

- N.2.9.2 3.6-Mile In-ROW Underground Line Route Variation Transition Station Site..... N-68
- N.2.9.3 Newgate Road Transition Station Site..... N-69
- N.2.9.4 State Route 168/187 Underground Variation Transition Station Site N-70
- N.3 Connecticut Portion of the Massachusetts Southern Route Alternative from Agawam to Ludlow 345-kV Line Route N-70**
 - N.3.1 Overhead Line Route N-71**
 - N.3.1.1 Topography, Geology, and Soils N-71
 - N.3.1.2 Water Resources N-72
 - N.3.1.3 Groundwater and Public Water Supplies..... N-72
 - N.3.1.4 Biological Resources N-73
 - N.3.1.5 Land Use, Statutory Facilities, Recreational Resources, and Scenic Resources..... N-74
 - N.3.1.6 Transportation and Access..... N-74
 - N.3.1.7 Cultural (Archaeological and Historic) Resources N-75
 - N.3.1.8 Air Quality N-75
 - N.3.1.9 Noise..... N-75
 - N.3.2 Massachusetts State Route 220/Enfield Underground Line Route Variation N-75**
 - N.3.2.1 Transition Stations..... N-76

O. ELECTRIC AND MAGNETIC FIELDS (EMF).....O-1

- O.1 Electric and Magnetic Fields from Power Lines and Other Sources O-1
- O.2 EMF Regulations and Guidelines in Connecticut O-6
 - O.2.1 Statement of Compliance With BMP and Buffer Zone Requirements O-8
- O.3 Methods for EMF Measurements and Calculations..... O-9
 - O.3.1 Field Measurements of EMF from Existing Sources..... O-9
 - O.3.2 Calculations of EMF from Transmission Lines O-10
- O.4 Magnetic Field Measurements and Calculations Developed to Comply with BMP and to Develop the Plan..... O-16
 - O.4.1 The Connecticut Portion of the North Bloomfield to Agawam Line O-16
 - O.4.1.1 North Bloomfield – Granby Junction – XS-1 O-16
 - O.4.1.2 Granby Junction to CT/MA State Border – XS-2..... O-20
 - O.4.1.3 Magnetic Fields Associated with Underground Line Variations O-30
 - O.4.2 The Potential Connecticut Portion of the Massachusetts Southern Route Alternative for the Agawam to Ludlow 345-kV Line..... O-38**
 - O.4.2.1 Connecticut Border (Suffield) to Massachusetts Border (Enfield) O-38**
 - O.4.2.2 State Route 220/Enfield Underground Line Route Variation.... O-46**
 - O.4.3 The Manchester to Meekville Junction Circuit Separation Project (MMP) O-49
 - O.4.3.1 Existing Line Configurations and EMF..... O-49
 - O.4.3.2 Proposed Changes to the Existing Line Configurations and Magnetic Fields O-55
- O.5 Update on the EMF Health Research..... O-58
- O.6 Summary of Actions Demonstrating Consistency with CSC Guidelines O-59
- O.7 Technical Description of Proposed and Best Management Practice Alternative Line Design O-61
 - O.7.1 Base Design of Proposed Connecticut Facilities for the GSRP O-61
 - O.7.1.1 General..... O-61

O.7.1.2 Segment 2 (Granby Junction - CT/MA State Border) O-61

O.7.2 Design and Appearance of BMP Alternative (Country Club Lane to Phelps Road)..... O-62

O.7.3 Base Design Comparison to BMP Design Alternative for a Section of GSRP Segment 2..... O-63

O.7.4 Base Design of the MMP Facilities O-64

 O.7.4.1 General..... O-64

O.7.5 Design and Appearance of BMP Alternative for MMP..... O-66

O.7.6 Base Design Comparison to BMP Design Alternative for the MMP..... O-67

O.8 References O-68

Appendix O-1 CL&P’s Field Management Design Plan

Appendix O-2 Connecticut Siting Council’s EMF Best Management Practices

Appendix O-3 Tabular summaries of magnetic fields at AAL, APL and PDAL loadings and electric fields for the Preferred Northern Route of the GSRP

Appendix O-4 Tabular summaries of magnetic fields at AAL, APL and PDAL loadings and electric fields for the Southern Alternative Route for the GSRP

