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June 1, 2007

Dr. Burl Haar, Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101

Re: In the Matter of the Application of Kenyon Wind, LLC for a Large Wind Energy Conversion System Site Permit for a 18.9 Megawatt Wind Farm in Goodhue County

PUC Docket Number IP 6605/WS-06-1445

Dear Dr. Haar:

The Department of Commerce (DOC) Energy Facilities Permitting (EFP) staff respectfully submits the attached documents into the record in the above referenced docket.

The attached documents provide information about issues raised during the course of the site permitting process for the Kenyon Wind Project. The documents were submitted by Kenyon Wind, LLC, and Suzlon Wind Energy in response to the Department's request for additional information. Several of these documents are typically filed by the Permittee after a site permit issued, but prior to construction. The attached documents include:

- Microwave beam path search conduced by Comsearch
- Natural heritage inventory conducted by Minnesota Department of Natural Resources
- Geotechnical Exploration Report conducted by Pinnacle Engineering
- Kenyon Wind, LLC, description of efforts to locate, avoid, and repair drain tile
- Kenyon Wind, LLC, updated proposed turbine site locations
- Calculations predicting noise levels at residential receivers conducted by Suzlon Wind Energy
- Federal Aviation Administration "Determinations of No Hazard to Air Navigation"

Sincerely,

Adam M. Sokolski
Project Manger

attachments

Executive Summary – Wind Power GeoPlanner™

Licensed Microwave Search

Comsearch performed an analysis to evaluate the potential effect of the planned Kenyon Wind Project area in Goodhue County, Minnesota on existing non-Federal Government microwave telecom systems.

Comsearch's Wind Power GeoPlanner™ provides a graphical representation of affected microwave paths and provides supporting technical parameters. The microwave path data is overlaid on USGS topographic basemaps.

Microwave Search Results. Comsearch identified no microwave paths that intersect the project area (see Figure 1).

Therefore, none of the proposed turbines will conflict with licensed microwave systems in the frequency bands listed in Figure 1's legend.

Turbines: 9 turbines were considered in the analysis, each with a blade diameter of 88 meters. The coordinates were provided in NAD83.

Map Projection: The ESRI® Shapefiles contained in the enclosed GeoPlanner CD are in NAD 83 UTM Zone 15 projected coordinate system.

Comsearch Contact:
Denise Finney, Account Manager
Phone: (703) 726-5650 Fax: (703) 726-5599
Email: dfinney@comsearch.com

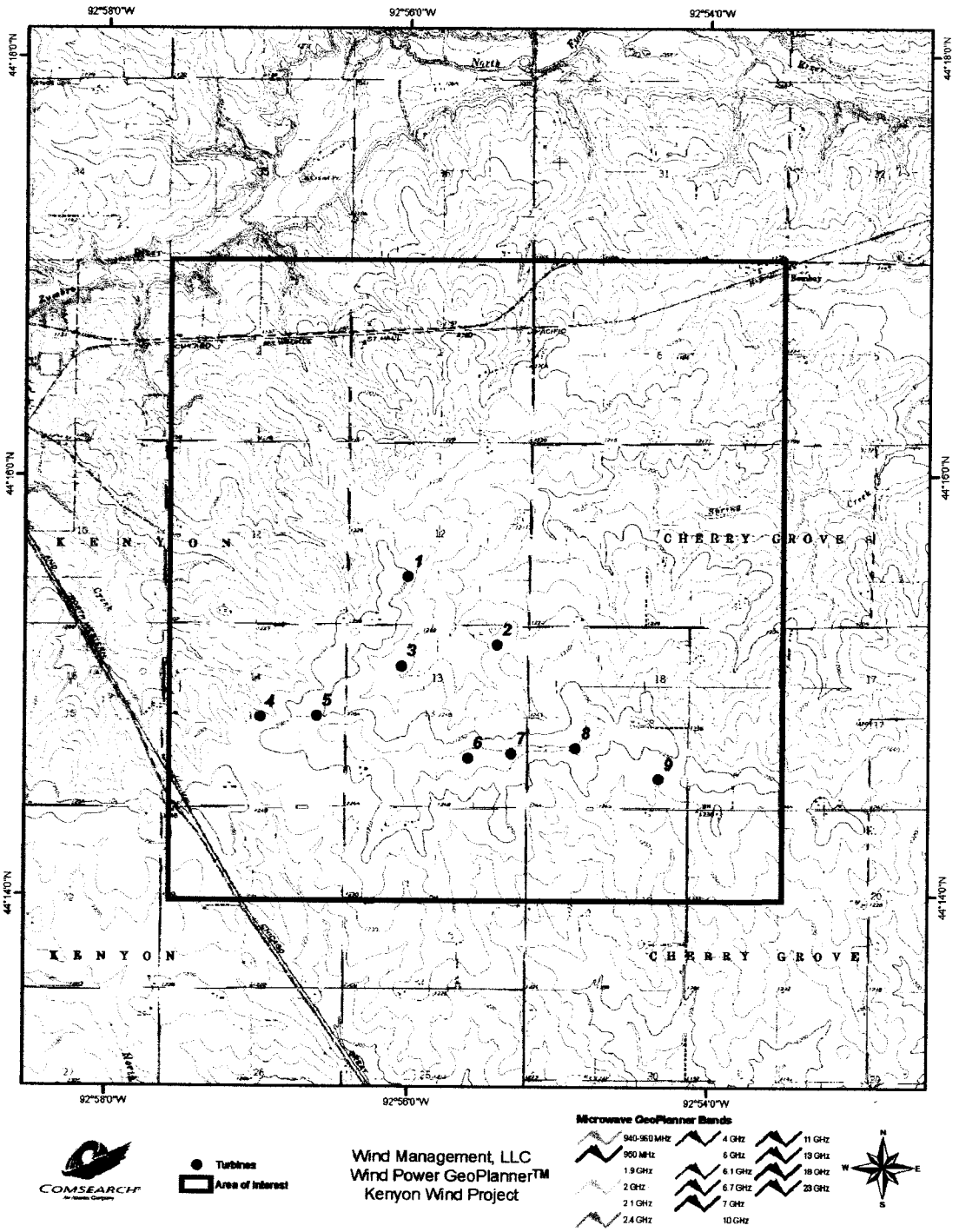

Figure 1 – Wind Power GeoPlanner™

Minnesota Department of Natural Resources

Natural Heritage and Nongame Research Program, Box 25
500 Lafayette Road
St. Paul, Minnesota 55155-40__

Phone: (651) 259-5109 Fax: (651) 296-1811 E-mail: lisa.joyal@dnr.state.mn.us

May 3, 2007

Mr. Todd Andrews
Kenyon Wind, LLC
201 Ridgewood Ave.
Minneapolis, MN 55403

Re: Request for Natural Heritage information for vicinity of proposed Kenyon Wind Farm, T109N R18W Sections 1, 2, 11-14, 23, 24, T109N R17 W Sections 6, 17-19, Goodhue County
NHNRP Contact #: ERDB 20070752

Dear Mr. Andrews,

Please note that we detected what *we believe to be* an error in the Township, Range, or Section information as it was submitted to us on the Information Request Form. Because the location description that was submitted on the Information Request Form did not exactly match the project area outlined on the map that was submitted with the form, the enclosed search results are for the area indicated on the map (as listed in the subject line of this letter). If the location description of your project area, as listed above, is in error, please contact me.

The Minnesota Natural Heritage database has been reviewed to determine if any rare plant or animal species or other significant natural features are known to occur within an approximate one-mile radius of the area indicated on the map enclosed with your information request. Based on this review, there are 11 known occurrences of rare species or native plant communities in the area searched (for details, please see the enclosed database printouts and the explanation of selected fields).

Current workloads prevent us from providing detailed comments at this time about which rare features may be impacted by your project. To avoid delaying your project planning and to assist you in evaluating whether your project might impact rare features, we are providing printouts of known locations of rare features in the vicinity of your project, and a fact sheet that provides guidance on determining whether your project might negatively affect one of these rare features. If you have specific questions regarding whether a particular activity might impact a rare feature, please contact me.

The Natural Heritage database is maintained by the Natural Heritage and Nongame Research Program, a unit within the Division of Ecological Services, Department of Natural Resources. It is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. Its purpose is to foster better understanding and protection of these features.

Because our information is not based on a comprehensive inventory, there may be rare or otherwise significant natural features in the state that are not represented in the database. A county-by-county survey of rare natural features is now underway, and has been completed for Goodhue County. Our information about native plant communities is, therefore, quite thorough for that county. However, because survey work for rare plants and animals is less exhaustive, and because there has not been an on-site survey of all areas of the county, ecologically significant features for which we have no records may exist on the project area.

The enclosed results of the database search are provided in two formats: short record report and long record report. To control the release of locational information, which might result in the damage or destruction of a rare element, both printout formats are copyrighted.

The short record report provides rare feature locations only to the nearest section, and may be reprinted, unaltered, in an Environmental Assessment Worksheet, municipal natural resource plan, or report compiled by your company for the project listed above. If you wish to reproduce the short record report for any other purpose, please contact me to request written permission. **The long record report includes more detailed locational information, and is for your personal use only. If you wish to reprint the long record report for any purpose, please contact me to request written permission.**

Please be aware that review by the Natural Heritage and Nongame Research Program focuses only on *rare natural features*. It does not constitute review or approval by the Department of Natural Resources as a whole. If you require further information on the environmental review process for other natural resource-related issues, you may contact your Regional Environmental Assessment Ecologist, Wayne Barstad, at (651) 772-7940.

An invoice in the amount of $129.14 will be mailed to you under separate cover within two weeks of the date of this letter. You are being billed for map and database search. Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources.

Sincerely,

Lisa A. Joyal
Endangered Species Environmental Review Coordinator

encl: Database search results
Rare Feature Database Print-Outs: An Explanation of Fields

The Natural Heritage & Nongame Research Program recently adopted a new database system called Biotics. As a result of this change, the layout and contents of the database reports have been revised. Many of the fields included in the new reports are the same or similar to the previous report fields, however there are several new fields and some of the field definitions have been slightly modified. We recommend that you familiarize yourself with the latest field explanations.

Rare Features Database Reports: An Explanation of Fields

The Rare Features database (Biotics) is part of the Natural Heritage Information System, and is maintained by the Natural Heritage and Nongame Research Program, a unit within the Division of Ecological Services, Minnesota Department of Natural Resources (DNR).

Please note that the print-outs are copyrighted and may not be reproduced without permission

Field Name: [Full (non-abbreviated) field name, if different]. Further explanation of field.

-E-

Element Name and Occ #: [Element Name and Occurrence Number]. The Element is the name of the rare feature. For plant and animal species records, this field holds the scientific name followed by the common name in parentheses; for all other elements (such as native plant communities, which have no scientific name) it is solely the element name. Native plant community names correspond to Minnesota's Native Plant Community Classification (Version 2.0). The Occurrence Number, in combination with the Element Name, uniquely identifies each record.

EO Data: [Element Occurrence Data]. For species elements, this field contains data collected on the biology of the Element Occurrence* (EO), including the number of individuals, vigor, habitat, soils, associated species, peculiar characteristics, etc. For native plant community elements, this field is a summary text description of the vegetation of the EO, including structure (strata) and composition (dominant/characteristic species), heterogeneity, successional stage/dynamics, any unique aspects of the community or additional noteworthy species (including animals). Note that this is a new field and it has not been filled out for many of the records that were collected prior to conversion to the new database system. Some of the information meeting the field definition may be found in the General Description field.

EO ID#: [Element Occurrence Identification Number]. Unique identifier for each Element Occurrence record.

EO Rank: [Element Occurrence Rank]. An evaluation of the quality and condition of an Element Occurrence (EO) from A (highest) to D (lowest). Represents a comparative evaluation of: 1) quality as determined by representativeness of the occurrence especially as compared to EO specifications and including maturity, size, numbers, etc. 2) condition (how much has the site and the EO itself been damaged or altered from its optimal condition and character). 3) viability (the long-term prospects for continued existence of this occurrence - used in ranking species only). EO Ranks are assigned based on recent fieldwork by knowledgeable individuals.

Extent Known?: A value that indicates whether the full extent of the Element is known (i.e., it has been determined through field survey) at that location. If null, the value has not been determined.

-F-

Federal Status: Status of species under the U.S. Endangered Species Act: LE = endangered; LT = threatened; LE,LT = listed endangered in part of its range, listed threatened in another part of its range; LT,PDL = listed threatened, proposed for delisting; C = candidate for listing. If null or "No Status" the species has no federal status.

First Observed Date: Date that the Element Occurrence was first reported at the site in format YYYY-MM-DD. A year followed by "Pre" indicates that the observed date was sometime prior to the date listed, but the exact date is unknown.

-G-

General Description: General description or word picture of the area where the Element Occurrence (EO) is located (i.e., the physical setting/context surrounding the EO), including a list of adjacent communities. When available, information on surrounding land use may be included. Note that the information tracked in this field is now more narrowly defined than it was in the old database system, and some of the information still in this field more accurately meets the definition of the new EO Data field. We are working to clean up the records so that the information in the two fields corresponds to the current field explanations described herein. Also note that the use of uppercase in sentences in this field is not significant but rather an artifact of transferring data from the old database system to the new system.

Global Rank: The global (i.e., range-wide) assessment of the relative rarity or imperilment of the species or community. Ranges from G1 (critically imperiled due to extreme rarity on a world-wide basis) to G5 (demonstrably secure, though perhaps rare in parts of its range). Global ranks are determined by NatureServe, an international network of natural heritage programs and conservation data centers.

-L-

Last Observed Date: Date that the Element Occurrence was last observed to be extant at the site in format YYYY-MM-DD.

Last Survey Date: Date of the most recent field survey for the Element Occurrence, regardless of whether it was found during the visit. If the field is blank, assume the date is the same as the Last Observed Date.

Location Description: County or Counties in which the Element Occurrence was documented followed by Township, Range, and Section information (not listed in any particular order). Each unique Township, Range, and Section combination is separated by a comma. In some cases, there are too many Township, Range, and Section combinations to list in the field, in which case, the information will be replaced with, "Legal description is too lengthy to fit in allotted space".

-M-

Managed Area(s): Name of the federally, state, locally, or privately managed park, forest, refuge, preserve, etc., containing the occurrence, if any. If this field is blank, the element probably occurs on private land. If "(Statutory Boundary)" occurs after the name of a managed area, the location may be a private inholding within the statutory boundary of a state forest or park.

MN Status: [Minnesota Status]. Legal status of plant and animal species under the Minnesota Endangered Species Law: END = endangered; THR = threatened; SPC = special concern; NON = tracked, but no legal status. Native plant communities, geological features, and colonial waterbird nesting sites do not have any legal status under the Endangered Species Law and are represented by a N/A.

-N-

NPC Classification (v1.5): Native plant community name in Minnesota's Native Vegetation: A Key to Natural Communities (Version 1.5). This earlier classification has been replaced by Minnesota's Native Plant Community Classification (Version 2.0).

-O-

Observed Area: The total area of the Element Occurrence, in acres, which is measured or estimated during fieldwork. If null, the value has not been determined.

Ownership Type: Indicates whether the land on which the Element Occurrence was located was publicly or privately owned; for publicly owned land, the agency with management responsibility is listed, if known.

-S-

Site Name: The name of the site(s) where the Element Occurrence is located. Sites are natural areas of land with boundaries determined and mapped according to biological and ecological considerations.

Survey Site #/Name: The name of the survey site, if applicable, where the Element Occurrence is located. Survey sites are sites that provide a geographic framework for recording and storing data, but their boundaries are not based on biological and ecological considerations. Minnesota County Biological Survey site numbers, if applicable, are also listed in this field.

Survey Type: Information on the type of survey used to collect information on the Element Occurrence.

