Exhibit 15B
Soil Survey, Collector Line
Stantec

Table of Contents

List of Appendices

1.0 INTRODUCTION

The proposed Bowers Wind Project includes approximately five miles of new collector line connecting wind turbine strands in the southern portion of the project area to a substation near the northern border of Carroll Plantation. Stantec Consulting (Stantec) is providing this modified Class L Soil Survey for the collector corridor, located entirely in Carroll Plantation, Penobscot County, Maine. This "modified" level of soil survey was performed to satisfy the requirements of Dave Rocque, State Soil Scientist, and the Maine Land Use Regulation Commission guidelines for linear transmission line corridor projects.

2.0 PURPOSE

The purpose of our investigation was to provide taxonomic classification for soils identified along the proposed collector corridor and to identify limitations for development with respect to soil drainage, physical properties and depth to bedrock. Additionally, areas containing "hydrologically sensitive features" such as surface drainages and groundwater seeps were surveyed and described. These areas are not mapped as jurisdictional wetlands or streams but have a seasonal or permanent hydrology that may pose erosion and sediment control risks during construction.

Due to the relatively low impacts of installing a collector line (compared to other linear projects such as roads), it was not necessary to perform a traditional Class L Soil Survey where soils are surveyed and described at the Class A High Intensity Map Unit size. Instead, the complete corridor was surveyed and soils were investigated and described where landscape features such as slope or cover type changed, as well as in areas suspected of containing "hydrologically sensitive features". This approach should address Dave Rocque's concern with retaining hydraulic connections and maintain the natural perched ground water and surface run-off pattern as much as is feasible, as well as properly dealing with sensitive soil areas for erosion and sediment control.

Stantec's soil and wetland scientists examined the proposed collector line corridor and identified and survey-located areas where soils are poorly or very poorly drained, exhibit oxyaquic conditions, or concentrate surface water runoff during periods of spring snowmelt or heavy precipitation.

3.0 METHODOLOGY

Soils identification and mapping were based on the techniques derived from standards adopted by the Maine Association of Professional Soil Scientists (revised 2004/2009).

Soils are described using standard soil terminology developed by the U.S. Department of Agriculture Natural Resources Conservation Service, which is the origin of soil interpretation records for each soil series described in Maine. Where important, distinctions are made between hydric and non-hydric soils. The Maine Association of Professional Soil Scientists Key to Soil Drainage Classes was also utilized, as well as a list of regional indicators for identification of hydric soils (Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, Version 7.0, 2010).

The proposed collector line corridor soils were examined in the field on November 15, 16 and 17, 2010. Test pits and borings were located using a Global Positioning System (GPS) unit with submeter accuracy. Field work consisted of documenting soil morphology and characteristics with hand dug test pits and borings. Soil types were identified and depicted on the proposed project Site Plan 1" = 200'.

The soil investigations were performed using a tile spade shovel and hand soil auger to excavate test pits to a depth of 40 inches or until refusal due to encountering bedrock, boulders or basal lodgement till. Test pits were identified on-site with pink numbered flagging tape. Bedrock outcroppings were located by a GPS receiver to further identify shallow to bedrock soil map units. It should be noted that these soils were not observed with profile depths suitable for classifications to the series level. It is not feasible to observe soil profiles to depths greater than 60 inches without any excavating equipment; however, sufficient data were collected to determine the underlying soils limitations for this modified Class "L" Soil Survey.

Soil map units were designed to report the pertinent soil characteristics along with their soil limitations for the proposed use and management of a collector line corridor project. *Ad hoc* symbols were used in places on the map to provide locations of bedrock outcroppings, surface boulders, channelized surface water runoff and soil areas comprised of oxyaquic soils.

A preliminary soils map was developed by obtaining the electronic layer of the Natural Resource Conservation Service medium intensity map and importing the soil boundary information into the project CAD file (State Plane). Soil test pit excavations data and two-foot contour data were used to upgrade, refine, and modify the map within the proposed corridor.

The soils data provide useful information for engineering by anticipating existing and proposed conditions with regards to depth to bedrock that will affect construction techniques, soil drainage characteristics that will affect erosion and sediment control, and slopes that will affect construction techniques and erosion and sediment control.

4.0 SITE LOCATION/SETTING

The proposed Bowers Wind Project collector line is located entirely within Carroll Plantation, Maine. The corridor is approximately five miles in length. The project area is gently to steeply sloping and is comprised mainly of forested land except for portions that cross existing roadways or areas which have been cleared for agriculture.

5.0 GENERAL SITE AND SUBSURFACE CONDITIONS

The site includes primarily forested side and shoulder slopes and hilltop ridges. Soil landforms generally consist of silt loam soils with coarse fragments derived from glacial till. The hill tops and shoulders are generally bedrock controlled and exhibit shallow to bedrock soils or exposed bedrock outcrops. The sideslopes tend to be comprised of deeper soils and commonly exhibit a firm substratum that produces a perched groundwater table.

