



CITY OF PACIFIC GROVE
300 Forest Avenue, Pacific Grove, California 93950

AGENDA REPORT

TO: Honorable Mayor and Members of the City Council

FROM: Wendy Lao, AICP, Associate Planner

MEETING DATE: September 5, 2018

SUBJECT: Appeal of Planning Commission's approval of Use Permit #17-1111 to allow a new pole with a small-cell antenna and associated wireless telecommunications facility equipment, including a meter pedestal, along the public right-of-way of the 700 block of Forest Lodge Road.

APPLICANT: Pete Shubin & Ben Hackstedde, Sequoia Deployment Services, on behalf of Verizon Wireless, Inc.

APPELLANT: Amy Fallavena

ZONING/LAND USE: None; public right-of-way

CEQA: Categorical Exemption, Section 15303, Class 3, Construction or Conversion of Small Structures

RECOMMENDATION

Uphold Planning Commission's approval of Use Permit #17-1111 to allow a new pole with a small-cell antenna and associated wireless telecommunications facility equipment, including a meter pedestal, along the public right-of-way of the 700 block of Forest Lodge Road.

DISCUSSION/BACKGROUND

On July 26, 2018, the Planning Commission approved Use Permit #17-1111 to allow a new pole with a small-cell antenna and associated wireless telecommunications facility equipment, including a meter pedestal, along the public right-of-way of the 700 block of Forest Lodge Road.

On August 6, 2018, within the 10-day appeal period, appellant Amy Fallavena filed an appeal of the Planning Commission's approval. The appeal cited concerns regarding possibility of a future height increase to the pole, potential fire risk, sufficiency of capacity and coverage, adverse impacts on property value, and potential impacts on Monarch Butterflies.

Timeline:

On December 5, 2017, the applicant applied for a Use Permit to allow installation of wireless telecommunication facility equipment onto an existing utility pole. The proposed project was to

be located on the eastern side of the public right-of-way of Sunset Drive, adjacent to single-family homes, with a meter pedestal across Sunset Drive on the western side of the public right-of-way, adjacent to Pacific Grove High School (PGHS). The applicant held a community workshop on April 26, 2018 to discuss the project and answer questions. Approximately 20 members of the public attended. Public notice for the workshop included notice in a local newspaper, postings on site, and mailing neighbors within 300' of the project site.

The Planning Commission held a public hearing on [June 7, 2018](#). Public notice for the hearing included a notice in a local newspaper, postings on site, and mailing neighbors within 300' of the project site, as required by the municipal code. The Planning Commission reviewed the proposed project, as well as an alternative design where a pole-mounted shroud concealed some of the equipment. Following public testimony and discussion, the Planning Commission passed a motion to continue the item to a future date and to consider relocating the project across the street with the possibility of installing a new pole.

On June 11, 2018, the applicant submitted a revised project to City staff. The project was modified and proposed a new pole with an antenna and associated equipment in the public right-of-way of Sunset Drive, adjacent to PGHS. The applicant also offered three different color and design options, ranging from gray paint color, to yellow paint color, to a sculpture in the form of a traditional yellow #2 pencil.

The Planning Commission held a second public hearing on [June 21, 2018](#) to review the revised project. Again, public notice for the hearing included a notice in a local newspaper, postings on site, and mailing neighbors within 300' of the project site. After receiving further public testimony and additional discussion, the Planning Commission passed a motion to continue the item to July 26, 2018, where a variety of locations and feasible designs could be considered.

Following multiple discussions between the City of Pacific Grove, Pacific Grove Unified School District Administration staff (PGUSD) and Sequoia Deployment Services (on behalf of Verizon Wireless, Inc.), the applicant submitted another alternative project location on July 11, 2018. This alternative project location was preferred to the others by PGUSD, and is to be located along the northern side of the public right-of-way of Forest Lodge Road. The site is located approximately between a small parking lot at the rear of PGHS and the rear of Country Club Gate shopping center. The project proposed a new pole with an antenna and associated equipment, totaling approximately 29'-6" in height. A meter pedestal and PG&E transformer would also be located near the pole within the public right-of-way. The equipment and pole would be painted brown to complement the surrounding trees. Compared to the previous proposals, this site is the furthest away from the nearest building. The Planning Commission approved this proposal at its [July 26](#) meeting, with modifications to the draft permit.

ANALYSIS

The City may not prohibit the installation of wireless facilities on utility poles along the public right-of-way, under the Federal Telecommunications Act Section 253. However, the City may regulate placement, construction, and modification of personal wireless service facilities, except as provided, under the Telecommunications Reform Act of 1996 (Telecommunications Reform Act or Act) Section 704(a)(7)(A).

The following is a summary of applicable key provisions of the Telecommunication Reform Act:

Local Zoning Authority Preserved – Section 704(a)(7)(A) preserves authority of State and local governments over decisions regarding the placement, construction, and modification of personal wireless service facilities, except as provided.

State and Localities May Not Take Discriminatory or Prohibiting Actions – The City shall not unreasonably discriminate among providers of functionally equivalent services and shall not prohibit or have the effect of prohibiting the provision of personal wireless services.

Procedures for Ruling on Requests to Place, Construct, or Modify Personal Wireless Service Facilities – Requires local government to act upon a request for authorization to place, construct, or modify personal wireless service facilities within a reasonable time. Any decision to deny a request must be made in writing and be supported by substantial evidence contained in a written record.

Regulations for Evaluating the Environmental Effects of Radiofrequency Radiation – The City is prohibited from denying a permit to install wireless communication equipment ***based on health concerns over radio frequency (RF) emissions provided emissions from the facility comply with FCC standards.*** The Act also prohibits local jurisdictions from imposing more stringent safety standards than the FCC standards.

Any action to deny an application must be in accordance with The National Telecommunications Reform Act of 1996, Section 704, (B) (I) (iii): *“Any decision by a State or local government to deny a request to place, construct, or modify personal wireless service facilities shall be in writing and be supported by substantial evidence contained in a written record.”*

The “substantial evidence” standard is deferential to local governments, and generally requires courts to uphold a local finding that is (1) authorized by local law, such as the City Code, and (2) supported by enough evidence for the court to find reasonable minds could differ as to whether the evidence supports the conclusion. Evidence must be specific to the proposed facility. “Generalized grievances” applicable to all wireless telecommunications facilities are not considered substantial evidence.

Under California law, telephone corporations are granted a limited right to use the public right-of-way to the extent necessary to provide services to the public in a manner that does not “incommode” the public use of the rights-of-way. Municipalities also retain reasonable time, place and manner control over temporary construction activities. Federal and California courts hold that the “incommode” standard preserves local authority to regulate against both physical obstructions and unreasonable aesthetic impacts.

Pacific Grove Municipal Code (PGMC) §23.64.060 permits wireless telecommunication facilities in any district, except the O district, subject to first obtaining a use permit. The public right-of-way does not have a zoning designation. However, the adjacent PGHS is located in the

Unclassified (U) zoning district, the Country Club Gate shopping center is located in the Commercial-Forest Hill (C-FH) zoning district, and the nearest residential properties are located in the R-1 zoning district.

The analysis below restates the required findings for a use permit, and provides staff's comments based on this particular application.

1. Use Permit Finding Subsection A – PGMC §23.70.080(a)(4)(A) – “The proposed use is allowed with a use permit within the applicable zoning district and complies with all applicable provisions of these regulations.”

Staff Comments: The proposal is located within the public right-of-way, which does not have a zoning district. PGMC. §23.64.060 allows wireless telecommunication facilities in any district, except the O district, subject to first obtaining a use permit. Otherwise, the zoning code is silent with respect to wireless telecommunication facilities.

2. Use Permit Finding Subsection B - PGMC §23.70.080(a)(4)(B) – “The proposed use is consistent with the general plan, the local coastal program, and any applicable specific plan.”

Staff Comments: The General Plan is silent with respect to telecommunications equipment and facilities. However, the General Plan Chapter 8, Urban Structure and Design, Program K, states, “Underground all utilities in entry areas that are particularly scenic or provide important views into Pacific Grove.” As a result, depending on the selected location and design, staff recommends undergrounding equipment where feasible, or ensuring the equipment is not visually significant from the street. The project site is not located within the Coastal Zone, and therefore the Local Coastal Program does not apply. The project is located near to but outside of the Forest Hill Specific Plan project area, and therefore this specific plan does not apply.

3. Use Permit Finding Subsection C - PGMC §23.70.080(a)(4)(C) – “The establishment, maintenance, or operation of the use will not, under the circumstances of the particular case, be detrimental to the health, safety, or general welfare of persons residing or working in the neighborhood of the proposed use.”

Staff Comments: The wireless telecommunication facilities would not be detrimental to the health, safety, or general welfare because the equipment would be installed, maintained and operated in compliance with all applicable public health and safety regulations, including but not limited to all building codes, electrical codes, pole attachment or pole installation regulations and regulations for exposure to RF emissions.

Section 704 of the Act expressly preempts City regulation of the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of RF emissions as long as such facilities comply with the FCC's regulations concerning such emissions. The Act also prohibits the City from imposing more stringent safety standards than the FCC standards. The RF report submitted by the applicant

provides the proposal will be below the FCC's permitted maximums, and therefore will be in full compliance with FCC RF public and occupational safety exposure standard. Staff recommends a condition of approval requiring full and ongoing compliance with all applicable FCC regulations.

The design involves installations on a fairly large, 40' wide right-of-way, which would not result in significant obstructions that could impede access or create hazards for pedestrians, persons protected under the federal Americans with Disabilities Act, bicyclists or motorists. The proposed equipment on the pole would generally be inaccessible to the general population because it is pole-mounted at least approximately 9 feet above ground. A report prepared by Hammet & Edison, Inc., Consulting Engineers, determined the proposed facility will comply with all FCC standards for limiting public exposure to RF energy. As noted in the permit's condition of approval, signage shall be installed to notify people about potential exposure to RF emissions.

The City's Fire Department (contracted through the Monterey Fire Department – AKA "MFD") and the Building Division reviewed the project proposal, and have not identified any concerns that pose a significant risk. MFD has further advised that the project site is not located within a High Severity Fire Zone.

4. Use Permit Finding Subsection D - PGMC. §23.70.080(a)(4)(D) – “The use, as described and conditionally approved, will not be detrimental or injurious to property and improvements in the neighborhood or to the general welfare of the city.”

Staff Comments: The proposed facility would not be detrimental or injurious to properties or improvements in the neighborhood or to the general welfare of the City because there is no site or context specific evidence in the record to show the proposed installation would result in such an impact. Although public comments have been made expressing concerns that the project proposal may result in negative impact to residential property values, generalized grievances do not amount to substantial evidence. Accordingly, staff believes there is no evidence in the record to show the proposed installation would be detrimental to properties or improvements in the neighborhood or to the general welfare of the city.

5. Use Permit Finding Subsection E - PGMC. §23.70.080(a)(4)(E) – “The location, size, design, and operating characteristics of the proposed use are compatible with the existing and future land uses in the vicinity.”

Staff Comments: The approved site is located in the public right-of-way of Forest Lodge Road. This location is between PGHS, which has a land use designation of Public, and the Country Club Gate shopping center, which has a land use designation of Commercial. The project would serve many nearby users and is compatible with nearby land uses. The size and design of the structure appears similar to existing utility structures, and will be painted brown to blend into the trees nearby. The proposed use is considered a utility use and therefore will not generate noise or odors that adversely impact neighboring uses. The applicant provided photo simulations to illustrate existing

and proposed site elevations. Staff recommends undergrounding equipment where possible to reduce visual clutter. Various design options have been proposed.

Operating characteristics of the proposed use appear compatible with existing and future land use of commercial, public schools, and residences nearby, as this project will serve many users within those areas. Installation of proposed antennas and equipment will provide service capacity for some areas that currently have poor service and will boost service levels for areas that currently have good capacity. The proposed project will provide an enhanced level of telecommunication service for residents, businesses, and visitors. Businesses and residences have come to rely on wireless technologies in their day-to-day operations. Enhanced service levels will support both current and future technologies within the City.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

City staff determined the project is exempt from CEQA pursuant to the CEQA Guidelines, Article 19, Section 15303, Class 3, for “construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures” because the project involves the construction of a wireless communication facility on a new pole. Furthermore, the project does not qualify for any of the exceptions to the categorical exemptions found at CEQA Guidelines Section 15300.2. Please see attachment for more information.

CONDITIONS

Staff recommends if UP 17-1111 is approved, the permit must be approved subject to the specific findings above, and subject to the recommended conditions (see attachment).

OPTIONS

1. Approve with modifications
2. Provide alternate direction

FISCAL IMPACT

There is no fiscal impact. The project would be funded by the applicant.

GOAL ALIGNMENT

Not applicable.

ATTACHMENTS

- A. Application
- B. Appeal Form and Associated Exhibits
- C. Draft Permit with modifications from Planning Commission
- D. Planning Commission July 26, 2018 Draft Meeting Minutes
- E. Radio Frequency Emissions Report
- F. CEQA Documentation
- G. Site Plans and Renderings
- H. Public Comments
- I. Applicant’s Response

RESPECTFULLY SUBMITTED:



Wendy Lao, AICP
Associate Planner



CITY OF PACIFIC GROVE

Community Development Department – Planning Division

300 Forest Avenue, Pacific Grove, CA 93950

Tel: 831.648.3190 • Fax: 831.648.3184 • www.cityofpacificgrove.org/cedd

Permit Application

Application # UP17-1111
Date: 12/5/17
Total Fees: \$4,208.10

APPLICANT/OWNER:	Project Address: <u>Public ROW in front of 618 Sunset Drive, Pacific Grove, CA 93950</u> APN: <u>N/A</u>	
	Project Description: <u>Telecommunications facility consists of adding a 4' antenna within a canister ('cantenna' design) mounted on the top of the existing 24'-8" high NCJPA pole. In addition, the Radio Remote Units (RRU's) and the equipment cabinet will be mounted on the existing pole between approximately 10' high for equipment cabinet and 20' high for the RRU's. The pole, cantenna and RRU's will be painted to match the existing utility pole. The meter pedestal will be located across the street on the other side of Sunset Drive in the existing parkway.</u>	
PLANNING STAFF USE ONLY:	Tree Work? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
	Applicant Owner	
	Name: <u>Ben Hackstedde w/Sequoia Deployment Services on behalf of Verizon Wireless</u> <u>Public ROW</u>	
	Phone: <u>949-259-3344</u> <u>N/A</u>	
	Email: <u>ben.hackstedde@sequoia-ds.com</u> <u>N/A</u>	
	Mailing Address: <u>22471 Aspan Street, Suite 290, Lake Forest, CA 92630</u> <u>N/A</u>	
Permit Request: <input type="checkbox"/> CRD: Counter Determination <input checked="" type="checkbox"/> SP: Sign Permit <input type="checkbox"/> LM: Lot Merger <input type="checkbox"/> EIR: Environmental Impact <input type="checkbox"/> AP: Architectural Permit <input checked="" type="checkbox"/> UP: Use Permit <input type="checkbox"/> IHS: Initial Historic Screening <input type="checkbox"/> VAR: Variance <input type="checkbox"/> AAP: Administrative AP <input type="checkbox"/> AUP: Administrative UP <input type="checkbox"/> HPP: Historic Preservation <input type="checkbox"/> MMP: Mitigation Monitoring <input type="checkbox"/> ADC: Arch Design Change <input type="checkbox"/> ADU: Acc. Dwelling Unit <input type="checkbox"/> A: Appeal <input type="checkbox"/> Stormwater Permit <input type="checkbox"/> ASP: Admin Sign Permit <input type="checkbox"/> LLA: Lot Line Adjustment <input type="checkbox"/> TPD: Tree Permit W/ Dev't <input type="checkbox"/> Other: _____		
CEQA Determination: Review Authority: Active Permits: Overlay Zones: <input checked="" type="checkbox"/> Exempt <input type="checkbox"/> Staff <input type="checkbox"/> HRC <input type="checkbox"/> Active Planning Permit <input type="checkbox"/> Butterfly Zone <input type="checkbox"/> Initial Study & Mitigated Negative Declaration <input type="checkbox"/> ZA <input checked="" type="checkbox"/> PC <input type="checkbox"/> Active Building Permit <input type="checkbox"/> Coastal Zone <input type="checkbox"/> Environmental Impact Report <input type="checkbox"/> SPRC <input type="checkbox"/> CC <input type="checkbox"/> Active Code Violation <input checked="" type="checkbox"/> Area of Special Biological Significance (ASBS) <input type="checkbox"/> _____ <input type="checkbox"/> ARB <input type="checkbox"/> _____ Permit #: _____ <input type="checkbox"/> Environmentally Sensitive Habitat Area (ESHA)		
Property Information Lot: _____ Block: _____ Tract: _____ ZC: <u>R-1</u> GP: <u>MDR 17.4 DU/A.C.</u> Lot Size: _____ <input type="checkbox"/> Historic Resources Inventory <input type="checkbox"/> Archaeologically Sensitive Area		
Staff Use Only: Received by: <u>A. Aziz</u> <u>DEC 05 2017</u> SPAID <u>1,500.00 + 2,816.42 = 4,316.42</u> Assigned to: <u>W. Lao</u> <u>CITY OF PACIFIC GROVE 12-5-17</u> <u>COMMUNITY DEV DEPT</u>		

CERTIFICATION – I, the undersigned, under penalty of perjury, depose and certify that I am the applicant for this request, that the property owner approves this application and that all statements contained herein, including all documents and plans submitted in connection with this application, are true and accurate to the best of my knowledge.
I further acknowledge it is my responsibility to determine whether additional permits are required.

Applicant Signature: [Signature] **Date:** 08/28/2017

Owner Signature (Required): N/A **Date:** _____



CITY OF PACIFIC GROVE

Community Development Department – Planning Division
300 Forest Avenue, Pacific Grove, CA 93950
T :: 831.648.3190 • F :: 831.648.3184 • www.ci.pg.ca.us/cdd

RECEIVED
CITY OF PACIFIC GROVE
APPEALS DIVISION
2018 AUG - 6 P 3:53
Appeal #: _____
Date: August 6, 2018
Received By: Bandra Kendall, City Clerk
Total Fee: 1353.80

Appeal Form

Project Information

Project Address: Cell Tower at Forest Lodge Rd. APN: Permit # 17-1111
 On HRI / Not on HRI

Application & No.: _____
 Applicant Name: Amy Fallavena Phone #: 209-321-7359
 Mailing Address: 402 2nd St., Pacific Grove, CA 93950
 Email Address: borman3@comcast.net
 Owner Name: _____ Phone #: _____
 Mailing Address: _____
 Email Address: _____

Action¹

ARB: Architectural Review Board
 CDD: Planning Staff
 HRC: Historic Resources Committee

PC: Planning Commission
 NRC: Natural Resources Committee
 SPRC: Site Plan Review Committee
 ZA: Zoning Administrator

Date of Action: _____
 Action Taken: _____

Appeal Information

Appellant Name: Amy Fallavena Phone #: 209-321-7359
 Mailing Address: 402 2nd St., Pacific Grove, CA 93950
 Email Address: borman3@comcast.net
 Appeal Deadline: 5:00 p.m. on 8 / 6 / 2018
 Grounds for Appeal: See attached documents...

If necessary, use additional pages.

Fees

Discretionary Fees ²	\$	_____
Appeal Fee = 25% of discretionary fees	\$	<u>1000-</u>
Cost of publication of legal notice ³	\$	<u>325.00</u>
Photocopies _____ copies @ 10¢ each	\$	_____
Postage ⁴ _____ stamps @ 45¢ each	\$	_____
Other <u>nothing mailings</u>	\$	<u>28.80</u>
Total Appeal Fee		<u>1353.80</u>

Appellant Signature: [Signature] Date: 8-6-2018

¹ See Table 23.70.012-1 in the Pacific Grove Zoning Code, which identifies roles of review authorities as they relate to appeals.
² Whatever fee was collected by the city for the application for use permit, architectural approval, variance, etc., or combination of more than one fee if more than one decision is being appealed.
³ Currently averaging \$250-300.
⁴ Typically the number of address labels for parcels (or portions thereof) found within a 300 ft radius of the subject parcel (350 ft radius for homes in the Asilomar Dunes area) is approximately 120. Mailing is sent to owners and occupants (including most individual apartments) of properties.

APPEAL OF USE PERMIT APPLICATION #17-1111

August 6, 2018

Honorable Mayor and Members of the City Council;

Re: Appeal of the City Planning Commission approval of- Use Permit Application #17-1111 to determine a location, and to add a small-cell antenna and associated wireless telecommunications facility equipment to an existing utility pole, or to add a new pole of approximately 29'-6" height with a small cell antenna and associated wireless telecommunications facility equipment.

We the undersigned 10 appellants appeal the July 26, 6-0, unanimous decision of the Planning Commission to approve the above Use Permit. The appellants feel that the commission did not take into account several issues, were unprepared for the level of technical discussion, did not provide their own engineer and EMF expert, did not consider the safety of the children at Forest Grove Elementary and Pacific Grove High School, and did not research the topic beyond agreeing with Verizon that they had the power under the FCC rules. We find the City is administratively negligent in not requesting a city ordinance after the last cell tower issue at the Pacific Grove Adult School and Parents Place location on Lighthouse and sited at the Wilkies Motel where many of the same issues were stated and/or raised on August 21, 2013.

The City of Pacific Grove does not have an ordinance to decline the continued proliferation of cell towers. We need one to protect our community and to provide defined guidelines to future development.

Appeal Condition #1:

The potential height increase was not discussed or communicated to the public at any public hearing.

Verizon's application states: "Consideration of Use Permit Application #17-1111 to determine a location, and to add a small-cell antenna and associated wireless telecommunications facility equipment to an existing utility pole, or to add a new pole of approximately 29'-6" height with a small cell antenna and associated wireless telecommunications facility equipment."

The Middle Class Tax Relief Act of 2012 and Federal Communications Commission (FCC) guidelines, once a radio or cell tower under 30' tall is erected, it can be extended to 130 feet (or more) in height and 40 feet in width without a permit by adding 5 (or more) antennas.

Appeal Condition #2

The risk of fires was not adequately evaluated by the Pacific Grove Planning Commission for this location as set in a forested area.

- The documented drought has left our community and others throughout the state, with millions of trees that are stressed and combustible.
- Because of this fire potential, the nearby Pacific Grove High School is at extreme risk. The health and safety of the Pacific Grove Children was not considered adequately.
- Additionally, Verizon has no liability to cover the cost of fires. To put our community at risk is negligent.
- The Pacific Grove Unified School District, especially Forest Grove Elementary and Pacific Grove High School, may need to incur unplanned costs, time and training in revising their fire safety plan with this hazard introduced adjacent to evacuation areas.
- Cell Towers have been documented further effecting the health of trees which increases the fire danger and introduces yet another condition killing our trees.
 - Progressive deterioration of trees near phone masts has also been observed. Trees located inside the main lobe (beam), look sad and feeble, have dried tops, show slow growth and high susceptibility to illnesses and plagues. Also, electromagnetic radiations generate heat. Due to this, the microorganisms present in the soil near it would be killed. This in turn harms those organisms which feed on them and disturbs the ecological cycle.

EXHIBIT 1, Section 6.4, Pp 27-28

Documented Cell Phone Fires

- Cell phone tower near Virginia Heritage High School catches fire. Now it is leaning over. EXHIBIT 2 <http://wtkr.com/2015/06/16/cell-phone-tower-near-heritage-high-school-catches-fire/>
- School Football Field Cell phone tower catches fire in Grandview, Ohio. EXHIBIT 3 <http://www.dispatch.com/content/stories/local/2014/07/15/0715-grandview-cellphone-tower-fire.html>
Sept 13, 2014 Cell tower fire at Thurston High sends up smoky plume. EXHIBIT 4
- <http://www.kval.com/news/local/Cell-tower-fire-near-Thurston-High-sends-up-smoky-plume-275018241.html>
- Cell tower at Risk of Falling after Fire Atlanta Georgia. EXHIBIT 5 <http://www.wsbtv.com/videos/news/emergency-crews-worry-cell-tower-may-fall-after/vFQDs/>
- Pennsylvania Fire results in Collapse Fears: Collapse Zone created at base and they vacated the buildings. EXHIBIT 6 <http://www.nbcphiladelphia.com/news/breaking/Cell-Phone-Tower-Fire-Collapse-Bucks-County-212501221.html>
- Cell tower fire closes Rockbridge Road, evacuates day care. EXHIBIT 7 <http://www.gwinnettdailynews.com/news/2011/dec/02/fire-closes-rockbridge-road/>
- New Jersey Cell Tower Fire. EXHIBIT 8 http://www.nj.com/monmouth/index.ssf/2013/05/cell_tower_fire_knocks_out_main_middleton_police_communications.html

- Explosion near cell tower likely caused by propane leak, Iowa. EXHIBIT 9
<http://www.lemarssentinel.com/story/1641878.html>
- Cell phone tower to be taken down following fire, Georgia. EXHIBIT 10
<http://www.ajc.com/news/news/local/cell-phone-tower-to-be-taken-down-following-fire/nQPC6/>
- Cell phone tower catches fire near U.S. 95 Las Vegas. EXHIBIT 11
<http://www.fox5vegas.com/story/20959950/cell-phone-tower-catches-fire-near-us-95>
- Maryland Cell Tower Destroyed by Fire. EXHIBIT 12
<http://www.firehouse.com/news/10500668/maryland-cell-tower-destroyed-by-fire>
- Cell tower catches fire, nearby buildings evacuated, San Bernardino County, California. EXHIBIT 13
<http://www.dailybulletin.com/20110113/cell-tower-catches-fire-nearby-buildings-evacuated>
- Kansas City Cell Tower Fire closes Interstate 435 EXHIBIT 14
<https://screen.yahoo.com/raw-video-cell-tower-fire-213100571.html>
- Osprey nest, electrical problem sparked Poulsbo cell tower fire Washington State. EXHIBIT 15
<http://www.northkitsapherald.com/news/124300644.html>

Compiled by Dr. David M. Stupin, retired physicist from Los Alamos National Laboratory.

Additional list of fires:

EXHIBIT 16 4/14/2006 Temple Hills, Prince George County, MD

EXHIBIT 17 7/4/2007 Howell, MI

EXHIBIT 18 10/2007 Malibu, CA A settlement was reached. Sprint, Verizon, AT&T sign \$12 million settlement over 2007 Malibu Canyon fire.

EXHIBIT 19 5/10/2010 Madison, WI

EXHIBIT 20 5/10/2010 Madison, WI

EXHIBIT 21 1/13/2011 Rancho Cucamonga, CA

EXHIBIT 22 1/21/2011 Poulsbo, WA

EXHIBIT 23 1/22/2011 Wall, NJ, Tinton Falls, NJ and Neptune, NJ

EXHIBIT 24 1/22/2011 Wall, NJ, Tinton Falls, NJ and Neptune, NJ (video)

EXHIBIT 25 12/2/2011 Lilburn, GA

EXHIBIT 26 12/2/2011 Lilburn, GA

EXHIBIT 27 5/16/2013 Middletown, NJ

EXHIBIT 28 5/16/2013 Middletown, NJ (video)

EXHIBIT 29 6/21/2013 Bensalem, PA

EXHIBIT 30 7/8/2013 West Salem, OR

EXHIBIT 31 7/8/2013 Bensalem, PA

EXHIBIT 32 8/21/2013 Sanford, FL

EXHIBIT 33 1/6/2014 Brownsville, TX

EXHIBIT 34 1/6/2014 Brownsville, TX

EXHIBIT 35 2/4/2014 Las Vegas, NV- Cell tower fire closes U.S. 95 exit ramp at Jones Boulevard

EXHIBIT 36 6/16/2015 Newport News, VA

Additionally, even the INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS (IAFF) Opposes tower and/or antennas. In part, “The IAFF opposes the use of fire stations as base stations for towers and/or antennas for the conduction of cell phone transmissions...”

- The IAFF Official Position Against Cell Towers on Fire Stations passed in 2004.
- Those concerns led Assemblyman Bill Quirk, D-Hayward, to agree to exempt all fire stations in the state from a related bill he authored that streamlined the time for wireless Telecommunications system permits. Incidentally, this Bill never became law.

Appeals Condition #3

Capacity is not a coverage issue which is what Section 253 of the Federal Telecom Act protects, see Verizon Coverage Map, EXHIBIT 37.

This community has not prohibited Verizon or other telecom companies from providing service. There is excellent coverage in this particular neighborhood. Section 253 says that local governments can manage the Public Right Of Way as long as it does not prohibit service

Each of these proposed locations are within the city’s jurisdiction. This project is at odds with the city’s general plan. The city is within its authority to regulate the right of way and potential uses, and it is not prohibiting Verizon from providing service by enforcing city rules.

Pivotal to any Planning Commission decision is that there is excellent Verizon coverage and no significant coverage gap in this neighborhood. Coverage has been proven with a site test, Verizon customer testimony, Verizon personnel sales presentations, and Verizon coverage maps. Since great service exists, Verizon/Sequoia must comply with city and state rules and cannot argue a prohibition of service if this project is denied.

PGHS PTSA Statement EXHIBIT A

PGMS PTSA Statement EXHIBIT B

Forest Grove PTA Statement EXHIBIT C

Appeal Condition #4

The Verizon tower is not necessary for Verizon coverage. Again, please see EXHIBIT 37. Capacity is not a coverage issue which is what Section 253 of the Federal Telecom Act protects.

And while the applicant shared that the tower direction is changing to offer capacity to the Pacific Grove High School and the Country Club Gate Shopping Center, we heard from Pacific

Grove Principal Matt Bell, PGUSD Facilities Director Matt Kelly, students and the community at both the June 21 and July 26 Planning Commission meetings, stating the schools had adequate coverage with room to grow. Please refer to City audio recording of the Planning Commission meeting.

Also, while statistically NOT something that occurs in communities in California, WE as a community passed Measure A Bond by a 55% supermajority vote, which has allowed for even faster capacity for the school. Measure A issued \$18 million in bonds to benefit Pacific Grove Unified School District. The funds were designated to increase student access to computers, maintain and upgrade educational software and significantly reduce borrowing costs.

The coverage is not needed as the fiber optic cables is the premium coverage for school.

Appeal Condition #5

This proposed site by Verizon has an adverse effect on property values.

This is the fourth site proposed to the public due to the substantial public concern. The commercial Country Club Gate Shopping Center declined to have the tower on their property according to Verizon's representative. Decreased property values remain a concern and have fiscal impact on the City of Pacific Grove.

- "The effect of distance to cell phone towers on house prices" by Sandy Bond, Appraisal Journal, Fall 2007, see attached. Source, Appraisal Journal, http://www.ppres.net/papers/Bond_Squires_Using_GIS_to_Measure.pdf EXHIBIT 5A
- Sandy Bond also co-authored, "Cellular Phone Towers: Perceived impact on residents and property values" University of Auckland, paper presented at the Ninth Pacific-Rim Real Estate Society Conference, Brisbane, Australia, January 19-22, 2003; see attached. Source: Pacific Rim Real Estate Society website, http://www.ppres.net/Papers/Bond_The_Impact_Of_Cellular_Phone_Base_Station_Towers_On_Property_Values.pdf EXHIBIT 5B
- 94% of people surveyed would not buy or rent a home next to a cell tower: <http://www.businesswire.com/news/home/20140703005726/en/Survey-National-Institute-Science-Law-Public-Policy> EXHIBIT 5C
- Here is an excellent study in The Appraisal Journal that shows cell tower installations negatively impact property values. NY Times article on how realtors have a hard time selling homes next to cell towers: <http://www.nytimes.com/2010/08/29/realestate/29Lizo.html> EXHIBIT 5D

Appeal Condition # 6

The City has not considered the effects of additional cell towers on our Monarchs which are a candidate for the Endangered Species Classification.

Monarchs are a candidate for Endangered Species classification: EXHIBIT 6A
<https://www.fws.gov/savethemonarch/SSA.html> . As such, they are protected while the evaluation for Endangered Species is completed under the US Fish and Wildlife "Candidate Conservation Agreement" <https://www.fws.gov/endangered/esa-library/pdf/CCAs.pdf>

Verizon has not adhered to the US Fish and Wildlife "Candidate Conservation Agreement" <https://www.fws.gov/endangered/esa-library/pdf/CCAs.pdf> . and produced evidence of no harm to Monarchs. EXHIBIT 6B

As the City Council is aware, the Monarch Butterfly population has decreased 90% since the 1980's. "Scientists believe declines in US monarch populations are linked to human development that has wiped out their habitats"

"The U.S. Fish and Wildlife Service determined that the petition was worth its consideration, and the agency launched a year-long review into the status of monarch butterflies this week."

Additional information:

EXHIBIT 6C Balmori, Alfonso. "[Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation.](#)" *Science of The Total Environment*, vol. 518–519, 2015, pp. 58–60

- The growth of wireless telecommunication technologies causes increased electrosmog. Radio frequency fields in the MHz range disrupt insect and bird orientation.
- Radio frequency noise interferes with the primary process of magnetoreception. Existing guidelines do not adequately protect wildlife. Further research in this area is urgent.

EXHIBIT 6D Cucurachi, C., et al. "[A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\).](#)" *Environment International*, vol. 51, 2013, pp. 116–40.

- A Review of 113 studies from original peer-reviewed publications. RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. Development and reproduction of birds and insects are the most strongly affected endpoints.

EXHIBIT 6E Manville, Albert M. "[A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don't Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife.](#)" *Wildlife and Habitat Conservation Solutions*, 2014.

- “In summary, we need to better understand ... how to address these growing and poorly understood radiation impacts to migratory birds, bees, bats, and myriad other wildlife. At present, given industry and agency intransigence ... massive amounts of money being spent to prevent addressing impacts from non-thermal radiation — not unlike the battles over tobacco and smoking — and a lack of significant, dedicated and reliable funding to advance independent field studies, ... we are left with few options. Currently, other than to proceed using the precautionary approach and keep emissions as low as reasonably achievable, we are at loggerheads in advancing meaningful guidelines, policies and regulations that address non-thermal effects....”

EXHIBIT 6F **EKLIPSE REPORT**, an EU-funded review body dedicated to policy that may impact biodiversity and the ecosystem, looked over 97 studies on how electromagnetic radiation may affect the environment. It concluded this radiation could indeed pose a potential risk to bird and insect orientation and plant health. [EKLIPSE REPORT WEBPAGE:](#)

- EXHIBIT 6G Malkemper EP, Tscheulin T, VanBergen AJ, Vian A, Balian E, Goudeseune L (2018). [The impacts of artificial Electromagnetic Radiation on wildlife \(flora and fauna\). Current knowledge overview: a background document to the web conference.](#) A report of the EKLIPSE project.
- EXHIBIT 6H Goudeseune L, Balian E, Ventocilla J (2018). [The impacts of artificial Electromagnetic Radiation on wildlife \(flora and fauna\). Report of the web conference. A report of the EKLIPSE project.](#) <http://bit.ly/EKLIPSEconfreport>

In closing, thank you for your time, acknowledgment and interest in the City of Pacific Grove resident’s concerns. Please decline the Use Permit Application #17-1111 to determine a location, and to add a small-cell antenna and associated wireless telecommunications facility equipment to an existing utility pole, or to add a new pole of approximately 29’-6” height with a small cell antenna and associated wireless telecommunications facility equipment.

Declination of the Use Permit noted above can be based on many valid reasons, including those we cited in our Appeal above and summarized here:

- Since their tower is 29’, they can extend it to 130 feet (or more) in height and 40 feet in width without a permit by adding 5 (or more) antennas according to the The Middle Class Tax Relief Act of 2012 and Federal Communications Commission (FCC) guidelines, once a radio or cell tower under 30’ tall is erected. This was not discussed or disclosed to the public.
- The risk of fires was not adequately evaluated for this (or the other) location as set in a forested area by the Pacific Grove Planning Commission with further risk related to how the cell towers dry out and stunt tree growth as cited.
- Section 253 of the Federal Telecom Act protects coverage for cell phone companies, but does NOT protect increased capacity. Verizon is clearly seeking additional capacity, as

their coverage maps clearly show they have complete coverage in Pacific Grove and specifically in the neighborhood around the new cell tower site.

- PGUSD has a fiber optic cable system providing adequate coverage for it's students and staff with room to grow, so the increase in capacity Verizon is seeking is not for the school, students or staff.
- Cell towers have an adverse impact in home values and careful consideration should be given to locations to protect our resident's and the fiscal impact on the City of Pacific Grove.
- Monarchs are a candidate for Endangered Species Classification and several trees in our City are fiercely protected, yet not considered in relation to this (and future) cell towers.

Please deny this application on the above basis. Our neighborhood does not need any additional cell towers.

I respectfully request that a committee be formed to create a formal policy around cell towers in Pacific Grove.

I would also respectfully request that the City Council waive the appeal fee.

PKDFR INC
1021 SOMBRERO RD
PEBBLE BEACH, CA 93953-2724

1005
11-4288/1210 4264

8-6-18
Date

Pay to the Order of City of Pacific Grove \$ 1,353.80
One thousand three hundred fifty-three dollars and 80/100

VOID AFTER 90 DAYS

WELLS FARGO Wells Fargo Bank, N.A. California wells.fargo.com

For Appeal Permit 17-1111 Katherine Ryan

⑆ 121042882⑆ 2214066090⑆ 01005

CITY OF PACIFIC GROVE, CA
RECD BY: CEDD 02000108963
PAYOR: PKDFR INC
TODAY'S DATE: 08/06/18
REGISTER DATE: 08/06/18 TIME: 19:41
DESCRIPTION AMOUNT
CUST ID: 624 SUNSET
CDD-APPEALS \$1,353.80

TOTAL DUE: \$1,353.80
TENDERED: \$1,353.80
CHANGE: \$.00
CHECK : \$1,353.80
REF NUM: 1005

REPORT
ON
CELL TOWER RADIATION

Submitted To

Secretary, DOT, Delhi



Prepared By

Prof. Girish Kumar

Electrical Engineering Department

IIT Bombay, Powai, Mumai – 400 076

gkumar@ee.iitb.ac.in

December 2010

When honey bee colonies were exposed with radiation, the honeycomb weight and area were reduced and returning time of honey bees increased compared to similar non-exposed colonies. Several other studies show that the high-frequency electromagnetic fields of mobile phones alter the resonant stimulus of living organisms and can cause modifications in certain areas of their brain. Changes in the brain structure of bees can be a cause of alterations of the returning capabilities of bees.

It's not just the honey that will be lost if populations plummet further. Bees are estimated to pollinate 90 commercial crops worldwide. The current dying/vanishing of honey bees can have serious consequences for human health. Scientists warn that the steady decline in bees and other pollinators could trigger crises bigger and more immediate than global warming.

Honey bees brain anatomy as well as the learning regions of the bee brain are well known and comparable to those of vertebrates and are well suited as a bio-indicator. We are fortunate that the warning bells have been sounded and it is for us to timely plan strategies to save not only the bees but human life and environment from the ill effects of such EMR.

6.2 Effect on Birds

When birds are exposed to weak electromagnetic fields, they disorient and begin to fly in all directions, which explain migratory birds undermining navigational abilities. A large number of birds like pigeons, sparrows, swans are getting lost due to interference from the new "unseen enemy", i.e. mobile phone masts. Several million birds of 230 species die each year from collisions with telecommunications masts in the United States during migration. Accidents happen mainly in the night, in fog, or bad weather, when birds might be using the earth's magnetic field for navigation, and could be seriously disoriented by the microwave radiation from telecommunication masts.

During recent decades there has been a marked decline of the house sparrow population. London has witnessed a steep fall in its sparrow population; a 75 per cent fall since 1994. There have been dramatic declines, almost to the point of extinction in Glasgow, Edinburgh, Hamburg, Ghent, Brussels, Dublin, Belgium, etc. Studies show that the disappearance of the sparrow and the introduction of phone mast GSM towers correlate closely in terms of time.

In Spain, to monitor the breeding success of the white stork population, 60 nests were selected and visited from May to June of 2003. Thirty nests were located within 200 m of mobile masts and other 30 were located at a distance of more than 300 m from any transmitter. 40% of the nests close to the antennae were without young, as opposed to 3.3% among those at a larger distance. Behavioural changes were also observed among birds close to the phone antennae. Young birds died from unknown causes and bird couples frequently fought while constructing their nests. Some nests were never completed and the storks remained passively in front of the antennae.

Microwaves from phone masts also interfere with reproductive success of birds. In an experiment, 75% of chicken embryos that were exposed to a GSM mobile phone during incubation died compared to 16%, who were not exposed to any radiation. Birds having nest near

towers were found to leave their nests within one week. The eggs laid in nests near towers failed to hatch.

A general disappearance of birds like Kestrel, White Stork, Rock Dove, pigeons, Magpie has been observed near base stations for mobile telecommunication. Locomotive problems, breeding problems, and tendency to stay long in lower parts of the trees and on the ground have been observed. In some tracked nests (blackbird), the eggs never hatched and also many dead specimens were found near phone masts areas.

A house sparrow is associated with human habitation. Being very sensitive to changes in the environment, it is one of the most preferred indicator species of urban ecosystems. A stable house sparrow population indicates a healthy ecosystem for human beings in terms of air and water quality, vegetation and other parameters of habitat quality. Whereas, a declining population of the bird provides a warning that the urban ecosystem is experiencing some environmental changes unsuitable for human health in the immediate future.

6.3 Effect on mammals and amphibians

The study in Germany showed that cows grazing near cell towers are more likely to experience still births, spontaneous abortions, birth deformities, behavioral problems and general declines in overall health. Moving cattle herds away from such towers has reportedly led to immediate health improvements. Exposing dairy cows to magnetic fields can also result in reduction in milk yield, changed milk composition and fertility problems. Recently, a significant increase of micronuclei in erythrocyte in the blood of cattle grazing on a farm near a transmitting facility was discovered. This is an indication of a genotoxic effect of the exposure, which means the change will pass on to their subsequent generations.

Similarly, impaired immune system in sheep, reproductive and developmental problems in dogs and cats, anxiety and alarm in rabbits, frequent death of domestic animals such as, hamsters, and guinea pigs living near base stations of mobile telecommunication towers has been observed.

Electromagnetic pollution is a possible cause for deformations and decline of some amphibian populations too. Morphological abnormalities, allergies, changes in blood counts, increase in the heart rate, arrhythmia and increased mortality has been found in amphibians like Newts and frog tadpoles. Bat activity is significantly reduced in habitats exposed to electromagnetic field. During a study, in a free-tailed bat colony, the number of bats decreased when several phone masts were placed 80m from the colony.

6.4 Effect on Plants

Apart from bees, birds and animals, electromagnetic radiation emanating from cell towers can also affect vegetables, crops and plants in its vicinity. Studies show definitive clues that cell phone EMF can choke seeds, inhibit germination and root growth, thereby affecting the overall growth of agricultural crops and plants. A reduction in wheat and corn yield in the fields near high EMF lines has also been reported.

Exhibit 2

Cell phone tower near Heritage High School catches fire

POSTED 1:00 PM, JUNE 16, 2015, BY BECCA MITCHELL, UPDATED AT 04:13PM, JUNE 16, 2015



This is an archived article and the information in the article may be outdated. Please look at the time stamp on the story to see when it was last updated.

PHOTO GALLERY



 [VIEW GALLERY \(4 IMAGES\)](#)

Newport News, Va. – A cell phone tower in the 5800 block of Marshall Avenue caught on fire Monday around noon, according to the Newport News Fire Department.

Fire Chief Stephen Pincus says a company was working on the tower doing some welding when some insulation to the wires caught on fire.

Crews arrived to find a massive amount of fire at the base of the tower and wires burning along the full length of the tower.

With heat index values already over 100 degrees in Newport News, fire crews had some difficulty putting the fire out because the heat was so taxing. It took approximately 25 minutes to get the fire under control.

The structural integrity of the tower was compromised due to the heat of the fire and the tower is now leaning. The damage is extensive and the tower has been disabled.

Cell phone coverage in the area may be affected. Officials from Verizon and Sprint were on scene to assess the damage. Virginia Power was summoned to the scene to disable all electrical power going to the tower.

The tower is located on property in between Heritage High School and Achievable Dreams Middle & High School. Students were not in school but teachers were at both locations. No one inside the school was in any danger at the school.

Additional updates will be posted as they become available.

Exhibit 3

The Columbus Dispatch

Cell phone tower catches fire in Grandview

Posted Jul 15, 2014 at 12:01 AM

Updated Jul 15, 2014 at 2:58 PM

Black smoke poured from a cell tower and light pole in Grandview Heights this morning. The fire was reported before 10 a.m. in the 1400 block of Fairview Avenue.

Black smoke poured from a cell tower and light pole in Grandview Heights this morning.

The fire was reported before 10 a.m. in the 1400 block of Fairview Avenue.

The pole held lights for the football field as well as cell phone equipment.

Fairview Avenue was closed between 3rd and 5th avenues while emergency crews were on the scene.

Homes within a one-block radius of the school were evacuated.

Officials on the scene said all activities outside of the school were canceled for the day.

No injuries were reported.



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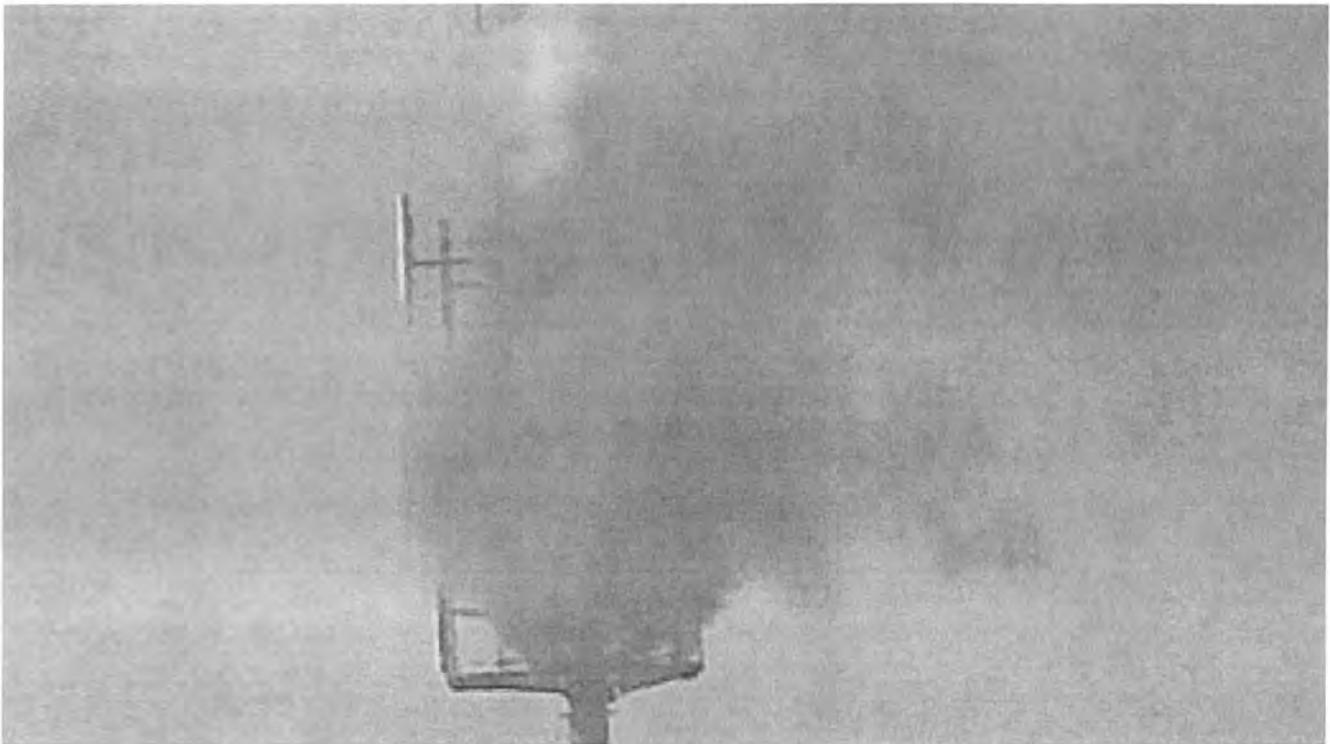
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Cell tower fire near Thurston High sends up smoky plume

by News Staff |



THURSTON, Ore. — A cell phone tower caught fire near Thurston High School Saturday afternoon, sending a plume of smoke high above the Colts' sports fields.



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Crews were called out to the fire near

62nd Place and A Streets ([https://www.google.com/maps/place/A+St+%26+62nd+Pl,+Springfield,+OR+97478/@44.0470425,-122.9186708,17z](https://www.google.com/maps/place/A+St+%26+62nd+Pl,+Springfield,+OR+97478/@44.0470425,-122.9186708,17z/data=!3m1!4b1!4m2!3m1!1s0x54c0e0ac6f6f1335:0x80d46aa304ca65f3)

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at around 1:45 p.m. Saturday.

Firefighters got the smoky fire under control and crews started to clear the scene about 45 minutes after the fire was reported.

"It is contained and basically under control, but we have to wait until Springfield Utility Board gets here to get the power completely shut off to finish extinguishing it," said Battalion Chief Marcus Lay.

No word from officials on what caused the fire.

The fire destroyed some of the shrubbery near the athletic fields, but officials said it won't delay classes.

This is a developing story, updates will be posted as information comes in.

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(http://kval.com/news/local/south-valley-fire-now-60-percent-contained-crews-focus-on-mop-up?utm_source=taboola&utm_medium=referral&utm_campaign=internal)

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Exhibit 7

http://www.gwinnettdaily.com/archive/cell-tower-fire-closes-rockbridge-road-evacuates-day-care/article_c799bdd9-1162-52a6-8cd7-7784653883ae.html

Expand

Cell tower fire closes Rockbridge Road, evacuates day care

Josh Green Dec 1, 2011



Firefighters work to extinguish a fire at a cell phone tower at Rockbridge and Lilburn-Stone Mountain roads near Lilburn on Friday.

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LILBURN A cellphone tower fire in the 500 block of Lilburns Rockbridge Road shut down the busy thoroughfare before rush hour Friday and evacuated a daycare and two nearby homes, officials said.

A transmission cable running the length of the 150-foot tower caught fire when a telecommunications crew was welding near the summit about 4 p.m., Gwinnett County Fire Department spokesman Capt. Thomas Rutledge said.

As a precaution, authorities closed Rockbridge Road between Arcado Road and Lilburn-Stone Mountain Road. Crews were still wetting hot spots around the tower about 5:30 p.m.

Were not completely sure what the damage is going to be to the tower structure itself, Rutledge said. It is leaning somewhat.

MONMOUTH COUNTY

Update: Cell tower fire unrelated to Middletown police communication interruption

Updated May 16, 2013;
Posted May 16, 2013

By **Ashley Peskoe**, apeskoe@njadvancemedia.com

NJ Advance Media for NJ.com

Middletown police are operating their radios on a secondary frequency after a fire at a cell tower on Normandy Road knocked out communications. [Google Maps](#)

MIDDLETOWN – Authorities have determined the cell tower fire on Normandy Road was unrelated to the police department's main radio channel going down.

The fire, which has since been extinguished, started around 11:20 a.m. on a Normandy Road cell tower that crews were working on, police said.

The Middletown Police Department's main radio frequency went out shortly after, and was originally believed to be caused by the fire. However, police said at around 2:20 p.m. that they determined the department does not have any equipment on the cell tower and that the radio problem is unrelated.

Police are still working to determine what's wrong with the main radio channel and are operating on a secondary channel. The department's phones are also working, police said.



Editor's Note: This story was originally published at 12:49 p.m.

Exhibit 9



LeMars Daily Sentinel
PLYMOUTH COUNTY'S NEWSPAPER

Explosion near cell tower likely caused by propane leak

Friday, June 11, 2010

By Magdalene Landegent

The explosion of an equipment building near a Verizon cell tower Tuesday was heard even by residents about one-quarter mile away in Hinton.

"It was a big, giant, loud thud," said Hinton Fire Chief Chad Beck.

His fire crew responded to the blaze, which destroyed the about 10-by-30 foot building near the tower on C-60, Beck said.

"The whole building was engulfed," he said. "As near as we can tell, there was a propane leak inside the building, then something in there set off a spark, and it blew up."

The explosion happened about 8:30 p.m. and the Hinton Fire Department was on the scene until after midnight, Beck said.

No one was injured in the explosion or fire.

Merrill Fire Department assisted on the fire call, sending a tanker to the tower site, according to Merrill Fire Chief Bill Merchant.

The equipment building is a total loss, according to Beck.

The tower, however, was not damaged by the fire, he said.

The Hinton Fire Department received a second call Wednesday that the fire at the cell tower was rekindling. The call came at 11:18 p.m. and the crew returned to base at 11:41 p.m.

"There was one little hotspot, they took care of it," Beck said.

Agenda No. 11A, Attachment B
Exhibit to Page 26 of 186



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Cell phone tower to be taken down following fire

Updated Dec 02, 2011

By Alexis Stevens, The Atlanta Journal-Constitution



NONE — The engineers and owners of a cell phone tower in Gwinnett County that was damaged by fire will begin the process of taking it down Saturday, authorities said.

Fiber optic cable on the tower caught fire Friday afternoon, forcing road closures in the Lilburn area.

A telecommunications company was welding on the 150-foot tower, in the 500 block of Rockbridge Road, when the fire sparked shortly before 3 p.m., according to Capt. Tommy Rutledge with the Gwinnett County Fire Department.

After the fire was extinguished, fighters remained on the scene for several hours and were wetting down the area around the tower in preparation for any falling embers or the possibility of the tower falling, Rutledge said. The tower was leaning slightly and firefighters created a "collapse zone" in the event it falls, he said.

Rockbridge Road was temporarily closed between Arcado Road and Lilburn-Stone Mountain Road while firefighters battle the blaze, according to Cpl. Jake Smith of the Gwinnett County Police Department. Miller Road also was shut down at the intersection of Lilburn-Stone Mountain Road, Smith said.

A crew was dispatched to the scene to cut the power supply to the tower, Rutledge said.

Five homes and a daycare center were evacuated as a precaution. About 20 children and 10 adults were moved to a parking lot across the street, away from the hazardous area, Rutledge said.

Rutledge told the AJC his home was one of those evacuated. She and other neighbors were



Cell phone tower catches fire near U.S. 95

Posted: Feb 04, 2013 12:43 PM PST
Updated: Jul 24, 2013 2:33 PM PDT

LAS VEGAS (FOX5) - Welding work caused a fire on a Verizon cellular phone tower near U.S. 95 and Jones Boulevard on Monday.

Las Vegas Fire and Rescue reported the fire just after 11:30 a.m.

There were no injuries as a result of the fire. LVFR said it forced the closure of on and off-ramps at Jones Boulevard.

LVFR noted the tower near Elton Avenue and Jones Boulevard was leaning towards power lines.

LVFR also said the tower will have to be taken down.

There was no word on when the ramps will re-open.

Stay tuned to FOX5 for the latest on this developing story.

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Exhibit 12

FIREHOUSE

HOME | HOME | MARYLAND CELL TOWER DESTROYED BY FIRE

Maryland Cell Tower Destroyed by Fire

The leaning tower straightened up after it cooled down.

APRIL 14, 2006

Prince George's County firefighters battled a blaze at a cell phone tower in Temple Hills Friday morning.

Units were called to the 5300 block of Beech Place just before 11 a.m. for a 125-foot tower on fire and leaning.

"People see it, and they see this large, humongous metal structure, and it's on fire," Mark Brady, of Prince George's County Fire and EMS. "And the only thing combustible about it is the wiring and the conduit inside of it, and that's exactly what was on fire."

According to the fire department, contractors doing welding work accidentally ignited conduit and wiring inside of the tower shaft. The heat caused the tower to lean, and a waste management company was evacuated.

Authorities said the fire was extinguished in about 35 minutes, and once the tower cooled down, it moved back into a vertical position.

The tower, which is owned by Cingular, was declared a total loss, and the integrity of the tower was compromised, so the tower was scheduled to be dismantled. A mobile tower will be set up until a new permanent structure can be built. Cell phone service may be spotty in the area until the mobile tower is erected.

Damages from the fire are estimated at \$75,000.

Stay with *News4* and *nbc4.com* for more information.

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Osprey nest, electrical problem sparked Poulsbo cell tower fire

Exhibit 15

POULSBO — An osprey nest and an electrical malfunction ignited the cell phone tower fire that closed down State Route 305 for 12 hours Monday in the Lemolo area. Kitsap County Deputy Fire Marshal Tina Turner said an electrical malfunction at a lighted beacon on top of the 150-foot tower caught the bird's nest on fire before 4 a.m. Monday. Turner said the birds likely damaged the beacon or its 110-volt power wire while building their nest, contributing to the fire.

By Tad Sooter

Tuesday, June 21, 2011 9:22pm | [NEWS](#) [NORTH KITSAP](#)



An osprey



POULSBO — An osprey nest and an electrical malfunction ignited the cell phone tower fire that closed down State Route 305 for 12 hours Monday in the Lemolo area. Kitsap County Deputy Fire Marshal Tina Turner said an electrical

malfunction at a lighted beacon on top of the 150-foot tower caught the bird's nest on fire before 4 a.m. Monday. Turner said the birds likely damaged the beacon or its 110-volt power wire while building their nest, contributing to the fire.

The fire spread from the top of the tower down through its hollow interior, burning through electrical cable insulation, Poulsbo Fire Battalion Chief Bruce Peterson said. The tower was glowing red nearly to its base when fire crews arrived. Firefighters allowed the fire to burn out on its own.

The tower leaned precariously, raising concern it could fall across the highway. The state Department of Transportation closed both lanes of SR 305 and detoured traffic through Lemolo. Verizon, which operates the tower jointly with AT&T, dispatched a crane company to dismantle the tower. The crane lowered the tower to the ground at about 4 p.m. and the highway was reopened.

The ospreys remained in the area for the remainder of the day, circling their former nest site. One bird was missing a large section of feathers on its right wing, apparently burned away during the fire. Witnesses said the ospreys began bringing new sticks to the tower shortly after the fire subsided.

Damage to the ospreys' wings may appear dramatic, but the outlook for the birds is good, said Mike Pratt, wildlife services director at West Sound Wildlife Shelter.

"If that bird was in my rehab, I'd say there's no way I'd release it," Pratt said, after inspecting the Herald photo above. "But, it's flying."

Since the birds are flying, they can hunt and feed themselves, Pratt said. And since summer is molting season — when birds lose and re-grow their feathers — the missing wing feathers should grow back in coming months.

Pratt said the nesting pair likely lost a clutch of young in the fire. They should be able to lay a second batch of eggs this season if they can find another nesting site.

Osprey nests on cell phone towers are an increasingly common site in Kitsap County. The towers provide the height and clear views the raptors favor for nest sites.

Ospreys are protected under the federal Migratory Bird Treaty Act and state law. State Department of Fish and Wildlife Biologist Jeff Skriletz told the Herald in April that companies can modify the nests outside of the nesting season, which lasts through September, but modifications require state approval and careful oversight. In some cases the state has allowed property owners to remove a nest while building an alternative nesting platform nearby.

"It's getting to be a real issue," Skriletz said of ospreys nesting on cell towers. "We still need to work out a statewide approach to it."

Exhibit 16

Advertisement

washingtonpost.com > Metro > Maryland > Pr. George's

Fire in Pr. George's Cell Phone Tower Extinguished

Advertisement

By *Ruben Castaneda*
Washington Post Staff Writer
Friday, April 14, 2006; 2:42 PM

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Prince George's County firefighters this morning extinguished a fire that broke out in a cell phone tower in Temple Hills where contract workers were applying additional support beams, a fire department spokesman said.

The fire ignited around 11:10 a.m. in the 5300 block of Beech Place, said Mark Brady, chief spokesman for the county fire department. Contract workers were using a welder to apply the support beams, and plastic pipeway inside the tower caught fire, Brady said.

It took county firefighters about a half hour to put out the blaze, Brady said. Firefighter used a 100-foot tower ladder to help extinguish the blaze. Fire and heavy smoke was visible from the top of the tower to about three-quarters of the way down, he said.

The tower at one point leaned to one side, and about a dozen workers from a nearby waste management company were briefly evacuated, Brady said.

After the tower cooled, it straightened out, Brady said. The tower, owned by the cell phone company Sprint, sustained about \$75,000 in damage, and Sprint officials said they will replace the tower, he said. No injuries were reported.

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ANN ARBOR NEWS ARCHIVES

Cell phone tower fire burns itself out

Updated Jul 25, 2007;

Posted Jul 24, 2007

1

3
shares

By **Steve Pepple**

 JAMIE CHARBENEAU-PISELLA, THE LIVINGSTON COMMUNITY NEWSA fire inside this cell phone tower near Howell High School Tuesday morning took the tower out of service. Workers were expected to take down the tower and eventually replace it.

A cell phone tower on the property of the Howell High School complex on Highlander Way in Howell caught fire and forced the evacuation of several buildings and closure of the middle school because firefighters feared it would fall.

Howell Fire dispatcher Barb Souchick said the fire, which started at about 9 a.m., burned itself out by about 10 a.m. She said firefighters had to let the fire burn because the tower was too tall to hit with water from hoses.

1 

The tower started leaning heavily, but guidewires remained in place and appeared to have kept it from falling, according to witnesses.

Howell Fire Chief James Reed said he believes a contractor working with a torch at the base of the tower may have set it on fire, and that the entire interior of the tower burned.

He said the tower served AT&T, Sprint, and carried the Internet connections for five Howell schools, but did not know which schools were affected.

John Johnson, transportation supervisor for Howell schools, said the tower is near the school bus garage. Buses already parked near there were not in danger, he said, but buses that came in with students had to park farther away than usual to stay out on the way of the fire.

Souchick said people in the pool building and bus garage also had to be evacuated, but no one was injured. School officials could not be reached for comment.



Exhibit 18

Sprint, Verizon, AT&T sign \$12 million settlement over 2007 Malibu Canyon fire

Canyon Fire, October 2007.
LARRY CUMMINGS VPP LACOFD

Molly Peterson | September 13, 2012

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PACIFIC SWELL

KPCC's Molly Peterson on a Gilligan's Island style tour of environmental stories in and affecting Southern California. Named for the Yvor Winters poem: "The slow Pacific swell stirs on the sand/Sleeping to sink away, withdrawing land..." Follow the blog at @PacificSwell and Molly at @KPCCmolly.

YOUR HOST

Molly Peterson

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All posts by Molly

California utility regulators have settled a dispute with three telecommunication companies over responsibility for a wildfire in Malibu five years ago.

When Santa Ana winds swept through Malibu Canyon in October of 2007, they knocked over three utility poles. Those poles sparked a fire that burned nearly 4,000 square acres. It destroyed 14 structures and three dozen cars.

Cell phone companies had antennas on the poles, or shared pole ownership with other telecommunication companies. The California Public Utilities Commission investigated whether these five companies contributed to the fire by unsafely mounting equipment there.

The settlement just announced resolves liability for three companies: Sprint, Verizon, and AT&T. Together they'll pay \$12 million in equal shares. About \$7 million will go to the state's general fund and the rest goes into a new utility pole inspection fund.

The Public Utilities Commission is still investigating two more companies, Southern California Edison and NextG. Regulators say the settlement can help deter other utilities that maintain electronic equipment in wildland or fire-prone areas.

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August 10, 2017

Water Tower Fire Wipes Out WiMAX and Cell Phone Service on Madison, Wisconsin's West Side

Phillip Dampier May 20, 2010 Consumer News, TDS Telecom, Video 1 Comment



This empty water tower in Madison, Wis. caught fire Friday as workers began painting preparations, disrupting wireless communications services on the city's west side for months. (Photo: WMTV Madison)

A water tower fire on Madison's west side has wiped out WiMAX broadband service for at least 150 fixed wireless broadband customers, leaving them cut off for so long, provider TDS Telecom is canceling their service and assisting customers in switching providers.

A Madison utility manager said workers Friday were preparing to paint the 100,000-gallon tower in the 2700 block of Prairie Road when insulation around communications cables caught fire. Smoke was visible from the empty water tower for miles, and several nearby homes had to be evacuated because of fears of a potential collapse.

City engineers have since deemed the tower safe, but the real impact will be several months of interrupted broadband and cell service from several area providers who depended on the tower as an antenna site. The tower was particularly crucial to TDS Telecom, which depended on its strategic location to deliver its wireless broadband service in western Madison. It will take several months to restore service.

"Based on our discussions with the City, we anticipate it could take a very long time to repair the damaged tower," states DeAnne Boegli, TDS National Public Relations Manager. "Since this is the only viable tower location TDS can use to serve these homes, and because temporary solutions are not available, our customer's best option is to select another facilities-based communications provider."

TDS will assist all 147 impacted customers in changing their service without penalty and remove the equipment from customer homes at their request and convenience. The company is also providing the customers a month's service credit.



“Unfortunately, this accident has left us with no reliable or timely restoration options. TDS understands communications services are critical to our customers and we want to get them transitioned as quickly as possible, even though it means they must select another provider,” said Boegli.

Affected cell phone companies are trying to establish temporary cell tower sites to improve service in the area while repairs get underway.

[flv]http://www.phillipdampier.com/video/WMTV Madison Water Tower Fire Wipes Out WiMAX 5-14-10.flv[/flv]

WMTV-TV in Madison broke into regular programming to deliver a special report on the fire. We've also included some raw video of the fire. (11 minutes)

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Related

Clear WiMAX Ends Nov. 6: You Don't Have to Go Home But You Can't Stay Here

If you are among the dwindling number of customers still using Sprint's Clearwire 4G WiMAX service, the wireless provider would like you to leave. After about a year of successive September 28, 2015
In "Clearwire"

11 Cities Getting Verizon 5G Beta Test: No Details on Speed or Pricing Yet
Verizon will invite several thousand customers in 11 cities to participate in a "pre-commercial" beta test of its newly built 5G wireless network during the first half of 2017. The fixed wireless, February 22, 2017
In "Broadband Speed"



Wireless Company Lobbyists Add Cell Tower Deregulation to Connect Every Iowan Act
April 7, 2014
In "AT&T"

Currently there is 1 comment on this Article:

- 1. *DAVID ehm* says:
May 21, 2010 at 1:19 pm

Well, those residents can breathe a sigh of relief for a short while as they won't be blasted with wi-max wi fi super radio frequency radiation on steroids. before the fire their dna was being blasted. perhaps someone set the fire as an act of self defense !!

I think 23

Cell Tower Fire in New Jersey

By btanta | Posted January 22, 2011 | Wall, New Jersey

It's not common, and quite frankly the first that most of us has seen - but we were dispatched for a cell phone tower fire. The tower was near the border of Wall, Tinton Falls and Neptune, NJ.

A lot of variables play into attacking a fire such as this, including weather, structural damage suffered by the tower from the heat, the high voltage lines that feed the tower, etc...

Companies were very cautious and placed the safety of first responders first. As there were no immediate dangers to civilian life and property, extra care was taken prior to engaging the fire.

Exhibit 25

Firefighters put out cell phone tower fire in Lilburn

Posted: Dec 02, 2011 1:02 PM PST

Updated: Dec 30, 2011 1:02 PM PST

LILBURN, GA (CBS46) - Two homes and a daycare were evacuated Friday after a cell phone tower fire at 592 on Rockbridge Road. No injuries were reported.

According to Gwinnett County Fire Captain Tommy Rutledge, the fire is believed to have been sparked by a telecommunications contract company working on the tower.

The tower is leaning at this point and fire crews have established a collapse zone in the event the tower comes down.

An engineer working for a cell phone company told CBS Atlanta that temporary cell towers were being considered as a short-term solution to remedy spotty outages in the area.

The owner of the tower said they plan to demolish the structure in the next few days.

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EXHIBIT 29

UPDATED: Cell Tower May Collapse After Fire



Tom Sofield June 21, 2013

Friday, 1:48 p.m.:

Residents of the Bensalem Woods complex remain out of their homes due to safety concerns, Bensalem police say.

PECO crews were called to the scene to de-energize electric service to the tower.

As of 1:45 p.m., the tower is still standing, but it is leaning over the Public Works facility.

Thackeray Crane representatives are at the scene to see what can be done with the leaning tower.



Credit: Twitter.com/Mz_Erica7801

Exhibit 35

Cell tower fire closes U.S. 95 exit ramp at Jones Boulevard



COURTESY LAS VEGAS FIRE & RESCUE

A Verizon Communications Inc. cellphone tower caught fire Monday as welders were working on the structure. The blaze forced authorities to shutdown the U.S. 95 exit ramp to Jones Boulevard.

By William D'Urso 

Published Monday, Feb. 4, 2013 | 2:10 p.m.

Updated Monday, Feb. 4, 2013 | 4:20 p.m.

A fire on a Verizon Communications Inc. cell phone tower has forced authorities to shut down the U.S. 95 exit and on-ramps to Jones Boulevard.

The fire started about 11:30 a.m. when welders were working to reinforce the structure with additional metal plates, Las Vegas Fire & Rescue spokesman Tim Szymanski said.

Szymanski said the ramps were closed because the tower is leaning toward NV Energy power lines.

He said workers were using a crane to take the tower down in sections that was to take about an hour. He said power in the area was shut down while the work is under way.

The ramp remains closed, and it is unclear when traffic will be allowed through, Nevada Highway Patrol Trooper Loy Hixson said.

Workers from NV Energy and Verizon are on scene, but authorities did not know if power to homes or cellphone coverage had been affected.

Welders were working on tower when the fire started, Szymanski said.

The screenshot shows a web browser window with the Verizon website. The address bar displays the URL: <https://www.verizonwireless.com/featured/better-matters/malware-digital-maps>. The Verizon logo is visible in the top left. Navigation links include Wireless, In Home, Business, Phone, Plans, Deals, Shop, Support, Stores, Search, Español, and Sign In. The main content area features the headline "We have coverage where it counts." followed by three statistics: "We cover 322 million people", "More than 98% of the US population.", and "And over 2.4 million square miles or about 400,000 square miles more coverage than the nearest competitor." A map of the United States is shown with red dots indicating coverage locations. A Windows taskbar is visible at the bottom of the browser window.

Exhibit 37



verizon



03050
Map to the center of 03050



Site to search

August 6, 2018

Pacific Grove City Council
City Hall
300 Forest Ave.
Pacific Grove, CA 93950

Dear members of Pacific Grove City Council,

I am writing you on behalf of Pacific Grove High School PTA in regard to the Pacific Grove Planning Commission's vote on July 26, 2018, which approved a request by Verizon Wireless to install and maintain a cell tower adjacent to Pacific Grove High School (PGHS). For the reasons described below, the Pacific Grove High School PTA **is strongly opposed** to the location of the Verizon cell tower and is requesting that the City Council consider and support the appeal that is being filed by a group of concerned parents who live in Pacific Grove and send their children to PG schools.

The installment of a cell tower adjacent to PGHS poses significant potential health dangers to both students and staff at PGHS. While some argue that radiation emitted from a cell tower is not a health danger, data from many studies indicate the opposite. Research shows that children and pregnant women are the most vulnerable – two demographics most likely to be on PGHS school grounds on a regular basis. The actual placement of the cell tower – near the back of PGHS and very close to Forest Grove Elementary School – only increases the concerns of the frequency in exposure.

Cell towers also pose a risk to students due to fire hazard. Many cell towers throughout the United States have caught fire and collapsed, posing a significant safety concern, especially in an area with young students walking to and from school every day.

The mission of all PTAs nationwide is to make every child's potential a reality by engaging and empowering families and communities to advocate for all children. Our local PTA is very active in expressing our support for or opposition to issues dealing with the health, safety, education, or general well-being of children and youth in our community.

The members of the Pacific Grove High School PTA strongly urge you to please reconsider the Pacific Grove Planning Commission's previous vote and rescind approval for the Verizon cell tower at Pacific Grove High School.

Sincerely,

Julie Kavanaugh
President, Pacific Grove High School PTA

August 6, 2018

Re: Cell Tower Appeal

To Whom it May Concern:

I am writing on behalf of Pacific Grove Middle School PTSA. Our board consisting of 16 members and 3 teachers has unanimously agreed that we oppose the construction of a Cell Tower next or near Pacific Grove High School. We support the appeal that is being filed and support the appellants as well.

Sincerely,

Ragni Coleman
President of Pacific Grove Middle School PTSA

August 6, 2018

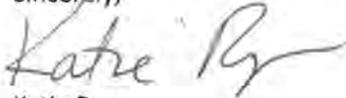
Re: Cell Phone Tower Appeal

To Whom it May Concern:

I am writing on behalf of the Forest Grove PTA. Our board consisting of 7 parents and 1 teacher has unanimously agreed that we are against the placement of a cell tower near the High School. We support the appeal that is being filed and support the appellants as well.

I have also been in contact with the President of the California State PTA Elena Shea. The California and National PTA are against cell phone towers near schools. I have attached the National PTA's resolution that they adopted in 2005.

Sincerely,



Katie Ryan

VP Forest Grove PTA

ELECTRO-MAGNETIC FIELDS
Adopted by Convention Delegates May 6, 1994
Reviewed by Board of Managers April 2005

- WHEREAS, The third Object of the National PTA states: To secure adequate laws for the care and protection of children and youth; and
- WHEREAS, There is great public concern based on recent studies that electro-magnetic fields (EMF) may cause or promote certain cancers; and
- WHEREAS, In response to the 1992 Swedish national study indicating an increase in childhood leukemia with exposure to EMFs, the Swedish government announced that it would act on the assumption that there is a connection between exposure to power frequency fields and cancer, and, would propose legislation limiting EMF exposure to 1 milliGauss (mG) or less; and
- WHEREAS, Children are exposed to sources of EMFs other than power lines, such as school computers, microwave ovens, televisions, and all electrical equipment; and
- WHEREAS, Legitimate and proven methods of mitigating EMFs from power lines, computers, and other sources are available; now therefore be it
- RESOLVED, That the California State PTA seek participation in coalitions to study the effects of electro-magnetic fields; and be it further
- RESOLVED, That the California State PTA educate and inform its districts, councils and units about the potential hazards of EMFs and encourage school districts and schools to develop risk reduction policies and continue to disseminate information on the subject as it becomes available.

