

One Financial Plaza, Suite 1430
Providence, RI 02903-2485
Direct (401) 709-3314
Fax (401) 709-3377
placouture@rc.com

Via Hand Delivery

April 10, 2014

Patricia S. Lucarelli, Esq.
Energy Facility Siting Board
89 Jefferson Boulevard
Warwick, RI 02888

Re: Docket No. SB-2003-1
In re: The Narragansett Electric Company d/b/a National Grid
(E-183 115kV Transmission Line Relocation)

Dear Patti:

I am enclosing for filing an original and four (4) copies of National Grid's Response to the Energy Facility Siting Board's the First Record Request of March 20, 2014 in the above referenced matter.

Please acknowledge receipt of this filing on the enclosed copy of this letter and the response and return them to me. Thank you.

Sincerely,



Peter V. Lacouture

PVL/blv
Enclosures

Copy to: Chairperson Margaret E. Curran, Esq. *(via hand delivery)*
Janet Coit *(via hand delivery)*
Kevin Flynn *(via hand delivery)*
Service List *(via electronic mail)*



Law Offices

BOSTON

PROVIDENCE

HARTFORD

NEW LONDON

STAMFORD

WHITE PLAINS

NEW YORK CITY

ALBANY

SARASOTA

www.rc.com

12841182-v1

STATE OF RHODEISLAND AND PROVIDENCE PLANTATIONS
ENERGY FACILITY SITING BOARD

In re: The Narragansett Electric Company :
(E-183 115 kV Transmission Line : Docket No. SB-2003-01
Relocation Project – A/C I-195 Relocation) :

The Narragansett Electric Company d/b/a National Grid
Response to the
Energy Facility Siting Board's
Record Request No. 1 of March 20, 2014

RECORD REQUEST NO. 1: Provide a copy of the underground cable bid package after it is issued.

RESPONSE: The e-mail announcement, bid specifications and attachments are attached. The project is being bid pursuant to a Master Services Agreement arrangement. The bid package went out on April 2 and responses are due on April 23.

CERTIFICATE OF SERVICE

I hereby certify that a true copy of the within was sent by e-mail to the following this the 10 th day of April, 2014.

Department of Attorney General
150 South Main Street
Providence, RI 02903

LWold@riag.ri.gov

klyons@riag.ri.gov
Jmunoz@riag.ri.gov
dmacrae@riag.ri.gov

Division of Public Utilities & Carriers

Thomas.kogut@ripuc.state.ri.us
JHagopian@dpuc.ri.gov
Steve.scialabba@ripuc.state.ri.us

Janet Coit, Director
Dept. of Environmental Management
235 Promenade Street
Providence, RI 02908

janet.coit@dem.ri.gov

Rayna.maguire@dem.ri.gov

Kevin Flynn, Associate Director for
Division of Planning
Department of Administration
One Capitol Hill, 3rd Floor
Providence, RI 02903

kevin.flynn@doa.ri.gov

Adrienne G. Southgate, City Solicitor
City of Providence
Department of Law
275 Westminster Street
Providence, RI 02903

asouthgate@providenceri.com

RI Public Utilities Commission
89 Jefferson Blvd.
Warwick, RI 02888

Cynthia.WilsonFrias@puc.ri.gov

alan.nault@puc.ri.gov

Paul.roberty@puc.ri.gov

John J. Spirito, Esq. (e-mail only)

jspirito@ripuc.state.ri.us

Division of Public Utilities and Carriers

JoAnne Sutcliffe (e-mail only)

Josut321@cox.net

Timothy J. Chapman, City Solicitor
City of East Providence
145 Taunton Avenue
East Providence, RI 02914-4505

tchapman@cityofeastprov.com

Mark W. Russo, Esq.
Ferrucci Russo P.C.
55 Pine Street, 4th Floor
Providence, RI 02903

mrusso@frlawri.com

Terence Tierney (e-mail only)

wsmith@frlawri.com
jboyle@cityofeastprov.com
tierneylaw@yahoo.com

National Grid

jennifer.hutchinson@nationalgrid.com

National Grid

celia.obrien@nationalgrid.com

File an original and 4 copies w/:
Patricia S. Lucarelli, Esq.
Energy Facility Siting Board
89 Jefferson Boulevard
Warwick, RI 02888

patricia.lucarelli@puc.ri.gov

Margaret.curran@puc.ri.gov


Brenda L. Vucci

SPECIFICATION

PROFESSIONAL ENGINEERING SERVICES

**PROPOSED E183W UNDERGROUND 115 kV
ELECTRIC TRANSMISSION CABLE SYSTEM**

PROVIDENCE and EAST PROVIDENCE, RHODE ISLAND

March 2014

NATIONAL GRID USA SERVICE COMPANY

WALTHAM, MASSACHUSETTS

TABLE OF CONTENTS

1.0	PURPOSE	1 -
2.0	PROJECT DESCRIPTION.....	1 -
3.0	DEFINITIONS	3 -
3.1.	<u>OWNER</u>	3 -
3.2.	<u>CONTRACTOR</u>	3 -
3.3.	<u>THE PARTIES</u>	3 -
3.4.	<u>SUBCONTRACTOR</u>	3 -
3.5.	<u>LINE</u>	3 -
3.6.	<u>WORK</u>	3 -
4.0	SITE.....	3 -
4.1.	<u>VEGETATION REMOVAL</u>	3 -
4.2.	<u>VEHICLE MARKINGS</u>	4 -
5.0	DRAWINGS	4 -
6.0	SCOPE OF WORK	4 -
6.1.	<u>GENERAL</u>	4 -
6.2.	<u>ROUTE IDENTIFICATION AND SELECTION</u>	4 -
6.3.	<u>CIVIL DESIGN</u>	4 -
6.3.1.	<i>Baseline Drawings</i>	4 -
6.3.2.	<i>Preliminary Drawings</i>	4 -
6.3.3.	<i>Final Drawings</i>	4 -
6.3.4.	<i>Route Overview Map</i>	5 -
6.3.5.	<i>Key Sheet, Detail Sheets</i>	5 -
6.3.6.	<i>Manhole Drawings</i>	5 -
6.3.7.	<i>Town Franchise Maps</i>	5 -
6.3.8.	<i>State Highway Franchise Maps</i>	5 -
6.3.9.	<i>Horizontal Directional Drill (HDD) Design</i>	5 -
6.3.10.	<i>Pipejacking Design and Drawings</i>	7 -
6.3.11.	<i>Cost Estimating</i>	8 -
6.3.12.	<i>Civil Installation Specifications</i>	9 -
6.3.13.	<i>Traffic Control Plan</i>	9 -
6.3.14.	<i>As Built Drawings</i>	9 -
6.4.	<u>GEOTECHNICAL EXPLORATION</u>	9 -
6.4.1.	<i>Subsurface Exploration Observation</i>	11 -
6.4.2.	<i>Field Screening for VOCs</i>	11 -
6.4.3.	<i>Geotechnical Review, Recommendations and Report</i>	11 -
6.4.4.	<i>Borings and Probes</i>	11 -
6.4.5.	<i>Records</i>	11 -
6.4.6.	<i>Steam Cleaning</i>	11 -
6.4.7.	<i>Intermediate Borings</i>	11 -
6.5.	<u>ELECTRICAL DESIGN</u>	12 -
6.5.1.	<i>Ampacity Calculations</i>	12 -
6.5.2.	<i>Cable Pulling Calculations / Siting Manhole Locations</i>	12 -
6.5.3.	<i>Electric and Magnetic Field (EMF) Calculations</i>	12 -
6.5.4.	<i>Special Cable Considerations</i>	12 -
6.5.5.	<i>Procurement Specifications</i>	12 -
6.5.6.	<i>Installation Specifications</i>	13 -
7.0	SCHEDULE OF WORK	14 -

