ENGINEERING REPORT
CONCERNING THE EFFECTS UPON
FCC LICENSED RF FACILITIES
DUE TO CONSTRUCTION OF THE
SAND HILL WIND ENERGY PROJECT
IN ALTAMONT PASS
ALAMEDA COUNTY, CALIFORNIA

Prepared for
Tetra Tech, Inc.

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I. INTRODUCTION

This engineering report describes the results of a study and analysis to determine the locations of federally-licensed (FCC) microwave and fixed station radio frequency (RF) facilities that may be adversely impacted as a result of the construction of the Sand Hill wind energy project in Alameda County, California. This document describes impact zones and any necessary mitigation procedures, along with recommendations concerning individual wind turbine siting. All illustrations, calculations and conclusions contained in this document are based on FCC database records.

Frequently, wind turbines located on land parcels near RF facilities can cause more than one mode of RF impact, and may require an iterative procedure to minimize adverse effects. This procedure is necessary in order to ensure that disruption of RF facilities either does not occur or, in the alternative, that mitigation procedures will be effective. The purpose of this study is to facilitate the siting of turbines to avoid such unacceptable impact.

The Sand Hill wind project as currently planned involves the replacement of 40 wind turbines in Altamont Pass in Alameda County, California. The wind turbines proposed to be erected are FloDesign turbines with a maximum height of 46.2 meters AGL.

Using industry standard procedures and FCC databases, a search was conducted to determine the presence of any existing microwave paths crossing the subject property, land mobile and other RF facilities within or adjacent to the identified area and broadcast signals receivable in the area. A specific turbine layout has been submitted for analysis. Accordingly, this report will address the potential conflicts that may be caused by the proposed turbine sites.

The following tabulation and analysis consists of four sections:

1. Microwave point-to-point path analysis[1]
2. Land mobile, public safety and other communications tower sites
3. Broadcast AM, FM and TV
4. Cell Phone Tower Search

The attached figures were generated based upon the operating parameters of the FCC-licensed stations as contained in the FCC station database.

The following analysis examines the pertinent FCC licensed services in the area for impact. This analysis assumes that all licensed services have been designed and constructed according to FCC requirements and good engineering practice.

Each of the RF analyses is described separately in the sections that follow.

II. ANALYSIS OF MICROWAVE LINKS

An extensive analysis was undertaken to determine the likely effect of the replacement wind turbines upon the existing microwave paths, consisting of a Fresnel x/y/z axis study. The microwave paths have been overlaid on Google Earth™ maps, and the images of the microwave paths and the proposed turbines are also available as KMZ files.

For this microwave study, *Worst Case Fresnel Zones* (WCFZ) were calculated for each microwave path. The mid-point of a microwave path is the location where the widest (or worst case) Fresnel zone occurs. Possible geographic coordinate errors must be added to the Fresnel zone clearance numbers[2]. The radius *R* of the Worst Case Fresnel Zone, in meters, is calculated for each path using the following formula:

$$R \cong 8.65\sqrt{\frac{D}{F_{GHz}}}$$

where D is the microwave path length in kilometers and F_{GHz} is the frequency in gigahertz.

[1] Only point-to point microwave facilities were considered (for instance, a study of earth station facilities is not included).

[2] Many microwave facilities were built before accurate methods were available to establish exact geographic coordinates (such as GPS). It is not unusual for database errors of up to 4 or 5 seconds to occur, which can effect the positioning of critical turbines located near Fresnel paths.

In general, the WCFZ is defined by the cylindrical area whose axis is the direct line between the microwave link endpoints and whose radius is *R* as calculated above. This is the zone where the siting of obstructions should be avoided. Evans Engineering Solutions has identified and tabulated 39 licensed microwave links existing in the FCC database below in Table 1 that cross or are close to the project areas. Two microwave links, which are along the same path but are transmitted in opposite directions, have been determined to be potentially affected by the turbine replacement project. These links are shaded in yellow in Table 1.

Table 1 – Active Microwave Links in and near Sand Hill Project Area

Call Sign	Name Site 1	Name Site 2	Freq. (MHz)	Licensee	WCFZ (m)
KJI22	Tesla Substation	Clayton Hill	6625	Pacific Gas and Electric Co.	20.8
KJI22	Tesla Substation	ADCC Sub	6550.625	Pacific Gas and Electric Co.	7.1
KMT50	Stockton Stn. "A"	Tesla Sub	6123.1	Pacific Gas and Electric Co.	20.9
KNF41	Clayton Hill	Tesla Substn.	6825	Pacific Gas and Electric Co.	20.4
WLR689	Wind Farm	North Tracy	6197.24	GTE Mobilnet Of California LP	15.4
WLV548	Altamont Ps	West Tracy	11525	New Cingular Wireless PCS, LLC	7.1
WLW582	North Tracy	Wind Farm	5945.2	Sacramento Valley LP	15.8
WNEZ558	Station	Station	6755.625	Modesto Irrigation District	20.1
WNEZ558	Station	Mtn House Sub.	5974.85	Modesto Irrigation District	21.1
WNTJ319	Highland Peak	Mount Oso	6685	Pacific Gas and Electric Co.	24.1
WNTJ320	Mt Oso	Highland Peak	6845	Pacific Gas and Electric Co.	23.8
WNTP581	Station	Tracy Substn.	6745	Transmission Agency of N. Calif.	19.5
WNTP582	Station	Pixley	6585	Transmission Agency of N. Calif.	19.8
WNTP582	Station	Highland Peak	6555	Transmission Agency of N. Calif.	15.1
WNTP582	Station	Mount Oso	6545	Transmission Agency of N. Calif.	20.6
WNTP583	Station	Tracy Sub	6725	Transmission Agency of N. Calif.	14.9
WNTP975	Tesla Substation	Stockton Stn. “A”	6375.14	Pacific Gas and Electric Co.	20.5
WNTQ512	Ralph Substation	Ralph Passive	10567.5	Pacific Gas and Electric Co.	1.6
WNTQ513	Bethany CS	Ralph Passive	10632.5	Pacific Gas and Electric Co.	4.8
WNTZ553	Station	Station	6625.625	Modesto Irrigation District	20.3
WPNG622	SS07400ATRCY	BA02111A I-580	19425	T-Mobile License LLC	7.4
WPON276	KCRA Trans-Walnut Gr	Altamonte Pass	6845	Pacific Satellite Connection, Inc.	25.2
WPQP800	West Tracy	South Altamont	18025	New Cingular Wireless PCS, LLC	4.1

WPQP800	West Tracy	Altamont Pass	11035	New Cingular Wireless PCS, LLC	7.3
WPQP801	South Altamont	West Tracy	19585	New Cingular Wireless PCS, LLC	4.0
WPQR818	Mt Oso	Tracy Substn	6715	Transmission Agency of N. Calif.	20.3
WPRW946	BA02111A I-580	SC07400A Tracy	17865	T-Mobile License LLC	7.7
WPSK340	ADCC Substation	Tesla Substn.	6730.625	Pacific Gas and Electric Co.	7.0
WPYH451	BA02110A ALA	BA02113A LIV	17795	T-Mobile License LLC	2.1
WPZE336	BA02113A LIV	BA02110A ALA	19355	T-Mobile License LLC	2.0
WQJJ565	Mtn House Substn	Mt Oso	6226.89	Modesto Irrigation District	20.6
WQKD503	Radio Tower	Livermore Hl	6345.49	City & Co. of San Francisco PUC	19.7
WQKD503	Radio Tower	Livermore Hl	6256.54	City & Co. of San Francisco PUC	19.8
WQKD504	Livermore Hl	Radio Tower	6093.45	City & Co. of San Francisco PUC	20.1
WQKD504	Livermore Hl	Radio Tower	6004.5	City & Co. of San Francisco PUC	20.2
WQQD503	SF58XC002	SF72XC931	11585	Sprint Spectrum L.P.	12.0
WQQE305	SF72XC931	SF58XC002	11095	Sprint Spectrum L.P.	12.3
WNTQ512	Ralph Passive	Bethany CS	10567.5	Pacific Gas & Electric Co.	4.8
WNTQ513	Ralph Passive	Ralph Substn.	10632.5	Pacific Gas & Electric Co.	1.6

