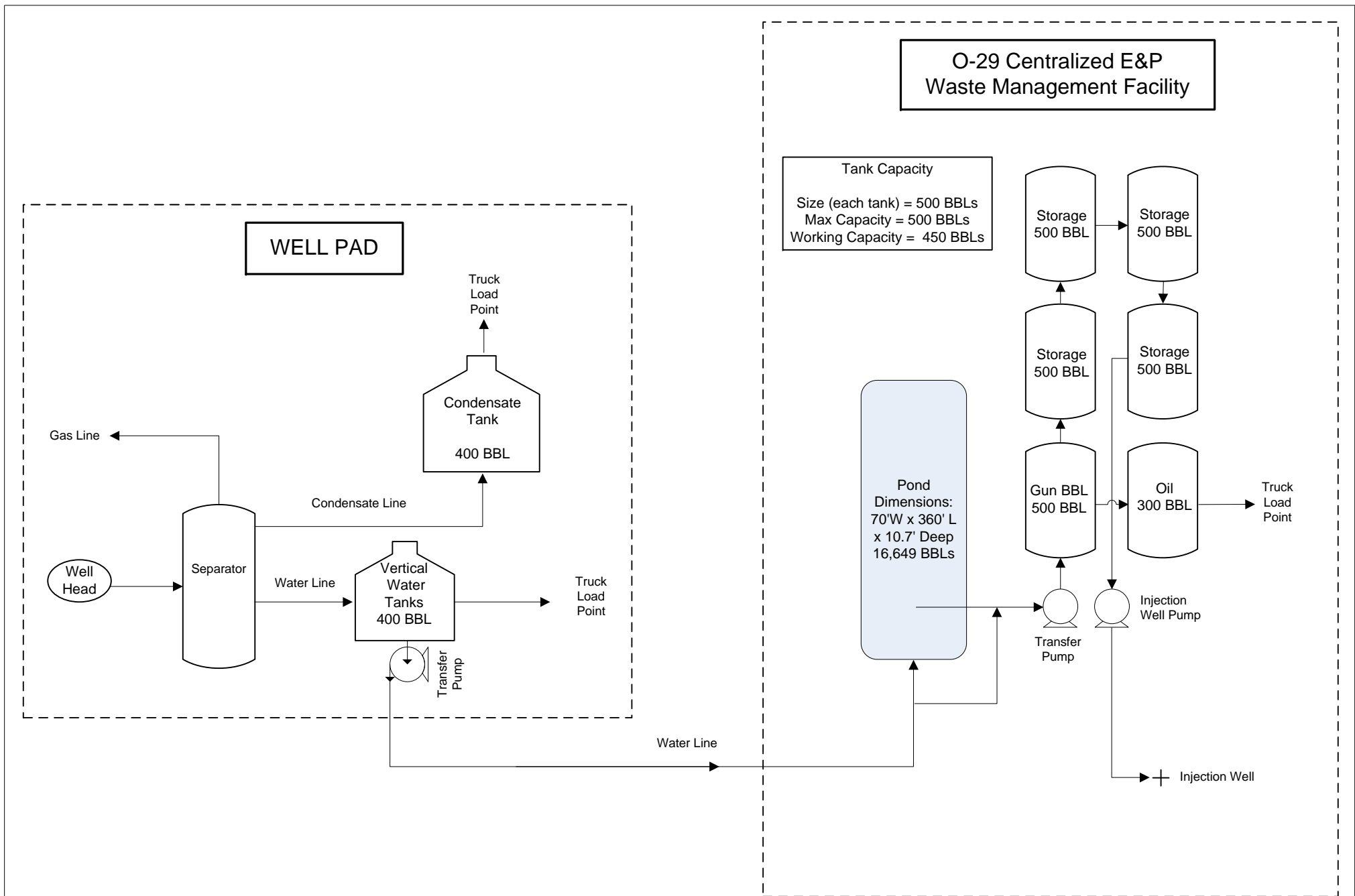


# **Rule 908.b(7) Facility Design and Engineering Data**

**LINN Operating Inc.  
O-29 Centralized E&P Waste  
Management Facility**

**OA Project No. 014-1565**

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PROJECT NO:	014-1565
DRAWN BY:	TME
DATE:	10/01/2014

**Process Flow Diagram**  
 Linn Operating Company, Inc.  
 O-29 Centralized E&P Waste Management Facility  
 Garfield County, Colorado



760 Horizon Drive, suite 102  
 Grand Junction, CO 81506  
 TEL 970.263.7800  
 FAX 970.263.7456

FIGURE

**PFD 1**

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# **FINAL DRAINAGE REPORT**

**PREPARED FOR**

**Linn Operating Inc. O-29 Water Storage**  

---

**Garfield County, Colorado**

**PREPARED BY**


**Olsson Associates  
760 Horizon Drive, Suite 102  
Grand Junction, CO 81506  
970-263-7800**

**June 22, 2015**

**Olsson Associates Project No. 014-1565**



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## ENGINEER'S STATEMENT

I hereby certify that this Final Drainage Report for the design of Linn Operating Inc. O-29 Water Storage was prepared by me, or under my direct supervision, in accordance with sound engineering practices for the owners thereof. I understand that Garfield County does not and will not assume liability for drainage facilities designed by others.

\_\_\_\_\_  
Wyatt E. Popp, PE  
Registered Professional Engineer  
State of Colorado No. 38514



\_\_\_\_\_  
6/30/15

Date

## OWNER'S STATEMENT

I, \_\_\_\_\_, hereby certify that the drainage facilities for O-29 Water Storage shall be constructed according to the design presented in this report. I understand that Garfield County does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that Garfield County reviews drainage plans but cannot, on behalf of O-29 Water Storage, guarantee that final drainage design review will absolve Linn Operating, Inc. and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's drainage design.

\_\_\_\_\_  
Owner/Developer

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Date



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Appendix C	Hydraulic Calculations

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## 1.0 INTRODUCTION

### 1.1 Background

This Final Drainage Report has been prepared by Olsson Associates for Linn Operating Inc.'s O-29 Water Storage and the Latham O-29-696 pad (the SITE). This report evaluates the SITE's existing drainage patterns and provides the drainage parameters and design for the stormwater management facilities for the stormwater exiting the SITE.

### 1.2 Project Location

The SITE is located in the SW1/4 of the SE1/4 of Section 29, Township 5 South, Range 96 West of the 6<sup>th</sup> Principle Meridian, County of Garfield, State of Colorado. The SITE is approximately 11.4 miles northwest of the town of Parachute, CO and 4.4 miles west of County Road 215. Refer to Figure 1 for project location.

**Figure 1. Project Location**



### 1.3 Project Description

The SITE consists of an existing 0.6 acre water impoundment that is located on an existing 4.2 acre pad site. The SITE is built on a hill that slopes generally from south to north. Runoff from the pad appears to pond on the pad and drain down the access road on the east when the stormwater exceeds the capacity of the pad. On the north side of the pad, two swales convey the runoff from the east and west sides of the fill slope towards the center and runoff exits the SITE undetained to the north towards a tributary to Little Creek.

According to the NRCS Web Soil Survey, soils in the area of the SITE consist of Parachute-Irigul-Rhone association and are classified as hydrologic soil group Type C. A soil map from the NRCS is included in Appendix A.



## 1.4 Previous Investigations

To our knowledge, no previous investigation has been prepared for this SITE.

## 2.0 DRAINAGE SYSTEM DESCRIPTION

### 2.1 Historic and Existing Drainage Conditions

It is assumed that the SITE had native vegetation as surface cover for the historic drainage calculations in this study.

An existing water impoundment is located at the southeast corner of the existing pad site. The remaining pad area is effectively flat with berms on the north, east, and west sides and a cut slope on the south side. North of the pad, there are two swales at the toe of the fill slope that convey the flow of the fill slope to an undetained exit point from which the runoff flows into a tributary of Little Creek. Refer to Appendix A General Location Map for the SITE location relative to tributary drainages.

The existing SITE consists of a pad graded into mountainous terrain. The SITE was graded such that it was cut into the existing slope on the south side of the SITE and was filled on the north, east and west sides of the SITE. A berm on the north, east, and west sides of the pad appear to allow stormwater to pond on the pad and into the impoundment until it reaches a level that allows it to exit the SITE undetained down the access road on the east side of the pad. On the north side of the SITE, the fill slope drains into two swales on the north side of the pad which are released to the north undetained and into a tributary of Little Creek.

Two basins were used to model the historic drainage patterns before the SITE was developed. The developed SITE was placed on a ridge that drained in two directions – one to the southeast into Little Creek, and one to the north into a tributary of Little Creek. The confluence of Little Creek and the tributary to the north is located just northeast of the developed SITE. With regards to the allowable discharge from the SITE, the total runoff from both historic basins will be the maximum allowable discharge from the developed SITE.

Basin H1 is the area on the southeast side of the ridge which drained to the southeast into Little Creek.

Basin H2 is the area on the northwest side of the ridge which drained to the north into a tributary of Little Creek.

Two basins were used to model the SITE as it relates to existing drainage patterns. The area for the water impoundment will be excluded in the overall discharge parameters.

Basin 1 is the impoundment and the cut slope directly to the south of the impoundment which will intentionally flow into the impoundment. This runoff does not need to be included in the SITE discharge calculations.

Basin 2 is the area to the west and north of the impoundment that will need to flow off the SITE into a detention basin before being released to the north into the tributary of Little Creek.

Historic and existing peak flow rates are listed in Table 1, and calculations for each flow rate are presented in Appendix B. Historic and existing drainage maps are presented in Appendix A.



**Table 1. SITE Peak Runoff (Historic and Existing)**

Design Point	Historic 2-YR Peak Flow (cfs)	Historic 25-YR Peak Flow (cfs)	Existing 2-YR Peak Flow (cfs)	Existing 25-YR Peak Flow (cfs)
H1	0.08	1.21	--	--
H2	0.29	4.47	--	--
<b>H1+H2</b>	<b>0.37</b>	<b>5.68</b>	--	--
1 <sup>A</sup>	--	--	1.71	3.84
2	--	--	1.40	5.58

<sup>A</sup>Design Point 1 is the water impoundment. It is self-contained and will not contribute to runoff from the SITE

## 2.2 Offsite Tributary Area

Offsite tributary run-on is not a part of this analysis. However, on the south side of the pad, there is an existing swale to divert offsite stormwater around the SITE. For the purposes of this study, this swale is considered offsite and is presumed to prevent stormwater run-on from entering the SITE.

It is assumed that all land will remain undeveloped for the foreseeable future.

## 2.3 Master Drainage Plan

To our knowledge, no master drainage study has analyzed the SITE.

## 2.4 Drainage Facility Maintenance

The owner shall be responsible for maintaining all on-site drainage facilities. In addition, the water impoundment should be examined after any significant rainfall event to ensure proper functionality and maintain the required freeboard.

## 3.0 DRAINAGE ANALYSIS AND DESIGN CRITERIA

### 3.1 Regulations

This report has been prepared in accordance with common engineering practices, Garfield County Land Use and Development Code, and the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*.

### 3.2 Development Criteria

There are no known constraints placed on the SITE due to floodplain studies, master studies, or adjacent property drainage studies. The SITE will not receive any tributary flows from upstream land or adjacent development.

### 3.3 Hydrologic Criteria

Hydrologic calculations have been prepared in accordance with common engineering practices. Refer to Appendix B for all hydrologic calculations.

### 3.4 Hydraulic Criteria

Hydraulic calculations for facility design have been prepared in accordance with common engineering practices and the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*. Refer to Appendix C for all hydraulic calculations.

## 4.0 POST-CONSTRUCTION STORMWATER MANAGEMENT

### 4.1 Stormwater Quality Control Measures

Stormwater quality control measures will be implemented as part of the detention basin. Garfield County Land Use and Development Code requires a maximum emptying time of 40 hours for a design precipitation event of 0.5 inches in 24 hours, with no more than 50% of the water being released in 12 hours.

## 5.0 CONCLUSIONS

### 5.1 Compliance with Manual

This report has been prepared in accordance with common engineering practices, Garfield County Land Use and Development Code, and the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*.

Garfield County requires detention facilities to be designed for a 2-year, 24-hour minor storm event and a 25-year, 24-hour major storm event. The detention facilities shall not discharge at rates higher than the historic discharge rates. In addition, Garfield County requires the design to allow a 100-year storm event to pass through the facilities without causing damage.

#### 5.1.1 Stormwater Runoff from the SITE

Basin 1 is self-contained and will not contribute to the SITE runoff. The water impoundment should be inspected after any significant storm event and measures should be taken to ensure the water level does not exceed the freeboard limit for the impoundment.

For a minor precipitation event (2-year 24-hour event), the facilities must accommodate stormwater runoff from the SITE of 1.40 cfs into a detention facility that will hold a minimum runoff volume of 1082 cu.ft. The release rate from the detention facilities for the 2-year event must be no greater than 0.37 cfs. For a major precipitation event (25-year 24-hour event), the facilities must accommodate stormwater runoff from the SITE of 5.58 cfs into a detention facility that will hold a minimum runoff volume of 1503 cu.ft. The release rate from the detention facilities for the 25-year event must be no greater than 5.68 cfs. These required release rates will be achieved using a 2-stage outlet structure with outlet orifices and restrictor plates sized to meet the release rates noted above. See Table 2 below for basin storage volumes summary used in the proposed design calculations. Refer to Appendices B and C for hydrologic and hydraulic calculations.

**Table 2. Detention Basin Storage Volumes**

Design Event	Minimum Required Storage	Proposed Storage
2-year	1082 cu. ft.	1215 cu. ft.
25-year	1503 cu. ft.	1784 cu. ft.

Release from the detention facility is required to achieve stormwater quality for precipitation events of 0.5 inches in 24 hours with no more than 50% of the water being released in 12 hours. A 1-7/16" diameter orifice at the bottom of the outlet structure will meet this stormwater quality requirement. Refer to Appendix C for the outlet structure calculations.

The detention facility is also required to pass through the stormwater runoff of a 100-year storm event at a minimum rate of 9.09 cfs. This will be achieved through a 44' wide and 0.5' high spillway at the top of the basin which will release onto a riprapped bank of varying dimensions and riprapped channel 3' wide with 1' deep 3:1 sides. The spillway conveys a flow through of 54 cfs. The top of the bank will be 44' wide and 0.5' deep and will convey a flow 10.23 cfs with 0.38' of freeboard. The bottom of the bank will be 3' wide with 1' deep 3:1 sides and will convey a flow up to 9.34 cfs with 0.57' of freeboard. The channel at the outlet of the basin will convey a flow of 9.26 cfs with 0.50' of freeboard. See Table 3 for a summary of the 100-year event conveyance flows.

**Table 3. Detention Basin Outlet Flows for 100-year Event**

Design Point	Minimum Required Discharge	Proposed Design Discharge	Freeboard
Spillway	9.09 cfs	54 cfs	N/A
Top of Bank	9.09 cfs	10.23 cfs	0.38'
Bottom of Bank	9.09 cfs	9.34 cfs	0.57'
Channel	9.09 cfs	9.26 cfs	0.50'

The channel downstream from the detention facility discharge will be designed to withstand scour, instability, erosion, and sedimentation from a 25-year 24-hour design storm. This channel will also be designed to allow the 100-year event to pass through without damaging the channel. The channel will be riprap lined and will accommodate a flow of 9.09 cfs with adequate freeboard to avoid bank erosion and instability. Refer to Appendix B and C for hydrologic and hydraulic calculations.

## 5.2 Compliance with Colorado Oil and Gas Conservation Commission Criteria

### 100-Year Run-on Diversion

There is a small area directly south of the water impoundment that will drain into the water impoundment itself. It is not practical to divert this small amount of run-on around the impoundment. The impoundment should be inspected after all significant precipitation events to ensure the water level is maintained below the freeboard limit.

### 25-Year Run-off Control

The existing water impoundment is self-contained without an outlet; therefore, no runoff is present.

### Fire Access

No changes to the existing fire access are proposed at this time.

### Fencing and Bird Netting

No changes to the existing fencing or bird netting are proposed at this time.

### Lining

No changes to the existing impoundment are proposed at this time.

### 5.3 Design Effectiveness

Proper implementation of the proposed measures outlined in this report will alleviate the direct impacts of stormwater runoff on adjacent, downstream lands. The quantity of stormwater released from the SITE will be no more than the historic conditions.

### 5.4 Areas in Flood Hazard Zone

The SITE is within a FEMA designated Zone D – areas of undetermined flood hazards. Refer to the FIRM Index Panel in Appendix A for the SITE location relative to FEMA designated flood plains.

### 6.0 REFERENCES

Garfield County Land Use and Development Code

Urban Drainage and Flood Control District Urban Storm Drainage and Criteria Manual, Vols. 1-3



## APPENDIX A

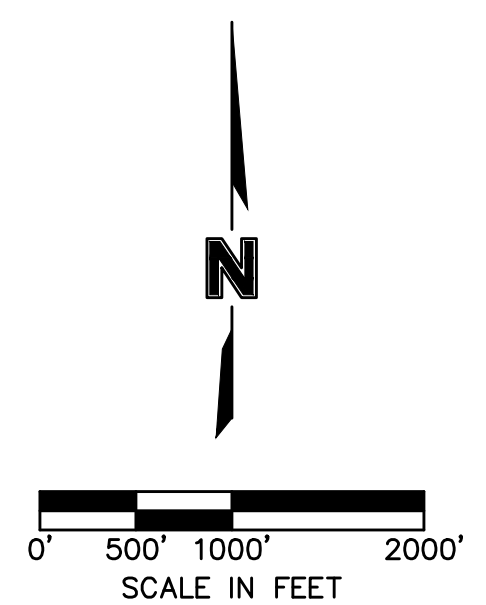
### MAPS AND EXHIBITS

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**NOTE**  
THIS DOCUMENT HAS BEEN  
RELEASED BY OLSSON  
ASSOCIATES ONLY FOR REVIEW  
BY REGULATORY AGENCIES AND  
OTHER PROFESSIONALS, AND IS  
SUBJECT TO CHANGE. THIS  
DOCUMENT IS NOT TO BE USED  
FOR CONSTRUCTION.

SSON ASSOCIATES ASSUMES RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS (HORIZONTAL OR VERTICAL), THE EXISTING UTILITIES SHOWN ON THIS DRAWING HAVE BEEN OBTAINED FROM THE BEST AVAILABLE INFORMATION. IT IS HOWEVER THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.



now what's **below**.  
**Call** before you dig.

CALL 811 SEVENTY-TWO HOURS  
PRIOR TO DIGGING, GRADING OR  
CAVATING FOR THE MARKING OF  
UNDERGROUND MEMBER UTILITIES

[illegible]

GENERAL LOCATION MAP	
LATHAM O-29-696 PAD AND WATER STORAGE POND	
LINN OPERATING INC.	2015
GARFIELD COUNTY, COLORADO	

Drawn by:	ABL
Checked by:	WEP
Approved by:	WEP
QA/QC by:	WEP
Project no.:	014-1565
Drawing no.:	
Date:	03.30.2015







Hydrologic Soil Group—Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties




Map Scale: 1:999 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84









MAP LEGEND

**Area of Interest (AOI)**









 Area of Interest (AOI)

**Soils**





**Soil Rating Polygons**

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


**Soil Rating Lines**

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


**Soil Rating Points**


	A
	A/D
	B
	B/D


**Water Features**


 Streams and Canals


**Transportation**

 Rails


 Interstate Highways


 US Routes


 Major Roads


 Local Roads


**Background**

 Aerial Photography

 C

 C/D

 D

 Not rated or not available

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties  
Survey Area Data: Version 7, Sep 22, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 22, 2010—Sep 2, 2010

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 — Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties (CO682)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
52	Northwater-Adel complex, 5 to 50 percent slopes	B	0.0	0.4%
56	Parachute-Irigul-Rhone association, 25 to 50 percent slopes	C	3.8	99.6%
<b>Totals for Area of Interest</b>			<b>3.8</b>	<b>100.0%</b>

## 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:* Higher



**NOAA Atlas 14, Volume 8, Version 2**  
**Location name: De Beque, Colorado, US\***  
**Latitude: 39.5798°, Longitude: -108.1915°**  
**Elevation: 7947 ft\***  
\* source: Google Maps



### POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

### PF tabular

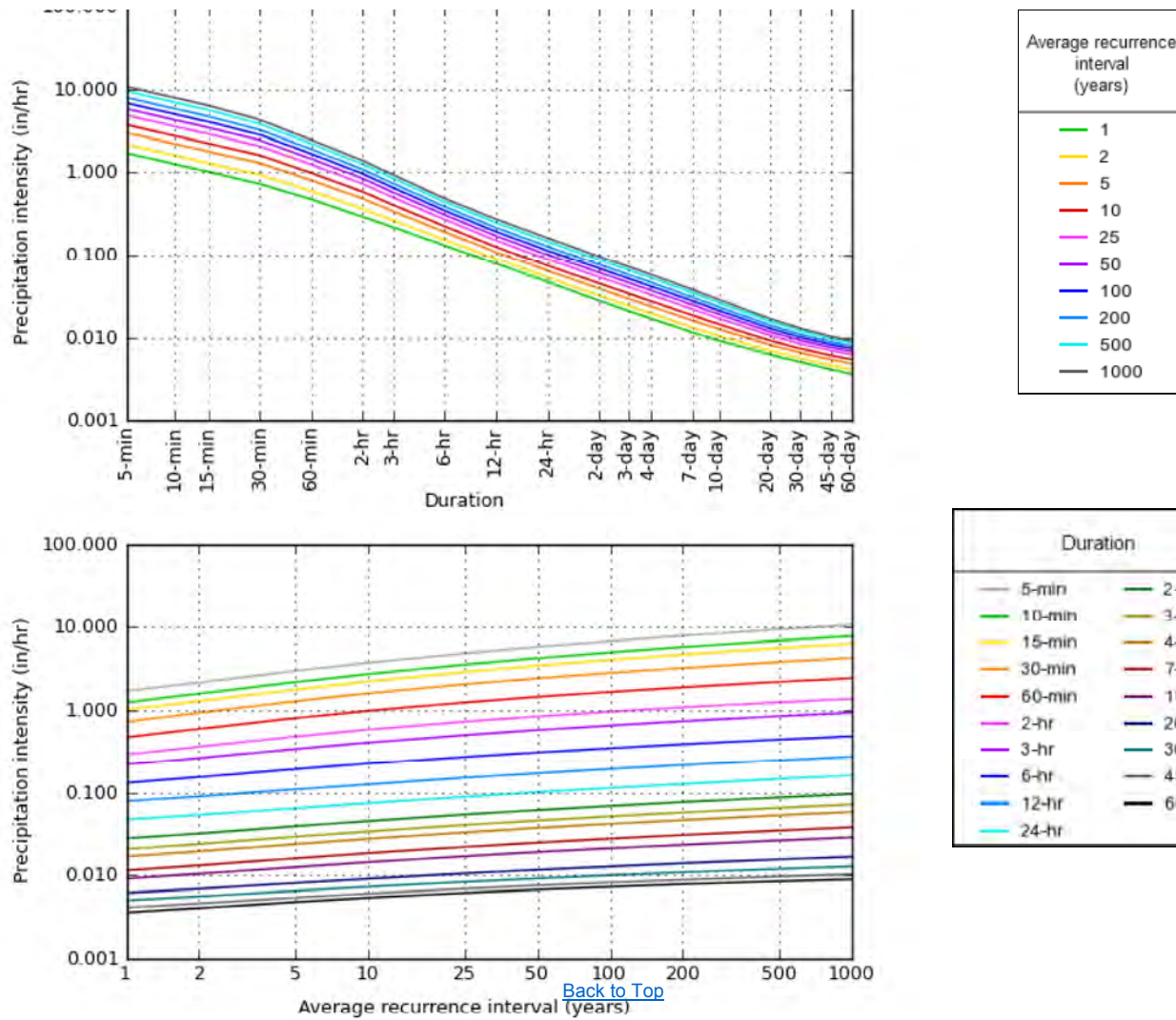
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.72 (1.37–2.17)	2.17 (1.74–2.76)	3.00 (2.39–3.82)	3.74 (2.96–4.79)	4.87 (3.74–6.61)	5.82 (4.34–7.98)	6.83 (4.90–9.64)	7.92 (5.42–11.5)	9.46 (6.20–14.2)	10.7 (6.79–16.2)
10-min	1.25 (1.01–1.59)	1.60 (1.27–2.02)	2.20 (1.75–2.80)	2.74 (2.17–3.51)	3.56 (2.74–4.84)	4.26 (3.18–5.84)	5.00 (3.59–7.06)	5.80 (3.97–8.44)	6.92 (4.54–10.4)	7.84 (4.97–11.9)
15-min	1.02 (0.816–1.29)	1.30 (1.04–1.64)	1.78 (1.42–2.27)	2.23 (1.76–2.85)	2.90 (2.23–3.93)	3.46 (2.58–4.75)	4.06 (2.92–5.74)	4.71 (3.23–6.86)	5.63 (3.69–8.46)	6.38 (4.04–9.67)
30-min	0.730 (0.584–0.924)	0.938 (0.750–1.19)	1.29 (1.03–1.65)	1.61 (1.27–2.06)	2.07 (1.58–2.78)	2.44 (1.82–3.33)	2.83 (2.03–3.98)	3.25 (2.22–4.71)	3.82 (2.50–5.73)	4.28 (2.72–6.50)
60-min	0.474 (0.380–0.601)	0.598 (0.478–0.758)	0.807 (0.643–1.03)	0.988 (0.782–1.26)	1.25 (0.953–1.67)	1.46 (1.08–1.98)	1.67 (1.20–2.34)	1.90 (1.30–2.75)	2.21 (1.45–3.31)	2.46 (1.56–3.73)
2-hr	0.292 (0.236–0.366)	0.364 (0.293–0.456)	0.484 (0.388–0.608)	0.586 (0.468–0.741)	0.731 (0.563–0.966)	0.846 (0.635–1.14)	0.965 (0.696–1.33)	1.09 (0.750–1.55)	1.26 (0.830–1.85)	1.39 (0.890–2.08)
3-hr	0.219 (0.178–0.273)	0.264 (0.214–0.329)	0.341 (0.275–0.426)	0.407 (0.327–0.511)	0.502 (0.389–0.659)	0.578 (0.437–0.771)	0.657 (0.478–0.902)	0.740 (0.514–1.05)	0.853 (0.568–1.25)	0.942 (0.609–1.40)
6-hr	0.131 (0.108–0.162)	0.154 (0.126–0.190)	0.192 (0.156–0.237)	0.225 (0.182–0.279)	0.272 (0.213–0.352)	0.309 (0.236–0.407)	0.348 (0.256–0.471)	0.388 (0.273–0.543)	0.444 (0.299–0.641)	0.487 (0.319–0.714)
12-hr	0.079 (0.065–0.096)	0.090 (0.074–0.109)	0.109 (0.090–0.133)	0.126 (0.103–0.155)	0.151 (0.120–0.194)	0.171 (0.132–0.223)	0.193 (0.144–0.259)	0.216 (0.154–0.299)	0.248 (0.169–0.354)	0.273 (0.181–0.396)
24-hr	0.047 (0.039–0.057)	0.053 (0.044–0.064)	0.064 (0.053–0.078)	0.074 (0.061–0.090)	0.089 (0.071–0.113)	0.101 (0.079–0.130)	0.113 (0.085–0.150)	0.127 (0.092–0.174)	0.146 (0.101–0.206)	0.162 (0.108–0.231)
2-day	0.028 (0.023–0.033)	0.032 (0.027–0.038)	0.039 (0.033–0.047)	0.045 (0.038–0.054)	0.054 (0.044–0.067)	0.061 (0.048–0.078)	0.069 (0.052–0.090)	0.076 (0.056–0.103)	0.087 (0.061–0.121)	0.096 (0.065–0.135)
3-day	0.021 (0.018–0.024)	0.024 (0.020–0.028)	0.029 (0.025–0.035)	0.034 (0.028–0.040)	0.040 (0.033–0.050)	0.046 (0.036–0.058)	0.051 (0.039–0.066)	0.057 (0.042–0.076)	0.065 (0.046–0.090)	0.071 (0.049–0.100)
4-day	0.017 (0.014–0.020)	0.019 (0.017–0.023)	0.024 (0.020–0.028)	0.027 (0.023–0.033)	0.033 (0.027–0.041)	0.037 (0.030–0.047)	0.042 (0.032–0.054)	0.046 (0.034–0.062)	0.053 (0.037–0.072)	0.058 (0.040–0.080)
7-day	0.012 (0.010–0.013)	0.013 (0.011–0.015)	0.016 (0.014–0.019)	0.018 (0.016–0.022)	0.022 (0.018–0.027)	0.025 (0.020–0.031)	0.028 (0.021–0.035)	0.031 (0.023–0.040)	0.035 (0.025–0.047)	0.038 (0.026–0.052)
10-day	0.009 (0.008–0.011)	0.010 (0.009–0.012)	0.013 (0.011–0.015)	0.014 (0.012–0.017)	0.017 (0.014–0.021)	0.019 (0.015–0.023)	0.021 (0.016–0.027)	0.023 (0.017–0.030)	0.026 (0.019–0.035)	0.029 (0.020–0.039)
20-day	0.006 (0.005–0.007)	0.007 (0.006–0.008)	0.008 (0.007–0.009)	0.009 (0.008–0.011)	0.011 (0.009–0.013)	0.012 (0.010–0.014)	0.013 (0.010–0.016)	0.014 (0.011–0.018)	0.016 (0.011–0.021)	0.017 (0.012–0.023)
30-day	0.005 (0.004–0.006)	0.006 (0.005–0.006)	0.007 (0.006–0.007)	0.007 (0.006–0.008)	0.008 (0.007–0.010)	0.009 (0.008–0.011)	0.010 (0.008–0.012)	0.011 (0.008–0.014)	0.012 (0.009–0.016)	0.013 (0.009–0.017)
45-day	0.004 (0.004–0.005)	0.005 (0.004–0.005)	0.005 (0.005–0.006)	0.006 (0.005–0.007)	0.007 (0.006–0.008)	0.008 (0.006–0.009)	0.008 (0.007–0.010)	0.009 (0.007–0.011)	0.010 (0.007–0.013)	0.010 (0.007–0.014)
60-day	0.004 (0.003–0.004)	0.004 (0.004–0.005)	0.005 (0.004–0.005)	0.005 (0.005–0.006)	0.006 (0.005–0.007)	0.007 (0.006–0.008)	0.007 (0.006–0.009)	0.008 (0.006–0.010)	0.009 (0.006–0.011)	0.009 (0.007–0.012)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).  
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.  
 Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

### PF graphical



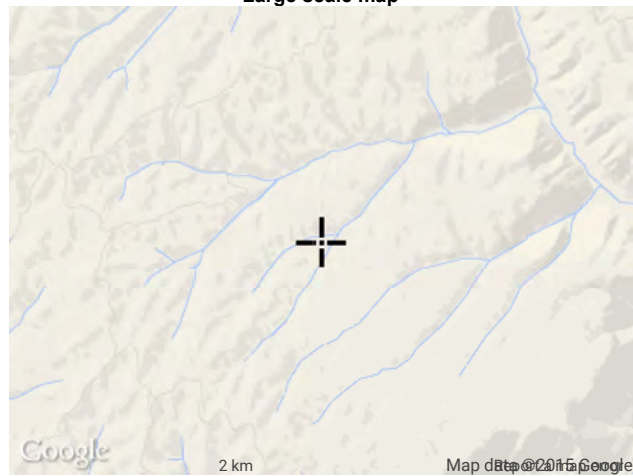


NOAA Atlas 14, Volume 8, Version 2

**Maps & aerials**

Created (GMT): Fri Mar 20 21:03:36 2015

**Small scale terrain**

**Large scale terrain****Large scale map****Large scale aerial**[Back to Top](#)

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[US Department of Commerce](#)  
[National Oceanic and Atmospheric Administration](#)  
[National Weather Service](#)  
[Office of Hydrologic Development](#)  
1325 East West Highway  
Silver Spring, MD 20910

Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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**NFIP**

**MAP INDEX**

**FIRM**


**FLOOD INSURANCE RATE MAP**

**GARFIELD COUNTY,  
COLORADO**

**(UNINCORPORATED AREAS)**

**MAP INDEX**

PANELS PRINTED: 955, 964, 995, 1015,  
1043, 1045, 1091, 1092, 1111 1315,  
1351, 1352, 1353, 1354, 1431 1432,  
1434, 1445, 1453, 1465, 1470 1705,  
1855, 1856, 1857, 1858, 1859 1870,  
1880

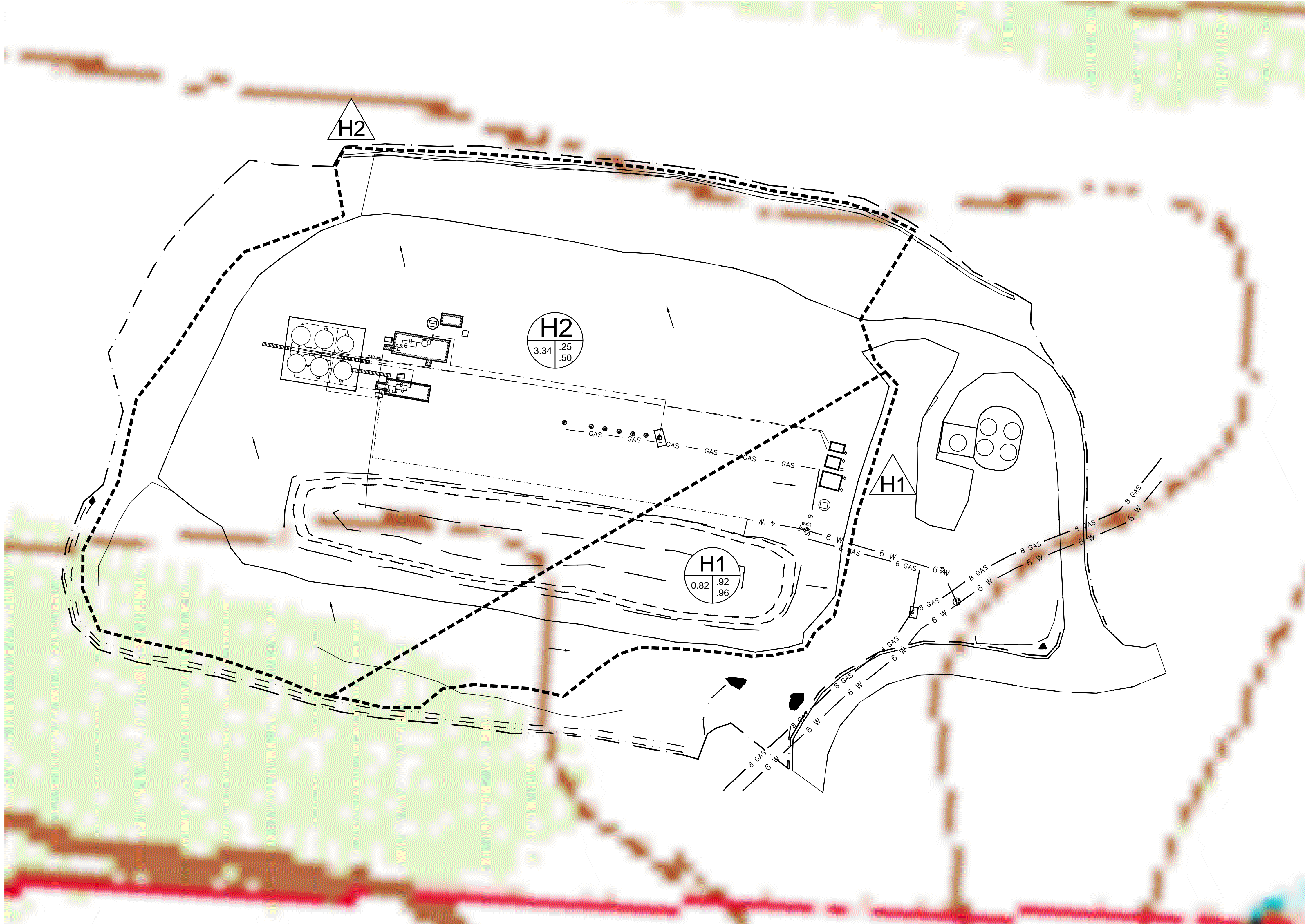


**MAP NUMBER  
080205INDOA**

**MAP REVISED  
AUGUST 2, 2006**

**Federal Emergency Management Agency**





A north arrow pointing upwards with the letter 'N' in the center. Below it is a scale bar labeled 'SCALE IN FEET' with markings at 0', 20', 40', and 80'.


