MASTER DEVELOPMENT DRAINAGE PLAN
AND FINAL DRAINAGE REPORT
FOR
CREEKSIDE AT ROCKRIMMON
FILING NO. 1

J·R ENGINEERING

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A Westrian Company

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT FOR CREEKSIDE AT ROCKRIMMON FILING NO. 1

March 2008
Revised July 2008
Revised September 2008
Revised December 2008

Prepared For:

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DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Aaron B. Egbert, Colorado P.E. # 34208 — Date: 12-11-08
For and On Behalf of JR Engineering, LLC

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

Business Name: Housing Partners, Inc.

By:

Title: Proj Man.

Address: 1880 Office Club Point, Ste. 2000

Colorado Springs, CO 80920

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

City Engineer — Date: 2/5/09

Conditions:

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MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT FOR CREEKSIDE AT ROCKRIMMON FILING NO. 1

PURPOSE

This document is the Master Development Drainage Plan and Final Drainage Report for Creekside at Rockrimmon Filing No. 1, located on unplatted lots and tracts of land being a portion of Lot 3 Rockrimmon Vista Filing No. 2 and Lot 2 Colorado Springs Technological Center North Fil. No. 1 along the north-line of South Rockrimmon Boulevard. The purpose of this report is to identify on-site drainage patterns and to safely route developed stormwater runoff to adequate outfall facilities.

GENERAL DESCRIPTION

Creekside at Rockrimmon Filing No. 1 is a 44-acre site located in the west half of Section 18, Township 13 South, Range 66 West and the east half of Section 13, Township 13 South, Range 67 West of the Sixth Principal Meridian, in the City of Colorado Springs, County of El Paso, State of Colorado. See the vicinity map in the appendix. The site is bounded to the west by Saddle Ridge Sub. Fil. No. 1, to the east by future Wildgrass Filing No. 1, to the south by South Rockrimmon Boulevard, and to the north by the Retreat at Rockrimmon, Rockrimmon Vista Fil. No. 1, Saddle Ridge Sub. Fil. No. 2, and an unplatted tract. This project lies within the Rockrimmon North Drainage Basin. This site currently consists of vacant land which will all be zoned "PUD HS SS" (Planned Unit Development, Hillside, Stream Side).

The soils within the proposed site consist mainly of Chaseville-Midway complex (Soil Map Unit No. 18) and a small portion of Razor clay loam (Soil Map Unit No. 73) as determined by the "Soil Survey of El Paso County Area, Colorado" prepared by the U.S.D.A. Soil Conservation Service, now known as the Natural Resources Conservation Service. See the soils map in the appendix. Chaseville-Midway complex is considered Hydrologic Soil Group 'A'. Razor clay loam is considered Hydrologic Soil Group 'C'.

EXISTING DRAINAGE CONDITIONS

The existing site slopes to the southeast and contains native grasses and trees. The site drains into the existing channel that runs along the northerly boundary of the property. Stormwater is conveyed southeast in said existing channel. The existing channel has natural sandstone formations that provide channel stability, however outside bend erosion still occurs in the channel. In past drainage reports, the City suggested that the channel should remain as natural as possible and protect as many adjacent existing trees as possible.

Surrounding properties and roadway convey sheet flow and discharge pipe flow onto the site historically. South Rockrimmon Boulevard has several storm sewer pipes that historically discharge into existing swales on the site, and continues down to the existing channel. Saddle Ridge Sub. Fil. No. 1 has an existing sump inlet that historically discharges into existing storm sewer pipe, into an existing swale on-site, and continues down to the existing channel. The back lots of Saddle Ridge Sub. Fil. No. 1, Saddle Ridge Sub. Fil. No. 2, Retreat at Rockrimmon, and Rockrimmon Vista Fil. No. 1 historically sheet flow into existing swales, and continue down to the existing channel. Stormwater from Lot 1 Colorado Springs Technological Center North Filing No. 1 historically flows into an existing sump inlet, into existing storm sewer, and into the existing channel. Stormwater will continue to be routed through the site to the historic destination of the existing channel.

Several storm sewer pipes that convey stormwater under or from South Rockrimmon Boulevard have been analyzed in their respective drainage reports, and those analyses are used in this report. Subbasins 2, 4, and C in the "Bridgeport Subdivision Drainage Report" drain to an existing grated sump inlet adjacent to the south-line of South Rockrimmon Boulevard and Saddle Ridge Sub. Fil. No. 1, to existing 24" RCP, and into an existing swale on-site. Basins A through C and H in the "Rockrimmon Apartments Drainage Plan and Report" drain to existing 6' D10-R inlets (designed for the 5-year storm event) in the apartment's access drive adjacent to the south-line of South Rockrimmon Boulevard, to existing 18" RCP, combine with flows from existing D10-R inlets in South Rockrimmon Boulevard, and into an existing swale on-site. Basins D through G in the "Rockrimmon Apartments Drainage Plan and Report" drain to existing 6' D10-R inlets (designed for the 5-year storm event) in the apartment's access drive adjacent to the southwest-line of South Rockrimmon Boulevard (southeast of Basins A and H), to existing 18" RCP, combine with flows from existing D10-R inlets in South Rockrimmon Boulevard, and into an existing swale on-site. The analyses from the respective off-site reports were updated, as necessary, to reflect the currently used intensity values and minimum 5 minute time of concentration.

The "Final Drainage Study, Rockrimmon Boulevard" analyzes flowrates into the existing D10-R's in the street, and several drainage reports approved thereafter have analyzed the respective contribution to those inlets and piping systems. Inlet #1 captured stormwater confluences with inlet #2 stormwater, which then confluences with stormwater from Basins A through C and H in the "Rockrimmon Apartments Drainage Plan and Report". Inlet #1 is a 6' D10-R in sump condition located on the south-line of South Rockrimmon Boulevard that also captures stormwater from Basins AA and BB in the "Rockrimmon Apartments", Basins B, 1 and 3 in the "Bridgeport Subdivision Drainage Report", and Basin E in the "Drainage Plan and Report, Rockridge Senior Housing". Inlet #2 is a 6' D10-R in sump condition located on the north-line of South Rockrimmon Boulevard. Stormwater from Basins D through G in the "Rockrimmon Apartments Drainage Plan and Report" confluences with inlet #4 captured stormwater, which then confluences with inlet #5 stormwater. Inlet #4 is a 4' D10-R on-grade located on the southwest-line of South Rockrimmon Boulevard and also receives stormwater from Basin CC in the "Rockrimmon Apartments". Inlet #5 is a 4' D10-R on-grade located on the north-line of South Rockrimmon Boulevard. The analyses from the respective off-site reports were updated, as necessary, to reflect the currently-used intensity values, Rational Method for basins under 100 acres, and minimum 5 minute time of concentration.

The lots of the adjacent single-family subdivisions have been analyzed in their respective drainage reports, and those analyses are used in this report. Basin D in the "Final Drainage Report and Plan for the Retreat at Rockrimmon" single family back-lots sheet flow on to this report's Basin A3. Basin E in the "Final Drainage Report Addendum for Rockrimmon Vista Filing No. 1 (the Retreat at Rockrimmon)" single-family back-lots sheet flow on to this report's Basin A1. The back lots in the "Final Drainage Study, Saddle Ridge Filing 1 and 2" were not studied, and the area was combined with Basin E in the "Final Drainage Report Addendum for Rockrimmon Vista Filing No. 1 (the Retreat at Rockrimmon)" to determine single family back-lots sheet flow on to this report's Basin A1. Basins B-1 and B-2 in the "Final Drainage Study, Saddle Ridge Filing 1 and 2" single family lots drain to an existing 4' D10-R sump inlet at the cul-de-sac of Ocelot Drive, existing 18" RCP, and into an existing swale on-site in this report's Basin A1. Basin A2 in the "Colorado Springs Technological Center North Filing No. 1, Colorado Springs, Colorado" drainage report analyzes stormwater from Lot 1 Colorado Springs Technological Center North Filing No. 1 that historically flows into an existing 10' D10-R sump inlet, into 18" RCP, and into the existing channel. The analyses from the respective off-site reports were updated, as necessary, to reflect the currently used intensity values and minimum 5 minute time of concentration.

Existing conditions on-site were initially analyzed to the existing pond near the cul-de-sac bulb of Perfect View in the Retreat at Rockrimmon. The intent of the analysis was to assure similar flowrates after development. Existing basin EX 1 flows to Design Point EX1 at the existing pond and releases through an existing elliptical 72"X54" CMP. Based on the analysis, the existing pond will receive almost identical amounts of stormwater flow after development.

The remaining portion of the site, existing basin EX 2, was analyzed during existing conditions as well. Existing basin EX 2 flows to the southeast corner of the site at Design Point EX2. The flows at Design Point EX2 are expected to be similar after development, since the overall basin is rather large and the delays in routing through the water quality features such as the Extended Detention Basin will slow runoff further. The individual drainage reports for the individual developments within the site will address the specifics of the water quality features.

PROPOSED DRAINAGE CONDITIONS

As currently planned, the mixed-use site will consist of single-family lots, multi-family lots, and commercial lots. The single-family lots will be located in the west third of the site on 17 acres. The multi-family lots will be located in the middle third of the site on 11 acres. The commercial lots will be located in the east third of the site on 15 acres. Appropriate landscape buffers will be provided between the different land uses and adjacent to the existing channel.

Basin A1 consists of future single-family lots and a future tract containing existing sanitary sewer in the northeast corner of the site. An existing pipe from Basins B-1 and B-2 in the "Final Drainage Study, Saddle Ridge Filing 1 and 2" single family lots, the back lots in the "Final Drainage Study, Saddle Ridge Filing 1 and 2", and Basin E from in the "Final Drainage Report Addendum for Rockrimmon Vista Filing No. 1 (the Retreat at Rockrimmon)" drain into Basin A1. Basin A1 will flow to Design Point 1.

Basin A2 consists of future single-family lots and drains to the north corner of the intersection of the future access drive and the future road servicing the future single-family lots. Basin A2 will flow to Design Point 2. Historically, an existing pipe draining Subbasins 2, 4, and C in the "Bridgeport Subdivision Drainage Report" outlets to Basin A2 at Analysis Point EX103 and will be rerouted to the proposed storm sewer system at Analysis Point 200.

Basin A3 consists of future single-family lots just south of Rockrimmon Vista Filing No. 1. Basin D in the "Final Drainage Report and Plan for the Retreat at Rockrimmon" single family back-lots drain on to Basin A3. Basin A3 will flow to Design Point 3.

Basin A4 consists of future single-family lots and drains to a proposed sump inlet at Design Point 4, then through proposed storm sewer, to Analysis Point 100 at an existing swale in Basin A5. Stormwater from Design Points 1 through 3, and 6 join with the stormwater from Basin A4 at Design Point 4. Stormwater captured by the proposed sump inlet at Design Point 4 will be conveyed by proposed storm sewer to Analysis Point 100.

Basin A5 consists of future single-family lots and a future open space tract containing existing sanitary sewer and drains to an existing 72"x54" elliptical CMP pipe near the southeast corner of the Retreat at Rockrimmon. Basin A5 will flow to Design Point 5. Stormwater from Analysis Point 100 will discharge into a proposed forebay prior to the existing wetlands and then joins with the stormwater from Basin A5 at Design Point 5.

Basin A6 consists of future single-family lots and drains to the south corner of the intersection of the future access drive and the future road servicing the future single-family lots. Basin A6 will flow to Design Point 6.

Basin A7 consists of future single-family lots, a future tract containing landscape buffer, and part of a future multi-family lot and drains to a proposed sump inlet at Design Point 7. Basin A7 will flow to Design Point 7. Historically, existing pipes draining Basins A through C and H in the "Rockrimmon Apartments Drainage Plan and Report" (at Analysis Point EX101) and Inlets #1 & 2 in the "Final Drainage Study, Rockrimmon Boulevard" (at Analysis Point EX100), as well as Basins D through G in the "Rockrimmon Apartments Drainage Plan and Report" and Inlets #4 & 5 in the "Final Drainage Study, Rockrimmon Boulevard" (at Analysis Point EX104), outlets to Basin A7, and will be rerouted to the proposed storm sewer system at Analysis Pont 101. Historically, Analysis Point EX101 stormwater confluences with Analysis Point EX100 stormwater at Analysis Point EX102. Proposed storm sewer at Analysis Point 200 confluences with proposed storm sewer from rerouted Analysis Point EX100 at Analysis Point 201 proposed storm sewer. Proposed storm sewer at Analysis Point 201 confluences with proposed storm sewer from rerouted Analysis Point EX101 at Analysis Point 202 proposed storm sewer. Analysis Point 202 proposed storm sewer and proposed storm sewer from rerouted EX104 join with stormwater captured from Design Point 7 at Analysis Point 101.

Basin A8 consists of future single-family lots and drains to a proposed sump inlet at Design Point 8. During the 100-year storm event, some minor overtopping of the crown allows a small amount of stormwater from Design Point 7 to flow over to Design Point 8, thereby allowing flow equalization in sump condition. Design Point 8 stormwater joins with Analysis Point 101 stormwater, flows to a proposed water quality pond, to Analysis Point 102 proposed storm sewer and into the existing channel.

Basin A9 consists of part of a future multi-family lot and drains to a proposed sump inlet at Design Point 9. Emergency overflow for the inlet will continue to the adjacent Design Point 7. Design Point 9 stormwater is conveyed through proposed storm sewer to Analysis Point 101, after confluencing with other proposed storm sewer as discussed previously with Basin A7, confluences with stormwater from Design Point 8, and discharges into a proposed water quality pond before reaching Analysis Point 102.

Basin A10 consists of open space adjacent to the existing channel and drains to the southeast corner of the site. The great majority of Basin A10 sheet flows to the existing channel. Basin A10 will flow to Design Point 10. Outside bend protection of the existing channel will occur in Basin A10 under the direction of approved construction documents for the individual developments.

Basin A11 consists of part of a future multi-family lot and drains to a proposed sump inlet at Design Point 11. Emergency overflow for the inlet will continue around the proposed retaining wall and into the existing channel. Stormwater captured by the proposed sump inlet at Design Point 11 will be conveyed by proposed storm sewer to a proposed water quality pond, to Analysis Point 103 and to the existing channel.

Basin A12 consists of part of a future multi-family lot, part of a future tract containing landscape buffer, and part of commercial lots. Basin A12 drains to a proposed on-grade inlet at Design Point 12, just prior to the southwest corner of the intersection of the site's internal access drive with the proposed extension of Tech Center Drive. Bypass from the proposed on-grade inlet at Design Point 12 will continue down the street to Design Point 17. Stormwater captured by the proposed on-grade inlet at Design Point 12 confluences with stormwater captured at Design Point 14 in proposed storm sewer and will be conveyed by proposed storm sewer to the proposed on-grade inlet at Design Point 13 across the street.

Basin A13 consists of mostly street and drains to a proposed on-grade inlet at Design Point 13, just prior to the north corner of the intersection of the site's internal access drive with the proposed extension of Tech Center Drive. During the 100-year storm event, some minor overtopping of the crown allows a small amount of stormwater from Basin A12 to flow over to Basin A13, thereby allowing some flow equalization prior to the on-grade inlets at Design Points 12 and 13. Bypass from the proposed on-grade inlet at Design Point 13 will continue down the street to Design Point 17. Stormwater captured by the proposed on-grade inlet at Design Point 13 confluences with stormwater captured at Design Points 12 and 14 and will be conveyed by proposed storm sewer to Analysis Point 104 at the existing channel.

