HYDROLOGY AND FLOOD INUNDATION STUDY

POWERS BUTTE SOLAR PROJECT
ADA & CANYON COUNTY, IDAHO
KLEINFELDER PROJECT NO: 24001535.001A

January 4, 2024

A Report Prepared for:

Savion Energy
422 Admiral Blvd
Kansas City, MO 64106

HYDROLOGY AND FLOOD INUNDATION STUDY
POWERS BUTTE SOLAR PROJECT
ADA & CANYON COUNTY, IDAHO

Prepared by:

Nora Barto
Staff Engineer

Reviewed by:

Jason Calhoun, PE
Project Manager II

KLEINFELDER
3200 Gateway Centre Blvd, Suite 100
Morrisville, NC 27560
Phone: 919.755.5011

January 4, 2024

Kleinfelder Project No.: 24001535.001A

TABLE OF CONTENTS

TABLES

APPENDICES

HYDROLOGY AND FLOOD INUNDATION REPORT

POWERS BUTTE SOLAR PROJECT

ADA & CANYON COUNTY, IDAHO

1 EXECUTIVE SUMMARY

Savion Energy (Savion) is considering development of a 205 MW AC solar energy facility, located in Ada and Canyon County, Idaho. The property is located along Southside Boulevard, approximately 20 miles southwest of Boise, Idaho.

The project is located on approximately 2,385 acres of property and will include ground-mounted solar photovoltaic (PV) arrays and underground electrical conduits. Ancillary construction will consist of gravel access roads, perimeter fence, and pads for power transformers, inverters, and switchgear.

Hydrologic and hydraulic modeling analyses were performed to evaluate maximum flood depths, velocities and scour potential for the 100-year, 24-hour storm event associated with the pre-development condition of the proposed project area.

This report represents the pre-development hydrologic and hydraulic model results for the site. The pre-development hydrologic and hydraulic model results are based on publicly available data described herein. Flood depths range from 0 to 1.5 feet and flood velocities range from 0 to 3 feet per second (fps) within the project area.

2 INTRODUCTION

2.1 PROJECT DESCRIPTION

The proposed solar site is approximately 2,385 acres and located along the Ada and Canyon County line, south of Stage Coach Road and east of Southside Boulevard. Refer to **Appendix A** for the location map.

The topography in the project area contains elevations ranging from approximately 2,722 to 2,906 feet – NAVD 88. All elevations listed in this report and provided in appendices are referenced to NAVD 88 unless otherwise noted.

2.2 DESIGN DATA AND METHODOLOGIES

Based on a review of the FEMA Flood Insurance Rate Map (FIRM)[1] panel 16001C0375G (effective February 19, 2003) and panel 16001C0400J (effective October 2, 2003), the project site is within FEMA unshaded Zone X floodplain. Zone X floodplains are at minimal risk of inundation. **Appendix B** shows the project boundary with the FEMA floodplain delineation obtained from the online FEMA mapping database.

The stormwater analyses of the proposed solar site were conducted in accordance with the Boise Stormwater Design Manual[2]. Rainfall data at the project site for the design storm events was obtained from the NOAA Atlas 2 Precipitation Frequency Database[3]. **Appendix C** shows the rainfall depth data used for the study area. Type II 24-hour rainfall distribution was utilized for the 100-year, 24-hour storm event and average moisture conditions were utilized in all simulations.

Soil data was obtained from the National Resources Conservation Service (NRCS) Web Soil Survey[4] database to determine soil type and runoff parameters. Refer to **Appendix D** for the soil types and hydrologic soil groups (HSG) defined in the study area. Soils within the study area generally have moderately high runoff potential. The most common HSG in the study area is soil group C. For this analysis, dual class soil groups were modeled as soil group D.

Topographic LiDAR (Light Detection and Ranging) Digital Elevation Model (DEM) was downloaded for the study area from the United States Geological Survey (USGS) data portal[5]. The elevation data was collected in 2018 and published in 2019. The DEM elevations were converted from meters to feet. This best available USGS LiDAR data has 13 arc-second resolution, which resulted in a DEM with approximately 29 by 29 feet cell size. The DEM lacks definition at this resolution to show the elevations of features like ditches and roads within the project area. The DEM also included some interpolation artifacts in the eastern portion of the project area. A site-specific topographic survey is recommended to update the flood analysis as design progresses.

