CONNECTICUT SITING COUNCIL

IN RE:		
THE UNITED ILLUMINATING COMPANY (UI) APPLICATION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE FAIRFIELD TO CONGRESS RAILROAD TRANSMISSION LINE 115-KV REBUILD PROJECT THAT CONSISTS OF THE RELOCATION AND REBUILD OF ITS EXISTING 115-KILOVOLT (KV) ELECTRIC TRANSMISSION LINES FROM THE RAILROAD CATENARY STRUCTURES TO NEW STEEL MONOPOLE STRUCTURES AND RELATED MODIFICATIONS ALONG APPROXIMATELY 7.3 MILES OF THE CONNECTICUT DEPARTMENT OF TRANSPORTATION'S METRO-NORTH RAILROAD CORRIDOR BETWEEN STRUCTURE B648S LOCATED EAST OF SASCO CREEK IN FAIRFIELD: AND UI'S CONGRESS STREET SUBSTATION IN BRIDGEPORT, AND THE REBUILD OF TWO EXISTING 115-KV TRANSMISSION LINES ALONG 0.23 MILES OF EXISTING UI RIGHT-OF-WAY TO FACILITATE INTERCONNECTION OF THE REBUILT 115-KV ELECTRIC TRANSMISSION LINES AT UI'S EXISTING ASH CREEK, RESCO, PEQUONNOCK AND CONGRESS STREET SUBSTATIONS TRAVERSING THE MUNICIPALITIES OF BRIDGEPORT AND FAIRFIELD, CONNECTICUT	:	**DOCKET NO. 516** **NOVEMBER 9, 2023**

PRE-FILED TESTIMONY OF – HAROLD ORTON, P.ENG.

Q1. Please state your name, profession and position with your employer.

A1. Harold Orton. I am an electrical engineer and underground power cable specialist. I am the owner and Principal of Orton Consulting Engineers International Ltd., Box 38715 Metropolitan PO, North Vancouver, BC V7M 3N1, Canada.

Q2. What services does Orton Consulting Engineers International Ltd. provide?

A2. Through my business, I offer engineering consulting services related to the manufacture, planning, installation, and maintenance of underground power cables, in a variety of locations across the world.

Q3. **<u>What is your professional background?</u>**

A3. I have been a specialist in underground cable technology for about fifty (50) years. I received a Diploma in Electrical Engineering in 1964 from Sydney Technical College (ASTC), graduated from the University of New South Wales with a Bachelor of Engineering (Honours) in Electrical Engineering in 1966 and a Master of Applied Science from the University of British Columbia, Vancouver, Canada in 1969. I graduated from the BCIT Venture Program in May 1995. After graduation in 1969, I worked at BC Hydro as an Electrical Research Engineer where I helped build one of the largest utility-based research centers in North America. For over twenty (20) years I worked as a specialist in the field of underground power transmission and distribution cables and accessories. I progressed to the level of section supervisor in charge of Insulation Studies and then to Manager of Technical Activities. I have been a project manager on Canadian Electricity Association (CEATI, Montreal) and Electric Power Research Institute (EPRI, Palo Alto, California) underground cable research projects from 1977 to 1996 and was Chairman of the CEATI Cable Failure Task Force from 1987 until 1993. In 1994 I started my consulting engineering practice as an underground power cable specialist. Attached as **Exhibit 1** is my resume with further information regarding my professional background, experience and accomplishments.

Q4. <u>Are you affiliated with any professional or industry organization</u>?

A4. Yes. I am active in the IEEE, Insulated Conductors Committee (ICC) as Past-chairman of Task Group A2D on the Characteristics of Semiconductive Shields, Chairman of the Submarine Cable Working Group C11W, Past-chairman of Task Group B15D on Cable Accessory Diagnostics, Past Chairman of the Transnational Subcommittee on Underground Cables, and immediate past Chair of the Communications Committee. I am on the International Scientific and Technical Committees of Jicable (Paris) and has published over 70 papers on the applications of underground transmission, offshore submarine cables, distribution power cables and accessories and has given many presentations to the IEEE, ICC, research institutes, universities, manufacturers, and utilities worldwide. I am a member of CIGRE based in Paris and is presently the Convener of Working Group B1.54 on "Behaviour of Cable Systems under Large disturbances." I have given invited presentations and seminars in Australia, Brunei, Canada, China, Hong Kong, Indonesia, India, Japan, Korea, Malaysia, New Zealand, Singapore, Sweden, Thailand and the US. At present I hold six US, Canadian and International patents on cable diagnostics. The first edition of the book entitled "Long-life XLPE Insulated Power Cables" joint with Rick Hartlein of Georgia Tech was published in 2006 and the second edition was published with Dr. Nigel Hampton at UL in April 2021. I was a member on the Board of Governors for the EIC and is a Registered

Professional Engineer in the Province of British Columbia, Canada.

Q5. Do you hold any licenses or certifications?

A5. Yes, I hold a Professional Engineer certification (P. Eng.).

Q6. Have you published professional articles regarding topic areas that are relevant to this Application?

A6. Yes, I have published over seventy (70) professional papers on the applications of underground transmission, offshore submarine cables, distribution power cables and accessories.

Q7. Have you authored any recent articles on cable technology and electric grid disruptions?

A7. Yes. I have published 8 papers since 2018, with topics including from the life cycle of XLPE insulated power cables, strategies for managing cable corrosion, and the effect of new water-blocking materials on cable conductivity. I also have a forthcoming technical report with Working Group for the International Council on Large Electric Systems (CIGRE) titled "Behavior of Cable Systems under Large Disturbances."

Q8. Have you performed any prior consulting work in the geographic area of the proposed facility?

A8. Yes. I was a consultant on several projects in Boston for NSTAR. I also did consulting work on the Cross Sound submarine cable and on a second transmission cable in New York State. All of this consulting work concerned failures or other issues in installation or operation.

Q9. What is your involvement in the present proceeding?

A9. To provide expert opinions regarding the underground cable technology and installation that could be implemented in this Application, including the cost and timing for constructing the project underground.

Q10. Did you prepare a report for this matter entitled "Connecticut Siting Council Docket No. 516 Analysis RE: Fairfield-Congress Rebuild Project 115 kV Underground Cable Configuration Alternatives"?

A10. Yes, and a copy of that report is attached hereto as **Exhibit 2.**

Q11. Did you review the Application and all relevant paperwork filed by The United Illuminating Company ("UI") in this matter (Docket No. 516)?

A11. Yes, I reviewed the application and other relevant documents and testimony submitted by UI in this proceeding.

Q12. Did you have an opportunity to inspect the project site?

A12. Yes, on November 3, 2023, I physically inspected the area of the proposed project. Figure 9-1, pages 9-9 and 9-10 of the CSC Application, "General Location of All-Underground 115kV Route Evaluated for the Project" as used as a guide for the inspection. The site inspection photographic record is presented in Figures 8 to 26 in my report (Exhibit 2).

Q13. What work did you perform to prepare your Report?

A13. I reviewed the application and other relevant records and testimony that has been submitted in this proceeding. As stated above, I conducted a physical inspection of the area of the proposed project and met with affected property owners and local officials in the area. I independently researched and analyzed cost figures and timing estimates, including within the local market, to construct the underground cable system for this project.

Q14. What work did you do to determine the local market for costs and timing?

A14. Cost figures and timing estimates within the local market were provided by the City of Norwalk Department of Public Works and Division of Engineering and Wellsdach Electric Corporation. The analysis of the information I received from Norwalk and Wellsdach is included in Sections 3 and 4 (pages 4 to 6) of my report (Exhibit 2).

Q15. Do you believe that UI's project can be cost effectively and timely constructed underground?

A15. Yes.

Q16. What was your analysis that led you to that conclusion?

A16. For a double circuit 115 kV underground cable the maximum trench excavation is 6 to 8 feet deep and approximately 5 feet wide. Examples are provided in Figure 1 in my report where the ROW width is much less than the 115 kV OH construction as depicted in Figure 28 of the report. Tree clearing and loss of vegetation buffer is minimum for underground installation, or not at all.

Joint bays (splice chambers) will be required approximately every 1800 m or 6000 feet, depending upon cable drum capacity, along the cable route. This means that ten or eleven joint bays or vaults will be required for the project. The dimensions of each joint bay for the two circuit 115 kV transmission line will be approximately 8 feet wide by 8 feet deep by 12 feet long.