TABLE OF CONTENTS

8.0	ACCESS TO THE SITE(S)	- 14 -
8.1.	<u>REGULATIONS, PERMITS, LOCAL LICENSES, APPROVALS</u>	- 14 -
8.2.	<u>CONDUCT OF WORK</u>	- 14 -
8.3.	<u>TRAFFIC CONTROL</u>	- 14 -
9.0	PAYMENT SCHEDULE	- 15 -
10.0	HEALTH AND SAFETY	- 15 -
11.0	PERSONNEL	- 15 -
12.0	FIELD SURVEYS	- 15 -
13.0	HORIZONTAL AND VERTICAL CONTROL	- 15 -
13.1.	<u>CONTROL STANDARDS</u>	- 15 -
14.0	PLAN AND PROFILE MAPPING	- 16 -
14.1.	<u>BASILINE DRAWINGS WITH UTILITIES AND SURFACE FEATURES</u>	- 16 -
14.2.	<u>ADDITION OF LINE</u>	- 16 -
14.3.	<u>HORIZONTAL STATIONING</u>	- 16 -
14.4.	<u>PIPE BEND / SLOPE DATA</u>	- 17 -
14.4.1.	<i>Vertical or Horizontal Bends</i>	- 17 -
14.4.2.	<i>Pipe Dips</i>	- 17 -
14.4.3.	<i>Slopes</i>	- 17 -
14.5.	<u>CASINGS</u>	- 17 -
14.6.	<u>MANHOLE ADDITION</u>	- 17 -
14.7.	<u>SOIL BORINGS</u>	- 17 -
14.8.	<u>ENVIRONMENTALLY SENSITIVE AREAS</u>	- 17 -
14.9.	<u>PRIVATE PROPERTY EASEMENTS</u>	- 17 -
15.0	MAP ACCURACY AND ANNOTATION	- 18 -
15.1.	<u>PLAN AND PROFILE STANDARDS</u>	- 18 -
15.2.	<u>TOPOGRAPHIC STANDARDS</u>	- 18 -
15.3.	<u>STATIONING AND ANGLE DETAILS</u>	- 19 -
15.4.	<u>CONTROL POINTS</u>	- 19 -
15.5.	<u>MAP PROJECTION INFORMATION</u>	- 19 -
15.6.	<u>PROFILE PRECISION</u>	- 19 -
15.7.	<u>PLOTTING PRECISION</u>	- 19 -
16.0	SPECIAL PROVISIONS REQUIRED	- 19 -
16.1.	<u>MEETINGS</u>	- 19 -
16.2.	<u>DIGITIZING SERVICES</u>	- 20 -
16.3.	<u>DRAWING FORMAT</u>	- 20 -
16.3.1.	<i>Drawing Lettering</i>	- 20 -
16.3.2.	<i>Drawing Size</i>	- 20 -
16.3.3.	<i>Layer Information</i>	- 21 -
16.3.4.	<i>Color Scheme</i>	- 21 -
17.0	PROJECT CONTACT PERSONNEL	- 21 -
	FIGURE 1: E183 RELOCATION PROPOSED LINE ROUTING	- 23 -
	FIGURE 2: PRELIMINARY HDD ALIGNMENTS	- 24 -
	FIGURE 3: TRANSITION STATION DRAWINGS	- 25 -

TABLE OF CONTENTS

APPENDIX A - PLAN AND PROFILE ANNOTATION..... - 26 -

E183W 115KV CABLE PROJECT
PROFESSIONAL ENGINEERING SERVICES
TECHNICAL SPECIFICATION

1.0 PURPOSE

The purpose of this Specification is to provide information and requirements for the surveying, mapping, engineering, project estimating, and other services for National Grid's proposed underground electric transmission line between the company's Franklin Square Substation in Providence, RI, and a proposed overhead to underground transition station in East Providence, RI, designated as the Mauran Avenue Transition Station.

The Contractor shall provide civil engineering, electrical engineering, geotechnical investigation, design, survey, mapping, drafting, cost estimating, and other services required for complete and accurate estimating and layout of the transmission line.

The Contractor shall provide plan and profile drawings and other drawings for the licensing and installation of approximately 1.2 miles of underground transmission and communication lines as required by this Specification.

The Contractor shall develop a project cost estimate for the proposed underground transmission line installation.

The Owner's proposed schedule for the project is included in Section 7.

2.0 PROJECT DESCRIPTION

The Owner requires engineering and design services to support the route selection, cost estimating, permitting, licensing and installation of an underground 115kV electric transmission line between an existing substation in Providence, RI, and a proposed overhead to underground transition station in East Providence, RI. The underground line will replace an existing 115 kV overhead transmission line. The project is being funded by third party entities, designated as "the Parties".

The cable system shall consist of the following:

- The on-land ductline and manhole system shall consist of nine (9) six inch polyvinyl chloride (PVC) conduits encased in concrete. This may be modified based on detailed design.
- There are two river crossings along the potential cable route (Providence River and Seekonk River). It is anticipated that the river crossings will be performed by Horizontal Directional Drilling (HDD). It is also anticipated that two HDDs will be needed at each river crossing (four total) for cable ampacity rating reasons. Development and design of the river crossing conduit system is included in the design portion of the Specification.
- There is a limited access highway crossing along the potential cable route. It is anticipated that the highway crossing will be performed by pipe-jacking. Development and design of the highway crossing conduit system is included in the design portion of the Specification.
- Pre-cast concrete manholes installed at appropriate intervals to provide points for cable splicing and shield bonding, and to provide transitions between HDD conduit systems and "on-land" conduit systems.

- An 115kV solid dielectric cable system, including power cables, ground continuity conductors, and fiber optic communication cables.
 - The Company has preliminarily sized the cable system utilizing two cables per phase of 1/c 3000 kcmil cu Cross-Linked Polyethylene (XLPE) insulated 115 kV cable. Ampacity calculations are required as part of the design portion of the Specification.
 - The underground cable shall terminate with air insulated terminations at both ends.

The Owner has selected a proposed cable route between the Franklin Square Substation and the East Providence Transition Station location. The proposed cable route is shown in Figure 1. The required activities for this scope of work include but are not limited to the following:

- Perform an engineering review of the selected route and nearby variations to identify existing underground utilities, other underground obstructions, and above-grade obstacles along the route. Engineering review shall include:
 - Obtain utility records, highway plans, in-river construction plans (highways, Fox Point Hurricane Barrier, river walls, docks, piers, etc), and other existing information for the proposed route.
 - Generate baseline drawings of the proposed route
 - Add existing utility information to the baseline drawings, including tie-ins to visible manhole covers, valve gate box covers, grates and other surface feature information obtained from field survey.
 - Perform geotechnical and geothermal borings on land and in the two rivers to characterize soil conditions for physical and thermal properties, and as needed for HDD and pipejacking design.
- Perform a detailed design and layout (plan and profile) of the Horizontal Directional Drilling installations at the Providence River and the Seekonk River Crossings.
- Perform detailed design of the pipejacking crossing of Interstate 195.
- Perform a cable ampacity study of the proposed cable installation, including conventional ductline segments, HDDs, and pipejackings.
- Work with the Owner's environmental consultant to perform an environmental assessment of the proposed route, and outline potential public and environmental obstacles and risks.
- Develop and present an engineering report detailing the results of these investigations for the Owner's use in selecting a preferred route for the Line.
- Once the Owner has selected a preferred route for the Line, perform detailed design and engineering on the preferred route to create plans and specifications for the permitting, licensing, and construction of the underground system.
- Perform a detailed cost estimate for the proposed cable system.
- Work with the Owner's environmental consultant to develop plans and specifications suitable for all permits and license applications.

