11.0 SOILS

11.1 INTRODUCTION

Required soil surveys have been completed within turbine pads, crane pads, and access roads within the project area. Albert Frick Associates conducted a Class L Soil Survey of the turbine and road areas and a Class B High Intensity Soil Survey for the Operations and Maintenance building location (Exhibit 11A). The report concludes that with proper planning and construction techniques, the soils are appropriate for the proposed construction activities. Stantec conducted a Class D Soil Survey of the transmission line (Exhibit 11B). The report concludes that with employment of standard construction techniques and Best Management Practices, the soils are appropriate for the proposed construction activities.

Prior to construction, a geotechnical investigation of new road segments and each turbine pad will be conducted. The results of this investigation will determine the final turbine foundation design appropriate for each turbine location.

Exhibit 11A: Class L Soils Survey for Roads and Turbine Pads and Class B Soils Survey for O&M Building

Exhibit 11D: Class L Soils Survey for Generator Lead

Class D Soil Survey Report

Blue Sky West II Generator Lead
Kingsbury Plantation, Abbot, and Parkman
Somerset and Piscataquis Counties, Maine

Prepared for:

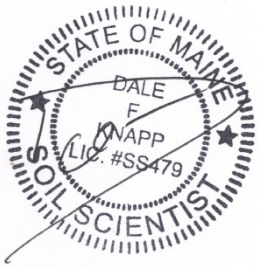
Blue Sky West II, LLC

Prepared by:

Stantec Consulting

30 Park Drive
Topsham, ME 04086

March, 2013



Dale Knapp, Certified Soil Scientist

March 15, 2013
Date

Stantec

1.0 INTRODUCTION

Stantec Consulting (Stantec) compiled soil survey information in association with a proposed generator lead project located in Somerset and Piscataquis counties, Maine. The proposed project will involve the construction of an approximately 17-mile 115-kilovolt generator lead running from Kingsbury to an existing CMP substation in Parkman to serve the Bingham Wind Project (project).

The purpose of this report is to identify and describe the soil types that can be expected to occur along the proposed generator lead route and to provide details of specific areas that have the potential to be hydrologically sensitive or present challenges during construction of the generator lead. Each soil description includes information on the ability or limitation of the soil to support the activities inherent to the construction and operation of the proposed line.

This report is a Class D Medium intensity Soil Survey; it is a compilation of existing information from the United States Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS) soil surveys for Somerset and Piscataquis counties. Soil unit descriptions in this report are based directly upon published soil maps and respective official soils descriptions. This report has been prepared as part of the project requirements and to support permitting procedures as required under the Maine Department of Environmental Protection (MDEP) Site Location of Development Act (Site Law).

2.0 PURPOSE OF SOIL SUVEY

The purpose of this soil report is to review, identify, and describe the mapped soils that occur within the proposed corridor of the generator lead. The soil information may be used to obtain hydrological grouping ratings to assist in the calculations for stormwater runoff curve values required by the MDEP, under Site Law, 38 M.R.S.A. §§ 481-490; Section 12. The soil information may also be used for general planning purposes relating to development for the project.

3.0 SITE DESCRIPTION

The proposed route primarily crosses soils that are derived and formed in glacial tills, including basal till with a few small areas formed in recent alluvial deposits or organic materials. According to the NRCS soil maps and relevant soil interpretations, the study area consists primarily of low-lying hills and valleys. Slopes along the proposed route are generally nearly level (0-3%) to moderate (2-15%) with few moderately steep (15-25%) slopes. Streams and brooks in this survey area flow toward the Piscataquis River to the north.

4.0 SITE INVESTIGATION

For the purpose of this report, soil information was obtained from the existing USDA and NRCS soil surveys for Somerset[1] and Piscataquis[2] counties and the NRCS Web Soil Survey.[3] There were no field investigations associated with this survey, and the information contained therein is based only on published data and soils descriptions.

5.0 SOIL CHARACTERISTICS

Soils identified along the proposed corridor are primarily formed in glacial deposits. Soils formed in glacial till include: Abram, Brayton, Burnham, Chesuncook, Colonel, Danforth, Dixfield, Elliottsville, Howland, Lyman, Marlow, Monarda, Monson, Peacham, Penquis, Plaisted, Telos and Throndike. Soils formed in recent alluvium include the Charles and Cornish series. Soils formed in decomposed organic matter include Buxport, Ricker and Wonsqueak series. While some of the map units represent a single soil series, many others represent complexes or associations where more than one soil series can be expected to occur. The table included in Appendix A lists the associations and complexes as they occur on the soil map. Descriptions for each soil series that occurs within the proposed corridor are located in Appendix B.

6.0 SOIL MAP AND MAP UNIT DESCRIPTIONS

The attached soil survey maps depict the size and location of the soil map units relative to each other and existing site features. The soil unit boundaries delineated on the map are taken from the USDA and NRCS Web Soil Survey.

Map units that represent a soil complex (e.g., CQB – Colonel, Brayton, Lyman Complex) contain two or more component soils and may exhibit properties of multiple soils series within a given map unit. Other map units that represent a soil association contain two or more adjacent soils that occur in areas large enough to be shown individually but occur in repeating patterns in the landscape, these soils are listed as an association because the time and effort to delineate the individual soils would be too great for the general soil survey. Descriptions of individual soil series that appear in complexes and associations have been included while complexes and associations are listed in the table. When planning work within a map unit that represents soil complex or association, properties of all component soil series should be reviewed and considered.

Every map unit is composed of the soil and some soils that belong to other taxonomic classes. These soils are called inclusions and are listed in each soil series description. Most inclusions have properties or patterns that are similar to those of the dominant soil or soils in the map unit and generally do not affect use and management.

[1] USDA. 1972. Soil Survey of Somerset County, Maine, Southern Part. U.S Government Printing Office, Washington, D.C.
[2] USDA. 2005. Soil Survey of Piscataquis County, Maine, Southern Part. U.S. Government Printing Office, Washington, D.C.
[3] http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

7.0 CONCLUSIONS AND STUDY LIMITATIONS

This report concludes that with proper planning and construction techniques, the soils are appropriate for the proposed construction of a generator lead from the Bingham Wind Project to the Parkman substation.

The scope of this investigation has been limited to a compilation of Class D Medium Intensity Soil Survey data in general accordance with standards and guidelines established by the Maine Association of Professional Soil Scientists.[4] This soil report and these soil maps have been prepared for exclusive use by Blue Sky West II, LLC for specific application to their proposed construction of the 115-kilovolt generator lead from Kingsbury to Parkman, Maine.

No other warranty, expressed or implied, is made. The conclusions and recommendations presented in this soil report are based on data obtained from the USDA/NRCS soil maps and information. Data from this soil report and soil map should not be used for any other purpose other than the construction of the proposed Project.