The first costs for an OH steel monopole project provided by Eversource are $4,334,499 per mile, but for UI the cost is $10,819,493, a marked difference. And this figure is very close to the Norwalk City estimate of $12M per mile for an underground cable project.

HDD could be used at two river crossing at Mill River and Ash Creek as well as the modified route under Southport Harbor. The advantage of HDD is that the local environmental impact will be minimum. (See Figures 4, 18, 22 and 24 in my report)

Furthermore, the presence of other buried utilities such as water, sewer, storm sewer and gas is normal for most underground installations and do not create a major deterrent for project progress. Plus, underground cable entry into the Ash Creek and Congress Street substations for underground cables is once again normal procedure, plus the space required for the cable terminations is adequate. See Figure 12 in my report for the Ash Creek substation. Normally right of way excursion is not required. A 20 feet distance from the 345 kV UG transmission cable is unnecessary and not warranted. Thermal analysis will assess the interaction between the two cable systems, suggest optimum spacing, and determine if any remedial action is required. Inclusion of DTS in the 115 kV XLPE cable to monitor hot spots is an option.

I believe that this Project can be constructed underground for a cost of approximately $157,200,000 (single circuit) to $182,300,000 (double circuit) based on the following table of estimated project costs:

Cost Item	Single Circuit	Double Circuit
HV Cable and Accessories	12,700,000	25,400,000
HV Cable Installation	4,430,000	8,860,000
Construction, Excavation Ducts and Vaults	91,000,000	91,000,000
Design and Engineering	90,000	110,000
Final Testing	800,000	1,200,000
Financial and Administration 20%	21,964,000	25,314,000
Contingencies 20%	26,197,000	30,377,000
Project Totals	157,181,000	182,261,000

Q19. What are your overall conclusions with respect to UI's application?

A19. UI cost estimates and excavation timing predictions suggest a lack of understanding and experience with HV underground cable technology. They have grossly overestimated the EPC and O&M costs for an XLPE underground cable system. Cost figures and timing estimates provided by the City of Norwalk and Wellsdach Electric confirm that UI needs to revisit its underground plans and significantly adjust their cost and timing estimates.

Minor adjustment to the underground cable route will eliminate taking large areas of private property, shorten the route, eliminate tree removal, save the vegetation buffer, and reduce overall project costs. Proximity to a 345 kV underground transmission cable as well as other buried utilities is a normal occurrence and should not be used as a deterrent to go underground for this Fairfield - Congress Rebuild Project.

When an underground cable system installation is meticulously planned and every technical detail is covered including respect of environmental issues, the result is an aesthetically pleasing installation, which can be achieved here in a reasonable and cost effective manner.

RESPECTFULLY SUBMITTED BY:
SASCO CREEK NEIGHBORS ENVIRONMENTAL TRUST INCORPORATED, STEPHEN OZYCK, KARIM MAHFOUZ, WILLIAM DANYLKO, DAVID PARKER, 2190 POST ROAD, LLC, INVEST II and INTERNATIONAL INVESTORS

BY: ______________________

Mario Coppola, Esq.
Matthew Studer, Esq.
Berchem Moses P.C.
1221 Post Road East, Suite 301
Westport, CT 06880
Telephone No.: (203) 227-9545
Email: mcoppola@berchemmoses.com
Their Attorneys

CERTIFICATE OF SERVICE

This is to certify that a true copy of the foregoing was electronically mailed and/or deposited in the United States mail, first-class, postage pre-paid this 9th day of November, 2023 to the individuals on the Service List for this Docket, as of November 9, 2023.

Mario F. Coppola, Esq.

EXHIBIT 1

Resume: HARRY ORTON, ASTC, BE, MASc., SLMIEEE, PEng.

Background

Harry Orton received a Diploma in Electrical Engineering in 1964 from Sydney Technical College (ASTC), graduated from the University of New South Wales with a Bachelor of Engineering (Honours) in Electrical Engineering in 1966 and a Master of Applied Science from the University of British Columbia, Vancouver, Canada in 1969. He graduated from the BCIT Venture Program in May 1995.

After graduation in 1969, Harry worked at BC Hydro as an Electrical Research Engineer where he helped build one of the largest utility-based research centers in North America. For over twenty years he worked as a specialist in the field of underground power transmission and distribution cables and accessories. He progressed to the level of section supervisor in charge of Insulation Studies and then to Manager of Technical Activities. He has been a project manager on Canadian Electricity Association (CEATI, Montreal) and Electric Power Research Institute (EPRI, Palo Alto, California) underground cable research projects from 1977 to 1996 and was Chairman of the CEATI Cable Failure Task Force from 1987 until 1993.

In 1994 he went into his own consulting engineering practice as an underground power cable specialist. He is now Principal and Owner of Orton Consulting Engineers International Ltd. based in Vancouver, Canada. Contract work takes him to the US, Asia, the Middle East and to Europe.

Related Experience

Litigation and Deposition Testimony Projects:

1. Wando-Jeju -do ±180 kV HVDC submarine cable for KEPCO, South Korea.
2. 230 kV XLPE cable for Singapore Power.
3. 35 kV XLPE cable failure at Hylsa steel plant in Puebla, Mexico.
4. ±150 kV HVDC Cross Sound submarine cable for the US Department of Justice, New York State.
5. 230 kV XLPE cable investigation for PG&E, San Francisco.
6. 115 kV HPFF transmission cable splice failures at NSTAR for Cooley Manion Jones of Boston.
7. Commonwealth of Virginia Legislature on the Comparison of Overheard and Underground Power Transmission Lines.

8. 345 kV PPLP EHV transmission cable mediation for McGuire Woods of New York.

9. 15 kV separable connectors for Thomas and Betts versus Cooper Industries with Fulbright, Houston, Texas.

10. Hydro Tasmania, 400 kV HVDC Basslink with Clayton Utz, Melbourne, Australia.

11. Midland Metals Singapore versus AMA with Church & Grace, Sydney, Australia,

12. KHNP nuclear power cable LV cable damage with BKL, Seoul, South Korea.

13. Port of Gunam submarine cable failure investigation for KERI, South Korea.

14. Hudson River 350 kV HPFF submarine cable for Paul Weiss, New York.

15. 220 kV termination failure Auckland, New Zealand with GE Renewable Energy.

16. 150 kV Bangka Strait submarine cable damage investigation with SGI, Jakarta, Indonesia, HV Cable Expert.

17. LV substation control cables for Coleman and Horowitt, Fresno, California.

18. MV Coldshrink distribution cable splices with Norton Rose Fulbright, New York, NY.

19. 150 kV Bangka Strait submarine cable failure investigation for PLN, Jakarta, Indonesia, HV Cable Expert.

Professional Activities

Harry is very active in the IEEE, Insulated Conductors Committee (ICC) as Past-chairman of Task Group A2D on the Characteristics of Semiconductive Shields, Chairman of the Submarine Cable Working Group C11W, Past-chairman of Task Group B15D on Cable Accessory Diagnostics, Past Chairman of the Transnational Subcommittee on Underground Cables, and immediate past Chair of the Communications Committee. Harry is on the International Scientific and Technical Committees of Jicable (Paris) and has published over 70 papers on the applications of underground transmission, offshore submarine cables, distribution power cables and accessories and has given many presentations to the IEEE, ICC, research institutes, universities, manufacturers, and utilities worldwide. He is a member of CIGRE based in Paris and is presently the Convener of Working Group B1.54 on "Behaviour of Cable Systems under Large Distrubances". Harry has given invited presentations and seminars in Australia, Brunei, Canada, China, Hong Kong, Indonesia, India, Japan, Korea, Malaysia, New Zealand, Singapore, Sweden, Thailand and the US. At present he holds six US, Canadian and International patents on cable diagnostics. The first edition of the book entitled "Long-life XLPE Insulated Power Cables" joint with Rick Hartlein of Georgia Tech was published in 2006 and the second edition was published with Dr. Nigel Hampton at UL in April 2021.

Harry was a member on the Board of Governors for the EIC and is a Registered Professional Engineer in the Province of British Columbia, Canada.