Land use and cover data were obtained from the 2019 National Land Cover Dataset (NLCD)[6]. Curve numbers for the study area were selected using the NRCS hydrologic soil groups, land use/land cover data for the pre-development conditions and the Urban Hydrology for Small Watersheds TR-55[7] manual, as directed by the Boise Stormwater Design Manual.

Kleinfelder conducted a site visit on July 20, 2023, to observe existing conditions and site drainage considerations.

3 PRE-DEVELOPMENT FLOOD STUDY

A hydrologic and hydraulic analysis was performed on the existing conditions of the proposed solar site to determine flooding depths and velocities during the 100-year 24-hour storm. The total flood model area is approximately 16,858 acres and includes upstream drainage areas that generate runoff to the project and downstream areas to simulate any tailwater conditions that may impact flooding onsite.

The study area topography includes butte landforms in otherwise mildly sloping topography. The majority of the existing landcover is cultivated crops and herbaceous, with smaller areas of shrub/ scrub and hay/pasture.

Onsite culvert sizes, material and condition were verified during the site visit. The USGS DEM utilized for the analyses did not contain some roads noted within Google Earth imagery and the site visit, which precluded the inclusion of some culverts. It is recommended that the analyses are updated after a topographic survey of the site is conducted, which may result in changes to the findings and therefore conclusions.

The pre-development flood analyses were simulated using the computer modeling software HEC-RAS[8]. HEC-RAS is a computer design program for modeling the hydraulics of open channel systems. The 2-dimensional (2D) capabilities of HEC-RAS version 6.4.1 were utilized for the solar site. HEC-RAS 2D can simulate water flow in multiple directions over large terrain. The topography used in the pre-development flood study is described in Section 2.2.

Variable Manning's 'n' values are utilized to represent ground roughness across the site. Manning's 'n' values were estimated based on pre-development land cover. Manning's 'n' values from NLCD types, which range from 0.027 to 0.16, were developed from the Boise Stormwater Design Manual Table G-5, with values from any excluded types developed using the HEC-RAS 2D Modeling User's Manual Table 2-19. Refer to Table 3-1 for Manning's 'n' values used in the analysis.

TABLE 3-1: MANNING'S 'N' VALUES

MANNING'S 'n'	LAND COVER DESCRIPTION
0.027	Barren Land
0.03	Hay/Pasture
0.035	Cultivated Crops
0.038	Herbaceous, Open Water
0.04	Developed, Open Space
0.06	Shrub/Scrub
0.09	Developed, Low Intensity
0.12	Developed, Medium Intensity
0.16	Developed, High Intensity

A computational mesh made up of 100-foot cells was generated to conduct the analysis. Hydraulic breaklines were utilized at locations of hydraulic barriers (roads) and major conveyance locations (ditches, streams) discernable in the DEM. A variable computational time-step based on the Courant number was utilized to increase model efficiency. A Courant number-based time-step allows the model to adjust to large inflows or outflows throughout the simulation. The Full Momentum equations were utilized. The model was run for a simulation time of 48 hours, which allows the peak stage to pass through the entire study area after the 24-hour duration storm.

The hydrologic analysis of the flood model area was conducted using the NRCS Curve Number method. Kleinfelder utilized the 'Infiltration Layer' functionality within HEC-RAS to create a spatially variable representation of infiltration capacity and runoff generation within the study area. The NRCS Infiltration Method within HEC-RAS uses a unique curve number assigned to each land cover and soil type combination, and an abstraction ratio, to calculate the runoff from each cell within the model. An abstraction ratio of 0.2 was used for the study area.

Normal depth and precipitation boundary conditions were utilized for the analysis. Normal depth slope boundary conditions were used in locations where water is expected to leave the site and are based on the terrain slope. The precipitation hyetograph is based on NOAA Atlas 2 rainfall depths for the design storm and SCS Type II rainfall distribution, discussed above.

