

# Stormwater Study of South Rifle



Prepared for:

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## Section 1.0 Purpose of Study

The South Rifle area included within the scope of this study generally is described by County Road 320 on the west to the County Road 319 and 346 intersections on the east. It is further described as that area tributary to and south of the Colorado River. The following figure generally describes the study area by which this study includes. The figure is a photographic representation of the view of the study area as viewed to the south from the core area of the City of Rifle.



Figure 1-1: View of South Rifle Study Area  
(looking south)

In early 2004, the ownership of the Last Chance Ditch decided to pipe the Last Chance Ditch for a variety of reasons among of which was the ever increasing development activities that were occurring above and below the ditch. Prior to the ditch piping, the Last Chance Ditch served as a conduit that intercepted and transported drainage waters from lesser events away from the developing portions of South Rifle. As a result, the developing properties grew accustomed to the lack of “nuisance” waters that never impacted them.

In late 2004 and early 2005, the true impacts of the Last Chance Ditch piping were finally felt with a mid-winter snow melt event that created a number of problems that would not have been normally a concern. Additionally, a new property development located near the base of Grass Mesa modified historic drainage patterns that further compounded the problems observed. The major problems observed are shown in Figures 1-2 and 1-3, which follow.

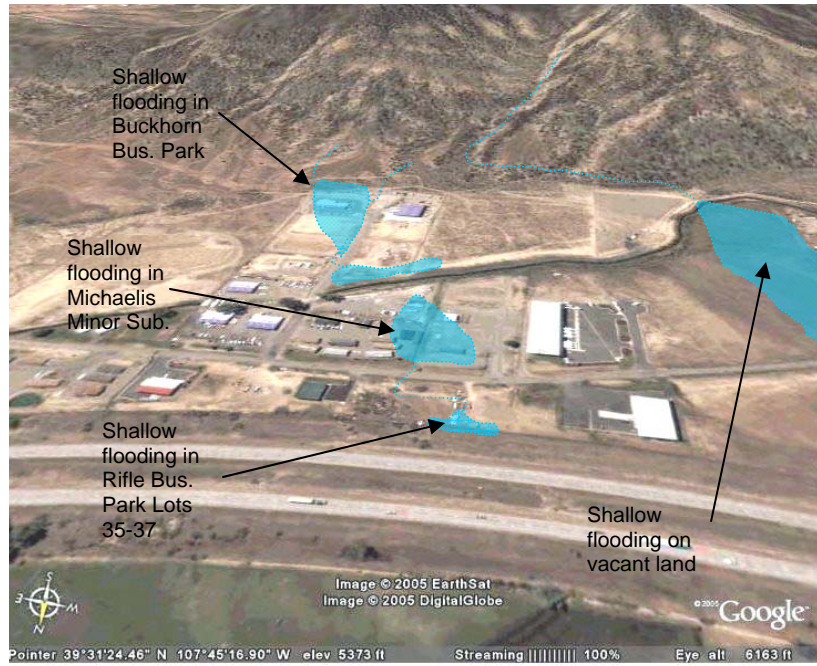


Figure 1-2: View of Early 2005 Nuisance Flooding Areas (eastern portion of Study Area, looking south)

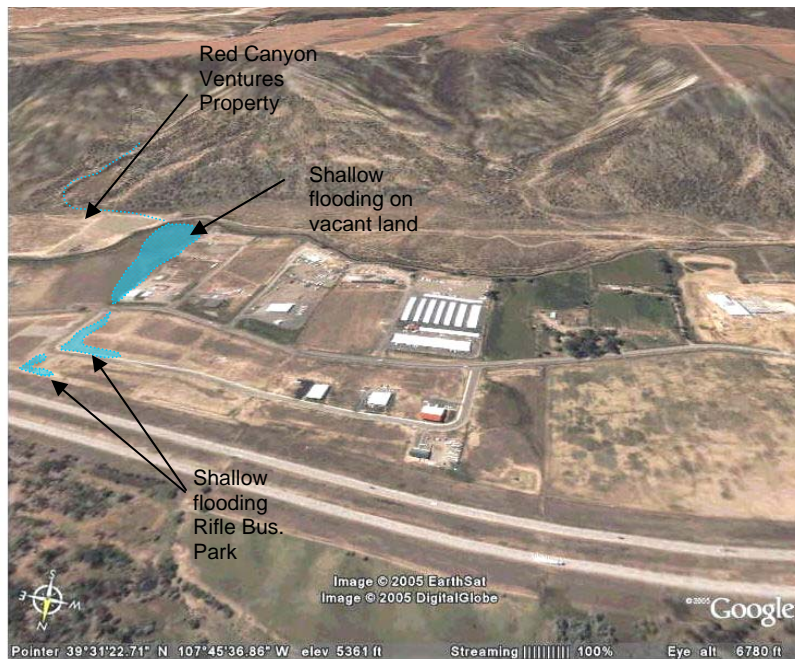


Figure 1-3: View of Early 2005 Nuisance Flooding Areas (middle portion of Study Area, looking south)

Subsequent to the nuisance flooding events of early 2005, the City commissioned this study to make a determination of the condition of the watershed as it relates to the piping of the Last Chance Ditch and its affects upon the existing properties. Additionally, this study was to evaluate the condition of the properties that have recently developed in the City and have since abandoned or modified their appurtenant drainage structures due to the ditch's "pre-piped" effects on the properties. Subsequently, the City could encourage each of these property owners to redevelop or maintain their drainage structures. Finally, the study was to determine the capital needs in the watershed that are necessary to properly transport drainage waters through the South Rifle area to the Colorado River to avoid the re-occurrence of the problems observed in early 2005.



## Section 2.0 Description of Watershed

The entire watershed evaluated in this study consumes an area of approximately 4080 acres. Figure 1-1 in the prior discussion identified a schematic of the watershed. The lowest point in the watershed is located at the intersection of South 7<sup>th</sup> Street and CR 320. The highest point in the watershed is in the Ramsey Gulch basin at an elevation of 9080 feet above mean sea level.

This Study has evaluated eighteen (18) separate outfalls (or points of concentration) that generally are located at critical drainage facilities. From those outfalls points, an additional thirty-six (36) basins are defined of which 14 basins are classified as off-site and 22 are classified as on-site. Ramsey Gulch consumes nearly 75% (3025 acres +/-) of the watershed and has a mapped floodplain identified in the Federal Emergency's 1986 Flood Insurance Study for the City of Rifle.

The lower portions of the watershed consist of a mix of light industrial, business, residential as well as agricultural uses. Geographically, these portions consist of the on-site basins discussed in this report. The geographic character of the lower portions of the study contain a mix of type B and type C soils as defined in the Soil Conservation Services "Soil Survey of Rifle Area, Colorado". Ground cover, in undeveloped areas, consists of sagebrush vegetation with a fair density of grass understory. Other undeveloped portions of the lower portions contain historically irrigated farmlands with good ground cover.

The middle portions of the watershed typically are characteristic of cedar, juniper and sagebrush ground cover with poor understory density. These areas consist of the steep hillsides that connect the lower portions of the watershed with Grass Mesa. These areas represent, aside from impervious recent industrial/business land uses, the higher runoff curve numbers found in the watershed.

The upper portions of the watershed are that of Grass Mesa and adjacent drainage ways that are inclusive of the Ramsey Gulch Basin. Grass Mesa contains a mix of historical agricultural land uses as well as moderately sloped areas that are undeveloped with similar ground cover found on the steep hillsides below. Higher up in the upper portions of the watershed, the cedar/juniper ground cover transforms to a dense mix of oak brush with grass understory.





### Section 3.0 Off-site Basins

The off-site basins for this study are schematically shown in Figures 3-1 and 3-2. As previously stated, the largest of these basins is the Ramsey Gulch basin. A variety of recent studies have been conducted which focused on the Ramsey Gulch basin. These studies were prepared in relation to the development of the Grand River Hospital District and the Rifle Retail Ventures project. Both studies were conducted in concert with the development of the properties so as to assure that the flooding from the Ramsey Gulch basin would be isolated to roadway and parking lot flooding in lieu of building flooding. In addition to the Grand River Hospital District and Rifle Retail Ventures drainage studies, the drainage work performed in conjunction with the Gould Subdivision and Wapiti Park subdivisions to the west as well as the widening of the 5<sup>th</sup> lane of Airport Road were performed bearing in mind the magnitude of the flooding associated with the Ramsey Gulch flooding.

The following table (Tables 3-1), to be used in relationship to Figures 3-1 and 3-2, identifies a summary of data generated to describe the hydrologic and hydraulic characteristics of the off-site basins. Larger copies of Figures 3-1 and 3-2 can be found in Appendix A.