 DRAINAGE BOUNDARY  
 DRAINAGE FLOW DIRECTION

Diagram illustrating the components of the station identification symbol:

- XX: BASIN DESIGNATION
- X.XX: 10-YR RUNOFF COEFF.
- .XX: 100-YR RUNOFF COEFF.
- .XX: BASIN AREA IN AC.




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**ASSOCIATES**

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PRIOR TO DIGGING, GRADING OR  
EXCAVATING FOR THE MARKING OF  
UNDERGROUND MEMBER UTILITIES

[illegible]

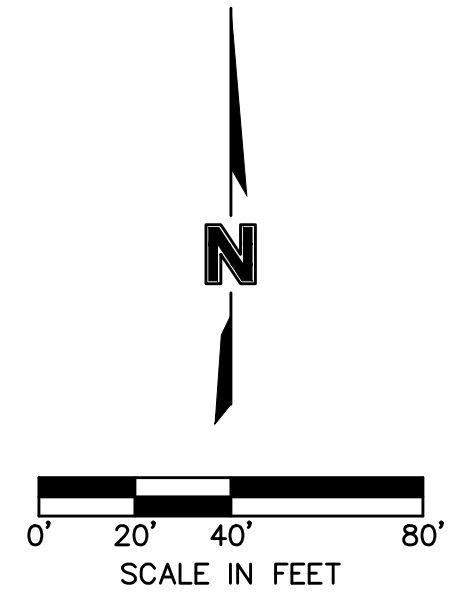
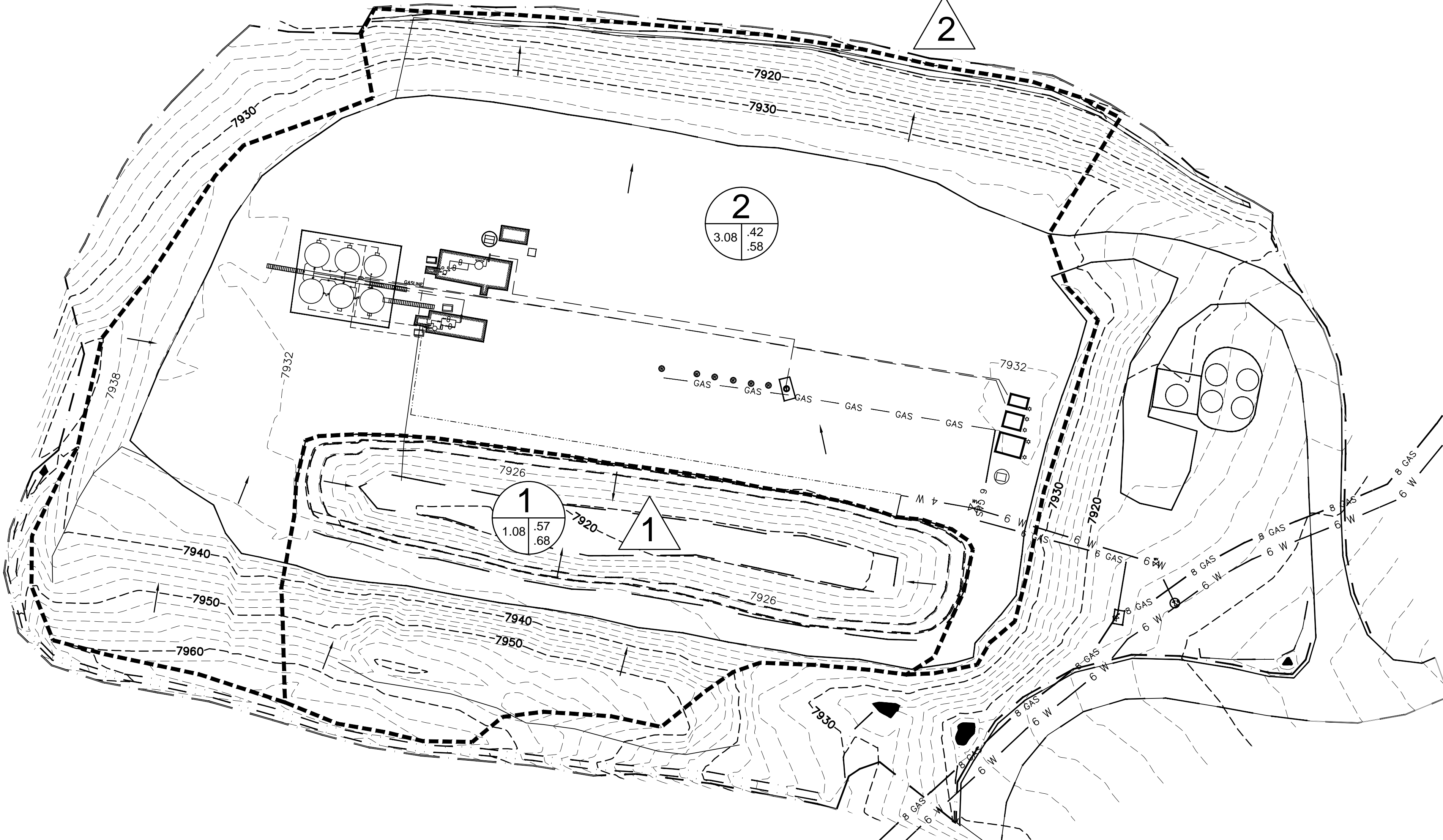
HISTORIC DRAINAGE MAP	LATHAM O-29-696 PAD AND WATER STORAGE POND	2015
	LINN ENERGY, LLC	
	GARFIELD COUNTY, COLORADO	

drawn by:	ABL
checked by:	WEP
approved by:	WEP
QA/QC by:	WEP
project no.:	014-1565
drawing no.:	
date:	03.30.2015

EXHIBIT  
2







■ ■ ■ ■ ■ DRAINAGE BOUNDARY  
 — — 7400 — — MAJOR CONTOUR  
 ← DRAINAGE FLOW DIRECTION

XX BASIN DESIGNATION  
 10-YR RUNOFF COEFF.  
 X.XX 100-YR RUNOFF COEFF.  
 .XX BASIN AREA IN AC.  
 .XX



DESIGN POINT DESIGNATOR

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[illegible]

## EXISTING DRAINAGE MAP

LATHAM O-29-696 PAD AND WATER STORAGE POND

LINN ENERGY, LLC  
GARFIELD COUNTY, COLORADO

2015	
------	--

drawn by: ABL  
checked by: WEP  
approved by: WEP  
QA/QC by: WEP  
project no.: 014-1565  
drawing no.:  
date: 03.30.2015

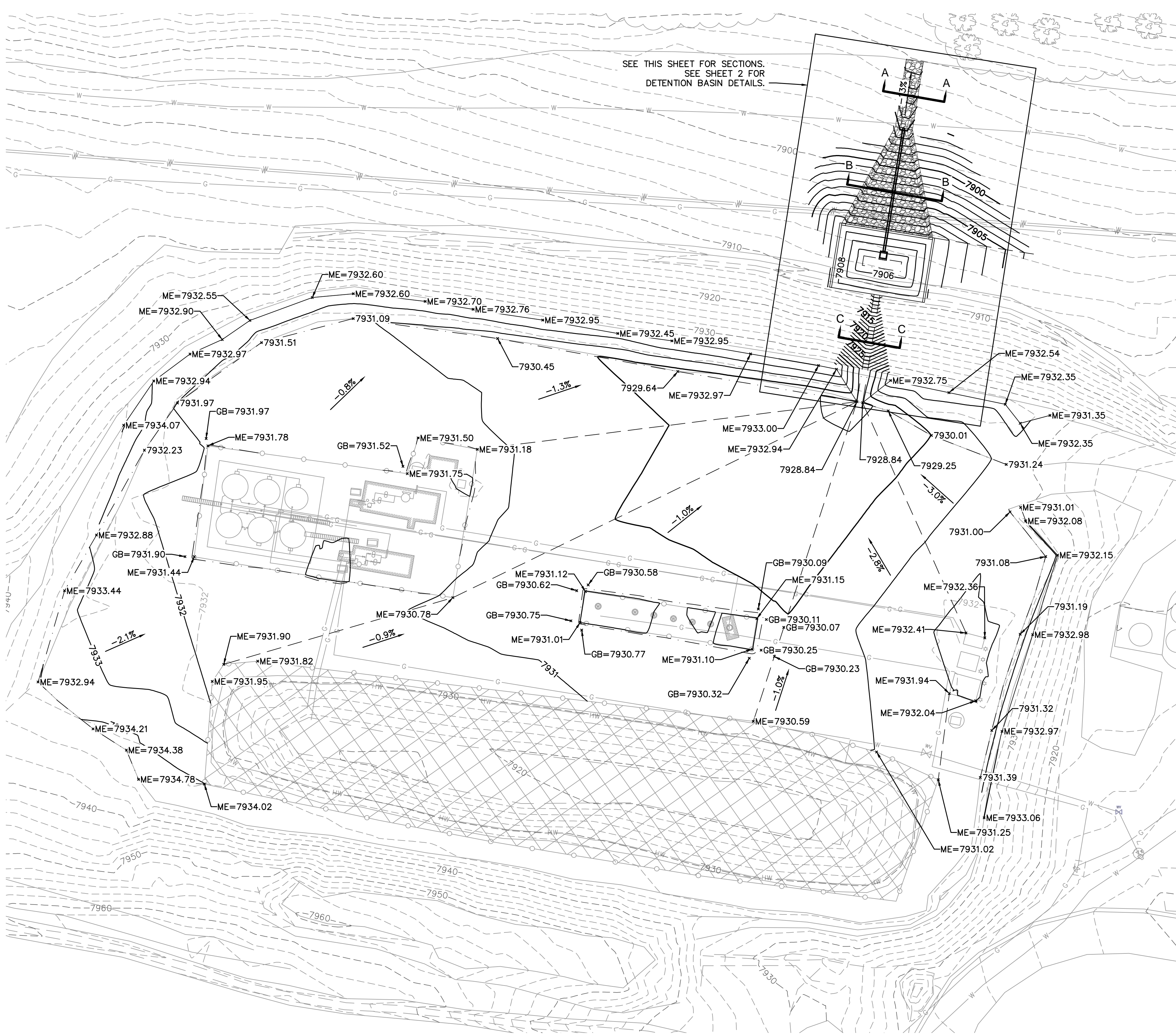
EXHIBIT  
3





NOTES:

1. NO BUILDING, STRUCTURE OR FILL WILL BE PLACED IN THE DETENTION BASIN AREA AND NO CHANGES OR ALTERATIONS AFFECTING THE HYDRAULIC CHARACTERISTICS OF THE DETENTION BASIN WILL BE MADE WITHOUT THE APPROVAL OF THE COUNTY.
2. MAINTENANCE AND OPERATION OF THE DETENTION BASIN IS THE RESPONSIBILITY OF THE PROPERTY OWNER. IF THE OWNER FAILS IN THIS RESPONSIBILITY, THE COUNTY HAS THE RIGHT TO ENTER THE PROPERTY, MAINTAIN THE DETENTION BASIN AREA, AND BE REIMBURSED FOR THE COSTS INCURRED.
3. PERMISSION TO REPRODUCE THESE PLANS IS HEREBY GIVEN TO GARFIELD COUNTY FOR COUNTY PURPOSES ASSOCIATED WITH PLAN REVIEW, APPROVAL, PERMITTING, CONSTRUCTION, AND INSPECTION OF WORK.
4. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR THE OUTLET STRUCTURE TO THE OWNER. SHOP DRAWINGS SHALL BE SIGNED AND SEALED BY A COLORADO LICENSED PROFESSIONAL ENGINEER.

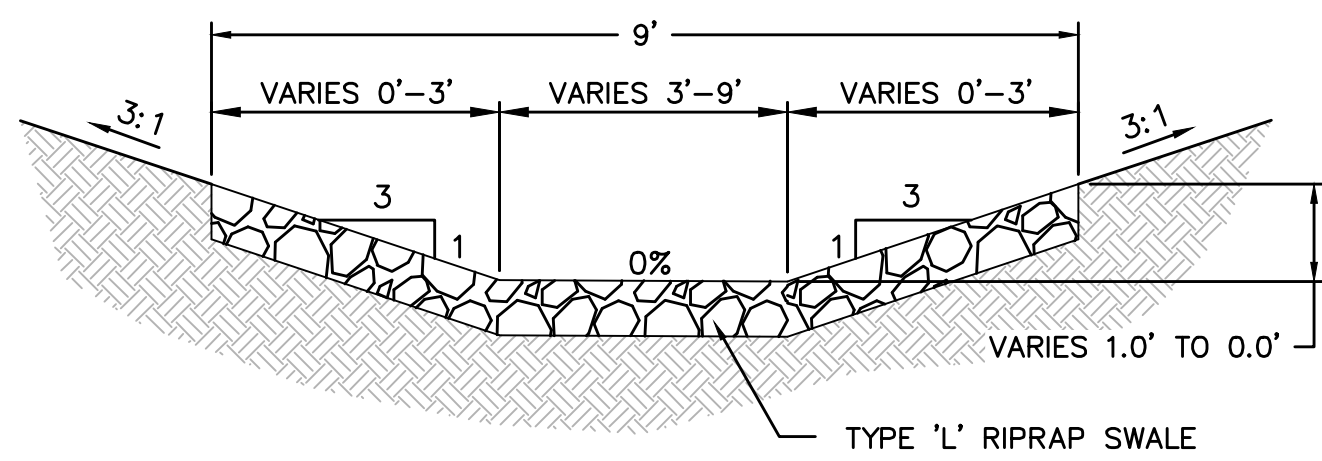


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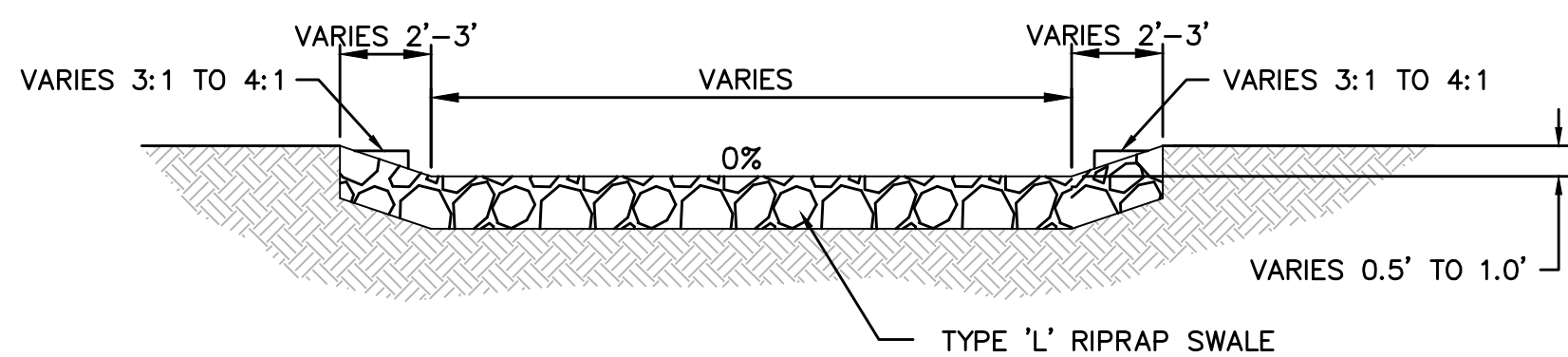
- PROPOSED CONTOUR - MAJOR
- PROPOSED CONTOUR - MINOR
- EXISTING CONTOUR - MAJOR
- EXISTING CONTOUR - MINOR
- PROPOSED RIPRAP
- PROPOSED BREAKLINE - TOP
- PROPOSED BREAKLINE - TOE
- PROPOSED GRADE BREAK
- EXISTING BREAKLINE - TOP
- EXISTING BREAKLINE - TOE
- EXISTING FENCE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING BUSH LINE

ABBREVIATIONS:

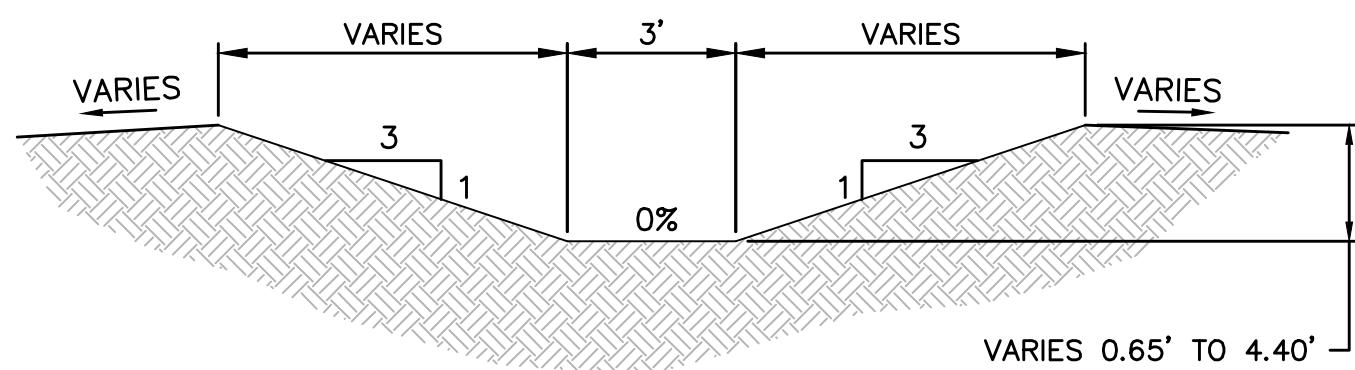
- TOP TOP OF BERM/BASIN/CHANNEL
- BTM BOTTOM OF BERM/BASIN/CHANNEL
- GB GRADE BREAK
- INV INVERT
- ME MATCH EXISTING



SECTION A-A  
NTS



SECTION B-B  
NTS



SECTION C-C  
NTS



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REVISIONS DESCRIPTION		DATE	REV. NO.

GRADING PLAN OVERALL SITE		2015
LATHAM O-29-696 PAD AND WATER STORAGE POND		
LINN ENERGY, LLC		
GARFIELD COUNTY, COLORADO		

drawn by:	ABL
checked by:	WEP
approved by:	WEP
QA/QC by:	WEP
project no.:	014-1565
drawing no.:	
date:	06.22.2015

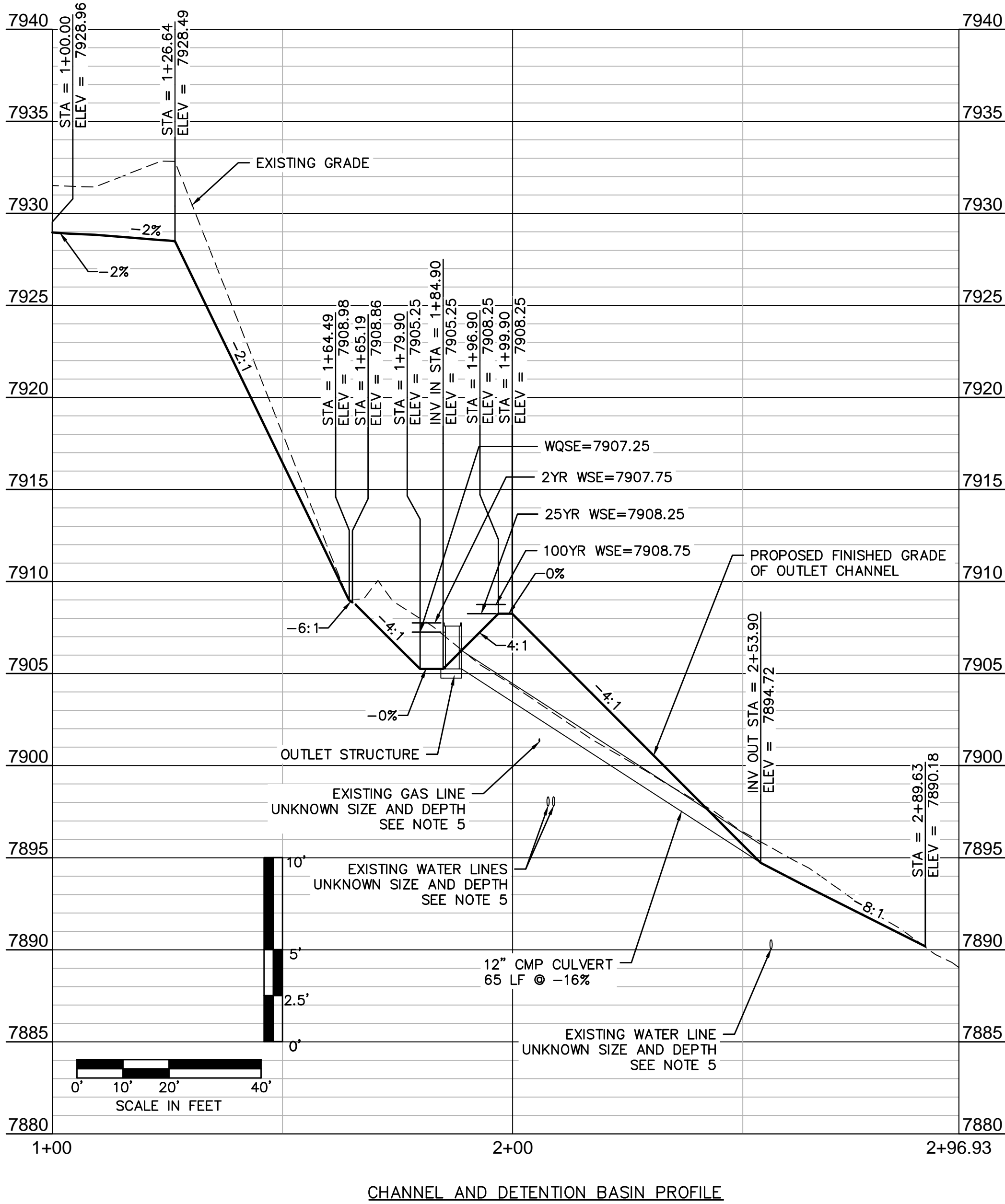
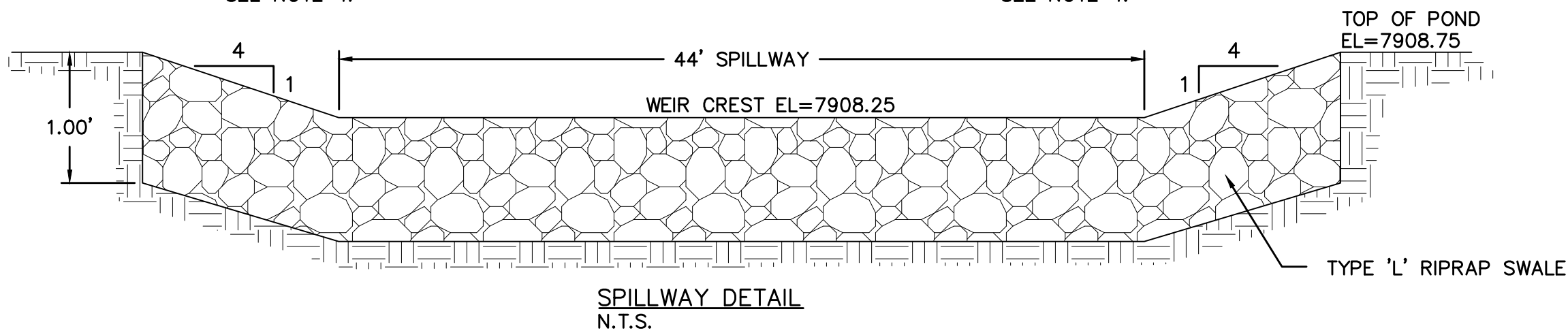
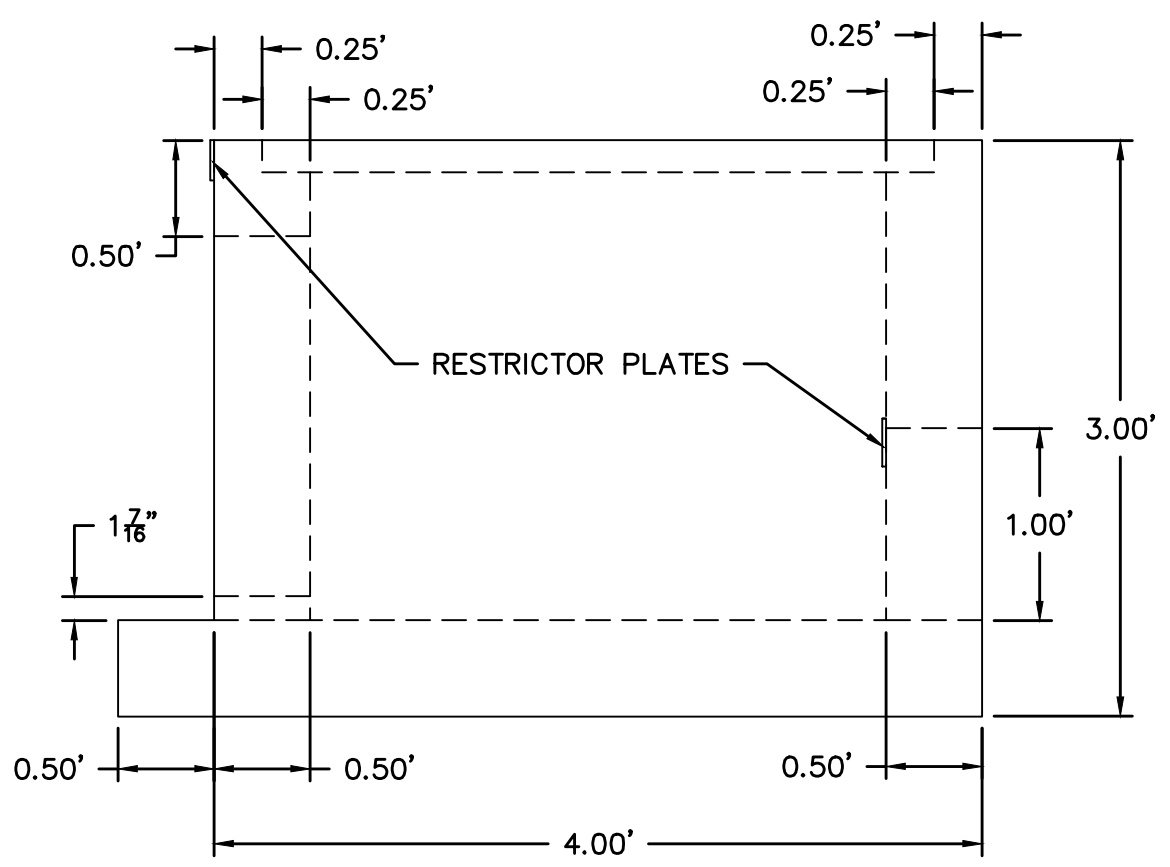
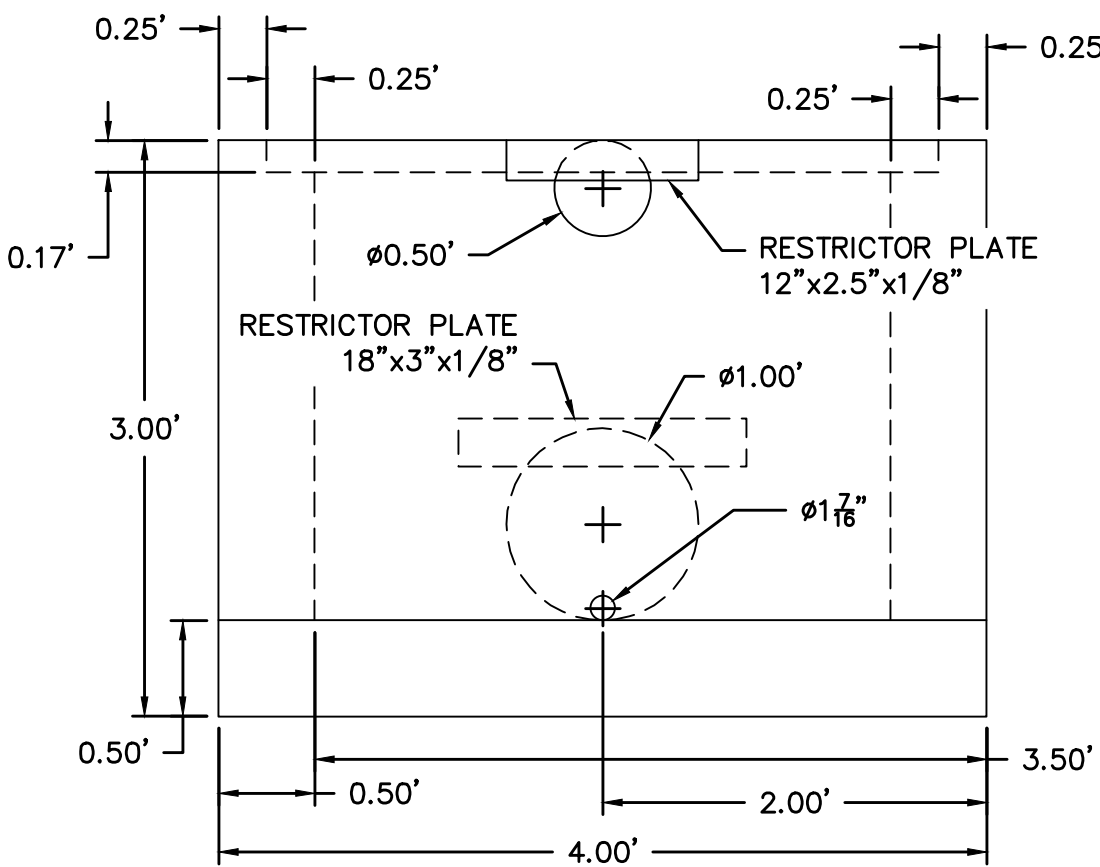
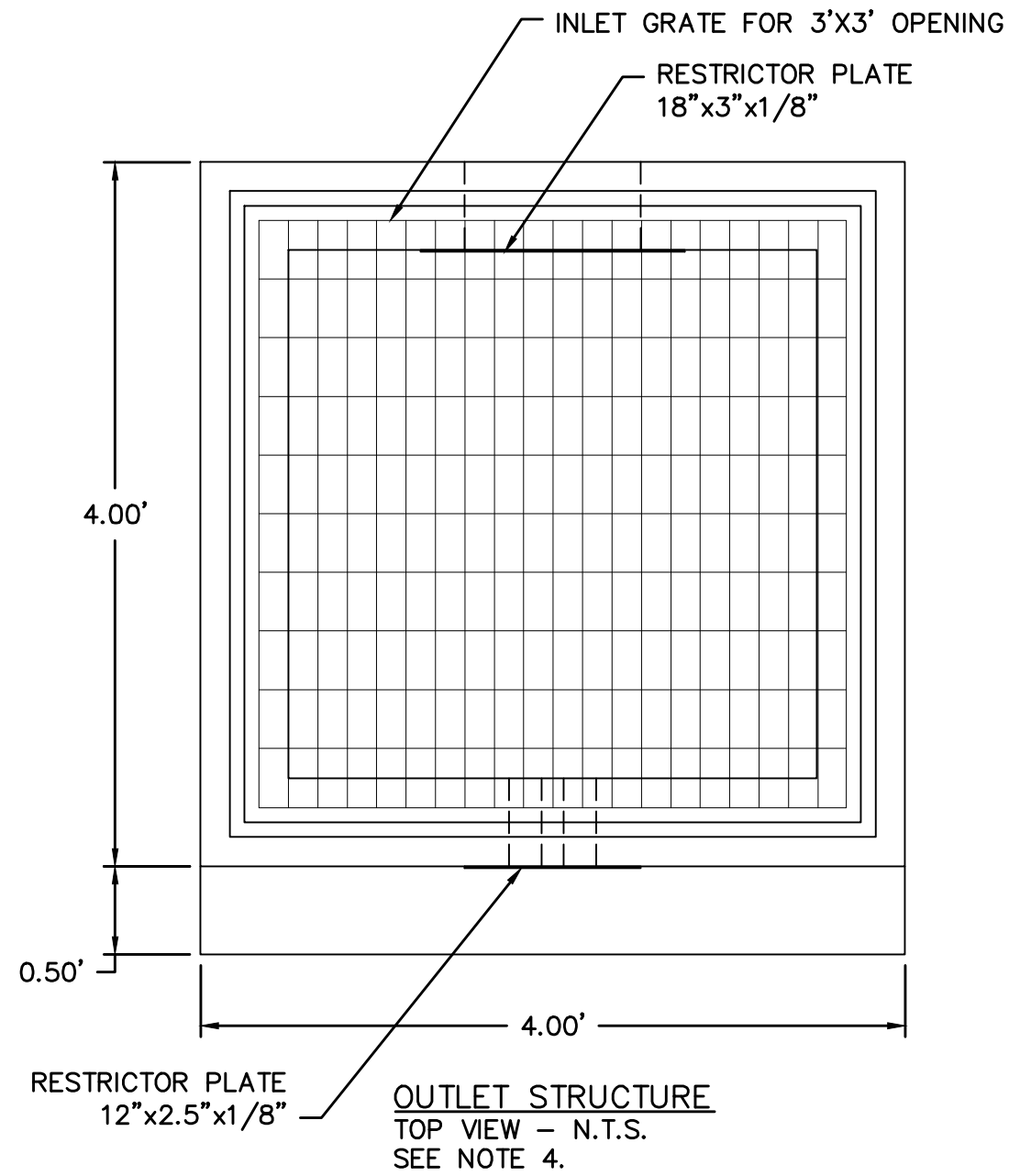






NOTES:

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5. UTILITY LINES SHOWN WERE PROVIDED BY CONSTRUCTION SURVEYS, INC. LOCATION OF UTILITIES HAVE NOT BEEN VERIFIED. CONTRACTOR TO FIELD VERIFY UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR TO PROTECT UTILITIES DURING CONSTRUCTION.



