DOCKETED	
Docket Number:	21-AFC-02
Project Title:	Willow Rock Energy Storage Center
TN #:	254808
Document Title:	Willow Rock Energy Storage Center SAFC Volume II-Appendix 515A-Part II
Description:	N/A
Filer:	Amanda Cooey
Organization:	Ellison Schneider Harris & Donlan LLP
Submitter Role:	Applicant Representative
Submission Date:	3/1/2024 5:20:21 PM
Docketed Date:	3/4/2024

NOTES:

1. POND DETAIL
   RESERVOIR BERM ELEV: 2570.00
   RESERVOIR BERM EXTERIOR SLOPE MIN. TOE ELEV: 2564.00
   TOP OF WORKING RESERVOIR / MAX POOL: 2566.00
   BOTTOM OF WORKING RESERVOIR: 2526.00
   BOTTOM OF SUMP: 2512.00
   WORKING RESERVOIR STORAGE VOLUME: 188 MG
   MAX POOL SURFACE AREA: 21.4 AC

NOTES:

1. PRELIMINARY EARTHWORK QUANTITIES:
   SITE
   CUT= 99,810 CY
   FILL= 72,940 CY
2. BALANCE VOLUMES ARE FROM EXISTING GROUND TO MASS GRADE.
3. REFER TO PLOT PLAN (PP-001) FOR EQUIPMENT LAYOUT.

4' AIR

7' AIR

8' SVC

EVAPORATION POND

DAWN ROAD

SIERRA HIGHWAY

SCALE IN FEET
100 0 100 200
SCALE: 1" = 100'-0"

- PRELIMINARY -
NOT FOR CONSTRUCTION

REV	DESIGN BY	CHECKED BY	DATE
0	ISSUED FOR AFC		
	A. ROSS	R. PILES	01-05-24

HYDROSTOR
WILLOW ROCK ENERGY STORAGE CENTER

HYDROSTOR

Kiewit

GRADING PLAN
OPERATIONS PHASE - WITHOUT BERM

ENGINEER/DESIGN ORIGINATOR	A. ROSS
LEAD ENG	R. PILES
ENG MGR	S. GAMER
PROJ MGR	J. LUNDQUIST

DRAWING NUMBER
20045352-CG-003

$$DATE$$ $$TIME$$ $$USERNAME$$ $$FILENAME$$

NOTES:

1. POND DETAIL
   RESERVOIR BERM ELEV: 2570.00
   RESERVOIR BERM EXTERIOR SLOPE MIN. TOE ELEV: 2564.00
   TOP OF WORKING RESERVOIR / MAX POOL: 2566.00
   BOTTOM OF WORKING RESERVOIR: 2526.00
   BOTTOM OF SUMP: 2512.00
   WORKING RESERVOIR STORAGE VOLUME: 188 MG
   MAX POOL SURFACE AREA: 21.4 AC

NOTES:

1. PRELIMINARY EARTHWORK QUANTITIES:
   SITE
   BEDROCK CUT = 1,539 CY
   CUT= 957,665 CY
   FILL= 1,200,790 CY
2. BALANCE VOLUMES ARE FROM EXISTING GROUND TO MASS GRADE.
3. REFER TO PLOT PLAN (PP-001) FOR EQUIPMENT LAYOUT.

NOM 50,000 BBL
CUTTINGS POND
(CLEANOUT DURING
DRILLING)

4' AIR

NOM 200,000 BBL
CUTTINGS POND
3:1 SLOPE
14' DEPTH,
12' WATER DEPTH
(CLEANOUT DURING
DRILLING)

EXPLOSIVES
BUNKERS

TEMPORARY EARTHWORK
STORAGE AREA
3 AC

TEMPORARY CRUSHING
1 AC

TEMPORARY CAVERN ROCK
STORAGE AREA
3 AC

8' SVC

8' PROD'N

7' VENT

8' PROD'N

7' VENT
(CONV TO AIR)

AGG BINS

BATCH
PLANT

HOISTS

SHAFT &
HEADFRAME

WHSE

MTCE

LAYDOWN

OFFICES

PARKING

DAWN ROAD

SIERRA HIGHWAY

SIERRA HIGHWAY

- PRELIMINARY -
NOT FOR CONSTRUCTION

SCALE IN FEET
100 0 100 200
SCALE: 1" = 100'-0"

REV	DESIGN BY	CHECKED BY	DATE
0	ISSUED FOR AFC		
	A. ROSS	R. PILES	01-05-24

HYDROSTOR
WILLOW ROCK ENERGY STORAGE CENTER

HYDROSTOR

Kiewit

GRADING PLAN
CONSTRUCTION PHASE - WITHOUT BERM

ENGINEER/DESIGN ORIGINATOR	A. ROSS
LEAD ENG	R. PILES
ENG MGR	S. GAMER
PROJ MGR	J. LUNDQUIST

DRAWING NUMBER
20045352-CG-004

$$DATE$$ $$TIME$$ $$USERNAME$$ $$FILENAME$$

August 2nd, 2023

TO: Hydrostor

FROM: Kiewit Engineering Group, Inc.

