



**FAIRWAYS AT WOLF CREEK  
PHASE 4 AND 5  
PRELIMINARY DRAINAGE REPORT**

Eden, Utah

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Prepared: March 14, 2016

## **Project Location and Description**

The construction of roadways and utility infrastructure for approximately 40 residential lots is proposed in the open space between the dead end roads of Sunrise Drive and Patio Springs Drive at Wolf Creek in Eden, Utah. The project will be completed into (2) Phases of construction. The Phases will be referred to as Phase 4 and Phase 5.

The proposed site is located within the Wolf Creek Development in Weber County. The subject property is zoned for residential, and is currently platted as Parcel 22-020-0034, situated in the NW ¼ of Section 22, Township 7 North, Range 1 East SLCBM. The site is bound by adjacent subdivisions incorporated into the natural contours. The Wolf Creek Country Club golf course also is in the vicinity of the development.

The intent of this report is to show that the development of this site, and the construction of the proposed public roadways, will be in conformance with the requirements of the City of Eden and Weber County Storm Drain Requirements.

## **Existing Conditions**

The subject property is currently undeveloped. Existing on-site vegetation is extremely sparse and is limited to native grasses and shrubs. Existing grades slope to the east at slopes ranging from 6%-12%, falling a total of 66' across the site, with the typical slope of 10%.

According to the FEMA Flood Insurance Rate Map, Map number 49057C0229F, dated June 2, 2015 the proposed site is outside of the identified special flood hazard areas. A copy of this flood plain map has been included in Appendix B of this report.

Site soils are made up of Yeates Hollow very stony loam, classified as Hydrologic Soil Group C by the NRCS. These soils characteristically have slow infiltration rates, and high runoff potential. A copy of the NRCS soil classification map has been included in Appendix C of this report.

## **Design Methodology & Criteria**

### **Methodology**

Storm runoff calculations for the proposed development were performed using the Rational Method.

The Rational Method utilizes the following equation:

$$Q = CIA$$

Q = storm runoff in cubic feet per second;

C = runoff coefficient based on surface impermeability;

I = rainfall intensity in inches per hour;

A = drainage basin area in acres.

Runoff coefficients were determined for each sub-basin within the proposed development based on the varying surface types present. Storm intensities were taken from the National Oceanic and Atmospheric Administration (NOAA) database and can be found in Appendix D of this report.

## Criteria

Per Weber County, the following criteria were utilized in the design of the stormwater management system for the proposed development.

- The proposed development will utilize on-site detention basins to accommodate the storm runoff volume resulting from the 24-hour duration, 10-year return period design storm and will provide an additional 1' of freeboard above the high water elevation of these basins. Stormwater release rates from the site will be limited to 0.1 cfs per acre during this design storm event.
- On-site storm infrastructure including inlets, pipes and curb-cuts have been designed to accommodate the peak runoff resulting from the 10-year return period design storm.

## Existing Major Drainage Basin Description

The existing site currently drains from the North to the West at slopes ranging from 6%-12%, falling a total of 66' across the site. There are limited natural gulleys and depressions throughout the site, however there are no identified drainage ways or streams. There is no existing on-site storm sewer infrastructure and the site currently drains stormwater via overland flow to the south and into the existing drainage channel along the eastern portion of the site.

Preliminary storm runoff calculations show that the undeveloped/historic peak stormwater runoff from this site during the 10-year storm event is approximately 4.05 cfs. The allowable release rate from the site would be, per the 0.1 cfs/acre release rate, **1.58 cfs**. All assumptions and calculations used to determine the historic runoff rate can be found in Appendix F of this report.

## Proposed Major Basin Description

The proposed development will split on-site stormwater runoff flows into two major drainage basins; A and B. A copy of the Proposed Major Drainage Basin Map, EX-2, can be found in Appendix G of this report.

Drainage Basin A contains all of Phase 4 totaling 9.45 acres. This basin will drain via sheet flow, roof drains, curb and gutter, and storm sewer into the North Detention Basin (Pond A) located in the middle of the site. The North Detention Basin will release stormwater to the existing storm drainage canal located adjacent to the golf course on the eastern property line via an outlet structure equipped with an orifice plate at a maximum flow rate of **0.95 cfs** during the design storm event (10-year frequency). The required detention volume for this basin is **20,344 CF**. The design detention volume available in this basin is **22,000 CF**. Stormwater flows in excess of the design storm event will safely overflow into the right-of-way and flow into the existing storm drainage canal system via existing curb inlets and channels.

Drainage Basin B is located in the south half of the proposed development, and contains all of Phase 5. Storm runoff from this drainage basin will sheet flow into the proposed storm sewer system and drain into the South Detention Basin located in the southern portion of the site. The South Detention Basin will release stormwater to the existing storm drainage channel system located adjacent to the site via an outlet structure equipped with an orifice plate at a maximum

flow rate of **0.636 cfs** during the design storm event (10-year frequency). The required detention volume for this basin is **6,284 CF**. The design detention volume available in this basin is **8,800 CF**. Stormwater flows in excess of the design storm event will safely overflow into the right-of-way and flow into the existing storm channel system via existing curb inlets.