6.0 SOIL MAP UNIT DESCRIPTIONS

The soil map unit descriptions included in Appendix C provide taxonomic details regarding the soil series most closely matching soils encountered in the portions of the soil profile that could be excavated using hand tools. Descriptions also include a summary of the composition and soil characteristics of soils within a given map unit, as well as a list of similar and dissimilar soil series inclusions which occur within a given mapping unit. Slope gradient ranges are provided and refer to slope phases indicated in the soil survey map and in the soil legend. The soil narrative report is provided to describe the soil composition and physical characteristics and the general soil limitations for the proposed use and management. The soils map (Appendix B) depicts the spatial location of the soil series or complexes within the project site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our observations of the project site and our knowledge of the proposed use of the property, the soils within the development area are generally suitable for the proposed collection line. However, areas of somewhat poorly, poorly, or very poorly drained soils where seasonal high groundwater tables may be within 12 inches of the mineral soil surface for a significant portion of the year may need special erosion and sediment control measures if field work takes place on unfrozen ground and/or during periods of heavy precipitation.

Areas identified as unique hydrologic features (see Appendix F) will require site-specific erosion control measures due to their mucky surface horizons, susceptibility to large quantities of sheet flow, and areas of channelized flow at or near the mineral soil surface.

Areas identified as poorly or very poorly drained hydric soils have limitations due to instability and prolonged saturation and may have additional permitting implications due to their identification as jurisdictional wetlands.

Areas of the project where stony or rubbly soil surfaces were observed may impede vehicular traffic or require additional time and cost to clear the soil surface for use.

APPENDIX A
Limitations

This soil narrative report and accompanying soil survey map have been prepared by Stantec Consulting (Stantec) for its specific application to the proposed Bowers Wind Farm Project in Carroll Plantation and Kossuth Township, Maine. Stantec conducted the work in accordance with generally accepted soil science practices outlined in the Maine Association of Professional Soil Scientists guidelines and the Maine Board of Certification of Geologists and Soil Scientists guidelines. No other warranty, expressed or implied, is made.

It should be recognized that map unit design is influenced by the intended use of the soil survey information, and may not be adequate or sufficient to evaluate for uses other than that for which the specific soil survey was developed. Soils which are non-limiting for one use may be considered a limitation for different use than that identified.

The analysis contained herein is based on data obtained during subsurface exploration of the site, and the interpretation of published information by the U.S. Department of Agriculture Natural Resources Conservation Services. Due to the glaciations of Maine and the complexity of the landscaping, variations in subsurface conditions may exist between exploration sites, which may not become evident until significant project excavation begins. Should significant variations in subsurface conditions become evident after the submission of this report, it may be necessary to re-evaluate the nature of the variation in light of the recommendations enclosed herein.

Due to the combination of remoteness, current inaccessibility of heavy excavation equipment (e.g., backhoe, excavator, drill auger) and permitting constraints, Stantec used hand shovels and soil augers. Refusal or depth limitation to hand operated equipment may be due to bedrock and/or large stone or boulders.

APPENDIX B
Modified Class L (Linear) Soil Survey Map

Purpose – This soil survey standard is designed to provide the minimum soil information necessary to allow for the design and construction of long, narrow projects such as access roads, utility lines or trails with little or no adjacent development. Soil observations were made entirely by use of a hand shovel and soil auger.

1. Modified Class L soil survey map units were differentiated on the basis of parent material, slope, soil texture, soil depth to dense till or bedrock and soil wetness. Map unit sizes are based on field observations as well as phase changes indicated by the slope map; some map units may contain inclusions slightly larger than that allowed for Class A High Intensity Surveys. The preferred method of naming the soil map units is by assigning a soil series name or names for complexes. Soil classifications have been made to the series level despite soils information coming from shallow observations only; conditions in the unobserved subsoil layer could affect actual soils series and/or drainage class. Areas containing “unique hydrologic features” are identified within soil series map units and are addressed in Appendix F.

2. Scale is 1 inch equals 200 feet.

3. Ground Control – base line and test pits for which detailed data are recorded are located to sub-meter accuracy under the direction of a qualified professional.

4. Base map with two foot contours.

APPENDIX C
Soil Map Unit Descriptions

BANGOR SERIES

Setting

Parent Material:	Coarse-loamy glacial till
Landform:	Till plains and ridges
Position in Landscape:	Upper positions in landscape
Slope Gradient Ranges:	(B) 3-8%

Composition and Soil Characteristics

Typical Profile:

Ap--0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; friable; 10 percent gravel
Bs1--5 to 11 inches; brown to dark brown (7.5YR 4/4) silt loam; friable; 10 percent gravel
Bs2--11 to 21 inches; yellowish brown (10YR 5/8) silt loam; friable; 10 percent gravel
Bs3--21 to 24 inches; light olive brown (2.5Y 5/4) silt loam; friable; 10 percent gravel;
BC--24 to 27 inches; light olive brown (2.5Y 5/4) silt loam; friable; 5 percent gravel
C1--27 to 33 inches; olive (5Y 5/4) silt loam; firm; 10 percent gravel
C2--33 to 65 inches; olive (5Y 5/4) gravelly silt loam; firm; 15 percent gravel; gray (5Y 6/1) faces of peds

Taxonomic Class

Coarse-loamy, isotic, frigid Typic Haplorthods

Drainage Class

Well drained

Hydrologic Group

Group C

Permeability

Moderate throughout the soil profile

Depth to Bedrock

Very deep; greater than 60”

Hazard to Flooding

None

Typical Inclusions

Similar:	Elliotsville, Dixmont
Dissimilar:	Monarda, Telos

Use and Management

There are few limitations associated with this soil type relative to the proposed development.

