APPENDIX I-2
ADDENDUM TO PRELIMINARY HYDROLOGY STUDY AND HYDRAULICS REPORT

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ADDENDUM to

Preliminary Hydrology & Hydraulics Report

Daggett Solar Power Facility

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San Bernardino County, CA

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A. Introduction

1.1 Background

This Addendum serves to provide focused hydrology calculations and preliminary design calculations for retention basins proposed as part of the NRG Daggett Solar Power Facility in San Bernardino County, CA. A Preliminary Hydrology & Hydraulics Report, prepared by Joseph E. Bonadiman & Associates and dated November 2017, provided general discussion regarding retention basin requirements, but did not include specific design calculations, as the project size/extents and layout was at the conceptual stage at the time of report preparation and has since been revised.

1.2 Scope

This scope of this Addendum is as follows:

1.) Identification of drainage areas within the proposed project boundaries that are expected to cause an increase in runoff.

2.) Calculations to determine existing and developed conditions 100-year, 24-hour runoff volumes and peak flow rates for these drainage areas.

3.) Determination of 100-year, 24-hour volume and peak flow increases, resulting from the proposed project improvements, for each drainage area. Volume increases are proposed to be captured in the proposed retention basins.

4.) Delineation of drainage subareas tributary to each of the proposed retention basins.

5.) Determination of the proportioned fraction of developed conditions runoff tributary to each basin.

6.) Determination of the proportioned fraction of calculated volume increase to be captured in each basin.

7.) Preliminary design (sizing) of each retention basin.

8.) Preliminary infiltration (drawdown) calculations to substantiate preliminary design depths for the proposed retention basins.

9.) Discussion of peak flow increases and any potential impact to downstream conveyances, as well as adherence to all applicable CEQA thresholds for surface hydrology and water quality.

10.) Additional hydraulics calculations to supplement the Preliminary Hydrology & Hydraulics Report.

B. Methodology

1.1 General Methodology

The requirements and recommendations found in the San Bernardino County Hydrology Manual (August 1986) provided by the San Bernardino County Department of Public Works was used as the basis for the methodology and calculations found in this Addendum. Refer to the previously-submitted Preliminary Hydrology & Hydraulics Report for additional information.

1.2 Watershed Precipitation

Precipitation values used in this Addendum were based on the 100-year, 1-hour, 100-year, 6-hour, and 100-year, 24-hour NOAA Atlas 14 grids used in the previously-submitted Preliminary Hydrology & Hydraulics Report. These values were area-averaged using ArcGIS for each of the 10 drainage areas analyzed in this addendum. Refer to Exhibits "A.1" through "A.3" for these precipitation grids.

1.3 Watershed Losses

SCS values for existing and developed conditions used in this Addendum were based on the SCS values and associated cover types and hydrologic soils groups used in the previously-submitted Preliminary Hydrology & Hydraulics Report. Refer to Exhibits "B.1" and "B.2" for these SCS values. For existing conditions, a pervious fraction of 100% was used. For developed conditions, a pervious fraction of 90% was used.

C. Existing Conditions Hydrology Calculations

1.1. Existing Conditions Unit Hydrograph Calculations

The proposed Daggett Solar Power Facility project is to be constructed as six (6) Conditional Use Permit (CUP) sites, in three (3) phases. These CUP sites are to be constructed on approximately 3,141 acres total (net). The actual proposed disturbed acreage expected to cause an increase in runoff is approximately 2,860 acres and will include compacted native on-site access roads, photovoltaic (PV) arrays, electrical equipment areas, and other miscellaneous improvements. The remaining acreage is to be utilized for generation tie line (gen-tie) easements, open/reserved areas, retention basins, and other uses that will not result in an increase in runoff. Refer to the CUP Site Plans for the six (6) sites prepared by Joseph E. Bonadiman & Associates, Inc. and dated February 2018 for additional details.

To determine the increase in 100-year, 24-hour runoff volume and peak flows caused by the proposed improvements, the 2,680-acre study area was divided into ten (10) drainage areas. Hydrograph calculations were performed for existing conditions for these areas, based on the input values summarized on the following page.

Table 1 – Existing Conditions Unit Hydrograph Input Values

AREA	SIZE (AC)	SCS	IMP. %	RAIN 100-1	RAIN 100-6	RAIN 100-24	S-GRAPH	LEN. (FT.)	Lca (FT.)	U.S. ELEV. (FT.)	D.S. ELEV. (FT.)	Δ. ELEV. (FT.)	"n"
1.1	127.89	60.3	0%	1.36	1.84	2.46	DESERT	2,390	1,195	1930	1923	7	0.035
1.2	140.22	58.6	0%	1.37	1.84	2.46	DESERT	2,624	1,312	1923	1913	10	0.035
1.3	443.93	60.1	0%	1.35	1.84	2.48	DESERT	5,386	2,693	1937	1925	12	0.035
1.4	41.87	62.0	0%	1.36	1.84	2.48	DESERT	1,993	997	1926	1914	12	0.035
1.5	165.80	60.2	0%	1.36	1.83	2.53	DESERT	2,634	1,317	1943	1932	11	0.035
2	169.66	59.2	0%	1.37	1.83	2.50	DESERT	2,379	1,190	1925	1921	4	0.035
3	588.34	61.3	0%	1.39	1.83	2.50	DESERT	5,144	2,572	1911	1898	13	0.035
4	252.12	68.2	0%	1.40	1.84	2.56	DESERT	2,544	1,272	1910	1903	7	0.035
5	587.02	63.4	0%	1.39	1.83	2.51	DESERT	5,748	2,874	1899	1887	12	0.035
6	343.42	82.1	0%	1.40	1.85	2.56	DESERT	3,833	1,917	1888	1878	10	0.035

Refer to Attachment No. 1 for printouts of the existing conditions unit hydrograph calculations.
Refer to Exhibit "C" for the Hydrologic Analysis map.