The combined maximum release rate from both the North and South Detention Ponds is **1.58 cfs**, matching the historic stormwater runoff rate from the property.

## Conclusion

In conclusion, the proposed development has been designed in compliance with the standards of the City of Eden and the Weber County Drainage Manual. It is anticipated the proposed development will not negatively impact the existing storm sewer system or the regional groundwater system.

If any questions arise, please feel free to contact me directly.

Sincerely,  
Galloway

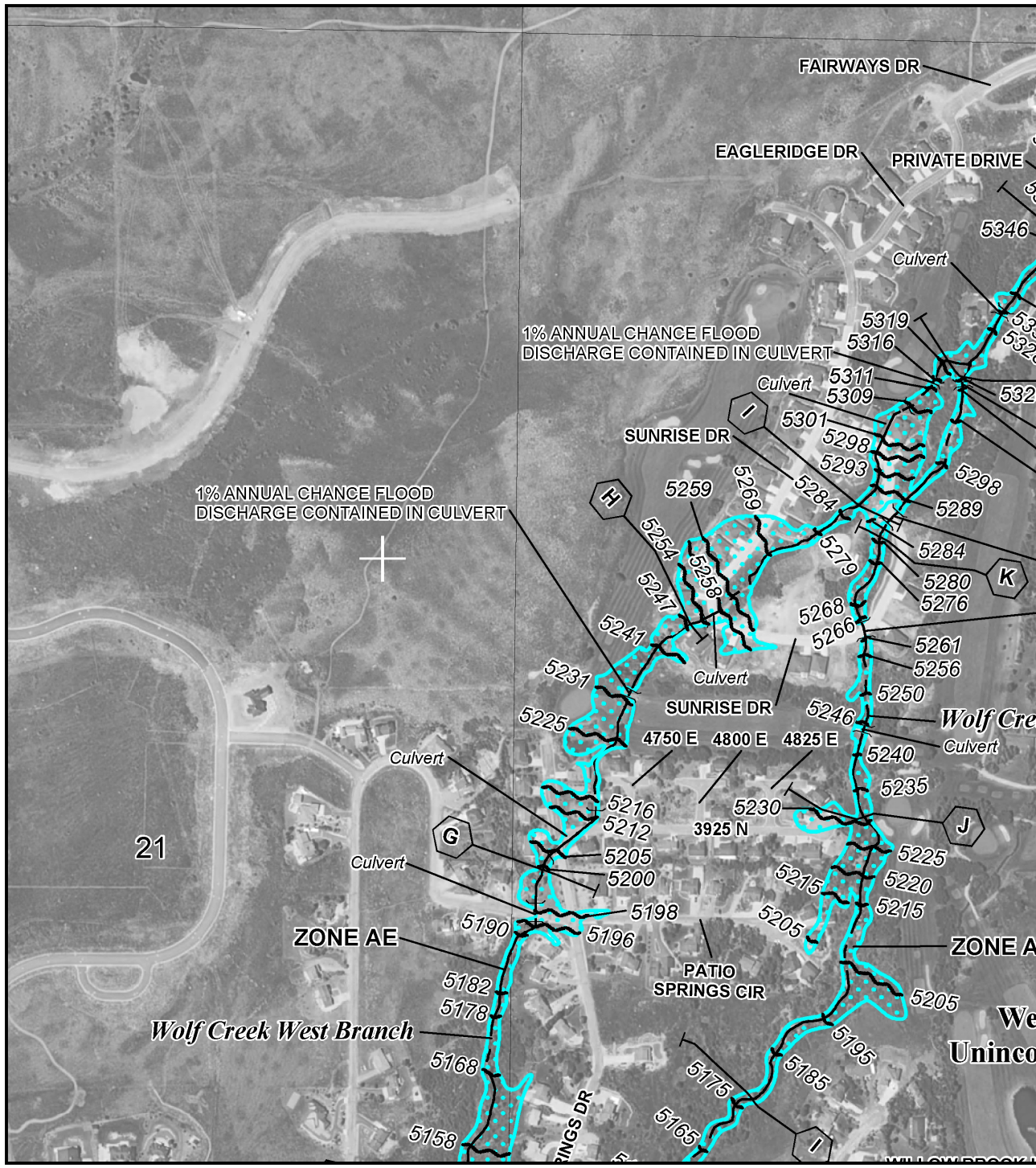
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Richard@GallowayUS.com




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Weber County Drainage Manual

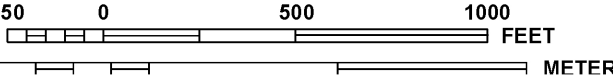
NOAA Atlas 14, Volume 1, Version 5 – Eden, Utah



