

May 2019 | EMF Study and Exemption Request

# NAKASE ELEMENTARY SCHOOL

Toll Brothers

*Prepared for:*

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# 1. Introduction

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## 1.1 PURPOSE

This report presents the results of an Electromagnetic Field (EMF) study and documentation to support a California Department of Education (CDE) Power Line Setback Exemption Request for the proposed Nakase Elementary School. The EMF study includes an evaluation of the potential exposure to EMF for students and staff at the school site in accordance with the CDE's Power Line Setback Exemption Guidance Policy (CDE 2006).

## 1.2 SCHOOL SITE LOCATION

Toll Brother (the project developer) is working to gain approval for construction of an elementary school on 10-acres of the 120.83-acre Nakase Property Area Plan located at 20621 Lake Forest Drive, Lake Forest, California. The project developer will dedicate the elementary school site to the Saddleback Valley Unified School District (SVUSD) following the City of Lake Forest certification of the Nakase Property Area Plan Final Environmental Impact Report, general plan amendment, zone change, development agreement, and subject to SVUSD's environmental review and approval of the school site, California Department of Education's (CDE) final approval, as well as completion and approval of grading and infrastructure plans. The school site would accommodate up to 1,000 students from kindergarten through sixth grade. The Nakase Property Area Plan is bounded by Bake Parkway to the northwest, office buildings to the southwest, Serrano Creek to the southeast, and Rancho Parkway to the east. The proposed elementary school and play fields and active use areas (project site) are in the northeast corner of the Nakase Nursery site (Figure 1).

## 1.3 REGULATORY REQUIREMENTS

There currently are Southern California Edison (SCE) 66 kilovolt (kV) double circuit overhead transmission lines northwest of the school site located in a 20-foot wide easement along Bake Parkway. However, planned infrastructure improvements for the Nakase Nursery site include undergrounding the overhead power lines along Bake Parkway (City of Lake Forest 2018). The infrastructure improvements would occur prior to construction of the proposed school. Therefore, this study address EMF exposure from underground 66 kV transmission lines.

The existing California Code of Regulations (CCR), Title 5, Section 14010(c) specifies a distance setback requirement of 25 feet from 50 to 130 kV underground power lines for proposed school sites as follows:

*The property line of the site even if it is a joint use agreement as described in subsection (o) of this section shall be at least the following distance from the edge of respective power line easements:*

## 1. Introduction

- 25 feet for 50-133 kV line (interpreted by CDE up to <200 kV)
- 37.5 feet for 220-230 kV line
- 87.5 feet for 500-550 kV line.

CDE has an interim policy that allows schools within the vicinity of underground lines to apply for variances to this regulation as described in the *Power Line Setback Exemption Guidance Policy* (CDE 2006). However, the setback exemption request is only applicable for new schools that are planning to have *limited activity uses* within the setback zone. Limited activity uses are defined as staff/visitor/joint-use parking, bus and parent drop-off parking, driveways, access roads, sidewalks, fire lanes, and landscaping.

### 1.4 REPORT OBJECTIVES

To meet the requirements of CCR Title 5 Sections 14010(c) and CDE's policy on transmission lines, this EMF Report is designed to meet the following objectives:

- Determine the encroachment distance of the setback zone onto the proposed school site
- Determine proposed uses at the school within the setback distance
- Recommend design measures for construction of the new school to minimize exposure to EMF



Source: Esri, PlaceWorks, 2019.

