Q-CSC-III-1: Was the proposed substation expansion area surveyed for wetlands? If so, describe the methodology used.

A-CSC-III-1: UI delineated wetlands on the existing substation property and a parcel identified to the west of the existing substation. The parcel west of the existing substation was investigated in the field on September 5, 2014, using a crisscrossing pattern, walking the property, noting changes in hydrology, vegetation, and soils. No wetlands were identified on these parcels. A partial boundary of a wetland off of the site was delineated in the field. The methodology was in accordance with the USDA Soil Survey Manual and the ACOE Northcentral Northeast Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. The wetland report titled "Wetland Identification and Delineation Report" dated September 10, 2014 further describes the methodology used to determine the presence or absence of wetlands and watercourses. The investigation was completed and conducted by a wetland scientist and qualified soil scientist in accordance with the United States Department of Agriculture Soil Survey Manual (1993).

The September 2014 Report states, "Vegetation, soils, and hydrology were observed and documented during the site investigation in order to meet the criteria of state and federal delineation methodologies. Soil types were identified by observing soil morphology (soil texture, color, structure, etc.). To observe the morphology of the soils, numerous test pits and/or hand borings (generally to a depth of at least two feet) are completed. If wetland and/or watercourses were determined to be present, their boundaries were identified with flags hung from vegetation or stakes. These flags are labeled "Wetland Boundary" and are generally spaced a maximum of approximately 50 feet apart. It is important to note that flagged wetland and watercourse boundaries are subject to verification by regulatory agencies."

Q-CSC-III-2: Were soil augerings performed to assess the wet area located on the north side of the proposed substation expansion area? If yes, please provide field test data. If no, please provide the rationale used to arrive at such a decision.

A-CSC-III-2: Yes, numerous hand augers were taken in the field, both during the initial September field visit and also again on April 14, 2015. Soil hand auger pits were performed to determine the wetland boundary located on the north side of the existing substation. No data sheets were generated for the wet area located on UI property as the area was determined non-wetland through field investigation of soils, hydrology and vegetation in accordance with USDA Soil Survey Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region.

Q-CSC-III-3: How was the determination reached that the onsite wet area is not a wetland or intermittent watercourse? How does that reconcile with what was observed in the field on March 31, 2015 including presence of standing/seeping water, saturated soils, and the condition of tree trunks and roots that indicate seasonal saturation of the soil?

A-CSC-III-3: The onsite wet area was investigated during the September 5, 2014 field visit. Hand auger pits were performed at that time and it was determined the soil value and chroma did not meet hydric soil criteria as defined in USDA Soil Survey Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. As stated in CSC-III-2, if an area was determined to be non-wetland, an ACOE data sheet is not generated.

This area was reinvestigated on April 14, 2015. Although surface water, seeps and buttressed Red maple tree trunks were present in this area, soils investigations confirmed initial findings in September 2014 that soil value and chroma in this area did not meet the hydric soils criteria.

Red Maples, although present, were located along the outside perimeter of the “wet area” in question. Red maples are a facultative species and are opportunistic, inhabiting a range of soils and hydrologic conditions. Overall, all three parameters for the area to be considered a federal wetland were not met.

In regards to the intermittent watercourse criteria, the area contained no defined bed and bank, and no evidence of scour or deposition or accumulated detritus. Therefore, neither the federal or state wetland criterion were met, nor were the criteria for an intermittent watercourse.

Interrogatory CSC-III-4

The United Illuminating Company

Witness: Matthew Cloud
Ron Rossetti

Petition 1120

Q-CSC-III-4: How does the wet area, whether or not it is classified as a wetland, affect the plan to install fill? Are the soils sufficiently stable enough to accommodate the weight of the proposed fill and new substation equipment?

A-CSC-III-4: The area in question will not affect the plan to install fill at the site as the existing soil in the expansion area will have a negligible impact from a general grading standpoint. During preliminary design the soils are assumed to have adequate stability, but a Geotechnical Engineer will perform a stability analysis on the soil within the substation expansion area during the detail design phase of the project to determine whether modifications to the foundation are required.

Interrogatory CSC-III-5

The United Illuminating Company

Witness: Raina Huebner
Bohdan Katreczko

Petition 1120

Q-CSC-III-5: If the wet area is classified as a wetland, would filling require an Army Corp of Engineers permit?

A-CSC-III-5: The wet area is not a wetland and therefore does not require an ACOE permit.

Q-CSC-III-6: Does the wet area extend to the northeast, connecting to the previously delineated wetland on the adjacent GE property? How does the proposed filling of the wet area affect storm water run-off to this delineated wetland?

A-CSC-III-6: The area in question appears to contribute to the hydrology of the delineated wetland during certain times of the year, however, it is important to note that no evidence of such hydraulic inputs were present during the wetland delineation. Therefore, there only appears to be a seasonal connection between these two areas.

The storm water pollution control plan specifies use of erosion control blankets and sedimentation barriers that will be used to minimize any adverse impacts associated with stormwater runoff. No adverse impacts due to stormwater runoff are anticipated long-term, and short term impacts will be avoided and minimized via the use of proper erosion and sedimentation controls identified in the Project's stormwater pollution control plan approved by DEEP.

Witness: Dennis Quinn
Bohdan Katreczko

Q-CSC-III-7: If the previously delineated wetland is a vernal pool, is filling and disturbance occurring within the 100-foot vernal pool envelope?

A-CSC-III-7: The previously delineated wetland is not a vernal pool. *See* Attachment CSC-III-7, *Assessment for the Presence of Vernal Pool Breeding Amphibians*.

Q-CSC-III-8: If the previously delineated wetland is a vernal pool, how does the proposed project affect the critical upland terrestrial habitat (100-750 feet) of the vernal pool?

A-CSC-III-8: Please *see* UI's response to Interrogatory CSC-III-7.

Q-CSC-III-9: In regards to the Response to Town of Fairfield Interrogatories, dated March 16, 2015, Response 3 - Phase II Environmental Assessment, please clarify the Chain of Custody information on the last page of the document - items 1A and 5B, as discussed at the March 31, 2015 hearing.

A-CSC-III-9: On October 28, 2014, the original soil samples were submitted to and received by Con-Test Analytical Laboratory, meeting method-specified preservation and holding time requirements. This initial round of constituents included: VOCs, SVOCs, PCBs, Total & RCRA 8 Metals, and Pesticide/Herbicide. Both the original Chain of Custody Record and the primary Reasonable Confidence Protocol (RCP) Laboratory Analysis QA/QC Certification Form associated with these samples were filled out properly. These are found within the Phase II Environmental Site Assessment report.

The secondary RCP Laboratory Analysis QA/QC Certification Form on the last page of the Phase II Environmental Site Assessment is specific only to the RCP methods (e.g. ETPH) used for additional analyses that were requested on November 17, 2014 from the original samples. The reason that Con-Test checked “No” in question 1-A is because this additional analysis - for landfill profiling purposes only - was requested after the recommended holding time had passed. It was also determined that Con-Test inadvertently answered “Yes” to question 5A when it should have been “No”. This secondary RCP Laboratory Certification Form has been revised and a revised laboratory report was re-issued April 1, 2015. *See* Attachment CSC-III-9, *Clarification to Response 3 – Phase II Environmental Assessment*.

Q-CSC-III-10: At the March 31, 2015 hearing, UI offered to submit a revised version of the Electric and Magnetic Field Assessment: The Hawthorne Substation prepared by Exponent that does not contain Critical Energy Infrastructure Information (CEII) Please submit a revised version or a summary of findings that does not contain CEII.

A-CSC-III-10: *See* Attachment CSC-III-10, *CEII Compliant EMF Assessment*.

Attachment CSC-III-7

Hawthorne Substation

180 Hawthorne Drive, Fairfield, Connecticut

Connecticut Siting Council Petition No. 1120

Assessment for the Presence of Vernal Pool Breeding Amphibians

Prepared for:

UIL HOLDINGS

180 Marsh Hill Rd.
Orange, CT 06477

Prepared by:
Dennis P. Quinn - Owner

CT Herp Consultant LLC

40 Pine Street
Plantsville, CT 06479

Attachment CSC-III-7

On September 10, 2014 a document prepared by BL Companies, Inc. titled *Wetland Identification and Delineation Report* identified, north of 180 Hawthorne Drive on the General Electric property, a wetland just outside of the Hawthorne Capacitor Bank Addition project site. This wetland was described as an isolated non-vegetated concave depression wetland with a palustrine forested broad leaved deciduous classification (USFW Classification: PFO1) with Red Maple (*Acer rubrum*) dominant along the edge. This report further stated that this wetland was potential breeding habitat for amphibians during the spring seasons. To determine if this wetland was serving as amphibian breeding grounds, CTHerpConsultant, LLC performed a two-day field assessment on April 10 and 11, 2015.

In order to assess if the above described wetland was an active breeding site for amphibians and therefore, classified as a vernal pool, egg mass count, dip-netting, minnow trapping and cover object survey methods were performed to document the presence and/or breeding activity of amphibians.

Egg mass count surveys were performed on April 10 at 9:15 A.M. during overcast conditions and again on April 11 at 10:30 A.M. during clear conditions. Counts were conducted by walking the perimeter and through the center of the wetland to visually observe and document amphibian egg masses, specifically wood frog (*Lithobates sylvatica*) and spotted salamander *(Ambystoma maculatum*). No egg masses were detected during survey efforts.

A total of 12 samples were taken with a 12 inch D-frame dip-net around the edge and from the middle of the wetland on April 10. The purpose of the dip-net survey was to determine if larval marbled salamanders (*Ambystoma opacum*) were present in the wetland. During this survey no larval salamanders were observed. Additionally no invertebrates were documented during the dip-net surveys, an unusual absence and critical piece in the food chain of a healthy breeding pool.

A total of nine minnow traps were set on April 10 and checked the following day, allowing for a 24-hour set for each trap. Traps were dispersed throughout the wetland area (Figure 1). No salamanders were captured during the minnow trapping efforts.

Cover object surveys were performed on April 10 within the upland areas surrounding the wetland on both the 180 Hawthorne Drive and General Electric properties. A total of 109 cover objects were surveyed yielding two redback salamanders (*Plethodon cinereus*), a fully terrestrial species that does not use wetlands for reproduction, instead laying eggs in moist terrestrial environments. No additional salamander species were documented during the cover object survey.

This wetland does not support any amphibian breeding populations and does not have the required characteristics to be classified as a vernal pool. The current classification, described as an isolated non-vegetated concave depression wetland with a palustrine forested broad leaved deciduous classification (USFW Classification: PFO1), is appropriate. The absence of vernal pool breeding species is not surprising as many of the characteristics of this site are not typical of wetlands that support breeding amphibian populations, especially vernal pool indicator species, such as, *A. maculatum* and *L. sylvatica*. Located within a highly fragmented landscape, seventy percent of the critical terrestrial habitat surrounding this wetland is developed, where it is recommend in the *Best Development Practices Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States*, a minimum of fifty percent of this forested buffer should remain intact (Calhoun and Klemens, 2002). This wetland is also shallow, nine inches at its greatest depth and with a discharge flow channel that is piped underground to a roadside drainage swale, both characteristics that do not support the typical hydrologic conditions required for vernal pool breeding species (Figure 1). Lastly, the intact critical upland habitat, approximately 30%, is maintained and manicured (Figure 1), having highly reduced amounts of woody vegetation and

downed debris typical of woodlands that support the terrestrial life-stage of amphibian populations.

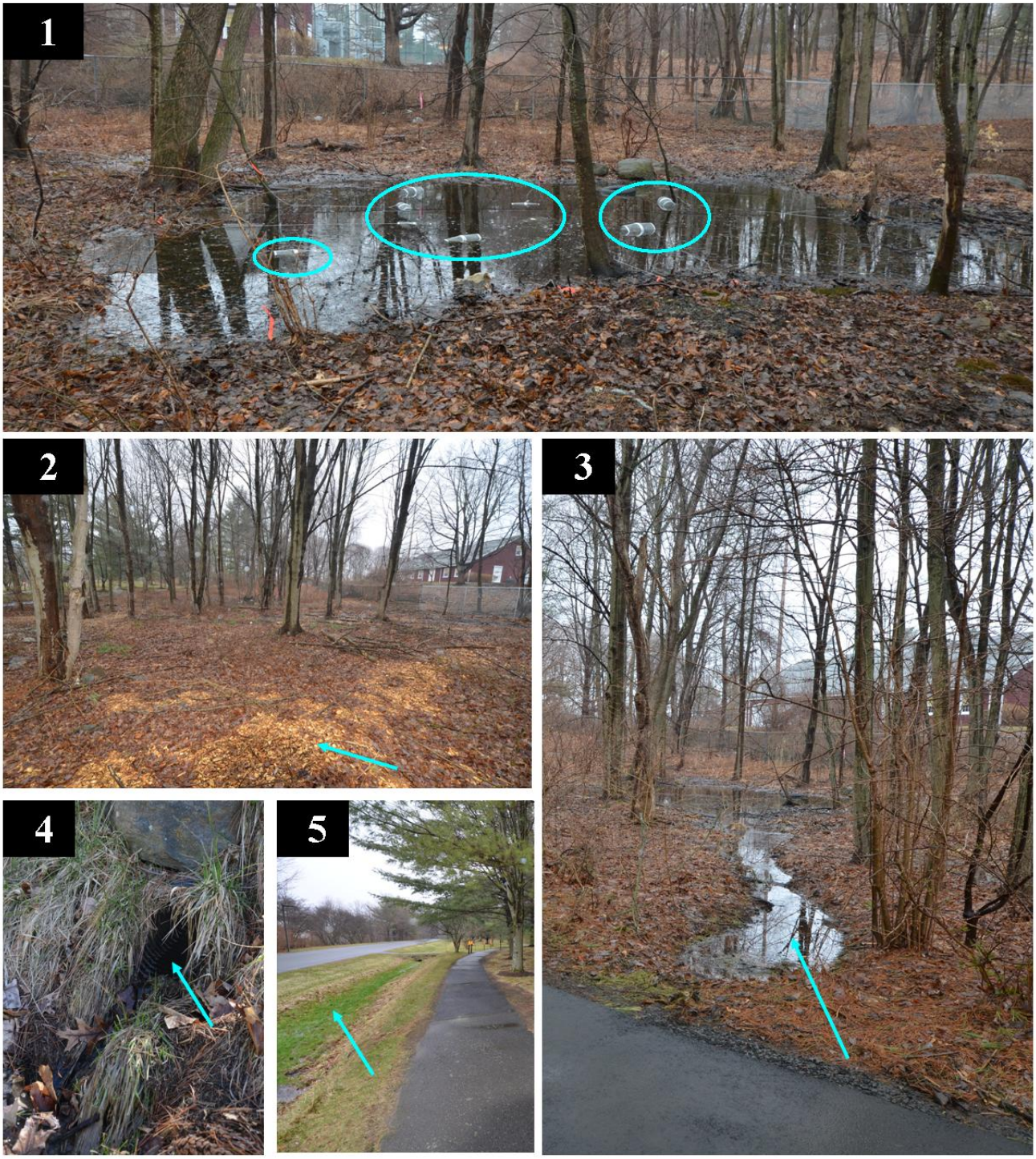

Figure 1. Site photos showing minnow traps locations 1-9 (Photo No. 1), wood chips from cleared understory brush and vegetation surrounding wetland (Photo No. 2), discharge flow (Photo No. 3), drain pipe discharge into drainage swale (Photo No.4) and drainage swale (Photo No. 5).

Literature Cited:

Calhoun, A. J. K. and M, W. Klemens. 2002. Best development practices conserving pool-breeding amphibians in residential and commercial developments in the northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Concervation Society, Bronx, New York.

Attachment CSC-III-7

Dennis P. Quinn

40 Pine Street
Plantsville, CT 06479
Phone: (203) 430-7830
E-mail: ctherpconsultant@gmail.com

EDUCATION

University of Massachusetts, Amherst, MA.

- New England Regional Soil Science Certificate Program. (2014)

Central Connecticut State University (CCSU), New Britain, CT.

- Masters in Ecology and Environmental Science. Thesis research: Radio-telemetry of eastern box turtles to determine home-range, habitat use and hibernacula selection in CT. (2008)
- Bachelors in Biology with a concentration in Ecology, Biodiversity and Evolutionary Biology. (2002)

PADI Certified Scuba Diver. (1999)

EMPLOYMENT

Owner – CTHerpConsultant, LLC. Plantsville, CT. (2007 – present)

CTHerpConsultant, LLC was founded in 2007 to facilitate the pursuit and passion I have for reptile and amphibian research, conservation and preservation. A wide variety of ecological services are offered by my company, ranging from general wildlife and habitat characterization surveys, to detailed environmental impact assessments complete with land use planning, mitigation design and monitoring. I have worked directly with a variety of State and Federally threatened and endangered species, ranging from the bog turtle and spadefoot toad, to the slimy salamander. Currently, I am the consulting herpetologist for the CTDEEP where I coordinate state and northeast regional amphibian and reptile projects. Additionally, I am coordinating for the CTDEEP Regional Conservation and Competitive State Wildlife Grant Projects involving long-term wood turtle monitoring, leopard frog genetics and distribution and SFD prevalence in snakes across CT. Additional SFD sampling is taking place with the Roger Williams Park Zoo to investigate the rate of occurrence, effect and cause of Snake Fungal Disease (SFD) in timber rattlesnake populations across the northeast.

Clients:

CT Department of Energy and Environmental Protection
CT Department of Transportation
Farmington River Watershed Association
Fitzgerald & Halliday, Inc.
Michael W. Klemens, LLC
O & G Industries, Inc.
Parsons Corporation
Regional Water Authority
Simsbury Land Trust
Wildlife Management Institute

Creator and maintainer of www.ctherpetolgy.com: A photographic atlas to the amphibians and reptiles of Connecticut.

Wildlife Photographer – photographs can be viewed at www.dennisquinnphotography.com

Associate Scientist, Parsons Corporation East Berlin, CT. (2005 - 2007)

- Radio-telemetric study of eastern box turtles and eastern hog-nosed snakes for ConnDOT CT Route 7 Bypass. Responsible for data collection, terrestrial mitigation design, assist with culvert design and placement, data analysis, and report preparation.
- Northern slimy salamander presence/absence survey for ConnDOT CT Route 7 Bypass. Responsibilities included field surveys and assist in report preparation.

Environmental Scientist, Maguire Group Inc. New Britain, CT. (2005)

- Field surveys for proposed Route 11 corridor and assisted in preparation of the environmental impact statement.
- Impact Assessment for emergency by-pass pipeline, data analysis, technical writing and mitigation planning.

Herpetological Field Surveyor, Farmington River Watershed and Wildlife Conservation Society (2002)

- Surveyed local reptile and amphibian populations throughout the Farmington River Valley. Identification, data collection, photography.

EMPLOYMENT IN EDUCATION

Adjunct Instructor, Naugatuck Valley Community College Waterbury, CT. (2004 - present)
Courses Taught:

Bio 105 Introductory Biology - Lec/Lab
Bio 171 Field Biology - Lec/Lab
Bio 145 General Zoology - Lec/Lab

Technical Advisor, CCSU New Britain, CT. (2011 - present)

- Serve as a technical research advisor to undergraduate and graduate students working on research in the field of herpetology.
- Graduate Thesis Committee – serve as an expert external committee member for herpetological theses.

Environmental Science Instructor, Post University Waterbury, CT. (2006)
Courses Taught:

Bio 134 General Biology - Lab
Bio 200 Ecology - Lec
Env 200 Sustainable Development - Lec
Env 230 Environmental Policy - Lec

Received honors for outstanding service to students in environmental science instruction.