Insurance Program at 1-800-638-6620



**MAP SCALE 1" = 500'**



**NATIONAL FLOOD INSURANCE PROGRAM**

PANEL 0229F

# FIRM

**FLOOD INSURANCE RATE MAP**

**WEBER COUNTY,  
UTAH  
AND INCORPORATED AREAS**


**PANEL 229 OF 600**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WEBER COUNTY	490187	0229	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



**MAP NUMBER  
49057C0229F**

**MAP REVISED  
JUNE 2, 2015**

Federal Emergency Management Agency

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



# Custom Soil Resource Report for Morgan Area, Utah - Morgan County and Part of Weber County



# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<http://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# **How Soil Surveys Are Made**

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Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

## Custom Soil Resource Report

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

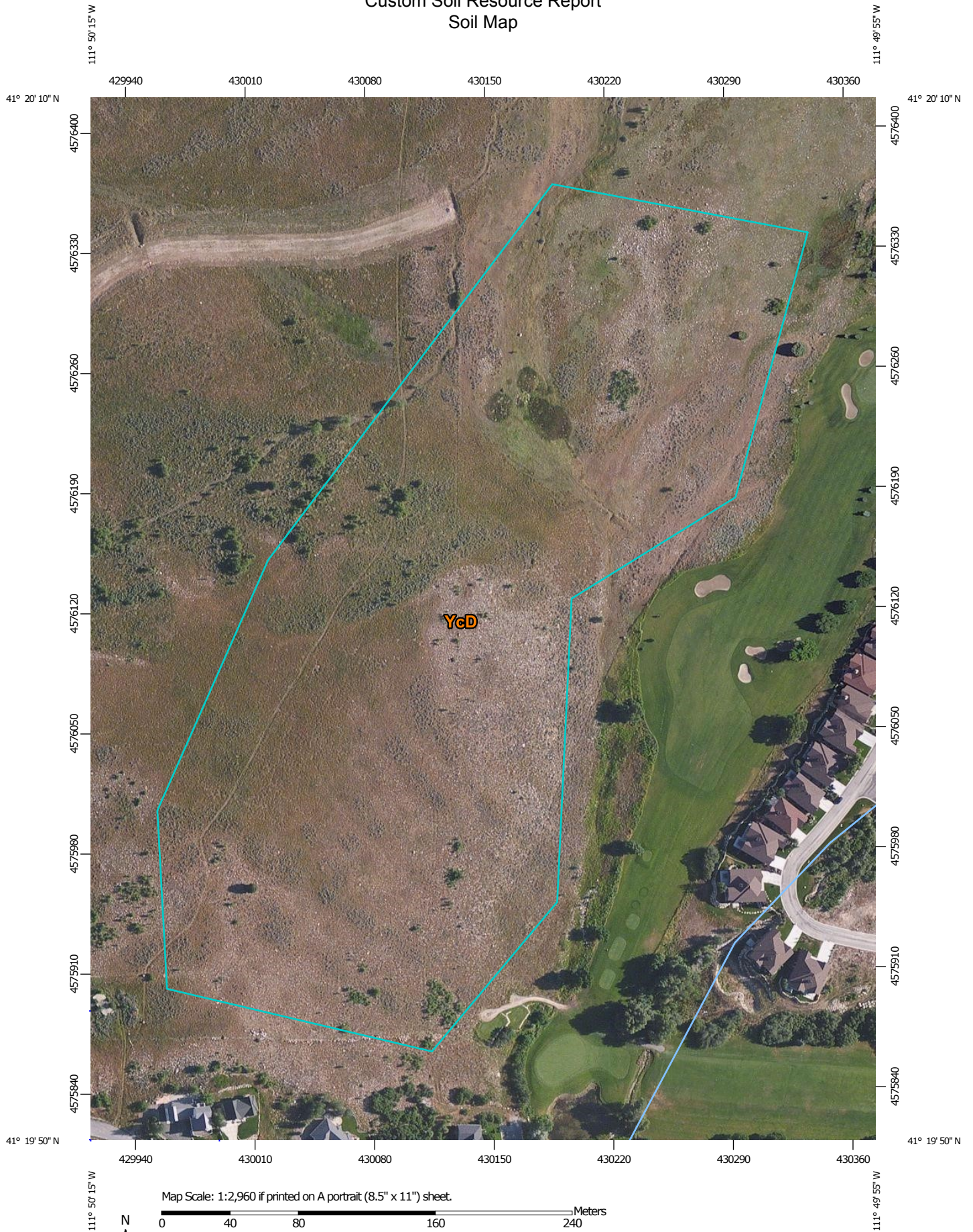


# Soil Map

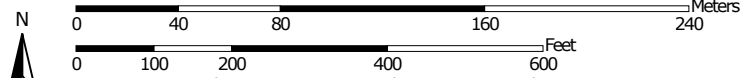
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The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report Soil Map



Map Scale: 1:2,960 if printed on a portrait (8.5" x 11") 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 Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

**Special Point Features**

 Blowout

 Borrow Pit


 Clay Spot


 Closed Depression

 Gravel Pit

 Gravelly Spot


 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip


 Sodic Spot


 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

**Water Features**

 Streams and Canals


**Transportation**

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

**Background**

 Aerial Photography

### 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: Morgan Area, Utah - Morgan County and Part of Weber County  
 Survey Area Data: Version 8, Aug 1, 2014

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 28, 2011

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.