RE: Project Ansel – Hydrostor Preliminary Drainage Memorandum

Executive Summary

This memorandum is to present the existing and preliminary proposed site drainage conditions for Hydrostor's Project Ansel. The onsite retention/infiltration basin was sized to convey onsite proposed flows once the site is developed. Offsite flows will be diverted via ditches along the north and west side of the site to route them to where they are currently flowing. Note that this memo conveys a preliminary analysis that will be confirmed during final design.

Existing Conditions

The site proposed for the Hydrostor's advanced compressed air energy storage Project Ansel is located in Kern County, California (34.91086 ˚, -118.1558˚). The site is desert and undeveloped with contours sloping from northwest to southeast with slopes varying between 1% to 2% as shown in Figure 1. According to the Web Soil survey by the USDA, soils on this site are primarily hydrologic soil Group A Cajon Sand.

The total drainage area that encompasses the project site is approximately 246 acres. Stormwater conveyed on the property site meanders via washes towards Sierra Highway to the east and Dawn Road on the south. Since these are highly pervious soils, water that currently runs off the site property is conveyed via a ditch along the highway and road to the east and south.

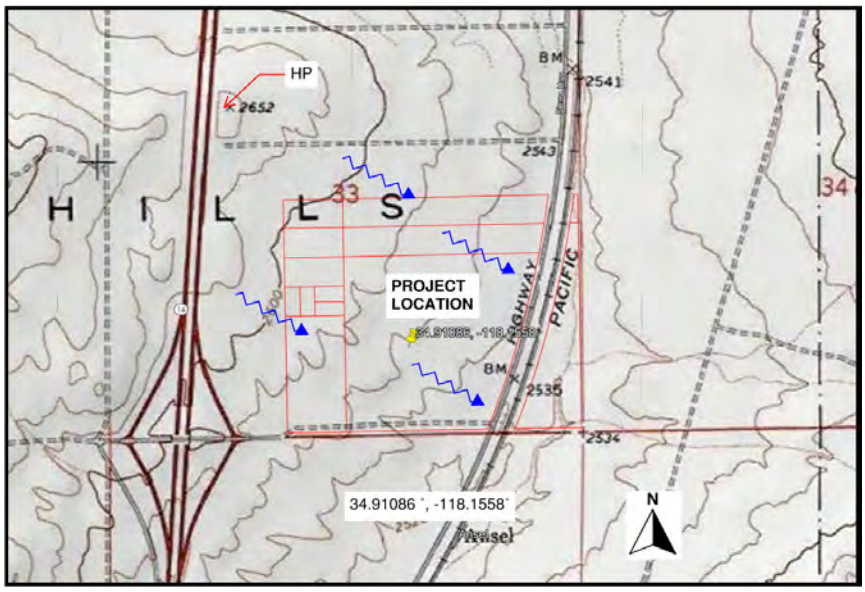

FIGURE 1

FEMA and EPA databases identify a floodplain east of Sierra highway via an unnamed tributary. The floodplain is designated as FEMA Zone A, located in FIRM Panel 06029C3675E eff. 9/26/2008 shown in Figure 2. The Zone A designation notes areas that have a 1% (100-year) annual chance of flooding with no detailed analysis performed to establish the base flood elevations within this zone. Note that no development is expected within this floodplain area.

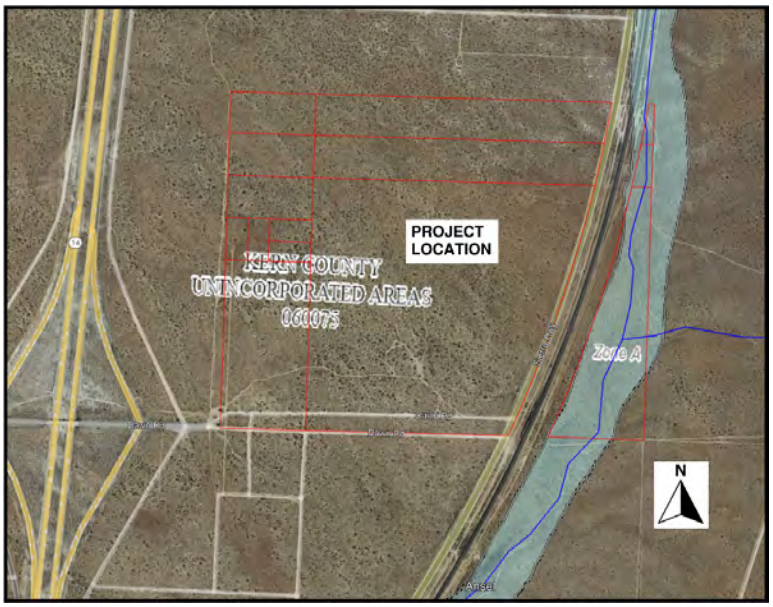

FIGURE 2

Using the Kern County Development Standard as outlined in Engineering Bulletin 11-02, which is included in Appendix A for reference, existing rainfall depths were gathered from the NOAA National Weather Service, Hydrometeorological Design Studies Center, Precipitation Frequency Data Server (PFDS), NOAA Atlas 14, Volume 6, Version 2. The precipitation data necessary to calculate runoff volumes as required by Kern County are summarized in the table below:

Average recurrence interval (years)	10-year	100-year
Duration		
24hr		3.81 in
4-day	3.28 in	
7-day	3.58 in	

Proposed Conditions

Offsite and onsite drainage was accounted for in this preliminary analysis. The existing offsite drainage will be diverted using proposed ditches along the north and west project boundary lines. The flows conveyed by the west ditch will discharge stormwater south and then across Dawn Road. The flows conveyed by the north ditch will discharge stormwater to the east to Sierra Highway as shown in Figure 4. These ditches will convey

approximately 156.5 acres of the existing overall drainage basin of 246 acres. Approximately 84 acres will drain to the west ditch and 45 acres will drain to the north ditch. These ditches will be sized to carry at a minimum the 100-year discharge calculated using TR55 SCS Unit Hydrograph methodology. The discharge points for both ditches are in general accordance with the existing flow patterns as shown in Figure 1.