D. Developed Conditions Hydrology Calculations

1.1 Developed Conditions Unit Hydrograph Calculations

Hydrograph calculations were subsequently performed for developed conditions for the ten (10) drainage areas, adjusted for the developed conditions SCS values (for barren cover) and assuming a pervious fraction of 90% (both conservative estimates). Input values area summarized as follows (note that as only minimum grading/smoothing of existing topography is anticipated, flow paths, elevations, and Manning's "n" values were unchanged from existing conditions, and the proposed project will not result in any substantial change to the direction of existing flows to the east/northeast):

Table 2 – Developed Conditions Unit Hydrograph Input Values

AREA	SIZE (AC)	SCS	IMPERVIOUS %	RAIN 100-1	RAIN 100-6	RAIN 100-24	S-GRAPH
1.1	127.89	78.0	10%	1.36	1.84	2.46	DESERT
1.2	140.22	78.0	10%	1.37	1.84	2.46	DESERT
1.3	443.93	78.0	10%	1.35	1.84	2.48	DESERT
1.4	41.87	78.0	10%	1.36	1.84	2.48	DESERT
1.5	165.80	78.0	10%	1.36	1.83	2.53	DESERT
2	169.66	78.0	10%	1.37	1.83	2.50	DESERT
3	588.34	78.6	10%	1.39	1.83	2.50	DESERT
4	252.12	83.4	10%	1.40	1.84	2.56	DESERT
5	587.02	80.1	10%	1.39	1.83	2.51	DESERT
6	343.42	91.0	10%	1.40	1.85	2.56	DESERT

Refer to Attachment No. 2 for printouts of the developed conditions unit hydrograph calculations.
Refer to Exhibit "C" for the Hydrologic Analysis map.

E. Comparative Analysis & Preliminary Basins Design

1.1 Comparative Analysis & Flow / Volume Increase

The 100-year, 24-hour increase in volume and peak flows expected to be generated by the project is summarized as follows:

Table 3 – Existing vs. Developed Conditions Volume & Peak Flows Increase Increase

AREA	SIZE (AC)	EXISTING VOLUME (AF)	DEVELOPED VOLUME (AF)	INCREASE (AF)	INCREASE 115% (AF)	BASIN VOLUME PROVIDED (AF)	EXISTING FLOW (CFS)	DEVELOPED FLOW (CFS)	INCREASE (CFS)	INCREASE (%)
1.1	127.89	14.53	21.56	7.03	8.08	8.58	346	377	31	9.0%
1.2	140.22	15.42	23.36	7.94	9.13	9.60	377	414	37	9.8%
1.3	443.93	49.94	75.15	25.21	28.99	29.16	721	819	98	13.6%
1.4	41.87	4.98	7.12	2.14	2.46	2.62	116	126	10	8.6%
1.5	165.80	19.27	28.75	9.48	10.90	11.06	447	487	40	8.9%
2	169.66	19.16	29.10	9.94	11.43	12.04	436	479	43	9.9%
3	588.34	69.29	101.70	32.41	37.27	39.82	1,055	1,181	126	11.9%
4	252.12	35.70	48.22	12.52	14.40	14.78	709	757	48	6.8%
5	587.02	72.64	104.27	31.63	36.37	37.09	1,000	1,117	117	11.7%
6	343.42	63.72	69.45	5.73	6.59	7.21	817	837	20	2.4%
TOTALS:		***364.65***	***508.68***	***144.03***	***165.63***	***171.96***	***6,024***	***6,594***	***570***	***9.5%***

For preliminary retention basin design, a 15% buffer was added to the calculated volume increases for each drainage area. This buffer was added to account for anticipated basin check dams, internal access road crossings, and electrical conduit crossings that will reduce the preliminary basin footprints shown in this Addendum.

1.2 Preliminary Retention Basins Design

Refer to Exhibit "D" for the Proposed Drainage Plan for the project, which illustrates the proposed basin locations and design details, included to demonstrate the following:

1.) Each retention basin has adequate tributary area to ensure the basin will be completely filled in the 100-year, 24-hour storm event; and

2.) Each retention basin will have capacity to retain the calculated proportionate volume increase of the subarea tributary to the basin;

3.) Each retention basin will completely draw-down within a 72-hour period.

No. 1: *Demonstrate each retention basin has adequate tributary area to ensure the basin will be completely filled in the 100-year, 24-hour storm event.*

Developed conditions 100-year, 24-hour volumes for the subareas tributary to each basin were calculated by determining a per-acre volume for each of the ten (10) drainage areas, as summarized on the following page.

Table 4 – Developed Conditions Per-Acre Runoff

AREA	SIZE (AC)	DEVELOPED VOLUME (AF)	PER ACRE VOLUME (AF)
1.1	127.89	21.56	0.17
1.2	140.22	23.36	0.17
1.3	443.93	75.15	0.17
1.4	41.87	7.12	0.17
1.5	165.80	28.75	0.17
2	169.66	29.10	0.17
3	588.34	101.70	0.17
4	252.12	48.22	0.19
5	587.02	104.27	0.18
6	343.42	69.45	0.20

These per-acre runoff values were then multiplied by the subareas illustrated on Exhibit "D", as tabulated on the following page.

Table 5– Tributary Subareas Developed Conditions Runoff

AREA	SIZE (AC)	PER ACRE VOLUME (AF)	AREA VOLUME (AF)
1.1	128.02	0.17	21.76
1.2	111.12	0.17	18.89
1.2.1	29.71	0.17	5.05
1.3	238.09	0.17	40.48
1.3.1	23.25	0.17	3.95
1.4	70.06	0.17	11.91
1.5	105.34	0.17	17.91
1.6	77.26	0.17	13.13
1.7	88.40	0.17	15.03
1.8	19.80	0.17	3.37
1.9	10.28	0.17	1.75
1.1	12.39	0.17	2.11
2.1	68.40	0.17	11.63
2.2	101.16	0.17	17.20
3.1	284.04	0.17	48.29
3.1.1	6.49	0.17	1.10
3.2	292.77	0.17	49.77
3.3	6.45	0.17	1.10
4.1	30.03	0.19	5.71
4.2	89.03	0.19	16.92
4.3	134.33	0.19	25.52
5.1	225.49	0.18	40.59
5.1.1	53.19	0.18	9.57
5.1.2	18.05	0.18	3.25
5.2	17.87	0.18	3.22
5.2.1	16.51	0.18	2.97
5.2.2	33.97	0.18	6.11
6.1	45.01	0.20	9.00
6.2	98.68	0.20	19.74
6.3	179.75	0.20	35.95
6.4	19.87	0.20	3.97

Based on these values, and as illustrated on Exhibit "D", there is adequate developed conditions 100-year, 24-hour volume for each subarea to completely fill each of the proposed retention basins.