**Table 3-1  
Off-site Basin Area and Curve Numbers**

<u>BASIN NAME</u>	<u>AREA</u> (acres)	<u>COMPOSITE CURVE NUMBER</u>
RAMSEY GULCH	3025.3899	73.60
OS1 WEST	36.9228	75.40
OS2 WEST	1.7730	75.10
OS3 WEST	107.8484	77.80
OS4 WEST	28.4051	70.60
OS5 WEST	47.2171	68.20
OS1 EAST	13.3852	73.00
OS2 EAST	22.1402	80.20
OS3 EAST	204.2936	73.00
OS4 EAST	21.4327	77.80
OS5 EAST	17.7402	70.60
OS6 EAST	92.2766	68.20
OS7 EAST	82.2384	68.20
OS8 EAST	42.5021	65.80

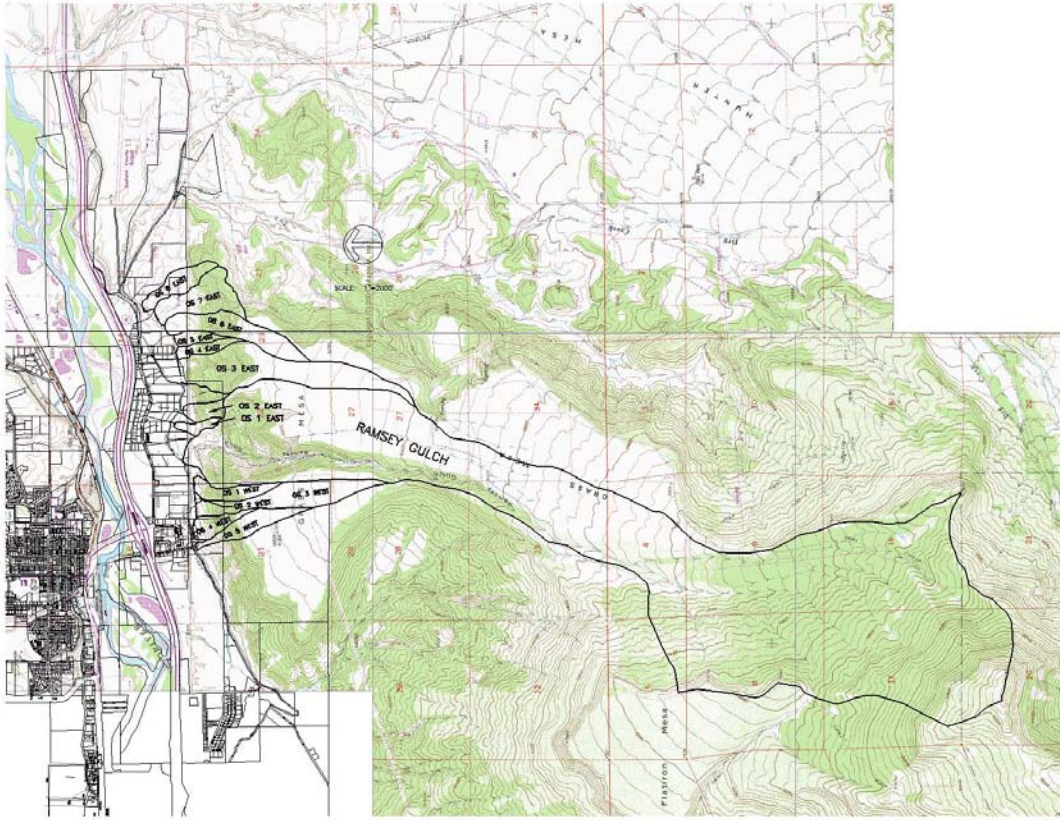


Figure 3-1 Offsite Basin Schematic

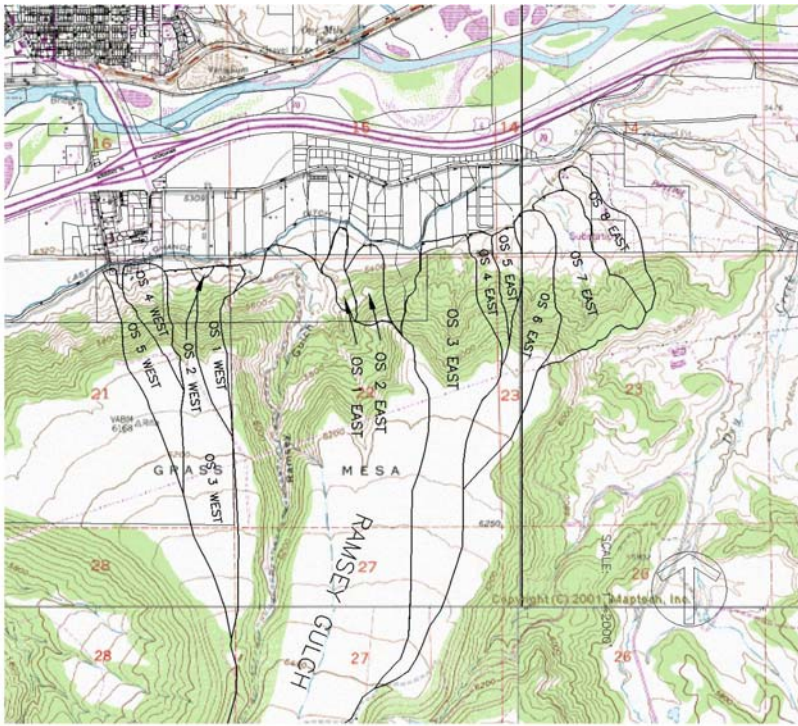


Figure 3-2 Offsite Basin Schematic (Blow Up)





## Section 4.0 On-site Basins

The on-site basins for this study are also schematically shown in Figures 4-1 and 4-2. The purpose of defining the on-site basins is to define those areas that exclude the larger off-site basins that also produce significant volumes of runoff in the design event. Additionally, this study provides for a snapshot of hydrologic and hydraulic conditions of the developable portions of the watershed in 2005. With this snapshot in time, the City will be able to use this study as a tool to help guide current needed drainage improvements as well as future improvements needed as a result of future development. Finally, the on-site basins complete the definition of the tributary areas of the critical drainage features evaluated in this study.

The following table (Tables 4-1), to be used in relationship to Figures 4-1 and 4-2, identifies a summary of data generated to describe the hydrologic and hydraulic characteristics of the on-site basins. Larger copies of Figures 4-1 and 4-2 can be found in Appendix B.

**Table 4-1  
On-site Basin Area and Curve Numbers**

<u>BASIN NAME</u>	<u>AREA</u> (acres)	<u>COMPOSITE CURVE NUMBER</u>
SOUTH RIFLE 1	16.7433	75.40
SOUTH RIFLE 2	9.1995	80.00
SOUTH RIFLE 3	8.7619	85.50
SOUTH RIFLE 4	16.6857	82.75
WAPITI GOULD	41.3823	86.25
GRHD SNYDER	55.6533	74.75
WEST SLAPPY	1.1356	86.90
SLAPPY BTE	22.6154	88.00
EAST SLAPPY	0.4236	92.00
HARRY 1	7.0092	80.40
HARRY 2	12.6397	80.40
HARRY 3	4.3881	80.40
HARRY 4	27.0675	80.40
GOLDBURG 1	24.3398	88.00
GOLDBURG 2	4.4694	88.00
WESTERN SLOPE TRAILER	6.7128	88.00
WEST BUCK	3.2567	88.00
RED CANYON	13.8804	69.00
BUCKHORN 1	5.0430	88.00
BUCKHORN TRAILER	15.1084	88.00
EAST SNYDER 1	21.8581	69.00
EAST SNYDER 2	14.6069	69.00

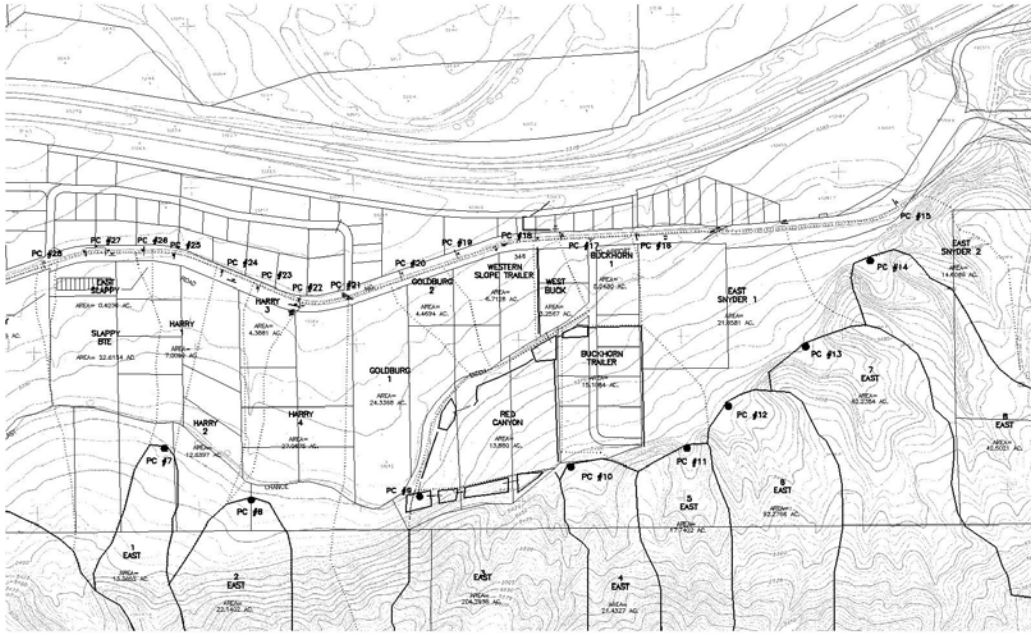


Figure 4-1: On-Site Basins (east end of study area)