Appendix O-5 Tabular summaries of magnetic fields at AAL, APL and PDAL loadings and electric fields for Manchester – Meekville Junction Circuit Separation Project

Appendix O-6 EMF and Health: Review and Update of the Scientific Research December 2007 – June 2008

P. PROJECT SCHEDULE..... P-1

Q. AGENCY CONSULTATIONS Q-1

 Q.1 Agency Consultations Prior to Filing Application..... Q-1

 Q.2 Additional Agency Approvals..... Q-2

R. APPLICATION DIRECTORY R-1

LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
Figure ES-1	The Greater Springfield Reliability Project Potential Routes.....	ES-3
Figure ES-2	Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route.....	ES-8
Figure ES-3	The MMP Line Route.....	ES-10
Figure ES-4	Newgate Road Underground Line Route Variation	ES-14
Figure ES-5	State Route 168/187 Underground Line Route Variation	ES-15
Figure ES-6	3.6-Mile In-ROW Underground Line Route Variation.....	ES-16
Figure ES-7	4.6-Mile In-ROW Underground Line Route Variation.....	ES-17
Figure ES-8	Map Comparison of Corridors for the Preferred Northern Route and the Massachusetts Southern Route Alternative	ES-19
Figure F-1:	Reliability Concerns in the Southern New England Region	F-9
Figure F-2:	NEEWS Project Elements	F-13
Figure F-3:	RSP Geographic Scope of the New England Bulk Electric Power System.....	F-18
Figure F-4:	Southern New England Load Concentrations	F-19
Figure F-5:	Western Massachusetts and Connecticut Transmission Systems	F-22
Figure G-1:	Number of Distinct Facility Overloads under Contingency Conditions (N-1 and N-1-1) for Various Load Reduction Scenarios.....	G-12
Figure G-2:	Geographical locations of assumed new generation additions in scenarios 3, 4 and 5	G-13
Figure G-3:	Preferred North Bloomfield – Agawam – Ludlow Solution (“Preferred Solution”)....	G-18
Figure G-4:	N. Bloomfield – Ludlow (“Option B”).....	G-19
Figure G-5:	Manchester – Ludlow (“Option C”).....	G-19
Figure G-6:	Potential Routes - Option A	G-24
Figure G-7:	Potential Routes - Option B.....	G-25
Figure H-1:	Route Analysis Map	H-17
Figure H-2	All-Underground In-ROW Variation Considered But Eliminated.....	H-21
Figure H-3:	All-Underground Road Variation Considered But Eliminated	H-22
Figure H-4:	GSRP Potential Routes.....	H-30
Figure H-5:	Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route.....	H-33
Figure H-6:	Newgate Road Underground Line Route Variation	H-40
Figure H-7:	State Route 168/187 Underground Line Route Variation	H-42
Figure H-8:	4.6-Mile In-ROW Underground Line Route Variation.....	H-45
Figure H-9:	3.6-Mile In-ROW Underground Line Route Variation.....	H-47
Figure H-10:	Massachusetts Southern Route Alternative	H-56
Figure H-11:	Massachusetts State Route 220/Enfield Underground Line Route Variation.....	H-59
Figure M-1	Newgate Road Underground Line Route Variation	M-4
Figure M-2	State Route 168/187 Underground Line Route Variation	M-15
Figure O-1:	Electric and Magnetic Field Levels in the Environment	O-3
Figure O-2:	Typical Magnetic Field Personal Exposures	O-5
Figure O-3:	Cross-Section XS-1: North Bloomfield Substation to Granby Junction	O-17
Figure O-4:	Profile XS-1: North Bloomfield Substation to Granby Junction – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-19
Figure O-5:	Cross-Section XS-2: Granby Junction to CT/MA State Border.....	O-21
Figure O-6:	Profile XS-2: Granby Junction to CT/MA State Border – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL.....	O-24
Figure O-7:	Cross-Section XS-2: BMP – Existing Str. 3191 to Existing Str. 3221	O-27
Figure O-8:	Profile XS-2 BMP: Existing Str. 3191 to Existing Str. 3221 – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL.....	O-29
Figure O-9:	Cross-Section XS-2 UG – Granby Junction to Phelps Road transition station – UG Variations along the ROW	O-33

LIST OF FIGURES (cont.)