BURNHAM SERIES

Setting

Parent Material:	Coarse-loamy glacial till
Landform:	Nearly level and depressional areas
Position in Landscape:	Lower positions in landscape, bases of long slopes, swales and depressions
Slope Gradient Ranges:	(A) 0-3%

Composition and Soil Characteristics

Typical Profile:

Oa1--0 to 4 inches; black (10YR 2/1) muck (sapric material); very friable

Oa2--4 to 13 inches; dark reddish brown (5YR 2/2) muck (sapric material); friable

Bg--13 to 18 inches; gray (N 5/0) channery silt loam; firm; many coarse prominent olive (5YR 5/3) masses of iron accumulation; 10 percent channers, 5 percent cobbles

Cdg1--18 to 34 inches; olive gray (5Y 4/2) channery silt loam; firm; many coarse prominent dark gray (N 4/0) iron depletions and many medium prominent light olive brown (2.5Y 5/4) masses of iron accumulation; 15 percent channers

Cdg2--34 to 65 inches; dark grayish brown (2.5Y 4/2) channery silt loam; firm; many medium distinct gray (5Y 5/1) iron depletions and many medium prominent yellowish brown (10YR 5/4) masses of iron accumulation; 20 percent channers

Taxonomic Class

Loamy, mixed, superactive, nonacid, frigid, shallow Histic Humaquepts

Drainage Class

Very poorly drained soils.

Hydrologic Group

Group D

Permeability

Permeability is moderately slow to moderately rapid in the organic surface, moderately slow in the subsoil, and slow or very slow in the substratum.

Depth to Bedrock

Very deep; greater than 60 inches.

Hazard to Flooding

Soil is not flooded but frequently ponded

Typical Inclusions

Similar:	Monarda, Wonsqueak, Peat and Muck
Dissimilar:	None

Use and Management

The limiting factor for site development is wetness due to the presence of a water table at or near the soil surface for a significant portion of the year. Burnham soil has severe limitations for construction, due to the instability of thick organic deposits and ponding. Proper drainage or other site modification is recommended for construction. This soil type is listed as hydric.

CHESUNCOOK SERIES

Setting

Parent Material:	Coarse-loamy glacial till
Landform:	Till plains, hills, ridges and mountains
Position in Landscape:	Upper positions in landscape
Slope Gradient Ranges:	(C) 8-15% (D) 15-25%

Composition and Soil Characteristics

Typical Profile:

Oa--0 to 1 inch; black (5YR 2/1) sapric material

E--1 to 4 inches; pinkish gray (7.5YR 6/2) silt loam; very friable; 10 percent gravel and channers, 2 percent cobbles and 1 percent stones

Bhs--4 to 5 inches; dark reddish brown (5YR 3/3) silt loam; very friable; 10 percent gravel and channers, 3 percent cobbles and 1 percent stones

Bs1--5 to 11 inches; reddish brown (5YR 4/4) silt loam; very friable; 10 percent gravel and channers, 3 percent cobbles and 1 percent stones

Bs2--11 to 18 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; very friable; 15 percent gravel and channers, 3 percent cobbles and 1 percent stones;

BC--18 to 21 inches; light olive brown (2.5Y 5/4) gravelly loam; friable; common medium prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and few medium distinct grayish brown (2.5Y 5/2) iron depletions; 20 percent gravel and channers, 3 percent cobbles and 1 percent stones

Cd--21 to 65 inches; light olive brown (2.5Y 5/3) gravelly loam; light brownish gray (2.5Y 6/2) faces of prisms which are separated by a thin layer of strong brown (7.5YR 5/6); common medium prominent strong brown (7.5YR 4/6) masses of iron accumulation and common coarse distinct light olive gray (5Y 6/2) iron depletions; 25 percent gravel and channers, 3 percent cobbles and 1 percent stones

Taxonomic Class

Coarse-loamy, isotic, frigid Aquic Haplorthods

Drainage Class

Moderately well drained soils

Hydrologic Group

Group C

Permeability

Permeability is moderate in the solum, and slow or very slow in the dense substratum.

Depth to Bedrock

Very deep; greater than 60 inches.

Hazard to Flooding

None

Typical Inclusions

Similar:	Elliotsville
Dissimilar:	Monson, Telos, Danforth, Daigle

Use and Management

There are few limitations for the proposed development within this map unit. These soils may have wetness due to the presence of a perched water table within 18 inches of the mineral soil surface during some portion of the year.

DIXMONT SERIES

Setting

Parent Material:	Coarse-loamy glacial till
Landform:	Till plains and ridges
Position in Landscape:	Upper positions in landscape
Slope Gradient Ranges:	(B) 3-8% (C) 8-15%

Composition and Soil Characteristics

Typical Profile:

A--0 to 2 inches, very dark grayish brown (10YR 3/2) silt loam, light brownish gray (2.5Y 6/2) dry; friable; 10 percent rock fragments

Bs1--2 to 8 inches, brown (7.5YR 4/4) silt loam; friable; many fine roots; 10 percent rock fragments

Bs2--8 to 13 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; friable; 15 percent rock fragments

Bs3--13 to 20 inches; olive brown (2.5Y 4/4) silt loam; friable; 10 percent rock fragments; many coarse prominent yellowish red (5YR 5/6) masses of iron accumulation and many distinct grayish brown (2.5Y 5/2) iron depletions