[4] Maine Association of Professional Soil Scientists. 1989 rev. 2004. *Guidelines for Maine Certified Soil Scientists for Soil Identification and Mapping. www.mapss.org*

Appendix A

Class D Soil Survey Table

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Hydric Rating	Erosion Hazard
BP	Brayton, Peacham Association, coarse-loamy	Poorly Drained	C/D	All Hydric	Not Highly Erodible Land
CC	Charles, Cornish, Wonsqueak Complex; coarse-silty; 0-2 percent slopes	Poorly Drained	B/D	Partially Hydric	Not Highly Erodible Land
CPB	Colonel, Brayton, Dixfield Association; Coarse-loamy; 3-8 percent slopes	Somewhat Poorly Drained	C	Partially Hydric	Potentially highly erodible land
CQB	Colonel, Brayton, Lyman Complex; coarse-loamy; 3-8 percent slopes	Somewhat Poorly Drained	C	Partially Hydric	Potentially Highly Erodible Land
DBC	Danforth channery, silt loam; 8-15 percent slopes	Well Drained	B	Not Hydric	Highly Erodible Land
DXC	Dixfield, Colonel Association, coarse-loamy; 8-15 percent slopes	Moderately well drained	C	Not Hydric	Potentially Highly Erodible Land
DYC	Dixfield, Colonel, Lyman Association; Coarse-loamy; 8-15 percent slopes	Moderately well drained	C	Not Hydric	Potentially Highly Erodible Land
HoB	Howland; Silt loam; 3-8 percent slopes	Moderately well drained	C	Not Hydric	Potentially Highly Erodible Land
HRB	Howland, Monarda Association; coarse-loamy; 3-8 percent slopes	Moderately well drained	C/D	Partially Hydric	Potentially Highly Erodible Land
MND	Marlow, Lyman, Dixfield Association; coarse-loamy; 15-25 percent slopes	Well Drained	C	Not Hydric	Highly Erodible Land
MW	Monarda, Burnham Association, coarse-loamy	Poorly Drained	D	All Hydric	Potentially Highly Erodible Land
MXB	Monarda, Howland, Thorndike Complex; undulating; very stony	Poorly Drained	C/D	Partially Hydric	Potentially highly erodible land
MYD	Monson, Elliottsville, Ricker Complex; moderately steep, very stony	Well Drained	C/D	Not Hydric	Highly Erodible Land
PWC	Plaisted, Howland, Penquis Association; coarse-loamy; 8-15 percent slopes	Well Drained	C	Not Hydric	Potentially Highly Erodible Land

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Hydric Rating	Erosion Hazard
TLC	Telos, Chesuncook, Elliottsville Association, coarse-loamy; 8-15 percent slopes	Somewhat Poorly Drained	D/C	Not Hydric	Potentially Highly Erodible Land
TNB	Telos, Monarda, Monson Complex; undulating, very stony	Somewhat Poorly Drained	D and C/D	Partially Hydric	Potentially highly erodible land
TSC	Throndike, Penquis Complex; loamy-skeletal, 8-15 percent slopes	Somewhat excessively drained	C/D	Not Hydric	Potentially Highly Erodible Land
TtB	Thorndike, Penquis, Abram complex; loamy-skeletal; 3-8 percent slopes	Somewhat excessively drained	C/D	Not Hydric	Potentially Highly Erodible Land
WB	Wonsqueak, Buxport; histosols; 0-2 percent slopes	Very porrly drained	D	All Hydric	Not Highly Erodible Land

Appendix B

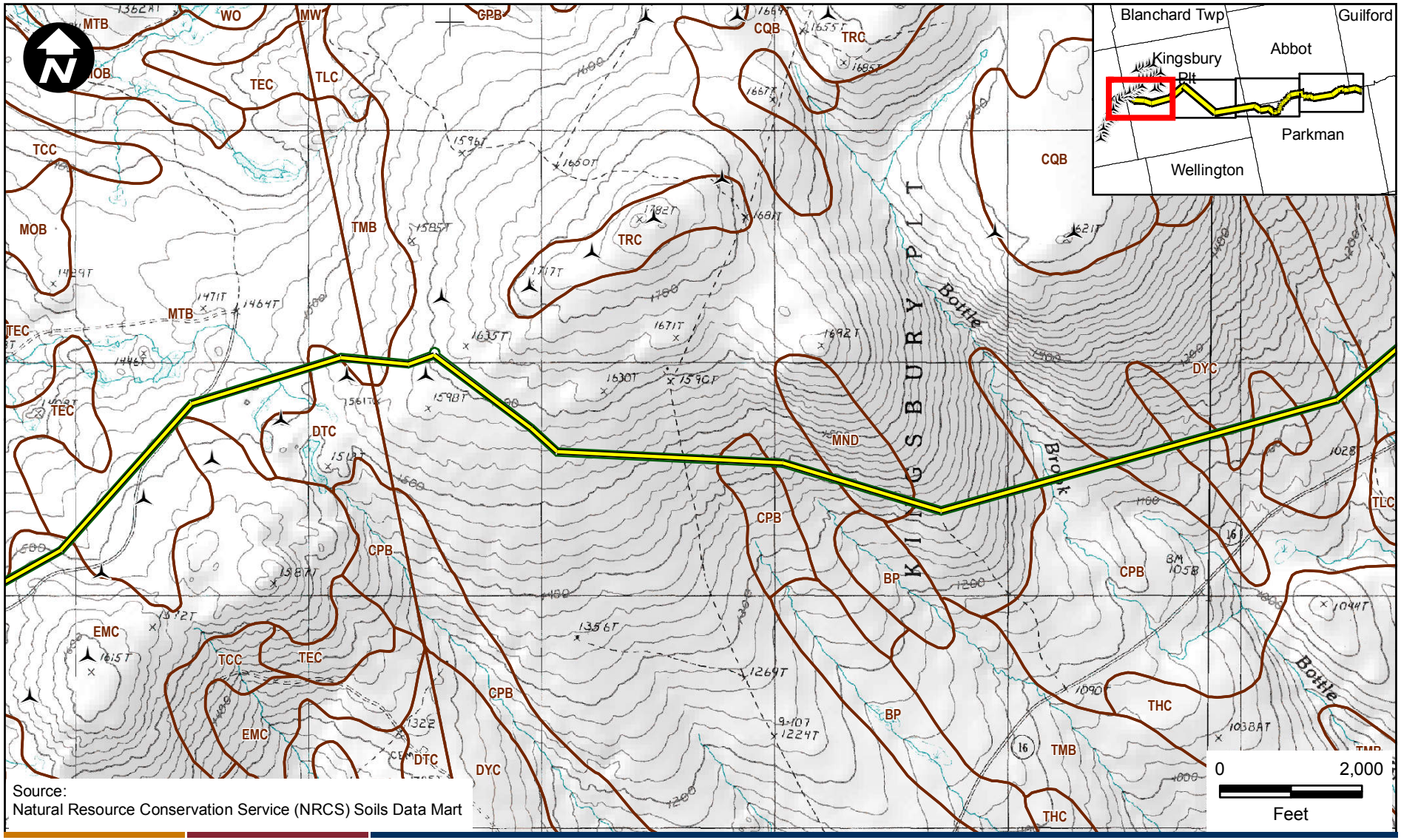
Maine Association of Professional Soil Scientists Standards for a Class D (Medium Intensity) Soil Survey

1. Map units may contain dissimilar limiting individual inclusions larger than 5 acres provided that each dissimilar limiting inclusion is smaller than the minimum map unit size utilized. Dissimilar inclusions within a map unit may total more than the minimum map unit size, in the aggregate, if not contiguous.