Rewards

2003	"Technical Council Committee of the Year Award", Insulated Conductors Committee, Transnational Activities Committee.
2003	"Review of Metro Vancouver 230 kV Transmission Supply Development", Consulting Engineers of BC, Award of Merit, Category 4 - Soft Engineering, with Sandwell Engineering.
2005	"Technical Committee Distinguished Service Award", IEEE Power Engineering Society, Insulated Conductors Committee.
2007	Inducted into the EIC Hall-of-fame.
2011	Excellent Foreign Expert Honour, Ningbo Municipal Government, Zhejiang Province, China.

Recent Publications

Harry has published over 70 papers on the applications of underground transmission, offshore submarine cables, distribution power cables and accessories. The following is a list of the most recent publications.

1. "Behaviour of Cable Systems under Large Disturbances", CIGRE WG B1.54, Pending publication 2023.

2. "Influence of water blocking materials on the performance and conductivity of aluminium conductors", with Detlef Wald, Jicable 2023, Lyon, France, June 2023.

3. "Safety: a crucial issue to sustainability on insulated cable systems", CIGRE WG B1.71, with Julio Lopes, et al, May 2021.

4. "Recommendations for testing DC extruded cable systems for power transmission at a rated voltage up to and including 800 kV", CIGRE WG B1.62, with Franchi Bononi, Davide Pietribiasi et al, May 2021.

5. "Long-life XLPE Insulated Power Cables", second edition with Nigel Hampton, April 2021. Published by Borealis, Sweden and Dow, USA.

6. "XLPE Based Products Available in the Market and Their Applications", with Detlef Wald, Chapter 12, "Crosslinkable Polyethylene Based Blends and Nanocomposites", Springer Publications, April 2021, ISBN: 978-981-16-0486-7

7. "Indispensable Insulated Conductors", IEEE, DEIS EIM (Electrical Insulation Magazine), Editorial, Volume 35, Number 5, September/October 2019.

8. "Behaviour of Cable Systems under Large Disturbances-Status Report", with CIGRE WG B1.54, Jicable 2019, Versailles, France, Paper D7.3, June 25, 2019.

9. "Corrosion, we just have to live with it", with Detlef Wald, Srecko Aljinovic and Toni, Dropulic, Jicable 2019, Versailles, France, Paper A5.1, June 25, 2019,

10. "Implementation of Long AC HV and EHV Cable Systems", with CIGRE WG B1.47, CIGRE TB 680, March 2017.

11. "Development of an Alternative Solution to Mica Tape for Fire Resistance Cables", with Detlef Wald, Jicable, June 2015, Paper C10.1.

12. "Power Cable Technology Review", High Voltage Engineering, Vol.41, No.4, April 30, 2015, pp 1057-1067.

13. "Offshore Generation Cable Connections", with CIGRE WG B1.40, CIGRE TB610, February 2015.

14. "Impact of EMF on Current Ratings and Cable Systems", with CIGRE WG B1.23, ICSGTEIS, November 5-7, 2014, Bali, Indonesia.

15. "Impact of EMF on Current Ratings and Cable Systems", Convenor of CIGRE WG B1.23, CIGRE TB 559, Published December 2013.

16. "History of Underground Power Cables", IEEE, DEIS, Insulation Magazine, July/August 2013, Vol. 29, Number 4, page 52.

17. "Testing of Long AC Submarine Cables", with Anders Gustafsson, et al, CIGRE WG B1.27, January 2012. CIGRE TB 490, Published in February 2012.

18. "Submarine Cable Metallic Sheath Diagnostic", with Avaral Rao, Dave Hicks and Dave Gung, Jicable 2011 Proceedings, Paper A.7.1, Page 262, Volume 1, 19-23 June 2011.

19. "Impact of Electromagnetic Fields on Current Ratings and Systems", with Paolo Maioli, Heiner Brakelmann, Jarle Bremnes, Frederic Lesur, Josu Orella Sanez and Jacco Smit, Jicable 2011 Proceedings, Paper B.1.1, Page 382, Volume 1, 19-23 June 2011.

20. "Improved Cooling of High Voltage Cables", with Detlef Wald, Herbert Nyffenegger, and George Anders, Jicable 2011 Proceedings, Paper C.10.4, , Page 245, Volume 2, 19-23 June 2011.

21. "Impact of Electromagnetic Fields on Current Ratings and Systems", with Paolo Maioli, Heiner Brakelmann, Jarle Bremnes, Frederic Lesur, Josu Orella Sanez and Jacco Smit, Paper 55, EMF ELF Colloquium, Paris, France March 24-25, 2011.

22. "Fluid-filled Underground Transmission Cable Condition Assessment", with Lisa Ogawa and David Arnold, Conference Record of the 2010 IEEE International Symposium on Electrical Insulation, Page 565, San Diego, California, 6-10 June 2010.

23. "Requirements for Different Components in Cables for Offshore Applications", with Detlef Wald, Roman Svoma, CIRED Prague, 8-11 June 2009.

24. "Condition Assessment of Fluid-Filled MV and HV Underground Power Cables", CEATI Underground Cable Workshop, Vancouver, BC Canada, March 4-5, 2008

25. "Long-Life XLPE Insulated Power Cables", with Rick Hartlein, Nigel Hampton, Hakan Lennartsson and Ram Ramachandran, Conference on the Applications of Polymers to Electrical Apparatus, October 4-6, 2007, Bangalore, India.

26. "Long-life XLPE Insulated Power Cables", with Rick Hartlein, Nigel Hampton, Hakan Lennartsson and Ram Ramachandran, Jicable 2007, Versailles, France, Paper 5.1.5, Page 593.

EXHIBIT 2

Connecticut Siting Council Docket No. 516

Analysis RE: Fairfield-Congress Rebuild Project

115 kV Underground Cable Configuration Alternatives

Submitted by: Harry E. Orton, PEng.
Orton Consulting Engineers International Ltd.
Box 38715 Metropolitan PO,
North Vancouver, BC V7M 3N1
Canada.

Phone: 604 722 3234
Fax: 604 929 3802
Email: h.orton.1966@ieee.org

Date: 6 November 2023.

Executive Summary

The United Illuminating Company ("UI") cost estimates and excavation timing predictions suggest a lack of understanding and experience with high voltage ("HV") underground cable technology. They have grossly overestimated the engineering, procurement and construction ("EPC") and operations and maintenance ("O&M") costs for an XLPE underground cable system. Cost figures and timing estimates within the local market provided by the City of Norwalk and Wellsdach Electric Corporation suggest that UI need to revisit their Connecticut Siting Council ("CSC") project application and adjust their cost estimates for an XLPE underground cable system.

Minor adjustment to the underground cable route will eliminate taking private property, shorten the route, eliminate tree removal, save the vegetation buffer, and reduce overall project costs. Proximity to a 345 kV underground transmission cable as well as other buried utilities is a normal occurrence and should not be used as a deterrent to go underground for the Fairfield - Congress Rebuild Project (the "Project").

When an underground cable system installation is meticulously planned and every technical detail is covered, including respect of environmental issues, the result is an aesthetically pleasing installation.

1.0 Table of Contents

2.0 Background

The undergrounding of electrical power systems in comparison to overhead systems reduces global warming gases such as ozone, produced by corona discharge on overhead line conductors. Undergrounding of electrical power systems, both transmission and distribution, is part of clean energy policies and best practices and a shift to a clean energy economy. Community members in every state are working with local leaders in support of stronger climate pollution standards.

In Canada registered professional engineers abide by a code of ethics as part of their licencing and registration that binds them to consider climate change, public safety and commit to environmentally sound projects. They are required to consider all opinions on proposed projects and to make sound and wise decisions based upon the Profession Engineers of BC Climate Change Action Plan ("EGBC CCAP"). Failure to do so could result in the loss of licence to practice.

This report provides a comparison between overhead and underground electrical transmission lines. The comparative analysis includes initial and life cycle costs, installation times, aesthetics, environmental impact, ROW widths, vegetation buffers and the application of HDD. Support for the comparative data was received from Norwalk City Operations and Public Works and Wellsdach Electric in NYC.

Suggested underground cable route modifications will not take private property and will reduce the route length.

