Spread	13.7 '	L(1)	25.6	Flow-by = 5.0 cfs
				FB- CA(eqv.) = 1.42
CROSS SLOPE	2.0%	L(2)	15.4	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	47.5	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	19.9 cfs	I(100)	6.3	Inlet size (Li) = 12 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 7.2 cfs
Depth	0.43 '	Fw	2.19	Qi- CA(eqv.)= 1.15
Spread	17.0 '	L(1)	33.1	Flow-by = 12.7 cfs
				FB- CA(eqv.) = 2.01
CROSS SLOPE	2.0%	L(2)	19.9	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	61.4	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 17 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - At-Grade)

Proposed 12' Inlet at DP 1A

5-YR FLOW

Q(5)	18.1 cfs	I(5)	3.4	Inlet size (Li) = 12 feet
Q overtop	17.7 cfs			
				Li < L(2) then Qi = 5.9 cfs
Depth	0.41 '	Fw	2.39	Qi- CA(eqv.) = 1.75
Spread	16.9 '	L(1)	36.0	Flow-by = 11.8 cfs
				FB- CA(eqv.) = 3.49
CROSS SLOPE	2.0%	L(2)	21.6	
				Overtop Flow-By = 0.4 cfs
STREET SLOPE	3.1%	L(3)	66.7	Overtop FB- CA(eqv.) = 0.11

Flow overtopping crown: Assuming 0.4 cfs is crossing the crown and a spread of 16.9 feet.
Depth and Qi based on a street capacity prior to overtopping the crown. (Qovertop)

100-YR FLOW

Q(100)	39.9 cfs	I(100)	6.0	Inlet size (Li) = 12 feet
Q overtop	17.7 cfs			
				Li < L(2) then Qi = 13.2 cfs
Depth	0.53 '	Fw	2.39	Qi- CA(eqv.)= 2.20
Spread	17.0 '	L(1)	36.1	Flow-by = 26.7 cfs
				FB- CA(eqv.) = 4.43
CROSS SLOPE	2.0%	L(2)	21.7	
				Overtop Flow-By = 0
STREET SLOPE	3.1%	L(3)	67.0	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 17 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: BS
Date: 11/26/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP-2

Total Flow:

Q_5 = 18.9 cfs

Q_{100} = 42.0 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **14** foot inlet required

100-Year Event: **14** foot inlet required

(Install a Public 14' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: BS

Date: 11/26/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 2A

Total Flow:

Q_5 = 0.8 cfs

Q_{100} = 1.7 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 3/12/2007

Checked by:

(Inlet Calculations - Sump Condition)

DP 3

Total Flow:

Q_5 = 0.7 cfs
Q_{100} = 1.4 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50
$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$
For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$
where: W = 3 feet
w = 4 inches

Clogging Factor = 1.25
Li (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: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 3A

Total Flow:

Q_5 = 16.2 cfs

Q_{100} = 35.9 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **10** foot inlet required

100-Year Event: **12** foot inlet required

(Install a Public 12' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 3/12/2007

Checked by:

(Inlet Calculations - At-Grade)

Proposed 12' Inlet at DP 4

5-YR FLOW

Q(5)	10.3 cfs	I(5)	3.7	Inlet size (Li) = 12 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 4.6 cfs
Depth	0.35 '	Fw	2.12	Qi- CA(eqv.) = 1.24
Spread	14.2 '	L(1)	26.7	Flow-by = 5.7 cfs
				FB- CA(eqv.) = 1.53
CROSS SLOPE	2.0%	L(2)	16.1	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	49.6	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	21.5 cfs	I(100)	6.6	Inlet size (Li) = 12 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 7.8 cfs
Depth	0.44 '	Fw	2.19	Qi- CA(eqv.)= 1.19
Spread	17.0 '	L(1)	33.1	Flow-by = 13.7 cfs
				FB- CA(eqv.) = 2.08
CROSS SLOPE	2.0%	L(2)	19.9	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	61.4	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 17 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: SM
Date: 3/12/2007
Checked by:

(Inlet Calculations - Sump Condition)

DP5

Total Flow:

Q_5 = 15.6 cfs
Q_{100} = 34.3 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'
$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$
For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$
where: W = 3 feet
w = 4 inches

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: **10** foot inlet required

100-Year Event: **10** foot inlet required

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

Calculated by: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 5A

Total Flow:

Q_5 = 11.3 cfs

Q_{100} = 24.0 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.98

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **6** foot inlet required

(Install a Public 6' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - At-Grade)

Proposed 14' Inlet at DP 6

5-YR FLOW

Q(5)	17.2 cfs	I(5)	3.3	Inlet size (Li) = 14 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 8.7 cfs
Depth	0.47 '	Fw	1.46	Qi- CA(eqv.) = 2.65
Spread	19.9 '	L(1)	25.9	Flow-by = 7.4 cfs
				FB- CA(eqv.) = 2.26
CROSS SLOPE	2.0%	L(2)	15.6	
				Overtop Flow-By = 1.0 cfs
STREET SLOPE	1.1%	L(3)	48.1	Overtop FB- CA(eqv.) = 0.31

Flow overtopping crown: Assuming 1 cfs is crossing the crown and a spread of 19.9 feet.
Depth and Qi based on a street capacity prior to overtopping the crown. (Qovertop)

100-YR FLOW

Q(100)	34.8 cfs	I(100)	5.9	Inlet size (Li) = 14 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 18.7 cfs
Depth	0.60 '	Fw	1.46	Qi- CA(eqv.)= 3.19
Spread	20.0 '	L(1)	26.1	Flow-by = 16.1 cfs
				FB- CA(eqv.) = 2.74
CROSS SLOPE	2.0%	L(2)	15.7	
				Overtop Flow-By = 0
STREET SLOPE	1.1%	L(3)	48.3	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 20 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: BS
Date: 11/26/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - At-Grade)

Proposed 10' Inlet at DP 7

5-YR FLOW

Q(5)	7.2 cfs	I(5)	3.6	Inlet size (Li) =	10 feet
Q overtop	16.2 cfs				
				Li < L(2) then Qi =	3.2 cfs
Depth	0.31 '	Fw	2.07	Qi- CA(eqv.) =	0.88
Spread	12.3 '	L(1)	22.6	Flow-by =	4.0 cfs
				FB- CA(eqv.) =	1.11
CROSS SLOPE	2.0%	L(2)	13.6		
				Overtop Flow-By =	0
STREET SLOPE	2.6%	L(3)	41.9	Overtop FB- CA(eqv.) =	0.00

100-YR FLOW

Q(100)	15.1 cfs	I(100)	6.4	Inlet size (Li) =	10 feet
Q overtop	16.2 cfs				
				Li < L(2) then Qi =	4.8 cfs
Depth	0.40 '	Fw	2.17	Qi- CA(eqv.)=	0.74
Spread	16.4 '	L(1)	31.8	Flow-by =	10.4 cfs
				FB- CA(eqv.) =	1.62
CROSS SLOPE	2.0%	L(2)	19.1		
				Overtop Flow-By =	0
STREET SLOPE	2.6%	L(3)	58.9	Overtop FB- CA(eqv.) =	0.00

Calculated by: SM
Date: 7/12/2007
Checked by:

(Inlet Calculations - At-Grade)

Proposed 10' Inlet at DP 7A

5-YR FLOW

Q(5)	8.5 cfs	I(5)	3.7	Inlet size (Li) = 10 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 3.5 cfs
Depth	0.33 '	Fw	2.09	Qi- CA(eqv.) = 0.95
Spread	13.2 '	L(1)	24.5	Flow-by = 5.1 cfs
				FB- CA(eqv.) = 1.38
CROSS SLOPE	2.0%	L(2)	14.8	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	45.5	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	20.0 cfs	I(100)	6.5	Inlet size (Li) = 10 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 6.1 cfs
Depth	0.43 '	Fw	2.19	Qi- CA(eqv.)= 0.93
Spread	17.0 '	L(1)	33.1	Flow-by = 14.0 cfs
				FB- CA(eqv.) = 2.14
CROSS SLOPE	2.0%	L(2)	19.9	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	61.4	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 17 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: SMS
Date: 3/12/2007
Checked by:

(Inlet Calculations - At-Grade)

Proposed 10' Inlet at DP 8

5-YR FLOW

Q(5)	10.8 cfs	I(5)	3.7	Inlet size (Li) = 10 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 3.9 cfs
Depth	0.36 '	Fw	2.13	Qi- CA(eqv.) = 1.08
Spread	14.4 '	L(1)	27.3	Flow-by = 6.8 cfs
				FB- CA(eqv.) = 1.86
CROSS SLOPE	2.0%	L(2)	16.4	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	50.6	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	25.9 cfs	I(100)	6.5	Inlet size (Li) = 10 feet
Q overtop	16.2 cfs			
				Li < L(2) then Qi = 7.8 cfs
Depth	0.47 '	Fw	2.19	Qi- CA(eqv.)= 1.20
Spread	17.0 '	L(1)	33.1	Flow-by = 18.1 cfs
				FB- CA(eqv.) = 2.77
CROSS SLOPE	2.0%	L(2)	19.9	
				Overtop Flow-By = 0
STREET SLOPE	2.6%	L(3)	61.4	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 17 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 9

Total Flow:

Q_5 = 13.5 cfs

Q_{100} = 31.8 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **8** foot inlet required

100-Year Event: **10** foot inlet required

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

Calculated by: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 9A

Total Flow:

Q_5 = 12.3 cfs

Q_{100} = 25.7 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **6** foot inlet required

(Install a Public 6' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 11

Total Flow:

Q_5 = 4.3 cfs

Q_{100} = 9.2 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 5/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 11A

Total Flow:

Q_5 = 1.9 cfs

Q_{100} = 3.9 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{\wedge}0.5$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 3/12/2007

Checked by: SS

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 11B

Total Flow:

Q_5 = 3.3 cfs

Q_{100} = 7.0 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 12

Total Flow:

Q_5 = 1.7 cfs

Q_{100} = 3.5 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 5/12/2007

Checked by:

(Inlet Calculations - Sump Condition)

DP 12A

Total Flow:

Q_5 = 1.5 cfs
Q_{100} = 3.1 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50
$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$
For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$
where: W = 3 feet
w = 4 inches

Clogging Factor = 1.25
Li (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: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 13

Total Flow:

Q_5 = 4.1 cfs

Q_{100} = 9.8 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 13A

Total Flow:

Q_5 = 12.3 cfs

Q_{100} = 27.8 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **8** foot inlet required

(Install a Public 8' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 3/12/2007

Checked by:

(Inlet Calculations - At-Grade)

Proposed 4' Inlet at DP 14

5-YR FLOW

Q(5)	2.1 cfs	I(5)	4.7	Inlet size (Li) = 4 feet
Q overtop	9.0 cfs			
				Li < L(2) then Qi = 0.9 cfs
Depth	0.26 '	Fw	1.09	Qi- CA(eqv.) = 0.19
Spread	9.6 '	L(1)	9.3	Flow-by = 1.2 cfs
				FB- CA(eqv.) = 0.25
CROSS SLOPE	2.0%	L(2)	5.6	
				Overtop Flow-By = 0
STREET SLOPE	0.8%	L(3)	17.3	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	4.3 cfs	I(100)	8.4	Inlet size (Li) = 4 feet
Q overtop	9.0 cfs			
				Li < L(2) then Qi = 1.3 cfs
Depth	0.32 '	Fw	1.15	Qi- CA(eqv.)= 0.16
Spread	12.7 '	L(1)	13.0	Flow-by = 3.0 cfs
				FB- CA(eqv.) = 0.35
CROSS SLOPE	2.0%	L(2)	7.8	
				Overtop Flow-By = 0
STREET SLOPE	0.8%	L(3)	24.1	Overtop FB- CA(eqv.) = 0.00

Calculated by: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 15

Total Flow:

Q_5 = 3.9 cfs

Q_{100} = 8.1 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 15A

Total Flow:

Q_5 = 20.4 cfs

Q_{100} = 45.0 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **16** foot inlet required

100-Year Event: **16** foot inlet required

(Install a Public 16' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 8/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 16

Total Flow:

Q_5 = 9.4 cfs

Q_{100} = 17.6 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 3/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 16A (EX)

Total Flow:

Q_5 = 13.4 cfs

Q_{100} = 27.1 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.93'

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **8** foot inlet required

100-Year Event: **8** foot inlet required

(Install a Public 8' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 8/17/2007

Checked by:

(Inlet Calculations - At-Grade)

Proposed 12' Inlet at DP 17

5-YR FLOW

Q(5)	6.9 cfs	I(5)	3.9"	Inlet size (Li) = 12 feet
Q overtop	15.9 cfs			
				Li < L(2) then Qi = 3.8 cfs
Depth	0.31 '	Fw	2.02	Qi- CA(eqv.) = 0.99
Spread	12.2 '	L(1)	21.9	Flow-by = 3.1 cfs
				FB- CA(eqv.) = 0.81
CROSS SLOPE	2.0%	L(2)	13.2	
				Overtop Flow-By = 0
STREET SLOPE	2.5%	L(3)	40.6	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	13.0 cfs	I(100)	6.9"	Inlet size (Li) = 12 feet
Q overtop	15.9 cfs			
				Li < L(2) then Qi = 5.3 cfs
Depth	0.38 '	Fw	2.11	Qi- CA(eqv.)= 0.77
Spread	15.7 '	L(1)	29.5	Flow-by = 7.7 cfs
				FB- CA(eqv.) = 1.13
CROSS SLOPE	2.0%	L(2)	17.8	
				Overtop Flow-By = 0
STREET SLOPE	2.5%	L(3)	54.7	Overtop FB- CA(eqv.) = 0.00

Calculated by: SMS
Date: 3/12/2007
Checked by:

(Inlet Calculations - At-Grade)

Proposed 12' Inlet at DP 17B

5-YR FLOW

Q(5)	12.0 cfs	I(5)	3.9 in/hr	Inlet size (Li) = 12 feet
Q overtop	15.9 cfs			
				Li < L(2) then Qi = 5.1 cfs
Depth	0.37 '	Fw	2.10	Qi- CA(eqv.) = 1.31
Spread	15.2 '	L(1)	28.4	Flow-by = 6.9 cfs
				FB- CA(eqv.) = 1.79
CROSS SLOPE	2.0%	L(2)	17.1	
				Overtop Flow-By = 0
STREET SLOPE	2.5%	L(3)	52.7	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	23.1 cfs	I(100)	6.9 in/hr	Inlet size (Li) = 12 feet
Q overtop	15.9 cfs			
				Li < L(2) then Qi = 8.6 cfs
Depth	0.46 '	Fw	2.15	Qi- CA(eqv.)= 1.25
Spread	17.0 '	L(1)	32.5	Flow-by = 14.6 cfs
				FB- CA(eqv.) = 2.12
CROSS SLOPE	2.0%	L(2)	19.5	
				Overtop Flow-By = 0
STREET SLOPE	2.5%	L(3)	60.2	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 17 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: SM
Date: 3/12/2007
Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 18

Total Flow:

Q_5 = 10.0 cfs

Q_{100} = 20.5 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (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: SM

Date: 4/12/2007

Checked by:

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Inlet Calculations - Sump Condition)

DP 18A

Total Flow:

Q_5 = 13.5 cfs

Q_{100} = 26.8 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50

$Dmax_{100}$ = 0.93

For d <= 0.67 feet : $Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$

For d >= 0.94 feet : $Qi = 3.6 * Li * (Dmax - 0.33 + w/12)^{0.5}$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **8** foot inlet required

100-Year Event: **8** foot inlet required

(Install a Public 8' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: SM

Date: 4/12/2007

Checked by:

HYDRAULIC CALCULATIONS

MOUNTAIN VISTA RANCH
FINAL DRAINAGE REPORT
(Storm Sewer Routing Summary)

Pipe	*Contributing Basins/Design Points / Pipe*	*Equivalent* CA_5	*Equivalent* CA_{100}	*Maximum* T_C	*Intensity*		*Flow*		*Comments*
					I_5	I_{100}	Q_5	Q_{100}	
602	**DP16A (EX)**	2.82	3.21	6.5	4.7	8.4	*13.4*	*27.1*	30" RCP
603	**DP16A (EX), DP16**	4.80	5.30	6.52	4.7	8.4	*22.8*	*44.8*	36" RCP
500	**DP17A - FES**	8.52	9.94	20.6	3.0	5.3	*25.3*	*52.5*	42" RCP
501	**DP17 COLLECTED**	0.99	0.77	11.7	3.9	6.9	*3.8*	*5.3*	18" RCP
502	**DP17B COLLECTED**	1.31	1.25	11.7	3.9	6.9	*5.1*	*8.6*	24" RCP
503	**500, 502**	9.83	11.19	11.7	3.9	6.9	*37.9*	*76.8*	42" RCP
504	**503**	9.83	11.19	12.7	3.7	6.6	*36.6*	*74.2*	42" RCP
401	**DP 11A**	0.42	0.47	7.1	4.6	8.2	*1.9*	*3.9*	18" RCP
402	**DP 11**	1.23	1.48	14.77	3.5	6.2	*4.3*	*9.2*	18" RCP
403	**401,402**	1.65	1.95	14.8	3.5	6.2	*5.7*	*12.1*	24" RCP
404	**DP 11B**	0.90	1.05	12.75	3.7	6.6	*3.3*	*7.0*	18" RCP
405	**403,404**	2.55	3.00	12.7	3.7	6.6	*9.5*	*19.8*	24" RCP
406	**DP 12**	0.42	0.49	10.42	4.0	7.2	*1.7*	*3.5*	18" RCP
407	**DP 12A**	0.36	0.42	9.40	4.2	7.5	*1.5*	*3.1*	18" RCP
408	**405,406,407**	3.33	3.91	12.7	3.7	6.6	*12.4*	*25.9*	36" RCP
409	**DP 14 COLLECTED**	0.35	0.35	15.0	3.5	6.2	*1.2*	*2.1*	18" RCP
**410A*	**OS-5 (FUTURE)**	14.76	17.22	26.0	2.6	4.7	*38.8*	*80.5*	42" RCP
410	**DP 13A**	3.05	3.86	10.38	4.0	7.2	*12.3*	*27.8*	30" RCP

Pipe	Contributing Basins/Design Points / Pipe	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow		Comments
					I_5	I_{100}	Q_5	Q_{100}	
411	DP 13	1.85	2.46	34.66	2.2	4.0	4.1	9.8	24" RCP
*412	410A,410,411	19.65	23.54	26.0	2.6	4.7	51.6	110.0	42" RCP
*413	408,409,412	23.33	27.79	27.0	2.6	4.6	60.0	127.2	54" RCP
*414A	OS-3 (FUTURE)	10.44	12.18	23.5	2.8	4.9	28.9	60.1	36" RCP
*414	OS-3 (FUT), DP 15A	17.38	20.77	23.60	2.8	4.9	48.1	102.3	48" RCP
415	DP 15	1.14	1.33	15.47	3.4	6.1	3.9	8.1	18" RCP
*416	414,415	18.52	22.10	23.9	2.7	4.9	50.9	108.1	48" RCP
*417	413,416	41.85	49.90	25.9	2.6	4.7	110.0	233.6	60" RCP
418	DP 18	2.79	3.22	13.99	3.6	6.4	10.0	20.5	30" RCP
419	DP 18A	3.77	4.21	13.99	3.6	6.4	13.5	26.8	36" RCP
419A	418, 419	6.57	7.43	14.10	3.6	6.3	23.4	47.1	36" RCP
*420	417	41.85	49.90	26.13	2.6	4.7	109.5	232.4	60" RCP
**301	DP 7 COLLECTED	0.88	0.74	13.7	3.6	6.4	3.2	4.8	18" RCP
**302	DP 7A COLLECTED	0.95	0.93	13.2	3.7	6.5	3.5	6.1	18" RCP
**303	301,302	1.83	1.67	13.2	3.7	6.5	6.7	10.9	24" RCP
304	(NOT USED)								
**305	DP 8 COLLECTED	1.08	1.20	13.2	3.7	6.5	3.9	7.8	18" RCP
**306	303,305	2.91	2.87	13.2	3.7	6.5	10.7	18.7	24" RCP
**307	DP 9	4.07	5.37	16.33	3.3	5.9	13.5	31.8	36" RCP
**308	306, 307	6.98	8.24	16.3	3.3	5.9	23.2	48.8	42" RCP

Pipe	Contributing Basins/Design Points / Pipe	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow		Comments
					I_5	I_{100}	Q_5	Q_{100}	
**309	DP 9A, 308	10.35	12.18	13.3	3.7	6.5	37.9	79.3	54" RCP
201	DP 3A	4.68	5.83	15.01	3.5	6.2	16.2	35.9	36" RCP
202	DP 3	0.18	0.21	12.90	3.7	6.6	0.7	1.4	18" RCP
203	201,202	4.86	6.04	15.0	3.5	6.2	16.8	37.2	36" RCP
204	DP 4 COLLECTED	1.24	1.19	12.9	3.7	6.6	4.6	7.8	18" RCP
205	203,204	6.10	7.22	15.0	3.5	6.2	21.1	44.5	36" RCP
206	DP 5	4.29	5.30	13.45	3.6	6.5	15.6	34.3	36" RCP
207	DP 5A	3.51	4.18	17.46	3.2	5.7	11.3	24.0	30" RCP
208	205,206,207	13.90	16.71	17.5	3.2	5.7	44.8	95.9	36" RCP
101	DP 1 COLLECTED	1.25	1.15	14.3	3.5	6.3	4.4	7.2	18" RCP
102	DP 1A COLLECTED	1.75	2.20	15.8	3.4	6.0	5.9	13.2	24" RCP
103	101, 102	3.00	3.35	15.8	3.4	6.0	10.2	20.1	24" RCP
104	DP 2	5.75	7.17	16.70	3.3	5.9	18.9	42.0	36" RCP
105	DP 2A	0.18	0.21	7.04	4.6	8.2	0.8	1.7	18" RCP
106	103,104,105	8.93	10.72	16.7	3.3	5.9	29.4	62.9	36" RCP
107	DP 6 COLLECTED	2.65	3.19	16.7	3.3	5.9	8.7	18.7	30" RCP
108	106, 107	11.58	13.91	16.7	3.3	5.9	38.1	81.5	42" RCP
EX-1	603, OS-1B	10.62	12.09	9.8	4.1	7.4	43.9	88.9	48" RCP

NOTES:

1. Pipe sizes per preliminary design and StormCad hydraulic model (see Hydraulic Computations in appendix).
2. MDDP OS-1 Tc unknown, therefore direct addition of Q and use known basins Tc (conservative).
3. Q, Tc and CA values tabulated for sump laterals reflect SPLIT conditions (i.e. - equal).
4. * REIMBURSABLE FILING NO.1
5. ** REIMBURSABLE FILING NO.2

Calculated by: SM
Date: 4/13/2007
Checked by: _____

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	7.2000 cfs
Slope	0.0290 ft/ft
Manning's n	0.0130

Computed Results:

Depth	7.9449 in
Area	1.7671 ft2
Wetted Area	0.7520 ft2
Wetted Perimeter	26.1593 in
Perimeter	56.5487 in
Velocity	9.5746 fps
Hydraulic Radius	4.1395 in
Percent Full	44.1385 %
Full flow Flowrate	17.8882 cfs
Full flow velocity	10.1227 fps

Critical Information

Critical depth	12.4686 in
Critical slope	0.0063 ft/ft
Critical velocity	5.4664 fps
Critical area	1.3171 ft2
Critical perimeter	35.2114 in
Critical hydraulic radius	5.3866 in
Critical top width	18.0000 in
Specific energy	2.0867 ft
Minimum energy	1.5586 ft
Froude number	2.3758
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	14.0000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	13.6610 in
Area	3.1416 ft2
Wetted Area	1.8467 ft2
Wetted Perimeter	41.0319 in
Perimeter	75.3982 in
Velocity	7.5809 fps
Hydraulic Radius	6.4811 in
Percent Full	56.9209 %
Full flow Flowrate	22.6224 cfs
Full flow velocity	7.2009 fps