 Site boundary

Figure 1  
Site Location

## 1. Introduction

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## 2. EMF Study

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### 2.1 SCHOOL SITE AND POWER LINE LOCATIONS

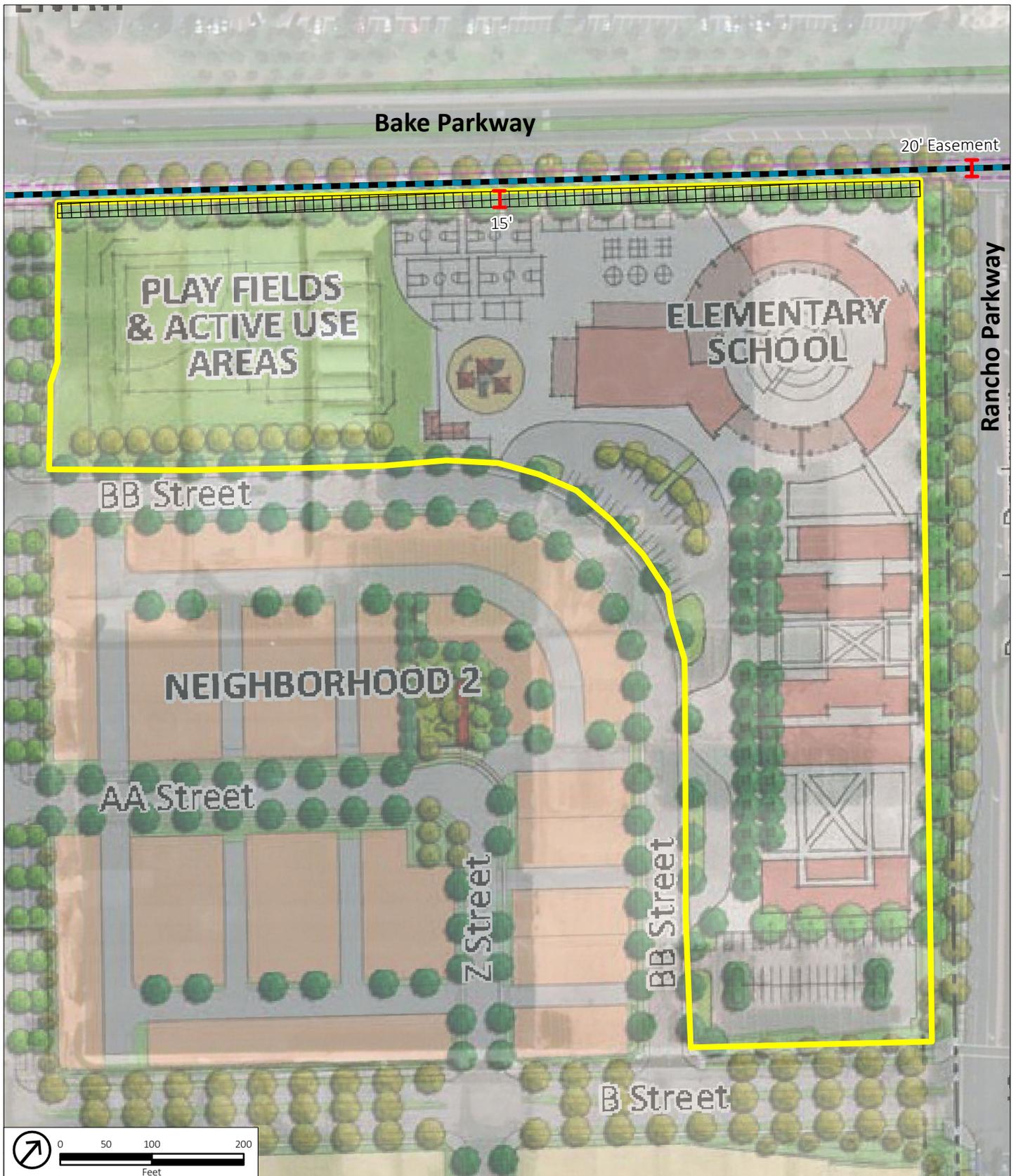
Toll Brothers is working to gain approval for construction elementary school located at the corner of Bake Parkway and Rancho Parkway in Lake Forest, California. There currently are SCE 66 kV double circuit overhead transmission lines that are within a 20-foot wide SCE easement along the south side of Bake Parkway that run parallel to the northwestern boundary of the proposed school site (SCE 2019). The southern edge of the SCE easement is the school's northwestern property line. However, there are plans to underground the power lines prior to the construction of the school site. Underground 66 kV power lines require a 25-foot setback from the edge of the SCE easement.