2. Scale of 1 inch equals 2,000 feet or larger (e.g. 1” = 1320’)

3. Ground control – as determined by the mapper

4. Base map – As determined by the mapper



Source:
Natural Resource Conservation Service (NRCS) Soils Data Mart

195600539

Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME USA
04086
Phone (207) 729-1199
Fax: (207) 729-2715
www.stantec.com

00539_ClassDSoils.mxd

Legend

- Turbine Layout
- Electrical Generator Lead
- Clearing Limits
- Soil Series Boundary

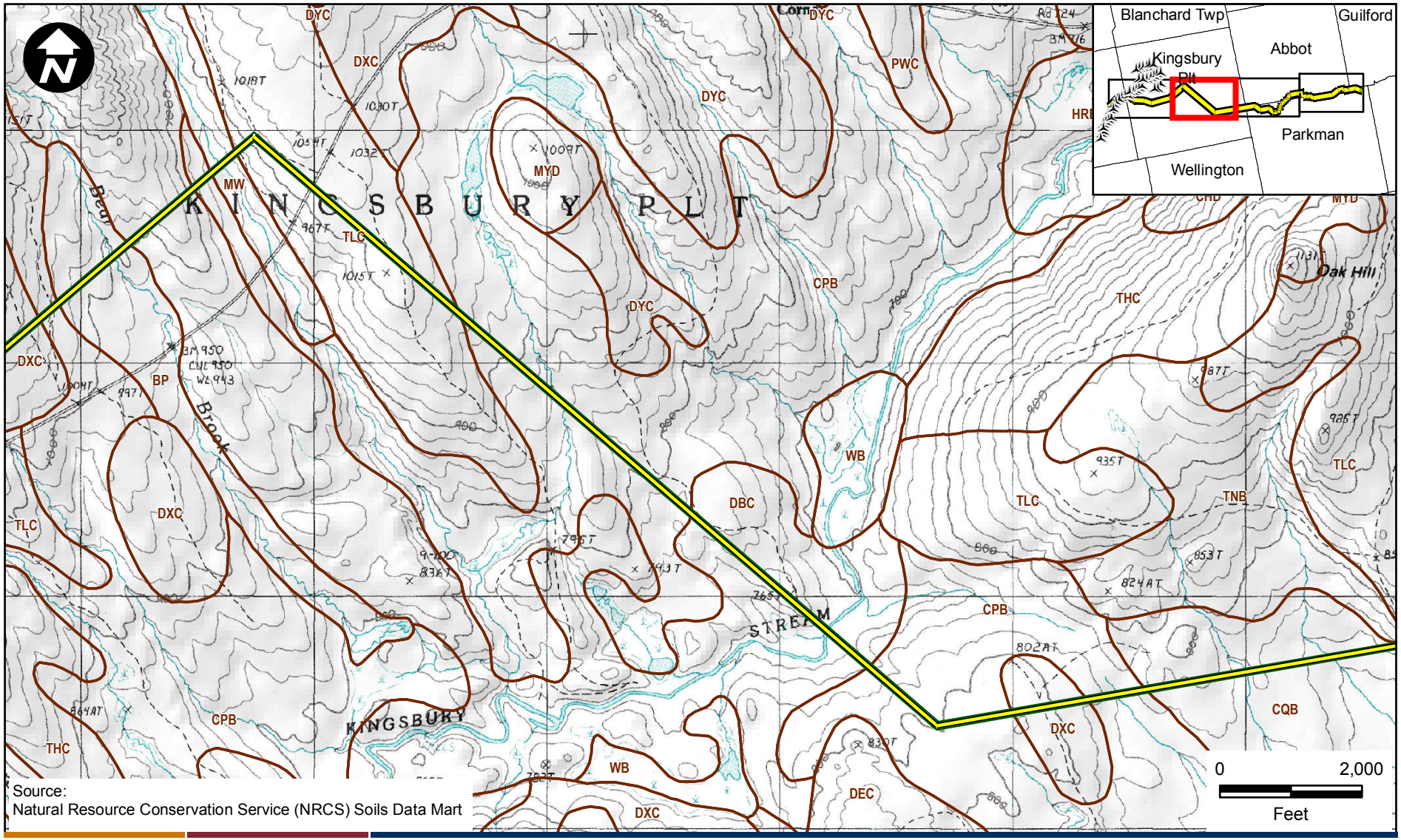
Client/Project

Bingham Wind Project

Figure No.
11B-1

Title
Class D Soil Survey Map

3/13/2013



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Legend

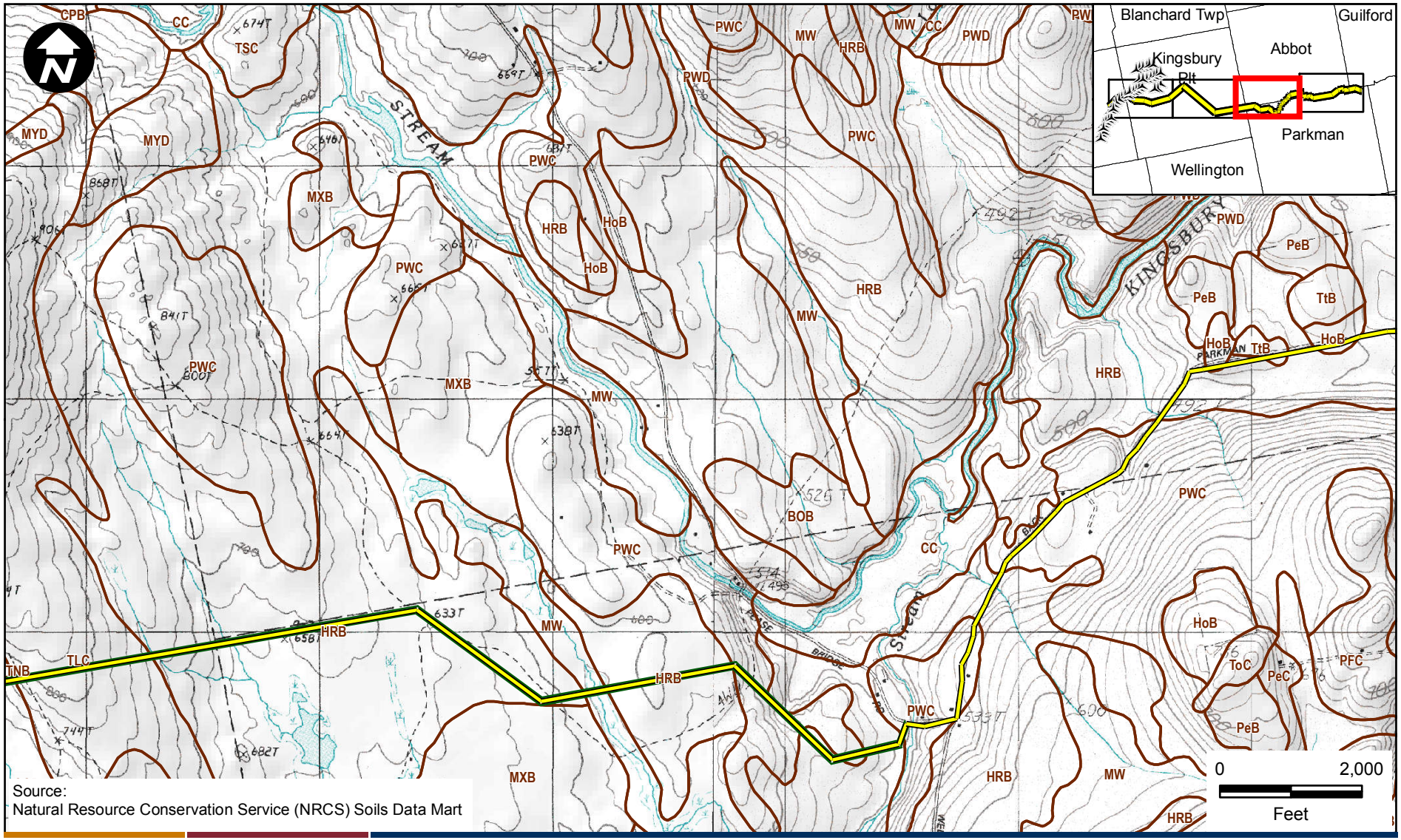
- Turbine Layout
- Electrical Generator Lead
- Clearing Limits
- Soil Series Boundary