Onsite flows generated by the 89.46 acres from the project site will not be discharged outside the project site as shown with cross-hatching in Figure 4. All of the project site stormwater will be conveyed via sheet flow and system flow to a proposed retention/infiltration basin on the southeast corner of the site as shown in Figure 4.

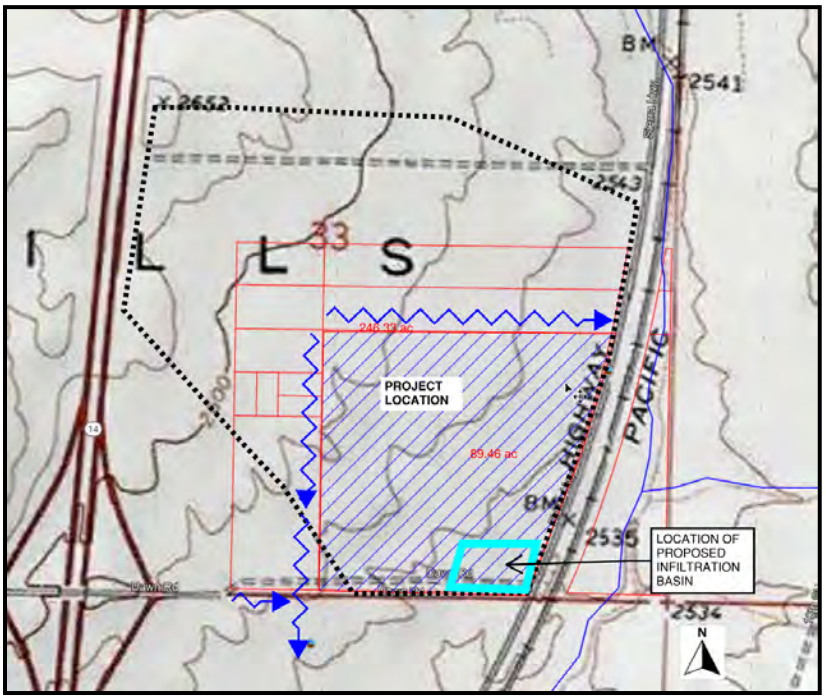

FIGURE 4

Retention/Infiltration Basin Calculation

The proposed sump volume calculation was computed using Engineering Bulletin 11-02 from the Kern County Development Standard, which again is included in Appendix A. The volume calculations are shown in Figure 5 on the next page and the basis for the rainfall data shown is from calculating the points on the log-log graph provided in the Engineering Bulletin 11-02 as shown in Figure 6. Note that the retention/infiltration basin has been sized to accommodate the 100-year rainfall event and a minimum of 1-foot of freeboard will be included in the final design.

Infiltration Basin Sump Volume Calculation		
10 Yr 4 day Rainfall	3.28	in
10 Yr 7 Day Rainfall	3.58	in
100 Yr 24Hr Rainfall	3.81	in
Runoff Volume		
D10yr-5 Day	3.4	in
100 Yr 24Hr Rainfall	3.81	in
ai	0.72	Avg. % of Impervious Area
Total Site Area	89.46	Acres
Reservoir Area	22.37	Acres
Total Retained Area	67.10	Acres
Total Retained Area	2,922,658	Sq.Ft.
Runoff Volume	668,120	CF
Retention Volume w/out freeboard	24,745	CY
Runoff Volume	15.34	AC-FT