STAGE STORAGE TABLE

ELEV. (FT)	AREA (FT²)	VOLUME (FT³)	ACCUM VOL. (FT³)	ACCUM VOL. (AC.FT.)
7905.25	100	0	0	0.000
7906.75	216	79	79	0.002
7908.25	364	145	224	0.005
7909.75	544	227	451	0.010
7907.25	756	325	776	0.018
7907.75	1000	439	1215	0.028
7908.25	1276	569	1784	0.041
7908.75	1584	715	2499	0.057

LEGEND:

- PROPOSED CONTOUR - MAJOR
- PROPOSED CONTOUR - MINOR
- EXISTING CONTOUR - MAJOR
- EXISTING CONTOUR - MINOR
- PROPOSED RIPRAP
- PROPOSED BREAKLINE - TOP
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- EXISTING BUSH LINE

ABBREVIATIONS:

- TOP TOP OF BERM/BASIN/CHANNEL
- BTM BOTTOM OF BERM/BASIN/CHANNEL
- GB GRADE BREAK
- INV INVERT
- ME MATCH EXISTING

CHANNELS AND DETENTION BASIN SCALE: 1"=30'

DETENTION BASIN DETAILS  
BOTTOM OF BASIN - 5'X20' AT EL=7905.25  
TOP OF BASIN - 33'X48' AT EL=7908.75  
BASIN SIDE SLOPES - 4:1  
RIPRAP TO BE 1' DEEP IN SPILLWAY AND OUTLET CHANNEL



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REV. NO.	DATE	REVISIONS DESCRIPTION

GRADING PLAN DETENTION BASIN DETAILS	LATHAM O-29-696 PAD AND WATER STORAGE POND LINN ENERGY, LLC GARFIELD COUNTY, COLORADO	2015
---	---	------

drawn by:	ABL
checked by:	WEP
approved by:	WEP
QA/QC by:	WEP
project no.:	014-1565
drawing no.:	
date:	06.22.2015





## APPENDIX B

# HYDROLOGIC CALCULATIONS

---



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Use HP 35s calculator

$$I_x = C1 * P_{60} / (C2 + T_x)^{C3}$$

project 14-1565

2 year coefficients

Equation coefficients

A	C1	30.801	30.801
B	C2	9.046	9.046
C	C3	0.809	0.809

Duration

T	5	min
U	60	min
V	360	min

Variables Values for 100 year

K	2.17	in/hr T min	= P 60 minutes
L	0.598	in/hr U min	
M	0.154	in/hr V min	

Keys

EQN Scroll to equation that starts M=Kx(B+T)...



SOLVE

B

value for M 0.154

R/S

value for K 2.17

R/S

value for T 5

R/S

value for L 0.598

R/S

value for U 60

R/S

value for V 360

R/S

solves for B B= 9.046 C= 0.809384

A= 30.80132



Use HP 35s calculator

$$I_x = C1 * P_{60} / (C2 + T_x)^{C3}$$

project 14-1565

25 year coefficients

Equation coefficients

A	C1	51.845	51.845
B	C2	11.416	11.416
C	C3	0.925	0.925

Duration

T	5	min
U	60	min
V	360	min

Variables Values for 100 year

K	4.87	in/hr T min	= P 60 minutes
L	1.25	in/hr U min	
M	0.272	in/hr V min	

Keys

EQN Scroll to equation that starts M=Kx(B+T)...



SOLVE

B

value for M 0.272

R/S

value for K 4.87

R/S

value for T 5

R/S

value for L 1.25

R/S

value for U 60

R/S

value for V 360

R/S

solves for B B= 11.416 C= 0.924969  
A= 51.84465

Use HP 35s calculator

$$I_x = C1 * P_{60} / (C2 + T_x)^{C3}$$

project 14-1565

100 year coefficients

Equation coefficients

A	C1	57.325	57.325
B	C2	11.135	11.135
C	C3	0.949	0.949

Duration

T	5	min
U	60	min
V	360	min

Variables Values for 100 year

K	6.83	in/hr T min	= P 60 minutes
L	1.67	in/hr U min	
M	0.348	in/hr V min	

Keys

EQN Scroll to equation that starts M=Kx(B+T)...



SOLVE

B

value for M 0.348

R/S

value for K 6.83

R/S

value for T 5

R/S

value for L 1.67

R/S

value for U 60

R/S

value for V 360

R/S

solves for B B= 11.135 C= 0.949388

A= 57.32518

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN 1 - Existing**

### I. Catchment Hydrologic Data

Catchment ID = **BASIN 1**  
 Area = **1.08** Acres  
 Percent Imperviousness = **71.67** %  
 NRCS Soil Type = **C** A, B, C, or D

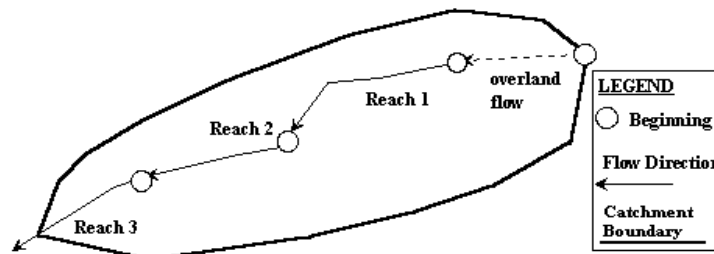
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **2** years (input return period for design storm)  
 $C1$  = **30.80** (input the value of  $C1$ )  
 $C2$  = **9.05** (input the value of  $C2$ )  
 $C3$  = **0.809** (input the value of  $C3$ )  
 $P1$  = **0.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.51**  
 Override Runoff Coefficient,  $C$  = **0.73** (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.55**  
 Override 5-yr. Runoff Coefficient,  $C$  = **0.64** (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.3300	131	0.64	N/A	0.73	3.00
1						
2						
3						
4						
5						
Sum		131				
Computed T <sub>c</sub> =						3.00
Regional T <sub>c</sub> =						10.73
User-Entered T <sub>c</sub> =						5.00

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **2.46** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **1.65** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **2.17** inch/hr

Peak Flowrate,  $Q_p$  = **1.94** cfs  
 Peak Flowrate,  $Q_p$  = **1.30** cfs  
 Peak Flowrate,  $Q_p$  = **1.71** cfs

Calculated values for T<sub>c</sub> & Q<sub>p</sub> are based on override values entered for C & C-5.

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

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 Catchment ID: **BASIN 1 - Existing**

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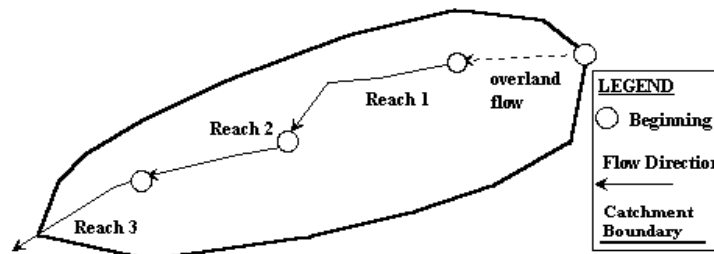
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **25** years (input return period for design storm)  
 $C1$  = **51.85** (input the value of  $C1$ )  
 $C2$  = **11.42** (input the value of  $C2$ )  
 $C3$  = **0.925** (input the value of  $C3$ )  
 $P1$  = **1.25** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.64**  
 Override Runoff Coefficient,  $C$  = **0.73** (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.55**  
 Override 5-yr. Runoff Coefficient,  $C$  = **0.64** (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.3300	131	0.64	N/A	0.73	3.00
1						
2						
3						
4						
5						
Sum		131				
Computed T <sub>c</sub> =						3.00
Regional T <sub>c</sub> =						10.73
User-Entered T <sub>c</sub> =						5.00

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **5.49** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **3.69** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **4.87** inch/hr

Peak Flowrate,  $Q_p$  = **4.33** cfs  
 Peak Flowrate,  $Q_p$  = **2.91** cfs  
 Peak Flowrate,  $Q_p$  = **3.84** cfs

Calculated values for T<sub>c</sub> & Q<sub>p</sub> are based on override values entered for C & C-5.

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN 2 - Existing**

### I. Catchment Hydrologic Data

Catchment ID = **BASIN 2**  
 Area = **3.08** Acres  
 Percent Imperviousness = **40.00** %  
 NRCS Soil Type = **C** A, B, C, or D

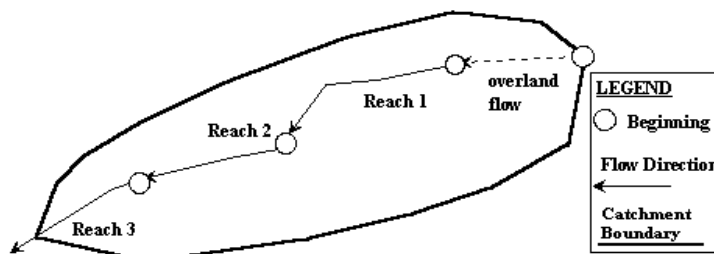
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **2** years (input return period for design storm)  
 $C1$  = **30.80** (input the value of  $C1$ )  
 $C2$  = **9.05** (input the value of  $C2$ )  
 $C3$  = **0.809** (input the value of  $C3$ )  
 $P1$  = **0.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.28**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.35**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.3300	71	0.35	N/A	0.33	3.60
1	0.0070	259		10.00	0.84	5.16
2	0.3100	45		15.00	8.35	0.09
3	0.0270	319		15.00	2.46	2.16
4						
5						
Sum		694				
Computed T <sub>c</sub> =						11.01
Regional T <sub>c</sub> =						13.86
User-Entered T <sub>c</sub> =						11.01

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **1.63** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **1.46** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **1.63** inch/hr

Peak Flowrate,  $Q_p$  = **1.40** cfs  
 Peak Flowrate,  $Q_p$  = **1.26** cfs  
 Peak Flowrate,  $Q_p$  = **1.40** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN 2 - Existing**

### I. Catchment Hydrologic Data

Catchment ID = **BASIN 2**  
 Area = **3.08** Acres  
 Percent Imperviousness = **40.00** %  
 NRCS Soil Type = **C** A, B, C, or D

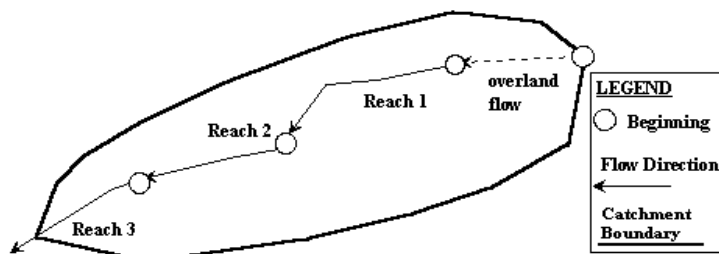
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **25** years (input return period for design storm)  
 $C1$  = **51.85** (input the value of  $C1$ )  
 $C2$  = **11.42** (input the value of  $C2$ )  
 $C3$  = **0.925** (input the value of  $C3$ )  
 $P1$  = **1.25** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.50**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.35**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.3300	71	0.35	N/A	0.33	3.60
1	0.0070	259		10.00	0.84	5.16
2	0.3100	45		15.00	8.35	0.09
3	0.0270	319		15.00	2.46	2.16
4						
5						
Sum		694				
Computed T <sub>c</sub> =						11.01
Regional T <sub>c</sub> =						13.86
User-Entered T <sub>c</sub> =						11.01

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **3.65** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **3.27** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **3.65** inch/hr

Peak Flowrate,  $Q_p$  = **5.58** cfs  
 Peak Flowrate,  $Q_p$  = **5.00** cfs  
 Peak Flowrate,  $Q_p$  = **5.58** cfs



## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN 2 - Existing**

### I. Catchment Hydrologic Data

Catchment ID = **BASIN 2**  
 Area = **3.08** Acres  
 Percent Imperviousness = **40.00** %  
 NRCS Soil Type = **C** A, B, C, or D

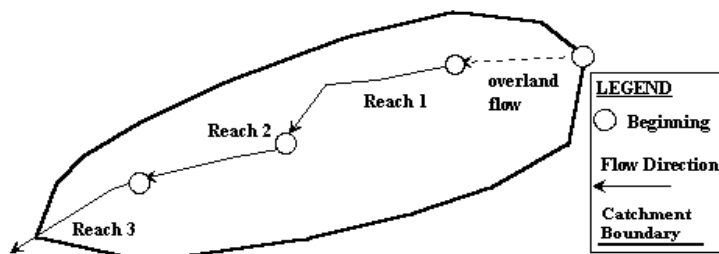
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **100** years (input return period for design storm)  
 $C1$  = **57.33** (input the value of  $C1$ )  
 $C2$  = **11.14** (input the value of  $C2$ )  
 $C3$  = **0.949** (input the value of  $C3$ )  
 $P1$  = **1.67** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.58**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.35**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.3300	71	0.35	N/A	0.33	3.60
1	0.0070	259		10.00	0.84	5.16
2	0.3100	45		15.00	8.35	0.09
3	0.0270	319		15.00	2.46	2.16
4						
5						
Sum		694				
Computed T <sub>c</sub> =						11.01
Regional T <sub>c</sub> =						13.86
User-Entered T <sub>c</sub> =						11.01

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **5.06** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **4.51** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **5.06** inch/hr

Peak Flowrate,  $Q_p$  = **9.09** cfs  
 Peak Flowrate,  $Q_p$  = **8.10** cfs  
 Peak Flowrate,  $Q_p$  = **9.09** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN H1 - HISTORIC**

### I. Catchment Hydrologic Data

Catchment ID = **H1**  
 Area = **0.82** Acres  
 Percent Imperviousness = **2.00** %  
 NRCS Soil Type = **C** A, B, C, or D

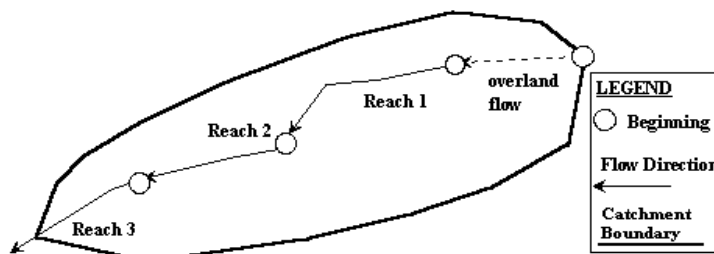
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **2** years (input return period for design storm)  
 $C1$  = **30.80** (input the value of  $C1$ )  
 $C2$  = **9.05** (input the value of  $C2$ )  
 $C3$  = **0.809** (input the value of  $C3$ )  
 $P1$  = **0.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.06**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.16**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.1236	168	0.16	N/A	0.29	9.56
1						
2						
3						
4						
5						
Sum		168				
Computed T <sub>c</sub> =						9.56
Regional T <sub>c</sub> =						10.93
User-Entered T <sub>c</sub> =						9.56

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **1.73** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **1.63** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **1.73** inch/hr

Peak Flowrate,  $Q_p$  = **0.08** cfs  
 Peak Flowrate,  $Q_p$  = **0.07** cfs  
 Peak Flowrate,  $Q_p$  = **0.08** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN H1 - HISTORIC**

### I. Catchment Hydrologic Data

Catchment ID = **H1**  
 Area = **0.82** Acres  
 Percent Imperviousness = **2.00** %  
 NRCS Soil Type = **C** A, B, C, or D

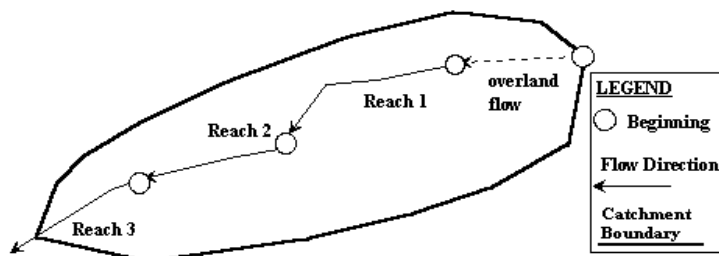
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **25** years (input return period for design storm)  
 $C1$  = **51.85** (input the value of  $C1$ )  
 $C2$  = **11.42** (input the value of  $C2$ )  
 $C3$  = **0.925** (input the value of  $C3$ )  
 $P1$  = **1.25** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.38**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.16**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.1236	168	0.16	N/A	0.29	9.56
1						
2						
3						
4						
5						
Sum		168				
Computed T <sub>c</sub> =						9.56
Regional T <sub>c</sub> =						10.93
User-Entered T <sub>c</sub> =						9.56

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **3.88** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **3.66** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **3.88** inch/hr

Peak Flowrate,  $Q_p$  = **1.21** cfs  
 Peak Flowrate,  $Q_p$  = **1.14** cfs  
 Peak Flowrate,  $Q_p$  = **1.21** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN H2 - HISTORIC**

### I. Catchment Hydrologic Data

Catchment ID = **H2**  
 Area = **3.34** Acres  
 Percent Imperviousness = **2.00** %  
 NRCS Soil Type = **C** A, B, C, or D

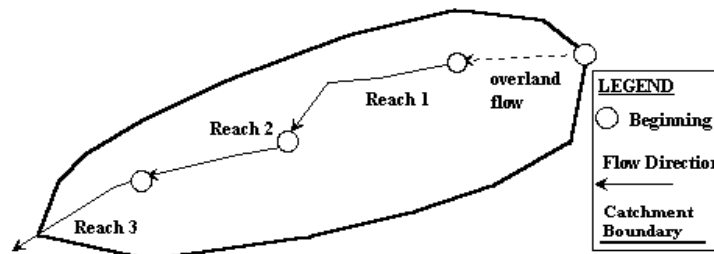
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **2** years (input return period for design storm)  
 $C1$  = **30.80** (input the value of  $C1$ )  
 $C2$  = **9.05** (input the value of  $C2$ )  
 $C3$  = **0.809** (input the value of  $C3$ )  
 $P1$  = **0.60** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.06**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.16**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.0862	300	0.16	N/A	0.35	14.39
1	0.0862	35		10.00	2.94	0.20
2						
3						
4						
5						
Sum		335				
Computed T <sub>c</sub> =						14.59
Regional T <sub>c</sub> =						11.86
User-Entered T <sub>c</sub> =						11.86

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **1.43** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **1.58** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **1.58** inch/hr

Peak Flowrate,  $Q_p$  = **0.26** cfs  
 Peak Flowrate,  $Q_p$  = **0.29** cfs  
 Peak Flowrate,  $Q_p$  = **0.29** cfs

## CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: **O-29 Water Storage**  
 Catchment ID: **BASIN H2 - HISTORIC**

### I. Catchment Hydrologic Data

Catchment ID = **H2**  
 Area = **3.34** Acres  
 Percent Imperviousness = **2.00** %  
 NRCS Soil Type = **C** A, B, C, or D

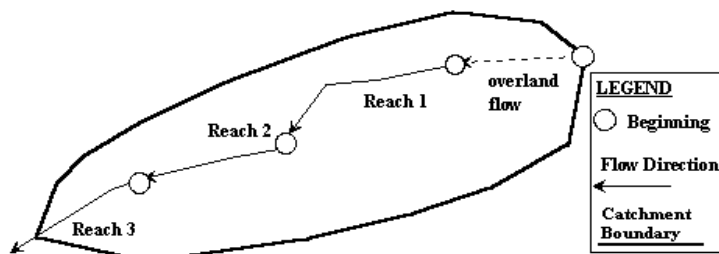
### II. Rainfall Information $I \text{ (inch/hr)} = C1 * P1 / (C2 + Td)^{C3}$

Design Storm Return Period,  $T_r$  = **25** years (input return period for design storm)  
 $C1$  = **51.85** (input the value of  $C1$ )  
 $C2$  = **11.42** (input the value of  $C2$ )  
 $C3$  = **0.925** (input the value of  $C3$ )  
 $P1$  = **1.25** inches (input one-hr precipitation--see Sheet "Design Info")

### III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient,  $C$  = **0.38**  
 Override Runoff Coefficient,  $C$  = (enter an override  $C$  value if desired, or leave blank to accept calculated  $C$ .)  
 5-yr. Runoff Coefficient,  $C-5$  = **0.16**  
 Override 5-yr. Runoff Coefficient,  $C$  = (enter an override  $C-5$  value if desired, or leave blank to accept calculated  $C-5$ .)

#### Illustration



NRCS Land Type	Heavy Meadow	Tillage/Field	Short Pasture/Lawns	Nearly Bare Ground	Grassed Swales/Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Conveyance input	Flow Velocity V fps output	Flow Time T <sub>f</sub> minutes output
Overland	0.0862	300	0.16	N/A	0.35	14.39
1	0.0862	35		10.00	2.94	0.20
2						
3						
4						
5						
Sum		335				
Computed T <sub>c</sub> =						14.59
Regional T <sub>c</sub> =						11.86
User-Entered T <sub>c</sub> =						11.86

### IV. Peak Runoff Prediction

Rainfall Intensity at Computed T<sub>c</sub>,  $I$  = **3.18** inch/hr  
 Rainfall Intensity at Regional T<sub>c</sub>,  $I$  = **3.53** inch/hr  
 Rainfall Intensity at User-Defined T<sub>c</sub>,  $I$  = **3.53** inch/hr

Peak Flowrate,  $Q_p$  = **4.03** cfs  
 Peak Flowrate,  $Q_p$  = **4.47** cfs  
 Peak Flowrate,  $Q_p$  = **4.47** cfs



## APPENDIX C

### HYDRAULIC CALCULATIONS

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# DETENTION VOLUME BY THE MODIFIED FAA METHOD

Project: Linn Operating Inc. O-29 Water Storage

Basin ID: 2

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing method)  
(NOTE: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