Basin A14 consists of part of a future tract containing landscape buffer and part of commercial lots and drains to a proposed sump inlet at Design Point 14. Emergency overflow for the inlet will continue to the adjacent Design Point 12. As discussed previously with Basins 12 and 13, the stormwater captured by the proposed sump inlet at Design Point 14 continues in proposed storm sewer to the proposed on-grade inlet at Design Point 12, to the proposed on-grade inlet at Design Point 13, into a proposed water quality pond, and ultimately discharging at Analysis Point 104.

Basin A15 consists of part of commercial lots and drains to a proposed sump inlet at Design Point 15. Emergency overflow for the inlet will continue to the existing channel. Stormwater captured by the proposed sump inlet at Design Point 15 is conveyed to a proposed water quality pond, to Analysis Point 104 and to the existing channel.

Basin A16 consists of part of a tract containing landscape buffer and drains southwest to South Rockrimmon Boulevard. Historically this basin has drained to the existing street and no development is proposed on Basin A16. Basin A16 will flow to Design Point 16 and continue to sheet flow onto South Rockrimmon Boulevard and on to an existing 12' long on-grade curb-opening inlet prior to the intersection with Tech Center Drive.

Basin A17 consists of open space and part of the proposed extension of Tech Center Drive. Bypass from Design Points 12 and 13 on-grade inlets flow onto Basin A17. Basin A17 will flow to a proposed sump inlet at Design Point 17. Proposed storm sewer will extend from the proposed sump inlet at Design Point 17 to the existing 10' D-10R sump inlet at Design Point 18, and the captured stormwater will continue to the existing channel in the existing 18" RCP pipe.

Basin A18 consists of part of a commercial lot and part of the proposed extension of Tech Center Drive that drains to an existing 10' D-10R sump inlet at Design Point 18. Basin A2 in the "Colorado Springs Technological Center North Filing No. 1, Colorado Springs, Colorado" drainage report historically flows into the existing 10' D10-R sump inlet at Design Point 18. During the 100-year storm event, some minor overtopping of the crown allows a small amount of stormwater from Design Point 17 to flow over to Design Point 18, thereby allowing flow equalization in sump condition. Stormwater captured from the existing sump inlet at Design

Point 18 confluences with the proposed storm sewer extending from the proposed sump inlet at Design Point 17, and is conveyed in existing 18" RCP pipe to the existing channel.

Basin A19 consists of part of a commercial lot and drains to the east corner of the site. Basin A19 will flow to a proposed sump inlet at Design Point 19, through proposed storm sewer to a proposed water quality pond, and to Analysis Point 106 at the existing channel.

Basin A20 consists of part of a commercial lot and drains to a proposed water quality feature and into a proposed sump inlet at Design Point 20. Emergency overflow for the inlet will outlet to the proposed extension of Tech Center Drive and continue down to Design Point 18. Stormwater captured by the proposed sump inlet at Design Point 20 is conveyed to the existing channel at Analysis Point 107.

The storm sewer systems were designed for the 100-year storm event. The preliminary design for the storm sewer was analyzed using Manning's equation in the FlowMaster software. The stormwater on-site will flow to the existing channel. The private water quality features, as required for the individual developments on-site in their respective final drainage plans and construction documents, are to be owned and maintained by the property owner(s). Possible locations of the private water quality features are located on the drainage plan. The preliminary calculations for the water quality features are located in the appendix, and further analysis will be provided in the final drainage reports for individual developments within the site. Refer to the hydrologic calculations, drainage plan and hydraulic calculations in the appendix for the proposed storm sewer system.

The existing channel will require improvements, including outside bend protection. The preliminary locations of the outside bend armoring are located on the drainage plan, and are discussed further in the "Preliminary Design Report for Creekside at Rockrimmon Filing No. 1 Channel Improvements," prepared by JR Engineering (Job# 29760.05). Channel improvements are currently proposed with the North Drainageway Design Report for Wildgrass Filing No. 1. Some deliberation as to the final details of the Wildgrass channel improvements is in progress and the outcome will determine this project's contribution to continuing the channel improvements upstream. Access for the channel will be provided in conjunction with a pedestrian trail alongside the channel. If the channel is public then it needs to be dedicated to the City.

An existing wetland is located within Basin A5. The existing wetland area is not to be disturbed without prior permission of the U.S. Army Corps of Engineers (USACE). The stormwater from the development must undergo water quality measures prior to the wetland area, so that any potential silt, sand or debris will not damage the wetland. A proposed forebay will provide the opportunity for the silt, sand and debris to settle out before the stormwater reaches the wetland area. The forebay design in the City's Drainage Criteria Manual Volume 2, "Design Procedure Form: Constructed Wetland Basin (CWB) - Sedimentation Facility" is proposed for this water quality measure.

An analysis is being performed to see if the wetland area will increase for the purposes of wetland mitigation. According to the "Preliminary Conceptual Mitigation Plan, Rockrimmon Development, Northwest of South Rockrimmon Bouleward and Tech Center Drive," prepared by Terracon and dated November 21, 2007, "The deeply incised channel [that enters the western portion of the site from the south under Rockrimmon Boulevard] may or may not be considered a Waters of the U.S. by the USACE." If the deeply incised channel is considered regulated, then mitigation would occur adjacent to the existing wetland. Any disturbance of regulated wetlands will warrant a 404 Permit being obtained for this project.

Overlot grading of the entire site is currently proposed. Three (3) public drainage systems currently discharge onto the site. The discharge location of the public drainage systems are below the proposed grade. If the site is overlot graded, then the extensions of the public drainage systems will need to be installed.

The preliminary geologic hazard report prepared by CTL|Thompson recommended that valley drains be installed. The valley drains would mitigate the excess groundwater resulting from fills more than 10' thick over the existing drainageways formed by the public drainage systems' discharge onto the site. Based on the valley drain detail from the geotechnical engineer, the proposed valley drain will consist of a sand and gravel gradation surrounded by nonwoven subsurface drainage geotextile. The proposed valley drain outfall location is labeled on the drainage plan. Maintenance of the system will not be required.

DETAILED DISCUSSION FOR FINAL DRAINAGE REPORT

The Planned Unit Development, as currently planned, is a mixed-use site. The various uses will consist of single-family lots, multi-family lots, and commercial lots. The single-family lots are located adjacent to the existing similar-sized single-family lots. The commercial lots are located adjacent to the existing commercial lot. The surrounding land is fully developed with the exception of the existing channel.

Distinct areas of open space are provided throughout the proposed development. Open space will provide a landscape buffer that separates the different land uses. Open space is also located along the existing channel. Landscaping areas are located within the individual site developments as well.

The single-family residential lots will be located in the west portion of the site on 17 acres. Approximately the north half of the residential lots are located within Hydrologic Soil Group 'C' and the south half within Hydrologic Soil Group 'A'. The single-family lots' runoff calculations were based on 1/8-acre residential lots. This residential area is considered 65% impervious for purposes of preliminary water quality feature calculations. These assumptions match the existing adjacent residential developments.

The multi-family lots will be located in the middle portion of the site on 11 acres within Hydrologic Soil Group 'A'. The proposed condominium lot is located within Basin A11 and the runoff calculations were based on that of business in neighborhood areas, since the impervious percentage matches that planned. This multi-family condominium area is considered 70% impervious for purposes of preliminary water quality feature calculations. These assumptions match the planned impervious area, since the lot is more impervious than residential 1/8 acre or less and about 30% of the area will be landscaping regardless of the current planned area.

The commercial lots will be located in the east portion of the site on 15 acres within Hydrologic Soil Group 'A'. The runoff calculations proposed commercial lots within Basins A14, A15, A18 and A20 were based on that of business in neighborhood areas. Businesses in neighborhood areas are considered 70% impervious for purposes of preliminary water quality feature calculations. The runoff calculations for the proposed commercial lot within Basin A19 were based on 80% impervious area. These assumptions match the land use for imperviousness of business in neighborhood areas, and between business in neighborhood areas and business in commercial areas.

EROSION CONTROL PLAN

The City of Colorado Springs Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan and cost estimate be submitted in conjunction with the Grading and Erosion Control Plan and construction assurances posted prior to obtaining a grading permit.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in October 1991 and November 1994. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5- and 100-year recurrence intervals. Intensity equations assume a minimum travel time of 5 minutes. See the hydrologic calculations in the appendix.

FLOODPLAIN STATEMENT

Portions of this site are within a designated F.E.M.A. floodplain, as determined by the Flood Insurance Rate Map for El Paso County, Colorado and Incorporated Areas, Community Panel Number 08041CO512 F, effective date March 17, 1997. The designated floodplain is along the northerly boundary of the site within and adjacent to the existing channel, as shown on the drainage plan and floodplain map in the appendix.

CONSTRUCTION COST OPINION

Private Storm System (For Information Only):

Item	Description	Quantity	Unit Cost	Cost
1.	18" RCP	766 LF	$35/LF	$ 26,810.00
2.	24" RCP	438 LF	$40/LF	$ 17,520.00
3.	30" RCP	243 LF	$45/LF	$ 10,935.00
4.	36" RCP	138 LF	$50/LF	$ 6,900.00
5.	18" FES	3 EA	$450/EA	$ 1,350.00
6.	24" FES	3 EA	$525/EA	$ 1,575.00
7.	30" FES	2 EA	$575/EA	$ 1,150.00
8.	36" FES	1 EA	$625/EA	$ 625.00
9.	4' D10-R inlet	6 EA	$2,500/EA	$ 15,000.00
10.	6' D10-R inlet	2 EA	$3,500/EA	$ 6,000.00
11.	18' D10-R inlet	1 EA	$5,500/EA	$ 5,500.00
12.	20' D10-R inlet	2 EA	$6,000/EA	$ 12,000.00
13.	10' D9 inlet	1 EA	$4,000/EA	$ 4,000.00
14.	Outlet Structure	4 EA	$3,000/EA	$ 12,000.00
15.	Water Quality Feature - EDB	830 CY	$5/CY	$ 4,150.00
16.	Water Quality Feature - PLD	84 SY	$60/SY	$ 5,040.00
17.	Water Quality Feature - forebay	4 CY	$200/CY	$ 800.00
			Sub-Total	$ 131,355.00
		15% Engineering & Contingencies		$ 19,703.00
			TOTAL	**$ 151,058.00**

Public Storm System:

Item	Description	Quantity	Unit Cost	Cost
1.	18" RCP	663 LF	$35/LF	$ 11,934.00
2.	24" RCP	21 LF	$40/LF	$ 840.00
3.	30" RCP	437 LF	$45/LF	$ 19,665.00
4.	36" RCP	401 LF	$50/LF	$ 20,050.00
5.	42" RCP	562 LF	$55/LF	$ 30,910.00
6.	30" FES	1 EA	$575/EA	$ 575.00
7.	42" FES	1 EA	$800/EA	$ 800.00
8.	Manhole	6 EA	$3,000/EA	$ 15,000.00
			Sub-Total	$ 99,774.00
		15% Engineering & Contingencies		$ 14,966.00
			TOTAL	**$ 114,740.00**

Public Drainage Facilities (Reimbursable):

Item	Description	Quantity	Unit Cost	Cost
1.	Earthwork (CIP)	24,137 CY	$2.50/CY	$ 60,343.00
2.	Clearing and Grubbing	4 AC	$1,600/AC	$ 6,400.00
3.	Grouted Boulder Drop	3 EA	$58,000/EA	$ 174,000.00
4.	Native Seeding	4 AC	$1,000/AC	$ 4,000.00
5.	Retaining Walls	3,522 SF	$34/SF	$ 119,748.00
6.	Boulders 4' Diameter	9 EA	$250/EA	$ 2,250.00
7.	Type M Riprap	1,760 CY	$80/CY	$ 140,800.00
8.	Mobilization	1 LS	$10,000/LS	$ 10,000.00
9.	Silt Fence	2,400 LF	$1.75/LF	$ 4,200.00
10.	Dewatering	1 LS	$30,000/LS	$ 30,000.00
11.	Install Willow Stakes	1,200 LF	$1.10/LF	$ 1,320.00
			Sub-Total	$ 553,061.00
			15% Engineering & Contingencies	$ 82,959.00
			TOTAL	**$ 636,020.00**

JR Engineering cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

The public storm system under and within South Rockrimmon Boulevard must be extended to the proposed storm system in Creekside at Rockrimmon Filing No. 1 in order to continue to discharge to the existing channel. The South Rockrimmon Boulevard public storm system extension adds to the amount of storm sewer that this development would otherwise not have to provide. Therefore, this public storm sewer extension was included in the cost estimate for the public storm system.

The following construction cost opinion for Wildgrass at Rockrimmon Filing No. 1 Public Drainage Facilities (Reimbursable) was included in case Phase I of this project adjacent to the channel is constructed prior to the Wildgrass portion adjacent to the channel. Phase I of this project includes the commercial lots and associated infrastructure. This drainage improvement will be completed as part of Phase I unless the Wildgrass development starts. The construction documents for this drainage improvement may vary from the approved report due to collaboration with the U.S. Army Corps of Engineers.

Wildgrass at Rockrimmon Filing No. 1 Public Drainage Facilities (Reimbursable):

Item	Description	Quantity	Unit Cost	Cost
1.	Grading	1 LS	$15,000/LS	$ 15,000.00
2.	6" Concrete Channel	590 LF	$300/LF	$ 177,000.00
3.	Redi-rock Walls	6,000 SF	$25/LF	$ 90,000.00
4.	Cutoff Walls	40 LF	$250/LF	$ 10,000.00
5.	Riprap	200 CY	$40/CY	$ 8,000.00
6.	6" Bedding	400 CY	$8/CY	$ 3,200.00
7.	Erosion Control	1 LS	$5,000/EA	$ 5,000.00
			Sub-Total	$ 308,200.00
		15% Engineering & Contingencies		$ 46,230.00
			TOTAL	**$ 354,430.00**

DRAINAGE AND BRIDGE FEES

This area lies within the Rockrimmon North Drainage Basin boundaries. Portions of the property are within previously-platted Lot 3 Rockrimmon Vista Filing No. 2 and Lot 2 Colo Spgs Technological Center North Fil. No. 1. Drainage fees are assessed for the unplatted portions of the property. Drainage fees in excess of reimbursable public facilities are collected at the time of the final plat recording. Drainage improvement reimbursements are provided by the City for public storm systems' cost in excess of the drainage fees for the basin.

Assessed fee: 36.25 acres unplatted x $4,593 drainage fee/acre = $166,496.25 drainage fee
Reimbursable: $636,020.00 public facilities
Drainage improvement credits: **$469,523.75** drainage credits

SUMMARY

Construction of this project will not adversely affect surrounding development. Developed flows from the site will drain to the existing channel. Final drainage reports will be required for individual developments within the site. This drainage report conforms to the master development drainage plans in the area and the drainage basin planning study.