Graduate Teaching Assistant, CCSU New Britain, CT. **(2003)**
Courses Taught:

Bio 121 General Biology I - Lab
Bio 202 Principles of Ecology and Evolution - Lab

PUBLICATIONS

- Gruner, H. and Quinn, D. 2012. Project 18-113/129 U.S. Route 7 Bypass Brookfield, Connecticut, Slimy Salamander (*Plethodon glutinosus*) Ridge-wide Habitat Study, Kent to Bethel, Connecticut. Connecticut Department of Transportation, Newington, CT.
- Quinn, D. 2011. The Timber Rattlesnake: A Modern Day Legend. *Connecticut Wildlife*. Volume 31, No. 1, Jan/Feb 2011.
- Quinn, D. and Gruner, H. 2010. Project 18-113 U.S. Route 7 Bypass Brookfield, Connecticut, Eastern Box Turtle and Eastern Hog-nosed Snake Monitoring Report 2009. Connecticut Department of Transportation, Newington, CT.
- Quinn, D. 2009. Project 131-190 Removal of Bridge No. 00518 and Intersection Improvements Route 10 and Route 322 Southington, Connecticut: Eastern Box Turtle and Wood Turtle Presence/Absence Surveys and Report. Connecticut Department of Transportation, Newington, CT.
- Quinn, D. 2008. A radio-telemetric study of the Eastern Box Turtle (*Terrapene carolina carolina*) home range, habitat use, and hibernacula selection in Connecticut. M. Sc Thesis. Central Connecticut State University, New Britain, CT. 84 pp.

PRESENTATIONS, RADIO and VOLUNTEER WORK

Seminars:

- WNPR Where We Live hosted by John Dankosky Everything You Want to Know About Turtles. (2014)
- WNPR An Atlas to Track Connecticut Critters that Slither, Hop and Crawl. (2014)
- UCONN Department of Pathobiology and Veterinary Science Seminar Series. CT Amphibians and Reptiles and thier Conservation Challenges. (2014)
- CT Department of Energy and Environmental Protection. CT Salamanders and their Conservation Challenges. (2014)
- CT Department of Energy and Environmental Protection. *Natural History of the Northern Copperhead. (2013)*
- CT Department of Energy and Environmental Protection. *Natural History of the Hog-nosed Snake. (2013)*
- Simsbury Land Trust 25th Anniversary Celebration. *Connecticut Reptiles and Amphibians.* (2006)
- Biological Sciences Seminar Series. CCSU. *Land Management and Conservation Strategies for the Reptiles and Amphibians of the Farmington River Valley* (2002)

Volunteer:

Nutmeg Big Brothers Big Sisters. Big Brother Mentor. (2007 – 2010)
Regional Water Authority. A Walk with Connecticut's Reptiles and Amphibians. Pine Hill Recreational Area. (2010)
Connecticut Bio Blitz.

- Keney Park and Goodwin College. Hartford, CT. (2009)
- Wilbert Snow School. Middletown, CT. (2007)
- Two Rivers Magnet School. East Hartford, CT. (2005)

Wethersfield Nature Center. Reptile Day. Gave interactive talk with school children on reptiles and amphibians. (2005)
Simsbury Land Trust. Educational walk on vernal pools and the fauna that depend on them for survival. (2003, 2004 & 2005)

COMPUTER EXPERIENCE

Microsoft Office: Word, Excel, Access, Power Point; PC-ORD, ArcGIS, Graphical Analysis, Sigma Plot, Adobe Photoshop.

AWARDS and HONORS

Leeds M. Carluccio Award: For outstanding student service and leadership in Biological Sciences (2002)
Member Tri-beta National Honor Society (2002)

REFERENCES

Dr. Michael Klemens. Research Associate in Herpetology. American Museum of Natural History. fenbois@aol.com. (203) 448-8068. New York, NY 10024

Hank Gruner, Vice President of Programs. Connecticut Science Center, Hartford, CT. 06106. hgruner@ctsciencecenter.org (860) 712-1308.

Dr. Barbra Nicholson, Professor. Central Connecticut State University, New Britain, CT. 06050. nicholsonb@ccsu.edu. (860) 832-2706.

Cynthia Donaldson, Naugatuck Valley Community College, Waterbury, CT. 06708. cdonaldson@nvcc.commnet.edu (203) 596-8703.

Attachment CSC-III-9

con-test®
ANALYTICAL LABORATORY

39 Spruce Street
East Longmeadow, MA 01089

April 9, 2015

Mr. Shawn Crosbie
RE: Work Order 14K0721

Dear Mr. Crosbie:

This letter is in response to our conversation regarding work order 14K0721.

On 10/28/14, these samples were submitted and received by Con-Test per the request of Conestoga Rovers & Associates for a hazardous/non-hazardous determination. These samples were received within the recommended holding time when they were originally submitted to the laboratory. On 11/17/14, Con-Test was contacted by Conestoga Rovers & Associates to run additional analyses past the recommended holding time. The analyses requested past the recommended holding time are noted within the final report.

Per our conversation on 4/1/15, the RCP Laboratory Certification Form has been revised. Question 5A was inadvertently answered yes and should have been "no". The form has been revised and a revised report has been issued. Additionally, question 1A on the revised RCP form was checked "no" due to additional analysis requested for landfill profiling purposes requested past recommended holding time.

If you have any questions please feel free to call me at (413) 525-2332 ext. 41.

Sincerely,

Tod Kopyscinski

Tod Kopyscinski
Laboratory Director

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

April 1, 2015

Kathy Shaw - CRA
United Illuminating Company
180 Marsh Hill Road
Orange, CT 06477

Project Location: Hawthorne Substation Phase II - Fairfield, CT
Client Job Number:
Project Number: 086111-001
Laboratory Work Order Number: 14K0721

Enclosed are results of analyses for samples received by the laboratory on November 17, 2014. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

James M. Georgantas
Project Manager

Attachment CSC-III-9

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Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

United Illuminating Company
180 Marsh Hill Road
Orange, CT 06477
ATTN: Kathy Shaw - CRA

REPORT DATE: 4/1/2015

PURCHASE ORDER NUMBER: 4500424931-10

PROJECT NUMBER: 086111-001

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 14K0721

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: Hawthorne Substation Phase II - Fairfield, CT

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
SO-86111-102714-AB-001	14K0721-01	Soil		CTDEP ETPH	
				SM 2540G	
				SM21-22 2510B Modified	
				SW-846 1010	
				SW-846 9014	
				SW-846 9030A	
				SW-846 9045C	
SO-86111-102714-AB-002	14K0721-02	Soil		CTDEP ETPH	
				SM 2540G	
				SM21-22 2510B Modified	
				SW-846 1010	
				SW-846 9014	
				SW-846 9030A	
				SW-846 9045C	
SO-86111-102714-AB-003	14K0721-03	Soil		CTDEP ETPH	
				SM 2540G	
				SM21-22 2510B Modified	
				SW-846 1010	
				SW-846 9014	
				SW-846 9030A	
				SW-846 9045C	
SO-86111-102714-AB-004	14K0721-04	Soil		CTDEP ETPH	
				SM 2540G	
				SM21-22 2510B Modified	
				SW-846 1010	
				SW-846 9014	
				SW-846 9030A	
				SW-846 9045C	
SO-86111-102714-AB-005	14K0721-05	Soil		CTDEP ETPH	
				SM 2540G	
				SM21-22 2510B Modified	
				SW-846 1010	
				SW-846 9014	
				SW-846 9030A	
				SW-846 9045C	

Attachment CSC-III-9

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

REVISED REPORT 04/01/15 - RCP Laboratory Form question 5A updated from "yes" to "no". Additional analyses requested after reccomended holding time.

CTDEP ETPH

Qualifications:

H-10

Analysis was requested after the recommended holding time had passed.

Analyte & Samples(s) Qualified:

14K0721-01[SO-86111-102714-AB-001], 14K0721-02[SO-86111-102714-AB-002], 14K0721-03[SO-86111-102714-AB-003], 14K0721-04[SO-86111-102714-AB-004], 14K0721-05[SO-86111-102714-AB-005]

SW-846 1010

Qualifications:

H-10

Analysis was requested after the recommended holding time had passed.

Analyte & Samples(s) Qualified:

Flashpoint

14K0721-01[SO-86111-102714-AB-001], 14K0721-02[SO-86111-102714-AB-002], 14K0721-03[SO-86111-102714-AB-003], 14K0721-04[SO-86111-102714-AB-004], 14K0721-05[SO-86111-102714-AB-005]

SW-846 9045C

Qualifications:

H-10

Analysis was requested after the recommended holding time had passed.

Analyte & Samples(s) Qualified:

pH

14K0721-01[SO-86111-102714-AB-001], 14K0721-02[SO-86111-102714-AB-002], 14K0721-03[SO-86111-102714-AB-003], 14K0721-04[SO-86111-102714-AB-004], 14K0721-05[SO-86111-102714-AB-005]

The results of analyses reported only relate to samples submitted to the Con-Test Analytical Laboratory for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Johanna K. Harrington
Manager, Laboratory Reporting

con-test® ANALYTICAL LABORATORY

Attachment CSC-III-9

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-001 Sampled: 10/27/2014 09:15

Sample ID: 14K0721-01

Sample Matrix: Soil

Sample Flags: H-10

Petroleum Hydrocarbons Analyses

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
CT ETPH	ND	11	mg/Kg dry	1		CTDEP ETPH	11/18/14	11/19/14 15:09	SCS

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
o-Terphenyl	61.9	50-150		11/19/14 15:09

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-001 Sampled: 10/27/2014 09:15

Sample ID: 14K0721-01

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Flashpoint	> 212 °F		°F	1	H-10	SW-846 1010	11/18/14	11/18/14 15:10	AG
pH @22.2°C	5.0		pH Units	1	H-10	SW-846 9045C	11/18/14	11/18/14 8:20	LL
Reactive Cyanide	ND	4.0	mg/Kg	1		SW-846 9014	11/18/14	11/18/14 12:10	AG
Reactive Sulfide	ND	20	mg/Kg	1		SW-846 9030A	11/18/14	11/19/14 14:10	DJM
Specific conductance	6.6	2.0	µmhos/cm	1		SM21-22 2510B Modified	11/18/14	11/18/14 13:35	AG
% Solids	87.8		% Wt	1		SM 2540G	11/21/14	11/24/14 9:21	MRL

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-002 Sampled: 10/27/2014 10:30

Sample ID: 14K0721-02

Sample Matrix: Soil

Sample Flags: H-10

Petroleum Hydrocarbons Analyses

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
CT ETPH	ND	10	mg/Kg dry	1		CTDEP ETPH	11/18/14	11/19/14 15:27	SCS

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
o-Terphenyl	70.6	50-150		11/19/14 15:27

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-002 Sampled: 10/27/2014 10:30

Sample ID: 14K0721-02

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Flashpoint	> 212 °F		°F	1	H-10	SW-846 1010	11/18/14	11/18/14 15:10	AG
pH @23.1°C	5.6		pH Units	1	H-10	SW-846 9045C	11/18/14	11/18/14 8:20	LL
Reactive Cyanide	ND	3.9	mg/Kg	1		SW-846 9014	11/18/14	11/18/14 12:10	AG
Reactive Sulfide	ND	20	mg/Kg	1		SW-846 9030A	11/18/14	11/19/14 14:10	DJM
Specific conductance	3.4	2.0	µmhos/cm	1		SM21-22 2510B Modified	11/18/14	11/18/14 13:35	AG
% Solids	95.7		% Wt	1		SM 2540G	11/21/14	11/24/14 9:21	MRL

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-003 Sampled: 10/27/2014 11:00

Sample ID: 14K0721-03

Sample Matrix: Soil

Sample Flags: H-10

Petroleum Hydrocarbons Analyses

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
CT ETPH	ND	10	mg/Kg dry	1		CTDEP ETPH	11/18/14	11/19/14 15:44	SCS

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
o-Terphenyl	82.5	50-150		11/19/14 15:44

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-003 Sampled: 10/27/2014 11:00

Sample ID: 14K0721-03

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Flashpoint	> 212 °F		°F	1	H-10	SW-846 1010	11/18/14	11/18/14 15:10	AG
pH @25.9°C	5.6		pH Units	1	H-10	SW-846 9045C	11/18/14	11/18/14 8:20	LL
Reactive Cyanide	ND	4.0	mg/Kg	1		SW-846 9014	11/18/14	11/18/14 12:10	AG
Reactive Sulfide	ND	20	mg/Kg	1		SW-846 9030A	11/18/14	11/19/14 14:10	DJM
Specific conductance	2.7	2.0	µmhos/cm	1		SM21-22 2510B Modified	11/18/14	11/18/14 13:35	AG
% Solids	98.4		% Wt	1		SM 2540G	11/21/14	11/24/14 9:21	MRL

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-004 Sampled: 10/27/2014 11:25

Sample ID: 14K0721-04

Sample Matrix: Soil

Sample Flags: H-10

Petroleum Hydrocarbons Analyses

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
CT ETPH	24	11	mg/Kg dry	1		CTDEP ETPH	11/18/14	11/19/14 16:02	SCS

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
o-Terphenyl	75.6	50-150		11/19/14 16:02

con-test® ANALYTICAL LABORATORY

Attachment CSC-III-9

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-004 Sampled: 10/27/2014 11:25

Sample ID: 14K0721-04

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Flashpoint	> 212 °F		°F	1	H-10	SW-846 1010	11/18/14	11/18/14 15:10	AG
pH @23.5°C	5.7		pH Units	1	H-10	SW-846 9045C	11/18/14	11/18/14 8:20	LL
Reactive Cyanide	ND	3.9	mg/Kg	1		SW-846 9014	11/18/14	11/18/14 12:10	AG
Reactive Sulfide	ND	19	mg/Kg	1		SW-846 9030A	11/18/14	11/19/14 14:10	DJM
Specific conductance	3.3	2.0	µmhos/cm	1		SM21-22 2510B Modified	11/18/14	11/18/14 13:35	AG
% Solids	93.3		% Wt	1		SM 2540G	11/21/14	11/24/14 9:21	MRL

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-005 Sampled: 10/27/2014 12:30

Sample ID: 14K0721-05

Sample Matrix: Soil

Sample Flags: H-10

Petroleum Hydrocarbons Analyses

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
CT ETPH	ND	11	mg/Kg dry	1		CTDEP ETPH	11/18/14	11/19/14 16:19	SCS

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
o-Terphenyl	70.8	50-150		11/19/14 16:19

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Hawthorne Substation Phase II - F Sample Description: Work Order: 14K0721

Date Received: 11/17/2014

Field Sample #: SO-86111-102714-AB-005 Sampled: 10/27/2014 12:30

Sample ID: 14K0721-05

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Flashpoint	> 212 °F		°F	1	H-10	SW-846 1010	11/18/14	11/18/14 15:10	AG
pH @23.4°C	6.5		pH Units	1	H-10	SW-846 9045C	11/18/14	11/18/14 8:20	LL
Reactive Cyanide	ND	3.9	mg/Kg	1		SW-846 9014	11/18/14	11/18/14 12:10	AG
Reactive Sulfide	ND	20	mg/Kg	1		SW-846 9030A	11/18/14	11/19/14 14:10	DJM
Specific conductance	2.7	2.0	µmhos/cm	1		SM21-22 2510B Modified	11/18/14	11/18/14 13:35	AG
% Solids	93.8		% Wt	1		SM 2540G	11/21/14	11/24/14 9:21	MRL

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Sample Extraction Data

Prep Method: SW-846 3546-CTDEP ETPH

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
14K0721-01 [SO-86111-102714-AB-001]	B110040	30.0	1.00	11/18/14
14K0721-02 [SO-86111-102714-AB-002]	B110040	30.0	1.00	11/18/14
14K0721-03 [SO-86111-102714-AB-003]	B110040	30.1	1.00	11/18/14
14K0721-04 [SO-86111-102714-AB-004]	B110040	30.0	1.00	11/18/14
14K0721-05 [SO-86111-102714-AB-005]	B110040	30.3	1.00	11/18/14

Prep Method: % Solids-SM 2540G

Lab Number [Field ID]	Batch	Date
14K0721-01 [SO-86111-102714-AB-001]	B110298	11/21/14
14K0721-02 [SO-86111-102714-AB-002]	B110298	11/21/14
14K0721-03 [SO-86111-102714-AB-003]	B110298	11/21/14
14K0721-04 [SO-86111-102714-AB-004]	B110298	11/21/14
14K0721-05 [SO-86111-102714-AB-005]	B110298	11/21/14

SM21-22 2510B Modified

Lab Number [Field ID]	Batch	Initial [g]	Date
14K0721-01 [SO-86111-102714-AB-001]	B109968	1.00	11/18/14
14K0721-02 [SO-86111-102714-AB-002]	B109968	1.00	11/18/14
14K0721-03 [SO-86111-102714-AB-003]	B109968	1.00	11/18/14
14K0721-04 [SO-86111-102714-AB-004]	B109968	1.00	11/18/14
14K0721-05 [SO-86111-102714-AB-005]	B109968	1.00	11/18/14

SW-846 1010

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
14K0721-01 [SO-86111-102714-AB-001]	B109973	50.0	50.0	11/18/14
14K0721-02 [SO-86111-102714-AB-002]	B109973	50.0	50.0	11/18/14
14K0721-03 [SO-86111-102714-AB-003]	B109973	50.0	50.0	11/18/14
14K0721-04 [SO-86111-102714-AB-004]	B109973	50.0	50.0	11/18/14
14K0721-05 [SO-86111-102714-AB-005]	B109973	50.0	50.0	11/18/14

SW-846 9014

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
14K0721-01 [SO-86111-102714-AB-001]	B109971	25.3	250	11/18/14
14K0721-02 [SO-86111-102714-AB-002]	B109971	25.4	250	11/18/14
14K0721-03 [SO-86111-102714-AB-003]	B109971	25.2	250	11/18/14
14K0721-04 [SO-86111-102714-AB-004]	B109971	26.0	250	11/18/14
14K0721-05 [SO-86111-102714-AB-005]	B109971	25.4	250	11/18/14

SW-846 9030A

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
14K0721-01 [SO-86111-102714-AB-001]	B109991	25.3	250	11/18/14
14K0721-02 [SO-86111-102714-AB-002]	B109991	25.4	250	11/18/14
14K0721-03 [SO-86111-102714-AB-003]	B109991	25.2	250	11/18/14
14K0721-04 [SO-86111-102714-AB-004]	B109991	26.0	250	11/18/14

Attachment CSC-III-9

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Sample Extraction Data

SW-846 9030A

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
14K0721-05 [SO-86111-102714-AB-005]	B109991	25.4	250	11/18/14

SW-846 9045C

Lab Number [Field ID]	Batch	Initial [g]	Date
14K0721-01 [SO-86111-102714-AB-001]	B109943	20.0	11/18/14
14K0721-02 [SO-86111-102714-AB-002]	B109943	20.0	11/18/14
14K0721-03 [SO-86111-102714-AB-003]	B109943	20.0	11/18/14
14K0721-04 [SO-86111-102714-AB-004]	B109943	20.0	11/18/14
14K0721-05 [SO-86111-102714-AB-005]	B109943	20.0	11/18/14

con-test® ANALYTICAL LABORATORY

Attachment CSC-III-9

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

QUALITY CONTROL

Petroleum Hydrocarbons Analyses - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B110040 - SW-846 3546										
Blank (B110040-BLK1)				Prepared: 11/18/14 Analyzed: 11/19/14						
CT ETPH	ND	10	mg/Kg wet							
Surrogate: o-Terphenyl	*2.72*		mg/Kg wet	3.33		81.5	50-150			
LCS (B110040-BS1)				Prepared: 11/18/14 Analyzed: 11/19/14						
CT ETPH	25.3	10	mg/Kg wet	33.3		75.8	60-120			
Surrogate: o-Terphenyl	*2.65*		mg/Kg wet	3.33		79.6	50-150			
LCS Dup (B110040-BSD1)				Prepared: 11/18/14 Analyzed: 11/19/14						
CT ETPH	26.7	10	mg/Kg wet	33.3		80.1	60-120	5.40	30	
Surrogate: o-Terphenyl	*3.00*		mg/Kg wet	3.33		90.1	50-150			