###

BACKGROUND INFORMATION

There is growing concern about the effects of electro-magnetic fields (EMFs). A large body of evidence indicates a connection between exposure to EMFs and cancer. Some studies (for example, a study paid for by Southern California Edison) have not found a connection, but, more importantly, no study has concluded that EMFs do not cause or promote cancer.

Continued on next page

Electro-Magnetic Fields – continued

Many experts in the field including Carl Blackman, a biophysicist with the Environmental Protection Agency (EPA) and David Carpenter, Dean of the State University of the New York School of Public Health advocate "prudent avoidance." In other words, avoid EMF exposure whenever possible.

The problem is that most people do not understand where EMFs come from, let alone how to avoid exposure to EMFs. Most people assume that EMFs are generated only from high voltage transmission lines. In fact, EMFs are generated from many sources, including all electrical appliances (e.g., computers, hair dryers, electric blankets) and high levels of EMFs can be found in any home or school simply due to the way the building is wired.

Most public utilities offer free measurement services. All homes and schools should be measured as a matter of course. Where levels are unacceptably high, public utilities should be encouraged to mitigate the problem. The public also should be educated about the fact that legitimate methods and devices for mitigation exist and that the California Department of Health has a list of mitigation experts.

Computers are a major source of EMF exposure in schools. However, even old computers can be cheaply and easily retrofitted to reduce exposure. Sweden, which has taken the lead in the study of EMFs, has issued guidelines on computers and EMF exposure which should be followed until we have all the facts. The New York City Schools instituted such guidelines early in 1992.

Lessons learned from studies on smoking, asbestos, second-hand smoke and radon must not be ignored. We have an obligation to learn from the past and protect our children by reducing their exposure to what is clearly a serious and potential health hazard.

Thirteenth Pacific-Rim Real Estate Society Conference,
Perth, Western Australia 21-24 January 2007

**Using GIS to Measure the Impact of Distance to
Cell Phone Towers on House Prices in Florida**

Draft: December 2006

This is a draft; please do not quote or cite without permission of the authors.

*Sandy Bond, Ph.D., MBS, ANZIV,
Visiting Professor & Feng Shui Consultant,
University of North Florida,
PO Box 840027
Florida 32080, USA
Ph: 1 352 317 6488
E-mail: dr_sandybond@yahoo.com
Website: www.buildingchi.com*

&

*Larry Squires, Research Assistant,
Department of Finance Insurance & Real Estate
Warrington College of Business
University of Florida,
PO Box 117140,
Gainesville FL 32611-7140*

Using GIS to Measure the Impact of Distance to Cell Phone Towers on House Prices in Florida

Keywords: Cellular phone base stations – GIS - health risks – multiple regression analysis – property values – stigma

Abstract:

The siting of cellular phone transmitting antennas, their base stations and the towers that support them (*towers*) is a public concern due to fears of potential health hazards from the electromagnetic fields (EMFs) that these devices emit. Negative media attention to the potential health hazards has only fuelled the perception of uncertainty over the health effects. The unsightliness of these structures and fear of lowered property values are other regularly voiced concerns about the siting of these towers. However, the extent to which such attitudes are reflected in lower property values affected by tower proximity is controversial.

This paper outlines the results of a study carried out in Florida in 2004 to show the effect that tower proximity has on residential property prices. The study involved an analysis of residential property sales transaction data. Both GIS and multiple regression analysis in a hedonic framework were used to determine the effect of actual distance of homes to towers on residential property prices.

The results of the research show that prices of properties decreased by just over 2%, on average, after a tower was built. This effect generally reduced with distance from the tower and was almost negligible after about 200 meters (656 feet).

1. Introduction

This paper outlines the results of one of the first US-based cell-phone tower studies. The research was carried out in Florida in 2004 to show the effect that **distance** to a CPBS has on residential property prices. It follows on from several New Zealand (NZ) studies conducted in 2003.¹ The first of the earlier NZ studies examined residents' perceptions toward living near CPBSs, while the most recent NZ study adopted GIS to measure the impact that distance to a CPBS has on residential property prices using multiple regression analysis in a hedonic pricing framework. The current study was conducted to determine if US residents respond similarly to those in NZ towards living near CPBSs and hence, whether the results can be generally applied.

The paper commences with a brief literature review of the previous NZ studies for the readers' convenience as well as the literature relating to property value effects from other similar structures. The next section describes the research data and methodology used. The results are then discussed. The final section provides a summary and conclusion.

¹ Bond, S.G. and Wang, K. (2005). "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods", *The Appraisal Journal*, Volume LXXIII, No.3, pp.256-277, Bond, S.G., Beamish, K. (2005). "Cellular Phone Towers: Perceived Impact on Residents and Property Values", *Pacific Rim Property Research Journal*, vol. 11, no. 2, pp. 158-177 and Bond, S.G. and Xue, J. (2005). "Cell Phone Tower Proximity Impacts on House Prices: A New Zealand Case Study", *European Real Estate Society and International Real Estate Society Conference*, June 15-18, Dublin, Ireland.

2. Literature Review

2.1 Property Value Effects

First, an opinion survey by Bond and Beamish (2005) was used to investigate the current perceptions of residents towards living near CPBSs in a case study city of Christchurch, New Zealand and how this proximity might affect property values. Second, a study by Bond and Wang (2005) that analyzed property sales transactions using multiple regression analysis was conducted to help confirm the results of the initial opinion survey. It did this by measuring the impact of proximity to CPBSs on residential property prices in four case study areas. The Bond and Xue (2005) study refined the previous transaction-based study by including a more accurate variable to account for distance to a CPBS.

The City of Christchurch was selected as the case study area for all the NZ studies due to **the large amount of media attention** this area had received in recent years relating to the siting of CPBSs. Two prominent court cases over the siting of CPBSs were the main cause for this attention.² In summary, the Environmental Court ruled in each case that there is no established adverse health effects arising from the emission of radio waves from CPBSs as there is no epidemiological evidence to show this. However, in the court's decisions they did concede that while there is no proven health affects that there is evidence of **property values** being affected by both of the above allegations.

These court cases were only the start of the negative publicity surrounding CPBSs in Christchurch. Dr. Neil Cherry, a prominent and vocal local Professor, served only to fuel the negative attention to CPBSs by regularly publishing the health hazards relating to these structures.³ This media attention had an impact on the results of the studies, outlined next.

2.2 The Opinion Survey

The Bond and Beamish (2005) opinion survey study included residents in ten suburbs: five case study areas (within 100 feet of a cell phone TOWER) and five control areas (over 0.6 of a mile from a cell phone TOWER). The five the case study suburbs were matched with five control suburbs that had similar living environments (in socio-economic terms) except that the former are areas where a CPBS is located, while the latter are without a CPBS. Eighty questionnaires⁴ were distributed to each of the ten suburbs in Christchurch (i.e. 800 surveys were delivered in total). After sending out reminder letters to those residents who had not yet responded, an overall response rate of 46% was achieved. Over three-quarters (78.5%) of the case study respondents were homeowners compared to 94% in the control area.

The results were mixed with responses from residents ranging from having no concerns to being very concerned about proximity to a CPBS. Interestingly, in general, those people living in areas further away from CPBSs were **much more** concerned about issues from proximity to CPBSs than residents who lived near CPBSs.

² McIntyre and others vs. Christchurch City Council [1996] NZRMA 289 and Shirley Primary School vs. Telecom Mobile Communications Ltd [1999] NZRMA 66

³ For example, Cherry, N. (2000), "Health Effects Associated with Mobil Base Stations in Communities: The Need for Health Studies," Environmental Management and Design Division, Lincoln University, June 8. Available from: <http://pages.britishlibrary.net/orange/cherryonbasestations.htm>.

⁴ Approved by the University of Auckland Human Subjects Ethics Committee (reference 2002/185).

Over 40% of the control group respondents were worried a lot about future health risks, aesthetics and future property values compared to the case study areas where only 13% of the respondents were worried a lot about these issues. However, in both the case study and control areas, the impact of proximity to CPBSs on future **property values** is the issue of **greatest concern** for respondents. If purchasing or renting a property near a CPBS, over a third (38%) of the control group respondents would **reduce price** of their property by more than **20%**. The perceptions of the case study respondents were again less negative with a third of them saying they would reduce price by only 1-9%, and 24% would reduce price by between 10 and 19%.

Reasons for the lack of concern shown by the case study respondents may be due to the CPBS being either not visible or only barely visible from their homes. Another reason may be that the CPBS was far enough away from respondent's property (as was indicated by many respondents, particularly in St Albans West, Upper Riccarton, and Bishopdale) or hidden by trees and consequently it did not affect them much. The results may have been quite different had the CPBS being more visually prominent.

2.3 Transaction-based Market Study

The Bond and Wang (2005) market transaction-based regression study included 4283 property sales in four suburbs that occurred between 1986 and 2002 (approximately 1000 sales per suburb). The sales data that occurred before a CPBS was built were compared to sales data after a CPBS was built to determine any variance in price, after accounting for all the relevant independent variables.

Interestingly, the effect of a CPBS on price (a decrease of between 20.7% and 21%) was very similar in the two suburbs where the towers were built in the year 2000, after the negative media publicity given to CPBSs following the two legal cases outlined above. The other two suburbs that indicated a CPBS was either insignificant or increased prices by around 12%, had towers built in them in 1994, prior to the media publicity. Also, given that the cell phone technology was relatively new to NZ in 1994 (introduced in late 1987) there may have been more desire then to live closer to a tower to receive better coverage than in later years when the technology became more common and the potential health hazards from these became more widely publicized.

The main limitation affecting this study was that there was no accurate proximity measure included in the model, such as GIS coordinates for each property. Instead, street name was included as an independent variable to help to control for the proximity effects. A study has subsequently been performed using GIS analysis to determine the impact that distance to a CPBS has on residential property prices. The results from this study are outlined next.

2.4 Proximity Impact Study

Bond and Xue study conducted in 2004 involved analysis of the residential transaction data using the same hedonic framework as the previous study as well as including the same data but added a further six suburbs to give a total of ten suburbs: five suburbs with CPBSs located in them and five control suburbs without CPBSs. In addition, the geographical {x, y} coordinates that relate to each property's absolute location were included. A total of 9,514 geo-coded property sales were used (approximately 1000 sales per suburb).

In terms of the effect that proximity to a CPBS has on price the overall results indicate that this is significant and negative. Generally, the closer to the CPBS a property is the greater the decrease in price. The effect of proximity to a CPBS **reduces price by 15%, on average**. This effect reduces

with distance from the CPBS and is negligible after 1000 feet.

2.5 High Voltage Overhead Transmission Line Research

CPBSs are very similar structures to high voltage overhead transmission lines (HVOTLs) and their supporting structure, the pylons. Therefore, despite the limited research relating to value effects from CPBS, it is worthwhile reviewing the body of literature on the property values effects from HVOTLs and pylons.

2.5.1 New Zealand HVOTL Research

The only recently published study in New Zealand on HVOTLs value effects is by Bond and Hopkins (2000).⁵ The case study area selected for the research was a low-middle income, predominantly single-family residential district in the northern Wellington suburb of Newlands that is crossed by two 110KV transmission lines with 85 foot high steel pylons **located on private land**.

The results of the sales analysis, comprising sales from 1989 to 1991 (330 of which were within 1000 feet, or 300 meters, of a HVOTL), indicate the effect of having a 'pylon' close to a particular property is statistically significant and has a **negative effect of 27%** at 33 feet (10 meters) from the pylon, 18% at 50 feet (15 meters), decreasing to 5% at 164 feet (50 meters). This effect diminishes to a negligible amount after 328 feet (100 meters). However, the presence of a 'transmission line' in the case study area has a minimal effect and is not a statistically significant factor in the sales price.

2.5.2 UK HVOTL Research

In England, the effect of HVOTLs on the value of residential property remains relatively unexplored due, in part, to the lack of available transaction data for analysis. The most recently published study is by Sims and Dent (2005).⁶ They compare the results of two parallel UK studies: the first is an analysis of transaction data from a case study in Scotland where sales data are available; the second is a national survey of property appraisers' perceptions (Chartered Surveyors and members of the National Association of Estate Agents) of the presence of distribution equipment in close proximity to residential property.

The data set for the Scotland study consisted of 593 single-family houses that sold between 1994 and 1996 near Glasgow. There is a 275 kV HVOTL running through the centre of the neighborhood in a corridor of land. (Note: This scenario is akin to the US situation where HVOTLs are also situated in easement corridors).

In summary, the analysis of prices at varying distances from the HVOTL showed no clear pattern. The presence of a pylon was found to have a more significant impact on value than the HVOTL and could **reduce price by up to 20.7%**. All negative impacts appeared to reduce with distance and were negligible at around 820 feet (250 meters).

The results from the survey of appraisers and real estate agents indicate they **reduce house price by around 5-10%** when valuing a property within close proximity to a HVOTL. Comparing the

⁵ Bond, S.G. & Hopkins, J. (2000). "The Impact of Transmission Lines on Residential Property Values: Results of a Case Study in a Suburb of Wellington, New Zealand". *Pacific Rim Property Research Journal*, Vol.6, No.2, pp.52-60.

⁶ Sims, S. and Dent, P. (2005), "High-voltage overhead power lines and property values: A residential study in the UK", *Urban Studies*, Vol.42, No.4, pp. 665-694.

results from both studies suggests that appraisers and real estate agents underestimate the impact of proximate HVOTLs on value.

2.5.3 US and Canadian Research

There have been a number of HVOTLs studies carried out in the US and Canada. A major review and analysis of the literature by Kroll and Priestley indicated that in about half the studies carried out, HVOTLs had not affected property values and in the rest of the studies there was a loss in property value between 2-10%.⁷

Kroll and Priestley were generally critical of most valuer type studies because of the small number of properties included and the failure to use econometric techniques, such as multiple regression analysis. They found that the Colwell study was one of the more careful and systematic analysis of residential impacts.⁸ This study was carried out in Illinois and found that the strongest effect of the HVOTLs was within the first 50 feet (15m) but with this dissipating quickly further away, disappearing beyond 200 feet (60m).

A Canadian study (Des Rosiers, 2002) based on a sample of 507 single-family house sales in the City of Brossard, Greater Montreal that sold between 1991-1996 showed that the severe visual encumbrance due to a direct view of either a pylon or lines exerts a significantly negative impact on property prices of between 5% to well in excess of 20%. The extent of value diminution depended on the degree of set back of the homes with respect to the HVOTL easement. The smaller the set back the greater the reduction in price (for example, with a setback of 50ft price was reduced by 21%).

However, the study also showed that a house located adjacent to a transmission corridor may increase values. The proximity advantages include enlarged visual field and increased privacy. The decrease in value from the visual impact of the HVOTLs and pylons (between, on average, 5-10% of mean house value) tends to be cancelled out by the increase in value from proximity to the easement.⁹

A study by Wolverton and Bottemiller¹⁰ utilized a paired-sale methodology of home sales occurring in 1989-1992 to ascertain any difference in sale price between properties abutting rights-of-way of transmission lines (subjects) in Portland, Oregon; Vancouver, Washington; and Seattle, Washington and those located in the same cities but not abutting transmission line rights-of-way (comparisons). Their results did not support a finding of a price effect from abutting an HVTL right-of-way. In their conclusion they warn that the results cannot and should not be generalized outside of the data. They explain that

“limits on generalizations are a universal problem for real property sale data because analysis is constrained to properties that sell and sold properties are never a randomly drawn representative sample. Hence, generalizations must rely on the weight of evidence

⁷ Kroll, C. and Priestley, T. (1992), “The Effects of Overhead Transmission Lines on Property Values: A Review and Analysis of the Literature”, Edison Electric Institute, July.

⁸ Colwell, P. (1990), “Power Lines and Land Value”, *The Journal of Real Estate Research*, American Real Estate Society, Vol. 5, No. 1, Spring.

⁹ Des Rosiers, F. (2002), Power Lines, Visual Encumbrance and House Values: A Microspatial Approach to Impact Measurement, *Journal of Real Estate Research*, Vol.23, No.3, pp. 275 – 301.

¹⁰ Wolverton, M.L. & Bottemiller, S.C., (2003), “Further analysis of transmission line impact on residential property values”, *The Appraisal Journal*, Vol.71, No.3, pp. 244.

from numerous studies, samples, and locations,” p. 250.

Thus, despite the varying results reported in the literature on property value effects from HVOTLs, each study adds to the growing body of evidence and knowledge on this (and similar) valuation issue(s).

2.5.4 Summary

This literature review shows that the price effect of proximity to a HVOTL-pylon is generally consistent between studies (i.e. negative and significant) ranging from between 12 to 27% depending on the distance to these. The closer the home is to a pylon, the greater the diminution in price. The effect diminishes to a negligible amount after 820 feet (250 meters), on average.

The effect of proximity to CPBSs is similar to that caused by proximity to HVOTL-pylons and **reduces price by around 21%**. Taking actual distance into account (using GIS analysis) the effect is a reduction of price of 15%, on average (but up to 25% depending on the neighborhood). This effect reduces with distance from the CPBS and is negligible after 1000 feet (300 meters).

The literature on property value effects from HVOTLs, pylons and cell phone towers adds to the growing body of evidence and knowledge on this (and similar) valuation issue(s). The study reported here is one such study.

3. Market Study

3.1 The Data

Part of the selection process for finding an appropriate case study area was to find one where there were a sufficient number of property sales in suburbs where a tower had been built for analysis to provide statistically reliable and valid results. Sales were required both before and after the tower was built to study the effect of the existence the tower had on the surrounding property's sale prices.

Cellular phone tower information was obtained from the Federal Communication Commission (FCC). Approximately sixty-percent (60%) of the towers located in Orange County were constructed between the years 1990 and 2000. Additionally, twenty of the towers have the greatest potential for impact on the price of residential properties, based on the greatest number of residential properties close to each tower. These twenty towers were selected to construct a dataset for the study.

Residential properties that sold between 1990 and 2000, the years during which the towers were constructed and were closest to the twenty towers were selected. Parcel data was collected from the Office of the Property Appraiser for Orange County, Florida.¹¹ Overall, 5783 single-family, residential properties were selected from northeast Orange County (see Appendix I: Location Map).

The study investigates the potential impact of proximity to a tower on the price of residential property, as indicated by the dependant variable: SALE_PRICE.¹² The study controls for site and structural characteristics by assessing the impact of various independent variables. The independent data set was limited to those available in the dataset and known, based on other well-

¹¹ As reported to the Florida Department of Revenue.

¹² Model 1, Model 2, and Model 3 estimate the Log of the SALE_PRICE.

tested models reported in the literature and from valuation theory, to be related to property price. The independent variables selected include: lot size in square feet (LOT), floor area of the dwelling in square feet (SQFT), age of the dwelling in years (AGE), the time of construction (AFTER-TWR), the closest distance of each home to the associated tower (DISTANCE), and the dwelling's absolute location is indicated by the Cartesian coordinates (XCOORD) and (YCOORD).¹³

The effect of construction of a tower on price is taken into account by the inclusion of the dummy, independent variable AFTER_TWR. By including AFTER_TWR property prices prior to tower construction can be compared with prices after tower construction.¹⁴ Frequency distributions indicate that, among the residential properties that sold between 1990 and 2000, approximately eighty percent (80%) of the residential properties were sold after tower construction.

The mean SALE_PRICE of single-family, residential property that sold between 1990 and 2000 is \$113,830 for northeast Orange County. The mean square footage of a dwelling is 1535 sq. ft., the mean lot size is 8525 square feet and the mean age is 14 years. The mean DISTANCE from residential property to a tower is 1813 feet.¹⁵

Based on the parcel and tower data for Orange County, descriptive statistics for select variables are presented in Table 1, below.

VARIABLE	MEAN	STD. DEV.	MIN	MAX
SALE_PRICE	113830.6	58816.68	45000	961500
SQFT	1535.367	503.8962	672	5428
LOT	8525.193	4363.28	1638	107732
AGE	13.92755	10.03648	0	35
XCOORD	664108.9	6130.238	640460	671089
YCOORD	511489.4	2422.946	506361	531096
DISTANCE	1813.077	725.5693	133	6620

3.2 Methodology

The method selected for this study was a hedonic house price approach. GIS was also adopted to aid the analysis of distance to the towers. The null hypothesis states that tower proximity does not explain any variation in residential property sales price.

To address the many difficulties in estimating the composite effects of externalities on property price an interactive approach is adopted.¹⁷ To allow the composite effect of site, structural and

¹³ See Fik, Ling and Mulligan (2003) for further discussion of the significance of the absolute location in the form of {x, y} coordinates.

¹⁴ Dummy variables for each year of residential sales were also incorporated into each of the model specifications to control for the potential effects of time on the price of residential property.

¹⁵ Initially, the HEIGHT of the tower was also included among the explanatory variables. However, the HEIGHT variable provided no significant explanatory power.

¹⁶ Polynomial expansions of the independent variables, identified by the VARIABLE2 were included in the interactions in the three model specifications discussed in the methodology.

¹⁷ Externalities include influences external to the property such as school zoning, proximity to both amenities and dis-amenities, and the socio-economic make-up of the resident population.

location attributes on the value of residential property to vary spatially they are interacted with the Cartesian coordinates that are included in the model.

Unless the hedonic pricing equation provides for interaction between aspatial and spatial characteristics the effects of the explanatory variables on the dependant variable will likely be underestimated, misspecified, undervalued or, worse, overvalued. Including the Cartesian coordinates in the model is intended to increase the explanatory power of the estimated model, and reduce the likelihood of model misspecification (i.e. inaccurate estimates of the regression coefficients, inflated standard errors of the regression coefficients, deflated partial t-tests for the regression coefficients, false non-significant p-values, and degradation of the model predictability, etc.) by allowing the explanatory variables to vary spatially and by removing the spatial dependence observed in the error terms of aspatial, non-interactive models.

Adhering to the methodology proposed by Fik, Ling, and Mulligan (2003), empirical models were selected and progressively tested. The models were based on other well-tested hedonic housing price equations reported in the literature, to derive a best-fit model.

The methodology progresses from an interactive model specification which controls for site and structural attributes of residential property as well as the effects of absolute location and then proceeds to a model specification that measures the effects of discrete location characteristics based on distance intervals. The final model incorporates the impact of explicit location to measure the effects of the proximity to towers (as indicated by DISTANCE) on the sales price of residential property.

Preliminary tests of each model, proceeding from interactive aspatial and spatial estimates, were executed to identify an appropriate polynomial order, or a model that provided the greatest number of statistically significant coefficients and the highest adjusted R-squared value (Fik, et al., p. 633). Like the study by Fik, et al., sensitivity analyses suggested the use of a fourth-order model, at most. Similarly, the following model specifications are estimated with a stepwise regression procedure to ensure that the potential for model misspecification due to multi-collinearity is minimized and that only the independent variables offering the greatest explanatory power are included in the final model.

Model 1 was utilized as a benchmark for the remaining two models. The SALE_PRICE is estimated using the following independent variables: lot size (LOT), square footage of the dwelling (SQFT), age of the dwelling in years (AGE), and the dwelling's absolute location (XCOORD) and (YCOORD). To investigate the effect of tower construction on the price of homes the dummy variable (AFTER_TWR) was also included. Residential sales prices prior to tower construction, BEFORE (=0), were compared to sales prices after tower construction, AFTER (=1). With the addition of the absolute location Model 1 was used to provide a sound model specification, to maximize the explanatory value of the study and minimize the potential for misspecification in the estimated models.

Model 2 integrated the base-model with distance intervals akin to discrete locations. Residential properties within the discrete intervals were then coded according to the interval in which each property was located. The distance intervals, adopted are: 500MTRS (500 to 451 meters), 450MTRS (450 to 401 meters), 400MTRS (400 to 351 meters), 350MTRS (350 to 301 meters), 300MTRS (300 to 251 meters), 250MTRS (250 to 201 meters), 150MTRS (150 to 101 meters), 100MTRS (100 to 51 meters), 50 MTRS (50 meters, or less, to the tower). These distance rings are

within the range of distances used in other similar proximity studies of detrimental features on property values (see for example: Des Rosiers 2002; Reichert 1997; Colwell 1990, and Bond and Hopkins 2000).

Model 3 includes distance-based measures indicating the property's explicit location, with respect to the closest tower. Model 3 integrated the base-model (Model 1) with the distance from the tower to the property. Model 3 introduces the independent variable DISTANCE and interacts this variable with the variables from Model 1. The final model, Model 3, is used to assess the variation in sale price due to proximity to a tower.

3.4 Empirical Results

Tables 2, 3 and 5 are shown in Appendices II and III. The Tables show the progressive development of a spatial and fully interactive model specification to estimate the effects of the proximity to towers on the price of residential property, according to the base-model, Model 1.

In the semi-logarithmic equation the interpretation of the dummy variable coefficients involves the use of the formula: $100(e^{bn} - 1)$, where bn is the dummy variable coefficient (Halvorsen & Palmquist).¹⁸ This formula derives the percentage effect on price of the presence of the factor represented by the dummy variable.

Results in Table 2 (Appendix II) suggest that the price of residential properties sold after the construction of a tower increases by 1.47% (i.e. AFTER_TWR = 1.46E-02). Interactions with AFTER_TWR and other variables also suggest an increase in the price for single, family residential properties sold after tower construction. This may reflect residents' preference to live near a tower to obtain better cell phone coverage.

Among the control variables SQFT increases price by 0.039% with each additional square foot of space (i.e. SQFT = 3.88E). AGE reduces price by 0.25% for each additional year of age. The t-statistics for the explanatory variables SQFT, AGE, XCOORD and YCOORD suggest significant explanatory power within the specification (i.e. SQFT = 47, AGE2 = 7, XCOORD = -7.105 and YCOORD = 6.799). Model 1 accounts for 82% of the variation in the SALE_PRICE (i.e. Adj. R-Square = .08219987).

The results of Model 2 (in Table 3, Appendix II) indicate the estimated effect that proximity to a tower has on residential property prices. Although the SALE_PRICE of single-family, residential properties may appear to increase after the construction of towers as indicated by Model 1, the discrete intervals created in Model 2 suggest that the value of residential properties also increases as the distance from towers increases. That is, if the distance from the residential property to the tower decreases, then the price of the residential property likewise decreases.

Model 2 indicates that the influence of the proximity of towers on the price of residential properties increases inversely with the distance. Under 200MTRS from the towers, the negative signs of the estimate coefficients suggest a decrease in the value of residential properties with an increased proximity or decreased distance to towers. The price of a property located between 101 and 150 meters of a tower decreases by 1.57% ($1 - e^{-0.0156}$) relative to properties that sold prior to the tower being built when holding other explanatory variables constant. The price of properties

¹⁸ Halvorsen, R. and Palmquist, R. "The Interpretation of Dummy Variables in Semilogarithmic Equations," *American Economic Review*, (70:3, 1980): 474-475.

that are located between 151 and 200 meters from a tower is reduced by 2.71% ($1 - e^{-0.0275}$). Thus, a tower has a statistically significant, albeit minimal, effect on prices of property located within 200 meters of a tower.

From 300MTRS to 400MTRS, the price of residential property increases with the distance from the tower. Between 400MTRS and 500MTRS, the price continues to increase with the distance from the tower. These price increases vary from between 1.045% at 350 meters to 2.32% at 500 meters. Additionally, the t-statistics increase with the distance, further suggesting the impact indicated by the increase in estimate coefficients. Although the general trend in the data suggests a positive relationship between the price of residential properties and distance, anomalies exist within the distance intervals.

Having provided a preliminary assessment of the impact of the proximity of towers on residential property prices, Model 3 introduces the independent variable DISTANCE to better assess the variation in sale price due to the external effect of a tower.

Table 4 provides a summary of the distance-based results from Models 2 and 3. While the results of Model 2 present minor anomalies within the data intervals, the results of Model 3 suggest a greater consistency in the results. The results from Model 3 are presented in Table 5 (see Appendix III).

Table 4: A Comparison of Distance-Based Location Coefficients (% impact on price)	
DISCRETE LOCATION	ADJ. R² = 0.826257
500-450MTRS	2.30E-02 (2.33%)
450-400MTRS	1.91E-02 (1.93%)
400-350MTRS	2.17E-02 (2.19%)
350-300MTRS	1.04E-02 (1.045%)
200-150MTRS	-2.75E-02 (-2.71%)
150-100MTRS	-1.56E-02 (-1.57%)
EXPLICIT LOCATION	ADJ. R² = 0.8282641
DISTANCE	5.69E-05 (5.69-03%)
DISTANCE2	-1.49E-08

The results of Model 3 clearly show that the price of residential property increases with the distance from a tower. The independent variable, DISTANCE, estimates a coefficient with a positive sign, that increases with increasing distance from the tower (i.e. Distance = 5.69E-05). Moreover, the t-statistic associated with the estimated coefficient indicates the significance of the explanatory power of the variable (i.e. t-Stat = 10.751).

DISTANCE presents significant interactions with the other independent variables. The t-statistics associated with these interactions provide strong evidence that the price of residential property, while highly associated with site and structural characteristics, may be significantly impacted by proximity to towers (i.e. AFTER_TWR*DISTANCE = 3.519; DISTANCE2 = -12.258; DISTANCE*AGE = 4.829).

Further, although the estimated effect of the explanatory variable AFTER_TWR continues to suggest that the value of residential property increases with the distance from towers, the interactive nature of AFTER_TWR with DISTANCE2 suggests that the effect of AFTER_TWR

may vary due to varying distances from the tower. Indeed, the estimated coefficient for AFTER_TWR from Model 1 is diminished in Model 2 and Model 3 as discrete and explicit, distance-based locational attributes are included in the model specification (i.e. Model 1, AFTER_TWR = 1.46E-02 (1.47%), Model 2, AFTER_TWR = 1.1495-02 (1.156%) and Model 3, AFTER_TWR = .012722 (1.28%).

3.5 Limitations and Comparison with the NZ Study

This study analyzed residential property sales drawn from a number of different, but neighbouring, suburbs in Orange County, Florida as an entire dataset (the suburbs were grouped together and analyzed as a whole). While the Location Value Signature was included in the model to take into account composite externalities as well as to allow these and other independent variables in the model to vary spatially, and therefore preclude the need to analyse neighbourhoods separately, it is possible that not all neighbourhood differences were accounted for when these results are compared to those from the NZ study.

The NZ study (2004) included an analysis of the whole dataset but also of the separate suburbs. The analysis of the whole dataset indicates that CPBSs have a significant, but minimal, effect on the prices of proximate properties. The same general result was obtained for the current US study. However, what the NZ study showed by analyzing the suburbs separately was that substantive differences exist in the effect that CPBSs have on property prices between suburbs, since the distribution of the property sales prices is quite different in each.

The analysis showed that the most significant variables and their effect on price were similar between the four suburbs: St. Albans, Beckenham, Papanui, and Bishopdale. This indicates the relative stability of the coefficients between each model. The overall results indicate that the presence of a CPBS has a significant and negative effect on property prices. This effect is not very strong when the variable TOWER is included in the model fitted to the **entire dataset**. However, the effect in each suburb is quite pronounced. It is possible that if the current study had analyzed suburbs separately that similar differences would have been found. Table 6, below, summarizes the results.

Model & Date Tower Built		TOWER	Inv.dist	DIST1	DIST 2	DIST 3
All Suburbs	Coefficients	-2.29e-02	-3.68e-01	-2.78e-02	-2.91e-02	-3.98e-03
	Value Effects	-2.3%	50m @ -5.07% 100m @ -3.61%	-2.7%	-2.87%	Insignif.
St Albans 1994	Coefficients	1.48e-01	8.99e-01	1.45e-01	1.53e-01	1.44e-01
	Value Effects	+16% (+12%)	50m @ +13.6% 100m @ +9.4%	+15.6%	+16.5%	+15.5%
Beckenham 2000	Coefficients	-1.81e-01	-2.85e+00	-1.74e-01	-1.74e-01	-2.03e-01
	Value Effects	-16.56%	97m @ -25.13%	-15.9%	-15.9%	-18.37%
Bishopdale 1994	Coefficients	-9.86e-02	1.62e+00	-1.34e-01	-9.18e-02	
	Value Effects	-9.39%	50m @ -20.4% 100m @ -15%	-12.54%	-8.96%	

Papanui 2000	Coefficients	-8.17e-02	-2.24e+00	-7.02e-03	-1.55e-01	-6.70e-02
	Value Effects	-7.85%	177m @-15.5%	Insignif.	-14.36%	-6.48%

Other factors that could affect the results are the style and appearance of the CPBSs and how visible they are to residents.

4. Summary and Conclusions

This paper presents the results of a study carried out in Florida in 2004. The study involved the analysis of market transaction data of single-family homes that sold in Orange County between 1990 and 2000 to investigate the affect on the price of property in close proximity to a tower. The results showed that while a tower has a statistically significant effect on prices of property located near a tower, this effect is minimal. The price of properties within 200 meters (656 feet) decreased, on average, by just over 2%.

Each geographical location is unique as evidenced by the difference in results from the NZ and US studies. These observed differences are partly due to the manifold factors that influence the degree of negative reaction to towers. Residents' perceptions and assessments of risk vary according to a wide range of processes including psychological, social, institutional, and **cultural**. In addition to the potential health, aesthetic and property value impacts from towers, other factors that may impact on the degree of negative reaction from residents living near these structures and that may be reflected in price are listed below:

- The kinds of health and other risks residents associate with towers, and the level of risk perceived;
- The height, style, and appearance of the towers, how visible these are to residents and how they perceive such views;
- The marketability of homes near towers;
- The extent and frequency of negative media attention to towers;
- The socio-economic make-up of the resident population (prior research indicates that social class is an important variable influencing people's response to environmental detriments, Thayer *et al.* 1992, and Dale *et al.* 1999);
- The distance from the towers residents feel they have to be to be free of concerns.

As the results reported here are from a case study conducted in 2004 in a specific geographic area (Orange County, Florida) the results should not be generally applied. Wolverton and Bottemiller¹⁹ explain that:

“...limits on generalizations are a universal problem for real property sale data because analysis is constrained to properties that sell and sold properties are never a randomly drawn representative sample. Hence, generalizations must rely on the weight of evidence from numerous studies, samples, and locations,” p. 250.

Thus, to determine if the results are consistent across time and space many similar studies in different geographic locations would need to be conducted over time. Further, to allow valid comparison between them, such studies would need to be of similar design. As suggested by Bond

¹⁹ Wolverton, M.L. & Bottemiller, S.C., (2003), “Further analysis of transmission line impact on residential property values”, *The Appraisal Journal*, Vol.71, No.3, pp. 244.

and Wang (2005), the sharing of results from similar studies would aid in the development of a global database to assist appraisers in determining the perceived level of risk associated with towers and other similar structures from geographically and socio-economically diverse areas.

References

Bond, S.G., and Beamish, K. (2005). "Cellular Phone Towers: Perceived Impact on Residents and Property Values", *Pacific Rim Property Research Journal*, vol. 11, no. 2, pp. 158-177.

Bond, S.G. & Hopkins, J. (2000). "The Impact of Transmission Lines on Residential Property Values: Results of a Case Study in a Suburb of Wellington, New Zealand". *Pacific Rim Property Research Journal*, Vol.6, No.2, pp.52-60.

Bond, S.G. and Wang, K. (2005). "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods", *The Appraisal Journal*, Volume LXXIII, 3: 256-277.

Bond, S.G. and Xue, J. (2005). "Cell Phone Tower Proximity Impacts on House Prices: A New Zealand Case Study", European Real Estate Society and International Real Estate Society Conference, June 15-18, Dublin, Ireland.

Cherry, N. (2000), "Health Effects Associated with Mobil Base Stations in Communities: The Need for Health Studies," Environmental Management and Design Division, Lincoln University, June 8. Available from: <http://pages.britishlibrary.net/orange/cherryonbasestations.htm>.

Christchurch City Council website. Available from: www.ccc.govt.nz/index.asp

Cressine, J.P., Davis, O., and Jackson, J.E. (1967). "Urban Property Markets: Some Empirical Results and Their Implications for Municipal Zoning," *Journal of Law and Economics*, 10: 142-154.

Colwell, P. (1990), "Power Lines and Land Value", *The Journal of Real Estate Research*, American Real Estate Society, Vol. 5, No. 1, Spring.

Crone, T.M. (1983) "Elements of an Economic Justification for Municipal Zoning", *Journal of Urban Economics*, 14: 184-205.

Des Rosiers, F. (2002), Power Lines, Visual Encumbrance and House Values: A Microspatial Approach to Impact Measurement, *Journal of Real Estate Research*, Vol.23, No.3, pp. 275 – 301.

Fik, Timothy J.; Ling, David C., and Mulligan, Gordon F. (2003), "Modeling Spatial Variation in Housing Prices: A Variable Interaction Approach" *Real Estate Economics*, Winter 2003, Vol. 31: 647-670.

Gillen, K., Thibodeau, T.G., and Wachter, S. (2001) "Anisotropic Autocorrelation in House Prices", *Journal of Real Estate Finance and Economics*, 23: 5-30.

Fisher, W. (1971) "Econometric Estimation with Spatial Dependence", *Regional and Urban Economics*, 1: 19-40.

Kolhause, J.E. (1991) "The Impact of Toxic Waste Sites on Housing Values," *Journal of Urban Economics*, 30: 154- 173.

Kroll, C. and Priestley, T. (1992), "The Effects of Overhead Transmission Lines on Property Values: A Review and Analysis of the Literature", Edison Electric Institute, July.

Li, M.M., and Brown, H.J. (1980) "Micro-Neighborhood Externalities and Hedonic Housing Prices", *Land Economics* 56: 125-141, May.

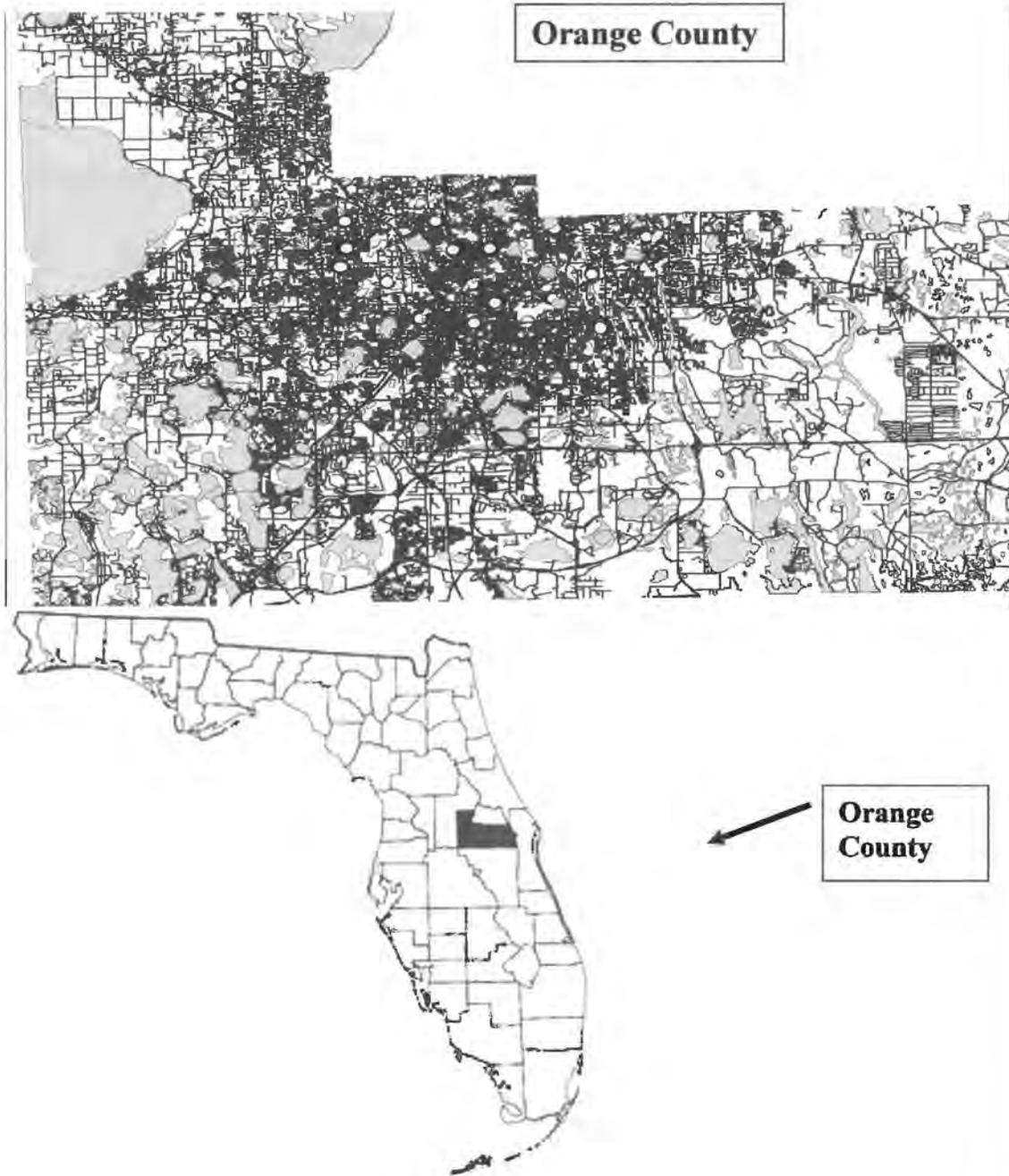
Reichert, A.J. (1997) "Impact of a Toxic Waste Superfund Site on Property Values" *The Appraisal Journal*, 65:4, pp. 381-392.

Sims, S. & Dent, P. (2003). "The Effect of Electricity Distribution Equipment on the UK Residential Property Market", paper presented at the Pacific Rim Real Estate Conference, Brisbane, Australia, January (available at: <http://www.business.unisa.edu.au/prres/Proceedings/Proceedings2003/>)

Swirko, Cindy (2004), "Cell Towers: Eyesores or Necessities?", *The Gainesville Sun*, Tuesday, September 28, p. 1B and 3B.

Wolverton, M.L. & Bottemiller, S.C., (2003), "Further analysis of transmission line impact on residential property values", *The Appraisal Journal*, Vol.71, No.3: 244.

Appendix I - Location Map



Appendix II – Model 1 & 2 Results

Table 2: Model 1 (n = 5783); Adjusted R-Square = .8219987

Variables	Est. Coefficient	Std. Error	Std. Coefficient	t-Stat	Significance
Constant	3.689244	0.257416		14.332	0.0000
AFTER_TWR	1.46E-02	5.08E-03	0.0353	2.867	0.0042
AFTER_TWR*AGE	5.99E-04	2.62E-04	0.0395	2.29	0.0221
AFTER_TWR*LOT	8.79E-07	2.91E-07	0.0272	3.018	0.0026
SQFT	3.88E-04	8.20E-06	1.2072	47.368	0.0000
SQFT2	-3.02E-08	1.90E-09	-0.3779	-15.912	0.0000
SQFT*AGE	3.52E-07	1.78E-07	0.0429	1.982	0.0475
AGE	-2.81E-03	5.17E-04	-0.1739	-5.429	0.0000
AGE2	7.12E-05	9.94E-06	0.1527	7.165	0.0000
XCOORD	-1.14E-06	1.61E-07	-0.0432	-7.105	0.0000
YCOORD	3.05E-06	4.48E-07	0.0456	6.799	0.0000

Table 3: Model 2 (n = 5783); Adjusted R-Square = .826257

Variables	Est. Coefficient	Std. Error	Std. Coefficient	t-Stat	Significance
Constant	3.9082	0.2556		15.291	0.0000
AFTER_TWR	0.011495	5.05E-03	0.0279	2.275	0.0230
AFTER_TWR*AGE	5.57E-04	2.59E-04	0.0367	2.151	0.0315
AFTER_TWR*LOT	1.25E-06	2.91E-07	0.0387	4.301	0.0000
SQFT	3.98E-04	7.78E-06	1.2385	51.236	0.0000
SQFT2	-3.21E-08	1.89E-09	-0.4011	-16.994	0.0000
SQFT*AGE					
AGE	-2.29E-03	4.36E-04	-0.1418	-5.247	0.0000
AGE2	7.11E-05	9.81E-06	0.1524	7.245	0.0000
XCOORD	-1.67E-06	1.65E-07	-0.0633	-10.134	0.0000
YCOORD	3.26E-06	4.45E-07	0.0487	7.324	0.0000
500MTRS	2.30E-02	2.94E-03	0.0699	7.835	0.0000
450MTRS	1.91E-02	3.97E-03	0.0344	4.813	0.0000
400MTRS	2.17E-02	4.04E-03	0.0376	5.364	0.0000
350MTRS	1.04E-02	4.30E-03	0.0162	2.415	0.0158
200MTRS	-2.75E-02	6.12E-03	-0.0271	-4.489	0.0000
150MTRS	-1.56E-02	7.16E-03	-0.0128	-2.177	0.0295

Appendix III – Model 3 Results

Table 5: Model 3 (<i>n</i> = 5783); Adjusted R-Square = .8282641					
Variables	Est. Coefficient	Std. Error	Std. Coefficient	t-Stat	Significance
Constant	3.097387	0.268028		11.556	0.0000
AFTER_TWR	0.012722	4.42E-03	0.0309	2.877	0.0040
AFTER_TWR*AGE			---		
AFTER_TWR*LOT	1.26E-06	2.86E-07	0.0389	4.4	0.0000
AFTER_TWR*DISTANCE2	2.72E-09	7.73E-10	0.055	3.519	0.0004
SQFT	4.01E-04	8.45E-06	1.2464	47.46	0.0000
SQFT2	-3.04E-08	1.93E-09	-0.3797	-15.726	0.0000
SQFT*AGE			---		
AGE	-2.80E-03	3.95E-04	-0.1731	-7.077	0.0000
AGE2	6.72E-05	9.70E-06	0.1442	6.931	0.0000
XCOORD	-1.61E-06	1.63E-07	-0.061	-9.911	0.0000
YCOORD	4.70E-06	4.80E-07	0.0702	9.798	0.0000
DISTANCE	5.69E-05	5.29E-06	0.2548	10.751	0.0000
DISTANCE2	-1.49E-08	1.22E-09	-0.2927	-12.258	0.0000
DISTANCE*AGE	6.20E-07	1.28E-07	0.0909	4.829	0.0000
DISTANCE*SQFT	-5.43E-09	2.71E-09	-0.0568	-2.002	0.0453

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The Impact Of Cellular Phone Base Station Towers On Property Values

*Sandy Bond, Ph.D., MBS, ANZIV, Senior Lecturer
Faculty of Architecture, Property, Planning & Fine Arts
University of Auckland, Private Bag 92019
Auckland, New Zealand
Work: 64 9 3737999 8898, Fax: 64 9 373 7410
E-mail: s.bond@auckland.ac.nz*

*Si-Yeoul Mun, PhD Candidate
Faculty of Architecture, Property, Planning & Fine Arts
E-mail: symun@world-net.co.nz*

*Pornsiri Sakornvanasak, Master or Property Candidate
Faculty of Architecture, Property, Planning & Fine Arts
E-mail: psak003@ec.auckland.ac.nz*

*Nick McMahon, Bachelor of Property student
Faculty of Architecture, Property, Planning & Fine Arts
E-mail: nickmcmahon@hotmail.com*

The Impact Of Cellular Phone Base Station Towers On Property Values

Keywords: Electromagnetic fields - radio frequency & microwave radiation - cellular phone base stations – property values - stigma

Abstract: Studies show that devices that emit electromagnetic fields (EMFs) are no longer seen as a welcome sign of progress. Media attention to the potential health hazards of EMFs has caused changes in public perception. The introduction of cellular phone systems and a rapid increase in the number of users of cellular phones in the last decade has increased the exposure of the population to EMFs quite considerably. Health consequences of long-term use of cellular phones are not known in detail, but available data indicate that development of non-specific health symptoms is possible (Szmigielski & Sobiczewska, 2000). Conversely, it appears health effects from cellular phone equipment (antennas and base stations) pose few (if any) known health hazards (Barnes, 1999).

A concern associated with cellular phone usage is the siting of cellular phone transmitting antennas and their base stations (CPBSs). These are appearing at an alarming rate across the country mainly on the rooftops of buildings but with numerous base stations installed on towers. These towers are occasionally located in close proximity to houses and schools. The extent of opposition from property owners affected by the siting of these is increasing due to fears of health risks from exposure to EMFs (despite the research reports to the contrary), changes in neighbourhood aesthetics and loss in property values. However, the extent to which such attitudes are reflected in lower property values affected by proximity to CPBSs is not known in New Zealand.

This paper outlines the results of a pilot study carried out in 2002 to show the effect of CPBSs on residential property values in Auckland, New Zealand. The research examines residents' perceptions toward living near CPBSs and how they evaluate the impacts of these structures. A case study approach was used. The results were mixed with responses from residents ranging from having no concerns to being very concerned about proximity to a CPBS. Consequently, how these perceptions impact on property values was also mixed with responses from residents ranging from being prepared to pay the same to being prepared to pay more than twenty percent less for a property located near a CPBS. Interestingly, in general, those people living near the CPBSs were much less concerned about issues such as future health risks or the aesthetic problems caused by the sites than people who lived in areas further away from them. A more in-depth study to confirm these results is to follow in 2003 that will include econometric analysis of sales transaction data.

1. Introduction

Understanding the effects of CPBSs on property values is important to telecommunications companies in helping plan the siting of these and for determining likely opposition from property owners. Similarly, property valuers need to understand the valuation implications of CPBSs when valuing CPBSs-affected property. The owners of affected property also want to understand the magnitude of effects, particularly if compensation claims or an award for damages are to be made against such property.

CPBSs are increasingly in demand as the two major cellular phone companies, Telecom and Vodafone, seek to upgrade and extend their network coverage. This demand could provide the owner of a well-located property a yearly income for the siting of a CPBS (Williams, 2001). However, new technology that represents potential hazards to human health and safety may cause property values to diminish due to the existence of "widespread public fear" and "widespread public perceptions of hazards". The increased media attention to the potential health hazards of CPBSs has caused a spread of such fear with a resulting increase in resistance to CPBSs due to the perceived negative effects on health, aesthetics and property values in close proximity to CPBSs.

Studies (for example, Krause et al. 2000 and Fesenko et al. 1999) suggest a positive correlation between long-term exposure to the electromagnetic fields produced by CPBSs and certain types of cancer. Yet other studies (for example, the World Health Organisation 1993, Royal Society of Canada 1999, and the UK Independent Expert Group on Mobile Phones 2000) report inconclusive results on health effects. Notwithstanding these results, recent media reports (for example, Fox 2002) indicate that the extent of opposition from some property owners affected by the siting of CPBSs is still strong. However, the extent to which such attitudes are reflected in lower property values affected by CPBSs is not widely known in New Zealand.

The two studies that have been conducted (commissioned by Telecom in Auckland (1998/99) and Christchurch (2001)) to ascertain the adverse health and visual effects of CPBSs on property values but these have not been made publicly known. Further, although the researchers reported through personal correspondence with Bond in 2002 that the results showed that property prices are not statistically significantly affected by the presence of CPBSs, their research involved only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, nor of the media attention to the sites and the affect this may have on saleability of properties in close proximity to CPBSs. Hence, this initial study aims to help fill the research void on this contentious topic. The research develops a case study approach to determine residents' perceptions towards living near CPBSs in two Auckland neighbourhoods and to quantify these effects in monetary terms according to an increasing or decreasing percentage of property value.

A more in-depth study will be undertaken in 2003 in Christchurch, NZ using both an opinion survey and econometric analysis of sales transaction data. The final results can then be used to help resolve compensation issues and damage claims in a quantitative way. Further, they will provide a potential source of information for related government agencies in assessing the necessity for increasing health and other information pertaining to CPBSs to help allay public concerns about these.

The paper provides a brief review of the cellular phone technology and relevant literature. The following section describes the research procedure used, including a description of both case study and control areas. The results are then discussed. The final section provides a summary and conclusion.

2. Literature Review

2.1 Background: Cellular Telephone Technology¹

Increasing demand for a more convenient communication system has led to the emergence of the wireless (mobile) telephone technology through the allocation of a portion of the radio frequency

¹ The information in this section was sourced from <http://www.telecom.co.nz>, <http://www.mfe.govt.nz> and <http://www.moh.govt.nz>.

to this and through interconnection with the existing wire telephone network.

Mobile phones are sophisticated two-way radios that use ultra high frequency (UHF) radio waves to communicate information. The information is passed between a mobile phone and a network of low-powered transceivers, called mobile phone sites or cell sites. As mobile sites are very low powered they serve only a limited geographic area (or "cell"), varying from a few hundred metres to several kilometres, and can handle only a limited number of calls at one time. When a mobile phone user on the move leaves one "cell" and enters another, the next site automatically takes over the call, allowing contact to be maintained.

When a mobile phone connects to the network, it uses radio signals to communicate with the nearest mobile phone site. All of the mobile phone sites in a network are interlinked by cable or microwave beam, enabling phone calls to be passed from one cell to another automatically. Mobile phone sites are also linked to the public telephone network so callers can access other networks, cities or countries. A mobile phone site is typically made up of a mast with antennas connected to equipment stored in a cabinet. Power is fed into the cabinet by underground cable. The antennas are designed to transmit most of the signal away horizontally, or just below the horizontal, rather than at steep angles to the ground.

The actual use of radio frequency transmission requires only a small amount of energy, making mobile phone technology one of the most efficient forms of communication available. Unlike television and radio transmitters which work at full power all the time, a mobile phone site is designed to control its output so that it provides exactly the signal strength required to handle the number of calls being made at that moment, no more and no less. Therefore, if no calls are being made at any one moment, the cell site will virtually shut itself down.

As mobile phone sites can only accommodate a limited number of calls at any one time, when this limit is reached the mobile phone signal is transferred to the next nearest site. If this site is full or is too far away, the call will fail. One way of achieving an increased capacity is with the use of micro-sites or infill sites. These are mini mobile phone sites that can be mounted on street light poles, traffic lights or building verandas. They are common at busy intersections where they can help handle the increased capacity at rush hour and during the day they will rarely be required. Micro-sites only have a range of one to two hundred metres, and therefore cannot be used everywhere. They are designed for operation in dense urban areas in conjunction with conventional sites.

2.1.1 NZ Adoption of Cellular Phone Technology

The cellular telephone service first became available in New Zealand in 1987. By mid 1988 there were approximately 2,300 customers throughout New Zealand. In the late 1990's over 300,000 customers had cellular phones. This figure has continued to balloon in recent years. It is estimated that today over 2.3 million New Zealanders have a mobile phone and it is expected that 80 percent of people will be mobile within five years (Telecom, 2002)².

Cell site capacity is a major issue that the telecommunication companies are faced with at present. As the population continues to grow and so does the number of people using mobile phones, more and more cell sites are going to be required to meet customer demand for reliable coverage. In

² At the end of March 2002, Telecom had more than 1.3 million mobile phone customers and more than 750 mobile phone sites throughout New Zealand (a 54% share of the mobile market). Vodafone had over 1.1 million mobile phone customers throughout New Zealand (a 46% share of the mobile market), (Vodafone, 2002).

areas such as Auckland where almost complete coverage has been achieved, the main issue is ensuring that there is the capacity to handle the ever-increasing number of mobile phones and calls being made.

2.2 Locating Cellular Phone sites

Unlike higher-powered transmission sites such as television and radio, mobile phone sites are very low powered. Therefore, if cellular service companies are to provide a reliable service to their customers they are required to locate their sites where the service is needed.

For cellular phone service providers the main aims when locating cell sites are finding a site that provides the best possible coverage in the area without causing interference with other “cells” and one that causes the least amount of environmental impact on the surrounding area. Where possible service providers will attempt to locate cell sites on existing structures such as buildings where antennas can be mounted on the roof to minimize the environmental impact. Where this is not possible the site will require a mast to be erected to support the antennas.

For service providers, the preferred location for cell sites is in commercial or industrial areas due to the previous difficulty in obtaining resource consent for towers located in residential areas under the Resource Management Act.³ Under the Resource Management Act 1991 (RMA), resource consent may be required from the local council to establish a cell site in the area. This may be either notified or non-notified. If the council decides it is to be notified this allows anyone in the community to have their say about it. Once submissions have been received and a hearing is held (if required) the council decides whether or not to grant the consent. One of the positive outcomes of the RMA resource consent procedure is the resulting unobtrusive nature of most cell sites. Some sites have even been incorporated into clock towers, building’s chimneys and building signage.

There is no concern of the providers running out of room to locate the towers in the short term, however, it is expected that in the future, service providers will be required to share sites as they do overseas. If the service providers were to use the same mast they would have to be well separated meaning a much higher mast and a more undesirable structure in the community.

Despite the high level of demand for better cell phone coverage, the location of cell sites continues to be a contentious issue. The majority of people want better cell phone coverage in areas where they live and work, but they do not want a site in their neighbourhood. Thus, cell sites in or near residential areas are of particular concern. Concerns expressed usually relate to health, property values and visual impact (Szmigielski and Sobiczewska, 2000 and Barnes, 1999).

In general, uncertainties in the assessment of health risks from base stations is presented and distributed by organised groups of residents who protest against settlement of base stations. These reports appear to be exaggerated with a frequent tendency for including incredible extrapolation of results from microwave exposure systems which do not resemble either the intensities or the frequencies applied in the cell phone systems being tested. When the media publishes these stories it serves only to amplify the negative bias in these results and raises public concern. According to Covello (1998), this leads to incorrect assessment of risks and threats by the public with a tendency to overestimate risks from base stations and neglect risks from the use of cell phones.

³ This has now been amended and replaced with a much simpler consent process.

2.3 Assessment of Environmental Effects

2.3.1 Introduction: The Resource Management Act 1991

Under the Resource Management Act 1991 (RMA) an assessment of environmental effects is required every time an application for resource consent is made. Information that must be provided includes the following:

“An assessment of any actual or potential effects that the activity may have on the environment, and the ways in which any adverse effects may be mitigated”. (Section 88(4)(b), RMA).

An assessment of the environmental effects (AEE) of cell sites would take into consideration such things as:

- Health and Safety effects
- Visual effects
- Effects on the neighbourhood
- Interference with radio and television reception

2.3.2 Radio Frequency and Microwave Emissions from CPBSs

According to the Ministry for the Environment (2000), the factors that affect exposure to radiation are as follows.

- Distance: Increasing the distance from the emitting source, decreases the radiation's strength and decreases the exposure.
- Transmitter power: The stronger the transmitter, the higher the exposure.
- Directionality of the antenna: Increasing the amount of antennas pointing in a particular direction increases the transmitting power and increases the exposure.
- Height of the antenna above the ground: Increasing the height of an antenna increases the distance from the antenna and decreases the exposure.
- Local terrain: Increasing the intervening ridgelines decreases the exposure.

The amount of radiofrequency power absorbed in the body, the dose, is measured in watts per kilogram, known as Specific Absorption Rate (SAR). The SAR depends on the power density in watts per square metre. The radio frequencies (RF) from cellular phone systems travel in a “line of sight”. The antennas are designed to radiate energy horizontally so that only small amounts of RF are directed down to the ground. The greatest exposures are in front of the antenna so that near the base of these towers, exposure is at minimum. Further, power density from the transmitter decreases rapidly as one moves away from the antenna. However, it should be noted that by initially walking away from the base, the exposure rises and then decreases again. The initial increase in exposure corresponds to the point where the lobe from the antenna beam intersects the ground. For instance, on the ground within 7-10 meters from the cell site, power densities are about 0.2 W/m^2 while within 100 metres, power densities will be around $0.0003\text{-}0.005 \text{ W/m}^2$ (Ministry for the Environment, 2000 and Szmigielski and Sobiczewska, 2000).

2.3.3 Adverse Health Effects

According to Barnes (1999) and Szmigielski and Sobiczewska (2000) the analog phone system (using 800-900 Megahertz band) and digital phone system (using 1850-1990 Megahertz band) expose humans to electromagnetic field (EMF) emissions: radio frequency radiation (RF) and microwave radiation (MW), respectively. These two radiations are emitted from both the cellular phones and CPBSs.

For years the cell phone companies have assured the public that cell phones are perfectly safe. They state that the particular set of radiation parameters associated with cell phones are the same

as any other radio signal. However, reported scientific evidence challenges this view and shows that cell phone radiation causes various effects, including:⁴

- Alters brain activity
- Disturbs sleep
- Alters human reaction times: responses and speed of switching attention significantly worse
- Weakness the blood brain barrier
- Increased auditory brainstem response and hearing deficiency in 2 KHZ to 10 KHZ range
- Causes significant changes in local temperature, and in physiologic parameters of the cardiovascular system
- Causes memory loss, connection difficulties, fatigue, and headaches
- Increases blood pressure
- Reduces melatonin, etc..

According to Cherry (2000), there is strong evidence to conclude that cell sites are risk factors for:

- Cancer, specifically brain tumours and leukaemia
- Heart attack and heart disease, particularly arrhythmia
- Neurological effects including sleep disturbance, learning difficulties, depression and suicide
- Reproductive effects, especially miscarriage and congenital malformation
- Viral and infectious diseases because of reduced immune system competency associated with reduced melatonin and altered calcium ion homeostasis.

The main health concerns relating to EMF emissions from CPBSs are caused by the fact that radio frequency fields penetrate exposed tissues. Radio frequency energy is absorbed in the body and produces heat. All established health effects of radio frequency exposure are clearly related to heating. Public concern regarding both cell phones and CPBSs in many countries has led to a number of independent expert groups being requested by governments and cellular service providers to carry out detailed reviews of the research literature.

Research on the health effects of exposures to RF are reviewed by, for instance, The New Zealand Radiation Laboratory (2001), the World Health Organization (1993), International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1997,1998), the Royal Society of Canada (1999) and the UK Independent Expert Group on Mobile Phones (2000). The reviews conclude that there are no clearly established health effects under low levels of exposure. Such exposures typically occur in publicly accessible areas around RF transmitters.

Various epidemiological studies⁵ have been undertaken on the health effects of exposure to RF/MW radiation. However, most of these studies are conducted with occupational groups exposed to the radiation at work rather than with the general population in the home environment. The results of such studies provide insufficient evidence of the linkage between exposure and cancers in the general population due to the different intensities and duration of MW exposure in workers compared to those in the general public. The MW exposure in the home environment is typically continuous but not exceeding 0.1 W/m^2 while in the working environment, the duration is

⁴ Mann & Roschkle (1996), Krause et al. (2000), Borbely et al. (1999), Kellenyi et al. (1999), Khdnisskil, Moshkarev & Fomenko (1999), Hocking (1998), Burch et al. (1998) and others as reported in Cherry, N. (2000).

⁵ Epidemiological studies study the relationship between exposure to EMFs and health in a population through observation. It is employed to provide evidence of EMF's association with any diseases, statistically. However, these studies cannot control for the degree of exposure. In the real world there are multiple exposures (such as radiation from television and radio).

limited to 1-2 hours period but intensities range between 2-10W/m² (Szmigielski and Sobiczewska, 2000).

According to Barnes (1999), the Institute of Electrical and Electronics Engineers (IEEE) and the American Food and Drug Administration (FDA) found no health hazard associated to cell phone use. Laboratory studies revealed no related cancer symptoms in people exposed to levels at or below current standards (refer to the discussion on standards, below, in section 2.3.4). Furthermore, Szmigielski and Sobiczewska (2000) add that MW radiation from cell phone systems contribute only 10 percent of the total MW energy emitted from other sources such as TV and radio signals. They conclude similarly to Barnes (1999) that there is currently no valid scientific data providing evidence of bio-effects from weak MW emission. However, there are questions over the delayed effects of exposure.

The Royal Society of Canada (1999) reports that biological effects, such as cell proliferation, are found at low levels of exposure and depend on other exposure conditions, stated earlier, but are not known to cause any adverse health effects. Nonetheless, at high exposures, heating is produced and can eventually damage tissues. Szmigielski and Sobiczewska (2000) state that at intense exposure the “thermal effect” from MW energy absorption inside tissues is associated with DNA damage. Further, they add that other non-specific health symptoms (NSHS) such as headaches, fatigue and small changes in blood pressure are also found.

While, at present, medical and epidemiological studies reveal weak association between bio-effects and low-level exposures of RF/MW fields, controversy remains between scientists, producers and the general public. Information from scientific or technological experts must be provided to the public to help allay fears about cell phone systems and help them to make rational investment decisions when considering the purchase of a property located in proximity to a CPBS. However, risk communication (“the exchange of information about the nature, magnitude, significance, acceptability and management of risk”, Covello 1998) has always posed a challenge to the policy makers (usually politicians) responsible for communicating risk data to the general public. Risk communication usually involves the provision of information about the probability of exposure to the risk and about the nature and extent of the consequences. Yet, events of a probabilistic nature relating to an uncertain science are not well understood by the general public. This, together with negative media attention, results in the perception of uncertainty over the health effects from cell phone systems.

2.3.4 Radio Frequency Exposure Standards

2.3.4.1 International Standards

Despite ongoing controversy, the reviews of research on the health effects of exposures to RF helped establish the basis for exposure standards that will limit exposures to a level for safe and healthy living and working conditions. Most standards set by, for example, the International Commission on Non-Ionising Radiation Protection (ICNIRP), the American National Standards Institute (ANSI) and New Zealand are based on the most adverse effects. These standards have been developed to give people an assurance that what cellular service providers are doing complies with safety guidelines.

The 1998 ICNIRP guidelines have been accepted by the world’s scientific and health communities as these are not only consistent with other stated standards but are also published by ICNIRP, a highly respected and independent scientific organisation. ICNIRP is responsible for providing guidance and advice on the health hazards of non-ionising radiation for the World Health

Organization (WHO) and the International Labour Office (Ministry for the Environment and Ministry of Health, 2000).

2.3.4.1 The New Zealand Standard

When a mobile phone site is being planned, radio frequency engineers calculate the level of electromagnetic energy (EME) that will be emitted by the site. The level of EME is predicted by taking into account power output, cable loss, antenna gain, path loss, height and distance from the antenna, etc. These calculations result in figures that allow engineers to calculate maximum possible emissions in a worst-case scenario – as if the site was operated at maximum power all the time. The aim is to produce EME levels that are below international and New Zealand standards in areas where the general public have unrestricted access.

It is a requirement that all mobile phone sites in New Zealand comply, in all respects, with the New Zealand Standard for radio frequency exposures, NZS 2772.1:1999 Radiofrequency Fields Part I: Maximum Exposure Levels – 3kHz to 300GHz. This standard, which was adopted in April 1999, was based largely on the 1998 ICNIRP recommendations for maximum human exposure levels to radio frequency. The standard also includes a requirement for:

“Minimising, as appropriate, Radio Frequency exposure which is unnecessary or incidental to achievement of service objectives or process requirements, provided that this can be achieved at modest expense.” (National Radiation Laboratory, 2001, p.7).

Currently this standard sets out a limit of continuous exposure to the public for radio frequency levels from mobile phone sites of 450 microwatts per square centimetre. This standard is the same as used in most European countries, and is more stringent than that used in the United States, Canada and Japan. This exposure level has been lowered even further in some cases. For example, the Christchurch City Council has made their allowable standard 200 microwatts per square centimetre (which is less than 50% of the New Zealand Standard). In reality however, mobile phone sites only operate at a fraction of the level set by the standard. The National Radiation Laboratory has measured exposures around many operating cell sites. Maximum exposures in publicly accessible areas around the great majority of sites are less than 1% of the public exposure limit in the standard. Exposures are rarely more than a few percent of the limit, and none have been above 10%.

2.3.5 Effects on Property Values in New Zealand

In New Zealand, based on two court cases: McIntyre and others vs. Christchurch City Council [1996] NZRMA 289 and Shirley Primary School vs. Telecom Mobile Communications Ltd [1999] NZRMA 66, there are two main alleged adverse effects of cell-phone base station on property values:

- The risk of adverse health effects from radio frequency radiation emitted from cell-phone base stations
- The adverse visual effects

Very few cell site cases have actually proceeded to Environment Court hearings. In McIntyre and others vs. Christchurch City Council, Bell South applied for resource consent to erect a cell phone base station in Fendalton, Christchurch. The activity was a non-complying activity under the Transitional District Plan. Residents' objected to the application. Their objections were related to the harmful health effects from radio frequency radiation. In particular, they argued it would be an error of law to decide on the present state of scientific knowledge that there were no harmful health effects from low-level radio frequency exposure levels. It was also argued that the Resource

Management Act (1991) contains a precautionary policy and that section 104 requires a consent authority to have regard to potential effects of low probability but high impact in considering an application.

The Planning Tribunal considered residents' objections and heard experts' opinions as to the potential health effects, and granted the consent, subject to conditions. It was found that there would be no adverse health effects from low levels of radiation from the proposed transmitter, not even effects of low probability but high potential impact.

In *Shirley Primary School vs. Telecom Mobil Communication Limited*, Telecom applied to the Christchurch City Council for resource consent to establish, operate and maintain a CPBS on land at Shirley Road, Christchurch, adjacent to the Shirley Primary School. This activity was also non-complying under the Transitional District Plan. Again, the Council granted the consent subject to conditions. However, the school appealed the decision, alleging four main adverse effects, as follows:

- The risk of adverse health effects from the radio frequency radiation emitted from the cell site
- The school's perception of the risks and related psychological adverse effects on pupils and teachers
- Adverse visual effects
- Reduced financial viability of the school if pupils were withdrawn because of the perceived adverse health effects

The Court concluded that the risk of the school children or teachers at the school incurring leukaemia or other cancer from radio frequency radiation emitted by the cell site is extremely low, and the risk to the pupils of exposure to radio frequency radiation causing sleep disorders or learning disabilities is higher but still very small. Accordingly, the Telecom proposal was allowed to proceed.

In summary, the Environmental Court has ruled that there are no established adverse health effects arising from the emission of radio waves from CPBSs as there is no epidemiological evidence to show this. The court was persuaded by the ICNIRP guidelines that risk of health effects from low-level exposure is very low and that the cell phone frequency imposed by the NZ standard is safe, being almost two and a half times lower than that of the ICNIRP's.

However, in the court's decisions they did concede that while there is no proven health effects that there is evidence of property values being affected by both of the above allegations. However, the court suggests that such a reduction in property values should not be counted as a separate adverse effect from, for example, adverse visual or amenities effects. That is, a reduction in property values is not an environmental effect in itself; it is merely evidence, in monetary terms, of the other adverse effects noted.

In *Chen vs. Christchurch City Council* the court stated that valuation is simply another expert opinion of the adverse effect (loss). Further, in this case the court established a precedent relating to the effects on property values. In *Goldfinch vs. Auckland City Council (NZRMA 97)* the Planning Tribunal considered evidence on potential losses in value of the properties of objectors to a proposal for the siting of a CPBS. The Court concluded that the valuer's monetary assessments support and reflect that the adverse effects of the CPBS. Further, it concluded that the effects are more than just minor as the CPBS stood upon the immediately neighbouring property.

2.3.6 Research on Property Value Effects

While experimental and epidemiological studies focus on the adverse health effects of radiation from the use of cell phones and CPBSs few studies have been conducted to ascertain the adverse health and visual effects of CPBSs on property values. Further, as there has been very few cell site cases proceeding to the Environment Court little evidence of property value effects has been provided by the courts. Thus, the extent to which opposition from property owners affected by the siting of CPBSs are reflected in lower property values is not well known in New Zealand. Two studies have been commissioned by Telecom in Auckland (1998/99) and Christchurch (2001) but these have not been made publicly known. Further, although the researchers communicated with the authors that results showed that property prices are not statistically significantly affected by the presence of CPBSs, their research involved only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, nor of the media attention to the sites and the affect this may have on saleability of properties in close proximity to CPBSs. This initial study aims to help fill the research void in this area.

3.0 DATA COLLECTION AND ANALYSIS

3.1 Research Objectives and Methodology

An opinion survey was conducted to investigate the current perceptions of residents towards living near cell-phone base stations and how this proximity might affect property values. Residents were asked questions, about: how they rate the suburb they live relative to other similar suburbs; when the CPBS was constructed and the proximity of it in relation to their home; the importance they place on the CPBS as a factor in relocation decisions and on the price/rent they were prepared to pay for their house; the degree of concern of the effects of health/stigma/aesthetic/property values, etc.

Two case study areas in the city of Auckland, New Zealand were selected for this pilot study: the residential suburbs of Clover Park, Manakau in south-Auckland and St Johns in east-Auckland. Each case study included residents in two areas: the case study area (within 300 metres of a cell phone tower) and a control area (over 1km from the cell phone tower). Both areas within each case study had the same living environment (in socio-economic terms) except that the former is an area with a CPBS while the latter is without a CPBS.

Sixty questionnaires⁶ were randomly distributed to each of the areas (case study and control) in each neighbourhood (i.e. 240 surveys were delivered in total). As time and cost in conducting the survey were both limited delivery of the surveys was by hand to the property owner's letterbox. Respondents were instructed to complete the survey and return it to the letterbox. These were collected by hand two days after delivery.