CDE allows an exemption to measure the setback distance from the centerline of the transmission line instead of the edge of the easement if it can reasonably be assumed that the utility would not place the utility line closer to the school site within the easement. Because the SCE easement is relatively narrow at this location (i.e., 20 feet wide), it is reasonable to assume that the undergrounded transmission lines would be placed in the center of the easement to maximize the space needed by SCE for future maintenance and repairs. Assuming the undergrounded lines are in the center of the SCE easement, the 25-foot setback zone would encroach 15 feet onto the northwestern portion of the school site. The proposed school layout, location of the future underground SCE transmission lines, and setback zone are shown in Figure 2. Photographs of the existing transmission lines and SCE easement near the school site are provided in Appendix A.

The SVUSD is currently considering various layouts for the proposed school site. The CDE Power Line Setback Exemption Guidance Policy requires an EMF study and an exemption request to be prepared for limited activity uses (i.e., landscaping, parking lots, driveways) within any setback zone. According to the current proposed school layout provided by Toll Brothers, it appears the 15-foot setback area within the school site would consist of landscaping (Figure 2), which is a limited activity use and acceptable for a CDE exemption. However, the final proposed school site plan should confirm that hardcourts and a grass playfield are not located within the setback zone. These uses are considered unrestricted uses, and CDE would require preparation of a Field Management Plan for school sites if unrestricted uses (classrooms, athletic fields, and joint-use facilities) are proposed within the setback zone.

## 2. EMF Study

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Source: C2 Collaborative Landscape Architecture, 2018; PlaceWorks, 2019.

-  Overhead 66kV Line
-  Site Boundary
-  15-foot Setback

Note: the on-site 15-foot setback is measured from the edge of the SCE easement. The centerline of the transmission line is setback 10-ft from the easement edge, resulting in a total setback of 25 feet from the powerline.

Figure 2  
Site and Setback Distance

## 2. EMF Study

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## 2. EMF Study

### 2.2 INTRODUCTION TO EMF

Electric and magnetic fields occur both naturally and as a result of human activity. Naturally occurring electric and magnetic fields are caused by the weather and the earth's geomagnetic field. Fields caused by human activity include areas that surround electrical devices, such as power lines, electrical wiring, and appliances.

Electric power flows across transmission systems from generating sources to serve electrical loads within the community. The power flowing through a transmission line is determined by the line's voltage and current. The higher the voltage level, the lower the amount of current needed to deliver the same amount of power. For example, a 115 kV transmission line will transmit 40,000 kilowatts (kW) with 200 amperes (amps) of current, whereas a 230 kV transmission line requires only 100 amps to deliver the same amount of power.

Magnetic fields from power lines are created whenever current flows through power lines at any voltage. The strength of the field is directly dependent on the current in the line. Magnetic field strength is typically measured in milliGauss (mG). Similar to electric fields, magnetic field strength attenuates rapidly with distance from the source. However, unlike electrical fields, magnetic fields are not easily shielded by objects or materials.

Public exposure to EMF is widespread and encompasses a wide range of electronic appliances or equipment, including computers, copy machines, fluorescent lights, hair dryers, televisions, ceiling fans, microwave ovens, refrigerators, digital clocks, washing machines, and dryers. Within urban areas of development, EMF also occurs from ground currents in water pipes and the electric distribution circuits that serve residences or businesses. Power line fields are typically at the front of residential lots where overhead or underground distribution lines are routed. Underground transmission lines typically have higher EMF values directly above the line than overhead transmission lines. However, the EMF values attenuate more quickly with distance from underground lines.