Flood depths are less than 1.5 feet during the design simulation, with most of the project area inundated by less than 0.5 feet. Velocities within the project area range from 0 to 3 feet per second (fps).

A scour analysis was performed on the study area to determine locations of scour potential at array piers during the design storms in the existing condition. The scour analysis utilized the maximum depth and velocity results of the pre-development HEC-RAS flood model.

Kleinfelder utilized the HEC-18 pier scour Equation 7.1 provided in Hydraulic Engineering Circular No. 18: Evaluating Scour at Bridges Fifth Edition[10] to assess scour potential surrounding the solar panel support piles. The HEC-18 pier scour equation is recommended for live-bed and clear-water pier scour and predicts maximum scour depths. Maximum Froude number and flood depth raster files were generated from the HEC-RAS flood model results and used in the scour calculations. This method can yield conservative scour estimates as it assumes the maximum flood depth and velocity occur at the same time, which may not be true onsite. Equation variable inputs and assumptions are listed in **Table 3-2**.

HEC-18 Equation 7.1

$$\frac{y_s}{y_1} = 2.0\ K_1\ K_2\ K_3 \left(\frac{a}{y_1}\right)^{0.65} Fr_1^{0.43}$$

y_s = Scour depth, ft (m)
y_1 = Flow depth directly upstream of the pier, ft (m)
K_1 = Correction factor for pier nose shape from Figure 7.3 and Table 7.1
K_2 = Correction factor for angle of attack of flow from Table 7.2 or Equation 7.4
K_3 = Correction factor for bed condition from Table 7.3
a = Pier width, ft (m)
L = Length of pier, ft (m)
Fr_1 = Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$
V_1 = Mean velocity of flow directly upstream of the pier, ft/s (m/s)
g = Acceleration of gravity (32.2 ft/s^2) (9.81 m/s^2)

TABLE 3-2: PIER SCOUR EQUATION ASSUMPTIONS

VARIABLE	INPUT	ASSUMPTION
y1	HEC-RAS depth (ft)	Maximum flood depth
K1	1.1	Square nose pier
K2	1.125	Skew angle of flow is 30 degrees
K3	1.1	Clear water scour
a	6-inch	W-pile dimension
L	4-inch	W-pile dimension

Scour calculations estimate that most of the project area is expected to experience less than 1.5 feet of scour. Areas of higher scour potential are located within deeper flood waters.

Kleinfelder recommends stabilizing all areas with velocities exceeding 2-fps with erosion control blanket and seeding for grass to grow. In areas with velocities exceeding 5 fps, using rip rap in place of the erosion control blanket and seeding to avoid excessive washout is recommended. Grading and longer pile-heights can be implemented in areas where flooding exceeds allowable depths.

4 REFERENCES

1. Federal Emergency Management Agency. Flood Insurance Rate Maps and 100-year Floodplain Delineation from Web Database.
   Available at https://msc.fema.gov/portal/advanceSearch

2. City of Boise Public Works. 2018. Boise Stormwater Design Manual.

3. National Oceanic and Atmospheric Administration. Atlas 14, Volume 8, Version 2. Precipitation Frequency Data Server.
   Available at: https://hdsc.nws.noaa.gov/hdsc/pfds/

4. U.S. Department of Agriculture. Natural Resources Conservation Service. *Web Soil Survey.*
   Available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

5. U.S. Geological Survey (USGS), National Elevation Dataset.
   Located at: https://viewer.nationalmap.gov/basic/

6. U.S. Geological Survey (USGS). 2019. National Land Cover Database (NLCD).
   Available at: https://www.mrlc.gov/data

7. U.S. Department of Agriculture, Natural Resources Conservation Service. 1986. *Urban Hydrology for Small Watersheds TR-55*.

8. U.S. Army Corps of Engineers. Hydrologic Engineering Center. March 2022. *HEC-RAS Version 6.4.1.*

9. HEC-RAS 2D Modeling User's Manual, Version 6.0, May 2021. Table 2-1 Page 2-21 to 2-23.

10. U.S. Department of Transportation Federal Highway Administration. Evaluating Scour at Bridges: Fifth Edition. April 2012.