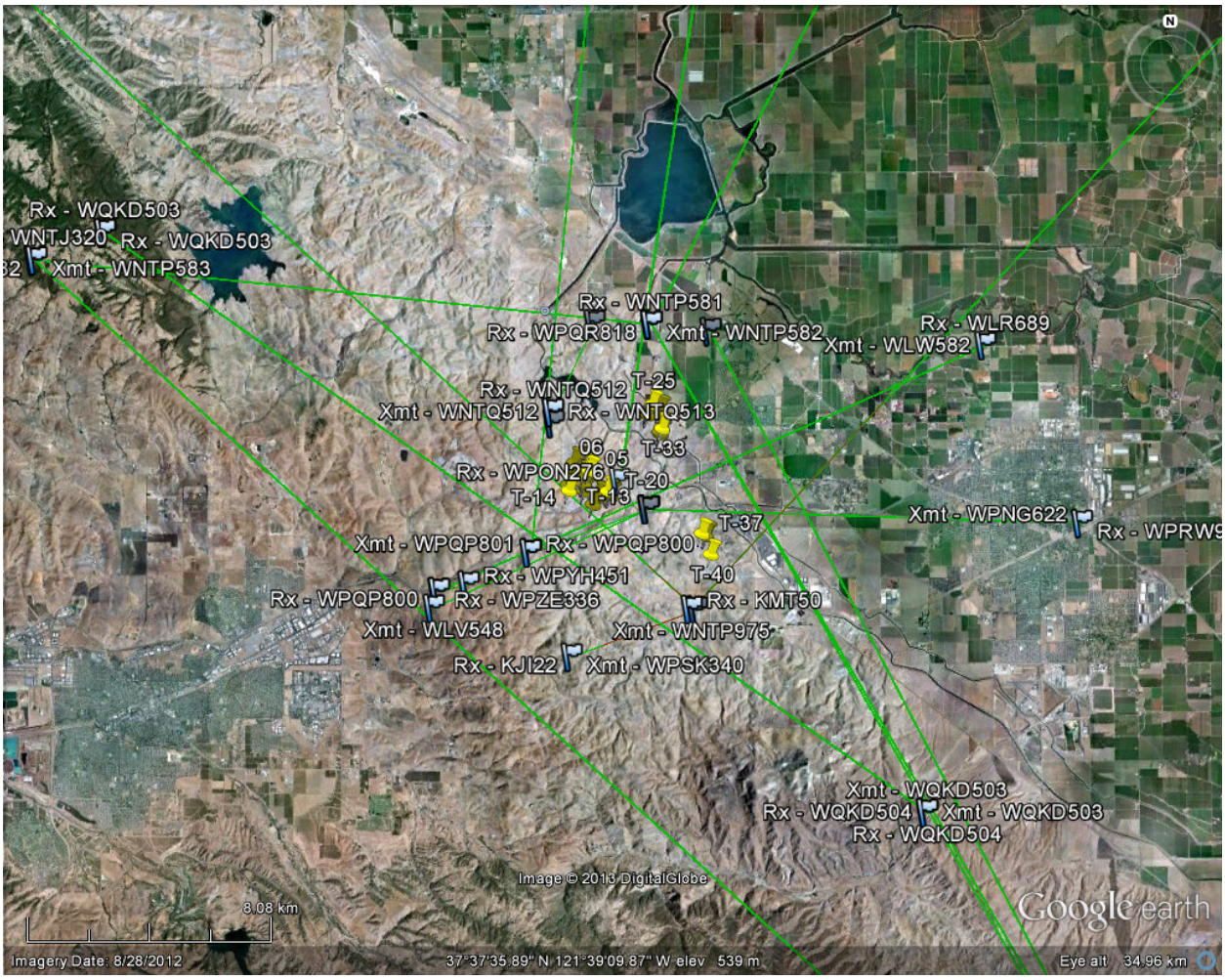

Figure 1 – Active Microwave Paths in and near Sand Hill Project Area

The reader is referred to the provided KMZ file for more magnification and closer inspection.

As can be seen in Figure 2 below, the proposed replacement Turbine 15 is directly in the path of microwave link KJI22/KNF41.

Figure 2 - Turbine 15 in Microwave Path KJI22/KNF41

A close-up view of Turbine 15, Figure 3 below, shows that the turbine rotor would penetrate the WCFZ of the microwave path.