Critical Information

Critical depth	16.1704 in
Critical slope	0.0056 ft/ft
Critical velocity	6.1787 fps
Critical area	2.2659 ft2
Critical perimeter	46.0399 in
Critical hydraulic radius	7.0870 in
Critical top width	24.0000 in
Specific energy	2.0313 ft
Minimum energy	2.0213 ft
Froude number	1.3914
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	20.8000 cfs
Slope	0.0290 ft/ft
Manning's n	0.0130

Computed Results:

Depth	12.5612 in
Area	3.1416 ft2
Wetted Area	1.6643 ft2
Wetted Perimeter	38.8220 in
Perimeter	75.3982 in
Velocity	12.4977 fps
Hydraulic Radius	6.1733 in
Percent Full	52.3385 %
Full flow Flowrate	38.5246 cfs
Full flow velocity	12.2627 fps

Critical Information

Critical depth	19.6151 in
Critical slope	0.0063 ft/ft
Critical velocity	7.3240 fps
Critical area	2.8400 ft2
Critical perimeter	52.9294 in
Critical hydraulic radius	7.7265 in
Critical top width	24.0000 in
Specific energy	3.4741 ft
Minimum energy	2.4519 ft
Froude number	2.4154
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	43.0000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	21.0312 in
Area	7.0686 ft2
Wetted Area	4.2885 ft2
Wetted Perimeter	62.6400 in
Perimeter	113.0973 in
Velocity	10.0268 fps
Hydraulic Radius	9.8586 in
Percent Full	58.4199 %
Full flow Flowrate	66.6984 cfs
Full flow velocity	9.4359 fps

Critical Information

Critical depth	25.6317 in
Critical slope	0.0051 ft/ft
Critical velocity	7.9012 fps
Critical area	5.4422 ft2
Critical perimeter	71.8121 in
Critical hydraulic radius	10.9129 in
Critical top width	36.0000 in
Specific energy	3.3146 ft
Minimum energy	3.2040 ft
Froude number	1.4795
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	1.7000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	4.8969 in
Area	1.7671 ft2
Wetted Area	0.3891 ft2
Wetted Perimeter	19.7535 in
Perimeter	56.5487 in
Velocity	4.3696 fps
Hydraulic Radius	2.8361 in
Percent Full	27.2051 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	64.5000 cfs
Slope	0.0200 ft/ft
Manning's n	0.0130

Computed Results:

Depth	21.8516 in
Area	7.0686 ft2
Wetted Area	4.4898 ft2
Wetted Perimeter	64.3118 in
Perimeter	113.0973 in
Velocity	14.3659 fps
Hydraulic Radius	10.0530 in
Percent Full	60.6988 %
Full flow Flowrate	94.3258 cfs
Full flow velocity	13.3444 fps

Critical Information

Critical depth	30.9262 in
Critical slope	0.0057 ft/ft
Critical velocity	9.5332 fps
Critical area	6.7658 ft2
Critical perimeter	82.4011 in
Critical hydraulic radius	11.8236 in
Critical top width	36.0000 in
Specific energy	5.0305 ft
Minimum energy	3.8658 ft
Froude number	2.0733
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	18.2000 cfs
Slope	0.0110 ft/ft
Manning's n	0.0130

Computed Results:

Depth	13.6197 in
Area	4.9087 ft2
Wetted Area	2.1672 ft2
Wetted Perimeter	44.3594 in
Perimeter	94.2478 in
Velocity	8.3979 fps
Hydraulic Radius	7.0352 in
Percent Full	45.3990 %
Full flow Flowrate	43.0191 cfs
Full flow velocity	8.7638 fps

Critical Information

Critical depth	17.3388 in
Critical slope	0.0048 ft/ft
Critical velocity	6.1871 fps
Critical area	2.9416 ft2
Critical perimeter	51.8015 in
Critical hydraulic radius	8.1772 in
Critical top width	30.0000 in
Specific energy	2.2310 ft
Minimum energy	2.1674 ft
Froude number	1.5868
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	82.8000 cfs
Slope	0.0400 ft/ft
Manning's n	0.0130

Computed Results:

Depth	18.7704 in
Area	9.6211 ft2
Wetted Area	4.1615 ft2
Wetted Perimeter	61.5059 in
Perimeter	131.9469 in
Velocity	19.8967 fps
Hydraulic Radius	9.7431 in
Percent Full	44.6915 %
Full flow Flowrate	201.2195 cfs
Full flow velocity	20.9143 fps

Critical Information

Critical depth	34.0575 in
Critical slope	0.0052 ft/ft
Critical velocity	9.6067 fps
Critical area	8.6190 ft2
Critical perimeter	92.0884 in
Critical hydraulic radius	13.4777 in
Critical top width	42.0000 in
Specific energy	7.7164 ft
Minimum energy	4.2572 ft
Froude number	3.2078
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	35.9000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	18.8068 in
Area	7.0686 ft2
Wetted Area	3.7359 ft2
Wetted Perimeter	58.1627 in
Perimeter	113.0973 in
Velocity	9.6094 fps
Hydraulic Radius	9.2494 in
Percent Full	52.2410 %
Full flow Flowrate	66.6984 cfs
Full flow velocity	9.4359 fps

Critical Information

Critical depth	23.3730 in
Critical slope	0.0048 ft/ft
Critical velocity	7.3603 fps
Critical area	4.8775 ft2
Critical perimeter	67.2946 in
Critical hydraulic radius	10.4372 in
Critical top width	36.0000 in
Specific energy	3.0023 ft
Minimum energy	2.9216 ft
Froude number	1.5181
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	1.4000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	4.4383 in
Area	1.7671 ft2
Wetted Area	0.3388 ft2
Wetted Perimeter	18.7066 in
Perimeter	56.5487 in
Velocity	4.1321 fps
Hydraulic Radius	2.6081 in
Percent Full	24.6570 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	37.2000 cfs
Slope	0.0140 ft/ft
Manning's n	0.0130

Computed Results:

Depth	17.3899 in
Area	7.0686 ft2
Wetted Area	3.3818 ft2
Wetted Perimeter	55.3283 in
Perimeter	113.0973 in
Velocity	11.0000 fps
Hydraulic Radius	8.8016 in
Percent Full	48.3054 %
Full flow Flowrate	78.9186 cfs
Full flow velocity	11.1647 fps

Critical Information

Critical depth	23.8059 in
Critical slope	0.0049 ft/ft
Critical velocity	7.4612 fps
Critical area	4.9858 ft2
Critical perimeter	68.1605 in
Critical hydraulic radius	10.5332 in
Critical top width	36.0000 in
Specific energy	3.3296 ft
Minimum energy	2.9757 ft
Froude number	1.8260
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	7.8000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	11.5504 in
Area	1.7671 ft2
Wetted Area	1.1981 ft2
Wetted Perimeter	33.4460 in
Perimeter	56.5487 in
Velocity	6.5106 fps
Hydraulic Radius	5.1582 in
Percent Full	64.1690 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Critical Information

Critical depth	12.9830 in
Critical slope	0.0064 ft/ft
Critical velocity	5.6463 fps
Critical area	1.3814 ft2
Critical perimeter	36.2403 in
Critical hydraulic radius	5.4891 in
Critical top width	18.0000 in
Specific energy	1.6195 ft
Minimum energy	1.6229 ft
Froude number	1.2885
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	44.5000 cfs
Slope	0.0140 ft/ft
Manning's n	0.0130

Computed Results:

Depth	19.3438 in
Area	7.0686 ft2
Wetted Area	3.8699 ft2
Wetted Perimeter	59.2387 in
Perimeter	113.0973 in
Velocity	11.4989 fps
Hydraulic Radius	9.4072 in
Percent Full	53.7327 %
Full flow Flowrate	78.9186 cfs
Full flow velocity	11.1647 fps

Critical Information

Critical depth	26.0766 in
Critical slope	0.0051 ft/ft
Critical velocity	8.0130 fps
Critical area	5.5534 ft2
Critical perimeter	72.7019 in
Critical hydraulic radius	10.9997 in
Critical top width	36.0000 in
Specific energy	3.6669 ft
Minimum energy	3.2596 ft
Froude number	1.7850
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	34.3000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	18.3017 in
Area	7.0686 ft2
Wetted Area	3.6097 ft2
Wetted Perimeter	57.1520 in
Perimeter	113.0973 in
Velocity	9.5022 fps
Hydraulic Radius	9.0950 in
Percent Full	50.8379 %
Full flow Flowrate	66.6984 cfs
Full flow velocity	9.4359 fps

Critical Information

Critical depth	22.8277 in
Critical slope	0.0048 ft/ft
Critical velocity	7.2344 fps
Critical area	4.7412 ft2
Critical perimeter	66.2041 in
Critical hydraulic radius	10.3126 in
Critical top width	36.0000 in
Specific energy	2.9283 ft
Minimum energy	2.8535 ft
Froude number	1.5272
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	24.0000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	16.4897 in
Area	4.9087 ft2
Wetted Area	2.7642 ft2
Wetted Perimeter	50.1083 in
Perimeter	94.2478 in
Velocity	8.6824 fps
Hydraulic Radius	7.9438 in
Percent Full	54.9658 %
Full flow Flowrate	41.0171 cfs
Full flow velocity	8.3559 fps

Critical Information

Critical depth	20.0182 in
Critical slope	0.0052 ft/ft
Critical velocity	6.8575 fps
Critical area	3.4998 ft2
Critical perimeter	57.1603 in
Critical hydraulic radius	8.8169 in
Critical top width	30.0000 in
Specific energy	2.5456 ft
Minimum energy	2.5023 ft
Froude number	1.4559
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	95.9000 cfs
Slope	0.0400 ft/ft
Manning's n	0.0130

Computed Results:

Depth	22.5949 in
Area	7.0686 ft2
Wetted Area	4.6704 ft2
Wetted Perimeter	65.8412 in
Perimeter	113.0973 in
Velocity	20.5336 fps
Hydraulic Radius	10.2145 in
Percent Full	62.7635 %
Full flow Flowrate	133.3968 cfs
Full flow velocity	18.8718 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	4.8000 cfs
Slope	0.0170 ft/ft
Manning's n	0.0130

Computed Results:

Depth	7.3565 in
Area	1.7671 ft2
Wetted Area	0.6793 ft2
Wetted Perimeter	24.9688 in
Perimeter	56.5487 in
Velocity	7.0663 fps
Hydraulic Radius	3.9176 in
Percent Full	40.8695 %
Full flow Flowrate	13.6960 cfs
Full flow velocity	7.7503 fps

Critical Information

Critical depth	10.1044 in
Critical slope	0.0056 ft/ft
Critical velocity	4.6984 fps
Critical area	1.0216 ft2
Critical perimeter	30.4831 in
Critical hydraulic radius	4.8261 in
Critical top width	18.0000 in
Specific energy	1.3890 ft
Minimum energy	1.2630 ft
Froude number	1.8356
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	6.1000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	9.8478 in
Area	1.7671 ft2
Wetted Area	0.9894 ft2
Wetted Perimeter	29.9725 in
Perimeter	56.5487 in
Velocity	6.1654 fps
Hydraulic Radius	4.7534 in
Percent Full	54.7101 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Critical Information

Critical depth	11.4495 in
Critical slope	0.0060 ft/ft
Critical velocity	5.1271 fps
Critical area	1.1898 ft2
Critical perimeter	33.1733 in
Critical hydraulic radius	5.1646 in
Critical top width	18.0000 in
Specific energy	1.4113 ft
Minimum energy	1.4312 ft
Froude number	1.3385
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	10.9000 cfs
Slope	0.0130 ft/ft
Manning's n	0.0130

Computed Results:

Depth	10.8887 in
Area	3.1416 ft2
Wetted Area	1.3858 ft2
Wetted Perimeter	35.4734 in
Perimeter	75.3982 in
Velocity	7.8652 fps
Hydraulic Radius	5.6257 in
Percent Full	45.3697 %
Full flow Flowrate	25.7935 cfs
Full flow velocity	8.2103 fps