- Develop specifications and drawings suitable for use in a competitive bid process for the procurement and installation of the underground system.

While the final length of the Line is dependent on the route selection, for bidding purposes the Contractor may assume that the proposed duct line will be approximately 1.2 miles in length.

3.0 DEFINITIONS

3.1. Owner

The Owner is National Grid.

3.2. Contractor

The Contractor is the entity that shall perform all the Work required by this Specification.

3.3. The Parties

The Parties are third party entities who are funding or are otherwise involved in the undergrounding of the transmission line. For this specification, the Parties consist of the City of Providence, the City of East Providence, and the Rhode Island Attorney General.

3.4. Subcontractor

The Subcontractor is any organization, firm or individual, regardless of tier, with whom the Contractor enters into an arrangement for the performance of the Work.

3.5. Line

Proposed underground 115 kV electric transmission and associated communications lines in Providence and East Providence, Rhode Island

3.6. Work

Work shall include all equipment, labor materials, and services provided by the Contractor and Subcontractors to carry out all duties, responsibilities, and obligations imposed by this Specification.

4.0 SITE

Contractor hereby represents that it has visited the site and satisfied itself as to the nature and location of the Work to be done, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, tides or similar physical conditions at the site, the condition of the ground, the character of equipment and facilities needed before and during the prosecution of the Work, and all other matters which can in any way affect the work or the cost thereof. Contractor shall assume all risk with respect to the character, quality and quantity of any and all surface and subsurface conditions, including surface water, to be encountered. Any failure of the Contractor to acquaint itself with all available information shall not relieve it from the responsibility for estimating properly the difficulty or cost of successfully performing the Work.

4.1. Vegetation Removal

There shall be no brush cutting or vegetation removal of any kind without prior approval of the Owner.

4.2. Vehicle Markings

All vehicles used in the field for prosecution of the Work shall be marked with appropriate identification of the Contractor or Subcontractors as determined by the Owner.

5.0 DRAWINGS

The Contractor shall provide drawings in accordance with Sections 6, 14, 15 and 16 of this Specification.

6.0 SCOPE OF WORK

6.1. General

The Contractor shall furnish all labor and material required to prepare plan and profile drawings and other drawings for the licensing, and installation of approximately 1.2 miles of underground electric transmission and communication lines. Provide civil & electrical engineering, design, survey, mapping, drafting, cost estimating, and other services as required to complete the Work. Provide technical specifications for the Owner's use in the bidding and construction of the proposed facilities.

6.2. Route Identification and Selection

With Owner input, identify a preferred routing for the Line. The Contractor shall work with the Owner's environmental contractor to perform sufficient investigation (existing underground utility density assessments, public and environmental impact) to determine the likelihood / difficulty of permitting or constructing the Line along each route.

6.3. Civil Design

6.3.1. Baseline Drawings

Aerial Photography / Post Marking

Perform or acquire aerial photography, as needed, to generate baseline drawings. Post mark photography for control for photo analytical work and subsequent centerline control. Aerial photography in general shall conform to National Grid's standards as outlined in Appendix B and be of sufficient detail to create drawings at a 1" = 20' horizontal scale and 1" = 4' vertical scale (profile).

Analytical Work and Profiling

Perform photogrammetric analytic work and aerial profiling along the designated route.

6.3.2. Preliminary Drawings

Prepare planimetric / topographic plan and profile manuscripts as working drawings. The format shall contain all features visible in the aerial photography or obtained from field surveys, and all existing underground utilities located within 50 feet of the roadway curb or Line alignment. Preliminary drawings shall be prepared and submitted by superimposing on the working drawings the preliminary Line alignment and the plan and profile location of underground utilities and obstructions and surface features, all as required by this Specification including, but not limited to Appendix A.

6.3.3. Final Drawings

Final drawings shall be prepared by superimposing on the intermediate drawings final Line alignment, line stationing, manhole / handhole locations, boring locations and other engineering features. Contractor shall also add physical environmental protection measure locations as supplied by the Owner's environmental contractor.

6.3.4. Route Overview Map

A route overview map, showing the proposed Line installation overlaid on a Rhode Island State grid map shall be generated by the Contractor. The route overview map will be used for public presentation and licensing presentation and shall show enough of the surrounding streets to clearly delineate the project area. Major streets, highways, water bodies, and all streets crossing or directly adjacent to the cable route shall be identified. A to-scale typical trench cross section shall be included on the route overview map. Manhole / handhole locations, once defined, shall be added to the route overview map.

6.3.5. Key Sheet, Detail Sheets

A key sheet, showing the entire Line route, shall be generated. The areas of the route shown on the individual plan and profile sheets shall be boxed on the key sheet to allow for rapid drawing location. Manhole / handhole locations and installation details, once defined, shall be added to the key sheet.

Detail sheet(s) shall be generated for the drawing set. All symbols and abbreviations used shall be listed and explained. To-scale typical trench cross section(s) shall be included on the detail sheet. The Detail sheet(s) shall show requirements for roadway repaving, sidewalk restoration, private property restorations (loaming and seeding), soil erosion control, and any other relevant details. Requirements of the various jurisdictional authorities as well as relevant notes or other details shall also be shown on the Detail sheet(s).

6.3.6. Manhole Drawings

Manhole Fabrication and Manhole General Arrangement drawings shall be generated. It is anticipated that all manholes of a particular type will be identical. Should site conditions require modification of manhole penetrations or accessories at particular route locations, separate manhole drawings shall be generated for these locations.

Manhole Fabrication Drawings shall show manhole internal dimensions, nominal wall, floor, and ceiling thickness, pipe and other penetration locations, cover location, pulley locations, and other fabrication details. Detailed civil engineering design, reinforcing schedules, etc., shall be performed by the manhole supplier.

Manhole plan and section drawings shall show power cable and splice installation, communication cable and splice installation, cathodic protection and thermocouple installation and other miscellaneous manhole details.

6.3.7. Town Franchise Maps

This Section not used.

6.3.8. State Highway Franchise Maps

This Section Not Used

6.3.9. Horizontal Directional Drill (HDD) Design

1. The Contractor shall furnish all labor, equipment and materials and provide survey, geotechnical, design, and engineering services to perform Horizontal Directional Drilling design work required by this specification. The scope of work includes, but is not limited to the following Tasks:
2. Participate in a field visit with the Owner to observe field conditions and discuss constraints and opportunities for HDD duct system installation. There is a proposed HDD crossing of the Providence River between the Manchester Street Station /Franklin Square Substation site and a private property parcel at the intersection of Water Street and Tockwotton Street in Providence. There is also a proposed HDD crossing of the Seekonk River between India Point Park in Providence and the vicinity of Mauran Avenue in East Providence. See Figure 2 for preliminary HDD alignments.
3. Complete a topographic land survey to be used to prepare plan and profile drawings of the site.
4. Arrange for and complete a subsurface exploration and marine survey program to provide detailed information on the river bottom(s) and sub-bottom profile.
5. Perform in-depth geotechnical analysis and review of all subsurface information for suitability and difficulty expected for the construction method under consideration. As part of the geotechnical program, the Contractor is expected to cooperate with the Owners designated environmental engineering firm to obtain any requested soil samples required for environmental analysis.
6. Arrange for and complete geothermal testing on existing soil conditions to provide information for use in a cable ampacity study.
7. Prepare and issue a comprehensive report on the geotechnical and geothermal analysis for the soil conditions involved in this crossing.
8. Develop plan and profile drawings, construction plans, and other drawings for the HDDs at both river crossings. Final HDD alignments are to be determined in consultation with the Owner. Drawings shall be suitable for permitting/licensing use as well as for construction. Construction plans shall show the necessary equipment setup areas for pilot-hole creation, reaming passes, drilling mud management, and conduit stringing/ conduit pullback.
9. Prepare performance-based specifications for the HDD installations suitable for permitting and construction.
10. Provide engineering support to the Owner or its designated subcontractor for all permitting activities associated with this project.
11. Prepare a comprehensive report of construction method recommendations, installation specifications, and crossing alignment. Report shall include drawings of horizontal alignment layout (plan) and a vertical representation (profile) of the bottom, soil types, possible obstructions, and duct system route