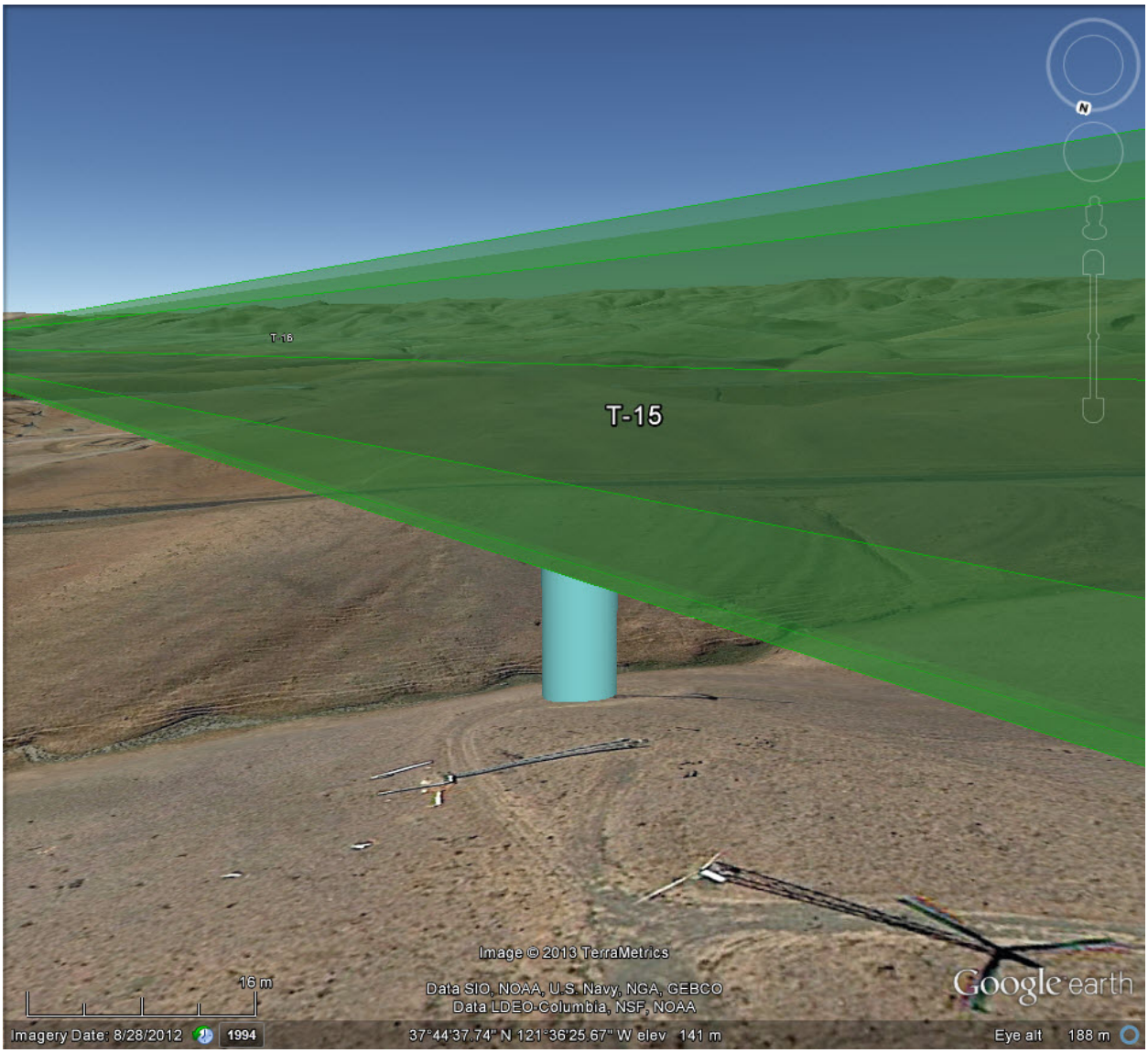

Figure 3 – Close-Up of Turbine 15 in Microwave Path

Further examination of this microwave path reveals that the microwave link was designed without sufficient ground clearance, resulting in the WCFZ of the path being blocked by terrain, as shown in Figure 4 below. This terrain blockage has the potential to compromise the performance of the microwave link.

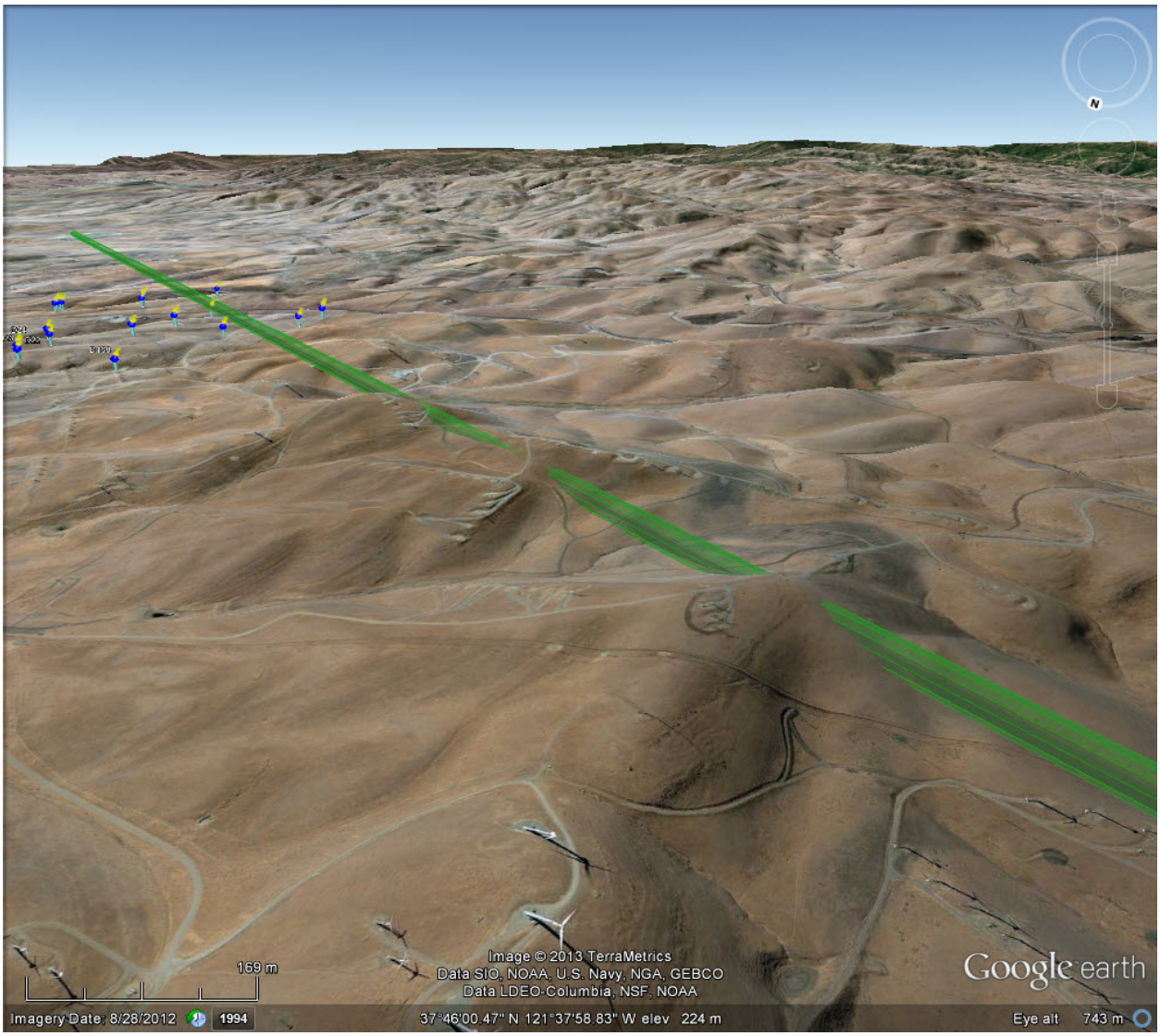

Figure 4 – Microwave Path KJI22/KNF41 Blocked by Terrain

Based on the microwave analysis described herein, it is believed that partial blockage of the WCFZ of the microwave link by the Turbine 15 rotor will have no more substantial harmful impact on the microwave link than the total blockage of the WCFZ by the terrain between the microwave transmitter and receiver.

III. ANALYSIS OF FIXED RADIO FACILITIES

3.1 Land Mobile & Public Safety Facilities

There are 18 land mobile and/or public safety stations identified from the FCC's database that fall within the search area (two miles beyond the project area boundaries). These land mobile sites are listed in Table 2 and mapped in Figures 5 and 6. The specifications on the area land mobile stations can be found in the associated land mobile (LM) spreadsheet file. The land mobile transmitter site whose licensed location is within 400 meters of a planned turbine is highlighted in yellow.

Table 2 – Land Mobiles within 2 Miles of Project Area

Call Sign	Latitude (NAD-83)	Longitude (NAD-83)	Ant. Ht. (m AGL)	Freq. (MHz)	Licensee
KIZ343	37.77908	-121.639	37	159.465	California, State Of
WQHC876	37.77875	-121.638	8.4	463.6125	Steve P Rados Inc.
WQPR550	37.73306	-121.63	4	160.8	Union Pacific Railroad Company
WNPA860	37.74853	-121.616	32	452.125	Seawest Power Resources, LLC
WNXY857	37.73769	-121.614	14	0.53	Alameda, County Of
WQPA973	37.78839	-121.606	7.3	464.4625	Mariposa Energy LLC
WNXY861	37.74464	-121.602	14	0.53	Alameda, County Of
WQPR550	37.72417	-121.6	4	160.8	Union Pacific Railroad Company
WPUT514	37.74222	-121.582	22	483.5875	Vegas Wireless LLC
WPUU810	37.74222	-121.582	22	483.3875	Fleettalk Partners Ltd
WPUV417	37.74222	-121.582	22	484.1875	RF Data Inc
KML232	37.76644	-121.543	10.5	158.895	Tracy, City Of
WQJM336	37.76644	-121.543	9.1	158.895	Tracy, City Of
WQGN647	37.71575	-121.536	9.1	453.875	San Francisco, City & County Of
WQLN851	37.75814	-121.535	6	461.9625	Costco Wholesale
WNUX312	37.73436	-121.535	9	464.425	Costco Wholesale Inc
KIG979	37.73631	-121.535	9	464.375	General Mills Cereal Properties, LLC
KZH63	37.74075	-121.532	8	49.28	Pacific Gas And Electric Company

The reader is referred to the provided KMZ file for more magnification and closer inspection.