3.0 Meeting with Ms. Vanessa Valadares, PE.

Construction and installation costs as well as project duration are specific to location. So, to gain an understanding of overall project costs and timing for a potential underground project in Connecticut, I attended a meeting on November 3, 2023 with Ms. Vanessa Valadares, City of Norwalk Chief of Operations and Public Works. As part of her duties, Ms. Valadares oversees the engineering and construction division of the Public Works Department. Ms. Valadares is also an accomplished professional engineer.

Over the years, Ms. Valadares has been involved with numerous underground cable projects on behalf of the City of Norwalk, including projects with Eversource, another electric supply company providing service to Norwalk, CT. Ms. Valadares provided me with her firsthand knowledge of both costs and project timing.

Ms. Valadares suggested that for estimating costs, we may consider a current project in the East Norwalk section of the City of Norwalk. That project is part of the Walk Bridge associated projects being administrated by the Connecticut Department of Transportation ("CT DOT"). That project was for the undergrounding of approximately one mile on East Avenue from Winfield Street to Fort Pointe Street in Norwalk. The total cost of the project is approximately twelve million dollars ($12,000,000).

Ms. Valadares estimated that the total time to complete that project in Norwalk would be around three (3) years. This time estimate was based on a requirement of about two years for design and permitting approvals and an additional period of 12 months or less for installation. She did not think that we would encounter any significant supply chain issues for a similar project in Bridgeport/Fairfield.

Ms. Valadares mentioned that aesthetics, and in particular tree conservation, is of high importance. Initial costs are used as guidance and normally lifetime costs are included in the cost assessment equation. There is no charge to an underground cable owner for a ("ROW") on Norwalk City property and roadways. Furthermore, relocation of contaminated soil can be an issue, for example where the battery manufacture plant was located. In the past local contractors were hired for trenching, but out-of-state contractors ("Big Players") were brought in for more specialized work such as HDD installation and cable pulling.

Ms. Valadares' goal is to install underground cables in the City of Norwalk where ROW widths are much less for UG cable thus occupying less city and residential land. She emphasized that people do not like change, so maintaining or improving the aesthetics of city and residential streets is very important.

4.0 Conversation with Mr. Mitch Mailman.

On November 5, 2023, I had a teleconference with Mr. Mitch Mailman, who is general manager of Wellsdach Electric Corporation, which is one of the largest commercial electrical contractors in New York City specializing in outdoor electrical construction and maintenance, including complete design build construction.

Mr. Mailman and Wellsach provide construction services to utilities in New York State for both overhead and underground projects. The major focus is on underground cable projects for large utilities such as Consolidated Edison of New York, (ConEd). His project locations have included Manhattan where there are no overhead lines and all electrical transmission and distribution is underground. In fact, underground cables have been installed in New York City since around 1890 when they were invented by Thomas Edison. Furthermore, HPFF cables have been installed in NYC since the 1930's, Self Contained Fluid Filled ("SCFF") cables since 1950 and XLPE insulated cables since 1995.

Mr. Mailman is involved in projects in the streets of NYC daily where there are telephone cables, Fiber Optic Cables ("FOC"), water supply pipes, office and apartment power cables, transmission cables up to 345 kV, street lighting cables, sewage pipes and high-pressure gas pipelines. During underground cable construction other utility installations are located, identified and construction proceeds without slowing the excavation rate. He has installed both HPFF and XLPE cables from 1.0 kV to 345 kV in Manhattan and the surrounding areas. The network of underground utilities in NYC in roadways and sidewalks is far more complex and congested than any location in both Fairfield and Bridgeport so the costs in these locations will be much lower. In addition, vehicular traffic control in Connecticut will be far less onerous than in NYC, so the costs of this service will be correspondingly lower.

Details of recent Engineering, Procurement and Construction ("EPC") projects were provided. The first project was on Staten Island for 4 miles, double circuit, for 24,600 feet (4.6 miles) for a total EPC cost of $132M. The second project was in Queens, single circuit, 16 manholes for one hundred and forty million dollars ($140,000,000) EPC. The excavation rate was 125 feet per day. And the third project mentioned was a 345 kV transmission cable project where the EPC cost was less than forty million dollars ($40,000,000) per mile, plus much of the cable route was through solid rock requiring blasting. These are actual costs in NYC; equivalent projects in Fairfield and Bridgeport will cost much less since the complexity of the project installation will be much lower.

Mr. Mailman provided further comments:

- OH lines require wide ROW spacing and hence tree removal or loss of vegetation buffer for audible noise and aesthetics.
- UG cables require much less ROW width.
- An UG installation will not take private property.
- Heating from other UG cables such as a 345 kV transmission cable is not an issue and 20 feet spacing is not necessary.
- Submarine cables by-passing the community and following a subsea route is not an option in this location. Installing cable across the mud flats is difficult.
- Minimum power system interruption is required during installation of the underground cables.
- Routing of UG cables along the MNR train tracks is out of the question.
- UG is safer than OH as a downed and energized lines can lead to a fire situation.
- UG is more reliable than OH.

5.0 UG Project Alternative Cost

When comparing overhead ("OH") and underground ("UG") costs, the lifetime costs must be considered not just the initial costs. Underground cables will usually be more expensive based upon the initial costs only but for a lifetime of 40 years or greater, UG becomes more attractive. So, when comparing cost estimates, the maintenance and repair costs for each technology over a 40-year lifetime must be included.

Shipping length on a cable drum depends upon route access by road or by barge on the water. For this project, the 115 kV drum length is approximately 1800 m or 6000 ft, which translates into approximately 10 joint bays or vaults. Cost savings can be achieved by installing sufficient ducts in the duct bank for two circuits even though only one circuit will be installed initially. See Figures 1 and 3.

In Florida, Hurricanes Michael and Irma collectively knocked out power for 6.5 million Floridians in a two-year period (2017-2018);, some for two weeks or more. State Senator Joe Gruters wondered "why are we putting up those same poles?" Putting the lines back up cost millions of dollars so Senator Gruters sponsored a bill that seeks to prevent massive power outages in future storms by "hardening the electric grid". Florida utility companies will develop a long-term 30-year plan to underground 4 percent of the grid every year that would prevent customers from seeing large rate increases. [1]

UG cables are out-of-sight, so aesthetics is a major advantage. When comparing the two technologies the following issues must be considered:

1. EMF (Electro Magnetic Fields) exposure with overhead lines. There is no electric field external to an UG cable and the magnetic field attenuates rapidly with distance from an UG cable ROW. Walking under an OH line with a high electrical field can be detected by hair movement on the body.
2. OH line audible noise during fog or light rain, due the corona discharge around the conductor surface. Corona discharges are mini arcs or a glow discharge around the conductor that are visible at night due to oxidation of the air caused by high electrical stress. This phenomenon can be very annoying to anyone close to an overhead transmission line.
3. Surface tracking and arcing on OH line insulators and support structures (loose hardware like nuts and washers) produces audible noise, television and radio interference and a visible glow at night.
4. TVI and RIV, television and radio interference, due to corona discharge around the conductor surface produces moving black lines on the TV screen and a frying sound on an AM radio.
5. Ozone production, a global warming gas, is produced by corona discharge oxidizing the air.
6. OH lines require continual maintenance such as tree trimming and insulator repairs.
7. Unplanned outages occur more frequently with OH due to major disturbances such as ice storms, hurricanes, and windstorms. UG cable systems are more reliable as they are underground and out of harm's way.
8. Public safety concerns due to vehicular collisions with the infrastructure and exposure to bare energized conductors. High resistance faults can be very dangerous for the public and can initiate wildfires.
9. Risk of public and wildlife electrocution.

UI have limited underground cables on their power grid, 28.8 miles, so it is not clear if they have an experienced underground cable engineer on staff. The voltage ratings and cable types of the installed cables are not available.

Most underground cable systems approach other utilities, in fact it is a normal situation that most contractors are aware of and have extensive experience dealing with. There is nothing new or different to be concerned about. Also, proximity to another cable such as 345 kV is not unusual. A spacing of 20 feet is not warranted nor necessary. Thermal studies are standard analytical tools to assess the operation of both cable systems. In addition, DTS (Distributed Temperature Sensing) can be used to monitor the operating temperature of the 115 kV cable system.