12. Provide engineering and technical support to Owner during the preparation and evaluation of construction proposals from civil contractors for the completion of the HDD crossings.
13. Provide engineering and technical support to Owner during the construction of the HDD crossings.
14. Revise plan and profile drawings based on field changes observed and approved during the construction and issue final drawings to the Owner.

6.3.10. Pipejacking Design and Drawings

A crossing of Interstate 195 is required between Tockwotton Street and India Street. The interstate highway in this area forms an integral part of a hurricane barrier, designated as "The Fox Point Hurricane Barrier". There are several surface streets that cross under the elevated highway in the general vicinity of the proposed cable route, including Benefit Street, South Main Street, and South Water Street. These streets have flood gates associated with the Hurricane Barrier, and the streets have heavy pile-supported concrete slabs across them to support the flood gates. It is anticipated that the at-grade street crossings of the highway are not suitable for installation of the transmission line, and that the highway crossing will be accomplished by a pipe jacking or "jack and bore" technique at a point off the street alignment.

The Contractor shall furnish all labor, equipment and materials and provide survey, geotechnical, design, and engineering services to perform the pipe jacking design work required by this specification. The scope of work includes, but is not limited to the following Tasks:

1. Participate in a field visit with the Owner to observe field conditions and discuss constraints and opportunities for a pipe jacking installation.
2. Complete a topographic land survey to be used to prepare plan and profile drawings of the site.
3. Arrange for and complete a subsurface exploration program to provide detailed geotechnical information on the pipe jacking location.
4. Perform in-depth geotechnical analysis and review of all subsurface information for suitability and difficulty expected for the construction method under consideration. As part of the geotechnical program, the Contractor is expected to cooperate with the Owners designated environmental engineering firm to obtain any requested soil samples required for environmental analysis.
5. Arrange for and complete geothermal testing on existing soil conditions to provide information for use in a cable ampacity study.
6. Prepare and issue a comprehensive report on the geotechnical and geothermal analysis for the soil conditions involved in this crossing.

Develop plan and profile drawings, construction plans, and other drawings for the pipejacking. Final pipejacking alignment is to be determined in consultation with the Owner. Drawings shall be suitable for permitting/licensing use as well as for construction. Casing detail drawings shall show casing and carrier pipe internal

dimensions, nominal wall thicknesses, material type and other information as specified by the RIDOT, the US Army Corps of Engineers, and the Owner.

7. Construction plans shall show the jacking pit, the receiving pit, line and grade of casing and carrier pipes, equipment space required to perform the pipejacking operation, and other information as specified by the RIDOT, the US Army Corps of Engineers, and the Owner. .
8. Prepare performance-based specifications for the pipejacking installation suitable for permitting and construction.
9. Provide engineering support to the Owner or its designated subcontractor for all permitting activities associated with this project.
10. Prepare a comprehensive report of construction method recommendations, installation specifications, and crossing alignment. Report shall include drawings of horizontal alignment layout (plan) and a vertical representation (profile) of the bottom, soil types, possible obstructions, and duct system route
11. Provide engineering and technical support to Owner during the preparation and evaluation of construction proposals from civil contractors for the completion of the pipejacking.
12. Provide engineering and technical support to Owner during the construction of the pipejacking.
13. Revise plan and profile drawings based on field changes observed and approved during the construction and issue final drawings to the Owner.

6.3.11. Cost Estimating

- 6.3.11.1. The Contractor shall develop a cost estimate for the complete transmission cable system, including material, installation, and engineering costs for the ductline, the HDDs, the pipe jacking, and the power cables and fiber optic cables. The estimate shall be from cable termination to cable termination, inclusive, including riser structures at both ends. The transition stations and substation modifications beyond the cable terminations will be estimated by others. See Figure 3 for preliminary transition station designs at both circuit ends.
- 6.3.11.2. The estimate shall have an expected accuracy of +/- 10 percent for the conventional ductline and manhole system, and for the cable installation. The estimate for the HDDs and the pipejacking shall have an expected accuracy of +/- 25%.
- 6.3.11.3. Contractor shall obtain estimating quotations from at least two cable suppliers for the cable and cable accessories associated with the line.
- 6.3.11.4. Contractor shall obtain estimating quotations from an HDD installation contractor for the HDD portions of the project.

- 6.3.11.5. Contractor shall obtain estimating quotations from a pipejacking installation contractor for the pipejacking portion of the project.
- 6.3.11.6. Conventional ductline installation estimates shall be adapted to reflect civil construction labor and material costs in the Providence, RI area.
- 6.3.11.7. Transmission cable installation, splicing, terminating, and bonding costs may be obtained from a transmission installation contractor, or may be based on the Contractors experience on recently constructed underground transmission line jobs.
- 6.3.11.8. Estimates shall be made available in an active Microsoft Excel spreadsheet format, with material, equipment, installation, engineering, and other items clearly delineated. This is to allow the Owner to review the estimate and to apply overheads and other factors to the estimate.

6.3.12. Civil Installation Specifications

The Contractor shall prepare complete technical specifications for the installation of the manhole and duct system, including restoration requirements. Separate specification documents shall be prepared for each construction type required along the Line alignment (open cut, pipe-jacking, etc.) Specifications shall be suitable for a competitive bid process.

To support Owner, Contractor shall:

- Prepare all technical requirements, schedules, proposal data sections, supporting drawings and design information
- Assist Owner in developing a qualified contractors' list
- Attend site visits during the proposal stages
- Perform bid evaluations and prepare a report including recommendations for award

6.3.13. Traffic Control Plan

The Contractor shall develop a traffic control plan for construction activities. The plan shall conform to the Manual of Uniform Traffic Control Devices and to the requirements of applicable municipal or state agencies.

6.3.14. As Built Drawings

The Contractor shall provide Time and Material (T&M) rates for creating As-Built drawings incorporating any field changes or observations made during construction activities.

6.4. Geotechnical Exploration

The Contractor shall develop and execute a soil boring and probe program to provide suitable subsurface information for the design and construction of the underground transmission lines.

The purpose of the geotechnical program is to obtain information about the soil, rock and environmental conditions required for the design and construction of the underground transmission lines. In addition to geotechnical borings, all boring locations shall be

evaluated for the thermal properties of the soil, for use in the cable rating portion of the Work. Thermal evaluations shall consist of in-situ testing utilizing a thermal needle and portable thermal property analyzer, as well as collection of bagged samples for laboratory thermal conductivity and dry-out testing. Thermal testing shall be performed in accordance with the Institute of Electrical and Electronic Engineers (IEEE) guide IEEE 442 "Guide for Soil Thermal Resistivity Measurements".