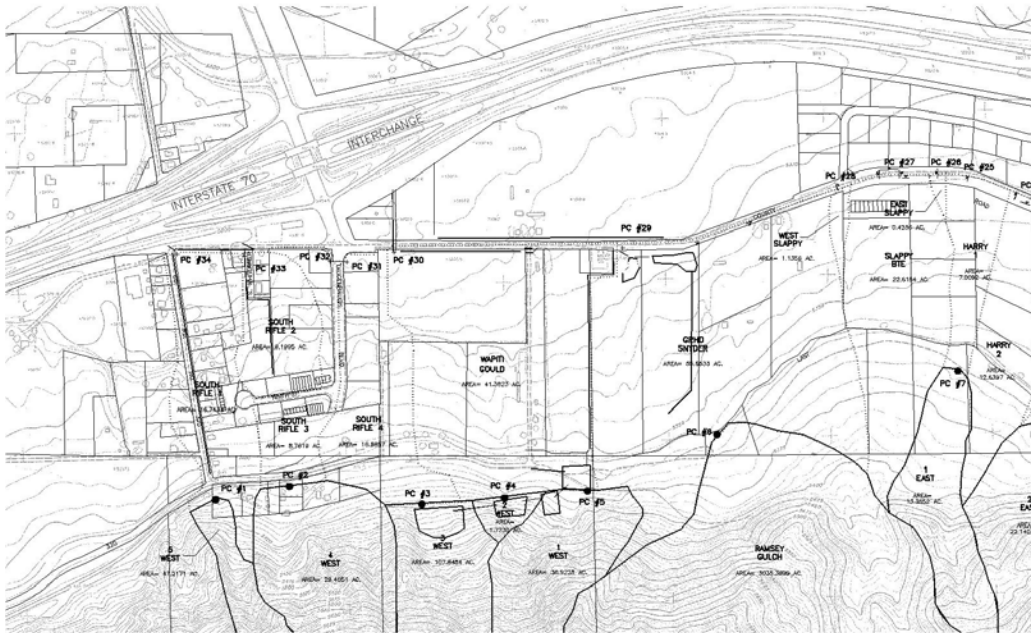


Figure 4-2: On-Site Basins (west end of study area)



## Section 5.0 Summary of Flow Calculations to Off and On-Site Basins and Points of Concentrations Identified

The following pages are a reprint of the calculation summary of flow data derived from the drainage model utilized by "PondPack Verison 7.5" for the South Rifle Storm Water Study. This information is being provided for future planning purposes towards providing flow information to size future drainage facilities that may otherwise be provided in any of the basins modeled.

Job File: C:\DOCUMENTS AND SETTINGS\JEFFEREY S. SIMONSON\MY DOCUMENTS\SOUTH RIFLE.PPW

Rain Dir: C:\HAESTAD\PPKW\RAINFALL\

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SOUTH RIFLE DRAINAGE
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Calculation of flows to a variety of structures in the South Rifle Area

S/N: 621601E06A8C Schmueser Gordon Meyer Inc  
PondPack Ver: 7.5 (767) Compute Time: 13:54:07 Date: 10-28-2005

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\*\*\*\*\* NETWORK SUMMARIES (DETAILED) \*\*\*\*\*

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Watershed..... 100  
Executive Summary (Nodes) ..... 2.03



MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID RIFLE.RNQ Rifle

Return Event	Total Depth in	Rainfall Type	RNF File	RNF ID	
100	2.4000	Synthetic Curve	SCSTYPES	TypeII	24hr
25	2.0000	Synthetic Curve	SCSTYPES	TypeII	24hr

MASTER NETWORK SUMMARY  
 SCS Unit Hydrograph Method

(\*Node=Outfall; +Node=Diversion;)  
 (Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Max Pond Storage Node ID ac-ft	Return Type Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft
BUCKHORN 1	AREA 100	.545		12.2000	5.51	
BUCKHORN 1	AREA 25	.406		12.2000	4.08	
BUCKHORN TRAILER	AREA 100	1.632		11.9200	30.74	
BUCKHORN TRAILER	AREA 25	1.215		11.9300	22.86	
EAST 1	AREA 100	.574		12.0900	6.98	
EAST 1	AREA 25	.357		12.1000	3.84	
EAST 2	AREA 100	1.532		12.0700	21.33	
EAST 2	AREA 25	1.053		12.0700	14.20	
EAST 3	AREA 100	8.757		12.8200	34.19	
EAST 3	AREA 25	5.453		13.0000	19.04	
EAST 4	AREA 100	1.276		12.1500	13.52	
EAST 4	AREA 25	.852		12.1500	8.42	
EAST 5	AREA 100	.633		12.0600	8.19	
EAST 5	AREA 25	.378		12.0600	4.08	
EAST 6	AREA 100	2.701		12.4200	13.87	

EAST 6	AREA	25	1.529	12.5200	6.09
EAST 7	AREA	100	2.407	12.2300	16.67

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PondPack Ver: 7.5 (767)    Compute Time: 13:54:07    Date: 10-28-2005

MASTER NETWORK SUMMARY  
SCS Unit Hydrograph Method

(\*Node=Outfall; +Node=Diversion;)  
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Max Pond Storage Node ID ac-ft	Return Type	Event Event	HYG Vol ac-ft	Trun Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft
EAST 7	AREA	25	1.363		12.2900	7.11	
EAST 8	AREA	100	1.000		12.3700	5.27	
EAST 8	AREA	25	.531		12.4500	1.89	
EAST SLAPPY	AREA	100	.057		12.1900	.56	
EAST SLAPPY	AREA	25	.044		12.1900	.43	
EAST SNYDER 1	AREA	100	.685		12.2100	5.41	
EAST SNYDER 1	AREA	25	.395		12.2200	2.38	
EAST SNYDER 2	AREA	100	.458		12.2000	3.60	
EAST SNYDER 2	AREA	25	.264		12.2500	1.59	
GOLDBURG 1	AREA	100	2.629		11.9900	43.30	
GOLDBURG 1	AREA	25	1.958		11.9900	32.26	
GOLDBURG 2	AREA	100	.483		12.1600	5.35	
GOLDBURG 2	AREA	25	.359		12.1600	3.96	
GRHD SNYDER	AREA	100	2.712		12.2900	21.67	
GRHD SNYDER	AREA	25	1.737		12.3000	12.49	
HARRY 1	AREA	100	.491		12.2300	4.24	
HARRY 1	AREA	25	.338		12.2900	2.78	
HARRY 2	AREA	100	.886		12.2200	8.30	
HARRY 2	AREA	25	.610		12.2200	5.46	
HARRY 3	AREA	100	.307		12.2500	2.73	
HARRY 3	AREA	25	.212		12.2500	1.79	
HARRY 4	AREA	100	1.896		12.2700	15.41	
HARRY 4	AREA	25	1.306		12.2700	10.06	

MASTER NETWORK SUMMARY  
SCS Unit Hydrograph Method

(\*Node=Outfall; +Node=Diversion;)  
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Max Pond Storage Node ID ac-ft	Return Type	Event Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft
*PC 15	JCT	100	1.457		12.3200	8.29	
*PC 15	JCT	25	.795		12.3300	3.17	
*PC 16	JCT	100	5.793		12.3700	32.64	
*PC 16	JCT	25	3.287		12.4300	14.04	
*PC 17	JCT	100	.545		12.2100	5.51	
*PC 17	JCT	25	.406		12.2100	4.08	
*PC 18	JCT	100	13.049		12.9800	41.80	
*PC 18	JCT	25	8.379		12.0400	26.08	
*PC 19	JCT	100	.725		12.1800	7.86	
*PC 19	JCT	25	.540		12.1900	5.83	
*PC 20	JCT	100	.483		12.1700	5.35	
*PC 20	JCT	25	.359		12.1700	3.96	
*PC 21	JCT	100	2.629		12.0000	43.30	
*PC 21	JCT	25	1.958		12.0000	32.26	
*PC 22	JCT	100	3.429		12.1900	34.66	
*PC 22	JCT	25	2.359		12.1900	22.79	
*PC 23	JCT	100	.307		12.2600	2.73	
*PC 23	JCT	25	.212		12.2600	1.79	
*PC 24	JCT	100	.886		12.2300	8.30	
*PC 24	JCT	25	.610		12.2300	5.46	
*PC 25	JCT	100	1.065		12.1900	10.96	
*PC 25	JCT	25	.695		12.1900	6.43	
*PC 26	JCT	100	.057		12.2000	.56	
*PC 26	JCT	25	.044		12.2000	.43	