<u>Figure No.</u>		<u>Page No.</u>
Figure O-10:	Profile XS-2 UG: 4.6-mile/3.6-mile UG line variations within ROW to Phelps Road transition station – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-35
Figure O-11:	Profile XS-2 UG Variation in streets – Magnetic fields under post-NEEWS (2107) conditions at AAL	O-37
Figure O-12:	Cross-Section XS-S05 – CT border to CT River	O-39
Figure O-13:	XS-S07 – CT border to MA border	O-41
Figure O-14:	Profile XS-S05: CT border to CT River – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-45
Figure O-15:	Profile XS-S07: CT border to CT River – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-46
Figure O-16:	Profile XS-S07 UG variation within ROW – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-47
Figure O-17:	Profile XS-S07 UG variation in streets – Magnetic fields under post-NEEWS (2017) conditions at AAL	O-48
Figure O-18:	Cross-Section XS-21: Manchester Substation to Meekville Junction	O-51
Figure O-19:	Cross-Section XS-21 BMP: Manchester Substation to Meekville Junction	O-53
Figure O-20:	Profile XS-21: Manchester Substation to Meekville Junction – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-56
Figure O-21:	Profile XS-21 BMP: Manchester Substation to Meekville Junction – Magnetic fields under pre-NEEWS (2012) and post-NEEWS (2017) conditions at AAL	O-57

LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
Table ES-1	Summary of Project Characteristics Connecticut Portion of North Bloomfield to Agawam 345-kV and the MMP Line Routes	ES-25
Table ES-2	Summary of Environmental Features and Potential Effects Connecticut Portion of North Bloomfield to Agawam 345-kV and MMP Line Routes.....	ES-26
Table ES-3	Summary of Project Characteristics Connecticut Portion of Massachusetts Southern Route Alternative.....	ES-29
Table ES-4	Summary of Environmental Features and Potential Effects Connecticut Portion of Massachusetts Southern Route Alternative from Agawam to Ludlow.....	ES-30
Table F-1:	Greater Springfield Area Generation.....	F-26
Table F-2:	North-Central Connecticut Area Generation.....	F-27
Table F-3:	Greater Springfield Area Generation Dispatch Scenarios.....	F-32
Table G-1:	Non-Transmission Resource Alternatives Simulated.....	G-9
Table G-2:	Hartford Area Construction Summary	G-22
Table H-1	Key to Towns Along or Near the Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route, Aerial Alignment Map Sheets.....	H-32
Table H-2	Summary of Engineering Design and ROW Characteristics for the Connecticut Portion of the North Bloomfield to Agawam Line Route	H-35
Table H-3	Comparison of Costs: Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route to Variations	H-49
Table H-4	Comparative Summary of the Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route 345-kV Overhead Line and 3.6-Mile In-ROW, 4.6-Mile In-ROW, Newgate Road and State Route 168/187 Underground Line Route Variations, East Granby and Suffield	H-52
Table H-5	Comparative Summary of the Massachusetts Southern Route Alternative 345-kV Overhead Line and Enfield Underground Variation, Enfield.....	H-60
Table I-1	Key to Towns Along or Near the Proposed Projects, Aerial Alignment Map Sheets	I-9
Table I-2	Summary of Existing and Proposed ROW Configurations: GSRP and MMP	I-11
Table I-3	Comparison of Connecticut Portion of the North Bloomfield to Agawam Overhead 345-kV Line Route to Underground Variations	I-15
Table I-4	Comparison of Life-Cycle Costs for the Connecticut portion of the North Bloomfield to Agawam Line Route and Variations	I-16
Table J-1	Review of Potential Material Staging Sites.....	J-6
Table J-2	Review of Potential Access Roads for Connecticut Portion of The North Bloomfield to Agawam 345-kV Line Route.....	J-11
Table J-3	Review of Potential Access Roads for Manchester to Meekville Junction Circuit Separation Project.....	J-12
Table L-1	Soils and Soil Characteristics along the Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route.....	L-6
Table L-2	Watercourses Traversed along the Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route.....	L-9
Table L-3	Summary of Connecticut Water Use Goals.....	L-11
Table L-4	Delineated Wetlands along the Connecticut portion of the North Bloomfield to Agawam 345-kV Line Route	L-14
Table L-5	Vernal Pool Habitat Associated with the Connecticut portion of the North Bloomfield to Agawam 345-kV Line Route.....	L-27

LIST OF TABLES (cont.)