BC--20 to 26 inches, light olive brown (2.5Y 5/4) silt loam; firm in place, friable when removed; 10 percent rock fragments; many coarse prominent light brownish gray (10YR 6/2) iron depletions; many fine prominent strong brown (7.5YR 5/6) and coarse distinct light olive brown (2.5Y 5/6) masses of iron accumulation

C--26 to 65 inches, olive (5Y 5/3) silt loam; firm; 10 percent rock fragments; many coarse prominent strong brown (7.5YR 5/6) masses of iron accumulation

Taxonomic Class

Coarse-loamy, isotic, frigid Aquic Haplorthods

Drainage Class

Moderately well to somewhat poorly drained

Hydrologic Group

Group C

Permeability

Permeability is moderate in the A and upper part of the B horizons, and moderately slow or slow in the lower B and C horizons

Depth to Bedrock

Very deep; greater than 60”

Hazard to Flooding

None

Typical Inclusions

Similar:	Penquis, Bangor
Dissimilar:	Abram, Thorndike, Monarda, Burnham

Use and Management

There are few limitations associated with this soil type. Some areas within this map unit may have a groundwater table within 1 foot of the mineral soil surface during heavy precipitation or following spring snowmelt.

ELLIOTTSVILLE SERIES

Setting

Parent Material:	Coarse-loamy glacial till
Landform:	Till plains, hills, ridges and mountains
Position in Landscape:	Upper positions in landscape
Slope Gradient Ranges:	(D) 15-25%

Composition and Soil Characteristics

Typical Profile

Oa--0 to 1 inch; dark reddish brown (5YR 2.5/2) sapric material; very friable

E--1 to 2 inches; pinkish gray (7.5YR 7/2) silt loam; friable; 10 percent channers

Bh--2 to 4 inches; dark reddish brown (5YR 3/4) silt loam; very friable; 10 percent channers

Bs--4 to 11 inches; strong brown (7.5YR 5/6) flaggy loam; very friable; 15 percent channers and 10 percent flagstones

BC--11 to 17 inches; light olive brown (2.5Y 5/6) channery loam; friable; 10 percent channers and 5 percent flagstones

C--17 to 26 inches; olive (5Y 5/4) channery loam; friable; 10 percent channers and 5 percent flagstones

R--26 inches; slate.

Taxonomic Class

Coarse-loamy, isotic, frigid Typic Haplorthods

Drainage Class

Well drained

Hydrologic Group

Group B

Permeability

Permeability is moderate

Depth to Bedrock

Very deep; greater than 60”

Hazard to Flooding

None

Typical Inclusions

Similar:	Chesuncook
Dissimilar:	Monson, Telos, Danforth, Daigle

Use and Management

Soils within this map unit may have bedrock within 20 inches of the mineral soil surface. Drilling or blasting may be necessary for the proposed development.

HOWLAND SERIES

Setting

Parent Material: Coarse-loamy glacial till
Landform: Drumlins and till ridges
Position in Landscape: Upper positions and side slopes
Slope Gradient Ranges: (B) 3-8% (C) 8-15% (D) 15-25%

Composition and Soil Characteristics

Typical Profile:

Oa--0 to 1 inch; black (10YR 2/1) sapric material; very friable

E--1 to 2 inches; grayish brown (10YR 5/2) silt loam; very friable; 5 percent gravel

Bh--2 to 4 inches; dark reddish brown (5YR 3/4) silt loam; very friable; 5 percent gravel

Bs1--4 to 13 inches; dark brown (7.5YR 4/4) silt loam; very friable; 5 percent gravel, 3 percent cobbles

Bs2--13 to 17 inches; yellowish brown (10YR 5/6) gravelly silt loam; very friable; 15 percent gravel and 3 percent cobbles

BC1--17 to 21 inches; light olive brown (2.5Y 5/4) gravelly silt loam; very friable; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation; 15 percent gravel, 3 percent cobbles and 1 percent stones

BC2--21 to 25 inches; olive (5Y 5/3) gravelly silt loam; friable; common coarse faint light olive gray (5Y 6/2) iron depletions; 15 percent gravel, 3 percent cobbles and 1 percent stones

Cd--25 to 65 inches; olive (5Y 4/3) gravelly silt loam; very firm; common coarse prominent light brownish gray (2.5Y 6/2) iron depletions; 20 percent gravel, 5 percent cobbles and 3 percent stones

Taxonomic Class

Coarse-loamy, isotic, frigid Aquic Haplorthods

Drainage Class

Moderately well to somewhat poorly drained.

Hydrologic Group

Group C

Permeability

Moderate in the solum and moderately slow or slow in the dense substratum.

Depth to Bedrock

Deep, greater than 60 inches.

Hazard to Flooding

None

Typical Inclusions

Similar: Plaisted, Penquis
Dissimilar: Thorndike, Monson, Monarda, Elliotsville

Use and Management

The limiting factor for proposed development is depth to seasonal high groundwater table, which is 1.0' – 3.5' beneath the soil surface. Regrading or other site modifications may be necessary to mitigate concerns over sheet flow drainage, which can be perched on top of the dense substratum. Proper foundation drainage or import of sandy granular fill is recommended for construction.