MASTER NETWORK SUMMARY  
 SCS Unit Hydrograph Method

(\*Node=Outfall; +Node=Diversion;)  
 (Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Max Pond Storage Node ID ac-ft	Return Type	Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft
*PC 27	JCT	100	2.443		12.2100	25.29	
*PC 27	JCT	25	1.819		12.2100	18.76	
*PC 28	JCT	100	.116		12.1200	1.31	
*PC 28	JCT	25	.085		12.1600	.96	
*PC 29	JCT	100	148.112		12.7800	671.76	
*PC 29	JCT	25	94.592		12.9300	386.74	
*PC 30	JCT	100	12.461		12.5200	75.08	
*PC 30	JCT	25	8.541		12.5500	48.08	
*PC 33	JCT	100	3.817		12.1900	31.24	
*PC 33	JCT	25	2.589		12.1300	20.36	
*PC 34	JCT	100	2.233		12.2600	14.87	
*PC 34	JCT	25	1.332		12.2600	7.33	
RAMSEY	AREA	100	145.399		12.6700	662.79	
RAMSEY	AREA	25	92.855		12.8200	382.22	
RED CANYON	AREA	100	.435		12.4300	2.38	
RED CANYON	AREA	25	.251		12.5200	1.08	
SLAPPY BTE	AREA	100	2.443		12.2000	25.29	
SLAPPY BTE	AREA	25	1.819		12.2000	18.76	
SOUTH RIFLE 1	AREA	100	.850		12.1300	9.07	
SOUTH RIFLE 1	AREA	25	.550		12.1300	5.28	
SOUTH RIFLE 2	AREA	100	.629		12.0200	9.77	
SOUTH RIFLE 2	AREA	25	.431		12.0400	6.51	
SOUTH RIFLE 3	AREA	100	.825		12.1700	8.86	

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MASTER NETWORK SUMMARY  
 SCS Unit Hydrograph Method

(\*Node=Outfall; +Node=Diversion;)  
 (Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Max Pond Storage Node ID ac-ft	Return Type	Event Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft
SOUTH RIFLE 3	AREA	25	.600		12.1700	6.36	
SOUTH RIFLE 4	AREA	100	1.348		12.1900	13.19	
SOUTH RIFLE 4	AREA	25	.953		12.1900	9.05	
WAPITI GOULD	AREA	100	4.075		12.2700	33.25	
WAPITI GOULD	AREA	25	2.985		12.2700	23.93	
WEST 1	AREA	100	1.875		12.1700	19.01	
WEST 1	AREA	25	1.212		12.1700	11.14	
WEST 2	AREA	100	.088		12.0100	1.39	
WEST 2	AREA	25	.057		12.0200	.84	
WEST 3	AREA	100	6.422		12.5000	39.81	
WEST 3	AREA	25	4.287		12.5000	24.71	
WEST 4	AREA	100	1.014		12.2600	7.52	
WEST 4	AREA	25	.605		12.3200	3.64	
WEST 5	AREA	100	1.382		12.3300	8.70	
WEST 5	AREA	25	.782		12.3300	3.70	
WEST BUCK	AREA	100	.315		12.0800	4.11	
WEST BUCK	AREA	25	.230		12.0800	2.97	
WEST SLAPPY	AREA	100	.116		12.1100	1.31	
WEST SLAPPY	AREA	25	.085		12.1500	.96	
WESTERN SLOPE TR	AREA	100	.725		12.1700	7.86	
WESTERN SLOPE TR	AREA	25	.540		12.1800	5.83	

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NETWORK SUMMARY -- NODES  
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DEFAULT Design Storm File, ID = RIFLE.RNQ Rifle

Storm Tag Name = 25  
 Description: 25 Year Storm in Rifle

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 Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr  
 Storm Frequency = 25 yr  
 Total Rainfall Depth= 2.0000 in  
 Duration Multiplier = 1  
 Resulting Duration = 24.0000 hrs  
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Qpeak Trun. hrs	Qpeak cfs	Max WSEL ft
-----	----	-----	-----	-----	-----
BUCKHORN 1	AREA	.406	12.2000	4.08	
BUCKHORN TRAILER	AREA	1.215	11.9300	22.86	
EAST 1	AREA	.357	12.1000	3.84	
EAST 2	AREA	1.053	12.0700	14.20	
EAST 3	AREA	5.453	13.0000	19.04	
EAST 4	AREA	.852	12.1500	8.42	
EAST 5	AREA	.378	12.0600	4.08	
EAST 6	AREA	1.529	12.5200	6.09	
EAST 7	AREA	1.363	12.2900	7.11	
EAST 8	AREA	.531	12.4500	1.89	
EAST SLAPPY	AREA	.044	12.1900	.43	
EAST SNYDER 1	AREA	.395	12.2200	2.38	
EAST SNYDER 2	AREA	.264	12.2500	1.59	
GOLDBURG 1	AREA	1.958	11.9900	32.26	
GOLDBURG 2	AREA	.359	12.1600	3.96	
GRHD SNYDER	AREA	1.737	12.3000	12.49	
HARRY 1	AREA	.338	12.2900	2.78	
HARRY 2	AREA	.610	12.2200	5.46	
HARRY 3	AREA	.212	12.2500	1.79	
HARRY 4	AREA	1.306	12.2700	10.06	
Outfall PC 15	JCT	.795	12.3300	3.17	
Outfall PC 16	JCT	3.287	12.4300	14.04	
Outfall PC 17	JCT	.406	12.2100	4.08	
Outfall PC 18	JCT	8.379	12.0400	26.08	
Outfall PC 19	JCT	.540	12.1900	5.83	
Outfall PC 20	JCT	.359	12.1700	3.96	
Outfall PC 21	JCT	1.958	12.0000	32.26	
Outfall PC 22	JCT	2.359	12.1900	22.79	
Outfall PC 23	JCT	.212	12.2600	1.79	
Outfall PC 24	JCT	.610	12.2300	5.46	

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 RIFLE.PPW  
 Storm... TypeII 24hr Tag: 25

NETWORK SUMMARY -- NODES  
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

Node ID	Type	HYG Vol ac-ft	Qpeak Trun. hrs	Qpeak cfs	Max WSEL ft
Outfall PC 25	JCT	.695	12.1900	6.43	
Outfall PC 26	JCT	.044	12.2000	.43	
Outfall PC 27	JCT	1.819	12.2100	18.76	
Outfall PC 28	JCT	.085	12.1600	.96	
Outfall PC 29	JCT	94.592	12.9300	386.74	
Outfall PC 30	JCT	8.541	12.5500	48.08	
Outfall PC 33	JCT	2.589	12.1300	20.36	
Outfall PC 34	JCT	1.332	12.2600	7.33	
RAMSEY	AREA	92.855	12.8200	382.22	
RED CANYON	AREA	.251	12.5200	1.08	
SLAPPY BTE	AREA	1.819	12.2000	18.76	
SOUTH RIFLE 1	AREA	.550	12.1300	5.28	
SOUTH RIFLE 2	AREA	.431	12.0400	6.51	
SOUTH RIFLE 3	AREA	.600	12.1700	6.36	
SOUTH RIFLE 4	AREA	.953	12.1900	9.05	
WAPITI GOULD	AREA	2.985	12.2700	23.93	
WEST 1	AREA	1.212	12.1700	11.14	
WEST 2	AREA	.057	12.0200	.84	
WEST 3	AREA	4.287	12.5000	24.71	
WEST 4	AREA	.605	12.3200	3.64	
WEST 5	AREA	.782	12.3300	3.70	
WEST BUCK	AREA	.230	12.0800	2.97	
WEST SLAPPY	AREA	.085	12.1500	.96	
WESTERN SLOPE TR	AREA	.540	12.1800	5.83	

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 PondPack Ver: 7.5 (767) Compute Time: 13:54:07 Date: 10-28-2005



Type.... Executive Summary (Nodes) Page 2.03  
 Name.... Watershed Event: 100 yr  
 File.... C:\DOCUMENTS AND SETTINGS\JEFFEREY S. SIMONSON\MY DOCUMENTS\SOUTH  
 RIFLE.PPW  
 Storm... TypeII 24hr Tag: 100

NETWORK SUMMARY -- NODES  
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File, ID = RIFLE.RNQ Rifle

Storm Tag Name = 100  
 Description: 100 Year Storm in Rifle

-----  
 Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr  
 Storm Frequency = 100 yr  
 Total Rainfall Depth= 2.4000 in  
 Duration Multiplier = 1  
 Resulting Duration = 24.0000 hrs  
 Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Qpeak Trun. hrs	Qpeak cfs	Max WSEL ft
-----	----	-----	-----	-----	-----
BUCKHORN 1	AREA	.545	12.2000	5.51	
BUCKHORN TRAILER	AREA	1.632	11.9200	30.74	
EAST 1	AREA	.574	12.0900	6.98	
EAST 2	AREA	1.532	12.0700	21.33	
EAST 3	AREA	8.757	12.8200	34.19	
EAST 4	AREA	1.276	12.1500	13.52	
EAST 5	AREA	.633	12.0600	8.19	
EAST 6	AREA	2.701	12.4200	13.87	
EAST 7	AREA	2.407	12.2300	16.67	
EAST 8	AREA	1.000	12.3700	5.27	
EAST SLAPPY	AREA	.057	12.1900	.56	
EAST SNYDER 1	AREA	.685	12.2100	5.41	
EAST SNYDER 2	AREA	.458	12.2000	3.60	
GOLDBURG 1	AREA	2.629	11.9900	43.30	
GOLDBURG 2	AREA	.483	12.1600	5.35	
GRHD SNYDER	AREA	2.712	12.2900	21.67	
HARRY 1	AREA	.491	12.2300	4.24	
HARRY 2	AREA	.886	12.2200	8.30	
HARRY 3	AREA	.307	12.2500	2.73	
HARRY 4	AREA	1.896	12.2700	15.41	
Outfall PC 15	JCT	1.457	12.3200	8.29	
Outfall PC 16	JCT	5.793	12.3700	32.64	
Outfall PC 17	JCT	.545	12.2100	5.51	
Outfall PC 18	JCT	13.049	12.9800	41.80	
Outfall PC 19	JCT	.725	12.1800	7.86	
Outfall PC 20	JCT	.483	12.1700	5.35	
Outfall PC 21	JCT	2.629	12.0000	43.30	
Outfall PC 22	JCT	3.429	12.1900	34.66	
Outfall PC 23	JCT	.307	12.2600	2.73	
Outfall PC 24	JCT	.886	12.2300	8.30	