Client/Project

Bingham Wind Project

Figure No.
11B-2

Title
Class D Soil Survey Map
3/13/2013



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Legend

- Turbine Layout
- Electrical Generator Lead
- Clearing Limits
- Soil Series Boundary

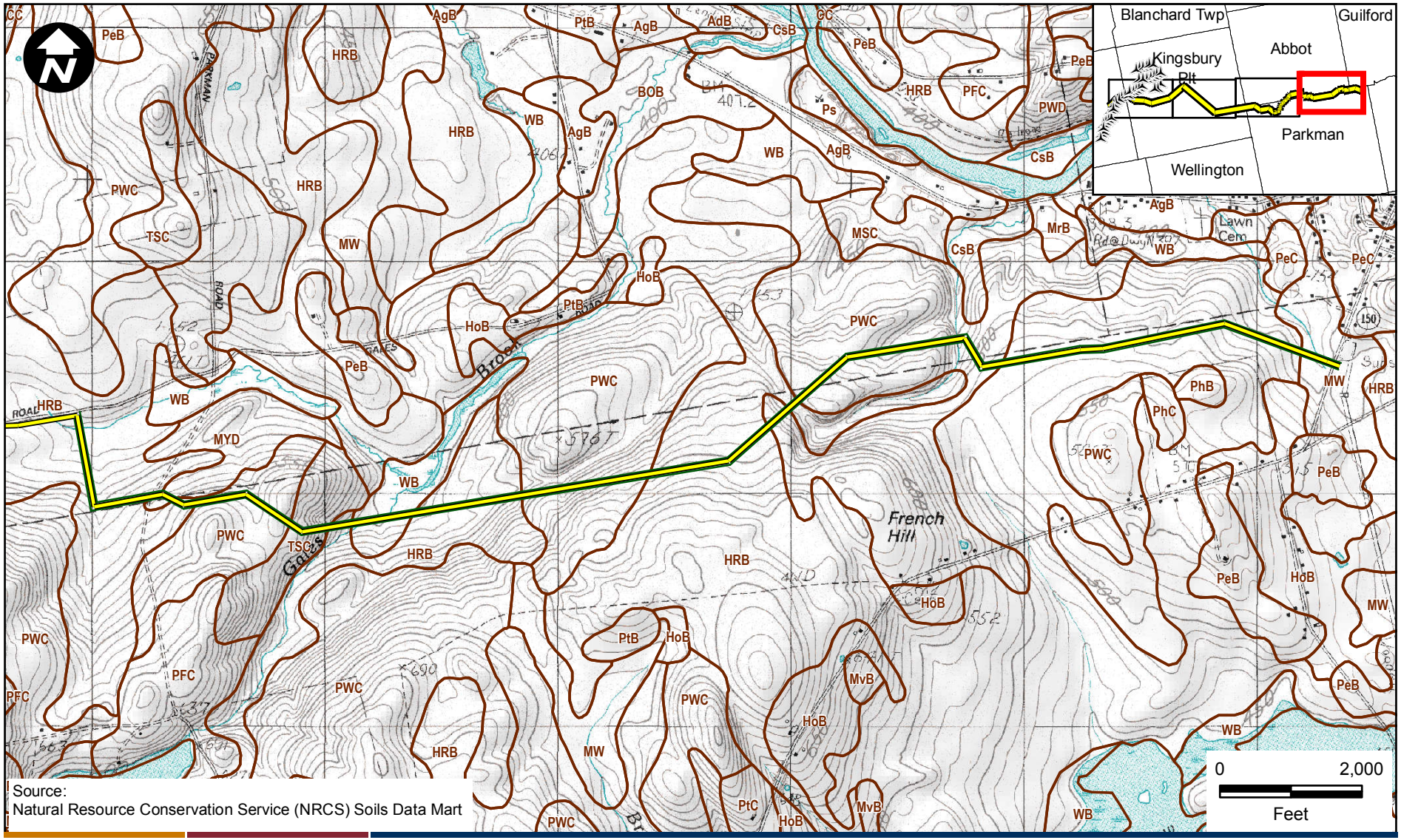
Client/Project

Bingham Wind Project

Figure No.
11B-3

Title
Class D Soil Survey Map

3/13/2013



Source:
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Legend

- Turbine Layout
- Electrical Generator Lead
- Clearing Limits
- Soil Series Boundary

Client/Project

Bingham Wind Project

Figure No.
11B-4

Title
Class D Soil Survey Map

3/13/2013

Appendix C

Soil Series Descriptions

ABRAM SERIES
(Lithic Udorthents)

SETTING

Parent Material: Glacial till
Landform: Ridges and mountains
Position in Landscape: Crests and side slopes in more distinctly convex areas
Slope Gradient Range: **(C)** 8-20% **(D)** 20%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, isotic, frigid Lithic Haplorthods
Drainage Class: Excessively drained

Typical Profile Description:	Surface layer:	0-1” Black sapric organic material
	Subsurface layer:	1-2” Pinkish gray sandy loam
	Subsoil layer:	2-5” Very dusky red to brown sandy loam
	Substratum:	5” hard bedrock

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderately rapid
Depth to Bedrock: Very shallow, 5”
Hazard to Flooding: None
T Erosion Factor: 1

INCLUSIONS

Similar: Ricker (cryic), Knob Lock (frigid), Saddleback, Hogback, Rawsonville, Rock Outcrop, Lyman, Tunbridge

Dissimilar: Naskeag, Dixfield

Occurrence on the survey map: TtB - Thorndike, Penquis Abram Complex

USE AND MANAGEMENT

The possible limiting factor with Abram soils is the shallow depth. Typically depth to bedrock is 1-10” below the soil surface, this should be taken into consideration for generator lead construction. The risk of erosion is high here and proper erosion control techniques may need to be applied in these areas. The Shallow bedrock could also create challenges with utility pole placement and should be considered in the planning and construction process.

BRAYTON SERIES
(Aeric Epiaquepts)

SETTING

Parent Material: Compact loamy glacial till
Landform: Depressions and toe slopes of glaciated uplands
Position in Landscape: Lowest positions on landform
Slope Gradient Range: **(A)** 0-3% **(B) 3-8%**

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, mixed, nonacid, fridgid Aeric Epiaquepts
Drainage Class: Poorly drained, with a perched water table 0-1' beneath the soil surface from November through May or during periods of excessive precipitation.

Typical Profile Description:	Surface layer:	0-5" Very dark grayish brown sandy loam
	Subsurface layer:	5-15" Grayish brown sandy loam
	Subsoil layer:	15-24" Olive Gray fine sandy loam
	Substratum:	24-65" Olive sandy loam

Hydrologic Group: Group C
Surface Runoff: Moderate to moderately rapid.
Permeability: Moderate in solum, moderately slow or slow in dense substratum
Depth to Bedrock: Deep, greater than 40"
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Colonel, Monarda, Telos, Pillsbury

Dissimilar Naskeag, Peacham, Waskish

Occurrence on the survey map: BP – Brayton, Peacham Association
CPB – Colonel, Brayton Dixfield Association
CQB – Colonel, Brayton, Lyman Complex

USE AND MANAGEMENT

The potential limiting factor for development on this soil type is wetness. The seasonal groundwater table is generally close to the soil surface from October to June, and may cause problems with heavy machinery for most of the year. Proper erosion and sediment control techniques should be applied in these areas.

