3.13 Electric and Magnetic Fields

This section assesses whether electric and magnetic fields (EMF) generated by light-rail transit (LRT) facilities, which use an overhead electrical supply, would cause adverse effects. The information in this section is based on the Electromagnetic Fields Technical Report (as listed in Appendix H).

The assessment of reasonably foreseeable effects in this section is based upon the geographic and temporal proximity parameters detailed in the Chapter 3 introduction.

3.13.1 Changes or New Information Since 2013

The Columbia River Crossing (CRC) Selected Alternative identified in the 2011 Record of Decision (ROD), as revised by the 2012 and 2013 re-evaluations, is referred to as the CRC Locally Preferred Alternative (LPA). Over the past 10+ years since the CRC LPA was identified, the physical environment near the Interstate Bridge, community priorities, and regulations have changed, which necessitated design revisions and resulted in the proposed IBR Program Modified LPA (see Section 2.5.2). Evaluation of potential impacts associated with EMF has been updated in this Final SEIS to include:

- Updates to methodology for evaluating EMF.
- Changes in the project footprint necessitated by changed conditions resulting in shifting the light-rail transit alignment and locations of traction power substations (TPSS) and a new overnight facility.

3.13.2 Existing Conditions

Current Guidelines and Regulations

Federal regulations set limits for EMF exposure in the workplace and in public areas that apply to AM and FM radio, television, and wireless sources (47 CFR § 1.1307(b)). Schools, daycare facilities, hospitals, senior living facilities, research facilities, and universities are considered sensitive receptors to EMF. The FTA has adopted guidance on approaches to preventing and reducing community environmental, health, and safety impacts from transit-generated EMF and electromagnetic radiation, including best management practices for light-rail systems.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP), in association with the World Health Organization and the American Conference of Governmental Industrial Hygienists, has developed voluntary occupational guidelines for EMF exposure, shown in Table 3.13-1.

Table 3.13-1. Exposure Guidelines for Power Frequency (60 Hz) Electromagnetic Fields

Exposure at 60 Hz	Electrical Field (kV/m)	Magnetic Field (mG)
International Commission on Non-Ionizing Radiation Protection		
Occupational	8.3	10,000
General Public	4.2	2,000
American Conference of Governmental Industrial Hygienists		
Occupational Exposure Should Not Exceed this Level	25	10,000
Prudence Dictates Use of Protective Clothing Above this Level	15	–
Exposure of Workers with Cardiac Pacemakers Should Not Exceed this Level	1	1,000

Sources: ICNIRP 2010; ACGIH 2015
Hz = hertz; kV/m = kilovolts per meter; mG = milligauss

EMF Generation and the Existing TriMet Light-Rail System

The main sources of EMF associated with LRT are the traction power system elements for the TriMet MAX LRT system. Table 3.13-2 shows the strength of the magnetic field at distances of 30, 65, and 100 feet from the light-rail tracks. As shown in Table 3.13-2, the magnetic field strength weakens rapidly as distance from the tracks increases. The highest measured value (167 milligauss [mG]) is well below the ICNIRP standard of 2,000 mG for public exposure to magnetic fields.

Units for Electric and Magnetic Fields

Voltage is similar to "electrical pressure" in an electrical line. This pressure produces an electrical field that extends out from the line and is measured in volts per meter (V/m). Current, in an active electrical line, also produces a magnetic field around the line. Magnetic fields are measured in units of gauss (G). Since most magnetic fields are weak, these fields are typically measured in milligauss (mG or 1/1,000th of a gauss).

Electrical systems can be either direct current (DC) or alternating current (AC). The electricity in wall sockets and power lines is alternating current. Direct current powers the MAX light-rail system in Portland. The frequency of alternating current is measured in hertz (Hz).

Table 3.13-2. Magnetic Field Strength at Distance from TriMet's Light-Rail Tracks (mG)

Direction	30 Feet	65 Feet	100 Feet
Horizontal	167.0	44.6	13.3
Vertical	17.8	8.2	3.4

Source: Edelson and Holmstrom 1998
mG = milligauss

Direct current magnetic fields measured in 2008 at TriMet's light-rail TPSSs ranged from 107 to 601 mG at the perimeter of the buildings and from 47 to 551 mG at light-rail stations. Magnetic field measurements taken inside light-rail cars fluctuated between approximately 0.38 and 8.13 mG at approximately seat height (CRC 2011), indicating that EMF emissions are extremely low within the light-rail vehicles used in the existing light-rail system. All the field intensities measured in TriMet's system are below the public exposure guidelines.