Critical Information

Critical depth	14.2025 in
Critical slope	0.0053 ft/ft
Critical velocity	5.6247 fps
Critical area	1.9379 ft2
Critical perimeter	42.1041 in
Critical hydraulic radius	6.6277 in
Critical top width	24.0000 in
Specific energy	1.8688 ft
Minimum energy	1.7753 ft
Froude number	1.6622
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	7.8000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	11.5504 in
Area	1.7671 ft2
Wetted Area	1.1981 ft2
Wetted Perimeter	33.4460 in
Perimeter	56.5487 in
Velocity	6.5106 fps
Hydraulic Radius	5.1582 in
Percent Full	64.1690 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Critical Information

Critical depth	12.9830 in
Critical slope	0.0064 ft/ft
Critical velocity	5.6463 fps
Critical area	1.3814 ft2
Critical perimeter	36.2403 in
Critical hydraulic radius	5.4891 in
Critical top width	18.0000 in
Specific energy	1.6195 ft
Minimum energy	1.6229 ft
Froude number	1.2885
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	18.7000 cfs
Slope	0.0130 ft/ft
Manning's n	0.0130

Computed Results:

Depth	15.1497 in
Area	3.1416 ft2
Wetted Area	2.0897 ft2
Wetted Perimeter	44.0731 in
Perimeter	75.3982 in
Velocity	8.9489 fps
Hydraulic Radius	6.8275 in
Percent Full	63.1236 %
Full flow Flowrate	25.7935 cfs
Full flow velocity	8.2103 fps

Critical Information

Critical depth	18.6762 in
Critical slope	0.0061 ft/ft
Critical velocity	6.9685 fps
Critical area	2.6835 ft2
Critical perimeter	51.0514 in
Critical hydraulic radius	7.5693 in
Critical top width	24.0000 in
Specific energy	2.5065 ft
Minimum energy	2.3345 ft
Froude number	1.5475
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	31.8000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0130

Computed Results:

Depth	21.6508 in
Area	7.0686 ft2
Wetted Area	4.4407 ft2
Wetted Perimeter	63.9013 in
Perimeter	113.0973 in
Velocity	7.1610 fps
Hydraulic Radius	10.0070 in
Percent Full	60.1412 %
Full flow Flowrate	47.1629 cfs
Full flow velocity	6.6722 fps

Critical Information

Critical depth	21.9470 in
Critical slope	0.0047 ft/ft
Critical velocity	7.0338 fps
Critical area	4.5210 ft2
Critical perimeter	64.4427 in
Critical hydraulic radius	10.1025 in
Critical top width	36.0000 in
Specific energy	2.5992 ft
Minimum energy	2.7434 ft
Froude number	1.0389
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	48.8000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0130

Computed Results:

Depth	25.5464 in
Area	9.6211 ft2
Wetted Area	6.1262 ft2
Wetted Perimeter	75.1388 in
Perimeter	131.9469 in
Velocity	7.9658 fps
Hydraulic Radius	11.7405 in
Percent Full	60.8248 %
Full flow Flowrate	71.1418 cfs
Full flow velocity	7.3943 fps

Critical Information

Critical depth	26.1827 in
Critical slope	0.0045 ft/ft
Critical velocity	7.7188 fps
Critical area	6.3222 ft2
Critical perimeter	76.3389 in
Critical hydraulic radius	11.9257 in
Critical top width	42.0000 in
Specific energy	3.1122 ft
Minimum energy	3.2728 ft
Froude number	1.0631
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	54.0000 in
Flowrate	79.3000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0130

Computed Results:

Depth	29.2169 in
Area	15.9043 ft2
Wetted Area	8.7826 ft2
Wetted Perimeter	89.2618 in
Perimeter	169.6460 in
Velocity	9.0293 fps
Hydraulic Radius	14.1683 in
Percent Full	54.1054 %
Full flow Flowrate	139.0519 cfs
Full flow velocity	8.7430 fps

Critical Information

Critical depth	31.2482 in
Critical slope	0.0040 ft/ft
Critical velocity	8.3078 fps
Critical area	9.5452 ft2
Critical perimeter	93.3194 in
Critical hydraulic radius	14.7291 in
Critical top width	54.0000 in
Specific energy	3.7015 ft
Minimum energy	3.9060 ft
Froude number	1.1395
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	3.9000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	7.5946 in
Area	1.7671 ft2
Wetted Area	0.7086 ft2
Wetted Perimeter	25.4520 in
Perimeter	56.5487 in
Velocity	5.5037 fps
Hydraulic Radius	4.0091 in
Percent Full	42.1922 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Critical Information

Critical depth	9.0634 in
Critical slope	0.0054 ft/ft
Critical velocity	4.3747 fps
Critical area	0.8915 ft2
Critical perimeter	28.4011 in
Critical hydraulic radius	4.5201 in
Critical top width	18.0000 in
Specific energy	1.1036 ft
Minimum energy	1.1329 ft
Froude number	1.4030
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	9.2000 cfs
Slope	0.0150 ft/ft
Manning's n	0.0130

Computed Results:

Depth	11.2570 in
Area	1.7671 ft2
Wetted Area	1.1627 ft2
Wetted Perimeter	32.8371 in
Perimeter	56.5487 in
Velocity	7.9125 fps
Hydraulic Radius	5.0988 in
Percent Full	62.5390 %
Full flow Flowrate	12.8651 cfs
Full flow velocity	7.2802 fps

Critical Information

Critical depth	14.0729 in
Critical slope	0.0067 ft/ft
Critical velocity	6.0619 fps
Critical area	1.5177 ft2
Critical perimeter	38.4201 in
Critical hydraulic radius	5.6883 in
Critical top width	18.0000 in
Specific energy	1.9108 ft
Minimum energy	1.7591 ft
Froude number	1.5880
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	12.1000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0130

Computed Results:

Depth	15.6001 in
Area	3.1416 ft2
Wetted Area	2.1617 ft2
Wetted Perimeter	45.0120 in
Perimeter	75.3982 in
Velocity	5.5975 fps
Hydraulic Radius	6.9156 in
Percent Full	65.0006 %
Full flow Flowrate	15.9965 cfs
Full flow velocity	5.0918 fps

Critical Information

Critical depth	14.9967 in
Critical slope	0.0054 ft/ft
Critical velocity	5.8447 fps
Critical area	2.0702 ft2
Critical perimeter	43.6925 in
Critical hydraulic radius	6.8230 in
Critical top width	24.0000 in
Specific energy	1.7821 ft
Minimum energy	1.8746 ft
Froude number	0.9529
Flow condition	Subcritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	7.0000 cfs
Slope	0.0600 ft/ft
Manning's n	0.0130

Computed Results:

Depth	6.4151 in
Area	1.7671 ft2
Wetted Area	0.5650 ft2
Wetted Perimeter	23.0307 in
Perimeter	56.5487 in
Velocity	12.3902 fps
Hydraulic Radius	3.5324 in
Percent Full	35.6395 %
Full flow Flowrate	25.7303 cfs
Full flow velocity	14.5604 fps

Critical Information

Critical depth	12.2907 in
Critical slope	0.0062 ft/ft
Critical velocity	5.4058 fps
Critical area	1.2949 ft2
Critical perimeter	34.8557 in
Critical hydraulic radius	5.3497 in
Critical top width	18.0000 in
Specific energy	2.9203 ft
Minimum energy	1.5363 ft
Froude number	3.4835
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	19.8000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0130

Computed Results:

Depth	18.1899 in
Area	4.9087 ft2
Wetted Area	3.1139 ft2
Wetted Perimeter	53.5528 in
Perimeter	94.2478 in
Velocity	6.3586 fps
Hydraulic Radius	8.3730 in
Percent Full	60.6330 %
Full flow Flowrate	29.0035 cfs
Full flow velocity	5.9085 fps

Critical Information

Critical depth	18.1186 in
Critical slope	0.0049 ft/ft
Critical velocity	6.3787 fps
Critical area	3.1041 ft2
Critical perimeter	53.3611 in
Critical hydraulic radius	8.3767 in
Critical top width	30.0000 in
Specific energy	2.1422 ft
Minimum energy	2.2648 ft
Froude number	1.0059
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	3.5000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	7.1556 in
Area	1.7671 ft2
Wetted Area	0.6547 ft2
Wetted Perimeter	24.5593 in
Perimeter	56.5487 in
Velocity	5.3464 fps
Hydraulic Radius	3.8385 in
Percent Full	39.7535 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	3.1000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	6.7005 in
Area	1.7671 ft2
Wetted Area	0.5993 ft2
Wetted Perimeter	23.6237 in
Perimeter	56.5487 in
Velocity	5.1728 fps
Hydraulic Radius	3.6530 in
Percent Full	37.2249 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	25.9000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0130

Computed Results:

Depth	19.0358 in
Area	7.0686 ft2
Wetted Area	3.7931 ft2
Wetted Perimeter	58.6214 in
Perimeter	113.0973 in
Velocity	6.8282 fps
Hydraulic Radius	9.3175 in
Percent Full	52.8772 %
Full flow Flowrate	47.1629 cfs
Full flow velocity	6.6722 fps

Critical Information

Critical depth	19.7151 in
Critical slope	0.0044 ft/ft
Critical velocity	6.5353 fps
Critical area	3.9631 ft2
Critical perimeter	59.9790 in
Critical hydraulic radius	9.5147 in
Critical top width	36.0000 in
Specific energy	2.3108 ft
Minimum energy	2.4644 ft
Froude number	1.0706
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	2.1000 cfs
Slope	0.1230 ft/ft
Manning's n	0.0130

Computed Results:

Depth	2.9170 in
Area	1.7671 ft2
Wetted Area	0.1859 ft2
Wetted Perimeter	14.9154 in
Perimeter	56.5487 in
Velocity	11.2960 fps
Hydraulic Radius	1.7948 in
Percent Full	16.2058 %
Full flow Flowrate	36.8401 cfs
Full flow velocity	20.8473 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	27.8000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	18.1038 in
Area	4.9087 ft2
Wetted Area	3.0963 ft2
Wetted Perimeter	53.3766 in
Perimeter	94.2478 in
Velocity	8.9783 fps
Hydraulic Radius	8.3534 in
Percent Full	60.3459 %
Full flow Flowrate	41.0171 cfs
Full flow velocity	8.3559 fps

Critical Information

Critical depth	21.5717 in
Critical slope	0.0054 ft/ft
Critical velocity	7.2709 fps
Critical area	3.8235 ft2
Critical perimeter	60.2673 in
Critical hydraulic radius	9.1356 in
Critical top width	30.0000 in
Specific energy	2.7606 ft
Minimum energy	2.6965 ft
Froude number	1.4241
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	80.5000 cfs
Slope	0.0200 ft/ft
Manning's n	0.0130

Computed Results:

Depth	22.6141 in
Area	9.6211 ft2
Wetted Area	5.2809 ft2
Wetted Perimeter	69.2047 in
Perimeter	131.9469 in
Velocity	15.2437 fps
Hydraulic Radius	10.9883 in
Percent Full	53.8430 %
Full flow Flowrate	142.2837 cfs
Full flow velocity	14.7887 fps

Critical Information

Critical depth	33.6236 in
Critical slope	0.0052 ft/ft
Critical velocity	9.4790 fps
Critical area	8.4925 ft2
Critical perimeter	91.2207 in
Critical hydraulic radius	13.4061 in
Critical top width	42.0000 in
Specific energy	5.4958 ft
Minimum energy	4.2030 ft
Froude number	2.1880
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	9.8000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	11.0435 in
Area	3.1416 ft2
Wetted Area	1.4115 ft2
Wetted Perimeter	35.7840 in
Perimeter	75.3982 in
Velocity	6.9428 fps
Hydraulic Radius	5.6802 in
Percent Full	46.0144 %
Full flow Flowrate	22.6224 cfs
Full flow velocity	7.2009 fps

Critical Information

Critical depth	13.4342 in
Critical slope	0.0051 ft/ft
Critical velocity	5.4149 fps
Critical area	1.8098 ft2
Critical perimeter	40.5675 in
Critical hydraulic radius	6.4242 in
Critical top width	24.0000 in
Specific energy	1.6694 ft
Minimum energy	1.6793 ft
Froude number	1.4546
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	110.0000 cfs
Slope	0.0590 ft/ft
Manning's n	0.0130