## Map Unit Legend

Morgan Area, Utah - Morgan County and Part of Weber County (UT609)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
YcD	Yeates Hollow very stony loam, 10 to 30 percent slopes	24.8	100.0%
<b>Totals for Area of Interest</b>		<b>24.8</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

## Custom Soil Resource Report

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Morgan Area, Utah - Morgan County and Part of Weber County

### YcD—Yeates Hollow very stony loam, 10 to 30 percent slopes

#### Map Unit Setting

*National map unit symbol:* k06b  
*Mean annual precipitation:* 18 to 22 inches  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Yeates hollow and similar soils:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Yeates Hollow

##### Setting

*Landform:* Alluvial fans, benches, mountainsides  
*Landform position (three-dimensional):* Mountainflank  
*Down-slope shape:* Concave, linear, convex  
*Across-slope shape:* Convex, linear  
*Parent material:* Colluvium and/or slope alluvium over residuum weathered from conglomerate

##### Typical profile

*A1 - 0 to 10 inches:* very stony loam  
*B21t - 10 to 19 inches:* very gravelly loam  
*B22t - 19 to 29 inches:* very gravelly clay loam  
*B23t - 29 to 55 inches:* very gravelly clay loam  
*R - 55 to 59 inches:* unweathered bedrock

##### Properties and qualities

*Slope:* 10 to 30 percent  
*Percent of area covered with surface fragments:* 13.0 percent  
*Depth to restrictive feature:* 40 to 60 inches to lithic bedrock  
*Natural drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 5.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 6s  
*Hydrologic Soil Group:* C  
*Ecological site:* Mountain Gravelly Loam (Mountain Big Sagebrush)  
(R047XA406UT)

#### Minor Components

##### Henefer

*Percent of map unit:* 3 percent

## Custom Soil Resource Report

### **Ant flat**

*Percent of map unit: 3 percent*

### **Holmes**

*Percent of map unit: 3 percent*

### **Lamondi**

*Percent of map unit: 2 percent*

### **Yeates hollow**

*Percent of map unit: 2 percent*

### **Manila**

*Percent of map unit: 2 percent*

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United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>



## Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2\\_054242](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053624](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_052290.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf)

Project: Fairways at Wolf Creek  
 Address:  
 Eden, UT  
 Date: 12//2015

**10-Year Recurrence Interval Storm (Per NOAA Atlas 14)**  
**Site Coordinates: 41.335531, -111.832861**

<u>Time</u> (minutes)	<u>Depth</u> (inches)	<u>Intensity</u> (in/hr)
5	0.339	4.07
10	0.517	3.10
15	0.640	2.56
30	0.862	1.72
60	1.070	1.07
120	1.310	0.66
180	1.420	0.47
360	1.830	0.31
720	2.390	0.20
1440	3.090	0.13