FIGURE 5

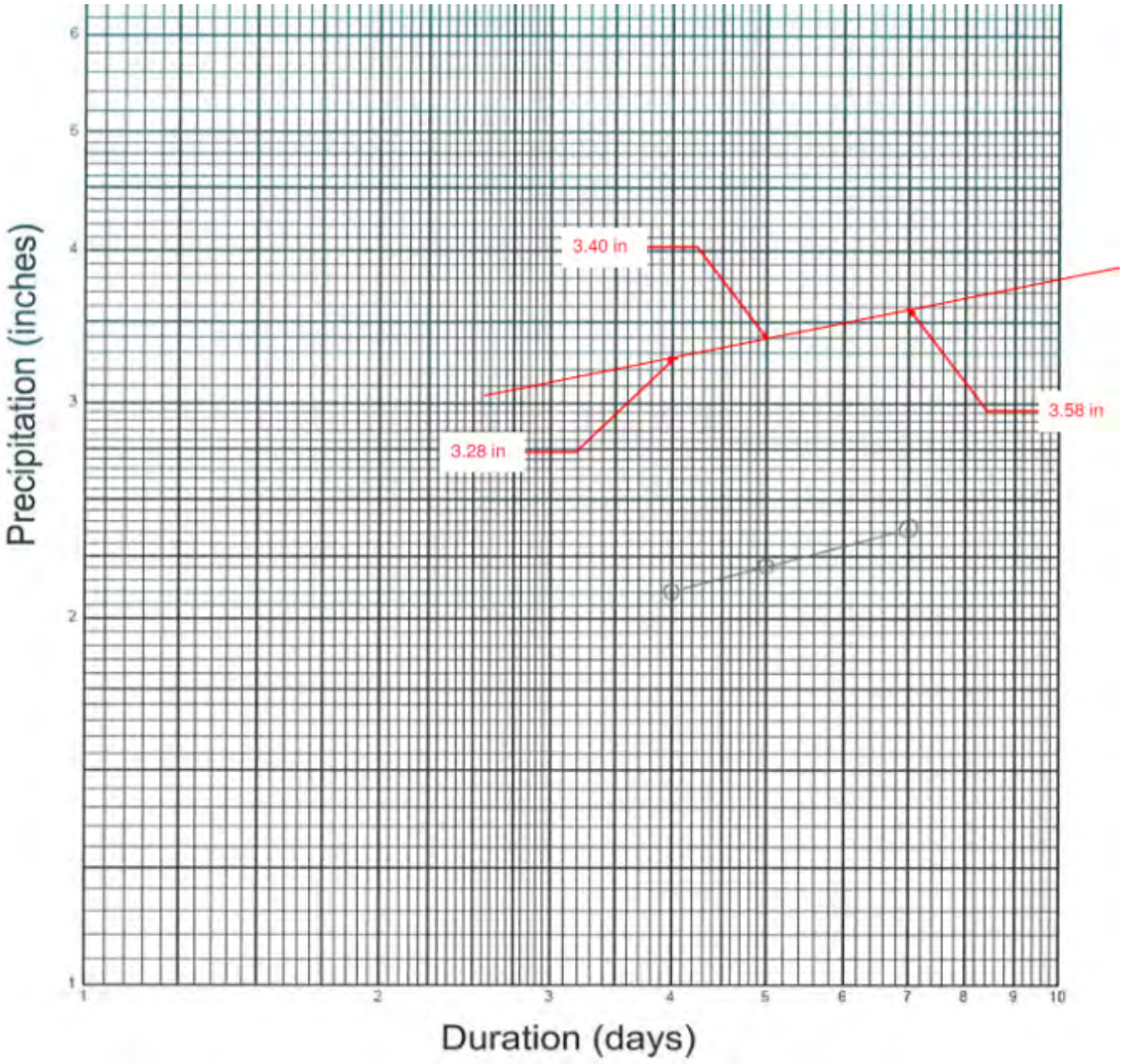
Precipitation (inches)
Duration (days)
3.40 in
3.28 in
3.58 in
1
2
3
4
5
6
7
8
9
10

FIGURE 6

APPENDIX A

ENGINEERING, SURVEYING &
PERMIT SERVICES DEPARTMENT
CHARLES LACKEY, P.E., DIRECTOR
2700 M STREET, SUITE 570
BAKERSFIELD, CA 93301-2370
Phone: (661) 862-8603 Fax: (661) 862-5149
E-mail: esps@co.kern.ca.us
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DEVELOPMENT SERVICES AGENCY
Engineering, Surveying and Permit Services Department
Planning and Community Development Department
Roads Department

Engineering Bulletin 11-02

Subject: Sump Volume Requirements **Date: December 21, 2011**
Application: Kern County Development Standards

Background: In 1995, Kern County revised the standard by which retention basin sizing is based, and published it in the latest edition of the Kern County Development Standards dated August 5, 2010. Division 4 of the Development Standards defined the design volume for basins as runoff from the Intermediate Storm Design Discharge (ISDD) 5-day rainfall event from the impervious area. The equation is;

Runoff Volume = 0.12 (D_{10}) (a_i) (Area) where:

D_{10} = 10 yr 24-hr. depth of rainfall (in.)
a_i = average percentage of impervious area
Area = Drainage area of total development
0.12 = 1.44 x 1/12
1.44 = 5 day mass ratio (KC Hydrology Manual, Table B-1)
1/12 = Conversion of rainfall depth in inches to feet

The revision to the standard was chosen for consistency with the newly created multi-day detention basin sizing standard and to approximate the sump sizing criteria used by the City of Bakersfield in their application of 100yr 24hr rainfall event. The new Development Standards also linked ISDD calculations to the application of rainfall/runoff methodology found in the Kern County Hydrology Manual. Since the Hydrology Manual had adopted rainfall data found in NOAA Atlas 2, Volume XI, retention basin sizing was also tied to that data base.

Data Update: In May of 2011 the National Weather Service published NOAA Atlas 14, Volume 6, Version 2.0 for California. As stated in the introduction of the publication, this document supersedes precipitation-frequency estimates found in NOAA Atlas 2, Volume 11 and NOAA Atlas 14 Volume 1, which covered Kern County's desert region. Gage data used in the precipitation-frequency analysis for NOAA Atlas 14, Volume 6 incorporates the latest, quality-verified rainfall information available up through June, 2010. The precipitation-frequency data is now available to the public, via a graphic interface, at the Hydrometeorological Design Studies Center's web site. (http://hdsc.nws.noaa.gov/hdsc/pfds/). It contains both short and long duration, including multi-day rainfall data in tabular and graphic formats.