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 PondPack Ver: 7.5 (767) Compute Time: 13:54:07 Date: 10-28-2005

Type.... Executive Summary (Nodes) Page 2.04  
 Name.... Watershed Event: 100 yr  
 File.... C:\DOCUMENTS AND SETTINGS\JEFFEREY S. SIMONSON\MY DOCUMENTS\SOUTH  
 RIFLE.PPW  
 Storm... TypeII 24hr Tag: 100

NETWORK SUMMARY -- NODES  
 (Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

Node ID	Type	HYG Vol ac-ft	Qpeak Trun. hrs	Qpeak cfs	Max WSEL ft
Outfall PC 25	JCT	1.065	12.1900	10.96	
Outfall PC 26	JCT	.057	12.2000	.56	
Outfall PC 27	JCT	2.443	12.2100	25.29	
Outfall PC 28	JCT	.116	12.1200	1.31	
Outfall PC 29	JCT	148.112	12.7800	671.76	
Outfall PC 30	JCT	12.461	12.5200	75.08	
Outfall PC 33	JCT	3.817	12.1900	31.24	
Outfall PC 34	JCT	2.233	12.2600	14.87	
RAMSEY	AREA	145.399	12.6700	662.79	
RED CANYON	AREA	.435	12.4300	2.38	
SLAPPY BTE	AREA	2.443	12.2000	25.29	
SOUTH RIFLE 1	AREA	.850	12.1300	9.07	
SOUTH RIFLE 2	AREA	.629	12.0200	9.77	
SOUTH RIFLE 3	AREA	.825	12.1700	8.86	
SOUTH RIFLE 4	AREA	1.348	12.1900	13.19	
WAPITI GOULD	AREA	4.075	12.2700	33.25	
WEST 1	AREA	1.875	12.1700	19.01	
WEST 2	AREA	.088	12.0100	1.39	
WEST 3	AREA	6.422	12.5000	39.81	
WEST 4	AREA	1.014	12.2600	7.52	
WEST 5	AREA	1.382	12.3300	8.70	
WEST BUCK	AREA	.315	12.0800	4.11	
WEST SLAPPY	AREA	.116	12.1100	1.31	
WESTERN SLOPE TR	AREA	.725	12.1700	7.86	

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Watershed... 1.01, 2.01, 2.03

S/N: 621601E06A8C    Schmueser Gordon Meyer Inc  
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Date:



## Section 6.0 Existing Critical Drainage Features and Their Capacity

The critical drainage features in the study area are those features that have been defined as the necessary elements to adequately transport offsite drainage waters through the South Rifle “On-Site” basins. A number of these facilities are associated with Airport Road itself while the other facilities are located between Airport Road and the base of the Grass Mesa hillside. Currently, there are a variety of developments that have already developed and constructed facilities to minimize their individual impacts to down stream properties all the while transporting off-site drainage waters “through” their properties. These developments and the associated drainage improvements/conditions are discussed as follows:

*Buckhorn Business Park Subdivision:* This subdivision was developed in the 1999 to 2000 time frame. The drainage plan prepared by High Country Engineering honored the code required objective of assuring that runoff exiting the site, exited at historic rates based upon the 25-year rainfall event. This was accomplished by providing internal drainage facilities consisting of borrow ditches, inlets and culverts that ultimately culminated in the placement of a detention pond located just uphill of the Loesch and Crann (Last Chance Ditch) Ditch. The off-site drainage patterns, from the Grass Mesa hillside, were directed around both the east and west sides of the subdivision and ultimately deposited into the Last Chance Ditch. Until piping of the Last Chance Ditch occurred, the discharge of drainage waters from the Buckhorn Business Park as well as the off-site basins was not realized as the Last Chance Ditch collected and transported drainage waters away from down hill properties. Since the piping of the ditch has occurred, the drainage facilities constructed with the Buckhorn Business Park have become more critical towards limiting their rates of runoff that deposit on downstream properties. These downstream properties are Michaelis Subdivision Lots 1 through 3 and Rifle Business Park Lots 36 through 39. Since the time of the original development of Buckhorn Business Park, visual field observation has revealed that the detention facility has been encroached upon and that the full intended volume of the detention pond no longer exists.

*Michaelis Minor Subdivision, Lots 1 through 3* was designed taking into consideration the non-existence of the Last Chance Ditch. However, no formal easements were dedicated at the time of the minor subdivision review process that would allow the City of Rifle to adequately maintain the drainage facilities that were built in the 1999-2000 time frame. Drainage facilities were designed and constructed through the subdivision which would transport both on-site and off-site drainage facilities through the subdivision to existing facilities in Airport Road. Since the time the original tenant uses were established on the three lots, the uses have changed from trailer and modular sales to heavy industrial uses which support the drilling industry. Subsequently, the drainage facilities that were originally designed and constructed, no longer exist. The off-site drainage from Buckhorn Business Park now exits onto Lot 1 of Michaelis Minor Subdivision and “sheet flows” through the lot, uncontrolled to Airport Road.

*Lots 36 through 39, Rifle Business Park:* At Airport Road, drainage waters from Michaelis Minor flows through two (2) culverts into the Airport Road right of way where it is directed to the west to deposit between Lots 36 and 37 of Rifle Business Park to eventually deposit into



the Interstate 70 right of way. Recent improvements by the City and the lot owner of lots 37 and 38 of the Rifle Business Park have constructed these improvements as a result of the drainage problems experienced in late 2004-early 2005 time frame. The current owners of lots 36 through 38 understand the critical nature of the improvements constructed in 2005 on lots 36 through 38 of the Rifle Business Park. The City and the lot owners alike should endeavor to allow or ensure the integrity of the improvements constructed by dedication of a drainage easement to the City that encompasses the improvements constructed.

*Red Canyon Ventures:* This property is a piece of ground currently utilized by support services for the drilling industry. This property is located to the west of the Buckhorn Business Park and consists of three lots that were original lots subdivided in the McClearn Orchard Lands. These lots are located above the Last Chance Ditch and below the base of the hillside that climbs to Grass Mesa. Recent project proposals associated with the acquisition of a Conditional Use Permit have required the construction of a number of drainage improvements that have been designed and constructed in response to the drainage problems experienced in the late 2004- early 2005 time frame. The significance of these improvements were the development of collection, transport and detention facilities at the base of the draws that define the OS 3 East drainage basin. Prior to construction of these facilities, the tenants of these lots were allowing discharge of the drainage waters to trespass onto the adjacent (west) Goldberg-Tarasiuk Minor Subdivision and in particular, the 10 acre Mc31, Llc property that is currently undeveloped. With the improvements constructed in 2005, drainage is controlled to historic rates of runoff (on the 25-year event) and discharge into expanded detention and treatment facilities that also discharge into Michaelis Minor Subdivision. Flows on the west side of the Red Canyon Ventures property (ie., west retention pond) will store significant flood water volume prior to allowing a discharge to occur (at less than historic rates) in a sheet flow manner onto the Mc31, LLC property.

*Mc31, LLC Property:* Ultimately, as drainage waters discharged and sheet flowed from Red Canyon Ventures (prior to 2005 improvements), west across the Mc31, LLC property, they, they ultimately ended up concentrating along the west property line and flowing in a northerly direction to the two (2) 36" pipes that drain under Airport Road at the east tie of Enterprise Court with Airport Road. From the 36" pipes, water entered into the planned drainage transport facilities on lots 10, 24 and 25 of the Rifle Business Park. Future development of the Mc31, LLC property will need to assure that the offsite drainage waters (as well as on-site waters) are properly routed to the two (2) 36 inch pipes under Airport Road.

*Rifle Business Park Lots 10, 24 and 25:* These three lots identified as receiving the drainage waters from the Mc31, LLC property remain currently undeveloped. As a result, the final improvements recommended to be constructed with the original subdivision of the Rifle Business Park were not fully developed and exhibited perceived drainage problems at the outfall of the twin 36 inch pipes. Future development of the proper drainage facilities (identified in the Rifle Business Park drainage plan) will assure proper transport of drainage waters through and from Lots 24 and 25 of RBP to existing culverts located at the northeast bend of Enterprise Court (in the vicinity of Lots 9-11). From these culverts, water will flow into a detention facility located along the Lot 9/Lot 10 property line and along the north property line of Lot 10. Completion of the drainage facilities will need to be coordinated with the developer of the Rifle Business Park to assure proper collection and treatment of storm waters prior to discharge into the Interstate 70 right of way.