Substation UG cable entry and termination is not an insurmountable task as suggested. Connection to substation equipment is similar to an OH connection with the addition of cable terminations. Surge arresters, bus couplers, potential and current instrument transformers, and associated switchgear are the same. Furthermore, transition from OH to UG transition on a monopole structure is depicted in Figure 5.

6.0 Site Inspection

A site inspection was carried out on Friday November 3, 2023, with the assistance of Mr. Steve Ozyck. Figure 9-1, Pages 9-9 and 9-10 of the CSC Application "General Location of All-Underground 115 kV Route Evaluated for the Project" was used a guide for the inspection. The site inspection photographic record is presented in Figures 8 to 26. The salient features of the inspection can be summarized as:

1. Installing an underground 115 kV cable system will relieve congestion in the Congress Substation area, as well as other sections along the MNR train tracks. (Figures 10, 13 and 14)
2. The proposed UG cable route has very few limitations or major obstacles. (Figures 11, 13, 16, 17, 21, 25)
3. There is adequate space in the Ash Creek substation to accommodate two circuits of 115 kV cable terminations. (Figure 12)
4. OH lines can be very dangerous as an electrocution hazard due to exposed energized conductors when close to apartment and office buildings. (Figure 15)
5. There are several creek crossings with bridges where the UG cable can be supported by the bridge or HDD used under the creek. (Figure 18)
6. The Pequot Library would lose the vegetation buffer increasing noise levels and exposing the building to rail traffic reducing the aesthetic appeal of the building. (Figures 19, 20)
7. One recommended modification is to re-route the cable to the northern side of the golf course and go under Southport Harbor with HDD. (Figures 21 to 24)
8. A second route modification is to divert the cable route along the DOT dirt road before transitioning to the overhead system at P648S. (Figures 25, 27)

7.0 Document Review

7.1 Life-Cycle 2022 Report, January 5, 2023

Estimated Life-Cycle Cost Components per mile for 115 kV XLPE single circuit are listed on Page 10. The following table compares cost estimates provided from other sources.

Estimate Source	EPC/Circuit Mile	O&M/Circuit Mile (1)
CSC Eversource	$20,840,500	$20,155 (2)
United Illuminating	$100,000,000	$34,501 (2)
Norwalk City	$12,000,000	
Wellsdach Electric, NYC	$37, 000,000	
US Cable Supplier	$17,148,482 (3)	NA

Footnotes:
1. It is not clear if the O&M costs for Eversource and UI are for HPFF or XLPE.
2. Average cost for 5 years 2017 to 2021. This figure has decreased over the last five years. UI has 28.8 circuit miles of UG and Eversource has 119.73 miles.
3. Civil work is not included, cable materials and installation only.

Costs of Electrical Losses (Page 12) are similar for OH and UG. For a residential load, the load factor of about 0.4 is reasonable and this yields the loss factor of between 0.2 and 0.3. And for industrial loads a minimum of 0.75 for the load factor is assumed. Some industries, that operate 24h might have a load factor of 1.0. For 115 kV XLPE cables it is reasonable to neglect dielectric losses as they are very small. The dispersion of residential and industrial loads has not been given.

7.2 Fairfield – Congress Rebuild Project. CSC Application

A detailed UI viewpoint on the 115 kV Underground Cable Configuration Alternatives is presented in the Fairfield-Congress Rebuild Project – CSC Application, March 2023.

The vast majority of electrical transmission lines in Connecticut and the US are OH lines (Page 9-4). But in cities the situation is very different. For example, all cables in NYC, both transmission and distribution, are underground. So, when making comparisons the exact details must be considered.

For a double circuit 115 kV underground cable the maximum trench excavation is 6 to 8 feet deep and approximately 5 feet wide. Examples are provided in Figure 1 where the ROW width is much less than the 115 kV OH construction as depicted in Figure 28. Tree clearing and loss of vegetation buffer is minimum for UG, or not at all, and taking of private property in avoided.

Joint bays (splice chambers) will be required approximately every 1800 m or 6000 feet, depending upon cable drum capacity, along the cable route. This means that ten or eleven joint bays or vaults will be required for the project. The dimensions of each joint bay for the two circuit 115 kV transmission line will be approximately 8 feet wide by 8 feet deep by 12 feet long.

The first costs for an OH steel monopole project provided by Eversource are $4,334,499 per mile, but for UI the cost is $10,819,493, a marked difference. And this figure is very close to the Norwalk City estimate of $12M per mile for an underground cable project. The figures for O&M are confusing, as clarification is needed. The OH O&M costs are greater than the UG, but the text states the opposite.

HDD could be used at two river crossing at Mill River and Ash Creek as well as the modified route under Southport Harbor. (Page 9-11) The advantage of HDD is that the local environmental impact will be minimum. (See Figures 4, 18, 22 and 24)

Furthermore, the presence of other buried utilities such as water, sewer, storm sewer and gas is normal for most UG installations and do not create a major deterrent for project progress. Plus, underground cable entry into the Ash Creek and Congress Street substations for underground cables is once again normal procedure, plus the space required for the cable terminations is adequate. See Figure 12 for the Ash Creek substation. Normally ROW excursion is not required. A 20 feet distance from the 345 kV UG transmission cable is unnecessary and not warranted. Thermal analysis will assess the interaction between the two cable systems, suggest optimum spacing, and determine if any remedial action is required. Inclusion of DTS in the 115 kV XLPE cable to monitor hot spots is an option.

I believe that this Project can be constructed underground for a cost of approximately $157,200,000 (single circuit) to $182,300,000 (double circuit) based on the following table of estimated project costs:

Cost Item	Single Circuit	Double Circuit
HV Cable and Accessories	12,700,000	25,400,000
HV Cable Installation	4,430,000	8,860,000
Construction, Excavation Ducts and Vaults	91,000,000	91,000,000
Design and Engineering	90,000	110,000
Final Testing	800,000	1,200,000
Financial and Administration 20%	21,964,000	25,314,000
Contingencies 20%	26,197,000	30,377,000
Project Totals	157,181,000	182,261,000

8.0 Concluding Comments

UI cost estimates and excavation timing predictions suggest a lack of understanding and experience with HV underground cable technology. They have grossly overestimated the EPC and O&M costs for an XLPE underground cable system. Cost figures and timing estimates provided by the City of Norwalk and Wellsdach Electric confirm that UI needs to revisit its UG CSC project application and adjust their estimates.

Minor adjustment to the underground cable route will eliminate taking large areas of private property, shorten the route, eliminate tree removal, save the vegetation buffer, and reduce overall project costs. Proximity to a 345 kV underground transmission cable as well as other buried utilities is a normal occurrence and should not be used as a deterrent to go underground for this Fairfield - Congress Rebuild Project.

When an underground cable system installation is meticulously planned and every technical detail is covered including respect of environmental issues, the result is an aesthetically pleasing installation as indicted in Figures 2, 6 and 7.

9.0 References

[1] Capitol News Service, Tallahassee, Florida, March 08, 2019.

[2] "Long-life XLPE Insulated Power Cables", Harry Orton and Nigel Hampton, Book published by Borealis, Sweden. https://www.borealis.solutions/xlpe-insulated-power-cables-handbook/

10.0 Appendix A – Acronyms

AC	Alternating Current
CSC	Connecticut Siting Council
DC	Direct Current
DOT	Department of Transport
EHV	Extra High Voltage (345 kV)
EPC	Engineering, Procurement and Construction
FOC	Fiber Optic Cable
HDD	Horizontal Directional Drilling
HV	High Voltage (115 kV)
HVAC	High Voltage Alternating Current
OCEI	Orton consulting Engineers International
OH	Overhead transmission lines
O&M	Operating and Maintenance
PVC	Polyvinylchloride
ROW	Right-of-way
SCFF	Self-Contained Fluid Filled Cables
UG	Underground cables
UI	The United Illuminating Company
XLPE	Cross Linked Polyethylene

11.0 Appendix B - Photographs

Figure 1. Trench design, direct buried flat configuration (left) and duct bank (right). (Courtesy Southwire) [2]