No. 2: *Demonstrate each retention basin will have capacity to retain the calculated proportionate volume increase of the subarea tributary to the basin.*

Basin design details and calculated retention volumes are summarized as follows:

Table 6 – Retention Basin Design Details & Capture Volumes

BASIN NO.	TRIBUTARY SITE RUNOFF (AF)	CAPTURE VOLUME (AF)	DISCHARGE VOLUME (AF)	BASIN LENGTH (FT)	BASIN WIDTH (FT)	BASIN DEPTH (FT)	BASIN SLOPES
1.1	21.76	8.58	13.18	2351.00	65.00	3.00	4:1
1.2	18.89	7.31	11.58	2212.00	60.00	3.00	4:1
1.2.1	5.05	2.16	2.89	2140.00	30.00	2.00	4:1
1.3	40.48	15.99	24.49	3870.00	72.00	3.00	4:1
1.3.1	3.95	1.46	2.49	1325.00	32.00	2.00	4:1
1.4	23.18	4.68	18.50	2345.00	41.00	3.00	4:1
1.5	31.13	6.96	24.17	1870.00	66.00	3.00	4:1
1.6	13.83	5.37	8.46	3250.00	36.00	3.00	4:1
1.7	15.03	5.79	9.24	2100.00	52.00	3.00	4:1
1.8	3.37	1.94	1.43	N/A	N/A	3.00	4:1
1.9	1.75	0.68	1.07	1347.00	30.00	1.00	4:1
1.10	2.11	0.86	1.25	1040.00	26.00	2.00	4:1
2.1	28.83	12.04	16.79	3799.00	58.00	3.00	4:1
3.1	48.29	18.53	29.76	4984.00	66.00	3.00	4:1
3.1.1	1.10	0.69	0.41	840.00	26.00	2.00	4:1
3.2	79.53	18.88	60.65	4984.00	67.00	3.00	4:1
4.1	5.71	1.87	3.84	2140.00	42.00	1.00	4:1
4.2	16.92	5.09	11.83	1040.00	218.00	1.00	4:1
4.3	25.52	7.63	17.89	3570.00	43.00	3.00	4:1
5.1	40.59	14.40	26.19	4545.00	58.00	3.00	4:1
5.1.1	9.57	3.60	5.97	2270.00	35.00	3.00	4:1
5.1.2	3.25	1.14	2.11	2250.00	26.00	1.00	4:1
5.2	42.21	14.86	27.35	4540.00	59.00	2.50	4:1
5.2.1	2.97	1.25	1.72	1513.00	26.00	2.00	4:1
5.2.2	6.11	2.33	3.78	735.00	58.00	3.00	4:1
6.1	9.00	0.89	8.11	2291.00	21.00	1.00	4:1
6.2	19.74	2.18	17.56	2454.00	43.00	1.00	4:1
6.3	35.95	3.49	32.46	1810.00	87.00	1.00	4:1
6.4	3.97	0.42	3.55	544.00	38.00	1.00	4:1

The retention volumes shown are based on the volume increases (+ %15 buffer) shown on Table 3 (Page 8). These increases were proportioned based on the acreage of each subarea tributary to each basin. The tributary site runoff column of the above table is based on Table 5 (Page 10). This information is also illustrated on Exhibit "D".

Per the capture volumes tabulated on the previous page, total retention provided for each of the ten (10) drainage areas analyzed in the addendum is summarized as follows:

Table 7 – Total Retention Provided by Drainage Area

AREA	SIZE (AC)	EXISTING VOLUME (AF)	DEVELOPED VOLUME (AF)	INCREASE (AF)	INCREASE 115% (AF)	BASIN VOLUME PROVIDED (AF)
1.1	127.89	14.53	21.56	7.03	8.08	8.58
1.2	140.22	15.42	23.36	7.94	9.13	9.60
1.3	443.93	49.94	75.15	25.21	28.99	29.16
1.4	41.87	4.98	7.12	2.14	2.46	2.62
1.5	165.80	19.27	28.75	9.48	10.90	11.06
2	169.66	19.16	29.10	9.94	11.43	12.04
3	588.34	69.29	101.70	32.41	37.27	39.82
4	252.12	35.70	48.22	12.52	14.40	14.78
5	587.02	72.64	104.27	31.63	36.37	37.09
6	343.42	63.72	69.45	5.73	6.59	7.21

As shown above, the proposed basins are of adequate capacity to offset the proposed 100-year, 24-hour increase in runoff volume expected to be caused by the project. The basins have been situated and sized to capture this volume proportioned by acreage to the subareas tributary to each basin, as illustrated on Exhibit "D".

No. 3: *Demonstrate each retention basin will completely draw-down within a 72-hour period.*

To determine preliminary infiltration rates for each basin, the NRCS Web Soil Survey report was obtained for the project site (see Attachment No. 3). Page 9 of this report delineates the NRCS soil classes in question; the report also gives estimated infiltration rates for each class (minimum to maximum range). For conservative purposes, and in lieu of a safety factor, the minimum values were used. These values, and calculated 72-hour drawdown depths in feet, are summarized as follows:

Table 8 – Calculated Drawdown by NRCS Soil Class

NRCS SOIL CLASS	LOW-END OF NRCS INFILTRATION RATE RANGE (IN/HR)	72-HOUR DRAWDOWN (IN)	72-HOUR DRAWDOWN (FT)
112	5.95	428.40	35.70
113	5.95	428.40	35.70
115	5.95	428.40	35.70
117	0.57	41.04	3.42
127	0.20	14.40	1.20
128	0.20	14.40	1.20
137	0.57	41.04	3.42
138	1.98	142.56	11.88
151	0.57	41.04	3.42

Note that for preliminary basin design purposes, it was determined that any drawdown depth in excess of three (3) feet would be unrealistic, pending localized infiltration testing.

Based on these calculated drawdown values, and examination of the proposed basin locations in relation to the NRCS soil class delineations, preliminary basin depths were established, as follows:

Table 9 – Retention Basin Depths Determination

BASIN NO.	NRCS SOIL CLASS(ES)	72-HOUR DRAWDOWN (FT)	BASIN DEPTH (FT)
1.1	112	35.70	3.00
1.2	112	35.70	3.00
1.2.1	112	35.70	2.00
1.3	112	35.70	3.00
1.3.1	112	35.70	2.00
1.4	112	35.70	3.00
1.5	112	35.70	3.00
1.6	112 & 137	35.70 (72%) & 3.42 (28%) = 26.66 AVG.	3.00
1.7	112 & 137	35.70 (66%) & 3.42 (34%) = 24.72 AVG.	3.00
1.8	112	35.70	3.00
1.9	112	35.70	1.00
1.10	112	35.70	2.00
2.1	112	35.70	3.00
3.1	113 & 117	35.70 (83%) & 3.42 (17%) = 30.21 AVG.	3.00
3.1.1	112	35.70	2.00
3.2	113, 117, 127	35.70 (17%), 3.42 (69%), 1.20 (14%) = 8.55 AVG.	3.00
4.1	112, 113, 127	35.70 (56%) & 1.20 (44%) = 20.51 AVG.	1.00
4.2	127	1.20	1.00
4.3	112, 127, 117	35.70 (60%), 1.20 (24%), 3.42 (16%) = 22.26 AVG.	3.00
5.1	113 & 127	35.70 (88%) & 1.20 (12%) = 31.56 AVG.	3.00
5.1.1	138	11.88	3.00
5.1.2	127	1.20	1.00
5.2	117 & 127	3.42 (63%) & 1.20 (37%) = 2.59 AVG.	2.50
5.2.1	117	3.42	2.00
5.2.2	117	3.42	3.00
6.1	128	1.20	1.00
6.2	128	1.20	1.00
6.3	128	1.20	1.00
6.4	128	1.20	1.00

Note that for basins proposed within multiple soil class delineations, an average depth was calculated based on percentage of basin length within each soil class. Also note that basin-specific infiltration testing will be necessary to confirm final basin designs in accordance with San Bernardino County requirements. Based on site-specific testing, basin depths (and associated widths) will be adjusted in final design.