The surveys were coded and the property address of each, once delivered, was recorded. This enabled each respondent's property to be located on a map and to show this in relation to the cell site. With a sample size of just 60 for each area within each neighbourhood the results are not fully representative of how the entire population perceive cell sites. However, the results do provide a gauge of the perceptions that people have about living near a cell site, or moving to an area near one, and how this might impact on values of properties in proximity to a CPBS.

The analysis of responses included the calculation of means and percentage of responses to each question to allow for an overview of the response patterns in each area. Comparison of the results between the case study area and the control area reveal any significant differences.

⁶ Approved by the University of Auckland Human Subjects Ethics Committee (reference 2002/185).

3.2 Case Study Areas

3.2.1 St Johns

The east-Auckland suburb of St Johns was selected (see Appendix A for a location map) as there are two CPBSs within close proximity of each other on St Johns Road near its intersection with St Heliers Bay Road. It is a medium to upper priced residential housing suburb⁷ in a generally sought after neighbourhood due to its close proximity to beaches, schools, shopping, recreational facilities and the Auckland CBD.

3.2.2. Manakau

The south-Auckland neighbourhood of Clover Park, Manukau City was selected (see Appendix A for a location map) as it is also proximate to a CPBS but it provides a different (lower) socio-economic sample to the first study area. The address of the CPBS site is 726 Great South Road, Manukau City and is located on a BP petroleum station property. It is situated among trees between Valentine Restaurant and Rainbows End Theme Park, at the corner of Great South Road and Redoubt Road, Manukau City.

The questionnaires were distributed to properties in Sikkim Crescent, the residential area that runs off Great South Road. The area is an older, lower-priced residential suburb area characterised by houses in a poor state of repair.⁸ It has good access to the Auckland-Hamilton Motorway and is within close proximity to a primary school and recreational facilities such as the Cycling Velodrome, Manukau Sports Bowl and the Greyhound Race Track. However, there are no shops nearby apart from the basic supplies available from the BP petroleum station. Some properties are also near a high voltage power pylon.

3.3 Control Areas

3.3.1 St Johns

The control area for St Johns is located further away (over 1 kilometre) from the CPBS in the case study area and is in the same suburb. The area contains a living environment and housing stock very similar to the case study area, as stated above, the only exception is that there is no cell site.

3.3.2 Manakau

The control area for Manakau is in the neighbourhood of Manukau Heights, Manukau City. It is located further away (over 1.5 kilometre) from Clover Park. The area contains a living environment and housing stock very similar to Clover Park, as stated above, the only exception is that there is no cell site. The questionnaires were distributed to properties in the streets of Sidey Avenue, Dillion and Darrell Crescents. Manakau Heights has good access to the Auckland-Hamilton Motorway and is within close proximity to a primary school and recreational facilities (Totara Park and Murphys Bush Scenic Reserve).

4. Research Results

Appendix B provides a summary of the main findings from the survey. These are outlined and discussed in more detail below.

⁷ The median house price for Auckland city in October 2002 was \$335,000 and for St Johns it was \$375,000. St Johns borders the high-priced Eastern Suburbs where the median house price was \$515,000.

⁸ The median house price for Auckland city in October 2002 was \$335,000 and for Manakau it was \$278,000.

4.1 Survey 1: Cell Site: St Johns

Of the 60 questionnaires mailed to homeowners and tenants in the study area, 53% were completed and returned. Over half (56%) of the respondents were homeowners.

4.1.1 Desirability of the suburb as a place to live

One-third (34%) of respondents have lived in St Johns for between 1- 4 years, and 40% for more than five years. Two-thirds (66%) rated St Johns as either desirable or very desirable as a place to live when compared with other similar suburbs. The reasons given for this include that the suburb is within walking distance to shops and is clean and relatively graffiti-free. The reasons 17% responded that St Johns is less desirable compared with other suburbs is that it is not as close to the waterfront/beaches as the adjoining suburbs of Kohimarama and St Heliers.

4.1.2 Feelings towards the CPBS as an element of the neighbourhood

The CPBS was already constructed when 81% of the respondents bought their house or began renting. Of these respondents, 21 (80%) said the proximity of the tower was of no concern to them. For the 20% of respondents' that said the proximity of the tower was of concern to them the most common reasons given for this were: health reasons, as proclaimed by the media, and that it obstructed their views somewhat. Of the 19% that said the CPBS was not constructed when they bought the house or began renting all said they would have gone ahead with the purchase anyway if they had known that the CPBS was to be constructed.

4.1.3 Affect on Decision to Purchase or Rent

The tower was visible from the house of 60% (19) of the respondents, yet the majority (13) said it was barely noticeable. Over two-thirds (71%) of the respondents said the location of the cell site nearby did not affect the price they were prepared to pay for the property. Ten percent said they were prepared to pay a little less (between 0-9% less) and the remaining 19% bought their property before the cell site was constructed.

4.1.4 Concerns About the Proximity to the CPBS

Generally, residents were not particularly worried about the effects that proximity to a CPBS has on health, stigma, property value or aesthetics. Of the concerns about towers that respondents were asked to comment on, the negative effects on aesthetics and future health were what respondents were most worried about, but only to a limited degree. Over two-thirds were not worried about the possibility of harmful health effects in the future (28% were somewhat worried) and 72% were not worried about "stigma" associated with houses near CPBSs (18% were somewhat worried and 10% were very worried). The majority of respondents (90%) were not worried about the affect that proximity to a CPBS will have on property values in the future (10% were somewhat worried) and just over half (53%) were not worried about the aesthetic problems caused by CPBSs (47% were somewhat worried).

4.2 Survey 2: Control Group: St Johns

Of the 60 questionnaires mailed to homeowners and tenants in the study area, 57% were completed and returned. Nearly two-thirds (65%) of the respondents were homeowners.

4.2.1 Desirability of the suburb as a place to live

Nearly a third (29%) of respondents have lived in St Johns for between 1- 4 years, and over half (53%) for more than five years. Over three-quarters (76%) of the respondents rated St Johns as either desirable or very desirable as a place to live when compared with other similar suburbs. The reasons given for this include that the suburb has cheaper house prices but is still central to

services and the beaches, it has good views, the houses are of a good quality and the area is well serviced by public transport. The reasons 6% responded that St Johns is less desirable compared with other suburbs include its proximity to lower socio-economic areas and the high number of sub-standard rental properties in the area.

4.2.2 Feelings towards a CPBS as an element of the neighbourhood

Two-thirds (65%) of the respondents would be opposed to the construction of a cell phone tower nearby. The location of a CPBS would be taken into account by 82% of respondents if they were to consider moving.

4.2.3 Affect on Decision to Purchase or Rent

If a CPBS were located nearby over half (53%) of the respondents would be prepared to pay substantially less for their property, and nearly one-third (29%) would be prepared to pay just a little less for their property.

4.2.4 Concerns About the Proximity to a CPBS

Of the concerns about towers that respondents were asked to comment on, the negative effects on aesthetics and future health were what respondents were most worried about. More than half (59%) of the respondents were worried somewhat and over one-third (35%) were very worried about the possibility of harmful health effects in the future and the aesthetic problems caused by CPBSs. Similar responses were recorded for the “stigma” associated with houses near CPBSs (59% were somewhat worried and 23% were very worried) and the affect that proximity to a CPBS will have on property values in the future (53% were somewhat worried and 35% were very worried).

Other comments provided by respondents at the end of the survey, include:

- “In no way would I choose to live near such a cell phone site at all”.
- “A decisive statement on the health, aesthetic and property value issues by the authorities concerned is long overdue – there seems to have been a great deal of procrastination to date”.
- “This survey appears to be biased as you haven’t asked, for example, how important coverage is, and if this meant putting in a cell phone site what would this mean for you. Also, a lot of people are complaining about roads being dug up to lay phone cables – at least cell sites are not disruptive to the same extent when being installed”.

4.3 Discussion of the Results: St Johns

From the above responses it appears that people who live near cell sites seem to be far less concerned about the possible associated health risks and aesthetic issues of the sites than those people who live further away from the sites. An explanation for the difference between the case study and control groups’ responses is that the case study group are those people that have already purchased or rent in an area where a CPBS is constructed and may not represent the entire population of potential land purchasers/renters. Such residents are, by the very fact that they have purchased/rented in an area where a CPBS is located, less sensitive to this than might be the case for the market as a whole. Such people who live near something that is perceived but not proven to be a risk tend may pass the threat off and take the view that there is no evidence of it being a problem so why worry about it.

Alternatively, the case study residents’ apparent lower sensitivity to the CPBS than the control group residents may be due to the possible affect of cognitive dissonance reduction. In this case,

they are not necessarily less sensitive to the CPBS but are unwilling to admit, due to the large amounts of money already paid, that they may have made a poor purchasing/renting decision to buy a property located in close proximity to a CPBS.

4.4 Survey 1: Cell Site: Manakau Results

After the distribution of the questionnaires, the collection of survey responses resulted in only 3 responses (5%) from each area. With such a lower than expected response rate, the results are unlikely to be representative of the total population and the impact that CPBSs have on property values could not be conclusively determined. However, some interesting perceptions were revealed and are described generally below.

4.4.1 Desirability of the suburb as a place to live

Two-thirds (67%) of the respondents were homeowners and have been residing in the area for over 5 years. Half of the respondents rated Clover Park as desirable and the other 50% rated it as less desirable as a place to live compared to other similar suburbs (for example, East Tamaki and Manakau Heights).

4.4.2 Feelings towards the CPBS as an element of the neighbourhood

Two-thirds of the respondents did not know about the existence of the CPBS when they brought or began renting their house. The remaining third said it was not constructed. Consequently, the proximity of the CPBS was not of concern to them. If they had known at the time of purchase or rental that the CPBS was to be constructed half said they would not have gone ahead with the purchase/rental whereas the other half said they would have.

4.4.3 Affect on Decision to Purchase or Rent

None of the respondents could see the CPBS from their house. Consequently, it did not affect the price or rent they were prepared to pay for the property.

4.4.4 Concerns About the Proximity to a CPBS

Of the concerns about CPBSs that respondents were asked to comment on two-thirds (66%) were somewhat worried about the possibility of harmful health effects in the future, the stigma associated with houses near CPBSs and the affect on property values. The remaining one-third was not worried about these things. All respondents were somewhat concerned about the aesthetic problems caused by the towers.

4.5 Survey 2: Control Group: Manakau

Two-thirds of the control group respondents were tenants living in the area between 6 months and 4 years. They rated their suburb as either desirable or very desirable as a place to live compared to other similar suburbs due to the easy access to amenities.

4.5.1 Feelings towards a CPBS as an element of the neighbourhood

Two-thirds of respondents would be opposed to the construction of a CPBS nearby. Yet, at odds to this response, only a third said it would be a factor to consider when relocating.

4.5.2 Affect on Decision to Purchase or Rent

One-third of the respondents said they would be prepared to pay 0-9% less for a property nearby a CPBS, one-third were prepared to pay 10-19% less and the remaining one-third would pay 20% or more, less for such a property.

4.5.3 Concerns About the Proximity to a CPBS

All of the respondents were greatly concerned about the harmful health effects from proximity to a CPBS while two-thirds were worried a lot about stigma, loss in property values in the future and aesthetic problems associated with houses near CPBSs. The remaining one-third of respondents were only somewhat worried about these factors.

4.6 Discussion of the Results: Manakau

From the responses above, it appears that the effects of CPBSs tend to be ignored in Manakau if the residents are unaware of them in their neighbourhood, as would be expected. Yet, there are strong concerns about the effects of CPBSs from residents in the control area. Nonetheless, these survey results are inconclusive due to the limited response rate.

5. Limitations of the Research

There are a number of limitations affecting this survey in addition to the limited response rate for Manakau. There was a time constraint in locating an appropriate CPBS that was visible to the residents in the Manakau case study area. The selected site is situated amongst trees and not highly visible. Many of the residents were not aware of its existence that likely affected both the responses and response rate. Further, giving respondents only two days to complete the survey may have been insufficient. Fortunately, this time constraint did not adversely affect the St Johns area response rate.

Finally, it must be kept in mind that these results are the product of only two case studies carried out in a specific area (Auckland) at a specific time (2002). The value-effects from CPBSs may vary over time as market participants' perceptions change due to increased public awareness regarding the potential adverse health and other effects of living near a CPBS. Perceptions toward CPBSs can change either positively or negatively over time. For example, as the World Health Organisation's ten-year study of the health effects from CPBSs is completed and becomes available consumers' attitudes may either increase or decrease depending on the outcome of those studies. To confirm this, many similar studies, of similar design to allow comparison between them, need to be conducted over time and the results made public.

As a result of these limitations caution must be used in making generalisations from the study or applying the results directly to other similar studies or valuation assignments.

6. Areas for Further Study

This research has focused on residents' perceptions of negative affects from proximity to CPBSs rather than the scientific or technological estimates of these risks. The technologists' objective view of risk is that risk is measurable solely in terms of probabilities and severity of consequences, whereas the public, while taking experts' assessments into account, view risk more subjectively, based on other factors. Further, the results of scientific studies about the health effects of radio frequency and microwave radiation from CPBSs are not always consistent. Residents' perceptions and assessments of risk vary according to a wide range of processes including psychological, social, institutional, and cultural and a reason why their assessments may be at odds with those of the experts.

Given the public concerns about the potential risk arising from being located nearby a CPBS it is important for future studies to focus more attention on this issue. More information is needed on the kinds of health and other risks the public associates with CPBSs, and the level of risk

perceived. How far away from the CPBS do people feel they have to be to be safe? What are the social, economic, educational and other demographic variables that influence how people perceive the risks from CPBSs? Are these perceived risks reflected in property values and to what extent? Do these perceived risks vary over time, and to what degree?

Answers to these questions, if shared amongst researchers and made public, could lead to the development of a global database. Such a database could assist valuers in determining the perceived level of risk associated with CPBSs from geographically and socio-economically diverse areas to aid in the valuation of property affected by these, anywhere in the world. Similarly, knowledge of the extent these risks are incorporated into property prices and how they vary over time will lead to more accurate value assessments of properties in close proximity to a CPBS.

7. Summary and Conclusions

This research report presents the results of an opinion survey undertaken in 2002 to residents' perceptions towards living near CPBSs and how this impacts on property values. From the results it appears that people whom live close to a CPBS perceive the sites less negatively than those whom live further away.

As research to date (ICNIRP, 1998) reports that there are no clearly established health effects from RF emissions of CPBSs operated at, or below, the current safety standards the only reason a rational investor might continue to avoid property near a cell site would be because it was intrusive on the views received from the property or because of the adverse aesthetic effects of the CPBS on the property. Yet, recent media reports (for example, Fox, 2002) indicate that people still perceive that CPBSs have harmful health effects.

Thus, whether or not CPBSs are ever proven conclusively to be free from health risks is only relevant to the extent that buyers of property near a CPBS perceive this to be true. Consequently, values of residential property located in close proximity to CPBSs may be adversely affected by the negative perceptions of buyers, regardless of research evidence to the contrary.

Further research is needed to provide more statistically valid conclusions than this pilot study provide about the public perceptions towards the health and visual effects of CPBSs and how this influences property values. To this end a larger study is to be conducted in 2003 that will include, in addition to a survey of affected residents living in close proximity to a CPBS, econometric analysis of the sales transaction data.

The results from such studies can provide useful information to related government agencies in assessing the need for increasing the public's understanding of CPBSs of how radio frequency transmitting facilities operate and of the strict exposure standard limits imposed on the telecommunication industry. A lack of understanding of these issues creates public concern about the location of CPBSs. As more information is discovered that refutes any adverse health effects from CPBSs and as this, together with information about the NZ Standards for high safety margins regarding the emission of RF and MW radiation, are made more publicly available, the perceptions of risk may gradually change. The visual effects can still pose a concern to residents, however, but this may vary according to the size, height and design of the CPBSs as well as the landscape surrounding them.

References

Barnes, J. R. (1999), "Cellular phones: are they safe?" *Professional Safety*, Vol. 44 (12), pp. 20-23. Available from: <http://proquest.umi.com> [Accessed 21 May 2002].

Borbely, A.A., Huber, R., Graf, T., Fuchs, B., Gallmann, E., Achermann, P., (1999), "Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram", *Neurosci Lett*, vol. 275(3), pp. 207-210.

Burch, J.B., Reif, J.S., Yost, M.G., Keefe, T.J. and Pittrat, C.A., (1998), "Nocturnal excretion of urinary melatonin metabolite among utility workers", *Scand J Work Environ Health*, Vol. 24(3), pp. 183-189.

Cherry, N. (2000), "Health Effects Associated with Mobil Base Stations in Communities: The Need for Health Studies," Environmental Management and Design Division, Lincoln University, June 8. Available from: <http://pages.britishlibrary.net/orange/cherryonbasestations.htm>.

Christchurch City Council website. Available from: www.ccc.govt.nz/index.asp

Covello, V. T. (1998), "Risk Perception, Risk Communication and EMF Exposure: Tools and Techniques for Communicating Risk Information" Risk Perception, Risk Communication and Its Application to EMF Exposure, Vol (5), International Commission Non-IONIZ, Radiation Protection, Munich, Germany, pp 179-214.

Fesenko, E.E., Makar, V.R., Novoselova, E.G., Sadovnikov, V.B. (1999), "Microwaves and cellular immunity: Effect of whole body microwave irradiation on tumor necrosis factor production in mouse cells". *Bioelectrochem Bioenerg*, 49(1):29-35.

Fox, S. (2002), "Cellphone Aantenna worries family", *East & Bays Courier*, Fiday November 8, p.1.

Hocking, B., (1998), "Preliminary report: symptoms associated with mobile phone use", *Occup Med (Lond)*, Vol.48 (6), pp.357-360.

Kellenyi, L., Thuroczy, G., Faludy, B., and Lenard, L. (1999), "Effects of mobile GSM radiotelephone exposure on the auditory brainstem response (ABR)", *Neurobiology* Number 7, pp.79-81.

Khudnitskii, S.S., Moshkarev, E.A., Fomenko, T.V. (1999), "On the evaluation of the influence of cellular phones on their users", [Article in Russian] *Med Tr Prom Ekol*, Number 9, pp. 20-24.

Krause, C.M., Sillanmaki, L., Koivisto, M., Haggqvist, A., Saarela, C., Revonsuo, A., Laine, M. and Hamalainen H., (2000), "Effects of electromagnetic field emitted by cellular phones on the EEG during a memory task", *Neuroreport*, 11(4): 761-764.

Independent Expert Group on Mobile Phones:[Chairman, Sir William Stewart], (2000), *Mobile Phones and Health*. Report to the United Kingdom Government. [www.iegmp.org.uk].

International Commission on Non-Ionizing Radiation Protection (1996), "Health Issues Related to the Use of Hand Held Radio Telephone and Base Transmitters", *Health Physics*, 70(9): 587-593.

International Commission on Non-Ionizing Radiation Protection (1998), "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)", *Health Physics*, 74(4): 494-522.

Mann, K. and Roschke, J. (1996), "Effects of pulsed high-frequency electromagnetic fields on human sleep", *Neuropsychobiology*, Vol. 33(1), pp.41-47.

Ministry for the Environment and Ministry of Health (2000) *National guidelines for managing the effects of radiofrequency transmitters*. [online] Available from: <http://www.mfe.govt.nz> and <http://www.moh.govt.nz> [Accessed 21 May 2002].

National Radiation Laboratory (2001), "Cellsites", March. Available from: <http://www.nrl.moh.govt.nz>

Repacholi, M.H., Basten, A., Gebiski, V., Noonan, D., Finnie, J., Harris, A.W., (1997). "Lymphomas in E mu-Pim1 transgenic mice exposed to pulsed 900 MHz electromagnetic fields", *Radiat Res*, 147(5):631-640.

Royal Society of Canada (1999), "*A review of the potential health risks of radiofrequency fields from wireless telecommunication devices*". An expert report prepared at the request of the Royal Society of Canada for Health Canada, Ontario. [www.rsc.ca]

Szmigielski, S. and Sobiczewska, E. (2000). "Cellular phone systems and human health – problems with risk perception and communication", *Environmental Management and Health*, Vol. 11 (4), pp 352-368. Available from: <http://halv.emeraldlibrary.com/vl=10902366/cl=13/nw=1/fm=html/rpsv/cw/mcb/09566163/v11n4/s5/p352> [Accessed 21 May 2002].

Telecom (2002), <http://www.telecom.co.nz/content/0,3900,27116-1536,00.html> [Accessed 19 December 2002].

Williams, R. (2001), "Phone zone – renting roofspace to Ma Bell", *The Property Business*. April, (12), 6-7.

WHO (1993), *Electromagnetic fields (300 Hz to 300 GHz)*, Environmental Health Criteria 137. World Health Organization, Geneva.

Vodafone (2002). http://www.vodafone.co.nz/aboutus/vdfn_about_cellsites.pdf [Accessed 19 December 2002] and http://www.vodafone.co.nz/aboutus/vdfn_about_health_and_safety.pdf [Accessed 19 December 2002].

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Appendix A- Survey Location Map

Appendix B - Survey Results

Case Study Area:

Questions	St Johns Response (*%, n = 32)	Manakau Response (*%, n = 3)
1. Which one of the following categories best describes you?	- Homeowner (56%) - Tenant (44%)	- Homeowner (67%) - Tenant (33%)
2. How long have you lived at this address?	- Less than 6 months (12%) - 6 months ~ 1 year (12%) - 1 ~ 4 years (34%) - More than 5 years (40%)	- Less than 6 months (0%) - 6 months ~ 1 year (0%) - 1 ~ 4 years (33%) - More than 5 years (67%)
3. Comparing your suburb to other similar suburbs, how do you consider your suburb:	- Very desirable (22%) - Desirable (44%) - Less desirable (19%) - About average (15%)	- Very desirable (0%) - Desirable (50%) - Less desirable (50%) - About average (0%)
4. When you purchased this house / began renting, was the cell phone tower already constructed?	- Yes (81%) - No (19%)	- Yes (0%) - No (33%) - I don't know (67%)
5. Was the proximity of the cell phone site of concern to you?	- Yes (80%) - No (20%)	- Yes (0%) - No (100%)
6. If you had known at the time of purchase or rental that a CPBS was to be constructed, would you still have purchased or rented?	- Yes (100%) - No (0%)	- Yes (50%) - No (50%)
7. Is the cell phone tower visible from your house?	- Yes (60%) - No (40%)	- Yes (0%) - No (100%)
8. How did the cell phone site affect the price or rent you were prepared to pay for this property?	- Substantially more (0%) - A little more (0%) - No Influence (71%) - A little less (10%) - Substantially less (0%) Tower not constructed (19%)	- Substantially more (0%) - A little more (0%) - No Influence (100%) - A little less (0%) - Substantially less (0%)
9. Concerns associated with properties near a CPBS:		
(a) The possibility of harmful health effects in the future.	- Not worried (69%) - Somewhat worried (28%) - This worries you a lot (3%)	- Not worried (33%) - Somewhat worried (67%) - This worries you a lot (0%)
(b) The stigma associated with houses near cell phone sites.	- Not worried (72%) - Somewhat worried (18%) - This worries you a lot (10%)	- Not worried (33%) - Somewhat worried (67%) - This worries you a lot (0%)
(c) The affect on your properties value in the future	- Not worried (90%) - Somewhat worried (10%) - This worries you a lot (0%)	- Not worried (33%) - Somewhat worried (67%) - This worries you a lot (0%)
(d) The aesthetic problems caused by the tower	- Not worried (53%) - Somewhat worried (47%) - This worries you a lot (0%)	- Not worried (0%) - Somewhat worried (100%) - This worries you a lot (0%)

* Valid Percentage: This indicates the percent of those respondents that answered that specific question (it does not include non-responses).

Appendix B continued - Survey Results

Control Area

Questions	St Johns Response (*%, n = 34)	Manakau Response (*%, n = 3)
1. Which one of the following categories best describes you?	- Homeowner (65%) - Tenant (35%)	- Homeowner (33%) - Tenant (67%)
2. How long have you lived at this address?	- Less than 6 months (12%) - 6 months ~ 1 year (6%) - 1 ~ 4 years (29%) - More than 5 years (53%)	- Less than 6 months (0%) - 6 months ~ 1 year (33%) - 1 ~ 4 years (33%) - More than 5 years (33%)
3. Comparing your suburb to other similar suburbs, how do you consider your suburb:	- Very desirable (35%) - Desirable (41%) - Less desirable (6%) - About average (18%)	- Very desirable (33%) - Desirable (33%) - Less desirable (0%) - About average (33%)
4. Would you be opposed to the construction of a cell phone site nearby?	- Yes (65%) - No (35%)	- Yes (67%) - No (33%)
5. If you were to consider moving houses, would the location of a CPBS be a factor?	- Yes (82%) - No (18%)	- Yes (33%) - No (67%)
6. How would a cell phone site nearby affect the price or rent you would be prepared to pay for this property? Please specify as a % of total property price	- Pay substantially more (0%) - Pay a little more (0%) - No Different (18%) - Pay a little less (29%) - Pay substantially less (53%) - +20% or more (0%) - +10% to +20% (0%) - 1% to +9% (0%) - -9% to 0% (47%) - -19% to -10% (0%) - -20% or less (53%)	- Pay substantially more (0%) - Pay a little more (0%) - No Different (33%) - Pay a little less (0%) - Pay substantially less (67%) - +20% or more (0%) - +10% to +20% (0%) - 1% to +9% (0%) - -9% to 0% (33%) - -19% to -10% (33%) - -20% or less (33%)
7. Concerns associated with properties near CPBSs: (a) The possibility of harmful health effects in the future. (b) The stigma associated with houses near cell phone sites. (c) The affect on your properties value in the future (d) The aesthetic problems caused by the tower	- Not worried (6%) - Somewhat worried (59%) - This worries you a lot (35%) - Not worried (18%) - Somewhat worried (59%) - This worries you a lot (23%) - Not worried (12%) - Somewhat worried (53%) - This worries you a lot (35%) - Not worried (6%) - Somewhat worried (59%) - This worries you a lot (35%)	- Not worried (0%) - Somewhat worried (0%) - This worries you a lot (100%) - Not worried (0%) - Somewhat worried (33%) - This worries you a lot (67%) - Not worried (0%) - Somewhat worried (33%) - This worries you a lot (67%) - Not worried (0%) - Somewhat worried (33%) - This worries you a lot (67%)

EMF Real Estate Survey Results: “Neighborhood Cell Towers & Antennas—Do They Impact a Property’s Desirability?”



The National Institute for Science, Law and Public Policy’s survey “Neighborhood Cell Towers & Antennas—Do They Impact a Property’s Desirability?” initiated June 2, 2014, has now been completed by 1,000 respondents as of June 28, 2014. The survey, which circulated online through email and social networking sites, in both the U.S. and abroad, sought to determine if nearby cell towers and antennas, or wireless antennas placed on top of or on the side of a building, would impact a home buyer’s or renter’s interest in a real estate property.

The overwhelming majority of respondents (94%) reported that cell towers and antennas in a neighborhood or on a building would impact interest in a property and the price they would be willing to pay for it. And 79% said under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or antenna.



- 94% said a nearby cell tower or group of antennas would negatively impact interest in a property or the price they would be willing to pay for it.
- 94% said a cell tower or group of antennas on top of, or attached to, an apartment building would negatively impact interest in the apartment building or the price they would be willing to pay for it.
- 95% said they would opt to buy or rent a property that had zero antennas on the building over a comparable property that had several antennas on the building.
- 79% said under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or antennas.
- 88% said that under no circumstances would they ever purchase or rent a property with a cell tower or group of antennas on top of, or attached to, the apartment building.
- 89% said they were generally concerned about the increasing number of cell towers and antennas in their residential neighborhood.

The National Institute for Science, Law and Public Policy (NISLAPP) was curious if respondents had previous experience with physical or cognitive effects of wireless radiation, or if their concern about neighborhood antennas was unrelated to personal experience with the radiation. **Of the 1,000 respondents, 57% had previously experienced cognitive effects from radiation emitted by a cell phone, wireless router, portable phone, utility smart meter, or neighborhood antenna or cell tower, and 43% had not experienced cognitive effects. 63% of respondents had previously experienced physical effects from these devices or neighborhood towers and antennas and 37% had not experienced physical effects.**

The majority of respondents provided contact information indicating they would like to receive the results of this survey or news related to the possible connection between neighborhood cell towers

and antennas and real estate decisions.

Comments from real estate brokers who completed the NISLAPP survey:

“I am a real estate broker in NYC. I sold a townhouse that had a cell tower attached. Many potential buyers chose to avoid purchasing the property because of it. There was a long lease.”

“I own several properties in Santa Fe, NM and believe me, I have taken care not to buy near cell towers. Most of these are rental properties and I think I would have a harder time renting those units... were a cell tower or antenna nearby. Though I have not noticed any negative health effects myself, I know many people are affected. And in addition, these antennas and towers are often extremely ugly—despite the attempt in our town of hiding them as chimneys or fake trees.”

“We are home owners and real estate investors in Marin County and have been for the last 25 years. We own homes and apartment building here in Marin. We would not think of investing in real estate that would harm our tenants. All our properties are free of smart meters. Thank you for all of your work.”

“I’m a realtor. I’ve never had a single complaint about cell phone antennae. Electric poles, on the other hand, are a huge problem for buyers.”

Concern was expressed in the comments section by respondents about potential property valuation declines near antennas and cell towers. While the NISLAPP survey did not evaluate property price declines, a study on this subject by Sandy Bond, PhD of the New Zealand Property Institute, and Past President of the Pacific Rim Real Estate Society (PRRES), [The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods](http://snurl.com/2922m58) (<http://snurl.com/2922m58>), was published in *The Appraisal Journal* of the Appraisal Institute in 2006. The Appraisal Institute is the largest global professional organization for appraisers with 91 chapters. The study indicated that **homebuyers would pay from 10%–19% less to over 20% less for a property if it were in close proximity to a cell phone base station.** The ‘opinion’ survey results were then confirmed by a market sales analysis. **The results of the sales analysis showed prices of properties were reduced by around 21% after a cell phone base station was built in the neighborhood.”**

The Appraisal Journal study added,

“Even buyers who believe that there are no adverse health effects from cell phone base stations, knowing that other potential buyers might think the reverse, will probably seek a price discount for a property located near a cell phone base station.”

James S. Turner, Esq., Chairman of the National Institute for Science, Law & Public Policy and Partner, Swankin & Turner in Washington, D.C., says,

“The recent NISLAPP survey suggests there is now a high level of awareness about potential risks from cell towers and antennas. In addition, the survey indicates respondents believe they have personally experienced cognitive (57%) or physical (63%) effects from radiofrequency radiation from towers, antennas or other radiating devices, such as cell phones, routers, smart meters and other consumer electronics. Almost 90% are concerned about the increasing number of cell towers and antennas generally. A study of real estate sales prices would be beneficial at this time in the United States to determine what discounts homebuyers are currently placing on properties near cell towers and antennas. Americans deserve to know.”

Betsy Lehrfeld, Esq., an attorney and Executive Director of NISLAPP, says,

“The proliferation of this irradiating infrastructure throughout our country would never have occurred in the first place had Section 704 of the Telecommunications Act of 1996 not prohibited state and local governments from regulating the placement of wireless facilities on health or environmental grounds. The federal preemption leaves us in a situation today where Americans are clearly concerned about risks from antennas and towers, some face cognitive and physical health consequences, yet they and their families increasingly have no choice but to endure these exposures, while watching their real property valuations decline.”

The National Institute for Science, Law, and Public Policy (NISLAPP) in Washington, D.C. was founded in 1978 to bridge the gap between scientific uncertainties and the need for laws protecting public health and safety. Its overriding objective is to bring practitioners of science and law together to develop intelligent policy that best serves all interested parties in a given controversy. Its focus is on the points at which these two disciplines converge.

NISLAPP contact:
James S. Turner, Esq.
(202) 462-8800 / jim@swankin-turner.com
Emily Roberson
er79000@yahoo.com

If you can support NISLAPP's work, please donate here:
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See Commentary by ElectromagneticHealth.org on NISLAPP EMF Real Estate Survey Results and Recommendations for Real Estate Agents and Homebuyers here:
<http://electromagnetichealth.org/electromagnetic-health-blog/survey-commentary/>

A Pushback Against Cell Towers

nytimes.com/2010/08/29/realestate/29Lizo.html

By MARCELLE S. FISCHLER

August 27, 2010

Wantagh

TINA CANARIS, an associate broker and a co-owner of RE/MAX Hearthstone in Merrick, has a \$999,000 listing for a high ranch on the water in South Merrick, one of a handful of homes on the block on the market. But her listing has what some consider a disadvantage: a cell antenna poking from the top of a telephone pole at the front of the 65-by-100-foot lot.

"Even houses where there are transformers in front" make "people shy away," Ms. Canaris said. "If they have the opportunity to buy another home, they do."

She said cell antennas and towers near homes affected property values, adding, "You can see a buyer's dismay over the sight of a cell tower near a home just by their expression, even if they don't say anything."

By blocking, or seeking to block, cell towers and antennas over the course of the last year, Island homeowners have given voice to concerns that proximity to a monopole or antenna may not be just aesthetically unpleasing but also harmful to property values. Many also perceive health risks in proximity to radio frequency radiation emissions, despite industry assertions and other evidence disputing that such emissions pose a hazard.

Emotions are running so high in areas like Wantagh, where an application for six cell antennas on the Farmingdale Wantagh Jewish Center is pending, that the Town of Hempstead imposed a moratorium on applications until Sept. 21. That is the date for a public hearing on a new town ordinance stiffening requirements.

At a community meeting on Aug. 16 at Wantagh High School, Dave Denenberg, the Nassau county legislator for Bellmore, Wantagh and Merrick, told more than 200 residents that 160 cell antennas had been placed on telephone poles in the area in the last year by NextG, a wireless network provider.

"Everyone has a cellphone," Mr. Denenberg said, "but that doesn't mean you have to have cell installations right across the street from your house." Under the old town code, installations over 30 feet high required an exemption or a variance. But in New York, wireless providers have public utility status, like LIPA and Cablevision, and they can bypass zoning boards.

Earlier this month in South Huntington, T-Mobile was ordered to take down a new 100-foot monotower erected on property deemed environmentally sensitive (and thus requiring a variance). Andrew J. Campanelli, a civil rights lawyer in Garden City, said a group of residents had hired him to oppose the cellular company's application.

"They were worried about the property values," Mr. Campanelli said. "If your home is near a cell antenna, the value of your property is going down at least 4 percent. Depending on the size of the tower and the proximity, it is going down 10 percent."



Jodi Turk Goldberg and her husband, Michael, with their son Charlie, near a school in Merrick, are among those concerned about cell antennas (center rear). Phil Marino for The New York Times

In January, in an effort to dismantle 50 cell antennas on a water tower across from a school in the village of Bayville, Mr. Campanelli filed a federal lawsuit that cited health risks and private property rights.

In a statement, Dr. Anna F. Hunderfund, the Locust Valley superintendent, said that in February 2009 the district had engaged a firm to study the cellphone installations near the Bayville schools, finding that the tower "posed no significant health risks," and she noted that the emission levels fell well below amounts deemed unsafe by the Federal Communications Commission.

In June 2009, Sharon Curry, a psychologist in Merrick, woke up to find a cell antenna abutting her backyard, level to her 8-year-old son's bedroom window.

Puzzled by its presence, particularly because she lives next to an elementary school, she did research to see if there was cause for concern. What she learned about possible health impacts, she said, led her to seek help from civic associations and to form a group, Moms of Merrick Speak Out, to keep new cell towers out. She said she was seeking the "responsible" placement of cell antennas, away from homes and schools.

The Federal Communications Act of 1996 says health concerns are not a valid reason for a municipality to deny zoning for a cell tower or antenna. Property values and aesthetics, however, do qualify, according to the act.

Frank Schilero, an associate broker with RE/MAX Innovations in Wantagh, has a listing on a \$629,000 home down the street from the Farmingdale Wantagh Jewish Center, where the application is pending to put six cell antennas on the roof.

"People don't like living next to cell towers, for medical reasons or aesthetics," Mr. Schilero said. "Or they don't want that eyesore sticking up in their backyards." There is an offer on his listing, he added, but since the buyer heard about the possible cell antennas she has sought more information from the wireless companies about their size and impact.

Charles Kovit, the Hempstead deputy town attorney, said that under the proposed code change any new towers or antennas would have to be 1,500 feet from residences, schools, houses of worship and libraries.

The town recently hired a consultant, Richard A. Comi of the Center for Municipal Solutions in Glenmont, to review antenna applications.

Under the new ordinance, applications for wireless facilities would require technical evidence that they had a "gap" in coverage necessitating a new tower.

"If not, they will get denied," Mr. Kovit said. The wireless companies would also have to prove that the selected location had "the least negative impact on area character and property values." If another location farther away from homes can solve the gap problem, "they are going to have to move."

Assessing the status of the monarch butterfly

 fws.gov/savethemonarch/SSA.html



Tagged monarch butterfly in Minnesota.
Photo by Katie Steiger-Meister/USFWS.

In 2014, we were petitioned to protect the monarch butterfly under the Endangered Species Act. Based on information in the petition, we determined that federally protecting the monarch may be warranted and we published a 90-day substantial finding in the Federal Register on December 31, 2014. Publication of the 90-day finding also announced that we would conduct a thorough assessment to determine if the monarch butterfly needs Endangered Species Act protection. We are now conducting the assessment using the Species Status Assessment framework.

Learn more

[Petition to protect the monarch butterfly under the Endangered Species Act \(4.8 MB PDF\)](#)

[Monarch species status assessment fact sheet \(PDF\)](#)

[Monarch Conservation Database](#)

[Species status assessment fact sheet \(PDF\)](#)

[Species status assessment update presentation - August 2017 \(4 MB PDF\)](#)

[Watch the species status assessment update webinar - August 2017 \(24 minutes\)](#)

Scientists can connect through the [Monarch Conservation Science Partnership](#)

90-Day warranted finding on petition; Service initiates status review

- [News Bulletin](#)
- [Federal Register](#)

Conservation for species being evaluated for listing

Many folks are taking action to conserve monarch butterflies. Sometimes early conservation efforts can prevent the need to list a species under the Endangered Species Act, if they are effective. Below are tools used under the Act to encourage and document conservation for species that we are considering for listing.



Overwintering monarch butterflies in California.
Photo by Lisa Hupp/USFWS.

Candidate conservation agreements fact sheet (PDF)

One of the principal ways of identifying appropriate conservation efforts is through the development of a Candidate Conservation Agreement (CCA). CCAs are formal, voluntary agreements between the Service and one or more parties to address the conservation needs of candidate species or species likely to become candidates in the near future.

Policy for candidate conservation agreements with assurances (PDF)

This policy offers assurances as an incentive for non-Federal property owners to implement conservation measures for species that are proposed for listing under the Act, species that are candidates for listing, and species that are likely to become candidates or proposed in the near future.

Policy for evaluation of conservation efforts (PECE) when making listing decisions (PDF)

When making a listing decision, the Endangered Species Act requires the Service to take into account all conservation efforts being made to protect a species. This policy identifies criteria we use in determining whether formal conservation efforts that have yet to be implemented or to show effectiveness contribute to making listing a species unnecessary.

What's next

June 13, 2018

Monarch Conservation Database launch

Late June 2018

Peer review of Draft Species Status Assessment Report

June 2019

Listing decision is due



U.S. Fish & Wildlife Service

Candidate Conservation Agreements

What are candidate species?

What the U.S. Fish and Wildlife Service (FWS) considers candidate species are those plants and animals that are candidates for listing under the Endangered Species Act (ESA). These are species for which the FWS has enough information regarding their biological status and threats to propose them as threatened or endangered, but listing is currently precluded by higher priority listing activities. Candidate species are not subject to the legal protections of the ESA. Proactive conservation efforts for these species can, in some cases, eliminate the need to list them under the ESA.

What are the benefits of conserving candidate species?

Implementing conservation efforts before species are listed and their habitats become highly imperiled increases the likelihood that simpler, more cost-effective conservation options are available, and that conservation efforts will succeed. In addition, through early conservation efforts before species are listed, resource managers and property owners have more flexibility to manage their resources in using their land.

What is a Candidate Conservation Agreement?

Early conservation efforts for declining species can be greatly expanded through collaborative approaches that foster cooperation and exchange of ideas among multiple parties. One of the principal ways of identifying appropriate conservation efforts is through the development of a Candidate Conservation Agreement (CCA). CCAs are formal, voluntary agreements between the FWS and one or more parties to address the conservation needs of one or more candidate species or species likely to become candidates in the near future. Participants voluntarily commit to implement specific actions designed to remove or reduce threats to the covered species, so that listing



USFWS

Private landowners, Montana Fish, Wildlife and Parks, the Natural Resources Conservation Service, and Montana Department of Natural Resources are implementing a CCAA to conserve and enhance the Arctic grayling in the upper Big Hole River. These efforts resulted in not needing to list this species under the ESA.

may not be necessary. The degree of detail in CCAs can vary widely, and there are no specific permits or assurances associated with them. The FWS has entered into many CCAs over the years, primarily with other federal agencies and states. Local governments, tribes, private property owners, and other entities may also participate. Some CCAs have been so successful that listing the covered species was not necessary.

What is a Candidate Conservation Agreement with Assurances?

Conservation of animal and plant resources on non-federal lands is important because many species rely heavily – or even entirely – on such lands. However, due to concern about potential land use restrictions that could occur if a species becomes listed under the ESA, some property owners have been reluctant to engage in conservation activities that encourage use of their land or water by such

species. A Candidate Conservation Agreement with Assurances (CCAA) addresses this concern by providing incentives for non-federal property owners to engage in voluntary conservation activities that provides a net conservation benefit to the species.

More specifically, a CCAA provides participating property owners with a permit containing assurances that if they engage in certain conservation actions for species included in the agreement, they will not be required to implement additional conservation measures beyond those in the CCAA. If the species is listed, additional land, water, or resource use limitations will not be imposed on them, unless they consent to such changes.

What species can be included in a CCA or CCAA?

A CCA and CCAA may include plant and animal species that have been proposed for listing or are

candidates for listing, and at-risk species, which are species that may become candidates in the near future. These agreements can apply to a single species or multiple species. Agreements may vary widely in size, scope, structure, and complexity, and in the activities they address.

How does a CCA or CCAA help species?

These voluntary agreements reduce or remove identified threats to a species. Examples of beneficial activities include measures for restoring or enhancing habitat, expanding or establishing habitat connectivity, reestablishing populations or augmenting existing populations, control of competitive, invasive plants or animals, and reducing potential effects of significant disturbance events, such as extreme wildfires that could result from unnatural buildup of fuels.

How do CCAs and CCAAs differ?

Both CCAs and CCAAs can eliminate the need for listing candidate and at risk species under the ESA. A CCA can be between the FWS and other federal, state, or local agencies, or with private sector parties, and may include both federal and non-federal lands and waters. Under a CCA, no Enhancement of Survival Permit is issued. This means there is no permit that authorizes incidental take of the covered species in the event listing occurs, and no assurances are provided by the FWS.

A CCAA is only between non-federal property owners and the FWS, and covers the actions of those entities on non-federal lands. The FWS, through an Enhancement of Survival Permit issued in conjunction with a CCAA, provides assurances that, if the species is subsequently listed and no other changes have occurred, the FWS will not require the permittee to conduct any additional conservation measures without consent. Additionally, the permit authorizes a specific level of incidental take of the covered species, should listing occur.

In situations where a candidate or at-risk species is found on both non-federal and federal land, a CCA and a CCAA can be used in a complementary fashion to address threats and management needs on both, with the result that listing is less likely.

How does the CCAA process work?

Property owners agree to undertake activities on their non-federal lands to remove threats and otherwise improve the status of candidate and at-risk species. A variety of actions may qualify, such as:

- protecting and enhancing existing populations and habitats;
- restoring degraded habitat;
- creating new habitat;
- augmenting existing populations;
- restoring historic populations; and
- not undertaking a specific, potentially impacting/damaging activity.

In return for the participant's voluntary conservation action(s), the FWS provides an Enhancement of Survival Permit under section 10(a)(1)(A) of the ESA. The permit, which goes into effect if the covered species becomes listed, provides the participant with a prescribed amount of "take" of the species, and/or habitat modification when such take is incidental to activities specified in the CCAA. Such take might occur as the landowner implements agreed upon conservation actions or other ongoing management activities on the property enrolled in the CCAA.

The FWS recognizes that a single CCAA by itself may not be sufficient to reduce or remove all threats so that listing is unnecessary. In developing a CCAA, a non-federal property owner needs only to address those threats, or the proportion of those threats, that he or she can control on the property enrolled. The standard that must be met for the FWS to enter into a CCAA and issue the related permit is that the duration of the CCAA must be sufficient for the FWS to determine that the benefits of the conservation measures in the agreement provide a net conservation benefit to the covered species.

How long does it take to develop a CCAA?

Many agreements can be developed within six to nine months, although more complex agreements may take longer. A variety of factors influence the timeline, such as the number and characteristics of the species involved, the size of the area involved, the size

of the property or other activities to be conducted, the number of parties to the agreement, and other relevant factors.

Can a property owner sell or transfer property enrolled with a CCAA?

If a property owner sells or gives away lands enrolled in a CCAA, the FWS will honor the agreement and associated permit, providing the new owner agrees to become a party to the original CCAA and permit.

What happens when a CCAA expires?

The CCAA can be renewed for as long as the property landowner and FWS both agree. If the landowner does not renew the agreement, the assurances tied to the Enhancement of Survival Permit end when the permit expires. At that time, the owner becomes accountable to the provisions of the ESA if the species has been listed while the CCAA was in effect.

What is a programmatic CCAA?

A programmatic CCAA and its associated permits authorize state, local, tribal governments and other entities to enter into an agreement and hold the associated permit. This entity then enrolls individual property owners within a specific area or region, and conveys the permit authorization and assurances to them through a "certificate of inclusion." This programmatic approach is an efficient mechanism to encourage multiple non-federal property owners to voluntarily take management actions to remove threats to candidate and potential candidate species.

Who should I contact to initiate a CCA or CCAA?

Contact the nearest FWS Field Office in your state to discuss potential cooperative opportunities. For information and examples of Candidate Conservation Agreements and the final CCAA policy and regulations, please visit <http://www.fws.gov/angered/what-we-do/how-you-can-help.html>. A 12-minute video on Candidate Conservation Agreements is also posted at this site.

U. S. Fish and Wildlife Service Ecological Services Program

5275 Leesburg Pike
Falls Church, VA 22041

703-358-2171

<https://www.fws.gov/angered/>

October 2017

Short Communication Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation

 [sciencedirect.com/science/article/pii/S0048969715002296](https://www.sciencedirect.com/science/article/pii/S0048969715002296)

Outline

Alfonso Balmori

<https://doi.org/10.1016/j.scitotenv.2015.02.077> Get rights and content

Highlights

- The growth of wireless telecommunication technologies causes increased electrosmog.
- Radio frequency fields in the MHz range disrupt insect and bird orientation.
- Radio frequency noise interferes with the primary process of magnetoreception.
- Existing guidelines do not adequately protect wildlife.
- Further research in this area is urgent.

Abstract

The rate of scientific activity regarding the effects of anthropogenic electromagnetic radiation in the radiofrequency (RF) range on animals and plants has been small despite the fact that this topic is relevant to the fields of experimental biology, ecology and conservation due to its remarkable expansion over the past 20 years. Current evidence indicates that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base station emitters of radiofrequencies. Therefore, more research on the effects of electromagnetic radiation in nature is needed to investigate this emerging threat.

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Keywords

Ecological effect

Electromagnetic field exposure

Environmental pollution

Magnetic compass

Nonthermal effects

Orientation

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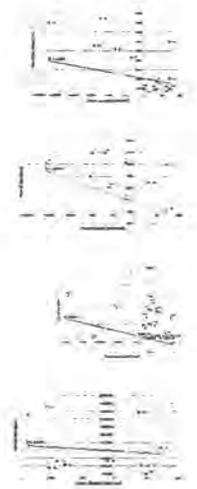
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<https://doi.org/10.1016/j.envint.2012.10.009>Get rights and content

Abstract

Objective

This article presents a systematic review of published scientific studies on the potential ecological effects of radiofrequency electromagnetic fields (RF-EMF) in the range of 10 MHz to 3.6 GHz (from amplitude modulation, AM, to lower band microwave, MW, EMF).

Methods

Publications in English were searched in ISI Web of Knowledge and Scholar Google with no restriction on publication date. Five species groups were identified: birds, insects, other vertebrates, other organisms, and plants. Not only clear ecological articles, such as field studies, were taken into consideration, but also biological articles on laboratory studies investigating the effects of RF-EMF with biological endpoints such as fertility, reproduction, behaviour and development, which have a clear ecological significance, were also included.

Results

Information was collected from 113 studies from original peer-reviewed publications or from relevant existing reviews. A limited amount of ecological field studies was identified. The majority of the studies were conducted in a laboratory setting on birds (embryos or eggs), small rodents and plants. In 65% of the studies, ecological effects of RF-EMF (50% of the animal studies and about 75% of the plant studies) were found both at high as well as at low dosages. No clear dose-effect relationship could be discerned. Studies finding an effect applied higher durations of exposure and focused more on the GSM frequency ranges.

Conclusions

In about two third of the reviewed studies ecological effects of RF-EMF was reported at high as well as at low dosages. The very low dosages are compatible with real field situations, and could be found under environmental conditions. However, a lack of standardisation and a limited number of observations limit the possibility of generalising results from an organism to an ecosystem level. We propose in future studies to conduct more repetitions of observations and explicitly use the available standards for reporting RF-EMF relevant physical parameters in both laboratory and field studies.

Highlights

► Scientific literature was screened for articles on ecological effects of RF-EMF. ► RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. ► Development and reproduction of birds and insects are the most strongly affected endpoints. ► There is a lack of field - and ecological studies on populations and the interaction of species. ► There is an urgent need for repetitions of studies finding effects and investigations into effects on ecosystems.

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Abbreviations

ELF-EMF

extremely low field electromagnetic field

CW

continuous wave

MW

microwave

PW

pulsed wave

GSM

global system for mobile communications

UHF

ultra-high frequency

VHF

very-high frequency

DECT

digital enhanced cordless telecommunications

UWB

ultra wide band

AM

amplitude modulation

FM

frequency modulation

GTEM

gigahertz transverse electromagnetic cell

UMTS

universal mobile telecommunications system

CDMA

code division multiple access

TDMA

time division multiple access

WCDMA

wideband code division multiple access

Wi-Fi

Wireless Fidelity

WLAN

wireless local area network

WiMAX

worldwide interoperability for microwave access

Keywords

Radiofrequencies

EMF

Biodiversity

Electromagnetic field exposure

Ecological effect

Mobile telecommunication

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Exhibit 05

A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don't Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife — for Public Release

Albert M. Manville, II, Ph.D., C.W.B.¹; Principal, *Wildlife and Habitat Conservation Solutions, LLC*²; Adjunct Professor, Johns Hopkins University's Krieger School of Arts and Sciences, DC Campus³; and former U.S. Fish and Wildlife Service agency lead on avian-structural impacts — including from radiation

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Introduction

There continues to be an active yet unsettled controversy about current radiation safety standards and their effects on humans and wildlife (www.livingplanet.be), most especially (1) with the exponential growth of ultra-high frequency (UHF) microwave radiation of electromagnetic fields (EMF) ranging from 900 MHz to 2500 GHz. The 900 and 1800 MHz fields are commonly used in communication devices such as cellular (cell) telephones, their antennas, related "smart" phones, digital "smart meters," computer wi-fi communication systems, and other sources of point-to-point and Internet communication. Much less attention is being paid to (2) frequency modulated (FM) impacts on migratory birds, including bandwidths ranging from 70 to 110 MHz also briefly discussed in this memo.

However, as concluded in this memo, the impacts from radiation especially at the non-thermal level (thermal effects are generally pretty clear) have already been well documented. Most scientists consider non-thermal effects as well established even though the implications are not fully understood. For example, in the June 2016 *Scientific American Blog* (Portier and Leonard 2016), in response to the question, "do cell phones cause cancer?" The authors response was clear: "probably, but it's complicated. The degree of risk almost certainly depends on the length and strength of exposure — but we still don't know how significant the actual danger is." These same issues pertain to impacts to wildlife from both thermal and non-thermal effects emitted from cellular (cell) communication towers and FM antennas (discussed in detail beyond). The radiation effects on wildlife need to be addressed by the Federal Communications Commission (FCC), the Environmental Protection Agency (EPA), the Department of Commerce, the U.S. Fish and Wildlife Service (FWS) and other governmental entities.

Focusing in the remainder of this memo primarily on wildlife impacts, radiation effects can be characterized as "near-field" (near the source of radiation), "far-field" (some distance from the source) or "intermediate." Negative reports of near-field (i.e., very close to power sources such as on or very near cellular antennas and antenna arrays) thermal radiation effects (capable of heating tissue) on laboratory animals and wildlife have been published in the scientific literature since at least 1950. An example includes Clark 1950, cited in Tanner 1966. Much of the controversy about effects involves "far field," non-thermal, low-level radiation impacts on humans, laboratory animals and wildlife. These are effects that can occur further away from the peak source of radiation (i.e., the tower antennas) due to signal attenuation, signal interference from objects and water droplets in the air, and other physical obstructions and disturbances. As concluded by Beason and Semm (2002), non-thermal effects had been the most difficult

¹ C.W.B. = Certified Wildlife Biologist, accredited and recognized by The Wildlife Society

² email at whcslc006@verizon.net

³ email at amanvilt1@jhu.edu

to explain because the mechanism by which they affect biological tissue was usually unknown or unclear. With much more current research and recent discoveries, the explanations are becoming much clearer as new research results become available and causality becomes more evident.

For human exposures, however, the FCC has operating rules. These rules require that power to cell and other broadcast towers must be turned off when workers are on and/or climbing the towers — due to health impacts and safety concerns from the thermal radiation.

Complicating the issue is the fact that there currently are no standards for wildlife exposure, including by the licensing and regulatory rules and procedures of the FCC. Other than a letter from the Interior Department's (DOI) Director of the Office of Environmental Policy and Compliance to the Commerce Department's National Telecommunications and Information Administration (NTIA; USDOJ 2014) — Attachment A involving effects of tower collisions and non-thermal radiation on migratory birds which I authored — neither DOI nor the FWS have any policy or quasi policy that currently addresses radiation effects to migratory birds. Arguably, “effects” need to be determined by the EPA, which has no funding for this, and regulated as part of a National Environmental Policy Act (NEPA) site review for a proposed cell tower, including both thermal and non-thermal effects.

Undebatable, however, is the exponential growth of cell phone technologies with an estimated 7 billion cell phones now available worldwide to a human population of 7.4+ billion (NPR March 2016 news report based on 2015 data). With this growing cell phone use and the communication systems that transmit and receive the signals from them, as well as the paucity of government regulatory oversight, this memorandum very briefly summarizes some of the major studies and take-aways conducted primarily on laboratory animals and wildlife, especially migratory birds. The issue represents a growing and troubling concern since migratory birds are in decline (at least 36% of which are in trouble species-wide in North America [USFWS 2008]), and which face additional uncertain impacts from non-ionizing, thermal and non-thermal radiation (Manville 2015, 2016).

Tests on laboratory animals such as chicken embryos, mice and rats are used as surrogates to predict harm to humans, protected migratory birds and other wildlife which, for practical, ethical and legal reasons in the United States would not otherwise be subjected to laboratory studies on impacts from radiation. Furthermore, scientists generally do not want to perform harmful experiments on either humans or protected wildlife such as migratory birds. Studies on the negative effects of non-thermal radiation to wild birds in Europe are clearly relevant as predictors of what will/is likely/is happening to wild birds in North America — the Bald Eagle as such as example due to its population growth and growing proximity to existing and proposed cell towers. That is why the published research results from European avian studies are so troubling.

Biological Systems and EMF

Living systems operating in animals support a variety of oscillatory electrical and/or biochemical activities which have been well documented to be affected by EMF. However, the direct relationship between electromagnetic radiation and wildlife health continues to be complicated and in cases involving non-thermal effects, still unclear. We know, for example, that brain waves are electrical, the heartbeat is electrical, the cell membrane has an electric field potential, cell division is electrically influenced, communication between neurons is electrical, and all of the hormonal and enzymatic activities are electrically regulated. Even the chemical-mechanistic model of the human and animal anatomy is essentially an electromagnetic model, because all chemical reactions involve the sharing, trading, or exchange of electrons at the elemental level (www.livingplanet.be) as explained by scientist J. Everaert in his website.

As J. Everaert further explains, there are studies showing frequency-specific biological effects, and studies demonstrating that a high frequency signal modulated at certain low frequencies, or a signal that is pulsed, has more harmful effects than an unmodulated, steady carrier wave (www.livingplanet.be).

Early Studies on EMF in the Microwave Bandwidth

Dating back to at least 1950, Tanner (1966, citing Clark 1950) concluded that much had been published on effects of microwave radiation on body tissues and animals, but most of the early experiments were concerned with the production of heat and its physiological effects. Tanner et al. (1967) looked briefly at the effects of microwave radiation on domestic chickens, and concluded that thermal effects were manifested by a rise in temperature of the irradiated birds, which were accompanied by physiological responses based on intensity and duration of the radiation field — escape or avoidance — but that non-thermal effects that impacted other physiological systems were more difficult to discern. Tanner (1966) and Tanner et al. (1967) discovered that birds' feathers are known to have piezoelectric properties, capable of conducting EMF/RF deep within bird body cavities. This finding can help, in part, explain increased bird sensitivity to EMF/RF radiation. In this early research, however, it remains unclear if thermal and non-thermal effects were adequately differentiated.

Wasserman et al. (1984) conducted field studies on 12 flocks of migratory birds subjected to various combinations of microwave power density and duration under winter conditions at Monomet, MA, with birds from 2 additional flocks serving as controls. Increased levels of aggression were noted in some of the irradiated birds suggesting effects, but calling for further study.

More Recent EMF Studies on Birds, Other Wildlife and Laboratory Animals in the Microwave Bandwidth

There is an increasing body of published laboratory research that finds DNA damage at low intensity exposures — well below levels of thermal heating — which may be comparable to far field exposures from cell antennas. This body of work would apply to all species, including migratory birds, since DNA is DNA, whether single-strand or double helix. The first study to find such effects was conducted by H. Lai and N.P. Singh in 1995 (Lai and Singh 1995). Their work has since been replicated (e.g., Lai and Singh 1996, as well as in hundreds of other more recent published studies), performed in at least 14 laboratories worldwide. The take-home message: low level transmission of EMF from cell towers and other sources probably causes DNA damage. The laboratory research findings strongly infer this relationship. Since DNA is the primary building block and genetic “map” for the very growth, production, replication and survival of all living organisms, deleterious effects can be critical.

The entire thermal model and all FCC categorical exclusions for all of the devices we see today, rests on the incorrect assumption that low-level, non-ionizing non-thermal radiation cannot cause DNA breaks because it is “*so low-power*” (B. Levitt and H. Lai, Comments Filed Jointly to FCC, ET Docket No. 13-84, 2013). These issues need to be adequately addressed by the appropriate authorities including the FCC, EPA and FWS. Currently they are not.

In laboratory studies by T. Litovitz (2000 pers. comm.) and DiCarlo et al. (2002) from the standard 915 MHz cell phone frequency on domestic chicken embryos showed that radiation from extremely low levels (0.0001 the level emitted by the average digital cellular telephone) caused heart attacks and deaths in some embryos. Controls, however, were unaffected (DiCarlo et al. 2002). In replicated experiments, similar results were obtained by Grigor’ev (2003) and Xenos and Magras (2003). These findings are important since similar evidence exists for lethal and injurious impacts to wild birds in Europe from cell

tower radiation, and based on anecdotal reports from the U.S., are very likely also occurring in North America (Manville 2016).

In field studies on wild birds in Spain, Balmori (2005) found strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, roosting and survival in the vicinity of electromagnetic fields. He documented nest and site abandonment, plumage deterioration, locomotion problems, and death in Wood Storks, House Sparrows, Rock Doves, Magpies, Collared Doves, and other species. While these species had historically been documented to roost and nest in these areas, Balmori (2005) did not observe these symptoms prior to construction and operation of the cell phone towers. Results were most strongly negatively correlated to proximity to antennas and Stork recruitment and survival. Twelve nests (40% of his study sample) were located within 200 m of the antennas and never successfully raised any chicks, while only 1 (3.3%), located further than 300 m, never had chicks. Strange behaviors were observed at Stork nesting sites within 100 m of one or several cell tower antennas. Those birds that the main beam impacted directly (i.e., electric field intensity/EFI > 2 V/m) included young that died from unknown causes. Within 100 m, paired adults frequently fought over nest construction sticks and failed to advance the construction of the nests with sticks falling to the ground while nests were being constructed. Balmori (2005) reported that some nests were never completed and the Storks remained passively in front of cellsite antennas. The electric field intensity was higher on nests within 200 m (2.36 ± 0.82 V/m) than on nests further than 300 m (0.53 ± 0.82 V/m). However, the EMF levels, including for nests < 100 m from the antennas, were not intense enough to be classified as thermally active. Power densities need to be at least 10 mW/cm² to produce tissue heating of even 0.5 C (Bernhardt 1992).

Balmori and Hallberg (2007) and Everaert and Bauwens (2007) found similar strong negative correlations among male House Sparrows and electromagnetic radiation in their studies. In another review, Balmori (2009) reported health effects to birds which were continuously irradiated. They suffered long-term effects including reduced territorial defense posturing, deterioration of bird health, problems with reproduction, and reduction of useful territories due to habitat deterioration.

Beason and Semm (2002) demonstrated that microwave radiation used in cell phones produces non-thermal responses in several types of neurons of the nervous system of Zebra Finches. The brain neurons of anesthetized birds were tested with a 900 MHz carrier, modulated at 217 Hz. Stimulation resulted in changes in the amount of neural activity by more than half of the brain cells with most (76%) of the responding cells increasing their rates of firing by an average 3.5-fold as opposed to controls — a clearly definitive study showing non-thermal effects. The other responding cells exhibited a decrease in their rates of spontaneous activity suggesting potential effects to humans using hand-held cell phones affecting sleep (Borbely et al. 1999). The Beason and Semm (2002) theoretical model could also help explain why birds may be attracted to cell towers, an important theoretical premise that they previously hypothesized in regard to Bobolinks (Semm and Beason 1990).

In a meta-review of studies through 2008, and based on laboratory research they conducted, Panagopoulos and Margaritas (2008) determined maximum radiation distances for both cell phones and for communication towers, based on the Global System for Mobile Telecommunications (GSM) and the Digital Cellular System (DCS). This maximum radiation distance corresponds to an intensity around 10 mW/cm² for both types of radiation in regards to the RF components — i.e., Bernhardt's (1992) threshold for thermal heating effects. Panagopoulos and Margaritas (2008) recorded an "intensity window" — a thermal effect — around 10 mW/cm² RF exposure where bio-effects became even more severe than at intensities higher than 200 mW/cm². This "intensity window" appeared at a distance of 20-30 cm from the cell phone antenna, corresponding to a distance of about 20-30 meters from a base station antenna. This could be considered a classic nonlinear effect and would apply to far field exposures. Since cell phone base station antennas are frequently located within residential areas where houses and workplaces are often situated at distances 20-30 m from such antennas, not to mention birds nesting and roosting close to

these antennas (e.g., Balmori 2005), humans, migratory birds and other wildlife may be exposed up to 24 hours per day.

Based on their research and meta-analyses, Panagopoulos and Margaritas (2008) concluded that large decreases in reproductive capacity were being caused by GSM and DCS radiation fields. This included extensive DNA fragmentation on reproductive cells of experimental animals induced by these fields, exerting an intense biological action able to kill cells, damage DNA, and dramatically decrease the reproductive capacity of living organisms, including populations of wild birds and insects. They cautioned, however, that the physical parameters of these radiations, including intensity, carrier frequency, pulse repetition frequency, distance from the antenna, and similar factors provided inconsistency and lack of standardization making it difficult to correlate specific thermal and non-thermal effects to specific types of radiation. Their take-away message, however, was clear: bio-effects to migratory birds, other wildlife, insects, laboratory animals and humans continue to be documented from thermal and non-thermal exposures, as well as effects from intermediate exposures between the near-field and far-field levels. All migratory birds are potentially at risk, whether they be Bald Eagles, Golden Eagles, Birds of Conservation Concern (USFWS 2008), Federally and/or State-listed bird species, other birds in peril regionally or population-wide, or birds whose populations are stable.

Cucurachi et al. (2013) reported on 113 studies from original peer-reviewed publications and relevant existing reviews. A limited number of ecological studies was identified, the majority of which were conducted in a laboratory setting on bird embryos or eggs, small rodents and plants. In 65% of the studies, ecological effects of RF-EMF (50% of the animal studies and about 75% of the plant studies) were found both at high as well as at low dosages. Lack of standardization and limited sampling made generalizing results from the organism to the ecosystem level very difficult. Cucurachi et al. (2013) concluded, however, that due to the number of variables, no clear dose-effect relationship could be found especially for non-thermal effects. However, effects from some of the studies reviewed were well documented, and certainly can serve as predictors for effects to wild, protected migratory birds and other wildlife in North America.

Engels et al. (2014) investigated “*electromagnetic noise*” emitted everywhere humans use electronic devices including from cell phones and their towers. While prior to their study on European Robins, no “*noise effect*” had been widely accepted as scientifically proven, the authors in this double-blind experiment were able to show that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise. The magnetic compass is integral to bird movement and migration. The findings clearly demonstrated a non-thermal effect on European Robins and clearly serves as a predictor for effects to other migratory birds including those in North America.

Levitt and Lai (2010) reported numerous biological effects from cell tower radiation documented at very low intensities comparable to what the population experiences within 60–150 m distance from a cell tower, including effects that occurred in studies of cell cultures and animals after exposures to low-intensity RFR. These reported effects were genetic, growth, and reproductive in nature; they documented increases in permeability of the blood-brain barrier; showed behavioral responses; illustrated molecular, cellular, and metabolic changes; and provided evidence of increases in cancer risk — all applicable to migratory birds, other wildlife and to far field exposures in general. They cited published, peer-reviewed examples of effects that included:

Dutta et al. (1989) who reported an increase in calcium efflux in human neuroblastoma cells after exposure to RFR at 0.005 W/kg. Calcium is an important component in normal cellular functions.

Fesenko et al. (1999) who reported a change in immunological functions in mice after exposure to RFR at a power density of 0.001 mW/cm². These results can serve as predictors for impacts to wild animals.

Magras and Xenos (1997) who reported a decrease in reproductive function in mice exposed to RFR at power densities of 0.000168— 0.001053 mW/cm². The results also serve as predictors for reproductive impacts to wildlife.

Forgacs et al. (2006) who reported an increase in serum testosterone levels in rats exposed to GSM-like RFR at specific absorption rates (SAR) of 0.018— 0.025 W/kg. The results also serve as predictors for reproductive impacts to wildlife.

Persson et al. (1997) who reported an increase in the permeability of the blood–brain barrier in mice exposed to RFR at 0.0004– 0.008 W/kg. The blood–brain barrier is a physiological mechanism that protects the brain from toxic substances, bacteria, and viruses. These findings have clear applicability to wildlife including migratory birds.

Phillips et al. (1998) who reported DNA damage in cells exposed to RFR at the SAR of 0.0024– 0.024 W/kg. DNA is integral to the very function and survival of all living organisms, including migratory birds.

Kesari and Behari (2009) also reported an increase in DNA strand breaks in brain cells of rats after exposure to RFR at the SAR of 0.0008 W/kg. The results also serve as predictors for impacts to DNA in wildlife. And,

Belyayev et al. (2009) who reported changes in DNA repair mechanisms after RFR exposure at a SAR of 0.0037 W/kg. DNA is integral to the maintenance and repair of cells and cellular function in all animals. All sources from above were cited in Levitt and Lai (2010).

In a 2-year study conducted by the National Toxicology Program (NTP) of the National Institutes of Health (May 2016), NTP (Wyde 2016) reported partial findings from their \$25 million study on cancer risk to laboratory rodents from cellphone radiation. The report summarizes a long-term exposure study to cell phone radiation, with statistically significant evidence of DNA damage from non-thermal exposure to cellphone radiation to laboratory mice and rats. Controlled studies on laboratory rats showed that cellphone radiation caused 2 types of tumors, glioma and schwannoma, the results which “*could have broad implications for public health.*” The report has been characterized as a “*game-changer*” as it proves that non-ionizing, radiofrequency radiation can cause cancer without heating tissue. The researchers controlled the temperature of the test animals to prevent heating effects so the cancers were caused by a non-thermal mechanism. The report on the mice component of the study will be released at a later date. Not surprisingly, much of the media coverage contained considerable bias or “media spin” intended to create doubt about the study’s important findings regarding cancer risk from exposure to cellphone radiation (Moskowitz 2016). The implications are troubling for migratory birds and other wildlife.

Likely Impacts to Migratory Birds from Frequency Modulated (FM) Signals

FM signals travel in line-of-sight paths, so antennas are located on the highest ground available to blanket an area wherever the target signal recipients are located, also providing convenient perches for migratory birds. FM digital (on/off) signals which simulate pulsed waves pose additional health concerns to migratory birds, especially from thermal heating which will be coupled with the UHF’s from cell phone providers often colocated on the same antennas (e.g., see cellphonetaskforce.com; work of Dr. O. Johansson). This creates a very dangerous frequency potential for protected migratory birds such as Bald Eagles since

the length of the FM signal is about 6 feet, creating a full-body resonant effect for both humans and Bald Eagles — an Eagle wingspan extends to about 6 feet. Power levels for FM transmission (e.g., 6,000 Watts for a commercial radio station) are far higher than that for a colocated UHF antenna(s), exacerbating thermal heating effects.

Modulated FM signals infuse the atmosphere with lower frequencies which become more bioactive, even at lower power intensities. These, in turn, coupled with a UHF cell phone frequency(s) will create greater thermal and non-thermal effects. Generally the approved level of power for an FM transmission antenna is considerable. The FCC does not measure the modulated signal, only the carrier signal (Levitt 1995). Let's evaluate a hypothetical FM antenna array, with a carrier signal of 104.9 MHz at 47 meters above ground level (AGL), and an effective radiated power of 6,000 Watts. Here, nesting, roosting, feeding and potentially breeding birds such as Bald Eagles using this hypothetical tower would almost certainly be affected by thermal heating, in addition to non-thermal impacts. These issues need to be assessed including through the NEPA review process (either an Environmental Assessment or an Environmental Impact Statement) by FCC and FWS.

The specific absorption rate (SAR) is the energy absorbed per unit of biological tissue, usually expressed in watts per kilogram or milliwatts per gram of tissue, and the SAR is used to focus on "harmful effects" to humans. SARs peak in the bands of 70 — 100 MHz (Cleveland 2001). However, as previously mentioned in this memo, there currently are no standards for wildlife exposure to RFR — both from FM and UHF radiation — including for Bald Eagles and all other protected migratory birds. These issues need to be addressed both by FCC and FWS.

Summary Recommendations

Levitt and Lai (2010) concluded that the obvious mechanism of effects from RFR are thermal (i.e., tissue heating) — which is what FCC bases its current radiation standards on, even if they are more than 30 years out of date and rejected both by the Department of Interior and Department of Commerce (USDOJ 2014, Manville 2016) as incomplete. However, for decades, there have been questions about non-thermal (i.e., not dependent on a change in temperature) effects, whether they exist, and what specifically causes the effects to surface. The sources cited above should help dispel that doubt or at the very least show that non-thermal effects do indeed occur, have been well documented, and can have significant deleterious effects on migratory birds and other wildlife.

Practically, as Levitt and Lai (2010) concluded, we do not actually need to know whether RFR effects are thermal or non-thermal to set exposure guidelines. Most of the biological-effects studies of RFR that have been conducted since the 1980s were under non-thermal conditions, including the most recent NTP (2016) studies. In studies using isolated cells, the ambient temperature during exposure was generally well controlled. In most animal studies, the RFR intensity used usually did not cause a significant increase in body temperature in the test animals. Most scientists consider non-thermal effects as well established, even though the implications are not fully understood.

Scientifically, Levitt and Lai (2010) concluded that there are three rationales for the existence of non-thermal effects:

1. Effects can occur at low intensities when a significant increase in temperature is not likely.
2. Heating does not produce the same effects as RFR exposure.

3. RFR with different modulations and characteristics produce different effects even though they may produce the same pattern of SAR distribution and tissue heating.

There is virtually no non-thermal research to indicate what is safe for either humans or wildlife, including migratory birds which are highly sensitive to perturbations in ways humans are not (see previous citations). Unfortunately, there also is very little far-field, distance-to-safety research for wildlife — most especially for migratory birds — as this has not been studied with that focus in mind. What little EMF/RF field research on wildlife that has been conducted, its focus has been on behavior, mortality and reproductive outcomes (e.g., B. Levitt and H. Lai, Comments Filed Jointly to FCC, ET Docket No. 13-84, 2013; Balmori 2005, 2009; Balmori and Hallberg 2007; Everaert and Bauwens 2007; Engels et al. 2014; Wasserman et al. 1984; and Semm and Beason 1990).

In summary, we need to better understand, tease out, and refine how to address these growing and poorly understood radiation impacts to migratory birds, bees, bats, and myriad other wildlife. At present, given industry and agency intransigence (with the exception of the Interior Department and Department of Commerce both which are now beginning to address non-thermal radiation issues), massive amounts of money being spent to prevent addressing impacts from non-thermal radiation — not unlike the battles over tobacco and smoking — and a lack of significant, dedicated and reliable funding to advance independent field studies and better understand the etiology and consequences of impacts, we are left with few options. Currently, other than to proceed using the precautionary approach and keep emissions as low as reasonably achievable, we are at loggerheads in advancing meaningful guidelines, policies and regulations that address non-thermal effects. The good news: there appears to be an awakening at least within a significant segment the scientific community to the realization that these issues must be addressed — for the health of humans, wildlife and our environment — and DOI and the Department of Commerce are also beginning to address non-thermal effects to migratory birds.