Despite extensive research over the past 20 years, the health risk caused by EMF exposure remains undetermined. Two national research organizations (the National Research Council and the National Institute of Health) have reviewed numerous health risk-related studies and have concluded that there is no strong conclusive evidence that EMF exposure poses a human health risk. However, the California Department of Health Services (CDHS) reached a different conclusion after a comprehensive review of existing studies related to EMF. The CDHS scientists concluded that EMFs *could* cause some degree of increased risk of childhood leukemia, adult brain cancer, Lou Gehrig's Disease, and miscarriage (CDHS 2002). As a result, the CDE has decided to employ the precautionary principle and limit exposure to EMF for students and staff at California schools (CDE 2006). The precautionary principle states that if an action or policy has a suspected risk of causing harm to the public or the environment in the absence of scientific consensus, there is a social responsibility to protect the public from exposure to harm. These protections can be relaxed if further scientific findings emerge that provide sound evidence that no harm will result.

There are no federal standards limiting occupational or residential exposure to EMF. Two states, Florida and New York, have set standards for magnetic fields at the edge of a transmission line right-of-way ranging from 150 mG to 250 mG, depending on the kV of the line. The California Public Utilities Commission (CPUC)

## 2. EMF Study

has requirements that utilities use “low-cost or no-cost” mitigation measures for the planning and construction of new or reconstructed transmission facilities (CPUC 2015). The International Commission on Non-Ionizing Radiation Protection (ICNIRP) in conjunction with the World Health Organization (WHO) has published recommended guidelines on electric and magnetic field exposures (NIH 2002). For the general public, the recommended limit is 830 mG. Neither of these organizations has governmental authority nor jurisdiction to enforce these guidelines. However, the guidelines are considered by utilities and regulators when reviewing EMF levels from electric power lines.

Research on ambient magnetic fields in homes and buildings in several western states found average magnetic fields within most rooms to be approximately 1 mG, while in a room with appliances present, the measured values ranged from 9 to 20 mG (CPUC 2003). The magnetic field at a distance of 12 inches from a color TV can range up to 20 mG and the magnetic field at a distance of 12 inches from a microwave oven can be up to 200 mG (NIH 2002).

### 2.3 EMF SETBACK EVALUATION

The pattern and strength of magnetic fields produced by underground transmission lines depend on the type of construction. Magnetic fields are typically higher for underground cables than overhead transmission lines, because the field source is only a few feet from the ground surface as compared to overhead conductors at the top of a 20 to 40-foot high transmission pole. However, due to the close spacing of underground cables, the magnetic field decreases more rapidly with distance from the source, resulting in a greatly reduced width of exposure to magnetic fields.

Typically to meet CDE requirements, an EMF survey would be conducted to determine EMF measurements at the proposed school site from the current power line configuration. However, since the proposed undergrounding of the power lines would occur prior to school construction, EMF measurements at the time of school occupancy would differ from the current power line configuration. Although an EMF survey was conducted for the overhead 66kV transmission lines, the results are not included as part of this setback evaluation since the EMF values will differ once the lines are undergrounded.

Currently, the 66 kV transmission lines northwest of the school site are located along the centerline of the 20-foot wide SCE easement, approximately 10 feet from the school’s property line. For the purposes of this evaluation it is assumed that the future underground power lines would also be located along the centerline of the SCE easement and remain 10 feet from the school’s northwestern property line. Therefore, the 25-foot setback zone extends approximately 15 feet onto the school property. According to the proposed school layout, it appears that only landscaping would be located within the 15-foot of the setback zone that extends onto the school property (Figure 2). However, a future site layout plan will need to confirm that unlimited uses, such as hardcourts and athletic fields do not encroach into the 15-foot setback area. If unlimited activity uses extend into the setback zone, an additional EMF study and a Field Management Plan would need to be prepared.

## 2. EMF Study

### 2.4 POWER LINE SETBACK EXEMPTION REQUEST

Pursuant to the CCR Title 5 regulations, the SVUSD is requesting a Power Line Setback Exemption from CDE for Limited Activity Use within the 25-foot setback zone along the northwestern boundary of the proposed school site. The future underground 66 kV transmission lines northwest of the school site are assumed to be 10 feet from the school's property line, along the centerline of the 20-foot wide SCE easement.