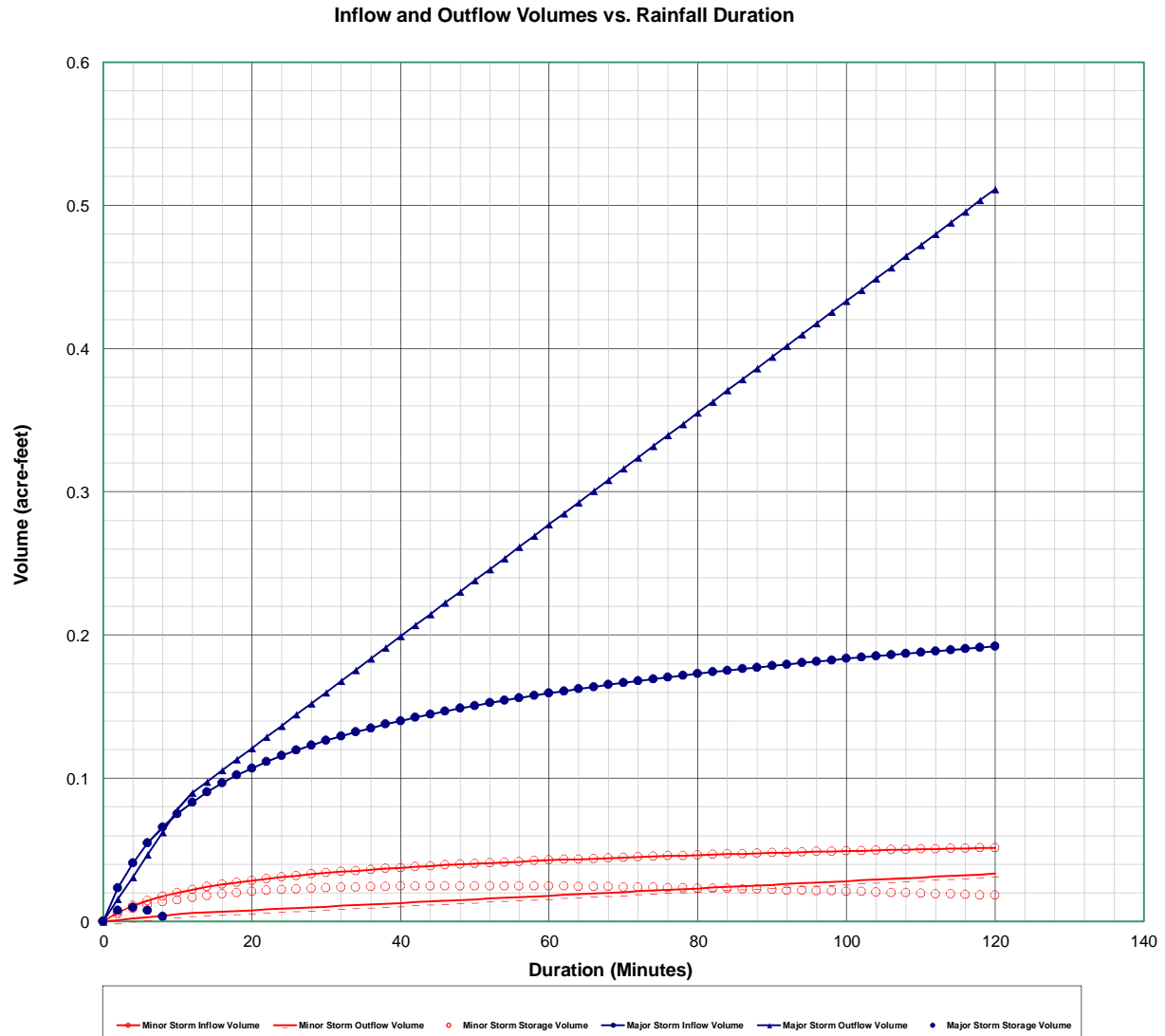
Determination of MINOR Detention Volume Using Modified FAA Method							Determination of MAJOR Detention Volume Using Modified FAA Method						
<b>Design Information (Input):</b> Catchment Drainage Imperviousness $I_p = 40.00$ percent Catchment Drainage Area $A = 3.080$ acres Predevelopment NRCS Soil Group Type = C A, B, C, or D Return Period for Detention Control $T = 2$ years (2, 5, 10, 25, 50, or 100) Time of Concentration of Watershed $T_c = 11$ minutes Allowable Unit Release Rate $q = 0.12$ cfs/acre One-hour Precipitation $P_1 = 0.60$ inches <b>Design Rainfall IDF Formula</b> $i = C_1 \cdot P_1 / (C_2 + T_c)^{C_3}$ Coefficient One $C_1 = 30.80$ Coefficient Two $C_2 = 9$ Coefficient Three $C_3 = 0.809$							<b>Design Information (Input):</b> Catchment Drainage Imperviousness $I_p = 40.00$ percent Catchment Drainage Area $A = 3.080$ acres Predevelopment NRCS Soil Group Type = C A, B, C, or D Return Period for Detention Control $T = 25$ years (2, 5, 10, 25, 50, or 100) Time of Concentration of Watershed $T_c = 11$ minutes Allowable Unit Release Rate $q = 1.84$ cfs/acre One-hour Precipitation $P_1 = 1.25$ inches <b>Design Rainfall IDF Formula</b> $i = C_1 \cdot P_1 / (C_2 + T_c)^{C_3}$ Coefficient One $C_1 = 30.80$ Coefficient Two $C_2 = 9$ Coefficient Three $C_3 = 0.809$						
<b>Determination of Average Outflow from the Basin (Calculated):</b> Runoff Coefficient $C = 0.28$ Inflow Peak Runoff $Q_{p-in} = 1.40$ cfs Allowable Peak Outflow Rate $Q_{p-out} = 0.37$ cfs <b>Mod. FAA Minor Storage Volume</b> = 1.082 cubic feet <b>Mod. FAA Minor Storage Volume</b> = 0.025 acre-ft							<b>Determination of Average Outflow from the Basin (Calculated):</b> Runoff Coefficient $C = 0.50$ Inflow Peak Runoff $Q_{p-in} = 5.24$ cfs Allowable Peak Outflow Rate $Q_{p-out} = 5.67$ cfs <b>Mod. FAA Major Storage Volume</b> = 421 cubic feet <b>Mod. FAA Major Storage Volume</b> = 0.010 acre-ft						
2 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)													
Rainfall Duration minutes (input)	Rainfall Intensity inches / hr (output)	Inflow Volume acre-feet (output)	Adjustment Factor "m" (output)	Average Outflow cfs (output)	Outflow Volume acre-feet (output)	Storage Volume acre-feet (output)	Rainfall Duration minutes (input)	Rainfall Intensity inches / hr (output)	Inflow Volume acre-feet (output)	Adjustment Factor "m" (output)	Average Outflow cfs (output)	Outflow Volume acre-feet (output)	Storage Volume acre-feet (output)
0	0.00	0.000	0.00	0.00	0.000	0.000	0	0.00	0.000	0.00	0.00	0.000	0.000
2	2.64	0.006	1.00	0.37	0.001	0.005	2	5.51	0.023	1.00	5.67	0.016	0.008
4	2.31	0.011	1.00	0.37	0.002	0.009	4	4.82	0.041	1.00	5.67	0.031	0.010
6	2.05	0.015	1.00	0.37	0.003	0.012	6	4.29	0.055	1.00	5.67	0.047	0.008
8	1.86	0.018	1.00	0.37	0.004	0.014	8	3.88	0.066	1.00	5.67	0.062	0.003
10	1.70	0.020	1.00	0.37	0.005	0.015	10	3.55	0.075	1.00	5.67	0.078	-0.003
12	1.57	0.022	0.96	0.35	0.006	0.016	12	3.27	0.083	0.96	5.43	0.090	-0.006
14	1.46	0.024	0.89	0.33	0.006	0.018	14	3.04	0.090	0.89	5.06	0.098	-0.007
16	1.36	0.026	0.84	0.31	0.007	0.019	16	2.84	0.097	0.84	4.78	0.105	-0.009
18	1.28	0.027	0.81	0.30	0.007	0.020	18	2.67	0.102	0.81	4.57	0.113	-0.011
20	1.21	0.029	0.78	0.29	0.008	0.021	20	2.52	0.107	0.78	4.39	0.121	-0.014
22	1.14	0.030	0.75	0.28	0.008	0.021	22	2.39	0.112	0.75	4.25	0.129	-0.017
24	1.09	0.031	0.73	0.27	0.009	0.022	24	2.27	0.116	0.73	4.13	0.137	-0.021
26	1.04	0.032	0.71	0.26	0.009	0.023	26	2.17	0.120	0.71	4.03	0.144	-0.025
28	0.99	0.033	0.70	0.26	0.010	0.023	28	2.07	0.123	0.70	3.95	0.152	-0.029
30	0.95	0.034	0.68	0.25	0.010	0.023	30	1.99	0.126	0.68	3.87	0.160	-0.034
32	0.91	0.035	0.67	0.25	0.011	0.024	32	1.91	0.129	0.67	3.81	0.168	-0.038
34	0.88	0.035	0.66	0.24	0.011	0.024	34	1.83	0.132	0.66	3.75	0.176	-0.043
36	0.85	0.036	0.65	0.24	0.012	0.024	36	1.77	0.135	0.65	3.70	0.183	-0.048
38	0.82	0.037	0.64	0.24	0.012	0.024	38	1.71	0.138	0.64	3.65	0.191	-0.054
40	0.79	0.038	0.64	0.24	0.013	0.025	40	1.65	0.140	0.64	3.61	0.199	-0.059
42	0.76	0.038	0.63	0.23	0.013	0.025	42	1.60	0.142	0.63	3.58	0.207	-0.064
44	0.74	0.039	0.63	0.23	0.014	0.025	44	1.55	0.145	0.63	3.54	0.215	-0.070
46	0.72	0.039	0.62	0.23	0.015	0.025	46	1.50	0.147	0.62	3.51	0.223	-0.076
48	0.70	0.040	0.61	0.23	0.015	0.025	48	1.46	0.149	0.61	3.48	0.230	-0.082
50	0.68	0.040	0.61	0.23	0.016	0.025	50	1.42	0.151	0.61	3.46	0.238	-0.087
52	0.66	0.041	0.61	0.22	0.016	0.025	52	1.38	0.153	0.61	3.43	0.246	-0.093
54	0.64	0.041	0.60	0.22	0.017	0.025	54	1.35	0.154	0.60	3.41	0.254	-0.099
56	0.63	0.042	0.60	0.22	0.017	0.025	56	1.31	0.156	0.60	3.39	0.262	-0.105
58	0.61	0.042	0.59	0.22	0.018	0.025	58	1.28	0.158	0.59	3.37	0.269	-0.112
60	0.60	0.043	0.59	0.22	0.018	0.025	60	1.25	0.159	0.59	3.35	0.277	-0.118
62	0.59	0.043	0.59	0.22	0.019	0.025	62	1.22	0.161	0.59	3.34	0.285	-0.124
64	0.57	0.044	0.59	0.22	0.019	0.024	64	1.20	0.162	0.59	3.32	0.293	-0.130
66	0.56	0.044	0.58	0.22	0.020	0.024	66	1.17	0.164	0.58	3.31	0.301	-0.137
68	0.55	0.044	0.58	0.21	0.020	0.024	68	1.15	0.165	0.58	3.29	0.308	-0.143
70	0.54	0.045	0.58	0.21	0.021	0.024	70	1.12	0.167	0.58	3.28	0.316	-0.150
72	0.53	0.045	0.58	0.21	0.021	0.024	72	1.10	0.168	0.58	3.27	0.324	-0.156
74	0.52	0.045	0.57	0.21	0.022	0.024	74	1.08	0.169	0.57	3.26	0.332	-0.163
76	0.51	0.046	0.57	0.21	0.022	0.024	76	1.06	0.171	0.57	3.24	0.340	-0.169
78	0.50	0.046	0.57	0.21	0.023	0.023	78	1.04	0.172	0.57	3.23	0.347	-0.176
80	0.49	0.046	0.57	0.21	0.023	0.023	80	1.02	0.173	0.57	3.22	0.355	-0.182
82	0.48	0.047	0.57	0.21	0.024	0.023	82	1.00	0.174	0.57	3.21	0.363	-0.189
84	0.47	0.047	0.57	0.21	0.024	0.023	84	0.98	0.175	0.57	3.21	0.371	-0.196
86	0.46	0.047	0.56	0.21	0.025	0.023	86	0.97	0.176	0.56	3.20	0.379	-0.202
88	0.45	0.048	0.56	0.21	0.025	0.022	88	0.95	0.177	0.56	3.19	0.386	-0.209
90	0.45	0.048	0.56	0.21	0.026	0.022	90	0.94	0.179	0.56	3.18	0.394	-0.216
92	0.44	0.048	0.56	0.21	0.026	0.022	92	0.92	0.180	0.56	3.17	0.402	-0.223
94	0.43	0.048	0.56	0.21	0.027	0.022	94	0.91	0.181	0.56	3.17	0.410	-0.229
96	0.43	0.049	0.56	0.21	0.027	0.021	96	0.89	0.182	0.56	3.16	0.418	-0.236
98	0.42	0.049	0.56	0.21	0.028	0.021	98	0.88	0.183	0.56	3.15	0.425	-0.243
100	0.41	0.049	0.56	0.21	0.028	0.021	100	0.87	0.183	0.56	3.15	0.433	-0.250
102	0.41	0.049	0.55	0.20	0.029	0.021	102	0.85	0.184	0.55	3.14	0.441	-0.257
104	0.40	0.050	0.55	0.20	0.029	0.020	104	0.84	0.185	0.55	3.13	0.449	-0.264
106	0.40	0.050	0.55	0.20	0.030	0.020	106	0.83	0.186	0.55	3.13	0.457	-0.270
108	0.39	0.050	0.55	0.20	0.030	0.020	108	0.82	0.187	0.55	3.12	0.464	-0.277
110	0.39	0.050	0.55	0.20	0.031	0.020	110	0.81	0.188	0.55	3.12	0.472	-0.284
112	0.38	0.051	0.55	0.20	0.031	0.019	112	0.79	0.189	0.55	3.11	0.480	-0.291
114	0.38	0.051	0.55	0.20	0.032	0.019	114	0.78	0.190	0.55	3.11	0.488	-0.298
116	0.37	0.051	0.55	0.20	0.032	0.019	116	0.77	0.191	0.55	3.10	0.496	-0.305
118	0.37	0.051	0.55	0.20	0.033	0.018	118	0.76	0.191	0.55	3.10	0.504	-0.312
120	0.36	0.051	0.55	0.20	0.033	0.018	120	0.75	0.192	0.55	3.09	0.511	-0.319
Mod. FAA Minor Storage Volume (cubic ft.) = 1,082 Mod. FAA Minor Storage Volume (acre-ft.) = 0.0248							Mod. FAA Major Storage Volume (cubic ft.) = 421 Mod. FAA Major Storage Volume (acre-ft.) = 0.0097						

UDFCD DETENTION BASIN VOLUME ESTIMATING WORKBOOK Version 2.34, Released November 2013

## DETENTION VOLUME BY THE MODIFIED FAA METHOD

Project: Linn Operating Inc. O-29 Water Storage

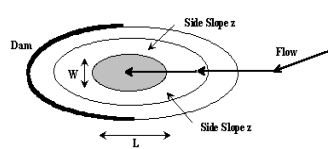
Basin ID: 2



## STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: LINN OPERATING, INC. O-29 WATER STORAGE

Basin ID: 2



**Design Information (Input):**

Width of Basin Bottom, W	=	20.00	ft
Length of Basin Bottom, L	=	5.00	ft
Dam Side-slope (H:V), $Z_d$	=	4.00	ft/ft

Right Triangle		OR...
Isosceles Triangle		OR...
Rectangle	X	OR...
Circle / Ellipse		OR...
Irregular		(Use Override values in cells G32:G52)

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':	0.025	0.010	acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':			acre-ft.

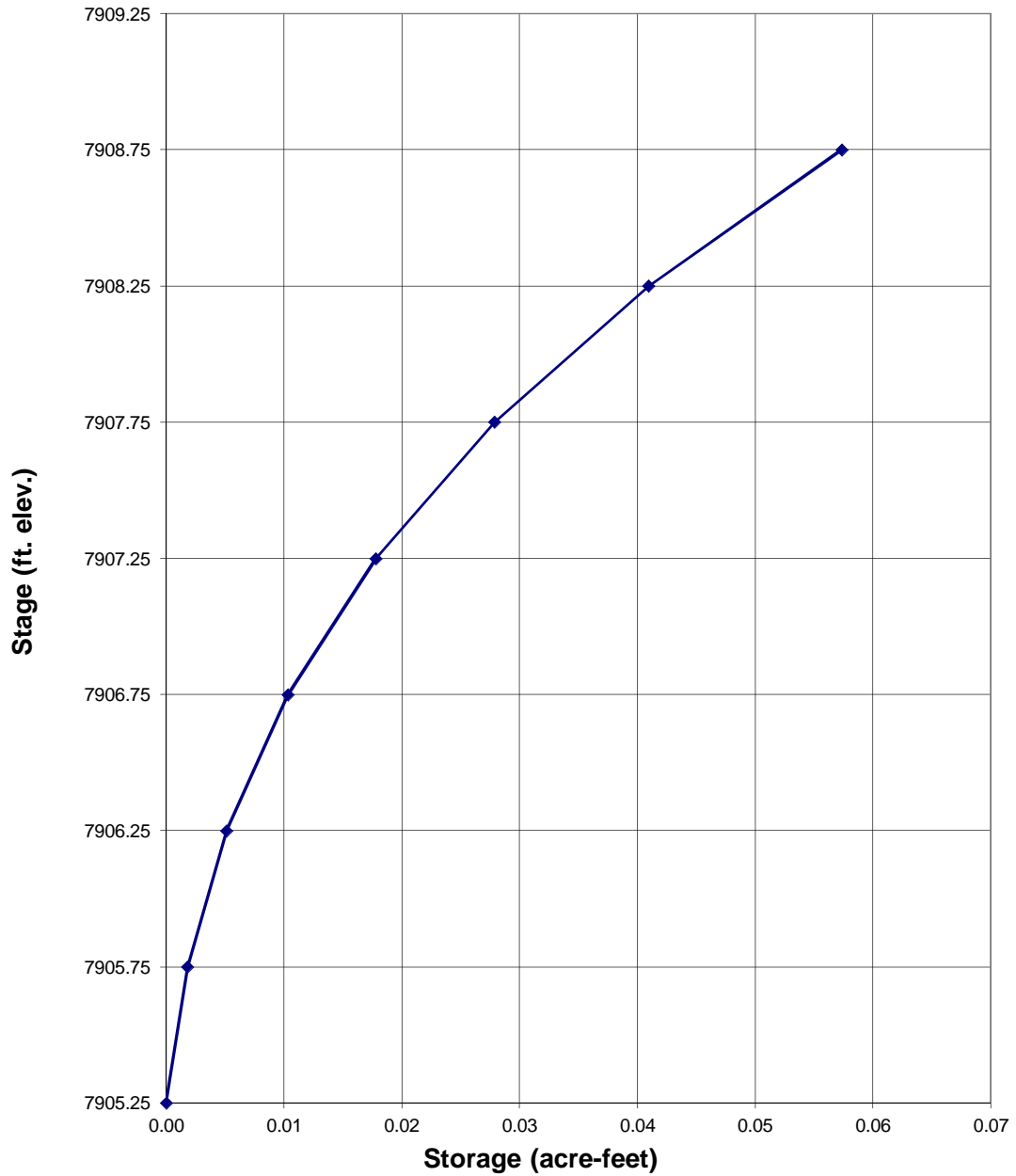
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## STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: \_\_\_\_\_

Basin ID: \_\_\_\_\_

**STAGE-STORAGE CURVE FOR THE POND**



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET	
1	1
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98	98
99	99
100	100

Project: LINN OPERATING, INC. O-29 WATER STORAGE

Basin ID: 2

**WQCV Design Volume (Input):** \_\_\_\_\_

Diameter of holes,  $D = \frac{1.408}{1}$  inches

Number of holes per row,  $N = \underline{\underline{1}}$

OR

Height of slot,  $H = \frac{\quad}{\quad}$  inches

Width of slot,  $W = \frac{\quad}{\quad}$  inches

Height of slot,  $H =$   inches  
Width of slot,  $W =$   inches

**Watershed Design Information (Input):**

Perforated Plate Examples

**Outlet Design Information (Output):**

Water Quality Capture Volume, WQCV =	0.233 watershed inches
Water Quality Capture Volume (WQCV) =	0.060 acre-feet
<b>Design Volume (WQCV / 12 * Area * 1.2) Vol =</b>	<b>0.072 acre-feet</b>
Outlet area per row, Ao =	1.56 square inches
Total opening area at each row based on user-input above, Ao =	1.56 square inches
Total opening area at each row based on user-input above, Ao =	0.011 square feet

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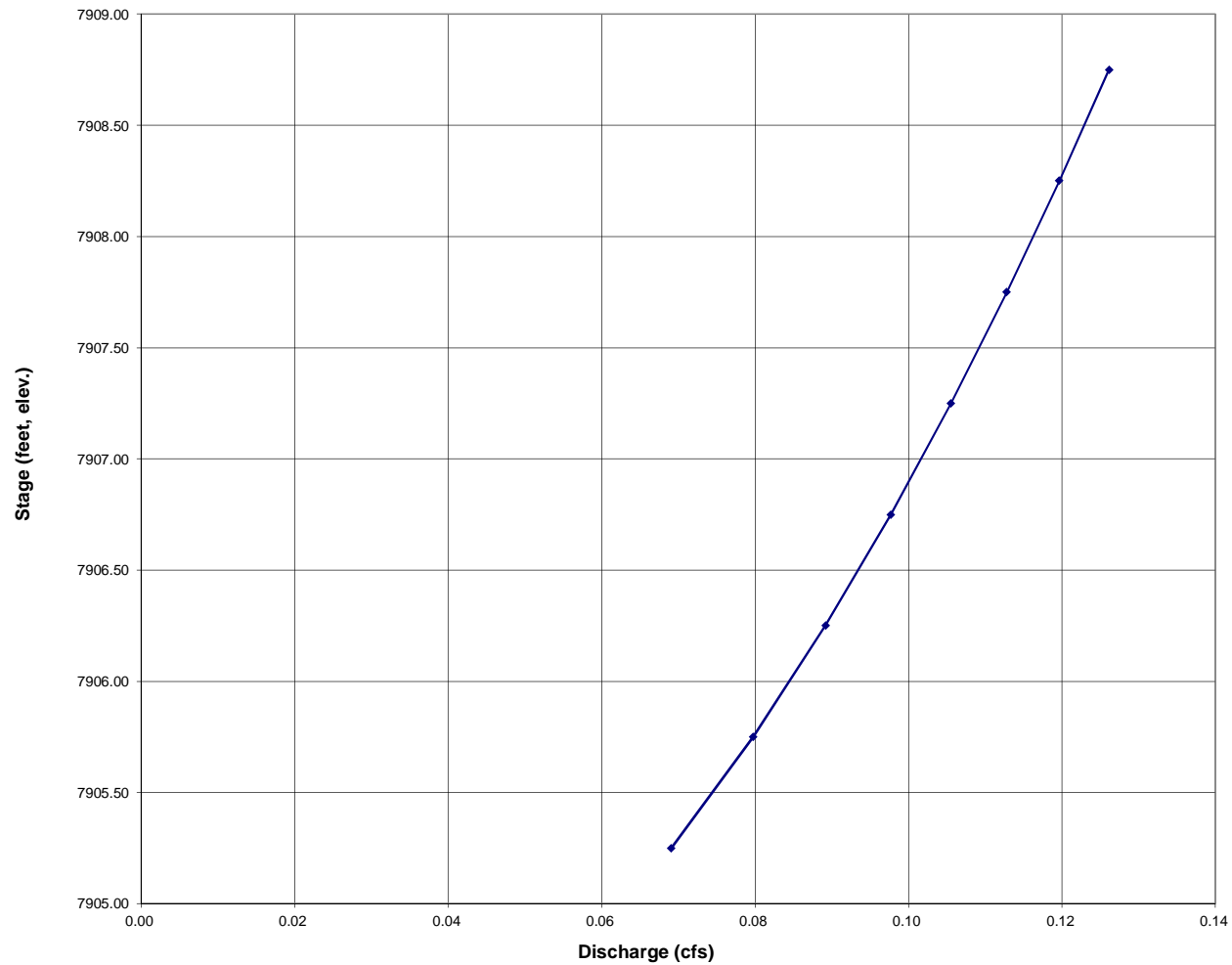
# STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: LINN OPERATING, INC. O-29 WATER STORAGE

Basin ID: 2

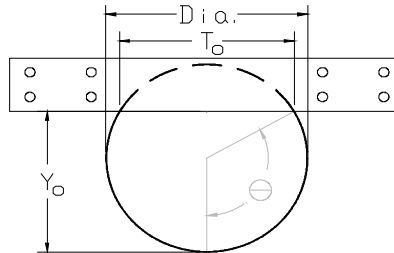
STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE



## RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: **LINN OPERATIONG, INC. O-29 WATER STORAGE**

Basin ID: **2**



### Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)

Water Surface Elevation at Design Depth  
 Pipe/Vertical Orifice Entrance Invert Elevation  
 Required Peak Flow through Orifice at Design Depth  
 Pipe/Vertical Orifice Diameter (inches)  
 Orifice Coefficient

	#1 Vertical Orifice	#2 Vertical Orifice	
Elev: WS =	7,907.75	7,908.25	feet
Elev: Invert =	7,907.25	7,905.25	feet
Q =	0.37	5.68	cfs
Dia =	6.0	12.0	inches
C <sub>o</sub> =	0.65	0.65	

### Full-flow Capacity (Calculated)

Full-flow area  
 Half Central Angle in Radians  
 Full-flow capacity

A <sub>f</sub> =	0.20	0.79	sq ft
Theta =	3.14	3.14	rad
Q <sub>f</sub> =	0.5	6.5	cfs
Percent of Design Flow =	138%	114%	

### Calculation of Orifice Flow Condition

Half Central Angle (0<Theta<3.1416)  
 Flow area  
 Top width of Orifice (inches)  
 Height from Invert of Orifice to Bottom of Plate (feet)  
 Elevation of Bottom of Plate  
 Resultant Peak Flow Through Orifice at Design Depth

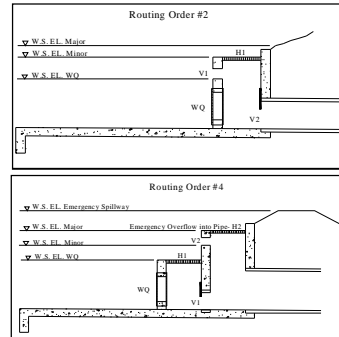
Theta =	1.74	2.22	rad
A <sub>o</sub> =	0.12	0.68	sq ft
T <sub>o</sub> =	5.91	9.55	inches
Y <sub>o</sub> =	0.29	0.80	feet
Elev Plate Bottom Edge =	7,907.54	7,906.05	feet
Q <sub>o</sub> =	0.4	5.7	cfs

### Width of Equivalent Rectangular Vertical Orifice

Equivalent Width = **0.41**      **0.85**      feet

## STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Basin ID: 2



**Design Information (Input):**

Diameter in Inches

Dia. = 

--	--	--	--

 inches

Width in Feet

W = 

3.00		0.41	0.85
------	--	------	------

 ft.

Length (Height for Vertical)

L or H =	3.00	0.29	0.80	ft.
----------	------	------	------	-----

% open = 

60		100	100
----	--	-----	-----

 %

$C_0 =$	0.65	0.65	0.65
---------	------	------	------

$C_w =$	3.33		
---------	------	--	--

$E_o =$	7907.75		7,907.25	7,905.25	ft.
---------	---------	--	----------	----------	-----

---

$$A_o = \frac{5.40}{0.12} \times 0.68 \text{ sq. ft.}$$

$A_0 =$   sq. ft.

$$L_w = \underline{\quad 9.60 \quad} \text{ ft.}$$

$L_w =$   ft.

Top Elevation of Vertical Orifice Opening, Top =	7907.54	7906.05	ft.
--	---------	---------	-----

Center Elevation of Vertical Orifice Opening, Cen =	7907.40	7905.65	ft.
---	---------	---------	-----

Routing 2: Water flows through WQCV plate and #1 vertical opening and #1 horizontal opening into #2 vertical opening (#2 horizontal opening is not used).

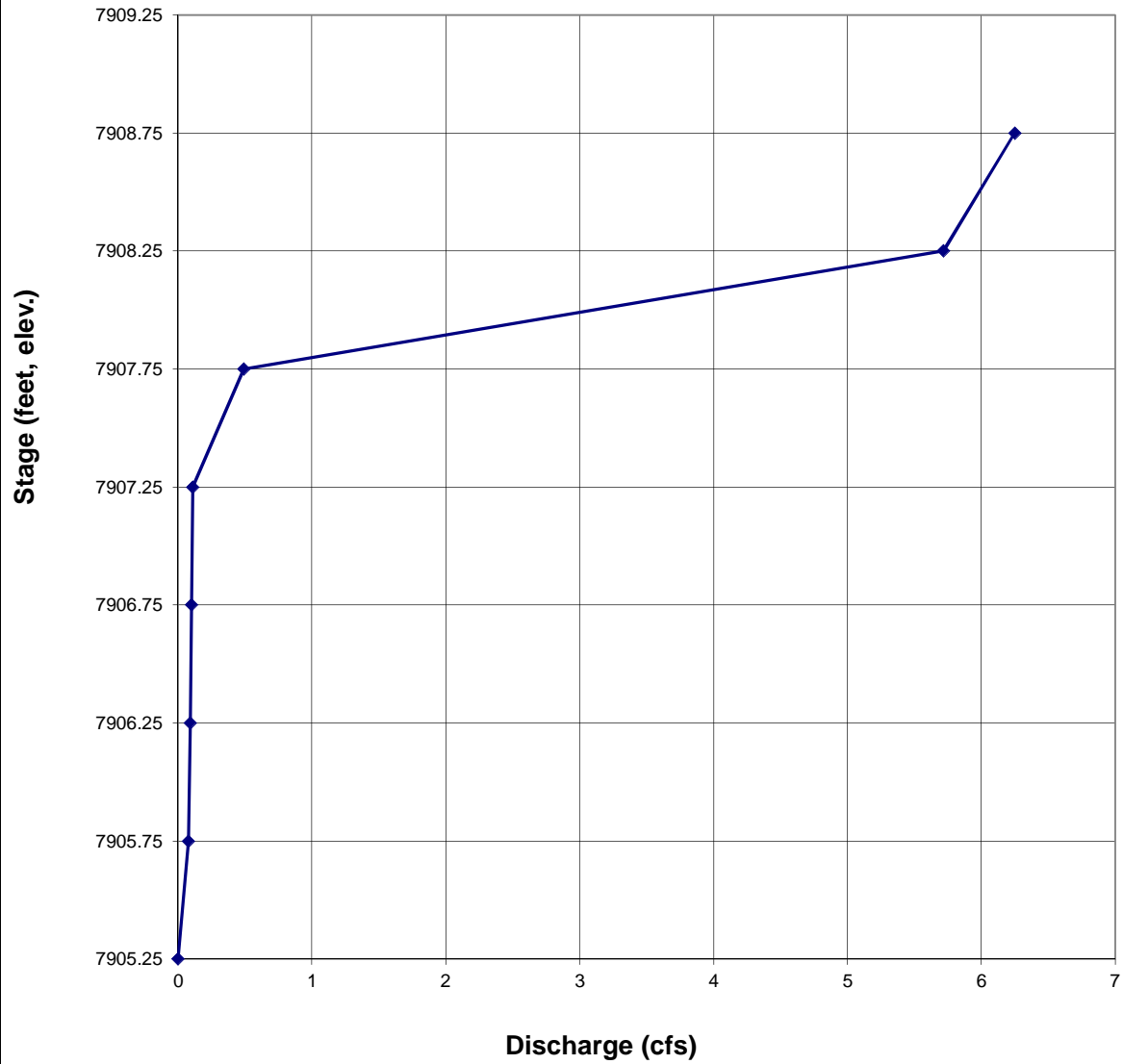
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## STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: LINN OPERATING, INC. O-29 WATER STORAGE  
Basin ID: 2

### STAGE-DISCHARGE CURVE FOR THE OUTLET STRUCTURE



Project: LINN OPERATING, INC. O-29 WATER STORAGE  
Basin ID: 2

D = 12 in.  
Square End with Headwall

Height (Rise) = ft.  
Width (Span) = ft.  
Square Edge w/ 90-15 deg. Flared Wingwall

No =	1	
$I_{elev}$ =	7905.25	ft. elev.
$O_{elev}$ =	7896.00	ft. elev.
L =	65.0	ft.
n =	0.0130	
$K_b$ =	0.00	
$K_x$ =	1.00	

$K_e =$	0.50
$K_f =$	2.02
$K_s =$	3.52
$C_d =$	0.88
$KE_{low} =$	-0.50

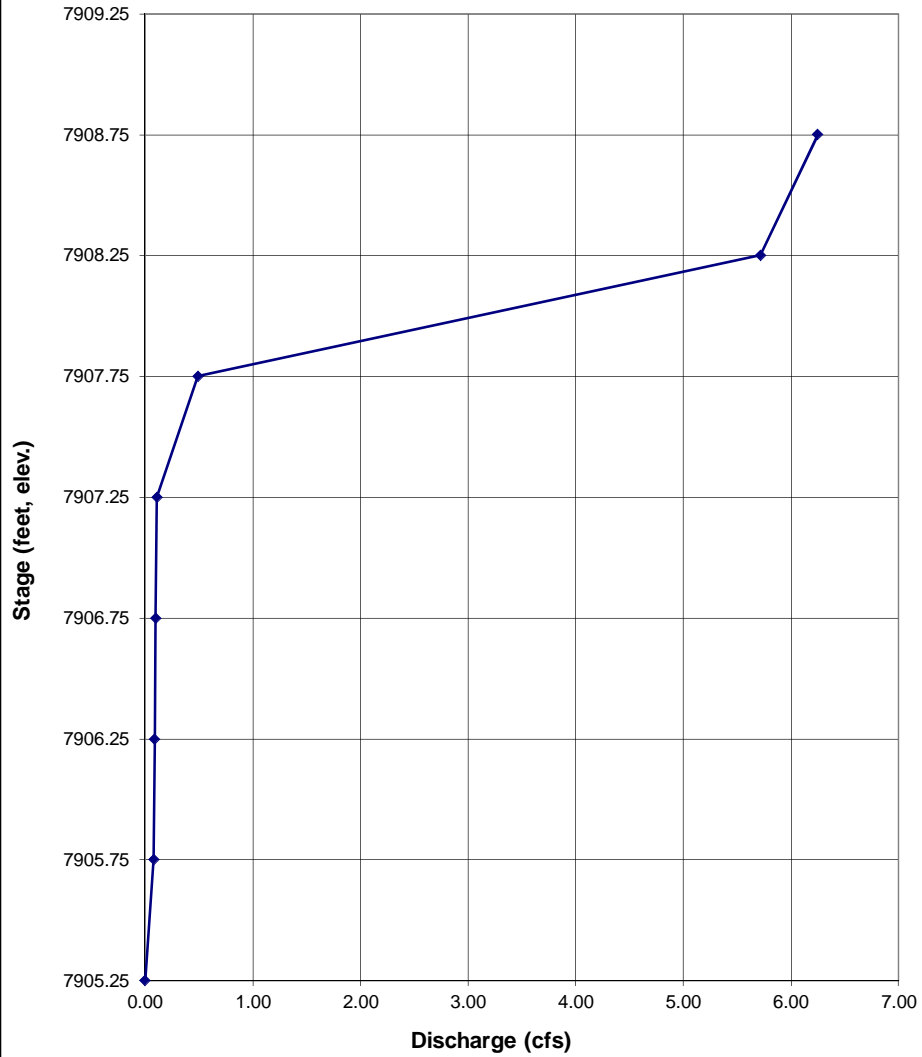
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STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: LINN OPERATING, INC. O-29 WATER STORAGE

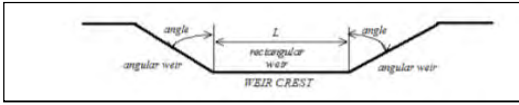
Basin ID: 2

STAGE-DISCHARGE CURVE FOR THE FINAL OUTLET PIPE CULVERT



## STAGE-DISCHARGE SIZING OF THE SPILLWAY

Basin ID: 2



**Design Information (input):**

Bottom Length of Weir  
Angle of Side Slope Weir  
Elev. for Weir Crest  
Coef. for Rectangular Weir  
Coef. for Trapezoidal Weir

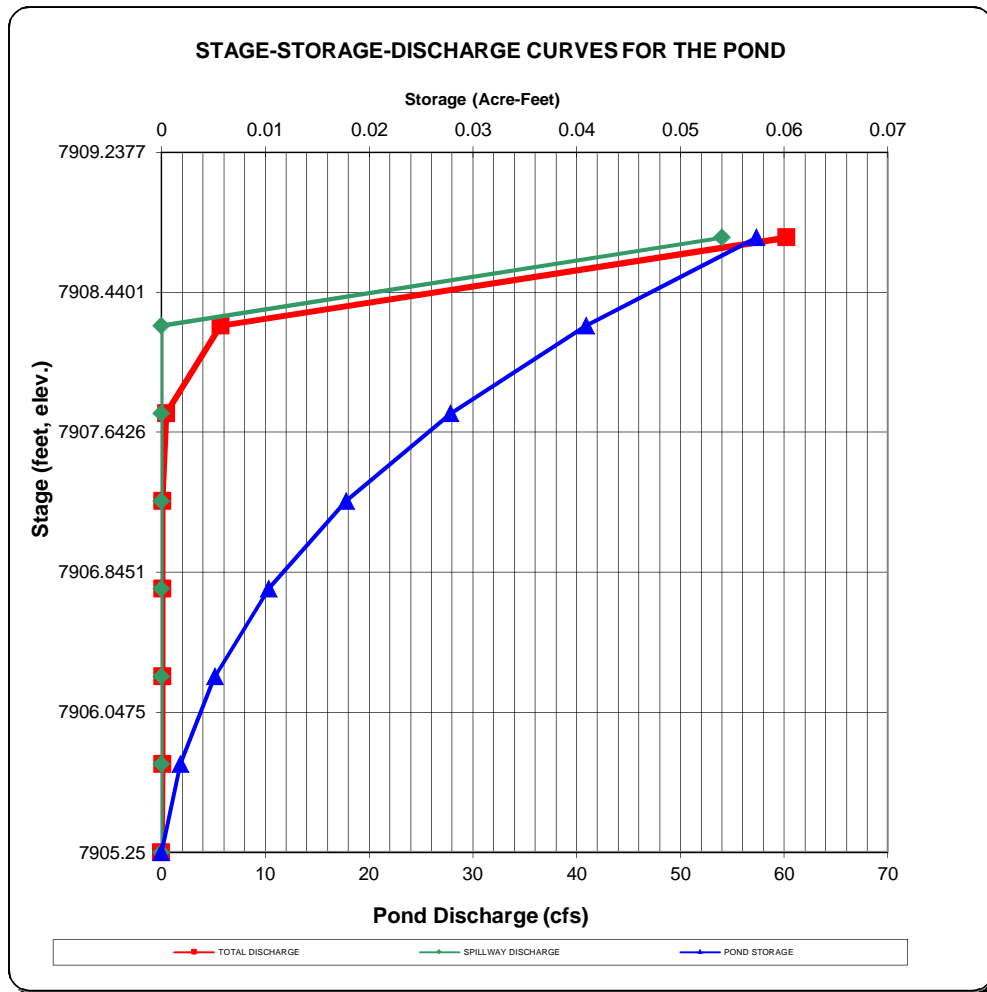
L =	44.00	feet
Angle =	75.96	degrees
EL. Crest =	7,908.25	feet
C <sub>w</sub> =	3.32	
C <sub>t</sub> =	3.32	

