APPENDIX 6.18-1

ELECTRIC AND MAGNETIC FIELD METHODOLOGY
AND CALCULATIONS

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ELECTRIC AND MAGNETIC FIELD METHODOLOGY AND CALCULATIONS

The following study and analysis is prepared for the proposed Avenal Energy project. This project will produce a net 600 MW of electric power for delivery to the existing PG&E transmission grid.

The following electric and magnetic field (EMF) analysis was conducted to assess the maximum likely EMF strengths that would result from operating the new generators at the proposed Avenal plant. This analysis addresses magnetic or electric field that will occur on the new transmission interconnection between the proposed Avenal plant and the point of interconnection at the existing Gates 230-kV substation.

The Corona and Field Effects Program - Version 3, developed by the Bonneville Power Administration (BPA), is a computer program that was used to model EMFs from the transmission lines. The model requires detailed inputs regarding line configuration, conductors, sub-conductors, voltage and current. The condition modeled includes a new net 600-MW combined-cycle plant connected to the existing Gates 230-kV substation via a new 230-kV switchyard and a new single-circuit, 230-kV transmission line (Figure 1). This new line is the subject of this analysis.

ASSUMPTIONS

Conductor currents produce magnetic fields. The strength of these fields depends on the quantity of current. The maximum currents for this analysis were obtained from the maximum output of the facility at 0.9 power factor. Further, magnetic fields are also dependent on transmission line configuration and separation between conductors. Below is information about the magnitude of currents used in the analysis and about the configuration of the new line.

LINE CONFIGURATIONS AND TABULATIONS

The new line will be constructed on steel poles to be located on a 120-foot-wide right-of-way (ROW). The new transmission line ROW cross section configuration is depicted in Figure 2.

The following are additional details for the Avenal transmission line configuration:

- **Figure 1**: Avenal-Gates Single Circuit, Single Pole Structure
  - The electric and magnetic field tabulations are included in Table A-6.18-1.
  - The circuit currents per phase (in amperes) are 1,674 amps on the Avenal-Gates line.
  - The circuit conductors per phase are 2-954 ASCR (1.092 inches diameter), with EHS (extra heavy strength, 0.385 inches diameter, all steel) static wires.

CORONA PERFORMANCE

See Table A-16.18-1 for the maximum gradient for each conductor in kilovolts/centimeter. The calculated fair and rain weather audible noise, radio interference and rain weather television interference values are listed as a function of lateral distance from the centerline reference of the transmission line configuration.

GATES SUBSTATION

ELECTRIC TRANSMISSION LINE

SAN LUIS CANAL

SITE BOUNDARY

0 1/4 1/2 3/4 1 MILE

SCALE 1:24,000

SOURCE: United States Geological Survey 7.5 Minute Topographic Map: Huron, California and La Cima, California Quadrangle