BURNHAM SERIES
(Histic Humaquepts)

SETTING

Parent Material: Dense glacial till
Landform: Glaciated uplands
Position in Landscape: Forested areas, Elevation ranges from 120-2200'
Slope Gradient Range: **(A)** 0-3%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Silt loam or loamy, mixed, superactive, nonacid, frigid, shallow Histic Humaquepts
Drainage Class: Very poorly drained

Typical Profile Description:

Surface layer:	0-13" Black sapric organic matter
Subsurface layer:	13-18" Gray channery silt loam
Subsoil layer:	18-34" Olive gray channery silt loam
Substratum:	34-65" Dark grayish brown channery silt loam

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderately slow to moderately rapid in the organic surface, moderately slow in subsoil and slow or very slow in the substratum
Depth to Bedrock: Very deep, more than 60"
Hazard to Flooding: None, but frequently ponded 7-30 days of the year
T Erosion Factor: 2

INCLUSIONS

Similar: Chesuncook, Monarda, Telos, Biddeford

Dissimilar: Naskeag, Peacham

Occurrence on the survey map: MW – Monarda, Burnham Association

USE AND MANAGEMENT

The Burnham series has high likelihood of ponding and shallow water table below the soil surface for most of the year. The thick organic surface associated with this soil series may require matting, bridging or high flotation devices. Proper erosion and sediment control techniques will likely be needed during generator lead construction.

BUXPORT SERIES
(Typic Borosaprists)

SETTING

Parent Material: Organic materials from herbaceous and woody plants
Landform: Depressions on ground moraines, glaciofluvial deposits
Position in Landscape: Between shallow till ridges and on floodplains
Slope Gradient Range: **(A)** 0-3%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Euic, frigid Typic Haplosaprists
Drainage Class: Very poorly drained

Typical Profile Description:	Surface layer:	0-12” Black organic sapric
	Subsurface layer:	12-25’ Dark reddish brown, organic sapric
	Subsoil layer:	25-45” Black sapric, woody fibers dark yellowish brown
	Substratum:	45-65” Black sapric, fibers pale brown

Hydrologic Group: Group D
Surface Runoff: Low or negligible
Permeability: Moderately slow to moderately rapid in the organic layers, and moderately slow or moderate in the substratum
Depth to Bedrock: Very deep, 65”
Hazard to Flooding: Rare to frequent of brief or long duration where occupies flood plains
T Erosion Factor: 2

INCLUSIONS

Similar: Colton, Sheepscot, Wonsqueak

Dissimilar: Dixfield, Hermon, Lyman, Schoodic, Tunbridge

Occurrence on the survey map: WB – Wonsqueak, Buxport histosols

USE AND MANAGEMENT

Thick organic surface layers can lead to instability in the Buxport soil series and my pose as a limitation to development. These soils have a seasonal high water that can be compacted if exposed to heavy equipment when wet and could present challenges during generator lead construction. All soils mapped in this series are considered hydric. Flooding is likely to occur here as the soil occupies floodplains within the proposed corridor, proper erosion and sediment control techniques will likely need to be applied in these areas.

CHARLES SERIES
(Aeric Fluvaquents)

SETTING

Parent Material: Recent alluvium
Landform: Concave to flat
Position in Landscape: Lower areas
Slope Gradient Range: **(A)** 0-3%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-silty, mixed superactive, nonacid, fridgid Aeric Fluvaquents
Drainage Class: Poorly drained

Typical Profile Description:	Surface layer:	0-8” Mottled very dark grayish brown, silt loam
	Subsurface layer:	8-17” Mottled dark grayish brown to olive gray, silt loam
	Subsoil layer:	17-48” Mottled olive gray very fine sandy loam to dark gray silt loam
	Substratum:	48-65” Dark gray silt loam

Hydrologic Group: Group B/D
Surface Runoff: Negligible or very high
Permeability: Moderate and moderate to rapid below 48”
Depth to Bedrock: More than 60”
Hazard to Flooding: Frequent, brief March to October
T Erosion Factor: 5

INCLUSIONS

Similar: Lovewell

Dissimilar: Fryeburg

Occurrence on the survey map: CC – Charles, Cornish Wonsqueak Complex

USE AND MANAGEMENT

Wetness and possibility of flooding are the likely limitations to generator lead development on this soil type. The depth to water table may remain at or near the soil surface throughout the majority of the year. The other potential limitation to construction on these soils is the likely proximity to a river, stream or brook, flooding could occur in the spring and after heavy rain events. Proper erosion and sediment control techniques should be applied in these areas.

CHESUNCOOK SERIES
(Aquic Haplorthods)

SETTING

Parent Material: Dense glacial till
Landform: Glaciated uplands
Position in Landscape: High on landscape
Slope Gradient Range: **(B)** 3-8% **(C)** 8-20%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Aquic Haplorthods
Drainage Class: Moderately well drained

Typical Profile Description:	Surface layer:	0-6” Dark brown silt loam
	Subsurface layer:	6-18” Reddish brown silt loam grading to dark yellowish brown gravely silt loam
	Subsoil layer:	18-21” Light olive brown, mottled, friable gravely loam
	Substratum:	21-65” Light olive brown, very firm gravely loam

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderate in the solum, slow or very slow in the substratum, depth to restrictive layer is 15-26”
Depth to Bedrock: Very deep, more than 60”
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Dixfield, Berkshire, Skerry

Dissimilar: Telos, Monson, Thorndike, Elliottsville, Tunbridge, Lyman, Colonel

Occurrence on the survey map: TLC – Telos, Chesuncook, Elliotsville Association

USE AND MANAGEMENT

The most likely limiting factor to generator lead construction within this soil mapping unit is the seasonable high water table and slow permeability. There may be a restrictive layer present that could result in a high or perched water table that may cause problems with heavy equipment.

COLONEL SERIES
(Aquic Haplorthods)

SETTING

Parent Material: Compact loamy glacial till
Landform: Glaciated uplands
Position in Landscape: Intermediate positions on the landform
Slope Gradient Range: **(A)** 0-3% **(B)** 3-8% **(C)** 8-20%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, isotic, frigid, shallow Aquic Haplorthods
Drainage Class: Somewhat poorly drained

Typical Profile Description:

Surface layer:	0-5” Dark brown gravely fine sandy loam
Subsurface layer:	5-12” Reddish brown grading to strong brown gravely fine sandy loam
Subsoil layer:	12-19” Dark yellowish brown grading to light olive brown, mottled gravely fine sandy loam
Substratum:	19-65” Grayish brown, mottled, firm gravely fine sandy loam

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderate in the solum, and moderately slow or slow in the sustratum
Depth to Bedrock: Very deep, more than 60”
Hazard to Flooding: None
T Erosion Factor: 2

INCLUSIONS

Similar: Dixfield, Skerry, Westbury, Telos

Dissimilar: Naskeag, Brayton

Occurrence on the survey map:
CPB – Colonel, Brayton, Dixfield Association
CQB – Colonel, Brayton, Lyman Complex
DXC – Dixfield Colonel Association
DYC – Dixfield, Colonel, Lyman Association

USE AND MANAGEMENT

The perched water table for the majority of the year and moderately high runoff potential characteristic of this series could cause limitations to development. Proper erosion and sediment control techniques will likely need to be applied in these areas.