Policy: Retention basin sizing shall continue to be based upon runoff from the ISDD 5 day storm event from impervious area. The equation is now;

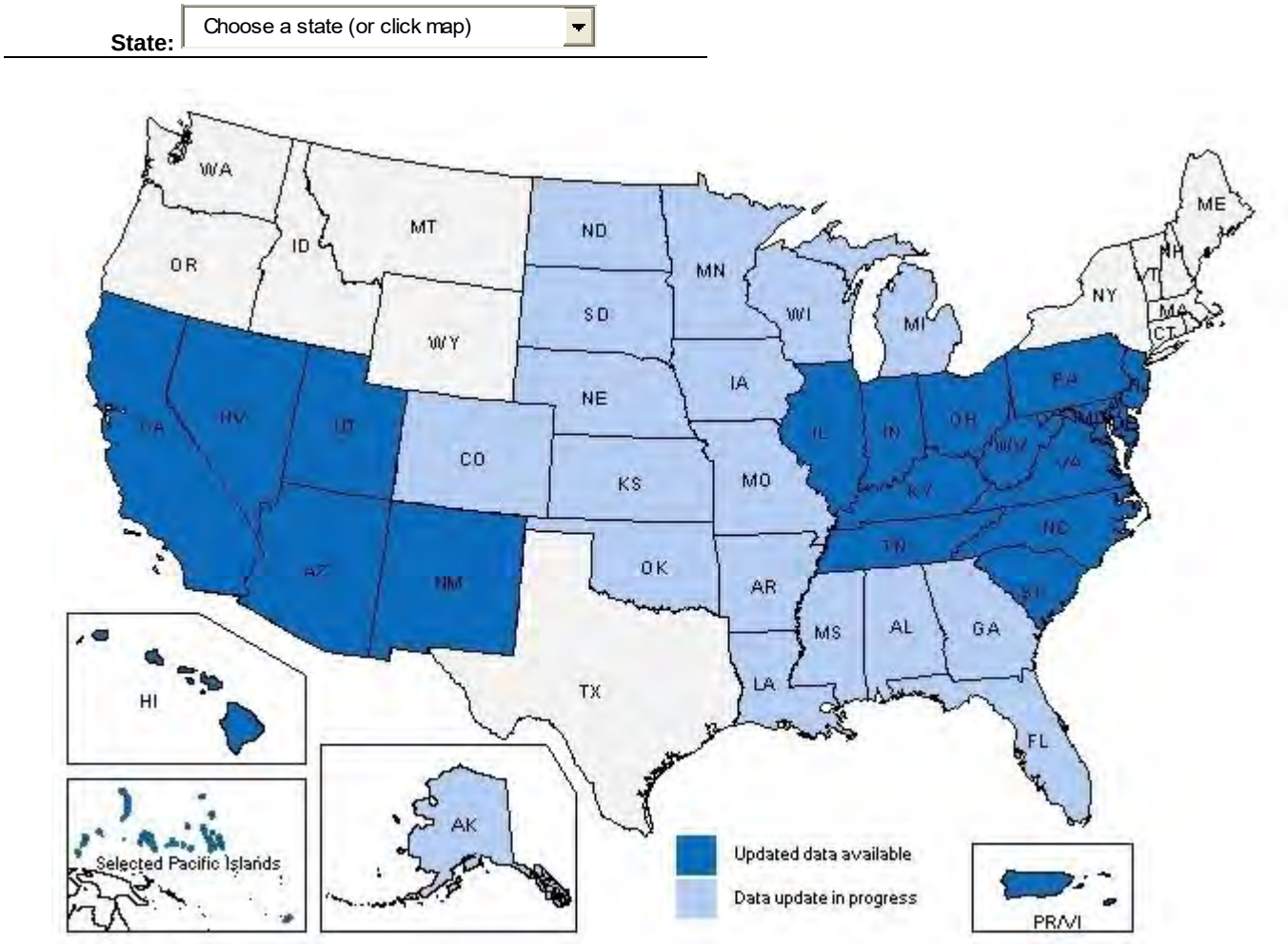
Runoff Volume (cu.ft.) = [($D_{10yr\text{-}5day}$)/12] (a_i) (Area) where;

$D_{10\text{-}5day}$ = 10yr 5 day depth of rainfall (in.) obtained from NOAA Atlas 14, Vol 6, Ver. 2.0
a_i = average percentage of impervious area
Area = Drainage area of total development (sq.ft.)

Example Problem;

Determine the retention basin requirement for a 1.00 acre industrial development located in Bakersfield, CA (Lat. 35.3940 Lon. -119.0505). Assume the development will have 95% imperviousness.

1) Determine the 10yr 5 day depth of rainfall. Connect to the Precipitation Frequency Data Server at http://hdsc.nws.noaa.gov/hdsc/pfds/
2) Click the drop down box and select California or move the cursor onto the map of California and click the left mouse button.



3). Under **Data Description** select Data type (**precipitation depth**), Units (**English**) and Time series type (**partial duration**).
4) **Select Location ;** .Manually enter Latitude and Longitude.
5) Click submit button.