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.160 (0.140-0.184)	0.203 (0.180-0.233)	0.275 (0.241-0.315)	0.339 (0.296-0.390)	0.442 (0.377-0.512)	0.536 (0.444-0.626)	0.647 (0.520-0.765)	0.778 (0.603-0.940)	0.992 (0.726-1.24)	1.19 (0.831-1.53)
10-min	0.244 (0.214-0.280)	0.308 (0.274-0.355)	0.418 (0.367-0.478)	0.517 (0.450-0.594)	0.673 (0.573-0.778)	0.815 (0.676-0.953)	0.984 (0.791-1.17)	1.18 (0.917-1.43)	1.51 (1.10-1.88)	1.82 (1.26-2.33)
15-min	0.302 (0.265-0.347)	0.382 (0.339-0.440)	0.518 (0.455-0.594)	0.640 (0.558-0.735)	0.834 (0.711-0.965)	1.01 (0.837-1.18)	1.22 (0.980-1.44)	1.47 (1.14-1.77)	1.87 (1.37-2.33)	2.25 (1.57-2.88)
30-min	0.407 (0.357-0.467)	0.514 (0.457-0.593)	0.697 (0.613-0.800)	0.862 (0.751-0.991)	1.12 (0.957-1.30)	1.36 (1.13-1.59)	1.64 (1.32-1.94)	1.98 (1.53-2.39)	2.52 (1.84-3.14)	3.03 (2.11-3.88)
60-min	0.503 (0.442-0.578)	0.637 (0.565-0.734)	0.863 (0.758-0.991)	1.07 (0.930-1.23)	1.39 (1.18-1.61)	1.68 (1.40-1.97)	2.03 (1.63-2.41)	2.44 (1.90-2.96)	3.12 (2.28-3.89)	3.75 (2.61-4.81)
2-hr	0.671 (0.589-0.761)	0.842 (0.750-0.954)	1.08 (0.961-1.23)	1.31 (1.15-1.49)	1.68 (1.45-1.93)	2.02 (1.70-2.33)	2.42 (1.97-2.83)	2.89 (2.27-3.46)	3.65 (2.70-4.50)	4.36 (3.08-5.50)
3-hr	0.774 (0.698-0.864)	0.959 (0.865-1.07)	1.20 (1.07-1.33)	1.42 (1.26-1.59)	1.77 (1.55-2.00)	2.10 (1.80-2.40)	2.50 (2.09-2.89)	2.96 (2.40-3.49)	3.72 (2.86-4.50)	4.41 (3.26-5.56)
6-hr	1.07 (0.983-1.18)	1.31 (1.20-1.44)	1.58 (1.44-1.74)	1.83 (1.65-2.02)	2.19 (1.96-2.44)	2.50 (2.21-2.81)	2.85 (2.48-3.24)	3.25 (2.76-3.73)	4.02 (3.30-4.72)	4.71 (3.77-5.66)
12-hr	1.40 (1.28-1.54)	1.72 (1.57-1.89)	2.07 (1.89-2.29)	2.39 (2.16-2.64)	2.86 (2.55-3.18)	3.25 (2.86-3.65)	3.67 (3.17-4.16)	4.11 (3.49-4.73)	4.80 (3.96-5.64)	5.35 (4.30-6.42)
24-hr	1.85 (1.67-2.05)	2.27 (2.05-2.51)	2.72 (2.45-3.01)	3.09 (2.79-3.42)	3.61 (3.24-3.99)	4.01 (3.58-4.43)	4.42 (3.94-4.89)	4.84 (4.29-5.35)	5.41 (4.76-6.00)	5.85 (5.11-6.50)
2-day	2.23 (2.02-2.49)	2.74 (2.49-3.06)	3.28 (2.96-3.66)	3.73 (3.36-4.15)	4.34 (3.90-4.83)	4.82 (4.30-5.37)	5.31 (4.72-5.91)	5.80 (5.13-6.47)	6.46 (5.67-7.22)	6.96 (6.07-7.81)
3-day	2.53 (2.29-2.82)	3.11 (2.81-3.46)	3.74 (3.38-4.16)	4.26 (3.84-4.74)	4.99 (4.47-5.54)	5.55 (4.95-6.17)	6.13 (5.45-6.81)	6.72 (5.94-7.49)	7.52 (6.59-8.40)	8.14 (7.08-9.12)
4-day	2.83 (2.56-3.15)	3.48 (3.15-3.87)	4.20 (3.79-4.66)	4.80 (4.32-5.33)	5.63 (5.04-6.24)	6.28 (5.60-6.97)	6.95 (6.17-7.72)	7.64 (6.75-8.51)	8.58 (7.50-9.58)	9.31 (8.08-10.4)
7-day	3.53 (3.17-3.96)	4.34 (3.90-4.88)	5.23 (4.68-5.87)	5.96 (5.33-6.70)	6.97 (6.22-7.83)	7.76 (6.90-8.73)	8.58 (7.58-9.65)	9.41 (8.27-10.6)	10.5 (9.18-11.9)	11.4 (9.86-13.0)
10-day	4.04 (3.64-4.54)	4.97 (4.48-5.58)	5.96 (5.35-6.68)	6.75 (6.05-7.57)	7.80 (6.98-8.74)	8.59 (7.66-9.63)	9.38 (8.34-10.5)	10.2 (9.00-11.4)	11.2 (9.85-12.6)	12.0 (10.5-13.6)
20-day	5.34 (4.82-5.83)	6.57 (5.82-7.29)	7.79 (7.02-8.65)	8.74 (7.86-9.70)	9.96 (8.94-11.0)	10.8 (9.71-12.0)	11.7 (10.5-13.0)	12.5 (11.2-13.9)	13.6 (12.0-15.1)	14.3 (12.7-16.0)
30-day	6.54 (5.94-7.24)	8.03 (7.29-8.89)	9.47 (8.60-10.5)	10.6 (9.60-11.7)	12.0 (10.9-13.3)	13.1 (11.8-14.5)	14.1 (12.7-15.7)	15.1 (13.6-16.8)	16.3 (14.6-18.2)	17.2 (15.3-19.3)
45-day	8.23 (7.48-9.05)	10.1 (9.16-11.1)	11.9 (10.8-13.0)	13.3 (12.0-14.6)	15.1 (13.6-16.6)	16.4 (14.8-18.0)	17.7 (15.9-19.5)	19.0 (17.0-20.9)	20.6 (18.3-22.7)	21.7 (19.3-24.1)
60-day	9.62 (8.77-10.5)	11.8 (10.8-12.9)	13.9 (12.6-15.2)	15.5 (14.1-16.9)	17.5 (15.9-19.2)	18.9 (17.2-20.8)	20.4 (18.4-22.4)	21.7 (19.6-23.9)	23.4 (21.0-25.8)	24.6 (22.0-27.2)

<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.