Surveyor(s): Name(s) of the person(s) that collected survey information on the Element Occurrence.

State Rank: Rank that best characterizes the relative rarity or endangerment of the taxon or plant community in Minnesota. The ranks do not represent a legal status. They are used by the Minnesota Department of Natural Resources to set priorities for research, inventory and conservation planning. The state ranks are updated as inventory information becomes available. S1 = Critically imperiled in Minnesota because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. S2 = Imperiled in Minnesota because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. S3 = Vulnerable in Minnesota either because rare or uncommon, or found in a restricted range, or because of other factors making it vulnerable to extirpation. S4 = Apparently secure in Minnesota, usually widespread. S5 = Demonstrably secure in Minnesota, essentially ineradicable under present conditions. SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, but suspected to be still extant. An element would become SH without the 20-year delay if the only known occurrences in the state were destroyed or if it had been extensively and unsuccessfully looked for. SNR = Rank not yet assessed. SU = Unable to rank. SX = Presumed extinct in Minnesota. SNA = Rank not applicable. S#S# = Range Rank: a numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element. S#B, S#N = Used only for migratory animals, whereby B refers to the breeding population of the element in Minnesota and N refers to the non-breeding population of the element in Minnesota.

-V-

Vegetation Plot: Code(s) for any vegetation plot data that have been collected within this Element Occurrence (i.e., either Releve Number or the word "RELEVE" indicates that a releve has been collected).

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* Element Occurrence – an area of land and/or water in which an Element (i.e., a rare species or community) is, or was, present, and which has practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. Specifications for each species determine whether multiple observations should be considered 1 Element Occurrence or 2, based on minimum separation distance and barriers to movement.

Data Security

Locations of some rare features must be treated as sensitive information because widespread knowledge of these locations could result in harm to the rare features. For example, wildflowers such as orchids and economically valuable plants such as ginseng are vulnerable to exploitation by collectors; other species, such as bald eagles, are sensitive to disturbance by observers. For this reason, we prefer that publications not identify the precise locations of vulnerable species. We suggest describing the location only to the nearest section. If this is not acceptable for your purposes, please call and discuss this issue with the Endangered Species Environmental Review Coordinator for the Natural Heritage and Nongame Research Program at (651) 259-5107.

Minnesota Natural Heritage & Nongame Research Program
Short Record Report of Element Occurrences within 1 mile radius of:
Kenyon Wind Farm
Multiple TRS
Goodhue County

Element Name and Occurrence Number	Federal Status	MN Status	State Rank	Global Rank	Last Observed Date	EO ID #
Goodhue County, MN						
Adoxa moschatellina (Moschatel) #12 Location Description: T110N R18W S34, T109N R18W S4, T109N R18W S3, T110N R18W S33		SPC	S3	G5	1945-05-06	3327
Erythronium propullans (Dwarf Trout Lily) #37 Location Description: T110N R18W S34, T109N R18W S3	LE	END	S1	G1	1992-05-08	13654
Freshwater Mussel Concentration Area (Mussel Sampling Site) #13 Location Description: T109N R18W S2, T110N R18W S35		No Status	SNR	GNR	1988-06-27	13408
Freshwater Mussel Concentration Area (Mussel Sampling Site) #21 Location Description: T110N R17W S29, T110N R17W S31, T110N R17W S30, T110N R17W S32		No Status	SNR	GNR	1988-07-06	13416
Freshwater Mussel Concentration Area (Mussel Sampling Site) #72 Location Description: T109N R17W S8		No Status	SNR	GNR	1988-08-25	13466
Lasmigona compressa (Creek Heelsplitter) #41 Location Description: T110N R18W S34, T109N R18W S2, T110N R18W S35, T109N R18W S3		SPC	S3	G5	1988-06-27	24959
Lasmigona compressa (Creek Heelsplitter) #43 Location Description: T110N R17W S29, T110N R17W S31, T110N R17W S30, T110N R17W S32		SPC	S3	G5	1988-06-06	24961
Mustela nivalis (Least Weasel) #12 Location Description: T110N R18W S34, T110N R18W S33, T109N R18W S3, T109N R18W S9, T109N R18W S8, T109N R18W S10, T109N R18W S4, T109N R18W S5		SPC	S3	G5	1952-03-01	30826
Native Plant Community, Undetermined Class #1406 Location Description: T109N R18W S3		N/A	SNR	GNR	1991-08-05	13283
Trillium nivale (Snow Trillium) #25 Location Description: T109N R18W S3		SPC	S3	G4	2001-04-28	13655
Venustaconcha ellipsiformis (Ellipse) #18 Location Description: T110N R17W S29, T110N R17W S30, T110N R17W S23, T110N R17W S24, T109N R18W S2, T110N R18W S35		THR	S2	G3G4	1988-06-27	24928

Records Printed = 11

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Reviewing Development Projects for Effects on Rare Features

This fact sheet was produced to accompany data from the Natural Heritage Information System regarding rare features (endangered, threatened, and special concern plants and animals; native plant communities; and animal aggregation sites) known to occur in the vicinity of a project location. It is designed to assist you in evaluating the potential effects of a proposed action (project) on rare natural features.

IF RARE FEATURES HAVE BEEN REPORTED FROM WITHIN THE PROJECT BOUNDARIES

Rare features that occur within a project's boundaries have a high likelihood of being affected by the project. That likelihood can be further assessed by considering the following:

- *Location of the project in relation to the rare feature occurrence.* Will the project affect the area the rare feature was last known to occupy? If so, it is highly likely there will be a "taking" if the project occurs (see "Taking of Endangered or Threatened Species" below). If the rare feature is federally or state listed as an endangered or threatened species, the project must be modified to avoid the taking, or, if this is not possible or practical, a takings permit must be obtained. Even if the project will not affect the area where the rare feature was last known to occur, a survey is usually advisable to determine the present location and extent of the rare feature on the site (see "Conducting Surveys for Rare Features" below).

- *Habitat.* Will the project affect the species' habitat through removal, degradation, conversion, or fragmentation? Negative impacts on habitat for animal or plant species can decrease or eliminate the population over time, even if individual organisms are not directly killed. For certain plant species (especially annuals) a large percentage of the habitat occupied by individual plants over the span of decades may be unoccupied during any one given year. Therefore, removal of habitat for these plant species can hurt the population. Avoidance or mitigation measures should be considered.

- *Date of record.* Does the rare feature still occur at the site? If the date the rare feature was last observed is less than 20 years ago, it should be assumed to still occur at the site. If habitat has altered dramatically since the last observed date (for example, if the site has been converted from a natural area to row crops), the presence of the rare feature should be considered possible, but not certain. An on-site survey is generally the most definitive way to determine the presence of the species of concern on the site (see "Conducting Surveys for Rare Features" below). If a survey reveals the species still occurs on the site, see "Taking of Endangered or Threatened Species" below.

- *Nature and Timing of Disturbance.* Will the disturbance during construction of the project be temporary (e.g., installing some underground utility lines) or permanent (e.g., building a housing development)? If temporary, see below under "Life History".

- *Life History.* For *temporary* disturbances, the following questions should be considered. What time of year will the disturbance occur, and what is the rare species' situation at that time of year? Many plants are dormant at certain times of the year (usually late fall and winter) and less susceptible to disturbance. Some animals only use certain areas during a portion of the year, and therefore projects can be conducted while the animals are not on the site, provided the project does not alter the habitat so that it is unsuitable for future use by the animal. Is there a time of year that disruption to the animal or plant will be less (e.g., during the non-breeding season for animals or when the ground is frozen for plants)? If so, can the project be completed at that time? If not, see "Taking of Endangered or Threatened Species" below.

Conducting Surveys For Rare Features: Because many rare species are difficult to identify, surveys should be performed by persons with training and experience identifying the species in question. The surveyor should also know the specific habitat of the target species. In addition, many species can only be observed or identified at certain times of the year, so the surveyor must be familiar with the species' life history to know when the species is most likely to be found. A survey that fails to find a species at a site, but which was conducted at the wrong time of year does not provide convincing proof that a species does not exist at the site. Survey results should be submitted to the DNR for review, and should include the date of the survey, background of the surveyor, as well as other details such as the length of time spent searching. The NHNRP Environmental Review Coordinator can be contacted at the address at the end of this document for a list of people who have, in the past, competently conducted surveys for rare features.

"Taking" of Endangered or Threatened Species: If, through the analysis process described above, it is determined that a state endangered or threatened species may be killed or destroyed by a development project, the state Endangered Species Coordinator should be contacted. Destruction of threatened or endangered species is prohibited by state law and rules, except under certain prescribed conditions (Minnesota Statute 84.0895 and associated rules). Questions about the Endangered Species Law and the permitting process should be directed to the state Endangered Species Coordinator at (651) 259-5073. If it is determined that a federally endangered or threatened species may be killed or destroyed by a development project, the U.S. Fish and Wildlife Service should be contacted at (612) 725-3276, ext. 250.

IF RARE FEATURES HAVE BEEN REPORTED OUTSIDE THE PROJECT BOUNDARIES

Rare features that occur in the vicinity of development projects but outside the project boundary can be affected by a project as described below.

- *Plant and Animal Populations.* Records of rare plants and animals in the Natural Heritage Rare Features Database represent observations of individuals from a population. In most cases, the size or the full extent of the population is unknown. If a rare species occurs in the vicinity of the project area and habitat for that species also occurs within the project boundary, it is possible that the species may occur on the project site. If this is the case, see "If Rare Features Have Been Reported From Within the Project Boundaries" above.
- *Hydrologic Patterns.* Changes in the local hydrologic patterns (e.g., amount or quality of surface runoff, appropriations or diversions of surface or ground water) can affect rare species or their habitats. Calcareous fens are particularly sensitive to changes in groundwater resources that occur within their recharge area, which can be quite large. Impacts of hydrologic changes on both on-site and off-site rare features in the vicinity of projects should be evaluated.
- *Invasive Exotics.* Projects that involve land disturbance can result in the deliberate or unintended introduction of invasive exotic (weed) species. Once established in an area, these species can spread into nearby native plant communities, thereby degrading them or making habitat no longer suitable for rare plant and animal species. Only local source native species should be used for revegetation, and equipment should be cleaned to avoid inadvertent spread of invasives.

Pinnacle Engineering

Pinnacle Engineering, Inc.
11541 95th Avenue North
Maple Grove, Minnesota 55369

Tel: 763 315-4501
Fax: 763 315-4507
www.pineng.com

April 16, 2007

Keith Thorstad
Carstensen Contracting, Inc.
P.O. Box 754
Pipestone, MN 56164

Re: **Geotechnical Exploration Report**
Kenyon Wind Project, Goodhue County, Kenyon, Minnesota
Pinnacle Project Number: MN07073.00

Dear Mr. Thorstad:

Pinnacle Engineering, Inc. (Pinnacle) has completed the on-site geotechnical exploration, soil laboratory testing, data analysis, and geotechnical exploration report for the proposed Kenyon Wind Project, located in Goodhue County, approximately 2 ½ miles southeast of Kenyon, Minnesota. Our services have been completed in accordance with your authorization of our proposal of geotechnical services dated February 28, 2007, and were performed to meet the general geotechnical investigation requirements for design of wind turbine tower foundations prepared by Barr Engineering, June 2006.

The purpose of the subsurface geotechnical exploration was to collect geotechnical information for the development of recommendations regarding the design and construction of nine wind turbine foundations. The purpose of this report is to relay the results of the subsurface exploration including soil laboratory test results, our analysis, and general recommendations based on a preliminary foundation design.

Based on the results of the geotechnical exploration and soil laboratory test results, the nine sites tested appear suitable for support of wind turbine structures.

Please refer to the attached report for a detailed summary of our site investigation procedures, test results, and general recommendations, or contact us at (763) 315-4501 if we can be of any further assistance or provide additional information regarding the contents in this report.

Sincerely,

PINNACLE ENGINEERING, INC.

Gregory J. Glitto, P.E.
Senior Engineer

Eric Hansen, P.E.
V.P - Environmental Engineering

Enclosure: Geotechnical Exploration Report

GEOTECHNICAL EXPLORATION REPORT

FOR:

KENYON WIND PROJECT
GOODHUE COUNTY
KENYON, MINNESOTA

PREPARED FOR:

CARSTENSEN CONTRACTING, INC.
P.O. BOX 754
PIPESTONE, MINNESOTA 56164

PREPARED BY:

PINNACLE ENGINEERING, INC.
11541 95TH AVENUE NORTH
MAPLE GROVE, MINNESOTA 55369
(763) 315-4501

PINNACLE PROJECT NUMBER: MN07073.00

April 16, 2007

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Eric Hansen

Eric Hansen, P.E. Registration No. 23833 Date: 4-16-2007

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1.0 INTRODUCTION

1.1 Project and Location

Carstensen Contracting, Inc. is proposing to construct the Kenyon Wind Project consisting of nine wind powered turbines and associated access roads. The project is planned to be build on four sections of land situated approximately 2 ½ miles southeast of the town of Kenyon, Goodhue County, Minnesota.

1.2 Purpose

The purpose of the geotechnical exploration was to obtain subsurface soil classifications and strength characteristics at each of the nine proposed turbine locations. The exploration procedure and testing was scoped to meet the general requirements of Barr Engineering's geotechnical investigation requirements for the design of wind turbine tower foundations. The geotechnical soil classification and strength information was used to develop recommendations regarding allowable soil bearing pressure and estimated settlement for turbine tower foundation design.

1.3 Scope of Service

Carstensen Contracting, Inc. authorized Pinnacle to conduct a geotechnical exploration at the project site. Our scope of service was to provide nine Cone Penetrometer Test (CPT) soundings to a depth of 65 feet each or to refusal, five with geophysical seismic tests, one Standard Penetration Test (SPT) boring to a depth of 65 feet or refusal, one consolidation test, and moisture content, hand penetrometer, Atterberg limits, and gradation tests as necessary. One report presenting the findings of the geotechnical exploration, the results of the sol laboratory tests, our analysis, and recommendations is included in the scope of services.

1.4 Project Information

We were provided with two site aerial photographs showing the proposed locations and numbers of wind towers and a turbine coordinates list showing the coordinates for each turbine location and turbine site elevations. Coordinates for the electrical substation and project corners were also given.

We understand Barr Engineering Company (Barr) has been contracted to providing the foundation design for the tower foundations. Based on communications with Barr we understand the preliminary foundation design is a 56 foot diameter octagonal shaped footing placed about 9 feet below the existing surface grade. We understand that with this design the soil bearing pressure due to dead load of the foundation, tower, and turbine is approximately 1,500 pounds per square foot (psf) distributed uniformly

across the foundation footprint, the soil bearing pressure due to operational loading is trapezoidal in shape having a maximum soil bearing pressure of 2500 psf at the outer footing edge and 250 psf soil bearing pressure at the opposite foundation edge, and the extreme loading condition has a triangular shaped distribution with a maximum soil bearing pressure of 3,500 psf at the footing outer edge and zero soil bearing pressure a distance of 44 feet away from the maximum load condition.

We understand a typical maximum allowable differential settlement tolerance is 0.18 degrees from level. Based on a foundation diameter of 56 feet, the typical maximum allowable differential settlement would be approximately 2 inches.

1.5 Boring Locations and Elevations

The CPT soundings and SPT borings were advanced at locations in the field determined by hand held GPS units and site features shown on the aerial photograph. The recorded average GPS coordinate readings are shown on the CPT sounding logs and SPT boring logs. Elevation at specific tower sites were not measured, however they were provided to us and are shown on the attached GPS coordinates sheet in Appendix A. Depths referenced on the CPT sounding and SPT borings reference existing grade at the time of our investigation.

2.0 GEOTECHNICAL INVESTIGATION

2.1 Cone Penetrometer Testing

Nine CPT soundings were advanced to a depth of 65 feet below the existing ground surface or to refusal, one at each proposed turbine location. The purpose of the soundings was to provide subsurface geotechnical soil strength properties at each proposed turbine location.