F. Conclusion

San Bernardino County Department of Public Works requirements for hydrology and drainage have been addressed in the Preliminary Hydrology & Hydraulics Report for the project and this Addendum. California Environmental Quality Act (CEQA) thresholds for surface hydrology and water quality have been addressed via this Addendum for the project as follows, with respect to whether or not the project is anticipated to:

CEQA Threshold 9(c): "Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion on- or off- site?"

The project will include minimal grading (smoothing) that will not change surface flow patterns in the project area. The disturbance area will be compacted and stabilized to prevent erosion/sedimentation. The Mojave River wash limits are not included within the project disturbance area.

CEQA Threshold 9(d): "Substantially alter the existing drainage pattern in the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or –off-site?"

Based on the hydrologic analysis and preliminary retention basins design outlined in this Addendum, the proposed Daggett Solar Power Facility will provide adequate retention facilities to mitigate the expected 100-year, 24-hour volume increase caused by the project. The proposed basins will be located below existing grade and at locations that will require little-to-no grading to direct drainage to the basins. The long, shallow design of the basins will maintain the existing conditions sheet flow drainage to the maximum extent possible without unnecessarily concentrating flows at any single location. Finally, the basin depths (1 to 3 feet) will ensure complete drawdown within 72 hours after cessation of the 100-year, 24-hour event, to prevent long-term standing water and associated vector issues.

As summarized on Table 3 (page 8), the proposed project will result in an increase in peak flows ranging from 2.4% to 13.6%, with a total site-wide increase of 9.5% (570 c.f.s.), and an average per-acre increase of 0.20 c.f.s. per-acre for the approx. 2,860-acre site. Note that this increase in flow is conservative, as the it has been assumed that the proposed conditions project cover will be 100% barren; following regrowth of natural vegetative cover, peak flow increases from the initial project developed will be reduced to near-existing conditions. As stated above, these increased flows will be discharged from the proposed basins via wide, shallow weirs to mimic sheet flow conditions and evenly spread the flow increases and prevent concentrated discharge at a single location.

Note that the published peak 100-year flow for the Mojave River (downstream conveyance for the project site) is 18,500 c.f.s. (refer to the Preliminary Hydrology & Hydraulics Report prepared for the project). Therefore, the proposed site-wide increase of 570 c.f.s. would result in a total wash flow of 18,500 c.f.s. – a 1% increase.

CEQA Threshold 9(e): "Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?"

No storm drain systems of note existing within the project site limits or downstream of the project site (see above for note regarding capacity of the Mojave River wash). See note below regarding water quality and pollutants.

CEQA Threshold 9(f): "Otherwise substantially degrade water quality?"

As stated earlier, the proposed retention basins will provide retention and infiltration of 115% of the calculated 100-year, 24-hour volume increase. This retention volume is far greater than the 2-year, 1-hour (85% percentile) event required by San Bernardino County for water quality treatment provided via infiltration Low Impact Development (LID) Best Management Practices (BMP's). The proposed retention and infiltration volume will be adequate for any anticipated pollutants resulted from the small amount of paving (parking areas) and rooftops proposed. As such, it is not anticipated the project will have an adverse impact on water quality.

CEQA Threshold 9(h): "Place within a 100-year flood hazard area structures which would impede or redirect flows?"

Note that as indicated in the Preliminary Hydrology & Hydraulics Report prepared for the project, there are no published FEMA FIRM panels or identified flood hazard area(s) data available for the project site. A FLO-2D floodplain model was independently developed as part of the Preliminary Hydrology & Hydraulics Report to assist in project design considerations.

The project proposes photovoltaic panels on pilings. Typical piling scenarios for this type of project are a square pile with a width of 6" or a round pile with a diameter of 4". Pursuant to the FEMA National Flood Insurance Program (NFIP) requirements (Unit 5, Section 3), piers and pilings are acceptable within flood-prone watersheds and not considered an impediment to flood flows.

HEC-18 calculations using FHWA Hydraulic Toolbox Ver. 4.1 provided by the Federal Highway Administration were performed to determine scour depths for the two piling scenarios discussed above. An average flood depth of 1.17 ft. and maximum flood depth of 4 ft. was derived from the calculated FLO-2D flood depths included in the Preliminary Hydrology & Hydraulics Report for the project; a focused project area exhibit illustrated these calculated flood depths is included as Exhibit "E" of this Addendum. An average flood velocity of 1.04 f.p.s. and maximum flood velocity of 5 f.p.s. was derived from the calculated FLO-2D flood velocities included in the Preliminary Hydrology & Hydraulics Report for the project; a focused project area exhibit illustrated these calculated flood velocities is included as Exhibit "F" of this Addendum. Per the HEC-18 scour calculations (included as Attachment No. 4 of this Addendum), the average scour depth for a 6" square pile is 0.76 ft, and the maximum scour depth for a 6" square pile is 1.76 ft. The average scour depth for a 4" round pile is 0.53 ft., and the maximum scour depth for a 4" round pile is 1.22 ft. Note that the maximum flow depth and velocity used is limited to a very small portion of the site (southeast portion of Area 1.5). A focused point-by-point comparative analysis and associated scour calculations will be performed in final design to provide detailed scour depths for all piling locations.

As previously discussed, Exhibit "E" of this Addendum illustrates calculated flood depths for the project area (depths less than 0.5 ft. have been excluded), with an average depth of 1.17 ft. and maximum depth of 4 ft. A focused point-by-point analysis will be performed in final design to provide detailed photovoltaic panel elevation requirements for all panel locations, to ensure that all panels are elevated a minimum of 1 ft. above the calculated flood depths.