The Owner requires borings and probes taken approximately every 500 feet along the entire route. Wherever possible, borings shall be taken on the centerline of the proposed Line (except for borings associated with HDDs). Borings shall be advanced to a sufficient depth to obtain the necessary information as outlined in this Specification. Borings associated with HDDs shall be offset from the proposed alignment to reduce the possibility of frac-outs during construction. In addition to the borings along the route, borings shall also be taken at all proposed manhole locations

For bid purposes, the Contractor may assume that a total of 15 borings will be required on land and a minimum of two borings in the water at each of the two river crossings.

6.4.1. Subsurface Exploration Observation

The Contractor shall provide a full time Geotechnical Engineer to observe all boring and thermal probe operations. The Contractor shall monitor all operations and track boring quantities.

6.4.2. Field Screening for VOCs

The Contractor shall field screen all soil samples for the potential presence of hazardous volatile organic compounds (VOCs).

The Contractor shall report any screening results that exceed 10 ppm to the Owner within 24 hours after discovery. The Contractor shall also take suitable precautions to protect the health and safety of field personnel and the public as required. The Contractor shall not continue work at a given site or boring if the work cannot be performed safely without respiratory protection.

6.4.3. Geotechnical Review, Recommendations and Report

The Contractor shall review all subsurface information and provide recommendations for the design and construction of the underground transmission lines. Recommendations shall address excavation difficulty, recommended bedrock excavation guidelines, excavation support, ground water; protection of adjacent facilities and utilities, backfill and compaction, and other geotechnical issues that may affect the construction.

The Contractor shall prepare a geotechnical investigation report summarizing the subsurface investigation program, the subsurface conditions, field screening for VOCs results and the geotechnical recommendations.

6.4.4. Borings and Probes

The Contractor shall determine the number, location and depth of the borings and probes and mark these locations on the plans. The desired location of the borings shall be marked in the field by the Contractor prior to drilling. The actual location of the borings so as to avoid utilities and subsurface constraints shall be the responsibility of the Contractor. All appropriate utilities and "Dig Safe" shall be contacted by the Contractor to obtain clearance for boring locations prior to drilling.

Location of utilities in the area to be drilled, so as to avoid interference thereof, shall be the sole responsibility of the Contractor. In the event a utility is impaired, it shall be the responsibility and financial obligation of the Contractor to see that the utility is repaired.

6.4.5. Records

The Contractor shall maintain logs of all borings and probes and shall submit copies of these logs to the Owner at the completion of the boring program.

6.4.6. Steam Cleaning

All down hole parts of the drilling equipment shall be steam cleaned prior to or upon set-up of the drilling equipment at each boring. Steam cleaning prior to performing probes will not be required.

6.4.7. Intermediate Borings

The Contractor shall provide Time and Material (T&M) rates for any intermediate or additional borings which may be required to adequately define rock boundaries, environmental contamination limits or other features as requested by the Owner along the Line route. The Contractor shall consult with the Owner and obtain approval for the additional borings prior to drilling.

6.5. Electrical Design

6.5.1. Ampacity Calculations

The Contractor shall perform ampacity calculations to determine the conductor size required to provide the requested capacity of the Line. The Contractor shall determine and identify the limiting section for the Line in consultation with the Owner. The ampacity calculations shall be based on a single point bonding scheme utilized for the underground cable system. The Contractor shall perform calculations for all expected trench cross sections and for any other unusual construction alignments (HDDs, pipejacking, deep burial, thermal interference areas, etc.).

6.5.2. Cable Pulling Calculations / Siting Manhole Locations

The Contractor shall perform all pulling calculations and sidewall pressure calculations to determine the location of the required manholes along the route. Pulling calculations shall be based on the proposed cable construction as determined through the ampacity calculations and for a maximum cable construction of 3000kcmil copper conductor, 800 mils of solid dielectric insulation, 125 mils of lead sheath and 140 mils of outer jacket.

Maximum calculated pulling tensions and sidewall pressures shall be compared to allowable pulling tensions based on manufacturer's recommendations. If the tensions / pressures are determined to be too large, then manhole locations / radius of curvature shall be adjusted to reduce the pulling tensions / sidewall pressures to acceptable levels.

Contractor shall minimize the number of required manholes to the extent possible based on good engineering practices and cable pulling guidelines

6.5.3. Electric and Magnetic Field (EMF) Calculations

The Contractor shall perform all necessary EMF analysis in support of permitting and licensing activities and equipment design specifications. EMF levels shall be calculated for all representative trench cross sections expected along the Line route and for both terminal end locations.

The Contractor shall make recommendations regarding optimal phase orientation or other construction techniques in the ductline to minimize EMF.

6.5.4. Special Cable Considerations

The Contractor shall perform all other calculations required to design and complete the specification of the cable system. These calculations shall include but are not limited to:

- Open sheath voltages
- Cable system operating losses
- Cable charging current
- Cable system impedances (both on a per unit and total length basis)

6.5.5. Procurement Specifications

The Contractor shall prepare all technical specifications for the bidding and procurement of the entire cable system including accessories.

Owner responsibilities related to Procurement of project equipment and materials shall include:

- Preparation of Request For Quote's (RFQ) using Contractor generated technical specifications, and submittal of RFQ's to Owner-approved vendors
- Evaluation of vendor proposals, in conjunction with Contractor
- Award of bids to vendors, including issuing purchase orders for equipment and materials
- Receipt of project equipment and materials.

Procurement support by Contractor shall include:

- Preparation of major and long-lead equipment technical specifications for Owner's use.
- Specifications shall be prepared so that the Owner may use the specifications as either a stand-alone material procurement or in combination with the installation specifications.
- Bid evaluation of vendor proposals including evaluation reports with recommendations
- Act as the technical representative responding to vendors questions during the bid process
- Review of vendor drawings and calculations
- Material expediting
- Witness of equipment testing, if requested to do so. Work hours for this task shall be performed as Time and Material and shall not be included in pricing estimates.

In preparing technical specifications, Contractor shall include all technical requirements, schedules, proposal data sections, supporting drawings and design information. Contractor shall use Owner's standard technical specification document format.

6.5.6. Installation Specifications

The Contractor shall prepare complete technical specifications for the installation of the cable system. Specifications shall be suitable for a competitive bid process. Specifications shall be prepared so that the Owner may use the documents in one of the following combinations:

- Stand Alone Ductline Installation
- Stand Alone Cable Installation
- Combined ductline and cable installation
- Combined material procurement, ductline and cable installation

To support Owner, Contractor shall:

- Prepare all technical requirements, schedules, proposal data sections, supporting drawings and design information
- Assist Owner in developing a qualified contractors' list
- Attend site visits during the proposal stages
- Perform bid evaluations and prepare a report including recommendations for award

7.0 Schedule of Work

The Contractor shall schedule their operations so as to complete the Work as follows:

August 15, 2014: Complete all route survey activities, utility research, geotechnical investigation, HDD design, pipejacking design, plan and profile drawings, ampacity study, and cable pulling calculations.

Sept 1, 2014: Complete cost estimate for Owner review

Sept 30, 2014: Owner will present design and cost estimate to the Parties who are funding the undergrounding of the transmission line. The Parties will decide whether to proceed with the undergrounding project.

If there is a decision from the Parties to proceed with the undergrounding project, the Owner and the Contractor will agree upon a schedule for the balance of the Work at that time.