**Calculation of Spillway Capacity (output):**

[illegible]

## STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: LINN OPERATING, INC. O-29 WATER STORAGE  
Basin ID: 2



## CHANNEL INTO DETENTION POND

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.069	
Channel Slope	0.02000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	5.68	ft <sup>3</sup> /s

### Results

Normal Depth	0.64	ft
Flow Area	3.18	ft <sup>2</sup>
Wetted Perimeter	7.07	ft
Hydraulic Radius	0.45	ft
Top Width	6.87	ft
Critical Depth	0.42	ft
Critical Slope	0.10461	ft/ft
Velocity	1.79	ft/s
Velocity Head	0.05	ft
Specific Energy	0.69	ft
Froude Number	0.46	
Flow Type	Subcritical	

### 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	0.64	ft
Critical Depth	0.42	ft
Channel Slope	0.02000	ft/ft

---

## CHANNEL INTO DETENTION POND

---

### GVF Output Data

Critical Slope 0.10461 ft/ft

## CULVERT OUT OF POND

### Project Description

Friction Method	Manning Formula
Solve For	Discharge

### Input Data

Roughness Coefficient	0.024	
Channel Slope	0.16000	ft/ft
Normal Depth	0.80	ft
Diameter	1.00	ft

### Results

Discharge	7.55	ft <sup>3</sup> /s
Flow Area	0.67	ft <sup>2</sup>
Wetted Perimeter	2.21	ft
Hydraulic Radius	0.30	ft
Top Width	0.80	ft
Critical Depth	0.98	ft
Percent Full	80.0	%
Critical Slope	0.13734	ft/ft
Velocity	11.20	ft/s
Velocity Head	1.95	ft
Specific Energy	2.75	ft
Froude Number	2.15	
Maximum Discharge	8.30	ft <sup>3</sup> /s
Discharge Full	7.72	ft <sup>3</sup> /s
Slope Full	0.15287	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	80.00	%
Downstream Velocity	Infinity	ft/s



---

## CULVERT OUT OF POND

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.80	ft
Critical Depth	0.98	ft
Channel Slope	0.16000	ft/ft
Critical Slope	0.13734	ft/ft

### Messages

#### Notes

Maximum culvert capacity with normal depth no higher than restrictor plate. >5.68 cfs

## CHANNEL OUT OF DETENTION

### Project Description

Friction Method	Manning Formula
Solve For	Discharge

### Input Data

Roughness Coefficient	0.069	
Channel Slope	0.14000	ft/ft
Normal Depth	0.50	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft

### Results

Discharge	9.26	ft <sup>3</sup> /s
Flow Area	2.25	ft <sup>2</sup>
Wetted Perimeter	6.16	ft
Hydraulic Radius	0.37	ft
Top Width	6.00	ft
Critical Depth	0.55	ft
Critical Slope	0.09722	ft/ft
Velocity	4.12	ft/s
Velocity Head	0.26	ft
Specific Energy	0.76	ft
Froude Number	1.19	
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	0.50	ft
Critical Depth	0.55	ft
Channel Slope	0.14000	ft/ft

---

## CHANNEL OUT OF DETENTION

---

### GVF Output Data

Critical Slope 0.09722 ft/ft

### Messages

#### Notes

Allows for 0.5' freeboard

## BANK OUT OF DETENTION - TOP

### Project Description

Friction Method	Manning Formula
Solve For	Discharge

### Input Data

Roughness Coefficient	0.069	
Channel Slope	0.25000	ft/ft
Normal Depth	0.10	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	44.00	ft

### Results

Discharge	10.23	ft <sup>3</sup> /s
Flow Area	4.44	ft <sup>2</sup>
Wetted Perimeter	44.82	ft
Hydraulic Radius	0.10	ft
Top Width	44.80	ft
Critical Depth	0.12	ft
Critical Slope	0.14183	ft/ft
Velocity	2.31	ft/s
Velocity Head	0.08	ft
Specific Energy	0.18	ft
Froude Number	1.29	
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	0.10	ft
Critical Depth	0.12	ft
Channel Slope	0.25000	ft/ft



---

## **BANK OUT OF DETENTION - TOP**

---

### GVF Output Data

Critical Slope 0.14183 ft/ft

### Messages

#### Notes

Still allows for 0.40' of freeboard

## BANK OUT OF DETENTION - BOTTOM

### Project Description

Friction Method	Manning Formula
Solve For	Discharge

### Input Data

Roughness Coefficient	0.069	
Channel Slope	0.25000	ft/ft
Normal Depth	0.43	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft

### Results

Discharge	9.34	ft <sup>3</sup> /s
Flow Area	1.84	ft <sup>2</sup>
Wetted Perimeter	5.72	ft
Hydraulic Radius	0.32	ft
Top Width	5.58	ft
Critical Depth	0.55	ft
Critical Slope	0.09710	ft/ft
Velocity	5.06	ft/s
Velocity Head	0.40	ft
Specific Energy	0.83	ft
Froude Number	1.55	
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	0.43	ft
Critical Depth	0.55	ft
Channel Slope	0.25000	ft/ft

---

## **BANK OUT OF DETENTION - BOTTOM**

---

### GVF Output Data

Critical Slope 0.09710 ft/ft

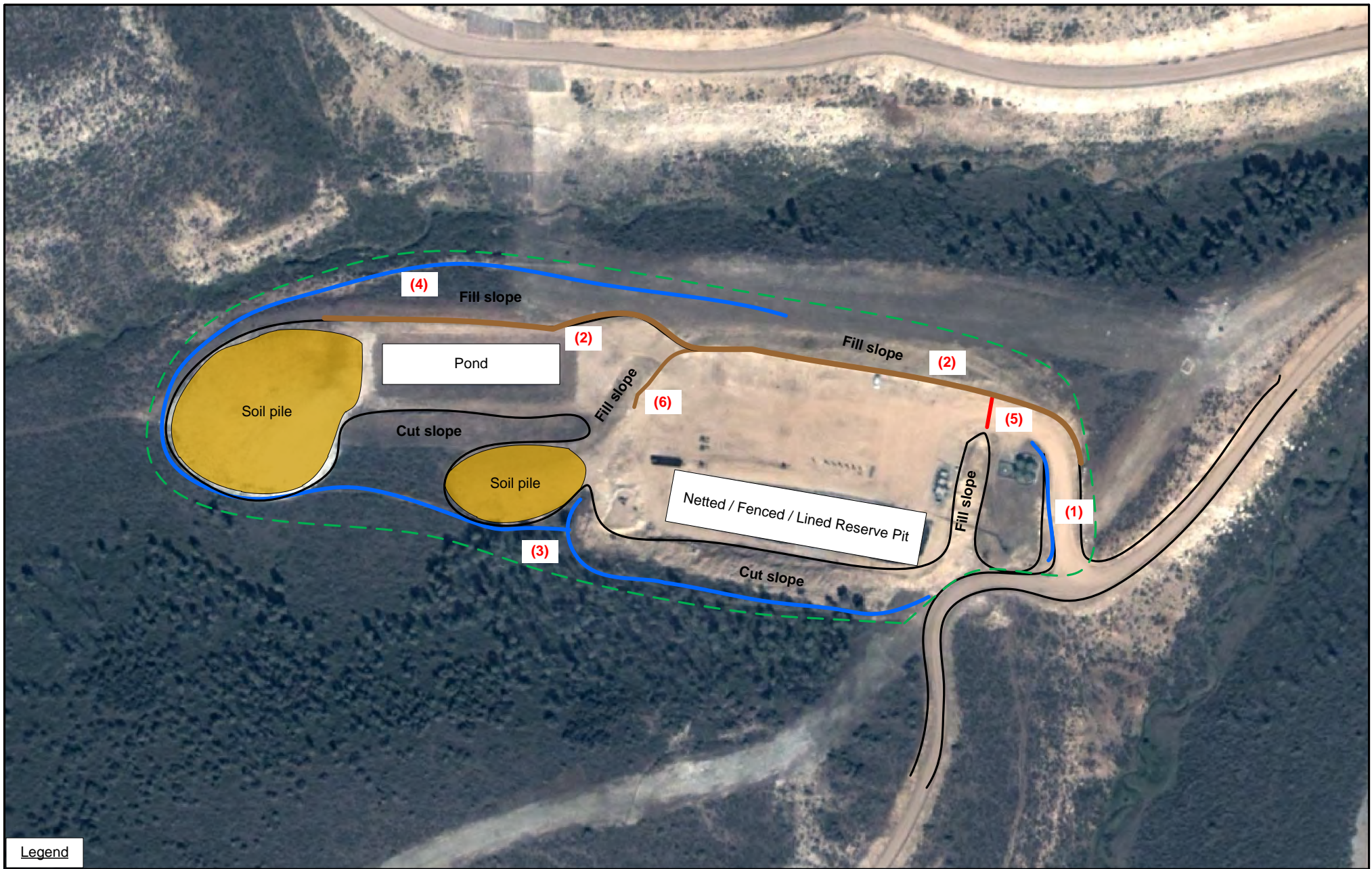
### Messages

#### Notes

Still allow for 0.5' of freeboard

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# Legend



Sediment Trap



Earthen Berm



Waterbar



Ditch



Construction Site Boundary



PROJECT NO: 008-2215

DRAWN BY: JAS

DATE: 10/01/10

## Latham 29-27D (O-29)

Berry Petroleum Company

SW SE, Section 29, Township 5S, Range 96W  
Garfield County, CO

**OLSSON**  
ASSOCIATES

826 21½ Road  
Grand Junction, CO 81505  
TEL 970.263.7800  
FAX 970.263.7456

Map Not to Scale

Revision: 1  
04/06/2011

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# **STORMWATER MANAGEMENT PLAN**

**Garden Gulch**

**Section 2**

**Garfield County, CO**

**Prepared For:**



**1999 Broadway Ave.,  
Denver, CO 80202**

**Prepared by:**



**826 21 ½ Road  
Grand Junction, Colorado 81505**

**Project # 010-0779**

**May 2010**

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~~**Appendix B**   Down Hole Chemicals~~

**Appendix B**   NRCS Soils Report

**Appendix C**   Site Map & Stormwater Inspection Form

**Appendix D**   BMP Installation and Selection Guide

## INTRODUCTION

This Stormwater Management Plan (SWMP) is written to comply with the Colorado Department of Public Health and Environment's (CDPHE) Permit No COR-030000, issued on July 1, 2007 and expires on June 30, 2012, and related U.S. Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) stormwater regulations. This SWMP addresses construction activities associated with the Berry Petroleum Company (Berry) Garden Gulch Section 2. A copy of this permit can be found in **Appendix A**.

This SWMP is intended to be revised as necessary to address planned developments, new disturbances, and other changes needed to manage stormwater and protect surface water quality.

### Stormwater Runoff Permitting Requirements

The Federal Clean Water Act [Section 402(p)] requires that discharges of pollutants to waters of the U.S. from any point source be regulated by NPDES permits. In November 1990 the EPA published final regulations that established application requirements for stormwater associated with construction activity for soil disturbances of 5 acres or more be regulated as an industrial activity and covered by an NPDES permit. In December 1999 the EPA published final Phase II NPDES regulations that established application requirements for stormwater associated with construction activity for soil disturbances to be regulated as an industrial activity and covered by an NPDES permit. These regulations became effective July 1, 2002.

On June 30, 2005, Colorado stormwater regulations went into effect to require Colorado Discharge Permit System (CPDS) permits for stormwater discharges from construction activities for (1 acre or greater) oil and gas activities. Federal permit coverage for these discharges was conditionally exempted from the Federal Clean Water Act by the 2005 Federal Energy Bill. On February 1, 2006, the CDPHE issued a letter clarifying that the CDPHE Water Quality Control Commission decided to maintain the existing requirements for stormwater permitting for oil and gas construction sites greater than 1 acre.

### Project Description

The Upper Garden Gulch Section 2 area wells are located within Sections 29, 30, 31 & 32, Township 6 S, Range 96 W. This permitted area includes six well pads, access road and pipeline with a total of approximately 40 acres. See **Figure 1** for area location maps and site ID.

The town of Parachute, Colorado is the nearest population center. The current drilling and development plan includes pad construction, access road improvement/construction, reserve pit construction, installation of associated facilities, well drilling, well completion, well testing and pipeline construction.

## **1. CONSTRUCTION SITE DESCRIPTION**

The following section describes site locations and provides a description of the construction areas. Runoff characteristics of these areas are also described.

### **1. A Nature of Construction Activity**

The Piceance Basin wells will be constructed using conventional cut and fill earthmoving techniques. Typically, the working pad surface will have dimension of approximately 200 feet by 400 feet. Each pad may have a reserve pit that is approximately 60 feet by 250 feet. Specific pad dimensions vary depending on the planned drill rig, number of wells to be drilled from each pad, and local conditions. Reserve pits will be used during activities to contain drilling fluids and cuttings. Specific pad dimensions vary depending on the planned drill rig, number of wells to be drilled from each pad, and local terrain conditions. The reserve pits will be designed, constructed, and reclaimed according to Colorado Oil and Gas Conservation Commission (COGCC) requirements.

In areas that are disturbed by well construction, topsoil will be stripped and stockpiled near the site. Soil materials will be managed so that erosion and sediment transport are minimized. Nearby drainages will be protected by appropriate measures. The well pad will be graded to drain the pad surface to the reserve pit and to direct runoff from surrounding areas away from the well pad and reserve pit.

If the well is not productive, it will be plugged according to COGCC rules and the pad area reclaimed to approximate pre-construction contours.

### **1. B Sequence of Construction Activities**

Natural gas exploration, development and production activities are currently underway within the Cascade Creek Common Plan of Development. For new disturbances, Best Management Practices (BMPs) will be installed prior to, during, and immediately following construction as practicable with consideration given to safety, access, and ground conditions (e.g. frozen ground) at the time of construction.

The development of natural gas wells is generally accomplished in three distinct work phases. The first phase is the Development (Construction/Drilling/Completion/Initial Reclamation), the second phase is the Production (Operation/Maintenance), and the third phase is the Abandonment and Final Reclamation. Each work phase is briefly discussed below.

For new disturbances covered by this plan, structural and non-structural best management practices (BMPs) will be installed prior to, during, and following construction activities, as practicable, with consideration given to safety, access, and ground conditions (e.g., frozen ground) at the time of construction. Non-structural BMPs will also be employed throughout the life of each well location as described below.

The development of natural gas wells is generally accomplished in six distinct work phases. They include Pad and Access Road Construction, Well Drilling, Well Completion, Pipeline Construction, Production, Interim Reclamation, and Final Reclamation. Each work phase and associated BMPs are briefly discussed below.

#### **Development (Construction/Drilling/Completion/Initial Reclamation)**

The Development phase includes the following activities; road and well pad construction, well drilling, well completion, gas line installation, and pad area reclamation. The well pad will be constructed and graded with a gentle slope to drain surface water to the reserve pit.

Initial pad reclamation is accomplished by backfilling the reserve pit, contouring disturbed soils to conform with the surrounding terrain, replacing stockpiled topsoil, seeding of disturbed soil areas in order to reestablish a cover vegetation, and construction of erosion and sediment control structures. The completion of a well (gas production) generally triggers a one-year time period in which the reclamation phase of work should be completed.

A listing of approved seed mixtures per vegetation land cover classification system identification is provided in **Table 1**.

### **Production (Operation/Maintenance)**

The production phase includes the operation and maintenance activities during natural gas production. Gas pipelines are installed during this phase of work. Typical well pad equipment includes a wellhead, a separation unit and one to several 210-400-barrel capacity aboveground storage tanks (ASTs) containing condensate or produced water. Smaller sized ASTs may contain lube oil, methanol, and triethylene glycol.

Reclamation activities during this phase include maintenance of revegetated areas and maintenance of the erosion and sediment control structures. Development of natural gas resources and associated construction activities will likely continue for the next 3 to 5 years. Natural gas wells in the Cascade Creek area are projected to produce for approximately 20 to 30 years.

### **Abandonment and Final Reclamation**

When the natural gas production of a well is exhausted it will be abandoned. Upon well abandonment each borehole will be plugged, capped, and all surface equipment will be removed. Subsurface pipelines will be removed to specified locations and plugged.

The pad area will be reclaimed by contouring disturbed soils to conform to the surrounding terrain, by replacing the stockpiled topsoil, by seeding of disturbed soil areas in order to reestablish cover vegetation, and by construction of erosion and sediment control structures as needed.

Once stabilization is achieved, defined as uniform vegetative cover established with a density of at least 70 percent of pre-disturbance levels, a well pad may be removed from this SWMP for sediment controls. However, if petroleum hydrocarbons or other chemicals impact storm water as a result of industrial activities onsite, the well pad will maintain permit coverage and ensure SPCC plan BMPs are maintained.

For new disturbances covered by this plan, structural and non-structural best management practices (BMPs) will be installed prior to, during, and following construction activities, as practicable, with consideration given to safety, access, and ground conditions (e.g., frozen ground) at the time of construction. Non-structural BMPs will also be employed throughout the life of each well location as described below.

The development of natural gas wells is generally accomplished in six distinct work phases. They include Pad and Access Road Construction, Well Drilling, Well Completion, Production, Interim Reclamation, and Final Reclamation. Each work phase and associated BMPs are briefly discussed below.

### **Pad Construction**

The Pad Construction phase includes the construction of the well pad surface and any associated access roads. Most work will be performed using traditional cut-and-fill construction but may also involve blasting. Reserve pits may be constructed at this time to store certain fluids and solids during later phases of drilling and completion operations. The pad surface will



be built with a slight grade to drain surface water into the reserve pit and not off site. No fluids or solids, excluding any accumulated stormwater, will be stored in the reserve pits during this phase. In the event that a reserve pit is not required for drilling, the pad surface will still be graded to drain surface water, and appropriate BMPs will be installed to control this surface water.

The basic construction activities that are conducted during this phase include clearing and grubbing; segregation of topsoil for use in reclamation; grading and excavation; compaction of well pad and road surfaces; final grading and contouring; and installation of gravel or other materials on well pads and road surfaces. Sediment discharge is the main potential pollutant of concern during this phase of construction. No chemicals or fuels will be stored on the pad during this phase, however, attention will be paid to the potential for spills that might occur during the refueling and use of construction equipment.

Structural BMPs will be installed and maintained before and during this phase of construction, as needed, to eliminate sediment discharges. These BMPs will be engineered to contain/control the anticipated flow of surface water at each location. Such BMPs should include slope stabilization, non-project related stormwater diversions, perimeter control, and site stormwater management such as run-on and run-off diversions, traps, berms and armoring. Most of these BMPs will be constructed to be present during the drilling and completion phases described below.

To the extent possible, BMPs that will be utilized to control stormwater throughout the life of the wells will be constructed during this phase.

Certain non-structural BMPs may be utilized, during this phase, to assist in managing stormwater compliance such as limiting traffic; conducting training and inspections; minimizing the disturbed area to only the required dimensions; preservation of mature vegetation, such as protective trees; standard procedures for refueling and maintaining equipment to prevent spills; and re-vegetation where practicable.

### **Well Drilling**

The Well Drilling phase includes the drilling of one or more wells at each location. Activities associated with the drilling phase include:

- Mobilization of the drilling rig and associated equipment, including generators and drilling-mud handling equipment – in some instances a smaller drilling rig may be used to drill the initial stages of each well prior to the larger drilling rig mobilizing to the location
- Installation of storage, office and housing trailers
- Storage of down hole chemicals, fuels and lubricants
- Installation of potable water tanks and sewage-handling equipment (e.g., portable toilets or sewage vaults)
- Well drilling activities including the installation and cementing of well casing
- Demobilization of the drilling rig and all other equipment at the completion of this phase

Sediment discharge, unused and used chemicals and drilling water/mud are potential pollutants of concern during this phase of construction. Drilling mud and water will be used to maintain appropriate down hole pressures and lubrication. Unused fresh water and mud chemicals will be stored on the pad. Used materials will either be discharged to the reserve pit or captured in tanks for closed-loop drilling processes. Petroleum products are used for the duration of the

drilling process to fuel or lubricate equipment and include: fuel, gear oil, hydraulic oil, brake fluid, and grease. Materials to be used to cement casing placed in the well may also be stored and prepared on location or may be transported to the site. For a list of down-hole chemicals used during well development please refer to **Appendix B**.

Structural BMPs that were installed during pad construction will be maintained before and during this phase of construction, as needed, to eliminate sediment, chemical or other non-stormwater related discharges. In addition, other BMPs may be installed to control discharges associated with specific pieces of equipment or facilities for storage of materials on the location. Such BMPs should include slope stabilization, non-project related stormwater diversions, secondary containment structures, perimeter control, and site stormwater management such as diversions, traps, berms and armoring.

Certain non-structural BMPs may be utilized, during this phase, to assist in managing stormwater compliance such as limiting traffic, conducting training and inspections, providing for equipment and procedures to prevent spills of sewage or other materials, and ensuring that good material management practices are being implemented.

Procedures will also be implemented for prompt containment and remediation of any spills that may occur during the drilling phase.

As equipment is demobilized at the completion of this phase, the well pad and surrounding areas will be carefully inspected to identify any spills or leaks that may have occurred so that those areas can be remediated prior to initiation of the well completion phase. All structural BMPs will also be inspected and maintained during the demobilization of equipment to insure that any damage to these BMPs resulting from demobilization is promptly repaired.

#### Well Completion

The Well Completion phase includes hydraulic fracturing (fracing), cementing, and other processes that stimulate the well and prepare it for production. The basic activities that are conducted during this phase include:

- Mobilization of equipment required for well completion
- Storage of downhole chemicals, fuels and lubricants
- Installation of potable water tanks and sewage-handling equipment (e.g., portable toilets or sewage vaults) or continued maintenance of such equipment installed during the drilling phase
- Fracing and other well-stimulation processes
- Drill out of any plugs placed during well completion with a work-over rig
- Flowback of the well to remove frac water, sand and other impurities
- Demobilization of equipment when this phase has been completed

Several temporary facilities/structures will be placed on site during this phase. These will include: frac trucks, storage and office trailers, generators, and frac tanks. During completions, certain chemicals may be used to stimulate the formation for the extraction of natural gas. Unused water and chemicals will be stored on the pad. Used water will be stored in the reserve pit or cleaned up and recycled in other operations.

Sediment discharge, unused and used chemicals and frac water are potential pollutants of concern during this phase of construction.

Structural BMPs that were installed during pad construction will be maintained before and during this phase of construction, as needed, to eliminate sediment, chemical or other non-stormwater related discharges. In addition, other BMPs may be installed to control discharges associated with specific pieces of equipment or facilities for storage of materials on the location. Such BMPs should include slope stabilization, non-project related stormwater diversions, secondary containment structures, perimeter control, and site stormwater management such as diversions, traps, berms and armoring.

Certain non-structural BMPs may be utilized, during this phase, to assist in managing stormwater compliance such as limiting traffic, conducting training and inspections, providing for equipment and procedures to prevent spills of sewage or other materials, and ensuring that good material management practices are being implemented. Procedures will also be implemented for prompt containment and remediation of any spills that may occur during the completion phase.

As equipment is demobilized at the completion of this phase, the well pad and surrounding areas will be carefully inspected to identify any spills or leaks that may have occurred so that those areas can be remediated prior to initiation of the production phase. All structural BMPs will also be inspected and maintained during the demobilization of equipment to insure that any damage to these BMPs resulting from demobilization is promptly repaired.

#### Production

The Production phase includes the installation of long-term facilities such as permanent well heads, storage tanks, gas processing equipment, flow measurement equipment, and any associated flow lines needed to produce natural gas from the formation. An actively producing gas well produces fluids phase along with gas phase products. Storage tanks may be placed on site during this phase to hold any produced water and/or fluid phase hydrocarbons (condensate).

Sediment discharge, produced fluids, and small amounts of equipment operational lube or fuel or corrosion inhibitors or other chemicals are potential pollutants of concern during this phase of construction.

The installation of tanks for storage of produced water and/or condensate triggers the requirement to include the site under the Spill Prevention Control and Countermeasure (SPCC) plan. Any stored chemical, including produced fluids, are required to have appropriate secondary containment.

Structural BMPs that were installed during pad construction will be maintained before and during this phase of construction, as needed, to eliminate sediment, chemical or other non-stormwater related discharges. As discussed below, these BMPs may be replaced or modified during interim reclamation. In addition, other BMPs may be installed to control discharges associated with specific pieces of equipment or facilities for storage of materials on the location. Such BMPs should include slope stabilization, non-project related stormwater diversions, secondary containment structures, perimeter control, and site stormwater management such as diversions, traps, berms and armoring.

Certain non-structural BMPs may be utilized, during this phase, to assist in managing stormwater compliance such as limiting traffic, conducting training and inspections, providing for equipment and procedures to prevent spills of sewage or other materials, and ensuring that good material management practices are being implemented.

Procedures will also be implemented for prompt containment and remediation of any spills that may occur during the production phase.

## **Interim Reclamation**

The Interim Reclamation phase includes the re-contouring of the majority of the pad to a smaller area that will be needed for long-term production and ongoing routine maintenance of the well(s). In general, this phase includes re-contouring of the site, spreading of topsoil on re-contoured areas and reseeding those areas.

Sediment discharge, produced fluids and small amounts of equipment operational lube or fuel or corrosion inhibitors or other chemicals are potential pollutants of concern during this phase of construction. As indicated in the previous section, the presence of tanks for storage of produced fluids will require implementation of an SPCC plan to prevent and control possible leaks from those tanks. In addition, secondary containment will be provided for any tanks storing chemicals that are utilized during the life of the wells.

Structural BMPs that were installed during pad construction will be maintained before and during this phase of construction, as needed, to eliminate sediment, chemical or other non-stormwater related discharges. It is likely that some of these BMPs will be replaced with new BMPs during interim reclamation. In addition, other BMPs may be installed to control discharges associated with specific pieces of equipment or facilities for storage of materials on the location. Such BMPs should include slope stabilization, non-project related stormwater diversions, secondary containment structures, perimeter control, reseeding reclaimed areas, and site stormwater management such as diversions, traps, berms and armoring.

Certain non-structural BMPs may be utilized, during this phase, to assist in managing stormwater compliance such as limiting traffic, conducting training and inspections, providing for equipment and procedures to prevent spills of sewage or other materials, and ensuring that good material management practices are being implemented. Procedures will also be implemented for prompt containment and remediation of any spills that may occur during the reclamation and/or production phase.

Permit coverage may be inactivated for an oil and gas construction site even if stabilized unpaved surfaces exist and/or disturbed land that has been restored to cropland remains non-vegetated, as long as construction activities have been completed and all other disturbed areas re-vegetated in accordance with the definition of "Finally Stabilized," as discussed in CDPHE's fact sheet titled "STORMWATER FACT SHEET –CONSTRUCTION at OIL and GAS FACILITIES."

## **Final Reclamation**

The Final Reclamation phase includes well abandonment and removal of all surface equipment. Subsurface pipelines may be removed or may be abandoned in place.

The pad area and associated access roads and pipeline right-of-ways will be reclaimed by contouring disturbed soils to conform to the surrounding terrain and seeding of disturbed areas to reestablish cover vegetation.

If the area to be disturbed during final reclamation will be one acre or greater in size, stormwater permit coverage will be required for that activity. Once stabilization is achieved, defined as uniform vegetative cover established with a density of at least 70 percent of pre-disturbance levels, permit coverage for the well pad and associated roads and pipelines may be inactivated.

## **Access Road Construction**

The development of natural gas wells also requires the construction of access roads. Access road construction is generally accomplished by using traditional cut and fills techniques but may also require blasting and other techniques. Size and maintenance requirements for each road are based on road location and traffic level.

BMPs will be implemented before and during construction of roads and will be maintained throughout the lifetime of the road or until stabilization reaches such a point that they are not needed. Structural BMPs used during road construction and maintenance will include, at a minimum, slope stabilization and revegetation; diversion of non-project water through armored culverts or other appropriate BMPs; placing gravel or other road surfacing materials on driving surfaces; and collection and management of onsite stormwater through ditches, dams, traps, and perimeter controls. Certain non-structural BMPs may be utilized to assist in managing stormwater compliance such as limiting traffic, planning for and proper maintenance during winter conditions, sediment tracking controls and contractor education.

Once stabilization is achieved, defined as uniform vegetative cover established with a density of at least 70 percent of pre-disturbance levels, an access road may be removed from this SWMP for sediment controls. However, if petroleum hydrocarbons or other chemicals impact stormwater as a result of industrial activities onsite, the well pad will maintain permit coverage and ensure SPCC plan BMPs are maintained.

### **Pipeline Construction**

The development of natural gas wells also requires the construction of pipelines used to transmit natural gas and other related fluids. Pipeline construction is generally accomplished by trenching. The area of disturbance for each pipeline is determined by location and pipeline size.

BMPs will be implemented before and during construction of pipelines and will be maintained throughout the lifetime of the pipeline or until stabilization reaches such a point that they are not needed. Structural BMPs used during pipeline construction and maintenance will include, at a minimum, slope stabilization; diversion of non-project water through armored drainage or other appropriate BMPs; and perimeter controls.

All disturbed areas will be reseeded immediately or once the area is not needed for the project. Certain non-structural BMPs may be utilized to assist in managing stormwater compliance such as limiting traffic, route planning to minimize runoff potential, minimizing the disturbed areas, and contractor education.

Once stabilization is achieved, defined as uniform vegetative cover established with a density of at least 70 percent of pre-disturbance levels, a pipeline may be removed from this SWMP for sediment controls. However, if petroleum hydrocarbons or other chemicals impact stormwater as a result of industrial activities onsite, the well pad will maintain permit coverage and ensure SPCC plan BMPs are maintained.

### **1.C Estimate of Total Area of Site and Area to be Disturbed**

The total area of disturbance including the natural gas well pads, the access roads and gathering system pipeline is approximately 40 acres.

### **1.D Soil Data and Erosion Potential**

Runoff characteristics are based primarily on site topography, soil type, and soil/vegetative cover. The major soil type in this permitted area are deep well drained loamy soils with moderate permeability and low water holding capacity.

The soil types include the following complexes: Nihill channery loam, Irigul-Starman channery loam, Northwater-Adel complex, Parachute –Irigul complex, Parachute-Irigul-Rhone association, and Parachute-Rhone loams. The slopes range from 6% to steep rock outcroppings. Native vegetation land cover types include Gambel Oak, Elk Sedge, Aspen, Bromes, Pinyon, Juniper, Indian Rice Grass, Wheatgrass, Junegrass, Serviceberry, Bitterbrush, Sagebrush, Shadecscale, Saltbrush, Greasewood, and Yucca. Pre-disturbance ground cover varies from 70 to 98 percent.



A NRCS soil report for each soil type is provided in **Appendix C**.

### **1.E Vegetation Description and Estimate**

Piceance Basin well pads and facilities are surrounded by the following Colorado Land Cover Classification Systems:

- Low Elevation Salt-Desert Scrub/Basin Big Sagebrush
- Pinyon-Juniper Woodland, Mountain/Wyoming Big Sagebrush Shrubland
- Mixed Mountain Shrub land Including Oak brush
- Spruce-Fir Forest, Including Mountain Meadows

Vegetation description for each Piceance Basin facility is provided in **Table 2**. Vegetative cover surrounding Piceance Basin facilities is well covered and ranges from 70-98%. Regional precipitation amounts vary from 11.59 inches per year in Rifle, Colorado to 14.8 inches in Collbran, Colorado (Western Regional Climate Center).

Due to regional climate conditions, lack of surface water or near surface ground water, and well pad construction design, construction dewatering is not expected for Piceance Basin development activities.

### **1.F Potential pollution sources and locations**

Potential pollution sources associated with construction sites and natural gas development include:

- Sediment resulting from erosion of soil stockpiles and other areas cleared of vegetation;
- Sediment discharges from vehicle tracking;
- Leakage of fuels and lubricants from equipment and spills from fueling;
- Trash and debris from clearing activities, construction materials, and workers and;
- Leakage or spills from storage tanks and process equipment associated with the natural gas development activities.