Next Steps

The following suggestions would help significantly advance the need to address effects/impacts from non-thermal radiation on migratory birds and other wildlife:

- We desperately need to conduct field research on thermal and non-thermal radiation impacts to wild migratory birds and other wildlife here in North America, similar to studies conducted in Europe. Specifically, the research focus should center on causality for “near-field,” “far-field” and “intermediate” effects, ideally based on some standard, agree-upon radiation metrics. The metrics need to be consistent with standards for intensity, carrier frequency, pulse repetition frequency, distance from the antenna, and similar factors. The research must be based on peer-reviewed monitoring and testing protocols (e.g., upgrades to the Manville 2002 peer-reviewed research protocol submitted to the U.S. Forest Service for studies on cell towers in Arizona, and key methodologies used in studies previously referenced in this memo, among others). The research needs to be conducted by credible, independent third party research entities with no vested interest in the outcomes, and the results need to be published in refereed scientific journals, made available to the public.
- Studies need to be designed to better tease out and understand causality of thermal and non-thermal impacts from radiation on migratory birds. Results need to be carefully compared with findings from Europe and elsewhere on wild birds, and efforts need to be made to begin developing exposure guidelines for migratory birds and other wildlife based on dose-effect and other nonlinear relationships. We do not actually need to know whether RFR effects are thermal or non-thermal to develop and set exposure guidelines (Levitt and Lai 2013).

- To minimize deleterious radiation exposures, these guidelines should include use of avoidance measures such as those developed by the electric utility industry for bird collision and electrocution avoidance (APLIC 2006, 2012) — both publications which I co-authored. In the case of Bald Eagles, the communication tower guidelines refined and updated by FWS (Manville 2013) — and submitted to the FCC and industry — recommend one-mile disturbance free buffers during active nesting of Ferruginous Hawks and Bald Eagles, and 0.5-mile buffers around other active raptor nests, based on nest studies conducted by the Wyoming Ecological Services Field Office in that State; Guideline #5). Impacts must address collision mortality, crippling loss, and injury; mortality, injury, population viability and survivorship based on impacts from radiation; as well as disturbance and habitat fragmentation. The updated 2013 Service Guidelines were intended to be inclusive.
- Studies need to be conducted on the use of “faux” branches (i.e., metal arms that mimic pine or fir branches) on cell and/or FM towers intended to disguise the towers as trees, but provide nesting and roosting opportunities for migratory bird including Bald Eagles, which will almost certainly be impacted both by thermal and non-thermal radiation effects. Additionally, birds such as Bald Eagles and others are subject to possible impalement from the sharp metal arms, with enhanced chances of injury and death due to disturbance from tower maintenance. Even if these “faux” branches are not constructed, Eagles for example tend to use the tallest objects available for roosting, so impacts from roosting, feeding and breeding on the antenna supports all must be considered by FCC and FWS.
- Agencies tasked with the protection, management, and research on migratory birds and other wildlife (e.g., FWS, U.S. Geological Survey, National Park Service, U.S. Forest Service, Bureau of Land Management, and USDA Wildlife Services, among others) need to develop radiation policies that avoid or minimize impacts to migratory birds and other trust wildlife species. This means supporting — and where applicable — conducting research, and developing policies that help minimize radiation impacts.
- As Levitt and Lai (2010) concluded, we do not actually need to know whether RFR effects are thermal or non-thermal to set exposure guidelines. Most scientists consider non-thermal effects as well established, even though the implications are not fully understood.
- Given the rapidly growing database of peer-reviewed, published scientific studies (e.g., <http://www.saferemr.com>, School of Public Health, University of California, Berkeley), it is time that FCC considers thermal and non-thermal effects from EMR in their tower permitting, and incorporates changes into their rulemaking regarding “effects of communication towers on migratory birds.”

Literature Cited

Avian Power Line Interaction Committee. 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC, and Sacramento, CA. 207 pp.

Avian Power Line Interaction Committee. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Edison Electric Institute and APLIC, Washington, DC. 159 pp.

Balmori, A. 2005. Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (*Ciconia ciconia*). *Electromagnetic Biology and Medicine* 24:109-119

Balmori, A. 2009. Electromagnetic pollution from phone masts. Effects on wildlife pathophysiology. *Electromagnetic Fields (EMF) Special Issue*, 16 (2-3): 191-199.

Balmori, A., and O. Hallberg. 2007. The urban decline of the House Sparrow (*Passer domesticus*): a possible link with electromagnetic radiation. *Electromagnetic Biology and Medicine* 26:141-151.

Beason, R.C., and P. Semm. 2002. Responses of neurons to amplitude modulated microwave stimulus. *Neuroscience Letters* 333 (2002):175-178.

Bernhardt, J.H. 1992. Non-ionizing radiation safety: radiofrequency radiation, electric and magnetic fields. *Phys. Med. Biol.* 37 (1992): 80–84.

Borbely, A.A., R. Huber, T. Graf, B. Fuchs, E. Gallmann, and P. Achermann. 1999. Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram. *Neurosci. Lett.* 275 (1999): 207–210.

Cleveland, R.F., Jr. 2001. Human exposure to radiofrequency electromagnetic fields: FCC guidelines; global standards; evaluating compliance; Federal and local jurisdiction. Pages 116-128 *In* B.B. Levitt (ed.). *Cell Towers: Wireless Convenience? or Environmental Hazard? Proceedings Cell Tower Forum*, New Century Publishing.

Cucurachi, S., W.L.M. Tamis, M.G. Vijver, J.W.G.M. Peijnenburg, J.F.B. Bolte, and G.R. de Snoo. 2013. A review of ecological effects of radio frequency electromagnetic fields (RF-EMF). *Environment International* 51 (January 2013): 116-140.

DiCarlo, A., N. White, F. Guo, P. Garrett, and T. Litovitz. 2002. Chronic electromagnetic field exposure decreases HSP70 levels and lowers cytoprotection. *Journal Cellular Biochemistry* 84: 447-454.

Engels, S., N-L. Schneider, N. Lefeldt, C.M. Hein, M. Zapka, A. Michalik, D. Elbers, A. Kittel, P.J. Hore, and H. Mouritsen. 2014. Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird. *Nature* 509 (May 15, 2014). doi:10.1038/nature13290.

Everaert, J. 2016. Electromagnetic radiation (EMR) in our environment. www.livingplanet.be

Everaert, J., and D. Bauwens. 2007. A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding House Sparrows (*Passer domesticus*). *Electromagnetic Biology and Medicine* 26:63-72.

Grigor'ev, I. 2003. Biological effects of mobile phone electromagnetic field on chick embryo (risk assessment using the mortality rate). *Radiats Biol Radioecol* 43(5):541-3.

ICNIRP. 1998. Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300GHz). *Health Phys.* 74: 494-522.

Lai, H., and N.P. Singh. 1995. Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells. *Bioelectromagnetics* 16 (1995): 207–210.

Lai, H., and N.P. Singh. 1996. Single and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation. *Int. J. Radiat. Biol.* 69 (1996): 513–521.

Levitt, B.B. 1995. *Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves*. Harcourt Brace. ISBN 0-15-628100-7

Levitt, B.B., and H. Lai. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. *Environ. Rev.* 18 (2010): 369–395. doi:10.1139/A10-018.

Levitt, B.B., and H. Lai. 2013. Comments Filed Jointly to the Federal Communications Commission, ET Docket No. 13-84, 2013.

Manville, A.M., II. 2002. Protocol for monitoring the impact of cellular telecommunication towers on migratory birds within the Coconino, Prescott, and Kaibab National Forests, Arizona. Peer-reviewed research protocol prepared for the U.S. Forest Service at their request. Division of Migratory Bird Management, USFWS. 9 pp.

Manville, A.M., II. 2013. U.S. Fish and Wildlife Service (USFWS) revised guidelines for communication tower design, siting, construction, operation, retrofitting, and decommissioning — Suggestions based on previous USFWS recommendations to FCC regarding WT Docket No. 03-187, FCC 06-164, Notice of Proposed Rulemaking, "Effects of Communication Towers on Migratory Birds," Docket No. 08-61, FCC's Antenna Structure Registration Program, and Service 2012 Wind Energy Guidelines. Division of Migratory Bird Management, Arlington, VA. 5 pp.

Manville, A.M. II. 2015. Recommendations for additional research and funding to assess impacts of non-ionizing radiation to birds and other wildlife. Memorandum to Dr. J. McGlade, Science Advisor to United Nations Environment Program, Key Research Needs Affecting Wildlife Suggesting UNEP's Immediate Attention. March 5, 2 pp.

Manville, A.M., II. 2016. Impacts to birds and bats due to collisions and electrocutions from some tall structures in the United States: wires, towers, turbines and solar arrays — state of the art in addressing the problems. Chap 20, pp 415-442, *In* F.M. Angelici (editor), *Problematic Wildlife: a Cross-Disciplinary Approach*, Springer International Publishing, Switzerland. DOI 10.1007/978-3-319-22246-2_20

Moskowitz, J.M. 2016. National Toxicology Program finds cell phone radiation causes cancer. *Electromagnetic Radiation Safety*. J. Moskowitz, Dir., Center for Family and Community Health, School of Public Health, Univ. CA— Berkeley. www.saferemr.com/2016/05/national-toxicology-program-finds-cell.html

Panagopoulos, D.J., and L.H. Margaritis. 2008. Mobile telephony radiation effects on living organisms. Chapter 3, pp. 107-149, *In* A.C. Harper and R.V. Buress (eds.), *Mobile Telephones*, Nova Science Publishers, Inc. ISBN: 978-1-60456-436-5.

Portier, C.J., and W.L. Leonard. 2016. *Scientific American Blog*. June 13.

Semm, P. and R.C. Beason. 1990. Responses to small magnetic variations by the trigeminal system of the bobolink, *Brain Res. Bull.* 25: 735–740.

Tanner, J.A. 1966. Effects of microwave radiation on birds. *Nature* 210, May 7, Letters to Nature, doi: 10.1038/210636a0

Tanner, J.A., C. Romero-Sierra, and S.J. Davie. 1967. Non-thermal effects of microwave radiant on birds. *Nature* 216. *Nature* 216, 1139 (Dec 16, 1967) doi:10.1038/2161139a0

United States Department of Interior. 2014. ER 14/0001-14/0004. Letter to Mr. Eli Veenendaal, Natl. Telecommunications and Information Administration, US Dept. Commerce. Signed by W.R. Taylor, Di-

rector Office of Environmental Policy and Compliance, Office of Secretary, DOI. February 7, 8 pp, in the public arena.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pp. (<http://www.fws.gov/migratorybirds/>>).

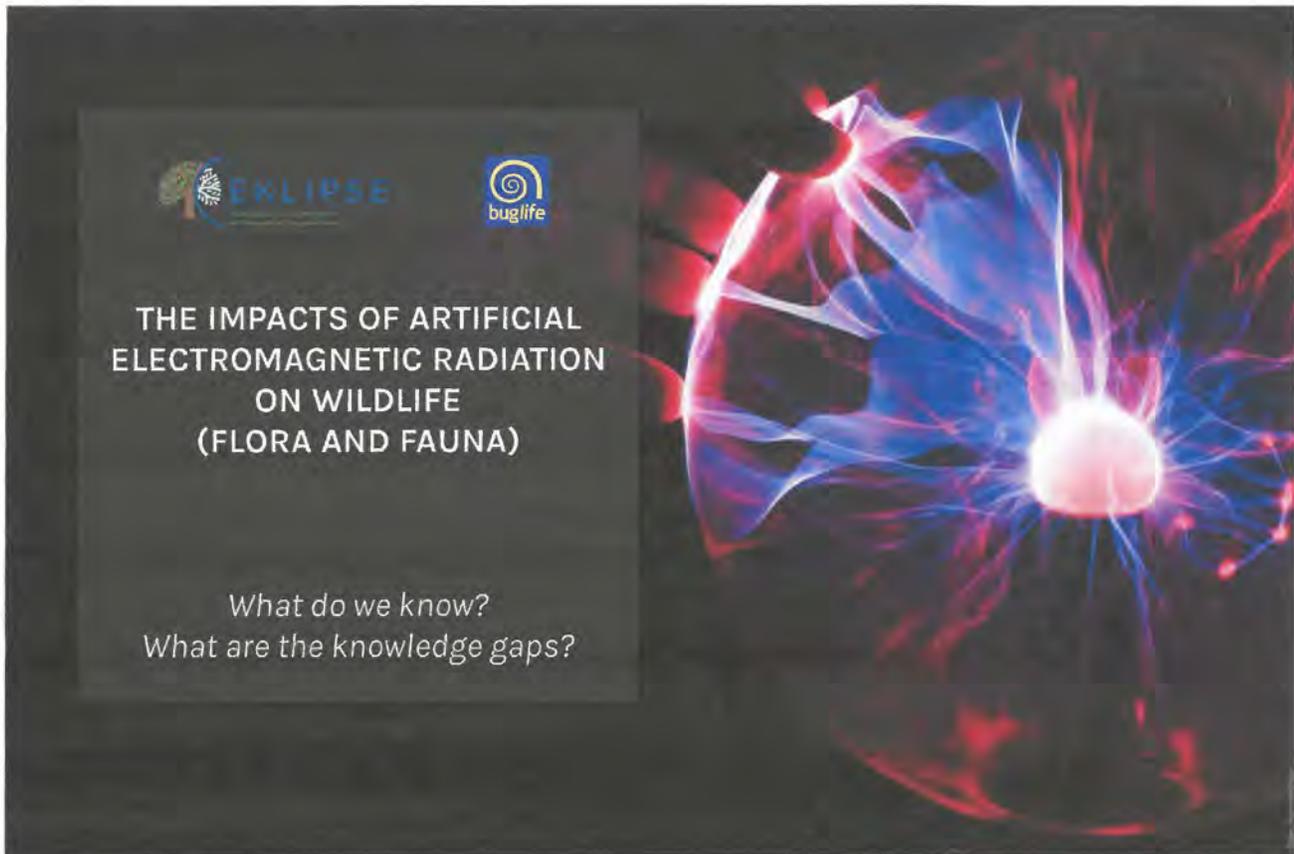
Wasserman, F.E., C. Dowd, B.A. Schlinger, D. Byman, S.P. Battista, and T.H. Kunz. 1984. The effects of microwave radiation on avian dominance behavior. *Bioelectromagnetics* 5(3): 331-339.

Wyde, M. 2016. National Toxicology Program finds cell phone radiation causes cancer. Summary Presentation at BioEM 2016 Meeting, Ghent, Belgium, by M. Wyde, Dir. NTP Studies of Cell Phone Radiation, NIEHS, June 8.

Xenos, T.D, and I.N. Magras. 2003. Low power density RF radiation effects on experimental animal embryos and fetuses *In*: P. Stavroulakis (Ed.), *Biological Effects of Electromagnetic Fields*, Springer, 579-602.

EMR conference

 eclipse-mechanism.eu/emr_conference



WEB CONFERENCE

The impacts of artificial Electromagnetic Radiations on wildlife (flora and fauna)

What do we know?

What are the knowledge gaps?

EKLIPSE organised a web conference from Monday 22nd of January to Thursday 25th of January 2018.

EKLIPSE invited a wide range of experts from different disciplines to discuss the current knowledge on the effects of Electromagnetic Radiation (EMR) on wildlife. The aim was to highlight the **current state of the art** in this field, to identify **knowledge gaps** related to the impacts on different taxonomic groups, to discuss the **technical aspects and methodologies** used in current studies, and to identify and prioritize **key research needs** and **policy recommendations**.

LATEST NEWS - The **two reports** related to the web conference are now available:

1/ The Current Knowledge Overview report explains the work done by the Expert Steering Group in analysing a representative set of the peer-reviewed literature and include their findings which consist of:

- a list of the main results extracted from the studies
- an assessment of the quality of the reviewed papers and studies
- the identification of knowledge gaps

2/ The Web Conference report outlines the outcomes of the discussions that took place during the web conference and consists of:

- feedback from the participants on the first document
- lists of research needs and policy recommendations identified by the participants

You will find below the slides of the **presentations** that were made along the week:

Monday, 22nd January at 16:00 CET. **Introduction session.**

- Estelle Balian - Introduction to EKLIPSE, the request by Buglife, and the web conference
- Lise Goudeseune - Introduction on the background document

Tuesday, 23rd January at 13:30 CET. **Thematic session on Plants.**

Alain Vian - Introduction on the analyses for Plants

Tuesday, 23rd January at 16:00 CET. **Thematic session on Vertebrates.**

Pascal Malkemper - Introduction on the analyses for Vertebrates

Wednesday, 24th January at 16:00 CET. **Thematic session on Invertebrates.**

Thomas Tscheulin - Introduction on the analyses for Invertebrates

Thursday, 25th January at 16:00 CET. **Transversal elements and conclusions.**

The **video recordings** of the web conference are available on the EKLIPSE Youtube channel:
<https://www.youtube.com/playlist?list=PLmbLthY1JfSqlZr6jAXX636u7Qubldl4d>

If you have attended the web conference, please leave your feedback through our evaluation form.

If you registered to the web conference, but could not attend it, do not hesitate to let us know why:
secretariat@eklipse-mechanism.eu.

In case you would like to share links or publications, or to continue discussions on the topic, feel free to use the dedicated thread on our KNOCK Forum. Note that registration is required to post messages.



The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna).
Current knowledge overview: a background document to the web conference

A report of the EKLIPSE project



Horizon 2020
European Union Funding
For Research & Innovation
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** These authors contributed equally to this work.*



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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Current knowledge overview: a background document to the web conference.

Authors: Erich P. MALKEMPER*, Thomas TSCHULIN*, Adam J. VANBERGEN*, Alain VIAN*, Estelle BALIAN, Lise GOUDESEUNE.

** These authors contributed equally to this work.*

1. Context and objectives

Organisers

EKLIPSE is an EU funded Coordination Action under H2020, aiming to develop a European Mechanism to answer requests from policy makers and other societal actors on biodiversity related issues.

EKLIPSE had a first "Call for request" in September 2016. The request submitted by Buglife on the impacts of anthropogenic electromagnetic radiation on invertebrates was selected to initiate a process of identifying key knowledge gaps and research needs, as well as to formulate recommendations. The scope of the request has been adjusted and it now extends to the impacts on invertebrates, vertebrates, and plants, and the range of EMR types has been reduced.

After a first scoping to compile a list of publications relevant to the topic, EKLIPSE has invited selected experts to join Experts Steering Group to analyse the publications and help prepare the organisation of a larger consultation through a web conference. The Experts Steering Group is multidisciplinary: it is composed of four biologists/ecologists specialised in different taxonomic groups, as well as two physicists having worked with electromagnetic field (see Appendix I - Members of the Experts Steering Group).

This document provides the results of the first scoping and analysis of available literature by the Experts Steering Group to provide a knowledge overview and identify knowledge gaps. It is a working document and it will lead to a more elaborated report integrating the results of the web conference

Objectives

This overview aims to identify which main taxonomic groups, which types of EMR, and associated effects have been addressed by the existing studies.

It will also assess the level of quality/reliability of the available studies on both technical and biological/ecological aspects.

Based on this overview, key knowledge gaps and assessments of the quality of the studies have been identified and have served as the basis of discussions for the larger consultation (web conference) that was organised by EKLIPSE at the beginning of 2018. This background document should be considered as a technical working report and does not aim to be exhaustive but rather to provide a first step in the analysis of the currently available knowledge and future research needs.

2. Knowledge overview methodology

2.1 Scoping of the literature

The literature used was restricted to peer-reviewed articles. The search for publications was made on the ISI Web of Knowledge platform and it was completed by searches on Google Scholar, using the following combinations of keywords:

- EMR; EMF; electrosmog; electromagnetic field; electromagnetic radiation; electromagnetic

AND

- wildlife; invertebrate(s); vertebrate(s); plant(s); animal(s); insect(s); arthropod(s); bee(s); drosophila; mammal(s); fish; amphibian(s); bird(s); tree(s); flower(s); biodiversity.

The publications cited in the identified papers were also examined to complement the list. A further search was done with the names of recurring experts. Only recent papers (from 2000 onwards) were considered.

The focus was made on wildlife (plants, invertebrates, vertebrates), although a few studies on domestic animals have been included.

The range of EMR types has also been restricted to artificial anthropogenic radiations. For example, it does not include research on the effects of light, the Earth's magnetic field, MRI-strength magnetic field, etc.) Studies that were considered out of this scope were discarded and not used in the analysis.

A Call for Knowledge was launched on the EKLIPSE KNOCK Forum (interactive discussion platform) and additional publications, suggested by the contributors, were added to the list. Finally, the experts from the Experts Steering Group provided a few more relevant sources.

In total, 147 scientific papers or reviews were identified, and 97 of them were used in the analyses (see list of References).

This final list of publications does not aim to be comprehensive, but to compile a representative set of papers and studies to allow an overview of the current knowledge and gaps.

2.2 Structuring of the literature and analyses

The Experts Steering Group structured the analyses in two different axes. On one hand, the biologists/ecologists divided the work amongst them according to three major taxonomic groups: 1/ invertebrates, 2/ vertebrates, 3/ plants. On the other hand, the physicists/engineers have created 15 categories of anthropogenic radiation types based on frequency and exposure identified by codes (see Table 1).



Table 1 Categorisation and identification of radiation types

Category	Identification
Non-specific magnetic fields	Static magnetic field
	Extremely low frequencies (< 1 kHz)
Non-specific electric fields	Static electric field
	Extremely low frequencies (< 1 kHz)
Non-specific radiofrequencies	Between 1 kHz and 6 GHz
Non-specific microwaves	Between 6 GHz and 300 GHz
Non-specific infrared	Between 300 GHz and 430 Thz
Application specific exposure	Power lines magnetic field (50 or 60 Hz)
	Power lines electric field (50 or 60 Hz)
	Analog broadcasting-like signals (TV, radio)
	Digital broadcasting-like signals (TV, radio)
	2G base station-like signals (GSM)
	3G base station-like signals (UMTS)
	4G base station-like signals
	Radar-like signals

Then, an analytical grid was produced with the publications identified per taxonomic group and radiation type. Different comment sections were added to assess the quality of the studies (technological aspects and biological aspects), the conditions of the studies, the results, the knowledge gaps, etc.

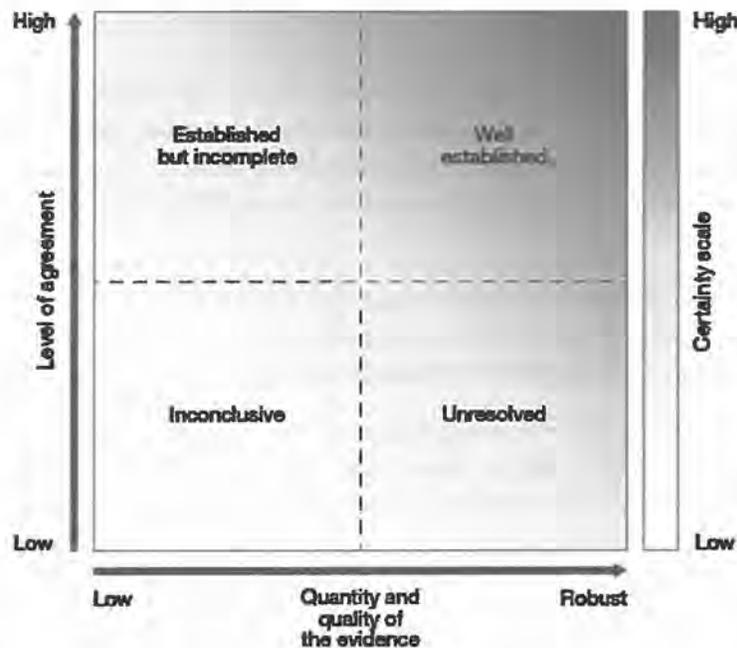
The following rating system was used:

1. bad quality
2. minimum quality, with some elements that can be used
3. normal quality, some gaps
4. excellent

2.3 Assessment of the confidence levels of the studies

In this background document, we make an initial attempt to distil the assessment of the published scientific literature into a series of 'key messages', which are succinct statements aimed at conveying important

information to the web conference participants and, ultimately, to decision-makers. The scientific evidence assessed included empirical data, theory, and models.



The summary terms to describe the evidence are:

- Well established: comprehensive meta-analysis²⁰ or other synthesis or multiple independent studies that agree.
- Established but incomplete: general agreement although only a limited number of studies exist but no comprehensive synthesis and, or the studies that exist imprecisely address the question.

- Unresolved: multiple independent studies exist but conclusions do not agree.
- Inconclusive: limited evidence, recognising major knowledge gaps

Confidence increases towards the top-right corner as suggested by the increasing strength of shading. Source: modified from Moss and Schneider (2000).

Figure 1 Four-box model for the qualitative communication of confidence.

For scientists and decision-makers to understand the level of the potential problem it is crucial that the degree of confidence in each key message is evaluated and communicated in ways that are effective but simple enough for a range of audiences to understand. In our assessment of the published evidence about the effects of EMR on wildlife we employ a qualitative ‘four-box model’ to communicate the level of certainty in knowledge, this allows us to show how each key message is based on the assessment of the quantity, quality and level of expert agreement in the evidence (see Figure 1). This model follows and is adopted from the Intergovernmental Platform for Biodiversity & Ecosystem Services (IPBES, 2016), which in turn adapted the model from Moss and Schneider (2000), which uses this approach to convey messages of its assessments to intergovernmental policymaking.



3. Key results: current state of knowledge

3.1 Quality of the studies in terms of technical aspects

a. Invertebrates

This document aims to frame the current knowledge about the impacts of EMR on wildlife as based on an assessment of the scientific literature. It is expected that debate and challenge during the web conference will either confirm our assessment of the evidence, the level of certainty, and the knowledge gaps or produce additional evidence that may stimulate a reassessment of the evidence and the resulting key messages to decision makers.

The quality of published studies investigating the impacts of EMR on invertebrates is very mixed. On the one hand, results from studies carried out in the laboratory are often not transferable to real life situations due to an oversimplification of effects and the limited exposure (both in time and space) to EMR of the subjects.

On the other hand, field studies suffer from a multitude of unmeasured potential effects that are indirectly related to EMR levels and can often not be disentangled, thereby confounding analysis. Field studies also often suffer from (very) low replication which makes drawing firm conclusions difficult.

Certain studies of very poor scientific quality (e.g. no or very low replication) employed highly artificial EMR treatments, such as placing a mobile phone either inside or immediately adjacent to honey bee hives. This represented a highly field-unrealistic exposure to a source of EMR and, even putting issues of replication aside, would mean no rigorous conclusions can be reached.

b. Vertebrates

Studies on the effects of time-varying magnetic fields on vertebrates are highly variable in terms of the exposure and the read-outs used to investigate possible effects. The magnetic fields range from extremely low frequency power line fields “applied” in the field to highly controlled gigahertz fields in the laboratory. Study qualities in terms of technical aspects are equally inhomogeneous. Not even half of the studies assessed were given the highest technical ranking (see Appendix II - Tables with number of assessed studies). The often poor design and missing control experiments impair assessment of the validity of the results and are likely to be the main reason for a low number of cross-laboratory replicated results. Unfortunately, the great variability in the qualities of primary research papers is not reflected in many reviews on the topic. Often, these reviews do not report selection criteria for the inclusion of studies. In addition, reviews suffer from the problem of comparing studies with highly variable descriptions of technical details on exposure parameters which hampers condensing similarities among the findings. In our assessment the studies with the lowest ratings in terms of technical aspects were:

1. Not blinding the experimenters
2. Not including appropriate controls
3. Inadequately characterized EMR exposure

We recommend that both laboratory studies and field studies which are equally important should apply to standard methodological criteria which are listed below in 3.1.4. As biologists are usually not experts on RF-physics, collaborations with physicists and engineers are crucial to achieve reliable exposure conditions. Studies on the effects of exposure in the fields should be accompanied by lab studies which simulate the

exposure under normal environmental conditions which some studies did quite well. The currently biggest issue is the time of exposure, as long-term studies are mostly missing. The development of devices to expose wild animals for a long time to controlled RF in the field should be impelled (e.g. coil-collars or large coil systems around enclosures).

c. Plants

Plants are outstanding models to study the impact of EMR on biological systems. Indeed, they are immobile and therefore can't escape from an environmental constraint and keep a constant orientation in the EMR. Their high surface to volume ratio place a high proportion of cells at the direct interface of the environment and are deprived of awareness, thus eliminating the interference with stressful conditions that could be encountered with animal experiments.

The technical aspect of the studies performed on plants ranked from very poor to excellent. The control of the exposure conditions is one of the most difficult to overcome. Concerning the laboratory studies, one could avoid the use of communication devices such as cell phones to expose sample since their automatism make difficult to control the emitted EMR and the samples are placed near the device in a region where the EMR is not well established (near field) and difficult to control and measure.

The studies conducted in the field are comparatively less abundant and raise two difficulties: i) the first is to efficiently measure the level of EMR in an open environment, where it may vary in nature and amplitude along the day; ii) the second is to avoid / limit or understand the interference with other environmental traits (wind, temperature, pathogens...) that may compromise or make difficult the interpretation of biological responses. The parameters that are used to report the EMR effect on plant are diverse and of unequal value. A high proportion of laboratory experiments concentrate on biochemical or molecular changes that occur shortly after sample exposure. They are using standardized protocols and are generally well conducted, but a greater attention should be paid to control samples. Indeed, most of biological traits vary along the day and changes may reflect natural events rather than responses to EMR if the proper control samples are not performed. Modifications of plant growth after exposure should be conducted with great care since they reveal delayed effects of the exposure and the experiments last for several days during which it can be difficult to avoid interference with other factors that could lead to misinterpretations.

Recommendations for future lab studies could include the use of dedicated devices (TEM-Cell and G-TEM) that offer several advantages, particularly the ability to obtain high EMR amplitude with relatively low injected power, and a very good control of the electromagnetic field characteristics. These devices however only allow the generation of polarized EMR, a situation that is rarely encountered in the true environment, especially in an urban environment, where the signals are reflected and diffracted. The mode stirred reverberation chamber (MSRC), is designed to mimic this situation and has proven to be a very valuable tool as exposure device. However, the cost and complexity has limited the use of this facility.

The field experiments are extremely interesting since plants are still witnesses of their environment and should report long term exposure effects in natural conditions. They are generally using an approach based on the observation of symptoms, linking appearance defects with exposure to electromagnetic fields. Since this approach could be a good starting point, the formal link between the symptoms and the exposure should be established with complementary laboratory studies.

Another key recommendation would be to ensure collaboration with physicists to avoid errors in the set-up of the experimental procedures and/or of the exposure level measurement.



d. General and cross-cutting observations

The studies with the highest rankings set the benchmark for the minimal requirements a future study should meet to be suitable for publication in peer-reviewed journals:

1. Data collection and/or analysis must be conducted in a blinded fashion to minimize observer bias
2. Proper controls for side effects accompanying magnetic exposure, such as vibrations, heat and electric fields need to be accounted for, e.g. by using double-wrapped coils.
3. Whenever magnetic fields are applied it needs to be made sure that all experimental groups are exposed to the same background field by shielding (Faraday cage). In any case the background field needs to be reported through continuous broadband measurements.
4. The magnetic fields used need to be accurately measured and the measurement devices and results reported in detail: Sensitivity of the devices, frequency (-range), intensity, polarization, duration, direction

Collaboration with physicists to better prepare and implement the technical protocols is a major aspect for ensuring technical quality of the studies.

3.2 Quality of the studies in terms of biological or ecological aspects

a. Invertebrates

Physiological and histological studies were usually well replicated and the scientific approach in terms of replication and analysis of the results was satisfactory.

There is a real lack of ecological studies looking at the effect of EMR on species assemblages. One study points out some guilds that seem to be less affected by EMR possibly due to different life history traits that minimise exposure levels at critical life stages. There are no published studies of effects of EMR on species interactions.

From a scientific and technical perspective, the best primary studies (i.e. those receiving a score = 3) tended to be those reporting on the fundamental biology of interactions between insects and naturally occurring electromagnetic fields. Such studies were always laboratory based, well replicated and controlled. Overall the next tier of primary studies (graded as score 2) were more focussed on anthropogenic sources of EMR, such as that produced by mobile phone masts, but were mostly laboratory based. This set of studies was very mixed with respect to scientific quality, sometimes replication appeared at a reasonable and appropriate level. However, a lack or underreporting of the design, replication levels or methods sometimes meant that the study could not be evaluated properly. Of the few field studies, there were either negligible, contrasting effects on behaviour or abundance.

The remaining field and laboratory studies (graded 0 or 1) were anecdotal or flawed from the perspective of scientific design, such as having very low or non-existent levels of replication, pseudoreplication, highly unrealistic treatments, or sometimes a combination of all flaws. Consequently, no statistical analysis can be done and no meaningful information can be gleaned from such studies.

b. Vertebrates

Readouts for effects of EMR on vertebrates span the whole spectrum from hormone levels and other physiological parameters to behaviour. Many of these readouts might have ecological implications (relevant for species survival and thus of interest for conservation efforts) but real ecological studies are extremely

rare. The lack of ecological studies is most probably based on the number of environmental variables that effect ecological communities which makes it hard to identify the influence of EMR in a controlled manner.

The studies focussing on single species often in a laboratory setting suffer from an additional and very general problem: They are not based on hypotheses of how EMR could influence biological structures and thus are not following hypothetico-deductive methodology. Therefore, the effects found are not explainable and no dose-response relationships are revealed. The exposure levels vary dramatically between studies and results are rarely replicated across laboratories.

However, there are two exceptions:

1. Heat effects: It is undisputed that strong EMR fields increase the temperature in tissue and many EMR effects found in (especially older) studies can explained by hyperthermia. However, the EMR intensities needed to induce the heating are not experienced by wildlife (so far).
2. The magnetic sense of birds: Two main hypotheses for the transduction mechanism are supported by manifold evidence and the influence of EMR can be specifically predicted and tested.

Of the 20 primary research studies rated in this assessment one quarter was of very low quality in terms of the biological aspects (see Appendix II - Tables with number of assessed studies). Of the rest, one half (7) was of mediocre quality while 8 studies where excellent, with clear hypothesis-based predictions that were specifically tested. 62.5% of these excellent studies were from the field of animal magnetoreception.

c. Plants

Angiosperms are by far the main taxonomic group to be studied (only a few used mosses).

The principal point is to achieve a formal link between the exposure and the biological responses, thus the main issue is to avoid the intrusion of environmental factors that may interfere with the conclusions. This point is especially critical for plants since their immobility make them very sensitive to even minute changes (light, mineral nutrition, wind, etc.). Basically, and apart from the lab/field point of view, studies can be divided in two:

1. those exposing seeds or seedlings and looking at events (biochemical and growth modifications) that follows the exposure. These had the advantage of using «naive» samples (i.e. with no or limited life history before the exposure) that self-feed on their reserves. They however present the disadvantage of incomplete metabolism and/or limited organ development that may minor interaction with EMR.
2. older or adult plants that present the advantage of fully functional metabolism (in particular the photosynthetic apparatus) and well developed vegetative organs to ensure efficient EMR signal pick-up. These models require however careful handling and constant environmental conditions over the exposure, this can only be achieved effectively in the laboratory.

While the experiments could be easily repeated in laboratory, field experiments could suffer from single observations that it may be difficult or impossible to observe a satisfying equivalent. These approaches should avoid such situation and concentrate on samples that are present similar exposure conditions and symptoms.



d. General and cross-cutting observations

Double-blind experimental procedures are ideal for exposures protocols. Anyway, special attention should be paid to set-up adequate controls and to properly evaluate the level of exposure. Also, the use of communication devices as EMR source should be avoided.

Of the reviews, the majority are not systematic or objective but appear to be unbalanced and asserting a particular world view (i.e. that it is a problem for biodiversity) without strong supporting evidence.

Cryptochromes are particularly interesting as they occur across all groups.

3.3 Key findings: studied organisms and observed effects

a. Invertebrates

Organisms studied for impacts of EMR are the western honey bee (*Apis mellifera*), *Drosophila* flies, specific beetle species, ants and in one/few cases wild pollinators (Diptera, Hymenoptera, Lepidoptera, Coleoptera).

Few, often high quality, published experiments on the fundamental biological responses of insects to naturally occurring electromagnetic fields (or experimentally imposed fields closely mimicking nature or their lack) demonstrate how insects detect and orientate with electrical or magnetic fields and the effects (or lack of) on behaviour, physiological function, reproduction. While providing some mechanistic basis for hypothesis testing, such studies do not provide evidence on effects of anthropogenic sources of EMR on invertebrate biodiversity.

The majority of laboratory studies are focussed on physiological or developmental responses to short-term or acute exposure to experimental sources of EMR. There are no studies that examine effects on invertebrates of long-term or chronic exposure to sources of anthropogenic EMR.

Effects on insects tend to be often complex, typically variable in direction or effect size, and only sometimes adverse. Of the few scientifically rigorous laboratory experiments on model species (i.e. *Drosophila*) there is some evidence of exposure leading to cell damage or effects on individual development, locomotion, or reproduction.

There is a dearth of evidence from scientifically robust field studies, those that are available range from deeply flawed investigations that provide no meaningful evidence to a very restricted number of relatively robust studies albeit of limited scope. Of the latter, there have been studies that have shown some evidence that close proximity to EMR (from mobile phones) can affect honey bee colony behaviour, that exposure to mobile phone antennas can elicit idiosyncratic effects on wild pollinator abundance according to taxon, and no effects on reproductive capacity.

b. Vertebrates

In vertebrates, there is not much agreement on the effect of EMR on ecologically relevant parameters. Studies reporting effects are approximately as frequent as those reporting no effects (50-50%).

Few studies exist on direct ecological effects such as species abundance near RF-towers or in cities where background EMR levels are elevated. The descriptive nature of the studies, however, makes it impossible to detangle real EMR effects from other confounders such as light-pollution. There is some evidence that

animals might avoid strong radiation sources such as radar and mobile phone towers but the few studies do not allow drawing definite conclusions about ecological implications.

Studies on physiological effects lack theoretical foundation which makes them appear as shots in the dark, a scientific practice which is prone to type I errors (finding effects that are not real). The reported findings range from effects on redox reactions and hormone levels to altered nociception and growth rates and malformations during (embryonic) development. Of these, a reducing effect of repeated exposure to a zero magnetic field on nociception seems to be the most established finding, even though completely independent replications are still needed. While many of the observed effects might be real, only strict hypothesis driven research based on a priori established theoretical models will eventually help to identify the RF real effects and the mechanisms underlying them. Dose-effect relationships are missing but as a rule, longer exposures were more often reported to have an effect. Birds comprise the most studied group of vertebrates followed by small rodents such as mice and rabbits. In sum, the findings of RF influence on physiological parameters in vertebrates can be described as contradictory and inconclusive.

By the far the most advanced theoretical foundation concerns the effects of RF fields on magnetic orientation migratory birds. Currently, there is strong evidence that the sensor is based on radical pair intermediates (perhaps in a protein called Cryptochrome) which are naturally sensitive to magnetic fields in the radiofrequency range. It is established that the magnetic compass of migratory birds can be disrupted by the weak RF background in larger cities (nT-intensities) but it is currently unclear which exact frequencies are most effective. Furthermore, some studies have suggested that fields emanating from power lines also affect the magnetic sense of vertebrates but again it is unclear whether this effect is specific to 50Hz-MF or to harmonics or even electric fields. More and more evidence is accumulating that mammals (e.g. bats and mice) have a magnetic sense which might be based on radical-pairs and as such will likewise be affected by RF. It remains to be tested whether disruption of a magnetic compass has real ecological consequences as animals make use of a variety of mechanisms for orientation.

c. Plants

Mainly Angiosperms. Significant changes have been demonstrated at cellular and molecular levels. Changes in oxidative metabolism are quite often reported: increase in peroxidase activity, membrane state. Exposure to low level of 900 MHz (10 min, 5 V/m) caused a rapid increase in stress-related transcript accumulation in tomato. The role of calcium has been characterized in this model by using chelators and by measuring the calmodulin gene expression. Calcium and a normal behaviour of the plant hormone abscisic acid are required to achieve the stress-related transcripts accumulation that occurred in a systemic way in plants; the energy metabolism is also transiently affected (about 30%). The genotoxicity of EMR is also questioned in some article. However additional data are still needed here since these methods could easily bring false positives. Terpene emission was reported to be enhanced by EMR and could also be considered as a marker of stress perception.

The metabolic and/or gene expression changes were not always related to changes in plant growth and development. It is however an excellent way to realize the integration of the EMR perception and responses in the development of the organism. However, several articles report impact on plants growth and development after exposure to EMR. The growth was reported to be reduced, either soon after the exposure or after a delay of several days, when new organs are created.



3.4 Knowledge gaps and research needs

a. Invertebrates

There is a dire need for more ecological studies, which measure the effects of EMR on wild communities. Studies which measure the community responses (abundance, diversity and ecosystem functioning) long-term and ideally pre- and post-exposure would be especially valuable. In order for such studies to be conclusive they would have to be carried out over a wide geographical extent and in different natural and anthropogenic systems. In addition, interdisciplinary collaborations that test hypotheses drawing on what is known about insect physiology to test probable biological and ecological impacts (and avoid speculative ad-hoc approach) at field-realistic exposure could give important insights.

We also need studies that assess chronic effects, as these are more likely to be occurring, as well as experiments that examine the potential interplay between EMR exposure and a) foraging ecology and b) other stressors (e.g. pathogens, environmental pollutants/chemicals) affecting nutritional ecology.

b. Vertebrates

In the field of animal magnetic navigation, knowledge about the definite receptor mechanism mediating the perception of the Earth's magnetic field will greatly facilitate the assessment of the effect of man-made magnetic fields on the ecology of wild migrants. Along the same lines, if it turns out that the receptors are also present in non-migratory species, but that they might fulfil a different function (e.g. in circadian rhythms in case of Cryptochromes) it will need to be assessed whether it still retained remnant magnetosensitivity that might be responsible for physiological effects of man-made magnetic field on organisms.

Studies on the effects on long-term exposure (e.g. throughout development) are needed.

Furthermore, real ecological studies are missing. Do electromagnetic fields have an effect on species populations? In order to reduce confounding effects of other factors, such studies should be performed on small vertebrates with fast reproduction rates under highly controlled conditions in outdoor enclosures as well as on whole communities using gigantic coils or antenna systems or perform meta-analyses on established data-sets by taking RF-data into account. To enable such studies in future, the establishment of fixed RF-measurement stations (e.g. at already established geomagnetic observatories) would be beneficial.

c. Plants

There is the need to improve the quality of the exposure system: to stop using telecom devices and prefer TEM/G-TEM cells and other well-defined devices.

Also, to use reliable markers (enzymatic and/or gene expression) which are both inexpensive and allow to report changes in the behaviour of plants. These markers also bring valuable information of molecular events that occur shortly after exposure. They also allow a better link with the exposure than growth studies that may integrate environmental signals other than EMR, leading to misinterpretations.

Ideally, these biochemical/molecular studies should be completed by growth studies to assess changes at the scale of the whole plant. Field experiments should this way relate symptoms observed to biological/molecular changes.

d. General and cross-cutting observations

- EM set up and quality: some technical standards/parameters that have to be included in future studies (to ensure replication)
- Studies on chronic/long-term exposure (with realistic exposure settings mimicking those in the field)
- Studies should be hypothesis driven, i.e. that should be based on a theoretical framework that allows making predictions of the outcome of the experiment
- Thermal- and non-thermal effects need to be clearly distinguished (exposures should not exceed relevant levels that could be encountered by wildlife in the field)
- Exposure systems that can be used in the field should be further developed

4. Conclusions

4.1 Invertebrates

EMR is an environmental cue detectable by invertebrate physiological mechanisms governing orientation or movement [*established but incomplete*].

EMR from anthropogenic sources (e.g. mobile phones) represent a potential risk to such physiological mechanisms [*established but incomplete*], but current evidence is limited, both by the number and quality of studies [*inconclusive*].

There is some evidence that anthropogenic EMR in laboratory experiments can affect behaviour or reproduction of model insect species such as the fruit fly *Drosophila melanogaster*), although effects are often negligible or inconsistent between studies [*unresolved*].

Currently evidence for effects of EMR on the diversity or abundance of invertebrates is very limited. Few ecological studies exist, but when they do, the reported EMR effects are negligible, contrasting, or cannot be separated from other environmental factors (e.g. land-use) [*inconclusive*].

The majority of experimental and field studies suffered from poor scientific method (e.g. zero or under-replicated, lack of covariate measurements), field-unrealistic exposures to EMR sources, or underreporting of scientific or technical details making evaluation difficult.



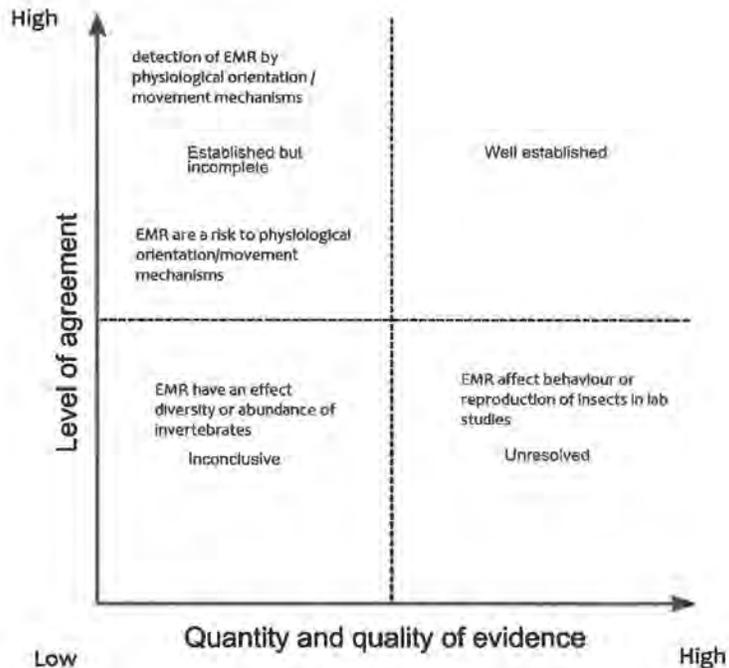


Figure 2 Level of confidence of the statements for the invertebrates

4.2 Vertebrates

Magnetic orientation of birds can be disrupted by weak magnetic fields in the radiofrequency range [*established but incomplete*], the same might be true for the magnetic sense of other vertebrates including mammals [*inconclusive*]. The ecological consequences of this compass disruption are completely unknown [*inconclusive*].

Some evidence points towards an influence of EMR not based on hyperthermia on the embryonic development of birds [*inconclusive*].

EMR seem to have an influence on vertebrate physiology, nociception in particular, but the mechanisms by which physiological effects are mediated are unclear [*unresolved*].

Whether EMR influence species abundance and distribution and thus biodiversity is completely unclear to date [*inconclusive*].

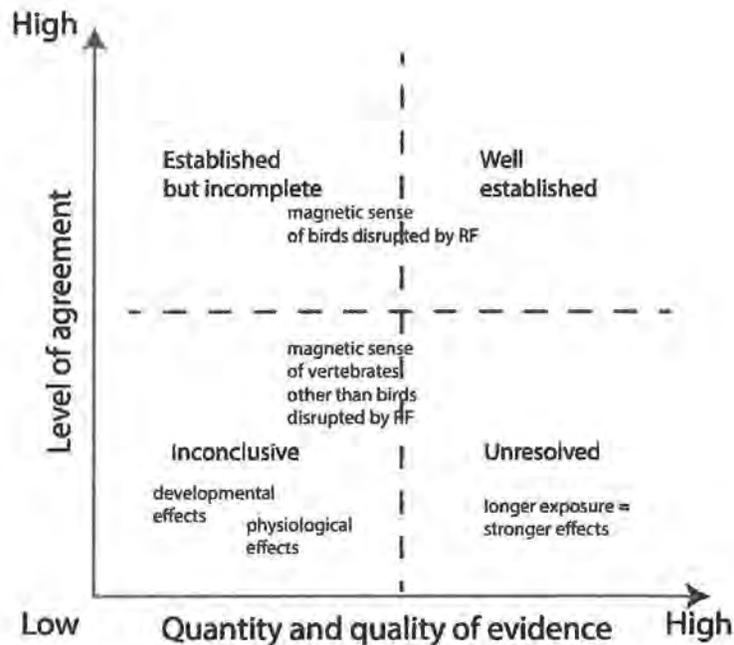


Figure 3 Level of confidence of the statements for the vertebrates

4.3 Plants

Several experiments conducted in laboratory tend to show that plant metabolism is affected by exposure to EMR [*established but incomplete*], particularly the ROS metabolism. However, the diversity of the exposure procedures makes it difficult to construct a clear scheme of what is happening in terms of metabolic changes [*inconclusive/unsolved*] after exposure to EMR. The rationalization of this aspect [*unsolved*] would enable the establishment of consensus by facilitating replications and enrichment of results by different research groups.

The impact of these changes on plant development is generally gathered as a growth reduction [*inconclusive*] but an unequivocal link of these changes with the exposure remains difficult to establish since plant growth integrates many environmental traits that may interfere with the conclusions. This is particularly true for field experiments [*inconclusive*] where the knowledge acquired after laboratory research would help to decipher what kind of symptoms could be truly attributed to EMR effects. Thus, it remains difficult to clearly state the exact impacts of EMR on plants in the real environment with a good level of confidence.



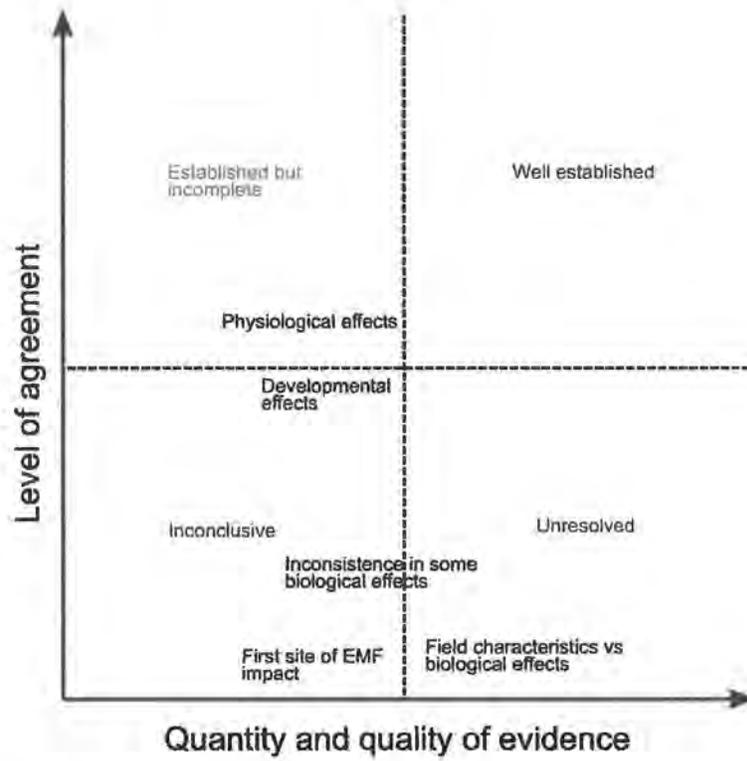


Figure 4 Level of confidence of the statements for the plants

References

- AL-KATHIRI F., AL-RAISI K., AL-HINAI K., AL-DROUSHI M., KHAN M., and NADIR Z. (2016). Impact of RF electromagnetic field on cucumber and tomato plants, 2016 IEEE 7th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), Vancouver, BC, 2016, pp. 1-6.
- BADGER M., ORTEGA-JIMENEZ V.M., VON RABENAU L., SMILEY A., DUDLEY R. (2015). Electrostatic Charge on Flying Hummingbirds and Its Potential Role in Pollination. *PLoS ONE* 10(9): e0138003.
- BAE J.E., BANG S., MIN S., LEE S.H., KWON S.H., LEE Y., LEE Y.H., CHUNG J., CHAE K.S. (2016). Positive geotactic behaviors induced by geomagnetic field in *Drosophila*. *Mol Brain* 9 (1): 55.
- BALMORI A. (2003). The effects of microwave radiation on the wildlife – preliminary results. By Alfonso Balmori Martínez, February 2003.
- BALMORI A. (2006). The incidence of electromagnetic pollution on the amphibian decline: Is this an important piece of the puzzle?. *Toxicological & Environmental Chemistry* 88(2): 287–299.
- BALMORI A. (2009). Electromagnetic pollution from phone masts. Effects on wildlife. *Pathophysiology* 16(2): 191-199.
- BALMORI A. (2010). The incidence of electromagnetic pollution on wild mammals: A new poison with a slow effect on nature? *The Environmentalist* 30(1): 90-97.
- BALMORI A. (2010b). Mobile phone mast effects on common frog (*Rana temporaria*) tadpoles: the city turned into a laboratory. *Electromagnetic Biology and Medicine* 29(1-12): 31-35.
- BALMORI A. (2014). Electrosmog and species conservation. *Science of the Total Environment* 496: 314-316.
- BALMORI A. (2015). Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation. *Science of the Total Environment* 518: 58-60.
- BALMORI A. (2016). Radiotelemetry and wildlife: Highlighting a gap in the knowledge on radiofrequency. *Sci Total Environ* 2016; 543 Pt A: 662-669.
- BALMORI A., HALLBERG Ö. (2007). The urban decline of the house sparrow (*Passer domesticus*): a possible link with electromagnetic radiation. *Electromagnetic Biology and Medicine* 26(2): 141-151.
- BEAUBOIS É., GIRARD S., LALLECHERE S., DAVIES E., PALADIAN F., BONNET P., LEDOIGT G., VIAN A. (2007). Intercellular communication in plants: evidence for two rapidly transmitted systemic signals generated in response to electromagnetic field stimulation in tomato. *Plant, Cell & Environment*, 30: 834–844.
- BEGALL S., MALKEMPER E.P., ČERVENÝ J., NĚMEC P., BURDA H. (2013). Magnetic alignment in mammals and other animals. *Mamm Biol - Z Saugtierkd.* 2013;78(1):10–20.
- BURDA H., BEGALL S., ČERVENÝ J., NĚMEC P. (2009). Extremely low-frequency electromagnetic fields disrupt magnetic alignment of ruminants. *PNAS*, vol. 106, 2009, pp. 5708-13.
- BUSYGINA A.V., KOMNATNOV M.A., MATVEYENKO O.A. (2015). Problems of investigations in sphere of electromagnetic fields impact on biological objects. *IEEE International Conference on Biomedical Engineering and Computational Technologies (SIBIRCON)*, 2015.
- CAMMAERTS M. C. (2017). Is Electromagnetism One of the Causes of the CCD? A Work Plan for Testing This Hypothesis. *Journal of Behavior*, vol. 2, no. 1, 2017, pp. 1006.
- CAMMAERTS M.C., JOHANSSON O. (2014). Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus. *Electromagnetic Biology and Medicine* 33:282–288.
- CAMMAERTS M.C., RACHIDI Z., BELLENS F., DE DONCKER P. (2013). Food collection and response to pheromones in an ant species exposed to electromagnetic radiation. *Electromagnetic Biology and Medicine* 32(3): 315-332.
- CAMMAERTS M.C., VANDENBOSCH G. A. E., VOLSKI V. (2014). Effect of Short-Term GSM Radiation at Representative Levels In Society on a Biological Model: The Ant *Myrmica sabuleti*. *Journal Insect Behaviour* 27 (4): 514-526.
- ČERVENÝ J., BURDA H., JEZEK M., KUSTA T., HUSINEC V., NOVÁKOVÁ P., HART V., HARTOVÁ V., BEGALL S., MALKEMPER, E. P. (2017). Magnetic alignment in warthogs *Phacochoerus africanus* and wild boars *Sus scrofa*. *Mammal Review Jg. Vol. 46* (2016) Nr. Issue 3, ISSN: 1365-2907; 0305-1838.



- CLARKE D., MORLEY E., ROBERT D. (2017). The bee, the flower, and the electric field: electric ecology and aerial electroreception. *Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology*. 2017 Jun 24.
- CLARKE D., WHITNEY H., SUTTON G., ROBERT D. (2013). Detection and learning of floral electric fields by bumblebees. *Science* 340(6128): 66-69.
- CUCURACHI S., TAMIS W.L., VIJVER M.G., PEIJENBURG W.J., BOLTE J.F., DE SNOO G.R. (2013). A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF). *Environment International* 51: 116-140.
- DIMITRIJEVIĆ D., JANAĆ B., Savić T. (2013). Temporal pattern of *Drosophila subobscura* locomotor activity after exposure to extremely low frequency magnetic field (50 Hz, 0.5 mT). *Drosoph Inf Serv* 96: 84-90.
- EDER S.H.K., CADIOU H., MUHAMAD A., MCNAUGHTON P. A., KIRSCHVINK J. L., WINKLHOFER M. (2012). Magnetic characterization of isolated candidate vertebrate magnetoreceptor cells. *Proceedings of the National Academy of Sciences* 109(30): 12022-12027.
- ENGELS S., SCHNEIDER N.-L., LEFELDT N., HEIN C.M., ZAPKA M., MICHALIK A., ELBERS D., KITTEL A., HORE P.J., MOURITSEN H. (2014). Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird. *Nature* 509(7500): 353-356.
- ERDREICH L.S., ALEXANDER D.D., WAGNER M.E., REINEMANN D. (2009) Meta-analysis of stray voltage on dairy cattle. *Journal of Dairy Science*, vol. 92, no. 12, 2009, pp. 5951-63.
- ERNST D.A., LOHMANN K.J. (2016). Effect of magnetic pulses on Caribbean spiny lobsters: implications for magnetoreception. *Journal of Experimental Biology*, vol. 219, pt. 12, pp. 1827-32.
- EVERAERT J., BAUWENS D. (2007). A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding house sparrows (*Passer domesticus*). *Electromagnetic biology and medicine* 26(1): 63-72.
- FAVRE D. (2011). Mobile phone-induced honeybee worker piping. *Apidologie* 42:270-279.
- FERNIE K.J., REYNOLDS S.J. (2005). The effects of electromagnetic fields from power lines on avian reproductive biology and physiology, Review. *Journal of Toxicology and Environmental Health, Part B*, 8:127-140.
- GREGGERS U., KOCH G., SCHMIDT V., DÜRR A., FLORIOU-SERVOU A., PIEPENBROCK D., GÖPFERT M.C., MENZEL R. (2013). Reception and learning of electric fields in bees. *Proceedings of the Royal Society of London* 280(1759): 20130528.
- GRÉMIAUX A., GIRARD S., GUÉRINA V., LOTHIERA J., BALUSKAD F., DAVIES E., BONNET P., VIAN A. (2016). Low-amplitude, high-frequency electromagnetic field exposure causes delayed and reduced growth in *Rosa hybrida*. *Journal of Plant Physiology*, vol 190: 44-53.
- GUERRA P.A., GEGEAR R.J., REPPERT S.M. (2014). A magnetic compass aids monarch butterfly migration. *Nature Communications*, vol. 5, no. 4164, 2014.
- GUSTAVINO B., CARBONI G., PETRILLO R., PAOLUZZI G., SANTOVETTI E., RIZZONI M. (2016). Exposure to 915 MHz radiation induces micronuclei in *Vicia faba* root tips, *Mutagenesis*, vol. 31, no. 2, 2016, pp. 187-92.
- HAGGERTY K. (2010). Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings. *International Journal of Forestry Research*, vol 2010, no. 836278, 2010.
- HALGAMUGE M.N. (2016). Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants. *Electromagnetic Biology and Medicine*, vol. 36, no. 2, 2016, pp. 213-235.
- HALGAMUGE M.N., YAK S.K., EBERHARDT J.L. (2015). Reduced growth of soybean seedlings after exposure to weak microwave radiation from GSM 900 mobile phone and base station. *Bioelectromagnetics*, vol. 36, no. 2, 2015, pp. 87-95.
- HARST W., KUHN J., STEVER H. (2007). Can Electromagnetic Exposure Cause a Change in Behaviour? Studying Possible Non-Thermal Influences on Honey Bees – An Approach within the Framework of Educational Informatics. *Acta Systemica* 6(1), 1-6.

- HÄSSIG M., WULLSCHLEGER M., NAEGELI H., KUPPER J., SPIESS B., KUSTER N., CAPSTICK M., MURBACH M. (2014). Influence of non ionizing radiation of base stations on the activity of redox proteins in bovines. *BMC Vet Res*, vol. 10, no. 136, 2014.
- HISCOCK H.G., MOURITSEN H., MANOLOPOULOS D.E., HORE P.J. (2017). Disruption of Magnetic Compass Orientation in Migratory Birds by Radiofrequency Electromagnetic Fields.
- HISCOCK H.G., WORSTER S., KATTNIG D.R., STEERS C., JIN Y., MANOLOPOULOS D.E., MOURITSEN H., HORE P.J. (2016). The quantum needle of the avian magnetic compass. *PNAS* in press.
- IPBES (2016). The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. S.G. Potts, V. L. Imperatriz-Fonseca, and H. T. Ngo, (eds). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany.
- JANKOWSKA, PAWLOWSKA-MAINVILLE, STANKIEWICZ, ROGALSKA, WYSZKOWSKA (2015). Exposure to 50 Hz electromagnetic field changes the efficiency of the scorpion alpha toxin. *Journal of Venomous Animals and Toxins Including Tropical Diseases* (2015) 21:38.
- KAVOKIN K., CHERNETSOV N., PAKHOMOV A., BOJARINOVA J., KOBYLKOVA D., NAMOZOV B. (2014). Magnetic orientation of garden warblers (*Sylvia borin*) under 1.4 MHz radiofrequency magnetic field. *Journal of the Royal Society, Interface*, vol. 11, no. 97, 2014.
- KIRSCHVINK J.L., WALKER M.M., DIEBEL C.E. (2001). Magnetite-based magnetoreception. *Current Opinion in Neurobiology* 2001, 11(4):462–467.
- KOLBABOVÁ T., MALKEMPER E.P., BARTOŠ L., VANDERSTRAETEN J., TURČÁNI M., BURDA H. (2015). Effect of exposure to extremely low frequency magnetic fields on melatonin levels in calves is seasonally dependent. *Scientific Reports* 5, Article number: 14206 (2015).
- KUMAR N.R., SANGWAN S., BADOTRA P. (2011). Exposure to cell phone radiations produces biochemical changes in worker honey bees. *Toxicology International*, 2011 Jan-Jun; 18(1): 70–72.
- LANDLER L., PAINTER M.S., YOUMANS P.W., HOPKINS W.A., PHILLIPS J.B. (2015). Spontaneous Magnetic Alignment by Yearling Snapping Turtles: Rapid Association of Radio Frequency Dependent Pattern of Magnetic Input with Novel Surroundings. *PLoS ONE* 10(5): e0124728.
- LÁZARO A., CHRONI A., TSCHULIN T., DEVALEZ J., MATSOUKAS C., PETANIDOU T. (2016). Electromagnetic radiation of mobile telecommunication antennas affects the abundance and composition of wild pollinators. *Journal of Insect Conservation* 20(2): 315-324.
- MAKAROV V.I., KHMELINSKII I. (2016). External control of the *Drosophila melanogaster* egg to imago development period by specific combinations of 3D low-frequency electric and magnetic fields. *Electromagn Biol Med* 35 (1): 15-29.
- MALKEMPER E.P., EDER S. H. K., BEGALL S., PHILLIPS J. B., WINKLHOFER M., HART V., BURDA H. (2015) Magnetoreception in the wood mouse (*Apodemus sylvaticus*): influence of weak frequency-modulated radio frequency fields; *Scientific Reports* 5, Article number: 9917 (2015).
- MALKEMPER E.P., PAINTER M.S., LANDLER L. (2016). Shifted magnetic alignment in vertebrates: Evidence for neural lateralization? *Journal of theoretical biology* 399: S. 141 - 147. ISSN: 0022-5193; 1095-8541.
- MALL P., KUMAR Y. (2014). Effect of electromagnetic radiations on brooding, honey production and foraging behavior of European honeybees (*Apis mellifera* L.). *African Journal of Agricultural research* 9(13).
- MARINESCU I., CURCAN G. (2015). The physiological and environmental potential effects of GSM technology. *University of Craiova*, Vol. 16 (new series) – 2014-2015.
- MOSS R.H., SCHNEIDER S.H. (2000). Uncertainties in the IPCC TAR: Recommendations to lead authors for more consistent assessment and reporting. *Guidance Papers on the Cross Cutting Issues of the Third Assessment Report of the IPCC* [eds. R. Pachauri, T. Taniguchi and K. Tanaka], World Meteorological Organization, Geneva, pp. 33-51.].



- NICHOLLS B., RACEY P.A. (2007). Bats Avoid Radar Installations: Could Electromagnetic Fields Deter Bats from Colliding with Wind Turbines? PLOS ONE 2(3): e297.
- NICHOLLS B., RACEY P.A. (2009). The aversive effect of electromagnetic radiation on foraging bats—a possible means of discouraging bats from approaching wind turbines. PLoS One 4(7): e6246.
- PAKHOMOV A., BOJARINOVA J., CHERBUNIN R., CHETVERIKOVA R., GRIGORYEV P.S., KAVOKIN K., KOBYLKOVA D., LUBKOVSKAJA R., CHERNETSOV N. (2017). Very weak oscillating magnetic field disrupts the magnetic compass of songbird migrants. Journal of the Royal Society Interface 14 (133).
- PANAGOPOULOS D.J., BALMORI A. (2017). On the biophysical mechanism of sensing atmospheric discharges by living organisms. Science of the Total Environment 599–600; 2026–2034.
- PANAGOPOULOS D.J., CHAVDOULA E.D., MARGARITIS L.H. (2010). Bioeffects of mobile telephony radiation in relation to its intensity or distance from the antenna. International Journal of Radiation Biology 86(5): 345-357.
- PANAGOPOULOS D.J., CHAVDOULA E.D., NEZIS I.P., MARGARITIS L.H. (2007). Cell death induced by GSM 900-MHz and DCS 1800-MHz mobile telephony radiation. Mutation Research 626(1-2):69-78.
- PANAGOPOULOS D.J., KARABARBOUNIS, MARGARITIS L.H. (2004). Effect of GSM 900-MHz Mobile Phone Radiation on the Reproductive Capacity of *Drosophila melanogaster*. Electromagnetic Biology and Medicine 23(1): 29-43.
- PINZON-RODRIGUEZ A., MUHEIM R. (2017). Zebra Finches Have a Light-dependent Magnetic Compass Similar to Migratory Birds. Journal of Experimental Biology 2017 Apr 1;220(Pt 7):1202-1209.
- POH A., Moghavverni, M., Shafiei, M., Leong, C., Lau, Y., Mahamd Adikan, F., Bakhtiari, M. and Abdulla Hassan, M. (2017). Effects of low-powered RF sweep between 0.01-20 GHz on female *Aedes Aegypti* mosquitoes: A collective behaviour analysis. PLOS ONE, 12(6), p.e0178766.
- POURLIS A.F. (2009). Reproductive and developmental effects of EMF in vertebrate animal models. Pathophysiology 16:179-189.
- PRATO F. (2015) Non-thermal extremely low frequency magnetic field effects on opioid related behaviors: Snails to humans, mechanisms to therapy. Bioelectromagnetics 36:333^348 (2015).
- QURESHI S.T., MEMON S.A., ABASSI A.R., SIAL M.A., BUGHIO F.A. (2017). Radiofrequency radiations induced genotoxic and carcinogenic effects on chickpea (*Cicer arietinum* L.) root tip cells. Saudi Journal of Biological Sciences. Volume 24, Issue 4, May 2017, Pages 883–891.
- ROUX D., VIAN A., GIRARD S., BONNET P., PALADIAN F., DAVIES E., LEDOIGT G. (2006). Electromagnetic fields (900 MHz) evoke consistent molecular responses in tomato plants. Physiologia Plantarum vol 128 issue 2: 283-288.
- ROUX D., VIAN A., GIRARD S., BONNET P., PALADIAN F., DAVIES E., LEDOIGT G. (2008). High frequency (900 MHz) low amplitude (5 V m⁻¹) electromagnetic field: a genuine environmental stimulus that affects transcription, translation, calcium and energy charge in tomato. Planta (2008) 227: 883.
- SAINUDEEN S.S. (2011). Electromagnetic Radiation (EMR) Clashes with Honey Bees. International Journal of Environmental Sciences, Volume 1, No 5, 2011.
- SARAVANAMUTT S., SUDARSANAM D. (2012). Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem-a review. Biology and Medicine. 4: 202.
- SCHWARZE S., SCHNEIDER, REICHL, DREYER, LEFELDT N., ENGELS S., BAKER, HORE, P.J. MOURITSEN H. (2016). Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird (*Erithacus rubecula*) than Strong Narrow-Band Fields. Frontiers in Behavioral Neuroscience, 22 March 2016;10:55.
- SENAVIRATHNA M.D.H.J., ASAEDA T. (2014). The significance of microwaves in the environment and its effect on plants. Environmental Reviews, 2014, 22:220-228, 10.1139/er-2013-0061.
- SENAVIRATHNA M.D.H.J., ASAEDA T., THILAKARATHNE B.L., KADONO H. (2014). Nanometer-scale elongation rate fluctuations in the *Myriophyllum aquaticum* (Parrot feather) stem were altered by radio-frequency electromagnetic radiation. Plant Signaling and Behavior, vol. 9, no. 3, 2014.

- SHARMA V.P., KUMAR N.R. (2010). Changes in honeybee behaviour and biology under the influence of cellphone radiations. *Current science*, 98 (10).
- SOETART M., DECOSTERE A., POLET H., VERSCHUEREN B., CHIERS K. (2014). Electrotrawling: a promising alternative fishing technique warranting further exploration. *Fish and Fisheries* 16: 104–124.
- SORAN M.L., STAN M., NIINEMETS U., COPOLOVICI L. (2014). Influence of microwave frequency electromagnetic radiation on terpene emission and content in aromatic plants. *Journal of Plant Physiology*, vol. 171, no. 15, 2014, pp. 1436-43.
- SPASIĆ S., KESIĆ S., STOJADINOVIĆ G., PETKOVIĆ B., TODOROVIĆ D. (2014). Effects of the static and ELF magnetic fields on the neuronal population activity in *Morimus funereus* (Coleoptera, Cerambycidae) antennal lobe revealed by wavelet analysis. *Comparative Biochemistry and Physiology - Part A Molecular & Integrative Physiology* 181:27-35. November 2014.
- STEFI A.L., MARGARITIS L.H., CHRISTODOULAKIS N.S. (2016) The effect of the non ionizing radiation on cultivated plants of *Arabidopsis thaliana* (Col.) *Flora* 223, 114–120 (2016).
- SUTTON G., CLARKE, D., MORLEY, E., ROBERT, D. (2016). Mechanosensory hairs in bumble bees (*Bombus terrestris*) detect weak electric fields. *Proceedings of the National Academy of Sciences*, 113(26), 7261-7265.
- TAFFOREAU et al. (2004). Plant sensitivity to low intensity 105 GHz electromagnetic radiation. *Bioelectromagnetics*. 25(6):403-407 (2004).
- TIRKEL A.Z., LAI J.C.S., EVANS T.A., RANKIN G.A. (2011). Effects of Millimetre Wave Exposure on Termite Behavior. *PIERS Online*, Vol. 7, No. 2, 171-175, 2011.
- TKALEC et al. (2005). Influence of 400, 900, and 1900 MHz electromagnetic fields on Lemna minor growth and peroxidase activity. *Bioelectromagnetics* 26, 185-193 (2005).
- TODOROVI D., PROLI Z., PETKOVI B., KALAUZI A. (2015). Effects of two different waveforms of ELF MF on bioelectrical activity of antennal lobe neurons of *Morimus funereus* (Insecta, Coleoptera). *Int J Radiat Biol*. 91:435–442.
- TOMANOVA K., VACHA M. (2016). The magnetic orientation of the Antarctic amphipod *Gondogeneia antarctica* is cancelled by very weak radiofrequency fields. *Journal of Experimental Biology* March 2016; 219 Pt 11: 1717-1724.
- VIAN A., DAVIES E., GENDRAUD M., BONNET P. (2016). Plant Responses to High Frequency Electromagnetic Fields. *BioMed Research International*, vol. 2016, Article ID 1830262, 13 pages, 2016.
- VIJVER M.G., BOLTE J.F., EVANS, TAMIS W.L., PEIJNENBURG W.J., MUSTERS, DE SNOO G.R. (2014). Investigating short-term exposure to electromagnetic fields on reproductive capacity of invertebrates in the field situation. *Electromagnetic Biology and Medicine* 33(1):21-28.
- WALDMANN-SELSAM C., BALMORI-DE-LA-PUENTE A., BREUNIG H., BALMORI A. (2016). Radiofrequency radiation injures trees around mobile phone base stations. *Science of the Total Environment* 572: 554-569.
- WAN G., ZHAO Z., XU J., TAO X., SWORD G.A., GAO Y., PAN W & CHEN F. (2014). Bio-effects of near-zero magnetic fields on the growth, development and reproduction of small brown planthopper, *Laodelphax striatellus* and brown planthopper, *Nilaparvata lugens*. *Journal of Insect Physiology* 68:7-15.
- WAN G.J., WANG W.J., XU J.J., YANG Q.F., DAI M.J., ZHANG F.J., SWORD G.A., CHEN P. (2015). Cryptochromes and Hormone Signal Transduction under Near-Zero Magnetic Fields: New Clues to Magnetic Field Effects in a Rice Planthopper. *PLoS ONE* 10(7): e0132966.
- WARD J., SCHULTZ I., WOODRUFF D., ROESIJADI G., COPPING A. (2010). Assessing the Effects of Marine and Hydrokinetic Energy Development on Marine and Estuarine Resources. *Oceans* 2010.
- WU C.L., FU T.F., CHIANG M.H., CHANG Y.W., HER J.L., WU T. (2016). Magnetoreception Regulates Male Courtship Activity in *Drosophila*. *PLoS One* 11 (5): e0155942.
- WYSZKOWSKA J., SHEPHERD S., SHARKH S., JACKSON C.W., NEWLAND P.L. (2016). Exposure to extremely low frequency electromagnetic fields alters the behaviour, physiology and stress protein levels of desert locusts. *Sci Rep*. 2016 Nov 3;6:36413.