PREPARED BY:

JR Engineering

Anna C. Sparks, PE
Project Lead Engineer

/9760.00/pre-fnl dr.doc

REFERENCES

1. "Hydrologic Engineering Study of the Rockrimmon North Drainage Basin" prepared by United Western Engineers, dated March 1973.

2. "Rockrimmon Drainage Basin Planning Study Alternative Analysis" prepared by Karicich and Weber, Inc., dated October 1990.

3. "Master Development Drainage Plan, Rockrimmon Vista Filing No. 2 & Final Drainage Report for Rockrimmon Vista Filing No. 2, Lot 3" prepared by Law & Mariotti Consultants, Inc., dated July 31, 2000, as revised May 15, 2001, and approved June 18, 2001.

4. "Master Development Drainage Plan for Rockrimmon Vista Subdivision and Preliminary & Final Drainage Report & Plan, Rockrimmon Vista Subdivision Filing No. 2" prepared by Leigh Whitehead & Associates, Inc., dated January 1996 and approved January 17, 1996.

5. "North Drainageway Design Report for Wildgrass Filing No. 1" prepared by Classic Consulting Engineers & Surveyors, dated July 2007 and revised September 2007.

6. "Final Drainage Report Addendum for Rockrimmon Vista Filing No. 1 (the Retreat at Rockrimmon)" prepared by JR Engineering, Ltd., dated October 1995 and approved November 7, 1995.

7. "Final Drainage Report and Plan for the Retreat at Rockrimmon" prepared by Leigh Whitehead & Associates, Inc., dated September 2002 and approved September 25, 2002.

8. "Final Drainage Study, Saddle Ridge Filing 1 and 2" prepared by Costin Engineering Company, dated November 21, 1983 and approved December 14, 1983.

9. "Bridgeport Subdivision Drainage Report" prepared by Polok Engineering, Inc., dated March 1984, revised June 15, 1984 and approved June 20, 1984.

10. "Rockrimmon Apartments Drainage Plan and Report" prepared by United Planning & Engineering Co., Inc., dated February 10, 1984 and approved March 7, 1984.

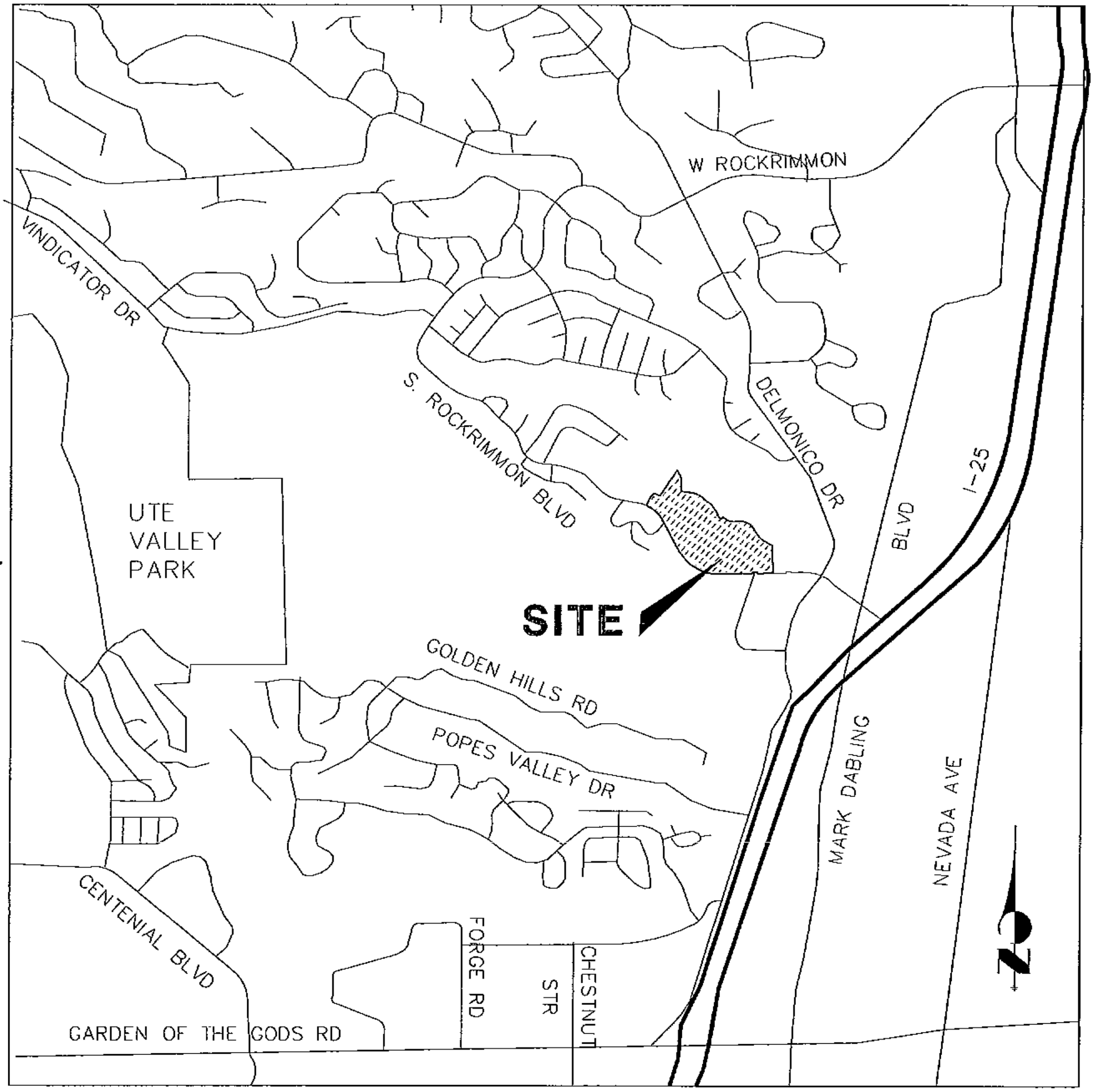
11. "Final Drainage Study, Rockrimmon Boulevard" prepared by Costin Engineering Company, dated December 2, 1983 and approved December 30, 1983.

12. "Drainage Plan and Report, Rockridge Senior Housing" prepared by Oliver E. Watts Consulting Engineer, dated November 20, 1985 and approved December 13, 1985.

13. "Colorado Springs Technological Center North Filing No. 1, Colorado Springs, Colorado" prepared by Claycomb Engineering Assoc., Inc., dated March 1987, as revised July 24, 1987, and approved August 3, 1987.

APPENDIX

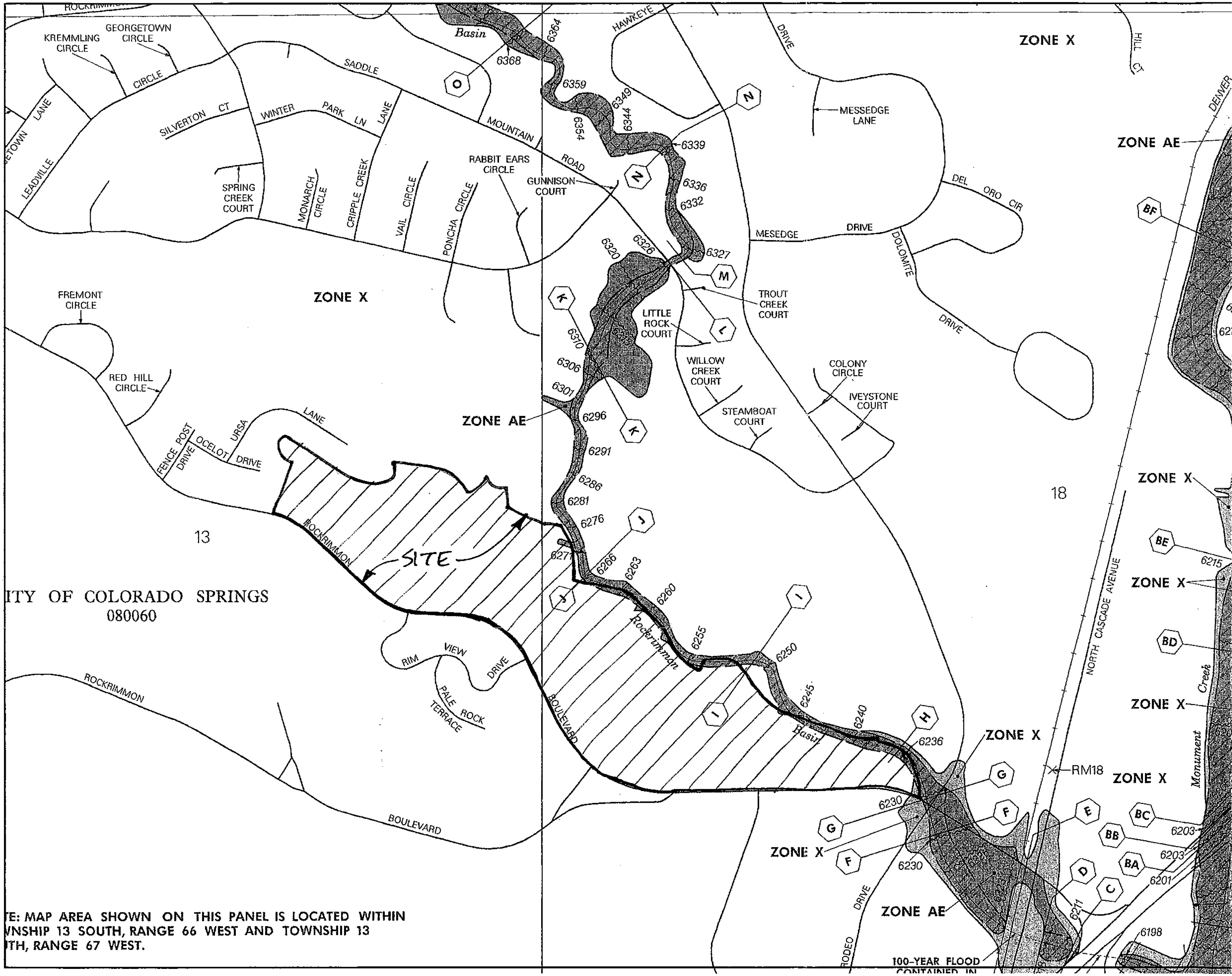
VICINITY MAP



VICINITY MAP

N.T.S.

FLOODPLAIN MAP



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 512 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0512	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0512	F

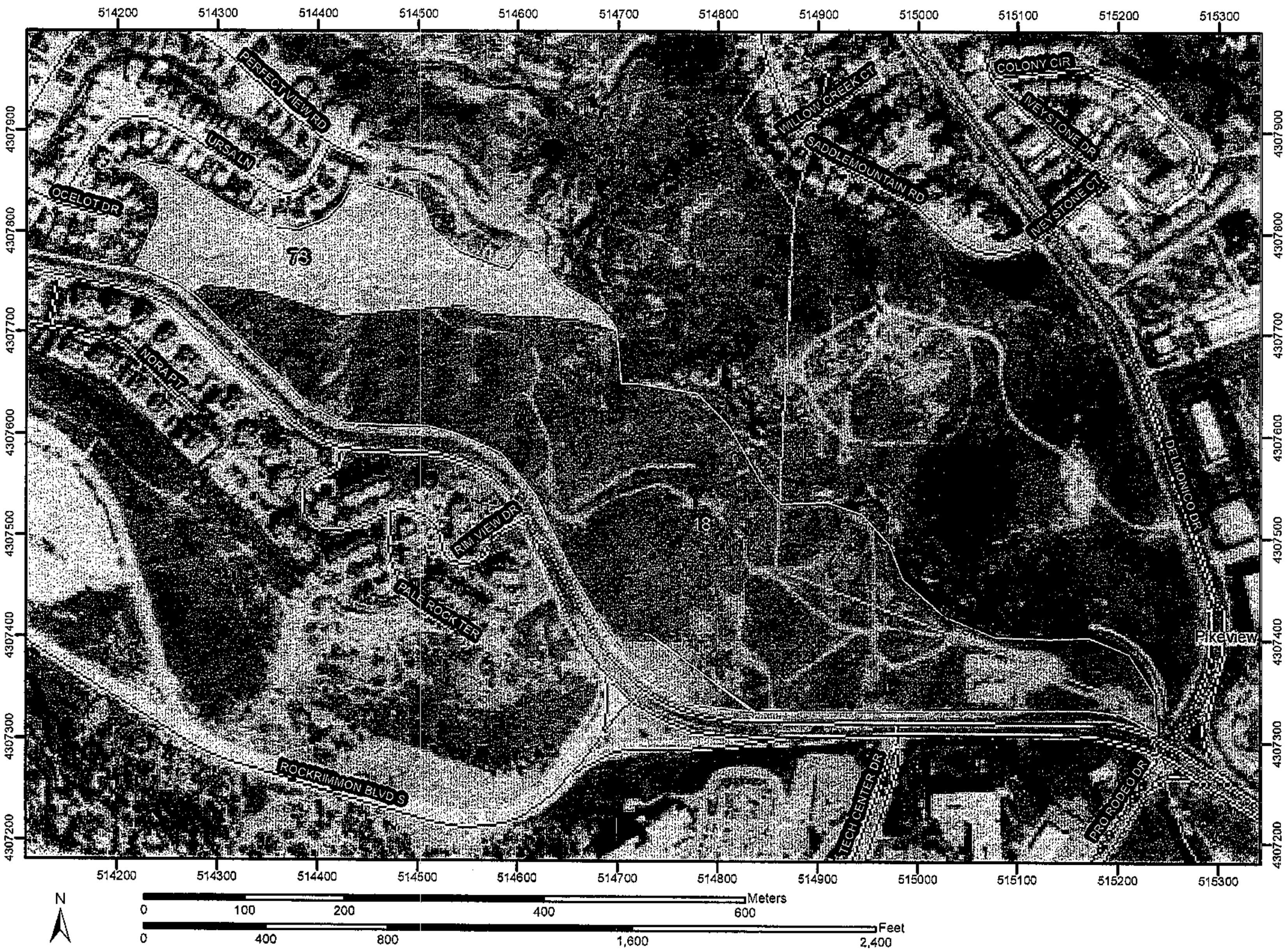
MAP NUMBER
08041C0512 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

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

SOILS MAP



514200
514300
514400
514500
514600
514700
514800
514900
515000
515100
515200
515300
4307900
4307800
4307700
4307600
4307500
4307400
4307300
4307200
PERFECT VIEW RD
URSA LN
OCELOT DR
73
NORA PT
RIM VIEW DR
PALE ROCK TER
ROCKRIMMON BLVD S
18
WILLOW CREEK CT
SADDLEMOUNTAIN RD
COLONY CIR
WEYSTONE DR
WEYSTONE CT
DELMONICO DR
Pikeview
TECH CENTER DR
PRO RODEO DR
N
0
100
200
400
600
Meters
0
400
800
1,600
2,400
Feet

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 5, Jan 15, 2008

Date(s) aerial images were photographed: 1999

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18	Chaseville-Midway complex	A	35.0	79.5%
73	Razor clay loam, 3 to 9 percent slopes	C	9.0	20.5%
Totals for Area of Interest (AOI)			44.1	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

HYDROLOGIC CALCULATIONS

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Area Runoff Coefficient Summary)