The analysis in this section includes a review of the EMF measurements reported in the CRC EMF technical report (CRC 2011), updated with similar and more recent rail systems approved and in operation since 2011. Because the proposed light rail extension with the Modified LPA would include system elements consistent with the existing TriMet MAX light rail system (such as power levels, TPSS ratings, and facility and system design), EMF levels along the light rail extension would be identical to those produced along the current TriMet MAX light rail system in Portland. Therefore, the data from the CRC EMF technical report is sufficient to assess potential EMF exposure levels for the proposed Modified LPA.

3.13.3 Long-Term Benefits and Reasonably Foreseeable Effects

The geographic proximity and temporal scope described in the Chapter 3 introduction are used to assess long-term benefits and reasonably foreseeable effects to EMF.

Table 3.13-3 summarizes the effects of the No-Build Alternative, Modified LPA, and design options on EMF. Detailed analysis of the effects is provided in the following sections.

Table 3.13-3. Long-Term Electric and Magnetic Fields Effects

Effect	No Build Alternative	Modified LPA (all design options)
EMF emissions	No change.	EMF emissions would increase slightly at certain locations along the light rail extension but would remain well below exposure guidelines.

EMF = electric and magnetic fields; LPA = Locally Preferred Alternative

No-Build Alternative

Existing EMF levels in the primary study area are a function of global background magnetic fields and EMF generated by nearby sources (e.g., utility power cables, office equipment, internal building wiring, and any other electrical apparatus). EMF levels fluctuate over time, depending on the operation of these nearby sources. Under the No-Build Alternative, there would be no change in existing EMF levels.

Modified LPA

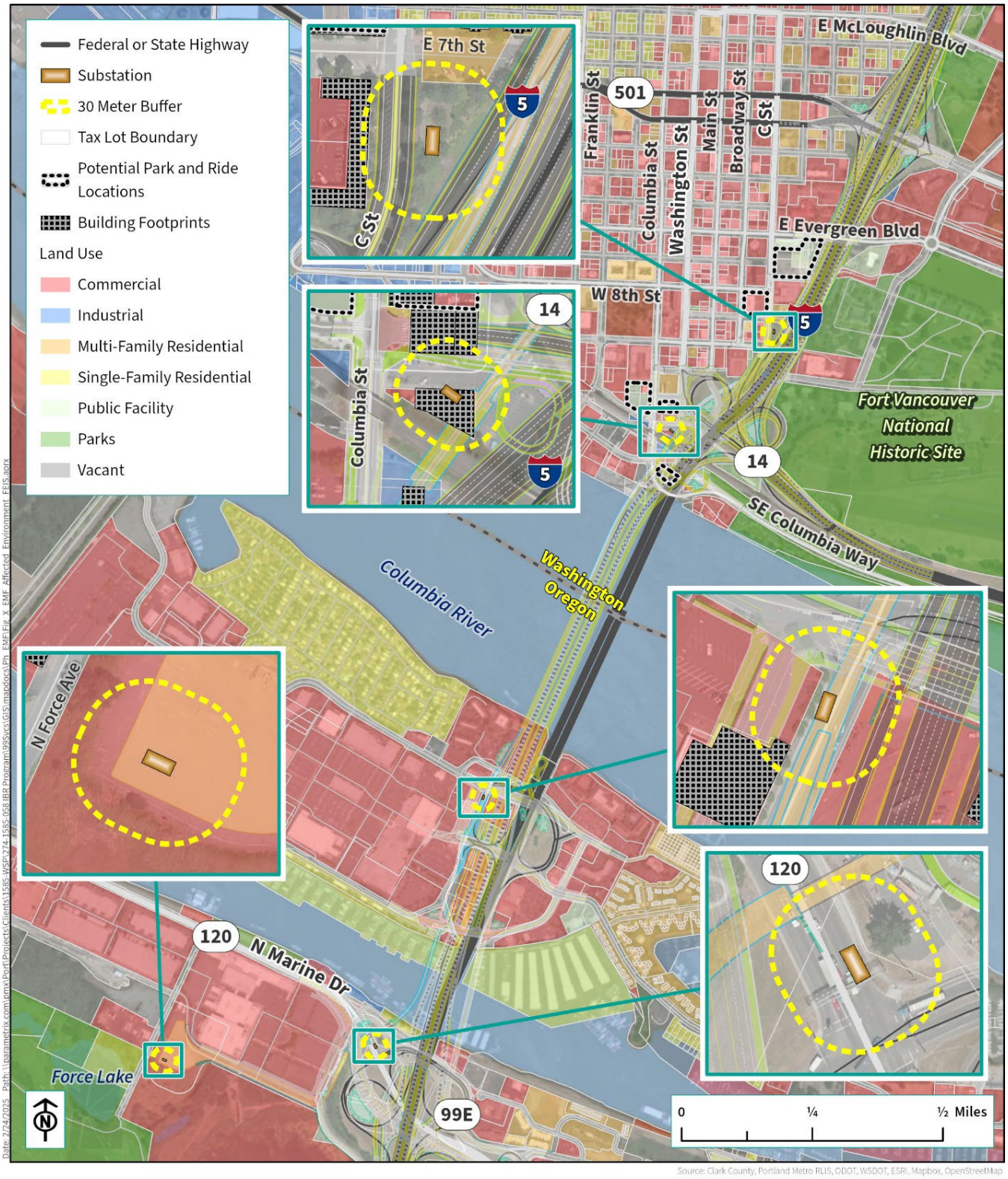
There would be no changes to existing EMF sources or levels related to the highway components (i.e., the bridges, shoulders, I-5 interchange and mainline improvements, and active transportation) of the Modified LPA, including the design options.