- ZAHRADNIK T.D. (2012). PhD thesis: Exploitation of electromagnetic radiation as a foraging cue by conophagous insects. Simon Fraser University, Biological Sciences Department.
- ZAIDI S., KHATOON S., IMRAN, ZOHAIR (2013). Effect of electromagnetic fields (created by high tension lines) on some indigenous species -VII. Mimosaceae, Molluginaceae, Nyctaginaceae and Papilionaceae. Pak. J. Bot., 45(6): 1857-1864, 2013.
- ZHANG Z.Y., ZHANG J., YANG C.J., LIAN H.Y., YU H., HUANG X.M., CAI P. (2016). Coupling Mechanism of Electromagnetic Field and Thermal Stress on *Drosophila melanogaster*. PLoS One 11 (9): e0162675.
- ZMEJKOSKI D., PETKOVIĆ B., PAVKOVIĆ-LUČIĆ S., PROLIĆ Z., ANĐELKOVIĆ M., SAVIĆ T. (2016) Different responses of *Drosophila subobscura* isofemale lines to extremely low frequency magnetic field (50 Hz, 0.5 mT): fitness components and locomotor activity. International Journal of Radiation Biology 93(5):1-29 · December 2016.

Appendix I: Members of the Experts Steering Group

Matt Shardlow (requester)

Buglife is the only organisation in Europe devoted to the conservation of all invertebrates, and we are actively working to save Britain's rarest little animals, everything from bees to beetles, worms to woodlice and jumping spiders to jellyfish. There are more than 40,000 invertebrate species in the UK, and many of these are under threat as never before. Invertebrates are vitally important to a healthy planet – humans and other life forms could not survive without them. The food we eat, the fish we catch, the birds we see, the flowers we smell and the hum of life we hear, simply would not exist without bugs. Invertebrates underpin life on earth and without them the world's ecosystems would collapse.

Prof Mario Babilon (expert)

Prof Babilon got his final degree in physics ("Diplom Physiker") in July, 2001 from the Technical University of Darmstadt. Thereafter he graduated in Nuclear Physics. During that time, he spent one year at Wright Nuclear Structure Lab at YALE University in the United States as a visiting assistant in research. He received his PhD in December 2004 and spent about one more year as a post-doc in Darmstadt, before switching to industry. He started a career in the corporate research department of BOSCH. Meanwhile he was giving lectures at the Cooperative State University in Stuttgart. He completely switched to the University in 2011 and since then he is a Professor in Computer Science.

Dr Erich Pascal Malkemper (expert)

Dr Malkemper is a biologist who received his PhD at the University of Duisburg-Essen in Germany. His thesis "The sensory biology of the red fox – hearing, vision, magnetoreception" was awarded the Fritz-Frank-Award of the German Society for Mammalian Biology in 2015. His research focusses on sensory systems, which he studies with behavioural experiments, histology and physiology, to understand ecological adaptations of a given species. He is currently based at the Research Institute of Molecular Pathology (IMP) in Vienna, Austria, where he conducts research on magnetoreception in homing pigeons.

Dr Benoît Stockbroeckx (expert)

Dr Stockbroeckx received the degree of Electrical Engineer from the Université Catholique de Louvain (UCL), Louvain-la-Neuve, Belgium, in 1993. He received his PhD degree in Applied Sciences in 1998 with a thesis on Space waves and surface waves in the Vivaldi antenna. He is involved in EMF exposure assessments since 1998. He is now the head of laboratory division at ANPI in charge of alarm systems, active fire prevention, theft prevention, CE marking (EMC, LVD, CPR), electromagnetic compatibility. He is also expert at the Belgian Health Council for non-ionising radiations.

Dr Thomas Tscheulin (expert)

Dr Tscheulin, holding a PhD in Population Ecology from Imperial College London, is currently an Assistant Professor at the University of the Aegean, Greece. He has a strong track record of collaborative research, both within and between host institutions in three different European countries. His main research interest is to relate assessments of the abundance, diversity, functional structure and trophic interactions of invertebrates, to the impacts of ecosystem disturbances such as agricultural practices, alien species invasion, climate change, wildfires, habitat loss and degradation. He is an associate editor for Animal Conservation and has so far published 36 scientific papers.



Dr Adam J. Vanbergen (expert)

Dr Adam Vanbergen is an invertebrate ecologist who received his PhD on 'Landscape to host-plant scales: bottom-up heterogeneity affects invertebrate diversity & interactions' from Cardiff University. He has been working for the Centre for Ecology & Hydrology since 1998. His research focusses on species interactions, community structure, and the relationship between biodiversity and ecosystem functions and services. He is particularly interested in understanding how anthropogenic disturbance across spatial scales governs diversity and interactions, above and belowground and at trophic levels directly (herbivores, pollinators) and indirectly (predators, parasites) connected to plants.

Prof Alain Vian (expert)

Prof Vian obtained his PhD in plant physiology at the University Blaise Pascal (1995) under the supervision of Dr Marie-Odile Desbiez, working on plant responses to wounding. He then performed a 2-years postdoctoral period in the laboratory of Prof. Eric Davies (North Carolina State University), working on the rapid molecular events following plant flaming. He obtained an assistant professor position at the university Blaise Pascal (Clermont-Ferrand) and rapidly specialized in plant responses to high frequency electromagnetic field, in collaboration with physicists (Profs Françoise Paladian and Pierre Bonnet). In 2008, he obtained a prize from the French Academy of Sciences for this work. He became full professor in 2009 at the University of Angers and since 2012 has worked in the Institut de Recherche en Horticulture et Semences (UMR 1345), studying the effect of environmental factors (mainly nitrogen nutrition) on the regulation of axillary bud outgrowth, a major event in the establishment of plant architecture. He is also continuing his work on the biological effects of high frequency electromagnetic field on plant development.

Appendix II: Tables with number of assessed studies

Quality of the studies in terms of biological or ecological aspects

Table 1: Invertebrates

Total number of studies on Invertebrates <i>(not including reviews on all taxonomic groups)</i>	39	
Number of studies assessed	39	100%
Number of studies that were irrelevant/bad quality (0)	7	18%
Number of studies of minimum quality (1)	8	21%
Number of studies of normal/medium quality (2)	15	38%
Number of studies of excellent quality (3)	9	23%

Table 2: Vertebrates

Total number of studies on Vertebrates <i>(not including reviews on all taxonomic groups)</i>	20	
Number of studies assessed	20	100%
Number of studies that were irrelevant/bad quality (0)	1	5%
Number of studies of minimum quality (1)	4	20%
Number of studies of normal/medium quality (2)	7	35%
Number of studies of excellent quality (3)	8	40%

Table 3: Plants

Total number of studies on Plants <i>(not including reviews on all taxonomic groups)</i>	23	
Number of studies assessed	20	87%
Number of studies that were irrelevant/bad quality (0)	1	4%
Number of studies of minimum quality (1)	2	9%
Number of studies of normal/medium quality (2)	4	17%
Number of studies of excellent quality (3)	13	57%



Quality of the studies in terms of technical aspects

Table 4: Invertebrates

Total number of studies on Invertebrates <i>(not including reviews on all taxonomic groups)</i>	39	
Number of studies assessed	26	67%
Number of studies that were irrelevant/bad quality (0)	7	18%
Number of studies of minimum quality (1)	2	5%
Number of studies of normal/medium quality (2)	5	13%
Number of studies of excellent quality (3)	12	31%

Table 5: Vertebrates

Total number of studies on Vertebrates <i>(not including reviews on all taxonomic groups)</i>	20	
Number of studies assessed	20	100%
Number of studies that were irrelevant/bad quality (0)	2	10%
Number of studies of minimum quality (1)	7	35%
Number of studies of normal/medium quality (2)	4	20%
Number of studies of excellent quality (3)	7	35%

Table 6: Plants

Total number of studies on Plants <i>(not including reviews on all taxonomic groups)</i>	23	
Number of studies assessed	16	70%
Number of studies that were irrelevant/bad quality (0)	2	9%
Number of studies of minimum quality (1)	3	13%
Number of studies of normal/medium quality (2)	1	4%
Number of studies of excellent quality (3)	10	43%

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The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Report of the web conference

A report of the EKLIPSE project



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A report of the EKLIPSE project

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Report of the EKLIPSE web conference “The impacts of artificial Electromagnetic Radiation on wildlife – fauna and flora”

Authors: Lise GOUDESEUNE, Estelle BALIAN, Jorge VENTOCILLA.

1. Executive Summary

EKLIPSE received in 2016 a request by Buglife to produce an overview of knowledge relating to the impacts of Electromagnetic Radiation (EMR) on wildlife and answered the request via an interactive web conference.

After evaluating and reformulating the question with the requester, EKLIPSE assembled the most recent literature on the topic and established a group of experts in the field to analyse the publications. They produced a preliminary document assessing the quality of the selected studies, pointing out the gaps, and describing the existing knowledge on the topic.

This document was used as the basis for discussions during the web conference that followed. The event included scientists and other stakeholders and was organised in sessions divided by taxonomic group (plants, vertebrates, invertebrates). The participants commented on the work done by the experts, discussed the findings, and developed a list of key research needs and policy recommendations for each taxonomic group.

Next to the specific knowledge gaps and research needs associated to each taxonomic group, several research needs that were common to the different groups were identified and ranked according to their importance, feasibility and contribution. EKLIPSE also extracted general policy recommendations based on the outputs of the participants.

The general message conveyed during the conference was that there is an urgent need to strengthen the scientific basis of the knowledge on EMR and their potential impacts on wildlife. In particular, there is a need to base future research on sound, high-quality, replicable experiments so that credible, transparent and easily accessible evidence can inform society and policy-makers to make decisions and frame their policies.

This report highlights the different steps leading to the organisation of the web conference, the details of the proceedings of the conference itself, as well as a summary of the main results.

2. Introduction and context

2.1 Organisers

EKLIPSE is an H2020 funded project that aims to develop an innovative and self-sustaining EU support mechanism for evidence-based and evidence-informed policy on biodiversity and ecosystem services. A major function covered by EKLIPSE is the identification of research needs and emerging issues. This is done by answering requests from policy, civil society and science. These requests then lead to an in-depth knowledge synthesis, a foresight activity (identification of research gaps and emerging issues), or a societal engagement activity – depending in the nature of the topic of the request.

Buglife is a non-profit organisation in Europe devoted to the conservation of all invertebrates.

Buglife's aim is to halt the extinction of invertebrate species and to achieve sustainable populations of invertebrates.

2.2 Context

Electromagnetic radiations or EMR are a combination of invisible electric and magnetic fields of force that can occur both naturally and due to human activity (anthropogenic EMR).

Anthropogenic EMR are used in a wide range of technologies (namely powerlines, TV/radio broadcasting, Wi-Fi, 2G/3G/4G communications), with their presence expanding in terms of the range of frequencies and the volume of transmissions. An important issue is to explore how current use of EMR is affecting biodiversity and ecosystem services (such as pollination and pest control). A better understanding and awareness of environmental risks from EMR can lead to the development, promotion and implementation of adequate and timely policy frameworks.

The increase of EMR and its potential effects on wildlife has already been identified by an international experts group led by Bill Sutherland as 1 of the 15 emerging issues that could affect global biodiversity but that are not yet well recognised by the scientific community, as reported by their 9th annual horizon scanning exercise for conservation and biodiversity (Sutherland, 2018).

However, the existing community of experts in this field is still very limited, and research tends to be focussed on only a few specific species or taxa, and certain types of radiations. The technical set up and conditions in which the studies are undertaken are often questionable, and there are no common standards or methodologies that can be used to compare and/or reproduce the experiments.

There are a number of policy documents and regulations published related to the risks and effects of EMR¹ but most of them refer to the impacts on human health, very rarely incorporating the effects on animals or plants.

In 2015, a group of international scientists released an appeal to the U.N. calling on them to better assess the risks and protect humans and wildlife from the effects of EMR (EMF, 2015). By 2017 this appeal had been signed by over 230 scientists.

2.3 Introduction to the request

EKLIPSE launched a first "Call for request" in September 2016, inviting decision-makers, practitioners and other stakeholders to submit a proposal with questions affecting biodiversity. The request submitted by Buglife on the impacts of anthropogenic EMR on invertebrates was selected to initiate a process for identifying key knowledge gaps and research needs, as well as to formulate recommendations. Because the corpus of research studies on the impacts of EMR on invertebrates specifically appeared limited, and because of the interest in comparing the effects on different types of organisms, the scope of the request was adjusted and extended to the impacts on vertebrates and plants too. However, it was decided to still exclude the impacts on human health, since humans are differently exposed to radiations and the literature – which is also more extensive - is part of the medical field of research.

¹ At European level, the latest one being the Directive 2013/35/EU of the European Parliament on minimum health and safety requirements regarding the exposure to electromagnetic fields (European Union, 2013). Other policy documents and reports found were mainly published by national agencies.



2.4 Scoping of the literature

A first search for relevant peer-reviewed literature was undertaken by EKLIPSE using ISI Web of Knowledge and Google Scholar using the following combinations of keywords:

- EMR; EMF; electrosmog; electromagnetic field; electromagnetic radiation; electromagnetic

AND

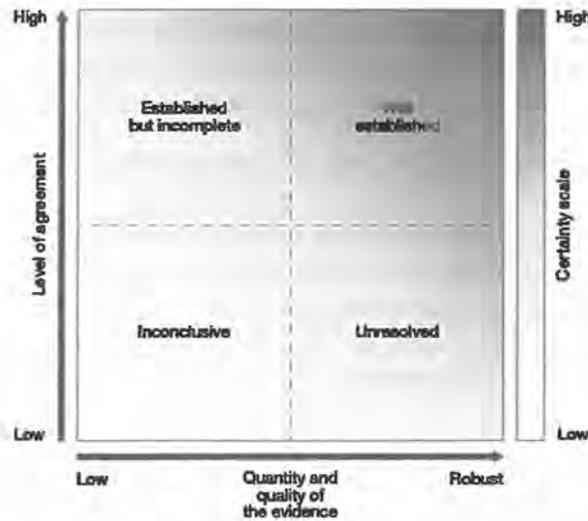
- wildlife; invertebrate(s); vertebrate(s); plant(s); animal(s); insect(s); arthropod(s); bee(s); *Drosophila*; mammal(s); fish; amphibian(s); bird(s); tree(s); flower(s); biodiversity.

Only recent papers (from 2000 onwards) were considered. The publications cited in the identified papers were also examined to complement the list and a further search was done with the names of recurring experts. The aim was not to compile a comprehensive list of references, but to gather a representative set of papers and studies to allow an overview of the current evidence and knowledge gaps. This evidence base was further complemented through a Call for Knowledge to the wider scientific community through the [EKLIPSE KNOCK Forum](#).

2.5 Analyses by the Experts Steering Group

EKLIPSE then invited selected scientists to join the Experts Steering Group to analyse the publications and help prepare the organisation of a consultation through a web conference. The Experts Steering Group was multidisciplinary and was composed of four biologists/ecologists specialised in different taxonomic groups, as well as two physicists having worked with electromagnetic field (see Appendix I: Members of the Experts Steering Group).

In total, 97 of the 147 scientific papers or reviews initially identified were used in the analysis (see the Knowledge framework document, Malkemper et al, 2018). The Expert Steering Group conducted the assessment according to their expertise by dividing the work into three main taxonomic groups (Plants, Vertebrates, Invertebrates). They examined the scientific quality and technical set up of the studies and identified research gaps and needs for each taxonomic group. They also assessed the confidence level of the findings and messages reported in the studies through a qualitative “four-box model” (see Figure 1), adopted from the IPBES (IPBES, 2016), to communicate the level of certainty in knowledge and show how each key message is based on the assessment of the quantity, quality and level of expert agreement in the evidence.



The summary terms to describe the evidence are:

- Well established: comprehensive meta-analysis¹⁰ or other synthesis or multiple independent studies that agree.
- Established but incomplete: general agreement although only a limited number of studies exist but no comprehensive synthesis and, or the studies that exist imprecisely address the question.
- Unresolved: multiple independent studies exist but conclusions do not agree.
- Inconclusive: limited evidence, recognising major knowledge gaps

*Confidence increases towards the top-right corner as suggested by the increasing strength of shading.
Source: modified from Moss and Schneider (2000).*

Figure 1 Four-box model for the qualitative communication of confidence

The experts' findings were compiled into a document that has been used as the basis for discussions during the web conference (see Malkemper et al, 2018).

3. The web conference

3.1 Objectives

EKLIPSE organised its online, interactive web conference from Monday 22nd to Thursday 25th of January 2018. A wide range of experts from different disciplines was selected and invited to discuss the current knowledge on the effects of EMR on wildlife.

The aim was to highlight the current state-of-the-art in this field, to identify knowledge gaps related to the impacts on different taxonomic groups, to discuss the technical aspects and methodologies used in current studies, and to identify and prioritize key research needs and policy recommendations.

The specific objectives of the web conference were to discuss the scope of existing studies, weaknesses and gaps as well as major findings; to identify and prioritize key research needs potentially in relation to current policy needs; and to identify policy recommendations based on current knowledge.



3.2 Format and organisation

To achieve its objectives, EKLIPSE used an innovative, collaborative format where the presentations were kept to a minimum. This meant the focus could be on capturing what the participants thought about the topics - which they explored in 15-20 minute, small-group discussions throughout the conference.

What made this conference different from other virtual conferences was that the ideas and insights from the participants' discussions were able to be recorded and integrated, so they formed the key output of the conference. This outcome was enabled by leveraging two online tools together. Zoom was used as a virtual "plenary room" for the presentations and to split participants in virtual, small discussion groups (5-6 people per group). A collaborative group-work tool from [Covision](#) made it possible for the participants to compile, and send to the facilitator, the ideas and insights they had identified during their discussions. The whole group was then able to see the key ideas that were generated and they could prioritize them through the online polling system.

The conference was organised in five sessions spread over four days (see Appendix II: Agenda of the web conference), with daily sessions of 2 hours:

- Monday 22nd at 16:00 CET for the introduction, framing and opening discussions

Invited expert/presenter: Matt Shardlow, Buglife

- Tuesday 23rd at 13:30 CET for group discussion on Plants

Invited expert/presenter: Prof Alain Vian, University of Angers

- Tuesday 23rd at 16:00 CET for group discussion on Vertebrates

Invited expert/presenter: Dr Pascal Malkemper, Research Institute of Molecular Pathology, Vienna

- Wednesday 24th at 16:00 CET for group discussion on Invertebrates

Invited expert/presenter: Dr Thomas Tschudin, University of the Aegean, and Dr Adam Vanbergen, Centre for Ecology and Hydrology, Edinburgh

- Thursday 25th at 16:00 CET for integration and final plenary recommendations

During the introduction session, a summary of the findings of the experts and the background document were presented, as well as an explanation on the use of the online tools.

The three sessions on each taxonomic group followed the same structure: the appointed expert of the Steering Group presented the findings related to its taxonomic group. The participants were invited to work in small groups three times per session to identify 1/ knowledge gaps (on the basis of the literature review), 2/ research needs, and 3/ policy recommendations. After a process of compiling the key ideas into themes done by EKLIPSE, using the Covision tool, the themes from those discussions were presented back to the participants, so they could vote on what they considered as the most important and relevant elements.

During the final session, a set of transversal research needs/priorities, as well as a set of transversal policy recommendations was compiled by EKLIPSE and presented to the participants who had the opportunity to rank the research needs/priorities according to a selected set of criteria.

3.3 Participants

EKLIPSE conducted a thorough analysis of relevant scientists with direct expertise in the impacts of EMR on wildlife. The scientific community appeared to be rather small and most of the identified researchers had

expertise on a specific taxonomic group but did not specialise on EMR impacts. Nevertheless, EKLIPSE identified over 250 experts who were invited to participate in the web conference. Information about the event was also largely disseminated to the scientific and knowledge community through mailing lists, social media and other communication channels of EKLIPSE and its networks.

During the four days and five sessions of the web conference, a total of 55 participants attended (see Appendix III: List of participants to the web conference), supported by a technical and organisational team of 6 people (see Figure 2).

In total, 19 countries from across the world were represented (see Figure 3).

	TOTAL All sessions	Introduction session 22/1	Plants session 23/1	Vertebrates session 23/1	Invertebrates session 24/1	Closing session 25/1
Participants	61	36	31	35	27	34

Figure 2 Number of participants per session

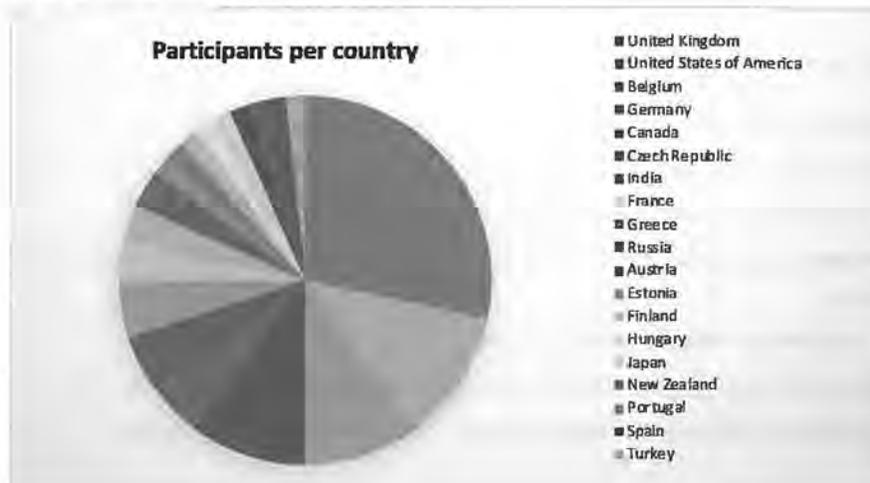


Figure 3 Number of participants per country

From the participants who shared information about themselves (see Figure 4), the large majority identified as scientists, but some also indicated that they work as policy-makers, practitioners, and/or² entrepreneurs on topics related to EMR. The great majority reported being active in the Natural Sciences, compared to only a few experts in Technology/Electrical Engineering, the others being professionals from other fields. A third of them had already at least some experience with studying the effects of EMR, even if mostly the case in the framework of research on specific species or ecosystems of their expertise.

² Participants could indicate more than one field of activity or area of expertise.



Figure 4 Profile of the participants

Current activity		Area of expertise		Experience with EMR	
Scientist/academic	56%	Natural Sciences	69%	Very experienced	25%
Policy-maker	10%	Technology/Electrical engineering	8%	Somewhat experienced	42%
Practitioner	6%	Other	22%	Little experience	11%
Entrepreneur	13%			No experience but interested	22%
Other	15%				

4. Results

4.1 Introduction session

For this first session, the participants were asked to discuss and answer the following question:

“What do you think of the results presented in the background document? What stands out for you? Is there anything missing?”

In general, the participants agreed with the conclusions of the expert group.

The results were compiled into main themes:

- More research is needed on migrating species (e.g. like dragonflies)
- Consider knowledge from local, non-expert people too
- Need for a standardized model and/or standardised criteria for EMR radiation
- Identify the best organisation/people to gather data on EMR effects and agree on a platform to share the knowledge
- Find a way to prioritise the risks related to EMR
- Need for studies that can be replicated to ascertain which results are consistent
- Fill the temporal gap: important research from past decades should be included

4.2 Session on a specific taxonomic group: Plants

The participants were asked to discuss and answer the following question:

“In reviewing the key knowledge gaps in the background document, what stands out for you? Is anything missing?”

The results were compiled into main themes. As a result, the participants pointed out additional knowledge gaps that they perceived should have been included in the background document:

- Older research studies about radar and broadcast transmitters on ecological systems
- Research on the effects on biota of low frequency fields and EM static fields
- To investigate research on positive, stimulating effects of EMR
- Research on synergistic effects of different kinds of EMR in the environment
- Assessments of the effects of "new" frequencies on biodiversity
- More knowledge on the mechanisms of EMR effects on biota

- Overall, more field studies are needed (e.g. to answer questions such as: How do the lab results and EMR relate to the real world? What frequencies are commonly encountered at what power in the real world? How much of a risk?)

Next, participants were asked to discuss and answer the following question:

“Based on the identified knowledge gaps, what do you consider as the most important research needs/priorities?”

The results were compiled into main research needs. After being presented to them, participants were able to vote on the most important ones (up to 3 research needs per participant). The ranking of research needs is shown below with the percentages indicated at the end.

- Standardization and standard methodology for future study designs (21%)
- More and better cooperation between field and lab studies (14%)
- Need to account for confounding/interfering factors in analyses of EMR effects (14%)
- Research on the effects at different levels of biological organisation (ecosystem, population, species) (14%)
- Better understanding of the role of natural EMR as basis for plant growth (10%)
- Research on the impacts of 5G technology and LED lamps (10%)
- Research on the effects of EMR on evolution and co-evolution (7%)
- Research on the impact of EMR on water uptake by plants (5%)
- Study the effects of pulsed radiation (5%)

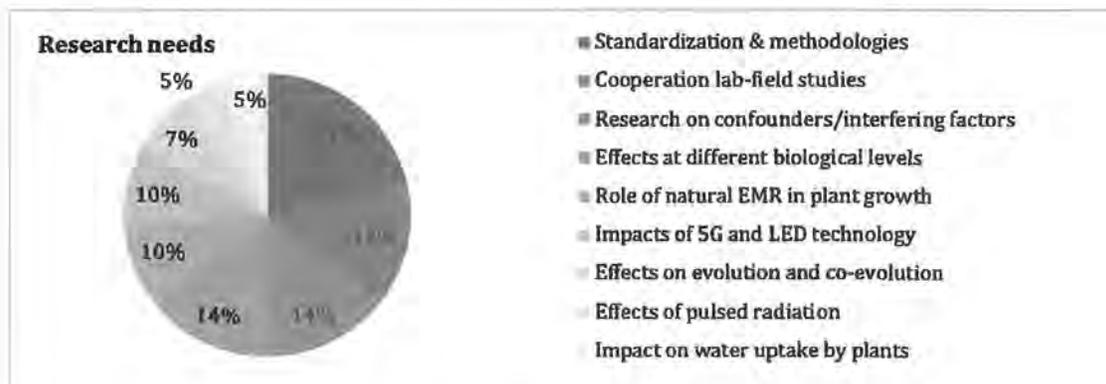


Figure 5 Results of the voting on research needs

Finally, the participants were asked to discuss and answer the following question:

“Based on the knowledge available, what policy recommendations would you propose?”

The results were compiled into main recommendations. After being presented to them, participants were able to vote on the most important ones (up to 2 recommendations per participant). The recommendations are presented below in rank order with percentages indicated.



- Foster cross-institutional/inter-disciplinary collaboration (including leading experts on exposure/dosimetry and biology/ecology) in the studies of EMR effects (46%)
- Define legal limits of EMR (based on scientific results), that will not be harmful to humans and wildlife (25%)
- Ensure knowledge sharing and faster learning through the establishment and use of open databases (14%)
- Use the precautionary principle in relation to EMR and their environmental impacts (14%)
- Develop alternative technology (regarding mobile phones, Wi-Fi) (0%)

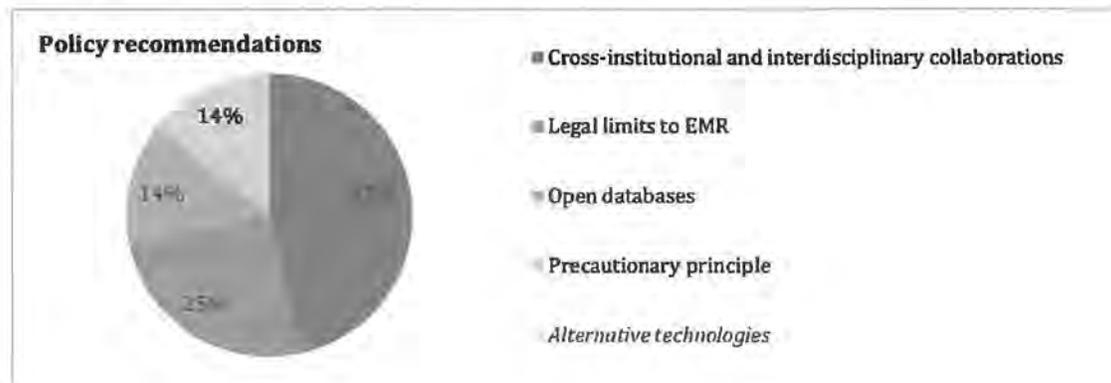


Figure 6 Results of the voting on policy recommendations

4.3 Session on a specific taxonomic group: Vertebrates

The participants were asked to discuss and answer the following question:

“In reviewing the key knowledge gaps in the background document, what stands out for you? Is anything missing?”

The results were compiled into main themes:

Gaps in the background document:

- Studies on lab animals (rodents,...)
- Search with keywords "radio-frequency" and "microwave"
- Older studies (before 2000)

General knowledge gaps:

- Research at the cellular level
- Knowledge about how real-world levels compare to the levels considered in lab experiments
- Studies pertaining to EMR mechanisms & dosimetry of EMR
- Observations from local people

- Rigorous research on animal populations near EMR sources (e.g. cell towers)
- Evidence for population declines of birds that are attributable to EMR

The participants were asked to discuss and answer the following question:

“Based on the identified knowledge gaps, what do you consider as the most important research needs/priorities?”

The results were compiled into main research priorities/needs. After being presented to them, participants were able to vote on the most important ones (up to 4 research needs per participant). The research priorities/needs are presented below in rank order with percentages indicated.

- Better replicated studies and high-quality papers (16%)
- Better understand better the patterns of real world exposure, including dosimetry (14%)
- Organisational coordination to develop standard data models and experimental methodologies, including standard reporting protocol, e.g. around powerful radars (14%)
- Multidisciplinary teams, especially including GIS experts (14%)
- Research of effects of EMR on different levels of biological organisation: at protein level, at genomic level, at assemblage level, etc. (11%)
- Improve understanding of the possible effects of EMR on movement, location and migration of vertebrates in real world situations (9%)
- Inclusion of citizens and consider citizen science approaches to improve knowledge base (7%)
- Research on how different frequencies interact in relation to affecting organisms (5%)
- Standardization of exposure levels and measurements (5%)
- Further explore the research on the Radical-Pair mechanism (4%)
- Establish how the (electro)magnetic sense in birds works (2%)

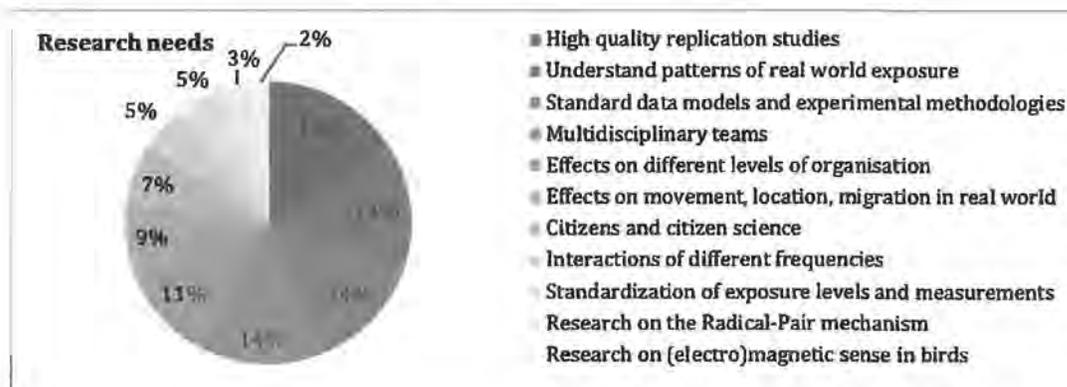


Figure 7 Results of the voting on research needs

Finally, the participants were asked to discuss and answer the following question:

“Based on the knowledge available, what policy recommendations would you propose?”



The results were compiled into main recommendations. After being presented to them, participants were able to vote on the most important ones (up to 4 recommendations per participant). The recommendations are presented below in rank order with percentages indicated.

- More funding available on EMR research (19%)
- Establish a cross-disciplinary platform in order to enhance understanding and foster collaborations between institutions, countries, and disciplines (19%)
- Conduct cross-institutional studies that include cooperation of dosimetry/technical experts and biology experts (13%)
- Find ways to ensure unbiased, independent research preceding deployment (8%)
- Set up advisory groups for governments on research needs and priorities (7%)
- Avoid putting EMR sources (e.g. cell towers) in wildlife areas (7%)
- Apply safe levels and/or exposure limits for EMR exposure (6%)
- Collaborations between nations and encourage young scientists (6%)
- Proper education about the potential risks of EMR, especially in poorer nations (5%)
- Apply the precautionary principle in relation to EMR and their environmental impacts (5%)
- Developers (companies) should fund research, study, and report on the technologies they develop, together with their testing (5%)



Figure 8 Results of the voting on policy recommendations

4.4 Session on a specific taxonomic group: Invertebrates

The participants were asked to discuss and answer the following question:

“In reviewing the key knowledge gaps in the background document, what stands out for you? Is anything missing?”

The results were compiled into main themes:

Gaps in the background document:

- Literature before the year 2000 had not been included

General knowledge gaps:

- Studies on the effects of EMR on aquatic invertebrates, i.e. molluscs, crustaceans, but also studies on other organisms, e.g. bacteria
- Research on the effects of photovoltaics and solar plants on invertebrates
- Research on the effects of EMR on migratory insects (e.g. dragonflies in Portugal, monarchs in North America, etc.)
- Studies into indirect effects on invertebrates via impacts on the plants that are hosting and/or serve as food supply for them
- More field studies

Then, the participants were asked to discuss and answer the following question:

“Based on the identified knowledge gaps, what do you consider as the most important research needs/priorities?”

The results were compiled into main research needs/priorities. After being presented to them, participants were able to vote on the most important ones (up to 3 needs per participant). The research priorities/needs are presented below in rank order with percentages indicated.

- More funding to study EMR impacts on invertebrates (29%)
- Standardised and agreed research methodologies/protocols to facilitate more comparable data (22%)
- Undertake both - laboratory and field work - iteratively, they are complementary (14%)
- Consider the observations of people who are not scientists, but who collectively observe changes. Anecdotal observations can drive experimental science (14%)
- Better understand the risks from EMR to reproduction, behaviour and populations in the field (11%)
- Identify a clear correlation between new types of EMR sources (e.g. cell towers, smart meters) and insect population abundance (6%)
- Use radar stations to investigate the impacts of high levels of EMR in the field (2%)
- Discern light pollution effects from other EMR effects (2%)



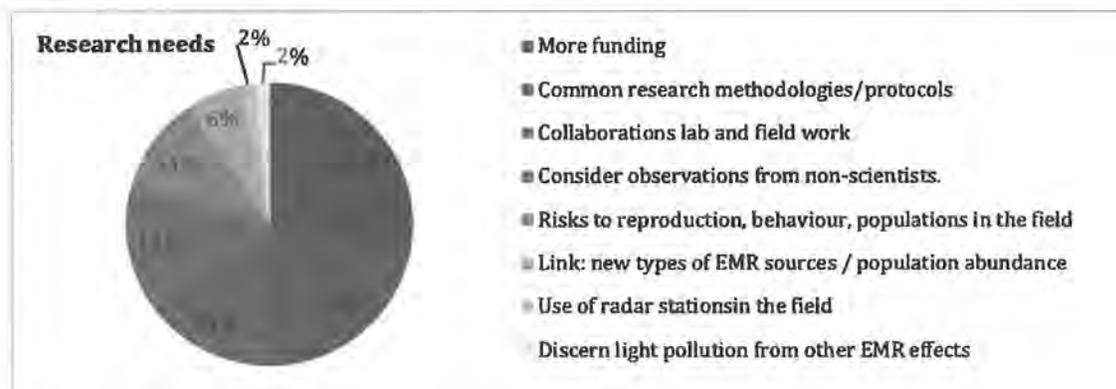


Figure 9 Results of the voting on research needs

Finally, the participants were asked to discuss and answer the following question:

“Based on the knowledge available, what policy recommendations would you propose?”

The results were compiled into main recommendations. After being presented to them, participants were able to vote on the most important ones (up to 3 recommendations per participant). The recommendations are presented below in rank order with percentages indicated.

- Allocate more funding for research on the topic (20%)
- Set up a stakeholders' group, bringing together scientists, industry, etc. to have open discussions on the effects of EMR (17%)
- Use "proof of safety" standards prior to the widespread proliferation/use of new technologies/EMR emissions (13%)
- Prohibit EMR sources such as phone masts in nature reserves (11%)
- Apply the precautionary principle (11%)
- Include EMR when evaluating effects of anthropogenic disturbances (chemicals, pollutants, climate change, etc.) to account for potential negative synergistic effects on invertebrates (11%)
- Identify "No Effect" EMR levels on a range of invertebrates in laboratory conditions and use these to develop Environmental Quality Standards that should not be exceeded (9%)
- Consider ecosystem services provided by invertebrates when developing regulations for EMR (7%)



Figure 10 Results of the voting on policy recommendations

4.5 Session on cross-cutting themes

Based on the results of the discussions from the specific sessions, EKLIPSE compiled a list of research priorities and policy recommendations that were highlighted in the different sessions.

Transversal research needs:

- Develop standardization/methodologies/protocols to better design future studies & compare research results, which could include:
 - Standardisation of EMR types, exposure levels and measurements
 - Common data models, experimental methodologies, protocols
 - Specific methodologies for different taxonomic groups/organisms
 - High-quality research and well-replicated studies to ascertain what are the consistent results
- Set up more field studies, more ecological studies & better integration amongst laboratory studies
- Initiate research on the impacts of new technologies, such as:
 - 5G technology, LED lamps, pulsed radiation, cell towers, smart meters, etc.
- Study the impacts of EMR at different biological organisations/levels, including:
 - On whole ecosystems, at populations' levels, etc.
 - At protein level, at genomic level, at the level of assemblages, etc.
- Account for confounding/interfering factors in analysing the effects of EMR & on how different frequencies interact
- Develop more and better cooperation/collaborations, especially interdisciplinary teams, in particular:
 - Cooperation between different countries, teams, etc.
 - Including GIS experts in studies
- Include observations and knowledge from local people & consider citizen science approaches

The participants were then asked to rate them on a scale from 1 to 5 for the three following criteria:

- The general importance or urgency to address the need



- The feasibility or ease to implement such a study (including the financial feasibility)
- The contribution of the expected results to the knowledge base and to support evidence-based decision-making

The results of the polling were presented with the average score for each research priority, per criteria, (see Figure 11) and depicted in a graphic representation (see Figure 12).

Research needs related to the content of the studies (confounding/interfering factors; impacts at different levels; effects of new technologies) and on how studies should be carried on (standard methodologies; more field studies; collaborations and interdisciplinarity) were considered particularly important and urgent (+ 4.0).

The polling reveals that the feasibility of such studies may appear more complicated to implement (3.0-3.8), especially regarding confounding/interfering factors (2.8).

As for the contribution to knowledge, standardization methods and field studies ranked quite high (+4.00), the other proposed research priorities being viewed as average to good (3.3-3.9), with the exception of local knowledge/citizen science which listed particularly low in the ranking (2.8).

		Importance	Feasibility	Contribution
1	Develop standardization/methodologies/protocols to better design future studies & compare research results	4,20	3,70	4,20
2	Set up more field studies, more ecological studies & better cooperation with lab studies	4,30	3,10	4,00
3	Initiate research on the impacts of new technologies	4,00	3,00	3,30
4	Study the impacts of EMR at different biological organisations/levels	4,40	3,40	3,90
5	Collect data on confounding/interfering factors & on how different frequencies interact	4,50	2,80	3,80
6	Develop more and better cooperation/collaborations, especially interdisciplinary teams	4,40	3,80	3,60
7	Include observations and knowledge from local people & consider citizen science approaches	3,40	3,80	2,80

Figure 11 Average weighting of the assessment of research needs per criteria

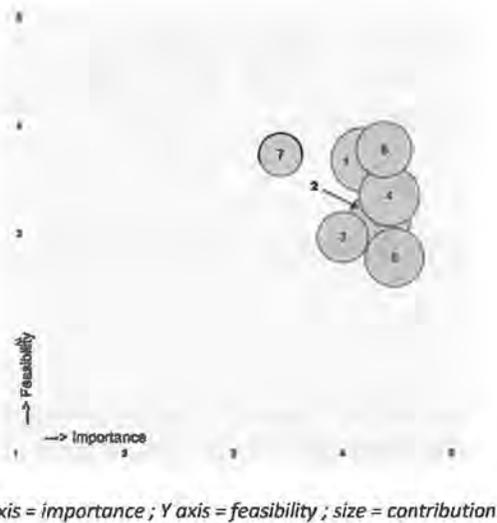


Figure 12 Graphic representation of the assessment of research needs per criteria

Transversal policy recommendations:

- Provide/release more funds for research on the effects of EMR
- Foster research collaborations at different levels, including:
 - Cross-institutional
 - Interdisciplinary (esp. biology/ecology vs technology/dosimetry experts)
 - Facilitate access for younger scientists
 - Between countries
- Enable data sharing and open discussions, in the form of:
 - Open databases
 - Platform for exchanges
 - Advisory group to governments
 - Stakeholders' group composed of companies, researchers, citizens, etc.
 - Adopt common standards

- Apply the precautionary principle for current and new technologies, for example:
 - Define safe levels and exposure limits
 - Avoid EMR sources in wildlife areas
 - Independent research in impacts before deployment
 - “Proof of safety” before widespread use

A word cloud was produced representing the recurring themes and ideas for recommendations to policymakers, whether in the environmental or other sectors (see Figure 13).



Figure 13 Word cloud of recurring themes for policy recommendations

5. Conclusions

The web conference was a success in terms of organisation, as the innovative, interactive tools used enabled an active participation of a very diverse audience from all over the world.

In terms of content, the participants further discussed the current state of knowledge related to the EMR impacts on wildlife, generally, in line with what the experts' group had identified. They contributed by discussing and providing a significant list of knowledge gaps, research needs or priorities and policy recommendations for each taxonomic group.

The most recurring problem in the current scientific studies (in all taxonomic groups) appeared to be the **lack of standardised and controlled technical set-ups** for the experiments and the monitoring of exposure levels and frequencies. The participants suggested several ways to overcome this shortcoming (standard methodologies, protocols, exposure levels and measures, common data models, etc.) to ensure the comparison and replication of the studies. In addition, it would require the **sharing and accessibility of open data** to the research community at large.

Among the other knowledge gaps, there is a need to address **some species or families that are currently being understudied**, but also to better understand the **interactions at different levels**. The participants also suggested potential improvements in the management of the scientific research itself, citing elements such as the importance of including **observations from local people** and the use of **citizen science**; the need for **collaborations** between areas of expertise, or institutions.

A key policy recommendation refers to the urgent need to allocate **more funding to research** on the topic. Participants also emphasized the importance of **bringing together different stakeholders** (not only scientists,

but also policymakers, businesses, citizens, decision makers, etc.) and to set up advisory groups. Finally, some participants recommended to apply the **precautionary principle**, to define and set **safe limits** to EMR exposure, and to **avoid placing EMR sources in nature reserves/wildlife areas**.

In terms of **science-policy interface**, a next step would be to determine more precisely which EMR frequencies and sources appear to have the most significant effects, to characterise the range of impacts, and to scope the scale of their potential effects on wildlife, so that policy and research priorities can be better framed. The current research needs to be grounded in studies with solid data and background to make sure a message, based on correct and verified knowledge, can be conveyed to decision-makers and the society in general.

6. Lessons learnt

In accordance with the “learning by doing” philosophy behind EKLIPSE, the method used for answering the request was adapted during the process. Instead of only being a support for discussions during the web conference, the analyses of the experts’ group provided much more input and answers to the requesters’ question than was initially expected. The web conference participants provided valuable feedback on the work already done and complemented the experts’ findings with new reflections and policy recommendations.

The community related to research on EMR is very limited, and the topic appeared to be very specific and sensitive. Many non-scientists showed an interest in the web conference and some contributed actively to the discussions. However, this specificity might have been better taken into account in the organisation of and the dissemination on the web conference, as it might explain – at least partly – the relatively low numbers of participants. The timing (January) and length (5 sessions of 2 hours) of the event might also not have been ideal and might also explain why fewer people were available than we had hoped.

The technical online tools were very useful but might not be the best option for a small conference aiming to answer specific questions of a very technical and scientific nature. Rather, with its potential to host hundreds of participants and make them work together in breakout groups, these tools would be a perfect fit for large consultation events where the objectives are to bring together a variety of stakeholders (scientists, policy-makers, citizens, businesses,...) around scientific topics and issues.



7. Glossary

Term	Definition
EKLIPSE	EKLIPSE (Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science-Society Interface on Biodiversity and Ecosystem Services) is a H2020 funded project that aims to develop an innovative and self-sustainable EU support mechanism for evidence-based and evidence-informed policy on biodiversity and ecosystem services.
Electromagnetic radiation	Electromagnetic fields (EMF) are a combination of invisible electric and magnetic fields of force. They occur both naturally and due to human activity. Naturally occurring EMF are for example, the earth static magnetic field to which we are constantly exposed, electric fields caused by electrical charges in the clouds or by the static electricity produced when two objects are rubbed together as well as sudden electric and magnetic fields caused by lightning, etc. Man-made electromagnetic fields (EMF) are for example generated by extremely low frequency (ELF) sources, such as power-lines, wiring and appliances as well as by higher frequency sources such as radio and television waves and, more recently, cellular telephones and their antennas. ³
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is the intergovernmental body which assesses the state of biodiversity and of the ecosystem services it provides to society, in response to requests from decision makers.

³ Source: [Greenfacts, 2018](#).

8. References

- EMF (2015). *Press release: International Scientists Appeal to U.N. to Protect Humans and Wildlife from Electromagnetic Fields and Wireless Technology*, 11 May 2015.
- EUROPEAN UNION (2013). *Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC.*, Official Journal of the European Union, 29 June 2013.
- GREENFACTS (2018). *Glossary: Electromagnetic fields (EMF)*. (Available at: <https://www.greenfacts.org/glossary/def/electromagnetic-field-EMF.htm>)
- IPBES (2016). *The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production*. S.G. Potts, V. L. Imperatriz-Fonseca, and H. T. Ngo, (eds). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany.
- MALKEMPER E. P.*, TSCHULIN T.*, VANBERGEN A. J.*, VIAN A.*, BALIAN E., GOUDESEUNE L. (2018). *The impacts of artificial Electromagnetic Radiation on wildlife (flora and fauna). Current knowledge overview: a background document to the web conference*. A report of the EKLIPSE project. (* These authors contribute equally to the work.)
- SUTHERLAND W. J. et al. (2018). *A 2018 Horizon Scan of Emerging Issues for Global Conservation and Biological Diversity*. *Trends in Ecology & Evolution*, 33 (1). 47-58.



Appendix I: Members of the Experts Steering Group

Matt Shardlow (requester)

Buglife is the only organisation in Europe devoted to the conservation of all invertebrates, and we are actively working to save Britain's rarest little animals, everything from bees to beetles, worms to woodlice and jumping spiders to jellyfish. There are more than 40,000 invertebrate species in the UK, and many of these are under threat as never before. Invertebrates are vitally important to a healthy planet – humans and other life forms could not survive without them. The food we eat, the fish we catch, the birds we see, the flowers we smell and the hum of life we hear, simply would not exist without bugs. Invertebrates underpin life on earth and without them the world's ecosystems would collapse.

Prof Mario Babilon (expert)

Prof Babilon got his final degree in physics ("Diplom Physiker") in July, 2001 from the Technical University of Darmstadt. Thereafter he graduated in Nuclear Physics. During that time, he spent one year at Wright Nuclear Structure Lab at YALE University in the United States as a visiting assistant in research. He received his PhD in December 2004 and spent about one more year as a post-doc in Darmstadt, before switching to industry. He started a career in the corporate research department of BOSCH. Meanwhile he was giving lectures at the Cooperative State University in Stuttgart. He completely switched to the University in 2011 and since then he is a Professor in Computer Science.

Dr Erich Pascal Malkemper (expert)

Dr Malkemper is a biologist who received his PhD at the University of Duisburg-Essen in Germany. His thesis "The sensory biology of the red fox – hearing, vision, magnetoreception" was awarded the Fritz-Frank-Award of the German Society for Mammalian Biology in 2015. His research focusses on sensory systems, which he studies with behavioural experiments, histology and physiology, to understand ecological adaptations of a given species. He is currently based at the Research Institute of Molecular Pathology (IMP) in Vienna, Austria, where he conducts research on magnetoreception in homing pigeons.

Dr Benoît Stockbroeckx (expert)

Dr Stockbroeckx received the degree of Electrical Engineer from the Université Catholique de Louvain (UCL), Louvain-la-Neuve, Belgium, in 1993. He received his PhD degree in Applied Sciences in 1998 with a thesis on Space waves and surface waves in the Vivaldi antenna. He is involved in EMF exposure assessments since 1998. He is now the head of laboratory division at ANPI in charge of alarm systems, active fire prevention, theft prevention, CE marking (EMC, LVD, CPR), electromagnetic compatibility. He is also expert at the Belgian Health Council for non-ionising radiations.

Dr Thomas Tscheulin (expert)

Dr Tscheulin, holding a PhD in Population Ecology from Imperial College London, is currently an Assistant Professor at the University of the Aegean, Greece. He has a strong track record of collaborative research, both within and between host institutions in three different European countries. His main research interest is to relate assessments of the abundance, diversity, functional structure and trophic interactions of invertebrates, to the impacts of ecosystem disturbances such as agricultural practices, alien species invasion, climate change, wildfires, habitat loss and degradation. He is an associate editor for Animal Conservation and has so far published 36 scientific papers.

Dr Adam J. Vanbergen (expert)

Dr Adam Vanbergen is an invertebrate ecologist who received his PhD on 'Landscape to host-plant scales: bottom-up heterogeneity affects invertebrate diversity & interactions' from Cardiff University. He has been working for the Centre for Ecology & Hydrology since 1998. His research focusses on species interactions, community structure, and the relationship between biodiversity and ecosystem functions and services. He is particularly interested in understanding how anthropogenic disturbance across spatial scales governs diversity and interactions, above and belowground and at trophic levels directly (herbivores, pollinators) and indirectly (predators, parasites) connected to plants.

Prof Alain Vian (expert)

Prof Vian obtained his PhD in plant physiology at the University Blaise Pascal (1995) under the supervision of Dr Marie-Odile Desbiez, working on plant responses to wounding. He then performed a 2-years postdoctoral period in the laboratory of Prof. Eric Davies (North Carolina State University), working on the rapid molecular events following plant flaming. He obtained an assistant professor position at the university Blaise Pascal (Clermont-Ferrand) and rapidly specialized in plant responses to high frequency electromagnetic field, in collaboration with physicists (Profs Françoise Paladian and Pierre Bonnet). In 2008, he obtained a prize from the French Academy of Sciences for this work. He became full professor in 2009 at the University of Angers and since 2012 has worked in the Institut de Recherche en Horticulture et Semences (UMR 1345), studying the effect of environmental factors (mainly nitrogen nutrition) on the regulation of axillary bud outgrowth, a major event in the establishment of plant architecture. He is also continuing his work on the biological effects of high frequency electromagnetic field on plant development.



Appendix II: Agenda of the web conference

Monday, 22 Jan 2018 // 16:00-18:00 CET // Introduction session

Time	Activity
16:00	Welcome Agenda and concept of the web conference Introduction to EKLIPSE and Buglife Introduction to Covision and the online tools
16:25	Small group discussion: <i>"What expectations do you have for this conference on EMR effects on wildlife?"</i>
16:40	Sharing of the expressed expectations with the audience.
16:50	Presentation of the background document by Lise Goudeseune
17:10	Small group discussion: <i>"What do you think of the results presented in the background document? What stands out for you? Is there anything missing?"</i>
17:30	Sharing of the main ideas with the audience.
17:45	Wrap up and end of the session

Tuesday, 23 Jan 2018 // 13:30-15:30 CET // Session on Plants

Time	Activity
13:30	Introduction
13:35	Presentation of the results of analyses for Plants by Prof Alain Vian
13:55	Small group discussion: <i>"In reviewing the key knowledge gaps in the background document on EMR impacts, what stands out for you? Anything missing?"</i>
14:10	Sharing of the identified knowledge gaps
14:15	Small group discussion: <i>"Based on the identified knowledge gaps, what are the most important research needs/priorities?"</i>
14:40	Small group discussion: <i>"Based on available knowledge, what policy recommendations (environmental or other sectors) would you propose?"</i>
14:55	Sharing of research needs/priorities and voting
15:05	Sharing of policy recommendations and voting
15:15	Summary and closing of the session

Tuesday, 23 Jan 2018 // 16:00-18:00 CET // Session on Vertebrates

Time	Activity
16:00	Introduction
16:05	Presentation of the results of analyses for Vertebrates by Dr Pascal Malkemper
16:25	Small group discussion: <i>"In reviewing the key knowledge gaps in the background document on EMR impacts, what stands out for you? Anything missing?"</i>
16:40	Sharing of the identified knowledge gaps
16:45	Small group discussion: <i>"Based on the identified knowledge gaps, what are the most important research needs/priorities?"</i>
17:10	Small group discussion: <i>"Based on available knowledge, what policy recommendations (environmental or other sectors) would you propose?"</i>
17:25	Sharing of research needs/priorities and voting
17:35	Sharing of policy recommendations and voting
17:45	Summary and closing of the session

Wednesday, 24 Jan 2018 // 16:00-18:00 CET // Session on Invertebrates

Time	Activity
16:00	Introduction
16:05	Presentation of the results of analyses for Invertebrates by Dr Thomas Tscheulin & Dr Adam Vanbergen
16:25	Small group discussion: <i>"In reviewing the key knowledge gaps in the background document on EMR impacts, what stands out for you? Anything missing?"</i>
16:40	Sharing of the identified knowledge gaps
16:45	Small group discussion: <i>"Based on the identified knowledge gaps, what are the most important research needs/priorities?"</i>
17:10	Small group discussion: <i>"Based on available knowledge, what policy recommendations (environmental or other sectors) would you propose?"</i>
17:25	Sharing of research needs/priorities and voting
17:35	Sharing of policy recommendations and voting
17:45	Summary and closing of the session



Thursday, 25 Jan 2018 // 16:00-18:00 CET // Closing session

Time	Activity
16:00	Introduction & summary
16:10	Presentation of the results from the last three sessions
16:25	Presentation of transversal research needs by Lise Goudeseune
16:35	Voting on transversal research needs
16:45	Presentation of transversal policy recommendations by Jorge Ventocilla
16:55	Voting on transversal policy recommendations
17:05	Small group discussion: <i>"What are your final thoughts about the results that have been presented? What should be done next?"</i>
17:20	Sharing of the final thoughts
17:30	Wrap up and closing of the session

Appendix III: List of participants (who agreed to share their information)

Tit le	First name	Last name	Email	Country	Organisation	Position
Dr	Olga	AMEIXA	olga.ameixa@ua.pt	Portugal	University of Aveiro/CESAM	
Dr	Niels	BOEHLING	nboehling@flora-x.de	Germany	ecologist, free	
Mr	James	BUTLER	emfguy@gmail.com	Canada	HomeSafe	President
Dr	Chris	CONNOLLY	c.n.connolly@dundee.ac.uk	United Kingdom	University of Dundee	Reader in Neurobiology
Dr	Suleyman	DASDAG	sdasdag@gmail.com	Turkey	Medical School of Istanbul Medeniyet University	Full Professor
Mr	Fórika	ENDRE	e@eaposztrof.com	Hungary		
Mr	David	GAZDAG	david.gazdag@wildpower.org	United Kingdom	Wild Power	Development Director
Ms	Alison	GIACOMELLI	alison.giacomelli@naturalengland.org.uk	United Kingdom	Natural England	Ornithologist
Ms	Arlene	HOPKINS	arlene.hopkins@gmail.com	United States of America	Arlene Hopkins & associates	Resilience Strategist
Ms	Alise	KARCEVSKA	AKarcevska@clientearth.org	United Kingdom	ClientEarth	Wildlife Intern
Dr	Elizabeth	KELLEY	lkelly_45@msn.com	United States of America	Electromagnetic Safety Alliance	Director
Dr	Francine	KERSHAW	fkershaw@nrdc.org	United States of America	Natural Resources Defense Council	Project Scientist
Dr	Kavindra	KESARI	kavindra.kesari@aalto.fi	Finland	Aalto University	Postdoc
Pr	Afifullah	KHAN	afifkhan@rediffmail.com	India	Department of Wildlife sciences,	Professor



Dr	Tarmo	KOPPEL	tarmo@koppel.e e	Estonia	Aligarh Muslim University Tallinn University of Technology	researcher
Ms	Diana	KORDAS	diana.kordas@ya ndex.com	Greece		
Dr	Horst	KORN	horst.korn@bfn. de	Germany	German Federal Agency for Nature Conservation	Head of International Nature Conservation Unit
Ms	Marie- Anne	LE MOIGNE	marianne.lemoi gne@univ- angers.fr	France	IRHS	PhD student
Dr	Esteban	MANRIQUE REOL	e.manrique@csic .es	Spain	Spanis Research Council - National Museum of Natural Sciences	Research Professor
Mr	Siraj Uddin	MAZUMDER	sirajwls@gmail.c om	India	Aligarh Muslim University	PhD Student
Mr	Lance	MCKEE	lmckee76@gmail .com	United States of America	No organizational affiliation.	Independent writer and researcher
Dr	Michael	PAINTER	painter@fld.czu.c z; mipainte@vt.edu	Czech Republic	Czech University of Life Sciences	Post-Doc
Mr	Alexander	PAKHOMOV	sasha_p.bio@ma il.ru	Russia	Biologocal Station Rybachy, Zoological Institute of RAS	scientific researcher
Ms	Barbara	PAYNE	barbara.payne@i existworld.org	Canada	Electromagnetic Pollution Illnesses Canada Foundation (EPIC) [not for profit organization]	President

Dr	Petr	PETRIK	petrik@ibot.cas.cz	Czech Republic	Institute of Botany, The Czech Academy of Sciences	Senior Researcher
Dr	Blanka	POPHOF	bpophof@bfs.de	Germany	Federal Office for Radiation Protection	scientist
Dr	Mary	REDMAYNE	redmaynereports@gmail.com	New Zealand	Mary Redmayne (Working independently as researcher, educator and consultant)	Director
Pr	Thorsten	RITZ	tritz@uci.edu	United States of America	University of California Irvine	Professor of Physics
Dr	Sivani	SARAVANA MUTTU	sivani.padmakumar@gmail.com	India		Researcher
Dr	Jayasanka	SENAVIRATNA	jayasanka@mail.saitama-u.ac.jp	Japan	Saitama University	Assistant Professor
Dr	Zenon	SIENKIEWICZ	z.sienkiewicz@icnirp.org	United Kingdom	ICNIRP	Member of main commission
Dr	Deborah	STEELE	deborah.steele@defra.gsi.gov.uk	United Kingdom	Defra	Higher Scientific Officer
Mr	Mark	STEELE	mark.steele@reevu.com	United Kingdom	Reevu Worldwide	Chief Technology Officer
Pr	Martin	VACHA	vacha@sci.muni.cz	Czech Republic	Masaryk University	Associated Prof.
Ms	Margreet	VAN DEN BERG	margreet@macberg.com	Canada		independent researcher/writer
Dr	Delny L.	BRITTON	delny.britton@gmail.com	United Kingdom	Ecologist, Homeopath & Writer	
Dr	Cornelia	WALDMANN-SELSAM	dr.waldmannselsam@googlemail.com	Germany	Competence Initiative for the Protection of Humanity, Environment	MD



Dr	Lee	WALKER	leew@ceh.ac.uk	United Kingdom	and Democracy e.V. NERC Centre for Ecology & Hydrology	Vertebrate Ecotoxicologist
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RESOLUTION 18-XXX

FOR USE PERMIT (UP) No. 17-1111 FOR A SITE LOCATED ALONG THE PUBLIC RIGHT-OF-WAY OF THE 700 BLOCK OF FOREST LODGE ROAD, TO ALLOW A NEW POLE OF APPROXIMATELY 29'-6" HEIGHT WITH A SMALL-CELL ANTENNA AND ASSOCIATED WIRELESS TELECOMMUNICATIONS FACILITY EQUIPMENT, INCLUDING THE INSTALLATION OF A METER PEDESTAL AND A TRANSFORMER.

FACTS

1. The subject site is located along the public right-of-way on Forest Lodge Road, Pacific Grove, CA 93950.
2. The site does not have a zoning designation as it is located in the public right-of-way.
3. The site is surrounded by properties in the Commercial-Forest Hill (C-FH) and Unclassified (U) zoning district.
4. The subject site is a 40' wide public right-of-way, which is not developed.
5. A tolling agreement, prepared by Mackenzie & Albritton LLP, has been executed to extend the Federal Communications Commission (FCC) shot clock deadline to August 9, 2018.
6. Wireless telecommunication facilities may be permitted in any district, except the O district, provided a use permit shall first be obtained in each case, per PGMC. Section 23.64.060.

FINDINGS

1. This project has been determined to be Exempt under California Environmental Quality Act (CEQA) Guidelines, Class 3, Section 15303(d); exceptions under Section 15300.2 do not apply.
2. Per PGMC. Section 23.70.080(a)(4):
 - a. The proposed use is allowed with a use permit within the applicable zoning district and complies with all applicable provisions of these regulations, and;
 - b. The proposed use is consistent with the general plan, and;
 - c. The establishment, maintenance, and operation of the use will not, under the circumstances of the particular case, and under the current standards, be detrimental to the health, safety, or general welfare of persons residing or working in the neighborhood of the proposed use, and;
 - d. The use, as described and conditionally approved, will not be detrimental or injurious to property and improvements in the neighborhood or to the general welfare to the city, and;
 - e. The location, size, design, and operating characteristics of the proposed use are compatible with the existing and future land uses in the vicinity.

CONDITIONS OF APPROVAL

1. **Permit Expiration:** This permit is valid for 10 years from the date of issuance. This permit shall expire and be null and void if a building permit has not been applied for within one (1) year from and after the date of approval. Application for extension of this approval must be made prior to the expiration date.
2. **Construction and Use Compliance:** All activities must occur in strict compliance with the proposal as set forth in the application for this Use Permit, subject to any special conditions of approval herein. Any deviation from approvals must be reviewed and approved by staff, and may require Planning Commission approval.
3. **Public Works, Fire, and Building:** Review and approval by the Public Works, Fire and Building Departments are required prior to issuance of a Building Permit. Work taking place in the public right-of-

way shall require an Encroachment Permit prior to issuance of the building permit. The equipment shall be installed, maintained and operated in compliance with all applicable public health and safety regulations, which includes without limitation all building codes, electrical codes, pole installation regulations and regulations for exposure to RF emissions.

4. **Conformance to Plans.** Development of the site shall conform to approved plans for “Pacific Grove HS SC1 – Location Code 425598”, submitted to the Community and Economic Development Department on July 11, 2018, with the exception of any subsequently approved changes. Subsequent changes shall require city approval and may require further CEQA review.
5. **Tree Protection Standards During Construction:** Pursuant to Municipal Code Chapters 12.20 and 12.30, and the Urban Forestry Standards, all trees that are otherwise protected and will be impacted as a result of Development, both proposed for pruning or removal and where the development will impact the critical root zone of the tree are protected. Prior to issuance of the building permit, the Project Arborist shall review grading, drainage, utility, building and landscape plans to determine impacts to individual Trees, to determine required minimum Tree protection standards during construction.
6. **During-Construction Pollution Prevention (a):** During construction, the developer shall employ storm water best management practices (BMPs) for erosion and sediment control, prevention of non-stormwater discharges, and implement good housekeeping and construction waste management practices to protect the storm drainage system and water quality as required by City Code Section 9.30.130(c), the City Phase II NPDES Permit, State Water Resources Control Board (SWRCB) Construction General Permit (CGP), and the Monterey Regional Storm Water Management Program (MRSWMP). Plans for during-construction storm water management and BMPs, such as a Storm Water Pollution Prevention Plan (SWPPP), shall be submitted to the City and subject to review and approval of the Public Works/Community Development Director and Building Official prior to issuance of a grading and/or building permit.
7. **During-Construction Pollution Prevention (b):** Construction activities subject to BMP requirements shall continuously employ measures to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality, contamination, or unauthorized discharge of pollutants.
8. **During-Construction Pollution Prevention (c):** Whenever construction activity is being done contrary to and in violation of Municipal Code Chapter 9.30, the Public Works/Community Development Director may order that construction activity to stop by posting a written notice on the premises. All persons shall immediately stop such work unless or until the public works director authorizes removing the stop work order and allows construction activity to proceed.
9. **Archaeology:** If human remains are encountered during excavations associated with this project, all work will halt, and the County Coroner will be notified. The County Coroner will determine the remains are of forensic interest. If the County Coroner, with the aid of the supervising archaeologist, determines the remains are prehistoric, he/she will contact the Native American Heritage Commission (NAHC). The NAHC will be responsible for designating the most likely descendant (MLD), who will be responsible for the ultimate disposition of the remains, as required by Section 7050.5 of the California Health and Safety Code. The MLD will make his/her recommendations within 24 hours of their notification by the NAHC. This recommendation may include scientific removal and nondestructive analysis of human remains and items associated with Native American burials (Section 7050.5 of the Health and Safety Code). In the event that any other cultural material is encountered during construction of this telecommunications facility, work shall be halted within 50 meters of the find and a qualified archaeologist should be notified. The archaeologist will assess the find and provide mitigation recommendations.

10. Health, Safety and Noise.

- a. Approval from the Monterey County Health Department, Environmental Health Bureau is required prior to the issuance of building permits.
 - b. Safety. The equipment shall be installed, maintained and operated in compliance with all applicable public health and safety regulations, which includes without limitation all building codes, electrical codes, pole installation regulations, and regulations for exposure to Electromagnetic Fields / Radio Frequency under the standards for permissible human exposure to EMF as established by the California Public Utility Commission (CPUC) General Order 159, the Federal Communications Act of 1996, and/or including any other standards adopted by the FCC that may come henceforth. The wireless facility will not be operated if it cannot operate in compliance with these safety conditions.
11. **Signature:** The resolution for the use permit is not valid and construction shall not commence until a copy of the resolution signed by the permittee or authorized agent, acknowledging receipt of the permits and acceptance of the terms and conditions, is returned to the Community Development Department.
 12. **Terms and Conditions:** These terms and conditions shall run with the land, and it is the intention of the Planning Commission and the Permittee to bind all permittees of the subject property to the terms and conditions, unless amended. Amendments to this permit may be achieved only if an application is made, and the Planning Commission approves, any such amendments pursuant to the Zoning Code regulations.
 13. **Conditions of Approval in Plans:** All conditions of approval for the Planning permit(s) shall be printed on a full size sheet and included with the construction plan set submitted to the Building Department.
 14. **Compaction Report:** The permittee shall submit a compaction report prior to paving or repaving, at the expense of the permittee/contractor.
 15. **Undergrounding Utilities:** Accessory utility equipment shall be undergrounded where feasible.
 16. **Traffic Control Plan:** The permittee shall submit a traffic control plan to be approved by the City Engineer.
 17. **Federal Communications Commission (FCC):** The facility shall be operated in full compliance at all times with all applicable Federal Communications Commission guidelines and regulations. Warning signs shall be posted in compliance with FCC guidelines and requirements and to notice about potential exposure to RF emissions.
 18. **Signage:** No logos, signs or other forms of advertising are permitted to be installed on antennas or related equipment, with the exception of warning signs as noted above, and signage that accurately identifies the facility owner and provides the facility owner's unique site number, and also provides a local or toll-free telephone number to contact the facility owner's operations center.
- ## 19. Reports:
- a. The permittee shall submit to the Community & Economic Development Department an annual monitoring report prepared by a licensed electrical/mechanical engineer, expert in the field of EMF/RF emissions, or a licensed Radio Frequency Engineer, and prepared pursuant to FCC OET 65, for the purpose of confirming that the facility is in full compliance with guidelines and regulations for permissible human exposure to EMF/RF, as established by the California Public Utility Commission (CPUC) General Order 159, the Federal Communications Act of 1996, and/or including any other standards adopted by the FCC. This report will be paid for by the permittee, and will be written in plain language understandable to the non-expert layperson.
 - b. The first report shall be due one year from final approval of the building permit required for installation of the equipment. The City of Pacific Grove may require the permittee to prepare additional reports, or

increase the frequency of reports, based on the report's results, or if changes are made to site by the permittee.

20. **Equipment:** No additional antennas or related equipment may be installed without prior approval from the Community & Economic Development Department. The permittee shall remove antennas and equipment that have not been in service for a continuous period of six months.
21. **Road, Sidewalk, and Landscape Condition:** All affected roads, sidewalks, and landscape shall be restored to original or better condition.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF PACIFIC GROVE:

- I. The Commission determines that each of the Findings set forth above is true and correct, and by this reference incorporates those Findings as an integral part of this Permit.
- II. The Commission authorizes approval of Use Permit No. 17-1111 for a site located along the public right-of-way of the 700 block of Forest Lodge Road, to allow a new pole of approximately 29'-6" height with a small-cell antenna and associated wireless telecommunications facility equipment, including the installation of a meter pedestal and a transformer.
- III. This permit shall become effective upon the expiration of the 10-day appeal period and extends for a period of 10 years.
- IV. This permit shall not take effect until the permittee acknowledges and agrees to all terms and conditions and agrees to conform to and comply with those terms and conditions.

PASSED AND ADOPTED BY THE CITY COUNCIL OF THE CITY OF PACIFIC GROVE this 5th day of SEPTEMBER, 2018, by the following vote:

AYES: **XXX**

NOES: **XXX**

ABSENT: **XXX**

APPROVED:

BILL KAMPE, MAYOR

ATTEST:

SANDRA KANDELL, City Clerk

APPROVED AS TO FORM:

DAVID C. LAREDO, City Attorney



NOTICE OF PUBLIC HEARING

CITY OF PACIFIC GROVE

PLANNING COMMISSION

SPECIAL MEETING AGENDA

6:00 p.m., Thursday, July 26, 2018
Council Chambers – City Hall – 300 Forest Avenue, Pacific Grove, CA

1. Call to Order - 6:00 p.m.

2. Roll Call

Commissioners present: Bill Bluhm (Vice-Chair), Jeanne Byrne, Mark Chakwin (Secretary) (arrived 6:03 p.m.), William Fredrickson (Chair), Steven Lilley, Donald Murphy.

Commissioners absent: Robin Aeschliman.

3. Approval of Agenda

On a motion by Commissioner Byrne, seconded by Commissioner Lilley, the Commission voted 5-0-2 (Commissioners Aeschliman and Chakwin absent) to approve the agenda. Motion passed.

4. Approval of Minutes

On a motion by Commissioner Lilley, seconded by Commissioner Byrne, the Commission voted 5-0-2 (Commissioners Aeschliman and Chakwin absent) to approve the minutes of the June 21st Planning Commission meeting. Motion passed.

5. Public Comments

a. Written Communications

None

b. Oral Communications

None

6. Consent Agenda

None.

7. Presentations and Trainings

None.

8. Regular Agenda

a. Application No.: Use Permit (UP) No. 17-1111

Location: Public right-of-way of 600 block of Sunset Drive or public right-of-way of 700 block of Forest Lodge Road, Pacific Grove, CA 93950

Description: To determine a location, and to add a small-cell antenna and associated

wireless telecommunications facility equipment to an existing utility pole, or to add a new pole of approximately 29 feet and 6 inches height with a small-cell antenna and associated wireless telecommunications facility equipment. A meter pedestal up to approximately 4 feet and 6 inches height and a transformer of up to approximately 2 feet height may also be located along the public right-of-way.

Zone District/General Plan Designation: None, public right-of-way

Applicant: Ben Hackstedde of Sequoia Deployment Services, on behalf of Verizon Wireless

CEQA Status: Exempt per CEQA Guidelines, Section 15303, Class 3, New Construction or Conversion of Small Structures

Staff Reference: Wendy Lao, AICP, Associate Planner

Recommended Action: Hold a public hearing to discuss Use Permit Application No. 17-1111, consider three location options and multiple design options, and approve Option 3, subject to recommended findings and conditions, including to underground utility equipment where feasible.

(Please refer to the audio recording for more details.)

Wendy Lao, AICP, Associate Planner, provided a staff report.