The most common source of pollution from pad and access road construction is sediment, which can be carried away from the work site with stormwater runoff and impact the water quality of a receiving stream. Clearing, grading, and otherwise altering previously undisturbed land can increase the rate of soil erosion over pre-disturbance rates.

Petroleum products can also be potential stormwater pollutants. These products are used in construction activities to power or lubricate equipment and include: fuel, gear oil, hydraulic oil, brake fluid, and grease.

Debris from laydown areas, residue from equipment cleaning and maintenance, and solid waste generated from land clearing operations and human activity (trees, brush, paper, trash, etc.) present other potential pollution sources within the construction site. Additionally, one or more facilities may contain construction supplies such as various sized pipe, culverts, metal sheds, empty tanks, drums and vessels, fencing and stairs.

Construction of new production facilities may require the use of concrete. Concrete wash out waters will be managed to prevent them from reaching waters of the state. Typically concrete wash out waters will be diverted to the well pad flare pit or other type of earthen impoundment to capture and evaporate wash out water.

Loading and unloading of condensate and produced water from above ground storage tanks are common and regular activities within the Piceance Basin. Spills and or tank over flows can contaminate stormwater runoff

.Magnesium chloride solution or other chemical dust suppressants may be applied during the summer to unpaved roads to order to reduce fugitive dust generation. Magnesium chloride solution is used in the winter for roadway deicing and in the summer for dust suppression by county and state government entities. The solution is typically delivered to the site by contractors in DOT approved tanker trailers and generally is quickly applied to the road surface. Occasionally, depending on work site conditions, the tanker trailers may be staged along the road until ready for application (typically no longer than overnight).

Spills or leaks from potential sources are described in the SPCC plan. Response to certain events may require specialized training due to health and safety concerns.

### **1.G Non-Stormwater Discharges**

Non-stormwater discharges are not expected from the construction projects. Possible exceptions include fire prevention/suppression or dust control activities.

Concrete batch plant and associated washout operations are not anticipated to be part of this construction project and will be added to the SWMP as needed.

Construction or groundwater de-watering operations are not anticipated to be part of this construction project and will be added to the SWMP as needed.

### **1.H Receiving Waters**

Stormwater runoff receiving waters include tributaries and seasonal washes to Bear Run, a perennial stream that flows northeasterly. The ultimate receiving water for Upper Garden Gulch is Parachute Creek, and for the Piceance Basin the Colorado River. A map showing the receiving waters is included as **Figure 2**.

## **2. SITE MAPS**

Due to the expanse and total acreage of the permitted area, one master map of the entire area will be provided with the SWMP. On this same note, the area is too large to address all construction boundaries on one map. Please refer to the site specific maps/inspection forms to accurately depict these items.

### **2.A Construction Site Boundaries**

Please refer to the site specific maps/inspection forms form an accurate depiction of Construction site boundaries

### **2.B Areas of Ground Disturbance**

Please refer to the site specific maps/inspection forms form an accurate depiction of areas of ground disturbance.

### **2.C Areas of Cut and Fill**

Please refer to the site specific maps/inspection forms form an accurate depiction of areas of cut and fill.

## **2.D Storage Areas for Materials, Equipment, Waste, and Soil**

Please refer to the site specific maps/inspection forms form an accurate depiction of storage areas for material, equipment, waste, and soil.

## **2.E Location of Dedicated Asphalt or Concrete Batch Plants**

There will be no dedicated asphalt or concrete batch plants within the permitted area that are under the control of Berry Petroleum.

## **2.F Location of All Structural BMPs.**

Please refer to the site specific maps/inspection forms form an accurate depiction of locations and type of all structural BMPs.

## **2.G Location of Non-Structural BMPs**

Please refer to the site specific maps/inspection forms form an accurate depiction of locations and type of all non-structural BMPs

## **2.H Location of Springs, Streams, Wetlands, and other Surface Waters**

Please refer to the site specific maps/inspection forms form an accurate depiction of locations of all springs, streams, wetlands, and other surface waters.

Example site maps and inspection forms are provided in **Appendix D**.

## **3. STORMWATER MANAGEMENT CONTROLS**

### **3.A Stormwater Administrator**

The property owner and operator is Berry Petroleum Company - ~~Denver, CO 80202. The Berry office phone is 303.825.3344. The Berry contact person and stormwater administrator for the project is ~~maintains an office in Parachute, Colo 970.930.0128.~~~~

1999 Broadway Suite 3700,  
Denver, CO 80202. The Berry  
office phone is 303.999.4400 (BJR,  
10/1/11)

Mr. Bryan Burns, Environmental Specialist. Mr. Burns  
maintains an office in Denver, CO and can be contacted at  
303-999-4245. (BJR, 10/1/11)

Berry Petroleum will be in charge of all aspects of the property and this project. Contractor(s) will perform the actual construction and drilling, but all work will be supervised by Berry Petroleum and all decisions will be made by Berry Petroleum

### **3.B Potential Pollution Sources**

Potential pollution sources associated with construction sites and natural gas development include

:Sediment resulting from erosion of soil stockpiles and other areas cleared of vegetation;

- Sediment discharges from vehicle tracking;
- Leakage of fuels and lubricants from equipment and spills from fueling;
- Trash and debris from clearing activities, construction materials, and workers and;
- Leakage or spills from storage tanks and process equipment associated with the natural gas development activities.

A common source of pollution from pad and access road construction is sediment, which can be carried away from the work site with stormwater runoff and impact the water quality of a

receiving stream. Clearing, grading, and otherwise altering previously undisturbed land can increase the rate of soil erosion over pre-disturbance rates.

Petroleum products can also be potential stormwater pollutants. These products are used in construction activities to power or lubricate equipment and include: fuel, gear oil, hydraulic oil, brake fluid, and grease.

Debris from laydown areas, residue from equipment cleaning and maintenance, and solid waste generated from land clearing operations and human activity (trees, brush, paper, trash, etc.) present other potential pollution sources within the construction site. Additionally, one or more facilities may contain construction supplies such as various sized pipe, culverts, metal sheds, empty tanks, drums and vessels, fencing and stairs.

Construction of new production facilities may require the use of concrete. Concrete wash out waters will be managed to prevent them from reaching waters of the state. Typically concrete wash out waters will be diverted to the well pad flare pit or other type of earthen impoundment to capture and evaporate wash out water.

Loading and unloading of condensate and produced water from above ground storage tanks are common and regular activities within the Piceance Basin. Spills and or tank over flows can contaminate stormwater runoff.

Magnesium chloride solution or other chemical dust suppressants may be applied during the summer to unpaved roads to order to reduce fugitive dust generation. Magnesium chloride solution is used in the winter for roadway deicing and in the summer for dust suppression by county and state government entities. The solution is typically delivered to the site by contractors in DOT approved tanker trailers and generally is quickly applied to the road surface. Occasionally, depending on work site conditions, the tanker trailers may be staged along the road until ready for application (typically no longer than overnight).

Spills or leaks from potential sources are described in the SPCC plan. Response to certain events may require specialized training due to health and safety concerns.

### **3.C BMPs for Stormwater Pollution Prevention**

#### **3.C.1 Structural Practices**

The installation and maintenance design specifications can be found in the Berry Petroleum Stormwater Manual of Best Management Practices (BMPs) for all BMP installation and maintenance design specifications for the Garden Gulch active stormwater permits. The manual is located at 235 Callahan Avenue Parachute, CO 81635 along with all hard copy SWMPs for the Garden Gulch active stormwater permits. (NH 3/26/2012)

#### **3.C.2 Non-Structural Practices**

The description and application practices of non-structural BMPs available and/or implemented will be found in the BMP manual. The location of non-structural practices will be found in the site specific maps.

#### **3.C.3 Phased BMP installation**

Preconstruction BMPs will include a down gradient perimeter BMP (wattle), with a slash pile inside. A diversion trench will be inside the slash pile, creating diversion to direct runoff to the designated point for control.

BMPs for the actual construction phase will consist of grading and stabilization through surface roughening. The pad surface will be an improved unpaved surface to reduce tracking and sediment migration. Sediment traps will be located on the three down gradient corners to treat runoff water prior to leaving the site. A culvert will be placed at the access point to the pad. A run-on diversion trench will be located on the up-gradient side of the pad to reduce the amount

of runoff from the site. Where appropriate, check dams will be placed in diversion trenches to reduce velocity and sediment migration. If necessary, armored rundowns will be utilized to transport runoff from the top of slopes to the base of slopes. A pad perimeter BMP consisting of a berm will be implemented at the top of fill slopes.

Interim reclamation BMPs will consist of any of the following, seeding and straw crimping, hydromulching, drill seeding, seeding with blanketing. These will be determined by the actual slopes present once the construction has been completed.

Final reclamation BMPs will consist of recontouring the site to as close to original slopes. Seeding and revegetation to a 70% distribution of original density will take place, prior to being released from the CDPHE regulatory compliance.

### **3.C.4 Materials Handling and Spill Prevention**

#### **Fuels and Materials Management**

Petroleum products which may be present at the construction site include: gasoline, diesel fuel, lubricant oils, hydraulic oils, used oils, and solvents. Gasoline and diesel fuel will be stored in portable storage tanks with secondary containment. Lubricant, hydraulic, and miscellaneous oils and solvents will be stored in 55-gallon or smaller containers.

Pollutants from petroleum products used during construction activities adhere easily to soil particles and other surfaces. In case of a spill or leak, soils contaminated with petroleum products will be contained and removed to a proper disposal site. Proposed soil erosion and sediment control practices will aid in retention of spills or leaks. Use of secondary containment and drip pans will reduce the likelihood of spills or leaks contacting the ground. Proposed maintenance and safe storage practices will reduce the chance of petroleum products contaminating the road site. Oily wastes such as crankcase oil, cans, rags, and paper containing oils will be placed in proper receptacles and disposed of or recycled. An additional source of petroleum contamination is leaks from equipment and vehicles. Routine daily inspections will be conducted to identify leaks and initiate corrective actions, if needed.

The following guidelines for storing and managing petroleum products will be used:

- All product containers will be clearly labeled.
- Drums will be kept off the ground within secondary containment and stored under cover if needed.
- Fuel tanks will be stored within secondary containment.
- Lids of drummed materials will be securely fastened.
- Emergency spill response procedures will be available on-site. Persons trained in handling spills will be on call at all times.
- Spill cleanup and containment materials (absorbent, shovels, etc.) will be easily accessible. Spills will be immediately cleaned up and contaminated materials will be properly stored on site until they can be disposed of in accordance with applicable regulations.
- Storage areas and containers will be regularly monitored for leaks and repaired or replaced as necessary. Contractors and subcontractors should be reminded about proper storage, handling and transferring of petroleum products or other hazardous materials during safety meetings.



All spills and releases of exploration and production waste or produced fluid exceeding 5 barrels (210 gallons) including those contained within unlined berms, shall be reported in writing on the COGCC Spill/Release Report Form 19 within 10 days of discovery of the spill.

All spills/releases that exceed 20 barrels (840 gallons) of exploration and production liquids/waste shall be verbally reported to the COGCC at (303) 894-2100 within 24 hours of discovery.

Spills or releases of any size that impact or threaten to impact any waters of the state, residence or occupied structure, livestock or public byway, shall be verbally reported to the COGCC as soon as practical after discovery (COGCC Rule 906). If the spill may reach waters of the state (which includes surface water, ground water and dry gullies or storm sewers leading to surface water), it must also be reported immediately to the Colorado Department of Public Health and Environment (CDPHE) at 1-877-518-5608.

Spills or releases of more than 25 gallons of refined petroleum crude oil products such as gasoline, diesel fuel, oil, or derivatives of mineral, animal or vegetable oil shall be reported to the state of Colorado Division of Oil and Public Safety at (303) 318-8547 within 24 hours.

A hazardous substance release in any amount which enters or threatens to enter waters of the state shall be reported to Colorado Department of Public Health & Environment (CDPHE).

#### Other Material/Chemical Product Management

Additional materials will be used and stored on site for use in construction. These materials will be stored appropriately and managed to minimize spills and leaks. Storage areas will be regularly inspected and any minor spills or leaks will be cleaned up immediately.

The construction contractor will maintain a laydown or staging area for equipment and materials storage on site. These areas will be maintained with good housekeeping and will be inspected on a regular basis for spills, leaks, and potential of materials commingling with stormwater runoff.

### **3.C.5 Dedicated Asphalt or Concrete Batch Plants**

There will be no dedicated asphalt or concrete batch plants within the permitted area.

### **3.C.6 Vehicle Tracking**

The access roads and pads used within the permitted area are unimproved and do not require the use of tracking pads. Dust suppression is used to minimize airborne based sediment discharges. This is done by spraying water or a mixture of water and magnesium chloride or another polymer as needed.

### **3.C.7 Waste Management and Disposal, Concrete Washout**

#### Waste Management and Disposal

Well pad construction and drilling will generate various other wastes during the course of construction. Other wastes may include the following:

- Sagebrush, shrubs and trees from clearing operations;
- Trash and debris from construction materials and workers;
- Drill cuttings, drilling fluids; and
- Sanitary sewage.

Each of these wastes will be managed so as to not contribute to stormwater pollution. Construction trash and debris will be collected in containers and hauled off-site for disposal according to local regulations. Sanitary waste will be containerized in portable toilets or other storage tanks with waste materials regularly pumped and transported off-site for disposal at approved facilities.

There will be no need for a concrete washout within the permitted area.

### **3.C.8 Ground Water and Stormwater Dewatering**

No groundwater dewatering is anticipated at this time. If groundwater is encountered, the dewatering of the site will be regulated by a dewatering permit issued through CDPHE. All stormwater will be diverted by diversion berms to avoid contact with the groundwater.

## **4. FINAL STABILIZATION AND LONG TERM STORMWATER MANAGEMENT**

Final Stabilization and Abandonment includes well abandonment and removal of all surface equipment. Subsurface pipelines will be removed to specified locations and plugged. The pad area will be reclaimed by contouring disturbed soils to conform to the surrounding terrain and seeding of disturbed areas to reestablish cover vegetation.

Once stabilization is achieved, defined as uniform vegetative cover established with a density of at least 70 percent of pre-disturbance levels, the well pad will be removed from this SWMP for sediment controls. However, if petroleum hydrocarbons or other chemicals impact stormwater as a result of industrial activities onsite, the well pad will maintain permit coverage and SPCC plan BMPs will be maintained. Permanent BMPs may be left in place if it is deemed necessary to maintain site stability. Bryan, it might be a good point to mention the post construction stormwater management program here. Let us know if you need help with this. We have put together one already for another client.

Please refer to **Table 1** for approved seed mixture selection.

## **5. INSPECTIONS AND MAINTAINCE PROCEDURES**

To meet requirements of Stormwater General Permit No. COR-039733, inspection and maintenance of erosion and sediment controls must occur during the construction project. Continued inspection and maintenance is required for specific structures after construction is completed. A complete list of active inspection locations, site diagrams and site specific stormwater BMPs are provided in the inspection report books. The inspection program will include the following:

A trained and qualified person familiar with the SWMP and stormwater controls will conduct facility inspections.

Inspections will cover these areas:

- Evidence of surface erosion for disturbed areas;
- Material and chemical storage areas;
- Straw bales, wattles, riprap areas, culverts and sediment traps;
- Surface water diversions and downgradient areas;
- New access roads and ditches; and

- Locations where vehicles enter or exit the site.

Inspections will occur at least once every 14 calendar days and after any amount of precipitation (rain or snowmelt) has fallen that results in surface erosion.

Permanently stabilized areas will be inspected at least once per month.

A log of inspections will be completed and maintained in Berry Petroleum's Parachute, Colorado office for a minimum of three years.

Inspections are not required for disturbed areas when snow cover exists over the entire site for an extended period as long as melting conditions do not exist, and construction has been suspended. (Reference CDPHE responses to public comments, Part II 6.d.i, dated 31May07)

Water quality will be visually assessed for all receiving streams and discharge areas during each inspection if present.

Disturbed areas and material storage areas that are exposed to precipitation will be inspected for evidence of pollutants entering nearby drainages.

Check dams, wattles, and other BMPs will be inspected for evidence of deterioration, undercutting, and build up of sediment. Sediment will be removed when it has built up to one-half the height of the hay bales or wattles.

Roads used for vehicle access will be inspected for evidence of off-site sediment transport.

The SWMP will be modified as necessary whenever there is a change in design, construction or operation that changes the potential for pollutant discharge to waters of the state.

An inspection report summarizing the scope of the inspection, the name of the person conducting the inspection, date of inspection, and observations relating to the implementation will be prepared. An inspection report is provided in **Appendix D**.

Actions taken to modify stormwater control measures will be recorded and maintained with the SWMP.

If no deficiencies are found during the inspection, the report contains a certification statement that the site is in compliance with the SWMP and the General Permit.

If deficiencies are found during the inspection, the contractor making the repairs will date the inspection report, where the deficiencies are mentioned on the report, when the repairs were done then the contractor will sign a certification statement that the site is in compliance with the SWMP and the General Permit.

Inspection record documents will include a notation of the frequency of the inspection.

#### **5.a. Inspection Reports**

The inspection reports will contain the following information;

- Inspection Date
- Name and title of person conducting inspection
- Location of discharges of sediment/pollutants from site if any
- Location of BMPs that need maintenance
- Location of BMPs that failed to perform

- Location of where additional BMPs are needed
- Deviations from minimum inspection schedule
- Descriptive action for 3, 4, 5, 6, above, dates action taken, and corrective measures to avoid future violations.
- After adequate corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report shall contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.

Permanently stabilized areas will be inspected at least once per month. A log of inspections will be completed and maintained at the field office for a minimum of three years.

Inspections are not required for disturbed areas when snow cover exists over the entire site for an extended period as long as melting conditions do not exist. Part I.D.6(a)(3) Snow cover conditions where there is no risk of surface erosion can exist at high elevations within the Colorado mountains during some periods of the year. It is not necessary for inspections to be conducted during these periods.

Water quality will be visually assessed for all receiving streams and discharge areas during each inspection if present.

Disturbed areas and material storage areas that are exposed to precipitation will be inspected for evidence of pollutants entering nearby drainages.

Check dams, wattles, and other BMPs will be inspected for evidence of deterioration, undercutting, and build up of sediment. Sediment will be removed when it has built up one-third to one-half the height of the hay bales or wattles.

The SWMP will be modified as necessary whenever there is a change in design, construction or operation that changes the potential for pollutant discharge to waters of the state.

An inspection report summarizing the scope of the inspection, the name of the person conducting the inspection, date of inspection, and observations relating to the implementation will be prepared.

Actions taken to modify stormwater control measures will be recorded and maintained with the SWMP.

If no deficiencies are found during the inspection, the report contains a certification statement that the site is in compliance with the SWMP and the General Permit.

Personnel performing site inspections will record site conditions on the Stormwater Field Inspection Report form in **Appendix C**. When deficiencies are discovered, the Berry Stormwater Administrator will be contacted and will direct designated subcontractors to perform BMP maintenance or replacement. Maintenance will include prompt adjustments and repairs to erosion and sediment control structures that are found to be performing inadequately or deteriorating. Signs of rill or gully surface erosion shall be immediately repaired. The Berry

Stormwater Administrator has the authority and will direct subcontractors to install new and or additional stormwater control BMPs as needed.

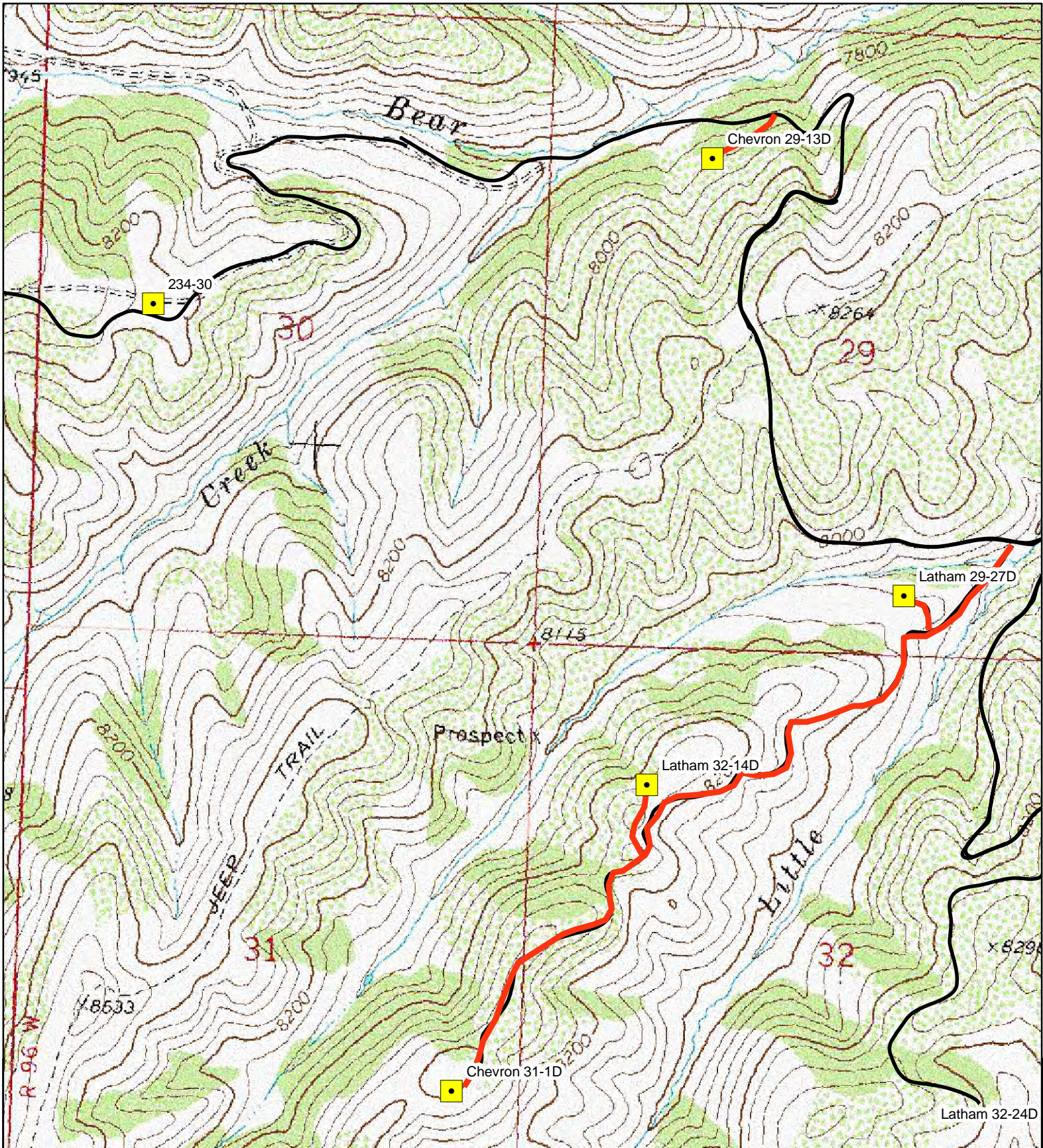
When deficiencies are discovered, the Berry Petroleum Production Superintendent will be contacted and will direct designated subcontractors to perform BMP maintenance or replacement. Maintenance will include prompt adjustments and repairs to erosion and sediment control structures that are found to be performing inadequately or deteriorating. Signs of rill or gully surface erosion shall be repaired as soon as possible. The Berry Petroleum Production Superintendent has the authority and will direct subcontractors to install new and or additional stormwater BMPs as needed. Example site maps and inspection forms are provided in **Appendix C**



## Figures

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Legend

- Pad Locations
- Sec2\_Road
- Garden Gulch Extension Road

0 0.125 0.25 0.5 Miles



PROJECT NO: 010-0779  
 DRAWN BY: JAS  
 DATE: 06/04/2010

AREA LOCATION MAP  
 GARDEN GULCH SECTION 2  
 BERRY PETROLEUM COMPANY  
 GARFIELD COUNTY, COLORADO

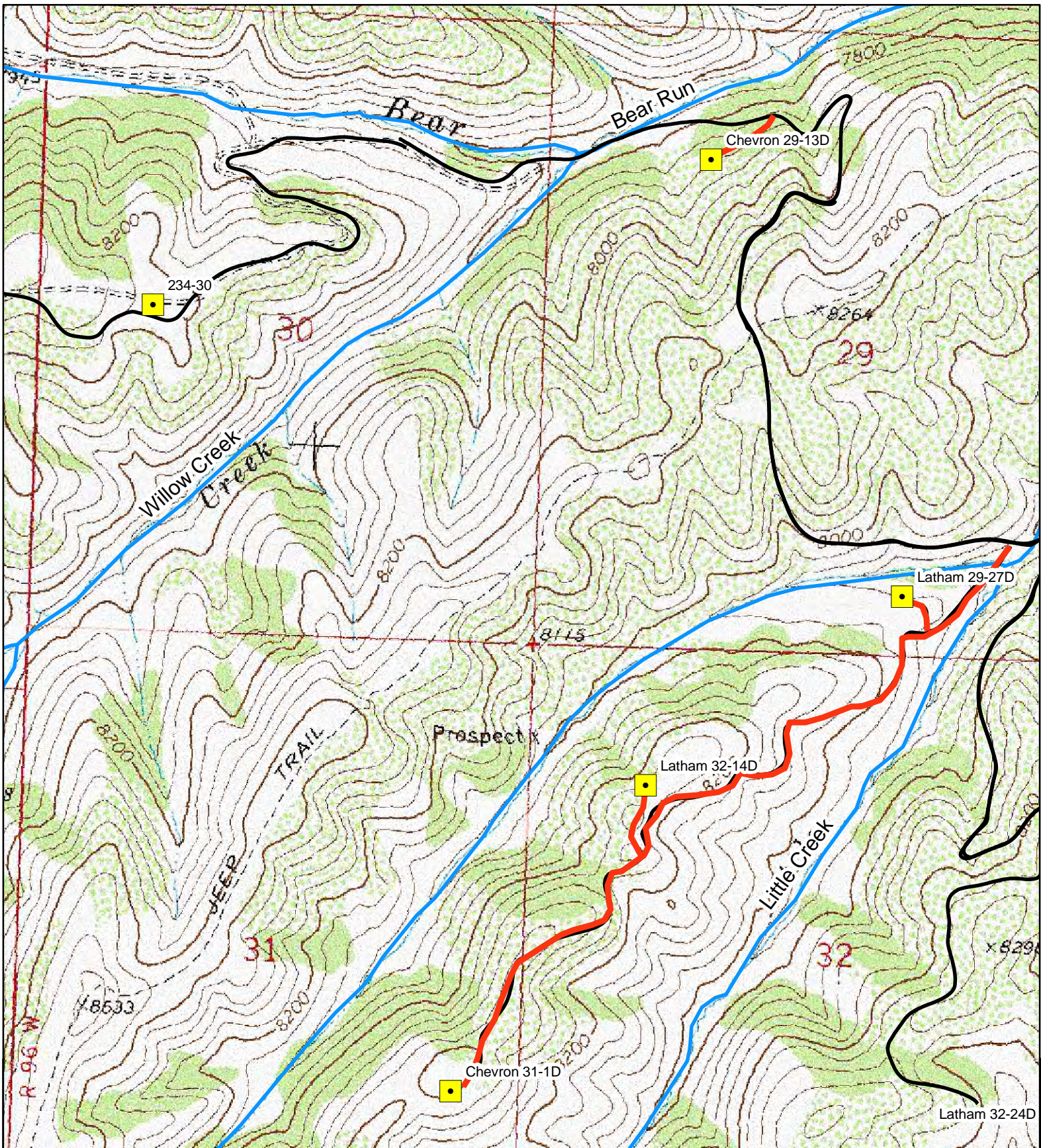
**OLSSON**  
 ASSOCIATES

826 21-1/2 ROAD  
 GRAND JUNCTION,  
 CO 81505  
 TEL 970.263.7800  
 FAX 970.263.7456

FIGURE

1





- Legend**
- Pad Locations
  - Sec2\_Road
  - Garden Gulch Extension Road
  - Streams/Ditches

0 0.125 0.25 0.5 Miles



PROJECT NO:	010-0779
DRAWN BY:	JAS
DATE:	06/04/2010

AREA LOCATION MAP  
GARDEN GULCH SECTION 2  
BERRY PETROLEUM COMPANY  
GARFIELD COUNTY, COLORADO

**OLSSON**  
ASSOCIATES

826 21-1/2 ROAD  
GRAND JUNCTION,  
CO 81505  
TEL 970.263.7800  
FAX 970.263.7456

FIGURE

1



## Tables



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# **Appendix A**

Garden Gulch Extension Road Permit COR-030000

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# STATE OF COLORADO

John W. Hickenlooper, Governor  
Christopher E. Urbina, MD, MPH  
Executive Director and Chief Medical Officer

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.  
Denver, Colorado 80246-1530  
Phone (303) 692-2000  
Located in Glendale, Colorado

Laboratory Services Division  
8100 Lowry Blvd.  
Denver, Colorado 80230-6928  
(303) 692-3090

<http://www.cdphe.state.co.us>



Colorado Department  
of Public Health  
and Environment

June 21, 2012

James T Albi, Piceance Basin Mgr  
Berry Petroleum Co  
1999 Broadway Ste 3700  
Denver, CO 80202

**RE: Renewal of Permit/Certification  
Administrative Continuation  
For: Garden Gulch Section 2  
Located at: CR 215 & Garden Gulch Rd, Uninc, Garfield County  
Permit No.: COR03G891**

Dear Mr. Albi;

The Division has received an application to renew the above permit/certification. It has been determined that there is sufficient information to make this permit/certification eligible for renewal. More information may be requested by the Division as progress is made in developing a new permit/certification for the above listed facility. This information must be made available to the Division when requested to complete the permit process.

The Division is currently in the process of developing a new permit or master general permit and associated certification for the above permitted facility. The development and review procedures required by law have not yet been completed. When the discharge permit issued to you for your facility expired on **June 30, 2012** your permit is administratively continued and remains in effect under Section 104(7) of the Administrative Procedures Act, C.R.S. 1973, 24-4-101, et seq (1982 repl. vol. 10) until the new permit/certification is issued and effective.

All effluent permit terms and conditions in your current permit will remain in effect until your new permit/certification is issued and effective.

**PLEASE KEEP THIS LETTER WITH YOUR PERMIT AND SWMP TO SHOW  
CONTINUATION OF PERMIT COVERAGE.**

Sincerely,

Debbie Jessop  
Permits Section  
WATER QUALITY CONTROL DIVISION

xc: Permit File

# STATE OF COLORADO

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT  
WATER QUALITY CONTROL DIVISION  
TELEPHONE: (303) 692-3500



**CERTIFICATION TO DISCHARGE  
UNDER  
CDPS GENERAL PERMIT COR-0300000  
STORMWATER ASSOCIATED WITH CONSTRUCTION ACTIVITIES**

Certification Number: **COR03G891**

**This Certification to Discharge specifically authorizes:**

**Berry Petroleum**

to discharge stormwater from the facility identified as

**Garden Gulch Section 2**

**to:**

**Little Creek to Bear Run to Parachute Creek - Colorado River**

**Construction Activities :** Oil and Gas Production and/or Exploration,

**Facility Located at:** County Rd 215 & Garden Gulch Rd, uninc Garfield County, CO 81635  
Latitude 39/34/24.74, Longitude -108/12/43.15

**Certification is effective:** 9/28/2010

**Certification Expires:** 6/30/2012

This certification under the permit requires that specific actions be performed at designated times. The certification holder is legally obligated to comply with all terms and conditions of the permit.

Signed,

Nathan Moore  
Construction/MS4/Pretreatment Unit Manager  
Water Quality Control Division

CDPS GENERAL PERMIT  
STORMWATER DISCHARGES ASSOCIATED WITH  
**CONSTRUCTION ACTIVITY**  
AUTHORIZATION TO DISCHARGE UNDER THE  
COLORADO DISCHARGE PERMIT SYSTEM

In compliance with the provisions of the Colorado Water Quality Control Act, (25-8-101 et seq., CRS, 1973 as amended) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq.; the "Act"), this permit authorizes the discharge of stormwater associated with construction activities (and specific allowable non-stormwater discharges in accordance with Part I.D.3 of the permit) certified under this permit, from those locations specified throughout the State of Colorado to specified waters of the State. Such discharges shall be in accordance with the conditions of this permit.

This permit specifically authorizes the facility listed on the certification page (page 1) of this permit to discharge, as of this date, in accordance with permit requirements and conditions set forth in Parts I and II hereof. All discharges authorized herein shall be consistent with the terms and conditions of this permit.