Computed Results:

Depth	19.7546 in
Area	9.6211 ft2
Wetted Area	4.4475 ft2
Wetted Perimeter	63.4813 in
Perimeter	131.9469 in
Velocity	24.7327 fps
Hydraulic Radius	10.0888 in
Percent Full	47.0349 %
Full flow Flowrate	244.3803 cfs
Full flow velocity	25.4004 fps

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	54.0000 in
Flowrate	127.2000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	31.6140 in
Area	15.9043 ft2
Wetted Area	9.6740 ft2
Wetted Perimeter	94.0965 in
Perimeter	169.6460 in
Velocity	13.1487 fps
Hydraulic Radius	14.8045 in
Percent Full	58.5445 %
Full flow Flowrate	196.6491 cfs
Full flow velocity	12.3645 fps

Critical Information

Critical depth	39.8338 in
Critical slope	0.0045 ft/ft
Critical velocity	9.9649 fps
Critical area	12.7648 ft2
Critical perimeter	110.4905 in
Critical hydraulic radius	16.6361 in
Critical top width	54.0000 in
Specific energy	5.3210 ft
Minimum energy	4.9792 ft
Froude number	1.5822
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	48.0000 in
Flowrate	102.3000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	29.9357 in
Area	12.5664 ft2
Wetted Area	8.2414 ft2
Wetted Perimeter	87.3941 in
Perimeter	150.7964 in
Velocity	12.4130 fps
Hydraulic Radius	13.5794 in
Percent Full	62.3660 %
Full flow Flowrate	143.6433 cfs
Full flow velocity	11.4308 fps

Critical Information

Critical depth	36.7587 in
Critical slope	0.0048 ft/ft
Critical velocity	9.7095 fps
Critical area	10.5361 ft2
Critical perimeter	100.9157 in
Critical hydraulic radius	15.0343 in
Critical top width	48.0000 in
Specific energy	4.8881 ft
Minimum energy	4.5948 ft
Froude number	1.5279
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	60.1000 cfs
Slope	0.0200 ft/ft
Manning's n	0.0130

Computed Results:

Depth	20.8736 in
Area	7.0686 ft2
Wetted Area	4.2496 ft2
Wetted Perimeter	62.3205 in
Perimeter	113.0973 in
Velocity	14.1424 fps
Hydraulic Radius	9.8193 in
Percent Full	57.9822 %
Full flow Flowrate	94.3258 cfs
Full flow velocity	13.3444 fps

Critical Information

Critical depth	30.0378 in
Critical slope	0.0056 ft/ft
Critical velocity	9.1844 fps
Critical area	6.5437 ft2
Critical perimeter	80.6243 in
Critical hydraulic radius	11.6875 in
Critical top width	36.0000 in
Specific energy	4.8486 ft
Minimum energy	3.7547 ft
Froude number	2.0961
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	8.1000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	11.8599 in
Area	1.7671 ft2
Wetted Area	1.2350 ft2
Wetted Perimeter	34.0951 in
Perimeter	56.5487 in
Velocity	6.5590 fps
Hydraulic Radius	5.2158 in
Percent Full	65.8884 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Critical Information

Critical depth	13.2295 in
Critical slope	0.0065 ft/ft
Critical velocity	5.7355 fps
Critical area	1.4123 ft2
Critical perimeter	36.7334 in
Critical hydraulic radius	5.5363 in
Critical top width	18.0000 in
Specific energy	1.6544 ft
Minimum energy	1.6537 ft
Froude number	1.2802
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	48.0000 in
Flowrate	108.1000 cfs
Slope	0.0260 ft/ft
Manning's n	0.0130

Computed Results:

Depth	23.0535 in
Area	12.5664 ft2
Wetted Area	5.9678 ft2
Wetted Perimeter	73.5047 in
Perimeter	150.7964 in
Velocity	18.1140 fps
Hydraulic Radius	11.6912 in
Percent Full	48.0281 %
Full flow Flowrate	231.6178 cfs
Full flow velocity	18.4316 fps

Critical Information

Critical depth	37.7365 in
Critical slope	0.0049 ft/ft
Critical velocity	9.9521 fps
Critical area	10.8620 ft2
Critical perimeter	102.8712 in
Critical hydraulic radius	15.2047 in
Critical top width	48.0000 in
Specific energy	7.0202 ft
Minimum energy	4.7171 ft
Froude number	2.6135
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	60.0000 in
Flowrate	233.6000 cfs
Slope	0.0160 ft/ft
Manning's n	0.0130

Computed Results:

Depth	37.3102 in
Area	19.6350 ft2
Wetted Area	12.8330 ft2
Wetted Perimeter	109.0169 in
Perimeter	188.4956 in
Velocity	18.2031 fps
Hydraulic Radius	16.9510 in
Percent Full	62.1837 %
Full flow Flowrate	329.4367 cfs
Full flow velocity	16.7781 fps

Critical Information

Critical depth	51.7447 in
Critical slope	0.0048 ft/ft
Critical velocity	12.3743 fps
Critical area	18.8778 ft2
Critical perimeter	137.7372 in
Critical hydraulic radius	19.7361 in
Critical top width	60.0000 in
Specific energy	8.2633 ft
Minimum energy	6.4681 ft
Froude number	2.0074
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	20.5000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	14.9963 in
Area	4.9087 ft2
Wetted Area	2.4536 ft2
Wetted Perimeter	47.1165 in
Perimeter	94.2478 in
Velocity	8.3551 fps
Hydraulic Radius	7.4988 in
Percent Full	49.9877 %
Full flow Flowrate	41.0171 cfs
Full flow velocity	8.3559 fps

Critical Information

Critical depth	18.4495 in
Critical slope	0.0050 ft/ft
Critical velocity	6.4607 fps
Critical area	3.1730 ft2
Critical perimeter	54.0229 in
Critical hydraulic radius	8.4578 in
Critical top width	30.0000 in
Specific energy	2.3345 ft
Minimum energy	2.3062 ft
Froude number	1.4868
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	26.8000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	17.6775 in
Area	4.9087 ft2
Wetted Area	3.0092 ft2
Wetted Perimeter	52.5078 in
Perimeter	94.2478 in
Velocity	8.9060 fps
Hydraulic Radius	8.2526 in
Percent Full	58.9251 %
Full flow Flowrate	41.0171 cfs
Full flow velocity	8.3559 fps

Critical Information

Critical depth	21.1774 in
Critical slope	0.0054 ft/ft
Critical velocity	7.1632 fps
Critical area	3.7413 ft2
Critical perimeter	59.4786 in
Critical hydraulic radius	9.0579 in
Critical top width	30.0000 in
Specific energy	2.7053 ft
Minimum energy	2.6472 ft
Froude number	1.4323
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	47.1000 cfs
Slope	0.0300 ft/ft
Manning's n	0.0130

Computed Results:

Depth	17.8449 in
Area	4.9087 ft2
Wetted Area	3.0435 ft2
Wetted Perimeter	52.8484 in
Perimeter	94.2478 in
Velocity	15.4757 fps
Hydraulic Radius	8.2928 in
Percent Full	59.4830 %
Full flow Flowrate	71.0438 cfs
Full flow velocity	14.4729 fps

Critical Information

Critical depth	27.1096 in
Critical slope	0.0062 ft/ft
Critical velocity	9.4631 fps
Critical area	4.9772 ft2
Critical perimeter	71.3431 in
Critical hydraulic radius	10.0461 in
Critical top width	30.0000 in
Specific energy	5.2117 ft
Minimum energy	3.3887 ft
Froude number	2.4752
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	60.0000 in
Flowrate	232.4000 cfs
Slope	0.0200 ft/ft
Manning's n	0.0130

Computed Results:

Depth	34.5740 in
Area	19.6350 ft2
Wetted Area	11.7159 ft2
Wetted Perimeter	103.4317 in
Perimeter	188.4956 in
Velocity	19.8363 fps
Hydraulic Radius	16.3112 in
Percent Full	57.6234 %
Full flow Flowrate	368.3215 cfs
Full flow velocity	18.7585 fps

Critical Information

Critical depth	51.6401 in
Critical slope	0.0048 ft/ft
Critical velocity	12.3393 fps
Critical area	18.8342 ft2
Critical perimeter	137.5280 in
Critical hydraulic radius	19.7205 in
Critical top width	60.0000 in
Specific energy	8.9980 ft
Minimum energy	6.4550 ft
Froude number	2.2858
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	52.5000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	21.5381 in
Area	9.6211 ft2
Wetted Area	4.9675 ft2
Wetted Perimeter	67.0497 in
Perimeter	131.9469 in
Velocity	10.5687 fps
Hydraulic Radius	10.6685 in
Percent Full	51.2811 %
Full flow Flowrate	100.6098 cfs
Full flow velocity	10.4572 fps

Critical Information

Critical depth	27.1939 in
Critical slope	0.0046 ft/ft
Critical velocity	7.9340 fps
Critical area	6.6171 ft2
Critical perimeter	78.3612 in
Critical hydraulic radius	12.1599 in
Critical top width	42.0000 in
Specific energy	3.5307 ft
Minimum energy	3.3992 ft
Froude number	1.5640
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	18.0000 in
Flowrate	5.3000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	9.0482 in
Area	1.7671 ft2
Wetted Area	0.8896 ft2
Wetted Perimeter	28.3708 in
Perimeter	56.5487 in
Velocity	5.9577 fps
Hydraulic Radius	4.5153 in
Percent Full	50.2680 %
Full flow Flowrate	10.5043 cfs
Full flow velocity	5.9442 fps

Critical Information

Critical depth	10.6416 in
Critical slope	0.0058 ft/ft
Critical velocity	4.8679 fps
Critical area	1.0888 ft2
Critical perimeter	31.5575 in
Critical hydraulic radius	4.9682 in
Critical top width	18.0000 in
Specific energy	1.3056 ft
Minimum energy	1.3302 ft
Froude number	1.3639
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	24.0000 in
Flowrate	8.6000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	10.2600 in
Area	3.1416 ft2
Wetted Area	1.2818 ft2
Wetted Perimeter	34.2068 in
Perimeter	75.3982 in
Velocity	6.7092 fps
Hydraulic Radius	5.3961 in
Percent Full	42.7501 %
Full flow Flowrate	22.6224 cfs
Full flow velocity	7.2009 fps

Critical Information

Critical depth	12.5461 in
Critical slope	0.0050 ft/ft
Critical velocity	5.1751 fps
Critical area	1.6618 ft2
Critical perimeter	38.7913 in
Critical hydraulic radius	6.1689 in
Critical top width	24.0000 in
Specific energy	1.5545 ft
Minimum energy	1.5683 ft
Froude number	1.4697
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	76.8000 cfs
Slope	0.0200 ft/ft
Manning's n	0.0130

Computed Results:

Depth	21.9785 in
Area	9.6211 ft2
Wetted Area	5.0959 ft2
Wetted Perimeter	67.9312 in
Perimeter	131.9469 in
Velocity	15.0711 fps
Hydraulic Radius	10.8022 in
Percent Full	52.3298 %
Full flow Flowrate	142.2837 cfs
Full flow velocity	14.7887 fps

Critical Information

Critical depth	32.8950 in
Critical slope	0.0051 ft/ft
Critical velocity	9.2754 fps
Critical area	8.2799 ft2
Critical perimeter	89.7634 in
Critical hydraulic radius	13.2828 in
Critical top width	42.0000 in
Specific energy	5.3614 ft
Minimum energy	4.1119 ft
Froude number	2.2020
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	42.0000 in
Flowrate	74.2000 cfs
Slope	0.0440 ft/ft
Manning's n	0.0130

Computed Results:

Depth	17.1954 in
Area	9.6211 ft2
Wetted Area	3.7070 ft2
Wetted Perimeter	58.3220 in
Perimeter	131.9469 in
Velocity	20.0162 fps
Hydraulic Radius	9.1528 in
Percent Full	40.9415 %
Full flow Flowrate	211.0408 cfs
Full flow velocity	21.9351 fps