The Chair opened the floor to public comments. The following members of the public spoke:

- Steven Lucas spoke against the use permit.
- Gary Bailey spoke against the use permit.
- Katie Ryan spoke against the Use Permit
- Nico Hubbard spoke against the Use Permit
- Toulia Hubbard spoke against the Use Permit
- Dana Jones spoke against the Use Permit
- Karen Locke spoke against the Use Permit
- Brian Swanson spoke against the Use Permit
- Mark Owner spoke against the Use Permit
- Summer Coe spoke against the Use Permit
- David Lemon spoke against the Use Permit
- Nina Beety spoke against the Use Permit
- Debbie Krandall spoke against the Use Permit
- Carol Kuzdenyi spoke against the Use Permit
- Tony Keppelman spoke against the Use Permit

The Chair closed the floor to public comments.

The commission discussed the Use Permit.

William Hammet of Hammet & Edison, Inc., Consulting Engineers, answered questions.

On a motion by Commissioner Byrnes, seconded by Commissioner Chakwin, the

Commission voted 6-0-1 (Commissioner Murphy dissent, Commissioner Aeschliman absent) to determine the project to be exempt from CEQA and find that the exceptions under Section 15300.2 do not apply, and to approve Use Permit Application #17-1111 Option 3 to allow a new pole of approximately 29'-6" height with a small-cell antenna and associated wireless telecommunications facility equipment, including the installation of a meter pedestal and a transformer, along the public right-of-way on Forest Lodge Road, with the following modifications to the draft permit: (change reflected in underline and strikeout)

- 1) Finding 2.C – “The establishment, maintenance, and operation of the use will not, under the circumstances of the particular case, and under the current standards, be detrimental to the health, safety, or general welfare of persons residing or working in the neighborhood of the proposed use, and;”
- 2) Condition of Approval #1 – “Permit Expiration: This permit is valid for 10 years from the date of issuance. This permit shall expire and be null and void if a building permit has not been applied for within one (1) year from and after the date of approval. Application for extension of this approval must be made prior to the expiration date.”
- 3) Condition of Approval #10 – ~~“Monterey County Health Department. Health, Safety and Noise.~~
 - a) Approval from the Monterey County Health Department, Environmental Health Bureau is required prior to the issuance of building permits.
 - b) Safety. The equipment shall be installed, maintained and operated in compliance with all applicable public health and safety regulations, which includes without limitation all building codes, electrical codes, pole installation regulations, and regulations for exposure to Electromagnetic Fields / Radio Frequency under the standards for permissible human exposure to EMF as established by the California Public Utility Commission (CPUC) General Order 159, the Federal Communications Act of 1996, and/or including any other standards adopted by the FCC that may come henceforth. The wireless facility will not be operated if it cannot operate in compliance with these safety conditions.
- 4) Condition of Approval #17 – “Federal Communications Commission (FCC): The facility shall be operated in full compliance at all times with all applicable Federal Communications Commission guidelines and regulations. Warning signs shall be posted in compliance with FCC guidelines and requirements and to notice about potential exposure to RF emissions.”
- 5) Condition of Approval #18 – “Signage: No logos, signs or other forms of advertising are permitted to be installed on antennas or related equipment; with the exception of warning signs as noted above, and signage that accurately identifies the facility owner and provides the facility owner’s unique site number, and also provides a local or toll-free telephone number to contact the facility owner’s operations center.”

- 6) Condition of Approval #19 – “Reports.
 - a) The permittee shall submit to the Community Development Department an annual monitoring report prepared by a licensed electrical/mechanical engineer, expert in the field of EMF/RF emissions, or a licensed Radio Frequency Engineer, and prepared pursuant to FCC OET 65, for the purpose of demonstrating confirming that the facility is in full compliance with guidelines and regulations established by the Federal Communications Commission regarding for permissible human exposure to EMF/RF, as established by the California Public Utility Commission (CPUC) General Order 159, the Federal Communications Act of 1996, and/or including any other standards adopted by the FCC regarding radio-frequency emissions. This report will be paid for by the permittee, and will be written in plain language understandable to the non-expert layperson.
 - b) The report shall be due one year from final approval of the building permit required for installation of the equipment, and any other additional reports may be required. The City of Pacific Grove may require the permittee to prepare additional reports, or increase the frequency of reports, based on the report’s results, or if changes are made to site by the permittee.”
- 7) Resolution #3 - “This permit shall become effective upon the expiration of the 10-day appeal period and extends for a period of 10 years.”

Motion passed.

9. Items to be Continued

a. Zoning Modifications to Off-Street Parking Requirements in Residential Districts

Location: R-1 and R-2 residential zoning districts

CEQA Status: Exempt per CEQA Guidelines, Section 15305, Class 5, Minor Alterations in land Use Limitations

Staff Reference: Mark Brodeur, Director of Community & Economic Development Department

Recommended Action: Forward a recommendation to the City Council to modify the Zoning Code under Chapters 23.16.070 and 23.20.080 to modify the off-street parking regulations in the referenced residential zoning districts.

Item continued to a following meeting.

10. Reports of PC Subcommittees

None

11. Reports of PC Members

(Please refer to the audio recording for more details.)

Commissioner Murphy offered a question for consideration about whether the Report of

the Council Liaison should be heard during the beginning of the meeting or remain at the end of the meeting.

Commissioner Chakwin requested that the Planning Commission consider appointing a subcommittee to guide the drafting of a Wireless Telecom Ordinance.

12. Reports of Council Liaison

City Councilmember and Mayor Pro Tempore, Dr. Robert Huitt provided an update on City Council items.

13. Staff Announcements

Staff provided an update on possible upcoming meeting dates.

14. Adjournment at 8:50 p.m.

**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Verizon Wireless, a personal wireless telecommunications carrier, to evaluate the base station (Site No. 425598 “Pacific Grove HS SC1”) proposed to be located near 740 Forest Lodge Road in Pacific Grove, California, for compliance with appropriate guidelines limiting human exposure to radio frequency (“RF”) electromagnetic fields.

Executive Summary

Verizon proposes to install a cylindrical antenna on top of a new steel pole to be sited near 740 Forest Lodge Road in Pacific Grove. The proposed operation will comply with the FCC guidelines limiting public exposure to RF energy.

Prevailing Exposure Standards

The U.S. Congress requires that the Federal Communications Commission (“FCC”) evaluate its actions for possible significant impact on the environment. A summary of the FCC’s exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. The most restrictive FCC limit for exposures of unlimited duration to radio frequency energy for several personal wireless services are as follows:

Wireless Service	Frequency Band	Occupational Limit	Public Limit
Microwave (Point-to-Point)	5–80 GHz	5.00 mW/cm ²	1.00 mW/cm ²
WiFi (and unlicensed uses)	2–6	5.00	1.00
BRS (Broadband Radio)	2,600 MHz	5.00	1.00
WCS (Wireless Communication)	2,300	5.00	1.00
AWS (Advanced Wireless)	2,100	5.00	1.00
PCS (Personal Communication)	1,950	5.00	1.00
Cellular	870	2.90	0.58
SMR (Specialized Mobile Radio)	855	2.85	0.57
700 MHz	700	2.40	0.48
[most restrictive frequency range]	30–300	1.00	0.20

General Facility Requirements

Base stations typically consist of two distinct parts: the electronic transceivers (also called “radios” or “channels”) that are connected to the traditional wired telephone lines, and the passive antennas that send the wireless signals created by the radios out to be received by individual subscriber units. The transceivers are often located at ground level and are connected to the antennas by coaxial cables. A small antenna for reception of GPS signals is also required, mounted with a clear view of the sky.

**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

Because of the short wavelength of the frequencies assigned by the FCC for wireless services, the antennas require line-of-sight paths for their signals to propagate well and so are installed at some height above ground. The antennas are designed to concentrate their energy toward the horizon, with very little energy wasted toward the sky or the ground. This means that it is generally not possible for exposure conditions to approach the maximum permissible exposure limits without being physically very near the antennas.

Computer Modeling Method

The FCC provides direction for determining compliance in its Office of Engineering and Technology Bulletin No. 65, “Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation,” dated August 1997. Figure 2 describes the calculation methodologies, reflecting the facts that a directional antenna’s radiation pattern is not fully formed at locations very close by (the “near-field” effect) and that at greater distances the power level from an energy source decreases with the square of the distance from it (the “inverse square law”). The conservative nature of this method for evaluating exposure conditions has been verified by numerous field tests.

Site and Facility Description

Based upon information provided by Verizon, including zoning drawings by CELLSITE Concepts, dated July 9, 2018, it is proposed to install one JMA Wireless Model CX06OMI436-0C/8C cylindrical omnidirectional antenna on top of a new 25-foot steel pole to be sited in the public right-of-way on the north side of Forest Lodge Road in Pacific Grove, just south of Pacific Grove High School. The antenna would employ 2° downtilt and would be mounted at an effective height of about 27½ feet above ground. The maximum effective radiated power in any direction would be 2,990 watts, representing simultaneous operation at 1,550 watts for AWS and 1,440 watts for PCS service. There are reported no other wireless telecommunications base stations at the site or nearby.

Study Results

For a person anywhere at ground, the maximum RF exposure level due to the proposed Verizon operation is calculated to be 0.057 mW/cm², which is 5.7% of the applicable public exposure limit. The maximum calculated level at any nearby building* is 17% of the public exposure limit. The maximum calculated level at the second-floor elevation of any building on the school campus† is 1.9% of the public exposure limit. The maximum calculated level at the second-floor elevation of any nearby residence‡ is 0.42% of the public exposure limit. It should be noted that these results include

* Located at least 65 feet away, based on review of photographs from Google Maps.
† Located at least 95 feet away, based on review of photographs from Google Maps.
‡ Located at least 390 feet away, based on review of photographs from Google Maps.

**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

several “worst-case” assumptions and therefore are expected to overstate actual power density levels from the proposed operation.

No Recommended Mitigation Measures

Due to its mounting location and height, the Verizon antenna would not be accessible to unauthorized persons, and so no mitigation measures are necessary to comply with the FCC public exposure guidelines. It is presumed that Verizon will, as an FCC licensee, take adequate steps to ensure that its employees or contractors receive appropriate training and comply with FCC occupational exposure guidelines whenever work is required near the antenna itself.

Conclusion

Based on the information and analysis above, it is the undersigned’s professional opinion that operation of the base station proposed by Verizon Wireless near 740 Forest Lodge Road in Pacific Grove, California, will comply with the prevailing standards for limiting public exposure to radio frequency energy and, therefore, will not for this reason cause a significant impact on the environment. The highest calculated level in publicly accessible areas is much less than the prevailing standards allow for exposures of unlimited duration. This finding is consistent with measurements of actual exposure conditions taken at other operating base stations.

Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration Nos. E-13026 and M-20676, which expire on June 30, 2019. This work has been carried out under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.

July 13, 2018



William F. Hammett

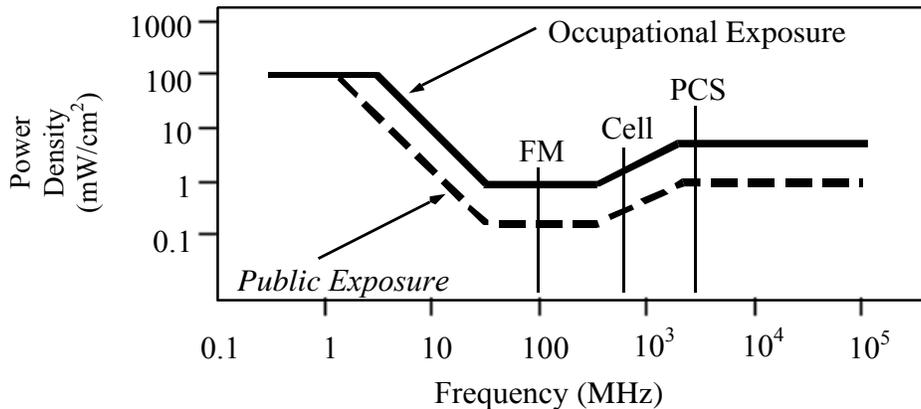
William F. Hammett, P.E.
707/996-5200

FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements (“NCRP”). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

Frequency Applicable Range (MHz)	Electromagnetic Fields (f is frequency of emission in MHz)					
	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm ²)	
0.3 – 1.34	614	<i>614</i>	1.63	<i>1.63</i>	100	<i>100</i>
1.34 – 3.0	614	<i>823.8/f</i>	1.63	<i>2.19/f</i>	100	<i>180/f²</i>
3.0 – 30	1842/f	<i>823.8/f</i>	4.89/f	<i>2.19/f</i>	900/f ²	<i>180/f²</i>
30 – 300	61.4	<i>27.5</i>	0.163	<i>0.0729</i>	1.0	<i>0.2</i>
300 – 1,500	3.54√f	<i>1.59√f</i>	√f/106	<i>√f/238</i>	f/300	<i>f/1500</i>
1,500 – 100,000	137	<i>61.4</i>	0.364	<i>0.163</i>	5.0	<i>1.0</i>



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density $S = \frac{180}{\theta_{BW}} \frac{0.1 \theta_{net} P_{net}}{4\pi D^2 \theta h}$, in mW/cm²,

and for an aperture antenna, maximum power density $S_{max} = \frac{0.1 \theta_{net} 16 \theta P_{net}}{4\pi h^2}$, in mW/cm²,

- where θ_{BW} = half-power beamwidth of the antenna, in degrees, and
- P_{net} = net power input to the antenna, in watts,
- D = distance from antenna, in meters,
- h = aperture height of the antenna, in meters, and
- θ = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

Far Field.

OET-65 gives this formula for calculating power density in the far field of an individual RF source:

power density $S = \frac{2.56 \theta_{net} 1.64 \theta_{net} 100 \theta_{net} RFF^2 \theta_{net} ERP}{4\pi \theta_{net} D^2}$, in mW/cm²,

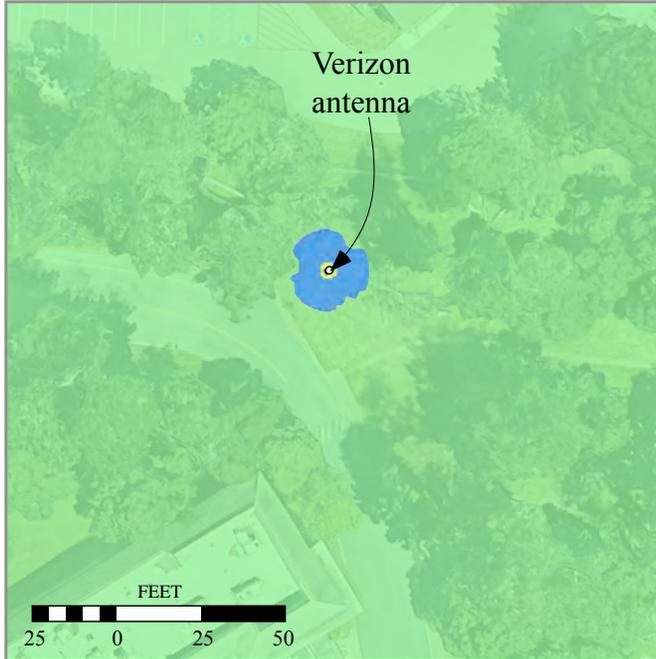
- where ERP = total ERP (all polarizations), in kilowatts,
- RFF = relative field factor at the direction to the actual point of calculation, and
- D = distance from the center of radiation to the point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.

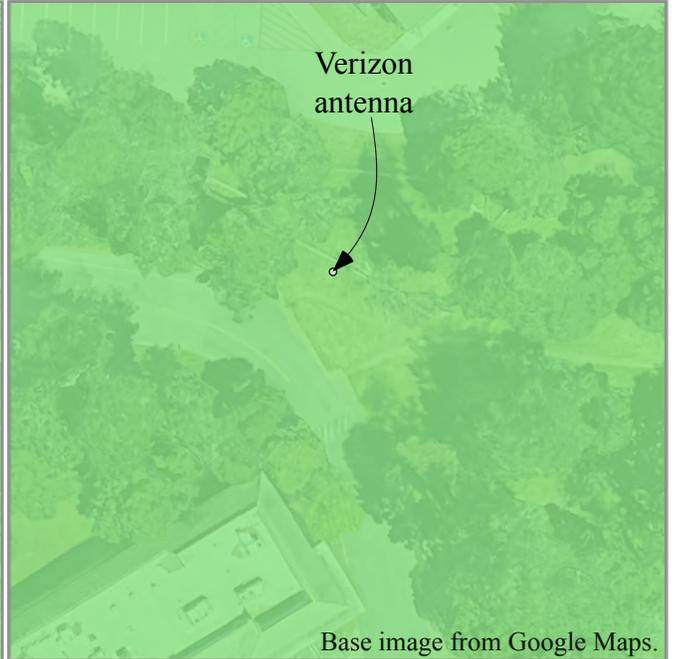
Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”) 740 Forest Lodge Road • Pacific Grove, California

Calculated RF Exposure Levels

in Immediate Airspace (26–29 feet above ground)



at Ground and at Nearby Buildings



Legend:

■	less than FCC Public Limit
■	greater than FCC Public Limit less than FCC Occupational Limit
■	greater than FCC Occupational Limit

Notes: See report dated July 13, 2018.
 Calculations performed according to OET Bulletin No. 65, August 1997.
 Base drawings from CELLSITE Concepts, dated July 9, 2018.

NOTICE OF EXEMPTION FROM CEQA
Use Permit Application #17-1111

ENVIRONMENTAL DETERMINATION:

The City of Pacific Grove Planning Division determined the project is exempt from the California Environmental Quality Act (CEQA) Guidelines (Article 19, Section 15303, Class 3, for “construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures,”) because the project involves the construction of one new pole with wireless communication facility equipment, or the installation of wireless communication facility equipment to be attached onto an existing utility pole, in addition to associated equipment such as a meter pedestal and a transformer.

Furthermore, the project does not qualify for any of the exceptions to the categorical exemptions found at CEQA Guidelines Section 15300.2:

Exception A – “Location. Classes 3, 4, 5, 6, and 11 are qualified by consideration of where the project is to be located – a project that is ordinarily insignificant in its impact on the environment may in a particularly sensitive environment be significant. Therefore, these classes are considered to apply all instances, except where the project may impact on an environment resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.”

Staff comment: The project site is located within an established urban environment and there are no potential issues related to an environmental resource of hazardous or critical concern. Furthermore, the project is not located within or near an environmental resource of hazardous or critical concern that has been designated, precisely mapped, or officially adopted pursuant to law by federal, state, or local agencies. The project site is not located adjacent to any historical properties.

Exception B – “Cumulative Impact. All exemptions for these classes are inapplicable when the cumulative impact of successive projects of the same type in the same place, over time is significant.”

Staff comment: The project site is located within an established urban environment. The applicant is proposing only one wireless communication facility. Furthermore, a permit condition of approval states, “Subsequent changes shall require city approval and may require further CEQA review.” The project does not pose a foreseeable environmental impact. No future addition is imminent or can be considered reasonably foreseeable. Therefore, no cumulative effect is anticipated.

Exception C – “Significant Effect. A categorical exemption shall not be used for an activity where there is a reasonable possibility that the activity will have a significant effect on the environment due to unusual circumstances.”

Staff comment: The project site is located within an established urban environment where utility poles with small wireless telecommunication facility equipment attached onto the pole or nearby are a commonplace feature. The City of Pacific Grove’s Fire Chief is not aware of any data classifying wireless telecommunication facility equipment

as causing or contributing to a fire hazard. Therefore, there are no unusual environmental circumstances.

Exception D – “Scenic Highways. A categorical exemption shall not be used for a project which may result in damage to scenic resources, including but not limited to, trees, historic buildings, rock outcroppings, or similar resources, within a highway officially designated as a state scenic highway. This does not apply to improvements which are required as mitigation by an adopted negative declaration or certified EIR.”

Staff comment: The project site is not located on, nor is it visible from, a designated state scenic highway. Highway 68 includes a portion of Sunset Drive. However, according to Caltrans, only the 14 mile portion of Highway 68 from State Route 1 in Monterey to the Salinas River is designated by Caltrans as a scenic highway and included in the State Scenic Highway System.

Exception E – “Hazardous Waste Sites. A categorical exemption shall not be used for a project located on a site which is included on any list compiled pursuant to Section 65962.5 of the Government Code.”

Staff comment: The project site is not located on a hazardous waste site pursuant to Government Code Section 65962.5.

Exception F – “Historical Resources. A categorical exemption shall not be used for a project which may cause a substantially adverse change in the significance of a historical resource.”

Staff comment: As the project site does not contain any historical resource, and is not located adjacent to any historical resources, there will not be any substantial adverse change in the significance of a historical resource.

CONCLUSION

For the reasons described above, the proposed project qualifies for a categorical exemption under Class 3, and no further environmental analysis is required.



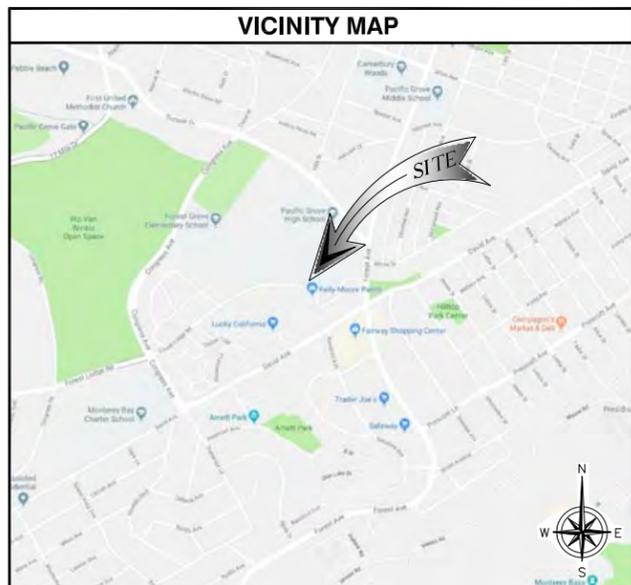
2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598



22471 ASPAN STREET, STE 290
LAKE FOREST, CA 92630



10650 SCRIPPS RANCH BLVD., SUITE 224
SAN DIEGO, CA 92131
tel: (858) 433-7173 / (858) 433-7176



verizon

**PROJECT TYPE: SMALL CELL
PACIFIC GROVE HS SC1
ROW NEAR 740 FOREST LODGE RD.
PACIFIC GROVE, CA 93950**

LOCATION CODE: 425598

SITE INFORMATION

POLE OWNER: VERIZON WIRELESS
ADDRESS: 2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598

APPLICANT: VERIZON WIRELESS
ADDRESS: 2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598

LATITUDE (NAD 83): 36°36'32.42" N
LONGITUDE (NAD 83): 121°55'27.73" W
GROUND ELEVATION: 285.00' AMSL
ZONING JURISDICTION: COUNTY OF MONTEREY
PROPOSED USE: UNMANNED TELECOMMUNICATIONS FACILITY

PROJECT TEAM

APPLICANT:
VERIZON WIRELESS
2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598
CONTACT: JORDAN THOMPSON
PHONE: (925) 895-1668
EMAIL: jordan.thompson@verizonwireless.com

SITE ACQUISITION:
SEQUOIA DEPLOYMENT SERVICES, INC.
22471 ASPAN, SUITE #290
LAKE FOREST, CA 92630
CONTACT: ROBERT BALLMAIER
PHONE: (949) 278-7747
EMAIL: bob.ballmaier@sequoia-ds.com

RF ENGINEER:
VERIZON WIRELESS
2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598
CONTACT: STEFANO IACHELLA
PHONE: (510) 381-2904
EMAIL: stefano.iachella@verizonwireless.com

ZONING:
SEQUOIA DEPLOYMENT SERVICES, INC.
22471 ASPAN, SUITE #290
LAKE FOREST, CA 92630
CONTACT: BEN HACKSTEDDE
PHONE: (949) 259-3344
EMAIL: ben.hackstedde@sequoia-ds.com

ARCHITECT/ENGINEERING:
CELLSITE CONCEPTS
10650 SCRIPPS RANCH BLVD., SUITE 224
SAN DIEGO, CA 92131
CONTACT: REGGIE GABRIEL
PHONE: (619) 200-7190
EMAIL: reggie.gabriel@cellsite.net

CONSTRUCTION:
SEQUOIA DEPLOYMENT SERVICES, INC.
22471 ASPAN, SUITE #290
LAKE FOREST, CA 92630
CONTACT: ESI LIEGE
PHONE: (714) 697-6600
EMAIL: esi.liege@sequoia-ds.com

APPROVALS

THE FOLLOWING PARTIES HEREBY APPROVE AND ACCEPT THESE DOCUMENTS & AUTHORIZE THE SUBCONTRACTOR TO PROCEED WITH THE CONSTRUCTION DESCRIBED HEREIN. ALL DOCUMENTS ARE SUBJECT TO REVIEW BY THE LOCAL BUILDING DEPARTMENT & MAY IMPOSE CHANGES OR MODIFICATIONS.

VZW PROJECT MANAGER: _____
VZW RF ENGINEER: _____
VZW EQUIPMENT ENGINEER: _____
VZW CONSTRUCTION MANAGER: _____
PLANNING MANAGER: _____
SITE ACQUISITION MANAGER: _____
A/E MANAGER: _____

DRAWING INDEX	
SHEET NO:	SHEET TITLE
T-1	TITLE SHEET
LS-1	TOPOGRAPHIC SURVEY
LS-2	TOPOGRAPHIC SURVEY
A-1	SITE PLAN
A-2	ENLARGED SITE PLAN, EQUIPMENT AND ANTENNA LAYOUT
A-3	ARCHITECTURAL ELEVATIONS

PROJECT DESCRIPTION

THE PROJECT CONSISTS OF INSTALLATIONS OF TELECOMMUNICATIONS EQUIPMENT FOR VERIZON WIRELESS TO COLLOCATE IN PUBLIC RIGHT-OF-WAY THE INSTALLATIONS ENTAILS:

- INSTALL (1) PROPOSED VERIZON WIRELESS 4"-0" HIGH CYLINDRICAL ANTENNA ON POLE
- INSTALL (1) PROPOSED VERIZON WIRELESS ANTENNA POLE TOP MOUNTING SKIRT
- INSTALL (1) PROPOSED VERIZON WIRELESS 24"-6" STEEL POLE
- INSTALL (1) PROPOSED VERIZON WIRELESS EQUIPMENT SHROUD ON POLE
- INSTALL (2) PROPOSED VERIZON WIRELESS REMOTE RADIO UNITS (RRUS) IN EQUIPMENT SHROUD
- INSTALL (2) PROPOSED VERIZON WIRELESS PSU UNITS IN EQUIPMENT SHROUD
- INSTALL (1) PROPOSED VERIZON WIRELESS DUAL DIPLEXER IN EQUIPMENT SHROUD
- INSTALL (1) PROPOSED VERIZON WIRELESS FIBER PATCH PANEL IN EQUIPMENT SHROUD
- INSTALL (1) PROPOSED VERIZON WIRELESS METER PEDESTAL

APPLICABLE CODES

ALL WORK AND MATERIALS SHALL BE PERFORMED AND INSTALLED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE FOLLOWING CODES AS ADOPTED BY THE LOCAL GOVERNING AUTHORITIES.

- CALIFORNIA ADMINISTRATIVE CODE (INCL TITLE 24 & 25)
- 2016 CALIFORNIA BUILDING CODE
- LOCAL BUILDING CODE
- CITY/COUNTY ORDINANCES
- ANSI/EIA-222-G LIFE SAFETY CODE NFPA-101
- 2016 CALIFORNIA ELECTRICAL CODE
- CA PUBLIC UTILITIES COMMISSION GENERAL ORDER 95 (GO 95)

DO NOT SCALE DRAWINGS

SUBCONTRACTOR SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS & FIELD CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME. IF USING "11"X17" PLOT, DRAWINGS WILL BE HALF SCALE.

811 Dig Alert
Know what's below.
Call before you dig.
Call Two Working Days Before You Dig!
811 / 800-227-2600
digalert.org

GENERAL NOTES

- LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. NEITHER THE OWNER NOR THE ENGINEER ASSUMES ANY RESPONSIBILITY FOR UTILITIES OR STRUCTURES NOT SHOWN OR NOT IN THE LOCATION SHOWN ON THE DRAWINGS.
- THE CONTRACTORS SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE, OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
- APPROVAL OF THESE PLANS BY THE CITY ENGINEER DOES NOT AUTHORIZE ANY WORK TO BE PERFORMED UNTIL A PERMIT HAS BEEN ISSUED.
- UPON ISSUANCE OF A PERMIT, NO WORK WILL BE PERMITTED ON WEEKENDS OR HOLIDAYS WITHOUT PERMISSION FROM THE ENGINEERING DEPARTMENT.
- THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT FROM DAMAGING EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE. CONTRACTOR SHALL, AT HIS OWN EXPENSE, REPAIR, REPLACE OR RECONSTRUCT ALL SUCH IMPROVEMENTS OR OTHER STRUCTURES DAMAGED BY HIS WORK, TO THE ENGINEER'S SATISFACTION.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SURVEY MONUMENTS AND/OR VERTICAL CONTROL BENCHMARKS WHICH ARE DISTURBED OR DESTROYED BY CONSTRUCTION. A LAND SURVEYOR MUST FILE LOCATE, REFERENCE, AND/OR PRESERVE ALL HISTORICAL OR CONTROLLING MONUMENTS PRIOR TO ANY EARTHWORK. IF DESTROYED, SUCH MONUMENTS SHALL BE REPLACED WITH APPROPRIATE MONUMENTS BY A LAND SURVEYOR. A CORNER RECORD OF SURVEY, AS APPROPRIATE, SHALL BE FIELD AS REQUIRED BY THE PROFESSIONAL LAND SURVEYORS ACT. IF ANY VERTICAL CONTROL IS TO BE DISTURBED OR DESTROYED, THE JURISDICTION'S FIELD SURVEY DIVISION MUST BE NOTIFIED, IN WRITING, AT LEAST 3 DAYS FROM OCCURRENCE, THE CONTRACTOR WILL BE RESPONSIBLE FOR THE COST OF REPLACING ANY VERTICAL CONTROL BENCHMARKS DESTROYED BY THE CONSTRUCTION.
- CONTRACTOR SHALL BE RESPONSIBLE FOR THE POTHOLE AND LOCATING OF ALL EXISTING UTILITIES THAT CROSS THE PROPOSED TRENCH LINE AND MUST MAINTAIN 1 FOOT MINIMUM VERTICAL CLEARANCE.
- DO NOT EXCAVATE OR DISTURB BEYOND THE PROPERTY LINES OR LEASE LINES, UNLESS OTHERWISE NOTED.
- CONTRACTOR SHALL REPLACE OR REPAIR ALL TRAFFIC SIGNAL LOOPS, CONDUIT, AND LANE STRIPPING DAMAGED DURING CONSTRUCTION.
- CONTRACTOR SHALL NOTIFY THE JURISDICTION. A MINIMUM OF 46 HOURS PRIOR TO COMMENCING WORK WITHIN 10 FEET OF ALL SEWER, WATER, AND STORM DRAIN MAIN INCLUDING ALL CROSSINGS.
- "PUBLIC IMPROVEMENT SUBJECT TO DESUETUDE OR DAMAGE." IF REPAIR OR REPLACEMENT OF SUCH PUBLIC IMPROVEMENTS IS REQUIRED, THE OWNER SHALL OBTAIN THE REQUIRED PERMITS FOR WORK IN PUBLIC RIGHT-OF-WAY, SATISFACTORY TO THE PERMIT-ISSUING AUTHORITY.
- THE CONTRACTOR SHALL MAKE ARRANGEMENTS FOR A PRE-CONSTRUCTION MEETING WITH THE CITY FIELD ENGINEERING DIVISION PRIOR TO ANY DISTURBANCE TO THE SITE, EXCLUDING UTILITY MARK-OUTS AND SURVEYING.
- MANHOLES OR COVERS SHALL BE LABELLED "NAME OF COMPANY".
- CONTRACTOR SHALL IMPLEMENT AN EROSION AND SEDIMENT CONTROL PROGRAM DURING THE PROJECT CONSTRUCTION ACTIVITIES. THE PROGRAM SHALL MEET THE APPLICABLE REQUIREMENTS OF THE STATE WATER RESOURCE CONTROL BOARD.
- THE CONTRACTOR SHALL HAVE EMERGENCY MATERIALS AND EQUIPMENT ON HAND FOR UNFORESEEN SITUATIONS, SUCH AS DAMAGE TO UNDERGROUND WATER, SEWER, AND STORM DRAIN FACILITIES WHEREBY FLOWS MAY GENERATE EROSION AND SEDIMENT POLLUTION.
- THE CONTRACTOR SHALL VERIFY LOCATION ALL EXISTING UNDERGROUND UTILITIES INCLUDING SEWER LATERALS & WATER SERVICES TO INDIVIDUAL LOTS OF BOTH VERTICAL AND HORIZONTAL PRIOR TO COMMENCING IMPROVEMENTS OPERATIONS.
- LOCATION AND ELEVATIONS OF IMPROVEMENTS, TO BE MET BY WORK, SHALL BE CONFIRMED BY FIELD MEASUREMENTS PRIOR TO CONSTRUCTION OF NEW WORK.
- GRADES SHOWN ARE FINISH GRADES. CONTRACTOR SHALL DETERMINE NECESSARY SUB GRADE ELEVATIONS AND SHALL CONSTRUCT SMOOTH TRANSITION BETWEEN FINISH GRADES SHOWN.
- THE CONTRACTOR SHALL SUBMIT WORK PLANS FOR ALL BORE OPERATIONS TWO WEEKS PRIOR TO COMMENCING WORK.
- THE CONTRACTOR SHALL BE TOTALLY RESPONSIBLE FOR COMPLIANCE WITH THE PROVISIONS OF THE STATE OF CALIFORNIA SAFETY ORDERS.
- CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE RESPONSIBILITY FOR JOB SITE CONDITION DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS EQUIPMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.
- THE LOCATIONS OF ALL EXISTING UTILITIES SHOWN ON THESE PLANS ARE FROM EXISTING RECORDS AND CORROBORATED, WHERE POSSIBLE WITH FIELD TIES. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING THE LOCATIONS SHOWN, BOTH HORIZONTALLY AND VERTICALLY PRIOR TO CONSTRUCTION. IF EXISTING LOCATIONS VARY SUBSTANTIALLY FROM THE PLANS, THE ENGINEER SHOULD BE NOTIFIED TO MAKE ANY CONSTRUCTION CHANGES REQUIRED.
- THE CONTRACTOR SHALL REPLACE OR REPAIR ALL TRAFFIC SIGNAL LOOPS, CONDUITS, AND LANE STRIPPING DAMAGED DURING CONSTRUCTION.
- CONTRACTOR SHALL BE RESPONSIBLE FOR THE POTHOLE AND LOCATING OF ALL EXISTING UTILITIES THAT CROSS THE PROPOSED TRENCH LINE AND MUST MAINTAIN ONE FOOT MINIMUM VERTICAL CLEARANCE
- AS-BUILT DRAWINGS MUST BE SUBMITTED TO THE CITY ENGINEER PRIOR TO ACCEPTANCE OF THIS PROJECT.
- ALL NEW AND EXISTING UTILITY STRUCTURES ON SITE AND IN AREAS TO BE DISTURBED BY CONSTRUCTION SHALL BE ADJUSTED TO FINISH ELEVATIONS PRIOR TO FINAL INSPECTION OF WORK.
- ANY DRAIN AND/OR FIELD TILE ENCOUNTERED/DISTURBED DURING CONSTRUCTION SHALL BE RETURNED TO ITS ORIGINAL CONDITION PRIOR TO COMPLETION OF WORK, SIZE, LOCATION AND TYPE OF ANY UNDERGROUND UTILITIES OR IMPROVEMENTS SHALL BE ACCURATELY NOTED AND PLACED ON "AS-BUILT" DRAWINGS BY GENERAL CONTRACTOR, AND ISSUED TO THE ARCHITECT OR ENGINEER AT COMPLETION OF PROJECT.
- ALL TEMPORARY EXCAVATIONS FOR THE INSTALLATION OF FOUNDATIONS, UTILITIES, ETC., SHALL BE PROPERLY LAD BACK OR BRACED IN ACCORDANCE WITH THE CORRECT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REQUIREMENTS.

ACCESSIBILITY NOTE

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. HANDICAPPED ACCESS REQUIREMENTS ARE NOT REQUIRED IN ACCORDANCE WITH THE 2016 CALIFORNIA BUILDING CODE. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OR EFFECT ON DRAINAGE; NO SANITARY SEWER SERVICE, POTABLE WATER, OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS NEW.

THE TELECOMMUNICATIONS EQUIPMENT SPACE SHOWN ON THESE PLANS IS NOT CUSTOMARILY OCCUPIED. WORK TO BE PERFORMED IN THIS FACILITY CANNOT REASONABLY BE PERFORMED BY PERSONS WITH A SEVERE IMPAIRMENT: MOBILITY, SIGHT, AND/OR HEARING. THEREFORE, PER 2016 CALIFORNIA BUILDING CODE SECTION 1105B.3.4, AND/OR 11B-203.5 OF 2016 CALIFORNIA BUILDING CODE, EXCEPTION 1, THIS FACILITY SHALL BE EXEMPTED FROM ALL TITLE 24 ACCESS REQUIREMENTS.

TRAFFIC CONTROL NOTE

THE CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN (11"X17") FOR APPROVAL PRIOR TO STARTING WORK. THE PLAN SHOULD BE SUBMITTED TO THE TRAFFIC CONTROL PERMIT COUNTER. CONTRACTOR SHALL OBTAIN A TRAFFIC CONTROL PERMIT A MINIMUM OF TWO (2) WORKING DAYS PRIOR TO STARTING WORK, AND A MINIMUM OF FIVE (5) DAYS IF WORK WILL AFFECT A BUS STOP OR AN EXISTING TRAFFIC SIGNAL, OR IF WORK WILL REQUIRE A ROAD OR ALLEY CLOSURE.

REV	DATE	DESCRIPTION
1	07/09/2017	90% ZONING DRAWINGS

ISSUED DATE: **JULY 09, 2018**

ISSUED FOR: **90% ZD SET**

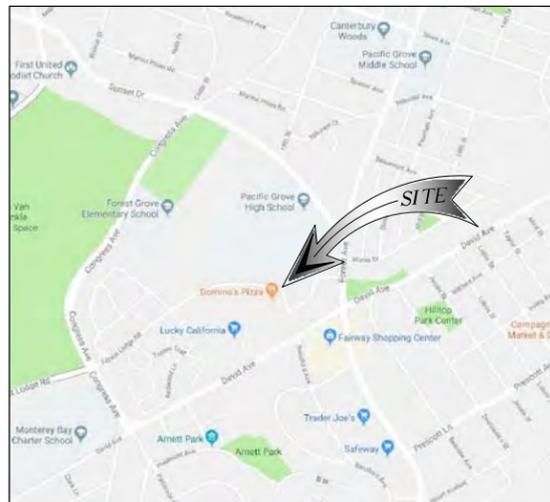
LICENSURE:

PROJECT INFORMATION:
PACIFIC GROVE HS SC1
LOCATION CODE: 425598
ROW NEAR 740 FOREST LODGE RD.
PACIFIC GROVE, CA 93950

DRAWN BY: MAM
CHECKED BY: FO

SHEET TITLE: **TITLE SHEET**

SHEET NUMBER: **T-1**



VICINITY MAP

BASIS OF BEARING

THE CENTERLINE OF FOREST LODGE ROAD BEARING N83°00'09"W WAS USED AS BASIS OF BEARING FOR THIS SURVEY.

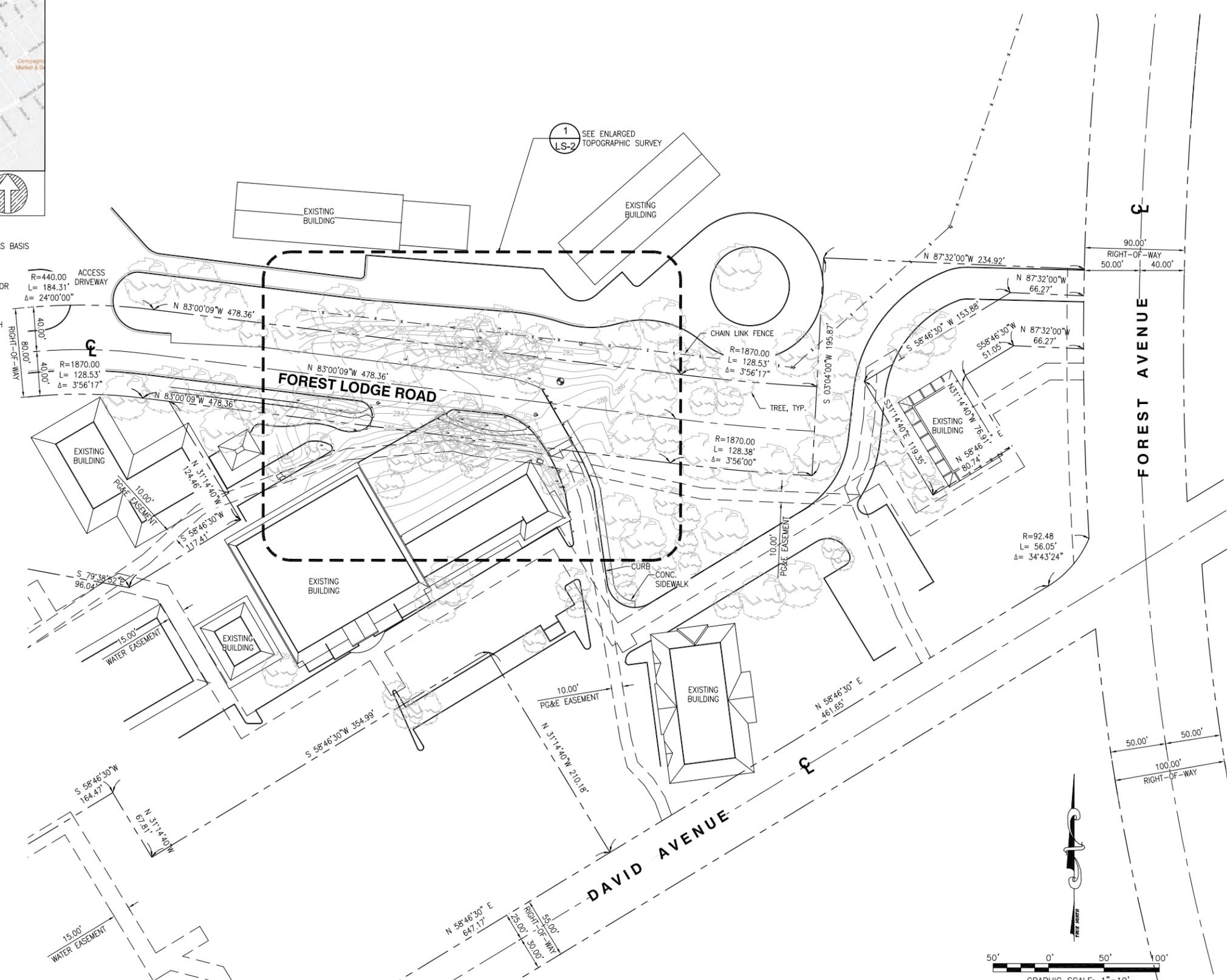
BASIS OF ELEVATIONS: (NAVD 1988)

ELEVATIONS ARE BASED ON CALVRS G.P.S. BROADCAST COORDINATE VALUES FOR 2017, NAVD 88

FLOOD ZONE

SITE IS LOCATED IN FLOOD ZONE "X" AS PER F.I.R.M. MAP NO. 06053C0306H EFFECTIVE DATE 06/21/2017

PROPERTY LINES ARE BASED FROM:
 PARCEL MAP NO. 21-76 DATED MARCH 2002
 R.O.S. NO. 18-49 DATED JULY 20, 1993
 TRACT NO. 785 DATED APRIL 1977
 TRACT NO. 693 DATED MARCH 06, 1974



REV	DATE	DESCRIPTION
1	07/06/2018	FINAL SURVEY

ISSUED DATE: **JULY 06, 2018**

ISSUED FOR: **FINAL SURVEY**

LICENSURE:

PROJECT INFORMATION:
PACIFIC GROVE HS SC1
 LOCATION CODE: 425598
 ROW NEAR 740 FOREST LODGE RD,
 PACIFIC GROVE, CA 93950

DRAWN BY: EMS
 CHECKED BY: RH

SHEET TITLE: **TOPOGRAPHIC SURVEY**

SHEET NUMBER: **LS-1**



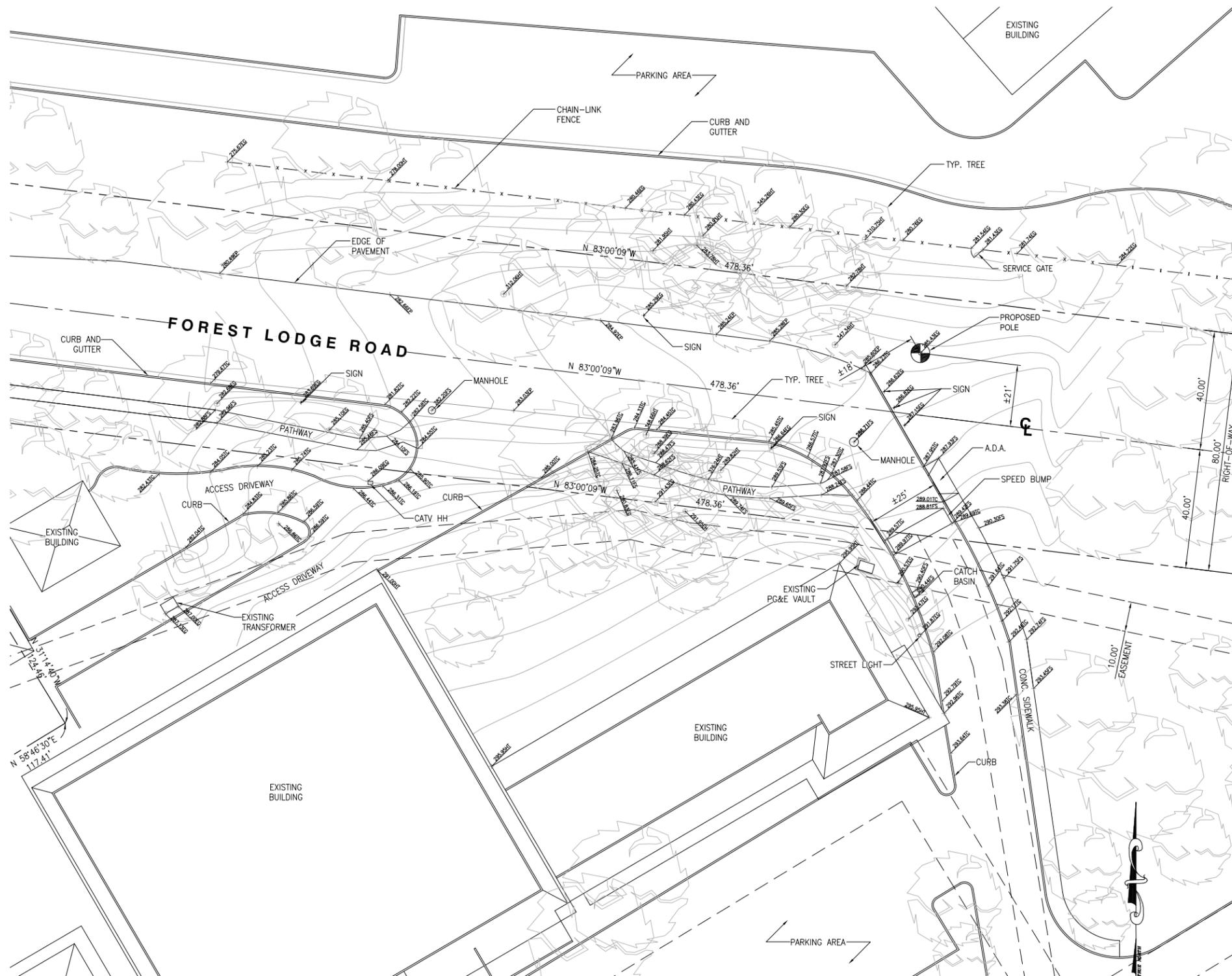
- NOTES:**
- THIS IS NOT A BOUNDARY SURVEY. THIS IS A SPECIALIZED TOPOGRAPHIC MAP. THE PROPERTY LINES AND EASEMENTS SHOWN HEREON ARE FROM RECORD INFORMATION AS NOTED HEREON. CELLSITE CONCEPTS TRANSLATED THE TOPOGRAPHIC SURVEY TO RECORD INFORMATION USING FOUND MONUMENTS SHOWN HEREON.
 - THE HEIGHTS AND ELEVATIONS FOR THE TREES, BUSHES AND OTHER LIVING PLANTS SHOWN HEREON, SHOULD BE CONSIDERED APPROXIMATE (+/-) AND ONLY FOR THE DATE OF THIS SURVEY. THEY ARE PROVIDED AS A GENERAL REFERENCE AND SHOULD NOT BE USED FOR DESIGN PURPOSES.
 - RIGHT OF WAY WAS ESTABLISHED BY LOCATING FOUND CENTERLINE CITY OR COUNTY MONUMENTS.
 - IF CENTERLINE MONUMENTS WERE NOT LOCATABLE, THE CENTERLINE OFFSET TIES WERE USED TO ESTABLISH THE INTERSECTIONS.
 - IF NEITHER CENTERLINE TIES OR CENTERLINE INTERSECTION MONUMENTS WERE LOCATABLE, EXISTING IMPROVEMENTS WERE USED TO ESTABLISH RIGHTS OF WAY.
 - ALL SHOWN RIGHTS OF WAY WERE BASED UPON RESEARCH AT COUNTY OR CITY FILES AND REFLECT THE LATEST RECORDED MAPS, RECORDS OF SURVEY, PARCEL MAPS OR OTHER RECORDS. RIGHTS OF WAY WILL NOT REFLECT ANY DEDICATION, TAKEN OR OFFERED AFTER THE THE RECORD MAP USED. ALL SURVEYS WERE COMPLETED WITHOUT THE BENEFIT OF A CURRENT TITLE REPORT AND MAY NOT SHOW ADDITIONAL DEDICATIONS NOT SHOWN ON THE RECORD MAPS USED.
 - FIELD SURVEY COMPLETED ON JULY 05, 2018

LEGEND

- CENTER LINE
- - - - - PROPERTY LINE
- x x x CHAIN-LINK FENCE
- WOOD FENCE
- WROUGHT IRON FENCE
- - - - - EASEMENT LINE
- ▬▬▬▬▬▬▬ RETAINING WALL
- TC TOP OF CURB
- FL FLOW LINE
- FS FINISH SURFACE
- EG EXISTING GRADE
- HT HEIGHT
- EP EDGE OF PAVEMENT
- BW BACK OF WALL
- EXISTING STREET LIGHT
- EXISTING TRAFFIC SIGNAL
- EXISTING SIGN
- GUY WIRE
- CATCH BASIN
- POWER POLE
- FIRE HYDRANT
- PINE TREE
- PALM TREE
- TREE
- BUSH
- EXISTING CONCRETE
- EXISTING GRASS/TURF
- MONUMENTS**
- MONUMENT FD.

COORDINATES

LATITUDE: 36°36'32.42" N (36.610690)
 LONGITUDE: 121°55'27.73" W (-121.924368748)



REV	DATE	DESCRIPTION
1	07/06/2018	FINAL SURVEY

ISSUED DATE: **JULY 06, 2018**

ISSUED FOR: **FINAL SURVEY**

LICENSURE:

PROJECT INFORMATION:
PACIFIC GROVE HS SC1
 LOCATION CODE: 425598
 ROW NEAR 740 FOREST LODGE RD,
 PACIFIC GROVE, CA 93950

DRAWN BY: EMS
 CHECKED BY: RH

SHEET TITLE: **TOPOGRAPHIC SURVEY**

SHEET NUMBER: **LS-2**



2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598



22471 ASPAN STREET, STE 290
LAKE FOREST, CA 92630



10650 SCRIPPS RANCH BLVD., SUITE 224
SAN DIEGO, CA 92131
tel: (858) 433-7173 / (858) 433-7176

REV	DATE	DESCRIPTION
1	07/09/2017	90% ZONING DRAWINGS

ISSUED DATE: **JULY 09, 2018**

ISSUED FOR: **90% ZD SET**

LICENSURE:

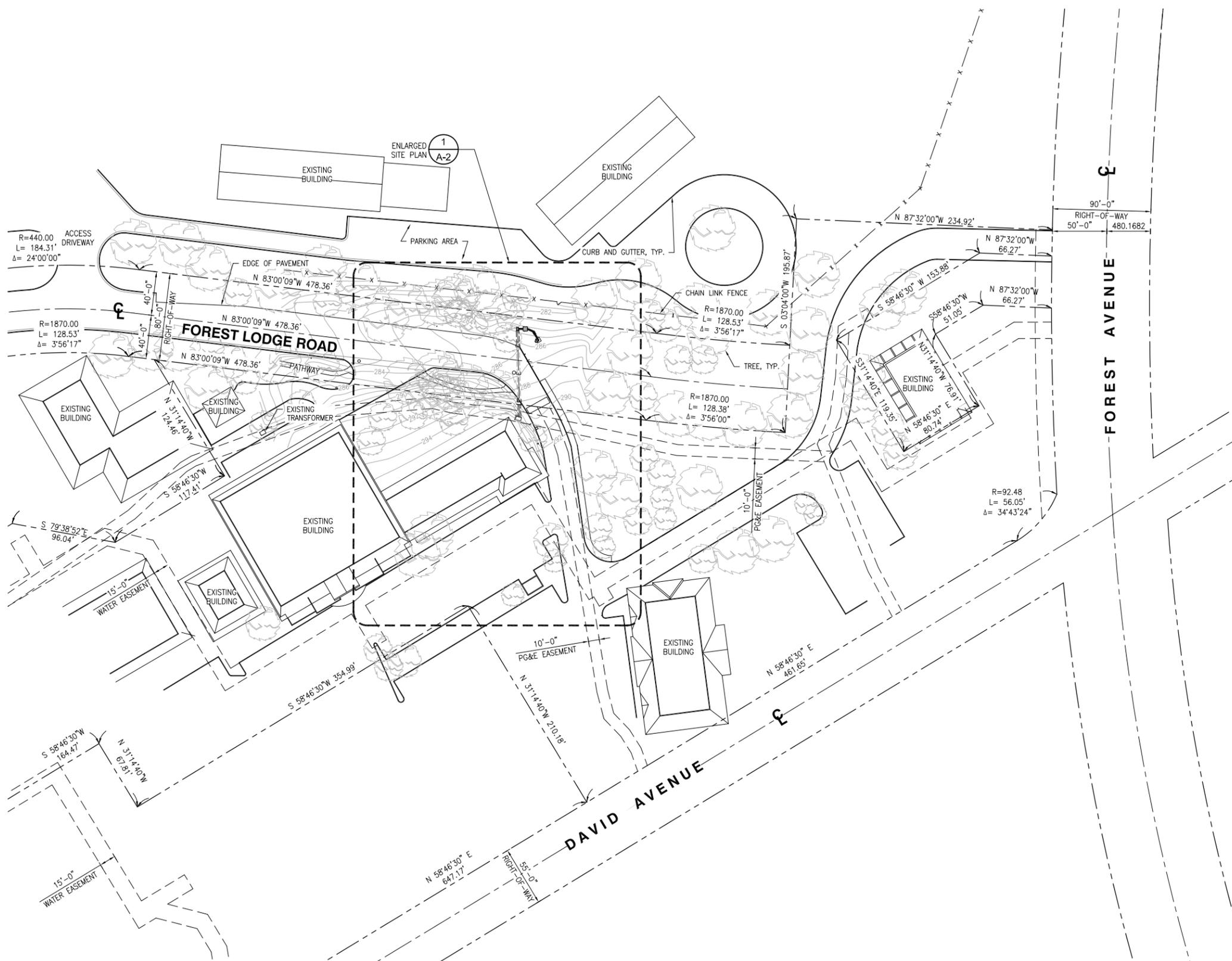
PROJECT INFORMATION:
PACIFIC GROVE HS SC1
LOCATION CODE: 425598
ROW NEAR 740 FOREST LODGE RD.
PACIFIC GROVE, CA 93950

DRAWN BY: MAM
CHECKED BY: FO

SHEET TITLE: **SITE PLAN**

SHEET NUMBER: **A-1**

- SITE NOTES:**
1. REPRESENTATIONS OF TRUE NORTH, OTHER THAN THOSE FOUND ON THE PLOT OF SURVEY DRAWINGS SHALL NOT BE USED TO IDENTIFY OR ESTABLISH BEARING OF TRUE NORTH AT THE SITE. THE CONTRACTOR SHALL RELY SOLELY ON THE PLOT OF SURVEY DRAWING AND ANY SURVEYOR'S MARKINGS AT THE SITE FOR THE ESTABLISHMENT OF TRUE NORTH, AND SHALL NOTIFY THE ARCHITECT/ENGINEER PRIOR TO PROCEEDING WITH THE WORK IF ANY DISCREPANCY IS FOUND BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS AND THE TRUE NORTH ORIENTATION AS DEPICTED ON THE CIVIL SURVEY. THE CONTRACTOR SHALL ASSUME SOLE LIABILITY FOR ANY FAILURE TO NOTIFY THE ARCHITECT/ENGINEER.
 2. CONTRACTOR TO VERIFY LOCAL UTILITY REQUIREMENTS FOR DEPTH, SIZES, AND SEPARATION OF CONDUITS PRIOR TO INSTALLATION. NOTIFY CONSTRUCTION MANAGER IMMEDIATELY OF ANY DISCREPANCIES.
 3. PROPOSED UTILITY SERVICES SHOWN NEED TO BE VERIFIED AND APPROVED BY UTILITY COMPANIES BEFORE START OF CONSTRUCTION. CONTRACTOR TO VERIFY WITH CLIENT PROJECT MANAGER TO OBTAIN FINAL APPROVAL.
 4. VERIFY, LOCATE, AND PROTECT ALL EXISTING SUBSTRUCTURES AS REQUIRED. CALL DIG ALERT @ (800) 227-2600 48 HOURS BEFORE ANY EXCAVATION. CONTRACTOR IS RESPONSIBLE TO HAVE ALL NON-PUBLIC UTILITIES LOCATED AT THEIR OWN EXPENSE.
 5. LINES SHOWN DOES NOT REPRESENT THE EXACT LOCATION OF THE CONDUIT ROUTES. CONTRACTOR TO VERIFY SERVICE LOCATIONS W/ ACTUAL FIELD CONDITIONS.
 6. CONTRACTOR SHALL IMMEDIATELY INFORM CLIENT OF ANY ACCIDENTAL DAMAGE TO EXISTING UTILITIES VIA PHONE OR EMAIL REGARDLESS OF ABILITY TO REPAIR OR MITIGATE. A FOLLOW-UP EMAIL REPORT WITH DIGITAL PHOTOS WILL BE REQUIRED DAILY UNTIL RESOLUTION HAS BEEN ACCEPTED BY CLIENT, AFFECTED SERVICE PROVIDERS, AND RECIPIENTS. AT THEIR OWN EXPENSE. CONTRACTOR WILL EXERCISE ALL EFFORTS TO HAVE REPAIRS MADE BY QUALIFIED TECHNICIANS AS APPROVED BY SERVICE PROVIDER.
 7. CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES, BOTH HORIZONTAL AND VERTICALLY, PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES OR DOUBTS AS TO THE INTERPRETATION OF PLANS SHOULD BE IMMEDIATELY REPORTED TO THE ARCHITECT/ENGINEER FOR RESOLUTION AND INSTRUCTION, AND NO FURTHER WORK SHALL BE REFORMED UNTIL THE DISCREPANCY IS CHECKED AND CORRECTED BY THE ARCHITECT/ENGINEER, FAILURE TO SECURE SUCH INSTRUCTION MEANS CONTRACTOR WILL HAVE WORKED AT HIS/HER OWN RISK AND EXPENSE.
 8. ALL NEW AND EXISTING UTILITY STRUCTURES ON SITE AND IN AREAS TO BE DISTURBED BY CONSTRUCTION SHALL BE ADJUSTED TO FINISH ELEVATIONS PRIOR TO FINAL INSPECTION OF WORK.
 9. ANY DRAIN AND /OR FIELD TILE ENCOUNTERED/DISTURBED DURING CONSTRUCTION SHALL BE RETURNED TO IT'S ORIGINAL CONDITION PRIOR TO COMPLETION OF WORK, SIZE, LOCATION AND TYPE OF ANY UNDERGROUND UTILITIES OR IMPROVEMENTS SHALL BE ACCURATELY NOTED AND PLACED ON "AS-BUILT" DRAWINGS BY GENERAL CONTRACTOR, AND ISSUED TO THE ARCHITECT OR ENGINEER AT COMPLETION OF PROJECT.
 10. ALL TEMPORARY EXCAVATIONS FOR THE INSTALLATION OF FOUNDATIONS, UTILITIES, ETC., SHALL BE PROPERLY LAID BACK OR BRACED IN ACCORDANCE WITH THE CORRECT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REQUIREMENTS.
 11. NEW CONDUITS SHALL BE INSTALLED IN TRENCH SUCH THAT THE TOP OF CONDUIT SHALL HAVE A MINIMUM COVER OF 24-INCHES BELOW ADJACENT EDGE OF PAVEMENT OR ORIGINAL GROUND, WHICHEVER IS LOWER IN ELEVATION.
 12. ALL PULL BOXES SHALL BE PRECAST REINFORCED CONCRETE AND HAVE NON CONDUCTIVE LIDS. EXISTING PULL BOX COVERS THAT ARE MARKED INCORRECTLY SHALL BE REPLACED.
 13. REGRADE LANDSCAPING AS NEEDED AND REPLACE DAMAGED IRRIGATION LINES WITHIN 24 HOURS.





2785 MITCHELL DRIVE, BLDG. 9
WALNUT CREEK, CA 94598



REV	DATE	DESCRIPTION
1	07/09/2017	90% ZONING DRAWINGS

ISSUED DATE:
JULY 09, 2018

ISSUED FOR:
90% ZD SET

LICENSURE:

PROJECT INFORMATION:
PACIFIC GROVE HS SC1
LOCATION CODE: 425598
ROW NEAR 740 FOREST
LODGE RD.
PACIFIC GROVE, CA 93950

DRAWN BY: MAM

CHECKED BY: FO

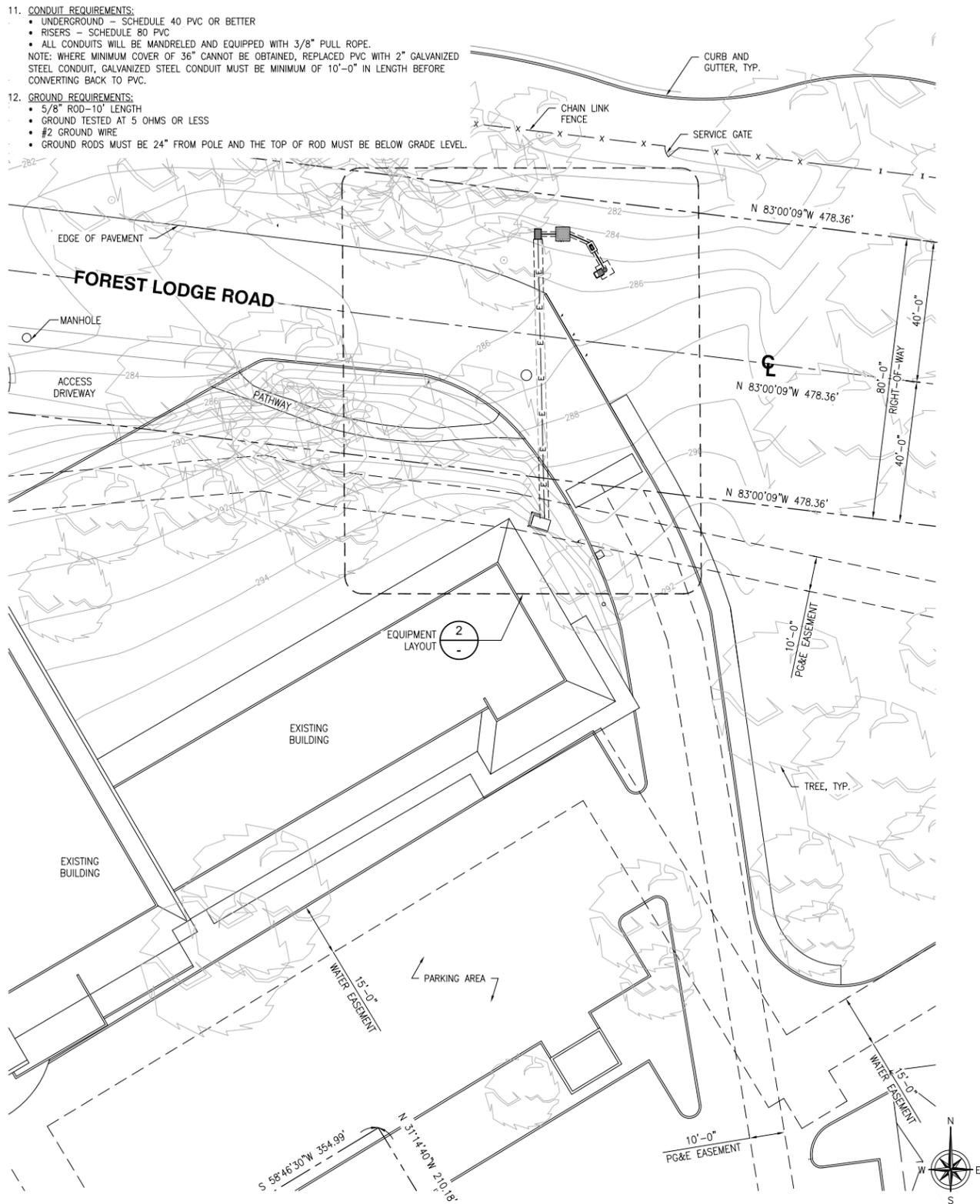
SHEET TITLE:
**ENLARGED SITE PLAN,
EQUIPMENT AND
ANTENNA LAYOUT**

SHEET NUMBER:

A-2

- CONSTRUCTION NOTES:**
- METER SHALL NOT FACE THE STREET, ALLEY, OR PROPERTY SIDE OF THE POLE.
 - METER BASE AND DISCONNECT SHALL BE BONDED TO A SEPARATE GROUND FROM THE POLE GROUND WITH CONDUCTOR HAVING A CURRENT CAPACITY THAN NO LESS THAN #6 SOLID COPPER CONDUCTOR.
 - VERIFY AND RECORD ALL TIES AND FOOTAGES IN FIELD PER FINAL AS-BUILT CONDITIONS.
 - PROVIDE ADEQUATE WORKMAN PROTECTION ON WINDING NARROW ROADS OR HEAVY TRAFFIC.
 - GROUNDS ARE TO BE TESTED-REQUIRES 5 OHMS OR LESS RESISTANCE.
 - ALL LANDSCAPING TO BE RESTORED TO ORIGINAL CONDITION.
 - NOTIFY PROPERTY OWNER BEFORE WORKING ON OR AROUND PRIVATE PROPERTY.
 - OBTAIN SPECIAL PERMITS AND PAY FEES AS REQUIRED WORKING ON COUNTY HIGHWAY.
 - MAINTAIN 36" MINIMUM COVER IN PARKWAY
 - MAINTAIN 30" MINIMUM COVER BELOW GUTTER GRADE ON SURFACE STREETS.
 - CONDUIT REQUIREMENTS:**
 - UNDERGROUND - SCHEDULE 40 PVC OR BETTER
 - RISERS - SCHEDULE 80 PVC
 - ALL CONDUITS WILL BE MANDRELED AND EQUIPPED WITH 3/8" PULL ROPE.

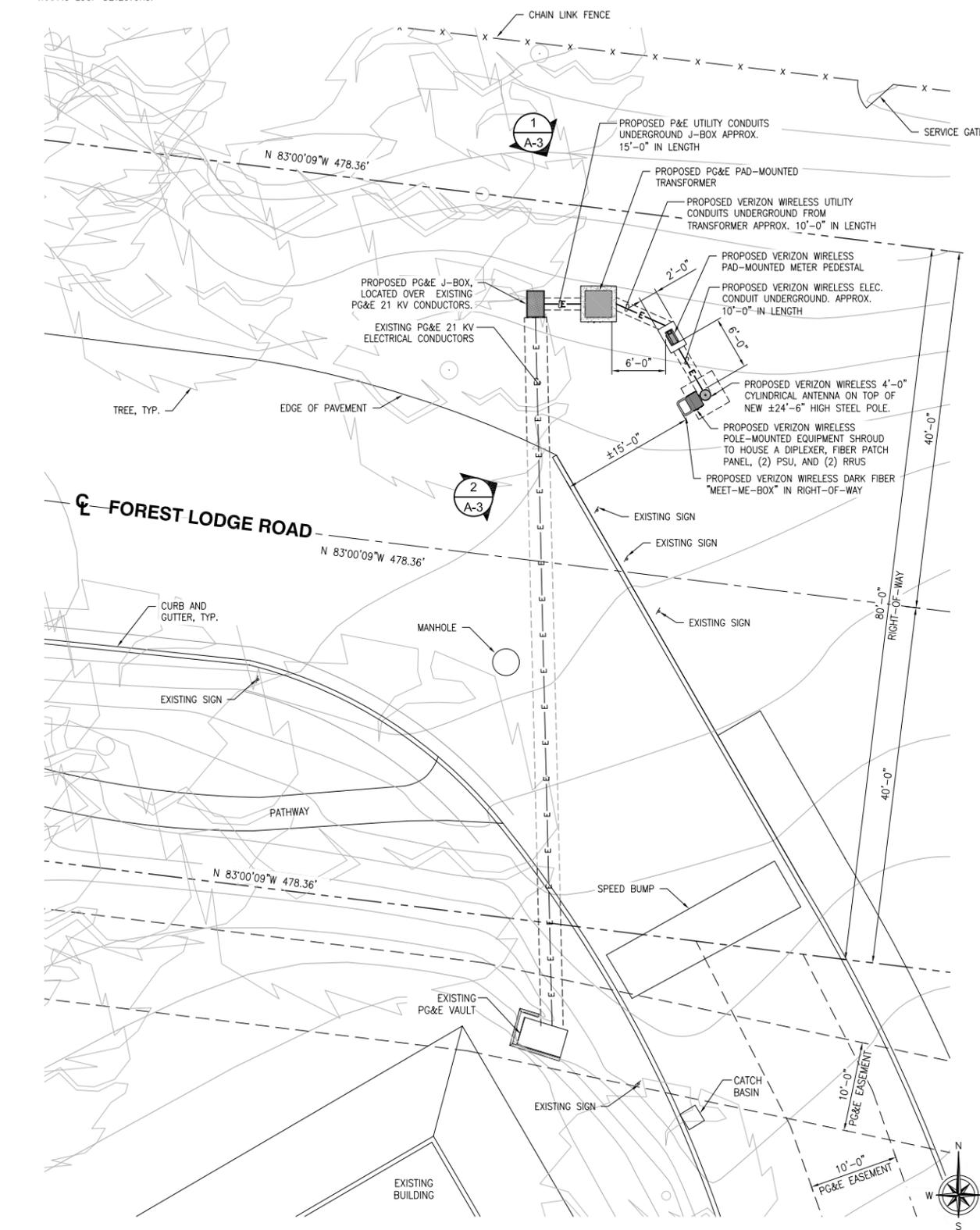
UNDERGROUND UTILITIES NOTE:
ALL EXISTING SUB-SURFACE UTILITIES, FACILITIES, CONDITIONS, AND THEIR DIMENSIONS SHOWN ON THE PLAN HAVE BEEN PLOTTED FROM FIELD SURVEY AND/OR AVAILABLE RECORDS, THE ARCHITECT/ ENGINEER AND THE OWNER ASSUME NO RESPONSIBILITY WHATSOEVER AS TO THE SUFFICIENCY OR THE ACCURACY OF THE INFORMATION SHOWN ON THE PLANS, OR THE MANNER OF THEIR REMOVAL OR ADJUSTMENT. CONTRACTORS SHALL BE RESPONSIBLE FOR THE DETERMINING EXACT LOCATION OF ALL EXISTING UTILITIES AND FACILITIES PRIOR TO START OF CONSTRUCTION. CONTRACTORS SHALL ALSO OBTAIN FROM EACH UTILITY COMPANY DETAILED INFORMATION RELATIVE TO WORKING SCHEDULES AND METHODS OF REMOVING OR ADJUSTING EXISTING UTILITIES. THERE MAY BE EXISTING UTILITIES OTHER THAN THOSE SHOWN ON THIS PLAN. THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINE SHOWN AND ANY OTHER LINES NOT SHOWN ON THIS PLAN.



24"x36" SCALE: 1" = 20'-0"
11"x17" SCALE: 1" = 40'-0"
20' 10' 0'

1

- NOTES:**
- CONTRACTOR TO PLACE SANDBAGS AROUND ANY/ALL STORM DRAIN INLETS TO PREVENT CONTAMINATED WATER.
 - SPOILS PILE WILL BE COVERED AND CONTAINED AND STREET WILL BE SWEEPED AND CLEANED AS NEEDED.
 - CONTRACTOR TO REPAIR DAMAGED PUBLIC IMPROVEMENTS TO THE SATISFACTION OF THE CITY ENGINEER.
 - CURB & GUTTER TO BE PROTECTED IN PLACE. SIDEWALK TO BE REPLACED TO THE SATISFACTION OF THE CITY ENGINEER.
 - THE CONTRACTOR SHALL RESTORE THE ROADWAY BACK TO ITS ORIGINAL CONDITION SATISFACTORY TO THE CITY ENGINEER INCLUDING, BUT NOT LIMITED TO PAVING, STRIPING, BIKE LANES, PAVEMENT, LEGENDS, SIGNS, AND TRAFFIC LOOP DETECTORS.