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

QUALITY CONTROL

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B109943 - SW-846 9045C										
LCS (B109943-BS1)				Prepared & Analyzed: 11/18/14						
pH	6.04		pH Units	6.00		101	98.5-102			
Batch B109968 - SM21-22 2510B Modified										
Blank (B109968-BLK1)				Prepared & Analyzed: 11/18/14						
Specific conductance	ND	2.0	µmhos/cm							
LCS (B109968-BS1)				Prepared & Analyzed: 11/18/14						
Specific conductance	270	2.0	µmhos/cm	286		95.8	86.9-106			
Duplicate (B109968-DUP1)		**Source: 14K0721-05**		Prepared & Analyzed: 11/18/14						
Specific conductance	3.3	2.0	µmhos/cm		2.7			20.0	24.7	
Batch B109971 - SW-846 9014										
Blank (B109971-BLK1)				Prepared & Analyzed: 11/18/14						
Reactive Cyanide	ND	0.40	mg/Kg							
LCS (B109971-BS1)				Prepared & Analyzed: 11/18/14						
Reactive Cyanide	9.9	0.40	mg/Kg	10.0		99.4	81.3-113			
Batch B109973 - SW-846 1010										
Blank (B109973-BLK1)				Prepared & Analyzed: 11/18/14						
Flashpoint	> 212 °F		°F							
LCS (B109973-BS1)				Prepared & Analyzed: 11/18/14						
Flashpoint	81		°F	81.0		100	98.8-101			
LCS Dup (B109973-BSD1)				Prepared & Analyzed: 11/18/14						
Flashpoint	81		°F	81.0		100	98.8-101	0.00	0.264	
Batch B109991 - SW-846 9030A										
Blank (B109991-BLK1)				Prepared: 11/18/14 Analyzed: 11/19/14						
Reactive Sulfide	ND	2.0	mg/Kg							
LCS (B109991-BS1)				Prepared: 11/18/14 Analyzed: 11/19/14						
Reactive Sulfide	13	2.0	mg/Kg	14.8		86.5	24.3-135			

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

QUALITY CONTROL

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B110298 - % Solids										
Duplicate (B110298-DUP1)		**Source: 14K0721-03**		Prepared: 11/21/14 Analyzed: 11/24/14						
% Solids	99.1		% Wt		98.4			0.709	20	

Attachment CSC-III-9

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level
	Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.
	No results have been blank subtracted unless specified in the case narrative section.
H-10	Analysis was requested after the recommended holding time had passed.

Attachment CSC-III-9

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
CTDEP ETPH in Soil	
CT ETPH	CT
SW-846 1010 in Soil	
Flashpoint	NY,NC,ME,VA,NJ

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations:

Code	Description	Number	Expires
AIHA	AIHA-LAP, LLC	100033	02/1/2016
MA	Massachusetts DEP	M-MA100	06/30/2015
CT	Connecticut Department of Publilc Health	PH-0567	09/30/2015
NY	New York State Department of Health	10899 NELAP	04/1/2016
NH-S	New Hampshire Environmental Lab	2516 NELAP	02/5/2016
RI	Rhode Island Department of Health	LAO00112	12/30/2015
NC	North Carolina Div. of Water Quality	652	12/31/2015
NJ	New Jersey DEP	MA007 NELAP	06/30/2015
FL	Florida Department of Health	E871027 NELAP	06/30/2015
VT	Vermont Department of Health Lead Laboratory	LL015036	07/30/2015
WA	State of Washington Department of Ecology	C2065	02/23/2016
ME	State of Maine	2011028	06/9/2015
VA	Commonwealth of Virginia	460217	12/14/2015
NH-P	New Hampshire Environmental Lab	2557 NELAP	09/6/2015

14K0721

CHAIN OF CUSTODY RECORD

CONESTOGA-ROVERS & ASSOCIATES

~~14J1384~~

Address: 45 Farmington Valley Dr., Plainville, CT
Phone: 860-747-1800 Fax: 860-747-1900

COC NO.: 41168
PAGE 1 OF 1
(See Reverse Side for Instructions)

Project No/ Phase/Task Code: 086111-20	Laboratory Name: Con-test	Lab Location:	SSOW ID: 086111-001
Project Name: Hawthorne Substation Phase II	Lab Contact: Jim Georgantas	Lab Quote No:	Cooler No:
Project Location: Fairfield, CT			Carrier:
Chemistry Contact: Kathy Shaw			Airbill No:
Sampler(s): Alex Brittingham			Date Shipped:

Item	Sample Identification (Containers for each sample may be combined on one line)		Date (mm/dd/yy)	Time (hh:mm)	Matrix Code (see back of COC)	Grab (G) or Comp (C)	Unpreserved	Hydrochloric Acid (HCl)	Nitric Acid (HNO_3)	Sulfuric Acid (H_2SO_4)	Sodium Hydroxide (NaOH)	Methanol/Water (Soil VOC)	EnCores 3x5-g, 1x25-g	Other:	Total Containers/Sample	TCL VOCs	TCL SVOCs	RCRA 8 metals (Total + SPLP)	Total PCBs	Pesticide/Herbicide		ETPH *	Reactivity *	pH, flashpoint *	Conductivity *	MS/MSD Request	Comments/ Special Instructions:
1	SO-86111-102714-AD-001	01	10/27/14	9:15	SO	G	1					3			4	X	X	X	X			X	X	X	X		
2	SO-86111-102714-AB-002	02	↓	10:30	SO	G	2					3			5	X	X	X	X	X		↓	↓	↓	↓		Total + SPLP
3	SO-86111-102714-AD-003	03	↓	11:00	SO	G	1					3			4	X	X	X	X			↓	↓	↓	↓		RCRA 8 metals
4	SO-86111-102714-AD-004	04	↓	11:25	SO	G	1					3			4	X	X	X	X			↓	↓	↓	↓		JG
5	SO-86111-102714-AD-005	05	↓	12:30	SO	G	1					3			4	X	X	X	X			↓	↓	↓	↓		
6																											
7																											
8																											* Additional analyses
9																											requested 1/17
10																											OK to run
11																											past hold 06 1/17
12																											
13																											
14																											
15																											

TAT Required in business days (use separate COCs for different TATs):
☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 1 Week ☒ 2 Week ☐ Other:

Total Number of Containers: 21

All Samples in Cooler must be on COC

Notes/ Special Requirements:

Relinquished By	Company	Date	Time	Received By	Company	Date	Time
1. [signature]	CRA	10/28/14	9:50	1. Paul Racicot	Contest	10/28/14	9:50
2. Paul Racicot		10/28/14	16:55	2. [signature] 5.4°C	Contest	10/28/14	~~9:50~~ 16 JDL
3.				3.			

THE CHAIN OF CUSTODY IS A LEGAL DOCUMENT – ALL FIELDS MUST BE COMPLETED ACCURATELY

Distribution: WHITE – Fully Executed Copy (CRA) YELLOW – Receiving Laboratory Copy PINK – Shipper GOLDENROD – Sampling Crew

CRA Form: COC-10B (20110804)

Attachment CSC-III-9

Table of Contents

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39 Spruce St.
East Longmeadow, MA. 01028
P: 413-525-2332
F: 413-525-6405
www.contestlabs.com

con-test ANALYTICAL LABORATORY

Sample Receipt Checklist

CLIENT NAME: Conestoga-Rovers and Associates RECEIVED BY: JDL DATE: 10/28/14

1) Was the chain(s) of custody relinquished and signed? (Yes) No No CoC Included

2) Does the chain agree with the samples? (Yes) No

If not, explain:

3) Are all the samples in good condition? (Yes) No

If not, explain:

4) How were the samples received:

On Ice [X] Direct from Sampling [ ] Ambient [ ] In Cooler(s) [X]

Were the samples received in Temperature Compliance of (2-6°C)? Yes No N/A

Temperature °C by Temp blank _____ Temperature °C by Temp gun 5.4

5) Are there Dissolved samples for the lab to filter? Yes (No)

Who was notified _____ Date _____ Time _____

6) Are there any RUSH or SHORT HOLDING TIME samples? Yes (No)

Who was notified _____ Date _____ Time _____

7) Location where samples are stored: 19

Permission to subcontract samples? Yes No
(Walk-in clients only) if not already approved
Client Signature: _____

8) Do all samples have the proper Acid pH: Yes No (N/A) _____

9) Do all samples have the proper Base pH: Yes No (N/A) _____

10) Was the PC notified of any discrepancies with the CoC vs the samples: Yes No (N/A)

Containers received at Con-Test

	# of containers		# of containers
1 Liter Amber		8 oz amber/clear jar	1
500 mL Amber		4 oz amber/clear jar	
250 mL Amber (8oz amber)		2 oz amber/clear jar	
1 Liter Plastic		Plastic Bag / Ziploc	
500 mL Plastic		SOC Kit	
250 mL plastic		Non-ConTest Container	
40 mL Vial - type listed below	15	Perchlorate Kit	
Colisure / bacteria bottle		Flashpoint bottle	
Dissolved Oxygen bottle		Other glass jar 16oz Amb	5
Encore		Other	

Laboratory Comments:

40 mL vials: # HCl _____ # Methanol 5

Bisulfate _____ # DI Water 10

Thiosulfate _____ Unpreserved _____

Time and Date Frozen: 10/28/14 ~~9:50~~ JDL 16:55

Doc# 277
Rev. 4 August 2013

Attachment CSC-III-9

Login Sample Receipt Checklist

(Rejection Criteria Listing - Using Sample Acceptance Policy)

Any False statement will be brought to the attention of Client

Question	Answer (True/False) T/F/NA	Comment
1) The cooler's custody seal, if present, is intact.	NA	
2) The cooler or samples do not appear to have been compromised or tampered with.	T	
3) Samples were received on ice.	T	
4) Cooler Temperature is acceptable.	T	
5) Cooler Temperature is recorded.	T	
6) COC is filled out in ink and legible.	T	
7) COC is filled out with all pertinent information.	T	
8) Field Sampler's name present on COC.	T	
9) There are no discrepancies between the sample IDs on the container and the COC.	T	
10) Samples are received within Holding Time.	T	
11) Sample containers have legible labels.	T	
12) Containers are not broken or leaking.	T	
13) Air Cassettes are not broken/open.	NA	
14) Sample collection date/times are provided.	T	
15) Appropriate sample containers are used.	T	
16) Proper collection media used.	T	
17) No headspace sample bottles are completely filled.	T	
18) There is sufficient volume for all requsted analyses, including any requested MS/MSDs.	T	
19) Trip blanks provided if applicable.	NA	
20) VOA sample vials do not have head space or bubble is <6mm (1/4") in diameter.	NA	
21) Samples do not require splitting or compositing.	T	

Who notified of False statements? Date/Time:

Log-In Technician Initials: JDL Date/Time: 10/28/14 ~~9:50~~ JDL 16:55

Doc #277 Rev. 4 August 2013

Attachment CSC-III-9

D:\HPCHEM\1\DATA\A111914.SEC\A1119031.D

CT ETPH DISCRIMINATION CHECK

Date Acquired	11/19/14
Data File Name	A1119031.D
Sample Name	ETPH 1500
Instrument Name	5890DFID

Compound	Ret Time	Target Response	Average Response	*%D +/- 20
c - 9	1.30	470977	492116	-4
c - 10	1.65	479715	492116	-3
c - 12	2.39	490176	492116	0
c - 14	3.07	501603	492116	2
c - 16	3.67	510158	492116	4
c - 18	4.31	502345	492116	2
o-Terphenyl	4.61	605035	492116	
c - 20	4.91	505531	492116	3
c - 22	5.41	502954	492116	2
c - 24	5.86	495221	492116	1
c - 26	6.25	493247	492116	0
c - 28	6.61	484875	492116	-1
c - 30	6.94	488514	492116	-1
c - 32	7.26	479073	492116	-3
c - 34	7.55	483811	492116	-2
c - 36	7.91	493545	492116	0

* One compound allowed %D <= 50%

Samples

14K0721-01
14K0721-02
14K0721-03
14K0721-04
14K0721-05

11/20/14 10:30 AM

C:\HPCHEM\CUSTRPT\ETPHDISC.CRT

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Attachment CSC-III-9

REASONABLE CONFIDENCE PROTOCOL
LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name: Con-Test Analytical Laboratory

Client: United Illuminating Company

Project Location: Hawthorne Substation Phase II - Fairfield, CT

Project Number: 14K0721

Laboratory Sample ID(s):

14K0721-01 thru 14K0721-05

Sample Date(s):

10/27/2014

List RCP Methods Used:

CTDEP ETPH

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CTDEP method-specific Reasonable Confidence Protocol documents?	☑ Yes ☐ No
1A	Were the method specified preservation and holding time requirements met?	☐ Yes ☑ No
1B	VPH and EPH Methods only: Was the VPH and EPH method conducted without significant modifications (see Section 11.3 of respective RCP methods)?	☐ Yes ☐ No ☑ N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	☑ Yes ☐ No
3	Were samples received at an appropriate temperature (< 6 degrees C.)?	☑ Yes ☐ No ☐ N/A
4	Were all QA/QC performance criteria specified in the CTDEP Reasonable Confidence Protocol documents achieved?	☑ Yes ☐ No
5A	Were reporting limits specified or referenced on the chain-of-custody?	☐ Yes ☑ No
5B	Were these reporting limits met?	☐ Yes ☐ No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?	☑ Yes ☐ No
7	Are project-specific matrix spikes and laboratory duplicates included in this data set?	☑ Yes ☐ No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence."
This form may not be altered and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete.

Authorized Signature: **Position: Manager, Laboratory Reporting**

Printed Name: Johanna K. Harrington **Date: 04/01/15**

This certification form is to be used for RCP methods only.

Attachment CSC-III-10

Exponent®

Electric and Magnetic Field Assessment: The Hawthorne Substation

CEII Compliant Version

Electric and Magnetic Field Assessment: The Hawthorne Substation

Prepared for

The United Illuminating Company
180 Marsh Hill Rd.
Orange, CT 06477

Prepared by

Exponent
420 Lexington Ave.
Suite 1740
New York, NY 10170

April 10, 2015

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Notice

At the request of The United Illuminating Company, Exponent modeled the electric and magnetic field associated with the addition of 115 kV capacitor banks at the Hawthorne Substation in Fairfield, Connecticut. This report summarizes work performed to date and presents the findings resulting from that work. In the analysis, we have relied on geometry, material data, usage conditions, specifications, and various other types of information provided by the client. We cannot verify the correctness of this input data, and rely on the client for the data's accuracy. Although Exponent has exercised usual and customary care in the conduct of this analysis, the responsibility for the design and operation of the project remains fully with the client.

The findings presented herein are made to a reasonable degree of engineering and scientific certainty. Exponent reserves the right to supplement this report and to expand or modify opinions based on review of additional material as it becomes available, through any additional work, or review of additional work performed by others.

The scope of services performed during this investigation may not adequately address the needs of other users of this report, and any re-use of this report or its findings, conclusions, or recommendations presented herein are at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. No guarantee or warranty as to future life or performance of any reviewed condition is expressed or implied.

At the request of United Illuminating Exponent has removed references to specific line numbers and loadings, which United Illuminating regards as data for which distribution is restricted and subject to protection under the federal Critical Energy Infrastructure Information program.

Executive Summary

The United Illuminating Company (UI) proposes to expand the Hawthorne Substation at 180 Hawthorne Drive in Fairfield, Connecticut. The proposed expansion includes installation of two capacitor banks on the west side of the substation and connected to the existing 115kV Transmission Line "A" that exits the substation to the south and proceeds west along the adjoining right-of-way (ROW).

At the UI property line, the calculated magnetic fields from the existing and proposed configurations of the Hawthorne Substation are nearly indistinguishable under future average and peak station loadings. The greatest change in the calculated magnetic field occurs on the south side of the property, beneath the conductors of the existing 115 kV Transmission Line "B" from the adjacent substation, to the east. At this location, the calculated magnetic field is 2 mG higher in the proposed configuration than in the existing configuration. This change reflects the small increase in average loading of the 115 kV line (Line "A" loading > Line "B" loading by 19 amperes) associated with operation of the Project. Under peak load conditions, the calculated magnetic field is 4 mG higher in the proposed configuration, again beneath the conductors of Line "B" and reflecting an increase of load from the adjacent substation(of only 40 amperes with the Project).

The proposed changes to the substation yard include an expansion of the existing fence. Evaluated at the proposed perimeter, which is located well within the boundary of the UI property, the calculated magnetic fields for the existing and proposed configurations of the Hawthorne Substation differ by less than 1.0 mG at the majority of locations. The effect of the new capacitor bank and ancillary equipment is discernible on the west and south sides of the expanded substation perimeter. On the west side of the expanded perimeter, the calculated magnetic field is 4 mG to 7.2 mG higher at some locations, depending on whether one or two capacitors are in operation.

Moving away from the proposed perimeter, and again comparing existing and proposed configurations of the substation, the calculated magnetic fields are within 0.2 mG at distances of 150 feet or more from the new fence line (average loading). Under peak loading conditions, calculated magnetic fields are within 0.4 mG at these same locations.

Along the ROW adjoining the Hawthorne Substation to the south, the post-Project magnetic field decreases slightly moving west from the substation, and increase slightly moving east from the substation. To the east, the calculated magnetic field levels increase by 1.8 mG directly beneath the conductors of the "B" Line at average loading. Moving west, the calculated magnetic field decreases by 1.4-2.7 mG with one or two capacitor banks online. These changes reflect the increase or decrease in loading of Lines "B" and "A", respectively, associated with operation of the Project.

The highest calculated electric field modeled outside the substation fence is 0.91 kV/m directly beneath the phase conductors of the "B" and "A" Lines. The electric fields from

transmission-line sources will not change significantly with operation of the Project, since overhead 115 kV conductors are not modified as part of the proposed additions to the Hawthorne Substation.

In summary, the addition of the proposed capacitor banks to the existing Hawthorne Substation will not cause any significant change to the existing levels of electric and magnetic fields at the boundary of the site. Levels of electric and magnetic fields under existing and proposed conditions would be far below levels recommended by the International Committee on Electromagnetic Safety and the International Commission on Non-Ionizing Radiation Protection for the general public and are similar to those found in homes not near substations.

Existing and Proposed Configurations

As part of the Hawthorne 115 kV Capacitor Bank Addition Project, UI proposes the installation of two 115 kV Capacitor banks installed on the "A" Line Terminal at Hawthorne Substation in Fairfield, Connecticut. The proposed changes to the substation yard include the expansion of the existing fence to establish a larger yard perimeter (s*ee* Figure 1). The proposed capacitor banks and ancillary equipment are located within the western portion of the expanded substation perimeter. The capacitor banks are connected to the "A" Line terminal bus in an ungrounded wye configuration. Ancillary equipment – including circuit breakers, disconnects, circuit switchers – allow one or both capacitor banks to be switched into and out of the 115 kV transmission system.