The Owner reserves the right to require the Contractor to add and/or replace personnel and/or material for performance of the work, if in the opinion of the Owner; such changes are required to adhere to the schedule or to provide the level of service required.

8.0 Access to the Site(s)

8.1. Regulations, Permits, Local Licenses, Approvals

The Contractor shall obtain all permits, licenses and permissions that are necessary to gain and maintain access to the site locations, and required for the execution of any portion of the Work. The Contractor shall coordinate activities on roads and property owned by local municipalities or the State of Rhode Island depending on the applicable jurisdictional authority.

In the event that the conditions of any permits require the Contractor to limit its working hours, no additional compensation beyond the prices in the Payment Schedule shall be paid for such working hour limitations.

The Contractor shall obtain Owner's permission before entering private property.

8.2. Conduct of Work

The Contractor shall exercise care in conducting all operations in public and private property to minimize the amount of disturbance and damage related to gaining access to the site locations. No trees or brush may be cut without written permission of the Owner. The Contractor shall be responsible for reasonable preventive measures to maintain all property in a condition acceptable to the Owner and the property owner.

In case of failure on the part of the Contractor to restore or make good such damage or injury, the Owner may, upon forty-eight (48) hours notice, proceed to affect such repairs and the cost thereof shall be deducted from any monies due the Contractor under this Contract.

8.3. Traffic Control

Traffic control on all municipal, state, and Federal highways and roads shall conform to appropriate regulations, including the Uniform Manual of Traffic Control. All police details shall be paid directly by the Contractor. Expenses for any traffic control measures requiring signs and lights shall be paid by the Contractor. In the event that traffic control considerations require that the Contractor limit or schedule other than normal working hours,

no additional compensation beyond the prices in the payment schedule shall be paid for such working hour limits.

9.0 PAYMENT SCHEDULE

The Contractor shall be paid in accordance with the Payment Schedule for all Work to be performed in fulfillment of the requirements of this Specification.

10.0 HEALTH AND SAFETY

The Contractor shall at all times be fully responsible for and exercise reasonable precautions for the health and safety of its employees and all others engaged in the execution and control of the work required in this Specification. The Contractor shall prepare a health and safety plan for all field operations prior to starting field operations. It shall comply with all applicable provisions of Federal, state and municipal health and safety statutes and codes. The Contractor shall also comply with any additional safety precautions required by the Owner during the progress of the work.

11.0 PERSONNEL

The Contractor shall engage personnel who are qualified, by training and experience, to carry out the functions to which they are assigned. Upon request and at the sole determination of the Owner, unqualified personnel shall be immediately replaced.

12.0 FIELD SURVEYS

The Contractor may generate baseline drawings photogrammetrically provided that appropriate supplemental field surveys are conducted to establish project control, photo control, and to locate planimetric details not identifiable through photogrammetric interpretive methods. The method of obtaining this information may be at the discretion of the Contractor as long as it meets the requirements of Section 14.0 and Appendix B.

Different scale drawings (1" = 20 ft, and 1"= 100 ft), and different plan view widths are required for the Drawings. Aerial photography shall be suitable for the various mapping requirements.

Where the Line crosses private property or privately owned streets, the Contractor shall perform additional surveying to accurately outline the property boundaries for purposes of obtaining easements.

Contractor shall submit a copy of all field notes to the Owner upon request.

13.0 HORIZONTAL AND VERTICAL CONTROL

Horizontal and vertical control shall be established by the Contractor on the photos and in the field. Care shall be taken when choosing control points to avoid placement and/or entry on private property wherever possible. Type and placement of this control shall be agreed to by the Contractor and the Owner.

13.1. Control Standards

Horizontal and vertical control standards established by the Contractor shall conform to third-order Class II standards as defined in the publication "Standards and Specifications for Geodetic Control Networks", National Oceanic and Atmospheric Administration, Federal Geodetic Control Committee, September 1984.

14.0 PLAN AND PROFILE MAPPING

14.1. Baseline Drawings with Utilities and Surface Features

The Contractor shall prepare plan and profile drawings showing existing and planned utilities, subsurface obstructions, and surface features along the designated route as required by this Specification including, but not limited to, Appendix A. Drawings shall cover the entire route from riser to riser. The survey shall include the Franklin Square Substation yard, the associated areas of the Manchester Street power plant yard, and the Mauran Avenue Transition Station yard for locating the riser terminal locations.

The Contractor shall gather all required utility data from the associated utilities, public works departments, and/or other controlling agencies or Owners for this task. The Contractor shall perform field survey work to locate visible manhole covers, drainage structures, valve boxes, hydrants and all other surface features. The Contractor shall physically confirm accessible pipe invert elevations and accessible feature sizes in the field. The Contractor shall use non-entry methods to determine physical features and is prohibited from entering any underground locations with obtaining permission from the respective utility.

Plan views shall be prepared at a 1 inch = 20 feet scale, and profile views shall be prepared at 1 inch = 20 feet horizontal, 1 inch = 4 feet vertical scale. Should site conditions warrant, the Owner may require a change in scale for portions of the route.

14.2. Addition of Line

For the preliminary drawings in addition to the existing and proposed utilities and features, the Contractor shall add the preliminary Line alignment as proposed by the Contractor for the Owners review to both the plan and profile views.

In adding the Line to the plan and profile drawings, the Line shall generally be shown in as straight an alignment as possible. Where vertical or horizontal curves are required to avoid utilities or obstructions, or to follow changes in roadway alignment, they shall be of as large a radius as practical.

All existing or proposed utilities or other existing or proposed features located within streets (property line to property line) or within right of way shall be shown in both the plan and profile views. In Plan view, utilities and/or features 8" in diameter or width or larger shall be shown approximately to scale (not as a line or small circle, etc.) to fully outline their outside dimension. In Profile view, utilities and/or features shall be shown to scale to fully outline their dimensions.

Clearance between utilities and obstructions and the concrete envelope surrounding the new Line shall be 12 inches minimum whenever possible. Owner will provide guidance where these clearances cannot be met. Where cast-iron gas pipeline are identified, Contractor shall attempt to locate the line remote from the gas line wherever possible to minimize cast-iron pipe replacements.

14.3. Horizontal Stationing

Once the Owner has accepted the alignment, the Contractor shall prepare intermediate drawings showing stationing of the Line centerline alignment, beginning stationing at 10+00 at the point where the cable exits the fence at the Mauran Avenue Transition Station, and continuing in a positive direction toward the Franklin Square Substation. Stations shall be marked at 100 foot intervals. Stationing shall be shown on both the plan and profile views. Use of negative or equation stations shall be avoided whenever possible.

14.4. Pipe Bend / Slope Data

In order for the Owner to review the cable pulling calculations, the Contractor shall generate the following additional information for all horizontal and vertical bends, pipe dips, sloped sections, etc.

14.4.1. Vertical or Horizontal Bends

- Station at start of bend
- Station at end of bend
- Radius of bend to nearest 0.1 feet
- Internal angle of bend to nearest degree
- Arc length of bend to nearest 0.1 feet

14.4.2. Pipe Dips

- Station at start of dip
- Station at end of dip
- Vertical offset of dip to nearest 0.1 feet
- Arc Length of dip to nearest 0.1 feet

14.4.3. Slopes

- Station at start of slope
- Station at end of slope
- Angle of slope from horizontal to nearest degree.

14.5. Casings

Where normal trenching is not permitted, and where obstructions may be crossed by jacking a casing (i.e. railroad crossings, limited access highways), the Contractor shall perform detailed design of said casings. The casing construction details shall be added to the drawings at the designated locations, and pipe alignments shall be modified as required to accommodate the casing. One cased crossing of Interstate 195 is required between Tockwotton Street and India Street in Providence.