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES

DATA DESCRIPTION

Data type: precipitation depth **Units:** english **Time series type:** partial duration

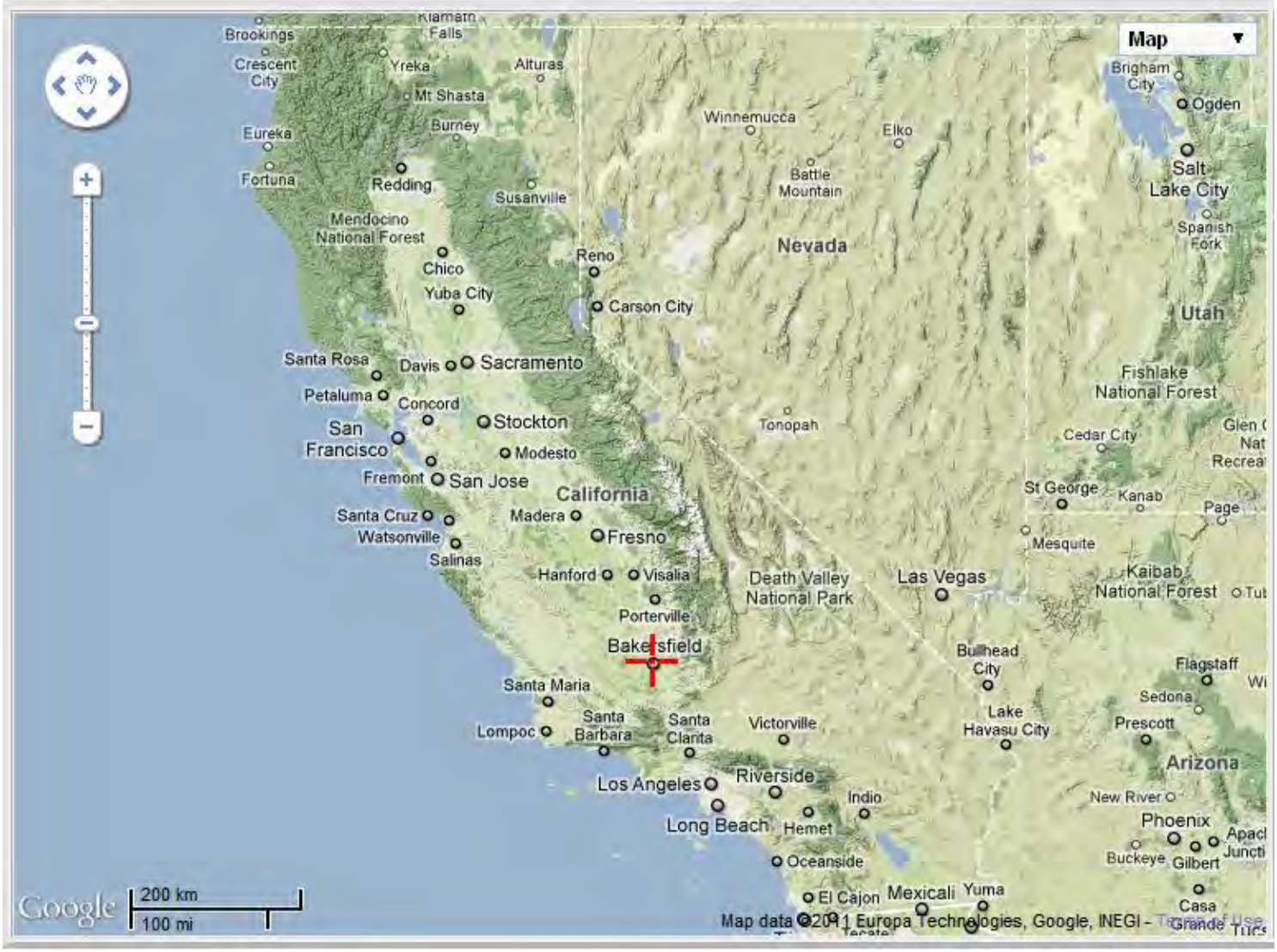
SELECT LOCATION

1. Manually:

a) Enter location (decimal degrees, use "-" for S and W): latitude: 35.3940 longitude: -119.0505 submit