This permit and the authorization to discharge shall expire at midnight, **June 30, 2012.**

Issued and Signed this 31<sup>st</sup> day of May, 2007

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT



Janet S. Kieler  
Permits Section Manager  
Water Quality Control Division

**SIGNED AND ISSUED MAY 31, 2007**

**EFFECTIVE JULY 1, 2007**





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PART I

A. COVERAGE UNDER THIS PERMIT

1. **Authority to Discharge**

Under this permit, facilities are granted authorization to discharge stormwater associated with construction activities into waters of the state of Colorado. This permit also authorizes the discharge of specific allowable non-stormwater discharges, in accordance with Part I.D.3 of the permit, which includes discharges to the ground. This includes stormwater discharges from areas that are dedicated to producing earthen materials, such as soils, sand and gravel, for use at a single construction site (i.e., borrow or fill areas). This permit also authorizes stormwater discharges from dedicated asphalt batch plants and dedicated concrete batch plants. (Coverage under the construction site permit is not required for batch plants if they have alternate CDPS permit coverage.) This permit does not authorize the discharge of mine water or process water from such areas.

- a) **Applicable Sections:** In accordance with Part I.A.3 of this permit, some parts of this permit do not apply to sites covered under a Qualifying Local Program, as defined in I.A.2.d. For sites not covered by a Qualifying Local Program, all parts of the permit apply except Part I.A.3. The permittee will be responsible for determining and then complying with the applicable sections.
- b) **Oil and Gas Construction:** Stormwater discharges associated with construction activities directly related to oil and gas exploration, production, processing, and treatment operations or transmission facilities are regulated under the Colorado Discharge Permit System Regulations (5CCR 1002-61), and require coverage under this permit in accordance with that regulation. However, references in this permit to specific authority under the Federal Clean Water Act (CWA) do not apply to stormwater discharges associated with these oil and gas related construction activities, to the extent that the references are limited by the federal Energy Policy Act of 2005.

2. **Definitions**

- a) **Stormwater:** Stormwater is precipitation-induced surface runoff.
- b) **Construction activity:** Construction activity refers to ground surface disturbing activities, which include, but are not limited to, clearing, grading, excavation, demolition, installation of new or improved haul roads and access roads, staging areas, stockpiling of fill materials, and borrow areas. Construction does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility.
- c) **Small construction activity:** Stormwater discharge associated with small construction activity means the discharge of stormwater from construction activities that result in land disturbance of equal to or greater than one acre and less than five acres. Small construction activity also includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale, if the larger common plan will ultimately disturb equal to or greater than one and less than five acres.
- d) **Qualifying Local Program:** This permit includes conditions that incorporate qualifying local erosion and sediment control program (Qualifying Local Program) requirements by reference. A Qualifying Local Program is a municipal stormwater program for stormwater discharges associated with small construction activity that has been formally approved by the Division.

Other Definitions: Definitions of additional terms can be found in Part I.E. of this permit.

3. **Permit Coverage Without Application – for small construction activities under a Qualifying Local Program only**

If a small construction site is within the jurisdiction of a Qualifying Local Program, the operator of the construction activity is authorized to discharge stormwater associated with small construction activity under this general permit without the submittal of an application to the Division.

- a) **Applicable Sections:** For sites covered by a Qualifying Local Program, only Parts 1.A.1, 1.A.2, 1.A.3, I.D.1, I.D.2, I.D.3, I.D.4, I.D.7, I.D.8, I.D.11, I.E and Part II of this permit, with the exception of Parts II.A.1, II.B.3, II.B.8, and II.B10, apply.

A. COVERAGE UNDER THIS PERMIT (cont.)

- b) **Local Agency Authority:** This permit does not pre-empt or supersede the authority of local agencies to prohibit, restrict, or control discharges of stormwater to storm drain systems or other water courses within their jurisdiction.
- c) **Permit Coverage Termination:** When a site under a Qualifying Local Program has been finally stabilized, coverage under this permit is automatically terminated.
- d) **Compliance with Qualifying Local Program:** A construction site operator that has authorization to discharge under this permit under Part I.A.3 shall comply with the requirements of the Qualifying Local Program with jurisdiction over the site.
- e) **Full Permit Applicability:** The Division may require any operator within the jurisdiction of a Qualifying Local Program covered under this permit to apply for and obtain coverage under the full requirements of this permit. The operator must be notified in writing that an application for full coverage is required. When a permit certification under this permit is issued to an operator that would otherwise be covered under Part I.A.3 of this permit, the full requirements of this permit replace the requirements as per Part I.A.3 of this permit, upon the effective date of the permit certification. A site brought under the full requirements of this permit must still comply with local stormwater management requirements, policies or guidelines as required by Part I.D.1.g of this permit.

4. **Application, Due Dates**

- a) **Application Due Dates:** At least **ten calendar days** prior to the commencement of construction activities, the applicant shall submit an application form as provided by the Division, with a certification that the Stormwater Management Plan (SWMP) is complete.

**One** original completed discharge permit application shall be submitted, by mail or hand delivery, to:

Colorado Department of Public Health and Environment  
Water Quality Control Division  
WQCD-Permits-B2  
4300 Cherry Creek Drive South  
Denver, Colorado 80246-1530

- b) **Summary of Application:** The application requires, at a minimum, the following:
  - 1) The applicant's company name; address; telephone number; and email address (if available); whether the applicant is the owner, developer, or contractor; and local contact information;
  - 2) Project name, address, county and location of the construction site, including the latitude and longitude to the nearest 15 seconds of the approximate center of the construction activity;
  - 3) Legal description or map of the construction site;
  - 4) Estimates of: the total area of the site, the area of the site that is expected to be disturbed, and the total area of the larger common plan of development or sale to undergo disturbance;
  - 5) The nature of the construction activity;
  - 6) The anticipated start date and final stabilization date for the project;
  - 7) The name of the receiving water(s), or the municipal separate storm sewer system and the ultimate (i.e., named) receiving water(s);
  - 8) Certification that the SWMP for the construction site is complete (see Part I.C. below); and
  - 9) The signature of the applicant, signed in accordance with Part I.F.1 of this permit.

5. **Permit Certification Procedures**

If this general permit is appropriate for the applicant's operation, then a certification will be developed and the applicant will be authorized to discharge stormwater under this general permit.

- a) **Request for Additional Information:** The Division shall have up to **ten calendar days** after receipt of the above information to request additional data and/or deny the authorization for any particular discharge. Upon receipt of additional information, the Division shall have an additional **ten calendar days** to issue or deny authorization for the particular discharge. (Notification of denial shall be by letter, in cases where coverage under an alternate general permit or an individual permit is required, instead of coverage under this permit.)



A. COVERAGE UNDER THIS PERMIT (cont.)

- b) **Automatic Coverage:** If the applicant does not receive a request for additional information or a notification of denial from the Division dated within ten calendar days of receipt of the application by the Division, authorization to discharge in accordance with the conditions of this permit shall be deemed granted.
- c) **Individual Permit Required:** If, after evaluation of the application (or additional information, such as the SWMP), it is found that this general permit is not appropriate for the operation, then the application will be processed as one for an individual permit. The applicant will be notified of the Division's decision to deny certification under this general permit. For an individual permit, additional information may be requested, and 180 days may be required to process the application and issue the permit. At the Division's discretion, temporary coverage under this general permit may be allowed until the individual permit goes into effect.
- d) **General vs. Individual Permit Coverage:** Any permittee authorized by this permit may request to be excluded from the coverage of this permit by applying for an individual CDPS permit. The permittee shall submit an individual application, with reasons supporting the request, to the Division at least 180 days prior to any discharge.
- e) **Local Agency Authority:** This permit does not pre-empt or supersede the authority of local agencies to prohibit, restrict, or control discharges of stormwater to storm drain systems or other water courses within their jurisdiction.

6. **Inactivation Notice**

When a site has been finally stabilized in accordance with the SWMP, the permittee must submit an **Inactivation Notice** form that is signed in accordance with Part I.F.1. of this permit. The Inactivation Notice form is available from the Division and includes:

- a) Permit certification number;
- b) The permittee's name, address, telephone number;
- c) Name, location, and county for the construction site for which the inactivation notice is being submitted; and
- d) Certification that the site has been finally stabilized, and a description of the final stabilization method(s).

7. **Transfer of Permit**

When responsibility for stormwater discharges at a construction site changes from one entity to another, the permittee shall submit a completed **Notice of Transfer and Acceptance of Terms** form that is signed in accordance with Part I.F.1. of this permit. The Notice of Transfer form is available from the Division and includes:

- a) Permit certification number;
- b) Name, location, and county for the construction site for which the Notice of Transfer is being submitted;
- c) Identifying information for the new permittee;
- d) Identifying information for the current permittee; and
- e) Effective date of transfer.

If the new responsible party will not complete the transfer form, the permit may be inactivated upon written request to the Division and completion of the Inactivation Notice if the permittee has no legal responsibility, through ownership or contract, for the construction activities at the site. In this case, the new owner or operator would be required to obtain permit coverage separately.

8. **Reassignment of Permit**

When a permittee no longer has control of a specific portion of a permitted site, and wishes to transfer coverage of that portion of the site to a second party, the permittee shall submit a completed **Notice of Reassignment of Permit Coverage** form that is signed in accordance with Part I.F.1. of this permit. The Notice of Reassignment of Permit Coverage form is available from the Division and includes:

- a) Current permit certification number;
- b) Identifying information and certification as required by Part I.A.4.b for the new permittee;
- c) Identifying information for the current permittee, revised site information and certification for reassignment; and
- d) Effective date of reassignment.

A. COVERAGE UNDER THIS PERMIT (cont.)

If the new responsible party will not complete the reassignment form, the applicable portion of the permitted site may be removed from permit coverage upon written request to the Division if the permittee has no legal responsibility, through ownership or contract, for the construction activities at the portion of the site. In this case, the new owner or operator would be required to obtain permit coverage separately.

9. **Sale of Residence to Homeowners**

For residential construction only, when a residential lot **has been conveyed to a homeowner** and all criteria in paragraphs a through e, below, are met, coverage under this permit is no longer required and the conveyed lot may be removed from coverage under the permittee's certification. At such time, the permittee is no longer responsible for meeting the terms and conditions of this permit for the conveyed lot, including the requirement to transfer or reassign permit coverage. The permittee remains responsible for inactivation of the original certification.

- a) The lot has been sold to the homeowner(s) for private residential use;
- b) the lot is less than one acre of disturbed area;
- c) all construction activity conducted by the permittee on the lot is completed;
- d) a certificate of occupancy (or equivalent) has been awarded to the home owner; and
- e) the SWMP has been amended to indicate the lot is no longer covered by permit.

Lots not meeting all of the above criteria require continued permit coverage. However, this permit coverage may be transferred (Part I.A.7, above) or reassigned (Part I.A.8, above) to a new owner or operator.

10. **Permit Expiration Date**

Authorization to discharge under this general permit shall expire on June 30, 2012. The Division must evaluate and reissue this general permit at least once every five years and must recertify the permittee's authority to discharge under the general permit at such time. Therefore, a permittee desiring continued coverage under the general permit must reapply by March 31, 2012. The Division will initiate the renewal process; however, it is ultimately the permittee's responsibility to ensure that the renewal is submitted. The Division will determine if the permittee may continue to operate under the terms of the general permit. An individual permit may be required for any facility not reauthorized to discharge under the reissued general permit.

11. **Individual Permit Criteria**

Various criteria can be used in evaluating whether or not an individual (or alternate general) permit is required instead of this general permit. This information may come from the application, SWMP, or additional information as requested by the Division, and includes, but is not limited to, the following:

- a) the quality of the receiving waters (i.e., the presence of downstream drinking water intakes or a high quality fishery, or for preservation of high quality water);
- b) the size of the construction site;
- c) evidence of noncompliance under a previous permit for the operation;
- d) the use of chemicals within the stormwater system; or
- e) discharges of pollutants of concern to waters for which there is an established Total Maximum Daily Load (TMDL).

In addition, an individual permit may be required when the Division has shown or has reason to suspect that the stormwater discharge may contribute to a violation of a water quality standard.

B. STORMWATER MANAGEMENT PLAN (SWMP) – **GENERAL REQUIREMENTS**

- 1. A SWMP shall be developed for each facility covered by this permit. The SWMP shall be prepared in accordance with good engineering, hydrologic and pollution control practices. (The SWMP need not be prepared by a registered engineer.)

B. STORMWATER MANAGEMENT PLAN (SWMP) – **GENERAL REQUIREMENTS** (cont.)

2. The SWMP shall:
  - a) Identify all potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharges associated with construction activity from the facility;
  - b) Describe the practices to be used to reduce the pollutants in stormwater discharges associated with construction activity at the facility; and ensure the practices are selected and described in accordance with good engineering practices, including the installation, implementation and maintenance requirements; and
  - c) Be properly prepared, and updated in accordance with Part I.D.5.c, to ensure compliance with the terms and conditions of this permit.
3. Facilities must implement the provisions of the SWMP as written and updated, from commencement of construction activity until final stabilization is complete, as a condition of this permit. The Division reserves the right to review the SWMP, and to require the permittee to develop and implement additional measures to prevent and control pollution as needed.
4. The SWMP may reflect requirements for Spill Prevention Control and Countermeasure (SPCC) plans under section 311 of the CWA, or Best Management Practices (BMPs) Programs otherwise required by a separate CDPS permit, and may incorporate any part of such plans into the SWMP by reference, provided that the relevant sections of such plans are available as part of the SWMP consistent with Part I.D.5.b.
5. For any sites with permit coverage before June 30, 2007, the permittee's SWMP must meet the new SWMP requirements as summarized in Section II.I of the rationale. Any needed changes must be made by **October 1, 2007**.

C. STORMWATER MANAGEMENT PLAN (SWMP) – **CONTENTS**

The SWMP shall include the following items, at a minimum.

1. **Site Description.** The SWMP shall clearly describe the construction activity, to include:
  - a) The nature of the construction activity at the site.
  - b) The proposed sequence for major activities.
  - c) Estimates of the total area of the site, and the area and location expected to be disturbed by clearing, excavation, grading, or other construction activities.
  - d) A summary of any existing data used in the development of the site construction plans or SWMP that describe the soil or existing potential for soil erosion.
  - e) A description of the existing vegetation at the site and an estimate of the percent vegetative ground cover.
  - f) The location and description of all potential pollution sources, including ground surface disturbing activities (see Part I.A.2.b), vehicle fueling, storage of fertilizers or chemicals, etc.
  - g) The location and description of any anticipated allowable sources of non-stormwater discharge at the site, e.g., uncontaminated springs, landscape irrigation return flow, construction dewatering, and concrete washout.
  - h) The name of the receiving water(s) and the size, type and location of any outfall(s). If the stormwater discharge is to a municipal separate storm sewer system, the name of that system, the location of the storm sewer discharge, and the ultimate receiving water(s).
2. **Site Map.** The SWMP shall include a legible site map(s), showing the entire site, identifying:
  - a) construction site boundaries;
  - b) all areas of ground surface disturbance;
  - c) areas of cut and fill;
  - d) areas used for storage of building materials, equipment, soil, or waste;
  - e) locations of dedicated asphalt or concrete batch plants;
  - f) locations of all structural BMPs;
  - g) locations of non-structural BMPs as applicable; and
  - h) locations of springs, streams, wetlands and other surface waters.

C. STORMWATER MANAGEMENT PLAN (SWMP) – CONTENTS (cont.)

3. **Stormwater Management Controls.**

The SWMP must include a description of all stormwater management controls that will be implemented as part of the construction activity to control pollutants in stormwater discharges. The appropriateness and priorities of stormwater management controls in the SWMP shall reflect the potential pollutant sources identified at the facility.

The description of stormwater management controls shall address the following components, at a minimum:

- a) **SWMP Administrator** - The SWMP shall identify a specific individual(s), position or title who is responsible for developing, implementing, maintaining, and revising the SWMP. The activities and responsibilities of the administrator shall address all aspects of the facility's SWMP.
- b) **Identification of Potential Pollutant Sources** - All potential pollutant sources, including materials and activities, at a site must be evaluated for the potential to contribute pollutants to stormwater discharges. The SWMP shall identify and describe those sources determined to have the potential to contribute pollutants to stormwater discharges, and the sources must be controlled through BMP selection and implementation, as required in paragraph (c), below.

At a minimum, each of the following sources and activities shall be evaluated for the potential to contribute pollutants to stormwater discharges, and identified in the SWMP if found to have such potential:

- 1) all disturbed and stored soils;
  - 2) vehicle tracking of sediments;
  - 3) management of contaminated soils;
  - 4) loading and unloading operations;
  - 5) outdoor storage activities (building materials, fertilizers, chemicals, etc.);
  - 6) vehicle and equipment maintenance and fueling;
  - 7) significant dust or particulate generating processes;
  - 8) routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.;
  - 9) on-site waste management practices (waste piles, liquid wastes, dumpsters, etc.);
  - 10) concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment;
  - 11) dedicated asphalt and concrete batch plants;
  - 12) non-industrial waste sources such as worker trash and portable toilets; and
  - 13) other areas or procedures where potential spills can occur.
- c) **Best Management Practices (BMPs) for Stormwater Pollution Prevention** - The SWMP shall identify and describe appropriate BMPs, including, but not limited to, those required by paragraphs 1 through 8 below, that will be implemented at the facility to reduce the potential of the sources identified in Part I.C.3.b to contribute pollutants to stormwater discharges. The SWMP shall clearly describe the installation and implementation specifications for each BMP identified in the SWMP to ensure proper implementation, operation and maintenance of the BMP.
    - 1) **Structural Practices for Erosion and Sediment Control**. The SWMP shall clearly describe and locate all structural practices implemented at the site to minimize erosion and sediment transport. Practices may include, but are not limited to: straw bales, wattles/sediment control logs, silt fences, earth dikes, drainage swales, sediment traps, subsurface drains, pipe slope drains, inlet protection, outlet protection, gabions, and temporary or permanent sediment basins.
    - 2) **Non-Structural Practices for Erosion and Sediment Control**. The SWMP shall clearly describe and locate, as applicable, all non-structural practices implemented at the site to minimize erosion and sediment transport. Description must include interim and permanent stabilization practices, and site-specific scheduling for implementation of the practices. The SWMP should include practices to ensure that existing vegetation is preserved where possible. Non-structural practices may include, but are not limited to: temporary vegetation, permanent vegetation, mulching, geotextiles, sod stabilization, slope roughening, vegetative buffer strips, protection of trees, and preservation of mature vegetation.

C. STORMWATER MANAGEMENT PLAN (SWMP) – CONTENTS (cont.)

- 3) Phased BMP Implementation. The SWMP shall clearly describe the relationship between the phases of construction, and the implementation and maintenance of both structural and non-structural stormwater management controls. The SWMP must identify the stormwater management controls to be implemented during the project phases, which can include, but are not limited to, clearing and grubbing; road construction; utility and infrastructure installation; vertical construction; final grading; and final stabilization.
- 4) Materials Handling and Spill Prevention. The SWMP shall clearly describe and locate all practices implemented at the site to minimize impacts from procedures or significant materials (see definitions at Part I.E.) that could contribute pollutants to runoff. Such procedures or significant materials could include: exposed storage of building materials; paints and solvents; fertilizers or chemicals; waste material; and equipment maintenance or fueling procedures.

Areas or procedures where potential spills can occur must have spill prevention and response procedures identified in the SWMP.

- 5) Dedicated Concrete or Asphalt Batch Plants. The SWMP shall clearly describe and locate all practices implemented at the site to control stormwater pollution from dedicated concrete batch plants or dedicated asphalt batch plants covered by this certification.
- 6) Vehicle Tracking Control. The SWMP shall clearly describe and locate all practices implemented at the site to control potential sediment discharges from vehicle tracking. Practices must be implemented for all areas of potential vehicle tracking, and can include: minimizing site access; street sweeping or scraping; tracking pads; graveled parking areas; requiring that vehicles stay on paved areas on-site; wash racks; contractor education; and/or sediment control BMPs, etc.
- 7) Waste Management and Disposal, Including Concrete Washout.
  - i) The SWMP shall clearly describe and locate the practices implemented at the site to control stormwater pollution from all construction site wastes (liquid and solid), including concrete washout activities.
  - ii) The practices used for concrete washout must ensure that these activities do not result in the contribution of pollutants associated with the washing activity to stormwater runoff.
  - iii) Part I.D.3.c of the permit authorizes the conditional discharge of concrete washout water to the ground. The SWMP shall clearly describe and locate the practices to be used that will ensure that no washout water from concrete washout activities is discharged from the site as surface runoff or to surface waters.
- 8) Groundwater and Stormwater Dewatering.
  - i) The SWMP shall clearly describe and locate the practices implemented at the site to control stormwater pollution from the dewatering of groundwater or stormwater from excavations, wells, etc.
  - ii) Part I.D.3.d of the permit authorizes the conditional discharge of construction dewatering to the ground. For any construction dewatering of groundwater not authorized under a separate CDPS discharge permit, the SWMP shall clearly describe and locate the practices to be used that will ensure that no groundwater from construction dewatering is discharged from the site as surface runoff or to surface waters.

4. Final Stabilization and Long-term Stormwater Management

- a) The SWMP shall clearly describe the practices used to achieve final stabilization of all disturbed areas at the site, and any planned practices to control pollutants in stormwater discharges that will occur after construction operations have been completed at the site.
- b) Final stabilization practices for obtaining a vegetative cover should include, as appropriate: seed mix selection and application methods; soil preparation and amendments; soil stabilization practices (e.g., crimped straw, hydro mulch or rolled erosion control products); and appropriate sediment control BMPs as needed until final stabilization is achieved; etc.



C. STORMWATER MANAGEMENT PLAN (SWMP) – CONTENTS (cont.)

- c) Final stabilization is reached when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed.

The Division may, after consultation with the permittee and upon good cause, amend the final stabilization criteria in this section for specific operations.

5. **Inspection and Maintenance**

Part I.D.6 of the permit includes requirements for site inspections. Part I.D.7 of the permit includes requirements for BMP maintenance. The SWMP shall clearly describe the inspection and maintenance procedures implemented at the site to maintain all erosion and sediment control practices and other protective practices identified in the SWMP, in good and effective operating condition.

D. TERMS AND CONDITIONS

1. **General Limitations**

The following limitations shall apply to all discharges covered by this permit:

- a) Stormwater discharges from construction activities shall not cause, have the reasonable potential to cause, or measurably contribute to an exceedance of any water quality standard, including narrative standards for water quality.
- b) Concrete washout water shall not be discharged to state surface waters or to storm sewer systems. On-site permanent disposal of concrete washout waste is not authorized by this permit. Discharge to the ground of concrete washout waste that will subsequently be disposed of off-site is authorized by this permit. See Part I.D.3.c of the permit.
- c) Bulk storage structures for petroleum products and any other chemicals shall have secondary containment or equivalent adequate protection so as to contain all spills and prevent any spilled material from entering State waters.
- d) No chemicals are to be added to the discharge unless permission for the use of a specific chemical is granted by the Division. In granting the use of such chemicals, special conditions and monitoring may be addressed by separate correspondence.
- e) The Division reserves the right to require sampling and testing, on a case-by-case basis, in the event that there is reason to suspect that compliance with the SWMP is a problem, or to measure the effectiveness of the BMPs in removing pollutants in the effluent. Such monitoring may include Whole Effluent Toxicity testing.
- f) All site wastes must be properly managed to prevent potential pollution of State waters. This permit does not authorize on-site waste disposal.
- g) All dischargers must comply with the lawful requirements of federal agencies, municipalities, counties, drainage districts and other local agencies regarding any discharges of stormwater to storm drain systems or other water courses under their jurisdiction, including applicable requirements in municipal stormwater management programs developed to comply with CDPS permits. Dischargers must comply with local stormwater management requirements, policies or guidelines including erosion and sediment control.

2. **BMP Implementation and Design Standards**

Facilities must select, install, implement, and maintain appropriate BMPs, following good engineering, hydrologic and pollution control practices. BMPs implemented at the site must be adequately designed to provide control for all potential pollutant sources associated with construction activity to prevent pollution or degradation of State waters.

D. TERMS AND CONDITIONS (cont.)

3. **Prohibition of Non-Stormwater Discharges**

- a) Except as provided in paragraphs b, c, and d below, **all discharges covered by this permit shall be composed entirely of stormwater associated with construction activity.** Discharges of material other than stormwater must be addressed in a separate CDPS permit issued for that discharge.
- b) Discharges from the following sources that are combined with stormwater discharges associated with construction activity may be authorized by this permit, provided that the non-stormwater component of the discharge is identified in the SWMP (see Part I.C.1.g of this permit):
  - emergency fire fighting activities
  - landscape irrigation return flow
  - uncontaminated springs
- c) Discharges to the ground of concrete washout water from washing of tools and concrete mixer chutes may be authorized by this permit, provided that:
  - 1) the source is identified in the SWMP;
  - 2) BMPs are included in the SWMP in accordance with Part I.C.3(c)(7) and to prevent pollution of groundwater in violation of Part I.D.1.a; and
  - 3) these discharges do not leave the site as surface runoff or to surface waters
- d) Discharges to the ground of water from construction dewatering activities may be authorized by this permit, provided that:
  - 1) the source is groundwater and/or groundwater combined with stormwater that does not contain pollutants in concentrations exceeding the State groundwater standards in Regulations 5 CCR 1002-41 and 42;
  - 2) the source is identified in the SWMP;
  - 3) BMPs are included in the SWMP, as required by Part I.C.3(c)(8); and
  - 4) these discharges do not leave the site as surface runoff or to surface waters.

Discharges to the ground from construction dewatering activities that do not meet the above criteria must be covered under a separate CDPS discharge permit. Contaminated groundwater requiring coverage under a separate CDPS discharge permit may include groundwater contaminated with pollutants from a landfill, mining activity, industrial pollutant plume, underground storage tank, or other source.

4. **Releases in Excess of Reportable Quantities**

This permit does not relieve the permittee of the reporting requirements of 40 CFR 110, 40 CFR 117 or 40 CFR 302. Any discharge of hazardous material must be handled in accordance with the Division's Noncompliance Notification Requirements (see Part II.A.3 of the permit).

5. **SWMP Requirements**

- a) **SWMP Preparation and Implementation:** The SWMP shall be prepared prior to applying for coverage under the general permit, and certification of its completion submitted with the application. The SWMP shall be implemented prior to commencement of construction activities. The plan shall be updated as appropriate (see paragraph c, below). SWMP provisions shall be implemented until expiration or inactivation of permit coverage.
- b) **SWMP Retention Requirements:** A copy of the SWMP must be retained on site unless another location, specified by the permittee, is approved by the Division.
- c) **SWMP Review/Changes:** The permittee shall amend the SWMP:
  - 1) when there is a change in design, construction, operation, or maintenance of the site, which would require the implementation of new or revised BMPs; or
  - 2) if the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity; or

D. TERMS AND CONDITIONS (cont.)

- 3) when BMPs are no longer necessary and are removed.

SWMP changes shall be made prior to changes in the site conditions, except as allowed for in paragraph d, below. SWMP revisions may include, but are not limited to: potential pollutant source identification; selection of appropriate BMPs for site conditions; BMP maintenance procedures; and interim and final stabilization practices. The SWMP changes may include a schedule for further BMP design and implementation, provided that, if any interim BMPs are needed to comply with the permit, they are also included in the SWMP and implemented during the interim period.

- d) **Responsive SWMP Changes:** SWMP changes addressing BMP installation and/or implementation are often required to be made in response to changing conditions, or when current BMPs are determined ineffective. The majority of SWMP revisions to address these changes can be made immediately with quick in-the-field revisions to the SWMP. In the less common scenario where more complex development of materials to modify the SWMP is necessary, SWMP revisions shall be made in accordance with the following requirements:
  - 1) the SWMP shall be revised as soon as practicable, but in no case more than 72 hours after the change(s) in BMP installation and/or implementation occur at the site, and
  - 2) a notation must be included in the SWMP prior to the site change(s) that includes the time and date of the change(s) in the field, an identification of the BMP(s) removed or added, and the location(s) of those BMP(s).

6. **Inspections**

Site inspections must be conducted in accordance with the following requirements and minimum schedules. The required minimum inspection schedules do not reduce or eliminate the permittee's responsibility to implement and maintain BMPs in good and effective operational condition, and in accordance with the SWMP, which could require more frequent inspections.

- a) **Minimum Inspection Schedule:** The permittee shall, at a minimum, make a thorough inspection, in accordance with the requirements in I.D.6.b below, at least once every 14 calendar days. Also, post-storm event inspections must be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion. Provided the timing is appropriate, the post-storm inspections may be used to fulfill the 14-day routine inspection requirement. A more frequent inspection schedule than the minimum inspections described may be necessary, to ensure that BMPs continue to operate as needed to comply with the permit. The following conditional modifications to this Minimum Inspection Schedule are allowed:
  - 1) **Post-Storm Event Inspections at Temporarily Idle Sites** – If no construction activities will occur following a storm event, post-storm event inspections shall be conducted prior to re-commencing construction activities, but no later than 72 hours following the storm event. The occurrence of any such delayed inspection must be documented in the inspection record. Routine inspections still must be conducted at least every 14 calendar days.
  - 2) **Inspections at Completed Sites/Areas** – For sites or portions of sites that meet the following criteria, but final stabilization has not been achieved due to a vegetative cover that has not become established, the permittee shall make a thorough inspection of their stormwater management system at least once every month, and post-storm event inspections are not required. This reduced inspection schedule is *only* allowed if:
    - i) all construction activities that will result in surface ground disturbance are completed;
    - ii) all activities required for final stabilization, in accordance with the SWMP, have been completed, with the exception of the application of seed that has not occurred due to seasonal conditions or the necessity for additional seed application to augment previous efforts; and
    - iii) the SWMP has been amended to indicate those areas that will be inspected in accordance with the reduced schedule allowed for in this paragraph.

D. TERMS AND CONDITIONS (cont.)

- 3) **Winter Conditions Inspections Exclusion** – Inspections are not required at sites where construction activities are temporarily halted, snow cover exists over the entire site for an extended period, and melting conditions posing a risk of surface erosion do not exist. This exception is applicable only during the period where melting conditions do not exist, and applies to the routine 14-day and monthly inspections, as well as the post-storm-event inspections. The following information must be documented in the inspection record for use of this exclusion: dates when snow cover occurred, date when construction activities ceased, and date melting conditions began. Inspections, as described above, are required at all other times.

When site conditions make the schedule required in this section impractical, the permittee may petition the Division to grant an alternate inspection schedule.

b) **Inspection Requirements**

- 1) **Inspection Scope** - The construction site perimeter, all disturbed areas, material and/or waste storage areas that are exposed to precipitation, discharge locations, and locations where vehicles access the site shall be inspected for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to state waters. All erosion and sediment control practices identified in the SWMP shall be evaluated to ensure that they are maintained and operating correctly.
- 2) **Inspection Report/Records** - The permittee shall keep a record of inspections. Inspection reports must identify any incidents of non-compliance with the terms and conditions of this permit. Inspection records must be retained for three years from expiration or inactivation of permit coverage. At a minimum, the inspection report must include:
- i) The inspection date;
  - ii) Name(s) and title(s) of personnel making the inspection;
  - iii) Location(s) of discharges of sediment or other pollutants from the site;
  - iv) Location(s) of BMPs that need to be maintained;
  - v) Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
  - vi) Location(s) where additional BMPs are needed that were not in place at the time of inspection;
  - vii) Deviations from the minimum inspection schedule as provided in Part I.D.6.a above;
  - viii) Description of corrective action for items iii, iv, v, and vi, above, dates corrective action(s) taken, and measures taken to prevent future violations, including requisite changes to the SWMP, as necessary; and
  - viii) After adequate corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report shall contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.
- c) **Required Actions Following Site Inspections** – Where site inspections note the need for BMP maintenance activities, BMPs must be maintained in accordance with the SWMP and Part I.D.7 of the permit. Repair, replacement, or installation of new BMPs determined necessary during site inspections to address ineffective or inadequate BMPs must be conducted in accordance with Part I.D.8 of the permit. SWMP updates required as a result of deficiencies in the SWMP noted during site inspections shall be made in accordance with Part I.D.5.c of the permit.

7. **BMP Maintenance**

All erosion and sediment control practices and other protective measures identified in the SWMP must be maintained in effective operating condition. Proper selection and installation of BMPs and implementation of comprehensive Inspection and Maintenance procedures, in accordance with the SWMP, should be adequate to meet this condition. BMPs that are not adequately maintained in accordance with good engineering, hydrologic and pollution control practices, including removal of collected sediment outside the acceptable tolerances of the BMPs, are considered to be no longer operating effectively and must be addressed in accordance with Part I.D.8, below. A specific timeline for implementing maintenance procedures is not included in this permit because BMP maintenance is expected to be proactive, not responsive. Observations resulting in BMP maintenance activities can be made during a site inspection, or during general observations of site conditions.