MONARDA SERIES

Setting

Parent Material: Loamy glacial till
Landform: Lower slopes or slight depressions on till plains
Position in Landscape: Lower positions in landscape, bases of long slopes, swales and depressions
Slope Gradient Ranges: (A) 0-3% (B) 3-8% (C) 8-15%

Composition and Soil Characteristics

Typical Profile:

Oe--0 to 3 inches; black (5YR 2/1) mucky peat (hemic material); very friable
Eg--3 to 6 inches; light gray (10YR 7/2) silt loam; friable; 5 percent gravel
Bg1--6 to 11 inches; light brownish gray (2.5Y 6/2) silt loam; friable; many medium distinct pale olive (5Y 6/3) masses of iron accumulation; 10 percent gravel
Bg2--11 to 16 inches; light olive gray (5Y 6/2) silt loam; firm; many medium prominent light olive brown (2.5Y 5/4) masses of iron accumulation; 10 percent gravel; (The combined thickness of the Bg horizon is 2 to 16 inches.)
BC--16 to 20 inches; olive (5Y 5/4) silt loam; firm; many medium distinct light olive brown (2.5Y 5/4) masses of iron accumulation and common fine distinct gray (5Y 6/1) iron depletions; 10 percent gravel
Cd--20 to 65 inches; olive (5Y 4/3) gravelly silt loam; firm, olive gray (5Y 5/2) faces of prisms which are separated from interiors of prisms by a thin layer of brown (7.5YR 4/4); common fine distinct gray (5Y 6/1) iron depletions and common medium distinct light olive brown (2.5Y 5/4) masses of iron accumulation; 15 percent gravel

Taxonomic Class

Loamy, mixed, active, acid, frigid, shallow Aeric Endoaquepts

Drainage Class

Poorly drained

Hydrologic Group

Group D

Permeability

Permeability is moderate to moderately rapid in the subsurface, moderate to moderately slow in the upper part of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum.

Depth to Bedrock

Very deep; greater than 60”

Hazard to Flooding

None

Typical Inclusions

Similar: Burnham, Peat and Muck
Dissimilar: Dixmont, Telos, Howland

Use and Management

The potential erosion hazard for these soils is slight. However, equipment limitations may be severe for Monarda soils. These soils have a seasonal high water table close to the mineral soil surface, and can be compacted if exposed to heavy equipment when wet. This can be circumvented by performing activities during dry (July – September) or frozen seasons. This series is listed as a hydric soil.

MONSON SERIES

Setting

Parent Material:	Loamy glacial till
Landform:	Knolls of till plains, hills, ridges and mountains
Position in Landscape:	Upper positions in landscapes
Slope Gradient Ranges:	(B) 3-8% (C) 8-15%

Composition and Soil Characteristics

Typical Profile:

Oa--0 to 4 inches; dark reddish brown (5YR 2/2) sapric material; very friable
E--4 to 5 inches; light gray (10YR 7/1) channery silt loam; very friable; 15 percent channers
Bh--5 to 6 inches; dark reddish brown (2.5YR 2/4) silt loam; very friable; 5 percent channers
Bs1--6 to 9 inches; brown (7.5YR 4/4) silt loam; very friable; 5 percent channers
Bs2--9 to 11 inches; yellowish brown (10YR 5/8) silt loam; very friable; 10 percent channers
BC--11 to 19 inches; light olive brown (2.5Y 5/4) channery silt loam; friable; 20 percent channers and 10 percent flagstones
R--19 inches; slate.

Taxonomic Class

Loamy, isotic, frigid Lithic Haplorthods

Drainage Class

Somewhat excessively drained

Hydrologic Group

Group C/D

Permeability

Permeability is moderate

Depth to Bedrock

Shallow; less than 20” to bedrock

Hazard to Flooding

None

Typical Inclusions

Similar:	Elliotsville, Danforth
Dissimilar:	Telos, Monarda, Chesuncook, Perham, Daigle

Use and Management

Soils within this map unit may have bedrock within 10 inches of the mineral soil surface. Drilling or blasting may be necessary for the proposed development.

PENQUIS SERIES

Setting

Parent Material:	Loamy glacial till
Landform:	Till plains and ridges
Position in Landscape:	Upper positions in landscape
Slope Gradient Ranges:	(B) 3-8% (C) 8-15%

Composition and Soil Characteristics

Typical Profile

Oe--0 to 1 inch; moderately decomposed needles

Ap--1 to 8 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; very friable; 5 percent channers

Bs1--8 to 12 inches; yellowish red (5YR 4/6) silt loam; very friable; 10 percent channers

Bs2--12 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; very friable; 10 percent channers

BC--15 to 26 inches; olive brown (2.5Y 4/4) channery silt loam; friable; 20 percent channers; some rock fragments can be crushed to very fine sand and silt

C--26 to 33 inches; olive (5Y 5/4) channery silt loam; friable; 20 percent channers, 5 percent cobbles; some rock fragments can be crushed to very fine sand and silt; few weathered rock fragments of olive (5Y 5/3)

R--33 inches; hard bedrock.

Taxonomic Class

Coarse-loamy, isotic, frigid Typic Haplorthods

Drainage Class

Well drained

Hydrologic Group

Group C

Permeability

Permeability is moderate throughout the soil.