The existing substation consists of two 115 kV incoming circuits, designated Line "B" and Line "A", with a 115 kV tie breaker (s*ee* Figure 2). The tie breaker is connected between the terminal buses of Lines "B" and "A". In the loading conditions provided by UI Transmission Planning for this report, power is transferred from Bridgeport and Milford load pockets west to Norwalk. Pass-through load enters the Hawthorne Substation on Line "B", passes through the tie breaker to the Line "A" terminal bus, and exits on the "A" Line.

The major substation yard equipment includes: two station power transformers, a 115kV tie breaker, two 115kV breaker isolation disconnect switches, two transmission circuit disconnect switches, two transformer high side disconnect switches, a 115kV circuit switcher, a 115kV series reactor, and various potential transformers (PT's), current transformers (CT's) and station service transformers. In addition, the station has three 13.8 kV distribution buses with a total of 15 feeder breakers along with four main breakers and one tie breaker.

To the north of the site is the General Electric property. To the south and east of the site are residential neighborhoods. The nearest existing equipment is approximately 210 feet away from the closest house.

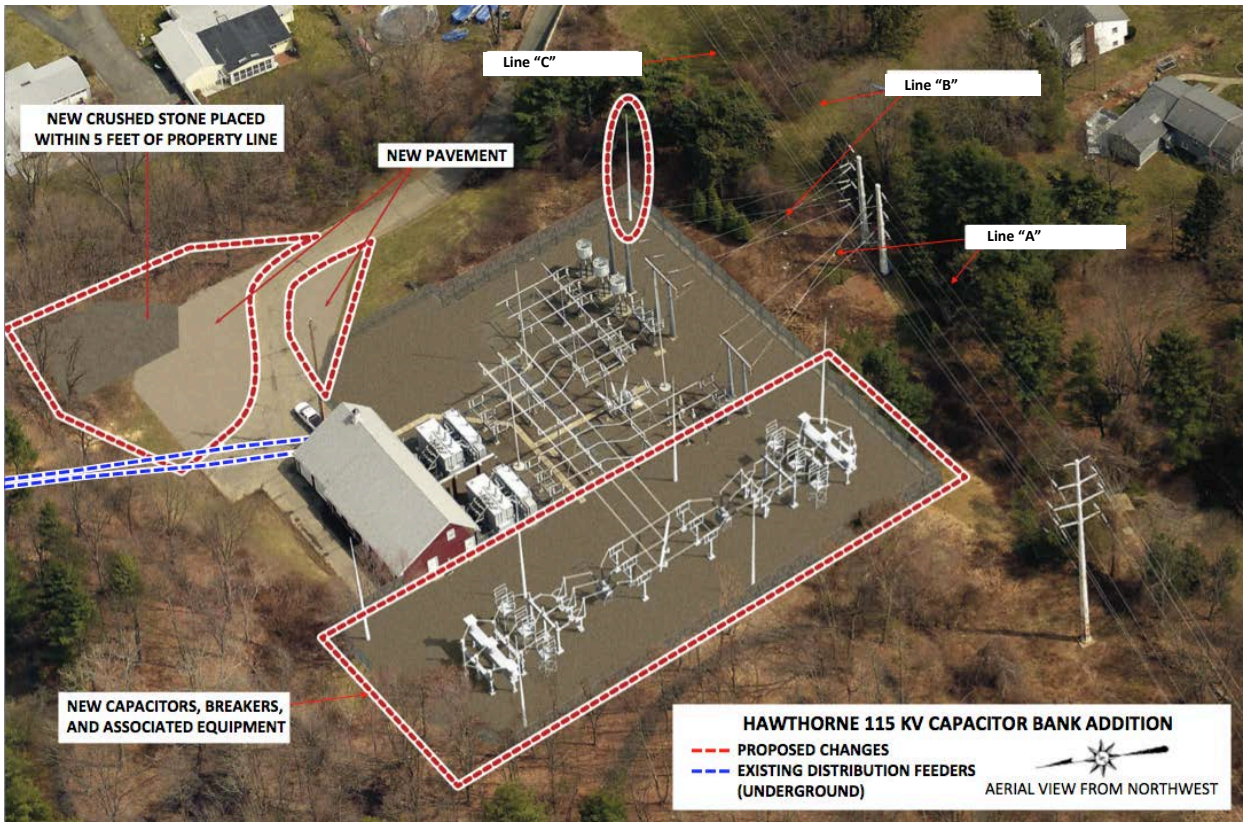

Figure 1. Simulated aerial view of the proposed Hawthorne 115 kV capacitor bank addition.

Figure 2. 115 kV transmission system diagram showing the proposed capacitor banks on the Line "C" terminal bus. *THIS FIGURE CONTAINS CEII DATA AND HAS BEEN REMOVED.*

The direction of current flow on Lines "C", "A" and "B" Lines are depicted, indicating a transfer of power from Bridgeport and Milford load pockets west to Norwalk. Pass-through load enters the Hawthorne Substation on Line "B", passes through the tie breaker to the Line "A" terminal bus, and exits on the "A" Line.

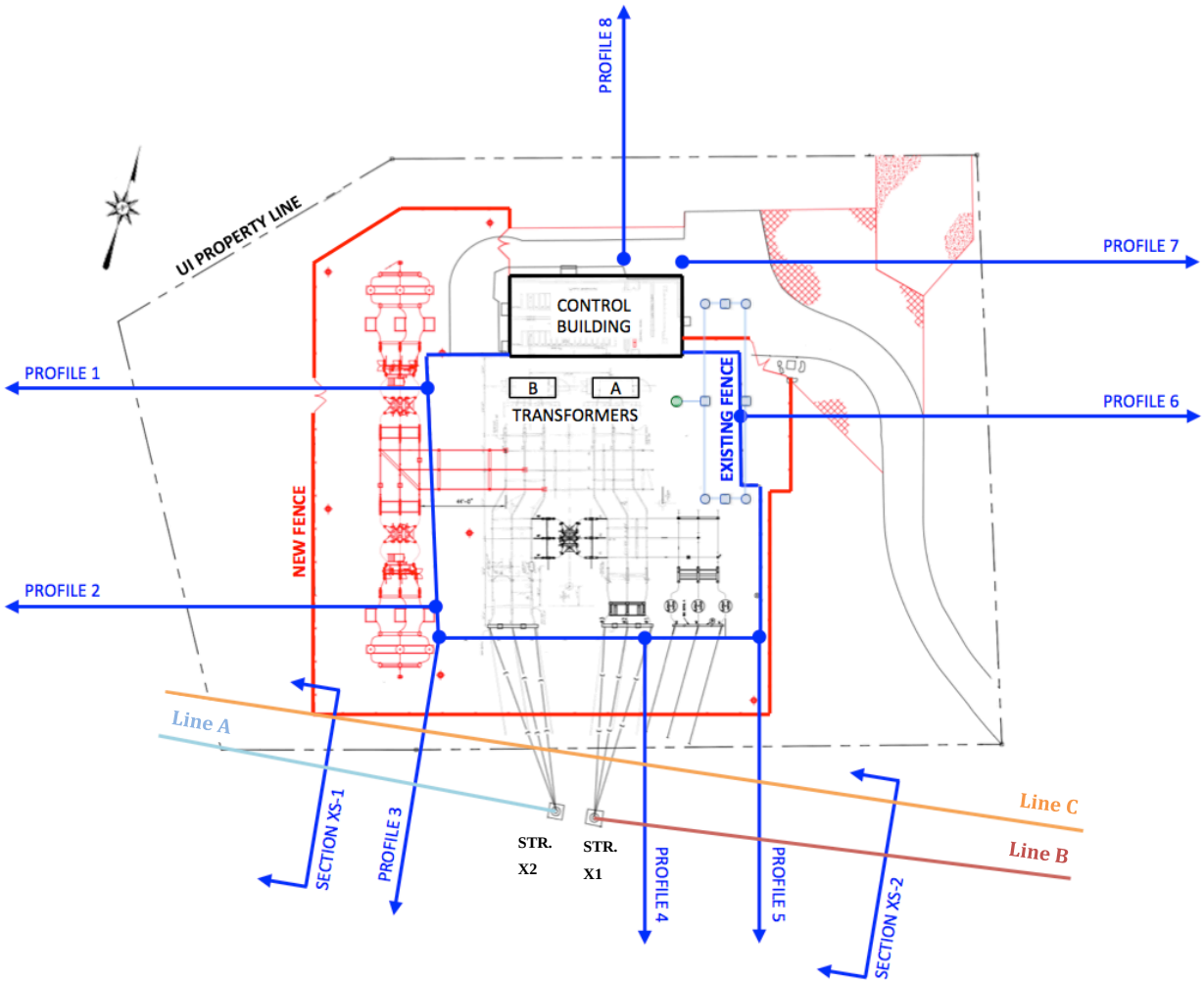

Figure 3. Plan view of the proposed Hawthorne Substation, showing the existing and proposed substation perimeter and the location of calculated profiles.

Note both existing and proposed modeling fence-line perimeters are well within the UI property line. *THIS FIGURE HAS BEEN EDITED TO REMOVE CEII DATA.*

In addition to calculations of magnetic field around the perimeter of the proposed site of the Hawthorne Substation, Exponent calculated the magnetic field along eight profiles perpendicular to the existing substation perimeter, directed outward onto adjoining property as shown in Figure 3.

Profile 1 starts at the existing substation fence nearest substation transformer B, and proceeds west.

Profile 2 is aligned with terminal structures of the "A" and "B" line and runs perpendicularly away from the existing substation fence to the west.

Profile 3 begins near the southwest corner of the existing substation fence, and crosses the "C" circuit centerline in a perpendicular transect.

Profile 4 begins at the existing substation fence underneath the conductors of the "B" Line conductors and runs south onto adjoining property.

Profile 5 begins at the southeast corner of the existing substation fence and proceeds south onto adjoining property.

Profile 6 starts at the existing substation fence near substation transformer A, and proceeds east.

Profile 7 begins near the northeastern corner of the substation control building and proceeds east over underground 13.9 kV distribution feeders. *See* Figure 1.

Profile 8 begins at the north wall of the substation control building and proceeds north.

The right-of-way south the proposed substation fence is elevated approximately 8 feet above the yard grade. To account for this change in elevation, Profiles 3-5 were modeled with rising elevation as they proceed south.

Cross sections XS-1 and XS-2, identified in Figure 3, characterize the magnetic field at transects perpendicular to the route of the "C", "A", and "B" Lines. Cross section XS-1 models the span between dead-end Structure 873A and the double-circuit monopole to the east, which supports conductors of the "C" and "A" Lines (s*ee* Figure 1). Section XS-2 models the span west of dead-end structure 872A and the double-circuit monopole to the east, which bears conductors of Lines "C" and "A". Structure dimensions for both the dead-end structures and the double-circuit monopoles are shown in Figure 4. In XS-1, the modeled height of the lowest phase above ground (phase C of Line "A") is 30.3 feet. In XS-2, the height of the lowest phase above ground (phase C of Line "B") was modeled at 30.6 feet. The conductors of the "C" Line are higher, 60.1 feet above ground in Sections XS-1 and XS-2. From dead-end Structures 873A and 872A, the conductors of the "C" and "B" Lines pass beneath the conductors of the "C" Line to terminal structures within the substation perimeter. To account for the rising elevation south of the Hawthorne Substation perimeter, the structures shown in Figure 4 were modeled with an additional height of 8 feet.

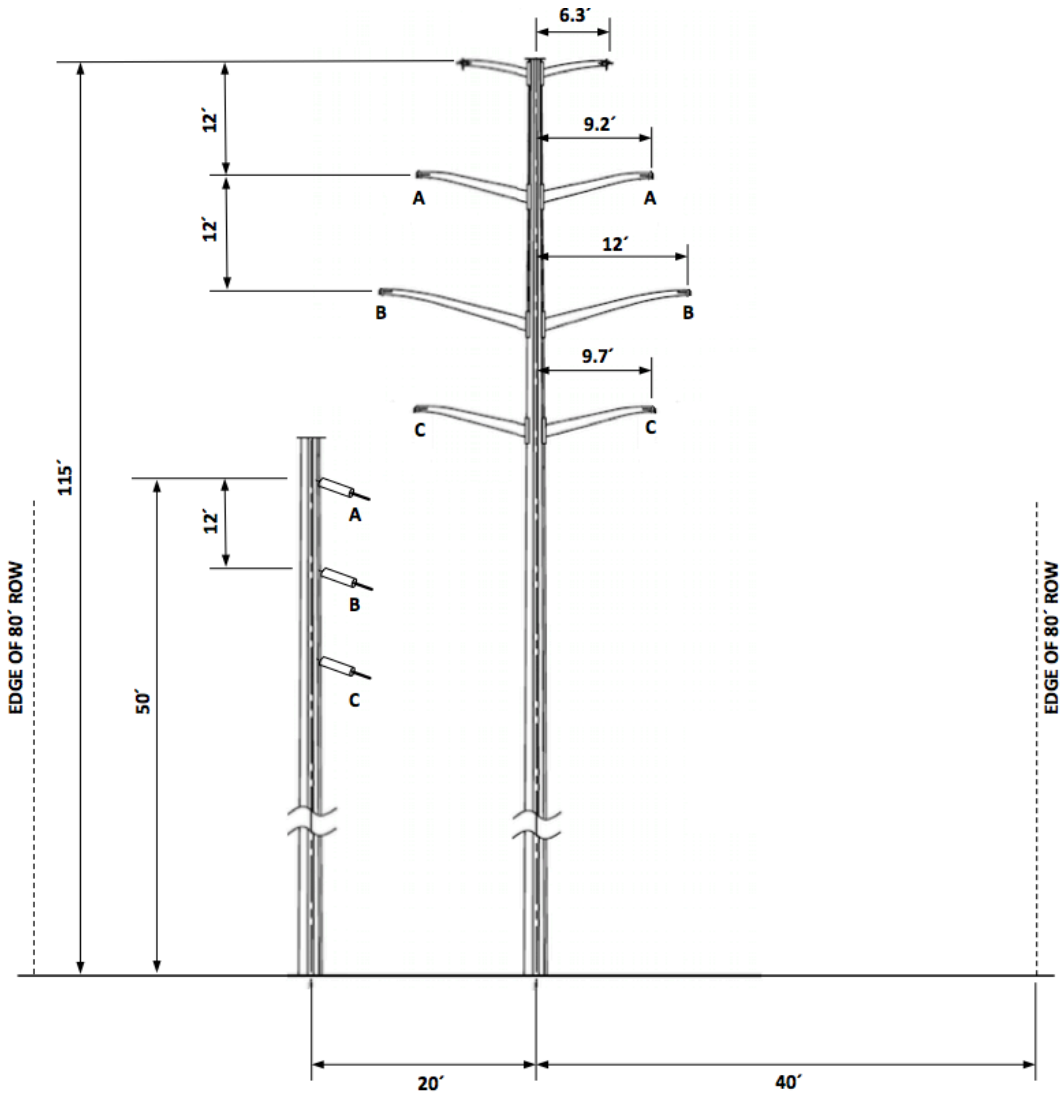

Figure 4. Profile view of double-circuit monopole and dead-end structures X1 and X2.

Line “B” extends east of dead-end structure X1, and Line “A” extends west of dead-end structure X2. View facing west. *THIS FIGURE HAS BEEN EDITED TO REMOVE CEII DATA.*

Assessment Criteria

Neither the federal government nor Connecticut has enacted standards for magnetic fields or electric fields from power lines or other sources at power frequencies. The Connecticut Siting Council has, however, adopted "EMF Best Management Practices for the Construction of Electric Transmission Lines in Connecticut" (BMP) in 2014 based upon a consensus of health and scientific agencies that the scientific evidence "reflects the lack of credible scientific evidence for a causal relationship between MF [magnetic field] exposure and adverse health effects." (CSC, p. 3). Nevertheless, the CSC concluded that precautionary measures for the siting of new transmission lines in the state of Connecticut are appropriate and should include "the use of effective no-cost and low-cost technologies and management techniques on a project-specific basis to reduce MF [magnetic field] exposure to the public while allowing for the development of efficient and cost-effective electrical transmission projects" (CSC, p. 11). Several methods are articulated in Section C (CSC, p. 8-9). The engineering control which applies most to the expansion of the Hawthorn Substation is maximizing the horizontal distance to surrounding residences from new electrical sources. This is accomplished by placing the new equipment on the western side of the substation and maintaining a buffer zone between the fence line of the substation and the UI property line.

Other EMF assessment criteria include the exposure limits recommended by scientific organizations. These exposure limits are included in guidelines developed to protect health and safety and are based upon reviews and evaluations of relevant health research. These guidelines include exposure limits for the general public recommended by the International Committee on Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) to address health and safety issues (ICES, 2002; ICNIRP, 2010).

In a June 2007 Factsheet, the World Health Organization included recommendations that policy makers should adopt international exposure limit guidelines, such as those from ICNIRP or ICES (Table 1), for occupational and public exposure to EMF.

Table 1. ICNIRP and ICES guidelines for EMF exposure

	Exposure (60 Hz)	
	Electric Field	Magnetic Field
ICNIRP	4.2 kV/m	2 G (2,000 mG)
ICES	5 kV/m*	9.040 G (9,040 mG)

*Within power line rights-of-way, the guideline is 10 kV/m under normal load conditions.

Methods

Exponent modeled EMF levels associated with the existing and proposed configurations of the Hawthorne Substation and 115 kV Transmission Lines “B”, “A”, and “C” using two methods:

(1) Three-dimensional modeling of magnetic fields, accounting for the arrangement of buswork, transmission-line interconnections, and other equipment inside the substation fence;
(2) Two-dimensional modeling of electric and magnetic fields, accounting only for the conductors of the “B”, “A”, and “C” Lines.

Magnetic field levels were calculated for peak loading conditions anticipated in 2016, as well as average loading conditions anticipated in 2021. In addition, electric and magnetic field measurements were recorded outside the existing perimeter of the substation.

Three-dimensional modeling

Magnetic fields along the UI property line, the internal fence-line perimeter of the proposed Hawthorne Substation, and along perpendicular profiles 1-8 were modeled using SUBCALC. SUBCALC, which is part of the Enertech EMF Workbench Suite, models the magnetic fields in and around substation equipment, accounting for the three-dimensional arrangement of breakers, transformers, reactors, capacitors, buswork, and transmission lines.

Two SUBCALC models were constructed using substation plan and profile data, and accounting for grade south the proposed substation internal fence-line perimeter. The inputs to the program include data regarding voltage, current flow, circuit phasing, and conductor configurations, which were provided by UI.

The first SUBCALC model was used to calculate magnetic fields for the existing configuration of the Hawthorne Substation (Figure 5). This model does not include proposed capacitors, reactors, breakers or buswork on the west side of the expanded substation perimeter. The second SUBCALC model includes new equipment within the proposed perimeter (Figure 6). Both three-dimensional models were used to calculate magnetic fields under average-load conditions in 2021 and peak-load conditions in 2016, as discussed further below. Based on these two models, changes in the calculated magnetic fields associated with the operation of the Project are provided in the Results section, below.