5 LIMITATIONS

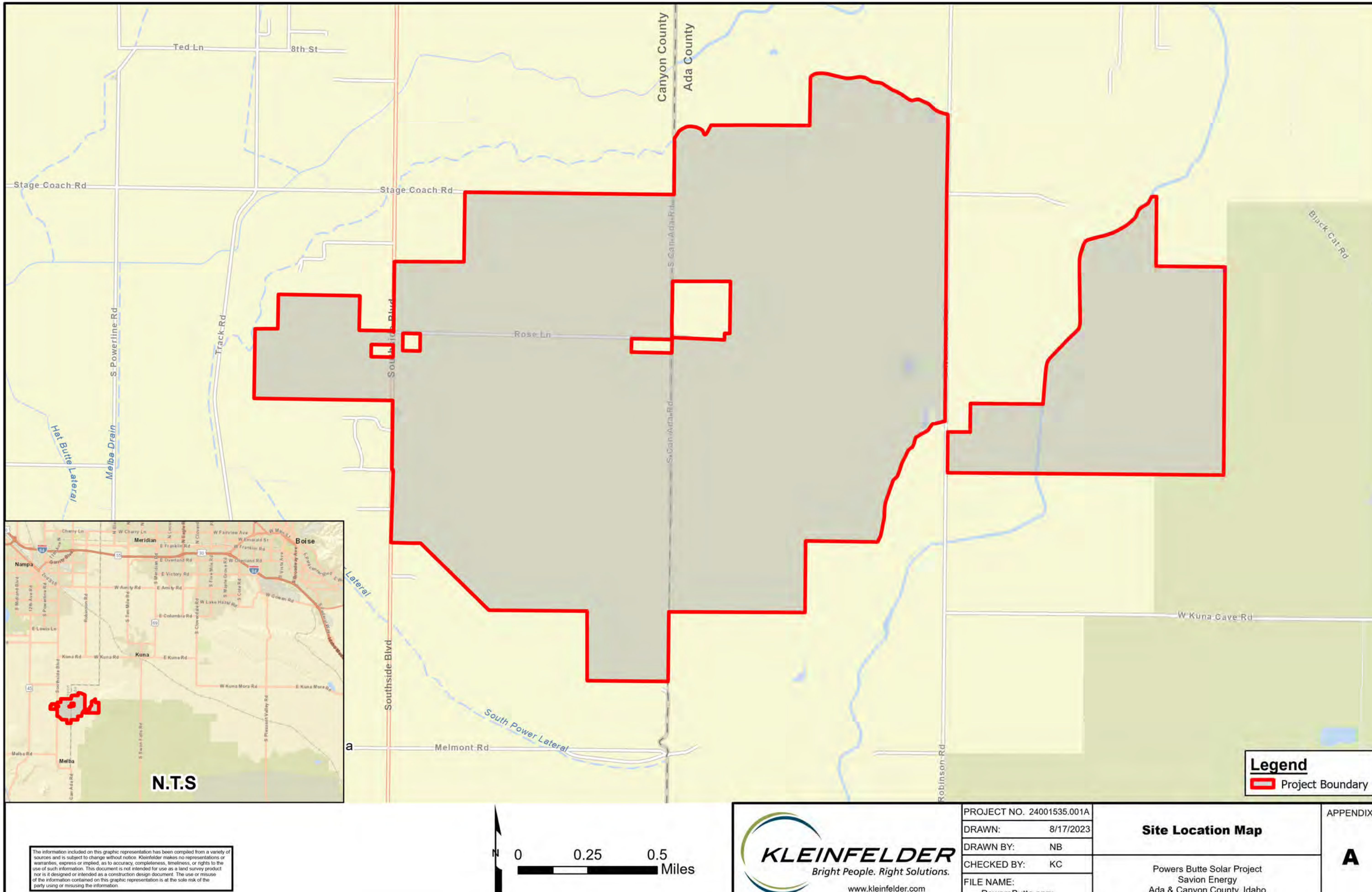
This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data known to date. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