b) Select station: select station

2. Use map:



NOAA Atlas 14, Volume 6, Version 2
Location name: Bakersfield, California, US*
Coordinates: 35.3940, -119.0505
Elevation: 404ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.077 (0.063–0.095)	0.097 (0.080–0.120)	0.127 (0.104–0.158)	0.154 (0.125–0.193)	0.195 (0.153–0.252)	0.230 (0.177–0.303)	0.269 (0.202–0.362)	0.313 (0.229–0.433)	0.421 (0.296–0.607)	0.580 (0.393–0.863)
10-min	0.110 (0.090–0.136)	0.140 (0.114–0.172)	0.183 (0.149–0.226)	0.221 (0.179–0.276)	0.280 (0.220–0.361)	0.330 (0.254–0.434)	0.386 (0.290–0.519)	0.449 (0.328–0.621)	0.604 (0.424–0.870)	0.831 (0.564–1.24)
15-min	0.133 (0.109–0.164)	0.169 (0.138–0.208)	0.221 (0.180–0.273)	0.268 (0.217–0.334)	0.339 (0.266–0.436)	0.399 (0.307–0.525)	0.467 (0.350–0.628)	0.543 (0.397–0.751)	0.731 (0.513–1.05)	1.01 (0.682–1.50)
30-min	0.182 (0.149–0.224)	0.231 (0.189–0.285)	0.302 (0.247–0.374)	0.366 (0.296–0.456)	0.463 (0.363–0.596)	0.546 (0.420–0.717)	0.638 (0.479–0.859)	0.743 (0.542–1.03)	0.999 (0.701–1.44)	1.37 (0.932–2.05)
60-min	0.256 (0.210–0.315)	0.325 (0.266–0.401)	0.425 (0.347–0.526)	0.515 (0.417–0.642)	0.651 (0.511–0.839)	0.768 (0.590–1.01)	0.898 (0.674–1.21)	1.05 (0.763–1.45)	1.41 (0.986–2.02)	1.93 (1.31–2.88)
2-hr	0.354 (0.290–0.437)	0.446 (0.365–0.550)	0.574 (0.468–0.709)	0.684 (0.554–0.853)	0.846 (0.663–1.09)	0.978 (0.752–1.29)	1.12 (0.842–1.51)	1.28 (0.933–1.77)	1.50 (1.05–2.16)	1.95 (1.33–2.91)
3-hr	0.417 (0.342–0.513)	0.524 (0.429–0.647)	0.673 (0.550–0.833)	0.801 (0.649–0.999)	0.985 (0.773–1.27)	1.14 (0.872–1.49)	1.29 (0.971–1.74)	1.47 (1.07–2.03)	1.71 (1.20–2.46)	1.97 (1.34–2.94)
6-hr	0.520 (0.426–0.641)	0.659 (0.540–0.813)	0.850 (0.694–1.05)	1.01 (0.820–1.26)	1.24 (0.976–1.60)	1.43 (1.10–1.88)	1.63 (1.22–2.19)	1.84 (1.34–2.54)	2.14 (1.50–3.08)	2.38 (1.61–3.54)
12-hr	0.606 (0.497–0.747)	0.780 (0.638–0.962)	1.02 (0.836–1.27)	1.24 (1.00–1.54)	1.54 (1.21–1.99)	1.80 (1.38–2.36)	2.07 (1.55–2.78)	2.37 (1.73–3.27)	2.79 (1.96–4.02)	3.15 (2.14–4.69)
24-hr	0.742 (0.676–0.832)	0.966 (0.878–1.08)	1.29 (1.17–1.45)	1.58 (1.42–1.79)	2.01 (1.74–2.37)	2.38 (2.02–2.86)	2.78 (2.30–3.44)	3.24 (2.60–4.12)	3.92 (3.01–5.21)	4.50 (3.33–6.20)
2-day	0.865 (0.787–0.969)	1.12 (1.02–1.26)	1.50 (1.36–1.69)	1.84 (1.65–2.09)	2.36 (2.05–2.78)	2.81 (2.39–3.38)	3.32 (2.74–4.10)	3.90 (3.13–4.96)	4.78 (3.67–6.35)	5.54 (4.10–7.64)
3-day	0.931 (0.847–1.04)	1.20 (1.09–1.35)	1.61 (1.46–1.81)	1.97 (1.77–2.24)	2.53 (2.19–2.98)	3.01 (2.56–3.63)	3.56 (2.94–4.39)	4.18 (3.35–5.31)	5.13 (3.94–6.82)	5.96 (4.41–8.22)
4-day	0.992 (0.903–1.11)	1.28 (1.17–1.44)	1.71 (1.55–1.93)	2.10 (1.88–2.38)	2.68 (2.32–3.15)	3.18 (2.69–3.82)	3.73 (3.08–4.61)	4.36 (3.50–5.54)	5.31 (4.07–7.05)	6.13 (4.54–8.45)
7-day	1.12 (1.02–1.26)	1.46 (1.33–1.64)	1.94 (1.76–2.18)	2.36 (2.12–2.68)	2.97 (2.58–3.50)	3.48 (2.95–4.18)	4.02 (3.32–4.97)	4.62 (3.70–5.87)	5.49 (4.21–7.29)	6.21 (4.59–8.56)
10-day	1.22 (1.11–1.37)	1.59 (1.45–1.78)	2.11 (1.91–2.38)	2.56 (2.30–2.90)	3.19 (2.77–3.76)	3.71 (3.15–4.46)	4.25 (3.52–5.25)	4.84 (3.88–6.15)	5.67 (4.35–7.53)	6.34 (4.69–8.74)
20-day	1.53 (1.39–1.71)	2.01 (1.83–2.26)	2.67 (2.42–3.01)	3.23 (2.90–3.67)	4.01 (3.48–4.72)	4.63 (3.92–5.57)	5.27 (4.35–6.50)	5.93 (4.76–7.55)	6.85 (5.26–9.10)	7.57 (5.60–10.4)
30-day	1.79 (1.63–2.01)	2.37 (2.15–2.66)	3.15 (2.86–3.55)	3.81 (3.42–4.33)	4.73 (4.11–5.57)	5.46 (4.63–6.57)	6.21 (5.13–7.67)	6.99 (5.60–8.89)	8.05 (6.18–10.7)	8.87 (6.57–12.2)
45-day	2.20 (2.00–2.47)	2.90 (2.64–3.26)	3.86 (3.50–4.35)	4.67 (4.19–5.30)	5.80 (5.03–6.83)	6.70 (5.68–8.06)	7.62 (6.29–9.40)	8.57 (6.87–10.9)	9.87 (7.58–13.1)	10.9 (8.05–15.0)
60-day	2.52 (2.30–2.83)	3.32 (3.02–3.72)	4.41 (3.99–4.96)	5.33 (4.78–6.05)	6.62 (5.74–7.79)	7.64 (6.48–9.19)	8.70 (7.19–10.7)	9.78 (7.85–12.4)	11.3 (8.65–15.0)	12.4 (9.19–17.1)

[1] 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.