The CPT soundings were completed by Minnesota GeoServices with truck-mounted CPT system manufactured by A. P. Van den Berg of Holland. The truck is equipped with a 20-ton Hyson hydraulic drive unit, and automated hydraulic controls to operate the pushing system. The data is collected and stored on a Windows based computer system in the field and is analyzed in detail after completion of the field sampling.

The CPT cones are 15 cm^2 in area and are advanced using 36 mm diameter steel rods. For this project, rod friction reducers were not used. The total pushing force of the CPT rig is approximately 20 tons. The Cones include measure tip resistance (Qc), sleeve friction (F_s), pore pressure (U_2), and inclination (i). The seismic cone (SCPTU) cone includes the standard cone parameters in addition to shear wave, S1 and S2, measurements. The energy for the seismic waves is created by pneumatic hammers

incorporated into a steel beam which is part of the front jack system of the CPT rig. The results of the CPT measurements and seismic tests are provided in the attached Appendix A.

2.2 Standard Penetration Test Borings

Three SPT borings were advanced at tower sites T4, T6, and T9 to a depth of 11, 66, and 12 feet below the existing ground surface, respectively. In addition to the three borings advanced at proposed tower locations, one boring was advanced to the depth of 25 feet at the proposed electrical substation. The purpose of the borings was to collect soil samples from select soil layers, based on results of the CPT soundings, to perform soil laboratory tests including unconfined compressive strength, consolidation, moisture content, visual manual classification, and soil density.

The borings were advanced by Chosen Valley Testing, Inc. with a truck-mounted drill rig using a hollow stem auger and a standard split spoon sampler. Soil samples were collected at approximately 2 ½ foot intervals with intermediate thin wall samples to a depth of 15 feet, and at five foot intervals with intermediate thin wall samples from the depth of 15 feet to the termination depth of the boring. After completion, the bore holes were left open to allow for long term water level measurements. The borings were then backfilled with soil cuttings mixed with grout.

Samples were collected in accordance with ASTM: D1586-84 using a standard 2-inch I.D. split spoon sampler. The sampler is driven into the soil with a 140-pound hammer at a free fall distance of 30 inches. The number of blows required to drive the sampling spoon the last 12 inches of an 18-inch penetration is recorded as the standard penetration resistance value (N-value). The N-value is an indicator of soil strength properties. Each recovered soil sample was initially classified in the field in accordance with ASTM: D2487-85 and D2488, placed into sealed containers to reduce moisture loss, and returned to our laboratory for final classification by the engineer. Specific conditions at the boring location are indicated on the log of test boring. The stratification boundaries shown on the boring log represents the approximate location of changes in soil types; in situ, the transition between materials may be gradual.

3.0 ANALYSIS AND RESULTS

3.1 Site Soil Conditions

Based on the CPT sounding, the general site soil profile is clay within the upper 20 to 30 feet gradually changing to a clayey silt and sandy silt. Intermittent layers of granular material were encountered at various depths and with variable thickness. Cone tip resistance ranged in general between 20 an 50 tons per square foot (tsf) indicating the site material is firm. Period layers of granular material had higher cone tip resistance

recordings. Soundings at T3, T4, T5, T7, and T9 were terminated prior to reaching a depth of 65 feet due to refusal at the depth of approximately 60, 53, 40, 57, and 48 feet, respectively.

Based on SPT borings, the site general site profile appears to have about 1 foot to 1 ¾ feet of topsoil, over sandy lean clay glacial till with layers of silty sand. Recorded N-values indicate the clay soils are medium stiff to hard and the granular soils are medium dense.

3.2 Water Level Observations

Water was not encountered during drilling, split spoon sampling, or after the auger was removed within the two shallow turbine borings, T4, and T9 and electrical substation boring, B-1. Water was observed at a depth of 56 feet while drilling and at a depth of 35 feet after auger removal within tower boring T6.

Based on the color of soil samples retrieved and water observations, the static groundwater table is likely well below the proposed excavations. Perched water may exist within the periodic granular layers or seams; however water infiltration into an open excavation would not likely have an impact on the excavation process or produce substantial amounts of water.

Fluctuations of the groundwater level can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Perched water may develop at higher levels within more permeable layers following periods of heavy or prolonged precipitation. The possibility of seasonal, particularly springtime, groundwater level fluctuations should be considered when developing the design and construction plans for the project. Long term monitoring of piezometers or wells sealed from surface water would be required to accurately determine the levels of groundwater at the site.

3.3 Laboratory Test Results

Laboratory tests performed included 30 hand penetrometer tests, 14 soil moisture content test, an unconfined compression stress/strain test, and a consolidation test. Hand penetrometer and soil moisture content tests were performed both in our soils laboratory and in our consultant's laboratory. The unconfined compression stress/strain test and the consolidation test were performed by Soil Engineering Testing, Inc., on samples collected by a 3-inch diameter thin wall sample tubes. The unconfined compression strength test was performed on a sample taken from proposed turbine 9, boring T9, from the depth of 9 ½ to 12 feet. This sample is representative of an area of soil indicated by the CPT sounding to be the weakest soil layer a short distance below the proposed bottom of foundation depth. The consolidation test was

performed on a sample taken from tower 6, boring T6, from the depth of 37 to 39 ½ feet. This sample represents the general soil with strength proprieties relatively consistent within the CPT recordings for this site. Hand penetrometer and soil moisture content test results are shown on the log of boring sheets attached in Appendix B. The unconfined compressive strength and consolidation test results including the soil moisture content and dry density of the thin wall sample are shown in the attached Appendix D.

3.4 Estimated Bearing Capacity

Based on the results of the CPT soundings, seismic shear wave tests, and SPT borings, the nine sites tested appear suitable for construction of the proposed wind turbine structures. It is our opinion the site soils are suitable to provide 4,500 pounds per square foot (psf) allowable soil bearing pressure with a factor of safety (f.s.) of at least 3 for "operation" loading and up to 6,000 psf allowable soil bearing pressure for "extreme" loading case with a factor of safety of at least 2.25.

3.5 Estimated Settlement

Based on the foundation designs and loadings described above, we estimate total settlement of the foundations will be less than 1 ½ inches and differential settlement should be less than ¾ inch.

4.0 RECOMMENDATIONS

4.1 Foundation Pad Preparation

For preparation of the foundation pads, we recommend soils be excavated using a backhoe equipped with a smooth edged bucket. To minimize disturbance of the bearing soils, we recommend construction equipment stays off the exposed excavation bottom. If the excavation bottom soils become disturbed, they should be removed and replaced with properly compacted fill or lean concrete. To reduce the risk of disturbing the bearing soils during construction of formwork and reinforcing, 3-inches of lean concrete or 12-inches of compacted aggregate base should be used as the working surface. Dewatering or water control should not be required, however, contingencies should be in place in the event water bearing seams are encountered or rain fall occurs.

Based on the CPT sounding, limited soil correction may be necessary at towers 1 and 9. At tower 1, the CPT data suggests an over excavation of about 1 to 1 ½ feet below the proposed bottom of foundation depth may be necessary. At tower 9, the CPT data suggests an over excavation of about 5 feet may be necessary. Based on the results of

the SPT boring and soil laboratory tests, tower site 9 does not appear to require over excavation to suitable bearing material.

We recommend the excavation bottom is observed by a geotechnical engineer to evaluate suitability of the exposed natural soils and that they are similar to the soil samples recovered by the borings and tested by the soundings. The observation should be performed prior to the placement of lean concrete or aggregate base material.

If excavation observations indicate soil conditions at the bottom of an excavation are not suitable for foundation support, we recommend they are removed and corrected or the foundation is lowered to a competent soil layer. We recommend excavations for soil correction are oversized at least one foot horizontally for each foot of fill placed below the foundation bottom.

4.2 Site Soils as Engineered Fill

The on-site mineral soils are primarily sandy lean clay with some layers of lean clay and silty sand. These soils should be suitable to use as engineered fill. In general, based on lab results, the natural moisture content range is about 15 to 20%. Based on our experience, the on site soils will require moisture conditioning prior to use as engineered fill. Depending upon the compaction requirements, moisture conditioning requirements will likely range from the material being no more than 2 to 5 percentage points over the optimum moisture content as determined by the Standard or Modified Proctor methods, ASTM: D698 and ASTM: D1557, respectively. Fill material moisture content percentage amount under the optimum moisture content may also be specified.

4.3 Backfill

We understand Barr will establish a soil compaction specification for the project. We recommend backfill placed be compacted to meet the project specifications. Backfill should be brought up evenly around the base of the tower foundations to minimize differential lateral forces.

The site mineral soils should be suitable for use as foundation backfill. However, some of the soils may be in a wet condition and will require drying during placement to lower their moisture contents so that the specified compacted densities can be achieved.

Fill and backfill used should be placed in thin lifts not exceeding 8 to 12 inches and compacted with equipment sized appropriately to achieve the recommended soil densities.

If water accumulates in the area of proposed fill we recommend it is removed prior to placement of the fill material.

Laboratory test results indicate the range of compacted soil moist density is 123 pcf to 134 pcf.

4.4 Service Roads Grading

We recommend the vegetation and topsoil be removed from below the service road areas. The excavation should be oversized at least 1 foot horizontal beyond the outside edges of roadways for each foot of fill placed below the roadway. Clay subgrades should be scarified, allowed to dry to near optimum moisture content, and compacted to meet the project specifications. Subgrades should be sloped to drain surface water.

4.4.1 Subgrade Proof Roll

Prior to placement of the aggregate base, we recommend the road subgrade be proof rolled with a loaded tandem truck of at least 25 tons axle weight. The purpose of the proof roll test is to detect unstable areas. Any unstable areas should be corrected or replaced with suitable compacted material.

4.5 Cold Weather Earthwork

Depending upon project scheduling, construction may be performed during cold weather. Accordingly, these recommendations are provided. Upon freezing, clay soils expand and lose their density. The expansion of the soil can heave foundations. Later, when they thaw, the soils are very weak and they may settle beneath the foundation.

Ideally, routine earthwork should be avoided during the winter. However, the following special precautions can be used to reduce problems due to frozen soils:

- Soils at subgrade should only be exposed during concrete placement. Then, the fresh concrete and adjacent soil should be insulated. Any excavated soil piles planned to be used for backfilling should also be insulated.
- Backfilling operations with non-frozen material should begin immediately following completion of the foundation.

Frost should be expected to develop overnight in larger areas that cannot be filled during the day. By leaving a layer of loose fill or insulating blankets on top of the soil overnight, the depth of frost penetration into the compacted fill can be minimized. Any loose or frozen soil should then be completely removed prior to additional earthwork. Frozen soils or soils containing ice or snow should never be used as fill material.

Backfilling operations performed during cold weather should be observed by a geotechnical engineer or another responsible member of the design team.

5.0 CONSTRUCTION

5.1 Excavation

Excavations for should be performed in accordance with OSHA Standards and in accordance with applicable local, state, and federal safety regulations. The contractor should be aware of slope height, slope inclination, and excavation depths and should in no case exceed those specified by these safety regulations. Flatter slopes may be required depending on encountered conditions. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. The OSHA regulations are strictly enforced and, if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable for substantial penalties.

6.0 CONSTRUCTION OBSERVATION AND TESTING

6.1 Foundation Soils and Subgrades

We recommend an experienced geotechnical engineer observe the excavation bottoms and subgrades to evaluate if the soils are similar to those encountered by the borings and adequate to support proposed foundation or traffic loads. In addition the excavation over-sizing should be checked. These observations should be conducted prior to placing fill material.

6.2 Compaction

We recommend density tests of compacted material placed beneath foundations, backfills, and road subgrades. Samples of proposed backfill and fill materials should be submitted to our testing laboratory at least two days prior to placement for evaluation of their suitability and determination of their optimum moisture contents and maximum dry densities. Compaction tests should be completed for each 2-foot lift of material with at least two tests per lift.

7.0 GENERAL COMMENTS

This report has been prepared for the specific site construction described in this report. It is recommended that a geotechnical engineer be retained to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications.

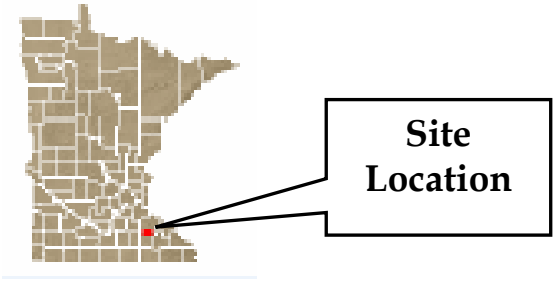
It is further recommended that a geotechnical engineer be retained for testing and observation during earthwork and foundation construction phases to help determine that the design requirements are fulfilled.

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until the subsurface soils are exposed during construction. If variations appear evident, it will be necessary to reevaluate the recommendations of this report.

This report has been prepared for the exclusive use of our client for specific application to the project discussed. Geotechnical services performed by Pinnacle scientists and engineers for the project have been conducted in a manner consistent with the degree of care and technical skill appropriately exercised by geotechnical professionals currently practicing in this area. Recommendations or opinions contained in this report represent our professional opinions and are generally based upon available information and currently accepted practices for geotechnical professionals. In the event that any changes in the nature, design, or location of the project as outline in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by a geotechnical engineer. Other than this, no warranty is implied or intended.

Appendix A

Site Location Map
Proposed Turbine Location Map
Coordinates for CPT Locations

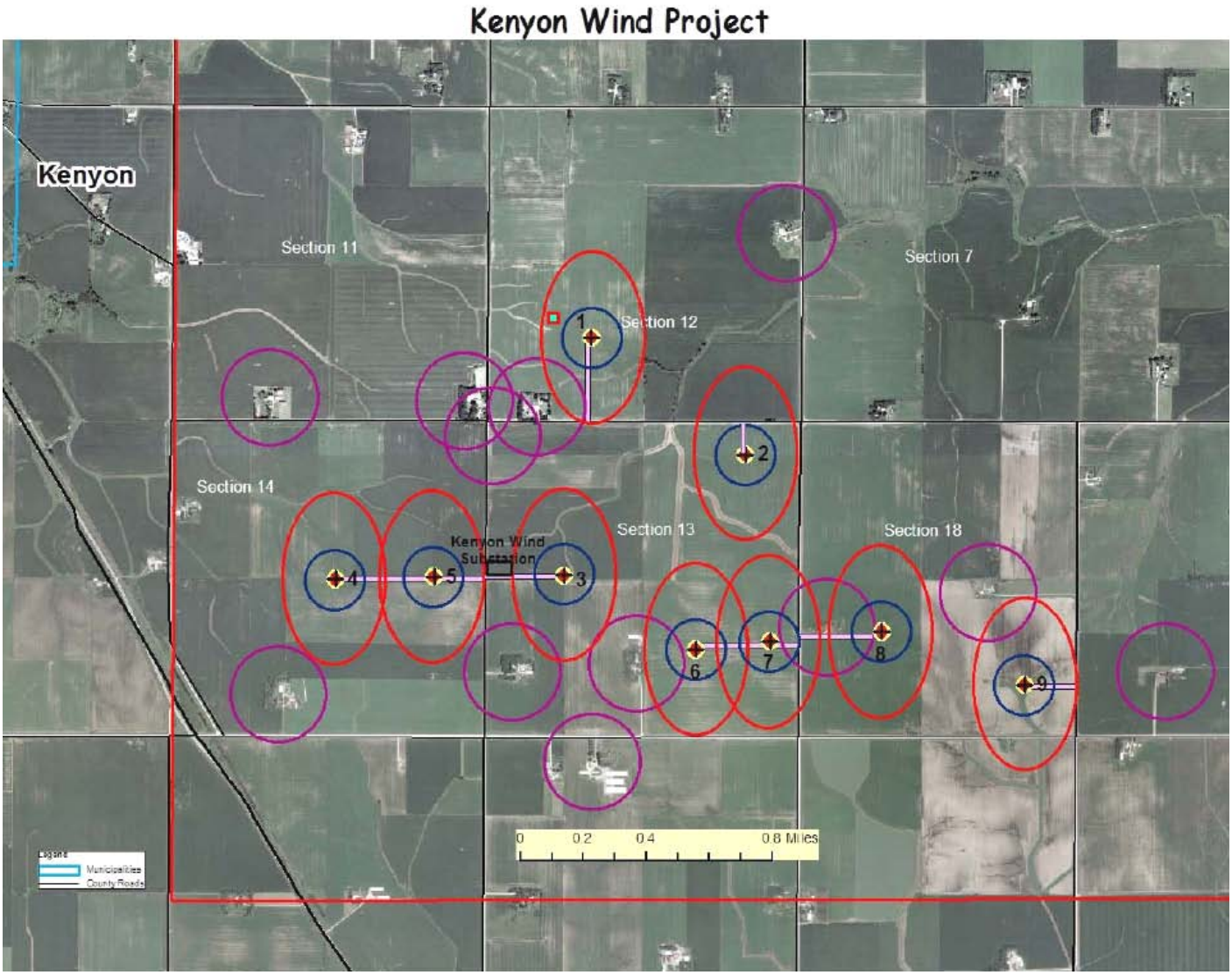


Scale: None

Pinnacle Engineering

11541 95th Avenue N, MN 55369
Phone: 763-315-4501, Fax: 763-315-4507

Figure 1
Site Location Map
Kenyon Wind Project
Goodhue County
Kenyon, Minnesota



Scale: None

Pinnacle Engineering

11541 95th Avenue N, MN 55369
Phone: 763-315-4501, Fax: 763-315-4507

Figure 2.
Proposed Turbine Location Map
Kenyon Wind Project
Goodhue County
Kenyon, Minnesota