Estimates from the table in csv format:

Project: Fairways at Wolf Creek  
 Address:  
 Eden, UT  
 Date: 12//2015

**100-Year Recurrence Interval Storm (Per NOAA Atlas 14)**  
**Site Coordinates: 41.335531, -111.832861**

<u>Time</u> (minutes)	<u>Depth</u> (inches)	<u>Intensity</u> (in/hr)
5	0.647	7.76
10	0.984	5.90
15	1.220	4.88
30	1.640	3.29
60	2.030	2.03
120	2.420	1.21
180	2.500	0.83
360	2.850	0.48
720	3.670	0.30
1440	4.420	0.18

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.160 (0.140-0.184)	0.203 (0.180-0.233)	0.275 (0.241-0.315)	0.339 (0.296-0.390)	0.442 (0.377-0.512)	0.536 (0.444-0.626)	0.647 (0.520-0.765)	0.778 (0.603-0.940)	0.992 (0.726-1.24)	1.19 (0.831-1.53)
10-min	0.244 (0.214-0.280)	0.308 (0.274-0.355)	0.418 (0.367-0.479)	0.517 (0.450-0.594)	0.673 (0.573-0.778)	0.815 (0.676-0.953)	0.984 (0.791-1.17)	1.18 (0.917-1.43)	1.51 (1.10-1.88)	1.82 (1.26-2.33)
15-min	0.302 (0.265-0.347)	0.382 (0.339-0.440)	0.518 (0.455-0.594)	0.640 (0.559-0.735)	0.834 (0.711-0.965)	1.01 (0.837-1.18)	1.22 (0.980-1.44)	1.47 (1.14-1.77)	1.87 (1.37-2.33)	2.25 (1.57-2.88)
30-min	0.407 (0.357-0.467)	0.514 (0.457-0.593)	0.697 (0.613-0.800)	0.862 (0.751-0.991)	1.12 (0.957-1.30)	1.36 (1.13-1.59)	1.64 (1.32-1.94)	1.98 (1.53-2.39)	2.52 (1.84-3.14)	3.03 (2.11-3.88)
60-min	0.503 (0.442-0.578)	0.637 (0.565-0.734)	0.863 (0.758-0.991)	1.07 (0.930-1.23)	1.39 (1.18-1.61)	1.68 (1.40-1.97)	2.03 (1.63-2.41)	2.44 (1.90-2.96)	3.12 (2.28-3.89)	3.75 (2.61-4.81)
2-hr	0.671 (0.599-0.761)	0.842 (0.750-0.954)	1.08 (0.961-1.23)	1.31 (1.15-1.49)	1.68 (1.45-1.93)	2.02 (1.70-2.33)	2.42 (1.97-2.83)	2.89 (2.27-3.46)	3.65 (2.70-4.50)	4.36 (3.08-5.50)
3-hr	0.774 (0.698-0.864)	0.959 (0.865-1.07)	1.20 (1.07-1.33)	1.42 (1.26-1.59)	1.77 (1.55-2.00)	2.10 (1.80-2.40)	2.50 (2.09-2.89)	2.96 (2.40-3.49)	3.72 (2.86-4.50)	4.41 (3.26-5.56)
6-hr	1.07 (0.983-1.18)	1.31 (1.20-1.44)	1.58 (1.44-1.74)	1.83 (1.65-2.02)	2.19 (1.96-2.44)	2.50 (2.21-2.81)	2.85 (2.48-3.24)	3.25 (2.76-3.73)	4.02 (3.30-4.72)	4.71 (3.77-5.66)
12-hr	1.40 (1.28-1.54)	1.72 (1.57-1.89)	2.07 (1.89-2.29)	2.39 (2.16-2.64)	2.86 (2.55-3.18)	3.25 (2.88-3.65)	3.67 (3.17-4.16)	4.11 (3.49-4.73)	4.80 (3.96-5.64)	5.35 (4.30-6.42)
24-hr	1.85 (1.67-2.05)	2.27 (2.05-2.51)	2.72 (2.45-3.01)	3.09 (2.79-3.42)	3.61 (3.24-3.99)	4.01 (3.58-4.43)	4.42 (3.94-4.89)	4.84 (4.29-5.35)	5.41 (4.76-6.00)	5.85 (5.11-6.50)
2-day	2.23 (2.02-2.49)	2.74 (2.49-3.06)	3.28 (2.96-3.66)	3.73 (3.36-4.15)	4.34 (3.90-4.83)	4.82 (4.30-5.37)	5.31 (4.72-5.91)	5.80 (5.13-6.47)	6.46 (5.67-7.22)	6.96 (6.07-7.81)
3-day	2.53 (2.29-2.82)	3.11 (2.81-3.46)	3.74 (3.38-4.16)	4.26 (3.84-4.74)	4.99 (4.47-5.54)	5.55 (4.95-6.17)	6.13 (5.45-6.81)	6.72 (5.94-7.49)	7.52 (6.59-8.40)	8.14 (7.08-9.12)
4-day	2.83 (2.56-3.15)	3.48 (3.15-3.87)	4.20 (3.79-4.66)	4.80 (4.32-5.33)	5.63 (5.04-6.24)	6.28 (5.60-6.97)	6.95 (6.17-7.72)	7.64 (6.75-8.51)	8.58 (7.50-9.58)	9.31 (8.08-10.4)
7-day	3.53 (3.17-3.96)	4.34 (3.90-4.88)	5.23 (4.68-5.87)	5.96 (5.33-6.70)	6.97 (6.22-7.83)	7.76 (6.90-8.73)	8.58 (7.58-9.65)	9.41 (8.27-10.6)	10.5 (9.18-11.9)	11.4 (9.86-13.0)
10-day	4.04 (3.64-4.54)	4.97 (4.48-5.58)	5.96 (5.35-6.68)	6.75 (6.05-7.57)	7.80 (6.98-8.74)	8.59 (7.66-9.63)	9.38 (8.34-10.5)	10.2 (9.00-11.4)	11.2 (9.85-12.6)	12.0 (10.5-13.6)
20-day	5.34 (4.82-5.93)	6.57 (5.92-7.29)	7.79 (7.02-8.65)	8.74 (7.86-9.70)	9.96 (8.94-11.0)	10.8 (9.71-12.0)	11.7 (10.5-13.0)	12.5 (11.2-13.9)	13.6 (12.0-15.1)	14.3 (12.7-16.0)
30-day	6.54 (5.94-7.24)	8.03 (7.29-8.89)	9.47 (8.60-10.5)	10.6 (9.60-11.7)	12.0 (10.9-13.3)	13.1 (11.8-14.5)	14.1 (12.7-15.7)	15.1 (13.6-16.8)	16.3 (14.6-18.2)	17.2 (15.3-19.3)
45-day	8.23 (7.48-9.05)	10.1 (9.16-11.1)	11.9 (10.8-13.0)	13.3 (12.0-14.6)	15.1 (13.6-16.6)	16.4 (14.8-18.0)	17.7 (15.9-19.5)	19.0 (17.0-20.9)	20.6 (18.3-22.7)	21.7 (19.3-24.1)
60-day	9.62 (8.77-10.5)	11.8 (10.9-12.9)	13.9 (12.6-15.2)	15.5 (14.1-16.9)	17.5 (15.9-19.2)	18.9 (17.2-20.8)	20.4 (18.4-22.4)	21.7 (19.6-23.9)	23.4 (21.0-25.8)	24.6 (22.0-27.2)