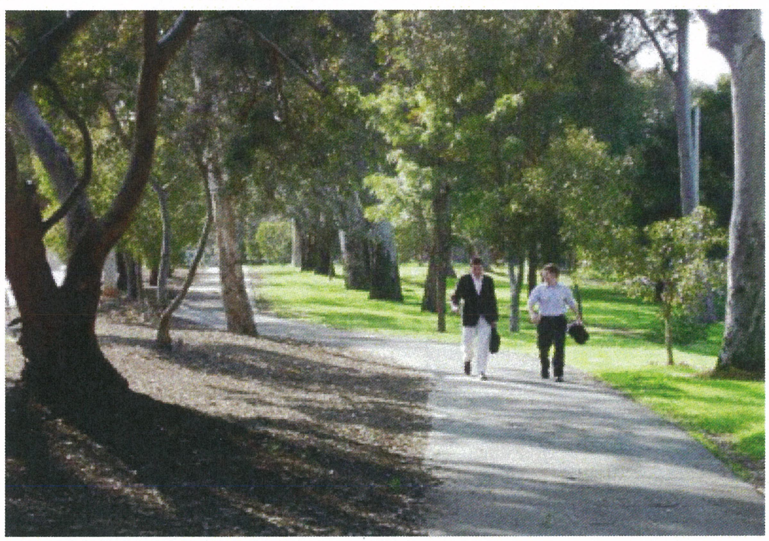

Figure 2. Large trees lining the route of a 275 kV direct buried cable. (Courtesy of ElectraNet/OCEI) [2]

Figure 3. Underground cable upgrading program in a duct system, pulling (left) and cable feed (right). (Courtesy of BC Hydro/OCEI) [2]

Figure 4. HDD (Horizontal Directional Drilling) [2]

4893-2865-3199, v. 1

Figure 5. 110 kV single circuit vertical transition tower from OH to UG with well positioned surge arresters. (Courtesy of Powerlink) [2]

Figure 6. In-road installation of a 138 kV transmission cable. Only the manhole covers are visible. (OCEI)

Figure 7. 275 kV XLPE cable installation under pathway through a residential area. (OCEI).

Figure 8. UI vehicle displaying the corporate logo "Energy ideas from the world to you".

Figure 9. Bridgeport generation plant.

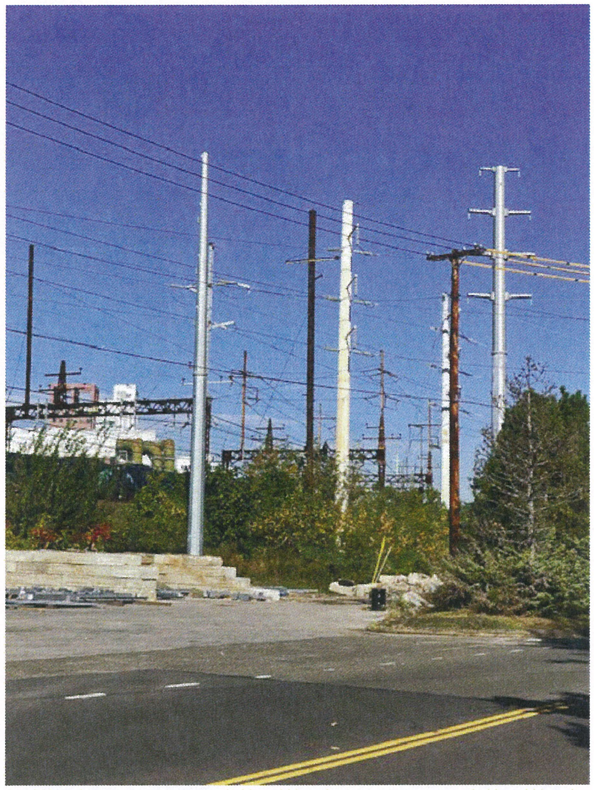

Figure 10, Overhead line congestion adjacent to Congress Substation.

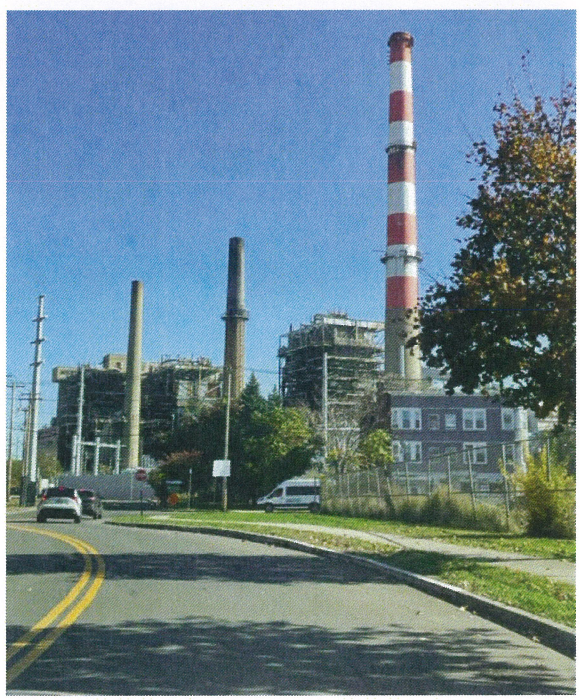

Figure 11. Road or sidewalk access for underground cable route.

4893-2865-3199, v. 1

Figure 12. Ash Creek Substation yard with ample room for UG cable terminations.

Figure 13. Road access for UG cables. The OH distribution (right) could also be placed in the UG cable duct.

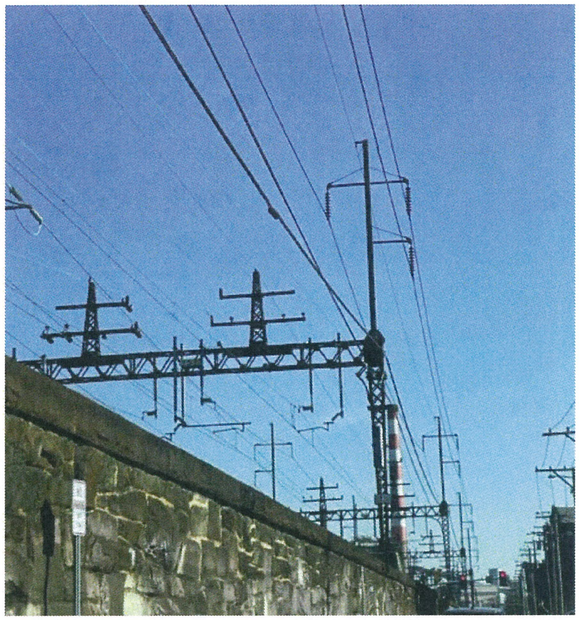

Figure 14. Railway overhead catenary and bonnet construction.

Figure 15. Dangerous OH line installation close to offices and apartments.

4893-2865-3199, v. 1

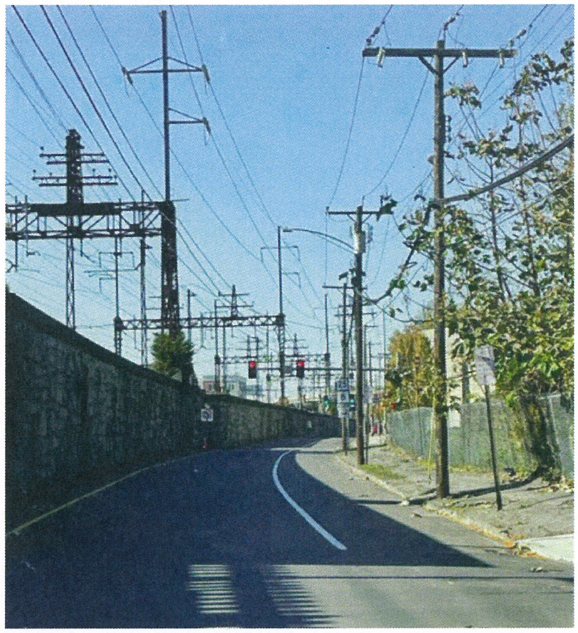

Figure 16. Underground cable route with easy road access. Distribution line (right) could be installed in the duct system.