*GSMI Minor, Kerr Minor, HHH Minor, BTE Minor and Slappy Minor.* These minor subdivisions are all located below the Last Chance Ditch and west (in order listed) of the prior discussed subdivisions. The drainage problems discussed in the late 2004-early 2005 time frame did not appear to be problematic with any of these listed subdivisions. However, it should be noted that these particular subdivisions are the first in line (below the undeveloped McClearn Orchard Lands Lots above the Last Chance Ditch) to receive a “direct hit” from a flood that would conceivably come down Ramsey Gulch. Site Plan Review of the development of individual lots have required the lot owners in each of these minor subdivisions to assure that the buildings constructed are above the 100-year flood of Ramsey Gulch and that adjacent grading will allow flood waters to “flow around” the buildings. By virtue of receiving a Certificate of Occupancy for their building and lot construction, it can be deduced that the Building Official for the City determined that the improvements were constructed as designed. Therefore, it was not in the scope of this study to evaluate the individual lots to assure that compliance has remained relative to the original design of the sites on the individual lots. Drainage from each of these lots, on a nuisance basis, is directed in a series of ditches, inlets and pipes to Airport Road. From Airport Road, drainage is then directed through the Rifle Business Park in a series of designed improvements that are to be “finalized” for construction at the time of individual lot construction. It will be incumbent upon the City to assure that development of the remaining (yet undeveloped) lots consider implementation of the drainage improvements identified in the drainage plan for the Rifle Business Park.

*Kathryn Snyder Property.* West of the Slappy Minor Subdivision is the Snyder Property of which remains undeveloped. As with the previously discussed minor subdivisions, nuisance drainage problems resulting from the piping of the Last Chance Ditch have not been apparent. Additionally, this is also a property that is likely to receive a “direct hit” from the Ramsey Gulch flooding. The future for the Snyder property will need to consider proper routing of off-site drainage waters through this property. Along the west property line is the start of the significant flood protection channel for the Grand River Hospital District. This channel would be the likely direction to route off-site floodwaters in any development off the Snyder property. However, it would be likely than any developer of this property would need to coordinate this plan with the Grand River Hospital District with the City mediating. Additionally, any development of this property would need to consider the fact that this property would likely receive a “direct hit” from the Ramsey Gulch flooding. Routing of floodwater through the property would be critical for any design to assure protection for new and existing buildings exists. Nuisance flows from the Snyder property are directed (via roadside borrow ditch) westward along Airport Road to the storm drainage facilities recently constructed at the entrance to the Grand River Hospital District. This borrow ditch has limited capacity to handle significant flows. For drainage waters that may be produced from the Snyder property, itself, the borrow ditch is competent enough to carry volumes of water produced. However, when considering peak flows potentially developed by the Ramsey Gulch basin, the borrow ditch will overtop Airport Road and discharge floodwaters into the downstream Wal-Mart property.

*Grand River Hospital District Property.* West of the Snyder property is the Grand River Hospital District property. Because of the obvious critical nature of the facility, itself, significant improvements were developed to protect the GRHD from a flood coming out of the Ramsey Gulch Drainage. Therefore, nuisance flows are obviously of no concern relative to the capacity built to accommodate the Ramsey Gulch flooding. Along the east side of the

GRHD property is a flood channel that was constructed to route the Ramsey Gulch flows. This channel directs Ramsey Gulch flows to the north to Airport Road. At Airport Road, the flood channel discharges into a shallow detention pond/borrow ditch area. Given the magnitude of flooding anticipated to discharge from Ramsey Gulch, it has been acknowledged that the drainage facilities parallel to and south of Airport Road are not competent enough to handle these flows. In fact, these facilities, in recently constructed improvements were constructed in such a manner as to limit the capacity of the new facilities to the historic rates of flow. The purpose being to assure that no additional floodwaters are introduced into the Airport Road/Taughenbaugh Boulevard intersection. Therefore, the development of the Rifle Retail Venture property north of GRHD, Snyder and Gould (to the west of GRHD) needed to consider the fact that the Ramsey Gulch floodwaters would overtop Airport Road and need to be routed through this property without damage to the proposed buildings. The drainage facilities south and west of the GRHD property are limited to 70 cfs capacity. Any peak flows over and above this amount will overtop Airport Road and proceed northward through the Rifle Retail Venture property to the Interstate 70 right of way.

*Rifle Retail Ventures/Wal-Mart Properties:* As discussed in the prior two (Snyder and Grand River Hospital District) property discussions, the design of the drainage facilities in the Wal-Mart development and the current Rifle Retail Ventures developments have considered the fact that it is anticipated that the Ramsey Gulch flooding will overtop Airport Road and impact each of these properties. In fact, it has been a requirement to assure that the site designs, to date, consider the full flow from Ramsey Gulch and not consider the 70 cfs that the south borrow ditch will carry to the west. It will be incumbent upon the City to assure that the future development of the Rifle Retail Ventures property continue to accommodate the entire flow of Ramsey Gulch for eventual discharge into the Interstate 70 right of way.

*Gould (Grand River Plaza) Property:* This subdivision is the first subdivision west of the direct impact of Ramsey Gulch flooding. However, the subdivision remains exposed to significant off-site flooding potential, particularly from debris flow. As a result, significant drainage detention areas were designed and constructed to limit the need to route significantly large volumes of water around the subdivision. In addition, this subdivision was designed with the Last Chance Ditch piped. It will be incumbent upon the City to remain cognoscente of the status of available storage in the detention ponds provided in Tract B of this subdivision. If and when debris is deposited in the detention ponds, it will need to be removed as soon as practical to assure proper function of the drainage plan. Drainage from the Gould (Grand River Plaza) subdivision is limited to historic rates of runoff and discharges into the south borrow ditch of Airport Road where it continues west to two (2) 30" pipes that ultimately cross Airport Road and discharge drainage waters into the Interstate 70 right of way. All of these improvements were designed and constructed for this consideration to occur.

*Wapiti Park Property:* This subdivision, like Grand River Plaza has been designed with the concept of limiting the rate of runoff from the site to the historic rate. This subdivision has limited off-site drainage to consider as the Grand River Plaza drainage improvements in Tract B intercept the majority of the off-site drainage. This subdivision has also been designed and constructed with the piping of the Last Chance Ditch having taken place. Like the Grand River Plaza drainage, the drainage from Wapiti Park drains to the south borrow ditch of Airport Road and continues west to the two (2) 30" pipes under Airport Road. The improvements in Wapiti Park were designed and constructed with these considerations.

*Old South Rifle Properties:* A variety of smaller subdivisions created in the late 1970's – early 1980's were developed south of Airport Road, west of and including Taughenbaugh Boulevard to the north-south leg of County Road 320. Each of these subdivisions individually handled drainage without the concept of the Last Chance Ditch being piped. Fortunately, the improvements at Airport Road and Taughenbaugh, when designed and built, considered the volumes of runoff produced from the tributary basins without consideration of the existence of the Last Chance Ditch. As storm drain facilities jointly served as irrigation transport facilities, the effects of piping the Last Chance Ditch will not be as dramatic as the east end of the study area as the tributary basins are smaller. However, it will be incumbent upon the City to assure that in-fill development properly considers off-site drainage and irrigation.

*East Snyder 1 and East Snyder 2 Properties:* These properties remain undeveloped. As the properties lay uphill of the Last Chance Ditch, nuisance drainage is not a problem within these basins. The future of the Snyder property will need to consider proper routing of the offsite drainage through each basin. Additionally, the code mandated drainage control devices will need to be properly designed and constructed.

For the known culvert crossings and critical structures identified in this study, the following table (Table 6-1, next page) identifies a summary of flow data versus capacity (when defined). Additionally, the appendix (Appendix C) contains an 11X17 drawing of the on-site basins complete with the locations of existing critical drainage features and their capacity identified.