The science of climate change and translating climate risks into design criteria are new and evolving practices, involving many uncertainties. The projections made in this report only reflect the professional judgment of the Project Team applying a standard of care consistent with the level of care and skill of other professionals undertaking similar work in the same locality under similar conditions at the date the services are provided. For these reasons, the recommendations, predictions, and projections made within this report provide guidelines based on the knowledge available to Kleinfelder as of the date provided based on Kleinfelder's review of the resources identified herein. Any predictions or projections made in this report are not guaranteed predictions or projections of future events. The nature and climate impacts may differ significantly from predictions based on currently available data. Kleinfelder recommends that the results of these evaluations be updated over time as science, data, and modeling techniques advance. Unless so engaged, Kleinfelder disclaims any undertaking to update these predictions in the future. Any reliance upon maps or data presented herein used to make decisions or conclusions is at the sole discretion and risk of the user. This information is provided with the understanding that the data is not guaranteed to be accurate, correct, or complete and assumes no responsibility for errors or omissions. This report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report.

The work performed was based on project information provided by Client and publicly available information. This work is preliminary in nature and not intended to be used for permitting, design, or construction.

APPENDIX A

SITE LOCATION MAP



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	24001535.001A
DRAWN:	8/17/2023
DRAWN BY:	NB
CHECKED BY:	KC
FILE NAME:	PowersButte.aprx

Site Location Map

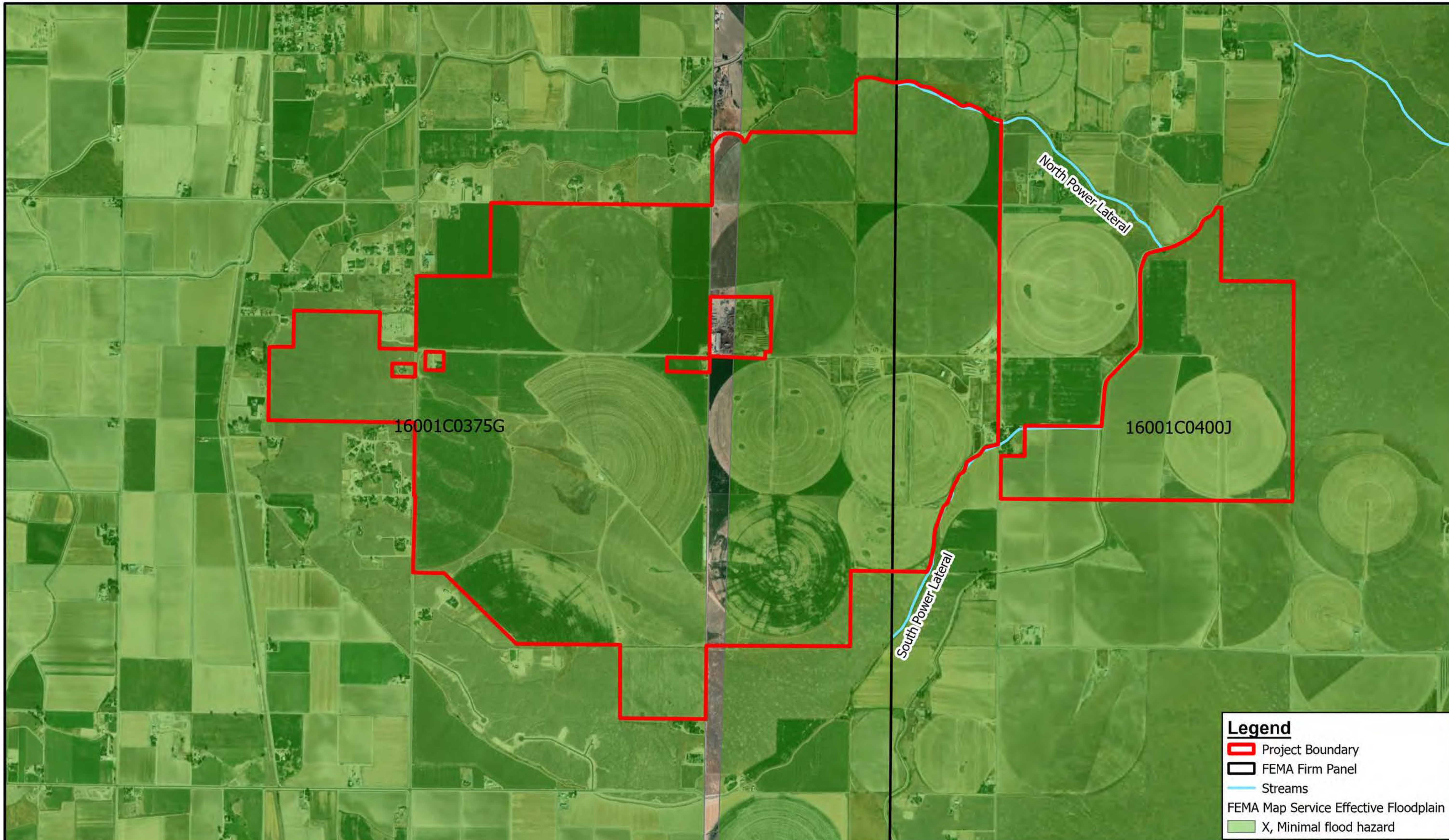
Powers Butte Solar Project
Savion Energy
Ada & Canyon County, Idaho