		STREETS / DEVELOPED			OVERLAND / UNDEVELOPED			WEIGHTED	
BASIN	TOTAL AREA *(Acres)*	AREA *(Acres)*	C_5	C_{100}	AREA *(Acres)*	C_5	C_{100}	C_5	C_{100}
A1	1.80	1.50	0.70	0.80	0.30	0.30	0.45	***0.63***	***0.74***
A2	0.73	0.73	0.70	0.80	0.00	0.30	0.45	***0.70***	***0.80***
A3	1.58	1.58	0.70	0.80	0.00	0.30	0.45	***0.70***	***0.80***
A4	0.52	0.52	0.70	0.80	0.00	0.30	0.45	***0.70***	***0.80***
A5	4.27	2.21	0.67	0.77	2.06	0.29	0.42	***0.49***	***0.60***
A6	2.11	2.11	0.66	0.76	0.00	0.28	0.41	***0.66***	***0.76***
A7	4.55	3.85	0.64	0.73	0.70	0.25	0.35	***0.58***	***0.67***
A8	1.38	1.38	0.65	0.74	0.00	0.25	0.35	***0.65***	***0.74***
A9	1.16	1.07	0.75	0.80	0.09	0.25	0.35	***0.71***	***0.77***
A10	9.24	0.50	0.60	0.70	8.74	0.25	0.35	***0.27***	***0.37***
A11	1.89	1.89	0.75	0.80	0.00	0.25	0.35	***0.75***	***0.80***
A12	4.47	2.81	0.75	0.80	1.66	0.25	0.35	***0.56***	***0.63***
A13	0.66	0.45	0.90	0.95	0.20	0.25	0.35	***0.70***	***0.76***
A14	2.95	2.25	0.75	0.80	0.57	0.25	0.35	***0.62***	***0.68***
A15	2.33	2.11	0.75	0.80	0.03	0.25	0.35	***0.68***	***0.73***
A16	0.83	0.00	0.90	0.95	0.83	0.25	0.35	***0.25***	***0.35***
A17	0.61	0.37	0.90	0.95	0.24	0.25	0.35	***0.64***	***0.71***
A18	0.33	0.33	0.75	0.80	0.00	0.25	0.35	***0.75***	***0.80***
A19	1.29	1.29	0.80	0.85	0.00	0.25	0.35	***0.80***	***0.85***
A20	1.00	1.00	0.75	0.80	0.00	0.25	0.35	***0.75***	***0.80***

Calculated by: ACS
Date: 7/8/2008
Checked by: ____

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	AREA TOTAL *(Acres)*	C_5	C_{100}	C_5	Length *(ft)*	Height *(ft)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	TOTAL *(min)*	Location	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		From DCM Table 5-1															
A1	1.80	0.63	0.74	0.30	138	16	7.8	672	3.7%	2.8	4.0	11.8	DP1	3.8	6.8	*4.4*	*9.1*
A2	0.73	0.70	0.80	0.30	57	1.14	9.0	438	1.5%	2.5	2.9	11.9	DP2	3.8	6.8	*1.9*	*4.0*
A3	1.58	0.70	0.80	0.30	56	1.12	8.9	358	5.3%	4.7	1.3	10.2	DP3	4.1	7.3	*4.5*	*9.2*
A4	0.52	0.70	0.80	0.30	33.5	0.67	6.9	371	6.0%	5.0	1.2	8.1	DP4	4.4	7.9	*1.6*	*3.3*
A5	4.27	0.49	0.60	0.30	245	37.7	9.5	31.7	3.2%	2.7	0.2	9.7	DP5	4.2	7.4	*8.6*	*19.0*
A6	2.11	0.66	0.76	0.30	97	1.94	11.7	453	1.5%	2.5	3.0	14.7	DP6	3.5	6.2	*4.9*	*10.0*
A7	4.55	0.58	0.67	0.25	207	6	16.1	762	2.7%	3.3	3.8	19.9	DP7	3.0	5.4	*7.9*	*16.3*
A8	1.38	0.65	0.74	0.25	33.5	0.67	7.3	803	2.9%	3.4	3.9	11.3	DP8	3.9	7.0	*3.5*	*7.1*
A9	1.16	0.71	0.77	0.25	43	0.86	8.3	224	2.0%	2.8	1.3	9.6	DP9	4.2	7.4	*3.4*	*6.6*
A10	9.24	0.27	0.37	0.25	193	60.67	7.1	201	5.5%	4.6	0.7	7.8	DP10	4.5	8.0	*11.1*	*27.2*

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5 (From DCM Table 5-1)	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	Location	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
A11	1.89	0.75	0.80	0.25	23	0.47	6.0	185	1.0%	2.0	1.5	7.6	DP11	4.5	8.1	6.4	12.2
A12	4.47	0.56	0.63	0.25	98	33	4.9	1180	4.6%	4.4	4.5	9.4	DP12	4.2	7.5	10.6	21.1
A13	0.66	0.70	0.76	0.25	28	9.5	2.6	672	5.5%	4.6	2.4	5.1	DP13	5.1	9.1	2.3	4.5
A14	2.95	0.62	0.68	0.25	240	74	7.9	393	1.5%	2.5	2.6	10.6	DP14	4.0	7.1	7.4	14.3
A15	2.33	0.68	0.73	0.25	69	21	4.3	560	3.0%	3.5	2.7	6.9	DP15	4.7	8.3	7.4	14.1
A16	0.83	0.25	0.35	0.25	137	36	6.3	110	7.3%	4.3	0.4	6.8	DP16	4.7	8.4	1.0	2.4
A17	0.61	0.64	0.71	0.25	76	4	8.0	687	3.8%	3.9	2.9	10.9	DP17	4.0	7.0	1.6	3.1
A18	0.33	0.75	0.80	0.25	68	4.5	7.0	272	4.0%	4.0	1.1	8.2	DP18	4.4	7.9	1.1	2.1
A19	1.29	0.80	0.85	0.25	42	3.3	5.2	315	2.1%	2.8	1.9	7.1	DP19	4.6	8.2	4.8	9.0
A20	1.00	0.75	0.80	0.25	34	4.2	4.0	234	1.7%	2.5	1.6	5.6	DP20	5.0	8.8	3.7	7.1

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

Calculated by: ACS
Date: 7/8/2008
Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Surface Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity *		Flow	
					I_5	I_{100}	Q_5	Q_{100}
1	A1, Off-site basins B-1, B-2 and E+	3.59	4.30	19.7	3.0	5.4	10.9	23.2
2	A2	0.51	0.58	11.9	3.8	6.8	1.9	4.0
3	A3, Off-site basin D (Retreat), FB DP1	1.16	1.82	10.2	4.1	7.3	4.7	13.2
4	DP2, DP3, DP6, A4	3.43	4.42	10.2	4.1	7.3	14.0	32.1
5	A5, AP100	24.45	29.71	44.5	1.9	3.4	46.8	101.3
6	A6	1.40	1.61	14.7	3.5	6.2	4.9	10.0
7	A7	2.63	3.04	19.9	3.0	5.4	7.9	16.3
8	A8	0.90	1.02	11.3	3.9	7.0	3.5	7.1
9	A9	0.82	0.89	9.6	4.2	7.4	3.4	6.6
10	A10, DP5, AP102-107	44.11	51.47	82.6	1.3	2.3	56.4	117.2
11	A11	1.42	1.51	7.6	4.5	8.1	6.4	12.2
12	A12	2.52	2.83	9.4	4.2	7.5	10.6	21.1
13	A13	0.46	0.50	5.1	5.1	9.1	2.3	4.5
14	A14	1.83	2.00	10.6	4.0	7.1	7.4	14.3
15	A15	1.59	1.70	6.9	4.7	8.3	7.4	14.1
16	A16	0.21	0.29	6.8	4.7	8.4	1.0	2.4

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity *		Flow	
					I_5	I_{100}	Q_5	Q_{100}
17	**A17, FB DP12, FB DP13**	1.20	1.56	10.9	4.0	7.0	***4.7***	***11.0***
18	**A18, Off-site basin A2**	0.82	0.92	8.2	4.4	7.9	***3.6***	***7.2***
19	**A19**	1.03	1.09	7.1	4.6	8.2	***4.8***	***9.0***
20	**A20**	0.75	0.80	5.6	5.0	8.8	***3.7***	***7.1***

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

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: ACS
Date: 7/8/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Storm Sewer Routing Summary)

Analysis Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow	
					I_5	I_{100}	Q_5	Q_{100}
100	DP4, AP203	22.37	27.13	42.4	2.0	3.5	44.1	95.2
101	DP7, DP9, EX104	5.47	5.54	19.9	3.0	5.4	16.5	29.8
102	AP101, DP8	6.37	6.57	20.0	3.0	5.4	19.2	35.2
103	DP11	1.42	1.51	7.6	4.5	8.1	6.4	12.2
104	INT DP12, INT DP13, DP14, DP15	5.59	5.90	10.7	4.0	7.1	22.4	42.0
105	DP17, DP18	2.02	2.48	10.9	4.0	7.0	8.0	17.5
106	DP19	1.03	1.09	7.1	4.6	8.2	4.8	9.0
107	DP20	0.75	0.80	5.6	5.0	8.8	3.7	7.1
200	EX103	3.93	5.00	21.7	2.9	5.1	11.3	25.7
201	EX100, EX101	11.43	13.90	41.1	2.0	3.6	23.0	49.7
202	AP200, AP201	15.35	18.90	41.5	2.0	3.6	30.7	67.3
203	AP202, INT DP1	18.94	22.70	42.1	2.0	3.5	37.5	80.0

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

DP - Design Point
EX - Existing Design Point
FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: ACS
Date: 7/8/2008
Checked by:

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Offsite Area Runoff Coefficient Summary)

			STREETS / DEVELOPED			OVERLAND / UNDEVELOPED			WEIGHTED	
BASIN	REPORT	TOTAL AREA (Acres)	AREA (Acres)	C_5	C_{100}	AREA (Acres)	C_5	C_{100}	C_5	C_{100}
E	Rockridge	4.03	3.71	0.70	0.80	0.32	0.30	0.45	0.67	0.77
B	Bridgeport	2.02	0.00	0.90	0.95	2.02	0.30	0.45	0.30	0.45
1	Bridgeport	4.05	1.27	0.90	0.95	2.78	0.30	0.45	0.49	0.61
3	Bridgeport	0.92	0.00	0.90	0.95	0.92	0.30	0.45	0.30	0.45
1/2 ST	Bridgeport	0.86	0.86	0.90	0.95	0.00	0.30	0.45	0.90	0.95
AA	Apartments	0.25	0.25	0.70	0.80	0.00	0.30	0.45	0.70	0.80
BB	Apartments	0.58	0.00	0.90	0.95	0.58	0.30	0.45	0.30	0.45
A	Apartments	1.28	1.28	0.70	0.80	0.00	0.30	0.45	0.70	0.80
B	Apartments	0.94	0.94	0.70	0.80	0.00	0.30	0.45	0.70	0.80
C	Apartments	1.68	1.68	0.70	0.80	0.00	0.30	0.45	0.70	0.80
H	Apartments	1.15	1.15	0.70	0.80	0.00	0.30	0.45	0.70	0.80
Off #1	Apartments	0.35	0.35	0.90	0.95	0.00	0.30	0.45	0.90	0.95
Off #2	Apartments	0.85	0.00	0.90	0.95	0.85	0.30	0.45	0.30	0.45
Off #3	Apartments	0.47	0.00	0.90	0.95	0.47	0.30	0.45	0.30	0.45
A-5	Boulevard	1.70	0.00	0.90	0.95	1.70	0.30	0.45	0.30	0.45
2	Bridgeport	5.43	1.70	0.90	0.95	3.73	0.30	0.45	0.49	0.61
4	Bridgeport	2.05	0.33	0.49	0.61	1.72	0.40	0.50	0.41	0.52
C	Bridgeport	1.43	0.00	0.90	0.95	1.43	0.30	0.45	0.30	0.45
D	Apartments	0.88	0.88	0.70	0.80	0.00	0.30	0.45	0.70	0.80
E	Apartments	0.88	0.88	0.70	0.80	0.00	0.30	0.45	0.70	0.80
F	Apartments	1.31	1.31	0.70	0.80	0.00	0.30	0.45	0.70	0.80
G	Apartments	0.90	0.90	0.70	0.80	0.00	0.30	0.45	0.70	0.80
B-3	Boulevard	0.50	0.50	0.90	0.95	0.00	0.30	0.45	0.90	0.95
B-4	Boulevard	0.50	0.50	0.90	0.95	0.00	0.30	0.45	0.90	0.95
CC	Boulevard	0.65	0.00	0.90	0.95	0.65	0.30	0.45	0.30	0.45
A2	Tech Ctr	0.82	0.82	0.70	0.80	0.00	0.25	0.35	0.70	0.80
B-1	Saddle	2.26	2.26	0.50	0.63	0.00	0.30	0.45	0.50	0.63

			STREETS / DEVELOPED			OVERLAND / UNDEVELOPED			WEIGHTED	
BASIN	**REPORT**	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
B-2	***Saddle***	0.58	0.58	0.50	0.63	0.00	0.30	0.45	***0.50***	***0.63***
E+	***Vista***	1.47	1.47	0.70	0.80	0.00	0.30	0.45	***0.70***	***0.80***
D	***Retreat***	0.08	0.08	0.70	0.80	0.00	0.30	0.45	***0.70***	***0.80***

Report Key:
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Calculated by: ACS
Date: 3/21/2008
Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Offsite Area Drainage Summary)

From Area Runoff Coefficient Summary					OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	REPORT	AREA TOTAL (Acres)	C_5 (From DCM Table 5-1)	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	Location	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
E	Rockridge	4.03	0.67	0.77	0.30	790	28	27.7					27.7		2.5	4.5	6.8	14.0
B	Bridgeport	2.02	0.30	0.45	0.30	150	8	10.5					10.5		4.0	7.2	2.4	6.5
1	Bridgeport	4.05	0.49	0.61	0.30	700	36	23.1					23.1		2.8	5.0	5.5	12.2
3	Bridgeport	0.92	0.30	0.45	0.30	100	28	5.0					5.0		5.1	9.1	1.4	3.8
1/2 ST	Bridgeport	0.86	0.90	0.95	0.30				1200	0.5%	1.5	13.3	13.3		3.6	6.5	2.8	5.3
AA	Apartments	0.25	0.70	0.80	0.30								5.0		5.1	9.1	0.9	1.8
BB	Apartments	0.58	0.30	0.45	0.30								5.0		5.1	9.1	0.9	2.4
A	Apartments	1.28	0.70	0.80	0.30								5.0		5.1	9.1	4.6	9.3
B	Apartments	0.94	0.70	0.80	0.30								5.0		5.1	9.1	3.4	6.8
C	Apartments	1.68	0.70	0.80	0.30								5.0		5.1	9.1	6.0	12.2