Depth to Bedrock

Moderately deep; 20-40”

Hazard to Flooding

None

Typical Inclusions

Similar:	Dixmont, Bangor
Dissimilar:	Abram, Thorndike, Monarda, Burnham

Use and Management

There are few limitations associated with this soil type relative to the proposed development

PLAISTED SERIES

Setting

Parent Material:	Loamy glacial till
Landform:	Drumlins and till ridges
Position in Landscape:	Upper positions in landscape
Slope Gradient Ranges:	(B) 3-8% (C) 8-15% (D) 15-25%

Composition and Soil Characteristics

Typical Profile

Oa--0 to 2 inches; dark reddish brown (5YR 2/2) highly decomposed plant material; very friable

E--2 to 3 inches; grayish brown (10YR 5/2) silt loam; very friable; 5 percent gravel and 1 percent cobbles

Bh--3 to 4 inches; reddish brown (5YR 4/3) silt loam; very friable; 5 percent gravel and 2 percent cobbles

Bs1--4 to 7 inches; brown (7.5YR 4/4) silt loam; very friable; 5 percent gravel and 5 percent cobbles

Bs2--7 to 9 inches; strong brown (7.5YR 5/6) silt loam; friable; 5 percent gravel and 5 percent cobbles

Bs3--9 to 19 inches; yellowish brown (10YR 5/4) silt loam; friable; 5 percent gravel and 5 percent cobbles

BC--19 to 28 inches; light olive brown (2.5Y 5/4), with yellowish brown (10YR 5/4) faces of peds, gravelly silt loam; friable; strong brown (7.5YR 5/6) channels from decayed roots; 10 percent gravel and 5 percent cobbles

Cd--28 to 65 inches; olive (5Y 4/3), with light olive brown (2.5Y 5/4) faces of peds, and olive (5Y 5/3) crushed, gravelly silt loam; firm; 15 percent gravel and 10 percent cobbles

Taxonomic Class

Coarse-loamy, isotic, frigid Oxyaquic Haplorthods

Drainage Class

Well drained.

Hydrologic Group

Group C

Permeability

Moderate in the solum and moderately slow or slow in substratum.

Depth to Bedrock

Deep, greater than 60 inches.

Hazard to Flooding

None

Typical Inclusions

Similar:	Howland, Penquis
Dissimilar:	Thorndike, Monson, Monarda, Elliotsville

Use and Management

This soil presents few limitations relative to the proposed project. Shrink-swell potential is low and there is no flooding or ponding hazard. Certain areas within this map unit are extremely stony or rubbly and may require additional time/cost to clear the soil surface for use.

TELOS SERIES

Setting

Parent Material:	Loamy dense basal till
Landform:	Till plains, hills and ridges
Position in Landscape:	Lower side slopes
Slope Gradient Ranges:	(A) 0-3% (B) 3-8%

Composition and Soil Characteristics

Typical Profile

Oa--0 to 2 inches; dark reddish brown (5YR 2/2) highly decomposed organic material; very friable

E--2 to 4 inches; pinkish gray (7.5YR 6/2) silt loam; friable; 5 percent gravel

Bhs--4 to 7 inches; dark reddish brown (5YR 3/3) silt loam; friable; 5 percent gravel

Bs1--7 to 12 inches; brown (7.5YR 4/4) silt loam; friable; 5 percent gravel

Bs2--12 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; friable; common medium distinct pinkish gray (7.5YR 6/2) iron depletions; 10 percent gravel

BC--15 to 20 inches; light olive brown (2.5Y 5/4) silt loam; friable; many medium prominent pinkish gray (7.5YR 6/2) iron depletions; 10 percent gravel

Cd--20 to 65 inches; olive (5Y 5/3) gravelly silt loam; firm; light olive gray (5Y 6/2) faces of prisms; many medium and common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation; 20 percent gravel

Taxonomic Class

Loamy, isotic, frigid, shallow Aquic Haplorthods

Drainage Class

Somewhat poorly drained

Hydrologic Group

Group C

Permeability

Moderate in the solum and slow or very slow in substratum.

Depth to Bedrock

Very deep, greater than 60 inches.

Hazard to Flooding

None

Typical Inclusions

Similar:	Chesuncook, Daigle
Dissimilar:	Monson, Danforth, Elliotsville, Monarda

Use and Management

The soil limiting factor for the proposed development is wetness, which imposes high potential for frost action. Special erosion and sediment control is recommended.

APPENDIX D
Soil Profile Descriptions

APPENDIX E
Glossary of Soil Terminology

Depth Classes
These refer to the depth of the particle control section used to describe the central concept of each taxonomic unit. These are as follows:

Very shallow	less than 10" to bedrock
Shallow	10" to 20" to bedrock
Moderately deep	20" to 40" to bedrock
Deep	40" to 60" deep
Very deep	greater than 60"

Drainage Class
Drainage class is a reference to the frequency and duration of periods of soil saturation and/or action by seasonal groundwater tables, as evidenced by soil morphologic features identified within each respective soil profile.

Seven classes of soil drainage are recognized:

Excessively drained — water is removed from the soil very rapidly. These are commonly very shallow to bedrock and are often very coarse-textured and rocky. Soils are free of redoximorphic features due to wetness.

Somewhat excessively drained — water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy-textured and very pervious/porous. Some are shallow. Some occur on steep slopes where much of the water they receive is lost as runoff. Soils are free of redoximorphic features due to wetness.