Along each profile and perimeter, magnetic-field levels were calculated at 1 meter (3.28 feet) above ground as the root mean square value of the field in accordance with IEEE Std. C95.3.1-2010 and IEEE Std. 644-1994.[1] To account for changes in elevation, Profiles 3-5 were modeled

[1] The resultant magnetic field is the Euclidian norm (square root of the sum of the squares) of the component magnetic-field vectors calculated along vertical, transverse, and longitudinal axes.

with 8-foot rising elevation as they proceed south. Calculated magnetic-field levels are reported as resultant quantities in units of milligauss (mG).[2]

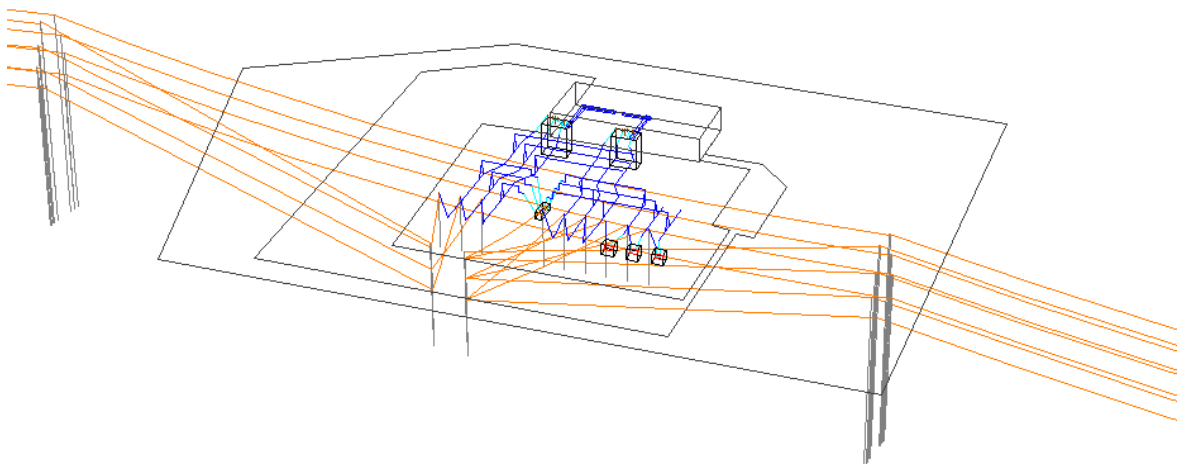

Figure 5. Overview of the three-dimensional SUBCALC model used to calculate perimeter and perpendicular magnetic-field profiles for the existing configuration of the Hawthorne Substation.

[2] The resultant magnetic field is the Euclidian norm (square root of the sum of the squares) of the component magnetic-field vectors calculated along vertical, transverse, and longitudinal axes.

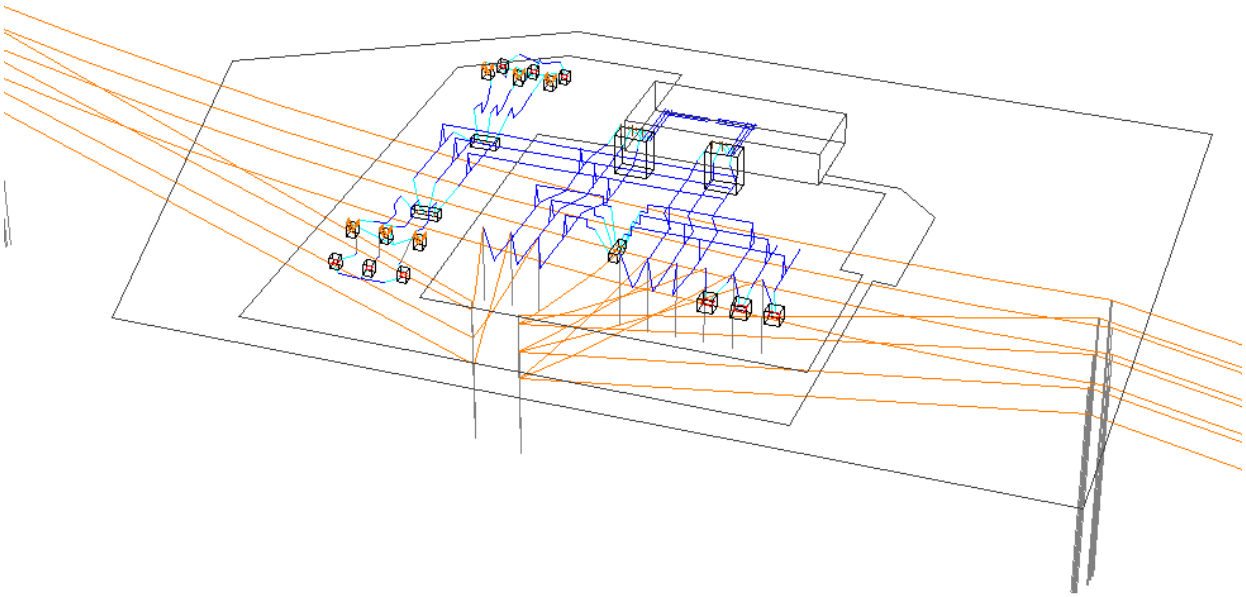

Figure 6. Overview of the three-dimensional SUBCALC model used to calculate perimeter and perpendicular magnetic-field profiles for the proposed configuration of the Hawthorne Substation.

Two-dimensional modeling

Project-related changes in EMF south of the proposed site were found to reflect loading changes in and out of Hawthorne, therefore two-dimensional computational models of EMF on transects perpendicular to Lines “B” and “C” Lines (Cross Sections XS-1 and XS-2) were also constructed. Magnetic and electric fields in Cross Sections XS-1 and XS-2 were calculated using computer algorithms developed by the Bonneville Power Administration, an agency of the U.S. Department of Energy (BPA, 1991). These algorithms have been shown to accurately predict EMF levels measured near transmission lines. The magnetic field levels in Sections XS-1 and XS-2 were calculated at 1 meter (3.28 feet) above ground as the root mean square value of the field in accordance with IEEE Std. C95.3.1-2010 and IEEE Std. 644-1994. The conductors were assumed to be located on flat terrain and at uniform height for the entire distance between structures. Balanced currents were modeled on all three phase conductors. As with SUBCALC, the inputs to the BPA algorithm are data regarding voltage, current flow, phasing, and conductor configurations, and were provided by UI.

Measurements

In order to characterize EMF levels for the existing configuration of the Hawthorne Substation, magnetic and electric fields were measured outside the existing substation fence on February 26, 2016. The measurements were taken at a height of 1 meter (3.28 feet) above ground in accordance with the standard methods for measuring near power lines (IEEE Std. 644-1994a). Both electric and magnetic fields were expressed as the total field computed as the resultant of

field vectors measured along vertical, transverse, and longitudinal axes.[3] The electric field was measured in units of kV/m with a single-axis field sensor and meter manufactured by Enertech Consultants. The magnetic field was measured in units of mG by orthogonally-mounted sensing coils whose output was logged by a digital recording meter (EMDEX II) manufactured by Enertech Consultants. These instruments meet the Institute of Electrical and Electronics Engineers **(**IEEE) instrumentation standard for obtaining accurate field measurements at power line frequencies (IEEE Std.1308-1994b). The meters were calibrated by the manufacturer by methods like those described in IEEE Std. 644-1994a.

Underground 13.8 kV distribution sources were not included in the SUBCALC or BPA models in order to characterize the effects of the new substation equipment. Magnetic fields from these underground sources were measured in the vicinity of the substation control building (Profiles 7 and 8), as described in the Results section below.

Loading

UI Transmission Planning provided the pre- and post-Project loadings for Lines “B”, “A”, and “C”, which are provided in Table 1 and Table 2 for average and peak-load conditions, respectively. Reference directions of current are shown in Figure 2.

UI is required by the CSC 2007 Electric and Magnetic Best Management Practices to provide line loadings for “pre and post project conditions under 1) peak load level at the time of the application filing and 2) at the projected seasonal maximum 24-hour average load level anticipated within five years” of operational in service date. As provided by UI transmission planning, the term “seasonal maximum 24-hour average” load level was replaced by the term “average daily peak.” In this report, “average load” refers to this case.

For peak load analysis, UI modeled the system to reflect transmission topology changes that were already approved by ISO-New England with an in service date of June 2016 or earlier. This included both Hawthorne capacitors to be in-service for the peak-load, post-project analysis. In addition, the study year 2021 was used for average daily peak load level analysis to satisfy the CSC requirement for obtaining EMF data within a five-year horizon. The average daily peak load for post-project conditions simulated a shoulder load scenario and therefore, one of the two capacitor banks was assumed online. In order to determine the scenario with the highest line loadings, generation dispatches were chosen that caused the highest projected flows. Dispatch 4 was selected for the average-load case, and Dispatch 4a was selected for the peak-load case.

The series reactor on the “B” line was assumed to be offline for both the peak and average load analysis. This methodology was conservative and provided results generally reflecting higher loadings of these transmission lines.

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[3] Measurements along the vertical, transverse, and longitudinal axes were recorded as root-mean-square magnitudes. Root mean square refers to the common mathematical method of defining the effective voltage, current, or field of an AC system.

Table 2. Circuit and equipment loading for average case in 2021 (Dispatch 4). ***THIS TABLE HAS BEEN EDITED TO REMOVE CEII DATA.***

Circuit or Equipment	Voltage (kV)	Notes	Condition	MW	MVAR	Current	
						Magnitude	Angle
"A"	115		pre-Project				
			post-Project				
"C"	115		pre-Project				
			post-Project				
"B"	115		pre-Project				
			post-Project				
A, B	115/13.8	Primary, transformers A and B	pre-Project				
			post-Project				
Tie breaker	115	"B" to "A" terminal bus	pre-Project				
			post-Project				
Capacitor bank	115	Single bank	pre-Project				
			post-Project				
Total capacitor	115	"A" terminal bus west to capacitors	pre-Project				
			post-Project				

Table 3. Circuit and equipment loading for 90/10 peak load case in 2016 (Dispatch 4a). ***THIS TABLE HAS BEEN EDITED TO REMOVE CEII DATA.***

Circuit or Equipment	Voltage (kV)	Notes	Condition	MW	MVAR	Current	
						Magnitude	Angle
"A"	115		pre-Project				
			post-Project				
"C"	115		pre-Project				
			post-Project				
"B"	115		pre-Project				
			post-Project				
A, B	115/13.8	Primary, transformers A and B	pre-Project				
			post-Project				
Tie breaker	115	"B" to "A" terminal bus	pre-Project				
			post-Project				
Capacitor bank	115	Single bank	pre-Project				
			post-Project				
Total capacitor	115	"A" terminal bus west to capacitors	pre-Project				
			post-Project				

Results and Discussion

Figure 7 depicts the calculated magnetic-field levels along the UI property line at 180 Hawthorne Drive for average-load conditions in 2021. The profile begins at the southwest corner of the substation, and proceeds counter-clockwise around the site when viewed from above. The x-axis of Figure 7 is labeled with the cumulative distance along the property perimeter. Comparing the results for the existing and proposed configurations of the Hawthorne Substation, the calculated magnetic field for these two configurations is within 0.5 mG at the majority of locations on the property line. The greatest change in the calculated magnetic field occurs beneath the conductors of Line "B" where they pass below the conductors of the "C" line. At this location, calculated magnetic fields are 2 mG higher in the proposed configuration compared to the existing configuration. This change reflects the increase in loading of Line "B" of 19 amperes associated with operation of the Project.

Figure 8 depicts the calculated magnetic-field levels along the UI property line for peak-load conditions in 2016. Calculated magnetic fields are within 1 mG at the majority of locations. Beneath the conductors of Line "B", the calculated magnetic field is 4 mG higher in the proposed configuration, again reflecting the increase of Line "B" load of 40 amperes, compared to the loading before operation of the Project).

Figure 9 depicts the calculated magnetic-field levels around the proposed fence line of the Hawthorne Substation for average-load conditions in 2021. In addition, Figure 9 depicts the measured magnetic field along the same path. The x-axis of Figure 9 is labeled with the cumulative distance along the proposed fence line, starting in the southwest corner and proceeding counter-clockwise. Comparing the results for the existing and proposed configurations of the Hawthorne Substation, calculated magnetic fields are within 1 mG at the majority of locations. In the average-load model, one capacitor bank is online, and the south bank was chosen for this purpose. The effect of the new capacitor bank and ancillary equipment is discernible on the west and south sides of the expanded substation internal fence-line perimeter. On the west side of the new internal fence-line perimeter, the calculated magnetic field is 4 mG higher near the proposed extension of the Line "A" terminal bus. On the south side of new fence line, the calculated magnetic field is 2.6 mG higher nearest the south capacitor bank and associated equipment. The measured magnetic field along the proposed internal fence-line perimeter follows the trend of the calculated profile (existing conditions), but are generally lower. This relationship reflects the load in and out of the Hawthorne Substation at the time of measurements, which was below the shoulder peak loading used in the SUBCALC model. At some locations near the substation control building, the measured magnetic fields are higher than the calculated profiles. At these locations, 13.8 kV distribution lines not included in the SUBCALC models exit the control building underground and proceed north. *See* Figure 1.

Figure 10 depicts the calculated magnetic-field levels around the proposed internal fence-line perimeter of the Hawthorne Substation for peak-load conditions in 2016. Comparing the results for the existing and proposed configurations, calculated magnetic fields are within 1 mG at the majority of locations. In the peak-load model, both capacitor banks are online. Comparison with the average-load profile in Figure 9 shows these additional sources cause a small but

discernible increase in the magnetic field at the northwest corner of the expanded internal fence line, where the calculated magnetic field is 7.2 mG higher in the proposed configuration. The calculated magnetic field is higher in the proposed configuration at other locations as well, including other areas around the western yard extension (2.0-4.2 mG increase) and beneath the conductors of the "B" Line (4.6 mG increase).

Figures 11-18 depict the calculated magnetic field levels along perpendicular Profiles 1-8 for average-load conditions in 2021. Table 3 summarizes calculated magnetic-field levels from these profiles at the existing internal fence-line perimeter, as well as at several distances beyond the proposed internal fence-line perimeter. Comparing the existing and proposed results at the proposed internal fence-line perimeter, calculated magnetic fields decrease at some locations (e.g., 0.2 mG decrease with operation of the Project in Profiles 2 and 6), and increase at other locations (0.5-4.0 mG increase in Profile 3-5). In all profiles, the calculated magnetic fields are within 0.2 mG at distances of 150 feet or more from the proposed internal fence-line perimeter.

Table 4 summarizes calculated magnetic-field levels for Profiles 1-8 under peak-load conditions. In all profiles, the calculated magnetic fields are within 0.4 mG at distances of 150 feet or more from the proposed internal fence-line perimeter.

Figure 19 and Figure 20 depict the calculated magnetic field levels along Cross Sections XS-1 and XS-2, accounting for transmission-line sources at these locations. Calculated magnetic fields are summarized in Table 5 at several locations along the XS-1 and XS-2 transects of the ROW. The calculated magnetic field levels in XS-1 decrease slightly with operation of the Project (1.4 mG under average-load conditions), corresponding to the decrease in loading of the "A" Line. These results correspond with the decrease in calculated post-Project magnetic fields in Profile 3 (0.3-1.2 mG decrease at distance 50 feet or more beyond the proposed perimeter).

To the east of dead-end structure 872A, the calculated magnetic field levels in XS-2 increase slightly with operation of the Project (1.8 mG under average-load conditions, beneath the conductors of the "B" Line). This change reflects the increase in loading of Line "B" (457 versus 438 amperes) associated with operation of the Project.

Figure 21 and Figure 22 depict the calculated electric field along Cross Sections XS-1 and XS-2, which are summarized in Table 6. The highest electric field in these sections is 0.91 kV/m calculated directly beneath the phase conductors of the "B" and "A" Lines. The electric field from transmission-line sources will not change significantly with operation of the Project, since the location of overhead 115 kV conductors is not modified as part of the proposed additions to the Hawthorne Substation.

Figure 23 depicts the location of electric-field measurements recorded on February 26, 2015. Measured electric-field values in three orthogonal axes are summarized in Table 7, along with calculated resultant quantities. The highest measured electric field (1.04 kV/m) was recorded beneath the conductors of the "B" Line. Away from overhead 115 kV transmission-line conductors, measured electric fields were low, below 0.06 kV/m. These results support the conclusion that electric fields from equipment within the substation are shielded by the substation fence and surrounding vegetation.

Conclusions

Electricity is an integral part of our infrastructure (e.g., transportation systems, homes, and businesses) and people living in modern communities are therefore surrounded by sources of EMF. Where the existing “C”, “A” and “B” transmission lines run overhead adjacent to the Hawthorne Substation, the electric-field levels are approximately 20% or less of recommended exposure limits and magnetic-field levels are approximately 3.5% or less of that recommended for the general public by international health-based standards (ICES and ICNIRP). The load on the “B” line will increase by a slight amount so that the magnetic field beneath the transmission lines increases by a similarly slight amount, less than 2 mG (3.7%) from existing conditions for average loading and by less than 4 mG (5.9%) for peak loading.

Because the design of the addition to the substation and because fields attenuate quickly with distance, the calculated and measured magnetic and electric fields are very low at the internal fence line around the substation and are still lower at the UI property line, consistent with IEEE Standard 1127-1990. The proposed equipment would not significantly increase the electric field beyond the property line because of shielding by metallic fences and surrounding vegetation. Although the magnetic field from existing and proposed equipment within the substation is not similarly shielded, the magnetic field diminishes from these sources so that at 50 feet from the internal substation fence the calculated magnetic field from existing and proposed configurations of the Hawthorne Substation differ by less than 1 mG at the majority of locations. The highest calculated magnetic-field level at the UI property line of the Hawthorne Substation at either peak or average loading is where the existing transmission lines pass overhead and is less than 3% of that recommended for the general public in international standards. Away from the transmission lines, the highest magnetic field level is less than 1% that of the recommended reference level (at either peak or average loading).