14.6. Manhole Addition

Once the Contractor has generated bend / slope data, cable pulling calculations for the proposed alignment shall be performed and manhole locations shall be designated along the route. The Contractor shall add manholes and/or handholes to the drawings at the designated locations, and shall modify pipe alignments as required to accommodate manholes and handholes. Contractor shall minimize the number of required manholes to the extent possible based on good engineering practices and cable pulling guidelines.

14.7. Soil Borings

The Contractor shall designate and add to the drawings all soil boring and thermal probe locations.

14.8. Environmentally Sensitive Areas

The Contractor shall work with the Owner's environmental contractor for this project. If the transmission lines pass through environmentally sensitive areas or their associated buffer zones, the Contractor shall add appropriate sedimentation control (hay bales, silt fence, etc.) or other protection, as identified by the environmental engineers, to the drawings.

14.9. Private Property Easements

If it becomes necessary for the Line to cross private property or along privately owned streets, the Contractor shall develop drawings suitable for the Owner's use in obtaining legal easements. These drawings shall show sufficient detail to clearly identify the Owner's requested easement boundaries and the full impact to the private property. In addition to the other requirements of this specification, the easement drawings shall show the following additional details:

1. Property boundary lines confirmed through field surveys.
2. The easement area shown as a shaded area centered on the Line alignment. The shaded area shall be of sufficient width for the Owner's ability to maintain the facilities at a future date. Proper width to be determined in consultation with the Owner.
3. Private property owner's name and property reference (Registry Book & Page) as determined through Assessors maps and records.

All easement drawings shall be stamped and signed by a Registered Land Surveyor registered in the State of Rhode Island.

Private Property Easements are anticipated on the east end of the Providence River HDD, near the Mauran Avenue Transition Station, and through several City parks. Other easements may be identified through performance of the Work.

15.0 MAP ACCURACY AND ANNOTATION

15.1. Plan and Profile Standards

The basis for the map projection shall be the Rhode Island state plane coordinate system. Coordinate grid cross ticks shall be placed on the plan in multiples of 200 feet such that a minimum of four reference cross ticks in multiples of 200 feet such that a minimum of four reference cross ticks shall appear on each sheet and not exceed 10 inches apart. These shall be located well out of the centerline area and shall be arranged with a minimum of two on the northing and two on the same easting. They shall be plotted to an accuracy of 1/40 inch, by 1/2 inch in length and be annotated with northing and easting coordinates at that point. Ground survey determined coordinates after adjustment shall be treated as absolute and take precedence over photogrammetrically measured coordinates where small differences occur. Final stationing shall be along the horizontal alignment of the Line, profile stationing shall be adjusted accordingly to insure tangent points of vertical curves match horizontal stations. Large differences may require resolution by ground surveys such as traverses, Global Positioning Systems, or other methods acceptable to the Owner. All stationing on the plan and profile shall be grid stationing based on adjustment to the North American Datum of 1927 (or 1983 if appropriate). Vertical control shall be based on the National Geodetic Vertical Datum of 1929. Other control adjustments may be suggested by the Contractor for approval by the Owner.

15.2. Topographic Standards

The two foot contours shall be accurate to a minimum of half the contour interval and shall be on a separate layer. Contours shall be shown as solid lines except in areas where the ground is completely obscured by heavy brush or tree cover; in such areas, the contours shall be shown as dashed lines and shall be plotted as accurately as possible from the stereoscopic model. Every contour line that is on a multiple of 10 feet shall be an index contour and shall be shown with a line weight heavier than that of the intermediate contours with elevation labeled at the outer regions of the plan or in regions as far as possible from the centerline.

15.3. Stationing and Angle Details

Stationing shall begin from Mauran Avenue Transition Station and run right to left on the plan and profile sheets. Equations shall be avoided where possible. When approved, equations shall be prominently displayed on both the plan and profile views. Stations on the profile that are multiples of 100 feet shall coincide with major vertical grid division lines. Stations shall be indicated at 100 foot intervals in both the plan and profile views. The calculated grid stationing and the grid coordinates of each angle point in the centerline and the magnitude of each angle to the nearest second shall be shown. Grid bearings shall be shown on each plan sheet to the nearest second and in the direction of increased stationing.

15.4. Control Points

All basic horizontal and vertical control points located within the map area shall be shown and identified on the plan sheet by appropriate symbol, number, and elevation where applicable. This control shall be shown as follows:

15.4.1. Basic horizontal control points shall be denoted by a small dot at the position of the point, and enclosed by an equilateral triangle with sides 0.2 inches long.

15.4.2. Basic vertical control points shall be denoted by cross ticks of 0.25 inches, oriented 45 degrees to the state grid ticks.

15.4.3. Only photo control points that are part of the basic control need to be shown.

15.5. Map Projection Information

A north arrow showing grid north and the correction to geodetic north shall be provided on every drawing. The map projection and the combined grid scale factor (elevation and reduction to grid) shall be provided at the same interval for that particular location. For final drawings, the reduction factor shall be given for the approximate center of that sheet.

15.6. Profile Precision

Stationing shown as profile data shall be recorded to the nearest one foot ground distance measured from the initial point. The vertical accuracy of all profile data shall be as follows:

15.6.1. Relative elevation error of any point with any point within 500' shall not exceed 0.10 feet.

15.6.2. The actual ground elevation error shall not exceed plus or minus 1.0 foot. Errors shall not be cumulative.

15.7. Plotting Precision

Major grid division lines on the profile plot shall be set up to fall on even stations. Stations for the plot shall be printed out at 100 foot intervals. All angles shall be designated. Resolution of the plot shall be a minimum of 1/100 inch. The plot shall be accurate to 1 part in 1,000 over 30 inches. All planimetric details shall be plotted within 1/40 inch of their true position.

16.0 SPECIAL PROVISIONS REQUIRED

16.1. Meetings

The Contractor shall attend meetings with the Owner as requested by the Owner. For bid purposes, the Contractor shall plan on attending a minimum of twenty-four (24) meetings with the Owner at the Owner's offices in Providence, RI or Waltham, MA.

16.2. Digitizing Services

The Contractor shall be required, when requested by the Owner, to provide digitizing services on a specific photo(s), identifying points such as substations, power pole bases, fence corners, road crossings, railroad crossings, pipe crossings, airport data, bridges, etc. These points shall be measured by methods to insure that their plotted location is within 1/40 inch at map scale of their true location.

16.3. Drawing Format

All drawings shall be CAD generated and shall be compatible with AutoCAD Map 2011. All hard copies of drawings for approval signatures and "Record Drawings" shall be supplied in AutoCAD Map 2011 format. Electronic files of the working drawings and final maps shall be supplied on Compact Discs (CD), IBM formatted in AutoCAD Map 2011 and, if different, in its native format.

16.3.1. Drawing Lettering

All lettering on the plan and profile sheets shall be large enough to be clear after 50% reduction.

16.3.2. Drawing Size

Plan and profile drawings shall be prepared on ANSI D size sheets. The sheets shall have a cut line of 24 inches by 36 inches, with a one inch border on all sides. A 2.5 inch high area shall be reserved above the border at the bottom of the drawing for the title block, revision block, map scale, map projection, Professional Engineers stamp box, Contractor's logo, etc. The drawing number, which will be provided by the Owner, shall be placed in the lower right portion of the drawing, and upside down in the upper left hand portion of the drawing.