Note that the Preliminary Hydrology & Hydraulics Report (Section "D", Page 25) assumed existing railroad Culverts No's. 1 and 2 are of adequate capacity to discharge the calculated tributary 100-year peak flows while maintaining flow depths below the existing railroad berms (4 ft. to 6 ft. height). Water Surface Pressure Gradient for Windows (WSPGW) hydraulics calculations for these existing culverts are included as Attachment No. 5 and are summarized as follows:

Table 10 – Existing Culverts Hydraulics Calculations Summary

CULVERT NO.	CULVERT WITH (FT)	CULVERT DEPTH (FT.)	CULVERT LENGTH (FT.)	UPSTREAM INVERT	DOWNSTREAM INVERT	APPROX. SLOPE	MAX. CALC. W.S.E. (AT UPSTREAM INVERT)	MAX. CALC. W.S. DEPTH (FT.) (AT UPSTREAM INVERT)
1	50	3	32	1985.59	1985.26	1.0%	1988.59	3.0 (FREE-FLOW CONDITION)
2	28	3	32	1985.32	1985.19	0.4%	1989.23	3.9 (PRESSURE -FLOW CONDITION)

As shown above, the maximum calculated flow depth (for Culvert No. 2) is approximately 3.9 ft. above the culvert invert (pressure flow condition). The culverts are therefore of adequate capacity to convey the calculated tributary 100-year flows without water overtopping the existing railroad berms.

In summary, the proposed project will provide mitigation for all calculated volume increases, will result in increases in peak flows (9.5% total) that are not anticipated to have a detrimental impact on downstream conveyances (and that will be reduced as natural vegetative cover is restored), will not have a substantial impact to the Mojave River Wash, will mimic existing conditions drainage patterns, will not create obstructions to the existing floodplain, and will provide water quality infiltration volume in excess of San Bernardino County requirements that will prevent any substantial degradation to water quality in the area.

(END)

EXHIBIT “A.1”

NOAA Precipitation
100-Year, 1-Hour

EXHIBIT A.1

100-YEAR, 1-HOUR NOAA PRECIPITATION

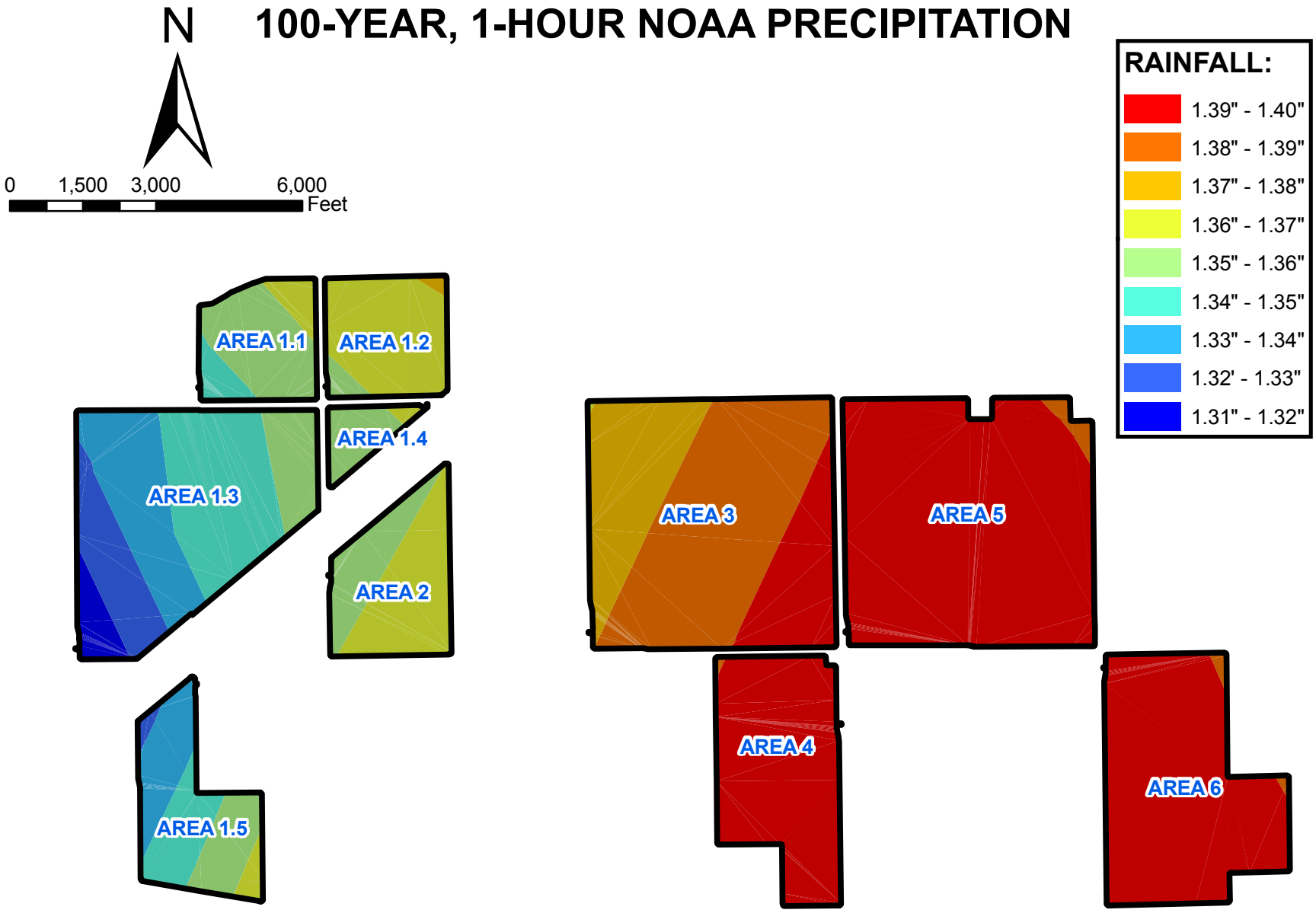


EXHIBIT “A.2”