<u>Table No.</u>		<u>Page No.</u>
Table L-6	Summary of Rare, Threatened and Endangered Species Along the Connecticut portion of the North Bloomfield to Agawam 345-kV Line Route	L-30
Table L-7	Road Crossings – Connecticut portion of the North Bloomfield to Agawam 345-kV Line Route	L-42
Table L-8	Ambient Air Quality Concentrations Around East Granby and Suffield, CT	L-48
Table L-9	Ambient Air Quality Concentrations Around Bloomfield, CT	L-49
Table L-10	Typical Noise Levels Associated with Different Indoor and Outdoor Activities.....	L-51
Table L-11	State of Connecticut Noise-Control Regulations by Emitter and Receptor Land-Use Classification	L-52
Table L-12	Existing Ambient Noise Level Measurements (Leq)	L-56
Table L-13	New Transformer Sound Power Levels at Each Octave Band Frequency	L-57
Table L-14	Predicted Sound Pressure Levels.....	L-57
Table L-15	Overall Projected Noise Levels and Connecticut Noise Limits for Receptor Class A..	L-58
Table L-16	General Characteristics of Soil Associations along the MMP Line Route.....	L-60
Table L-17	Watercourses Traversed along the MMP	L-62
Table L-18	Delineated Wetlands Along the MMP.....	L-64
Table L-19	Vernal Pool Habitat Associated with the MMP	L-67
Table L-20	Ambient Air Quality Concentrations Around Manchester, CT.....	L-74
Table M-1	Streams Crossed Along the Newgate Road Underground Line Route Variation.....	M-7
Table M-2	List of Wetlands Along The Newgate Road Underground Line Route Variation.....	M-9
Table M-3	Streams Crossed Along the State Route 168/187 Underground Line Route Variation	M-17
Table M-4	List of Wetlands Along the State Route 168/187 Underground Line Route Variation	M-19
Table M-5	Watercourses Traversed along the 4.6-Mile In-ROW Underground Line Route Variation	M-26
Table M-6	List of Wetlands along the 4.6-Mile In-ROW Underground Line Route Variation.....	M-27
Table M-7	Vernal Pool Habitat Associated with the 4.6-Mile In-ROW Underground Line Route Variation	M-28
Table M-8	Watercourses Traversed along the 3.6-Mile In-ROW Underground Line Route Variation	M-31
Table M-9	List of Wetlands along the 3.6-Mile In-ROW Underground Line Route Variation.....	M-32
Table M-10	Vernal Pool Habitat Associated with the 3.6-Mile In-ROW Underground Line Route Variation	M-33
Table M-11	General Characteristics of Soil Associations Along the Massachusetts Southern Route Alternative and Underground Variation.....	M-35
Table M-12	Streams Crossed Along the Massachusetts Southern Route Alternative.....	M-37
Table M-13	List of Wetlands Along The Massachusetts Southern Route Alternative	M-38
Table M-14	Vernal Pool Habitat Associated with the Massachusetts Southern Route Alternative.	M-41
Table M-15	Road Crossings – Massachusetts Southern Route Alternative (Connecticut Only)	M-44
Table M-16	Streams Along the Massachusetts State Route 220/Enfield Underground Line Route Variation.....	M-47
Table M-17	List of Wetlands Along The Massachusetts State Route 220/Enfield Underground Line Route Variation	M-48
Table M-18	Road Crossings – Massachusetts State Route 220/Enfield Underground Line Route Variation	M-51
Table N-1	Summary of Potential Effects on Wetlands, Watercourses and Floodplains Along the Connecticut Portion of the North Bloomfield to Agawam 345-kV Line Route.....	N-12
Table N-2	Summary of Potential Effects to Wetlands, Watercourses and Floodplains Town of Manchester, Manchester Substation to Meekville Junction	N-14