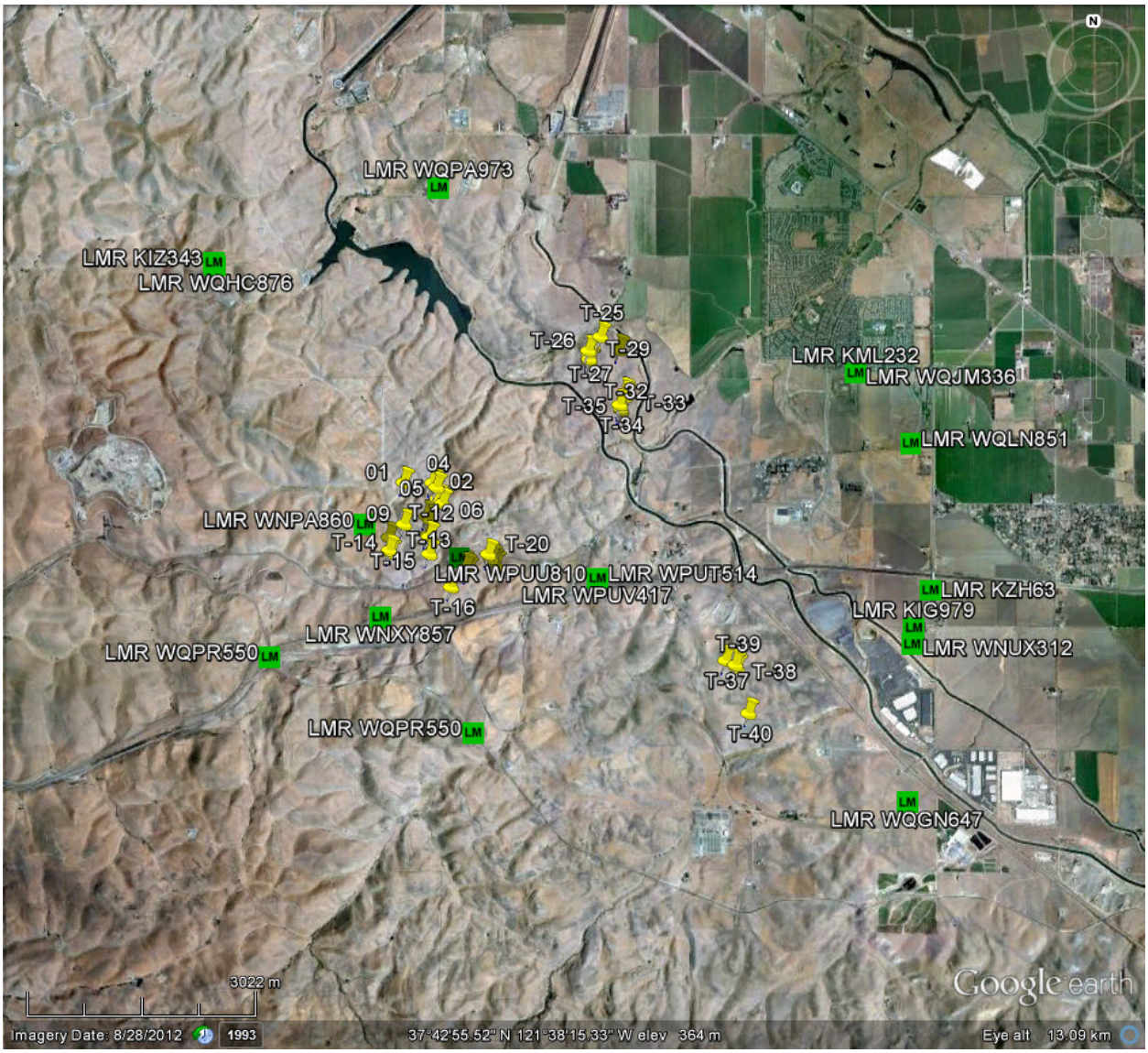

Figure 5 – Land Mobile Stations in and near Sand Hill Project Area

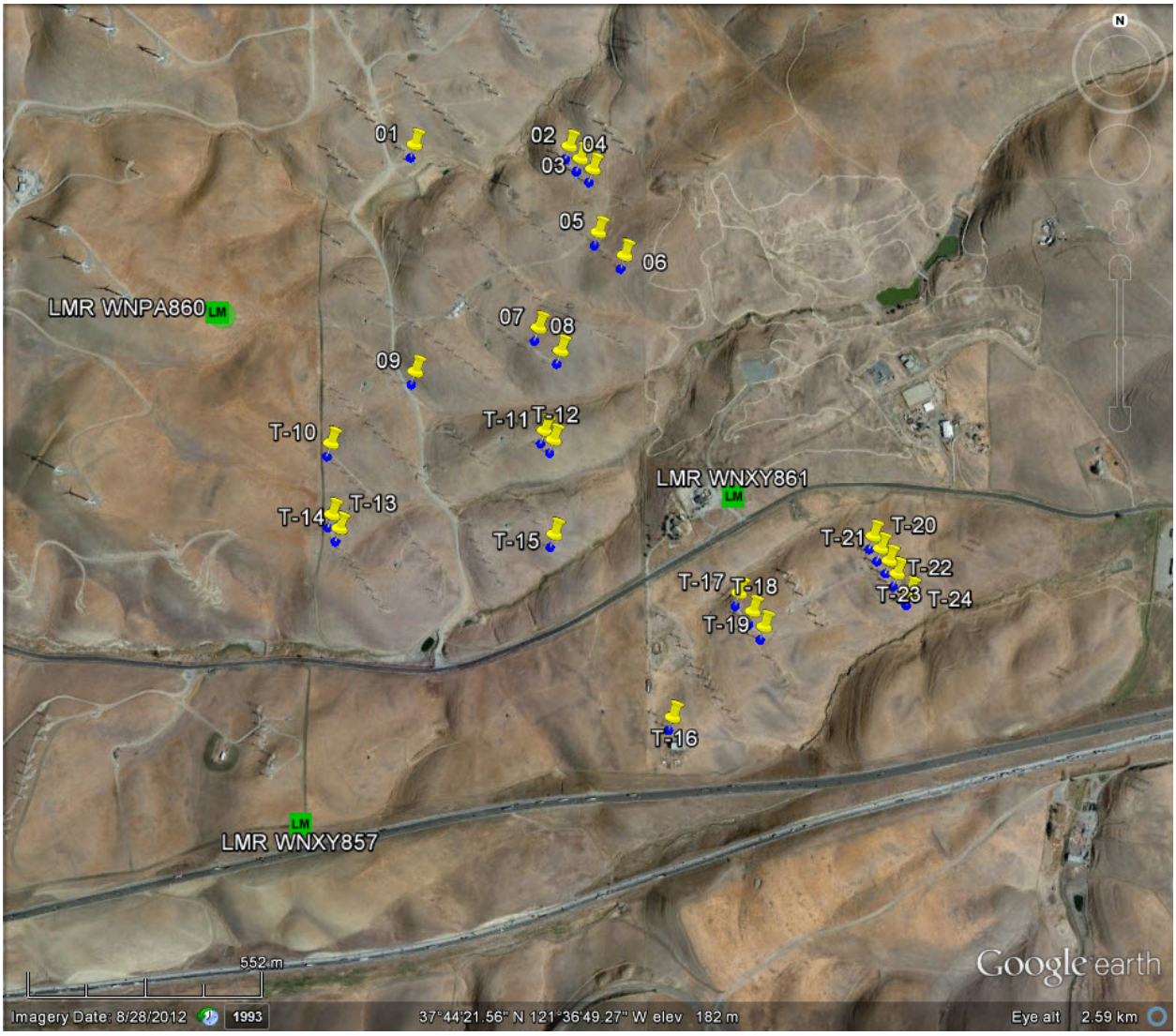

Figure 6 – Close-Up of Land Mobile Stations in Immediate Vicinity of Turbine Sites