Well drained — Water is removed from the soil readily, but not rapidly. Water may be available for plant growth at the deepest rooting depths, but soil is not so wet as to inhibit the growth of plant roots for significant periods during most growing seasons. Well drained soils are often medium textured and may contain restrictive subhorizons below 24". They are free of redoximorphic features related to wetness in the upper 40".

Moderately well drained — water is removed from the soils somewhat slowly during heavy rains and wet seasons. Moderately well drained soils are saturated in the upper soil profile for short duration during the growing season. Often, they contain a slowly pervious (or restrictive) layer beneath the solum, and may receive additional runoff from upslope areas.

Somewhat poorly drained — water is removed slowly such that the soil is wet for significant periods during the growing season. Somewhat poorly drained soils commonly have an impervious substratum that contributes to a perched water table, additional water through sideslope seeps, long continuous sheet flows below large watershed areas with few or no outlets, or a combination of these together.

Poorly drained — water is removed from these soils so slowly that the soil is saturated during the growing season or remains wet for long durations. Water is present during the growing

	season which may be prohibitive to plant root growth due to anaerobic/saturated conditions. These soils are classified as hydric.
Very poorly drained	water is removed from these soils so slowly that free water can be observed at or very near the mineral soil surface for long durations during the growing season. These commonly occur in nearly level or depressional areas, and can be frequently ponded. Often they include thick organic surface horizons. These soils are classified as hydric.

Hydrologic Soil Groups
A hydrologic soil group is a class of numerous soil series that all have the same runoff potential under similar climate and vegetative conditions. Soil properties that can influence runoff are those that affect minimum infiltration rates for a bare soil after prolonged wetting and with no frozen ground surface. Most important are depth to seasonal high groundwater table, permeability rates after prolonged wetting, and depth to slowly permeable (restrictive) layer.

Permeability
Permeability is the soil property which enables water to move downward through the soil profile. It is measured as the number of inches per hour of water that can be added to a particular soil as it moves downward through the unsaturated soil. Terminology and ranges are as flows:

Very slow	less than 0.06 in./hr
Slow	0.06 to 0.20 in./hr
Moderately slow	0.20 to 0.60 in./hr
Moderate	0.6 to 2.0 in./hr
Moderately rapid	2.0 to 6.0 in./hr
Rapid	6.0 to 20 in./hr

Soil Texture
Soil texture refers to the USDA classification for the relative proportions by weight of the three soil particle size classes (sand, silt, clay) that are finer than 2 millimeters in diameter and form the fine earth fraction. (Materials larger than 2 mm. in diameter are considered rock fragments).

Soil texture can influence on plant growth, or the soil mechanics of a particular site when used as construction and/or backfill material for foundations, etc. It influences such physical properties as load bearing strength, permeability, shrink/swell potential (frost action or due to wetness), compressibility and compaction. Rock fragment size and content can also affect applications for use as construction materials.

Soil Texture Modifiers
Named soil texture classes can be further modified by the addition of appropriate adjectives when rock fragment content approaches 15% by volume (i.e. gravelly sandy loam). “Mucky” or “peaty” are modifying terms used when organic matter content reaches 5% (i.e. mucky silt loam).

Additional Soil Terms

Flooding (Hazard to flooding)
Flooding is the temporary covering of the soil surface by flowing water from any source, including but not limited to: streams or rivers overflowing their banks, runoff from adjacent or upslope areas, inflow from

high tide action, or a combination of sources. Water due to snowmelt is excluded from this definition, as is standing or ponded water that forms a permanent or semi-permanent cover above the soil surface.

Flooding hazard is further expressed by frequency classes, duration, and the time of year that the flooding occurs. The velocity and depth of the floodwater are also important factors.

Ponding
Ponding is standing water in a closed depression. The water is removed only by evaporation, transpiration by plants, or percolation through the ground.

Soil complex
A map unit that consist of two or more kinds of soils (i.e. soil series/taxonomic unit) that occur on a non-regular, non-repeating pattern that cannot be separated out at the scale provided. The order of the soils named are generally in order of predominance within the map unit.

Soil map unit
A collection of soils or soil areas that are delineated during soils mapping. It generally is an aggregate of several soil entities with a predominant named soil type. Kinds of soil map units may include complexes, consociations, or associations.

Soil slope gradient range
The slope identified for any given map unit, based on the immediate topography within a specific portion of the mapping site. Designations generally are as follows:

A	0-3%	nearly level to level
B	3-8%	gently sloping
C	8-15%	strongly sloping
D	15-25%	moderately steep
E	25-45%	steep

Stoniness
This is a phase of surface characteristic that may be identified in soils mapping, ranging from stony or bouldery (0.01 to 0.1% of soil surface covered with stones) to rubbly or rubble land, in which up to 75% of the soil surface is covered with stones. Extremely stony sites or sites with rubble land may have additional limitations for use of mechanized equipment.

APPENDIX F
Hydrologically Sensitive Features Evaluation
Bowers Wind Project Collection Corridor

1.0 Introduction

In November 2010, Stantec Consulting (Stantec) conducted a survey to identify hydrologically sensitive features in association with the collector line project located in Carroll Plantation, Penobscot County, Maine. The proposed project will involve construction of approximately 5 miles of new transmission line and is part of the Bowers Wind Project.

The purpose of this report is to describe areas along the corridor identified during the survey where natural hydrology unique to the geographic region has created soil conditions that will require additional planning prior to construction of roads and infrastructure.