APPENDIX

A

APPENDIX B

FLOODPLAIN MAP



KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT NO.	24001535.001A
DRAWN:	8/17/2023
DRAWN BY:	NB
CHECKED BY:	KC
FILE NAME:	PowersButte.aprx

FEMA Floodplain Map

Powers Butte Solar Project
Savion Energy
Ada & Canyon County, Idaho

APPENDIX

B

APPENDIX C

PRECIPITATION DATA

Precipitation Frequency Data Output

NOAA Atlas 2

Idaho 43.4305092°N 116.5218909°W
Site-specific Estimates

Map	Precipitation (inches)	Precipitation Intensity (in/hr)
2-year 6-hour	0.65	0.11
2-year 24-hour	0.99	0.04
100-year 6-hour	1.53	0.26
100-year 24-hour	2.11	0.09

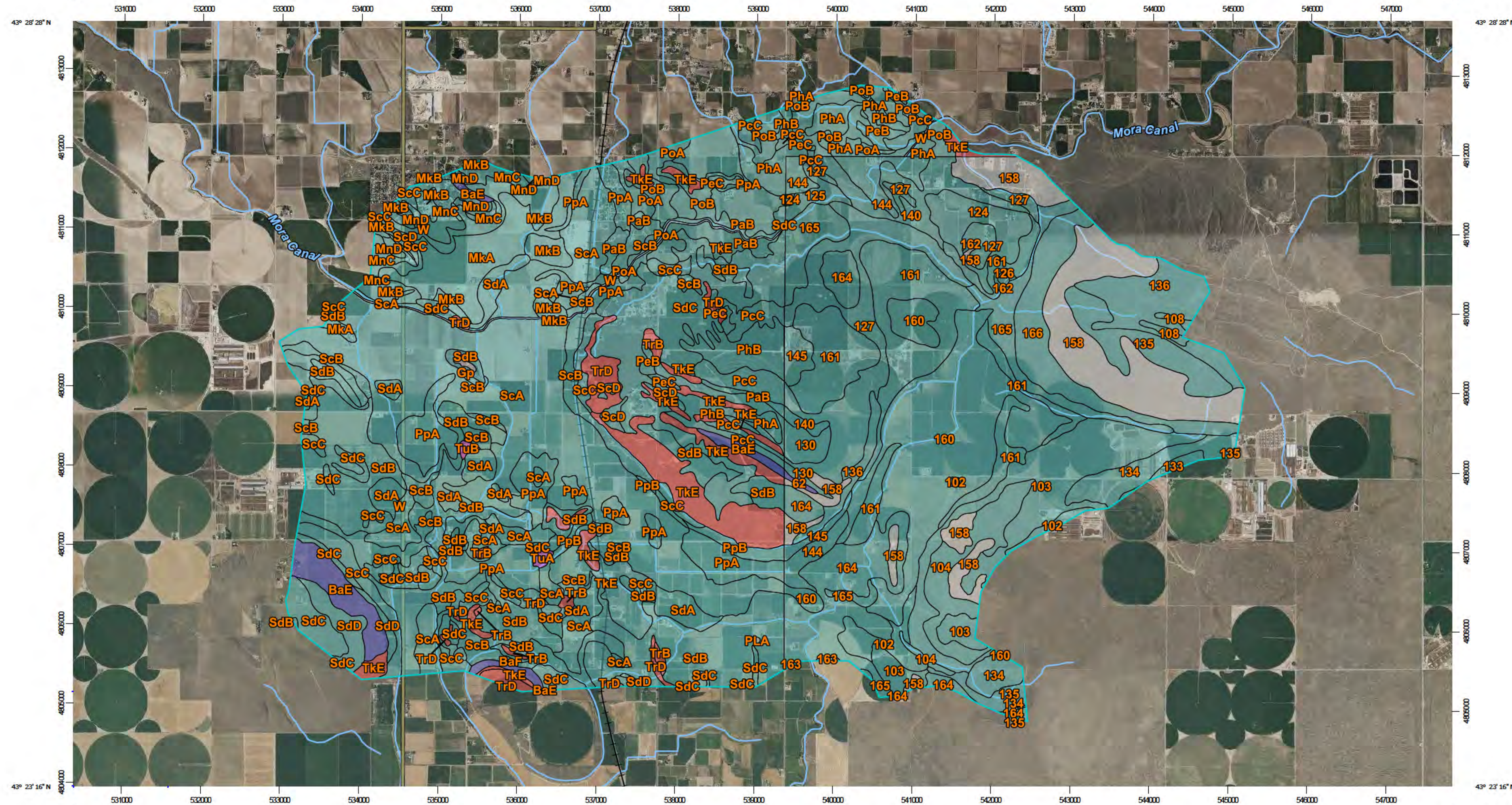
Go to PFDS
Go to NA2

Hydrometeorological Design Studies Center - NOAA/National Weather Service
1325 East-West Highway - Silver Spring, MD 20910 - (301) 713-1669
Mon Aug 7 17:48:06 2023

APPENDIX D

NRCS SOIL SURVEY REPORT

Hydrologic Soil Group—Ada County, Idaho, and Canyon Area, Idaho
(Savion Powers Butte Solar Project)



Map Scale: 1:46,900 if printed on B landscape (17" x 11") sheet.

N

0 500 1000 2000 3000 Meters

0 2000 4000 8000 12000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N 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
- C
- C/D
- D
- Not rated or not available

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 scales ranging from 1:20,000 to 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Ada County, Idaho
Survey Area Data: Version 10, Sep 2, 2022