Critical Information

Critical depth	32.3606 in
Critical slope	0.0050 ft/ft
Critical velocity	9.1334 fps
Critical area	8.1241 ft2
Critical perimeter	88.6946 in
Critical hydraulic radius	13.1898 in
Critical top width	42.0000 in
Specific energy	7.6592 ft
Minimum energy	4.0451 ft
Froude number	3.4004
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	30.0000 in
Flowrate	27.1000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	17.8052 in
Area	4.9087 ft2
Wetted Area	3.0354 ft2
Wetted Perimeter	52.7675 in
Perimeter	94.2478 in
Velocity	8.9281 fps
Hydraulic Radius	8.2834 in
Percent Full	59.3507 %
Full flow Flowrate	41.0171 cfs
Full flow velocity	8.3559 fps

Critical Information

Critical depth	21.2967 in
Critical slope	0.0054 ft/ft
Critical velocity	7.1956 fps
Critical area	3.7662 ft2
Critical perimeter	59.7174 in
Critical hydraulic radius	9.0816 in
Critical top width	30.0000 in
Specific energy	2.7220 ft
Minimum energy	2.6621 ft
Froude number	1.4298
Flow condition	Supercritical

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	36.0000 in
Flowrate	44.8000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0130

Computed Results:

Depth	21.5966 in
Area	7.0686 ft2
Wetted Area	4.4274 ft2
Wetted Perimeter	63.7907 in
Perimeter	113.0973 in
Velocity	10.1187 fps
Hydraulic Radius	9.9944 in
Percent Full	59.9907 %
Full flow Flowrate	66.6984 cfs
Full flow velocity	9.4359 fps

Critical Information

Critical depth	26.1642 in
Critical slope	0.0051 ft/ft
Critical velocity	8.0354 fps
Critical area	5.5754 ft2
Critical perimeter	72.8772 in
Critical hydraulic radius	11.0165 in
Critical top width	36.0000 in
Specific energy	3.3902 ft
Minimum energy	3.2705 ft
Froude number	1.4702
Flow condition	Supercritical

WATER QUALITY CALCULATIONS

MOUNTAIN VISTA RANCH - SE CORNER
FINAL DRAINAGE REPORT
EXTENDED DETENTION POND DESIGN FORM

Pond @ P1

1. Required Storage Volume

	I= 65.00	%
A) Tributary Area's Imperviousness Ratio (i=I^9/100)	i= 0.65	
B) Contributing Watershed Area (Area)	Area= 24.60	acres
C) Water Quality Capture Volume (WQCV) (WQCV=1.0*(0.91*I^3-1.19*I^2+0.78*I))	WQCV= 0.25	watershed inches
D) Design Volume: Vol=(WQCV / 12)*Area*1.2	Vol= 0.625	acre-feet

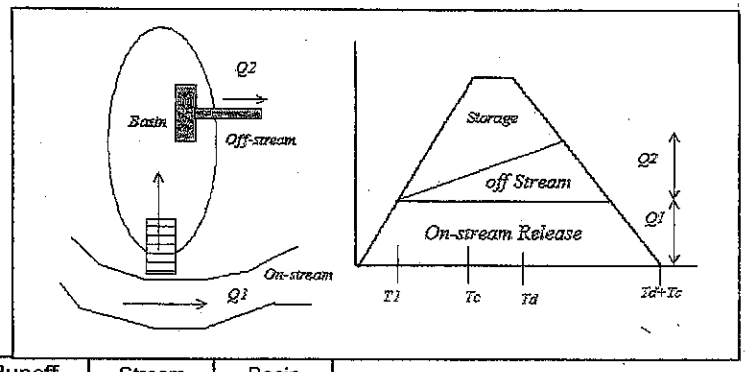
Rational Volumetric Method for On-Stream or Off-Stream Detention Basin

Watershed Information

Drainage Area	A=	23.20	acre
Flow Length	L=	1675.00	ft
Time of Concentration	Tc=	13.40	minutes

Rainfall Series

Beginning Rainfall Duration	5.00	minutes
Incremental Duration	5.00	minutes



Rainfall Intensity I = C1*H1/(C2+T)^C3

Return	Period	1-hr Depth H1 in inch	Coeff C1	Coeff C2	Coeff C3	Runoff Coeff	Stream Release Q1 cfs	Basin Release Q2 cfs
100	years	4.60	28.50	10.00	0.79	0.52	0.00	84.50
10	years	2.50	26.50	0.00	0.79	0.40	0.00	33.90

Note: Q1 =0 for On-Stream Basin
Q1 > 0 for Off-Stream Basin

Factor m = **0.5*(1+TC/TD-2*T1/TD)+Q1/Q2*(1+(TC-T1)/TD)**

Duration	100-year Event							10-year Event						
minutes	Rainfall Intensity inch/hr	Inflow Volume acre-ft	Peak Runoff cfs	Diversion Time T1 minutes	100-yr Coef m	Outflow Volume acre-ft	**Storage Volume acre-ft**	Rainfall Intensity inch/hr	Inflow Volume acre-ft	Peak Runoff cfs	Diversion Time T1 minutes	10-yr Coef m	Outflow Volume acre-ft	**Storage Volume acre-ft**
5.00	15.48	1.30	186.71	0.00	1.00	0.58	**0.71**	8.41	0.54	78.05	0.00	1.00	0.23	**0.31**
10.00	12.33	2.07	148.79	0.00	1.00	1.16	**0.90**	6.70	0.86	62.20	0.00	1.00	0.47	**0.40**
15.00	10.34	2.60	124.77	0.00	0.95	1.65	**0.95**	5.62	1.09	52.16	0.00	0.95	0.66	**0.42**
20.00	8.96	3.00	108.06	0.00	0.84	1.94	**1.06**	4.87	1.25	45.17	0.00	0.84	0.78	**0.48**
25.00	7.93	3.32	95.68	0.00	0.77	2.23	**1.09**	4.31	1.39	40.00	0.00	0.77	0.90	**0.49**
30.00	7.14	3.59	86.11	0.00	0.72	2.53	**1.06**	3.88	1.50	36.00	0.00	0.72	1.01	**0.49**
35.00	6.50	3.81	78.47	0.00	0.69	2.82	**1.00**	3.54	1.59	32.81	0.00	0.69	1.13	**0.46**
40.00	5.99	4.01	72.21	0.00	0.67	3.11	**0.90**	3.25	1.68	30.19	0.00	0.67	1.25	**0.43**
45.00	5.55	4.19	66.98	0.00	0.65	3.40	**0.79**	3.02	1.75	28.00	0.00	0.65	1.36	**0.39**
50.00	5.18	4.34	62.54	0.00	0.63	3.69	**0.65**	2.82	1.82	26.14	0.00	0.63	1.48	**0.34**
55.00	4.87	4.48	58.71	0.00	0.62	3.98	**0.50**	2.64	1.87	24.54	0.00	0.62	1.60	**0.28**
60.00	4.59	4.61	55.37	0.00	0.61	4.27	**0.34**	2.49	1.93	23.15	0.00	0.61	1.71	**0.22**
65.00	4.35	4.73	52.44	0.00	0.60	4.56	**0.17**	2.36	1.98	21.92	0.00	0.60	1.83	**0.15**

100-year Detention Vol= **1.09**

10-year Detention Vol= **0.49**

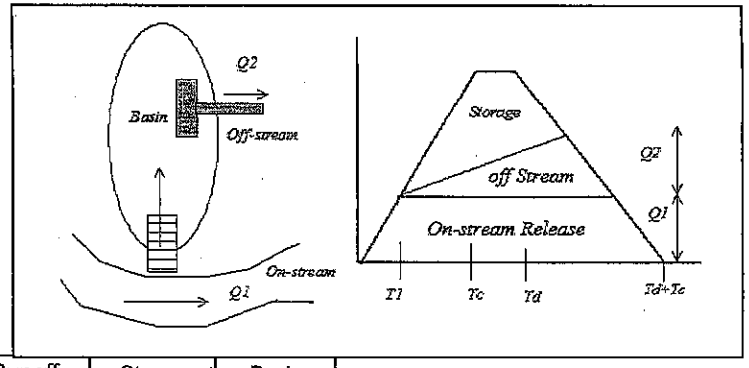
Rational Volumetric Method for On-Stream or Off-Stream Detention Basin

Watershed Information

Drainage Area	A=	54.40	acre
Flow Length	L=	3400.00	ft
Time of Concentration	Tc=	39.00	minutes

Rainfall Series

Beginning Rainfall Duration	5.00	minutes
Incremental Duration	5.00	minutes



Rainfall Intensity I = C1*H1/(C2+T)^C3

Return	Period	1-hr Depth H1 in inch	Coeff C1	Coeff C2	Coeff C3	Runoff Coeff	Stream Release Q1 cfs	Basin Release Q2 cfs
100	years	4.60	26.50	10.00	0.79	0.20	0.00	45.00
10	years	2.50	28.50	10.00	0.79	0.15	0.00	18.10

Note: Q1 =0 for On-Stream Basin
Q1 > 0 for Off-Stream Basin

Factor m = **0.5*(1+TC/TD-2*T1/TD)+Q1/Q2*(1+(TC-T1)/TD)**

	100-year Event							10-year Event						
Duration minutes	Rainfall Intensity inch/hr	Inflow Volume acre-ft	Peak Runoff cfs	Diversion Time T1 minutes	100-yr Coef m	Outflow Volume acre-ft	**Storage Volume acre-ft**	Rainfall Intensity inch/hr	Inflow Volume acre-ft	Peak Runoff cfs	Diversion Time T1 minutes	10-yr Coef m	Outflow Volume acre-ft	**Storage Volume acre-ft**
5.00	15.48	1.17	168.38	0.00	1.00	0.31	**0.86**	8.41	0.48	68.63	0.00	1.00	0.12	**0.35**
10.00	12.33	1.86	134.19	0.00	1.00	0.62	**1.24**	6.70	0.76	54.70	0.00	1.00	0.25	**0.51**
15.00	10.34	2.34	112.53	0.00	1.00	0.93	**1.41**	5.62	0.96	45.87	0.00	1.00	0.37	**0.58**
20.00	8.96	2.71	97.45	0.00	1.00	1.24	**1.47**	4.87	1.10	39.72	0.00	1.00	0.50	**0.60**
25.00	7.93	3.00	86.29	0.00	1.00	1.55	**1.45**	4.31	1.22	35.17	0.00	1.00	0.62	**0.60**
30.00	7.14	3.24	77.66	0.00	1.00	1.86	**1.38**	3.88	1.32	31.66	0.00	1.00	0.75	**0.57**
35.00	6.50	3.44	70.77	0.00	1.00	2.17	**1.27**	3.54	1.40	28.85	0.00	1.00	0.87	**0.53**
40.00	5.99	3.62	65.12	0.00	0.99	2.45	**1.17**	3.25	1.47	26.55	0.00	0.99	0.98	**0.49**
45.00	5.55	3.78	60.41	0.00	0.93	2.60	**1.17**	3.02	1.54	24.62	0.00	0.93	1.05	**0.49**
50.00	5.18	3.92	56.40	0.00	0.89	2.76	**1.16**	2.82	1.60	22.99	0.00	0.89	1.11	**0.49**
55.00	4.87	4.04	52.95	0.00	0.85	2.91	**1.13**	2.64	1.65	21.58	0.00	0.85	1.17	**0.48**
60.00	4.59	4.16	49.94	0.00	0.83	3.07	**1.09**	2.49	1.70	20.36	0.00	0.83	1.23	**0.46**
65.00	4.35	4.27	47.29	0.00	0.80	3.22	**1.05**	2.36	1.74	19.28	0.00	0.80	1.30	**0.44**

100-year Detention Vol= **1.47**

10-year Detention Vol= **0.60**

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	79.3000 cfs
Slope	0.0600 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	48.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	11.8623 in
Velocity	10.0854 fps
Full Flowrate	79.3000 cfs
Flow area	7.8628 ft2
Flow perimeter	145.8190 in
Hydraulic radius	7.7647 in
Top width	142.8984 in
Area	7.8628 ft2
Perimeter	145.8190 in
Percent full	100.0000 %