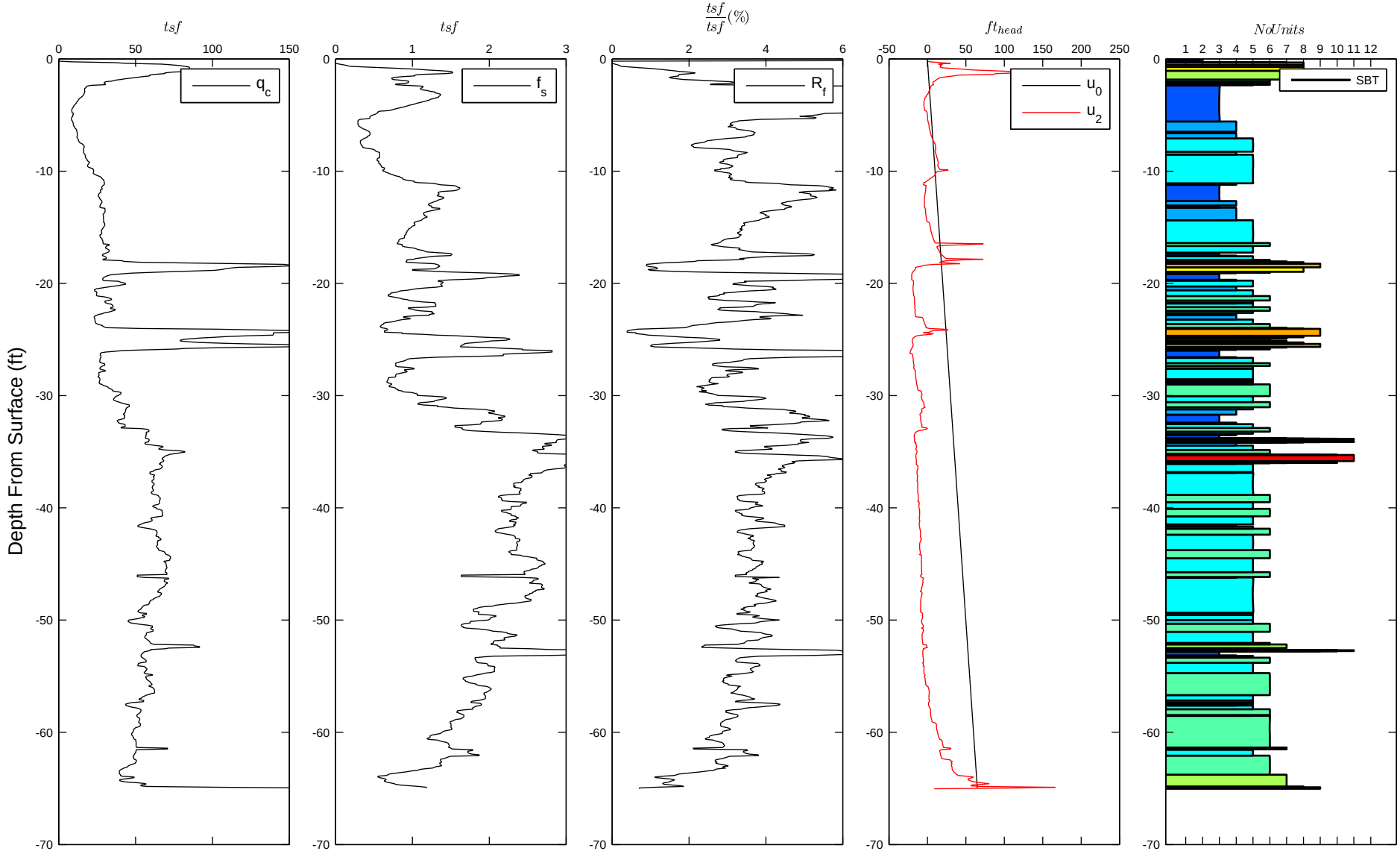
Kenyon Wind Project - GPS Coordinates (Decimal Degrees)							
Tower	CPT Location		Depth	SPT Location		Depth	Surface
	Latitude	Longitude	(ft)	Latitude	Longitude	(ft)	elevation
T1	44.2587	92.9335	65	-	-	-	1250
T2	44.2532	92.9236	65	-	-	-	1235
T3	44.2477	92.9352	60	-	-	-	1230
T4	44.2477	92.9509	53	44.2478	92.9509	11	1245
T5	44.2477	92.9435	40	-	-	-	1252
T6	44.2442	92.9267	64	44.2442	92.9267	66	1261
T7	44.2447	92.9220	57	-	-	-	1261
T8	44.2450	92.9148	65	-	-	-	1260
T9	44.2426	92.9056	48	44.2426	92.9056	12	1243
B1 Sub	44.2479	92.9398	-	-	-	26	-

Appendix B

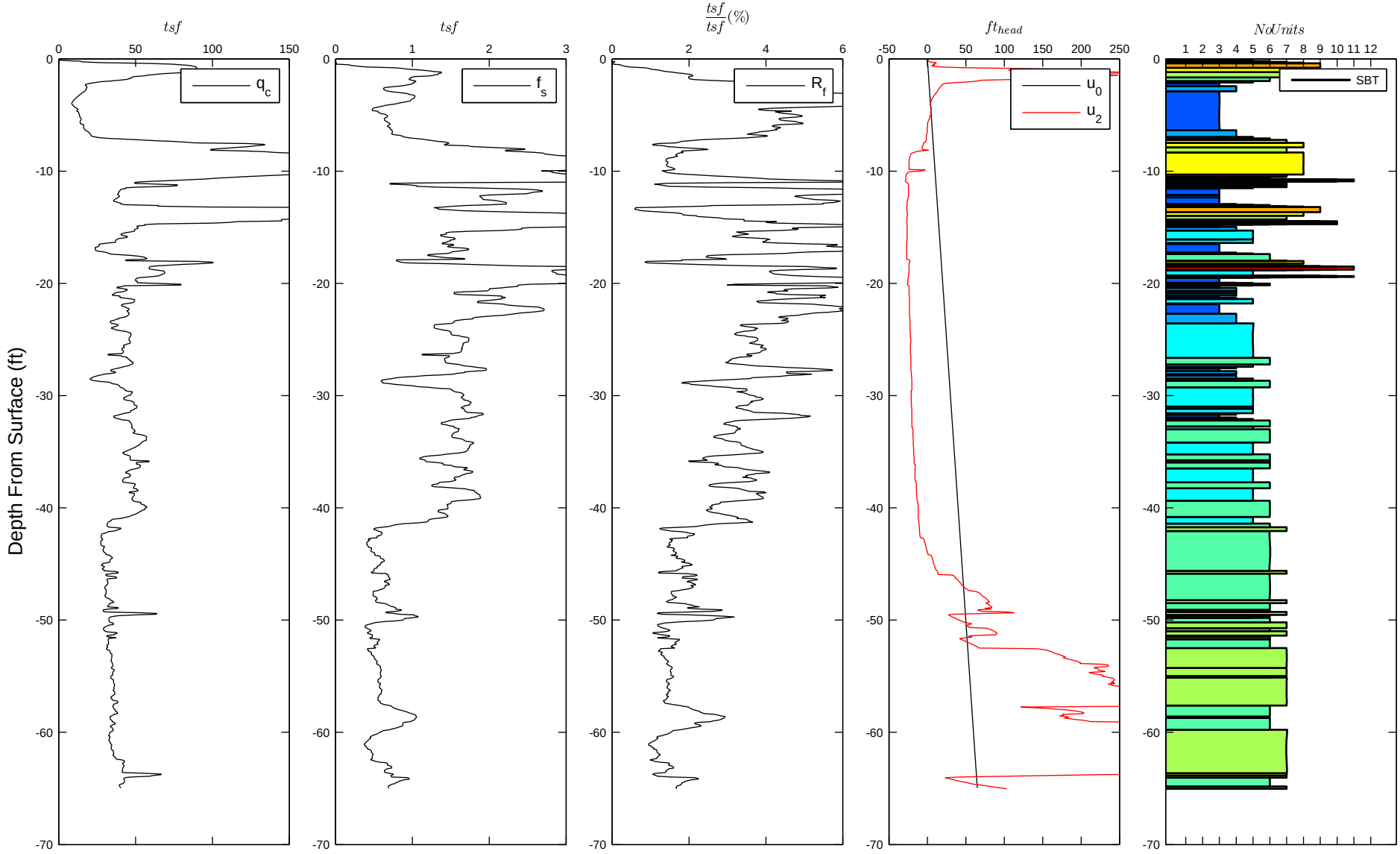
Soundings CPT-1 through CPT-9
Soil Behavior Type Chart
SPT Boring T-4, T-6, T-9, and B-1
General Terminology for Soil Description

Project:	Kenyon Wind Project	SoundID:	23070001.1	ControlID:	DOM.ControlBaseLine
Location:		D tot:	65.0262 (ft)	ConeID:	050509 S
Coord:	[44.2587, -92.9335, 0]	Elev.:	0 (ft)	Remarks: T1	
Collected:	2007-03-03 11:36:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:11:00	PreDrill:	0 (ft)		