2.0 Purpose of Unique Soil Feature Evaluation

Soils that have wetland hydrology generally develop readily identifiable morphological indicators (redoximorphic features, depleted soil matrix) in response to the anaerobic conditions caused by the groundwater table. Certain soils, however, will mask or fail to develop redoximorphic features despite the presence of groundwater. This phenomenon occurs in Maine, most commonly in northern, mountainous portions of the state, where soils have been altered, have dark parent materials, contain translocated soil materials or where groundwater remains oxygenated.

Areas with rolling to very steep topography may contain unique soils features (groundwater seeps, surface drainages, underground streams, boulderfields, etc.) where groundwater is seasonally or permanently near the mineral soils surface yet typical redoximorphic features are not observable. These areas are usually not mapped as jurisdictional wetlands or streams because soils do not meet current hydric soils criteria and surface flows occur too infrequently for stream characteristics (defined banks, aquatic vegetation, etc) to develop. Due to the small area encompassed by these features, they do not appear as soil series in a Class D Medium-Intensity Soil Survey. Therefore, despite presenting a potential for alteration of natural hydrology that often exceeds that of mapped wetland areas, unique soil features like those described above are frequently not identified or described on any resource maps used for project planning.

When planned for, these areas can be avoided or construction practices can be used which minimize the alteration of natural hydrology. For this reason, we have identified these unique soils features where they occur within the proposed collector line corridor and map and describe them in the “unique soil feature evaluation” that follows. This survey is intended for use in conjunction with the modified Class L Linear Soil Survey and the Delineated Natural Resource Map, both of which are included in this report.

3.0 Methods

During the week of November 15, 2010, Stantec Consulting (Stantec) surveyed the length of the proposed collector line corridor in search of soils with unique hydrologic features. Areas of concern were those which had not been mapped as jurisdictional streams and wetlands but where groundwater showed the potential to approach or reach the mineral soil surface during spring snowmelt or heavy rain events. Rainfall was very heavy throughout the week of survey and trees had already dropped their leaves; this must be taken into account when comparing pits or making interpretations based on free water in soil pits.

During the survey, site conditions were used to determine where specifically to dig test pits; these conditions included landscape position, soil surface stoniness, soil surface topography (pit-mound topo), vegetation type and rooting depth and surface soil consistence (muckiness).

At each selected location, test pits or borings were dug to a depth of 18” or greater using a drain spade and/or hand auger. Pits were marked in the field with pink flagging labeled with a unique pit identifier (eg. TP-6) and GPS-located using a Trimble Pro-XH backpack unit. In addition, GPS points were taken to mark other areas of interest (surface drainages, boulderfields, outcrops).

4.0 Findings

In total, 13 soil pits or borings identified areas as having "hydrologically sensitive features" which should be taken into account during project planning. Test pit and boring locations as well as other located site features are shown on the modified Class L Soil Survey in Appendix B.

Six locations (TP-2, TP-7, TP-12, TP-15 and TP-23) occurred on gentle (3-8%) concave toeslopes. These areas generally showed some boulder cover and were located upslope from jurisdictional wetlands. Pits contained free water within 12 inches of the mineral soil surface. TP-2 and TP-23 both had redoximorphic features within 5 inches of the mineral soil surface; TP-5, TP-7, TP-12 and TP-15 had dark mucky surface horizons.

Three locations (TP-4, TP-25, B-40) are on strong (8-15%) bouldery sideslopes which are near the base of long, sustained slopes. These locations had thick, dark silty surface horizons and free water within 12 inches of the mineral soil surface despite strong slopes; groundwater percolation at these sites was slowed by ledge or hardpan.

The four remaining locations (TP-9, B-30, B-36, B-37) exhibited hydric soils but due to a lack of hydrophytic vegetation, were not flagged as jurisdictional wetlands. These locations were level or nearly level (0-3% slope) and had standing water or free water at the mineral soil surface. These locations are contiguous with mapped, jurisdictional wetlands.

5.0 Recommendations

There were areas identified along the proposed Bowers collector corridor where unique hydrologic features must be taken into account when planning collector line construction. For all areas of the corridor, the modified Class L Soil Survey and map unit descriptions (Appendix B and C, respectively) provide information on extent of soil types, soil properties and limitations and should be consulted prior to construction. The soil survey map shows all test pits dug along the proposed collector line as well as areas which have been identified as "hydrologically sensitive". For these areas, as well as areas where surface drainages have been identified, temporary or permanent hydrology at or near the soil surface must be taken into account prior to construction.

Areas on gentle to strong slopes likely have flowing groundwater near the soil surface; this hydrology may be permanently altered if roads or equipment remove surface rocks and boulders or cut into the water table. These areas should be avoided when possible; when it is necessary for roads or infrastructure to transect these sloped areas care should be taken not to remove or disturb surface boulders and mucky surface soil horizons. Roads in these areas should be constructed along the contours and a rock sandwich road base design should be used to allow groundwater and sheet flow to pass and be discharged on the down-gradient side of the road without channelizing flow.

Areas with nearly level slopes that are near or between wetlands should be treated in the same manner as the adjacent wetlands; timber mats should be laid down prior to crossing these areas with heavy equipment and tree removal should be done as specified in wetland areas. Work should be performed during winter months when the ground is frozen if possible.