The plan and profile shall be blocked within the remaining 19.5 inch by 34 inch area. The plan view shall be blocked in the upper 9.75 inch by 34 inch area, and the profile shall be blocked within the lower 9.75 inch by 34 inch area.

For final "Record Drawings", a National Grid Standard "H" frame shall be superimposed around the ANSI D sized drawings. The National Grid "H" drawing has a cut line of 26.75 inches by 40.75 inches.

The franchise maps, if required, shall be prepared on National Grid "T" size sheets. The sheets shall have a cut line of 12 inches by 40 inches, with a one inch border on all sides. A 2.5 inch high area shall be reserved above the border at the bottom of the drawing for the title block, revision block, map scale, map projection, Registered Land Surveyors stamp box, Contractor's logo, etc. The drawing number, which will be provided by the Owner, shall be placed in the lower right portion of the drawing and upside down in the upper left hand portion of the drawing.

The Owner will provide sample National Grid "H", "T" and ANSI D masks. The Contractor shall prepare sample ANSI D and National Grid "H" & "T" masks for the Owner's approval prior to generating the finished drawings.

A graphical scale (with a textual scale directly beneath) shall be included on all drawings. All drawings shall have a north arrow on the plan view.

All final drawings as described in this specification shall be stamped and signed by a Professional Engineer registered in the State of Rhode Island, and shall be suitable as permit and construction drawings for the agencies involved.

Unless otherwise specified, the Owner will require three (3) copies of any preliminary or draft drawings and ten (10) copies of the final drawings.

16.3.3. Layer Information

All drawings shall conform to the layer format described below:

LAYER TITLE	INCLUDE
Roads	Highways, streets, roads & railroads
Topography	Contour lines
Buildings	Buildings, parking areas, etc.
Features	Physical features, tree lines
Town Line	Cities, towns, boundaries
Water	All water/wetlands information
Grid	Profile grid
Profile	Complete profile information, identified obstacles
Overhead Utilities	Above grade utilities
Underground Utilities	Below grade utilities
Pull Data	Bend data for cable pulling
Line	Transmission and communication

Each Layer shall be self contained including all the required annotations referring to that particular layer.

16.3.4. Color Scheme

All drawings shall conform to the following standard color scheme used by Dig Safe.

UTILITY	COLOR	Col. No.
Electrical, Power, Existing Electrical	Red	3
Gas, Oil, Steam	Yellow	2
Communication, Alarm, Phone	Orange	6
Water	Blue	7
Sewer, Storm	Green	2
Limits of Pavement	Gray	14
Hay Bales, Silt Fence	Black/Yellow	92
Auger Probes	Pink	5
Wetland Flags	Navy Blue	1
Wetland Numbers	Off White	32
Boring Locations	Off White	32
Existing Poles and Overhead Line	Black	0
Contours	Brown	54
Line (Line Weight = 3)	Black	0

17.0 PROJECT CONTACT PERSONNEL

8.0 National Grid Company Contacts

Technical Issues

David M. Campilii
Consulting Engineer
National Grid
40 Sylvan Road
Waltham, MA 02451

david.campilii@nationalgrid.com

Commercial Issues

Jason Henry
Principal Purchasing Agent
National Grid
40 Sylvan Road
Waltham, MA 02451

jason.henry@nationalgrid.com

FIGURE 1: E183 Relocation Proposed Line Routing
Sheet 1 Of 1 – Proposed Underground Alignment

FIGURE 2: Preliminary HDD Alignments

Sheet 1 of 2 – Providence River HDD Preliminary Alignment

Sheet 2 of 2 – Seekonk River HDD Preliminary Alignment

FIGURE 3: Transition Station Drawings

Sheet 1 of 3 – Franklin Square Transition – General Arrangement and Preliminary Location
Sheet 2 of 3 – Mauran Avenue Transition – General Arrangement
Sheet 3 of 3 – Mauran Avenue Transition – Preliminary Location

APPENDIX A - PLAN AND PROFILE ANNOTATION

A1 REQUIRED PLAN AND PROFILE INFORMATION

The following information and data required for the final design and procurement of right-of-way shall be placed on the plan and profile drawings by the Contractor. All physical features that may interfere with or be affected by the Line construction shall be shown in the profile view as well as the plan view. All of the information listed below shall be plotted; however, the Owner may approve the omission of some from the final plot for clarity.

A1.1. Electrical Stations

Terminal and switchyard or substation locations: Horizontal and vertical control which shall tie the end of the proposed Line survey to the existing switchyard or substation survey.

A1.2. Boundaries

State, county legal land subdivision lines, National and State forest boundaries, the corporate limits of cities, towns, counties, and states along with their names. Public and private property shall be identified with Owner and name commonly known by, if applicable. Note transmission line stationing at boundary line crossings.

Private property boundary lines shall be superimposed onto the drawings from available Assessors maps.

A1.3. Buildings and Signs

All buildings and structures within 50 feet of the roadway curb or Line alignment shall be identified on the drawings; only the front outline need be shown. "Landmark" buildings, street numbers, and signs shall be labeled for reference.

A1.4. Railroads

The location of all railroads within 50 feet of the roadway curb or Line alignment shall be shown and identified. All crossings shall be located, and the following information recorded:

- Name of railroad
- Station at the centerline of each track
- Elevation of rails

A1.5. Water Areas

All open water and wetlands areas and normally dry flood channels within 100 feet of the Line alignment and rivers within 200 feet of the Line alignment shall be located and the following information added:

- Elevation and station at high, low and normal water lines as applicable
- Direction of flow
- Geographical name, if any
- Boundary of areas and buffer zones designated as wetlands by jurisdictional authority, and required protective measures shown.

A1.6. Flood Plain Boundaries

Boundary of all 10 year and 100 year flood plains within 100 feet of the Line alignment shall be shown and identified on the drawings.

A1.7. Fences

The location and construction material of all fences and walls within 50 feet of the roadway curb or Line alignment shall be located on the drawings. All crossings shall be noted on the profile also.

A1.8. Contaminated Soils

Boundary of areas identified as 21E sites or designated as contaminated within 100 feet of the Line alignment shall be shown and identified on the drawings. These locations shall be determined in consultation with the Owner's environmental contractor.

A1.9. Subsurface and Surface Features

The location of all existing or proposed utilities or other existing or proposed features, whether above the surface or buried, which are within 50 feet of the roadway curb or Line alignment shall be plotted to scale to show extent of full dimensions on the drawings. The Contractor shall register utility record drawings to features found on site visits and/or found on aerial photos to the extent possible.

The following features shall be identified along the cable route:

- Subsurface Obstructions
 - Gas Line, including valves, services and accessories
 - Telephone ductbanks, manholes, vaults, lateral conduits, direct buried cables and accessories
 - Water Line, including valves, gates, thrust blocks and accessories
 - Sewer and storm drains, including manholes, catch basins and accessories
 - Electric ductbanks, manholes, vaults, lateral conduits, direct buried cables and accessories
 - Cable Television, including ductbanks, manholes, laterals, direct buried cables and accessories
 - Steam lines including accessories
 - Oil lines including accessories
 - Foundations, cellar protrusions
 - Traffic control conduits
 - Other features of record or as found or proposed
- Surface Features (existing and proposed)

Roadway and highway lines / curb lines
Sidewalk lines
Curb cuts
Utility poles
Street lights, signs, vent stacks
Trees, woodlands
Bridges, Culverts
Fire hydrants
Catch basins
Traffic Signal Control boxes, Loop Detectors
Manhole covers, valve covers
Other features as found or proposed