# MEMORANDUM

**TO:** TIMOTHY MCDONALD
DIRECTOR OF HEALTH & HUMAN SERVICES
TOWN OF NEEDHAM

**FROM:** RICHARD LESTER

**SUBJECT:** QUESTIONS ABOUT ELECTROMAGNETIC FIELDS – WEST ROXBURY TO NEEDHAM RELIABILITY PROJECT

**DATE:** OCTOBER 18, 2018

**CC:** KATE FITZPATRICK, RAY MIYARES, RICHARD MERSON

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At the request of the Town of Needham (the "Town"), I have reviewed electromagnetic field modeling for the proposed West Roxbury to Needham Reliability Project (the "Project"). I write to offer responses to three questions that may be of interest to concerned citizens with respect to the Project.

**How much EMF will the transmission line produce?**

Electromagnetic fields (EMF) are produced whenever a current flows through a transmission line. EMF is also produced by electric currents on wires within homes and in the vicinity of operating appliances. The physics of modeling EMF is very well understood, and it is straightforward to model electric and magnetic fields produced by electric current flowing on a transmission line using software designed for that purpose. Though I have not performed a detailed review of the modeling performed by Gradient Corporation for the Project, I have reviewed the results of the modeling, and the results are consistent with what I have seen at other similar projects.

Transmission lines produce both electric and magnetic fields. Underground lines do not produce measurable above ground electric fields. Only magnetic fields will be detectable above ground in the vicinity of the Project. Magnetic field strength is measured in units of milligauss, abbreviated mG. As a point of comparison, the earth's natural magnetic field in Needham has a strength of approximately 519 mG. The earth's magnetic field is a static field, meaning that it is always in the same orientation. This is why compass needles always point north. Magnetic fields associated with the Project will be much less strong than the earth's magnetic field, but differ in that they will alternate direction 60 times each second, corresponding to the fact that electricity in the United States is transmitted at a frequency of 60 hertz (abbreviated Hz). It is because the magnetic fields change direction that the magnetic field associated with transmission lines can be distinguished from the earth's magnetic field. 60 Hz magnetic fields (those associated with electricity use) are generally less than 10 mG in residences, but can be more than 100 mG in close proximity to operating appliances that use large amounts of electricity such as electric blankets,

hair dryers, and toasters. The most typical 60 Hz magnetic field levels in residences in the middle of rooms, away from wiring, range from 0.1 to 3 mG.

The magnetic fields produced by the Project will vary depending on the amount of current on the transmission line (the "load"). For this reason, Gradient's modeling evaluates magnetic fields at peak load (the maximum load that will be present on the lines) and at the annual average load. The load on the line on any given day depends on many factors, and it is not possible to predict with certainty when the load will be greatest, but in general, transmission line loads are frequently high in the afternoon of very hot summer days when air conditioning use and electricity use are greatest.

Magnetic field levels associated with the Project will be greatest immediately above the transmission line in the street. Magnetic field levels will decrease rapidly with distance from the line. At peak summer loads, the modeled magnetic field strength above the transmission line in its standard configuration is 71 mG. This field strength falls to 7.1 mG at a distance of 20 feet from the center of the transmission line. At the annual average load on the transmission line, the modeled magnetic field strength directly above the line is 33 mG, falling to 3.6 mG at a distance of 20 feet from the centerline.

**How much EMF will be produced at manholes without shielding?**

Magnetic fields in the vicinity of manholes will differ from those along the rest of the line. Modeled magnetic fields in the vicinity of manholes at peak load are 98.6 mG directly above the line and fall to 20 mG at a distance of 20 feet. Modeled magnetic fields in the vicinity of manholes at the annual average load are 46 mG and fall to 9 mG at a distance of 20 feet.

**What is the health standard for magnetic fields produced by the Project?**

The International Commission on Non Ionizing Radiation Protection (ICNIRP) has developed a health-based guideline for public exposure to 60 Hz magnetic fields. The ICNIRP guideline is 2,000 mG. Magnetic fields generated by the Project will be far less than this guideline.

While there are no other health-based standards for comparison, the Massachusetts Energy Facilities Siting Board has frequently used a guideline of 85 mG at the edge of a ROW when deciding whether to site a new transmission line. This is not a health-based standard or guideline, and it is applied at the edge of a right-of-way, not directly above or beneath a transmission line. Modeled project magnetic fields are less than 85 mG at all locations except for within approximately 5 feet of a manhole at peak load.

A significant amount of scientific research has been conducted examining whether long-term 60 Hz magnetic field exposure can be linked to childhood leukemia. This research has been conducted because a review of many studies looking at childhood leukemia suggested that there may be a two-fold increase in childhood leukemia at 60 Hz magnetic field levels greater than 4 mG. The World Health Organization (see the fact sheet at http://www.who.int/peh-emf/publications/facts/fs322/en/) has examined this literature and concluded that there are potential problems with the scientific studies and that it cannot be concluded that low frequency (60 Hz) magnetic fields cause childhood leukemia. Scientific research is still being conducted in this area. Because no causal relationship has been established, no health-based standards have been developed based on childhood leukemia.

Along the route of the proposed line, a fairly typical distance for the closest part of a residence to the street is approximately 35 feet. At a distance of 35 feet from the transmission line, average (long-term) magnetic field strengths associated with the Project are modeled to be less than 4 mG both near the transmission line and in the vicinity of manholes.