24"x36" SCALE: 1/8" = 1'-0"
11"x17" SCALE: 1/16" = 1'-0"
8' 6' 4' 2' 0' 8'

2

ENLARGED SITE PLAN

EQUIPMENT LAYOUT



REV	DATE	DESCRIPTION
1	07/09/2017	90% ZONING DRAWINGS

ISSUED DATE:
JULY 09, 2018

ISSUED FOR:
90% ZD SET

LICENSURE:

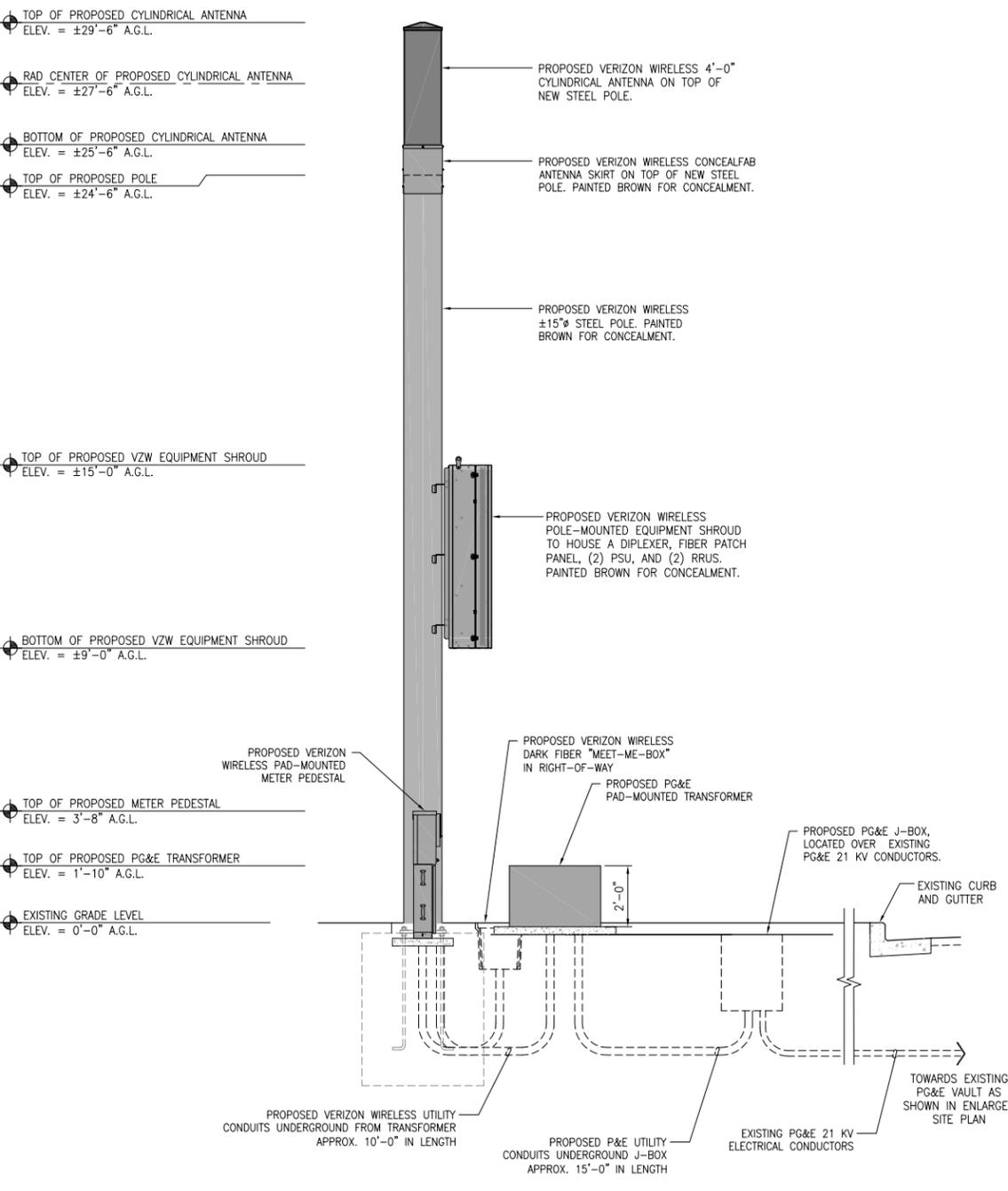
PROJECT INFORMATION:
PACIFIC GROVE HS SC1
LOCATION CODE: 425598
ROW NEAR 740 FOREST LODGE RD.
PACIFIC GROVE, CA 93950

DRAWN BY: MAM
CHECKED BY: FO

SHEET TITLE:
ARCHITECTURAL ELEVATIONS

SHEET NUMBER:
A-3

NOTES:
1. THE NEW LAYOUT IS PRELIMINARY AND SUBJECT TO CHANGE PENDING FULL STRUCTURAL ANALYSIS.
2. NEW TOWER, ANTENNAS, EQUIPMENT SHROUD, AND ALL EXPOSED HARDWARE SHOULD BE PAINTED BROWN FOR CONCEALMENT AS NECESSARY.

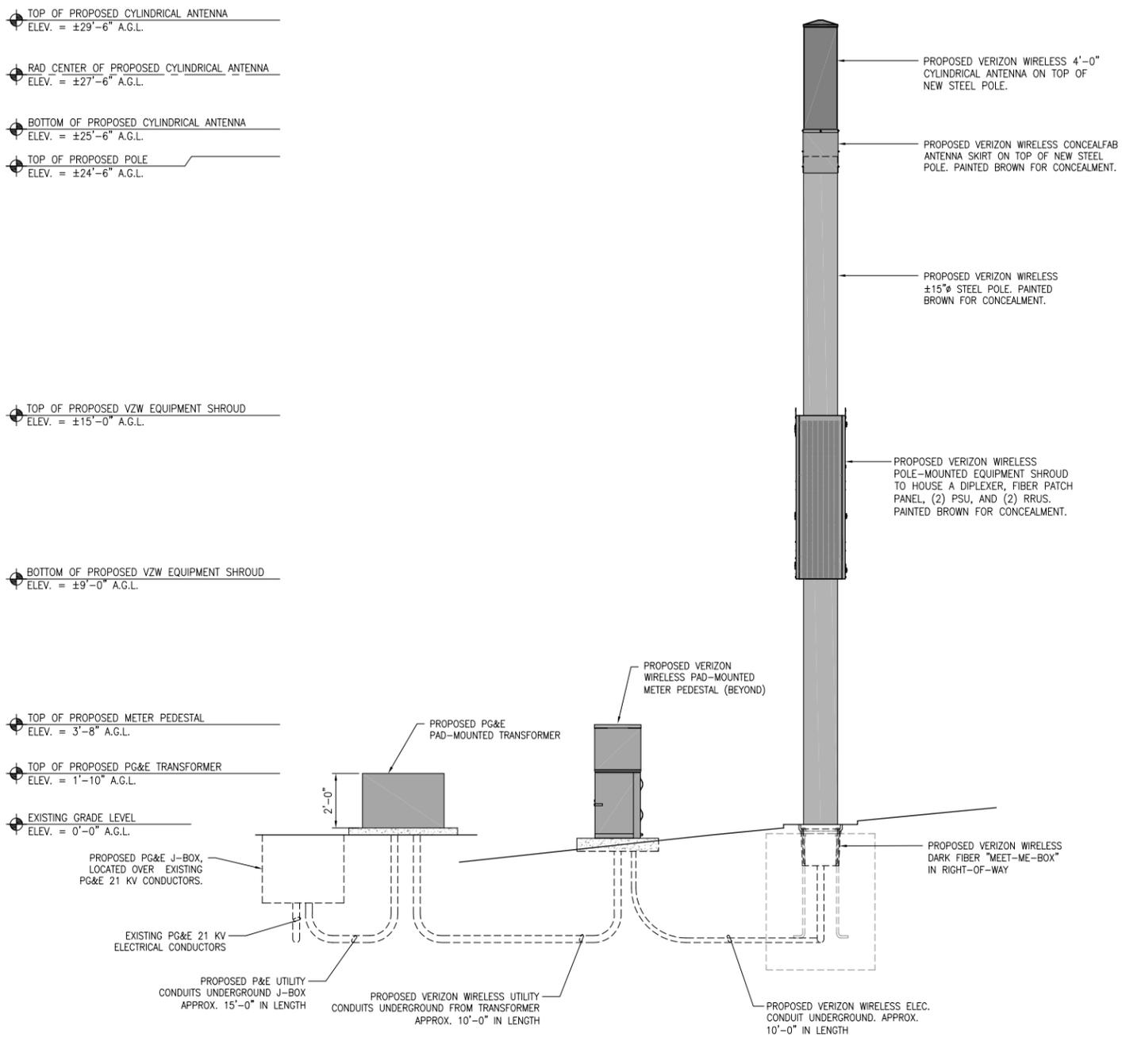


NORTHWEST ELEVATION

24"x36" SCALE: 3/8" = 1'-0"
11"x17" SCALE: 3/16" = 1'-0"

1

NOTES:
1. THE NEW LAYOUT IS PRELIMINARY AND SUBJECT TO CHANGE PENDING FULL STRUCTURAL ANALYSIS.
2. NEW TOWER, ANTENNAS, EQUIPMENT SHROUD, AND ALL EXPOSED HARDWARE SHOULD BE PAINTED BROWN FOR CONCEALMENT AS NECESSARY.



SOUTHWEST ELEVATION

24"x36" SCALE: 3/8" = 1'-0"
11"x17" SCALE: 3/16" = 1'-0"

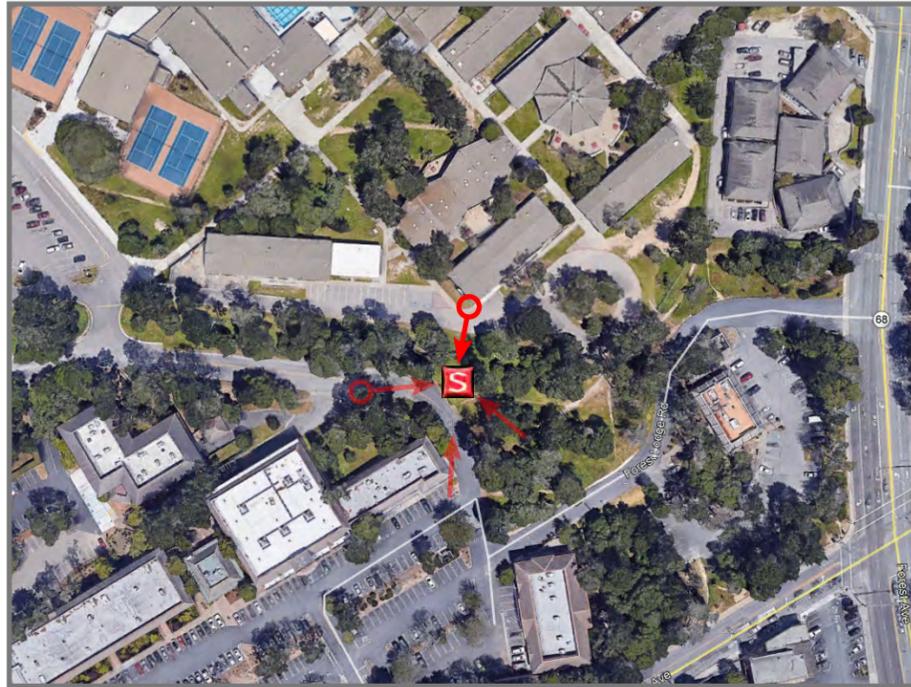
2



PACIFIC GROVE HS SC 1

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950

VIEW 1



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

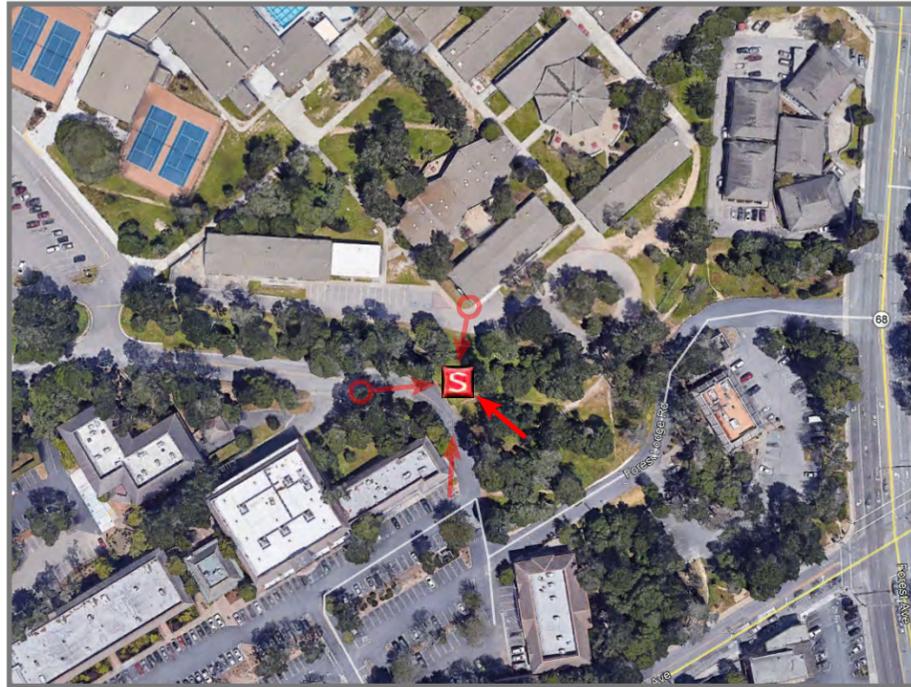
LOOKING SOUTH FROM CAMPUS



PACIFIC GROVE HS SC 1

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950

VIEW 2



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

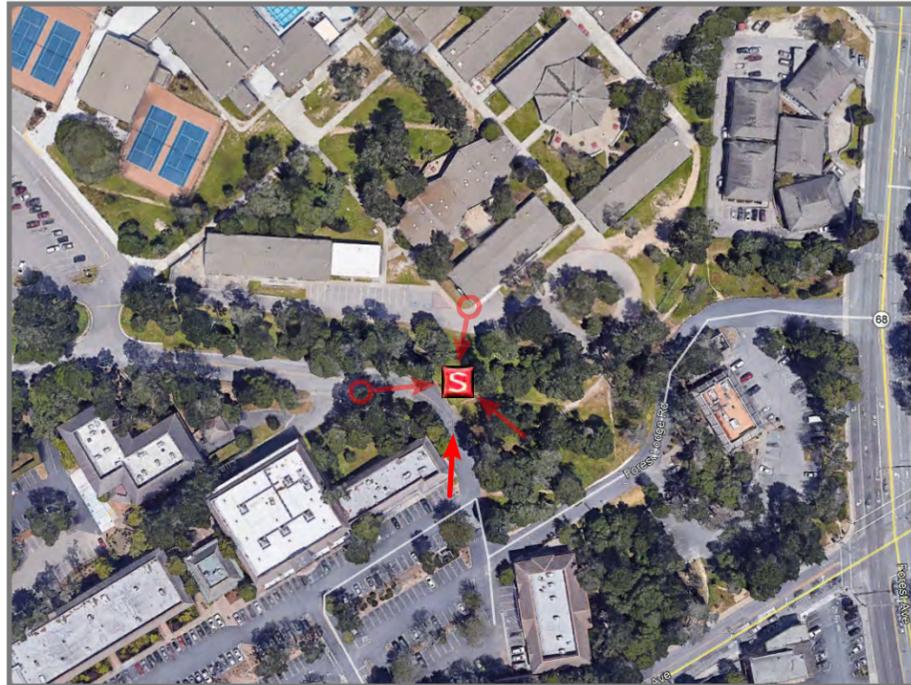
LOOKING NORTHWEST FROM SITE



PACIFIC GROVE HS

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950

VIEW 3



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

LOOKING NORTH FROM FOREST LODGE ROAD



PACIFIC GROVE HS

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950

VIEW 4



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

LOOKING EAST FROM FOREST LODGE ROAD



Sandra Kandell <skandell@cityofpacificgrove.org>

Verizon Cell Tower request

1 message

vincent alfait <docfreedaddy@hotmail.com>

Wed, Jul 25, 2018 at 4:59 PM

To: "rfischer@cityofpacificgrove.org" <rfischer@cityofpacificgrove.org>, "cgarfield@cityofpacificgrove.org" <cgarfield@cityofpacificgrove.org>, Bill Kampe <bkampe@cityofpacificgrove.org>, Bill Peake <bpeake@cityofpacificgrove.org>, "kencun17@icloud.com" <kencun17@icloud.com>, "huitt@comcast.net" <huitt@comcast.net>, "nsmith@cityofpacificgrove.org" <nsmith@cityofpacificgrove.org>, "citymanager@cityofpacificgrove.org" <citymanager@cityofpacificgrove.org>, "cityclerk@cityofpacificgrove.org" <cityclerk@cityofpacificgrove.org>, "dave@laredolaw.net" <dave@laredolaw.net>

Dear Mayor Kampe and Council Members,

- 1) Most community members' opposition to additional cell towers is due to the burgeoning evidence of serious health effects of wireless radiation from cell towers added to the exponential increase in other wireless radiation emitting devices: <https://drive.google.com/file/d/11EY3FtjAhujiTd685ErJChELHpiFLHJa/view>
- 2) Few community members are aware the Wireless Trade Group (CTIA) has known of the carcinogenic effects of wireless devices since 1993 when the CTIA commissioned Dr. George Carlo to provide an opinion regarding the safety of wireless devices: <http://media.withtbank.com/8966110b4e.pdf>
- 3) The public is understandably confused or unaware that local governments still cannot prohibit cell towers based on health effects due to the CTIA's effective lobbying for the Federal Telecommunications Act of 1996.
- 4) The PG City Council seems stymied in protecting community health
- 5) There may well be a solution. Our Monarchs. Monarchs are a candidate for Endangered Species classification: <https://www.fws.gov/savethemonarch/SSA.html>. As such, they enjoy protection while the evaluation for Endangered Species is completed under the US Fish and Wildlife "Candidate Conservation Agreement" <https://www.fws.gov/endangered/esa-library/pdf/CCAs.pdf>.
- 6) It is incumbent upon Verizon and other providers to demonstrate cell towers do not impair Monarchs navigation abilities or contribute in other ways their decline in Pacific Grove overall which serves as their habitat.
- 7) Recent studies (below) are confirming the damaging effects of cell towers on invertebrate and vertebrate species, including their navigation ability.
- 8) I believe the City Council has the acumen and resolve to require Verizon and others to adhere to the US Fish and Wildlife "Candidate Conservation Agreement" <https://www.fws.gov/endangered/esa-library/pdf/CCAs.pdf>. and produce evidence of no harm to Monarchs as a requirement for placing a new cell tower in Pacific Grove

Thank you,

Dr. Vincent Alfait

Studies: (partial list)

1. Algers B, Hennichs K (1983). Biological effects of electromagnetic fields on vertebrates.

[Areview.Vet Res Commun; 6\(4\):265-79](#)

<http://www.ncbi.nlm.nih.gov/pubmed/6359665> 2. Altmann, G. and Warnke, U. (1976), Der Stoffwechsel von Bienen (*Apis mellifica* L.) im 50-Hz-Hochspannungsfeld. Zeitschrift für Angewandte Entomologie, 80: 267–271.doi: 10.1111/j.1439-0418.1976.tb03324.x<http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0418.1976.tb03324.x/abstract>

3. Balmori A. (2009a). Electromagnetic pollution from phone masts. Effects on wildlife. Pathophysiology

16. 191–199. <http://wifiinschools.org.uk/resources/Balmori+2009.pdf>

4. Balmori A. (2009b) The incidence of electromagnetic pollution on wild mammals: A new “poison” with a slow effect on nature? *The Environmentalist* . 30 (1), pg. 90-97.

<http://www.springerlink.com/content/e03764404274q481/> 5. Balmori A. (2010). Mobile phone mast effects on common frog (*Rana temporaria*) tadpoles: the city turned into a laboratory. *Electromagn Biol Med*. 29(1-2):31-5. <http://www.ncbi.nlm.nih.gov/pubmed/20560769>

6. Balmori, A (2010). The incidence of electromagnetic pollution on wild mammals: A new “poison” with a slow effect on nature? *The Environmentalist*. 30(1): 90-97. DOI:10.1007/s10669-009-9248-y

<http://www.springerlink.com/content/e03764404274q481/> 7. Balmori, A and Ö. Hallberg, (2007) The urban decline of the house sparrow (*Passer domesticus*): a possible link with electromagnetic radiation. *Electromagn. Biol. Med*. 26 141–151. <http://www.ncbi.nlm.nih.gov/pubmed/17613041>

8. Balmori, A. (2005) Possible effects of electromagnetic fields from phone masts on a population of white stork (*Ciconia ciconia*), *Electromagn. Biol. Med*. 24 109–119. www.buergernetz.de/pdf/effects_of_emf_on_white_stork.pdf

9. Balmori, A. (2006) The incidence of electromagnetic pollution on the amphibian decline: Is this an important piece of the puzzle? *Toxicological Environmental Chemistry* 88(2): 287–299. <http://www.ingentaconnect.com/content/tandf/gtec/2006/00000088/00000002/art00010;jsessionid=45daaaisp3s1s.alexandra>

10. Balode, S. (1996). Assessment of radio-frequency electromagnetic radiation by the micronucleus test in bovine peripheral erythrocytes. *Sci. Total. Environm*. 180: 81-85.

<http://www.ncbi.nlm.nih.gov/pubmed/8717319> 11. Bastide M, Youbicier-Simo BJ, Lebecq JC, Giannis J. (2001). Toxicologic study of electromagnetic radiation emitted by television and video display screens and cellular telephones on chickens and mice. *Indoor Built Environ* 10:291–8. <http://ibe.sagepub.com/content/10/5/291.abstract> 12.

Batellier F, I. Couty, D. Picard, J.P. Brillard (2008). Effects of exposing chicken eggs to a cell phone in “call” position over the entire incubation period. *Theriogenology* 69: 737–745

<http://www.ncbi.nlm.nih.gov/pubmed/18255134> 13. Beason, RC and P. Semm (2002). Responses of neurons to an amplitude modulated microwave stimulus *Neuroscience Letters* 333: 175–178. <http://www.ncbi.nlm.nih.gov/pubmed/12429376>

14. Becker RO (1984). Electromagnetic Controls Over Biological Growth Processes. *Electromagnetic Biology and Medicine* 3(1-2). 105-118. <http://informahealthcare.com/doi/abs/10.1080/15368378409035962>

15. Begall S, Cerveny J, Neef J, Vojtech O, Burda H. (2008). Magnetic alignment in grazing and resting cattle and deer. *Proc Natl Acad Sci* 105(36):13451-5. <http://www.ncbi.nlm.nih.gov/pubmed/18725629>

16. Berman, E. L., Chacon, D., House, B., Koch, A., Koch, W. E., et al. (1990). Development of chicken embryos in a pulsed magnetic field. *Bioelectromagnetics* 11:169–187.

<http://www.ncbi.nlm.nih.gov/pubmed/2242052> 17. Bernabò N, E. Tettamanti, V. Russo, A. Martelli, M. Turriani, M. Mattoli, B. Barboni (2010). *Theriogenology*. 73(9):1293-1305

[http://www.theriojournal.com/article/S0093-691X\(10\)00047-6/abstract](http://www.theriojournal.com/article/S0093-691X(10)00047-6/abstract) 18. Bigu J. (1973) National Research Centre of Canada. Extract from Ltr-CS-113 “Interaction of electromagnetic fields and living systems with special reference to birds.” <http://www.ncbi.nlm.nih.gov/pubmed/16724328>

19. Bigu-del-Blanco and Romero-Sierra (1975) The properties of bird feathers as converse piezoelectric transducers and as receptors of microwave radiation. I. Bird feathers as converse piezoelectric transducers *Biotelemetry* 2:341-353. <http://www.ncbi.nlm.nih.gov/pubmed/1235241?dopt=AbstractPlus>

20. Bigu-del-Blanco and Romero-Sierra (1975). The properties of bird feathers as converse piezoelectric transducers and as receptors of microwave radiation. II. Bird feathers as dielectric receptors of microwave radiation. *Biotelemetry* 2:354-634

<http://www.ncbi.nlm.nih.gov/pubmed/1242004?dopt=AbstractPlus> 21. Bindokas VP, Gauger JR, Greenberg B. (1988). Mechanism of biological effects observed in honey bees (*Apis mellifera*, L.) hived under extra-high-voltage transmission lines: implications derived from bee exposure to simulated intense electric fields and shocks. *Bioelectromagnetics*. 9(3):285-301.

<http://www.ncbi.nlm.nih.gov/pubmed/3178903?dopt=Abstract> 22. Blackman CF, House DE, Benane SG, Joines WT, Spiegel RJ. (1988). Effect of ambient level of power-line-frequency electric fields on a developing vertebrate. *Bioelectromagnetics* ;9(2):129-140 <http://www.ncbi.nlm.nih.gov/pubmed/3377861>

23. Briefing Paper on the Need for Research into the Cumulative Impacts of Communication Towers on Migratory Birds and Other Wildlife in the United States http://www.healthandenvironment.org/wg_emf_news/6144 24. Bruder B., Boldt A. (1994). Homing pigeons under radio influence. *Naturewissenschaften* 81(7):316-17.

<http://www.springerlink.com/content/0028-1042/81/7/> 25. Bryan TE, Gildersleeve RP. (1988). Effects of nonionizing radiation on birds. *Comp Biochem Physiol A Comp Physiol*. 89(4):511-30.

<http://www.ncbi.nlm.nih.gov/pubmed/2899470> 26. Burchard, J. F., H. Monardes, and D. H. Nguyen. (2003). Effect of 10kV, 30 μ T, 60 Hz Electric and Magnetic Fields on Milk Production and Feed Intake in Nonpregnant Dairy Cattle. *Bioelectromagnetics* 24:557-563.

<http://www.ncbi.nlm.nih.gov/pubmed/14603475> 27. Burchard, J. F., Nguyen, D. H. and Rodriguez, R. (2006). Plasma concentrations of thyroxine in dairy cows exposed to 60 Hz electric and magnetic fields. *Bioelectromagnetics* 27: 553-559 <http://www.ncbi.nlm.nih.gov/pubmed/9771588>

28. Burda H, S Begall, J Cervený, J Neef, and P Nemeč (2009) Extremely low-frequency electromagnetic fields disrupt magnetic alignment of ruminants. *PNAS*. 106(14): 5708- 5713.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2667019/> 29. Cammaerts MC, Debeir O, Cammaerts R. (2011). Changes in *Paramecium caudatum* (Protozoa) near a switched-on GSM telephone. *Electromagn Biol Med*. 30(1):57-66.

<http://informahealthcare.com/doi/abs/10.3109/15368378.2011.566778> 30. Cammaerts MC, P De Doncker, X Patris, F Bellens, Z Rachidi, D Cammaerts (2012). GSM900 MHz radiation inhibits ants' association between food sites and encountered cues. *Electromagnetic Biology and Medicine*. Posted online on January 23, 2012. (doi:10.3109/15368378.2011.624661)

<http://informahealthcare.com/doi/abs/10.3109/15368378.2011.624661> 31. Clark MW, Gildersleeve RP, Thaxton JP, Parkhurst CR, McRee DI. (1987). Leukocyte numbers in hemorrhaged Japanese quail after microwave irradiation in ovo. *Comp Biochem Physiol A Comp Physiol*. 87(4):923-32.

<http://www.ncbi.nlm.nih.gov/pubmed/2887391> 32. Colin ME, D. Richard, S. Chauzy (1991). Measurement of Electric Charges Carried by Bees: Evidence of Biological Variations. *Electromagnetic Biology and Medicine* 10(1-2): 17-32.

<http://informahealthcare.com/doi/abs/10.3109/15368379109031397> 33. Corbet, SA, J Beament, and D Eisikowitch (1982). Are electrostatic forces involved in pollen transfer? *Plant, Cell, and Environ*. 5: 125-129.

<http://onlinelibrary.wiley.com/doi/10.1111/1365-3040.ep11571488/abstract> 34. Cramer, G. (2007). HAARP Transmissions May Accidentally be Jamming Bees Homing Ability

<http://www.hyperstealth.com/haarp/index.htm> 35. Daniells, C., Duce, I., Thomas, D., Sewell, P., Tattersall, J., & de Pomerai, D. (1998). Transgenic nematodes as biomonitors of microwave-induced stress. *Mutation Research*, 399(1), 55-64.

<http://www.ncbi.nlm.nih.gov/pubmed/9635489> 36. Delgado JMR (1985). Biological Effects of Extremely Low Frequency Electromagnetic Fields. *Electromagnetic Biology and Medicine*, 4(1): 75-92

<http://informahealthcare.com/doi/abs/10.3109/15368378509040362> 37. Doherty and Grubb, (1996). Effects of high-voltage power lines on birds breeding within the power lines electromagnetic fields. *Sialia* 18:129-134

<http://audubon-omaha.org/bbbox/nabs/pdtg1.htm> 38. Dongre S.D. and R.G.Verma (2009). Effect Of Cell Phone Radiation On Gauriya Sparrows *Passer Domesticus*. *International Research Journal Vol. II, Issue -7*
<http://ssmrae.com/admin/images/ddf68afa10cc9d1545ce7a5f0460bddf.pdf>

39. Durfee WK, Polk C, Smith LT, Yates VJ. (1975). Extremely Low Frequency Electric and Magnetic Fields in Domestic Birds. University of Rhode Island, Technical Report, Phase I (Continuous Wave), March 1, 1975.

40. Edwards, D. K. (1961). Influence of electrical field on pupation and oviposition in *Nepytia phantasmaria* str. (Lepidoptera, Geometridae). *Nature* 191, 976-993.

<http://www.nature.com/nature/journal/v191/n4792/abs/191976a0.html> 41. Eskov EK. (2006). [Destabilization of the cardiac function of an insect by a low-frequency electric field]. *Biofizika*. 51(1):153-5. [Article in Russian]. <http://www.ncbi.nlm.nih.gov/pubmed/16521566>

42. Eskov EK., Sapozhnikov AM (1976). [Mechanisms of generation and perception of electric fields by honey bees.] *Biophysik* 21(6): 1097-1102. [Article in Russian] <http://www.ncbi.nlm.nih.gov/pubmed/1009204>

<http://www.ncbi.nlm.nih.gov/pubmed/1009204>

43. Everaert, J. & D. Bauwens, (2007) A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding House Sparrows (*Passer domesticus*), *Electromagn. Biol. Med.* 26 63-72.

<http://www.ncbi.nlm.nih.gov/pubmed/17454083> Full text:

http://www.ct.gov/csc/lib/csc/pendingproceeds/docket_409/inlandwetland/409-iw_exh69-79.pdf#page=17 (p 40-49).

44. Farrell, J. M., Litovitz, T. L., Penafiel, M., Montrose, C.J., Doinov, P., Barber, M., Brown, K.M., and Litovitz, T. A. (1997). The effect of pulsed and sinusoidal magnetic fields on the morphology of developing chick embryos. *Bioelectromagnetics* 18:431-438.

<http://www.ncbi.nlm.nih.gov/pubmed/9261540> 45. Favre, D. (2011). Mobile phone-induced honeybee worker piping. *Apidologie*.

<http://www.springerlink.com/content/bx23551862212177/fulltext.pdf> 46. Fernie KJ, Reynolds SJ. (2005). The effects of electromagnetic fields from power lines on avian reproductive biology and physiology: a review. *Toxicol Environ Health B Crit Rev.* 8(2):127-40.

http://www.ierp.bham.ac.uk/documents/pub_Fernie_and_Reynolds_2005.pdf 47. Fernie, K.J, D.M. Bird, R.D. Dawson, P.C. Lague, (2000) Effects of electromagnetic fields on the reproductive success of American kestrels, *Physiol. Biochem. Zool.* 73 60-65.

- <http://www.ncbi.nlm.nih.gov/pubmed/10685907> 48. Fernie, K.J. & D.M. Bird, (1999) Effects of electromagnetic fields on body mass and food-intake of American kestrels, *Condor* 101 616–621.
- http://www.avaate.org/IMG/pdf/fernien_cernicalos.pdf 49. Fernie, K.J. & D.M. Bird, (2001) Evidence of oxidative stress in American kestrels exposed to electromagnetic fields, *Environ. Res. A* 86 198–207.
- <http://www.ncbi.nlm.nih.gov/pubmed/11437466> 50. Fernie, K.J., D M Bird, and D Petitclerc. (1999). Effects of electromagnetic fields on photophasic circulating melatonin levels in American kestrels. *Environ Health Perspect.*107(11): 901–904.
- <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1566687/> 51. Fernie, K.J., N.J. Leonard, D.M. Bird. (2000). Behavior of free-ranging and captive Americankestrels under electromagnetic fields, *J. Toxicol. Environ. Health, Part A* 59. 597–603.
- <http://www.ncbi.nlm.nih.gov/pubmed/10839495> 52. Friend AW, E. D. Finch and H. P. Schwan. (1975). Low frequency electric field inducedchanges in the shape and motility of amoebas. *Science*, 187: 357-359.
- <http://www.ncbi.nlm.nih.gov/pubmed/1111109> 53. Gabar, A.A. (2010). Biological Effects of Electromagnetic Radiation. PhD Thesis. Agricultural University of Athens.
- http://dspace.aua.gr/xmlui/bitstream/handle/10329/817/Gabr_A.pdf?sequence=1 54. Galvin MJ, McRee DI, Hall CA, Thaxton JP, Parkhurst CR. (1981). Humoral and cell-mediatedimmune function in adult Japanese Quail following exposure to 2.45-GHz microwaveradiation during embryogeny. *Bioelectromagnetics*. 2(3):269-78.
- <http://www.ncbi.nlm.nih.gov/pubmed/7306223> 55. Gildersleeve RP, Bryan TE, Galvin MJ, McRee DI, Thaxton JP. (1988). Serum enzymes inhemorrhaged Japanese quail after microwave irradiation during embryogeny. *Comp Biochem Physiol A Comp Physiol*. 89(4):531-4.
- <http://www.ncbi.nlm.nih.gov/pubmed/2899471> 56. Gildersleeve RP, MJGalvin, DI McRee, JP Thaxton (1986). Response of Japanese quail tohemorrhagic stress after exposure to microwave radiation during embryogeny. *Comp Biochem Physiol A Comp Physiol*. 85(4): 679-687.
- <http://www.ncbi.nlm.nih.gov/pubmed?term=2879671> 57. Gildersleeve RP, Satterlee DG, McRee DI, Bryan TE, Parkhurst CR. (1988). Plasmacorticosterone in hemorrhaged Japanese quail after microwave irradiation in ovo. *Comp Biochem Physiol A Comp Physiol*. 89(3):415-24.<http://www.ncbi.nlm.nih.gov/pubmed/2896572>
58. Gonet, B., Kosik-Bogacka, D.I., Kuźna-Grygiel, W. (2009). Effects of extremely low-frequencymagnetic fields on the oviposition of *Drosophila melanogaster* over three generations. *Bioelectromagnetics*. 30(8):687-9.
- <http://www.ncbi.nlm.nih.gov/pubmed/19630039> 59. Goodman, E.M., Greenbaum, B., and Marron, M.T. (1976). Effects of extremely low frequencyelectromagnetic fields on *Physarum polycephalum*. *Radiat. Res*. 66:531.
- <http://www.jstor.org/discover/10.2307/3574457?uid=3738776&uid=2&uid=4&sid=47698820671907> 60. Graue, L.C. (1975). Orientation of homing pigeons (*Columbia livia*) exposed to electromagneticfields at Project Sanguine’s Wisconsin test facility. In *Compilation of Navy Sponsored ELF Biomedical and Ecological Research Reports*, vol. I. Bethesda, Md: Naval Research and Development Command. 61. Greenberg B, J. C. Kunich, V. P. Binokas. (1978). Effect of High Voltage

Transmission on Honeybees, paper presented at 18th

Annual Life Sciences Symposium, Richland, Wn., October 16-18, 1978. 62. Greenberg, B., Bindokas, V. P., and Gaujer, J. R. (1981). Biological effects of a 760 kV transmission line: Exposures and thresholds in honeybee colonies. *Bioelectromagnetics* 2:315

<http://onlinelibrary.wiley.com/doi/10.1002/bem.2250020404/abstract> 63. Grefner, N. M., Yakovleva, T. L., Boreysha, I. K. (1998). Effects of electromagnetic radiation on tadpole development in the common frog (*Rana temporaria* L.). *Russian J. Ecol.* 29:133–

134. 64. Grigor'ev Iu G. (2003). Biological effects of mobile phone electromagnetic field on chick embryo (risk assessment using the mortality rate). *Radiats Biol Radioecol* 43:541–3.

<http://www.ncbi.nlm.nih.gov/pubmed/14658287> [Article in Russian] 65. Hamann, H.-J., Schmidt, K.-H., and Wiltshcko, W. (1998). Mögliche Wirkungen elektrischer und magnetischer Felder auf die Brutbiologie von Vögeln am Beispiel einer Population von höhlenbrütenden

Singvögeln an einer Stromtrasse. *Z. Vogelk. Natursch. Hessen VogelUmwelt* 9:215–246. 66. Hamrick PE, McRee DI, Thaxton P, Parkhurst CR. (1977). Humoral immunity of Japanese quails subjected to microwave radiation during embryogeny. *Health Phys.* 33(1):23-33. [Noabstract]

<http://www.ncbi.nlm.nih.gov/pubmed/893100> 67. Harst W., Kuhn J., Stever H.. (2006). Can electromagnetic exposure cause a change in behaviour? Studying possible non-thermal influences on honey bees- An approach within the frame work of Educational Informatics.

Acta Systematica – IIAS Intern. J. 6:1–6.

http://www.bemri.org/publications/cat_view/2-publications/5-biological-effects-of-non-ionizing-radiation/17-wildlife.html

68. Hässig M, Jud F, Spiess B. (2012). [Increased occurrence of nuclear cataract in the calf after erection of a mobile phone base station].

Schweiz Arch Tierheilkd. 154(2):82-6. [Article in German]

<http://www.ncbi.nlm.nih.gov/pubmed/22287140> 69. Hässig, M. Jud, F. Naegeli, H. Kupper, J. Spiess, B M.

(2009). Prevalence of nuclear cataract in Swiss veal calves and its possible association with mobile telephone antenna base stations. *Schweizer Archiv für Tierheilkunde.* 151.10.471

<http://www.ncbi.nlm.nih.gov/pubmed/19780007> 70. Hillman, D., Charles Goeke, and Richard Moser.

(2004). Electric and magnetic fields (EMFs) affect milk production and behavior of cows: Results using shielded-neutral isolation transformer. 12th Int. Conf. On

Production Diseases in Farm Animals, Mich. State Univ., College of Veterinary Medicine, July 2004, East Lansing, MI 48824. (Video-DVD available). 71. Hillman, D., D Stetzer, M Graham, CL. Goeke, K E. Mathson,

EE, H H. VanHorn, C J. Wilcox, (2003). Relationship of Electric Power Quality to Milk Production of Dairy Herds. Presentation Paper No.033116, American Society of Agricultural Engineers, International Meeting, July 27-30, 2003, Las Vegas, NV, USA.

www.pq.goeke.net 72. Hjeresen, D. L., Miller, M. C., Kaune, K. T. and Phillips, R. D. (1982). A behavioral response of swine to a 60 Hz electric field. *Bioelectromagnetics* 3, 443-451.

<http://onlinelibrary.wiley.com/doi/10.1002/bem.2250030407/abstract> 73. Hultgren, J. (1990a). Small electric currents affecting farm animals and man: A review with special reference to stray voltage. I.

Electrical properties of the body and the problem of

stray voltage. *Veterinary Research Communications*, 14:287-298. ©Kluwer Pub., Netherlands.

<http://www.springerlink.com/content/x848210574v142m7/> 74. Hultgren, J. 1990b. Small electric currents

affecting farm animals and man: A review with special reference to stray voltage. II. Physiological effects and the concept of stress. *Veterinary Research*

Communications, 14:299-308. ©Kluwer Academic Publishers – Netherlands

<http://www.springerlink.com/content/x848210574v142m7/> 75. Hynek Burda, S Begall, J Cervený, J Neef, and P Nemeč (2009) Extremely low-frequency electromagnetic fields disrupt magnetic alignment of ruminants. PNAS. 106(14):5708-13

<http://www.ncbi.nlm.nih.gov/pubmed/19299504> 76. Ingole IV and , S. K. Ghosh (2006). Exposure to radio frequency radiation emitted by cell phone and mortality in chick embryos (*Gallus domesticus*). Biomedical Research 17(3): 205-210

<http://www.indmedica.com/journals.php?journalid=12&issueid=112&articleid=1530&action=article> 77. Janac B Selaković V, Rauš S, Radenović L, Zrnić M, Prolić Z. (2012) Temporal patterns of extremely low frequency magnetic field-induced motor behaviour changes in Mongolian gerbils of different age, Int J Radiat Biol. 2012 Jan 6.

<http://www.ncbi.nlm.nih.gov/pubmed/22221164> 78. Kimmel S, Kuhn J, Harst W, Stever H (2007). Electromagnetic Radiation: Influences on Honeybees (*Apis mellifera*) (IIAS – InterSymp Conference, Baden-Baden 2007)

http://www.hese-project.org/hese-uk/en/papers/kimmel_iaas_2007.pdf 79. Kirk, J. H., N.D. Reese, and P C. Bartlett. (1984). Stray Voltage on Michigan Dairy Farms. J.American Veterinary Assoc. 185(4): 426-428

<http://www.ncbi.nlm.nih.gov/pubmed/6469841> 80. Kirschvink JL, S. Padmanabha, CK Boyce, J. Oglesby (1997). Measurement of the threshold sensitivity of honeybees to weak, extremely low-frequency magnetic fields. The Journal of Experimental Biology 200:1363–68

<http://jeb.biologists.org/content/200/9/1363.full.pdf+html> 81. Klimovitsky VYa, Loginov VA, Zagorskaya EA, Weissleder H, Drescher J, Hecht K. (1992). The evaluation of biological efficiency of electromagnetic fields generated by implanted radiotelemetric transmitters used in space research on animals. Physiologist. 35(1Suppl):S248-9.

<http://www.ncbi.nlm.nih.gov/pubmed?term=Hecht%2C%20K.%20emf> 82. Korall, H., Leucht, T., & Martin, H. (1988). Bursts of magnetic fields induce jumps of misdirection in bees by a mechanism of magnetic resonance. Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology, 162(3), 279-284. doi: 10.1007/BF00606116.

<http://www.springerlink.com/content/v6406173767q7445/> 83. Krueger WF, A. J. Giarola, J. W. Bradley, and A. Shrekenhamer (1975). Effects of Electromagnetic Fields on Fecundity in the Chicken, Ann. N.Y. Acad. Sci., 247: 391 <http://www.ncbi.nlm.nih.gov/pubmed/1054241>

84. Krylov, V.V. (2010). Effects of electromagnetic fields on parthenogenic eggs of *Daphnia magna* Straus. Ecotoxicology and Environmental Safety, 73(1): 62-66.

<http://www.ncbi.nlm.nih.gov/pubmed?term=19362370> 85. Kumar N. R., Sangwan S., Badotra P. (2011). Exposure to cell phone radiations produces biochemical changes in worker honey bees. Toxicol. Int. 18:70–72.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052591/> 86. Larkin RP and PJ Sutherland (1977) Migrating birds respond to Project Seafarer's electromagnetic field. Science 25 February 1977: 195(4280): 777-9.

<http://www.sciencemag.org/content/195/4280/777.2.abstract> 87. Lefcourt, Alan M., and R. M. Akers. 1981. Endocrine Response of Cows Subjected to Controlled Voltages During Milking. J. Dairy Sci. 65:2125-2130.

88. Levengood, WC (1969). A new teratogenic agent

applied to amphibian embryos. *J. Embryol. Exp. Morphol.* 21:23–31.

<http://www.ncbi.nlm.nih.gov/pubmed/5765792> 89. Levin, M. (2003). Bioelectromagnetics in morphogenesis. *Bioelectromagnetics* 24:295–315.

<http://www.ncbi.nlm.nih.gov/pubmed/12820288> 90. Löscher, W. and Käs, G. (1998). Conspicuous behavioural abnormalities in a dairy cow herd near a TV and Radio transmitting antenna. *Practical Veterinary surgeon*, 29: 5, 437-444

www.croww.org/study-effects.pdf 91. Magras, I.N and T.D. Xenos, (1997) RF-induced changes in the prenatal development of mice, *Bioelectromagnetics* 18. 455–461.

<http://www.ncbi.nlm.nih.gov/pubmed/9261543> 92. Marks TA., CC Rathke, WO English. (1995). Controversies in Toxicology—Stray voltage and development, reproductive and other toxicology problems in dogs, cats and cows: A discussion. *Vet Human Toxicol* 37(2):163-172.

93. Marks, T.A., C.C. Ratke and W.O. English. (1995). Stray voltage and developmental, reproductive and other toxicology problems in dogs, cats and cows: a discussion. *Vet. Hum. Toxicol*, 37: 163-172.

<http://www.ncbi.nlm.nih.gov/pubmed/7631499> 94. Marks, T.A., C.C. Ratke and W.O. English. (1995). Stray voltage and developmental, reproductive and other toxicology problems in dogs, cats and cows: a discussion. *Vet. Hum. Toxicol*, 37: 163-172.

<http://www.ncbi.nlm.nih.gov/pubmed/7631499> 95. Marsh, G. (1968). The effect of 60-cycle AC current on the regeneration axis of *Dugesia*. *J. Exp. Zool.* 169:65.

<http://onlinelibrary.wiley.com/doi/10.1002/jez.1401690109/abstract> 96. Maw, MG. (1962). Behaviour of insects in electrostatic fields. *Proc. Entomol. Soc. Manitoba.* 18,30-36. 97. McKinley G. M. and D.R. Charles (1930). Certain biological effects of high frequency fields, *Science*, 71: 490. 98. McKinley, G. M. (1930). Some biological effects of high frequency electrostatic fields', *Proc. Penn. Acad. Sci* 46. 99. Meral I, Mert H, Mert N, Deger Y, Yoruk I, Yetkin A, Keskin S. (2007). Effects of 900-MHz electromagnetic field emitted from cellular phone on brain oxidative stress and some vitamin levels of guinea pigs. *Brain Res.* 1169:120-4.

<http://www.ncbi.nlm.nih.gov/pubmed/17674954> 100. Neurath, P. W. (1968). High gradient magnetic field inhibits embryonic development of frogs. *Nature* 219: 1358 101. Newland PL, E Hunt, SM Sharkh, N Hama, M Takahata, CW Jackson (2008). Static electric field detection and behavioural avoidance in cockroaches. *J Exp Biol* 211, 3682-3690.

<http://jeb.biologists.org/content/211/23/3682.full> 102. Nicholls B, Racey PA. (2007). Bats avoid radar installations: Could electromagnetic fields deter bats from colliding with wind turbines? *PLoS ONE.* 2(3):e297.

<http://www.ncbi.nlm.nih.gov/pubmed/17372629> 103. Nicholls B, Racey PA. (2009). The aversive effect of electromagnetic radiation on foraging bats: a possible means of discouraging bats from approaching wind turbines. *PLoS One.* 16;4(7):e6246.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2705803/?tool=pubmed> 104. Nittby H, Moghadam MK, Sun W, Malmgren L, Eberhardt J, Persson BR, Salford LG. (2011). Analgetic effects of non-thermal GSM-1900 radiofrequency electromagnetic fields in the land snail *Helix pomatia*. *Int J Radiat Biol.* 2011 Dec 20. [Epub ahead of print]

<http://www.ncbi.nlm.nih.gov/pubmed/22124250> 105. Olsen, R.G., (1997). Insect teratogenesis in a

standing-wave irradiation system. *RadioScience* 12: 199-207.

<http://www.agu.org/pubs/crossref/1977/RS012i06Sp00199.shtml> 106. Orlov, V. M. (1990). Invertebrates and high voltage power lines *Electromagnetic Biology and Medicine* 9(2): 121-131

<http://informahealthcare.com/doi/abs/10.3109/15368379009119800> 107. Orlov, V. M. and Babenko, A. S. (1988). Effect of the electric field of high voltage transmission lines on land invertebrates. *Sov. J. Ecol.* 18,267 -274 108. Panagopoulos D.J., Karabarbounis A., and Margaritis L.H., (2004). Effect of GSM 900-MHz Mobile Phone Radiation on the Reproductive Capacity of *Drosophila melanogaster*, *Electromagnetic Biology and Medicine*, 23(1), 29-43.

<http://www.ncbi.nlm.nih.gov/pubmed/17045516> 109. Perumpral, J. V., Earp, U. F. and Stanley, J. M. (1978). Effects of electrostatic fields on locational preference of house flies and flight activities of cabbage loopers. *Environ. Entomol.* 7, 482-486.

<http://www.ingentaconnect.com/content/esa/envent/1978/00000007/00000003/art00032> 110. Prolić Z, R Jovanović, G Konjević, B Janać (2003). Behavioral Differences of the Insect *Morimus funereus* (Coleoptera, Cerambycidae) Exposed to an Extremely Low Frequency Magnetic Field. *Electromagnetic Biology and Medicine* 22(1): 63–73. <http://informahealthcare.com/doi/abs/10.1081/JBC-120020358>

111. Prolić, Z., Jovanović, Z. (1986) [Influence of magnetic field on the rate of development of honey bee preadult stage]. *Periodicum biologorum, Zagreb*, 88: 187-188 112. Rejt L, Mazgajski T, Kubacki R, Kieliszek J, Sobiczewska E, Szmigielski S. (2007). Influence of radar radiation on breeding biology of tits (*Parus* sp.). *Electromagn Biol Med* .26(3):235-8.

<http://www.ncbi.nlm.nih.gov/pubmed/17886009> 113. Rochalska M (2009). [The influence of electromagnetic fields on flora and fauna]. *Medycyna pracy* 60(1):43-50 [Article in Polish]

<http://ukpmc.ac.uk/abstract/MED/19603696> 114. Rochalska M (2007). [The effect of electromagnetic fields on living organisms: plants, birds and animals]. *Medycyna pracy* 58(1):37-48 [Article in Polish]

<http://ukpmc.ac.uk/abstract/MED/17571627> 115. Rochalska M.(2007). [The effect of electromagnetic fields on living organisms: plants, birds and animals]. *Med Pr.* 58(1):37-48. [Article in Polish]

<http://www.ncbi.nlm.nih.gov/pubmed/17571627> 116. Rodriguez, M., D. Petitclerc, J.F. Burchard, D.H. Nguyen, E. Block and B.R. Downey(2003). Responses of the estrous cycle in dairy cows exposed to electric and magnetic fields(60 Hz) during 8-h photoperiods. *Anim. Reprod. Sci.*, 15: 11-20.

[http://www.journals.elsevierhealth.com/periodicals/anirep/article/S0378-4320\(02\)00273-7/abstract](http://www.journals.elsevierhealth.com/periodicals/anirep/article/S0378-4320(02)00273-7/abstract) 117. Sainudeen Sahib S. (2011). Impact of mobile phones on the density of honeybees. *Journal of public administration and policy research* 3(4) pp. 131-117.

<http://www.academicjournals.org/jhf/PDF/pdf2011/April/Sainudeen%20sahib.pdf> 118. Sainudeen Sahib.S (2010). Electromagnetic Radiation (EMR) Clashes with Honey Bees. *International Journal of Environmental Sciences.* 1(5). 897-900.

<http://ipublishing.co.in/jesvol1no12010/EIJES2044.pdf> 119. Salama N, Kishimoto T, Kanayama HO, Kagawa S. (2010). Effects of exposure to a mobile phone on sexual behavior in adult male rabbit: an observational study, *Int J Impot Res* .22(2):12733

- <http://www.ncbi.nlm.nih.gov/pubmed/19940851> 120. Savić T, Janać B, Todorović D, Prolić Z. (2011). The embryonic and post-embryonic development in two *Drosophila* species exposed to the static magnetic field of 60 mT. *Electromagn Biol Med.* 30(2):108-14.
- <http://www.ncbi.nlm.nih.gov/pubmed/21591895> 121. Semm P.(1983) Neurobiological investigation of the magnetic sensitivity of the pineal gland in rodents and pigeons. *Comp Biochem Physiol A* 76:683–689
- <http://www.sciencedirect.com/science/article/pii/S0300962983901299> 122. Severini, M and Bosco, L. (2010). Delayed maturation of *Xenopus laevis* (Daudin) tadpoles exposed to a weak ELF magnetic field: sensitivity to small variations of magnetic flux density. *Eur. J. Oncol. Library.* 5: 247-60.
- <http://www.emf-portal.de/viewer.php?l=g&aid=18903> 123. Sharma V.P. and N.R. Kumar (2010). Changes in Honeybee Behaviour and Biology Under the Influence of Cellphone Radiations. *Current Science* 98 (10). 1376-78.
- http://www.bemri.org/publications/doc_view/286-changes-in-honeybee-behaviour-and-biology-under-the-influence-of-cellphone-radiations.raw?tmpl=component 124. Sheiman I. M., Kreshchenko N. D. (2009). [Influence of weak electromagnetic field on different forms of behavior in grain beetle, *Tenebrio molitor*] [Article in Russian]. *Zh Vyssh Nerv Deiat Im I P Pavlova.* Jul-Aug; 59(4):488-94.
- <http://www.ncbi.nlm.nih.gov/pubmed/19795812> 125. Shutenko, O. I., et al. (1981). Effects of super-high electromagnetic fields on animals of different ages. *Gigiyena i Sanitariya*, no. 10:35-38, *JPRS* 84 221: 85-90. 126. Southern W. (1975). Orientation of Gull Chicks Exposed to Project Sanguine's Electromagnetic Field, *Science*, 189: 143.
- <http://www.sciencemag.org/content/189/4197/143.short> 127. Stärk, K. D., Krebs, T., Altpeter, E., Manz, B., Griot, C., & Abelin, T. (1997). Absence of chronic effect of exposure to short-wave radio broadcast signal on salivary melatonin concentrations in dairy cattle. *Journal of Pineal Research*, 22(4), 171-6.
- <http://www.ncbi.nlm.nih.gov/pubmed/9247202> 128. Summers-Smith, J.D. (2003). The decline of the house sparrow: a review. *Brit. Birds* 96:439–446.
- <http://www.ndoc.org.uk/articles/passerine1.htm> 129. Tanner J.A. (1969) National Research centre of Canada Extract from LTR-CS-18. "Effects of microwave radiation on Parakeets in Flight" 130. Tanner J.A., C. Romero-Sierra (1982). The Effects of Chronic Exposure to Very Low Intensity Microwave Radiation on Domestic Fowl. *Electromagnetic Biology and Medicine.* 1(2): 195–205.
- <http://informahealthcare.com/doi/abs/10.3109/15368378209040336> 131. Tanner JA, C. Romero-Sierra and S.J. Davie (1969) The Effects of Microwaves on Birds: Preliminary Experiments. *JMPEE* 4(2): 122-28.
- http://www.jmpee.org/JMPEE_PDFs/04-2_bi/JMPEE-Vol4-Pg122-Tanner.pdf 132. Tanner JA, Romero-Sierra C. and Davie, SJ. (1969). The effects of microwave on birds: preliminary experiments. *Journal of Microwave Power.* 4(2): 122. (Cited in McRee 1972). 133. Tanner JA. (1966). Effect of microwave radiation on birds. *Nature.* 7; 210(5036):636.
- <http://www.ncbi.nlm.nih.gov/pubmed/5964569> 134. Tanner, J.A. & DR. Sierra, romero (1973) Dept of Anatomy, Queen University, Kingston Canada Extract from LTR- Cs-89. "Bird Feathers as Dialectic Receptors of Microwave Radiation." 135. Temuryants NA, Demtsun NA (2010). Seasonal differences in the regeneration of planarians under conditions of long-term

electromagnetic shielding. *Biophysics* 55(4): 628-632,

<http://www.springerlink.com/content/h34v2v174357v524/> 136. Ubeda, A., J Leal, M A Trillo, M A Jimenez, and J M Delgado. (1983). Pulse shape of magnetic fields influences chick embryogenesis. *Anat.* 137(Pt 3): 513–536.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1171845/pdf/janat00207-0069.pdf> 137. Ubeda, A; M.A. Trillo, L. Chacón, M.J. Blanco, J. Leal (1994). Chick embryo development can be irreversibly altered by early exposure to weak extremely-low-frequency magnetic fields, *Bioelectromagnetics* 15 (1994) 385–398.

<http://www.ncbi.nlm.nih.gov/pubmed/7802707> 138. Walker MM and M.E. Bitterman (1989). Honeybees Can Be Trained to Respond to Very Small Changes in Geomagnetic Field Intensity. *J. Exp. Biology* 145, 489-494

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1851986/> 139. Warnke . U. (1976). Effects of electric charges on honeybees Effects of electric charges on honeybees . *Bee World* 57(2):50-56.

<http://bemri.org/publications/biological-effects-of-non-ionizing-radiation.html> 140. Warnke . U. (2007). Birds, Bees and Mankind. The Competence Initiative for the Humanity, Environment and Democracy. Brochure 1.

http://www.bemri.org/publications/cat_view/2-publications/5-biological-effects-of-non-ionizing-radiation/17-wildlife.html 141. Wasserman et al. (1984) The effects of microwave radiation on avian dominance behavior *Bioelectromagnetics* 5:331-339

<http://www.ncbi.nlm.nih.gov/pubmed/6487384?dopt=Abstract> 142. Watson DB (1988). The bouncing of *Drosophila melanogaster* in power frequency electric fields *New Zealand Entomologist* 11(1): 21–24

http://www.ento.org.nz/nzentomologist/free_issues/NZEnto11_1_1988/Volume%2011-21-24.pdf 143. Weisbrot D, Lin H, Ye L, Blank M, Goodman R. (2003). Effects of mobile phone radiation on reproduction and development in *Drosophila melanogaster*. *J Cell Biochem.* 1;89(1):48-55

<http://www.ncbi.nlm.nih.gov/pubmed/12682907> 144. Wellenstein, G. (1973). The influence of high tension lines on honey bee colonies. *Zeitschrift fur Angewandte Entomologie*, 74, 86-94 145. Williams, T.C. (1976). A radar investigation of the effects of extremely low frequency electromagnetic fields on free flying migrant birds. In *Compilation of Navy Sponsored ELF Biomedical and Ecological Research Reports*, vol. 3. Bethesda, Md.: Naval Research and Development Command. 146. Windle BC. (1895). The Effects of Electricity and Magnetism on Development. *J Anat Physiol.* 29(Pt 3): 346–351

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1328408/> 147. Youbicier-Simo, B. J, Boudard, F., Cabaner, C., and Bastide, M. (1997). Biological effects of continuous exposure of embryos and young chickens to electromagnetic fields emitted by video display units. *Bioelectromagnetics* 18:514–523.

[http://onlinelibrary.wiley.com/doi/10.1002/\(SICI\)1521-186X\(1997\)18:7%3C514::AID-BEM7%3E3.0.CO;2-5/abstract](http://onlinelibrary.wiley.com/doi/10.1002/(SICI)1521-186X(1997)18:7%3C514::AID-BEM7%3E3.0.CO;2-5/abstract) 148. Zareen N, Khan MY. (2008). Effect of mobile phone induced electromagnetic fields on the development of chick embryo. *J Coll Physicians Surg Pak.* 18(8):528-9.

<http://www.ncbi.nlm.nih.gov/pubmed/18798598> 149. Zareen N, MY Khan, LA Minhas (2009). Dose Related Shifts In The Developmental Progress Of Chick Embryos Exposed To Mobile Phone Induced Electromagnetic Fields. *J Ayub Med Coll Abbottabad.* 21(1): 130-34.

<http://www.ncbi.nlm.nih.gov/pubmed/20364761>;

<http://ayubmed.edu.pk/JAMC/PAST/21-1/Zareen.pdf> 150. Stindl R, Stindl W Jr. (2010) Vanishing honey bees: Is the dying of adult worker bees a consequence of short telomeres and premature aging?, *Med Hypotheses*. 75(4):387-90. 151. van Engelsdorp D, Hayes

J Jr, Underwood RM, Pettis J. (2008) A survey of honey bee colony losses in the U.S., fall 2007 to spring 2008. *PLoS One*. 3(12):e4071. 152. Bacandritsos N, Granato A, Budge G, Papanastasiou I, Roinioti E, Caldon M, Falcaro C, Gallina A, Mutinelli F. (2010) Sudden

deaths and colony population decline in Greek honey bee colonies. *J Invertebr Pathol*. Sep 23

<http://www.ncbi.nlm.nih.gov/pubmed/20804765> 153. Erickson, EH (1975). Surface electric potentials on worker honeybees leaving and entering the hive. *J. Apic. Res.* 14: 141-147.



Sandra Kandell <skandell@cityofpacificgrove.org>

Butterfly disorientation from Wireless radiation--additional studies

1 message

vincent alfait <docfreedaddy@hotmail.com>

Wed, Jul 25, 2018 at 5:23 PM

To: "rfischer@cityofpacificgrove.org" <rfischer@cityofpacificgrove.org>, "cgarfield@cityofpacificgrove.org" <cgarfield@cityofpacificgrove.org>, Bill Kampe <bkampe@cityofpacificgrove.org>, Bill Peake <bpeake@cityofpacificgrove.org>, "kencun17@icloud.com" <kencun17@icloud.com>, "huitt@comcast.net" <huitt@comcast.net>, "nsmith@cityofpacificgrove.org" <nsmith@cityofpacificgrove.org>, "citymanager@cityofpacificgrove.org" <citymanager@cityofpacificgrove.org>, "cityclerk@cityofpacificgrove.org" <cityclerk@cityofpacificgrove.org>, "dave@laredolaw.net" <dave@laredolaw.net>

REVIEWS OF THE SCIENCE

Balmori, Alfonso. ["Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation."](#) *Science of The Total Environment*, vol. 518–519, 2015, pp. 58–60

- The growth of wireless telecommunication technologies causes increased electrosmog. Radio frequency fields in the MHz range disrupt insect and bird orientation.
- Radio frequency noise interferes with the primary process of magnetoreception. Existing guidelines do not adequately protect wildlife. Further research in this area is urgent.

Cucurachi, C., et al. ["A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\)."](#) *Environment International*, vol. 51, 2013, pp. 116–40.

- A Review of 113 studies from original peer-reviewed publications. RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. Development and reproduction of birds and insects are the most strongly affected endpoints.

Balmori, A. ["Electrosmog and species conservation."](#) *Science of the Total Environment*, vol. 496, 2014, pp. 314-6.

- "Conclusion: At the present time, there are reasonable grounds for believing that microwave radiation constitutes an environmental and health hazard....Concerning the exposure to electromagnetic fields, the precautionary principle is needed and should be applied to protect species from environmental non-thermal effects (Zinelis, 2010). Controls must be introduced and technology rendered safe to the environment, since this new ubiquitous and invisible pollutant could deplete the efforts devoted to species conservation."

Manville, Albert M. ["A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don't Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife."](#) *Wildlife and Habitat Conservation Solutions*, 2014.

- "In summary, we need to better understand ... how to address these growing and poorly understood radiation impacts to migratory birds, bees, bats, and myriad other wildlife. At present, given industry and agency intransigence ... massive amounts of money being spent to prevent addressing impacts from non-thermal radiation — not unlike the battles over tobacco and smoking — and a lack of significant, dedicated and reliable funding to advance independent field studies, ... we are left with few options. Currently, other than to proceed using the

precautionary approach and keep emissions as low as reasonably achievable, we are at loggerheads in advancing meaningful guidelines, policies and regulations that address non-thermal effects....”

EKLIPSE REPORT, an EU-funded review body dedicated to policy that may impact biodiversity and the ecosystem, looked over 97 studies on how electromagnetic radiation may affect the environment. It concluded this radiation could indeed pose a potential risk to bird and insect orientation and plant health. [EKLIPSE REPORT WEBPAGE](#)

- Malkemper EP, Tscheulin T, VanBergen AJ, Vian A, Balian E, Goudeseune L (2018). [The impacts of artificial Electromagnetic Radiation on wildlife \(flora and fauna\). Current knowledge overview: a background document to the web conference.](#) A report of the EKLIPSE project.
- Goudeseune L, Balian E, Ventocilla J (2018). [The impacts of artificial Electromagnetic Radiation on wildlife \(flora and fauna\). Report of the web conference.](#) A report of the EKLIPSE project. <http://bit.ly/EKLIPSEconfreport>

Bees, Bugs And Butterflies

“Cryptochromes are very badly affected by weak oscillating electromagnetic fields that are orders of magnitude weaker than the Earth’s steady magnetic field. This can disrupt both solar and magnetic navigation, which can account for colony collapse disorder in bees.”

—Dr. Andrew Goldsworthy

Research clearly shows that Bees and Butterflies are sensitive to electromagnetic fields.

Cammaerts, Marie-Claire. [“Is electromagnetism one of the causes of the CCD? A work plan for testing this hypothesis.”](#) *Journal of Behavior*, vol. 2, no. 1, 2017, pp. 1006.

- The decline of domestic bees all over the world is an important problem still not well understood by scientists and beekeepers, and far from being solved. Its reasons are numerous: among others, the use of pesticides and insecticides, the decrease of plant diversity, and bee’s parasites. Besides these threats, there is a potential adverse factor little considered: manmade electromagnetism.
- The present paper suggests two simple experimental protocols for bringing to the fore the potential adverse effect of electromagnetism on bees and to act consequently. The first one is the observation of bees’ avoidance of a wireless apparatus; the second one is the assessment of colonies’ strength and of the intensity of the electromagnetism field (EMF) surrounding them. If bees avoid a wireless apparatus, if hives in bad health are located in EMF of a rather high intensity, it can be presumed that bees are affected by manmade electromagnetism. This should enable searching for palliative measures.

Goldsworthy, Andrew. [“The Birds, the Bees and Electromagnetic Pollution: How electromagnetic fields can disrupt both solar and magnetic bee navigation and reduce](#)

immunity to disease all in one go.” 2009.

- Many of our birds are disappearing mysteriously from the urban environment and our bees are now under serious threat. There is increasing evidence that at least some of this is due to electromagnetic pollution such as that from cell towers, cell phones, DECT cordless phones and Wifi. It appears capable of interfering with their navigation systems and also their circadian rhythms, which in turn reduces their resistance to disease. The most probable reason is that these animals use a group of magnetically-sensitive substances called cryptochromes for magnetic and solar navigation and also to control the activity of their immune systems.

Guerra, Patrick A., Robert J. Gegear, and Steven M. Reppert. **“A magnetic compass aids monarch butterfly migration.”** *Nature Communications*, vol. 5, no. 4164, 2014.

- “Here we use flight simulator studies to show that migrants indeed possess an inclination magnetic compass to help direct their flight equator ward in the fall. Another vulnerability to now consider is the potential disruption of the magnetic compass in monarchs by human-induced electromagnetic noise, which can apparently disrupt geomagnetic orientation in a migratory bird.”

Kumar, Neelima R., Sonika Sangwan, and Pooja Badotra. **“Exposure to cell phone radiations produces biochemical changes in worker honey bees.”** *Toxicol Int.*, 18, no. 1, 2011, pp. 70–2.

- The present study was carried out to find the effect of cell phone radiations on various biomolecules in the adult workers of *Apis mellifera* L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees’ behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward “talk mode” cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.

Favre, Daniel. **“Mobile phone induced honeybee worker piping.”** *Apidologie*, vol. 42, 2011, pp. 270-9.

- Electromagnetic waves originating from mobile phones had a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.

Warnke, Ulrich. **“Birds, Bees and Mankind: Destroying Nature by ‘Electrosmog’.”** *Competence Initiative for the Protection of Humanity, Environment and Democracy*, Brochure 1, 2009.

- Bees pollinate approximately 1/3 of all crops and they are disappearing by the millions. Warnke raises the concern that the dense, energetic mesh of electromagnetic fields from wireless technologies may be the cause.

Sharma, V.P. and N.K. Kumar. **“Changes in honeybee behaviour and biology under the influence of cellphone radiations.”** *Current Science*, vol. 98, no 10, 2010, pp. 1376-8.

- We have compared the performance of honeybees in cell phone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment.”

“Briefing Paper on the Need for Research into the Cumulative Impacts of Communication Towers on Migratory Birds and Other Wildlife in the United States.” *Division of Migratory Bird Management (DMBM), U.S. Fish & Wildlife Service, 2009.*

- Of concern to DMBM are the potential impacts of radiation on bird populations. For example, preliminary research on wild birds at cellular phone tower sites in Spain showed strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, and roosting in the vicinity of the electromagnetic fields.

Harst, Wolfgang Harst, Jochen Kuhn and Hermann Stever. **“Can Electromagnetic Exposure Cause a Change in Behaviour? Studying Possible Non-thermal Influences on Honey Bees – An Approach Within the Framework of Educational Informatics.”** *Acta Systemica-IIAS International Journal*, vol 6, no. 1, 2006, pp. 1-6.

- A pilot study on honeybees testing the effects of non-thermal, high frequency electromagnetic radiation on beehive weight and flight return behavior. In exposed hives, bees constructed 21% fewer cells in the hive frames after 9 days than those unexposed.

Sainudeen, Sahib.S. **“Electromagnetic Radiation (EMR) Clashes with Honey Bees.”** *International Journal of Environmental Sciences*, vol. 1, no. 5, 2011.

- Recently a sharp decline in population of honey bees has been observed in Kerala. Although the bees are susceptible to diseases and attacked by natural enemies like wasps, ants and wax moth, constant vigilance on the part of the bee keepers can overcome these adverse conditions. The present plunge in population (< 0.01) was not due to these reasons. It was caused by man due to unscientific proliferation of towers and mobile phones.”
- Six colonies of honeybees (*Apis mellifera*) were selected. Three colonies were selected as test colonies (T1, T2 & T3) and the rest were as control (C1, C2 & C3). The test colonies were provided with mobile phones in working conditions with frequency of 900 MHz for 10 minutes for a short period of ten days. After ten days the worker bees never returned to their hives in the test colonies. The massive amount of radiation produced by mobile phones and towers is actually frying the navigational skills of the honey bees and preventing them from returning back to their hives.
- The study concludes, “More must also be done to compensate individuals and communities put at risk. Insurance covering diseases related to towers, such as cancer, should be provided for free to people living in 1 km radius around the tower. Independent monitoring of radiation levels and overall health of the community and nature surrounding towers is necessary to identify hazards early. Communities need to be given the opportunity to reject cell towers and national governments need to consider ways of growing their cellular networks without constantly exposing people to radiation.”

“The potential dangers of electromagnetic fields and their effect on the environment.” *Council of Europe Parliamentary Assembly*, resolution 1815, 2011.

- The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. While electrical and electromagnetic fields in certain frequency bands have fully beneficial effects which are applied in medicine, other non-ionising frequencies, be they sourced from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals, as well as the human body when exposed to levels that are below the official threshold values. One must respect the precautionary principle and revise the current threshold values; waiting for high

levels of scientific and clinical proof can lead to very high health and economic costs, as was the case in the past with asbestos, leaded petrol and tobacco

- As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty.

Kimmel, Stefan, et al. **“Electromagnetic radiation: influences on honeybees (*Apis mellifera*).”** *IAS-InterSymp Conference*, 2007.

- 39.7% of the non-irradiated bees had returned to their hives while only 7.3% of the irradiated bees had.

Clarke, Dominic, et al. **“Detection and Learning of Floral Electric Fields by Bumblebees.”** *Science*, vol. 340, no. 6128, 2013, pp. 66-9. 5

- “We report a formerly unappreciated sensory modality in bumblebees (*Bombus terrestris*), detection of floral electric fields. Because floral electric fields can change within seconds, this sensory modality may facilitate rapid and dynamic communication between flowers and their pollinators.”

Gegear, Robert J. et al. **“Animal Cryptochromes Mediate Magnetoreception by an Unconventional Photochemical Mechanism.”** *Nature*, vol. 463, no. 7282, 2010, pp. 804.

- “A team of neurobiologists that has investigated the mysteries of monarch migration for many years now reports that photoreceptor proteins found in monarch butterflies are linked to animal navigation. Their research finds that two types of photoreceptor proteins not only allow the butterflies to see UV light (light that is less than 420nm long, and thus, is invisible to humans), but also allows them to sense the Earth’s geomagnetic field. These photoreceptor proteins are known as cryptochromes.”

Oschman, James and Nora Oschman. **“Electromagnetic communication and olfaction in insects.”** *Frontier Perspectives*, 2004.

“Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees.” *Ministry of Environment and Forest*, Government of India, 2010.

- This report details the on impacts of communication towers on wildlife including birds and bees submitted to MoEF. It warns of harmful radiation and recommends special laws to protect urban flora & fauna from threats radiation emerging from mobile towers.

Sivani, S., and D. Sudarsanam. **“Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem – A Review.”** *Biology and Medicine*, vol. 4, no. 4, 2012, pp. 202–16.

- There is an urgent need for further research and “of the 919 research papers collected on birds, bees, plants, other animals, and humans, 593 showed impacts, 180 showed no impacts, and 196 were inconclusive studies”.
- “One can take the precautionary principle approach and reduce RF-EMF radiation effects of cell phone towers by relocating towers away from densely populated areas, increasing height of towers or changing the direction of the antenna.”