Critical Information

Critical depth	17.6639 in
Critical slope	0.0112 ft/ft
Critical velocity	5.4483 fps
Critical area	14.5550 ft2
Critical perimeter	193.6602 in
Critical hydraulic radius	10.8227 in
Critical top width	189.3111 in
Specific energy	2.5692 ft
Minimum energy	2.2080 ft
Froude number	2.1881
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	14.5000 cfs
Slope	0.0600 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	8.7866 in
Velocity	6.7613 fps
Full Flowrate	14.5000 cfs
Flow area	2.1446 ft2
Flow perimeter	72.4562 in
Hydraulic radius	4.2621 in
Top width	70.2929 in
Area	2.1446 ft2
Perimeter	72.4562 in
Percent full	100.0000 %

Critical Information

Critical depth	11.5242 in
Critical slope	0.0141 ft/ft
Critical velocity	3.9305 fps
Critical area	3.6891 ft2
Critical perimeter	95.0307 in
Critical hydraulic radius	5.5900 in
Critical top width	92.1933 in
Specific energy	1.4426 ft
Minimum energy	1.4405 ft
Froude number	1.9700
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	79.3000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	23.2509 in
Velocity	5.2808 fps
Full Flowrate	79.3000 cfs
Flow area	15.0167 ft2
Flow perimeter	191.7316 in
Hydraulic radius	11.2783 in
Top width	186.0069 in
Area	15.0167 ft2
Perimeter	191.7316 in
Percent full	100.0000 %

Critical Information

Critical depth	22.7390 in
Critical slope	0.0113 ft/ft
Critical velocity	5.5212 fps
Critical area	14.3628 ft2
Critical perimeter	187.5107 in
Critical hydraulic radius	11.0300 in
Critical top width	181.9121 in
Specific energy	2.3709 ft
Minimum energy	2.8424 ft
Froude number	0.9459
Flow condition	Subcritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	30.7000 cfs
Slope	0.0500 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	12.0457 in
Velocity	7.6169 fps
Full Flowrate	30.7000 cfs
Flow area	4.0305 ft2
Flow perimeter	99.3313 in
Hydraulic radius	5.8430 in
Top width	96.3655 in
Area	4.0305 ft2
Perimeter	99.3313 in
Percent full	100.0000 %

Critical Information

Critical depth	15.5567 in
Critical slope	0.0128 ft/ft
Critical velocity	4.5667 fps
Critical area	6.7225 ft2
Critical perimeter	128.2839 in
Critical hydraulic radius	7.5461 in
Critical top width	124.4536 in
Specific energy	1.9054 ft
Minimum energy	1.9446 ft
Froude number	1.8955
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	28.6000 cfs
Slope	0.0500 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	11.7298 in
Velocity	7.4831 fps
Full Flowrate	28.6000 cfs
Flow area	3.8219 ft2
Flow perimeter	96.7267 in
Hydraulic radius	5.6898 in
Top width	93.8387 in
Area	3.8219 ft2
Perimeter	96.7267 in
Percent full	100.0000 %

Critical Information

Critical depth	15.1220 in
Critical slope	0.0129 ft/ft
Critical velocity	4.5025 fps
Critical area	6.3521 ft2
Critical perimeter	124.6990 in
Critical hydraulic radius	7.3352 in
Critical top width	120.9758 in
Specific energy	1.8477 ft
Minimum energy	1.8902 ft
Froude number	1.8871
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	44.8000 cfs
Slope	0.0330 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	4.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	14.5111 in
Velocity	7.1653 fps
Full Flowrate	44.8000 cfs
Flow area	6.2523 ft2
Flow perimeter	123.6617 in
Hydraulic radius	7.2806 in
Top width	120.0889 in
Area	6.2523 ft2
Perimeter	123.6617 in
Percent full	100.0000 %

Critical Information

Critical depth	17.6039 in
Critical slope	0.0121 ft/ft
Critical velocity	4.9246 fps
Critical area	9.0973 ft2
Critical perimeter	149.1655 in
Critical hydraulic radius	8.7822 in
Critical top width	144.8312 in
Specific energy	2.0071 ft
Minimum energy	2.2005 ft
Froude number	1.5982
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	7.0000 cfs
Slope	0.0250 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	7.8797 in
Velocity	4.0586 fps
Full Flowrate	7.0000 cfs
Flow area	1.7247 ft2
Flow perimeter	64.9777 in
Hydraulic radius	3.8222 in
Top width	63.0376 in
Area	1.7247 ft2
Perimeter	64.9777 in
Percent full	100.0000 %

Critical Information

Critical depth	8.6119 in
Critical slope	0.0156 ft/ft
Critical velocity	3.3978 fps
Critical area	2.0602 ft2
Critical perimeter	71.0160 in
Critical hydraulic radius	4.1774 in
Critical top width	68.8956 in
Specific energy	0.9126 ft
Minimum energy	1.0765 ft
Froude number	1.2488
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	28.6000 cfs
Slope	0.0250 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	13.3578 in
Velocity	5.7703 fps
Full Flowrate	28.6000 cfs
Flow area	4.9564 ft2
Flow perimeter	110.1513 in
Hydraulic radius	6.4795 in
Top width	106.8625 in
Area	4.9564 ft2
Perimeter	110.1513 in
Percent full	100.0000 %

Critical Information

Critical depth	15.1220 in
Critical slope	0.0129 ft/ft
Critical velocity	4.5025 fps
Critical area	6.3521 ft2
Critical perimeter	124.6990 in
Critical hydraulic radius	7.3352 in
Critical top width	120.9758 in
Specific energy	1.6306 ft
Minimum energy	1.8902 ft
Froude number	1.3636
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	15.4000 cfs
Slope	0.0250 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	10.5905 in
Velocity	4.9430 fps
Full Flowrate	15.4000 cfs
Flow area	3.1155 ft2
Flow perimeter	87.3319 in
Hydraulic radius	5.1372 in
Top width	84.7243 in
Area	3.1155 ft2
Perimeter	87.3319 in
Percent full	100.0000 %

Critical Information

Critical depth	11.8051 in
Critical slope	0.0140 ft/ft
Critical velocity	3.9782 fps
Critical area	3.8711 ft2
Critical perimeter	97.3475 in
Critical hydraulic radius	5.7263 in
Critical top width	94.4410 in
Specific energy	1.2622 ft
Minimum energy	1.4756 ft
Froude number	1.3118
Flow condition	Supercritical

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	42.1000 cfs
Slope	0.0250 ft/ft
Manning's n	0.0270
Height	120000.0000 in
Bottom width	0.0000 in
Left slope	0.2500 ft/ft (V/H)
Right slope	0.2500 ft/ft (V/H)

Computed Results:

Depth	15.4420 in
Velocity	6.3559 fps
Full Flowrate	42.1000 cfs
Flow area	6.6238 ft2
Flow perimeter	127.3381 in
Hydraulic radius	7.4905 in
Top width	123.5361 in
Area	6.6238 ft2
Perimeter	127.3381 in
Percent full	100.0000 %

Critical Information

Critical depth	17.6512 in
Critical slope	0.0123 ft/ft
Critical velocity	4.8645 fps
Critical area	8.6546 ft2
Critical perimeter	145.5558 in
Critical hydraulic radius	8.5621 in
Critical top width	141.2099 in
Specific energy	1.9146 ft
Minimum energy	2.2064 ft
Froude number	1.3969
Flow condition	Supercritical

CONSTRUCTION COST OPINION

MOUNTAIN VISTA RANCH FILING NO. 1
Construction Cost Opinion

PROPOSED FILING NO. 1 STORM SEWER SYSTEM (DBPS Segments 31, 33)

DRAINAGE COSTS

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	REIMBURSABLE COST
36" RCP	LF	200	$85	$17,000	
42" RCP	LF	85	$100	$8,500	
48" RCP	LF	292	$185	$54,020	
54" RCP	LF	1134	$220	$249,480	$249,480
60" RCP	LF	628	$260	$163,280	$163,280
54" BEND	EA	1	$2,300	$2,300	$2,300
60" BEND	EA	1	$2,525	$2,525	$2,525
60" FES	EA	1	$4,000	$4,000	$4,000
TYPE 1 MANHOLE	EA	5	$6,000	$30,000	$30,000
TYPE H RIPRAP	CY	6754	$66	$442,387	$442,387
GROUTED RIPRAP	CY	3335	$97	$323,495	$323,495
STEEL SHEET PILE	SF	3960	$19	$75,240	$75,240
EMBANKMENT GRADING	CY	186,489	$1	$177,165	$177,165
			SUBTOTAL	$1,549,392	$1,378,872
		10%	ENGINEERING AND CONTINGENCIES	$154,939	$137,887
			TOTAL	**$1,704,331**	**$1,516,759**
			FEES		**$544,630**
			DIFFERENCE		**$972,129**

*** FOR THE RECORDATION OF THE FINAL PLAT FOR MOUNTAIN VISTA RANCH FILING NO.1, $972,129.16 IS OWED TO THE DEVELOPER FOR CONSTRUCTION OF THE REIMBURSABLE DRAINAGE FACILITIES.**

*** Facility Costs are greater than Drainage Fees, Therefore Drainage Fees will not be required**

MOUNTAIN VISTA RANCH FILING NO. 1
Construction Cost Opinion

NON-REIMBURSABLE COST

DRAINAGE COSTS

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
18" RCP	LF	959	$35	$33,565
24" RCP	LF	593	$45	$26,685
30" RCP	LF	250	$65	$16,250
36" RCP	LF	2209	$85	$187,765
42" RCP	LF	815	$100	$81,500
48" RCP	LF	357	$185	$66,045
18" BEND	EA	4	$700	$2,800
24" BEND	EA	2	$900	$1,800
30" BEND	EA	0	$1,200	$0
36" BEND	EA	2	$1,450	$2,900
42" BEND	EA	1	$1,700	$1,700
36" FES	EA	3	$2,500	$7,500
42" FES	EA	1	$3,000	$3,000
TYPE 1 MANHOLE	EA	7	$6,000	$42,000
TYPE 2 MANHOLE	EA	2	$2,500	$5,000
4' D-10-R INLET	EA	13	$4,000	$52,000
6' D-10-R INLET	EA	1	$6,000	$6,000
8' D-10-R INLET	EA	3	$8,000	$24,000
10' D-10-R INLET	EA	1	$10,000	$10,000
12' D-10-R INLET	EA	7	$12,000	$84,000
14' D-10-R INLET	EA	1	$14,000	$14,000
16' D-10-R INLET	EA	1	$16,000	$16,000
			SUBTOTAL	$684,510
			10% ENGINEERING AND CONTINGENCIES	$68,451
			TOTAL	**$752,961**

MOUNTAIN VISTA RANCH FILING NO. 2
Construction Cost Opinion

PROPOSED FILING NO. 2 STORM SEWER SYSTEM (DBPS Segments 31)

DRAINAGE COSTS

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	REIMBURSABLE COST
			REIMBURSABLE COST		
18" RCP	LF	435	$35	$15,225	
24" RCP	LF	176	$45	$7,920	
30" RCP	LF	307	$65	$19,955	
36" RCP	LF	26	$85	$2,210	
48" RCP	LF	8	$100	$800	$800
54" RCP	LF	130	$185	$24,050	$24,050
18" BEND	EA	3	$700	$2,100	
30" BEND	EA	2	$1,200	$2,400	
TYPE 1 MANHOLE	EA	2	$6,000	$12,000	
TYPE 2 MANHOLE	EA	1	$2,500	$2,500	
			SUBTOTAL	$89,160	$24,850
			10% ENGINEERING AND CONTINGENCIES	$8,916	$2,485
			TOTAL	**$98,076**	**$27,335**
			FEES		**$373,755**
			DIFFERENCE		**-$346,420**

***FOR THE RECORDATION OF THE FINAL PLAT FOR FILING NO. 2, $346,420 IS OWED TO THE CITY OF COLORADO SPRINGS FOR DRAINAGE FEES HOWEVER, THE DEVELOPER HAS $972,129.16 OF CREDIT FOR MOUNTAIN VISTA FILING NO. 1 (SEE PREVIOUS PAGES). THEREFORE A BALANCE OF $625,709.22 OF CREDIT IS LEFT OVER FOR DRAINAGE FEES.**