<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.

Estimates from the table in csv format: [precipitation frequency estimates](#)

Project: Fairways at Wolf Creek

Address:

Eden, UT

Date: 12//2015

### Site Percent Impervious and Runoff Coefficients

Basin	Land Use	Percent Impervious	Area (FT <sup>2</sup> )	Area (Ac.)	Soil Type	Composite C <sub>2</sub>	Composite C <sub>5</sub>	Composite C <sub>10</sub>	Composite C <sub>100</sub>
A1	Paved Areas	100%	41,504	0.95		0.87	0.88	0.90	0.93
	Roofs	90%	55,200	1.27		0.80	0.85	0.90	0.90
	Landscape	2%	314,851	7.23		0.10	0.11	0.13	0.15
	<b>TOTAL</b>	<b>24%</b>	<b>411,555</b>	<b>9.448</b>	<b>B</b>	<b>0.27</b>	<b>0.29</b>	<b>0.31</b>	<b>0.33</b>
B1	Paved Areas	100%	36,800	0.84		0.87	0.88	0.90	0.93
	Roofs	90%	40,800	0.94		0.80	0.85	0.90	0.90
	Landscape	2%	199,377	4.58		0.10	0.11	0.13	0.15
	<b>TOTAL</b>	<b>28%</b>	<b>276,977</b>	<b>6.359</b>	<b>B</b>	<b>0.31</b>	<b>0.32</b>	<b>0.35</b>	<b>0.36</b>



Project: Fairways at Wolf Creek

Address:

Eden, UT

Date: 12//2015

**Basin A - 10 year**

Site Area = 9.448 Acres

Runoff Coefficient = 0.310

Allowable Release = 0.945 cfs

10-Year Storm: NOAA				Maximum Allowable Discharge =			0.945cfs
Time (min)	Rate (in/hr)	Rainfall (Inches)	Q in (cfs)	Add. Q in (cfs)	Total Q in (cfs)	Q out (cfs)	Storage (cf)
5	4.068	0.339	11.915	0.00	11.915	0.945	3,291.0
10	3.102	0.517	9.085	0.00	9.085	0.945	4,884.4
15	2.560	0.640	7.498	0.00	7.498	0.945	5,897.9
30	1.724	0.862	5.049	0.00	5.049	0.945	7,388.3
60	1.070	1.070	3.134	0.00	3.134	0.945	7,880.8
120	0.655	1.310	1.918	0.00	1.918	0.945	7,010.1
180	0.473	1.420	1.386	0.00	1.386	0.945	4,768.6
360	0.305	1.830	0.893	0.00	0.893	0.945	-1,112.2
720	0.199	2.390	0.583	0.00	0.583	0.945	-15,615.4
1440	0.129	3.090	0.377	0.00	0.377	0.945	-49,050.3

Required Storage = 7,881 C.F.