**Table 6-1  
Flow Data/Capacity Table  
South Rifle Storm Water Study**

Point of Concentration	Description	25-Year Flow (CFS)	100-Year Flow (CFS)	Capacity (CFS)	Structure Description
1	Outfall of OS 5 West	3.70	8.70	n/a	
2	Outfall of OS 4 West	3.64	7.52	7.00	18" diameter pipe
3	Outfall of OS 3 West	24.71	39.81		
4	Outfall of OS 2 West	0.84	1.39		
5	Outfall of OS 1 West	11.14	19.01		
6	Outfall of Ramsey Gulch at Last Chance Ditch	382.22	662.79		
7	Outfall of OS 1 East	3.84	6.98		
8	Outfall of OS 2 East	14.20	21.33		
9	Outfall of OS 3 East	19.04	34.19		
10	Outfall of OS 4 East	8.42	13.52		
11	Outfall of OS 5 East	4.08	8.19		
12	Outfall of OS 6 East	6.09	13.87		
13	Outfall of OS 7 East	7.11	16.67		
14	Outfall of OS 8 East	1.89	5.27		
15	Pipe at Airport Road	3.17	8.29	6.00	12" diameter pipe
16	Pipe at Airport Road	14.04	32.64	13.50	18" diameter pipe
17	Pipe at Airport Road	4.08	5.51	18.60	24" diameter pipe
18	Pipe at Airport Road	26.08	41.80	9.00	18" diameter pipe
19	Pipe at Airport Road	5.83	7.86	7.00	18" diameter pipe
20	Pipe at Airport Road	3.96	5.35	7.30	18" diameter pipe
21	Pipe at Airport Road	32.26	43.30	123.00	Twin 36" diameter pipes
22	Pipe at Airport Road	22.79	34.66	13.00	15" diameter pipe
23	Pipe at Airport Road	1.79	2.73	0.00	12" diameter pipe
24	Pipe at Airport Road	5.46	8.30	6.00	24" diameter pipe
25	Pipe at Airport Road	6.43	10.96	27.00	18" diameter pipe
26	Pipe at Airport Road	0.43	0.56	6.00	15" diameter pipe
27	Pipe at Airport Road	18.76	25.29	6.00	18" diameter pipe (2)
28	Pipe at Airport Road	0.96	1.31	6.00	12" diameter pipe
29	Ramsey Gulch at Airport Road	386.74	671.76		
30	Pipes at Airport Road	48.08	75.08	118.00	Twin 30" diameter pipes
31	Outfall of South Rifle 4	9.05	13.19		
32	Outfall of South Rifle 3	6.36	8.86		
33	Outfall of South Rifle 2	6.51	9.77		
34	Outfall of South Rifle 1	5.28	9.07		



## Section 7.0 Recommendations

As build out has continued in the study area, the principal areas of concern towards providing proper, maintainable drainages within the city are less associated with providing immediate “physical” improvements but more associated with assuring development occurs bearing the current drainage plans in mind. None the less, a variety of recommendations are given to enhance performance of drainage appurtenant structures and minimize future potential flooding problems.

1. Identify the specific volume of the detention pond located on Lot 1 of Buckhorn Business Park. Make sure that the volume of the pond is capable of providing 15,458 CF of detention in accordance to the original drainage and grading plan noted as Exhibit 7-1 (Appendix D), attached. Additionally, verify that the swale sections identified on the exhibit remain in place as noted on the same exhibit. To the extent that improvements are necessary, the City can request from the respective property owners to make repairs. Otherwise, the City can intervene (as drainage easements exist) and provide necessary improvements of which the costs would then be reimbursed from the respective lot owners via negotiations or legal means.
2. Assure that the drainage improvements on the Michaelis Minor Subdivision Lots 1-3 are reinstated. Currently, the tenant of Lot 1, Speedy Heavy Haulers, has removed all of the drainage improvements on Lot 1 in an attempt to provide additional maneuvering room for their equipment. The drainage improvements on Lot 1 need to be reconstructed along both the east and west lot lines to assure proper transport of off-site flows through the site exists. The property owner, John Michaelis, has shown interest in assuring that the drainage is reinstated. He has gone to the extent of coordinating with the property owner of Lots 2 and 3 of the Goldberg-Tarasuik Subdivision to help define and locate additional improvements along their common property line. Finally, the City should actively pursue obtaining a “dedicated” drainage easement from each property owner so as to assure the City’s ability to police maintenance of the physical drainage improvements that are reinstated.
3. The City should actively secure a drainage easement along the common lot line of Lots 36 and 37 of the Rifle Business Park. Additionally, the City should secure a drainage easement along the common lot line of Lots 38 and 39 of the Rifle Business Park. By securing these easements, the City can assure itself that drainage crossing Airport Road can be safely and perpetually transported through the respective lots to the Interstate 70 right of way.
4. The City should assure that the drainage improvements identified to be constructed for Lot 39 of the Rifle Business Park be constructed properly. Field reconnaissance of the current improvements indicate that the drainage improvements may not have been fully constructed.
5. Future development of Mc31, LLC property will need to assure that proper transport of off-site drainage waters through their property will exist. This would be in

addition to the requirement that on-site drainage waters provide adequate detention and treatment of storm water in such a fashion as to limit the flow from the property to historic rates based upon the 25-year rainfall event. The City will need to require the dedication of drainage easements on all property lines to assure that the City has the flexibility to both construct and maintain any future drainage improvements that the City may deem are appropriate to best serve the City's needs. We would recommend that the improvements consider peak flows that would be the result of failed drainage appurtenant facilities currently existing and functional in drainage basin OS 3 East. The 25-year rate of flow from this basin is 19.04 cfs while the 100-year flow is 34.19 cfs.

6. Full implementation of the drainage plan developed for the Rifle Business Park should take place. Exhibit 7-2 (Appendix D) has been attached which identifies the improvements that need to be implemented. Implementation of these improvements can be a result of waiting for lot development to construct facilities or having the City construct necessary improvements and seek reimbursement from those affected lots or the developer of the Rifle Business Park. An alternative would be to negotiate with the developer of the Rifle Business Park to complete the drainage improvements identified on the drainage plan.
7. Construct debris catchments in the Ramsey Gulch basin to reduce debris laden peak flows from Ramsey Gulch. As the flood water peaks identified are a reflection of hydraulic (water) flow only, it is typical to see peaks resulting from the collection of debris in the tributary draws to increase the hydraulic peak by as much as 50%. By providing a debris catchment, the City could be assured of the "design" volume of flow from Ramsey Gulch as well as a "design" location for the debris to be deposited. With the catchment would be the recommendation to obtain any necessary easements to not only construct the catchment, but to also allow for maintenance of the catchment and placement of deposited debris. Exhibit 7-3 (Appendix D) identifies the schematic representation of the "catchment design" recommended for Ramsey Gulch.
8. Work with the Last Chance Ditch Company to strategically locate drain inlets in the western portions of the study area (ie., between Taughenbaugh and CR 320). As the ditch is yet to be piped in this location, the City could cost share inlet and/or junction box locations with the company to assure that offsite flows that, on a nuisance basis, remain their deposition into the ditch. The affected drainage basins are OS 4 West and OS 5 West. For the culverts that currently cross South 10<sup>th</sup> Street, the proposal would be to drop these culverts into an inlet in the Last Chance Ditch. Excessive flow volumes could continue beyond the capacity of the inlets into the drainage system associated with South 7<sup>th</sup>, Airport Road and Taughenbaugh Boulevard.



## Section 8.0 Costs

The following Table, Table 8.1 reflects a summary of the anticipated costs of the itemized recommendations outlined in Section 7.0. Many of these costs are costs that the City will be able to negotiate with the particular adjacent property owners as the improvements serve to reinstate drainage facilities that were eliminated as a result of change in use from their original approved site plans or subdivision improvements.

**Table 8.1**

### Summary of Anticipated Costs For Recommendations

Recommendation #	Description	Cost
1	Intervene to reconfigure Buckhorn Business Park drainage improvements. (Reconstruct detention pond and swales)	\$ 12,500.00
2	Reinstate drainage improvements for Michaelis Minor Subdivision	\$ 6,750.00
3	Purchase drainage easements on Lots 36,37,38 and 39 of Rifle Business Park	\$ 6,375.00
4	Reinstate drainage improvements for Lot 39 of Rifle Business Park	\$ 9,875.00
5	Drainage improvements on the Mc31, LLC property to be borne by the developer when development is proposed on this property.	\$ -
6	Full implementation of the Rifle Business Park Drainage plan.	\$ 68,750.00
7	Ramsey Gulch Debris Catchment and Flood Channel	\$ 73,875.00
8	Last Chance Drain Inlets	\$ 5,000.00

**Total Estimated Cost of all Recommendations**

**\$183,125.00**



The considerations made in developing the cost estimates are noted as follows:

**Recommendation #1:** The reconstruction of Buckhorn Drainage improvements will mostly involve equipment and labor. We estimate that the improvements can be reinstated within a two day time period utilizing the equivalent of a small excavator and loader along with three days of supervision and one day of surveying. Additionally, we identified the possibility of reinstalling the outfall pipe to the detention pond. With the consideration of the contingency, additional work items such as patching and base material incidental with the work would be covered. These are cost that the City can pass off to the adjacent lot owners if the City so desires. The reinstatement of the improvements is an obligation of the lot owner.

**Table 8.2  
Cost Estimate for Recommendation #1**

<b>Item</b>	<b>Description</b>	<b>Unit Price</b>	<b>Quantity</b>	<b>Total Price</b>
1	Mini Excavator	\$ 125.00	16	\$ 2,000.00
2	Loader	\$ 125.00	16	\$ 2,000.00
3	Survey	\$ 125.00	8	\$ 1,000.00
4	Supervision	\$ 100.00	24	\$ 2,400.00
5	Piping	\$ 55.00	40	\$ 2,200.00
6	End Sections	\$ 200.00	2	\$ 400.00
	Total			\$ 10,000.00
	25% Contingency			\$ 2,500.00
	<b>Total to Budget</b>			<b>\$ 12,500.00</b>

**Recommendation #2:** The reinstatement of Michaelis Minor Subdivision drainage improvements would be primarily performed to assure that the outfall to the Buckhorn detention pond can safely drain through the Michaelis Minor Subdivision. Along the west and east property lines of Lot 1 is required to exist a drainage swale that is 12” deep, at a minimum. This swale would then have side slopes that are 2:1. At a minimum, the swale on the east property line of Lot 1 would be necessary to be provided. If it is the only facility provided, it will need to be a minimum depth of 1.75 ft. and have 2:1 side slopes. The costs identified are chiefly labor, equipment and survey. Reinstatement of the swales should take no more than one day’s time. These are costs that the City can require the developer/lot owner to absorb or the City can choose to expend these costs and receive reimbursement from the lot owner. The lot owner has shown a willingness to work with the City in this regard.