CDE has provisions that enable the setback distance to be calculated from the centerline of the transmission line instead of the edge of the easement, if it can reasonably be determined that it is extremely unlikely that new or relocated transmission lines would be placed closer to the school within the easement. It is not likely that the transmission lines would be relocated closer to the future school site as part of the proposed infrastructure improvements for the Nakase Nursery site. Therefore, this criterion has been met and an on-site setback distance of 15 feet is used for this evaluation.

As shown on Figure 2, the preliminary site plan shows an encroachment of approximately 15 feet onto the school site. Therefore, only land uses that meet the definition of Limited Activity Use, described in the CDE *Power Line Setback Exemption Guidance*, are recommended within the 15-foot on-site setback zone. Limited activity uses are defined as staff/visitor/joint-use parking, bus and parent drop-off parking, driveways, access roads, sidewalks, fire lanes, and landscaping.

### 2.5 METHODS TO REDUCE EMF EXPOSURE

Because only limited activity use is being requested within the 15-foot on-site setback zone, an EMF Field Management Plan is not required. However, SVUSD could incorporate magnetic field reduction strategies into the architectural design of the proposed elementary school to reduce exposure for staff and students to the extent feasible. Potential EMF reduction measures include the following:

- Locate high occupancy areas such as classrooms as far as possible from magnetic field sources
- Locate electrical panels, transformers, mechanical equipment, raceways, etc. as far as possible from occupied areas
- Locate electrical equipment in dedicated spaces that are not normally occupied: equipment rooms, storage rooms, and supply rooms
- Locate the service transformer and main switchboard as close as possible and practical to the main service street connection
- Locate transformers, switchgear, and large panels remote from occupied spaces in outdoors or in parking structures
- Provide barriers, walls, and/or fencing to limit access to electrical equipment, if located outside
- Provide required clearances and work space according to code and utility company requirements
- Transformers shall comply with Department of Energy Policy Act of 2005
- Locate equipment and equipment rooms so they are not adjacent, directly above, or directly below classrooms, offices, libraries, and similar spaces

## 2. EMF Study

- Disburse power via low occupancy areas
- Use EMF-free or low-EMF electrical wiring, where appropriate
- Design distribution lines to minimize EMF fields with the following options:
  - Place distribution lines underground and shield in steel pipe or steel jacket, if possible
  - Close spacing or bundling of hot and neutral conductors
  - Use of triplex for service drops
- Designs incorporating branch circuits with double neutrals shall be provided with a harmonic content study to substantiate the need for double neutrals
- Avoid routing underground feeders to pass under occupied spaces; where underground feeders have to pass beneath the concrete slab to terminate at a distribution panel inside the building, install conduits 24 inches below finished floor
- If power is brought in overhead, avoid bringing it in adjacent to classrooms or assembly areas
- Locate sub panels away from heavily used spaces
- Minimize currents by using higher voltages whenever practical
- Utilize balanced three-phase systems
- Keep major wiring runs away from heavily used spaces, such as classrooms and assembly areas
- Run sub panel feeder conduits that are heavily loaded in concealed spaces away from seating areas for classrooms and offices
- Keep large electrical loads generated by motors, HVAC equipment, fans, and blowers as far as possible from student and staff occupied areas
- Avoid multiple main electric panels which can create the potential for a current loop, resulting in high EMF levels throughout the occupied building space
- Gas, electric, telephone, cable, and water systems should be located to enter buildings as close together as possible and bonded per the NEC to prevent an objectionable flow of current over the grounding conductors or grounding paths
- Minimize distance between conductors in a circuit
- Use LED lights or electronic ballasts in place of magnetic ballasts for fluorescent lights and mount the ballast in remote locations away from occupied space, where possible

According to the proposed site plan, all classroom and buildings are at least 50 feet from the SCE easement and are therefore outside of the 15-foot on-site setback zone. Placing landscaping or other limited activity uses nearest the power line easement will reduce EMF exposure to students and staff at the proposed school site.