Soil Survey Area: Canyon Area, Idaho
Survey Area Data: Version 19, Sep 2, 2022

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jul 14, 2010—Apr 21, 2021

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
62	Garbutt silt loam, 4 to 8 percent slopes	B	6.6	0.0%
102	McCain silt loam, 2 to 4 percent slopes	C	113.9	0.7%
103	McCain silt loam, 4 to 8 percent slopes	C	606.9	3.6%
104	McCain silt loam, 8 to 12 percent slopes	C	222.2	1.3%
108	McCain stony silt loam, 8 to 12 percent slopes, extremely stony	C	21.9	0.1%
124	Potratz silt loam, 0 to 2 percent slopes	C	170.5	1.0%
125	Potratz silt loam, 2 to 4 percent slopes	C	49.2	0.3%
126	Potratz silt loam, 4 to 8 percent slopes	C	4.4	0.0%
127	Potratz-Power silt loams, 4 to 8 percent slopes	C	548.0	3.3%
130	Power silt loam, 2 to 4 percent slopes	C	71.7	0.4%
133	Power-McCain silt loams, 0 to 2 percent slopes	C	22.0	0.1%
134	Power-McCain silt loams, 2 to 4 percent slopes	C	209.8	1.2%
135	Power-McCain silt loams, 4 to 8 percent slopes	C	251.3	1.5%
136	Power-McCain silt loams, 8 to 12 percent slopes	C	328.9	2.0%
140	Power-Potratz silt loams, 2 to 4 percent slopes	C	214.8	1.3%
144	Purdam-Power silt loams, 0 to 2 percent slopes	C	185.7	1.1%
145	Purdam-Power silt loams, 2 to 4 percent slopes	C	76.1	0.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
158	Rock outcrop-Trevino complex, 5 to 20 percent slopes		810.6	4.8%
160	Scism silt loam, 0 to 2 percent slopes	C	990.1	5.9%
161	Scism silt loam, 2 to 4 percent slopes	C	831.4	4.9%
162	Scism silt loam, 4 to 8 percent slopes	C	12.3	0.1%
163	Scism silt loam, bedrock substratum, 0 to 2 percent slopes	C	3.9	0.0%
164	Scism silt loam, bedrock substratum, 2 to 4 percent slopes	C	508.7	3.0%
165	Scism silt loam, bedrock substratum, 4 to 8 percent slopes	C	320.3	1.9%
166	Scism silt loam, bedrock substratum, 8 to 12 percent slopes	C	314.9	1.9%
Subtotals for Soil Survey Area			**6,896.3**	**40.9%**
Totals for Area of Interest			**16,858.6**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BaE	Bahem silt loam, 12 to 30 percent slopes	B	180.2	1.1%