CORNISH SERIES
(Fluvaquentic Dystrudepts)

SETTING

Parent Material: Recent alluvium
Landform: Floodplains, marshes and bogs
Position in Landscape: Higher areas
Slope Gradient Range: **(A)** 0-3%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-silty, mixed, superactive, frigid Fluvaquentic Dystrudepts
Drainage Class: Somewhat poorly drained

Typical Profile Description:

Surface layer:	0-12” Very dark grayish brown, very fine sandy loam
Subsurface layer:	12-24” Light olive brown, very fine sandy loam, mottled
Subsoil layer:	24-35” olive fine sandy loam
Substratum:	35-65” olive gray very fine sandy loam

Hydrologic Group: Group B/D
Surface Runoff: Moderately low to high runoff potential
Permeability: Moderate
Depth to Bedrock: Deep, over 65”
Hazard to Flooding: **Occasional, brief March to October**
T Erosion Factor: 5

INCLUSIONS

Similar: Lovewell

Dissimilar: Fryeburg

Occurrence on the survey map: CC – Charles, Cornish, Wonsqueak Complex

USE AND MANAGEMENT

Limitations here are the occasional hazard to flooding and the variable depth to water table which can be near the soil surface for a majority of the year. Cornish soil series will likely have restrictions for generator lead development because they occur within a wetland and/or the close proximity to a river, stream or brook. Due to the increased risk of flooding, proper erosion and sediment control techniques should be applied in these areas.

DANFORTH SERIES
(Typic Haplorthods)

SETTING

Parent Material: Glacial till
Landform: Glaciated uplands
Position in Landscape: Convex-shaped landform on the side of a ridge or ablation till landform in valleys
Slope Gradient Range: **(B)** 3-8% **(C)** 8-20% **(D)** 20%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy-skeletal, isotic, frigid Typic Haplorthods
Drainage Class: Well drained

Typical Profile	Surface layer:	0-2” Black, highly decomposed organic material 2-4” Pinkish gray channery silt loam
Description:	Subsurface layer:	4-6” Dark reddish brown channery silt loam
	Subsoil layer:	6-26” Reddish brown grading to dark brown very channery fine sandy loam
	Substratum:	31-52” Olive brown very channery fine sandy loam 52-65” Olive gray very channery sandy loam

Hydrologic Group: Group B
Surface Runoff: Low runoff potential
Permeability: Moderate in the solum and moderately rapid or rapid in the substratum
Depth to Bedrock: Deep, over 65”
Hazard to Flooding: None
T Erosion Factor: 5

INCLUSIONS

Similar: Berkshire

Dissimilar: Brayton, Colonel, Rock outcrop, Peacham

Occurrence on the survey map: DBC – Danforth channery silt loam

USE AND MANAGEMENT

This deep, well-drained soil with slight erosion hazard should have few limitations to development of a generator lead. Proper erosion and sediment control techniques will likely need to be applied in these areas.

DIXFIELD SERIES
(Aquic Haplorthods)

SETTING

Parent Material: Dense basal till
Landform: On ridges and till plains
Position in Landscape: On the more distinctly convex or more sloping areas
Slope Gradient Range: **(B)** 3-8**% (C) 8-20%**

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Aquic Haplorthods
Drainage Class: Moderately well drained

Typical Profile Description:

Surface layer:	0-1” Black, saprick organic material 1-5” Pinkish gray fine sandy loam
Subsurface layer:	5-17” Reddish brown grading to brown gravelly fine sandy loam
Subsoil layer:	17-21” Light olive brown, mottled gravelly fine sandy loam
Substratum:	21-65” Light olive brown grading to olive, mottled, firm gravelly sandy loam

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderate in the solum and slow or moderatey slow in the substratum
Depth to Bedrock: Over 65”, but 18-29” to the dense substratum
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Marlow, Chesuncook

Dissimilar: Colonel, Tunbridge, Lyman, Ellitotsville

Occurrence on the survey map:
DXC – Dixfield Colonel Association
DYC – Dixfield, Colonel, Lyman Association
CPB – Colonel, Brayton Dixfield Association

USE AND MANAGEMENT

Slow permeability in the substratum may create a perched water table near the soil surface for part of the year. Proper road base drainage by importation of coarse granular fill or other site modification to redirect run-off is recommended along with employing appropriate construction techniques. The stony phase of these mapping units has up to 15% of the soil surface covered with stones or boulders, which may add further limitations for vehicular traffic.

ELLIOTTSVILLE SERIES
(Typic Haplorthods)

SETTING

Parent Material: Glacial till
Landform: Glacial ridge
Position in Landscape: Higher on ridges
Slope Gradient Range: **(B)** 3-8% **(C)** 8-20% **(D)** 20%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Typic Haplorthods
Drainage Class: Well drained

Typical Profile Description:

Surface layer:	0-1” Dark reddish brown, sapric organic material 1-2” Pinkish gray silt loam
Subsurface layer:	2-6” Dark reddish brown grading to strong brown silt loam
Subsoil layer:	6-22” Yellowish brown grading to light olive brown channery silt loam
Substratum:	22-26” Olive brown channery silt loam

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderate
Depth to Bedrock: 26”
Hazard to Flooding: None
T Erosion Factor: 2

INCLUSIONS

Similar: Dixfield, Tunbridge, Chesuncook Dixmont

Dissimilar Lyman, Naskeag

Occurrence on the survey map: TLC – Telos, Chesuncook, Elliottsville Association

USE AND MANAGEMENT

Steeper slopes and likelihood of higher runoff are the greatest potential limitations for generator lead construction on Elliottsville soils. Proper erosion and sediment control techniques are recommended for generator lead construction in these areas.

HOWLAND SERIES
(Aquic Haplorthods)

SETTING

Parent Material: Dense glacial till
Landform: Glaciated uplands
Position in Landscape: Side slopes
Slope Gradient Range: **(B)** 3-8%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Aquic Haplorthods
Drainage Class: Moderately well drained

Typical Profile Description:	**Surface layer:**	0-7” Dark grayish brown silt loam
	Subsurface layer:	7-13” Dark brown silt loam
	Subsoil layer:	13-17” Yellowish brown gravelly silt loam
		17-25” light olive brown to olive, mottled gravely silt loam
	Substratum:	25-65” olive, mottled, very firm gravelly silt loam

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderate in the solum and slow or moderately slow in the substratum
Depth to Bedrock: Over 65” to bedrock, 20-33” to the dense substratum
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Telos, Bangor, Dixmont, Chesuncook

Dissimilar: Thorndike, Monarda, Naskeag

Occurrence on the survey map: HRB – Howland, Monarda Association

USE AND MANAGEMENT

There are few limitations with this soil type for generator lead construction. A perched water table may be present for a good portion of the year that could cause problems with heavy equipment. Proper erosion and sediment control techniques are recommended for these areas.

LYMAN SERIES
(Lithic Haplorthods)

SETTING

Parent Material: Glacial till
Landform: Till ridges
Position in Landscape: Near the crests of ridges, or on more distinctly convex slopes.
Slope Gradient Range: **(B)** 3-8% **(C)** 8-20% **(D)** 20%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, isotic, frigid Lithic Haplorthods
Drainage Class: Somewhat excessively drained

Typical Profile Description:
Surface layer: 0-2" Black sapric organic materials
Subsurface layer: 2-3" Grayish brown fine sandy loam
Subsoil layer: 3-5" Dark reddish brown fine sandy loam
Substratum: 5-15" dark brown to dark yellowish brown fine sandy Loam

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderately rapid
Depth to Bedrock: 10-20" to granite bedrock
Hazard to Flooding: None
T Erosion Factor: 1

INCLUSIONS

Similar: Tunbridge, Dixfield

Dissimilar: Rock outcrop, Naskeag

Occurrence on the survey map:
CQB – Colonel, Brayton Lyman Complex
DYC – Dixfield, Colonel, Lyman Association
MND – Marlow, Lyman, Dixfield Association

USE AND MANAGEMENT

Potential limitations to generator lead construction in Lyman soils are the shallow depth to bedrock, and the moderately high runoff potential. Proper erosion and sediment control techniques are recommended in these areas.