Land mobile stations that are within 400 meters of a turbine site customarily should be further evaluated for the possibility of transmitter interference caused by wind turbines. It appears that only land mobile station WNXY861 is within that distance from any of the proposed Sand Hill turbine locations. This station operates on 530 kHz, in the groundwave portion of the radio frequency spectrum, and as such, does not depend on a clear line of sight between transmitter and receiver for successful communication. Thus, the proposed turbines are not considered obstructions to the transmissions of station WNXY861.

Based on the current turbine layout, and assuming that the land mobile stations in and near the project area are actually located at their licensed locations, or located farther away, no adverse impact is expected to be caused to the transmissions of land mobile/public safety stations that are known to be in the area.

3.2 Other Communications Sites

A search of the FCC registered antenna structures database reveals the following existing registered communications towers located within about 15 kilometers of the center of the project area.

The locations of the towers listed in Table 3 are shown in Figure 7.

Table 3 – Communications Towers in Vicinity of Project

FCC Registr. #	Owner	Location	Coordinates	Height AGL (m)
1014680	Citadel Broadcasting Company	Modesto, CA	37-39-10.0; 121-28-42.0	105.5
1050801	T-Mobile West Tower LLC	Byron, CA	37-51-01.0; 121-37-57.0	20.7
1207882	American Towers, LLC	Tracy, CA	37-46-09.5; 121-27-45.1	30.2
1212742	STC Five LLC	Byron, CA	37-49-53.1; 121-39-09.2	6.2
1226397	International Communications Group, Inc. dba Corban Networks	Brushy Peak, CA	37-45-41.8; 121-41-24.3	29.6
1237814	SpectraSite Communications, LLC through American Towers, LLC	Tracy, CA	37-39-57.2; 121-26-11.0	35.0
1240897	City of Tracy	Tracy, CA	37-41-14.7; 121-26-28.8	9.1
1241905	City of Tracy	Tracy, CA	37-40-57.9; 121-26-30.8	21.3
1245135	Pacific Gas and Electric Company	Byron, CA	37-46-14.7; 121-37-03.8	12.2
1255949	Pacific Gas and Electric Company	Tracy, CA	37-42-16.9; 121-30-35.9	28.7
1258243	SBA Monarch Towers I, LLC	San Joaquin, CA	37-50-53.0; 121-31-56.0	27.4
1267359	New Cingular Wireless PCS, LLC	Tracy, CA	37-44-56.4; 121-27-05.6	35.7
1270776	GTE Mobilnet of California LP	Byron, CA	37-49-54.0; 121-39-08.5	6.2
1270777	GTE Mobilnet of California LP	Byron, CA	37-49-54.9; 121-39-11.5	6.2
1281446	GTE Mobilnet of California LP	Byron, CA	37-50-43.2; 121-37-22.7	30.5
1285416	Union Pacific Railroad	Tracy, CA	37-41-45.0; 121-27-10.0	9.1
1286806	New Cingular Wireless PCS, LLC	Tracy, CA	37-44-03.5; 121-32-05.9	33.5

The Sand Hill project is not expected to cause any turbine-related signal transmission problems to multi-directional transmitting facilities located at any of the above registered tower sites, since the closest one is two kilometers away from the nearest proposed replacement turbine.