### 3. Summary and Recommendations

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Toll Brothers is working to gain approval for an elementary school on 10-acres of the 120.83-acre Nakase Property Area Plan at 20621 Lake Forest Drive, Lake Forest, California. PlaceWorks was retained by Toll Brothers to perform an EMF study and provide supporting documentation for a Power Line Setback Exemption Request. The findings of the study are summarized below:

- There are Southern California Edison (SCE) 66 kilovolt (kV) double circuit overhead transmission lines northwest of the school site within a 20-foot wide SCE easement along the south side of Bake Parkway.
- The transmission line is approximately 10 feet from the school's northwestern property line along the center line of the SCE easement.
- Planned infrastructure improvements for the Nakase Nursery site include undergrounding the overhead power lines prior to construction of the proposed school.
- Assuming the underground power line would be located along the center line of the SCE easement, the 25-foot setback zone would encroach 15 feet onto the northwestern portion of the school site.
- The SVUSD is requesting that CDE provide an exemption for limited activity use (landscaping, driveways, access roads, sidewalks, fire lane, staff/visitor parking) within the 15-foot setback zone from the 66 kV transmission lines that will be undergrounded prior to the construction of the school site.

Once the 66-kV transmission lines have been undergrounded along Bake Parkway, SVUSD will evaluate the location of the lines with respect to the school site boundaries. If the location of the lines differ from what is presented in this report, an addendum will be prepared and submitted to CDE.

Based upon the information presented in this report, SVUSD is requesting and will comply with the requirements for an exemption for limited activity use within the transmission line setback zone along the SCE easement adjacent to Bake Parkway. By limiting activity within the setback distance from the future underground power lines, the exposure of students and staff to EMF levels at the proposed elementary school will be less than significant.

### 3. Summary and Recommendations

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## 4. References

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- Southern California Edison (SCE). 2019. Correspondence and information provided by Mr. Phil Hung, PE, EMF Program Manager for SCE to Ms. Danielle Clendening, Intern, PlaceWorks. Dated January 29, 2019.

## 4. References

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## Appendix A. Photo Essay

## Appendix

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**Client Name:** Toll Brothers  
**Site Location:** Nakase Elementary School  
**Project No.:** TBRO-02.0

<b>Photo No:</b> 1	<b>Date:</b> 2/8/19
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**Description:**

View looking to the northeast from the northern boundary of the school site. Bake Parkway and the 66 kV double circuit transmission lines are visible in the right-of-way next to the sidewalk.



<b>Photo No:</b> 2	<b>Date:</b> 2/8/19
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**Description:**

View looking to the southeast from the northern boundary of the school site. Bake Parkway and the 66 kV double circuit transmission lines are visible in the right-of-way next to the sidewalk.





**Client Name:** Toll Brothers  
**Site Location:** Nakase Elementary School  
**Project No.:** TBRO-02.0

**Photo No:** 3  
**Date:** 2/8/19

**Description:**

View looking to the northeast from the sidewalk south of Bake Parkway. The 66 kV double circuit transmission lines and the easement are shown. The northern fence line of the school site is along the right side of the photograph.



**Photo No:** 4  
**Date:** 2/8/19

**Description:**

View looking to the southwest from the 20-foot wide SCE easement south of Bake Parkway. The 66 kV double circuit transmission lines and SCE easement are shown. The northern fence line of the school site is along the left side of the photograph.