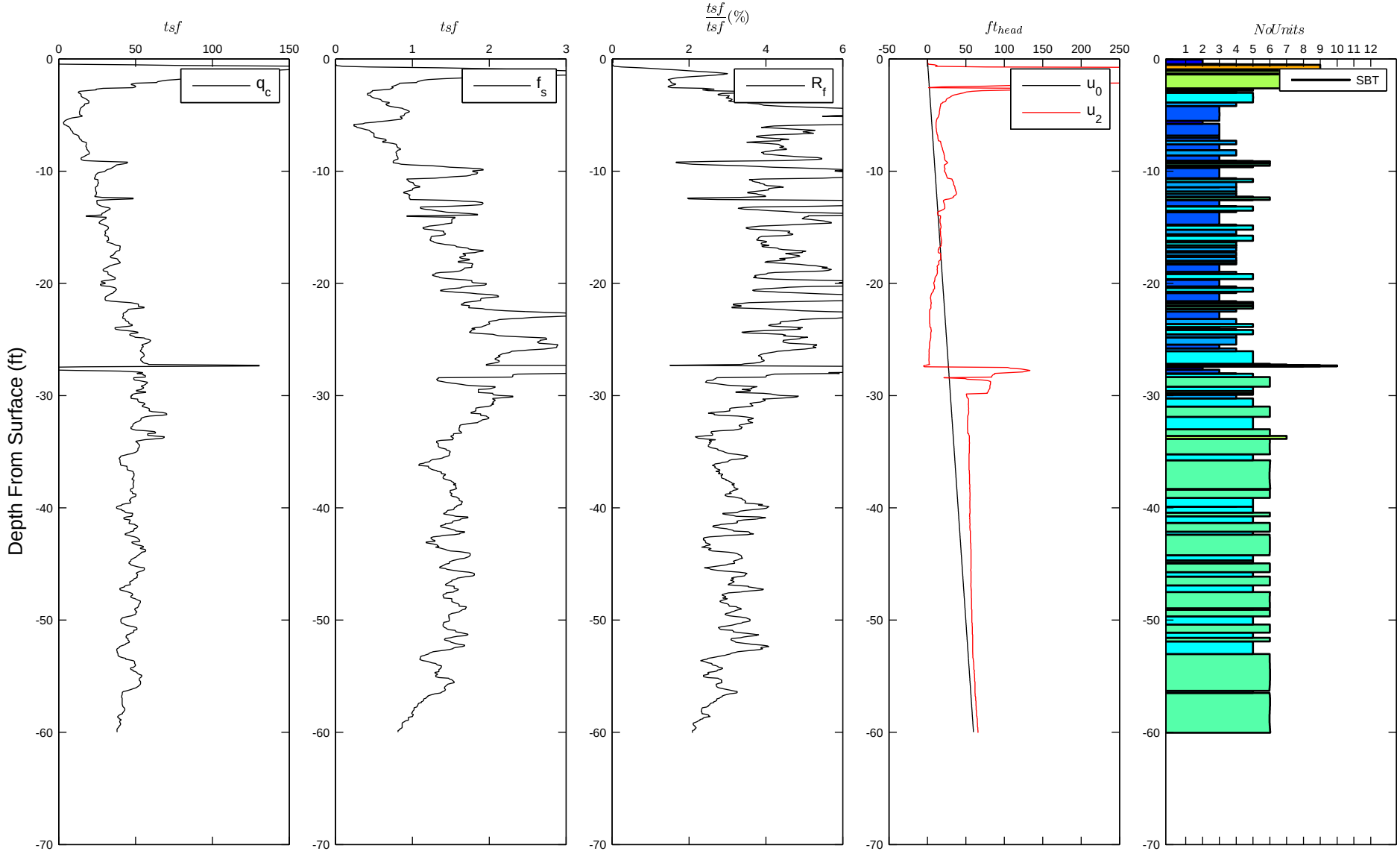
Pinnacle Engineering



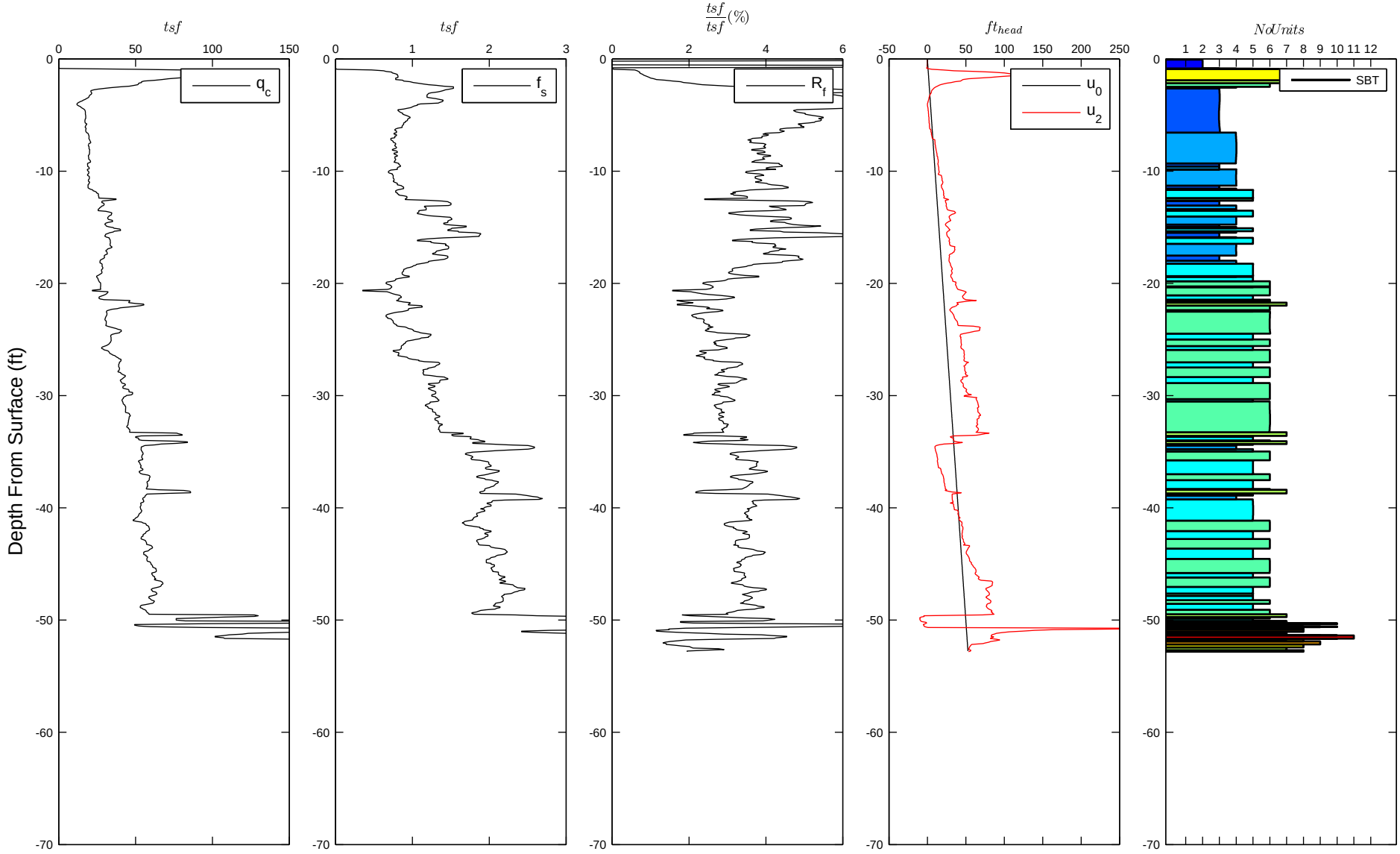
Project:	Kenyon Wind Project	SoundID:	23070001.2	ControlID:	DOM.ControlBaseLine
Location:		D tot:	65.0262 (ft)	ConeID:	050916 S
Coord:	[44.2532, 92.9236, 0]	Elev.:	0 (ft)	Remarks: T2	
Collected:	2007-03-03 12:54:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:12:43	PreDrill:	0 (ft)		



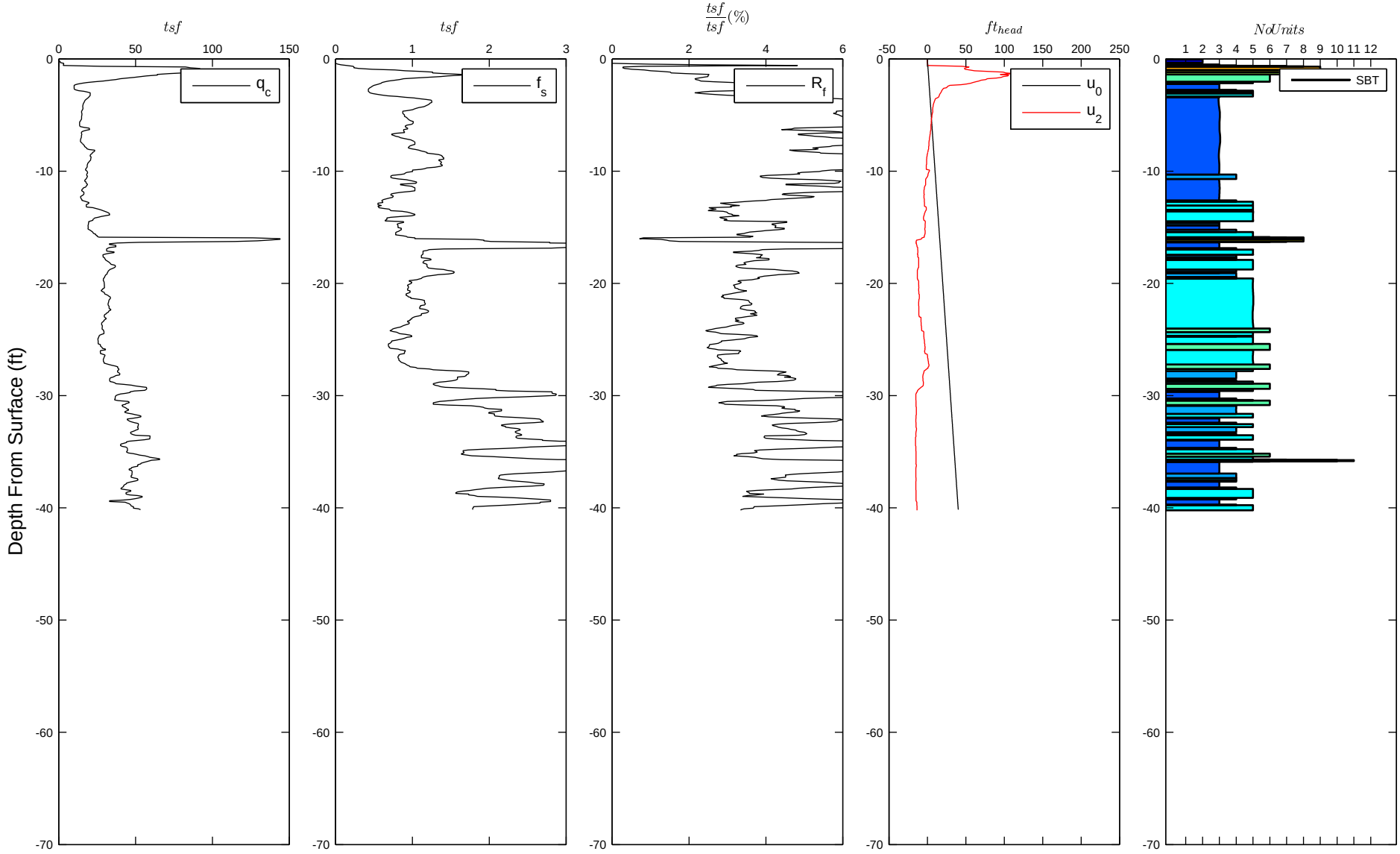
Project:	Kenyon Wind Project	SoundID:	23070001.3	ControlID:	DOM.ControlBaseLine
Location:		D tot:	60.0394 (ft)	ConeID:	060502
Coord:	[44.2477, -92.9352, 0]	Elev.:	0 (ft)	Remarks: T3	
Collected:	2007-06-03 09:20:00	GWT:	0 (ft)		
Printed:	2007-03-19 22:31:35	PreDrill:	0 (ft)		



Project:	Kenyon Wind Project	SoundID:	23070001.4	ControlID:	DOM.ControlBaseLine
Location:		D tot:	52.8215 (ft)	ConeID:	060501
Coord:	[44.2477, -92.9509, 0]	Elev.:	0 (ft)	Remarks: T4	
Collected:	2007-10-03 14:04:00	GWT:	0 (ft)		
Printed:	2007-03-19 22:32:36	PreDrill:	0 (ft)		



Project:	Kenyon Wind Project	SoundID:	23070001.5	ControlID:	DOM.ControlBaseLine
Location:		D tot:	40.2231 (ft)	ConeID:	050509 S
Coord:	[44.2477, -92.9435, 0]	Elev.:	0 (ft)	Remarks: T5	
Collected:	2007-06-03 11:03:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:14:12	PreDrill:	0 (ft)		



Project:	Kenyon Wind Project	SoundID:	23070001.6	ControlID:	DOM.ControlBaseLine
Location:		D tot:	64.4357 (ft)	ConeID:	060502
Coord:	[44.2442, -92.9267, 0]	Elev.:	0 (ft)	Remarks: T8	
Collected:	2007-03-03 15:50:00	GWT:	0 (ft)		
Printed:	2007-03-19 22:33:33	PreDrill:	0 (ft)		

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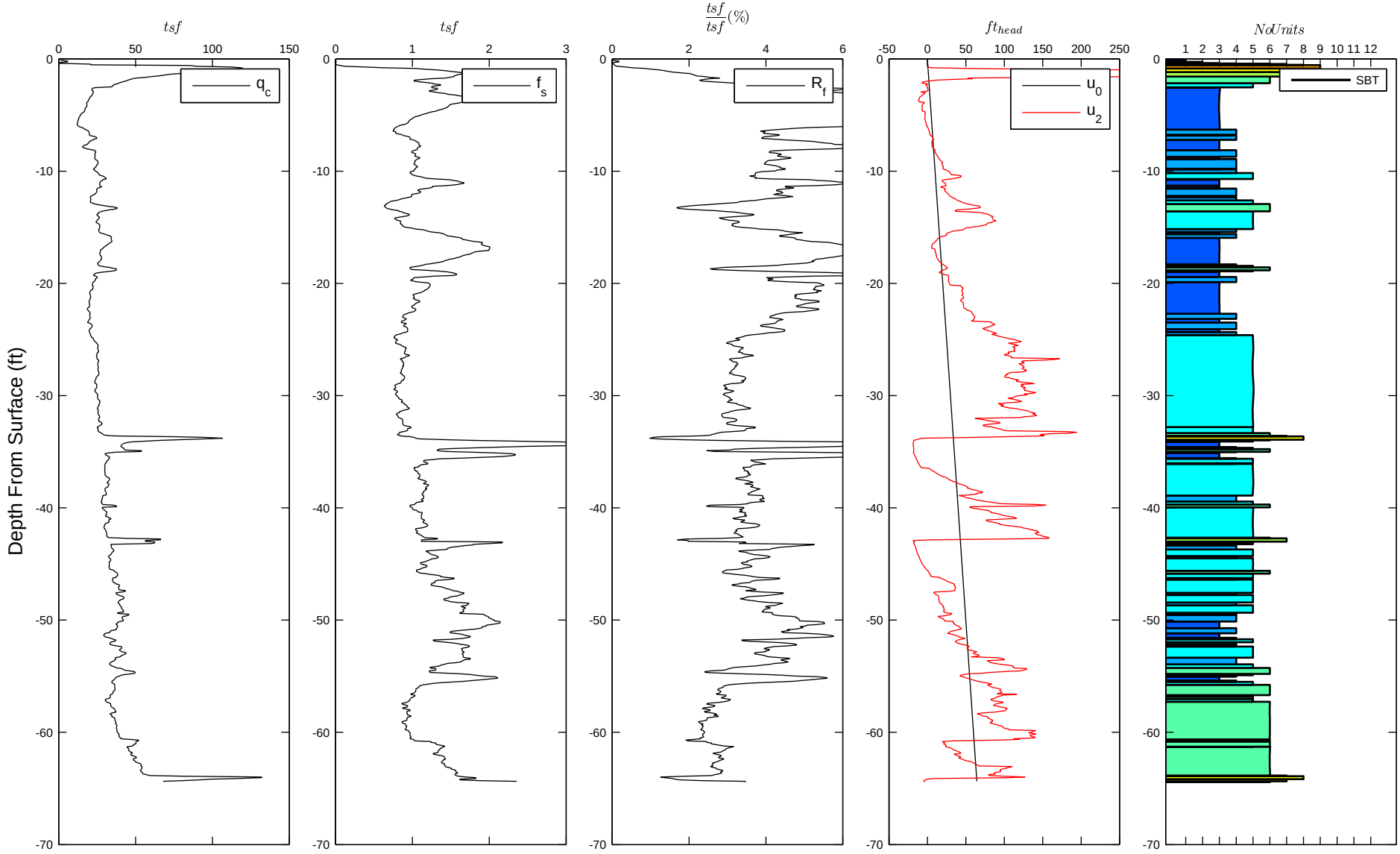
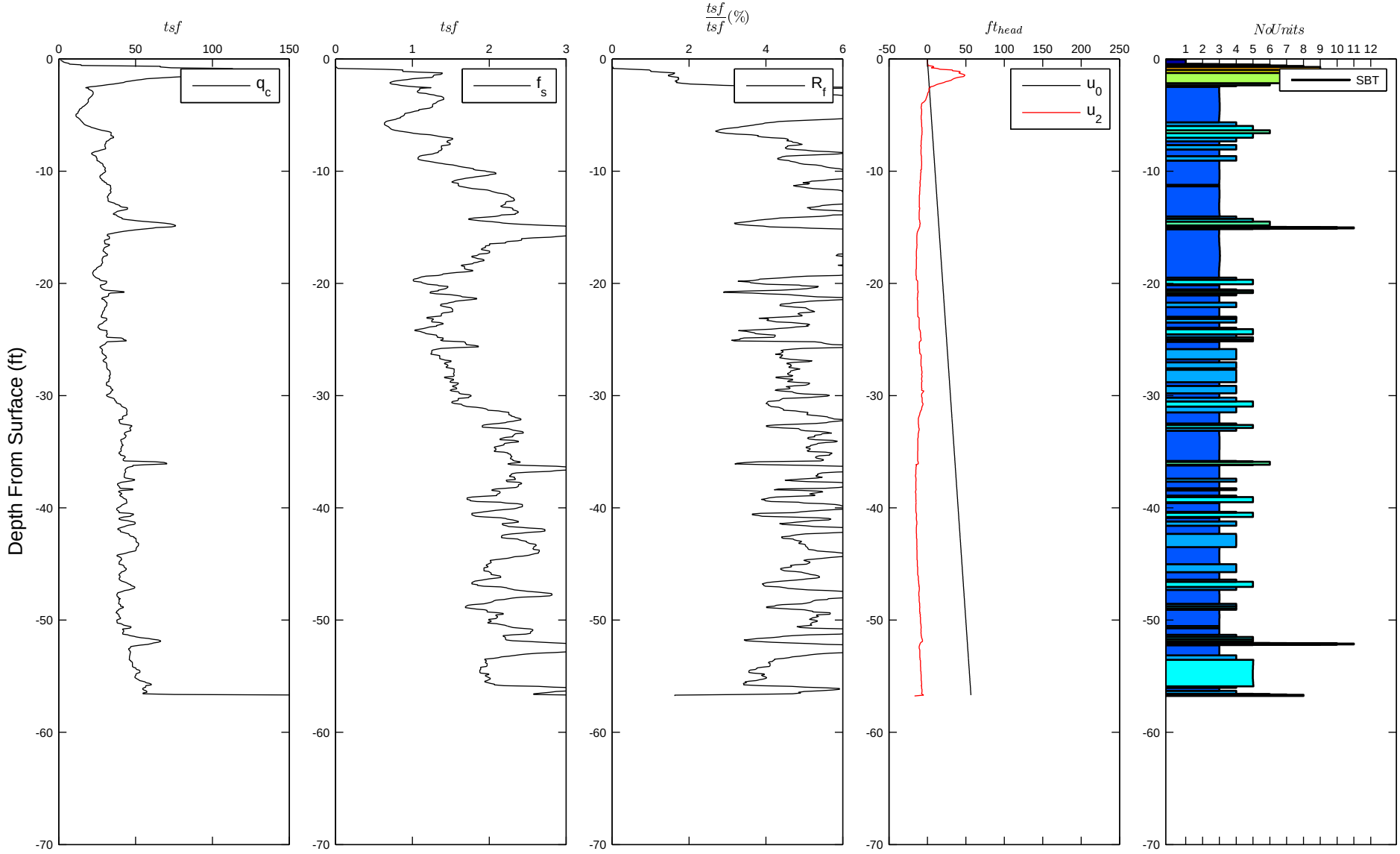
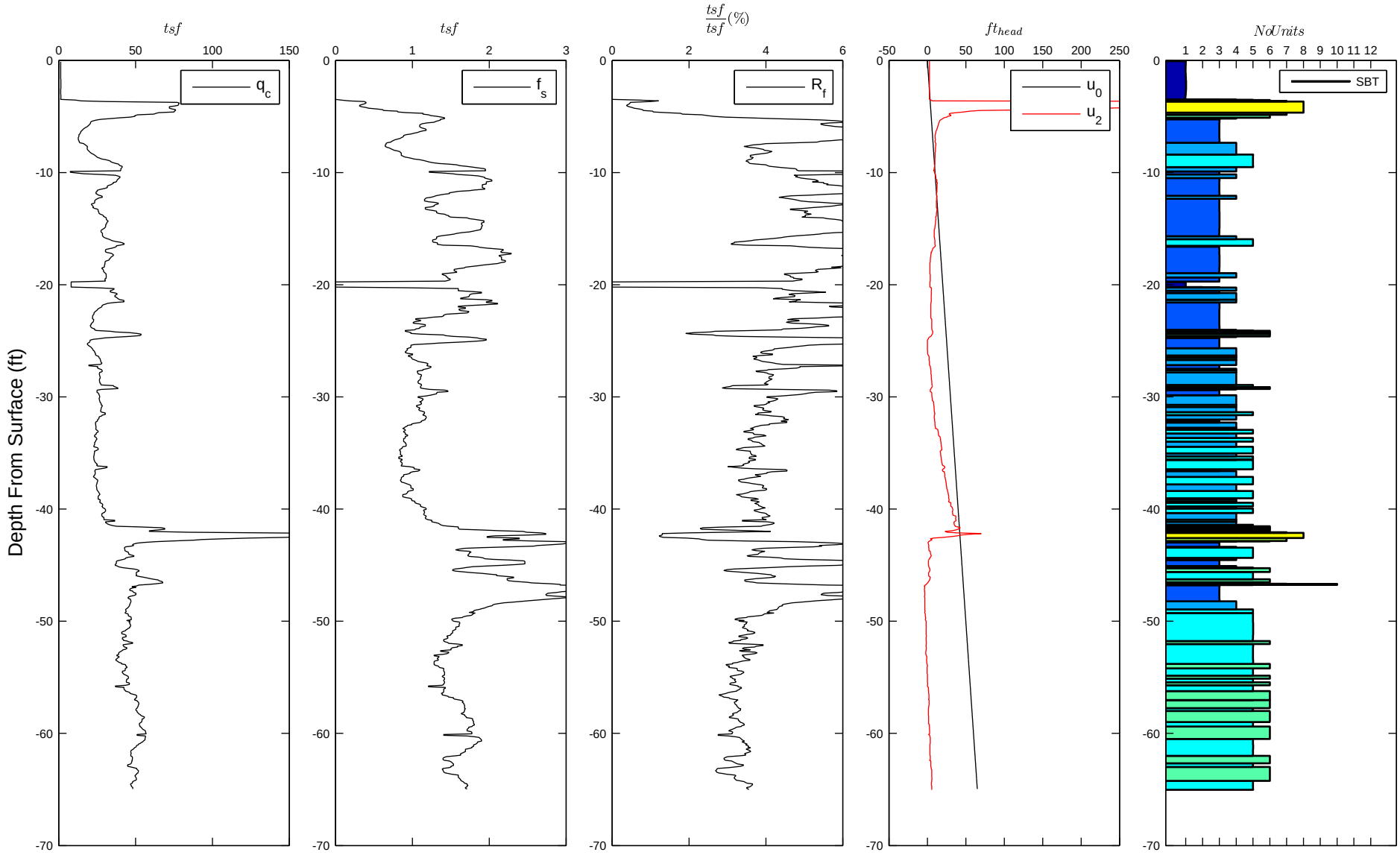