MARLOW SERIES
(Oxyaquic Haplorthods)

SETTING

Parent Material: Dense glacial till
Landform: Ridge
Position in Landscape: Side slopes of ridges
Slope Gradient Range: **(C)** 8-15% **(D)** 15-25%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Oxyaquic Haplorthods
Drainage Class: Well drained

Typical Profile Description:

Surface layer:	0-2" Black, sapric organic material
	2-3" Dark grayish brown fine sandy loam
Subsurface layer:	3-8" Dark reddish brown to brown fine sandy loam
Subsoil layer:	8-29" Dark yellowish brown to light olive brown gravelly fine sandy loam
Substratum:	29-65" olive brown and firm grading to olive, very firm gravelly fine sandy loam

Hydrologic Group: Group C
Surface Runoff: Medium to high
Permeability: Moderate in solum and slow or moderately slow in the substratum
Depth to Bedrock: Very deep, more than 60", 18-30" to dense substratum
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Dixfield, Tunbridge

Dissimilar: Colonel, Brayton

Occurrence on the survey map: MND - Marlow, Lyman, Dixfield Association

USE AND MANAGEMENT

The potential limiting factor for site development is wetness due to the presence of a shallow groundwater table for parts of the year. Accepted construction techniques such as proper drainage are recommended for construction. These soils may exhibit a perched ground water table in the spring and during times of heavy precipitation. Upslope interceptor drains cross culverting and rock layer subhorizons may be appropriate along with the use of erosion and sediment control techniques.

MONARDA SERIES
(Aeric Endoaquepts)

SETTING

Parent Material: Dense glacial till
Landform: Glaciated uplands
Position in Landscape: Lower on landscape
Slope Gradient Range: **(A)** 0-3% **(B)** 3-8%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, mixed, active, acid frigid, shallow Aeric Endoaquepts
Drainage Class: Poorly drained

Typical Profile Description:

Surface layer:	0-2” Black hemic organic materials
	2-4” Dark grayish brown, mottled, channery silt loam
Subsurface layer:	4-10” Grayish brown, mottled, channery silt loam
Subsoil layer:	10-14” Olive, mottled, firm channery silt loam
Substratum:	14-65” Olive, mottled, very firm, channery silt loam

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderate to moderately rapid in the surface layer, moderately slow or moderate in the upper part of the subsoil, and very slow or slow in the dense substratum and lower part of the subsoil
Depth to Bedrock: Very deep, more than 60”, 12-24” to dense substratum
Hazard to Flooding: None
T Erosion Factor: 2

INCLUSIONS

Similar: Brayton, Telos, Colonel

Dissimilar: Peacham, Ellitosville

Occurrence on the survey map: HRB - Howland, Monarda Association
MW - Monarda, Burnham Association

USE AND MANAGEMENT

Equipment limitations may be severe for Monarda soil series. These soils have a seasonal high water table at or close to the mineral soil surface, and can be compacted if exposed to heavy equipment when wet. Thick organic surface layers can lead to instability. This is listed as a hydric soil. Accepted construction techniques such as matting or bridging as well as erosion and sediment control techniques are recommended in these areas.

MONSON SERIES
(Lithic Haplorthods)

SETTING

Parent Material: Glacial till
Landform: Glacial till knolls and ridges
Position in Landscape: Top and side slopes
Slope Gradient Range: **(B)** 3-8% **(C)** 8-20% **(D)** 20%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, isotic, frigid Lithic Haplorthods
Drainage Class: Somewhat excessively drained

Typical Profile Description:	**Surface layer:**	0-2” Dark reddish brown, highly decomposed organics
		2-4” Pinkish gray silt loam
	Subsurface layer:	4-9” Dark reddish brown to yellowish red silt loam
	Subsoil layer:	9-18” Dark yellowish brown channery silt loam
	Substratum:	18” Slate bedrock

Hydrologic Group: Group C/D
Surface Runoff: Moderate to high runoff potential
Permeability: Moderate
Depth to Bedrock: Shallow, 10-20”
Hazard to Flooding: None
T Erosion Factor: 1

INCLUSIONS

Similar: Telos, Chesuncook, Thorndike, Ellitosville

Dissimilar: Naskeag

Occurrence on the survey map: TNB – Teols, Monarda, Monson Complex
MYD – Monson, Elliottsville, Ricker Complex

USE AND MANAGEMENT

The shallow depth to bedrock will likely be a limiting factor in generator lead development on Monson soils. Proper sediment and erosion control methods will likely need to be used here. Shallow bedrock could also pose as a problem relating to utility pole placement in these areas.

PEACHAM SERIES
(Histic Humaquepts)

SETTING

Parent Material: Basal till
Landform: Glaciated uplands
Position in Landscape: Lower depressions
Slope Gradient Range: **(A)** 0-3% **(B)** 3-8%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, mixed, active, nonacid, frigid, shallow Histick Humaquepts
Drainage Class: Very poorly drained

Typical Profile Description:

Surface layer:	0-13” Dark reddish brown to black muck
	13-14” Very dark brown gravelly fine sandy loam
Subsurface layer:	14-18” Olive gray, mottled gravelly fine sandy loam
Subsoil layer:	18-35” Gray, mottled, firm gravelly loam
Substratum:	35-65” Olive gray, mottled, firm gravelly loam

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderately slow to moderately rapid in the surface layer, moderate in the subsoil, and very slow or slow in the substratum
Depth to Bedrock: Very deep, more than 60”, Depth to water table 1’ above the surface and 2’ below, perched, September to July
Hazard to Flooding: Frequently ponded for 70-30 days after snowmelt or a major rain event
T Erosion Factor: 1

INCLUSIONS

Similar: Brayton, Whately

Dissimilar: Naskeag, Sebago

Occurrence on the survey map: BP – Brayton, Peacham Association

USE AND MANAGEMENT

The possible limiting factor for site development is wetness due to the presence of a shallow water table within for a significant portion of the year. Peacham soils have severe limitations for construction due to wetness and thick organic cap. Peacham soil is usually classified as wetland, based on the combined consideration of hydrology, hydric conditions, and vegetation. Proper sediment and erosion control methods as well as matting or bridging will likely be needed in these areas.

PENQUIS SERIES
(Typic Haplorthods)

SETTING

Parent Material: Glacial till
Landform: Glaciated uplands
Position in Landscape: Between and on the sides of small knolls
Slope Gradient Range: **(A)** 3-8% **(B)** 8-15%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Typic Haplorthods
Drainage Class: Well drained

Typical Profile Description:	**Surface layer:**	0-7” Dark brown silt loam
	Subsurface layer:	7-11” Yellowish red silt loam
		11-14” Dark yellowish brown silt loam
		14-25” Olive brown channery silt loam
	Subsoil layer:	25-32” Olive channery silt loam
	Substratum:	32” Calcareous metasiltstone bedrock

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderate
Depth to Bedrock: Moderately deep, 20-40”
Hazard to Flooding: None
T Erosion Factor: 2

INCLUSIONS

Similar: Dixmont, Bangor

Dissimilar: Abram, Thorndike, Monarda, Burnham

Occurrence on the survey map: PWC – Plaisted, Howland, Penquis Association
TSC – Thorndike, Penquis Complex
TtB – Throndike, Penquis Abram Complex

USE AND MANAGEMENT

There are few limitations to development on Penquis soil series. The depth to water table is typically more than six feet and the soil is well drained. The presence of shallow bedrock may need to be considered for construction of a generator lead. Proper sediment and erosion controls may be needed here.