D. TERMS AND CONDITIONS (cont.)

8. **Replacement and Failed BMPs**

Adequate site assessment must be performed as part of comprehensive Inspection and Maintenance procedures, to assess the adequacy of BMPs at the site, and the necessity of changes to those BMPs to ensure continued effective performance. Where site assessment results in the determination that new or replacement BMPs are necessary, the BMPs must be installed to ensure on-going implementation of BMPs as per Part I.D.2.

Where BMPs have failed, resulting in noncompliance with Part I.D.2, they must be addressed as soon as possible, immediately in most cases, to minimize the discharge of pollutants.

When new BMPs are installed or BMPs are replaced, the SWMP must be updated in accordance with Part I.D.5(c).

9. **Reporting**

No scheduled reporting requirements are included in this permit; however, the Division reserves the right to request that a copy of the inspection reports be submitted.

10. **SWMP Availability**

A copy of the SWMP shall be provided upon request to the Division, EPA, or any local agency in charge of approving sediment and erosion plans, grading plans or stormwater management plans, and within the time frame specified in the request. If the SWMP is required to be submitted to any of these entities, it must include a signed certification in accordance with Part I.F.1 of the permit, certifying that the SWMP is complete and meets all permit requirements.

All SWMPs required under this permit are considered reports that shall be available to the public under Section 308(b) of the CWA and Section 61.5(4) of the Colorado Discharge Permit System Regulations. The permittee shall make plans available to members of the public upon request. However, the permittee may claim any portion of a SWMP as confidential in accordance with 40 CFR Part 2.

11. **Total Maximum Daily Load (TMDL)**

If a TMDL has been approved for any waterbody into which the permittee discharges, and stormwater discharges associated with construction activity have been assigned a pollutant-specific Wasteload Allocation (WLA) under the TMDL, the Division will either:

- a) Ensure that the WLA is being implemented properly through alternative local requirements, such as by a municipal stormwater permit; or
- b) Notify the permittee of the WLA, and amend the permittee's certification to add specific BMPs and/or other requirements, as appropriate. The permittee may be required to do the following:
  - 1) Under the permittee's SWMP, implement specific management practices based on requirements of the WLA, and evaluate whether the requirements are being met through implementation of existing stormwater BMPs or if additional BMPs are necessary. Document the calculations or other evidence that show that the requirements are expected to be met; and
  - 2) If the evaluation shows that additional or modified BMPs are necessary, describe the type and schedule for the BMP additions/revisions.

Discharge monitoring may also be required. The permittee may maintain coverage under the general permit provided they comply with the applicable requirements outlined above. The Division reserves the right to require individual or alternate general permit coverage.



E. ADDITIONAL DEFINITIONS

For the purposes of this permit:

1. **Best Management Practices (BMPs):** schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, pollution prevention, and practices to control site runoff, spillage or leaks, waste disposal, or drainage from material storage.
2. **Dedicated asphalt plants and concrete plants:** portable asphalt plants and concrete plants that are located on or adjacent to a construction site and that provide materials only to that specific construction site.
3. **Final stabilization:** when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. For purposes of this permit, establishment of a vegetative cover capable of providing erosion control equivalent to pre-existing conditions at the site will be considered final stabilization.
4. **Municipal separate storm sewer system:** a conveyance or system of conveyances (including: roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains), owned or operated by a State, city, town, county, district, or other public body (created by state law), having jurisdiction over disposal of sewage, industrial waste, stormwater, or other wastes; designed or used for collecting or conveying stormwater.
5. **Operator:** the entity that has day-to-day supervision and control of activities occurring at the construction site. This can be the owner, the developer, the general contractor or the agent of one of these parties, in some circumstances. It is anticipated that at different phases of a construction project, different types of parties may satisfy the definition of 'operator' and that the permit may be transferred as the roles change.
6. **Outfall:** a point source at the point where stormwater leaves the construction site and discharges to a receiving water or a stormwater collection system.
7. **Part of a larger common plan of development or sale:** a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules.
8. **Point source:** any discernible, confined and discrete conveyance from which pollutants are or may be discharged. Point source discharges of stormwater result from structures which increase the imperviousness of the ground which acts to collect runoff, with runoff being conveyed along the resulting drainage or grading pattern.
9. **Pollutant:** dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, sewage sludge, garbage, trash, chemical waste, biological nutrient, biological material, radioactive material, heat, wrecked or discarded equipment, rock, sand, or any industrial, municipal or agricultural waste.
10. **Process water:** any water which, during manufacturing or processing, comes into contact with or results from the production of any raw material, intermediate product, finished product, by product or waste product. This definition includes mine drainage.
11. **Receiving Water:** any classified stream segment (including tributaries) in the State of Colorado into which stormwater related to construction activities discharges. This definition includes all water courses, even if they are usually dry, such as borrow ditches, arroyos, and other unnamed waterways.
12. **Significant Materials** include, but are not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to section 313 of title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharge.
13. **Stormwater:** precipitation-induced surface runoff.

F. GENERAL REQUIREMENTS

1. **Signatory Requirements**

- a) All reports required for submittal shall be signed and certified for accuracy by the permittee in accordance with the following criteria:
  - 1) In the case of corporations, by a principal executive officer of at least the level of vice-president or his or her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the form originates;
  - 2) In the case of a partnership, by a general partner;
  - 3) In the case of a sole proprietorship, by the proprietor;
  - 4) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee, if such representative is responsible for the overall operation of the facility from which the discharge described in the form originates.
- b) **Changes to authorization.** If an authorization under paragraph a) of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph a) of this section must be submitted to the Division, prior to or together with any reports, information, or applications to be signed by an authorized representative.
- c) **Certification.** Any person signing a document under paragraph a) of this section shall make the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

2. **Retention of Records**

- a) The permittee shall retain copies of the SWMP and all reports required by this permit and records of all data used to complete the application to be covered by this permit, for three years after expiration or inactivation of permit coverage.
- b) The permittee shall retain a copy of the SWMP required by this permit at the construction site from the date of project initiation to the date of expiration or inactivation of permit coverage, unless another location, specified by the permittee, is approved by the Division.

3. **Monitoring**

The Division reserves the right to require sampling and testing, on a case-by-case basis (see Part I.D.1.e), for example to implement the provisions of a TMDL (see Part I.D.11 of the permit). Reporting procedures for any monitoring data collected will be included in the notification by the Division of monitoring requirements.

If monitoring is required, the following definitions apply:

- a) The **thirty (30) day average** shall be determined by the arithmetic mean of all samples collected during a thirty (30) consecutive-day period.
- b) A **grab** sample, for monitoring requirements, is a single “dip and take” sample.

PART II

A. MANAGEMENT REQUIREMENTS

1. **Amending a Permit Certification**

The permittee shall inform the Division (Permits Section) in writing of changes to the information provided in the permit application, including the legal contact, the project legal description or map originally submitted with the application, or the planned total disturbed acreage. The permittee shall furnish the Division with any plans and specifications which the Division deems reasonably necessary to evaluate the effect on the discharge and receiving stream. If applicable, this notification may be accomplished through submittal of an application for a CDPS process water permit authorizing the discharge. The SWMP shall be updated and implemented prior to the changes (see Part I.D.5.c).

Any discharge to the waters of the State from a point source other than specifically authorized by this permit or a different CDPS permit is prohibited.

2. **Special Notifications - Definitions**

- a) **Spill:** An unintentional release of solid or liquid material which may cause pollution of state waters.
- b) **Upset:** An exceptional incident in which there is unintentional and temporary noncompliance with permit discharge limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

3. **Noncompliance Notification**

- a) The permittee shall report the following instances of noncompliance:
  - 1) Any noncompliance which may endanger health or the environment;
  - 2) Any spill or discharge of hazardous substances or oil which may cause pollution of the waters of the state.
  - 3) Any discharge of stormwater which may cause an exceedance of a water quality standard.
- b) For all instances of noncompliance based on environmental hazards and chemical spills and releases, all needed information must be provided orally to the Colorado Department of Public Health and Environment spill reporting line (24-hour number for environmental hazards and chemical spills and releases: 1-877-518-5608) within 24 hours from the time the permittee becomes aware of the circumstances.

For all other instances of noncompliance as defined in this section, all needed information must be provided orally to the Water Quality Control Division within 24 hours from the time the permittee becomes aware of the circumstances.

For all instances of noncompliance identified here, a written submission shall also be provided within 5 calendar days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of:

- 1) The noncompliance and its cause;
- 2) The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue;
- 3) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

A. MANAGEMENT REQUIREMENTS (cont.)

4. **Submission of Incorrect or Incomplete Information**

Where the permittee failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or report to the Division, or relevant new information becomes available, the permittee shall promptly submit the relevant application information which was not submitted or any additional information needed to correct any erroneous information previously submitted.

5. **Bypass**

- a) A bypass, which causes effluent limitations (i.e., requirements to implement BMPs in accordance with Parts I.B.3 and I.D.2 of the permit) to be exceeded is prohibited, and the Division may take enforcement action against a permittee for such a bypass, unless:
- 1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
  - 2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities (e.g., alternative BMPs), retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment (e.g., implemented additional BMPs) to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and
  - 3) The permittee submitted notices as required in "Non-Compliance Notification," Part II.A.3.

6. **Upsets**

- a) **Effect of an Upset:** An upset constitutes an affirmative defense to an action brought for noncompliance with permit limitations and requirements if the requirements of paragraph b of this section are met. (No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.)
- b) **Conditions Necessary for a Demonstration of Upset:** A permittee who wishes to establish the affirmative defense of upset shall demonstrate through properly signed contemporaneous operating logs, or other relevant evidence that:
- 1) An upset occurred and that the permittee can identify the specific cause(s) of the upset;
  - 2) The permitted facility was at the time being properly operated;
  - 3) The permittee submitted notice of the upset as required in Part II.A.3. of this permit (24-hour notice); and
  - 4) The permittee complied with any remedial measures required under 40 CFR Section 122.41(d) of the federal regulations or Section 61.8(3)(h) of the Colorado Discharge Permit System Regulations.
- c) **Burden of Proof:** In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

7. **Removed Substances**

Solids, sludges, or other pollutants removed in the course of treatment or control of discharges shall be properly disposed of in a manner such as to prevent any pollutant from such materials from entering waters of the State.

8. **Minimization of Adverse Impact**

The permittee shall take all reasonable steps to minimize any adverse impact to waters of the State resulting from noncompliance with any terms and conditions specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

A. MANAGEMENT REQUIREMENTS (cont.)

9. **Reduction, Loss, or Failure of Stormwater Controls**

The permittee has the duty to halt or reduce any activity if necessary to maintain compliance with the permit requirements. Upon reduction, loss, or failure of any stormwater controls, the permittee shall, to the extent necessary to maintain compliance with its permit, control production, or remove all pollutant sources from exposure to stormwater, or both, until the stormwater controls are restored or an alternative method of treatment/control is provided.

It shall not be a defense for a permittee in an enforcement action that it would be necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

10. **Proper Operation and Maintenance**

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

B. RESPONSIBILITIES

1. **Inspections and Right to Entry**

The permittee shall allow the Director of the State Water Quality Control Division, the EPA Regional Administrator, and/or their authorized representative(s), upon the presentation of credentials:

- a) To enter upon the permittee's premises where a regulated facility or activity is located or in which any records are required to be kept under the terms and conditions of this permit;
- b) At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit and to inspect any monitoring equipment or monitoring method required in the permit; and
- c) To enter upon the permittee's premises to investigate, within reason, any actual, suspected, or potential source of water pollution, or any violation of the Colorado Water Quality Control Act. The investigation may include, but is not limited to, the following: sampling of any discharge and/or process waters, the taking of photographs, interviewing permittee staff on alleged violations and other matters related to the permit, and access to any and all facilities or areas within the permittee's premises that may have any effect on the discharge, permit, or any alleged violation.

2. **Duty to Provide Information**

The permittee shall furnish to the Division, within the time frame specified by the Division, any information which the Division may request to determine whether cause exists for modifying, revoking and reissuing, or inactivating coverage under this permit, or to determine compliance with this permit. The permittee shall also furnish to the Division, upon request, copies of records required to be kept by this permit.

3. **Transfer of Ownership or Control**

Certification under this permit may be transferred to a new permittee if:

- a) The current permittee notifies the Division in writing when the transfer is desired as outlined in Part I.A.7; and
- b) The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage and liability between them; and
- c) The current permittee has met all fee requirements of the Colorado Discharge Permit System Regulations, Section 61.15.



B. RESPONSIBILITIES (cont.)

4. **Modification, Suspension, or Revocation of Permit By Division**

All permit modification, inactivation or revocation and reissuance actions shall be subject to the requirements of the Colorado Discharge Permit System Regulations, Sections 61.5(2), 61.5(3), 61.7 and 61.15, 5 C.C.R. 1002-61, except for minor modifications.

- a) This permit, and/or certification under this permit, may be modified, suspended, or revoked in whole or in part during its term for reasons determined by the Division including, but not limited to, the following:
  - 1) Violation of any terms or conditions of the permit;
  - 2) Obtaining a permit by misrepresentation or failing to disclose any fact which is material to the granting or denial of a permit or to the establishment of terms or conditions of the permit;
  - 3) Materially false or inaccurate statements or information in the application for the permit;
  - 4) Promulgation of toxic effluent standards or prohibitions (including any schedule of compliance specified in such effluent standard or prohibition) which are established under Section 307 of the Clean Water Act, where such a toxic pollutant is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit.
- b) This permit, and/or certification under this permit, may be modified in whole or in part due to a change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge, such as:
  - 1) Promulgation of Water Quality Standards applicable to waters affected by the permitted discharge; or
  - 2) Effluent limitations or other requirements applicable pursuant to the State Act or federal requirements; or
  - 3) Control regulations promulgated; or
  - 4) Other available information indicates a potential for violation of adopted Water Quality Standards or stream classifications.
- c) This permit, or certification under this permit, may be modified in whole or in part to include new effluent limitations and other appropriate permit conditions where data submitted pursuant to Part I indicate that such effluent limitations and permit conditions are necessary to ensure compliance with applicable water quality standards and protection of classified uses.
- d) At the request of the permittee, the Division may modify or inactivate certification under this permit if the following conditions are met:
  - 1) In the case of inactivation, the permittee notifies the Division of its intent to inactivate the certification, and certifies that the site has been finally stabilized;
  - 2) In the case of inactivation, the permittee has ceased any and all discharges to state waters and demonstrates to the Division there is no probability of further uncontrolled discharge(s) which may affect waters of the State.
  - 3) The Division finds that the permittee has shown reasonable grounds consistent with the Federal and State statutes and regulations for such modification, amendment or inactivation;
  - 4) Fee requirements of Section 61.15 of the Colorado Discharge Permit System Regulations have been met; and
  - 5) Applicable requirements of public notice have been met.

For small construction sites covered by a Qualifying Local Program, coverage under this permit is automatically terminated when a site has been finally stabilized.

B. RESPONSIBILITIES (cont.)

5. **Permit Violations**

Failure to comply with any terms and/or conditions of this permit shall be a violation of this permit.

Dischargers of stormwater associated with industrial activity, as defined in the EPA Stormwater Regulation (40 CFR 122.26(b)(14) and Section 61.3(2) of the Colorado Discharge Permit System Regulations, which do not obtain coverage under this or other Colorado general permits, or under an individual CDPS permit regulating industrial stormwater, will be in violation of the federal Clean Water Act and the Colorado Water Quality Control Act, 25-8-101, as amended. Failure to comply with CDPS permit requirements will also constitute a violation.

6. **Legal Responsibilities**

The issuance of this permit does not convey any property or water rights in either real or personal property, or stream flows, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority granted by Section 510 of the Clean Water Act.

7. **Severability**

The provisions of this permit are severable. If any provisions of this permit, or the application of any provision of this permit to any circumstance, are held invalid, the application of such provision to other circumstances and the application of the remainder of this permit shall not be affected.

8. **Renewal Application**

If the permittee desires to continue to discharge, a permit renewal application shall be submitted at least ninety (90) days before this permit expires. If the permittee anticipates that there will be no discharge after the expiration date of this permit, the Division should be promptly notified so that it can inactivate the certification in accordance with Part II.B.4.d.

9. **Confidentiality**

Except for data determined to be confidential under Section 308 of the Federal Clean Water Act and Colorado Discharge Permit System Regulations, Section 61.5(4), all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Division. The permittee must state what is confidential at the time of submittal.

Any information relating to any secret process, method of manufacture or production, or sales or marketing data which has been declared confidential by the permittee, and which may be acquired, ascertained, or discovered, whether in any sampling investigation, emergency investigation, or otherwise, shall not be publicly disclosed by any member, officer, or employee of the Commission or the Division, but shall be kept confidential. Any person seeking to invoke the protection of this section shall bear the burden of proving its applicability. This section shall never be interpreted as preventing full disclosure of effluent data.

10. **Fees**

The permittee is required to submit payment of an annual fee as set forth in the Water Quality Control Act. Failure to submit the required fee when due and payable is a violation of the permit and will result in enforcement action pursuant to Section 25-8-601 et. seq., C.R.S. 1973 as amended.

B. RESPONSIBILITIES (cont.)

11. **Requiring an Individual CDPS Permit**

The Director may require the permittee to apply for and obtain an individual or alternate general CDPS permit if:

- a) The discharger is not in compliance with the conditions of this general permit;
- b) Conditions or standards have changed so that the discharge no longer qualifies for a general permit; or
- c) Data/information become available which indicate water quality standards may be violated.

The permittee must be notified in writing that an application for an individual or alternate general CDPS permit is required. When an individual or alternate general CDPS permit is issued to an operator otherwise covered under this general permit, the applicability of this general permit to that operator is automatically inactivated upon the effective date of the individual or alternate general CDPS permit.

# **Appendix B**

NRCS Soils Report

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## Rifle Area, Colorado, Parts of Garfield and Mesa Counties

### 46—Nihill channery loam, 1 to 6 percent slopes

#### Map Unit Setting

*Elevation:* 5,000 to 6,500 feet

#### Map Unit Composition

*Nihill and similar soils:* 85 percent

#### Description of Nihill

##### Setting

*Landform:* Valley sides, alluvial fans

*Down-slope shape:* Convex, linear

*Across-slope shape:* Convex, linear

*Parent material:* Alluvium derived from sandstone and shale

##### Properties and qualities

*Slope:* 1 to 6 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.60 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 15 percent

*Gypsum, maximum content:* 1 percent

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)

*Available water capacity:* Low (about 3.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4s

*Land capability (nonirrigated):* 4s

*Ecological site:* Rolling Loam (R048AY298CO)

##### Typical profile

*0 to 11 inches:* Channery loam

*11 to 18 inches:* Very channery loam

*18 to 60 inches:* Stratified extremely channery sandy loam to extremely channery loam

## Data Source Information

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 6, Mar 25, 2008

## Rifle Area, Colorado, Parts of Garfield and Mesa Counties

### 47—Nihill channery loam, 6 to 25 percent slopes

#### Map Unit Setting

*Elevation:* 5,000 to 6,500 feet

#### Map Unit Composition

*Nihill and similar soils:* 85 percent

#### Description of Nihill

##### Setting

*Landform:* Valley sides, alluvial fans

*Down-slope shape:* Convex, linear

*Across-slope shape:* Convex, linear

*Parent material:* Alluvium derived from sandstone and shale

##### Properties and qualities

*Slope:* 6 to 25 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.60 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 15 percent

*Gypsum, maximum content:* 1 percent

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)

*Available water capacity:* Low (about 3.6 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 6e

*Ecological site:* Rolling Loam (R048AY298CO)

##### Typical profile

*0 to 11 inches:* Channery loam

*11 to 18 inches:* Very channery loam

*18 to 60 inches:* Stratified extremely channery sandy loam to extremely channery loam

## Data Source Information

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 6, Mar 25, 2008

## Rifle Area, Colorado, Parts of Garfield and Mesa Counties

### 52—Parachute loam, 25 to 65 percent slopes

#### Map Unit Setting

*Elevation:* 7,500 to 8,700 feet

#### Map Unit Composition

*Parachute and similar soils:* 85 percent

#### Description of Parachute

##### Setting

*Landform:* Mountainsides

*Landform position (three-dimensional):* Mountainflank

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Parent material:* Residuum weathered from sandstone

##### Properties and qualities

*Slope:* 25 to 65 percent

*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 3.3 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 7e

*Ecological site:* Brushy Loam (R048AY238CO)

##### Typical profile

*0 to 5 inches:* Loam

*5 to 18 inches:* Loam

*18 to 29 inches:* Extremely channery loam

*29 to 33 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 5, Feb 1, 2008

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 6, Mar 25, 2008

## Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties

### 55—Parachute-Irigul complex, 5 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 7,600 to 8,800 feet  
*Mean annual precipitation:* 18 to 22 inches  
*Mean annual air temperature:* 36 to 40 degrees F  
*Frost-free period:* 65 to 90 days

#### Map Unit Composition

*Parachute and similar soils:* 60 percent  
*Irigul and similar soils:* 30 percent

#### Description of Parachute

##### Setting

*Landform:* Mountains  
*Landform position (two-dimensional):* Shoulder, summit  
*Landform position (three-dimensional):* Mountaintop  
*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Parent material:* Residuum weathered from shale and siltstone and/  
or residuum weathered from sandstone and shale

##### Properties and qualities

*Slope:* 5 to 30 percent  
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water*  
*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Low (about 4.0 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 6e  
*Ecological site:* Mountain Loam (R048AY228CO)

##### Typical profile

*0 to 10 inches:* Loam  
*10 to 25 inches:* Very channery loam, extremely channery loam  
*25 to 29 inches:* Unweathered bedrock

#### Description of Irigul

##### Setting

*Landform:* Hills  
*Landform position (two-dimensional):* Backslope, shoulder, toeslope,  
summit, footslope  
*Landform position (three-dimensional):* Crest

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Residuum weathered from sandstone and shale

**Properties and qualities**

*Slope:* 5 to 30 percent

*Depth to restrictive feature:* 5 to 20 inches to lithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Very low (about 1.3 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e

*Ecological site:* Loamy Slopes (R048AY303CO)

**Typical profile**

*0 to 6 inches:* Channery loam

*6 to 13 inches:* Very channery loam

*13 to 17 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 5, Feb 1, 2008

## **Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties**

### **56—Parachute-Irigul-Rhone association, 25 to 50 percent slopes**

#### **Map Unit Setting**

*Elevation:* 7,600 to 8,800 feet  
*Mean annual precipitation:* 18 to 22 inches  
*Mean annual air temperature:* 36 to 40 degrees F  
*Frost-free period:* 65 to 80 days

#### **Map Unit Composition**

*Parachute and similar soils:* 35 percent  
*Irigul and similar soils:* 30 percent  
*Rhone and similar soils:* 20 percent

#### **Description of Parachute**

##### **Setting**

*Landform:* Mountains  
*Landform position (two-dimensional):* Summit, shoulder  
*Landform position (three-dimensional):* Mountaintop  
*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Parent material:* Colluvium derived from sandstone and shale and/or residuum weathered from siltstone

##### **Properties and qualities**

*Slope:* 25 to 50 percent  
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Low (about 4.0 inches)

##### **Interpretive groups**

*Land capability (nonirrigated):* 7e  
*Ecological site:* Brushy Loam (R048AY238CO)

##### **Typical profile**

*0 to 10 inches:* Loam  
*10 to 25 inches:* Very channery loam, extremely channery loam  
*25 to 29 inches:* Unweathered bedrock

#### **Description of Irigul**

##### **Setting**

*Landform:* Hills



*Landform position (two-dimensional):* Toeslope, summit, footslope, backslope, shoulder

*Landform position (three-dimensional):* Crest

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Residuum weathered from sandstone and shale

#### **Properties and qualities**

*Slope:* 25 to 50 percent

*Depth to restrictive feature:* 5 to 20 inches to lithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Very low (about 1.3 inches)

#### **Interpretive groups**

*Land capability (nonirrigated):* 7e

*Ecological site:* Loamy Slopes (R048AY303CO)

#### **Typical profile**

*0 to 6 inches:* Channery loam

*6 to 13 inches:* Very channery loam

*13 to 17 inches:* Unweathered bedrock

### **Description of Rhone**

#### **Setting**

*Landform:* Hills, mountains

*Landform position (two-dimensional):* Backslope, shoulder, summit, footslope

*Landform position (three-dimensional):* Mountainflank, side slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Parent material:* Colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale

#### **Properties and qualities**

*Slope:* 25 to 50 percent

*Depth to restrictive feature:* 40 to 60 inches to paralithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 7.5 inches)

#### **Interpretive groups**

*Land capability (nonirrigated):* 7e

*Ecological site:* Brushy Loam (R048AY238CO)

#### **Typical profile**

*0 to 10 inches:* Loam

*10 to 39 inches:* Channery loam  
*39 to 55 inches:* Very channery loam  
*55 to 59 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa  
Counties

Survey Area Data: Version 5, Feb 1, 2008

## Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties

### 57—Parachute-Rhone loams, 5 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 7,600 to 8,800 feet  
*Mean annual precipitation:* 18 to 22 inches  
*Mean annual air temperature:* 36 to 40 degrees F  
*Frost-free period:* 45 to 75 days

#### Map Unit Composition

*Parachute and similar soils:* 55 percent  
*Rhone and similar soils:* 35 percent

#### Description of Parachute

##### Setting

*Landform:* Mountains  
*Landform position (two-dimensional):* Summit, shoulder  
*Landform position (three-dimensional):* Mountaintop  
*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Parent material:* Hard residuum weathered from sandstone and siltstone

##### Properties and qualities

*Slope:* 5 to 30 percent  
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water*  
*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Very low (about 2.8 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 6e  
*Ecological site:* Mountain Loam (R048AY228CO)

##### Typical profile

*0 to 10 inches:* Loam  
*10 to 25 inches:* Very channery loam  
*25 to 29 inches:* Unweathered bedrock

#### Description of Rhone

##### Setting

*Landform:* Hills, mountains  
*Landform position (two-dimensional):* Backslope, shoulder, summit, footslope  
*Landform position (three-dimensional):* Mountainflank, side slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Parent material:* Colluvium derived from sandstone and shale and/or  
residuum weathered from sandstone and shale

**Properties and qualities**

*Slope:* 5 to 30 percent

*Depth to restrictive feature:* 40 to 60 inches to paralithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 7.5 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 6e

*Ecological site:* Mountain Loam (R048AY228CO)

**Typical profile**

*0 to 10 inches:* Loam

*10 to 39 inches:* Channery loam

*39 to 55 inches:* Very channery loam

*55 to 59 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa  
Counties

Survey Area Data: Version 5, Feb 1, 2008

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 6, Mar 25, 2008

## Rifle Area, Colorado, Parts of Garfield and Mesa Counties

### 61—Rhone loam, 30 to 70 percent slopes

#### Map Unit Setting

*Elevation:* 7,600 to 8,600 feet

#### Map Unit Composition

*Rhone and similar soils:* 85 percent

#### Description of Rhone

##### Setting

*Landform:* Ridges, mountainsides

*Landform position (three-dimensional):* Mountaintop, mountainflank

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Marl and/or residuum weathered from sandstone

##### Properties and qualities

*Slope:* 30 to 70 percent

*Depth to restrictive feature:* 40 to 60 inches to paralithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 6.2 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 7e

*Ecological site:* Brushy Loam (R048AY238CO)

##### Typical profile

*0 to 8 inches:* Loam

*8 to 28 inches:* Sandy clay loam

*28 to 52 inches:* Very channery sandy clay loam

*52 to 56 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 5, Feb 1, 2008

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties

Survey Area Data: Version 6, Mar 25, 2008

## Rifle Area, Colorado, Parts of Garfield and Mesa Counties

### 66—Torriorthents-Camborthids-Rock outcrop complex, steep

#### Map Unit Setting

*Elevation:* 5,000 to 8,500 feet  
*Mean annual precipitation:* 10 to 15 inches  
*Mean annual air temperature:* 39 to 46 degrees F  
*Frost-free period:* 80 to 105 days

#### Map Unit Composition

*Torriorthents, steep, and similar soils:* 45 percent  
*Camborthids, steep, and similar soils:* 20 percent  
*Rock outcrop, steep:* 15 percent

#### Description of Torriorthents, Steep

##### Setting

*Landform:* Mountainsides  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Mountainflank, base slope  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Parent material:* Stony, basaltic alluvium derived from sandstone and shale

##### Properties and qualities

*Slope:* 15 to 70 percent  
*Depth to restrictive feature:* 4 to 30 inches to lithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 5 percent  
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)  
*Available water capacity:* Very low (about 2.4 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 7e

##### Typical profile

*0 to 4 inches:* Variable  
*4 to 30 inches:* Fine sandy loam  
*30 to 34 inches:* Unweathered bedrock

#### Description of Camborthids, Steep

##### Setting

*Landform:* Mountainsides  
*Landform position (two-dimensional):* Footslope



*Landform position (three-dimensional):* Mountainflank, base slope  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Parent material:* Stony, basaltic alluvium derived from sandstone and shale

**Properties and qualities**

*Slope:* 15 to 65 percent  
*Depth to restrictive feature:* 15 to 60 inches to lithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 10 percent  
*Gypsum, maximum content:* 2 percent  
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)  
*Available water capacity:* Low (about 4.0 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e

**Typical profile**

*0 to 4 inches:* Variable  
*4 to 30 inches:* Clay loam  
*30 to 34 inches:* Unweathered bedrock

**Description of Rock Outcrop, Steep**

**Setting**

*Landform:* Mountainsides  
*Landform position (three-dimensional):* Free face  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex

**Properties and qualities**

*Slope:* 15 to 70 percent  
*Depth to restrictive feature:* 0 inches to paralithic bedrock  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Available water capacity:* Very low (about 0.0 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 8s

**Typical profile**

*0 to 60 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties  
Survey Area Data: Version 6, Mar 25, 2008

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# Appendix C

## Site Map & Stormwater Inspection Form






**NOTE:**

A representative example of the inspection form and site map are supplied in Appendix C of this SWMP. As of August 17, 2011, inspection report records and site specific BMP maps are maintained electronically through an external database, SWMP Compliance©, contracted and managed by Berry Petroleum Company. Each inspection report is completed, signed and filed electronically and is available for electronic review. Each site specific BMP map is updated accordingly, managed and maintained electronically and is available for electronic review. Hard copies can be made available on request. Access to inspection records in the SWMP Compliance© database can be granted under the direct supervision and/or permission of Berry Petroleum Company.

The SWMP Compliance© database was implemented August 17, 2011. All inspection records and historic site maps prior to this date remain in Appendix C. All inspection records and historic site maps from August 17, 2011 to present are managed and maintained through SWMP Compliance© database.



# Legend

- |  |               |   |                           |
|--|---------------|---|---------------------------|
|  | Wattle        |  | Earthen Berm              |
|  | Turn Out      |  | Construction Site Boundry |
|  | Sediment Trap |   |                           |



PROJECT NO:	008-2215
DRAWN BY:	JAS
DATE:	5/27/10

**PAD NAME**  
**Berry Petroleum Compay**  
 QTR QTR, Section #, Township #N, Range#  
 Garfield County, CO

**OLSSON**  
 ASSOCIATES

826 21½ Road  
 Grand Junction, CO 81505  
 TEL 970.263.7800  
 FAX 970.263.7456

Map Not to Scale  
 Revision: 0  
 5/27/10

# BERRY PETROLEUM COMPANY STORMWATER INSPECTION REPORT

General Information	
<b>Location</b>	
<b>Date of Inspection</b>	
<b>Inspector's Name</b>	
<b>Type of Inspection:</b> <input type="checkbox"/> 14 Day (active construction) <input type="checkbox"/> Post-storm event (active construction) <input type="checkbox"/> Monthly	
<b>Have there been any deviations from the required minimum inspection schedule as described in the SWMP?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No    If yes, describe:	

#	BMP & Location	BMP Installed & Functioning as intended?	BMP Maintenance / Replacement Required?	Notes/Corrective Action Needed (please bold all corrective action items)	Date Completed	Initial
1	Wattles	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No			
2	Wattles	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No			
3	Sediment Trap	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No			
4	Turnout	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No			
5	Perimeter Berm	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No			

Notes	Corrective Action	Date Completed	Initial

To the best of my knowledge and belief, this site is in compliance with the permit requirements.

Print name and title: \_\_\_\_\_

Inspector Signature: \_\_\_\_\_ Date: \_\_\_\_\_

The corrective action items noted in this inspection report have been completed.

Print name and title: \_\_\_\_\_

Contractor Signature: \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_

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# Appendix D

## BMP Installation

**NOTE:**

**Please refer to the Berry Petroleum Stormwater Manual of Best Management Practices (BMPs) for all BMP installation and maintenance design specifications for the Garden Gulch active stormwater permits. The manual is located at 235 Callahan Avenue Parachute, CO 81635 along with all hard copy SWMPs for the Garden Gulch active stormwater permits.**

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