Tabular and Graphical Results

Table 4. Summary of calculated magnetic fields for Profiles 1-8 for average load conditions in 2021

Profile	Heading	Modeling condition	Magnetic field at existing fence location	Distance from proposed substation perimeter (ft)			
				0	50	100	150
1	west	Pre-Project	6.0	2.4	2.2	2.2	2.4
		Post-Project	—†	3.2	2.5	2.3	2.4
2	west	Pre-Project	11.2	7.2	7.6	8.0	8.9
		Post-Project	—†	7.0	7.9	8.0	8.9
3	south	Pre-Project	12.1	16.4	19.1	8.1	3.8
		Post-Project	—†	20.4	17.8	7.6	3.6
4	south	Pre-Project	71.7	40.8	45.9	17.1	6.6
		Post-Project	—†	43.1	47.9	17.3	6.7
5	south	Pre-Project	10.1	15.0	27.1	17.9	7.5
		Post-Project	—†	15.5	28.1	18.3	7.7
6	east	Pre-Project	4.2	2.9	2.2	2.0	1.9
		Post-Project	—†	2.7	2.2	2.0	1.9
7	east	Pre-Project	3.7	*3.7	1.8	1.2	1.0
		Post-Project	3.6	*3.6	1.7	1.1	1.0
8	north	Pre-Project	4.5	*4.5	1.9	1.1	0.7
		Post-Project	4.4	*4.4	1.9	1.1	0.7

* 13.8 kV distribution circuits (not modeled) present at this location

† This location is within the proposed perimeter

Table 5. Summary of calculated magnetic fields for Profiles 1-8 for peak load conditions in 2016

Profile	Heading	Modeling condition	Magnetic field at existing fence location	Distance from proposed substation perimeter (ft)			
				0	50	100	150
1	west	Pre-Project	9.0	3.4	3.0	3.0	3.2
		Post-Project	—†	2.4	3.1	3.1	3.2
2	west	Pre-Project	14.8	9.6	10.2	10.8	12.0
		Post-Project	—†	9.7	10.6	10.7	11.8
3	south	Pre-Project	16.0	21.9	25.4	10.8	5.1
		Post-Project	—†	25.3	23.4	10.0	4.8
4	south	Pre-Project	97.6	55.6	62.5	23.2	9.0
		Post-Project	—†	60.5	66.6	23.9	9.2
5	south	Pre-Project	13.8	20.4	36.9	24.3	10.2
		Post-Project	—†	21.5	38.8	25.3	10.6
6	east	Pre-Project	5.8	4.0	3.0	2.7	2.5
		Post-Project	—†	3.5	2.8	2.7	2.5
7	east	Pre-Project	5.6	*5.6	2.7	1.7	1.4
		Post-Project	4.8	*4.8	2.2	1.4	1.3
8	north	Pre-Project	4.9	*4.9	2.6	1.5	1.0
		Post-Project	6.0	*6.0	2.6	1.4	0.9

* 13.8 kV distribution circuits (not modeled) present at this location

† This location is within the proposed perimeter

Table 6. Summary of calculated magnetic fields from existing "A" and "B" Lines for XS-1 and XS-2

Section	Modeling condition	Location				
		-50 ft beyond ROW edge	-ROW edge	Max on ROW	+ROW edge	+50 ft beyond ROW edge
XS-1	Pre-project, average load	7.8	23.4	30.3	11.9	5.8
	Post-project, average load	7.5	22.4	28.9	11.6	5.7
	Pre-project, peak load	10.4	31.1	40.2	15.9	7.8
	Post-project, peak load	9.8	29.1	37.5	15.4	7.6
XS-2	Pre-project, average load	11.8	37.5	48.9	16.4	7.6
	Post-project, average load	12.2	38.9	50.7	16.8	7.8
	Pre-project, peak load	16.1	51.0	66.5	22.2	10.4
	Post-project, peak load	16.9	53.9	70.4	23.2	10.8

Table 7. Summary of calculated electric fields for from existing "A" and "B" Lines for XS-1 and XS-2

Section	Modeling condition	Location				
		-50 ft beyond ROW edge	-ROW edge	Max on ROW	+ROW edge	+50 ft beyond ROW edge
XS-1	Pre-project	0.08	0.44	0.91	0.22	0.01
	Post-project	0.08	0.44	0.91	0.22	0.01
XS-2	Pre-project	0.08	0.43	0.92	0.22	0.01
	Post-project	0.08	0.43	0.92	0.22	0.01

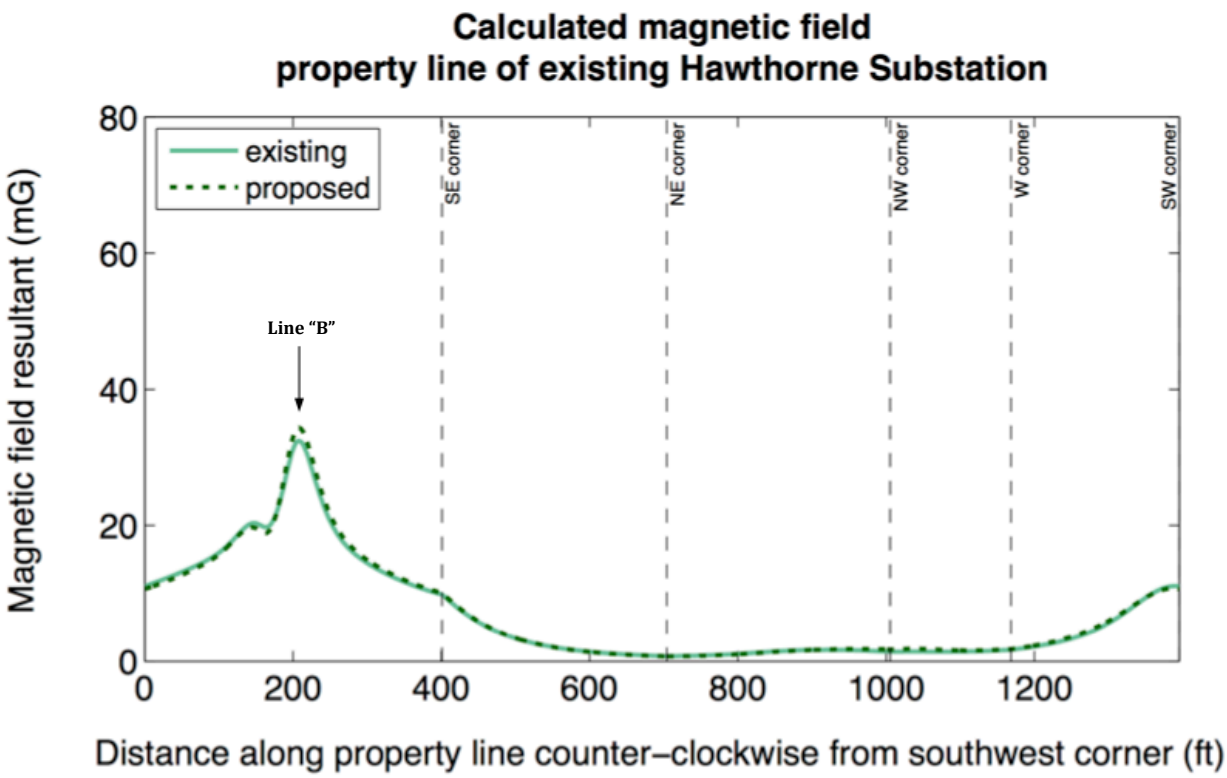

Figure 7. Calculated magnetic-field profiles around UI property line for average-load conditions in the year 2021.
The profile begins at the southwest corner of the substation, and proceeds counter clockwise along the south, west, north, and east sides of the property.

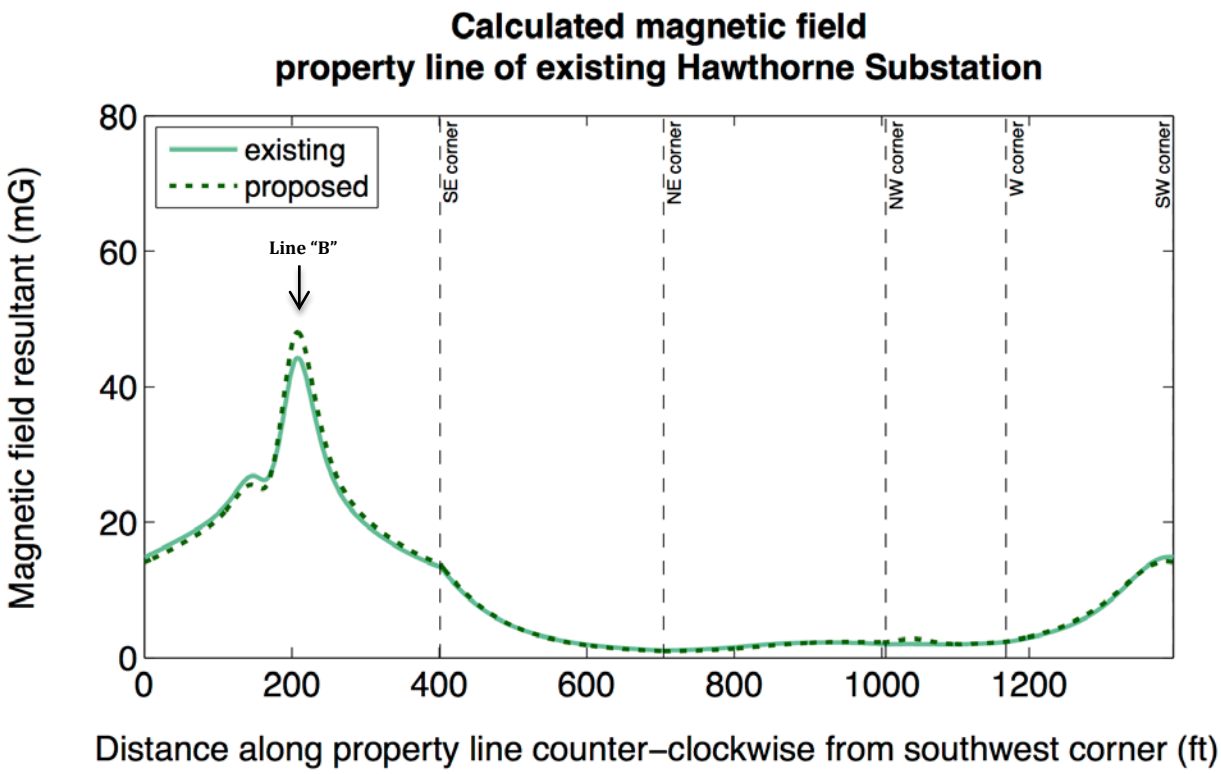

Figure 8. Calculated magnetic-field profiles around UI property line for peak-load conditions in the year 2016.
The profile begins at the southwest corner of the substation, and proceeds counter clockwise along the south, west, north, and east sides of the property.

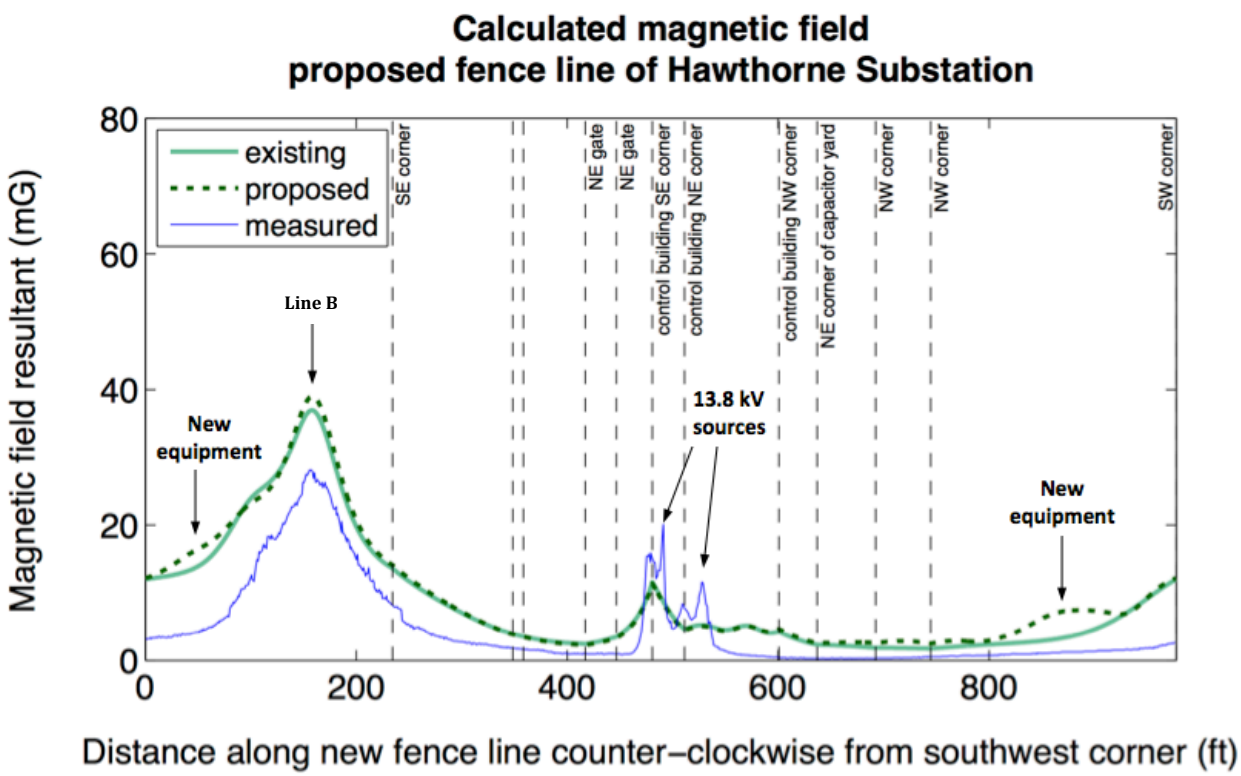

Figure 9. Calculated magnetic-field profiles around proposed fence line of the Hawthorne Substation for average-load conditions in the year 2021.
The profile begins at the southwest corner of the substation, and proceeds counter clockwise alone the fence line. The highest calculated fields are beneath the conductors of Line “B” where they pass above the proposed perimeter of the substation.

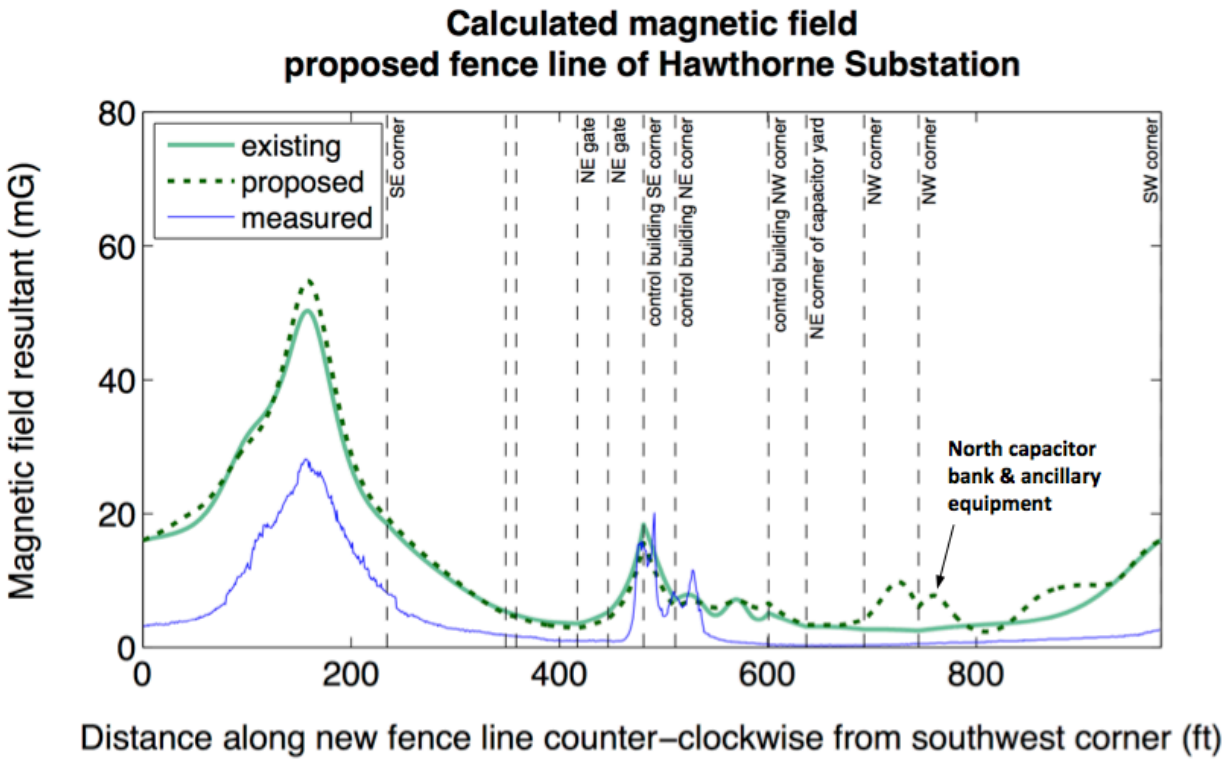

Figure 10. Calculated magnetic-field profiles around proposed fence line of the Hawthorne Substation for peak-load conditions in the year 2016.
The profile begins at the southwest corner of the substation, and proceeds counter clockwise alone the fence line. The highest calculated fields are beneath the conductors of Line “B” where they pass above the proposed perimeter of the substation.

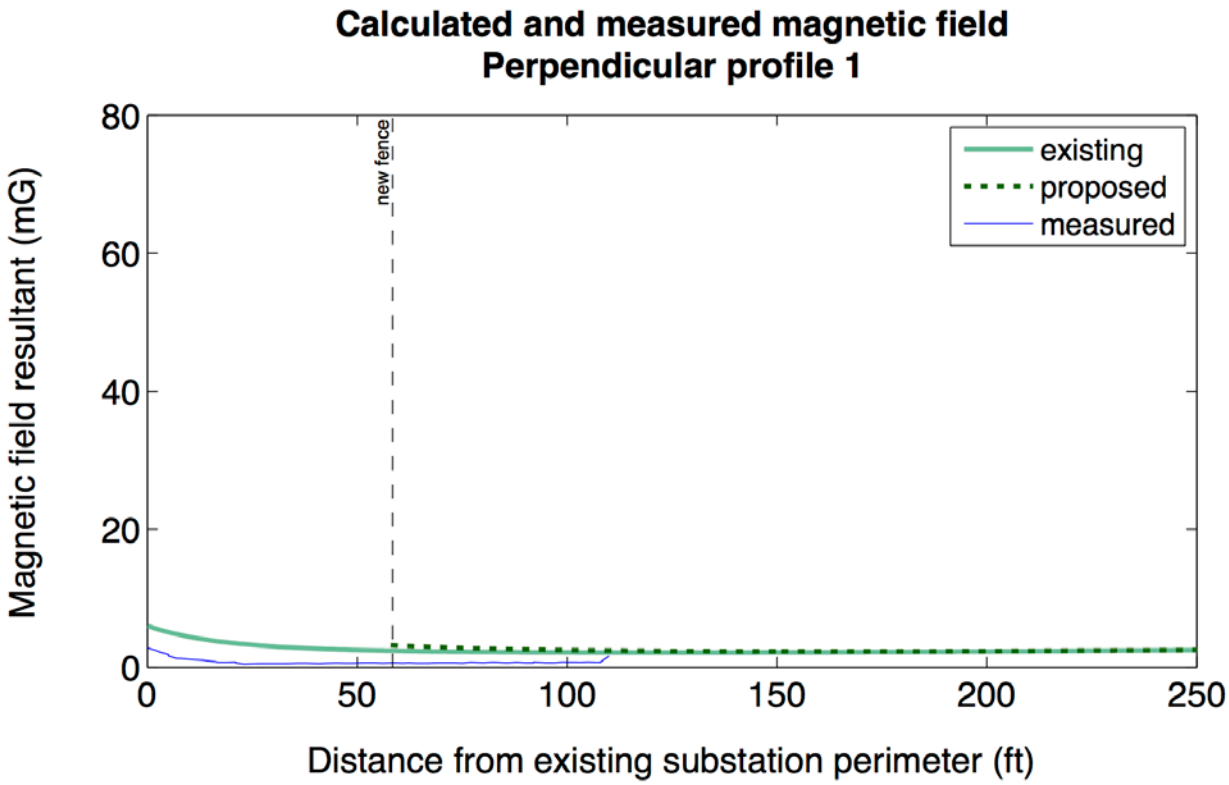

Figure 11. Calculated and measured magnetic-field levels along Profile 1.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