NOAA Precipitation
100-Year, 6-Hour

EXHIBIT A.2

100-YEAR, 6-HOUR NOAA PRECIPITATION

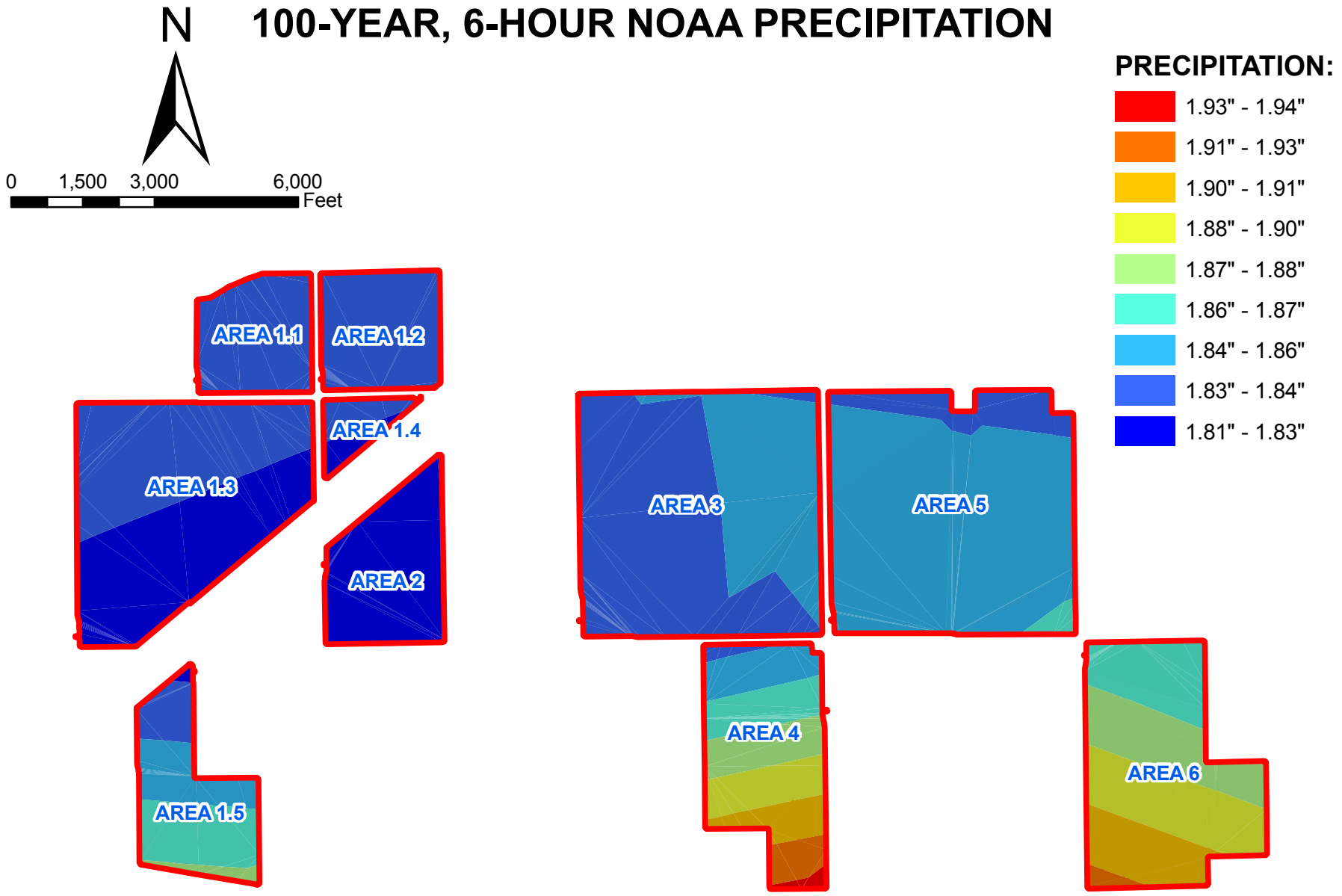


EXHIBIT “A.3”

NOAA Precipitation
100-Year, 24-Hour

EXHIBIT A.3

100-YEAR, 24-HOUR NOAA PRECIPITATION

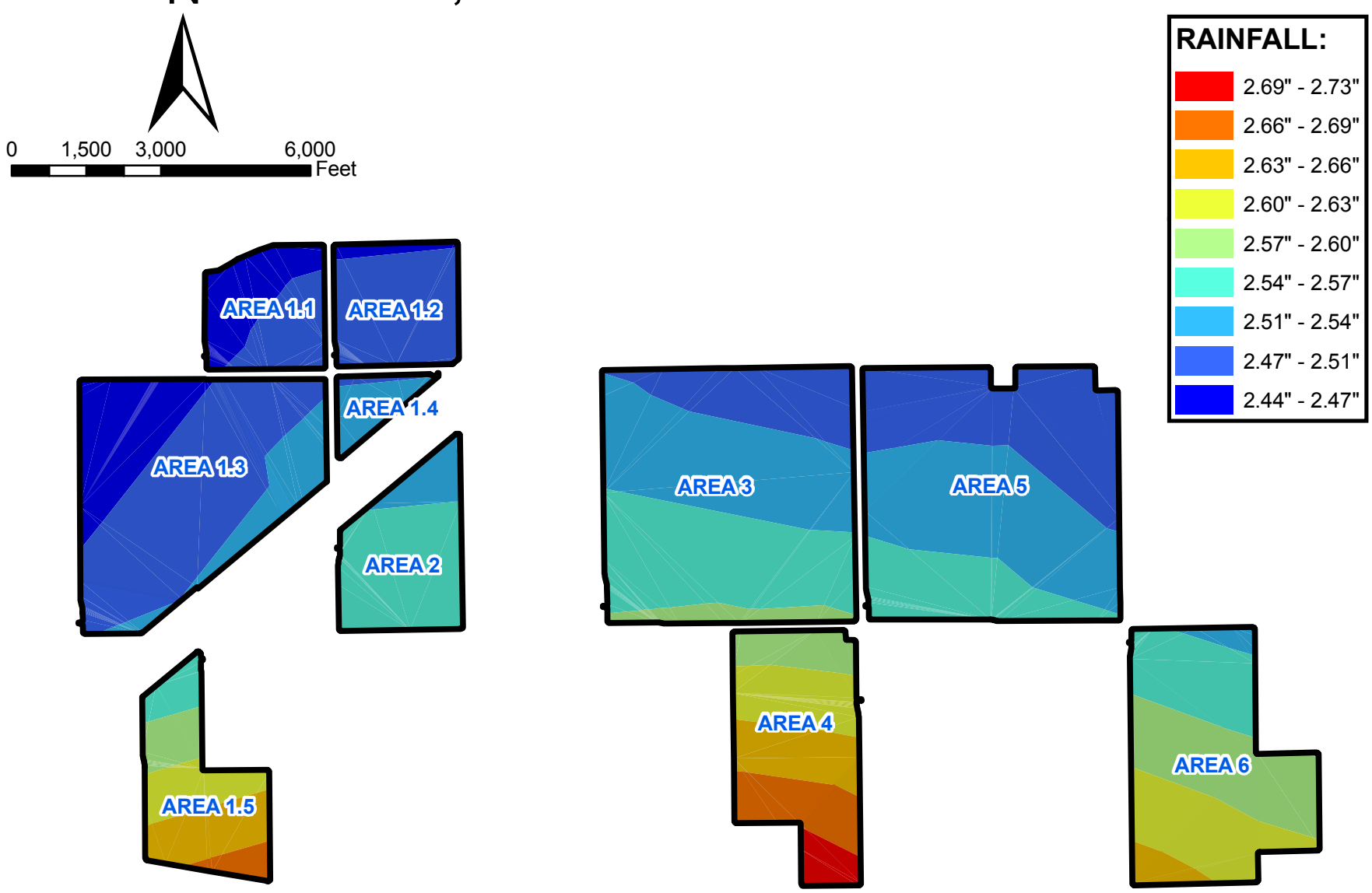


EXHIBIT “B.1”