**Table 8.3  
Cost Estimate for Recommendation #2**

<b>Item</b>	<b>Description</b>	<b>Unit Price</b>	<b>Quantity</b>	<b>Total Price</b>
1	Mini Excavator	\$ 125.00	8	\$ 1,000.00
2	Loader	\$ 125.00	8	\$ 1,000.00
3	Survey	\$ 125.00	8	\$ 1,000.00
4	Supervision	\$ 100.00	24	\$ 2,400.00
	Total			\$ 5,400.00
	25% Contingency			\$ 1,350.00
	<b>Total to Budget</b>			<b>\$ 6,750.00</b>

**Recommendation #3:** This cost is a cost that has been developed considering the City's need to assure that the drainage can continue in an uninterrupted and continuous fashion. The acquisition of the easements are costs associated mainly with legal, engineering and surveying costs with minimal costs associated with the purchase of the easements themselves. These are City borne costs.

**Table 8.4  
Cost Estimate for Recommendation #3**

<b>Item</b>	<b>Description</b>	<b>Unit Price</b>	<b>Quantity</b>	<b>Total Price</b>
1	Legal Council	\$ 500.00	1	\$ 500.00
2	Engineer	\$ 100.00	1	\$ 100.00
3	Survey	\$ 500.00	1	\$ 500.00
4	Easements	\$1,000.00	4	\$ 4,000.00
	Total			\$ 5,100.00
	25% Contingency			\$ 1,275.00
	<b>Total to Budget</b>			<b>\$ 6,375.00</b>

**Recommendation #4:** This is a cost that is associated with reinstating an approved drainage plan developed for Lot 39 of the Rifle Business Park. At a minimum, the City will install a roadside swale in Airport Road to a side lot line which already contains a swale. The chief costs are related to equipment and labor with a one to two day construction time required. The City could require the lot owner to provide these improvements or choose to construct them itself.

**Table 8.5  
Cost Estimate for Recommendation #4**

Item	Description	Unit Price	Quantity	Total Price
1	Mini Excavator	\$ 125.00	16	\$ 2,000.00
2	Loader	\$ 125.00	8	\$ 1,000.00
3	Survey	\$ 125.00	8	\$ 1,000.00
4	Landscaping	\$1,500.00	1	\$ 1,500.00
5	Supervision	\$ 100.00	24	\$ 2,400.00
	Total			\$ 7,900.00
	25% Contingency			\$ 1,975.00
	<b>Total to Budget</b>			<b>\$ 9,875.00</b>

**Recommendation #6:** This is a cost that is associated with assuring that the drainage plan prepared for the Rifle Business Park is implemented. Presently, a number of the improvements have been partially constructed and remain to be completed based upon the future development of undeveloped parcels. The main improvements considered in the estimate are those which assure swales are constructed to route nuisance flows through the site(s). These costs can be City funded costs that can be reimbursed by the developer or lot owners or improvements can wait until the developer/lot owner provides such.

**Table 8.6  
Cost Estimate for Recommendation #6**

Item	Description	Unit Price	Quantity	Total Price
1	Lot 22,23,27 and 28 swale	\$ 2,500.00	1	\$ 2,500.00
2	Lot 19,20,29 and 30 swale	\$ 2,500.00	1	\$ 2,500.00
3	Road	\$20,000.00	1	\$ 20,000.00
4	Swales adjacent to Airport	\$10,000.00	1	\$ 10,000.00
5	Lot 24 and 25 swale	\$15,000.00	1	\$ 15,000.00
6	Lot 10-13 and Lot 33 swale	\$ 2,500.00	1	\$ 2,500.00
7	Lot 9 and 10 swale	\$ 2,500.00	1	\$ 2,500.00
	Total			\$ 55,000.00
	25% Contingency			\$ 13,750.00
	<b>Total to Budget</b>			<b>\$ 68,750.00</b>

**Recommendation #7:** This is the cost associated with the Ramsey Gulch Debris Catchment and Flood Channel. An 18,000 s.f pond with a depth of 4 feet as well as a 1180 lf flood channel are depicted in the cost. Additionally, a budget has been established to purchase the easement (2 acres) from the land owner. Costs would be borne by the City.

**Table 8.7  
Cost Estimate for Recommendation #7**

Item	Description	Unit Price	Quantity	Total Price
1	18000 sf pond construction (2700 cf excavation)	\$ 7.50	2700	\$ 20,250.00
2	1180 lf of flood channel construction	\$ 15.00	1180	\$ 17,700.00
3	4100 sy erosion mat in swale	\$ 1.50	4100	\$ 6,150.00
4	50 cy of rip rap	\$ 100.00	50	\$ 5,000.00
5	Easement Purchase (2 acres)	\$ 5,000.00	2	\$ 10,000.00
	Total			\$ 59,100.00
	25% Contingency			\$ 14,775.00
	<b>Total to Budget</b>			<b>\$ 73,875.00</b>

**Recommendation #8:** This is a cost associated with providing drain inlets at key locations within the Last Chance Ditch. Coordination with the ditch company would be necessary to assure that the inlets can be constructed. A liberal cost of \$5,000 for coordination has been budgeted to provide some allowance for unknown challenges that may be associated with this coordination. These are costs that would be borne by the City.

**Table 8.8  
Cost Estimate for Recommendation #8**

Item	Description	Unit Price	Quantity	Total Price
1	Install Drain Inlets to capture o/s flows	\$ 3,000.00	5	\$ 15,000.00
2	Intercept Ditch Construction	\$ 8.00	1000	\$ 8,000.00
5	Coordination with Ditch Co.	\$ 5,000.00	1	\$ 5,000.00
	Total			\$ 28,000.00
	25% Contingency			\$ 7,000.00
	<b>Total to Budget</b>			<b>\$ 35,000.00</b>



## Section 9.0 Watershed Conditions Relative to Future NPDES Requirements

The Federal Clean Water Act (CWA) requires that cities and counties and other public facilities, which meet specific population standards apply for a stormwater permit for their storm sewer systems. The goal of the stormwater permit program is to reduce the amount of pollutants entering streams, lakes and rivers as a result of runoff from residential, commercial, municipal and industrial areas, including construction sites. The federal regulations which govern these permit standards require cities and counties to implement 6 programs designed to reduce pollutant loading from urban area via storm sewer systems. The Environmental Protection Agency (EPA) requires these stormwater discharge permits from various types of activities as part of the National Pollutant Discharge Elimination System (NPDES).

Ultimately, when the City of Rifle reaches a population of 10,000, the City will fall into the requirements of the MS4 program. At that point, the City will be required to implement the 6 programs stated as follows:

1. **Public Education:** The City will need to provide information and training for the general public. This is provided so as to educate the public to understand their role in stormwater pollution impacts to streams in their community.
2. **Public Involvement:** The City will need to provide opportunities for the public to become involved in decisions which address the management of stormwater pollution.
3. **Illicit Discharge Elimination:** The City will need to develop and implement programs to track and stop illegal discharges to storm sewer systems.
4. **Construction Management:** The City will need to develop and implement ordinances, inspection and enforcement procedures to manage sediment and pollutant discharges from construction sites which disturb greater than 1 acre.
5. **Post construction Management:** The City will need to develop and implement ordinances, inspection and enforcement procedures to manage pollutant discharges after construction is complete.
6. **Municipal Good Housekeeping:** This City will need to develop and implement procedures and practices to prevent pollution from operations of City, county and other public entities.

The Colorado Department of Public Health and Environment has followed the EPA in regulating stormwater discharges by implementing state regulations (thus paralleling EPA requirements) which require MS4 cities and counties and other public entities to permit their storm sewer systems and implement the six programs stated above. In addition, the state has allowed these MS4 cities 5 years to fully implement all 6 programs.

With the recent development activities that have occurred within the South Rifle drainage

study area, the City has required of the developers of the projects to implement a number of Best Management Practices that will afford the City the opportunity to control Illicit discharges (#3, above), implement inspection and management locations to manage pollutant discharges (#5, above) and implement procedures and practices that prevent pollution from City, county and other public entities.

The city has required detention/retention to be incorporated into all drainage plans for new development. In addition, the City has also been requiring the installation of water quality inlets by which floatable and settleable pollutants can be trapped prior to discharge into natural drainage ways or streams.

It should be the City's goal to assure that all development continue to adhere to the recent practices that the City has voluntarily followed. This assurance can be further reinforced by incorporating the applicable Best Management Practices developed by the EPA into the City's Public Works Manual. As the City is quickly approaching the 10,000 population threshold, the City should be giving consideration towards incorporating policies and municipal legislation that will assure compliance with the 6 programs for MS4 cities.