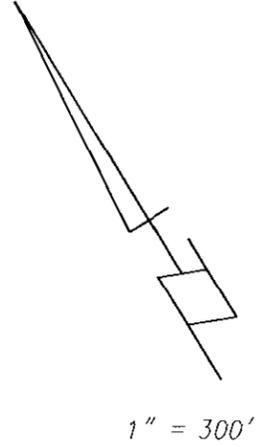
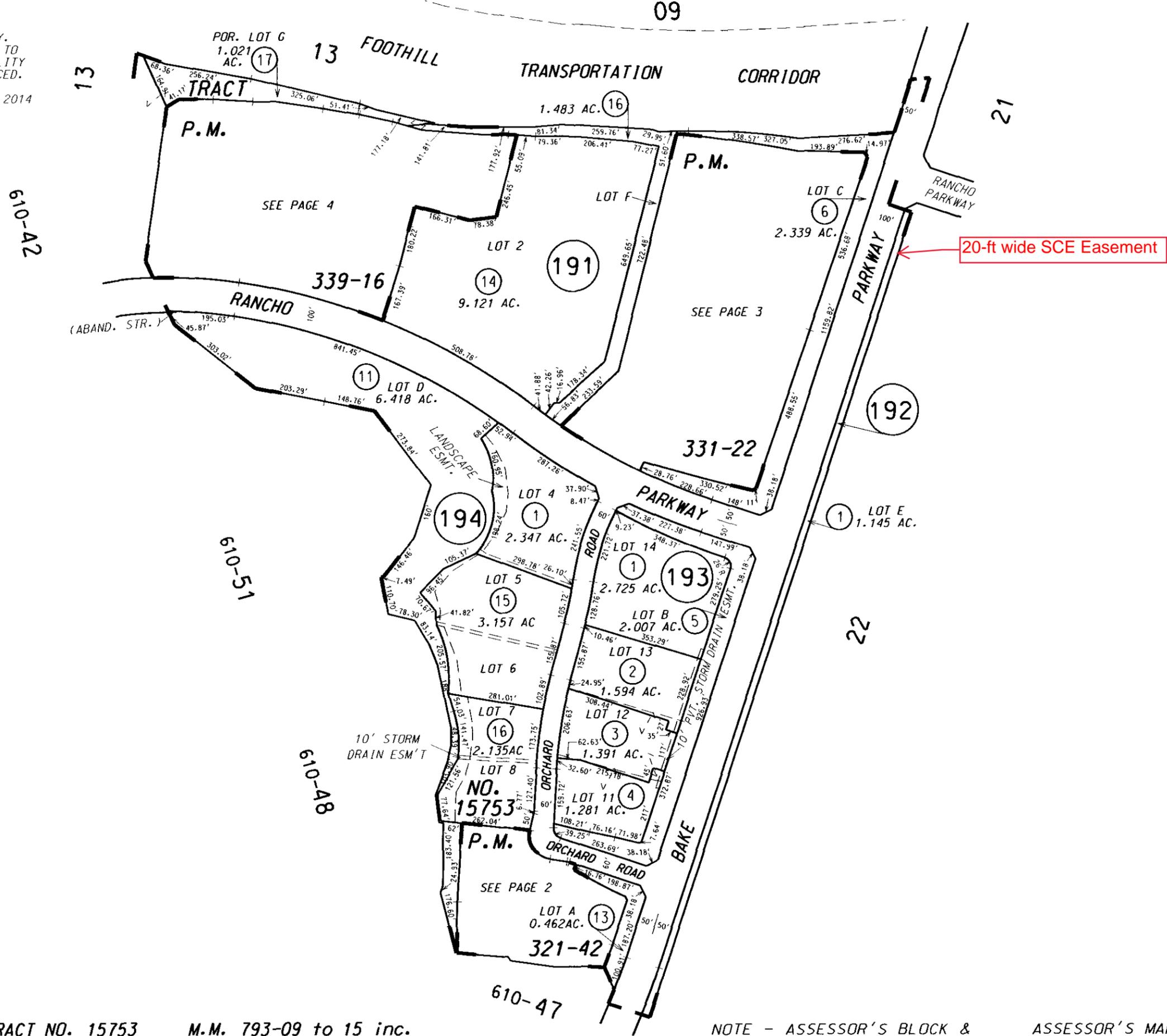
## Appendix B. Supporting Documentation

## Appendix

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