The light-rail trains would be powered by electricity, creating EMF fluctuations each time a train passes by. In the primary study area overall, EMF levels under the Modified LPA would be similar to those under the No-Build Alternative. Within and near the new light-rail right of way, near new TPSSs, and within the light-rail vehicles, EMF emissions would increase slightly compared to the No-Build Alternative but would remain well below exposure guidelines. The Modified LPA with the single-level fixed-span bridge configuration design option and the single-level movable-span bridge configuration design option would shift the LRT alignment across the Columbia River slightly west of the double-deck fixed-span bridge configuration design option. This would shift the geographic location of the EMF impacts, but EMF levels would remain well below exposure guidelines.

Figure 3.13-1 illustrates the locations of the five TPSSs proposed under the Modified LPA and the adjacent land uses. The locations of these TPSSs would not change relative to design options related to I-5 components. Additionally, EMF levels would reduce with distance and presence of physical barriers such as enclosures, building walls, and typical TPSS design features. The five proposed TPSSs would not be located near residential buildings or EMF-sensitive land uses.

The Modified LPA would produce EMF from LRT, which is powered by electricity. However, the EMF intensities would be below exposure guidelines for risks to human health.

Figure 3.13-1. Modified LPA Proposed Light-Rail Traction Power Substation and Existing Land Uses



3.13.4 Temporary Reasonably Foreseeable Effects

The geographic proximity and temporal scope described in the Chapter 3 introduction are used to assess temporary reasonably foreseeable effects to EMF.

Temporary effects on EMF would not differ among the Modified LPA design options. Construction of the Modified LPA and all design options, including construction of the new Columbia River bridges and removal of the Interstate Bridge, would require electrical power (i.e., through the use of generators) for certain activities (e.g., to operate certain tools and lighting equipment) but is not expected to result in appreciable changes to EMF levels in the primary study area. Magnetic fields from generators and associated cables at accessible distances would be well under the maximum short-term exposure limits (ICNIRP 2008, 2020).

3.13.5 Intentionally Left Blank

3.13.6 Potential Avoidance, Minimization, Regulatory, and Mitigation Measures

The levels of EMF anticipated to result from the proposed Modified LPA are less than the exposure standards for both the workplace and the public; therefore, mitigation would not be necessary. The design and location of facilities would help to reduce the intensity of magnetic fields and exposure of the public to EMF. Some examples include ensuring that all electrical equipment is operated with a good ground system and that proper shielding is provided for all electrical lines. The IBR Program would follow FTA guidance on best management practices for avoiding and minimizing EMF levels from light-rail systems.