From Area Runoff Coefficient Summary					OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	REPORT	AREA TOTAL (Acres)	C_5 (From DCM Table 5-1)	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	Location	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
H	***Apartments***	1.15	0.70	0.80	0.30								5.0		5.1	9.1	***4.1***	***8.4***
Off #1	***Apartments***	0.35	0.90	0.95	0.30								5.6		5.0	8.8	***1.6***	***2.9***
Off #2	***Apartments***	0.85	0.30	0.45	0.30								5.0		5.1	9.1	***1.3***	***3.5***
Off #3	***Apartments***	0.47	0.30	0.45	0.30								5.0		5.1	9.1	***0.7***	***1.9***
A-5	***Boulevard***	1.70	0.30	0.45	0.30				1390	4.0%	4.0	5.8	5.8		4.9	8.7	***2.5***	***6.7***
2	***Bridgeport***	5.43	0.49	0.61	0.30	800	62	21.5					21.5		2.9	5.2	***7.7***	***17.0***
4	***Bridgeport***	2.05	0.41	0.52	0.30	680	42	21.4					21.4		2.9	5.2	***2.5***	***5.5***
C	***Bridgeport***	1.43	0.30	0.45	0.30	150	8	10.5					10.5		4.0	7.2	***1.7***	***4.6***
D	***Apartments***	0.88	0.70	0.80	0.30								9.0		4.3	7.6	***2.6***	***5.3***
E	***Apartments***	0.88	0.70	0.80	0.30								5.0		5.1	9.1	***3.1***	***6.4***
F	***Apartments***	1.31	0.70	0.80	0.30								6.0		4.9	8.7	***4.5***	***9.1***
G	***Apartments***	0.90	0.70	0.80	0.30								10.0		4.1	7.3	***2.6***	***5.3***

From Area Runoff Coefficient Summary					*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**REPORT**	**AREA TOTAL** *(Acres)*	**C_5** *From DCM Table 5-1*	**C_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**Location**	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
B-3	***Boulevard***	0.50	0.90	0.95	0.30				475	2.3%	3.0	2.6	5.0		5.1	9.1	***2.3***	***4.3***
B-4	***Boulevard***	0.50	0.90	0.95	0.30				475	2.3%	3.0	2.6	5.0		5.1	9.1	***2.3***	***4.3***
CC	***Boulevard***	0.65	0.30	0.45	0.30	60	17	3.8					5.0		5.1	9.1	***1.0***	***2.7***
A2	***Tech Ctr***	0.82	0.70	0.80	0.25								5.0		5.1	9.1	***2.9***	***6.0***
B-1	***Saddle***	2.26	0.50	0.63	0.30	130	2.6	13.6	625	4.0%	4.8	2.2	15.7		3.4	6.0	***3.8***	***8.6***
B-2	***Saddle***	0.58	0.50	0.63	0.30	80	1.6	10.6	220	4.0%	4.1	0.9	11.5		3.9	6.9	***1.1***	***2.5***
E+	***Vista***	1.47	0.70	0.80	0.30	60	4	6.2					6.2		4.8	8.6	***5.0***	***10.1***
D	***Retreat***	0.08	0.70	0.80	0.30	50	6	4.7					5.0		5.1	9.1	***0.3***	***0.6***

Report Key:
Apartments = "Rockrimmon Apartments Drainage Plan and Report" prepared by United Planning & Engineering Co., Inc., dated February 10, 1984.
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Vista = "Final Drainage Report Addendum for Rockrimmon Vista Filing No. 1 (the Retreat at Rockrimmon)" prepared by JR Engineering, dated Oct. 1995.

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

Calculated by: ACS
Date: 3/21/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Offsite Surface Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity *		Flow	
					I_5	I_{100}	Q_5	Q_{100}
Inlet #1	South-line of S. Rockrimmon Blvd	9.52	11.90	41.0	2.0	3.6	19.2	42.6
Inlet #2	North-line of S. Rockrimmon Blvd	0.51	0.77	5.0	5.1	9.1	2.6	7.0
Inlet #1&2	Sump condition in S. Rockrimmon Blvd	10.03	12.66	41.0	2.0	3.6	20.2	45.4
Apt A&H	Inlets near south-line of S. Rockrimmon Blvd	4.25	4.97	16.0	3.4	6.0	14.3	29.7
Grated Inlet	Inlet near south-line of S. Rockrimmon Blvd and Saddle Ridge Sub. Fil. No. 1	3.93	5.00	21.5	2.9	5.2	11.4	25.8
Apt E&F	Inlets near SW-line of S. Rockrimmon Blvd	2.78	3.18	15.0	3.5	6.2	9.6	19.6
Inlet #4	Southwest-line of S. Rockrimmon Blvd	2.35	3.12	6.5	4.8	8.5	11.2	26.4
Inlet #5	Northeast-line of S. Rockrimmon Blvd	0.45	0.48	5.0	5.1	9.1	2.3	4.3
Tech Ctr Inlet	Lot 1 Colorado Springs Technological Center North Filing No. 1	0.57	0.66	5.0	5.1	9.1	2.9	6.0
Saddle Inlet	Cul-de-sac of Ocelot Drive	1.42	1.79	15.7	3.4	6.0	4.8	10.8
A1 Swale	Off-site basins contributing to Basin A1 swale on-site	2.45	2.97	15.7	3.4	6.0	8.3	17.9
A4 Inlet	Off-site basins contributing to Basin A4 inlet on site	2.51	3.03	15.7	3.4	6.0	8.5	18.3

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

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: ACS
Date: 3/21/2008
Checked by:

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Offsite Storm Sewer Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow	
					I_5	I_{100}	Q_5	Q_{100}
EX100	Inlet #1&2	10.03	12.66	41.1	2.0	3.6	20.2	45.3
EX101	INT Apt A&H	1.39	1.24	16.3	3.3	5.9	4.7	7.4
EX102	DP-EX100, DP-EX101	11.43	13.90	41.1	2.0	3.6	23.0	49.7
EX103	Grated Inlet	3.93	5.00	21.7	2.9	5.1	11.3	25.7
EX104	INT Apt E&F, INT Inlet #4, INT Inlet #5	2.01	1.62	15.4	3.4	6.1	6.9	9.9

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

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: ACS
Date: 3/21/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Existing Area Runoff Coefficient Summary)

		HYDROLOGIC SOIL GROUP A			*HYDROLOGIC SOIL GROUP C*			*WEIGHTED*	
BASIN	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
EX 1	14.1	5.1	0.25	0.35	9.0	0.30	0.45	***0.28***	***0.41***
EX 2	29.5	28.8	0.25	0.35	0.8	0.30	0.45	***0.25***	***0.35***

Calculated by: ACS
Date: 7/8/2008
Checked by: ___________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Existing Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5 (From DCM Table 5-1)	C_{100} (From DCM Table 5-1)	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	Location	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
EX 1	14.1	0.28	0.41	0.25	217	42	8.8	349	5.7%	3.6	1.6	10.4	EX1	4.0	7.2	16.1	42.0
EX 2	29.5	0.25	0.35	0.25	464	34.5	17.7	270	8.9%	6.0	0.8	18.4	EX2	3.1	5.6	23.3	58.2

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

Calculated by: ACS
Date: 7/8/2008
Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Existing Surface Routing Summary)

Design Point(s)	Contributing Basins/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity *		Flow	
					I_5	I_{100}	Q_5	Q_{100}
EX1	EX 1, B-1&B-2 (Saddle), D (Retreat), E+ (Vista), EX102-EX103	24.43	30.05	45.9	1.9	3.3	45.9	100.5
EX2	EX2, DP EX1, A2 (Tech Ctr), EX104	34.44	42.74	83.6	1.3	2.3	43.7	96.6

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

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EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: ACS
Date: 7/8/2008
Checked by: ______

HYDRAULIC CALCULATIONS

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 1

Total Flow:	Q_5 =	**10.9** cfs		I(5)= 3.0
	Q_{100} =	**23.2** cfs		I(100)= 5.4
Inlet Size:	P =	**25** feet		
	A =	**10** feet		

Maximum allowable ponding depth at sump:

$Dmax_5$	=	0.44'
$Dmax_{100}$	=	0.67'

Weir operation	Qi =	(3.0*P*(d^1.5))/F	
	Qi_5 =	10.9 cfs	
	Qi_{100} =	20.6 cfs	
Orifice operation	Qi =	(5.37*A*(d^0.5))/F	
	Qi_5 =	17.8 cfs	
	Qi_{100} =	22.0 cfs	
Clogging Factor	=	2.00	
5-Year Event:	Qi_5 =	10.9 cfs	CA(eqv.)= 3.59
	Flow-By =	0.0 cfs	CA(eqv.)= 0.00
100-Year Event:	Qi_{100} =	20.6 cfs	CA(eqv.)= 3.81
	Flow-By =	2.7 cfs	CA(eqv.)= 0.49

Calculated by: ACS
Date: 7/8/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 4

Total Flow: Q_5 = **14.0** cfs

Q_{100} = **32.1** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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: **18** foot inlet required

(Install a 18' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: ACS

Date: 7/8/2008

Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 7

Total Flow: Q_5 = 7.9 cfs
Q_{100} = 13.1 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'
$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS
Date: 7/8/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 8

Total Flow:

Q_5 = **3.5** cfs

Q_{100} = **11.3** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS

Date: 7/8/2008

Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 9

Total Flow: Q_5 = **3.4** cfs
Q_{100} = **6.6** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'
$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS
Date: 7/8/2008
Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 11

Total Flow:

Q_5 = **6.4** cfs

Q_{100} = **12.2** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS

Date: 7/8/2008

Checked by: ______________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - At-Grade)

Proposed 20' Inlet at DP-12

5-YR FLOW

Q(5)	10.6 cfs	I(5)	4.2	Inlet size (Li) = 20 feet
Q overtop	14.1 cfs			Li >= L(2) then Qi = 7.3 cfs
Depth	0.33 '	Fw	2.52	Qi- CA(eqv.) = 1.73
Spread	12.4 '	L(1)	24.0	Flow-by = 3.3 cfs FB- CA(eqv.) = 0.79
CROSS SLOPE	2.0%	L(2)	14.4	Overtop Flow-By = 0
STREET SLOPE	4.0%	L(3)	51.5	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	14.1 cfs	I(100)	7.5	Inlet size (Li) = 20 feet
Q overtop	14.1 cfs			Li >= L(2) then Qi = 9.1 cfs
Depth	0.37 '	Fw	2.58	Qi- CA(eqv.)= 1.22
Spread	14.0 '	L(1)	27.8	Flow-by = 5.0 cfs FB- CA(eqv.) = 0.67
CROSS SLOPE	2.0%	L(2)	16.7	Overtop Flow-By = 0
STREET SLOPE	4.0%	L(3)	59.6	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 14 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: ACS
Date: 7/8/2008
Checked by: ____

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - At-Grade)

Proposed 20' Inlet at DP-13

5-YR FLOW

Q(5)	2.3 cfs	I(5)	5.1	Inlet size (Li) = 20 feet
Q overtop	14.1 cfs			Li >= L(2) then Qi = 2.3 cfs
Depth	0.21 '	Fw	2.15	Qi- CA(eqv.) = 0.45
Spread	6.0 '	L(1)	9.9	Flow-by = 0.1 cfs FB- CA(eqv.) = 0.01
CROSS SLOPE	2.0%	L(2)	6.0	Overtop Flow-By = 0
STREET SLOPE	4.0%	L(3)	21.3	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	10.8 cfs	I(100)	7.5	Inlet size (Li) = 20 feet
Q overtop	14.1 cfs			Li >= L(2) then Qi = 7.4 cfs
Depth	0.33 '	Fw	2.52	Qi- CA(eqv.)= 0.99
Spread	12.4 '	L(1)	24.0	Flow-by = 3.4 cfs FB- CA(eqv.) = 0.45
CROSS SLOPE	2.0%	L(2)	14.4	Overtop Flow-By = 0
STREET SLOPE	4.0%	L(3)	51.5	Overtop FB- CA(eqv.) = 0.00

Calculated by: ACS
Date: 7/8/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 14

Total Flow:

Q_5 = 7.4 cfs

Q_{100} = 14.3 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS

Date: 7/8/2008

Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 15

Total Flow:

Q_5 = 7.4 cfs

Q_{100} = 14.1 cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS

Date: 7/8/2008

Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 17

Total Flow:	Q_5 =	**4.7** cfs	I(5)=	4.0
	Q_{100} =	**11.0** cfs	I(100)=	7.0
Inlet Size:	Li =	**4** feet		

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.22'

$Dmax_{100}$ = 0.44'

$$Qi = 1.7(L_{eff}+1.8(W))(Dmax + w/12)^{1.85}$$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li / 1.25 = Effective length of inlet opening (L_{eff})

5-Year Event:	Qi_5 =	4.7 cfs	CA(eqv.)=	1.20
	Flow-By =	0.0 cfs	CA(eqv.)=	0.00
100-Year Event:	Qi_{100} =	9.1 cfs	CA(eqv.)=	1.29
	Flow-By =	1.9 cfs	CA(eqv.)=	0.27

Calculated by: ACS
Date: 7/8/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 18 Existing Inlet

Total Flow:	Q_5 =	**3.6** cfs	I(5)=	4.4
	Q_{100} =	**8.4** cfs	I(100)=	7.0
Inlet Size:	Li =	**10** feet		

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.05'

$Dmax_{100}$ = 0.29'

$$Qi = 1.7(L_{eff}+1.8(W))(Dmax + w/12)^{1.85}$$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.25

Li / 1.25 = Effective length of inlet opening (L_{eff})

5-Year Event:	Qi_5 =	3.6 cfs	CA(eqv.)=	0.82
	Flow-By =	0.0 cfs	CA(eqv.)=	0.00
100-Year Event:	Qi_{100} =	8.4 cfs	CA(eqv.)=	1.19
	Flow-By =	0.0 cfs	CA(eqv.)=	0.00

Calculated by: ACS

Date: 7/8/2008

Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 19

Total Flow:

Q_5 = **4.8** cfs

Q_{100} = **9.0** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS

Date: 7/8/2008

Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point 20

Total Flow: Q_5 = **3.7** cfs

Q_{100} = **7.1** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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

Calculated by: ACS

Date: 7/8/2008

Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Existing 10' D10-R Inlet at Tech. Ctr.