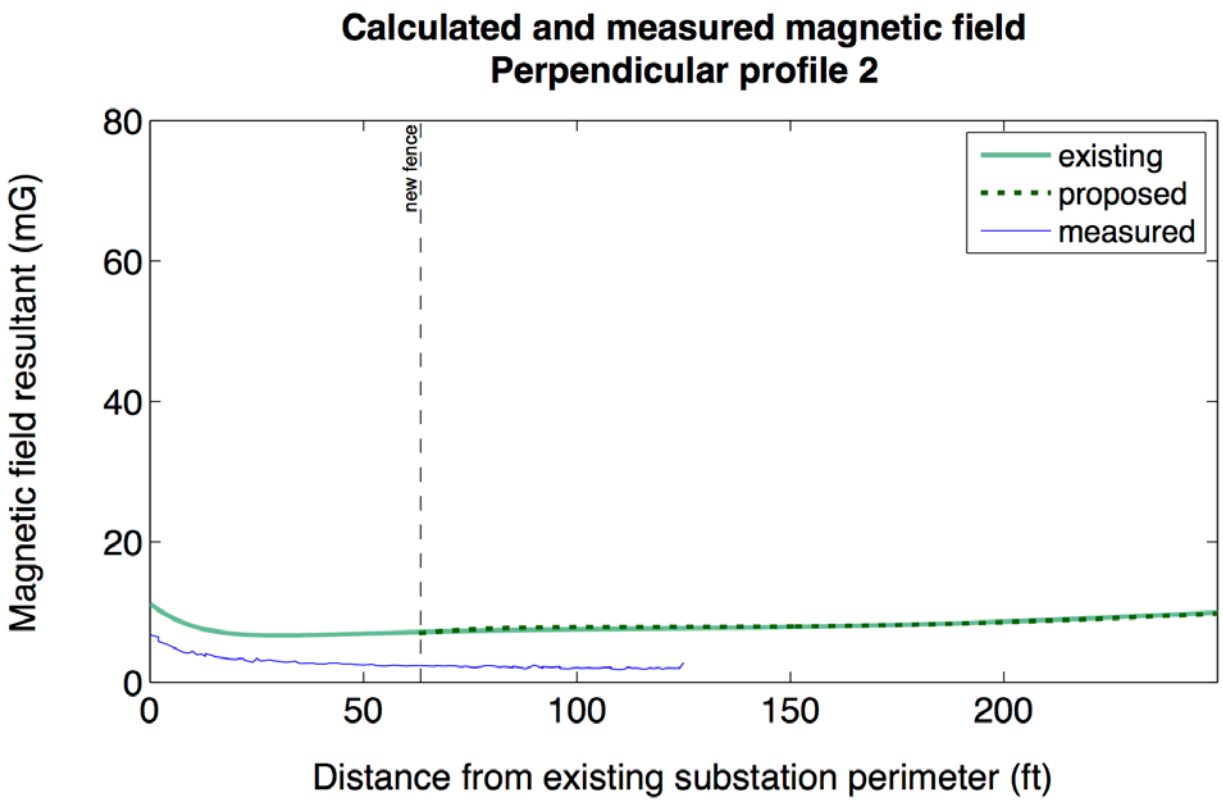

Figure 12. Calculated and measured magnetic-field levels along Profile 2. The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

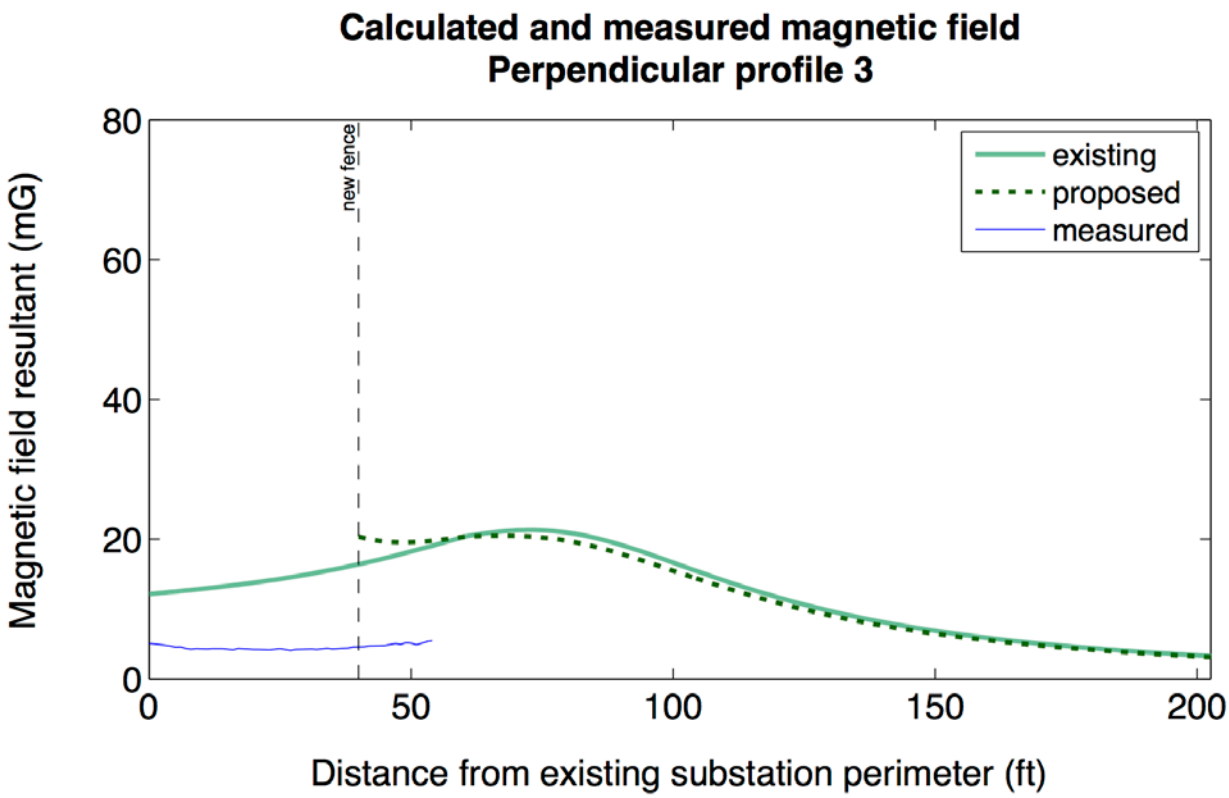

Figure 13. Calculated and measured magnetic-field levels along Profile 3.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

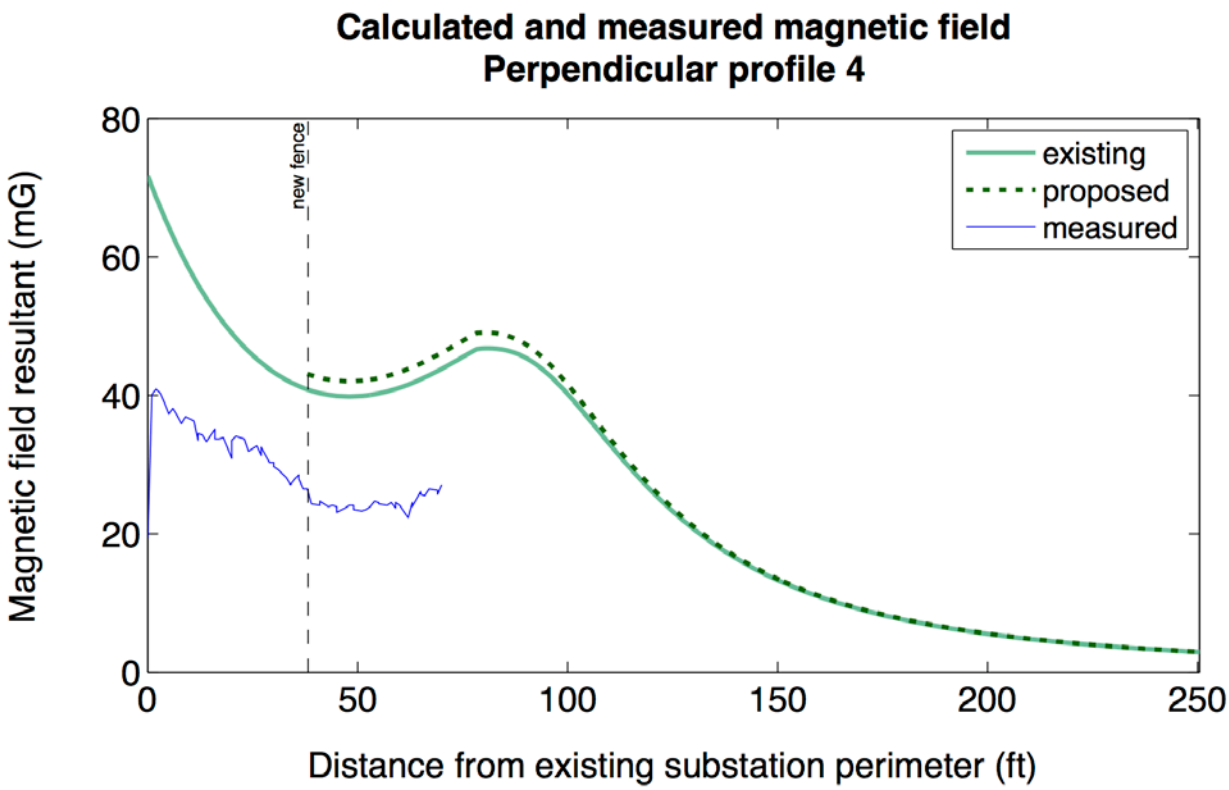

Figure 14. Calculated and measured magnetic-field levels along Profile 4.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

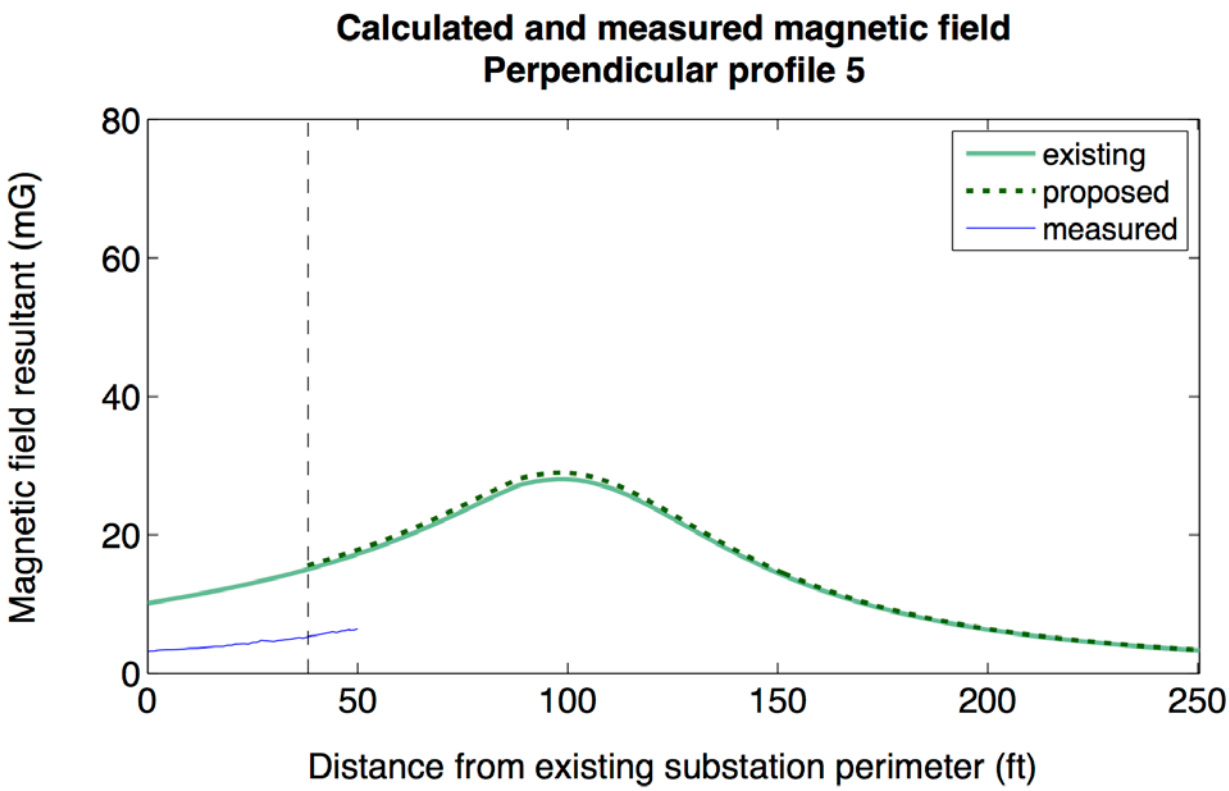

Figure 15. Calculated and measured magnetic-field levels along Profile 5.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

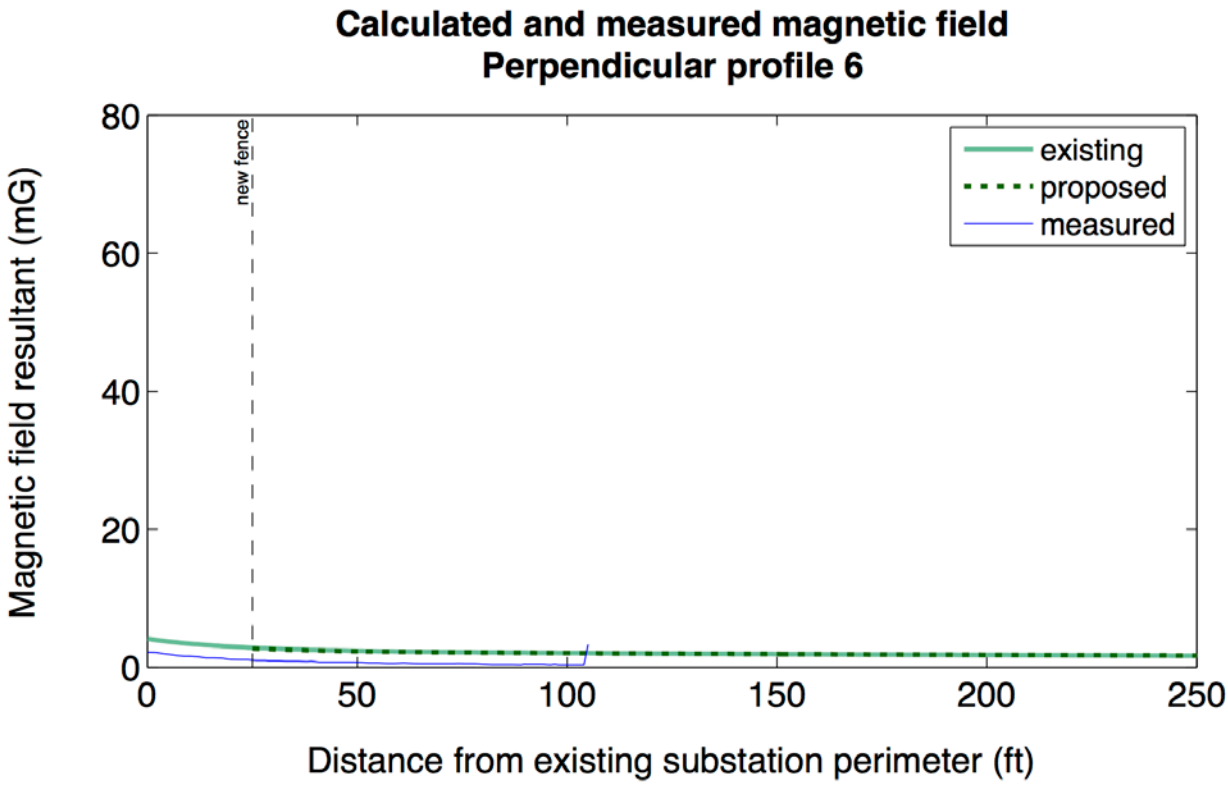

Figure 16. Calculated and measured magnetic-field levels along Profile 6.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

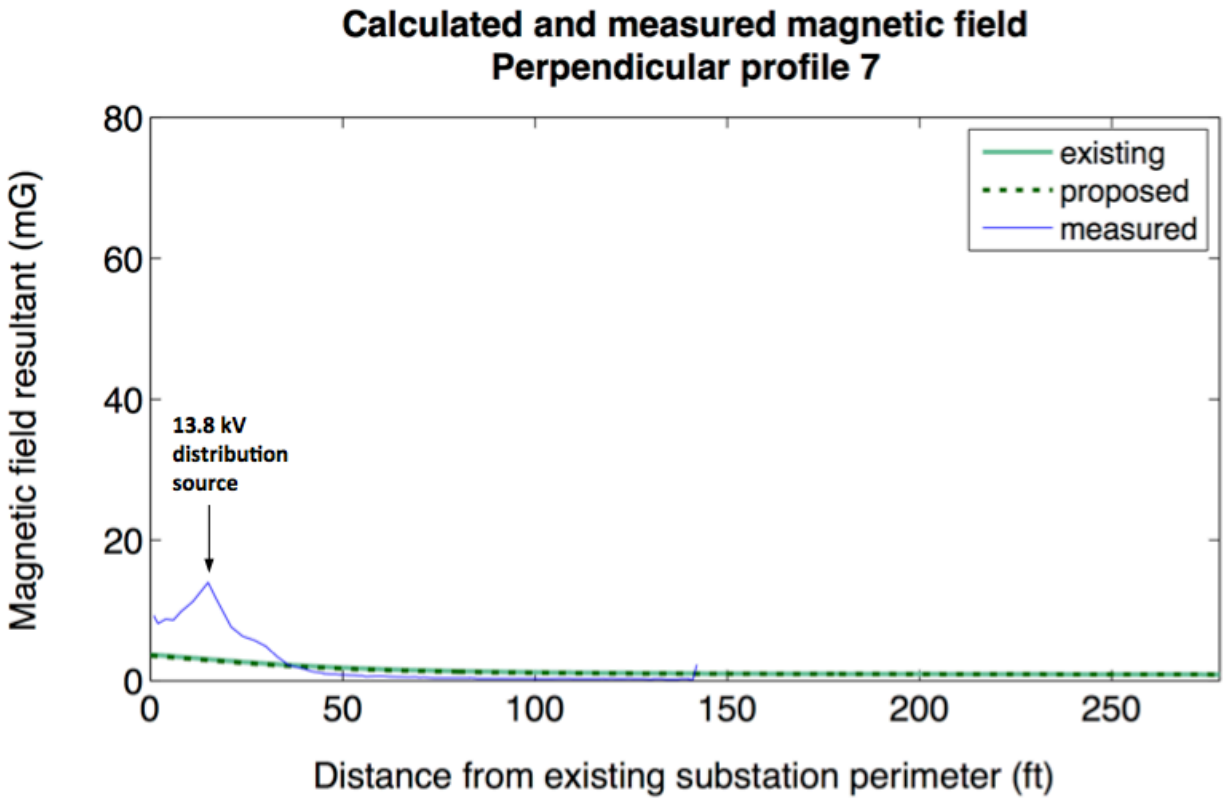

Figure 17. Calculated and measured magnetic-field levels along Profile 7.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

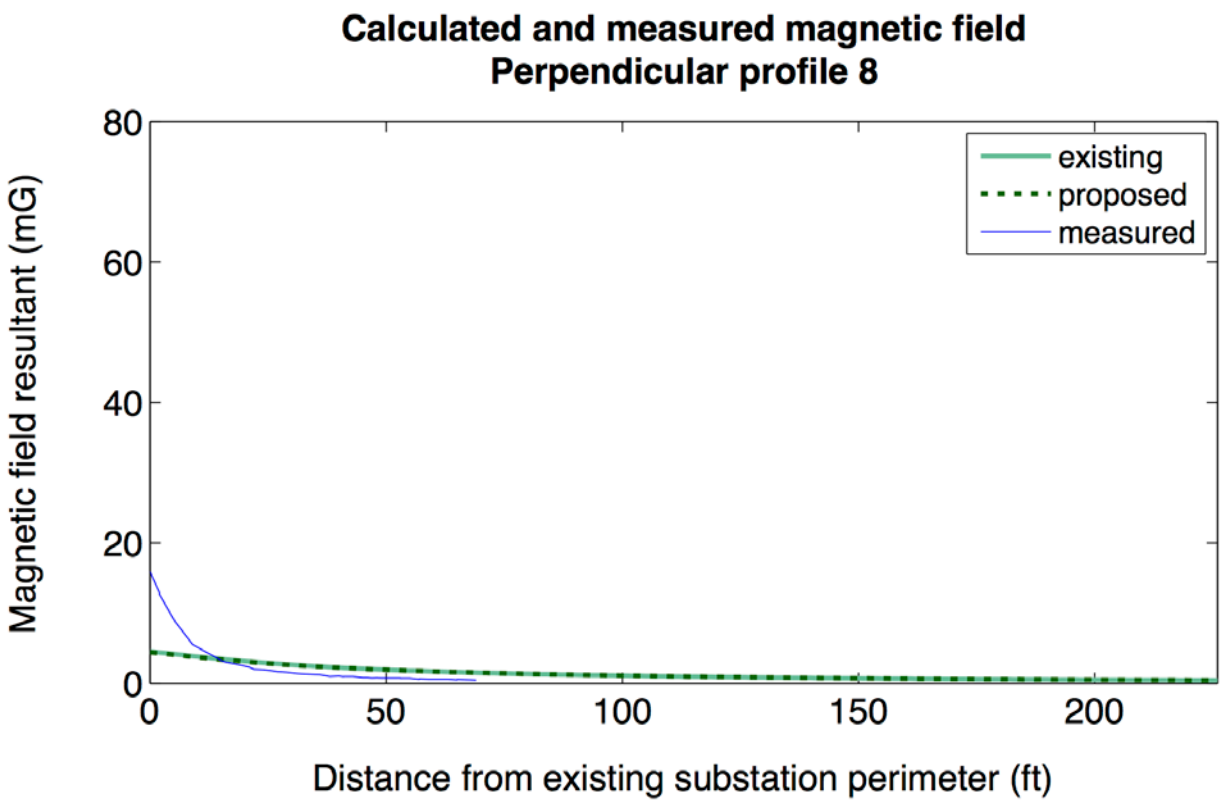

Figure 18. Calculated and measured magnetic-field levels along Profile 8.
The calculated magnetic-field levels are for existing and proposed configurations of the Hawthorne Substation under average-load conditions in 2021.