PLAISTED SERIES
(Oxyaquic Haplorthods)

SETTING

Parent Material: Dense glacial till
Landform: Glaciated uplands
Position in Landscape: Tops and upper side slopes of hills and ridges
Slope Gradient Range: **(B)** 3-8% **(C)** 8-15% **(D)** 15-25%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Coarse-loamy, isotic, frigid Oxyaquic Haplorthods
Drainage Class: Well drained

Typical Profile Description:	**Surface layer:**	0-7” Dark grayish brown silt loam
	Subsurface layer:	7-17” Strong brown grading to yellowish brown silt loam
	Subsoil layer:	17-28” Light olive brown and yellowish brown gravelly silt loam
	Substratum:	28-65” Olive and light olive brown firm gravelly silt loam

Hydrologic Group: Group C
Surface Runoff: Moderately high runoff potential
Permeability: Moderate in the solum and slow or moderately slow in the substratum
Depth to Bedrock: Very deep, more than 60”
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Howland, Penquis

Dissimilar: Thorndike, Monson, Monarda, Ellitosville

Occurrence on the survey map: PWC – Plaisted, Howland, Penquis Association

USE AND MANAGEMENT

A perched water table in the Plaisted series occurs for short periods in the spring. Heavy machinery may compact this soil when wet and cause problems with wetness and surface runoff. Proper sediment and erosion control measures will likely need to be used here.

RICKER SERIES
(Lithic Cryofolists)

SETTING

Parent Material: Organic material
Landform: Glacial till knolls and ridges
Position in Landscape: Tops and side slopes
Slope Gradient Range: **(C)** 8-20% **(D)** 20%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Dysic Lithic Cryofolists
Drainage Class: Well drained

Typical Profile Description:
Surface layer: 0-2” Dark reddish brown mucky peat
Subsurface layer: 2-4” Black muck
Subsoil layer: 4-5” Dark gray channery silt loam
Substratum: 5” Slate bedrock

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderately rapid in the organic material and moderate or moderately rapid in the mineral material
Depth to Bedrock: Very shallow, less than 10”
Hazard to Flooding: None
T Erosion Factor: 1

INCLUSIONS

Similar: Abram, Hogback ,Rawsonville, Throndike, Rock outcrop, Lyman, Tunbridge

Dissimilar: Naskeag

Occurrence on the survey map: MYD – Monson, Elliotsville, Ricker Complex

USE AND MANAGEMENT

The high organic content and shallow depth to bedrock may pose limitations to generator lead construction in Ricker soils. Proper sediment and erosion control methods should be used here. The shallow bedrock could create limitations with utility pole placement as well.

TELOS SERIES
(Aquic Haplorthods)

SETTING

Parent Material: Dense basal till
Landform: Glacial ridge
Position in Landscape: Downslope
Slope Gradient Range: **(B)** 3-8% **(C)** 8-20%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, isotic, frigid, shallow Aquic Haplorthods
Drainage Class:

Typical Profile Description:	**Surface layer:**	0-1” Organic, very dark brown highly decomposed
		1-3” Pinkish gray silt loam
	Subsurface layer:	3-11” Reddish brown to brown silt loam
	Subsoil layer:	11-21” Yellowish brown to olive, mottled channery silt loam
	Substratum:	21-65” Olive, mottled, firm channery silt loam

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderate in the solum and very slow or slow in the substratum
Depth to Bedrock: Very deep, more than 60”, depth to water table is 1-2’ perched, October to June
Hazard to Flooding: None
T Erosion Factor: 3

INCLUSIONS

Similar: Chesuncook, Colonel

Dissimilar: Brayton, Monarda

Occurrence on the survey map: TLC – Telos, Chesuncook, Ellittsville Association

USE AND MANAGEMENT

The likely limiting factor for development is wetness due to the presence of a perched water table for part of the year. Proper drainage, sediment and erosion control methods and construction techniques may be needed while working in Telos soils.

THORNDIKE SERIES
(Lithic Haplorthods)

SETTING

Parent Material: Glacial till
Landform: Ridge
Position in Landscape: Tops and sideslopes
Slope Gradient Range: **(C)** 8-15% **(D)** 15-25% **(E)** 25%+

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy-skeletal, isotic, frigid Lithic Haplorthods
Drainage Class: Somewhat excessively drained

Typical Profile Description:

Surface layer:	0-3” Organic, black highly decomposed organic material
	3-4” Pinkish gray channery silt loam
Subsurface layer:	4-8” Yellowish red to brown channery silt loam
Subsoil layer:	8-18” Dark yellowish brown very channery silt loam
Substratum:	18” Calcareous metasedimentary bedrock

Hydrologic Group: Group C/D
Surface Runoff: Moderately high to high runoff potential
Permeability: Moderate
Depth to Bedrock: 10-20” to bedrock
Hazard to Flooding: None

INCLUSIONS

Similar: Elliotsville, Chesuncook, Dixmont, Lyman, Tunbridge

Dissimilar: Monson, Rock outcrop, Abram, Ricker

Occurrence on the survey map: TSC – Thorndike, Penquis Complex
TtB – Throndike, Penquis, Abram Complex

USE AND MANAGEMENT

There are few construction limitations with in Thorndike soils; the depth to water table is typically more than 6 feet and the soil is somewhat excessively drained. The shallow depth to bedrock may be a limiting factor for development of a generator lead on Thorndike soils, and could pose problems relating to utility pole placement.

WONSQUEAK SERIES
(Terric Haplosaprists)

SETTING

Parent Material: Mantle of organic material over loamy mineral material
Landform: Floodplains, marshes and bogs
Position in Landscape: Depressions
Slope Gradient Ranges: **(A)** 0-3%

COMPOSITION AND SOIL CHARACTERISTICS

Taxonomic Class: Loamy, mixed euic, frigid Terric Haplosaprists
Drainage Class: Very poorly drained

Typical Profile Description:
Surface layer: 0-4" Organic, black muck
Subsurface layer: 4-23" Very dark brown muck
Subsoil layer: 23-31" Dark reddish brown muck
Substratum: 31-65" Gray and light gray gravelly silt loam

Hydrologic Group: Group D
Surface Runoff: High runoff potential
Permeability: Moderately slow to moderately rapid in the organic layers, and moderately slow or moderate in the substratum
Depth to Bedrock: Very deep, more than 60"
Hazard to Flooding: Frequent, long, March to October
T Erosion Factor: 1

INCLUSIONS

Similar: Naumburg variant, Searsport, Brayton

Dissimilar: Very deep Organic soils, Waskish

Occurrence on the survey map: CC – Charles, Cornish, Wonsqueak Complex
WB – Wonsqueak, Buxport histosols

USE AND MANAGEMENT

The hazard to flooding and variable depth to the water table could contribute to challenges associated to generator lead development on this soil. The thick organic layer at the surface could also limit access of heavy machinery; matting or bridging may be necessary in these areas. Wonsqueak soils are likely to occur within a wetland or floodplain, so the hazard to flooding is high. Proper sediment and erosion control methods will likely need to be used in areas that contain Wonswueak soils.