Total Flow:

Q_5 = **2.9** cfs

Q_{100} = **6.0** cfs

Maximum allowable ponding depth at sump:

$Dmax_5$ = 0.50'

$Dmax_{100}$ = 0.67'

$$Qi = 1.7(Li+1.8(W))(Dmax + w/12)^{1.85}$$

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: ACS

Date: 3/21/2008

Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point - Ex. Inlet #1 in South Rockrimmon Boulevard

Total Flow:	Q_5 =	**19.2** cfs	I(5)=	2.0
	Q_{100} =	**22.7** cfs	I(100)=	3.6
Inlet Size:	Li =	**6** feet		
Ponding depth at sump:				
	D_5 =	0.66'		
	D_{100} =	0.76'		
For d <= 0.67 feet :	Qi =	$1.7(L_{eff}+1.8(W))(Dmax + w/12)^{1.85}$		
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 =	1.00		
	Li / 1 =	Effective length of inlet opening (L_{eff})		
5-Year Event:	Qi_5 =	19.1 cfs	CA(eqv.)=	9.51
	Flow-By =	0.0 cfs	CA(eqv.)=	0.01
100-Year Event:	Qi_{100} =	22.7 cfs	CA(eqv.)=	6.33
	Flow-By =	0.0 cfs	CA(eqv.)=	0.00

Calculated by: ACS
Date: 3/21/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point - Ex. Inlet #2 in South Rockrimmon Boulevard

Total Flow: Q_5 = **2.6** cfs I(5)= 5.1
Q_{100} = **22.7** cfs I(100)= 3.6

Inlet Size: Li = **6** feet

Ponding depth at sump:

D_5 = 0.01'
D_{100} = 0.76'

For d <= 0.67 feet : $Qi = 1.7(L_{eff}+1.8(W))(Dmax + w/12)^{1.85}$
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 = 1.00
Li / 1 = Effective length of inlet opening (L_{eff})

5-Year Event: Qi_5 = 2.6 cfs CA(eqv.)= 0.51
Flow-By = 0.0 cfs CA(eqv.)= 0.00

100-Year Event: Qi_{100} = 22.7 cfs CA(eqv.)= 6.33
Flow-By = 0.0 cfs CA(eqv.)= 0.00

Calculated by: ACS
Date: 3/21/2008
Checked by: ______

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - Sump Condition)

Design Point - Ex. Inlet in Ocelot Drive cul-de-sac

Total Flow:	Q_5 =	**4.8** cfs		I(5)=	3.4
	Q_{100} =	**10.8** cfs		I(100)=	6.0
Inlet Size:	Li =	**4** feet			

Ponding depth at sump:

D_5 = 0.19'

D_{100} = 0.48'

$$Qi = 1.7(L_{eff} + 1.8(W))(Dmax + w/12)^{1.85}$$

where: W = 3 feet

w = 4 inches

Clogging Factor = 1.00

Li / 1 = Effective length of inlet opening (L_{eff})

5-Year Event:	Qi_5 =	4.8 cfs	CA(eqv.)= 1.42
	Flow-By =	0.0 cfs	CA(eqv.)= 0.00
100-Year Event:	Qi_{100} =	10.8 cfs	CA(eqv.)= 1.79
	Flow-By =	0.0 cfs	CA(eqv.)= 0.00

Calculated by: ACS

Date: 3/21/2008

Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - At-Grade)

Existing Inlet #4

5-YR FLOW

Q(5)	11.2 cfs	I(5)	4.8	Inlet size (Li) = 6 feet
Q overtop	112.0 cfs			Li < L(2) then Qi = 3.1 cfs
Depth	0.37 '	Fw	1.96	Qi- CA(eqv.) = 0.65
Spread	14.3 '	L(1)	21.5	Flow-by = 8.0 cfs FB- CA(eqv.) = 1.69
CROSS SLOPE	2.0%	L(2)	12.9	Overtop Flow-By = 0
STREET SLOPE	2.3%	L(3)	46.2	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	26.4 cfs	I(100)	8.5	Inlet size (Li) = 6 feet
Q overtop	112.0 cfs			Li < L(2) then Qi = 4.9 cfs
Depth	0.49 '	Fw	2.10	Qi- CA(eqv.)= 0.58
Spread	20.1 '	L(1)	32.4	Flow-by = 21.5 cfs FB- CA(eqv.) = 2.54
CROSS SLOPE	2.0%	L(2)	19.5	Overtop Flow-By = 0
STREET SLOPE	2.3%	L(3)	69.6	Overtop FB- CA(eqv.) = 0.00

Calculated by: ACS
Date: 3/21/2008
Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - At-Grade)

Existing Inlet #5

5-YR FLOW

Q(5)	2.3 cfs	I(5)	5.1	Inlet size (Li) = 6 feet
Q overtop	112.0 cfs			
				Li >= L(2) then Qi = 1.4 cfs
Depth	0.22 '	Fw	1.68	Qi- CA(eqv.) = 0.28
Spread	6.9 '	L(1)	8.9	Flow-by = 0.9 cfs
				FB- CA(eqv.) = 0.17
CROSS SLOPE	2.0%	L(2)	5.4	
				Overtop Flow-By = 0
STREET SLOPE	2.3%	L(3)	19.1	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	4.3 cfs	I(100)	9.1	Inlet size (Li) = 6 feet
Q overtop	112.0 cfs			
				Li < L(2) then Qi = 2.0 cfs
Depth	0.27 '	Fw	1.81	Qi- CA(eqv.)= 0.22
Spread	9.4 '	L(1)	13.0	Flow-by = 2.3 cfs
				FB- CA(eqv.) = 0.26
CROSS SLOPE	2.0%	L(2)	7.8	
				Overtop Flow-By = 0
STREET SLOPE	2.3%	L(3)	27.9	Overtop FB- CA(eqv.) = 0.00

Calculated by: ACS
Date: 3/21/2008
Checked by: ________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - At-Grade)

Existing Inlet at Apt A&H

5-YR FLOW

Q(5)	7.1 cfs	I(5)	3.4	Inlet size (Li) = 6 feet
Q overtop	12.2 cfs			Li < L(2) then Qi = 2.3 cfs
Depth	0.31 '	Fw	2.14	Qi- CA(eqv.) = 0.70
Spread	11.1 '	L(1)	18.3	Flow-by = 4.8 cfs FB- CA(eqv.) = 1.43
CROSS SLOPE	2.0%	L(2)	11.0	Overtop Flow-By = 0
STREET SLOPE	3.0%	L(3)	39.2	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	14.9 cfs	I(100)	6.0	Inlet size (Li) = 6 feet
Q overtop	12.2 cfs			Li < L(2) then Qi = 3.7 cfs
Depth	0.39 '	Fw	2.24	Qi- CA(eqv.)= 0.62
Spread	14.0 '	L(1)	24.1	Flow-by = 11.2 cfs FB- CA(eqv.) = 1.86
CROSS SLOPE	2.0%	L(2)	14.5	Overtop Flow-By = 0
STREET SLOPE	3.0%	L(3)	51.6	Overtop FB- CA(eqv.) = 0.00

Flow overtopping crown: Assuming Q(100) contained from flowline to crown and a spread of 14 feet.
Depth and Qi based on a symmetrical section carrying the same flow on the other side of the crown.

Calculated by: ACS
Date: 3/21/2008
Checked by: ____________

CREEKSIDE AT ROCKRIMMON FILING NO. 1

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT

(Inlet Calculations - At-Grade)

Existing Inlet at Apt E&F

5-YR FLOW

Q(5)	4.8 cfs	I(5)	3.5	Inlet size (Li) = 6 feet
Q overtop	14.1 cfs			
				Li < L(2) then Qi = 1.9 cfs
Depth	0.26 '	Fw	2.34	Qi- CA(eqv.) = 0.54
Spread	8.6 '	L(1)	15.5	Flow-by = 2.9 cfs
				FB- CA(eqv.) = 0.85
CROSS SLOPE	2.0%	L(2)	9.3	
				Overtop Flow-By = 0
STREET SLOPE	4.0%	L(3)	33.3	Overtop FB- CA(eqv.) = 0.00

100-YR FLOW

Q(100)	9.8 cfs	I(100)	6.2	Inlet size (Li) = 6 feet
Q overtop	14.1 cfs			
				Li < L(2) then Qi = 2.5 cfs
Depth	0.33 '	Fw	2.50	Qi- CA(eqv.)= 0.41
Spread	12.0 '	L(1)	23.1	Flow-by = 7.2 cfs
				FB- CA(eqv.) = 1.18
CROSS SLOPE	2.0%	L(2)	13.9	
				Overtop Flow-By = 0
STREET SLOPE	4.0%	L(3)	49.6	Overtop FB- CA(eqv.) = 0.00

Calculated by: ACS
Date: 3/21/2008
Checked by: ____________

Worksheet for AP100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	42	in
Discharge	95.20	ft³/s

Results

Normal Depth	2.71	ft
Flow Area	8.00	ft²
Wetted Perimeter	7.54	ft
Top Width	2.92	ft
Critical Depth	3.01	ft
Percent Full	77.5	%
Critical Slope	0.00829	ft/ft
Velocity	11.90	ft/s
Velocity Head	2.20	ft
Specific Energy	4.91	ft
Froude Number	1.27	
Maximum Discharge	108.22	ft³/s
Discharge Full	100.60	ft³/s
Slope Full	0.00895	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	77.52	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.71	ft
Critical Depth	3.01	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00829	ft/ft

Worksheet for AP101

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	30	in
Discharge	29.80	ft³/s

Results

Normal Depth	1.58	ft
Flow Area	3.27	ft²
Wetted Perimeter	4.60	ft
Top Width	2.41	ft
Critical Depth	1.86	ft
Percent Full	63.2	%
Critical Slope	0.00646	ft/ft
Velocity	9.11	ft/s
Velocity Head	1.29	ft
Specific Energy	2.87	ft
Froude Number	1.38	
Maximum Discharge	44.12	ft³/s
Discharge Full	41.01	ft³/s
Slope Full	0.00528	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	63.22	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.58	ft
Critical Depth	1.86	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00646	ft/ft

Worksheet for AP102

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	30	in
Discharge	35.20	ft³/s

Results

Normal Depth	1.78	ft
Flow Area	3.75	ft²
Wetted Perimeter	5.03	ft
Top Width	2.26	ft
Critical Depth	2.01	ft
Percent Full	71.4	%
Critical Slope	0.00760	ft/ft
Velocity	9.39	ft/s
Velocity Head	1.37	ft
Specific Energy	3.16	ft
Froude Number	1.29	
Maximum Discharge	44.12	ft³/s
Discharge Full	41.01	ft³/s
Slope Full	0.00737	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	71.36	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.78	ft
Critical Depth	2.01	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00760	ft/ft

Worksheet for AP103

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	24	in
Discharge	12.20	ft³/s

Results

Normal Depth	1.05	ft
Flow Area	1.66	ft²
Wetted Perimeter	3.23	ft
Top Width	2.00	ft
Critical Depth	1.26	ft
Percent Full	52.3	%
Critical Slope	0.00563	ft/ft
Velocity	7.34	ft/s
Velocity Head	0.84	ft
Specific Energy	1.88	ft
Froude Number	1.42	
Maximum Discharge	24.33	ft³/s
Discharge Full	22.62	ft³/s
Slope Full	0.00291	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.30	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.05	ft
Critical Depth	1.26	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00563	ft/ft

Worksheet for AP104

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	36	in
Discharge	42.00	ft³/s

Results

Normal Depth	1.73	ft
Flow Area	4.21	ft²
Wetted Perimeter	5.17	ft
Top Width	2.97	ft
Critical Depth	2.11	ft
Percent Full	57.6	%
Critical Slope	0.00558	ft/ft
Velocity	9.97	ft/s
Velocity Head	1.55	ft
Specific Energy	3.27	ft
Froude Number	1.48	
Maximum Discharge	71.74	ft³/s
Discharge Full	66.69	ft³/s
Slope Full	0.00397	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	57.56	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.73	ft
Critical Depth	2.11	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00558	ft/ft

Worksheet for AP105

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02872	ft/ft
Diameter	18	in
Discharge	17.80	ft³/s

Results

Normal Depth	1.23	ft
Flow Area	1.55	ft²
Wetted Perimeter	3.40	ft
Top Width	1.15	ft
Critical Depth	1.45	ft
Percent Full	82.0	%
Critical Slope	0.02516	ft/ft
Velocity	11.48	ft/s
Velocity Head	2.05	ft
Specific Energy	3.28	ft
Froude Number	1.75	
Maximum Discharge	19.15	ft³/s
Discharge Full	17.80	ft³/s
Slope Full	0.02872	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	81.96	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.23	ft
Critical Depth	1.45	ft
Channel Slope	0.02872	ft/ft
Critical Slope	0.02516	ft/ft

Worksheet for AP106

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18	in
Discharge	9.00	ft³/s

Results

Normal Depth	1.07	ft
Flow Area	1.35	ft²
Wetted Perimeter	3.02	ft
Top Width	1.36	ft
Critical Depth	1.16	ft
Percent Full	71.3	%
Critical Slope	0.00823	ft/ft
Velocity	6.68	ft/s
Velocity Head	0.69	ft
Specific Energy	1.76	ft
Froude Number	1.18	
Maximum Discharge	11.30	ft³/s
Discharge Full	10.50	ft³/s
Slope Full	0.00734	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	71.27	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.07	ft
Critical Depth	1.16	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00823	ft/ft

Worksheet for AP107

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18	in
Discharge	7.10	ft³/s

Results

Normal Depth	0.90	ft
Flow Area	1.11	ft²
Wetted Perimeter	2.67	ft
Top Width	1.47	ft
Critical Depth	1.03	ft
Percent Full	60.2	%
Critical Slope	0.00682	ft/ft
Velocity	6.38	ft/s
Velocity Head	0.63	ft
Specific Energy	1.54	ft
Froude Number	1.29	
Maximum Discharge	11.30	ft³/s
Discharge Full	10.50	ft³/s
Slope Full	0.00457	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	60.24	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.90	ft
Critical Depth	1.03	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00682	ft/ft

Worksheet for AP200

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	30	in
Discharge	25.70	ft³/s

Results

Normal Depth	1.43	ft
Flow Area	2.91	ft²
Wetted Perimeter	4.30	ft
Top Width	2.47	ft
Critical Depth	1.73	ft
Percent Full	57.4	%
Critical Slope	0.00579	ft/ft
Velocity	8.82	ft/s
Velocity Head	1.21	ft
Specific Energy	2.64	ft
Froude Number	1.43	
Maximum Discharge	44.12	ft³/s
Discharge Full	41.01	ft³/s
Slope Full	0.00393	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	57.37	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.43	ft
Critical Depth	1.73	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00579	ft/ft

Worksheet for AP201

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	36	in
Discharge	49.70	ft³/s

Results

Normal Depth	1.93	ft
Flow Area	4.81	ft²
Wetted Perimeter	5.58	ft
Top Width	2.87	ft
Critical Depth	2.29	ft
Percent Full	64.3	%
Critical Slope	0.00638	ft/ft
Velocity	10.34	ft/s
Velocity Head	1.66	ft
Specific Energy	3.59	ft
Froude Number	1.41	
Maximum Discharge	71.74	ft³/s
Discharge Full	66.69	ft³/s
Slope Full	0.00555	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	64.33	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.93	ft
Critical Depth	2.29	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00638	ft/ft

Worksheet for AP202

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	36	in
Discharge	67.30	ft³/s

Results

Normal Depth	2.48	ft
Flow Area	6.25	ft²
Wetted Perimeter	6.84	ft
Top Width	2.28	ft
Critical Depth	2.62	ft
Percent Full	82.5	%
Critical Slope	0.00920	ft/ft
Velocity	10.76	ft/s
Velocity Head	1.80	ft
Specific Energy	4.28	ft
Froude Number	1.15	
Maximum Discharge	71.97	ft³/s
Discharge Full	66.90	ft³/s
Slope Full	0.01012	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	82.52	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.48	ft
Critical Depth	2.62	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00920	ft/ft

Worksheet for AP203

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	42	in
Discharge	80.00	ft^3/s