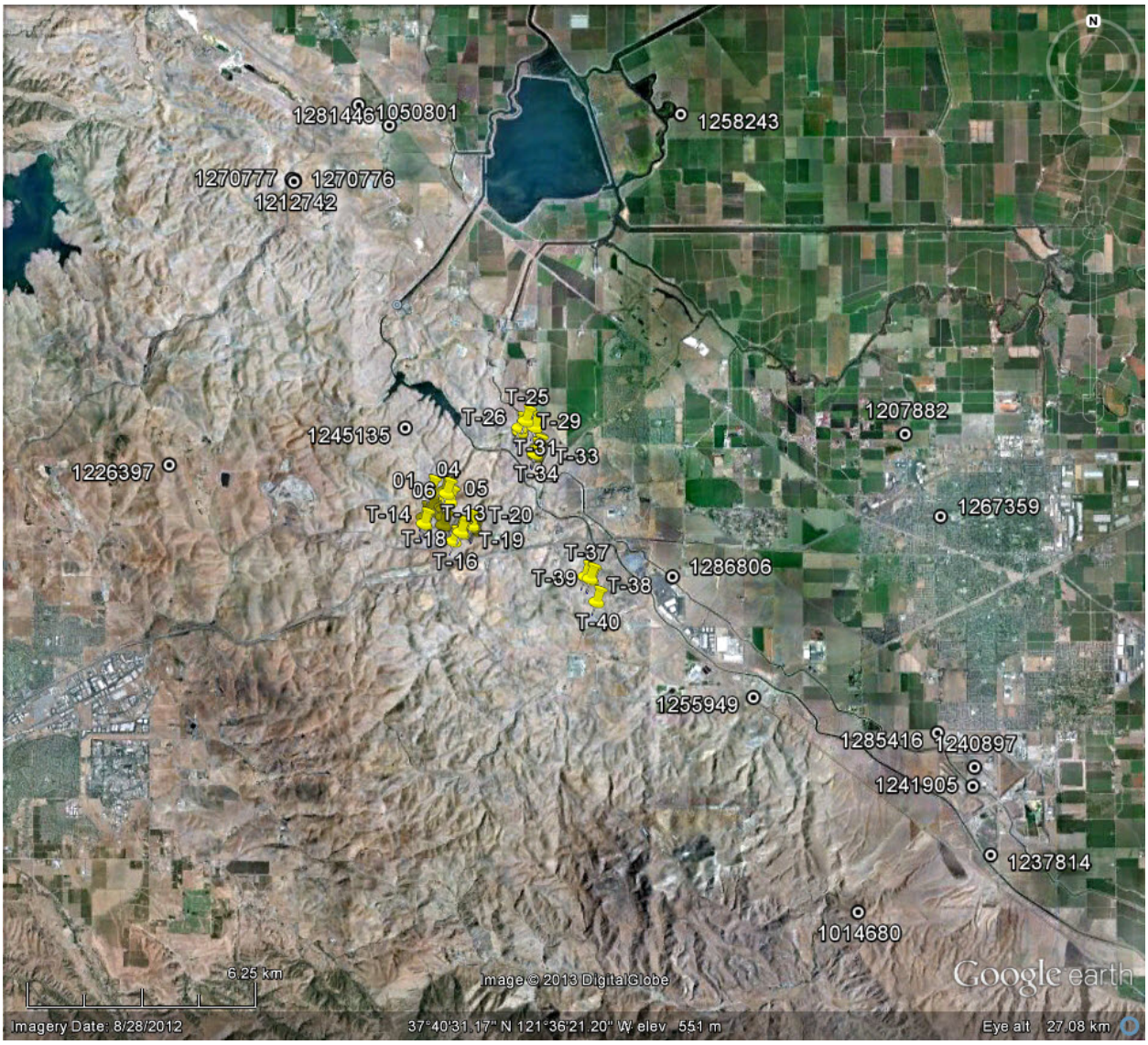

Figure 7 – FCC-Registered Antenna Structures near Sand Hill Project Area

IV. ANALYSIS OF BROADCAST FACILITIES

4.1 TV Broadcast Facilities

The rotating blades of a wind turbine have the potential to disrupt over-the-air broadcast TV reception within a few miles of the turbine, especially when the direct path from the viewer's residence is obstructed by terrain. Interference is caused when signals reflected by the blades arrive at the viewer's TV antenna along with the direct signal. This is known as "multipath interference." However, as turbine manufacturers have replaced all-metal blades with blades constructed of mostly nonmetallic materials[3], this effect has been reduced. Also, the new generation of HDTV receivers is better equipped to deal with minor multipath interference (which is manifested by "pixilating" or "freezing" of the digital picture) than analog TV sets, as special circuitry is employed to suppress the reflected signal. Occasionally, however, multipath interference from one or more turbines can cause video failure in HDTV receivers, especially if the receiver location is in a valley or other place of low elevation.

Alameda County is in the San Francisco-Oakland-San Jose, CA Designated Market Area (DMA) as defined by Nielsen Media Research, as is the adjacent County of Contra Costa to the north. San Joaquin County to the east is in the Sacramento-Stockton-Modesto, CA DMA. The TV stations that have been determined to place a predicted FCC primary over-the-air service signal over at least a portion of the project area are listed in Table 4.

Table 4 – TV Stations Serving Project Area

Call Sign	Network Affiliate	Channel	City of License	Power (KW)	Ant. Height (m HAAT)	Dist. (km)	Azimuth (°T)
KGO-TV	ABC	7	San Francisco, CA	23.8	519	76.8	271.3
KSBW	NBC	8	Salinas, CA	20.6	760	109.7	176.3
KVIE	PBS	9	Sacramento, CA	33	596.8	59.0	6.5
KXTV	ABC	10	Sacramento, CA	28.6	611.9	55.6	7.2
KNTV	NBC	12	San Jose, CA	103.1	376.6	75.5	265.4
KTNC-TV(CP)	Estrella TV	14	Concord, CA	40	962	33.4	297.5
KBSV	Independent	15	Ceres, CA	0.421	575.6	32.0	144.7
KUVS-DT	Univision	18	Modesto, CA	500	555	86.1	60.8
KOFY-TV	Independent/MeTV	19	San Francisco, CA	568	488.1	76.8	271.3

[3] Modern turbine blades are usually constructed from glass-reinforced plastic (GRP), although they usually contain some metal for strengthening, balance and grounding.

KMAX-TV[4]	The CW	21	Sacramento, CA	850	581.2	55.6	7.2
KRCB	PBS, APT Exchange	23	Cotati, CA	105	630.4	110.3	307.8
KOVR[5]	CBS	25	Stockton, CA	1000	593	55.6	7.2
KTFK-DT	Unimas	26	Stockton, CA	850	595	55.6	7.2
KTSF	Independent	27	San Francisco, CA	858	403.4	75.5	265.5
KPIX-TV	CBS	29	San Francisco, CA	1000	511.7	76.8	271.3
KQED[6]	PBS	30	San Francisco, CA	710	511.7	76.8	271.3
KSMS-TV	Univision	31	Monterey, CA	1000	700.6	109.7	176.3
KMTP-TV	Independent	33	San Francisco, CA	480	517	76.8	271.3
KFSF-DT	Unimas	34	Vallejo, CA	370	498	76.8	271.3
KCRA-TV	NBC/MeTV	35	Sacramento, CA	1000	579	58.5	7.8
KICU-TV	Independent/Fox	36	San Jose, CA	550	686	37.9	221.8
KRON-TV	MyNetworkTV	38	San Francisco, CA	1000	511.7	76.8	271.3
KCNS	MundoFox	39	San Francisco, CA	1000	511.7	76.8	271.3
KTXL	Fox	40	Sacramento, CA	1000	601	59.0	6.5
KKPX-TV	Ion Television	41	San Jose, CA	1000	418	75.4	265.6
KCSM-TV	Independent/MHz Worldview	43	San Mateo, CA	500	511.4	76.8	271.3
KTVU	Fox	44	Oakland, CA	1000	512	76.8	271.3
KBCW	The CW, CBS	45	San Francisco, CA	1000	490.5	76.8	271.3
KQCA	MyNetworkTV	46	Stockton, CA	600	580	58.5	7.8
KTLN-TV	Total Living Network	47	Novato, CA	1000	402	99.7	297.2
KSPX-TV	Ion Television	48	Sacramento, CA	1000	489	58.5	7.8
KSTS	NBC	49	San Jose, CA	257	688	37.3	223.5
KQEH	PBS/V-me	50	San Jose, CA	310	661.8	37.9	221.8
KDTV-DT	Univision	51	San Francisco, CA	476.3	701	37.3	23.5

CP = FCC Construction Permit.

Because the height and size of the rotors will not change significantly, the Sand Hill wind turbine replacement project is not expected to cause perceptible adverse changes to TV reception in the area; However, should disruptions to over-the-air TV viewing occur, methods to resolve them are available, and are as follows:

1. Relocation of the household antenna to receive a better signal
2. Installation of a better outside antenna, or one with a higher gain
3. Installation of satellite or cable TV

[4] Has a CP to increase power.
[5] Has a CP to increase power.
[6] Has a CP to increase antenna height.

It is the opinion of this engineer that all disruptions to over-the-air TV broadcast signals, if they occur, can be resolved satisfactorily.

4.2 FM Facilities

The full-service FM stations that place a predicted primary signal over at least part of the project area are listed in the following Table 5.

Table 5 – FM Stations Serving Project Area

Call Sign	Format	Freq. (MHz)	City of License	Power (KW)	Ant. Height (m HAAT)	Dist. (km)	Azimuth (°T)
KEAR-FM	Christian Radio	88.1	Sacramento, CA	8.4	303	56.4	7.1
KQED-FM	Public Radio	88.5	San Francisco, CA	110	387	75.7	265.8
KYNJ (CP)	Unknown	89.5	Tracy, CA	0.1	-48.5	11.4	131.9
New	Unknown	89.9	Livermore, CA	0.2	-81.0	14.4	240.3
KYCC	Christian Music	90.1	Stockton, CA	41	107	35.5	47.7
KAIS	Unknown	90.7	Tracy, CA	0.21	532	20.4	186.1
KUOP	Public Radio	91.3	Stockton, CA	7	372	35.6	145.1
KSJO	International	92.3	San Jose, CA	32	136	61.7	196.1
KRZZ	Regional Mexican	93.3	San Francisco, CA	6	415	75.5	265.5
KPFA	Public Radio	94.1	Berkeley, CA	59	405	57.9	283.7
KYLD	Rhythmic Contemporary	94.9	San Francisco, CA	30	369	75.6	265.7
KGMZ	Sports Talk	95.7	San Francisco, CA	6.9	393	75.7	265.8
KOIT	Lite Rock	96.5	San Francisco, CA	24	480	76.8	271.3
KLLC	Hot Adult Contemporary	97.3	San Francisco, CA	82	309	81.6	278.7
KISQ	Urban Oldies	98.1	San Francisco, CA	75	309.6	81.6	278.7
KUFX	Classic Rock	98.5	San Jose, CA	10	268	68.0	208.7
KSQL	Regional Mexican	99.1	Santa Cruz, CA	1.1	796	73.9	198.4
KMVQ-FM	Top 40 (CHR)	99.7	San Francisco, CA	40	396	75.5	265.6
KBRG	Spanish Adult Hits	100.3	San Jose, CA	14.5	786	73.9	198.4
KMIX	Regional Mexican	100.9	Tracy, CA	6	100	20.7	129.3
KIOI	Hot Adult Contemporary	101.3	San Francisco, CA	125	354	75.7	265.8
KKIQ	Hot Adult Contemporary	101.7	Livermore, CA	4.5	116	17.9	203.5
KUZX	Classic Rock	102.1	San Francisco, CA	33	319	81.6	278.7
KBLX-FM	Urban Adult Contemporary	102.9	Berkeley, CA	6.6	393	75.6	265.7
KATM	Country	103.3	Modesto, CA	50	152	27.4	132.9
KOSF (CP)	Classic Hits	103.7	San Francisco, CA	6.4	403	75.6	265.6
KHKK	Classic Rock	104.1	Modesto, CA	50	152	13.6	137.6
KFOG	Adult Album Alternative	104.5	San Francisco, CA	7.1	459	76.8	271.3
KITS	Modern Rock	105.3	San Francisco, CA	15	366	75.6	265.7
KMEL	Urban Contemporary	106.1	San Francisco, CA	69	393	75.7	265.8
KFRC-FM	News / Classic Hits	106.9	San Francisco, CA	80	305	81.6	278.7
KLVS	Contemporary Christian	107.3	Livermore, CA	8.1	491	19.6	296.4
KSAN	Mainstream Rock	107.7	San Mateo, CA	8.9	354	75.6	265.7