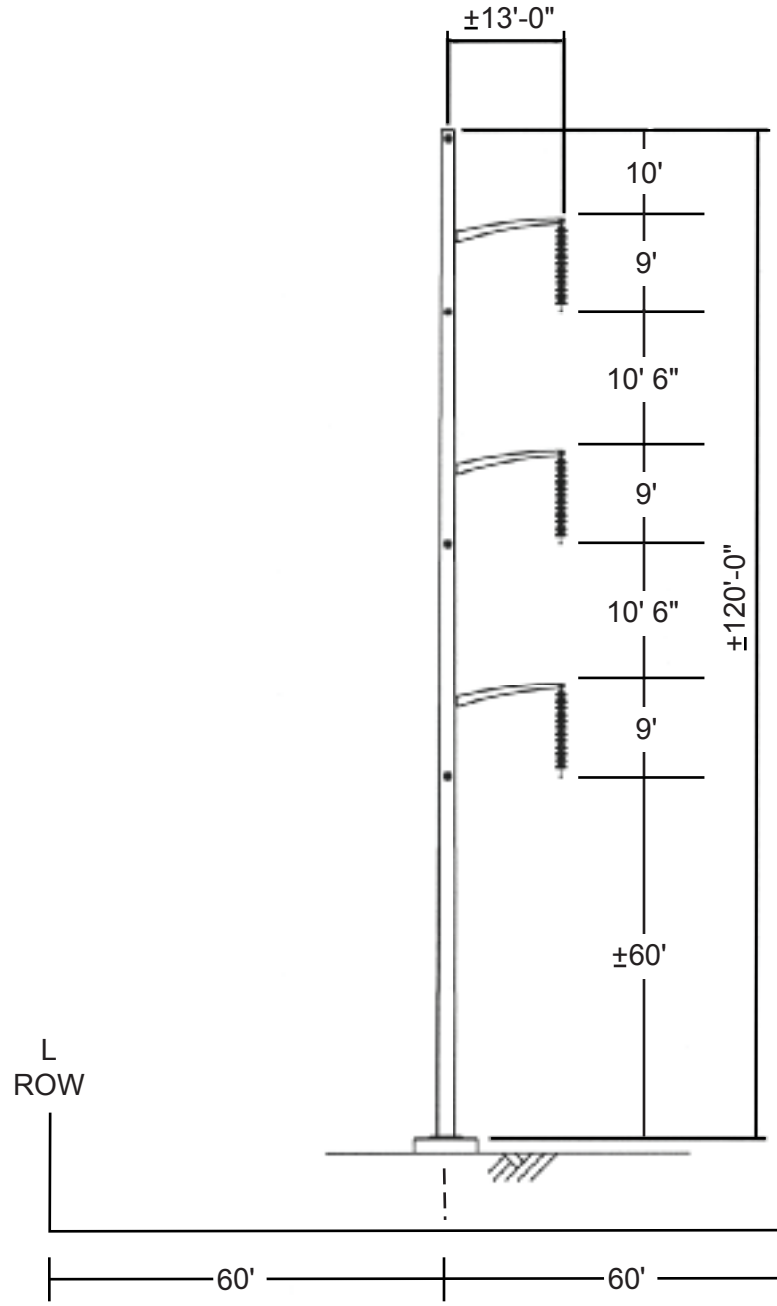
TRANSMISSION LINE INTERCONNECTION ROUTE

FEDERAL POWER AVENAL, LLC

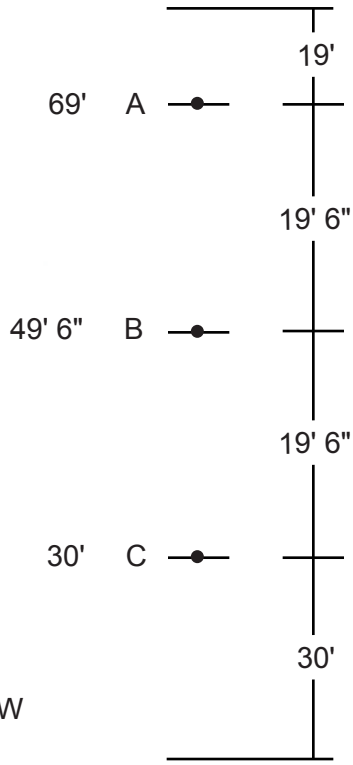
AVENAL ENERGY | FIGURE 1

I:\DUKE\290317\AFC\290317-AFC-6.18-1.dwg Sep 14, 2006 - 4:24pm rhughes

290317-AFC-FIG 2 REV. 09/14/06



MID-SPAN CONDUCTOR HEIGHT



NOT TO SCALE

TYPICAL RIGHT-OF-WAY CROSS SECTION

FEDERAL POWER AVENAL, LLC

AVENAL ENERGY | **FIGURE 2**

TABLE A-6.18-1
ELECTRIC AND MAGNETIC FIELD TABULATIONS

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, OZONE CONCENTRATION, GROUND GRADIENT AND MAGNETIC FIELD
Federal Power Avenal Generation Project - 2 x 954 kcm SSAC w/grd
Avenal Power Project 230 kV lines Single circuit structure

	DIST. FROM CENTER OF TOWER (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON DIAM. (IN)	NO. OF SUBCON	SUBCON SPACING (IN)	VOLTAGE L-N (KV)	PHASE ANGLE (DEGREES)	CURRENT (kAmps)	CORONA LOSSES (KW/MI)
av-gts a	13.00	69.00	10.23	1.20	2	18.00	132.80	.00	1.67	.781
av-gts b	13.00	49.50	11.23	1.20	2	18.00	132.80	-120.00	1.67	1.432
av-gts c	13.00	30.00	10.71	1.20	2	18.00	132.80	120.00	1.67	1.052
av-gt s1	.50	88.00	6.15	.38	1	.00	.00	.00	.00	.000