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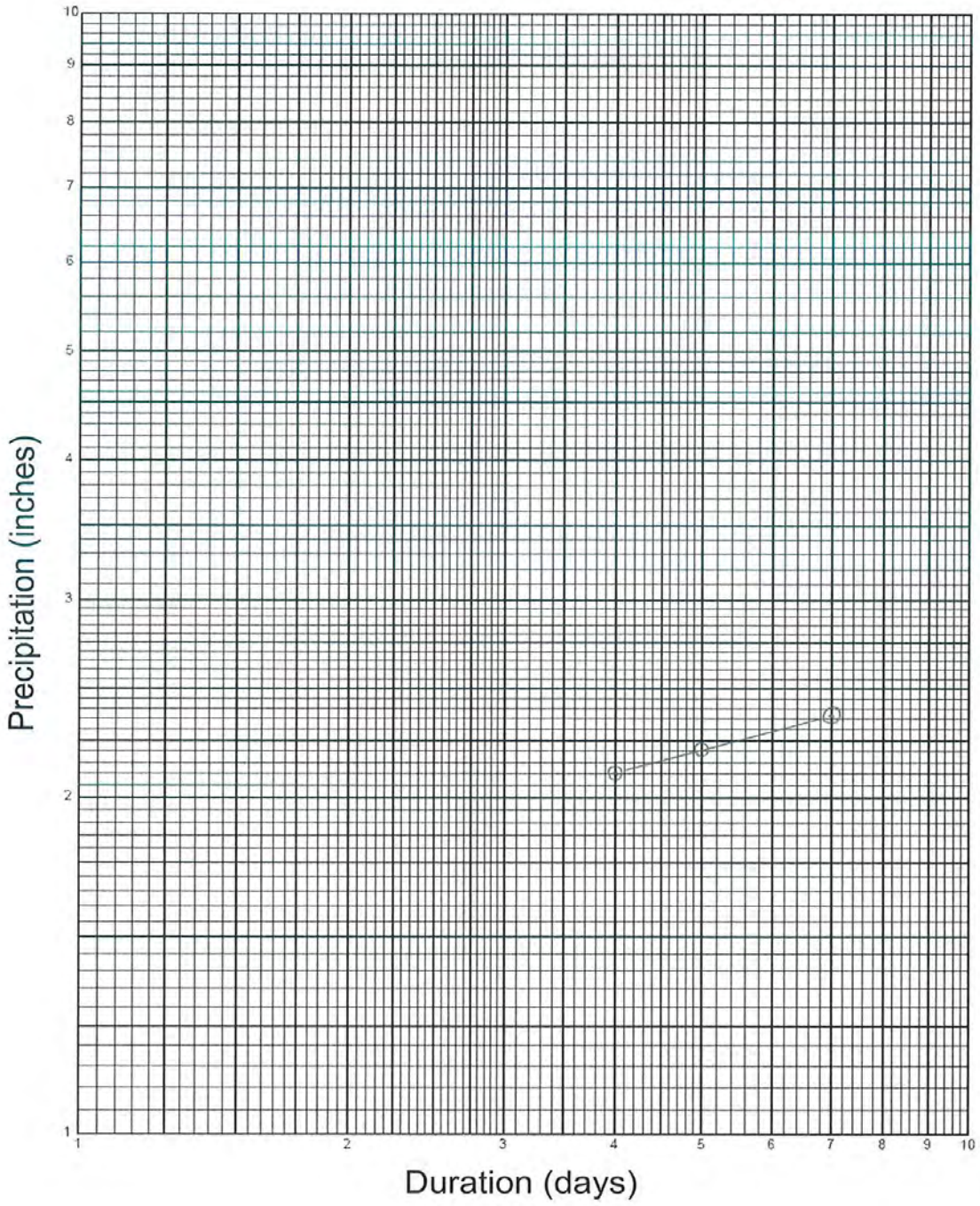
6) Select 10yr 4day rainfall depth – **2.10** and 10yr 7 day rainfall depth – **2.36**
7) Plot points on log–log graph paper.



8) Read the solution for the 10 yr 5 day depth of rainfall– **2.20 inches**

9) Sump volume calculation:

$$\text{Runoff Volume (cu.ft.)} = [(D_{10yr\text{-}5day})/12]\,(a_i)\,(\text{Area})$$
$$= [(2.20)/12](0.95)(1.00 \text{ ac. x } 43560 \text{ sq.ft/ac})$$
$$= 7{,}586.7 \text{ cu.ft or } 7{,}590 \text{ cu.ft.}$$