Provided Storage = 22,000 C.F.

**Basin B - 10 year**

Site Area = 6.359 Acres  
 Runoff Coefficient = 0.350  
 Allowable Release = 0.636 cfs

10-Year Storm: NOAA				Maximum Allowable Discharge =			0.636cfs
Time (min)	Rate (in/hr)	Rainfall (Inches)	Q in (cfs)	Add. Q in (cfs)	Total Q in (cfs)	Q out (cfs)	Storage (cf)
5	4.068	0.339	9.053	0.00	9.053	0.636	2,525.2
10	3.102	0.517	6.903	0.00	6.903	0.636	3,760.6
15	2.560	0.640	5.697	0.00	5.697	0.636	4,555.3
30	1.724	0.862	3.837	0.00	3.837	0.636	5,761.6
60	1.070	1.070	2.381	0.00	2.381	0.636	6,283.5
120	0.655	1.310	1.458	0.00	1.458	0.636	5,917.3
180	0.473	1.420	1.053	0.00	1.053	0.636	4,509.5
360	0.305	1.830	0.679	0.00	0.679	0.636	927.1
720	0.199	2.390	0.443	0.00	0.443	0.636	-8,320.8
1440	0.129	3.090	0.287	0.00	0.287	0.636	-30,181.6

Required Storage = **6,284 C.F.**  
 Provided Storage = **8,800 C.F.**



Project: Fairways at Wolf Creek  
 Address:  
 Eden, UT  
 Date: 12//2015

**Phase 4 (Basin A) - 100 year**

Site Area = 9.448 Acres  
 Runoff Coefficient = 0.330  
 Allowable Release = 0.947 cfs

100-Year Storm: NOAA				Maximum Allowable Discharge =			0.947cfs
Time (min)	Rate (in/hr)	Rainfall (Inches)	Q in (cfs)	Add. Q in (cfs)	Total Q in (cfs)	Q out (cfs)	Storage (cf)
5	7.764	0.647	24.207	0.00	24.207	0.9	6,978.0
10	5.904	0.984	18.408	0.00	18.408	0.9	10,476.5
15	4.880	1.220	15.215	0.00	15.215	0.9	12,841.4
30	3.280	1.640	10.227	0.00	10.227	0.9	16,703.3
60	2.030	2.030	6.329	0.00	6.329	0.9	19,376.2
120	1.210	2.420	3.773	0.00	3.773	0.9	20,344.4
180	0.833	2.500	2.598	0.00	2.598	0.9	17,833.2
360	0.475	2.850	1.481	0.00	1.481	0.9	11,534.1
720	0.306	3.670	0.954	0.00	0.954	0.9	282.8
1440	0.184	4.420	0.574	0.00	0.574	0.9	-32,209.3

Required Storage = **20,344 C.F.**  
 Provided Storage = **22,000 C.F.**

**Phase 5 (Basin B) - 100 yr**

Site Area = 6.359 Acres  
 Runoff Coefficient = 0.360  
 Allowable Release = 0.633 cfs

100-Year Storm: NOAA				Maximum Allowable Discharge =			0.633cfs
Time (min)	Rate (in/hr)	Rainfall (Inches)	Q in (cfs)	Add. Q in (cfs)	Total Q in (cfs)	Q out (cfs)	Storage (cf)
5	7.764	0.647	17.772	0.0	17.772	0.633	5,141.8
10	5.904	0.984	13.515	0.0	13.515	0.633	7,729.1
15	4.880	1.220	11.171	0.0	11.171	0.633	9,484.0
30	3.280	1.640	7.508	0.0	7.508	0.633	12,375.4
60	2.030	2.030	4.647	0.0	4.647	0.633	14,449.8
120	1.210	2.420	2.770	0.0	2.770	0.633	15,384.9
180	0.833	2.500	1.908	0.0	1.908	0.633	13,765.4
360	0.475	2.850	1.087	0.0	1.087	0.633	9,813.2
720	0.306	3.670	0.700	0.0	0.700	0.633	2,897.8
1440	0.184	4.420	0.422	0.0	0.422	0.633	-18,267.3

Required Storage = **15,385 C.F.**  
 Provided Detention Storage = **8,800 C.F.**  
 Provided Retention Storage = **0,000 C.F.**  
 Total Provided Storage = **8,800 C.F.**