Figure 17. Underground cable route under the highway eliminating the need for very high OH line monopole towers. (see Figure 13)

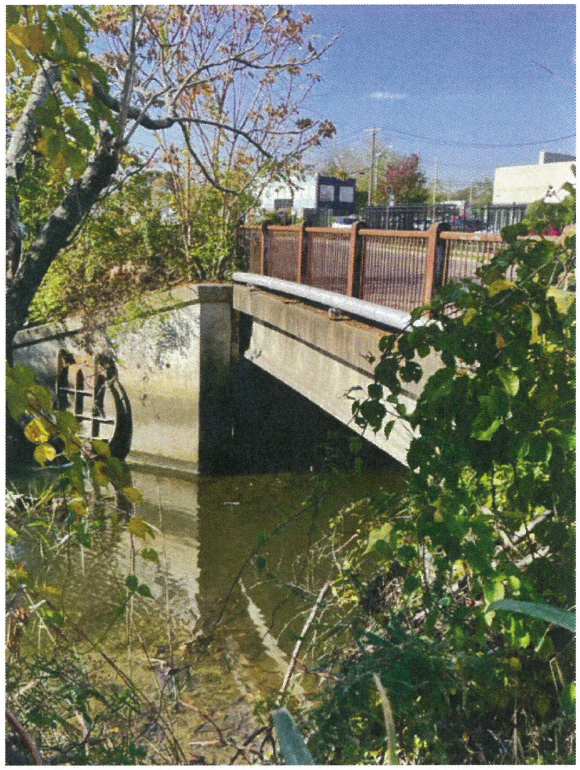

Figure 18. One of several river crossings at Mill River and Ash Creek. HDD, or support pipes attached to the bridge structure may be used.

Figure 19. Pequot Library.

Figure 20. Pequot Library would lose the vegetation buffer increasing noise levels and exposing the building to rail traffic reducing the aesthetic appeal of the building.

Figure 21. Modified route along the golf course road reducing route length and allowing HDD access under Southport Harbor.

4893-2865-3199, v. 1

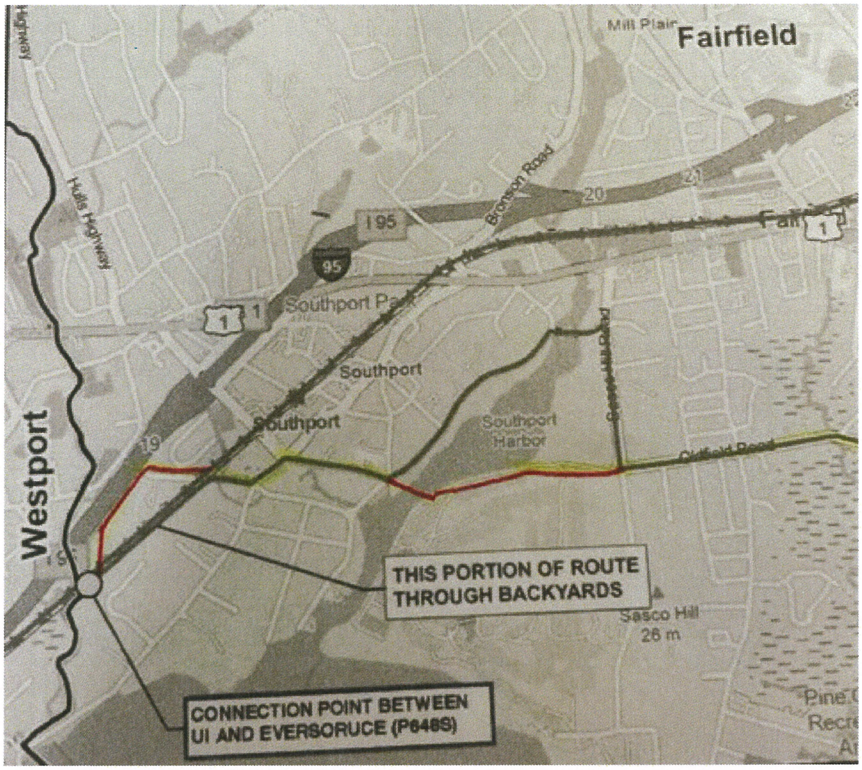

Figure 22. Section of Figure 9-1 General Location of All-Underground 115 kV Cable Route Evaluated for the Project, Page 9-9, CSC Application, March 2023. Red lines suggest cable route improvements that shorten route and do not take private property. HDD under Southport Harbor (right red line) and utilize DOT dirt road (left red line) Courtesy of Mr. Steve Ozyck.

Figure 23. Southport Golf clubhouse. Underground cables on the golf course road will not interfere with the golf course or restrict the view.

Figure 24. Proposed location of HDD on east side of Southport Harbor.

Figure 25. Road access from Southport Harbor.

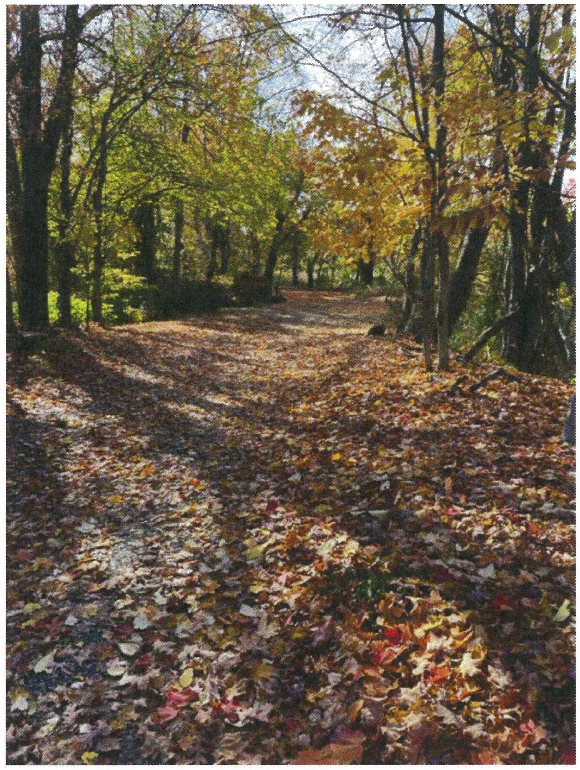

Figure 26. Proposed route modification along DOT dirt road to connection point between UI and Eversource (P648S). Modification would not take private property.

Figure 27. Connection point between UI and Eversource (P648S)

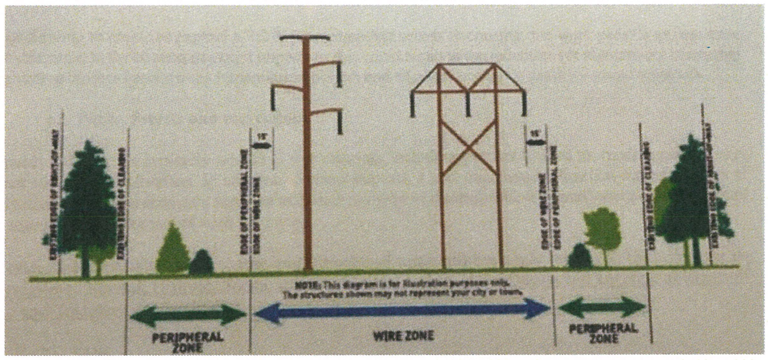

Figure 28. FERC Vegetation Management Recommendations, Figure 5, Page 18 of 32, Life Cycle 2022, CSC Report, January 5, 2023. An underground cable ROW would not be as wide as one OH line structure.

Resume: HARRY ORTON, ASTC, BE, MASc., SLMIEEE, PEng.

Background

Harry Orton received a Diploma in Electrical Engineering in 1964 from Sydney Technical College (ASTC), graduated from the University of New South Wales with a Bachelor of Engineering (Honours) in Electrical Engineering in 1966 and a Master of Applied Science from the University of British Columbia, Vancouver, Canada in 1969. He graduated from the BCIT Venture Program in May 1995.

After graduation in 1969, Harry worked at BC Hydro as an Electrical Research Engineer where he helped build one of the largest utility-based research centers in North America. For over twenty years he worked as a specialist in the field of underground power transmission and distribution cables and accessories. He progressed to the level of section supervisor in charge of Insulation Studies and then to Manager of Technical Activities. He has been a project manager on Canadian Electricity Association (CEATI, Montreal) and Electric Power Research Institute (EPRI, Palo Alto, California) underground cable research projects from 1977 to 1996 and was Chairman of the CEATI Cable Failure Task Force from 1987 until 1993.