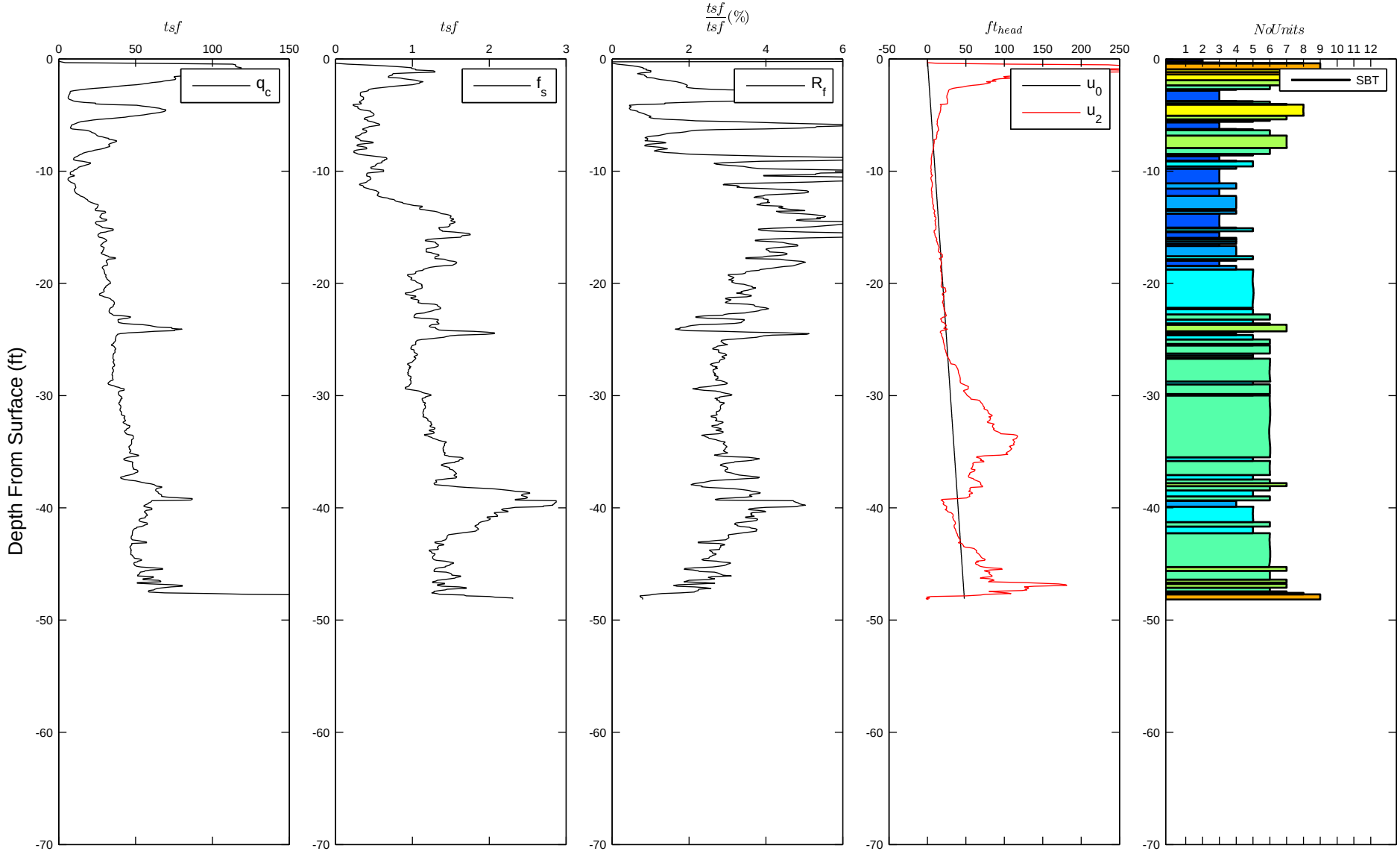
Project:	Kenyon Wind Project	SoundID:	23070001.7	ControlID:	DOM.ControlBaseLine
Location:		D tot:	56.7585 (ft)	ConeID:	050509 S
Coord:	[44.2447, -92.922, 0]	Elev.:	0 (ft)	Remarks: T7	
Collected:	2007-03-03 14:36:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:15:44	PreDrill:	0 (ft)		

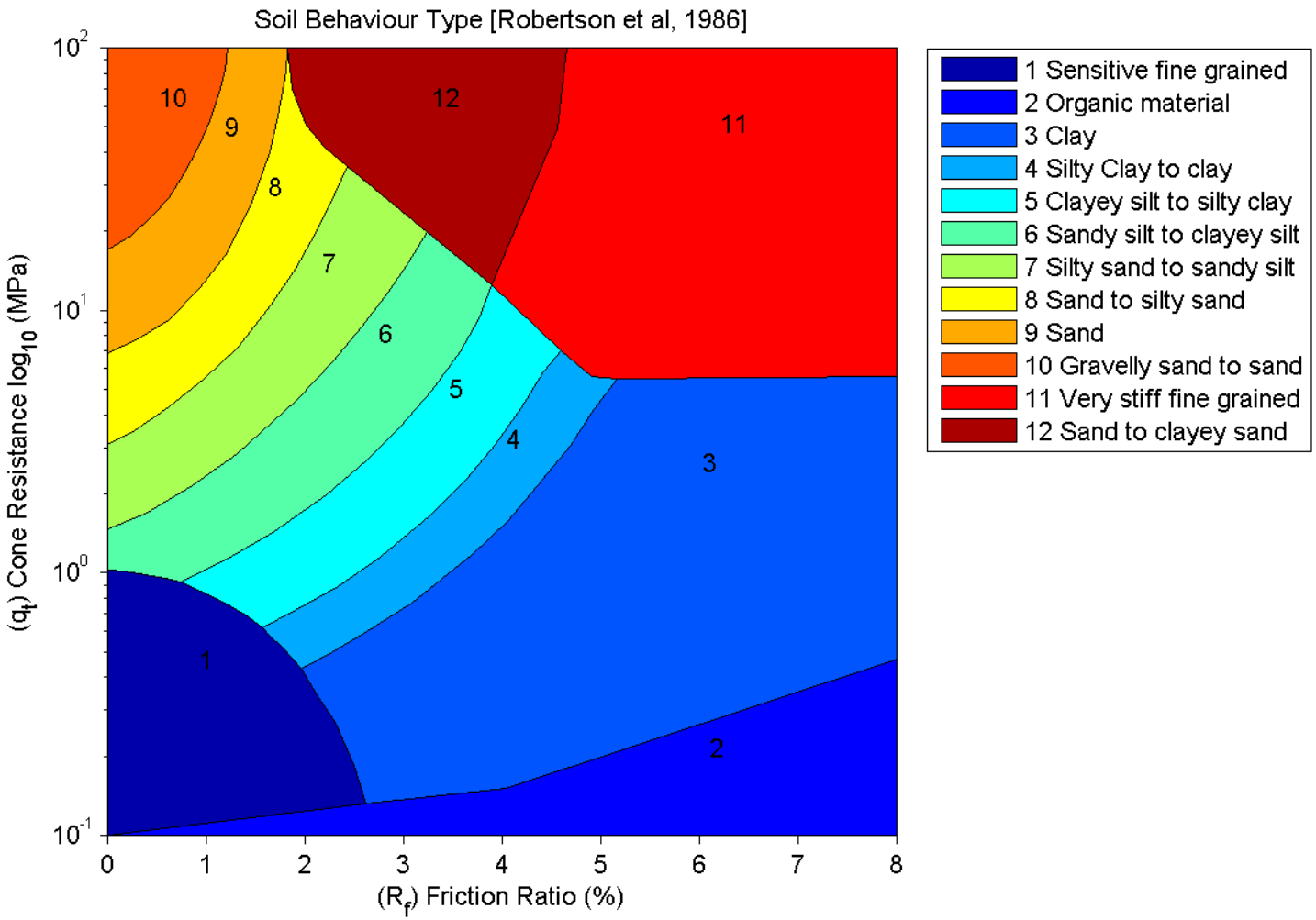


Project:	Kenyon Wind Project	SoundID:	23070001.8	ControlID:	DOM.ControlBaseLine
Location:		D tot:	65.0262 (ft)	ConeID:	050509 S
Coord:	[44.245, -92.9148, 0]	Elev.:	0 (ft)	Remarks: T-8	
Collected:	2007-10-03 15:17:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:17:22	PreDrill:	0 (ft)		



Project:	Kenyon Wind Project	SoundID:	23070001.9	ControlID:	DOM.ControlBaseLine
Location:		D tot:	48.1627 (ft)	ConeID:	060502
Coord:	[44.2426, -92.9056, 0]	Elev.:	0 (ft)	Remarks: T-9	
Collected:	2007-10-03 16:25:00	GWT:	0 (ft)		
Printed:	2007-03-19 22:30:39	PreDrill:	0 (ft)		




Soil Behaviour Type [Robertson et al, 1986]
10^2
10^1
10^0
10^{-1}
(q_t) Cone Resistance $\log_{10}$ (MPa)
0
1
2
3
4
5
6
7
8
(R_f) Friction Ratio (%)
1
2
3
4
5
6
7
8
9
10
11
12
1 Sensitive fine grained
2 Organic material
3 Clay
4 Silty Clay to clay
5 Clayey silt to silty clay
6 Sandy silt to clayey silt
7 Silty sand to sandy silt
8 Sand to silty sand
9 Sand
10 Gravelly sand to sand
11 Very stiff fine grained
12 Sand to clayey sand

LOG OF TEST BORING

PROJECT:
Kenyon Wind Project
Kenyon, Minnesota
Pinnacle Project No: MN07073.00

BORING NAME/LOCATION:
T-4
Lat. 44.24765 N, Long. 92.95088 W (decimal degrees)

SCALE:
1 in. = 5 ft.

LOGGED BY: Mark Reinbold/Pinnacle
DRILLING METHOD: HSA/Split Spoon
DRILLING DATE: 3/13/07

RELATIVE ELEV: 1245'
DRILLING CONTRACTOR: Chosen Valley Testing, Inc.

Depth	Sample Int. Rec.- (in.)	Log-Graphic	Description - ASTM D 2488	"N"	Water Level	Moisture Content	"Q" (tsf)	Comments
1.2			Topsoil	*				* Auger sample 0-2'
	23"		Sandy Lean Clay - trace gravel - yellowish brown with little mottling - moist - very stiff to hard - (CL) - glacial till			15%		Tube sample 2 1/2 - 5' Qp = 1.2 tsf Yd = 107.2 pcf
	12"			32		15%	2	
	18"			23			2	
11.0	5"			40		17%	2	
			The boring was terminated at 11 feet. Groundwater was not encountered during drilling. The boring was backfilled with soil cuttings.					

LOG OF TEST BORING

PROJECT:
Kenyon Wind Project
Kenyon, Minnesota
Pinnacle Project No: MN07073.00

BORING NAME/LOCATION:
T-6
Lat. 44.24423 N, Long. 92.92669 W (decimal degrees)

SCALE:
1 in. = 5 ft.

LOGGED BY: Mark Reinbold/Pinnacle
DRILLING METHOD: HSA/Split Spoon
DRILLING DATE: 3/13/07

RELATIVE ELEV: 1261'
DRILLING CONTRACTOR: Chosen Valley Testing, Inc.