MOUNTAIN VISTA RANCH FILING NO. 2
Construction Cost Opinion

NON-REIMBURSABLE COST

)RAINAGE COSTS

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	REIMBURSABLE COST
18" RCP	LF	435	$35	$15,225	$0
24" RCP	LF	176	$45	$7,920	$0
30" RCP	LF	307	$65	$19,955	$0
54" FES	EA	1	$3,500	$3,500	$0
18" BEND	EA	3	$700	$2,100	$0
30" BEND	EA	2	$1,200	$2,400	$0
TYPE 1 MANHOLE	EA	2	$6,000	$12,000	$0
TYPE 2 MANHOLE	EA	1	$2,500	$2,500	$0
6' D-10-R INLET	EA	1	$6,000	$6,000	$0
10' D-10-R INLET	EA	4	$10,000	$40,000	$0
INTERIM DET. POND #P1	EA	1	$10,000	$10,000	$0
			SUBTOTAL	$121,600	$0
		10%	ENGINEERING AND CONTINGENCIES	$12,160	$0
			TOTAL	**$133,760**	**$0**

DBPS COST OPINIONS AND MAPS

MASTER DEVELOPMENT DRAINAGE PLAN FOR MOUNTAIN VISTA RANCH

(FILING NO.1)

CONSTRUCTION COST OPINION PER DBPS

DRAINAGE FEE COMPARISON - FOR COST INCREASE (For Information Only)
1996 - 2008 DOLLARS

	1996	2008	DIFF	% INCREASE	MULTIPLIER
DRAINAGE	$4,895	$9,041	$4,146	185%	1.85
BRIDGE	$323	$568	$245	176%	1.76
POND LAND	$175	$1,070	$895	611%	6:11
POND FACILITY	$1,213	$2,744	$1,531	226%	2.26

Public Drainage Facilities (Reimbursable System per DBPS)*
Tributary Drainageway Conveyance Cost Estimate (pg. 74 DBPS)

ITEM	SEGMENT / DESCRIPTION	QUANTITY	UNIT COST	GRADE CONTROLS	LENGTH	1996 REIM. COST	2008 REIM. COST
1.	31 - 100-YEAR RIP RAP	500	$ 205.00 /LF	4	120	$ 120,500.00	$ 222,561.90
	SUB-TOTAL					$ 120,500.00	$ 222,561.90

Drainageway Conveyance Cost Estimate (pg. 69 DBPS)

ITEM	SEGMENT / DESCRIPTION	QUANTITY	UNIT COST	GRADE CONTROLS	LENGTH	1996 REIM. COST	2008 REIM. COST
1.	33 - 10-YEAR RIP RAP	1814	$ 185.00 /LF	8	1280	$ 565,990.00	$ 1,045,376.01
	SUB-TOTAL					$ 565,990.00	$ 1,045,376.01

Roadway Culvert Crossing Cost Estimate (pg. 78 DBPS)

ITEM	DESCRIPTION	QUANTITY	UNIT COST	COST	1996 REIM. COST	2008 REIM. COST
1.	Barnes Road - 8'Hx8'W CBC	250	$ 400.00 /LF	$ 100,000.00	$ 100,000.00	$ 184,698.67
	SUB-TOTAL				$ 100,000.00	$ 184,698.67
	SUB-TOTAL REIMBURSABLE DRAINAGE FACILITY COSTS PER DBPS				$ 786,490.00	$ 1,452,636.59

Public Bridge Facilities (Reimbursable System per DBPS)*
Bridge Crossing Cost Estimate (pg. 84 DBPS)

ITEM	DESCRIPTION	QUANTITY	UNIT COST	COST	1996 REIM. COST	2008 REIM. COST
1.	* Barnes Road - 2-10'Hx12'W CBC	0	$ 1,100.00 /LF	$ 0.00	$ 0.00	$ 0.00
	SUB-TOTAL				$ 0.00	$ 0.00
		* TO BE INSTALLED BY BLR WITH POND #96 CONSTRUCTION				
	SUB-TOTAL REIMBURSABLE BRIDGE FACILITY COSTS PER DBPS				$ 0.00	$ 0.00
	TOTAL REIMBURSABLE DRAINAGE COSTS PER DBPS				$ 786,490.00	$ 1,452,636.59
	10% ENGINEERING				$ 78,649.00	$ 145,263.66
	5% CONTINGENCY				$ 39,324.50	$ 72,631.83
	TOTAL REIMBURSABLE DRAINAGE COSTS PER DBPS				$ 904,463.50	$ 1,670,532.07

MASTER DEVELOPMENT DRAINAGE PLAN FOR MOUNTAIN VISTA RANCH

(FILING NO.2)

CONSTRUCTION COST OPINION PER DBPS

DRAINAGE FEE COMPARISON - FOR COST INCREASE (For Information Only)
1996 - 2008 DOLLARS

	1996	2008	DIFF	% INCREASE	MULTIPLIER
DRAINAGE	$4,895	$9,041	$4,146	185%	1.85
BRIDGE	$323	$568	$245	176%	1.76
POND LAND	$175	$1,070	$895	611%	6.11
POND FACILITY	$1,213	$2,744	$1,531	226%	2.26

Public Drainage Facilities (Reimbursable System per DBPS)*
Tributary Drainageway Conveyance Cost Estimate (pg. 74 DBPS)

ITEM	SEGMENT / DESCRIPTION	QUANTITY	UNIT COST	GRADE CONTROLS	LENGTH	1996 REIM. COST	2008 REIM. COST
1.	31 - 100-YEAR RIP RAP	1300	$ 205.00 /LF	4	120	$ 284,500.00	$ 525,467.72
	SUB-TOTAL					$ 284,500.00	$ 525,467.72
	SUB-TOTAL REIMBURSABLE DRAINAGE FACILITY COSTS PER DBPS					$ 284,500.00	$ 525,467.72
	TOTAL REIMBURSABLE DRAINAGE COSTS PER DBPS					$ 284,500.00	$ 525,467.72
	10% ENGINEERING					$ 28,450.00	$ 52,546.77
	5% CONTINGENCY					$ 14,225.00	$ 26,273.39
	TOTAL REIMBURSABLE DRAINAGE COSTS PER DBPS					$ 327,175.00	$ 604,287.88

The major portion of segment 31 improvements are no longer needed since Filing No. 2 reimbursable improvements (totaling $27,335) are conveying the flows of segment 31 to the south.

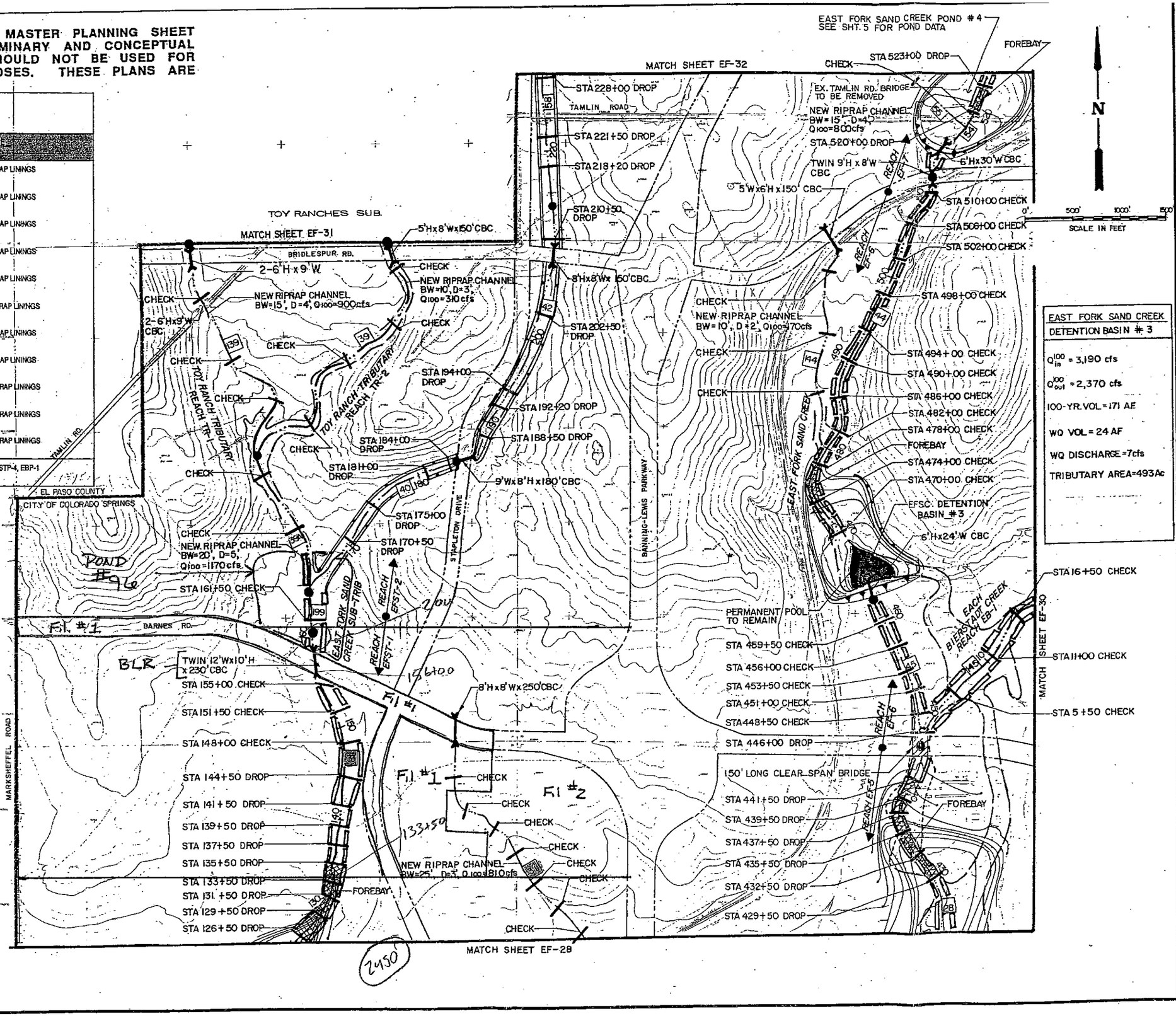
The northern portion of segment 31 anticipated flows are being redirected by a 54" RCP in Barnes Road to the pond with the development of this property. Therefore, a portion of segment 31 reimbursable facilities can be credited to Mountain Vista Ranch Filing No. 1 drainage improvements, instead of Filing No. 2.

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES. THESE PLANS ARE SUBJECT TO CHANGE.

CHANNEL IMPROVEMENTS

SEGMENT NO.	BOTTOM WIDTH (FT)	CHANNEL TYPE
26	65	10-YEAR RIPRAP LININGS 2' DEPTH
45	70	10-YEAR RIPRAP LININGS 2' DEPTH
44	80	10-YEAR RIPRAP LININGS 2' DEPTH
54	110	10-YEAR RIPRAP LININGS 4' DEPTH
145	195	10-YEAR RIPRAP LININGS 2' DEPTH
31	25	100-YEAR RIPRAP LININGS 3' DEPTH
33	155	10-YEAR RIPRAP LININGS 2' DEPTH
199	80	10-YEAR RIPRAP LININGS 2' DEPTH
40	90	100-YEAR RIPRAP LININGS 3' DEPTH
42	90	100-YEAR RIPRAP LININGS 3' DEPTH
58	10	100-YEAR RIPRAP LININGS 5' DEPTH

FOR PROFILE SEE SHEETS EFP-8, EFP-9, EFP-10, STP-3, STP-4, EBP-1



EAST FORK SAND CREEK DETENTION BASIN # 3

Q_{in}^{100} = 3,190 cfs

Q_{out}^{100} = 2,370 cfs

100-YR VOL = 171 AF

WQ VOL = 24 AF

WQ DISCHARGE = 7cfs

TRIBUTARY AREA = 493Ac

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

EAST FORK SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLANS

Project No.	88.11.23
Date:	6/89
Design:	JYC
Drawn:	EAK
Check:	
Revisions:	

EF-29

DRAINAGE MAP