Results

Normal Depth	2.36	ft
Flow Area	6.89	ft^2
Wetted Perimeter	6.74	ft
Top Width	3.28	ft
Critical Depth	2.79	ft
Percent Full	67.4	%
Critical Slope	0.00664	ft/ft
Velocity	11.60	ft/s
Velocity Head	2.09	ft
Specific Energy	4.45	ft
Froude Number	1.41	
Maximum Discharge	108.22	ft^3/s
Discharge Full	100.60	ft^3/s
Slope Full	0.00632	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	67.36	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.36	ft
Critical Depth	2.79	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00664	ft/ft

Worksheet for EX101

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18	in
Discharge	7.40	ft³/s

Results

Normal Depth	0.93	ft
Flow Area	1.15	ft²
Wetted Perimeter	2.72	ft
Top Width	1.46	ft
Critical Depth	1.05	ft
Percent Full	61.9	%
Critical Slope	0.00701	ft/ft
Velocity	6.44	ft/s
Velocity Head	0.64	ft
Specific Energy	1.57	ft
Froude Number	1.28	
Maximum Discharge	11.30	ft³/s
Discharge Full	10.50	ft³/s
Slope Full	0.00496	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	61.93	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.93	ft
Critical Depth	1.05	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00701	ft/ft

Worksheet for EX104

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18	in
Discharge	9.90	ft³/s

Results

Normal Depth	1.16	ft
Flow Area	1.46	ft²
Wetted Perimeter	3.22	ft
Top Width	1.26	ft
Critical Depth	1.21	ft
Percent Full	77.2	%
Critical Slope	0.00910	ft/ft
Velocity	6.76	ft/s
Velocity Head	0.71	ft
Specific Energy	1.87	ft
Froude Number	1.10	
Maximum Discharge	11.30	ft³/s
Discharge Full	10.50	ft³/s
Slope Full	0.00888	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	77.24	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.16	ft
Critical Depth	1.21	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00910	ft/ft

Worksheet for DP1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.04000	ft/ft
Diameter	18	in
Discharge	20.60	ft³/s

Results

Normal Depth	1.20	ft
Flow Area	1.52	ft²
Wetted Perimeter	3.33	ft
Top Width	1.19	ft
Critical Depth	1.47	ft
Percent Full	80.3	%
Critical Slope	0.03449	ft/ft
Velocity	13.55	ft/s
Velocity Head	2.85	ft
Specific Energy	4.06	ft
Froude Number	2.12	
Maximum Discharge	22.60	ft³/s
Discharge Full	21.01	ft³/s
Slope Full	0.03846	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	80.26	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.20	ft
Critical Depth	1.47	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.03449	ft/ft

Worksheet for DP9 to DP7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18	in
Discharge	6.60	ft³/s

Results

Normal Depth	0.86	ft
Flow Area	1.05	ft²
Wetted Perimeter	2.58	ft
Top Width	1.48	ft
Critical Depth	0.99	ft
Percent Full	57.5	%
Critical Slope	0.00653	ft/ft
Velocity	6.28	ft/s
Velocity Head	0.61	ft
Specific Energy	1.47	ft
Froude Number	1.31	
Maximum Discharge	11.30	ft³/s
Discharge Full	10.50	ft³/s
Slope Full	0.00395	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	57.48	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.86	ft
Critical Depth	0.99	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00653	ft/ft

Worksheet for DP12 to DP13

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	30	in
Discharge	23.00	ft³/s

Results

Normal Depth	1.34	ft
Flow Area	2.68	ft²
Wetted Perimeter	4.10	ft
Top Width	2.49	ft
Critical Depth	1.63	ft
Percent Full	53.5	%
Critical Slope	0.00543	ft/ft
Velocity	8.60	ft/s
Velocity Head	1.15	ft
Specific Energy	2.49	ft
Froude Number	1.46	
Maximum Discharge	44.12	ft³/s
Discharge Full	41.01	ft³/s
Slope Full	0.00314	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	53.55	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.34	ft
Critical Depth	1.63	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00543	ft/ft

Worksheet for DP13

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	30	in
Discharge	29.90	ft³/s

Results

Normal Depth	1.58	ft
Flow Area	3.28	ft²
Wetted Perimeter	4.60	ft
Top Width	2.41	ft
Critical Depth	1.86	ft
Percent Full	63.4	%
Critical Slope	0.00648	ft/ft
Velocity	9.12	ft/s
Velocity Head	1.29	ft
Specific Energy	2.88	ft
Froude Number	1.38	
Maximum Discharge	44.12	ft³/s
Discharge Full	41.01	ft³/s
Slope Full	0.00531	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	63.36	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.58	ft
Critical Depth	1.86	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00648	ft/ft

Worksheet for DP14 to DP12

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	24	in
Discharge	14.30	ft³/s

Results

Normal Depth	1.15	ft
Flow Area	1.88	ft²
Wetted Perimeter	3.45	ft
Top Width	1.98	ft
Critical Depth	1.36	ft
Percent Full	57.7	%
Critical Slope	0.00613	ft/ft
Velocity	7.62	ft/s
Velocity Head	0.90	ft
Specific Energy	2.06	ft
Froude Number	1.38	
Maximum Discharge	24.33	ft³/s
Discharge Full	22.62	ft³/s
Slope Full	0.00400	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	57.70	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.15	ft
Critical Depth	1.36	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00613	ft/ft

Worksheet for DP15

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	24	in
Discharge	16.40	ft³/s

Results

Normal Depth	1.26	ft
Flow Area	2.09	ft²
Wetted Perimeter	3.67	ft
Top Width	1.93	ft
Critical Depth	1.46	ft
Percent Full	63.1	%
Critical Slope	0.00674	ft/ft
Velocity	7.85	ft/s
Velocity Head	0.96	ft
Specific Energy	2.22	ft
Froude Number	1.33	
Maximum Discharge	24.33	ft³/s
Discharge Full	22.62	ft³/s
Slope Full	0.00526	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	63.12	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.26	ft
Critical Depth	1.46	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00674	ft/ft

Worksheet for DP17 to DP18

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01157	ft/ft
Diameter	18	in
Discharge	11.30	ft^3/s

Results

Normal Depth	1.23	ft
Flow Area	1.55	ft^2
Wetted Perimeter	3.40	ft
Top Width	1.15	ft
Critical Depth	1.28	ft
Percent Full	82.0	%
Critical Slope	0.01079	ft/ft
Velocity	7.29	ft/s
Velocity Head	0.83	ft
Specific Energy	2.06	ft
Froude Number	1.11	
Maximum Discharge	12.16	ft^3/s
Discharge Full	11.30	ft^3/s
Slope Full	0.01157	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	81.96	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.23	ft
Critical Depth	1.28	ft
Channel Slope	0.01157	ft/ft
Critical Slope	0.01079	ft/ft

Worksheet for Street Half Section to DP3 - 100 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	13.20	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+01	0.50
0+00	0.00
0+01	0.12
0+13	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+01, 0.50)	(0+13, 0.38)	0.013

Results

Normal Depth		0.38	ft
Elevation Range	0.00 to 0.50 ft		
Flow Area		2.07	ft²
Wetted Perimeter		14.06	ft
Top Width		13.98	ft
Normal Depth		0.38	ft
Critical Depth		0.53	ft
Critical Slope		0.00379	ft/ft
Velocity		6.38	ft/s
Velocity Head		0.63	ft
Specific Energy		1.01	ft
Froude Number		2.92	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Street Half Section to DP3 - 100 yr

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.38	ft
Critical Depth	0.53	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00379	ft/ft

Worksheet for Street Half Section to DP3 - 5 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	4.70	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
-0+01	0.50
0+00	0.00
0+01	0.12
0+13	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+01, 0.50)	(0+13, 0.38)	0.013

Results

Normal Depth		0.28	ft
Elevation Range	0.00 to 0.50 ft		
Flow Area		0.95	ft²
Wetted Perimeter		9.32	ft
Top Width		9.26	ft
Normal Depth		0.28	ft
Critical Depth		0.38	ft
Critical Slope		0.00466	ft/ft
Velocity		4.97	ft/s
Velocity Head		0.38	ft
Specific Energy		0.66	ft
Froude Number		2.74	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Street Half Section to DP3 - 5 yr

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.38	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00466	ft/ft

Worksheet for Street Half Section to DP4 - 100 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	18.90	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+01	0.50
0+00	0.00
0+01	0.12
0+13	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+01, 0.50)	(0+13, 0.38)	0.013

Results

Normal Depth	0.41	ft
Elevation Range	0.00 to 0.50 ft	
Flow Area	2.59	ft²
Wetted Perimeter	14.37	ft
Top Width	14.26	ft
Normal Depth	0.41	ft
Critical Depth	0.61	ft
Critical Slope	0.00355	ft/ft
Velocity	7.30	ft/s
Velocity Head	0.83	ft
Specific Energy	1.24	ft
Froude Number	3.02	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Street Half Section to DP4 - 100 yr

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.41	ft
Critical Depth	0.61	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00355	ft/ft

Worksheet for Street Half Section to DP4 - 5 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	9.20	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
-0+01	0.50
0+00	0.00
0+01	0.12
0+13	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+01, 0.50)	(0+13, 0.38)	0.013

Results

Normal Depth	0.34	ft
Elevation Range	0.00 to 0.50 ft	
Flow Area	1.58	ft^2
Wetted Perimeter	12.21	ft
Top Width	12.14	ft
Normal Depth	0.34	ft
Critical Depth	0.47	ft
Critical Slope	0.00407	ft/ft
Velocity	5.83	ft/s
Velocity Head	0.53	ft
Specific Energy	0.87	ft
Froude Number	2.85	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.47	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00407	ft/ft

Worksheet for Street Section to DP4 - 100 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	32.10	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
-0+01	0.50
0+00	0.00
0+01	0.12
0+13	0.38
0+25	0.12
0+26	0.00
0+28	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+01, 0.50)	(0+28, 0.50)	0.013

Results

Normal Depth	0.40	ft
Elevation Range	0.00 to 0.50 ft	
Flow Area	4.68	ft^2
Wetted Perimeter	28.60	ft
Top Width	28.44	ft
Normal Depth	0.40	ft
Critical Depth	0.57	ft
Critical Slope	0.00360	ft/ft
Velocity	6.85	ft/s
Velocity Head	0.73	ft
Specific Energy	1.13	ft
Froude Number	2.98	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft

Worksheet for Street Section to DP4 - 100 yr

GVF Input Data

Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.57	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00360	ft/ft

Worksheet for Street Section to DP4 - 5 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft
Discharge	14.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+01	0.50
0+00	0.00
0+01	0.12
0+13	0.38
0+25	0.12
0+26	0.00
0+28	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+01, 0.50)	(0+28, 0.50)	0.013

Results

Normal Depth	0.31	ft
Elevation Range	0.00 to 0.50 ft	
Flow Area	2.56	ft²
Wetted Perimeter	21.89	ft
Top Width	21.76	ft
Normal Depth	0.31	ft
Critical Depth	0.43	ft
Critical Slope	0.00428	ft/ft
Velocity	5.47	ft/s
Velocity Head	0.47	ft
Specific Energy	0.78	ft
Froude Number	2.81	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft

Worksheet for Street Section to DP4 - 5 yr

GVF Input Data

Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.43	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.00428	ft/ft

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	**Anna C. Sparks**
Company:	**JR Engineering, LLC**
Date:	**July 2, 2008**
Project:	**Creekside at Rockrimmon**
Location:	**DP102**

1. Basin Storage Volume			
	I_a =	65.00	%
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i =	0.65	
B) Contributing Watershed Area (Area)	Area =	7.15	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 =	0.182	acre-feet
2. Outlet Works			
A) Outlet Type (Check One)	X	Orifice Plate	
		Perforated Riser Pipe	
		Other:	
B) Depth at Outlet Above Lowest Perforation (H)	H =	2.00	feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o =	0.39	square inches
D) Perforation Dimensions **(enter one only)**:			
i) Circular Perforation Diameter **OR**	D =	0.6875	inches, **OR**
ii) 2" Height Rectangular Perforation Width	W =		inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc =	1	number
F) Actual Design Outlet Area per Row (A_o)	A_o =	0.37	square inches
G) Number of Rows (nr)	nr =	6	number
H) Total Outlet Area (A_{ot})	A_{ot} =	2.23	square inches
3. Trash Rack			
A) Needed Open Area: $A_t = 0.5 * (\text{Figure 7 Value}) * A_{ot}$	A_t =	79	square inches
B) Type of Outlet Opening (Check One)	X	≤ 2" Diameter **Round**	
		2" High **Rectangular**	
		Other:	
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):			
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} =	3	inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} =	48	inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	Anna C. Sparks
Company:	JR Engineering, LLC
Date:	July 2, 2008
Project:	Creekside at Rockrimmon
Location:	DP102

iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) ___ Other: ___
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) ___ Other: ___
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	0.75 inches #156 VEE
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	3/8 in. x 1.0 in. flat bar
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = ___ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = ___ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = ___ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = ___ inches
v) Type of Screen (based on depth H) (Describe if "Other")	___ Klemp™ KPP Series Aluminum ___ Other: ___
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	___ inches ___ Other: ___
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	___
4. Detention Basin length to width ratio	___ (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (5 to 10% of the Design Volume in 1D)	___ acre-feet
B) Surface Area	___ acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	___ inches
D) Paved/Hard Bottom and Sides	___ yes/no

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	Anna C. Sparks
Company:	JR Engineering, LLC
Date:	July 2, 2008
Project:	Creekside at Rockrimmon
Location:	DP102

6. Two-Stage Design	
A) Top Stage (D_{WQ} = 2' Minimum)	D_{WQ} = ____ feet Storage= ____ acre-feet
B) Bottom Stage (D_{BS} = D_{WQ} + 1.5' Minimum, D_{WQ} + 3.0' Maximum, Storage = 5% to 15% of Total WQCV)	D_{BS} = ____ feet Storage= ____ acre-feet Surf. Area= ____ acres
C) Micro Pool (Minimum Depth = the Larger of 0.5 * Top Stage Depth or 2.5 Feet)	Depth= ____ feet Storage= ____ acre-feet Surf. Area= ____ acres
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B Must be ≥ Design Volume in 1D	Vol_{tot} = ____ acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	X Native Grass ____ Irrigated Turf Grass ____ Other: ____

Notes:

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	**Anna C. Sparks**
Company:	**JR Engineering, LLC**
Date:	**July 3, 2008**
Project:	**Creekside at Rockrimmon**
Location:	**DP103**

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = 70.00 % i = 0.70
B) Contributing Watershed Area (Area)	Area = 0.66 acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV = 0.28 watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = 0.018 acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	X Orifice Plate __ Perforated Riser Pipe __ Other:
B) Depth at Outlet Above Lowest Perforation (H)	H = 2.00 feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = 0.04 square inches
D) Perforation Dimensions **(enter one only)**: i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	D = 0.2188 inches, **OR** W = __ inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = 1 number
F) Actual Design Outlet Area per Row (A_o)	A_o = 0.04 square inches
G) Number of Rows (nr)	nr = 6 number
H) Total Outlet Area (A_{ot})	A_{ot} = 0.23 square inches
3. Trash Rack	
A) Needed Open Area: $A_t = 0.5 * (\text{Figure 7 Value}) * A_{ot}$	A_t = 8 square inches
B) Type of Outlet Opening (Check One)	X ≤ 2" Diameter **Round** __ 2" High **Rectangular** __ Other:
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = 3 inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = 48 inches