BaF	Bahem silt loam, 30 to 50 percent slopes	B	25.2	0.1%
Gp	Gravel pit		4.8	0.0%
MkA	Minidoka silt loam, 0 to 1 percent slopes	C	326.3	1.9%
MkB	Minidoka silt loam, 1 to 3 percent slopes	C	299.9	1.8%
MnC	Minidoka-Scism silt loams, 3 to 7 percent slopes	C	170.9	1.0%
MnD	Minidoka-Scism silt loams, 7 to 12 percent slopes	C	39.8	0.2%
PaB	Potratz silt loam, 1 to 3 percent slopes	C	168.0	1.0%
PcC	Potratz-Power silt loams, 3 to 7 percent slopes	C	182.1	1.1%
PeB	Potratz-Power silt loams, 1 to 3 percent slopes	C	47.6	0.3%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
PeC	Potratz-Power silt loams, 3 to 7 percent slopes	C	46.0	0.3%
PhA	Power silt loam, 0 to 1 percent slopes	C	214.6	1.3%
PhB	Power silt loam, 1 to 3 percent slopes	C	292.1	1.7%
PLA	Playas		1.4	0.0%
PoA	Power-Potratz silt loams, 0 to 1 percent slopes	C	135.8	0.8%
PoB	Power-Potratz silt loams, 1 to 3 percent slopes	C	313.9	1.9%
PpA	Power-Purdam silt loams, 0 to 1 percent slopes	C	742.3	4.4%
PpB	Power-Purdam silt loams, 1 to 3 percent slopes	C	66.0	0.4%
ScA	Scism silt loam, 0 to 1 percent slopes	C	2,143.0	12.7%
ScB	Scism silt loam, 1 to 3 percent slopes	C	710.0	4.2%
ScC	Scism silt loam, 3 to 7 percent slopes	C	300.2	1.8%
ScD	Scism silt loam, 7 to 12 percent slopes	C	59.0	0.3%
SdA	Scism silt loam, deep over basalt, 0 to 1 percent slopes	C	222.3	1.3%
SdB	Scism silt loam, deep over basalt, 1 to 3 percent slopes	C	1,382.8	8.2%
SdC	Scism silt loam, deep over basalt, 3 to 7 percent slopes	C	1,072.2	6.4%
SdD	Scism silt loam, deep over basalt, 7 to 12 percent slopes	C	103.8	0.6%
TkE	Trevino-Rock outcrop complex, 0 to 20 percent slopes	D	470.7	2.8%
TrB	Trevino silt loam, 1 to 3 percent slopes	D	55.5	0.3%
TrD	Trevino silt loam, 3 to 12 percent slopes	D	130.3	0.8%
TuA	Turbyfill fine sandy loam, 0 to 1 percent slopes	A	10.4	0.1%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
TuB	Turbyfill fine sandy loam, 1 to 3 percent slopes	A	8.3	0.0%
W	Water		36.9	0.2%
Subtotals for Soil Survey Area			**9,962.3**	**59.1%**
Totals for Area of Interest			**16,858.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.