AN MICROPHONE HT.= 5.0 FT, RI ANT. HT.= 5.0 FT, TV ANT. HT.= 10.0 FT, ALTITUDE= .0 FT
RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ)= 2.000 MPH, GROUND CONDUCTIVITY = 2.0 MMHOS/M
E-FIELD TRANSDUCER HT.= 3.3FT, B-FIELD TRANSDUCER HT.= 3.3FT

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFERENCE (RAIN) L50 DBUV/M	RADIO INTERFERENCE (FAIR) L50 DBUV/M	TVI TOTAL RAIN DBUV/M	OZONE FOR RAIN RATE OF 1.00 IN/HR AT 0. FT LEVEL PPB	ELECTRIC FIELD KV/M	MAGNETIC FIELD GAUSS
-60.0	23.9	-1.1	36.0	19.0	-1.8	.000000	.095	.04871
-55.0	24.1	-.9	36.8	19.8	-1.3	.000000	.069	.05386
-50.0	24.4	-.6	37.6	20.6	-.8	.000000	.042	.05977
-45.0	24.7	-.3	38.5	21.5	-.3	.000000	.074	.06658
-40.0	25.0	.0	39.3	22.3	.2	.000000	.153	.07445
-35.0	25.3	.3	40.2	23.2	.7	.000000	.269	.08356
-30.0	25.6	.6	41.1	24.1	1.3	.000000	.429	.09411
-25.0	25.9	.9	42.0	25.0	1.8	.000000	.645	.10632
-20.0	26.3	1.3	42.9	25.9	2.4	.000000	.932	.12037
-15.0	26.6	1.6	43.8	26.8	3.4	.000000	1.304	.13632
-10.0	26.9	1.9	44.6	27.6	4.4	.000000	1.768	.15401
-5.0	27.2	2.2	46.0	29.0	5.5	.000000	2.313	.17276
.0	27.5	2.5	47.5	30.5	6.6	.000000	2.892	.19107
5.0	27.7	2.7	48.7	31.7	7.4	.000000	3.410	.20646
10.0	27.9	2.9	49.4	32.4	8.0	.000000	3.736	.21581
15.0	27.9	2.9	49.5	32.5	8.0	.000000	3.765	.21672
20.0	27.8	2.8	48.9	31.9	7.6	.000007	3.487	.20891
25.0	27.6	2.6	47.7	30.7	6.8	.001461	2.991	.19448
30.0	27.3	2.3	46.3	29.3	5.7	.006269	2.410	.17652
35.0	27.0	2.0	44.7	27.7	4.6	.011635	1.848	.15771
40.0	26.7	1.7	44.0	27.0	3.6	.016424	1.362	.13973
45.0	26.3	1.3	43.1	26.1	2.6	.020392	.968	.12340
50.0	26.0	1.0	42.2	25.2	1.9	.023495	.662	.10898
55.0	25.7	.7	41.3	24.3	1.4	.025796	.431	.09641
60.0	25.3	.3	40.4	23.4	.8	.027410	.260	.08555

TABLE A-6.18-1
(Cont)

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Û       C O R O N A   A N D   F I E L D      Û
Û E F F E C T S   P R O G R A M   V E R.  3  Û
Û   Source: Bonneville Power Administration   Û
ÛÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÛ


                                INPUT DATA LIST


                 9/15/2006          07:42:34
 Federal Power Avenal Generation Project - 2 x 954 kcm SSAC w/grd
 Avenal Power Project 230 kV lines  Single circuit structure
1,0, 3, 4,0.0,   2.00,   1.00,    .00

(ENGLISH UNITS OPTION)

(GRADIENTS ARE COMPUTED BY PROGRAM)

PHYSICAL SYSTEM CONSISTS OF  4 CONDUCTORS, OF WHICH  3 ARE ENERGIZED PHASES

OPTIONS: ALL
  5.000,  5.000, 10.000,   .000,  1.000, 75.000,  3.280,  2.000,  3.280
'av-gts a','A',   13.00,   69.00, 2,   1.196,  18.000, 132.800,    .000,   1.674,    .000
'av-gts b','A',   13.00,   49.50, 2,   1.196,  18.000, 132.800,-120.000,   1.674,    .000
'av-gts c','A',   13.00,   30.00, 2,   1.196,  18.000, 132.800, 120.000,   1.674,    .000
'av-gt s1','A',     .50,   88.00, 1,    .385,    .000,    .000,    .000,    .000,    .000
 13  -60.0    5.0
 12    5.0    5.0
  0     .0     .0
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