Designer:	Anna C. Sparks
Company:	JR Engineering, LLC
Date:	July 3, 2008
Project:	Creekside at Rockrimmon
Location:	DP103

iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) ___ Other: ___
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) ___ Other: ___
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	0.75 inches #156 VEE
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	3/8 in. x 1.0 in. flat bar
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = ___ inches
ii) Width of Perforated Plate Opening ($W_{conc} = W + 12"$)	W_{conc} = ___ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = ___ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = ___ inches
v) Type of Screen (based on depth H) (Describe if "Other")	___ Klemp™ KPP Series Aluminum ___ Other: ___
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	___ inches ___ Other: ___
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	___
4. Detention Basin length to width ratio	___ (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (5 to 10% of the Design Volume in 1D)	___ acre-feet
B) Surface Area	___ acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	___ inches
D) Paved/Hard Bottom and Sides	___ yes/no

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	Anna C. Sparks
Company:	JR Engineering, LLC
Date:	July 3, 2008
Project:	Creekside at Rockrimmon
Location:	DP103

6. Two-Stage Design	
A) Top Stage (D_{WQ} = 2' Minimum)	D_{WQ} = ______ feet Storage= ______ acre-feet
B) Bottom Stage (D_{BS} = D_{WQ} + 1.5' Minimum, D_{WQ} + 3.0' Maximum, Storage = 5% to 15% of Total WQCV)	D_{BS} = ______ feet Storage= ______ acre-feet Surf. Area= ______ acres
C) Micro Pool (Minimum Depth = the Larger of 0.5 * Top Stage Depth or 2.5 Feet)	Depth= ______ feet Storage= ______ acre-feet Surf. Area= ______ acres
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B Must be ≥ Design Volume in 1D	Vol_{tot} = ______ acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	X Native Grass ___ Irrigated Turf Grass ___ Other: ______

Notes:

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	**Anna C. Sparks**
Company:	**JR Engineering, LLC**
Date:	**July 3, 2008**
Project:	**Creekside at Rockrimmon**
Location:	**DP104**

1. Basin Storage Volume			
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a =	70.00	%
	i =	0.70	
B) Contributing Watershed Area (Area)	Area =	7.82	acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV =	0.28	watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol =	0.215	acre-feet
2. Outlet Works			
A) Outlet Type (Check One)	X	Orifice Plate	
		Perforated Riser Pipe	
		Other:	
B) Depth at Outlet Above Lowest Perforation (H)	H =	2.00	feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o =	0.46	square inches
D) Perforation Dimensions **(enter one only)**:			
i) Circular Perforation Diameter **OR**	D =	0.7500	inches, **OR**
ii) 2" Height Rectangular Perforation Width	W =		inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc =	1	number
F) Actual Design Outlet Area per Row (A_o)	A_o =	0.44	square inches
G) Number of Rows (nr)	nr =	6	number
H) Total Outlet Area (A_{ot})	A_{ot} =	2.65	square inches
3. Trash Rack			
A) Needed Open Area: $A_t = 0.5 * (\text{Figure 7 Value}) * A_{ot}$	A_t =	93	square inches
B) Type of Outlet Opening (Check One)	X	≤ 2" Diameter **Round**	
		2" High **Rectangular**	
		Other:	
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):			
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} =	6	inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} =	48	inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	Anna C. Sparks
Company:	JR Engineering, LLC
Date:	July 3, 2008
Project:	Creekside at Rockrimmon
Location:	DP104

iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) ___ Other: ______
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) ___ Other: ______
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	0.75 inches #156 VEE
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	3/8 in. x 1.0 in. flat bar
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = ______ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = ______ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = ______ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = ______ inches
v) Type of Screen (based on depth H) (Describe if "Other")	___ Klemp™ KPP Series Aluminum ___ Other: ______
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	___ inches ___ Other: ______
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	______
4. Detention Basin length to width ratio	______ (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (5 to 10% of the Design Volume in 1D)	______ acre-feet
B) Surface Area	______ acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	______ inches
D) Paved/Hard Bottom and Sides	______ yes/no

Designer:	Anna C. Sparks
Company:	JR Engineering, LLC
Date:	July 3, 2008
Project:	Creekside at Rockrimmon
Location:	DP104

6. Two-Stage Design	
A) Top Stage (D_{WQ} = 2' Minimum)	D_{WQ} = ______ feet Storage= ______ acre-feet
B) Bottom Stage (D_{BS} = D_{WQ} + 1.5' Minimum, D_{WQ} + 3.0' Maximum, Storage = 5% to 15% of Total WQCV)	D_{BS} = ______ feet Storage= ______ acre-feet Surf. Area= ______ acres
C) Micro Pool (Minimum Depth = the Larger of 0.5 * Top Stage Depth or 2.5 Feet)	Depth= ______ feet Storage= ______ acre-feet Surf. Area= ______ acres
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B Must be ≥ Design Volume in 1D	Vol_{tot} = ______ acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	X Native Grass ____ Irrigated Turf Grass ____ Other: ______

Notes: ______

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer:	**Anna C. Sparks**
Company:	**JR Engineering, LLC**
Date:	**July 3, 2008**
Project:	**Creekside at Rockrimmon**
Location:	**DP106**

1. Basin Storage Volume			
	I_a =	80.00	%
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i =	0.80	
B) Contributing Watershed Area (Area)	Area =	1.29	acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV =	0.33	watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol =	0.042	acre-feet
2. Outlet Works			
A) Outlet Type (Check One)	X	Orifice Plate	
		Perforated Riser Pipe	
		Other:	
B) Depth at Outlet Above Lowest Perforation (H)	H =	2.00	feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o =	0.09	square inches
D) Perforation Dimensions **(enter one only)**:			
i) Circular Perforation Diameter **OR**	D =	0.3125	inches, **OR**
ii) 2" Height Rectangular Perforation Width	W =		inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc =	1	number
F) Actual Design Outlet Area per Row (A_o)	A_o =	0.08	square inches
G) Number of Rows (nr)	nr =	6	number
H) Total Outlet Area (A_{ot})	A_{ot} =	0.46	square inches
3. Trash Rack			
A) Needed Open Area: $A_t = 0.5 * (\text{Figure 7 Value}) * A_{ot}$	A_t =	17	square inches
B) Type of Outlet Opening (Check One)	X	≤ 2" Diameter **Round**	
		2" High **Rectangular**	
		Other:	
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):			
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} =	3	inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} =	48	inches

Designer: **Anna C. Sparks**
Company: **JR Engineering, LLC**
Date: **July 3, 2008**
Project: **Creekside at Rockrimmon**
Location: **DP106**

iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) Other:
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) Other:
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	0.75 inches **#156 VEE**
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	**3/8 in. x 1.0 in. flat bar**
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = ___ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = ___ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = ___ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = ___ inches
v) Type of Screen (based on depth H) (Describe if "Other")	Klemp™ KPP Series Aluminum Other:
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	___ inches Other:
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	
4. Detention Basin length to width ratio	___ (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (5 to 10% of the Design Volume in 1D)	___ acre-feet
B) Surface Area	___ acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	___ inches
D) Paved/Hard Bottom and Sides	___ yes/no

Designer:	**Anna C. Sparks**
Company:	**JR Engineering, LLC**
Date:	**July 3, 2008**
Project:	**Creekside at Rockrimmon**
Location:	**DP106**

6. Two-Stage Design A) Top Stage (D_{WQ} = 2' Minimum)	D_{WQ} = ______ feet Storage= ______ acre-feet
B) Bottom Stage (D_{BS} = D_{WQ} + 1.5' Minimum, D_{WQ} + 3.0' Maximum, Storage = 5% to 15% of Total WQCV)	D_{BS} = ______ feet Storage= ______ acre-feet Surf. Area= ______ acres
C) Micro Pool (Minimum Depth = the Larger of 0.5 * Top Stage Depth or 2.5 Feet)	Depth= ______ feet Storage= ______ acre-feet Surf. Area= ______ acres
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B Must be ≥ Design Volume in 1D	Vol_{tot} = ______ acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	**X** Native Grass ____ Irrigated Turf Grass ____ Other: ______

Notes:

Designer: Anna C.Sparks
Company: JR Engineering, LLC
Date: October 17, 2008
Project: Creekside at Rockrimmon
Location: Existing Wetland at DP5

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = 65.00 % i = 0.65
B) Contributing Watershed Area (Area)	Area = 11.00 acres
C) Water Quality Capture Volume (WQCV) ($WQCV = 0.9 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV = 0.23 watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area	Vol = 0.21 acre-feet
2. Wetland Pond Volume, Depth, and Water Surface Area	
A) Minimum Permanent Pool: $Vol_{Pool} \geq 0.75 * Vol$	Calculated Required Minimums: $Vol_{Pool} \geq$ 0.16 acre-feet WS Area = 0.10 acres, estimated Enter the Actual Design Values: $Vol_{Pool} \geq$ 0.16 acre-feet, final design WS Area = 0.10 acres, final design
B) Forebay (Volume $\geq$ 0.05 * Vol in 1D) Depth minimum = 2.5', maximum = 4.0'	Volume= 0.01 acre-feet Depth= 2.50 feet Area= 0.004 acres, % = 4.00%
C) Outlet Pool (Area > 0.06 * Design WS Area) Depth minimum = 2.5', maximum = 4.0'	Depth= 2.50 feet Area= 0.006 acres, % = 6.00%
D) Wetland Zones with Emergent Vegetation (6" to 12" deep) (Area = 50% to 70% of Design WS Area)	Depth= 0.50 feet Area= 0.052 acres, % = 50.00%
E) Free Water Surface Areas (2' to 4' deep) (Area = 30% to 50% of Design WS Area)	Depth= 2.00 feet Area= 0.042 acres, % = 40.00% 100.00%
3 Average Side Slope Above Water Surface (3:1 or flatter)	Z = 4.00
A) Depth of WQCV Surcharge (above permanent pool, 2' max.)	1.7 feet
4. Outlet Works	
A) Outlet Type (Check One)	X Orifice Plate __ Perforated Riser Pipe __ Other:
B) Depth at Outlet Above Lowest Perforation (H, 2' max.)	H = 1.70 feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = 0.99 square inches
D) Perforation Dimensions (Refer to Figure 5 in W.Q. Str. Det.): **(Enter one only):** i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	D = 1.1250 inches, **OR** W = __ inches

Designer:	Anna C.Sparks
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Location:	Existing Wetland at DP5

E) Number of Columns (nc)	nc = 1 Number
F) Actual Design Outlet Area per Row (A_o)	A_o = 0.99 square inches
G) Number of Rows (nr)	nr = 5 Number
H) Total Outlet Area (A_{ot})	A_{ot} = 5.07 square inches
5. Trash Rack	
A) Needed Open Area: $A_t = 0.5 * (\text{UDFCD Vol. 3 Figure 7 Value}) * A_{ot}$	A_t = 169.76 square inches
B) Type of Outlet Opening (Check One)	X ≤ 2" Diameter **Round** 2" High **Rectangular** Other:
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from UDFCD Vol. 3, Table 6a-1	W_{conc} = 9 inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = 44 inches
iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) Other:
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) Other:
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: UDFCD Vol. 3 Table 6a-2)	0.75 inches #156 VEE
vi) Type and Size of Holding Frame (Ref.: UDFCD Vol. 3 Table 6a-2)	3/8 in. x 1.0 in. flat bar
D) For 2" High **Rectangular Opening** (Refer to UDFCD Vol. 3 Figure 6b):	
I) Width of Rectangular Opening (W)	W = inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = inches
v) Type of Screen (based on depth H) (Describe if "Other")	Klemp^{TM} KPP Series Aluminum Other:
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp^{TM} KPP Grating). Describe if "Other"	inches Other:

Design Procedure Form: Constructed Wetland Basin (CWB) - Sedimentation Facility

Designer:	Anna C.Sparks
Company:	JR Engineering, LLC
Date:	October 17, 2008
Project:	Creekside at Rockrimmon
Location:	Existing Wetland at DP5

vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6a-2) (Based on depth of WQCV surcharge)	______
6. Basin Use for Quantity Controls (Check one or describe if "Other")	____ Detention within the facility ____ Detention upstream of the facility __X__ Other: maintain pre-development flowrates to the wetland area
7. Basin length to width ratio	4.42 (L/W)
8. Basin Side Slopes (Z, horizontal distance per unit vertical)	3.00 (horizontal/vertical)
9 Annual/Seasonal Water Balance (Q_{net} has to be positive)	Q_{inflow} 18.48 acre-feet/year Q_{evap} 0.30 acre-feet/year $Q_{seepage}$ 0.12 acre-feet/year $Q_{E.T.}$ 0.32 acre-feet/year Q_{net} 17.73 acre-feet/year
10 Vegetation (Check the method being applied or describe)	____ Native Grass ____ Irrigated Turf Grass Side Slopes __X__ Wetland Species in Pool* ____ Other: ______ *Describe Species Density and Mixl. **Existing wetland contains existing wetland vegetation.**

Notes: Existing wetland area is not to be disturbed without prior permission of the U.S. Army Corps of Engineers.

Design Procedure Form: Porous Landscape Detention (PLD)

Designer:	**Anna C. Sparks**
Company:	**JR Engineering, LLC**
Date:	**September 10, 2008**
Project:	**Creekside at Rockrimmon**
Location:	**DP20**

1. Basin Storage Volume (I_a = 100% if all paved and roofed areas u/s of PLD) A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = 70.00 % i = 0.70
B) Contributing Watershed Area Including the PLD (Area)	Area = 41,372 square feet
C) Water Quality Capture Volume (WQCV) ($WQCV = 0.8 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)	WQCV = 0.22 watershed inches
D) Design Volume: $Vol_{PLD} = (WQCV / 12) * Area$	Vol = 758.6 cubic feet
2. PLD Surface Area (A_{PLD}) and Average Depth (d_{av})	A_{PLD} = 759 square feet
(d_{av}: = (Vol / A_{PLD}), Min=0.5', Max=1.0')	d_{av} = 1.00 feet
3. Base Course (See Figure PLD-1)	X 6" (Min.) Sandy Loam Turf Layer, Plus 18" (Min.) Layer of 25% Peat and 75% Sand Mix, Plus 9" (Min.) Layer of ASSHTO #8 Coarse Aggregate (CDOT Section 703 Specification). ___ Other: ___
5. Draining of porous pavement (Check a, **or** b, **or** c, **answer** d) Based on answers to 5a through 5d, check the appropriate method	___ Infiltration to Subgrade with Permeable Membrane: 5(c) checked **and** 5(d) = no
a) Check box if subgrade is heavy or expansive clay [ ] b) Check box if subgrade is silty or clayey sands [ ] c) Check box if subgrade is well-draining soils [X]	X Underdrain with Impermeable Membrane: 5(a) checked **or** 5(d) = yes
d) Does tributary catchment contain land uses that may have petroleum products, greases, or other chemicals present, such as gas station, hardware store, restaurant, etc.? yes [X] no [ ]	___ Underdrain with Permeable Membrane: 5(b) checked **and** 5(d) = no ___ Other: ___

Notes:

DRAINAGE PLAN