Arno Thielens, Duncan Bell, David B. Mortimore, Mark K. Greco, Luc Martens & Wouter Joseph, [Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz](#), Scientific Reports volume 8, Article number: 3924 (2018)

- Insects are continually exposed to Radio-Frequency (RF) electromagnetic fields at different frequencies. The range of frequencies used for wireless telecommunication systems will increase in the near future from below 6 GHz (2 G, 3 G, 4 G, and WiFi) to frequencies up to 120 GHz (5 G). This paper is the first to report the absorbed RF electromagnetic power in four different types of insects as a function of frequency from 2 GHz to 120 GHz. A set of insect models was obtained using novel Micro-CT (computer tomography) imaging.
- These models were used for the first time in finite-difference time-domain electromagnetic simulations.
- All insects showed a dependence of the absorbed power on the frequency. All insects showed a general increase in absorbed RF power at and above 6 GHz, in comparison to the absorbed RF power below 6 GHz. Our simulations showed that a shift of 10% of the incident power density to frequencies above 6 GHz would lead to an increase in absorbed power between 3–370%.

Schwarze, S., et al. [“Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird \(Erithacus rubecula\) than Strong Narrow-Band Fields.”](#) *Front Behav Neurosci.*, vol. 10, no. 55, 2016.

- Magnetic compass orientation in night-migratory songbirds is embedded in the visual system and seems to be based on a light-dependent radical pair mechanism. Recent findings suggest that both broadband electromagnetic fields ranging from ~2 kHz to ~9 MHz and narrow-band fields at the so-called Larmor frequency for a free electron in the Earth’s magnetic field can disrupt this mechanism. However, due to local magnetic fields generated by nuclear spins, effects specific to the Larmor frequency are difficult to understand considering that the primary sensory molecule should be organic and probably a protein. We therefore constructed a purpose-built laboratory and tested the orientation capabilities of European robins in an electromagnetically silent environment, under the specific influence of four different oscillating narrow-band electromagnetic fields, at the Larmor frequency, double the Larmor frequency, 1.315 MHz or 50 Hz, and in the presence of broadband electromagnetic noise covering the range from ~2 kHz to ~9 MHz. Our results indicated that the magnetic compass orientation of European robins could not be disrupted by any of the relatively strong narrow-band electromagnetic fields employed here, but that the weak broadband field very efficiently disrupted their orientation.

Engels, S. et al. [“Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird.”](#) *Nature*, vol. 509, 2014, pp. 353–6.

- Scientists found that migrating robins became disorientated when exposed to electromagnetic fields at levels far lower than the safety threshold for humans. “Here we show that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise... These fully double-blinded tests document a reproducible effect of anthropogenic electromagnetic noise on the behavior of an intact vertebrate.”

Balmori A. [“Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork \(Ciconia ciconia\).”](#) *Electromagn Biol Med*, vol. 24, no. 2, 2005, pp. 109-19.

- Interesting behavioral observations of the white stork nesting sites located within 100m of one or several cell site antennas were carried out. These results are compatible with the possibility that microwaves are interfering with the reproduction of white storks and would corroborate the results of laboratory research by other authors In far away areas, where the radiation decreases

progressively, the chronic exposure can also have long term effects. Effects from antennas on the habitat of birds are difficult to quantify, but they can cause a serious deterioration, generating silent areas without male singers or reproductive couples.

Kavokin, K., et al. **“Magnetic orientation of garden warblers (*Sylvia borin*) under 1.4 MHz radiofrequency magnetic field.”** Journal of the Royal Society, Interface, vol. 11, no. 97, 2014.

- “Birds in experimental cages, deprived of visual information, showed the seasonally appropriate direction of intended flight with respect to the magnetic meridian. Weak radiofrequency (RF) magnetic field (190 nT at 1.4 MHz) disrupted this orientation ability.”
- “These results may be considered as an independent replication of earlier experiments, performed by the group of R. and W. Wiltschko with European robins (*Erithacus rubecula*). Confirmed outstanding sensitivity of the birds’ magnetic compass to RF fields in the lower megahertz range demands for a revision of one of the mainstream theories of magnetoreception, the radical-pair model of birds’ magnetic compass.”
- “As discussed above, the high sensitivity of the birds’ magnetic compass to RF fields, found in [21,22,24] and now confirmed by us, is difficult to explain within the existing radical-pair theory
....”



Sandra Kandell <skandell@cityofpacificgrove.org>

Planning Commission Vote on Verizon Cell Tower

1 message

Dana Jones <jonesdana@gmail.com>

Thu, Jul 26, 2018 at 9:32 PM

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Mayor and City Council Members,

I am very disappointed in the City Planning Commission's handling of the Verizon cell tower.

1. The city's municipal code regarding building of wireless towers needs to be updated NOW. I am sure that companies, such as Verizon, are preying on small towns, such as ours, that have poor municipal codes who cannot stop the towers from being built. The city should have started updating the wireless municipal code as soon as Verizon's proposal was received. We are now behind. THIS NEEDS TO START TODAY!
2. The 6-0 approval was for the third option of the cell tower and it is now going to be located at the back of PGHS, right next to the small pedestrian gate. In the meeting tonight, Verizon claimed that it was an area with little pedestrian traffic and a small parking lot. I would disagree (and I said this in my public comments). There is content pedestrian traffic - before school, lunch, after school, even citizens walking past this area since there are no sidewalks in the area. It is also near a parking lot used by staff, classrooms, and the back parking lot of Forest Grove Elementary.
3. The planning commission used the scientific data from an engineer provided by, and paid by, Verizon. How is this acceptable? It is upsetting that the city would allow a biased scientist to provide the data, and to answer questions posed by the planning commission members.
4. Why were the 3 sites voted on tonight around PGHS? No other location in town? I posed this question to the planning commission chairman after the meeting and he said that these choices were narrowed down and the best. Again, unacceptable.
5. I understand that the FCC does not allow health reasons to be used when making decisions about cell towers. (I will be writing my Senators and Representatives about this) However, your planning commission spent a lot of their deliberation citing health. Why didn't they find another avenue that could have been used to disapprove this cell tower?

The bottom line is that you are allowing a private company to dictate how things are done in this town. You are allowing a private company to place a cell tower dangerously close to two of our schools. I don't know if the city voted yes to this proposal because you are scared of a lawsuit from Verizon? It is disappointing and I think the city could have done better. You honestly have more municipal code on trees than you do for wireless towers. Essentially I heard tonight that private companies are more important than my children who attend those schools.

Dana Jones



Sandra Kandell <skandell@cityofpacificgrove.org>

Cell tower

1 message

'sandy sanjurjo' via City Clerk <cityclerk@cityofpacificgrove.org>

Fri, Jul 27, 2018 at 4:06 AM

Reply-To: sandy sanjurjo <sandy.sanjurjo@icloud.com>

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Hi there-

I'm writing about the Verizon cell tower. Why on earth would we want to expose our children needlessly to radiation? Can someone explain how that makes any sense? I'm sure there are other locations that would not put our children in direct risk of increased odds for BRAIN CANCER! The community clearly doesn't want this. Please do your duty as REPRESENTATIVES OF THE COMMUNITY and oppose this or find an alternate location that is not between TWO SCHOOLS!!!!

Thank you!
The Sanjurjo Family

Sent from my iPhone



Sandra Kandell <skandell@cityofpacificgrove.org>

Cell phone tower

1 message

'KARI ANN SERPA' via City Clerk <cityclerk@cityofpacificgrove.org>

Fri, Jul 27, 2018 at 1:42 PM

Reply-To: KARI ANN SERPA <kari.serpa@me.com>

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Council Members & Mayor Kampe,

I am saddened, disappointed, and disgusted to hear that you voted unanimously to allow Verizon to put a cell phone tower between Forest Grove and PG High School. We do not need a cell tower to improve service, and our children and teachers certainly do not need exposure to what is very likely harmful (I can cite plenty of research here, but I know you have seen it). Some say there is no negative effect, but truly, if there is any doubt, should we risk it? I work at FG and both my children attend PGUSD (my daughter is at FG now, and my son will be at PGHS in a year). I had brain surgery in January of 2018. Can you guarantee that this cell tower will NOT have any negative health impacts on my children or on me? Shame on you all for voting to allow this to move forward. And having meetings in the summer when many of us are on family vacation (I am currently in DC) is unacceptable too. I have also noticed that you are placing this tower in an area of town that is socioeconomically disadvantaged. Don't think that is going unnoticed. So much for the last small town; we don't take care of our kids, our schools, or our SES population.

Disgusted and voting in November 2018,

Kari Serpa

Sent from my iPhone



Sandra Kandell <skandell@cityofpacificgrove.org>

Verizon Cell Tower - Appeal Fee

1 message

Dana Jones <jonesdana@gmail.com>

Mon, Jul 30, 2018 at 10:48 AM

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, David Laredo <dave@laredolaw.net>

Mayor and City Council,

I emailed you last week about my frustration concerning the planning commission's 6-0 decision in favor of the new Verizon cell tower near PGHS and Forest Grove Elementary. I am just learning that an appeal fee for you to look at this decision would cost us \$1353.80. That is an absurd amount. You should allow the citizens to file an appeal without a fee because there are so many of us opposing this tower.

I would urge you to reconsider.

Dana Jones
408-507-7692

MACKENZIE & ALBRITTON LLP

155 SANSOME STREET, SUITE 800
SAN FRANCISCO, CALIFORNIA 94104

TELEPHONE 415/288-4000
FACSIMILE 415/288-4010

August 7, 2018

VIA EMAIL

David C. Laredo, Esq.
City Attorney
City of Pacific Grove
300 Forest Avenue, 2nd Floor
Pacific Grove, California 93950

Re: Verizon Wireless Application No. 17-1111
Telecommunications Facility, Sunset Drive Right-of-Way
FCC Shot Clock Tolling Agreement: September 28, 2018

Dear David:

In a agreement dated June 28, 2018 (the "Tolling Agreement"), Verizon Wireless and the City of Pacific Grove (the "City") agreed to extend the time period for review under the federal Telecommunications Act for the above-referenced application through August 9, 2018 (the "Extension Date"). This letter, when countersigned, will confirm that Verizon Wireless and the City have agreed to further extend the time for the City to act on the application, and that the Tolling Agreement is hereby amended by changing the Extension Date to September 28, 2018. Except as expressly modified herein, the Tolling Agreement remains in full force and effect without modification.

This amendment to the Tolling Agreement may be executed in counterparts and facsimile, each of which shall be deemed an original.

Sincerely,



Paul B. Albritton

cc: Heidi Quinn, Esq.
Wendy Lao

David C. Laredo, Esq.
City of Pacific Grove
August 7, 2018
Page 2 of 2

ACCEPTED AND AGREED TO:

City of Pacific Grove

By: Heidi Quinn

Printed name: Heidi Quinn

Title: Assistant City
Attorney



Sandra Kandell <skandell@cityofpacificgrove.org>

Verizon Cell tower proposed at corner of Forest and Sunset Aves by Pacific Grove Schools

1 message

'Susan Stempson' via City Clerk <cityclerk@cityofpacificgrove.org>

Tue, Aug 7, 2018 at 4:12 PM

Reply-To: Susan Stempson <sstempson@aol.com>

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Dear Elected Official,

We are writing to inform you of our vehement objection to the Verizon Cell Tower proposal to be installed close to and directed at Pacific Grove High School and Forest Grove Elementary School. Verizon has stated that they intend to boost reception for high school students, in spite of statements from Matt Bell, Principal, and PGHS teachers who indicate that current bandwidth is acceptable.

The risks to our community, specifically to our developing young people, is one that we should NOT take!

The cell tower will beam microwave radiation directly at the campus and the shopping center. It will be next to the path leading to Starbucks, next to the upper parking lot and classrooms. This is UNACCEPTABLE!

- Cell towers emit microwave radiation – a Class 2B carcinogen (WHO, 2011).
- Cancer clusters occur around cell towers up to ¼ mile away. This radiation also harms trees and wildlife.
- Independent research finds DNA damage, cancers and tumors, cellular stress, blood-brain barrier disruption, altered hormones, changes in the blood, abnormal heart rhythms, altered brainwaves, neurological damage, problems with memory and concentration, insomnia, low birth weights, migraines, links to Alzheimer's, ADHD, and stroke. Children are especially vulnerable.
- 2016: The U.S. National Toxicology Program: After only 2 years of cell phone radiation exposure, 1 in 12 male rats developed malignant brain tumors, malignant heart tumors, and precancerous lesions. DNA damage also resulted for both sexes. Children will be exposed throughout the day and school year. Many experts call for WHO reclassification of this radiation to Class 1 -- carcinogen.

STOP THIS TOWER INSTALLATION in an area which exposes our children --- maybe even YOUR children or grandchildren--- certainly your neighbors' children, to this health risk! If you have ever known a young person to be diagnosed with cancer or a brain tumor, you will recognize the devastation that just one case brings to a family and community. We personally know this to be true.

Please be responsible to your Pacific Grove Community.

Sincerely,
Susan and Ken Stempson
Pacific Grove Residents



Sandra Kandell <skandell@cityofpacificgrove.org>

Cell tower behind PGHS

1 message

'Marla Martin' via City Clerk <cityclerk@cityofpacificgrove.org>

Sun, Aug 12, 2018 at 9:58 PM

Reply-To: Marla Martin <marlakmartin@yahoo.com>

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Good evening,

My daughter just started PGHS as a freshman last week. I am extremely concerned about the proposed cell tower and want to ask that it be appealed and denied.

Putting a cell tower near schools where children and teens are for hours per day is inappropriate and puts them at undue risk.

I could see there being a fire risk as well.

Furthermore, now is the time to deny this request as once one is installed in that area, we may not have the opportunity to stop it near as easily in the future. We don't want access granted in this location nor additional access in the future. It is a very poor choice that has unforeseen future dangers and risks.

I implore you to not let this cell tower be located near schools.

I already have a commitment Wednesday night or I would be at this city council meeting in person.

I hope many parents and community members write to you and show up at this meeting. This is the first I have heard about it. Please stop this cell tower from being near a school.

Thank you for your time.

Marla Martin
PGHS parent

Sent from my iPhone



Sandra Kandell <skandell@cityofpacificgrove.org>

P.G. High Small Cell Facility Denial

1 message

M Lucas <lucasinmonterey@gmail.com>

Thu, Aug 16, 2018 at 11:34 AM

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Dear Council Members,

I have personally tried to inform the Planning Commission to make a sound decision that protects the students and faculty of Pacific Grove High School from microwave injury associated with continuous wave devices. The faculty have a Right-to-Know about hazards in the workplace.

Since the decision was made to allow the small cell facility to be installed, the next logical step is to make sure that any microwave injury cluster associated with the device be identified as quickly as possible. I don't believe that the City has a desire to see ongoing suffering at the high school. Here is a tool to help the City to do just that.

This is a complimentary service for you, the faculty, the students, the parents, and the local pediatricians.

<https://www.microwavedvets.com/resources>

Kind regards,
Steven Lucas
admin@microwavedvets.com



Sandra Kandell <skandell@cityofpacificgrove.org>

Verizon info. re. proposed cell apparatus near PGHS

1 message

City Manager <citymanager@cityofpacificgrove.org>

Wed, Aug 22, 2018 at 4:39 PM

To: citycouncil@cityofpacificgrove.org

Cc: Mark Brodeur <mbrodeur@cityofpacificgrove.org>, wlao@cityofpacificgrove.org, Heidi Quinn <heidi@laredolaw.net>

Mayor and Council Members:

Please see the link, below, from Verizon re. the proposed cell apparatus near PGHS. You may have seen a recent email from a constituent on this topic.

<http://improveyourwireless.com/Pacific-Grove/>

Shared via the [Google app](#)

Ben Harvey
City Manager
City of Pacific Grove
bharvey@cityofpacificgrove.org



Sandra Kandell <skandell@cityofpacificgrove.org>

Verizon Sending Propaganda Texts

1 message

Dana Jones <jonesdana@gmail.com>

Wed, Aug 22, 2018 at 4:17 PM

To: rfischer@cityofpacificgrove.org, cgarfield@cityofpacificgrove.org, bkampe@cityofpacificgrove.org, bpeake@cityofpacificgrove.org, kencun17@icloud.com, huitt@comcast.net, nsmith@cityofpacificgrove.org, citymanager@cityofpacificgrove.org, cityclerk@cityofpacificgrove.org, dave@laredolaw.net

Mayor and City Council Members,

Verizon has been sending the following texts today to their customers in our area (I am not a Verizon customer, but have had several friends show me this text). Verizon is essentially sending propaganda, and is not allowing customers to say NO to this text message. We must stand up to Verizon and tell them NO. We must fight them and not allow them to build a wireless tower next to PGHS and adjacent to Forest Grove Elementary School.

Please fight with us and help us defeat Verizon. They do not get to come in and bully our city.

Thank you,
Dana Jones



image1.png
350K

MACKENZIE & ALBRITTON LLP

155 SANSOME STREET, SUITE 800
SAN FRANCISCO, CALIFORNIA 94104

TELEPHONE 415 / 288-4000
FACSIMILE 415 / 288-4010

August 29, 2018

VIA EMAIL

Mayor Bill Kampe
Mayor Protempore Robert Huitt
Councilmembers Ken Cuneo,
Rudy Fischer, Cynthia Garfield,
Bill Peake and Nick Smith
City Council
City of Pacific Grove
300 Forest Avenue
Pacific Grove, California 93950

Re: Verizon Wireless Response to Appeal, Application 17-1111
Small Cell Facility, Public Right-of-Way at 740 Forest Lodge Road
City Council Agenda, September 5, 2018

Dear Mayor Kampe, Mayor Protempore Huitt and Councilmembers:

We write on behalf of Verizon Wireless to ask that you uphold the approval of the Planning Commission and deny the appeal filed by Amy Fallarena (“Appellant”) of Verizon Wireless’s proposed small cell facility in the public right-of-way on Forest Lodge Road (the “Approved Facility”). Verizon Wireless’s small cell design meets all requirements of the Pacific Grove Municipal Code including all findings for a conditional use permit. Appellant’s objections to the Approved Facility raise no conflict with the Code and do not constitute substantial evidence to warrant denial. The Approved Facility will enhance Verizon Wireless network service for residents, students, visitors and emergency service personnel in the vicinity. We strongly encourage you to reject the appeal and approve the Approved Facility.

I. The Project

The Approved Facility was thoughtfully redesigned to minimize any impact to the adjacent neighborhood. The final location approved by the Planning Commission is distant from any residences. Verizon Wireless proposes to place a single cylindrical antenna on top of a new steel pole 15 inches in diameter, with an overall facility height of 29.5 feet. Radio equipment will be stacked vertically on the side of the pole between nine and 15 feet and covered with a concealing shroud. The pole and pole-mounted equipment will be painted brown. A 3 foot 8 inch tall electric meter pedestal and two

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August 29, 2018

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foot tall transformer will be placed on concrete pads on the ground next to the pole. All new utilities will be routed underground. Photosimulations of the Approved Facility are attached as Exhibit A.

Verizon Wireless hosted a community workshop on April 26, 2018 to discuss its original proposal for a facility on an existing utility pole along Sunset Drive adjacent to homes and across from Pacific Grove High School. Based on meeting feedback, Verizon Wireless redesigned the original facility to include an equipment shroud. Verizon Wireless presented the original location and designs to the Planning Commission at its June 7, 2018 hearing, at which the Commission suggested placement of a new pole in front of Pacific Grove High School. Verizon Wireless prepared designs for that new pole location and presented these at the Commission's June 21, 2018 hearing.

Thereafter, the Pacific Grove Unified School District administration suggested another option: a new pole behind the high school in the Forest Lodge Road right-of-way. Planning Division staff favored this option, and the Commission approved it unanimously on July 26, 2018 (a 6-0 vote). An Alternatives Analysis summarizing Verizon Wireless's review of locations in the right-of-way is attached as Exhibit B.

II. The Approved Facility Meets All Findings for a Conditional Use Permit.

As confirmed in the Planning Commission's approval, the Approved Facility satisfies all findings for approval of a conditional use permit. Code § 23.70.080(a)(4). As explained in the Planning Commission staff report, the Approved Facility poses no detriment to health, safety or general welfare as its out-of-the way location does not pose a hazard for pedestrians or bicyclists. As confirmed in a report by Hammett & Edison, Inc., Consulting Engineers, attached as Exhibit C, radio frequency exposure from the Approved Facility falls well under guidelines established by the Federal Communications Commission (the "FCC").

Similarly, the Approved Facility is not detrimental or injurious to properties or improvements in the neighborhood. It is located adjacent to a roadway behind the high school and a shopping center, not on one of the major roadways in the vicinity. Any visual impact is minimized through the pole's slender profile and placement among trees of greater height. These factors also render the Approved Facility to be compatible with existing land uses in the vicinity, and further, it involves no moving parts and will generate no noise. The Approved Facility will provide needed network capacity to serve students at the high school and customers of businesses in the adjacent commercial zone. The Planning Commission staff report also described how the Approved Facility complies with the General Plan. We note that because utility connections serving the Approved Facility will be placed underground, it is consistent with Urban Structure and Design Policy 11 to reduce overhead wires along the streetscape.

In sum, the Approved Facility meets all City requirements for approval.

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III. Verizon Wireless is Authorized to Place the Approved Facility in the Public Right-of-Way under State Law.

Verizon Wireless is entitled as a matter of law under California Public Utilities Code Section 7901 to install telephone equipment such as the Approved Facility “along any public road and highway,” subject only to reasonable local aesthetic criteria. Verizon Wireless is a telephone corporation as defined under Public Utilities Code Section 234 to include “every corporation or person owning, controlling, operating, or managing any telephone line for compensation within this state. . . .” A telephone line includes poles, fixtures and other equipment “managed in connection with or to facilitate communication by telephone, whether such communication is had with or without the use of transmission wires.” Public Utilities Code § 233.

IV. There is Substantial Evidence for Approval, and Appellant Presents No Substantial Evidence to Warrant Denial.

Under the federal Telecommunications Act, a local government’s denial of a wireless facility application must be based on “substantial evidence.” *See* 47 U.S.C. § 332(c)(7)(B)(iii). As interpreted under controlling federal court decisions, this means that denial of an application must be based on requirements set forth in the local code and supported by evidence in the record. *See Metro PCS, Inc. v. City and County of San Francisco*, 400 F.3d 715, 725 (9th Cir. 2005) (denial of application must be “authorized by applicable local regulations and supported by a reasonable amount of evidence”). While a local government may regulate the placement of wireless facilities based on aesthetics, mere generalized concerns or opinions about aesthetics or compatibility with a neighborhood do not constitute substantial evidence upon which a local government could deny a permit. *See City of Rancho Palos Verdes v. Abrams*, 101 Cal. App. 4th 367, 381 (2002).

As set forth above, Verizon Wireless has provided substantial evidence to show that the Approved Facility complies with all requirements for approval under the Code. Among other evidence, photosimulations demonstrate the minimal impact of Verizon Wireless’s small cell on a slender new pole placed among taller trees and distant from any important corridors. The Hammett & Edison report confirms compliance with FCC radio frequency exposure guidelines.

In contrast, Appellant has provided no evidence – let alone the substantial evidence required by federal law – to support denial of the Approved Facility. Appellant’s grounds for appeal fall into four general categories, none of which reveal any conflict with the Code.

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1. Future Modifications are Constrained by Federal Law and Require Local Approval.

Appellant misinterprets federal law and exaggerates by claiming that the Approved Facility can be expanded up to 130 feet in height. Section 6409 of *The Middle Class Tax Relief and Job Creation Act of 2012* grants limited modifications to a wireless facility only if they qualify as “eligible facilities requests” with no substantial change. See 47 U.S.C. § 1455(a). In 2014, The FCC issued rules interpreting Section 6409 and defining “substantial change.” See 47 C.F.R. § 1.40001. The FCC limited repeat increases in height and clarified that the maximum allowed increase is based on a facility’s height as “originally approved.” See 47 C.F.R. § 1.40001(b)(7)(i)(A); see also *In Re: Acceleration of Broadband Deployment by Improving Wireless Facilities Siting Policies, Etc.*, 29 FCC Rcd. 12865 (FCC October 17, 2014) (the “Spectrum Act Order”), ¶ 196.

One substantial change criterion requires that a modification not defeat the concealment elements of an existing facility. See 47 C.F.R. § 1.40001(b)(7)(v). For the Approved Facility, concealment elements include its narrow vertical profile design that mimics a utility pole and a cylindrical antenna that is the same diameter as the pole. Also, a vertically-oriented equipment shroud conceals radios and cabling. Future modifications must not defeat these concealment elements as determined by the City, limiting potential expansion.

The FCC also ruled that, to qualify as an eligible facilities request, there can be no replacement of the underlying structure. See Spectrum Act Order, ¶ 180. The Approved Facility is a unique custom design with a single four-foot cylindrical antenna enclosed inside an RF-transparent shroud mounted on top of a steel pole. Extension of the pole in a manner that would maintain adequate antenna separation while preserving the cylindrical concealment shape would pose insurmountable engineering constraints and would require replacement of the pole. With pole replacement, a modification would not qualify for approval under Section 6409.

Any Section 6409 modification is subject to the City’s future review and approval and beyond the scope of the present application. As this ground for appeal misconstrues federal law and bears no relation to use permit findings, it must be rejected.

2. The Approved Facility Will Be Structurally Safe and Pose No Fire Risk.

Appellant raises an alarmist concern over the Approved Facility causing a fire, but this is unfounded as the subject pole will be of adequate strength to support the single antenna, small radio equipment components and concealing shroud. The pole will be steel, not wood, and antenna and equipment components will be covered with metal or other fire-resistant materials. Verizon Wireless will supply a structural capacity report to

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the City as part of its application for a building permit. Per Condition of Approval 3, the Public Works Department, Fire Department and Building Department will review and approve the Approved Facility design prior to issuance of a building permit, and the City will conduct inspections to ensure compliance with building codes. Structural capacity is beyond the scope of this zoning permit application. Appellant's concerns over fire are groundless and must be dismissed.

3. Verizon Wireless Need Not Demonstrate the Necessity of Its Right-of-Way Facility.

Appellant challenges the Approved Facility claiming that there is no shortfall in Verizon Wireless coverage or capacity. As noted above, Public Utilities Code Section 7901 grants telephone corporations such as Verizon Wireless a right to place their telephone equipment in any right-of-way. Because of this statewide right, Verizon Wireless need not prove the necessity of its right-of-way facilities. Further, the City's conditional use permit findings do not require a demonstration of need or a service gap.

As noted above, the Approved Facility is compatible with surrounding land uses such as the high school and businesses because it will ensure reliable service to students and customers. Appellant claims there is excellent Verizon Wireless coverage but provides no substantial evidence. At the July 26, 2018 Planning Commission hearing, a Verizon Wireless radio frequency engineer provided coverage maps and network capacity charts to illustrate the service issues in the area. A letter from a Verizon Wireless Director, attached as Exhibit D, provides evidence of 176 Pacific Grove area residents who sent text messages and emails of support for improved Verizon Wireless service in the area. This ground for appeal raises no issues relevant to Code findings and must be dismissed.

We note that by alluding to a prohibition of service, appellant misconstrues the federal Telecommunications Act which protects wireless carriers from unlawful denials but does not require carriers to prove a prohibition of service to obtain local approval. Were the City to improperly deny the Approved Facility, Verizon Wireless maintains the right to demonstrate that such denial would constitute a prohibition of service in violation of the Telecommunications Act through coverage gap information and analysis of alternatives. *See* 47 U.S.C. § 332(c)(7)(B). In fact, as part of their presentation to the Planning Commission, Verizon Wireless RF engineers voluntarily provided information and graphics demonstrating the gap in service to be served by the Approved Facility. Together with the submitted Alternatives Analysis, Verizon Wireless has already included adequate evidence in the administrative record to make a *prima facie* case for prohibition of service under federal law. However, this "prohibition" determination is not required for any of the findings required by the Code to grant a conditional use permit for the Approved Facility.

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4. The Approved Facility Complies with FCC Radio Frequency Exposure Guidelines, and The City May Not Consider Concerns over Radio Frequency Emissions and Property Values.

Appellant raises concern over effects of radio frequency emissions on wildlife and trees as well as impacts on property values. However, the City may not consider radio frequency emissions as a factor because the Approved Facility complies with FCC guidelines. *See* 47 U.S.C. § 332(c)(7)(B)(iv). As confirmed in the Hammett & Edison report, the Approved Facility complies with FCC exposure guidelines, and in fact, the maximum exposure at ground level will be only 5.7 percent – or 17 times below – the applicable public exposure limit. The maximum exposure at a second-floor elevation of any high school building will be only 1.9 percent – or 52 times below – the applicable public exposure limit.

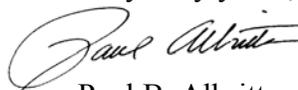
Federal law also bars efforts to circumvent preemption of health concerns through proxy concerns such as effects on property values. *See, e.g., AT&T Wireless Servs. of Cal. LLC v. City of Carlsbad*, 308 F. Supp. 2d 1148, 1159 (S.D. Cal. 2003) (in light of federal preemption, “concern over the decrease in property values may not be considered as substantial evidence if the fear of property value depreciation is based on concern over the health effects caused by RF emissions”); *Calif. RSA No. 4, d/b/a Verizon Wireless v. Madera County*, 332 F. Supp. 2d 1291, 1311 (E.D. Cal. 2003).

In sum, Appellant raises no grounds for appeal that constitute substantial evidence to deny the Approved Facility. In contrast, Verizon Wireless has provided ample evidence that the Approved Facility complies with all City requirements and should be approved. The appeal must be rejected.

Conclusion

Verizon Wireless has worked diligently to identify the ideal location and design for a small cell facility to serve Pacific Grove High School and the nearby commercial area. As confirmed by the Planning Commission’s approval, the Approved Facility meets all findings for a conditional use permit under the Code. Appellant raises no substantial evidence to contradict this approval. Ensuring reliable Verizon Wireless service in this area of Pacific Grove is critical to residents, students and visitors as well as emergency service personnel. We strongly encourage the Council to uphold the Planning Commission’s approval and deny the appeal.

Very truly yours,



Paul B. Albritton

cc: Heidi Quinn, Esq.
Wendy Lao

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Schedule of Exhibits

Exhibit A: Photosimulations

Exhibit B: Alternatives Analysis

Exhibit C: Radio Frequency Exposure Report by Hammett & Edison, Inc., Consulting
Engineers

Exhibit D: Letter from Verizon Wireless Customer Relationship Management Director
Regarding 176 Text Messages and Emails of Support

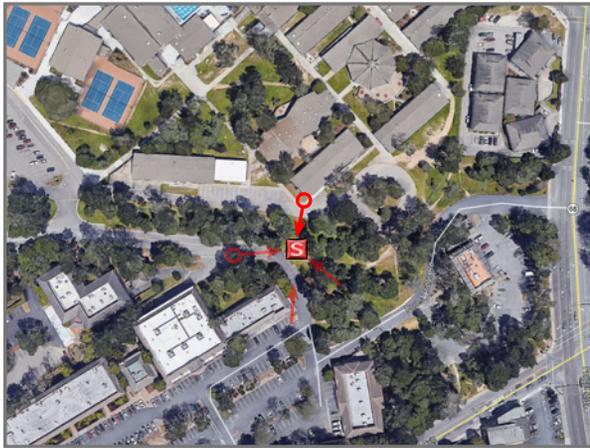


PACIFIC GROVE HS SC 1

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950



VIEW 1



LOCATION

©2017 Google Maps



EXISTING



PROPOSED LOOKING SOUTH FROM CAMPUS

ACCURACY OF PHOTO SIMULATION BASED UPON INFORMATION PROVIDED BY PROJECT APPLICANT.

Exhibit A



PACIFIC GROVE HS SC 1

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950



VIEW 2



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

LOOKING NORTHWEST FROM SITE

ACCURACY OF PHOTO SIMULATION BASED UPON INFORMATION PROVIDED BY PROJECT APPLICANT.

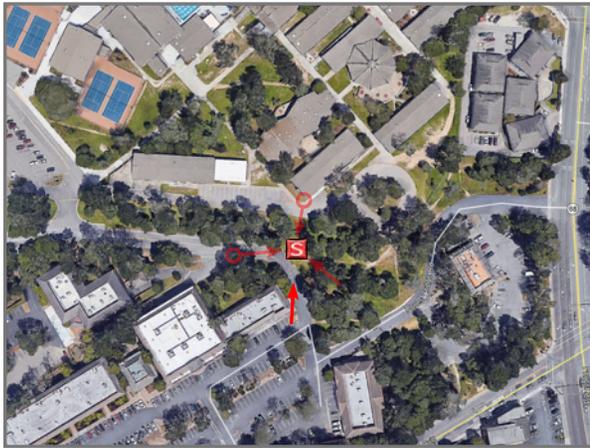


PACIFIC GROVE HS

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950



VIEW 3



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

LOOKING NORTH FROM FOREST LODGE ROAD

ACCURACY OF PHOTO SIMULATION BASED UPON INFORMATION PROVIDED BY PROJECT APPLICANT.

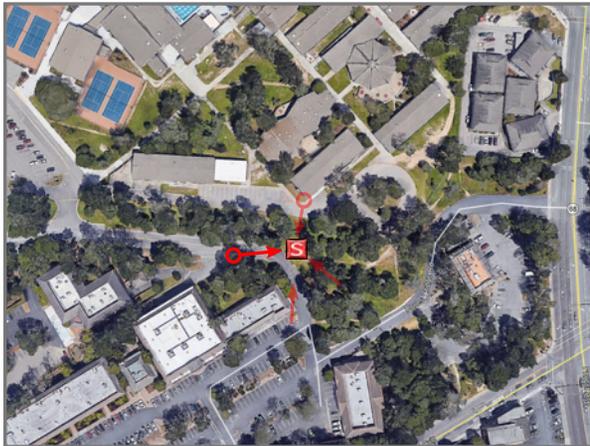


PACIFIC GROVE HS

740 FOREST LODGE ROAD PACIFIC GROVE CA 93950



VIEW 4



LOCATION

©2017 Google Maps



EXISTING



PROPOSED

LOOKING EAST FROM FOREST LODGE ROAD

ACCURACY OF PHOTO SIMULATION BASED UPON INFORMATION PROVIDED BY PROJECT APPLICANT.

Verizon Wireless Alternatives Analysis Pacific Grove HS SC1 Right-of-Way at 740 Forest Lodge Road

To meet increasing network demand in the area of Pacific Grove High School and the nearby Forest Road commercial area, Verizon Wireless must place a new facility in the right-of-way near the high school. Verizon Wireless reviewed placement of a small cell on existing poles of adequate height or placement of a new pole in order to identify the least intrusive feasible alternative to serve the area.

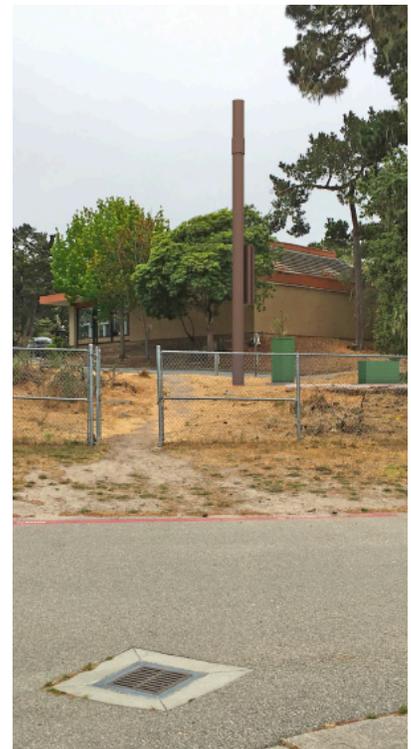
Alternatives evaluated along Sunset Drive north of the high school and Forest Road to the east are more visually prominent than the Approved Facility. Alternatives along Congress Avenue to the west are infeasible because they cannot provide service to the high school and commercial area. Along Forest Lodge Road south of the high school, there is only one existing pole near homes, a street light pole not available for attachment where a new facility would be more visually prominent than the Approved Facility.

The proposed small cell is on a new pole at an out-of-the-way location on Forest Lodge Road (the "Approved Facility"), distant from homes and not on a major roadway. The Pacific Grove Unified School District administration suggested this location, and the Planning Commission unanimously approved it. Based on the following analysis, Verizon Wireless considers the Approved Facility to be the least intrusive feasible alternative for providing service to the area.

APPROVED FACILITY

1. New Pole near 740 Forest Lodge Road 36.6090048074, -121.924368748

This location behind Pacific Grove High School and the Country Club Gate shopping center was suggested by the Pacific Grove Unified School District administration and unanimously approved by the Planning Commission. Verizon Wireless proposes to place a single cylindrical antenna on top of a new steel pole 15 inches in diameter, with an overall facility height of 29.5 feet. Radio equipment will be stacked vertically on the side of the pole between nine and 15 feet and covered with a concealing shroud. The pole and pole-mounted equipment will be painted brown. An electric meter pedestal and transformer will be placed on concrete pads on the ground next to the pole. All new utilities will be routed underground. This out-of-the-way location is not along major roadways, and taller trees adjacent to the facility provide screening. This location and design represent the least intrusive option for a new small cell to serve the surrounding area.

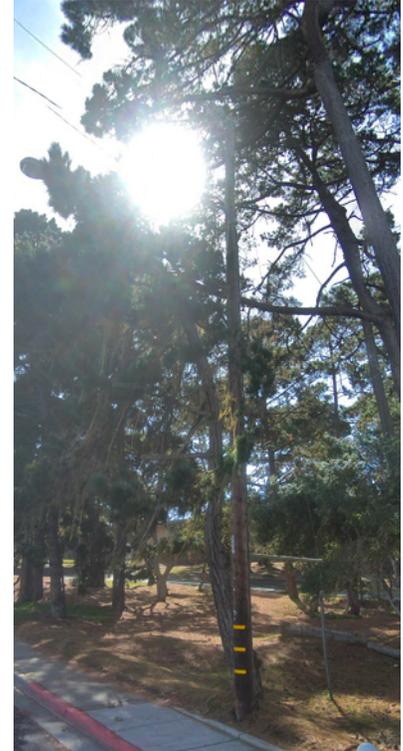


ALTERNATIVES

2. PG&E Pole across from 654 Sunset Drive

36.6118517155, -121.924491479

This wooden utility pole is located 1,025 feet north of the Approved Facility. Verizon Wireless determined that an adjacent pine tree must be substantially trimmed or removed to allow for attachment of wireless facility equipment. The additional weight of wireless facility equipment likely would require replacement of the pole to increase structural capacity; also, PG&E policy requires replacement of older poles old upon new attachments. A new wireless facility would add 11 feet in height to accommodate a four-foot antenna and antenna mount plus six feet of separation above the pole-top electrical lines as required by Public Utilities Commission General Order 95. This pole is also along a major roadway, Sunset Drive (Highway 68), and new wireless facility equipment and increased height would pose more visual impacts on this corridor. This is not a less intrusive alternative to the Approved Facility.



3. PG&E Pole near 648 Sunset Drive

36.6117524399, -121.92400623

This wooden utility pole is located 1,000 feet north of the Approved Facility. This pole already supports multiple cross-arms, electrical conductors and a street light. The additional weight of wireless facility equipment likely would require replacement of the pole to increase structural capacity; also, PG&E policy requires replacement of older poles upon new attachments. A new wireless facility would add 11 feet in height to accommodate a four-foot antenna and antenna mount plus six feet of separation above the pole-top electrical lines as required by Public Utilities Commission General Order 95. The additional height and new wireless facility equipment would pose substantial visual impact at this location on a property line adjacent to two homes. This pole is also along a major roadway, Sunset Drive (Highway 68), and new wireless facility equipment and increased height would pose more visual impacts on this corridor. This is not a less intrusive alternative to the Approved Facility.



4. New Pole at Bus Stop near High School

36.6113621476, -121.92388473

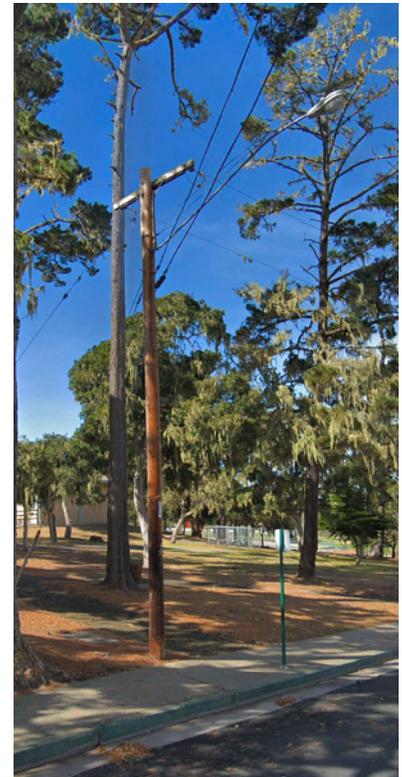
This right-of-way location is 890 feet north of the Approved Facility. The School District initially suggested this location, but later withdrew its support and instead suggested the Approved Facility location behind the school on Forest Lodge Road. This location is along a major roadway, Sunset Drive (Highway 68), and a new pole and wireless facility equipment would pose more visual impacts on this corridor. This is not a less intrusive alternative to the Approved Facility.



5. PG&E Pole near Bus Stop

36.611165, -121.923652

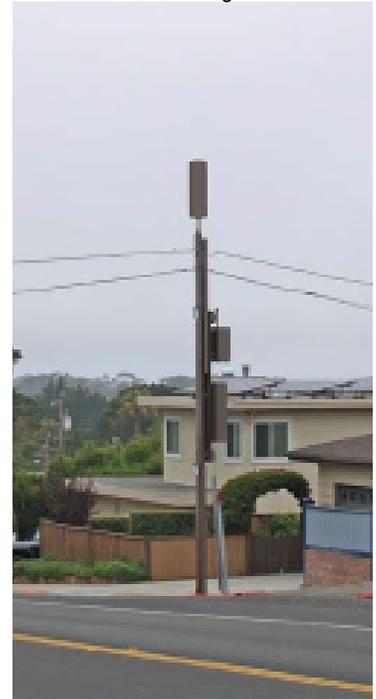
This wooden utility pole is located 870 feet north of the Approved Facility. This pole supports cross-arms, electrical conductors and a street light. The additional weight of wireless facility equipment likely would require replacement of the pole to increase structural capacity; also, PG&E policy requires replacement of older poles upon new attachments. A new wireless facility would add 11 feet in height to accommodate a four-foot antenna and antenna mount plus six feet of separation above the pole-top electrical lines as required by Public Utilities Commission General Order 95. The additional height and equipment would pose more visual impact at this location along a major roadway, Sunset Drive (Highway 68). This is not a less intrusive alternative to the Approved Facility.



6. Communications Pole near 618 Sunset Drive

36.6111497825, -121.9233449

This wooden utility pole is located 825 feet north of the Approved Facility and was the original location proposed for Verizon Wireless's small cell. This pole supports only two communication lines, not electrical lines. The additional weight of wireless facility equipment likely would require replacement of the pole to increase structural capacity. A new wireless facility would add five feet in height to accommodate a four-foot antenna and antenna mount. Addition of wireless facility equipment to this pole would pose substantial visual impact at this location on a property line adjacent to two homes. This pole is also along a major roadway, Sunset Drive (Highway 68), and new wireless facility equipment and increased height would pose more visual impacts on this corridor. The photosimulation depicts one of the designs for the original proposal for this pole. This is not a less intrusive alternative to the Approved Facility.



7. New Pole near High School Entrance

36.6109805556, -121.923494444

This right-of-way location is 760 feet north of the Approved Facility. This location was initially suggested by the Planning Commission, and Verizon Wireless proposed three design options including the design shown in the photosimulation. This location is along a major roadway, Sunset Drive (Highway 68), and a new pole and wireless facility equipment would pose more visual impacts on this corridor at this prominent location in front of the high school entrance. The School District also expressed concerns about construction impacts and obstruction of student foot traffic in this pick-up/drop-off area. This is not a less intrusive alternative to the Approved Facility.



8. Street Light near 606 Sunset Drive

36.6107926151, -121.923007225

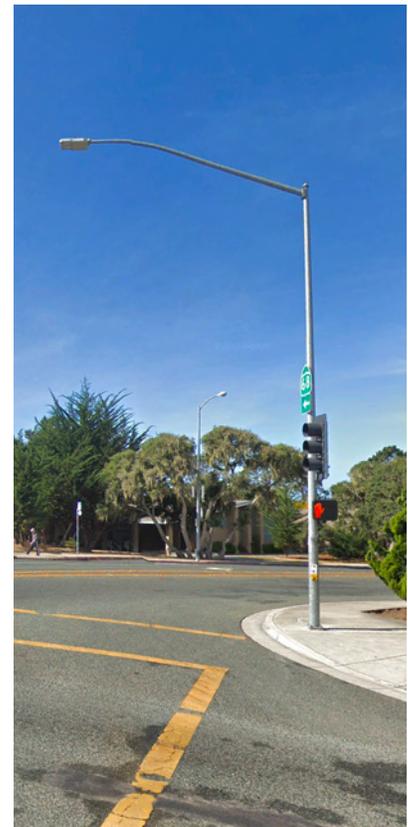
This wooden street light pole is located 1,000 feet north of the Approved Facility. Verizon Wireless does not have an agreement in place with the pole owner for use of wood street light poles, and this pole is not available for attachment. The additional weight of wireless facility equipment likely would require replacement of the pole to increase structural capacity. A new wireless facility would add five feet in height to accommodate a four-foot antenna and antenna mount. Addition of wireless facility equipment to this pole would pose substantial visual impact at this location on a property line adjacent to two homes. This pole is also along a major roadway, Sunset Drive (Highway 68), and new wireless facility equipment and increased height would pose visual impacts on this corridor. This is not a less intrusive alternative to the Approved Facility.



9. Metal Street Light Poles along Forest Avenue

Various Locations, Forest Road

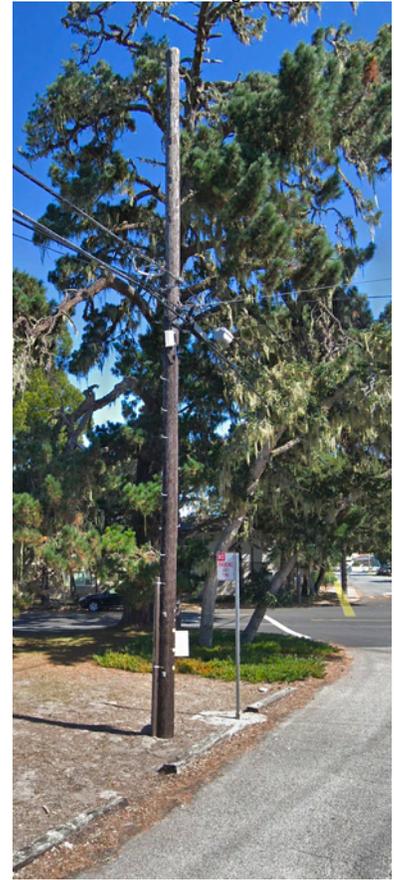
Along and near Forest Avenue, the only vertical infrastructure of significant height in the right-of-way is metal street light poles, some supporting traffic signals. Verizon Wireless does not have an agreement in place with the pole owner for use of metal street light poles, and these poles are not available for attachment. Small cells on metal street light poles require a two-foot tall antenna which provides limited service compared to the four-foot antenna proposed for the Approved Facility. Addition of wireless facility equipment to these street light poles would pose substantial visual impacts to adjacent homes. These pole are also along a major roadway, Forest Road (Highway 68). and new wireless facility equipment would pose more visual impacts on this corridor. These poles are not a less intrusive alternative to the Approved Facility.



10. Wood Utility Poles on Congress Avenue

Various Locations, Congress Avenue

Verizon Wireless reviewed placement of a small cell on wood utility poles along Congress Avenue across from the high school stadium, 1,560 to 1,700 feet west of the Approved Facility. Along this stretch, Congress Avenue is approximately 70 feet lower in elevation than the Approved Facility location. Due to distance and low elevation, a wireless facility on these poles cannot serve buildings at the high school and the commercial area along Forest Road. Due to inability to serve the high school and commercial areas, these poles are not a feasible alternative to the Approved Facility.



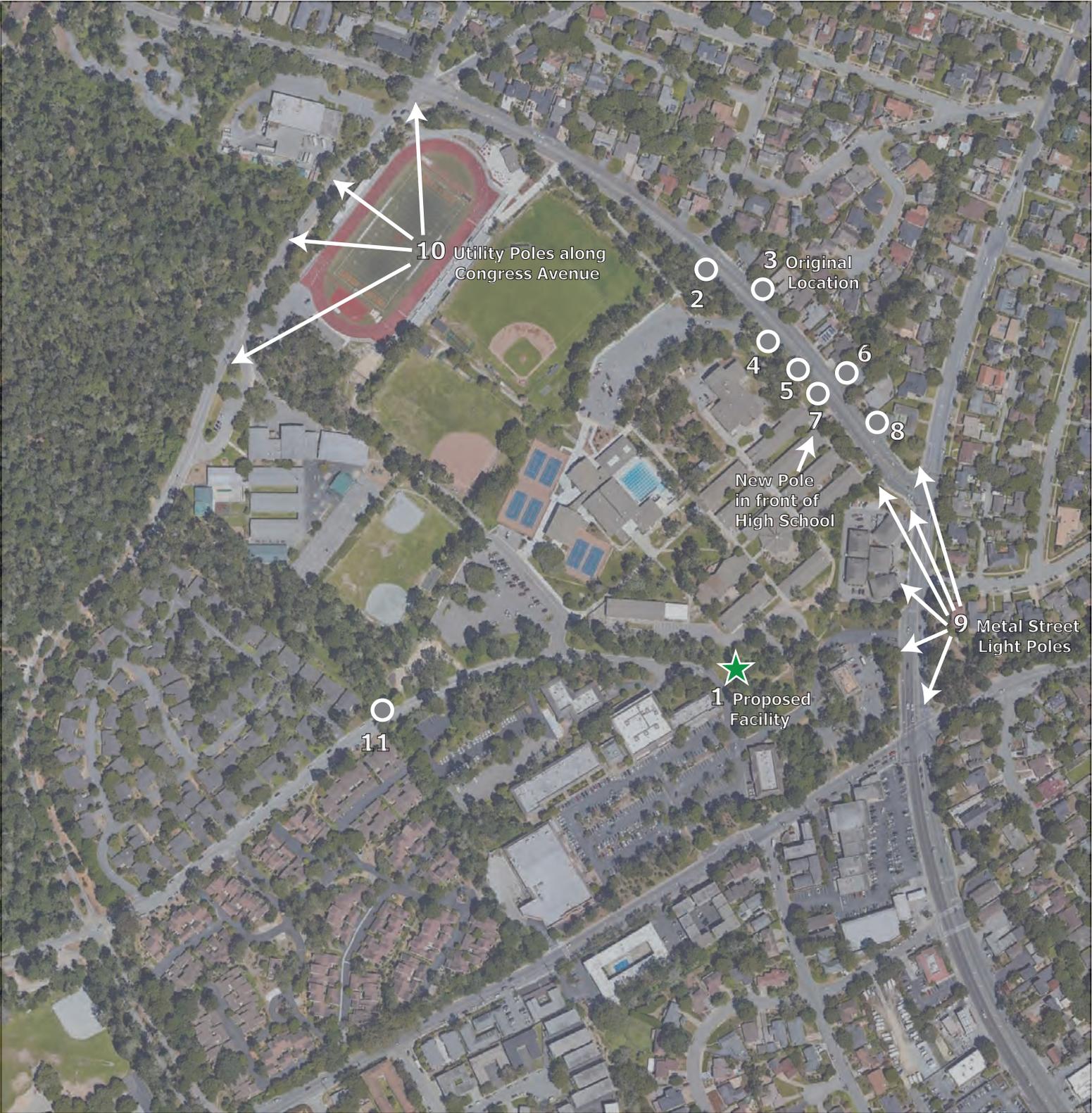
11. Street Light on 1200 Block of Forest Lodge Road

36.608647, -121.927469

This wooden street light pole is located 920 feet southwest of the Approved Facility. It is the only existing pole of significant height along Forest Lodge Road north of Congress Avenue. Verizon Wireless does not have an agreement in place with the pole owner for use of wood street light poles, and this pole is not available for attachment. The additional weight of wireless facility equipment likely would require replacement of the pole to increase structural capacity. A new wireless facility would add five feet in height to accommodate a four-foot antenna and antenna mount. Addition of wireless facility equipment to this pole would pose substantial visual impact at this location adjacent to and across from homes. This is not a less intrusive alternative to the Approved Facility.



verizon
Pacific Grove High School
Alternative Right-of-Way Sites



**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

Exhibit C

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Verizon Wireless, a personal wireless telecommunications carrier, to evaluate the base station (Site No. 425598 “Pacific Grove HS SC1”) proposed to be located near 740 Forest Lodge Road in Pacific Grove, California, for compliance with appropriate guidelines limiting human exposure to radio frequency (“RF”) electromagnetic fields.

Executive Summary

Verizon proposes to install a cylindrical antenna on top of a new steel pole to be sited near 740 Forest Lodge Road in Pacific Grove. The proposed operation will comply with the FCC guidelines limiting public exposure to RF energy.

Prevailing Exposure Standards

The U.S. Congress requires that the Federal Communications Commission (“FCC”) evaluate its actions for possible significant impact on the environment. A summary of the FCC’s exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. The most restrictive FCC limit for exposures of unlimited duration to radio frequency energy for several personal wireless services are as follows:

Wireless Service	Frequency Band	Occupational Limit	Public Limit
Microwave (Point-to-Point)	5–80 GHz	5.00 mW/cm ²	1.00 mW/cm ²
WiFi (and unlicensed uses)	2–6	5.00	1.00
BRS (Broadband Radio)	2,600 MHz	5.00	1.00
WCS (Wireless Communication)	2,300	5.00	1.00
AWS (Advanced Wireless)	2,100	5.00	1.00
PCS (Personal Communication)	1,950	5.00	1.00
Cellular	870	2.90	0.58
SMR (Specialized Mobile Radio)	855	2.85	0.57
700 MHz	700	2.40	0.48
[most restrictive frequency range]	30–300	1.00	0.20

General Facility Requirements

Base stations typically consist of two distinct parts: the electronic transceivers (also called “radios” or “channels”) that are connected to the traditional wired telephone lines, and the passive antennas that send the wireless signals created by the radios out to be received by individual subscriber units. The transceivers are often located at ground level and are connected to the antennas by coaxial cables. A small antenna for reception of GPS signals is also required, mounted with a clear view of the sky.

**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

Because of the short wavelength of the frequencies assigned by the FCC for wireless services, the antennas require line-of-sight paths for their signals to propagate well and so are installed at some height above ground. The antennas are designed to concentrate their energy toward the horizon, with very little energy wasted toward the sky or the ground. This means that it is generally not possible for exposure conditions to approach the maximum permissible exposure limits without being physically very near the antennas.

Computer Modeling Method

The FCC provides direction for determining compliance in its Office of Engineering and Technology Bulletin No. 65, “Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation,” dated August 1997. Figure 2 describes the calculation methodologies, reflecting the facts that a directional antenna’s radiation pattern is not fully formed at locations very close by (the “near-field” effect) and that at greater distances the power level from an energy source decreases with the square of the distance from it (the “inverse square law”). The conservative nature of this method for evaluating exposure conditions has been verified by numerous field tests.

Site and Facility Description

Based upon information provided by Verizon, including zoning drawings by CELLSITE Concepts, dated July 9, 2018, it is proposed to install one JMA Wireless Model CX06OMI436-0C/8C cylindrical omnidirectional antenna on top of a new 25-foot steel pole to be sited in the public right-of-way on the north side of Forest Lodge Road in Pacific Grove, just south of Pacific Grove High School. The antenna would employ 2° downtilt and would be mounted at an effective height of about 27½ feet above ground. The maximum effective radiated power in any direction would be 2,990 watts, representing simultaneous operation at 1,550 watts for AWS and 1,440 watts for PCS service. There are reported no other wireless telecommunications base stations at the site or nearby.

Study Results

For a person anywhere at ground, the maximum RF exposure level due to the proposed Verizon operation is calculated to be 0.057 mW/cm², which is 5.7% of the applicable public exposure limit. The maximum calculated level at any nearby building* is 17% of the public exposure limit. The maximum calculated level at the second-floor elevation of any building on the school campus† is 1.9% of the public exposure limit. The maximum calculated level at the second-floor elevation of any nearby residence‡ is 0.42% of the public exposure limit. It should be noted that these results include

* Located at least 65 feet away, based on review of photographs from Google Maps.
† Located at least 95 feet away, based on review of photographs from Google Maps.
‡ Located at least 390 feet away, based on review of photographs from Google Maps.

**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

several “worst-case” assumptions and therefore are expected to overstate actual power density levels from the proposed operation.

No Recommended Mitigation Measures

Due to its mounting location and height, the Verizon antenna would not be accessible to unauthorized persons, and so no mitigation measures are necessary to comply with the FCC public exposure guidelines. It is presumed that Verizon will, as an FCC licensee, take adequate steps to ensure that its employees or contractors receive appropriate training and comply with FCC occupational exposure guidelines whenever work is required near the antenna itself.

Conclusion

Based on the information and analysis above, it is the undersigned’s professional opinion that operation of the base station proposed by Verizon Wireless near 740 Forest Lodge Road in Pacific Grove, California, will comply with the prevailing standards for limiting public exposure to radio frequency energy and, therefore, will not for this reason cause a significant impact on the environment. The highest calculated level in publicly accessible areas is much less than the prevailing standards allow for exposures of unlimited duration. This finding is consistent with measurements of actual exposure conditions taken at other operating base stations.

Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration Nos. E-13026 and M-20676, which expire on June 30, 2019. This work has been carried out under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.

July 13, 2018



William F. Hammett

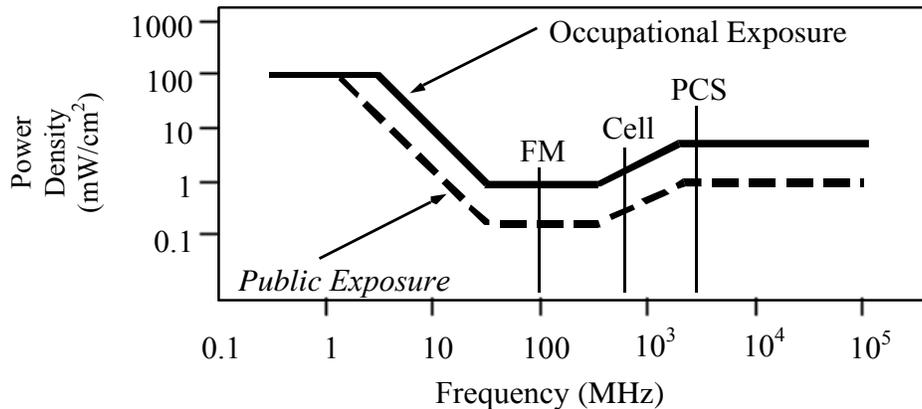
William F. Hammett, P.E.
707/996-5200

FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements (“NCRP”). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

Frequency Applicable Range (MHz)	Electromagnetic Fields (f is frequency of emission in MHz)					
	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm ²)	
0.3 – 1.34	614	<i>614</i>	1.63	<i>1.63</i>	100	<i>100</i>
1.34 – 3.0	614	<i>823.8/f</i>	1.63	<i>2.19/f</i>	100	<i>180/f²</i>
3.0 – 30	1842/f	<i>823.8/f</i>	4.89/f	<i>2.19/f</i>	900/f ²	<i>180/f²</i>
30 – 300	61.4	<i>27.5</i>	0.163	<i>0.0729</i>	1.0	<i>0.2</i>
300 – 1,500	3.54√f	<i>1.59√f</i>	√f/106	<i>√f/238</i>	f/300	<i>f/1500</i>
1,500 – 100,000	137	<i>61.4</i>	0.364	<i>0.163</i>	5.0	<i>1.0</i>



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density $S = \frac{180}{\theta_{BW}} \frac{0.1 \eta P_{net}}{4\pi D^2 \eta h}$, in mW/cm²,

and for an aperture antenna, maximum power density $S_{max} = \frac{0.1 \eta 16 \eta \theta_{BW} P_{net}}{4\pi h^2}$, in mW/cm²,

- where θ_{BW} = half-power beamwidth of the antenna, in degrees, and
- P_{net} = net power input to the antenna, in watts,
- D = distance from antenna, in meters,
- h = aperture height of the antenna, in meters, and
- η = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

Far Field.

OET-65 gives this formula for calculating power density in the far field of an individual RF source:

power density $S = \frac{2.56 \eta 1.64 \eta 100 \eta RFF^2 \eta ERP}{4\pi \eta D^2}$, in mW/cm²,

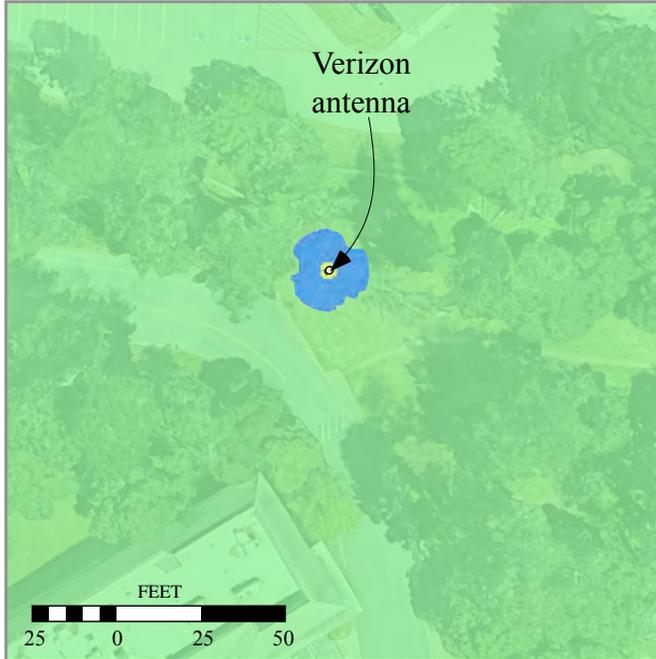
- where ERP = total ERP (all polarizations), in kilowatts,
- RFF = relative field factor at the direction to the actual point of calculation, and
- D = distance from the center of radiation to the point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.

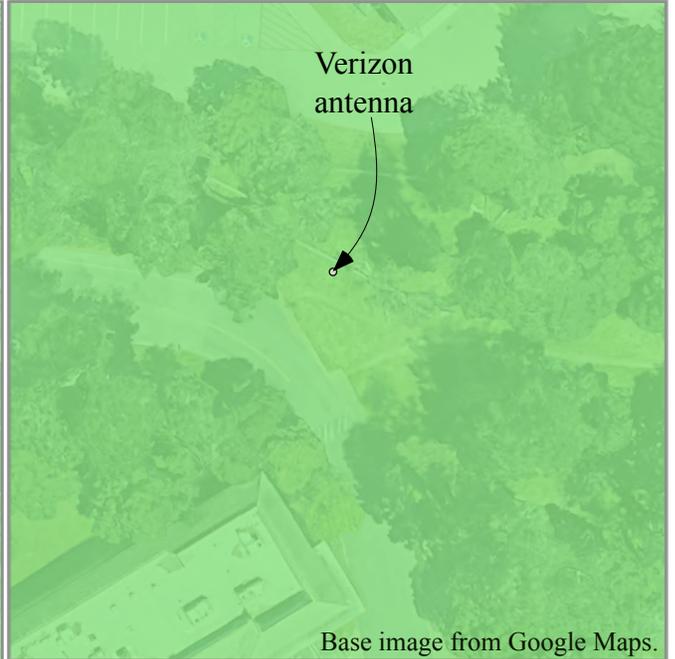
**Verizon Wireless • Proposed Base Station (Site No. 425598 “Pacific Grove HS SC1”)
740 Forest Lodge Road • Pacific Grove, California**

Calculated RF Exposure Levels

in Immediate Airspace (26–29 feet above ground)



at Ground and at Nearby Buildings



Base image from Google Maps.



Proposed Northwest Elevation

<p>Legend:</p> <ul style="list-style-type: none"> ■ less than FCC Public Limit ■ greater than FCC Public Limit less than FCC Occupational Limit ■ greater than FCC Occupational Limit 	<p>Notes: See report dated July 13, 2018.</p> <p>Calculations performed according to OET Bulletin No. 65, August 1997.</p> <p>Base drawings from CELLSITE Concepts, dated July 9, 2018.</p>
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verizon[✓]

Verizon Wireless

15505 Sand Canyon Ave, Bldg. D
Irvine, CA 92618

August 29, 2018

City Council
City of Pacific Grove
300 Forest Avenue
Pacific Grove, California 93950

Re: 176 Supporters for Verizon Wireless Facility
Forest Lodge Road Right-of-Way, Pacific Grove

Dear Councilmembers:

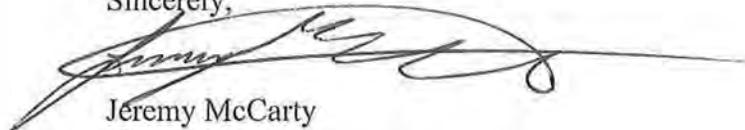
I am the Verizon Wireless Marketing Director over the team that maintains and manages all data and information messages that are sent to Verizon Wireless customers in California. In connection with the application referred to above, Verizon Wireless arranged for a text message to be sent to customers with billing addresses within ZIP code 93950 in the Pacific Grove area. The entire text message sent reads as follows:

Free Verizon Message: Reply YES to this text to show your support for improved Verizon Wireless service in Pacific Grove. Add a message to tell the City you support a new small cell wireless facility on Forest Lodge Road behind Pacific Grove High School. Visit <http://improveyourwireless.com/Pacific-Grove> to learn more and stay informed.

The text message above was sent on August 22, 2018. As of August 28, 2018, we have received 159 affirmative text message responses indicating support for the proposed facility and 23 respondents opposed. We also have received 17 emails of support and four emails in opposition. Text messages and emails received confirmed the need to provide improved Verizon Wireless service in Pacific Grove. Samples of the text messages of support received from Verizon Wireless customers appear on the attached page, followed by the emails of support.

I am available to verify the above information as you may require.

Sincerely,



Jeremy McCarty
Director
Customer Relationship Management

Attachments

Sample Text Messages of Support
Verizon Wireless Facility
Forest Lodge Road Right-of-Way, Pacific Grove

YES I do support a new small cell wireless facility on Pacific larger Road behind Pacific Grove high school.

YES I do support it. Please don't give up.

Yes please try to improve service. Too many dropped calls.

Yes we use Verizon and have horrible service in PG. Please put it up!!

Yes! I have been dealing with very poor service For 3 yrs here, which is why i am switching 2 ATT.

Yes! I definitely support a new wireless facility. Thanks

YES!!!!

Yes. Cell phone coverage in Del Monte Park is pathetic. Please support the new wireless facility.

Yes. I support this. Thank you

Yes. We all like to use our cell phones.

Yes. We do need better coverage in the beach tract area.

Sample Text Messages of Opposition

No, it affects butterfly flight patterns.

No, you should be a shamed of yourself! Why must you put it by 2 schools!!!! Never!!!!

Sent: Wednesday, August 22, 2018 11:58 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Joshua Gunn
City: Pacific Grove
ZIP code: 93950

Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Or create your own message:

I'm am a first responder in the US Coast Guard and my ability to respond to calls can be delayed due to the poor cell quality in the area. An increase in cell signal will increase the capacity and timeliness for people to be able to reach me and possibly save lives.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove., I would consider attending a public hearing. Please send me more information.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 11:40 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support uh Verizon Wireless's Small Cell for Pacific Grove."

From: Michael Williamson n Williamson
City: Pebble Beach
ZIP code: 93953

Subject: I Support uh Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Please support Verizon Wireless's proposed facility in Pacific Grove, providing service to Pacific Grove High School and surrounding areas. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 2:16 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: RAMON PEREZ PEREZ
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: My schedule may not allow me to attend a public meeting. Please accept this email as a show of my strong support for Verizon Wireless's network enhancements for Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 11:45 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: David Bergstrand Bergstrand
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 11:48 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Sabrina Clement
City: Pacific Grove
ZIP code: 93950-2336
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 11:48 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Yunjung Kim
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's proposed facility in Pacific Grove, providing service to Pacific Grove High School and surrounding areas. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 11:51 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Brian Schoenfelder Schoenfelder
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 11:59 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Seungyoung Yoon
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:05 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Carla Lloyd
City: Pacific Grove
ZIP code: 93950

Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Please let the cell tower into our area by Congress and Forest Grove. We barely get a signal and we must have a land line because of no service. It's embarrassing walking around asking if the person I'm speaking with can hear me. This is a huge issue that Pacific Grove needs to allow the tower. Why not put it where The old mission linen used to be?? Back in the Forest Area. What's that going to hurt. It's ridiculous that we have no service in our homes!

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:07 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Edward Tritico
City: Pacific Grove
ZIP code: 93950

Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Or create your own message:

Do anything to get us better service. I cannot use my cell phone at my home in Asilomar. I have to maintain a hardline. Add more towers if it will improve service.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:14 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Debra Ternullo
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's proposed facility in Pacific Grove, providing service to Pacific Grove High School and surrounding areas. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:14 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "divaterry1@ yahoo.com"

From: Thetesia Gardetto
City: Pacific Grove
ZIP code: 93950
Subject: divaterry1@ yahoo.com
Message Body: I spend time at Pacific Grove High School. I understand that the Verizon Wireless small cell will provide needed service capacity, particularly during emergencies. I support the installation of the utility pole style small cell on Forest Lodge Road behind the high school.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove., I would consider attending a public hearing. Please send me more information.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:16 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Richard Bryant
City: Pacific grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:23 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Gary Miller
City: Pacific Grove
ZIP code: 93950
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:45 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Richard Montori
City: Pacific Grove
ZIP code: 93940
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 12:39 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Do NOT support Verizon Wireless's Small Cell for Pacific Grove."

From: Dave R
City: Pacific Grove
ZIP code: 93950
Subject: I Do NOT support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Or create your own message:
Please, please do not allow this to be so close to our schools.
I would consider attending a public hearing. Please send me more information.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Wednesday, August 22, 2018 1:13 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: David Jones
City: Pacific Grove
ZIP code: 93950-5529
Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.
Message Body: Please support Verizon Wireless's proposed facility in Pacific Grove, providing service to Pacific Grove High School and surrounding areas. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove.

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Sent: Wednesday, August 22, 2018 5:18 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I DO NOT support Verizon Wireless's Small Cell for Pacific Grove."

From: Shelley Watson
City: Pacific grove
ZIP code: 93940
Subject: I DO NOT support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Or create your own message:

I would support any other wireless company than verizon. The very information on this website are untrue and misleading. The city is also complicit in costing parents (who want to protect their children from daily radiation) to pay \$1,500 to appeal the decision to put a cell tower at and near schools. We have been told that health issues are not a valid concern for protesting this permit? Way to side with a corporation against the taxpaying citizens of the city! What is going on here is ridiculous, but hold that thought. I have a plan to track the health of immune compromised children and hold Verizon and the city responsible for damages. The skulls of children are more vulnerable to Wi-Fi than adults, and it is our job to protect the children from political and corporate greed. Please put your cell towers by the fire department, or the police station, or anyplace else.... But NOT a school!?

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove., I would consider attending a public hearing. Please send me more information.

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Sent: Wednesday, August 22, 2018 7:52 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Do NOT Support Verizon Wireless's Small Cell for Pacific Grove."

From: Natalie Gray
City: Pacific Grove
ZIP code: 93950

Subject: I Do NOT Support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Or create your own message:

Verizon overcharged firefighters during the recent wildfires in Northern California, and slowed down the data stream. This is a company without conscience, and they deserve NO consideration.

I would consider attending a public hearing. Please send me more information.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Thursday, August 23, 2018 1:00 AM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I do not Support Verizon Wireless's Small Cell for Pacific Grove."

From: Daniel Niland
City: Seaside
ZIP code: 93955

Subject: I do not Support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Or create your own message:

Verizon wireless is a money grubbing shill of a company. They are under indictment for throttling network speeds for first responders and firefighters who were "on the wrong unlimited plan" forcing the to upgrade from a 39.99 plan for unlimited data to a 99.99 plan for the first 20 gigs and 8.99 for each additional gig. They put profits in front of people's safety. A new cell tower is unnecessary and uncalled for. Verizon should be ashamed of their service. I have coworkers who use Verizon for business who lose calls and never receive texts and who's calls do not get received by customers and suppliers. They are a terrible company unworthy of more space in our town. Down with Verizon. Bring back net neutrality.

Keep me informed of issues that impact the Verizon Wireless network in Pacific Grove., I would consider attending a public hearing. Please send me more information.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>

Sent: Saturday, August 25, 2018 2:37 PM
To: Support Wireless <SupportWireless@VerizonWireless.com>
Subject: Verizon "I Support Verizon Wireless's Small Cell for Pacific Grove."

From: Luis Reis
City: Pacific Grove
ZIP code: 93950

Subject: I Support Verizon Wireless's Small Cell for Pacific Grove.

Message Body: Please support Verizon Wireless's small cell network in the City of Pacific Grove. This is important for my family and friends. We want to be able to use our cell phones during emergencies and for 911 calls.

-- This e-mail was sent from a contact form on Verizon <https://improveyourwireless.com/>