Because of the "capture effect" supported by the "discriminator" in FM receivers, significant disruptions to the above facilities are not expected. Although the received signal may vary with the blade rotation at some receive locations in the immediate area, good quality FM receive radios will most likely factor out such time-varying signals. In those relatively few cases where significant impact is caused, home FM radios could be connected to the rooftop TV receive antennas to pull in a stronger direct signal.

4.3 AM Facilities

Metallic structures more than 100 feet above ground, such as wind turbines, can adversely affect the transmitted signals of AM broadcast stations up to three kilometers away. A search of the FCC's database revealed no AM facilities within the required notification distance of three kilometers beyond the project area boundaries. There should therefore be no reasonable expectations of disruptions in transmitted radiations on the AM band due to the presence of the turbines. Occasionally, depending upon ground conditions, local AM receivers may experience slight signal changes due to local effects, but such anomalies are not recognized by the FCC or the standards of good engineering practice as having an unduly adverse effect.

V. CELL PHONE TOWER SEARCH

5.1 Cell Phone Reception

There is no credible evidence known by this writer to suggest that cell phone reception has been a problem in and around wind turbines. Since cell phone service is mobile by design, operation of mobile devices in the area should theoretically not be significantly affected. In addition, cellular antennas employ diversity and multiple receivers to compensate for any disruptions at any one location.

5.2 FCC Database Search of Cell Towers in Area

A search of the FCC database of cellular telephone base station towers in the area is summarized in Table 6. These cell towers are mapped in Figures 8 and 9.

It should be noted that not all cellular base station towers are individually licensed by the FCC.

Table 6 - Licensed Cellular Base Station Towers in Vicinity of Project Area

Call Sign	Location #	FCC Coordinates	Location	Ant. Ht. (m)	Licensee
KNKA228	21	37-43-04.7 121-39-37.8	Livermore, CA	18.0	GTE Mobilnet of California, LP
KNKA228	44	37-44-32.0 121-34-55.0	Tracy, CA	23.0	GTE Mobilnet of California, LP
KNKA228	112	37-47-10.9 121-41-24.8	Byron, CA	6.1	GTE Mobilnet of California, LP
KNKA228	117*	37-49-54.9 121-39-11.5	Byron, CA	6.2	GTE Mobilnet of California, LP
KNKA228	118*	37-49-54.0 121-39-08.5	Byron, CA	6.2	GTE Mobilnet of California, LP
KNKA274	27	37-41-57.9 121-42-08.6	Livermore, CA	29.3	New Cingular Wireless PCS, LLC
KNKA274	37	37-45-52.1 121-44-39.8	Livermore, CA	4.0	New Cingular Wireless PCS, LLC
KNKA274	38	37-40-44.4 121-43-21.8	Livermore, CA	30.8	New Cingular Wireless PCS, LLC
KNKA274	39	37-43-45.0 121-37-33.6	Livermore, CA	4.6	New Cingular Wireless PCS, LLC
KNKA274	40	37-43-07.3 121-41-59.3	Livermore, CA	30.2	New Cingular Wireless PCS, LLC
KNKA378	3	37-47-25.7 121-27-17.8	Tracy, CA	48.5	Sacramento Valley LP
KNKA378	25	37-45-48.2 121-27-30.9	Tracy, CA	29.2	Sacramento Valley LP
KNKA378	26	37-41-41.7 121-24-50.0	Tracy, CA	29.3	Sacramento Valley LP
KNKA750	2*	37-44-03.5 121-32-05.9	Tracy, CA	25.0	New Cingular Wireless PCS, LP
KNKA750	19	37-42-16.9 121-30-35.9	Tracy CA	28.7	New Cingular Wireless PCS, LP