Depth	Sample Int. Rec.- (in.)	Log-Graphic	Description - ASTM D 2488	"N"	Water Level	Moisture Content	"Q" (tsf)	Comments
1.5			Topsoil	*				* Auger sample 0-2'
	17"		Sandy Lean Clay - trace gravel - mottled brown and yellowish brown - moist to wet - stiff to very stiff - (CL) - glacial till			14.0%		Tube sample 2 1/2 - 5' Qp = 1.9 tsf Yd = 112.2 pcf
	18"			11			1 1/4	
	18"			25		15%	4	
11.5	18"			23			3	
	18"		Lean Clay with some sand - grayish brown to brown with little mottling - moist - stiff to very stiff - (CL) - glacial till	19		23%	3 1/2	
	18"			19			3 1/4	
18.5	18"			27			3 1/2	
	18"		Silty sand - mostly fine to medium grained - lenses of silt - brown - moist - medium dense - (SM) - alluvium	23		23%		
22								Tube sample 21 - 23 1/2'. Disturbed Sample - 3 inches ok. Qp = 0.8 tsf
	27"		Sandy Lean Clay - trace gravel - yellowish brown to grayish brown with little mottling - moist - wet below 50' - very stiff to hard - (CL) - glacial till					
	18"			21			2 1/2	
	16"			20			2 1/2	
	18"			21	▼ 35.0'		4	
								Tube sample 37 - 39 1/2'

LOG OF TEST BORING

PROJECT:
Kenyon Wind Project
Kenyon, Minnesota
Pinnacle Project No: MN07073.00

BORING NAME/LOCATION:
T-6
Lat. 44.24423 N, Long. 92.92669 W (decimal degrees)

SCALE:
1 in. = 5 ft.

LOGGED BY: Mark Reinbold/Pinnacle
DRILLING METHOD: HSA/Split Spoon
DRILLING DATE: 3/13/07

RELATIVE ELEV: 1261'
DRILLING CONTRACTOR: Chosen Valley Testing, Inc.

Depth	Sample Int. Rec.- (in.)	Log-Graphic	Description - ASTM D 2488	"N"	Water Level	Moisture Content	"Q" (tsf)	Comments
	27"							Consolidation test. Yd = 118.1 pcf, m.c. = 15.0% Qp = 2.8 tsf
	18"			31		14%	4	
	18"			37			3 1/2	
	6"			28				
53.0			Poorly Graded Sand with Silt - fine to medium grained - trace fine gravel - dark yellowish brown - moist to wet - very dense - (SP-SM) - glacial till	58	▽ 56.0'			
58.0			Sandy Lean Clay - trace gravel - dark brownish gray to dark gray - moist to wet - hard - (CL) - glacial till					
	18"			60		13%	>4.5	
66.0	18"			74			>4.5	
			The boring was terminated at 66 feet. Water was encountered at 56 feet while drilling. Water was observed at 35 feet after removal of the hollow stem auger. The boring was backfilled with soil cuttings and cement grout.					

LOG OF TEST BORING

PROJECT:
Kenyon Wind Project
Kenyon, Minnesota
Pinnacle Project No: MN07073.00

BORING NAME/LOCATION:
T-9
Lat. 44.24263 N, Long. 92.90563 W (decimal degrees)

SCALE:
1 in. = 5 ft.

LOGGED BY: Mark Reinbold/Pinnacle
DRILLING METHOD: HSA/Split Spoon
DRILLING DATE: 3/13/07

RELATIVE ELEV: 1243'
DRILLING CONTRACTOR: Chosen Valley Testing, Inc.

Depth	Sample Int. Rec.- (in.)	Log-Graphic	Description - ASTM D 2488	"N"	Water Level	Moisture Content	"Q" (tsf)	Comments
1.5			Topsoil	*				* Auger sample 0-2'
5.5	13"		Sandy Lean Clay / Clayey Sand - little gravel - mottled brown and yellowish brown - moist - medium stiff - (CL/SC) - glacial till					Tube sample 2 1/2 - 5' Qp = 1.4 tsf
7.5			Silty Sand - mostly fine to medium grained - lenses of poorly graded sand with silt - light brown to yellowish brown with little mottling - wet - medium dense - (SM) - alluvium	13		18%		
				13		20%	1/2	
12	23"		Sandy Lean Clay - trace gravel - mottled yellowish brown and gray, - wet - stiff - (CL) - glacial till			14.6%		Tube sample 9 1/2 - 12' Qp = 3.2 tsf Td = 119.4 pcf Unconfined Comp. = 3.13 tsf
			The boring was terminated at 12 feet. Groundwater was not encountered during drilling. The boring was backfilled with soil cuttings.					

LOG OF TEST BORING

PROJECT:
Kenyon Wind Project
Kenyon, Minnesota
Pinnacle Project No: MN07073.00

BORING NAME/LOCATION: B-1
Substation Lat. 44.24789 N, Long. 92.93979 W Dec. Deg

SCALE: 1 in. = 5 ft.

LOGGED BY: Greg Glitto/Pinnacle
DRILLING METHOD: HSA / SPT
DRILLING DATE: 3/20/2007

RELATIVE ELEV: Existing Grade
DRILLING CONTRACTOR: Chosen Valley Testing, Inc.

Depth	Sample Int. Rec.- (in.)	Log-Graphic	Description - ASTM D 2488	"N"	Water Level	Moisture Content	"Q" (tsf)	Comments
1.75			Topsoil (21") - organic lean clay - black - trace root fibers - wet	*				* Auger Sample 0 - 2'
4.5			Lean Clay - some silt - yellowish brown - moist to wet - glacial till			20%		Tube Sample 2 - 4 1/2' Qp = 1.0 tsf Yd = 106.7 pcf
8.5			Sandy Lean Clay - trace fine gravel - brown and yellow mottled - moist - medium stiff to stiff - glacial till	8 13				Qp=1 1/2 tsf Qp=1 1/2 tsf
18			Sandy Lean Clay - trace fine gravel - brown and yellow mottled - moist - very stiff to hard - glacial till	18 21 22 30				Qp=2 3/4 tsf Qp=2 3/4 tsf Qp=3 tsf Qp=3 1/4 tsf
23			Sandy Lean Clay - trace fine gravel - brown and yellowish brown mottled with little gray - moist - hard - glacial till	45				Qp=4 1/4 tsf
26			Sandy Lean Clay - trace fine gravel - brown - moist to wet - hard - glacial till	48				Qp=2 1/4 tsf
			End of boring 26 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings and cement grout.					

Pinnacle Engineering

Pinnacle Engineering, Inc.
11541 95th Avenue North
Maple Grove, Minnesota 55369

Tel: 763 315-4501
Fax: 763 315-4507
www.pineng.com

GENERAL TERMINOLOGY FOR SOIL DESCRIPTION AND IDENTIFICATION

DRILLING AND SAMPLING SYMBOLS

ACR	After Casing Removal
AS	Auger Sample
BCR	Before Casing Removal
BS	Bulk Sample
CR	Core Recovery – Percent
CSS	Continuous Split Spoon Sampling
DM	Drilling Mud
_FA	4”, 6”, or 10” Flight Auger
_HA	2”, 4”, or 6” Hand Auger
HSA	Hollow Stem Auger- 3 ¼” ID
JS	Jar Sample
N	Blows/ft, 140 hammer lb, 30” drop, 2” OD Sampler
NMR	No Measurement Recorded, primary due to presence of drilling or coring fluid.
NSR	No Sample Recovered, classification based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit
PA	Power Auger
SS	Split Spoon – 1 3/8” ID, 2” OD, unless otherwise noted.
ST	Shelby Tube—3 “ unless otherwise noted.
VS	Vane Shear
WH	Weight of Hammer
WS	Wash Sample
▼	Water Level Symbol

TEST SYMBOLS

C	One Dimensional Consolidation – ASTM D 2435
CC	Chloride Content
D	Dispersion Test
D.S.	Direct Shear – ASTM D 3080
DH	Double Hydrometer – ASTM D 4221
G	Specific Gravity – ASTM D 854
IR	Infiltrometer Test – ASTM D 3385
K	Coefficient of Permcability – centimeters per second
MA	Particle Size Analysis – ASTM D 422
OC	Organic Content – combustion method
pH	Hydrogen Ion Content, meter method
PI	Plasticity Index
PL	Plastic Limit
Qc	Triaxal Compression
Qp	Hand Penetrometer Reading – tons/square foot
Qu	Unconfined Compressive Strength – pounds/square foot – ASTM D 2166
R	Laboratory, Resistivity, ohm-cm – ASTM G 57
RQD	Rock Quality Designation - percent
SC	Sulfate Content – parts per million (mg/l)
SL	Shrinkage Limits – ASTM D 427
Ts	Torvane Reading – tons/square foot
TRm	Thermal Resistivity (moist) – ASTM D5334, IEEE 422
TRd	Thermal Resistivity (dry) - ASTM D5334, IEEE 422
VS	Field Vane Shear – ASTM D 2573
Yd	Dry Unit Weight

DESCRIPTIVE TERMINOLOGY

Granular Soil Density Terms	Granular Soil “N” Value	Cohesive Soils Consistency Terms	Cohesive Soil “N” Value	Unconfined Compressive Strength, Qu, Qp
Very Loose	0 - 3	**Very Soft**	0 - 2	0.25-.049
Loose	4 - 9	**Soft**	3 – 4	0.50-0.99
Medium Dense	10 - 29	**Medium Stiff**	5 – 8	1.00-1.99
Dense	30 - 49	**Stiff**	9 – 15	2.00-4.99
Very Dense	50 - 80	**Very Stiff**	16 – 30	4.00-5.99
Extremely Dense	80 +	**Hard**	30 +	6.0 +

Standard “N” Penetration: Number of blows to advance a standard 2-inch split spoon sampler the last 12 inches of an 18 inch penetration. .

Relative Sizes

Boulder	Over 12”
Cobble	3” – 12”
Gravel	
Coarse	¾” – 3”
Fine	#4 – ¾”
Sand	
Coarse	#4 - #10
Medium	#10 - #40
Fine	#40 - #200
Silt & Clay	-#200 based on plasticity

Lamination	Up to ½” thick stratum.
Layer	½” to 6” thick stratum.
Lens	½” to 6” discontinuous stratum, pocket.
Varved	Alternating laminations, usually of clay and silt, or colors thereof.
Dry	Powdery, no noticeable water in soil.
Moist	Slightly damp to damp soil, near optimum moisture content.
Wet	Very damp to nearly saturated soil, wet of optimum moisture.
Water Bearing	Saturated, above liquid limit.

Description of Components	Percent of Dry Weight
Trace	0 – 5
Little	6 – 12
Some	12 – 24
And	24 -50

Appendix C

Seismic Data CPT-1, 2, 5, 7, & 8

Project:	Kenyon Wind Project	SoundID:	23070001.1	ControlID:	DOM.ControlBaseLine
Location:		D tot:	65.0262 (ft)	ConeID:	050509 S
Coord:	[44.2587, -92.9335, 0]	Elev.:	0 (ft)	Remarks: T1	
Collected:	2007-03-03 11:36:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:10:27	PreDrill:	0 (ft)		