In 1994 he went into his own consulting engineering practice as an underground power cable specialist. He is now Principal and Owner of Orton Consulting Engineers International Ltd. based in Vancouver, Canada. Contract work takes him to the US, Asia, the Middle East and to Europe.

Related Experience

Litigation and Deposition Testimony Projects:

1. Wando-Jeju -do ±180 kV HVDC submarine cable for KEPCO, South Korea.
2. 230 kV XLPE cable for Singapore Power.
3. 35 kV XLPE cable failure at Hylsa steel plant in Puebla, Mexico.
4. ±150 kV HVDC Cross Sound submarine cable for the US Department of Justice, New York State.
5. 230 kV XLPE cable investigation for PG&E, San Francisco.
6. 115 kV HPFF transmission cable splice failures at NSTAR for Cooley Manion Jones of Boston.
7. Commonwealth of Virginia Legislature on the Comparison of Overheard and Underground Power Transmission Lines.

8. 345 kV PPLP EHV transmission cable mediation for McGuire Woods of New York.

9. 15 kV separable connectors for Thomas and Betts versus Cooper Industries with Fulbright, Houston, Texas.

10. Hydro Tasmania, 400 kV HVDC Basslink with Clayton Utz, Melbourne, Australia.

11. Midland Metals Singapore versus AMA with Church & Grace, Sydney, Australia,

12. KHNP nuclear power cable LV cable damage with BKL, Seoul, South Korea.

13. Port of Gunam submarine cable failure investigation for KERI, South Korea.

14. Hudson River 350 kV HPFF submarine cable for Paul Weiss, New York.

15. 220 kV termination failure Auckland, New Zealand with GE Renewable Energy.

16. 150 kV Bangka Strait submarine cable damage investigation with SGI, Jakarta, Indonesia, HV Cable Expert.

17. LV substation control cables for Coleman and Horowitt, Fresno, California.

18. MV Coldshrink distribution cable splices with Norton Rose Fulbright, New York, NY.

19. 150 kV Bangka Strait submarine cable failure investigation for PLN, Jakarta, Indonesia, HV Cable Expert.

Professional Activities

Harry is very active in the IEEE, Insulated Conductors Committee (ICC) as Past-chairman of Task Group A2D on the Characteristics of Semiconductive Shields, Chairman of the Submarine Cable Working Group C11W, Past-chairman of Task Group B15D on Cable Accessory Diagnostics, Past Chairman of the Transnational Subcommittee on Underground Cables, and immediate past Chair of the Communications Committee. Harry is on the International Scientific and Technical Committees of Jicable (Paris) and has published over 70 papers on the applications of underground transmission, offshore submarine cables, distribution power cables and accessories and has given many presentations to the IEEE, ICC, research institutes, universities, manufacturers, and utilities worldwide. He is a member of CIGRE based in Paris and is presently the Convener of Working Group B1.54 on "Behaviour of Cable Systems under Large Distrubances". Harry has given invited presentations and seminars in Australia, Brunei, Canada, China, Hong Kong, Indonesia, India, Japan, Korea, Malaysia, New Zealand, Singapore, Sweden, Thailand and the US. At present he holds six US, Canadian and International patents on cable diagnostics. The first edition of the book entitled "Long-life XLPE Insulated Power Cables" joint with Rick Hartlein of Georgia Tech was published in 2006 and the second edition was published with Dr. Nigel Hampton at UL in April 2021.

Harry was a member on the Board of Governors for the EIC and is a Registered Professional

Engineer in the Province of British Columbia, Canada.

Rewards

2003	"Technical Council Committee of the Year Award", Insulated Conductors Committee, Transnational Activities Committee.
2003	"Review of Metro Vancouver 230 kV Transmission Supply Development", Consulting Engineers of BC, Award of Merit, Category 4 - Soft Engineering, with Sandwell Engineering.
2005	"Technical Committee Distinguished Service Award", IEEE Power Engineering Society, Insulated Conductors Committee.
2007	Inducted into the EIC Hall-of-fame.
2011	Excellent Foreign Expert Honour, Ningbo Municipal Government, Zhejiang Province, China.

Recent Publications

Harry has published over 70 papers on the applications of underground transmission, offshore submarine cables, distribution power cables and accessories. The following is a list of the most recent publications.

1. "Behaviour of Cable Systems under Large Disturbances", CIGRE WG B1.54, Pending publication 2023.

2. "Influence of water blocking materials on the performance and conductivity of aluminium conductors", with Detlef Wald, Jicable 2023, Lyon, France, June 2023.

3. "Safety: a crucial issue to sustainability on insulated cable systems", CIGRE WG B1.71, with Julio Lopes, et al, May 2021.

4. "Recommendations for testing DC extruded cable systems for power transmission at a rated voltage up to and including 800 kV", CIGRE WG B1.62, with Franchi Bononi, Davide Pietribiasi et al, May 2021.

5. "Long-life XLPE Insulated Power Cables", second edition with Nigel Hampton, April 2021. Published by Borealis, Sweden and Dow, USA.

6. "XLPE Based Products Available in the Market and Their Applications", with Detlef Wald, Chapter 12, "Crosslinkable Polyethylene Based Blends and Nanocomposites", Springer Publications, April 2021, ISBN: 978-981-16-0486-7

7. "Indispensable Insulated Conductors", IEEE, DEIS EIM (Electrical Insulation Magazine), Editorial, Volume 35, Number 5, September/October 2019.

8. "Behaviour of Cable Systems under Large Disturbances-Status Report", with CIGRE WG B1.54, Jicable 2019, Versailles, France, Paper D7.3, June 25, 2019.

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10. "Implementation of Long AC HV and EHV Cable Systems", with CIGRE WG B1.47, CIGRE TB 680, March 2017.

11. "Development of an Alternative Solution to Mica Tape for Fire Resistance Cables", with Detlef Wald, Jicable, June 2015, Paper C10.1.

12. "Power Cable Technology Review", High Voltage Engineering, Vol.41, No.4, April 30, 2015, pp 1057-1067.

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14. "Impact of EMF on Current Ratings and Cable Systems", with CIGRE WG B1.23, ICSGTEIS, November 5-7, 2014, Bali, Indonesia.

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18. "Submarine Cable Metallic Sheath Diagnostic", with Avaral Rao, Dave Hicks and Dave Gung, Jicable 2011 Proceedings, Paper A.7.1, Page 262, Volume 1, 19-23 June 2011.

19. "Impact of Electromagnetic Fields on Current Ratings and Systems", with Paolo Maioli, Heiner Brakelmann, Jarle Bremnes, Frederic Lesur, Josu Orella Sanez and Jacco Smit, Jicable 2011 Proceedings, Paper B.1.1, Page 382, Volume 1, 19-23 June 2011.

20. "Improved Cooling of High Voltage Cables", with Detlef Wald, Herbert Nyffenegger, and George Anders, Jicable 2011 Proceedings, Paper C.10.4, , Page 245, Volume 2, 19-23 June 2011.

21. "Impact of Electromagnetic Fields on Current Ratings and Systems", with Paolo Maioli, Heiner Brakelmann, Jarle Bremnes, Frederic Lesur, Josu Orella Sanez and Jacco Smit, Paper 55, EMF ELF Colloquium, Paris, France March 24-25, 2011.

22. "Fluid-filled Underground Transmission Cable Condition Assessment", with Lisa Ogawa and David Arnold, Conference Record of the 2010 IEEE International Symposium on Electrical Insulation, Page 565, San Diego, California, 6-10 June 2010.

23. "Requirements for Different Components in Cables for Offshore Applications", with Detlef Wald, Roman Svoma, CIRED Prague, 8-11 June 2009.

24. "Condition Assessment of Fluid-Filled MV and HV Underground Power Cables", CEATI Underground Cable Workshop, Vancouver, BC Canada, March 4-5, 2008

25. "Long-Life XLPE Insulated Power Cables", with Rick Hartlein, Nigel Hampton, Hakan Lennartsson and Ram Ramachandran, Conference on the Applications of Polymers to Electrical Apparatus, October 4-6, 2007, Bangalore, India.

26. "Long-life XLPE Insulated Power Cables", with Rick Hartlein, Nigel Hampton, Hakan Lennartsson and Ram Ramachandran, Jicable 2007, Versailles, France, Paper 5.1.5, Page 593.