*Note: These sites also appear in Tables 3

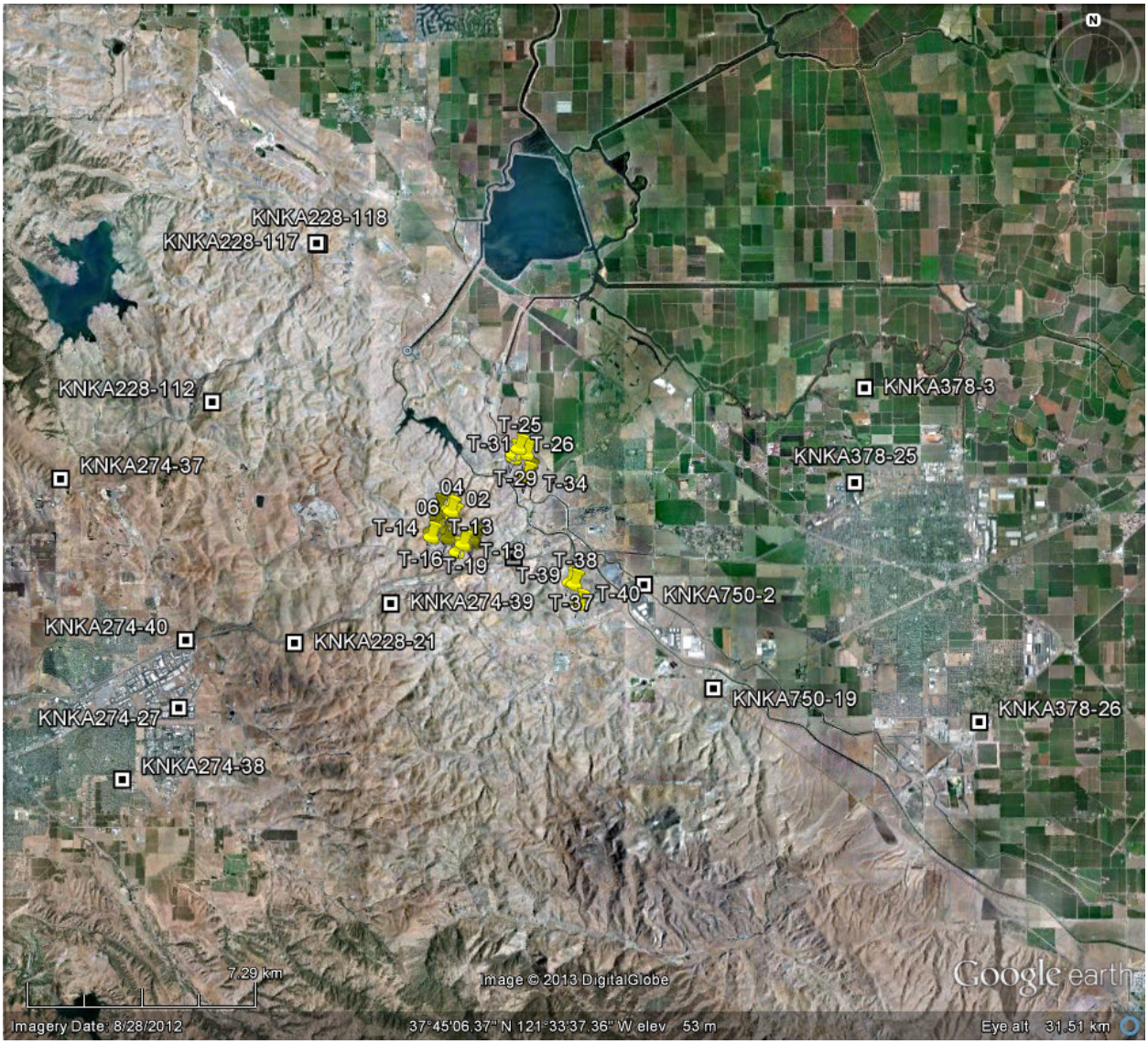

Figure 8 – FCC-Licensed Cell Towers near Sand Hill Project Area

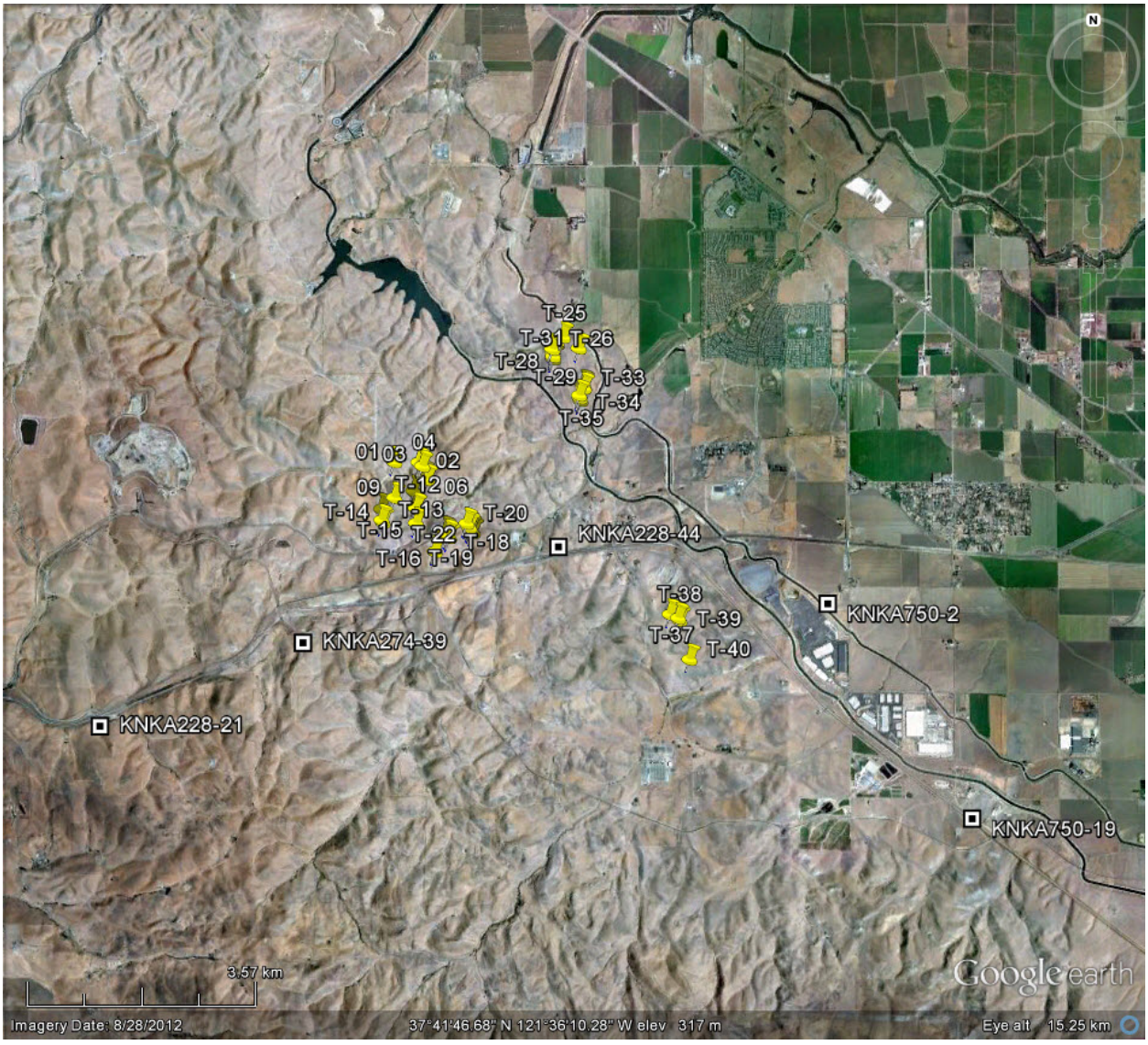

Figure 9 – Close-Up of FCC-Licensed Cell Towers near Sand Hill Turbines

Multidirectional signals emitted from any cellular tower that is not in the immediate area of the wind project (within 400 meters of the project area borders) would not be expected to be adversely affected by wind turbines. There are no cell towers individually notified to the FCC that are less than 1400 meters from the proposed replacement turbines. Therefore, the proposed wind project should not disrupt cell phone service in the area.

VI. CONCLUSIONS

The conclusions from the evaluation of potential effects upon FCC licensed radio frequency facilities by the proposed repowering of the Sand Hill facility are as follows:

1. No microwave beam paths are expected to experience substantial harmful effects as a result of any replacement turbine. One replacement turbine would be in the direct path of a microwave link. However, it is believed that the turbine would have no substantial additional harmful effect than what may already be experienced due to inadequate clearance of the path above the terrain.
2. No land mobile transmitting stations are expected to be adversely affected, assuming that their transmitters are located exactly as per their FCC licenses.
3. Cellular telephone transmission and reception is not expected to be adversely affected by the repowering project.
4. Over-the-air TV interference, if it occurs, can be mitigated.
5. Since this is a turbine replacement project, and the new turbines will be similar in height to to the existing ones, the overall expectation is that no over-the-air communications transmitting facilities in the area, either licensed or unlicensed by the FCC, will be adversely impacted by the project.

VII. STUDY LIMITATIONS

Known limitations of the data sources used for the evaluations described in this report are listed below.

1. The FCC database was used for creating the tables and maps provided in this report. Some point-to-point microwave links are not licensed by the FCC, and thus are not searchable in a central database.
2. Microwave path studies are based upon third party and FCC databases that normally exhibit a high degree of accuracy and reliability. Although Evans performs due diligence to ensure that all existing microwave facilities are represented, we cannot be responsible for errors in FCC databases that may lead to incomplete results.
3. Towers under 200 feet in height may not be required to be registered with the FCC.

Respectfully Submitted,

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RF Impact Consultant
May 23, 2013