SCS Values
Existing Conditions

EXHIBIT B.1
EXISTING CONDITIONS SCS VALUES

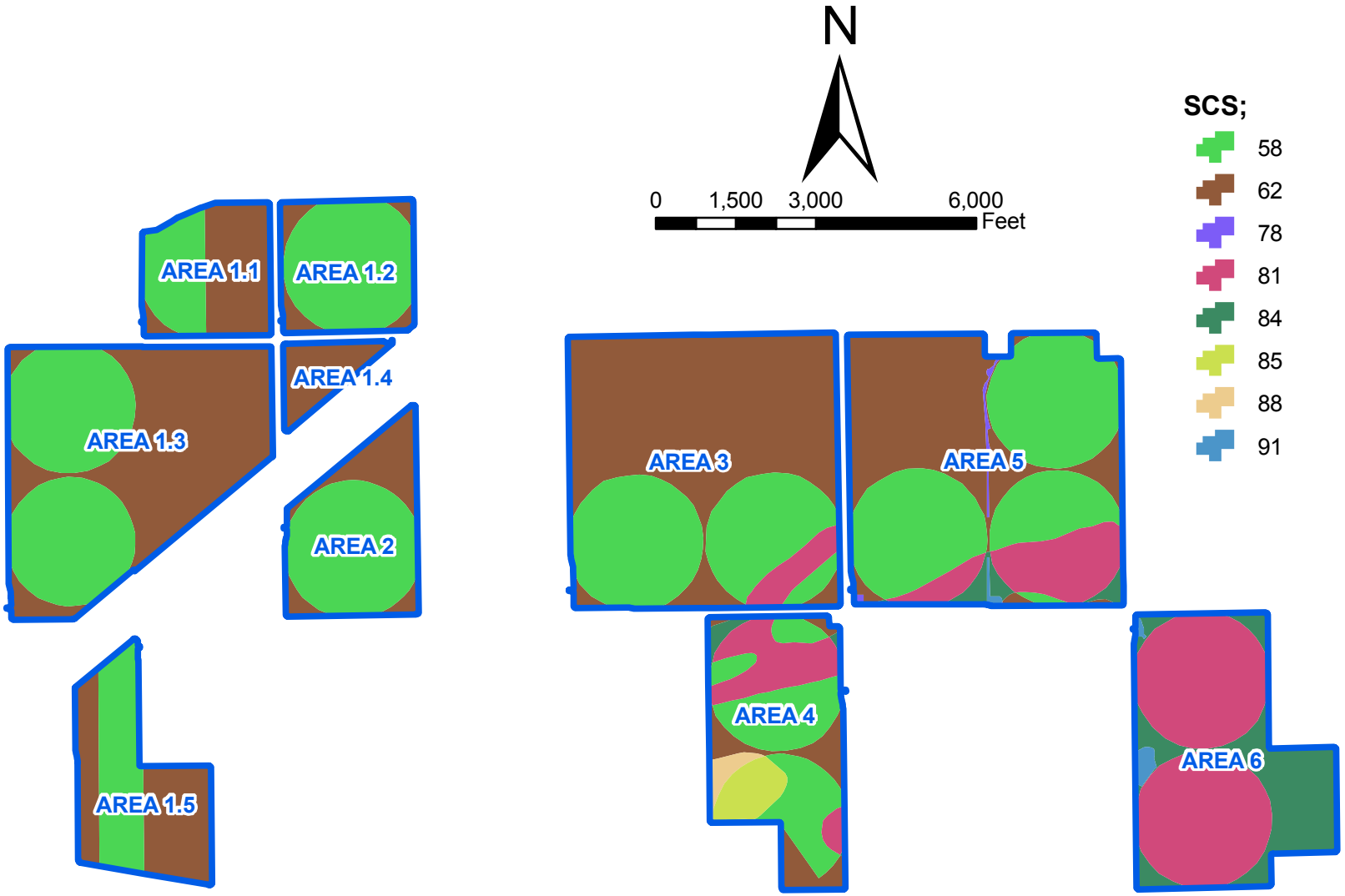


EXHIBIT “B.2”