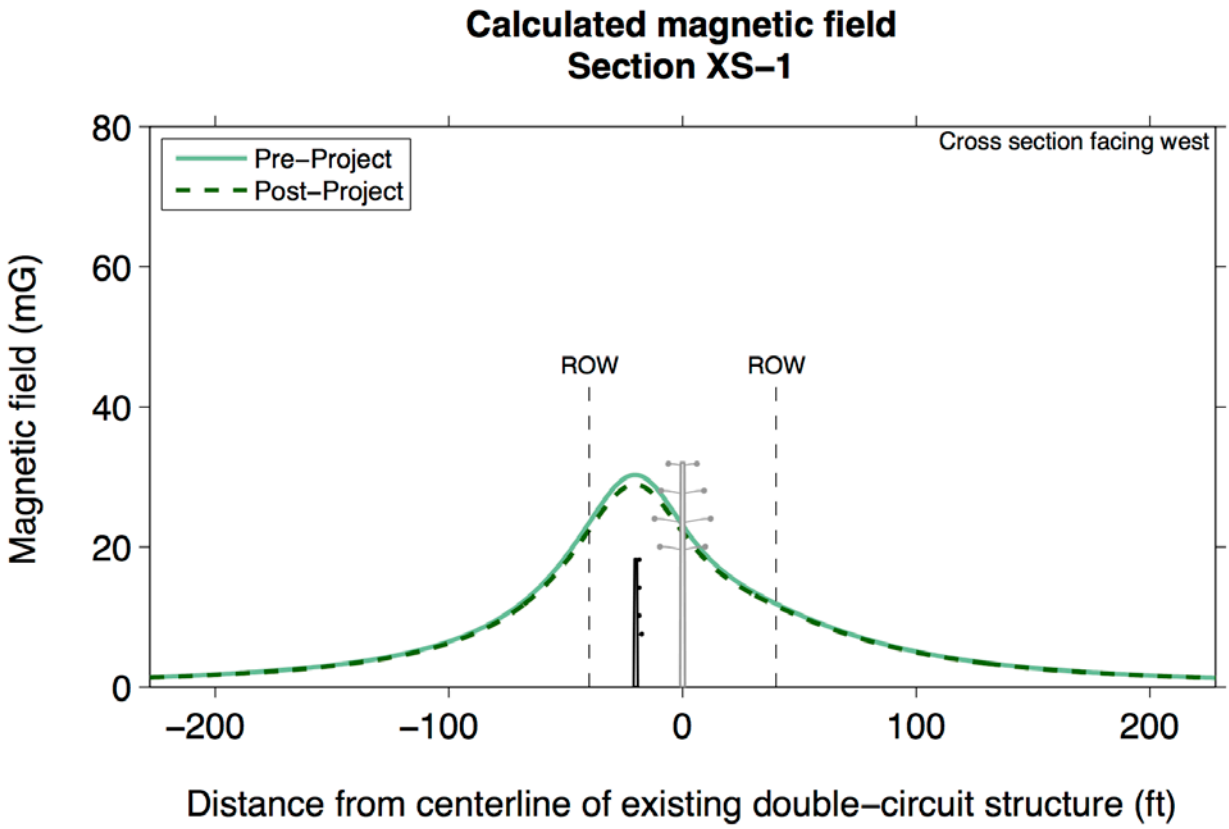

Figure 19. Calculated magnetic-field levels along Cross Section 1 for average-load conditions in 2021.

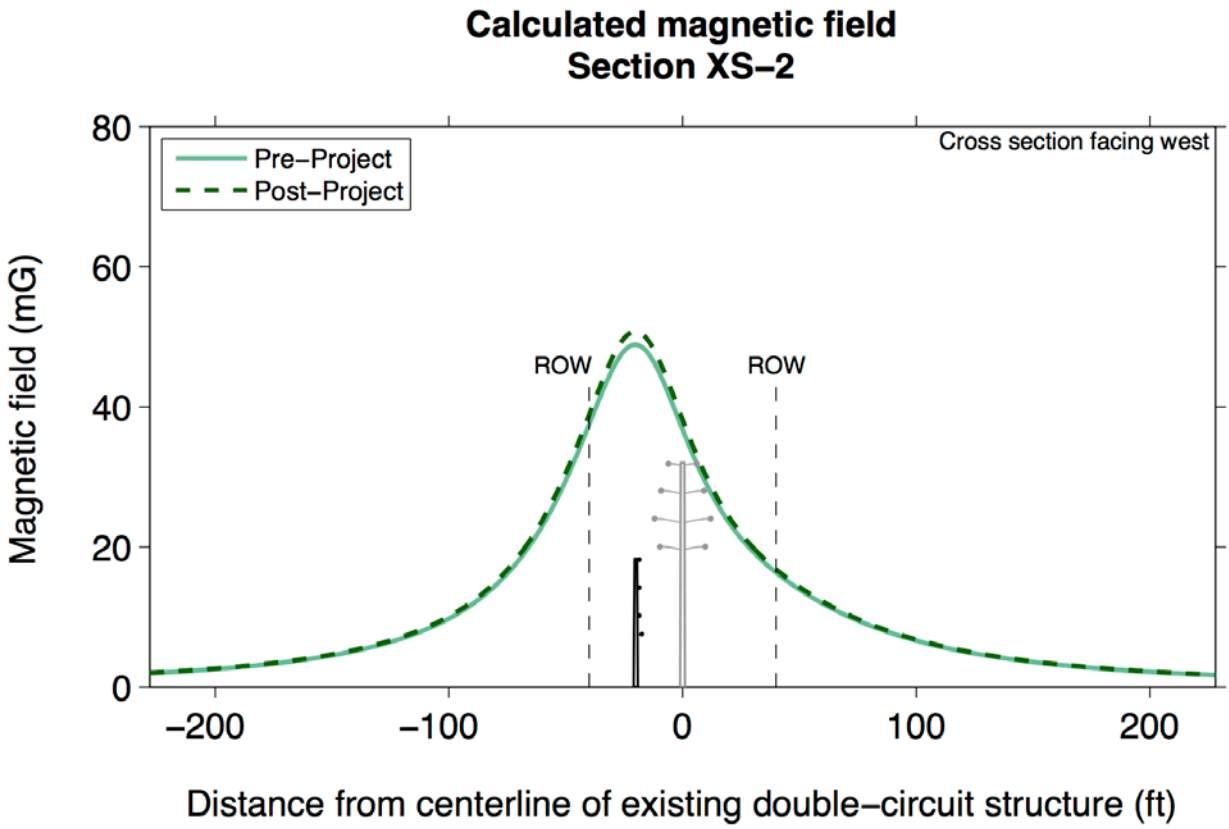

Figure 20. Calculated magnetic-field levels along Cross Section 2 for average-load conditions in 2021.

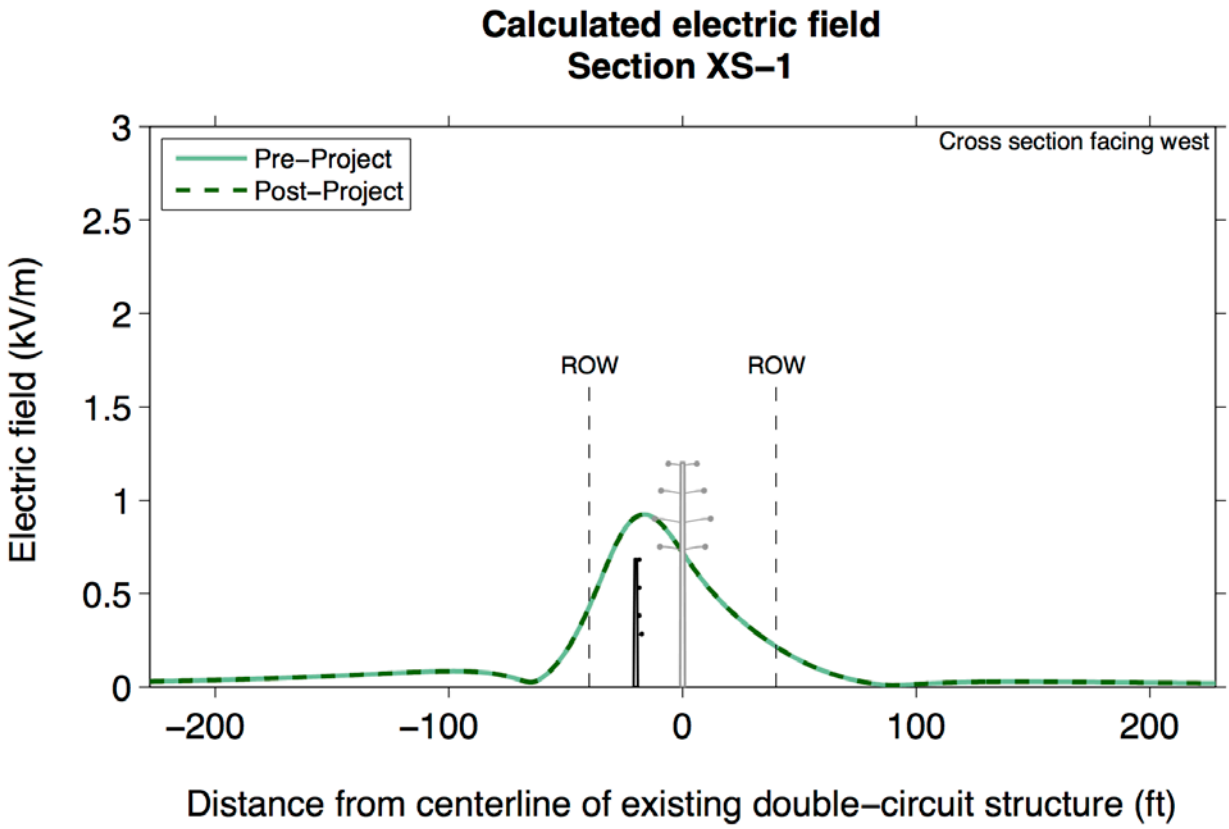

Figure 21. Calculated electric-field levels along Cross Section 1.

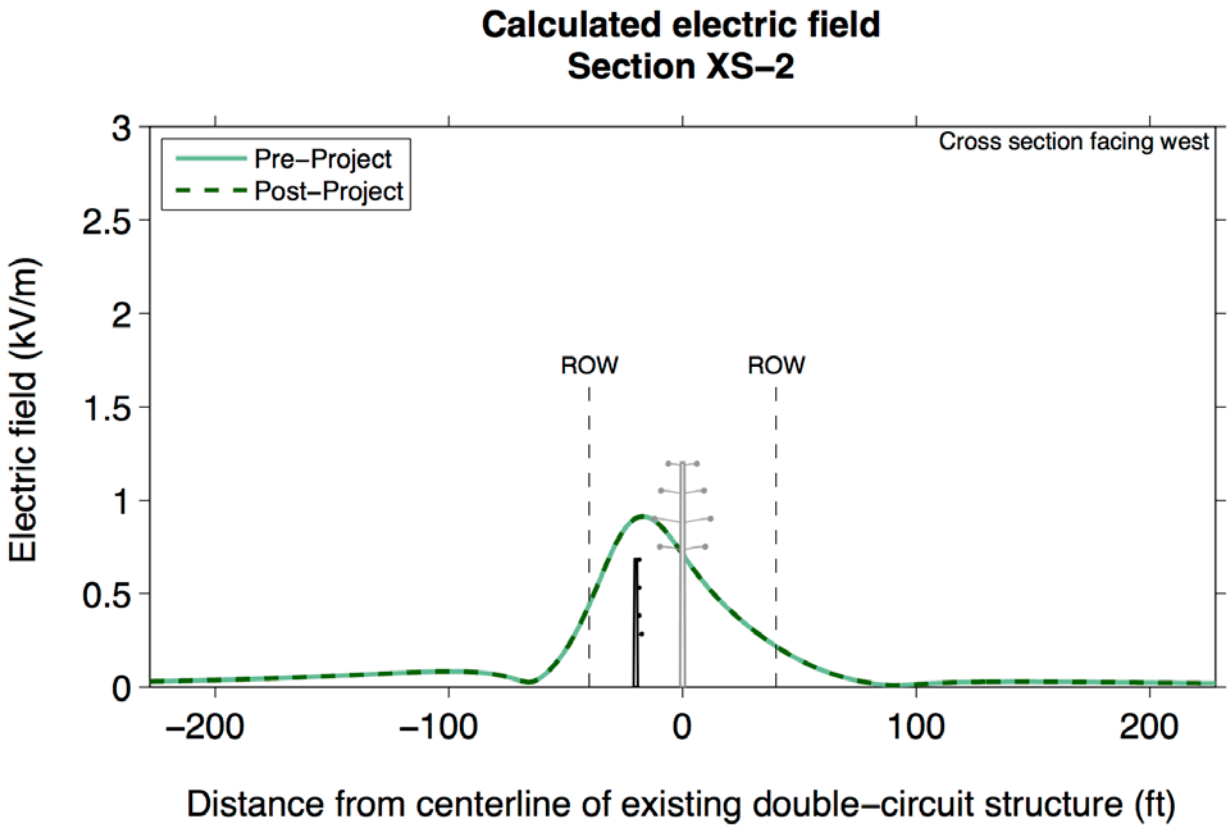

Figure 22. Calculated electric-field levels along Cross Section 2.

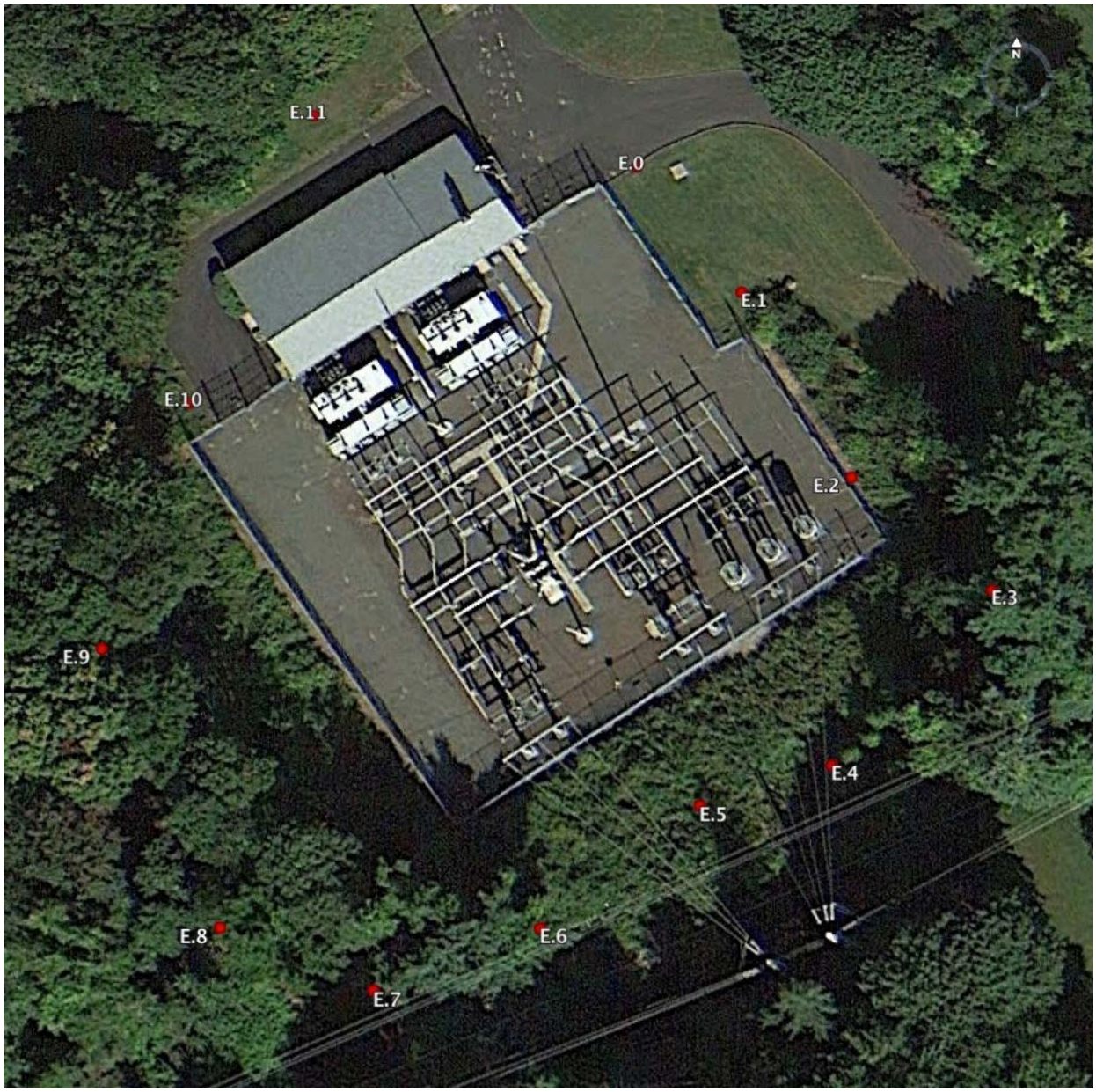

Figure 23. Location of electric field-measurements

Table 8. Summary of measured electric fields

Location (Figure 23)	Electric field (kV/m)			
	Vertical	Transverse	Longitudinal	Resultant
E0	0.005	0.000	0.000	0.005
E1	0.058	0.005	0.005	0.058
E2	0.251	0.005	0.005	0.251
E3	0.000	0.000	0.000	0.000
E4	1.007	0.235	0.048	1.035
E5	0.021	0.058	0.053	0.081
E6	0.095	0.005	0.016	0.096
E7	0.032	0.005	0.005	0.033
E8	0.000	0.000	0.000	0.000
E9	0.000	0.000	0.000	0.000
E10	0.020	0.000	0.000	0.020
E11	0.000	0.005	0.000	0.005