SCS Values
Developed Conditions

EXHIBIT B.2
DEVELOPED CONDITIONS SCS VALUES

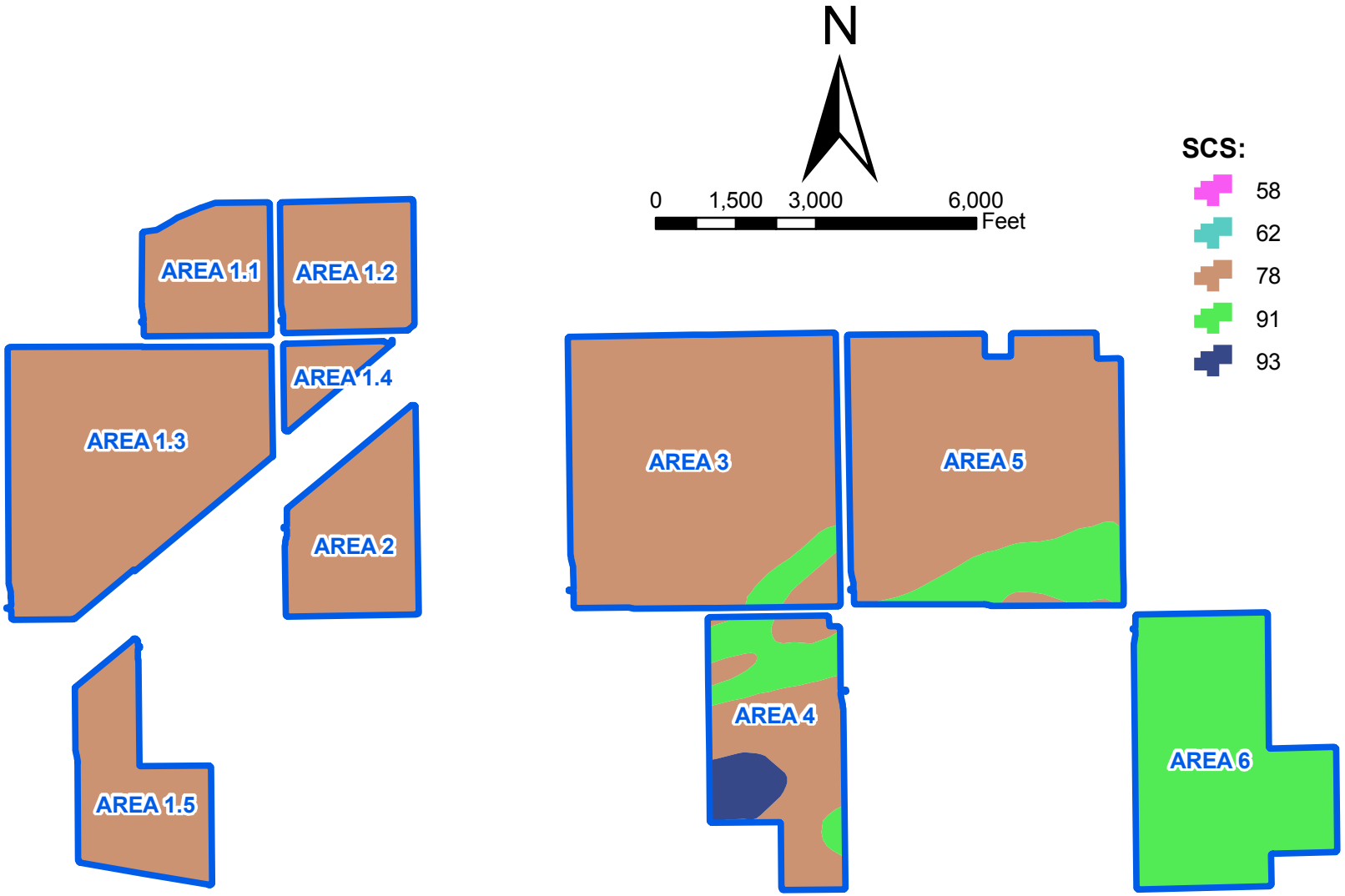


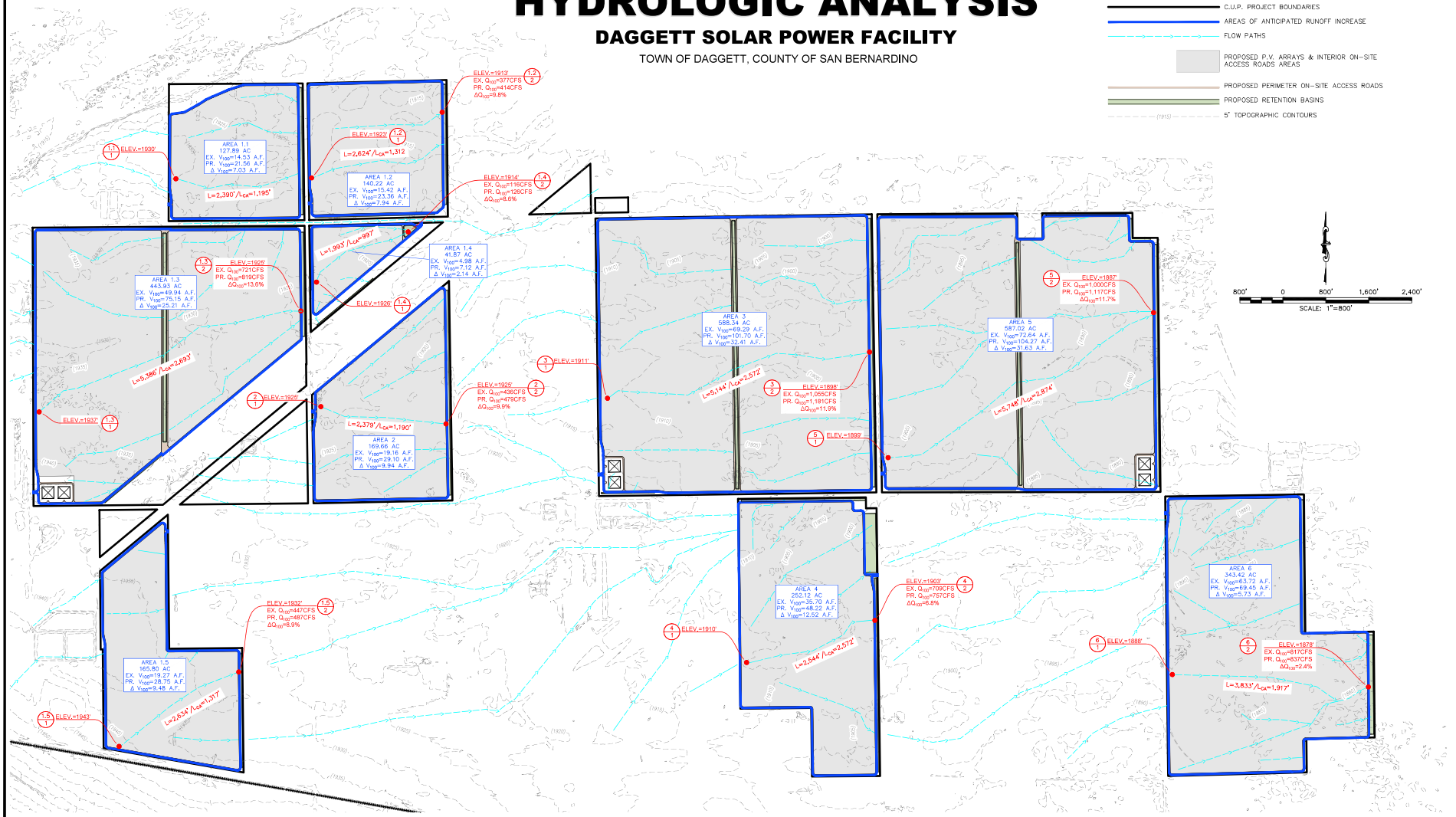
EXHIBIT “C”

Hydrologic Analysis

HYDROLOGIC ANALYSIS

DAGGETT SOLAR POWER FACILITY

TOWN OF DAGGETT, COUNTY OF SAN BERNARDINO



HYDROLOGIC ANALYSIS DAGGETT SOLAR POWER FACILITY IN THE TOWN OF DAGGETT, SAN BERNARDINO COUNTY, CA	PREPARED BY BONADIMAN CIVILDESIGN	PREPARED FOR: nrg	NOTE: JOSEPH E. BONADIMAN & ASSOCIATES, INC. DOES NOT WARRANT THE ACCURACY OF THE G.I.S. DATA PRESENTED IN THIS EXHIBIT. THIS EXHIBIT MAY CONTAIN INFORMATION COPYRIGHTED TO THE COUNTY OF SAN BERNARDINO, CA.	HYDROLOGIC ANALYSIS DAGGETT SOLAR POWER FACILITY IN THE TOWN OF DAGGETT, SAN BERNARDINO COUNTY, CA DISREGARD PRINTS BEARING EARLIER REVISION DATES → 06-07-18	C SHEET 1 OF 1

EXHIBIT “D”

Proposed Drainage Plan