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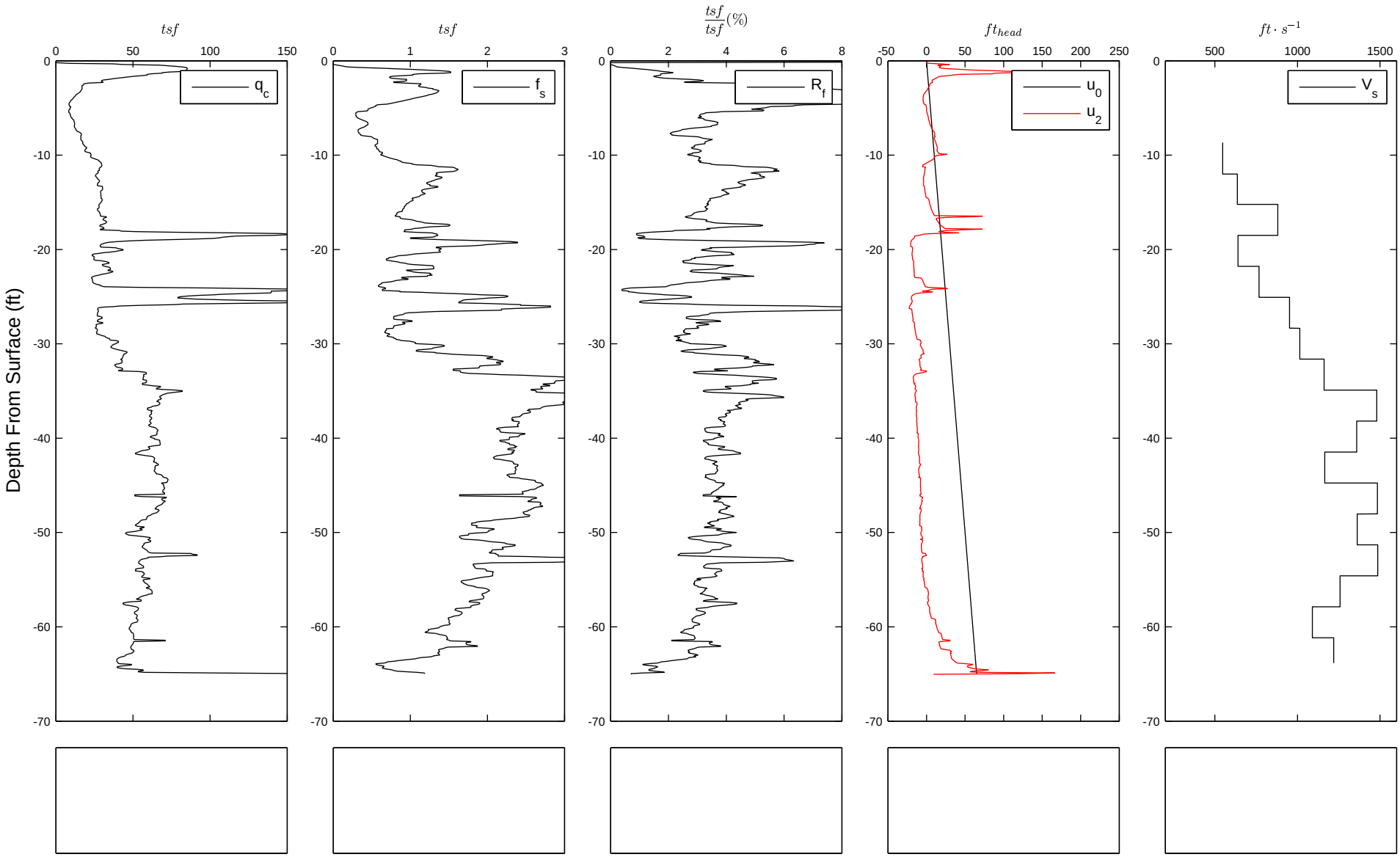
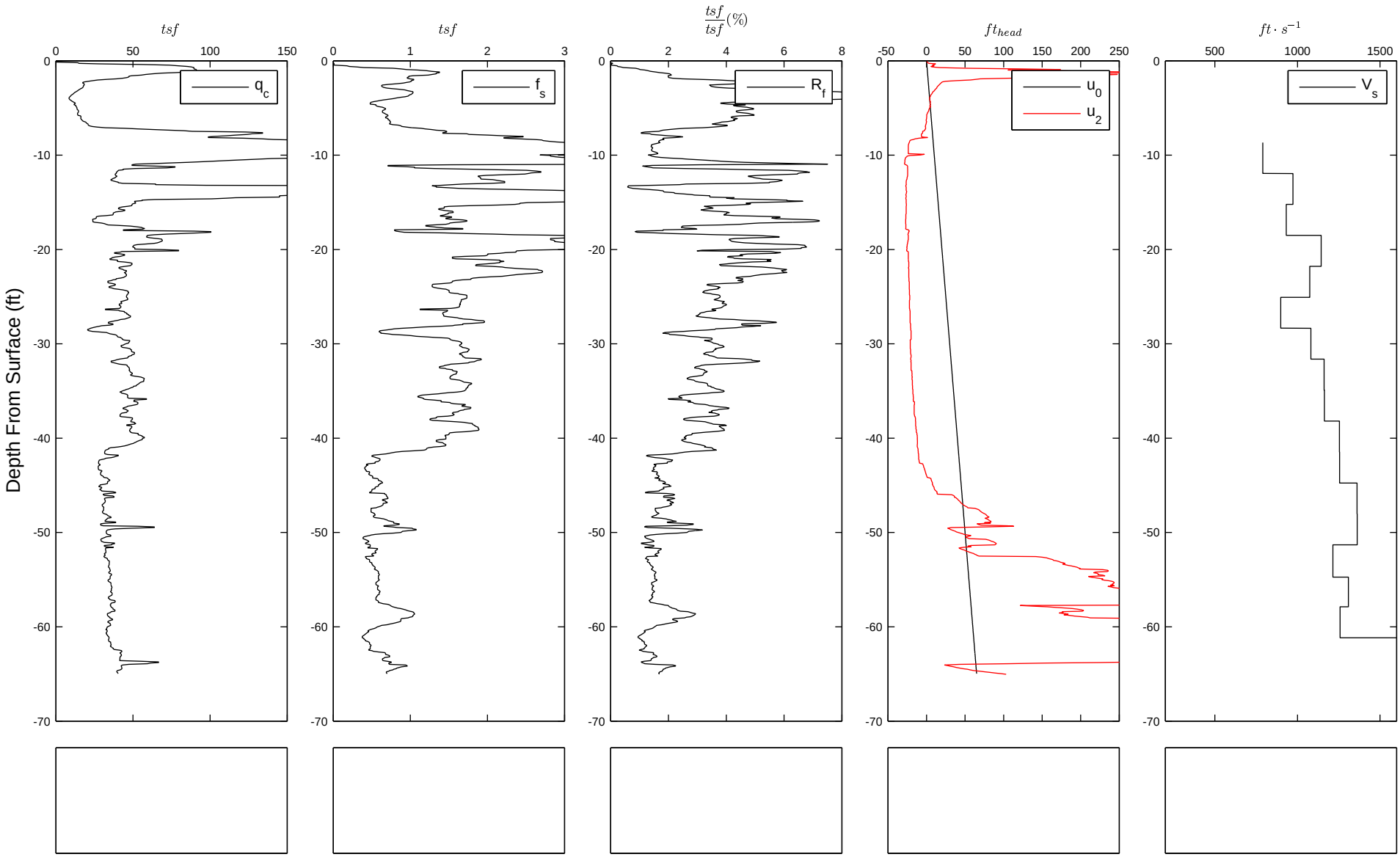
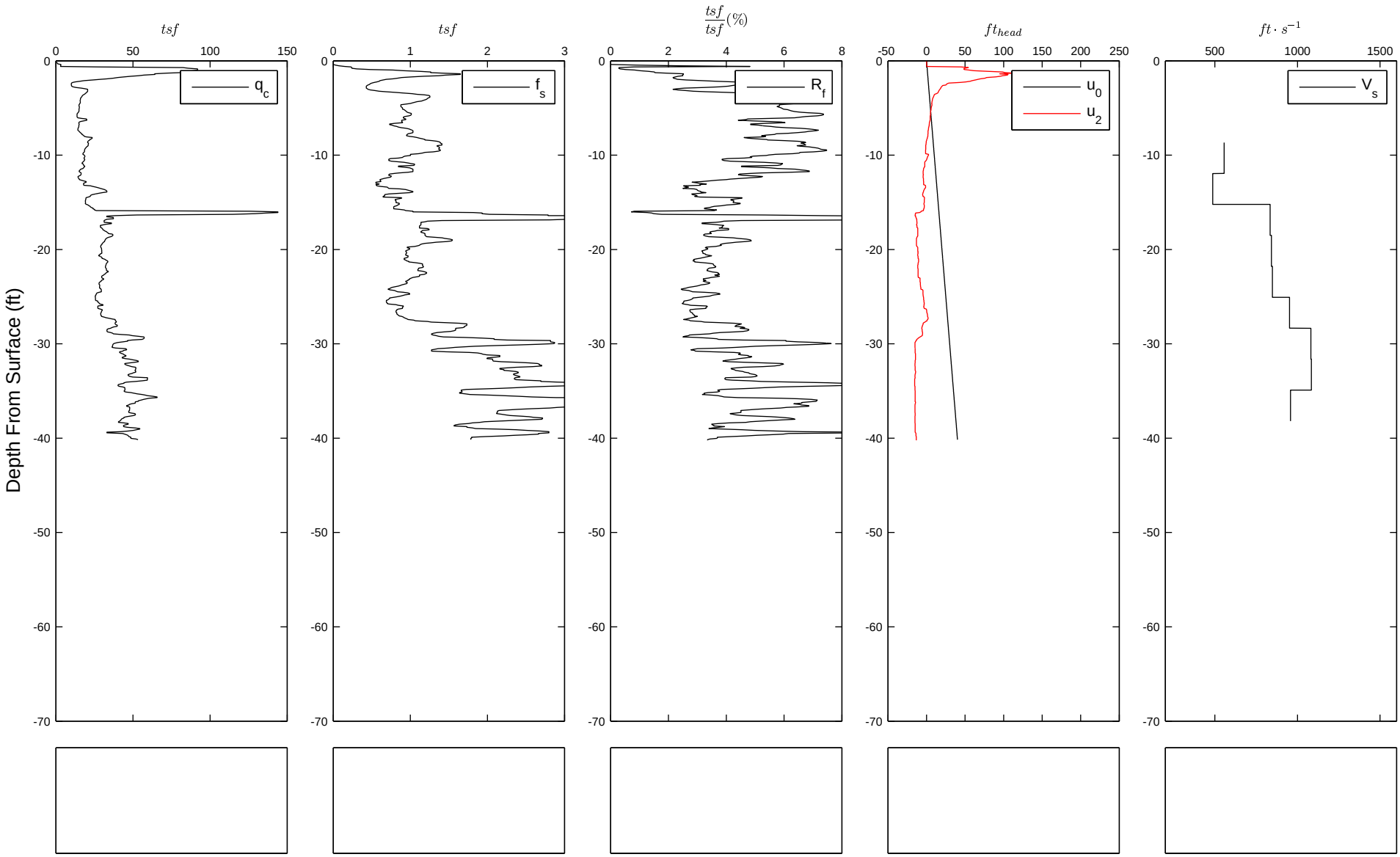


Project:	Kenyon Wind Project	SoundID:	23070001.2	ControlID:	DOM.ControlBaseLine
Location:		D tot:	65.0262 (ft)	ConeID:	050916 S
Coord:	[44.2532, 92.9236, 0]	Elev.:	0 (ft)	Remarks: T2	
Collected:	2007-03-03 12:54:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:12:08	PreDrill:	0 (ft)		

Pinnacle Engineering

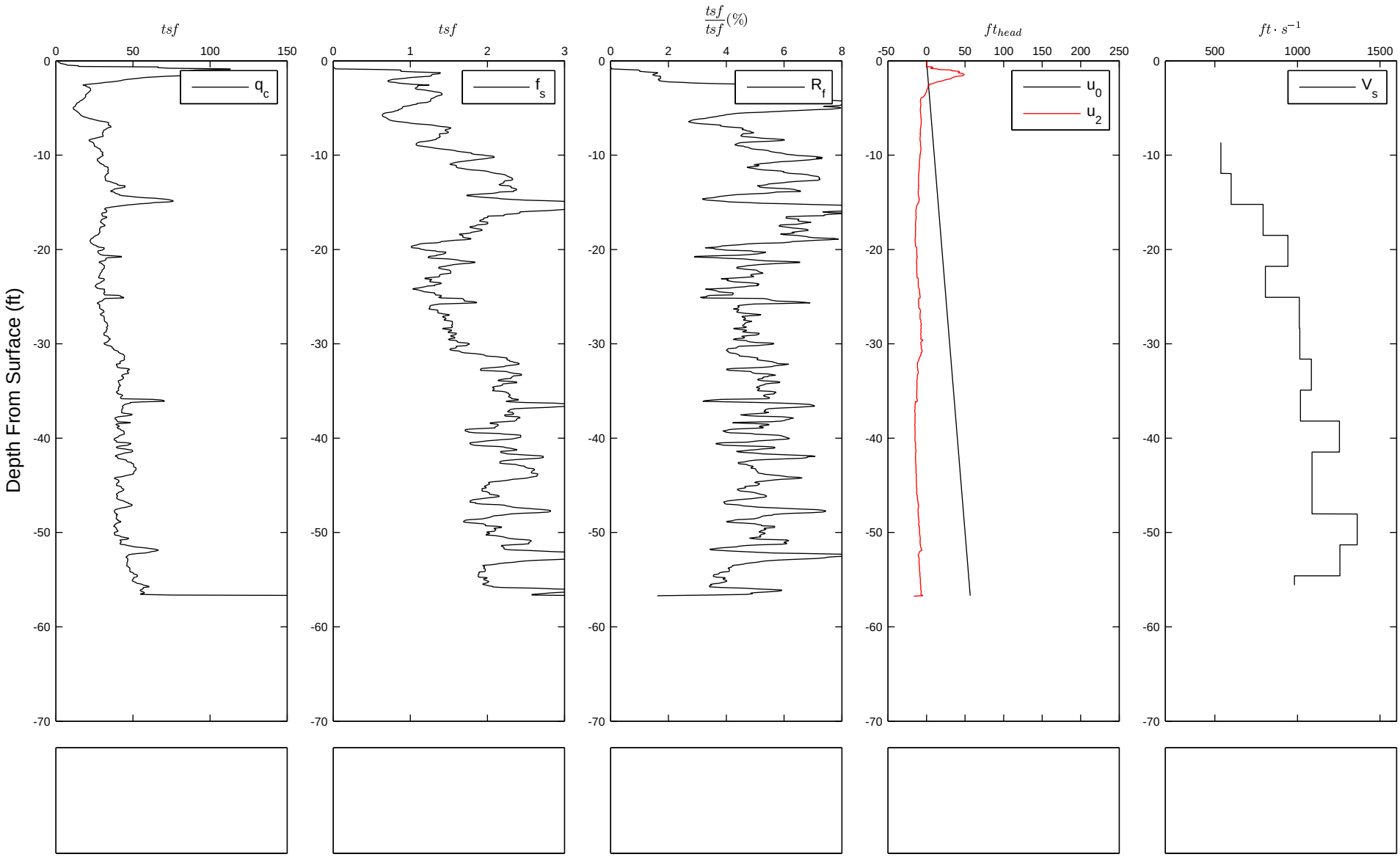


Project:	Kenyon Wind Project	SoundID:	23070001.5	ControlID:	DOM.ControlBaseLine
Location:		D tot:	40.2231 (ft)	ConeID:	050509 S
Coord:	[44.2477, -92.9435, 0]	Elev.:	0 (ft)	Remarks: T5	
Collected:	2007-06-03 11:03:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:13:41	PreDrill:	0 (ft)		

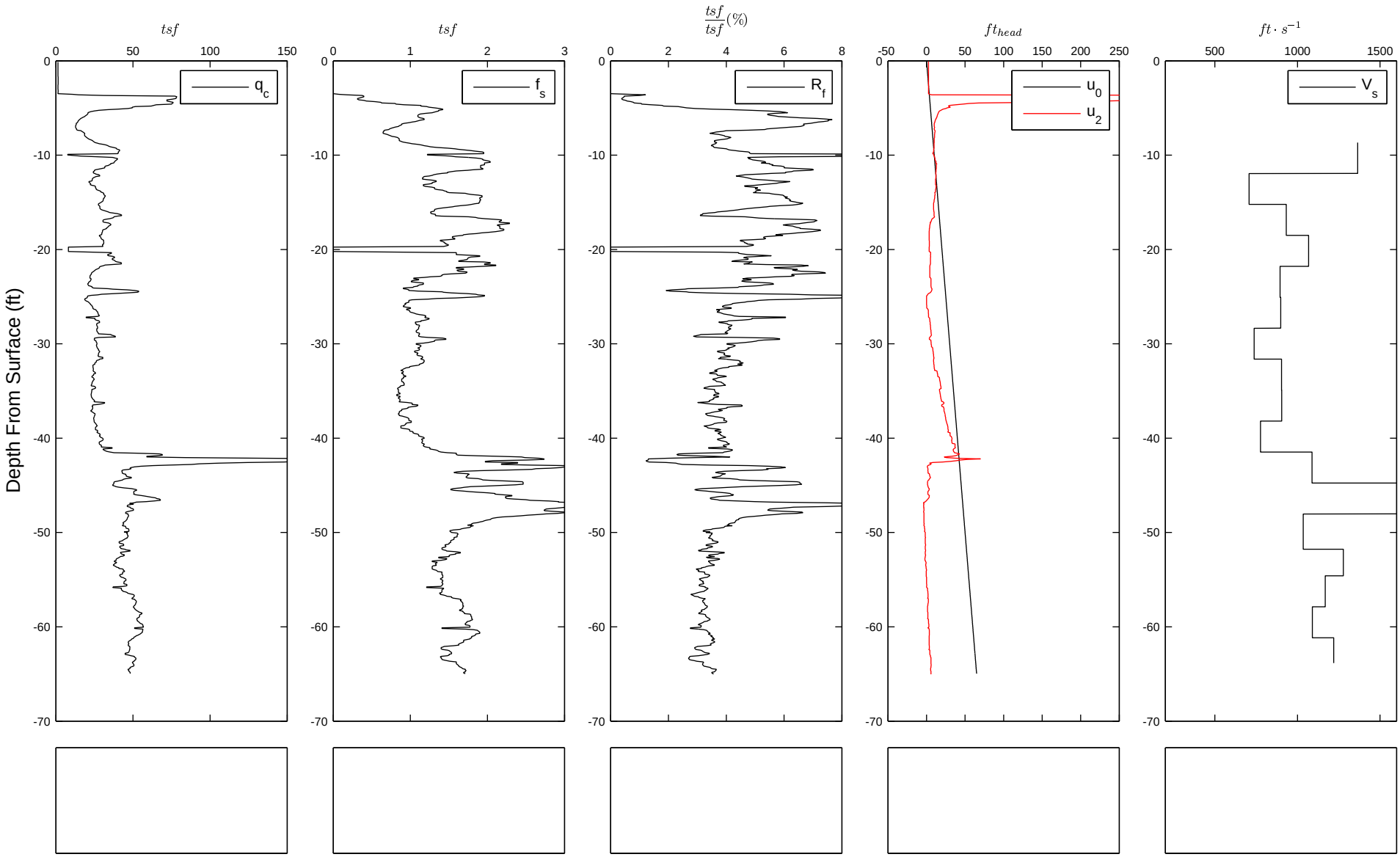


Project:	Kenyon Wind Project	SoundID:	23070001.7	ControlID:	DOM.ControlBaseLine
Location:		D tot:	56.7585 (ft)	ConeID:	050509 S
Coord:	[44.2447, -92.922, 0]	Elev.:	0 (ft)	Remarks: T7	
Collected:	2007-03-03 14:36:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:15:12	PreDrill:	0 (ft)		

Pinnacle Engineering



Project:	Kenyon Wind Project	SoundID:	23070001.8	ControlID:	DOM.ControlBaseLine
Location:		D tot:	65.0262 (ft)	ConeID:	050509 S
Coord:	[44.245, -92.9148, 0]	Elev.:	0 (ft)	Remarks: T-8	
Collected:	2007-10-03 15:17:00	GWT:	0 (ft)		
Printed:	2007-03-19 23:16:48	PreDrill:	0 (ft)		



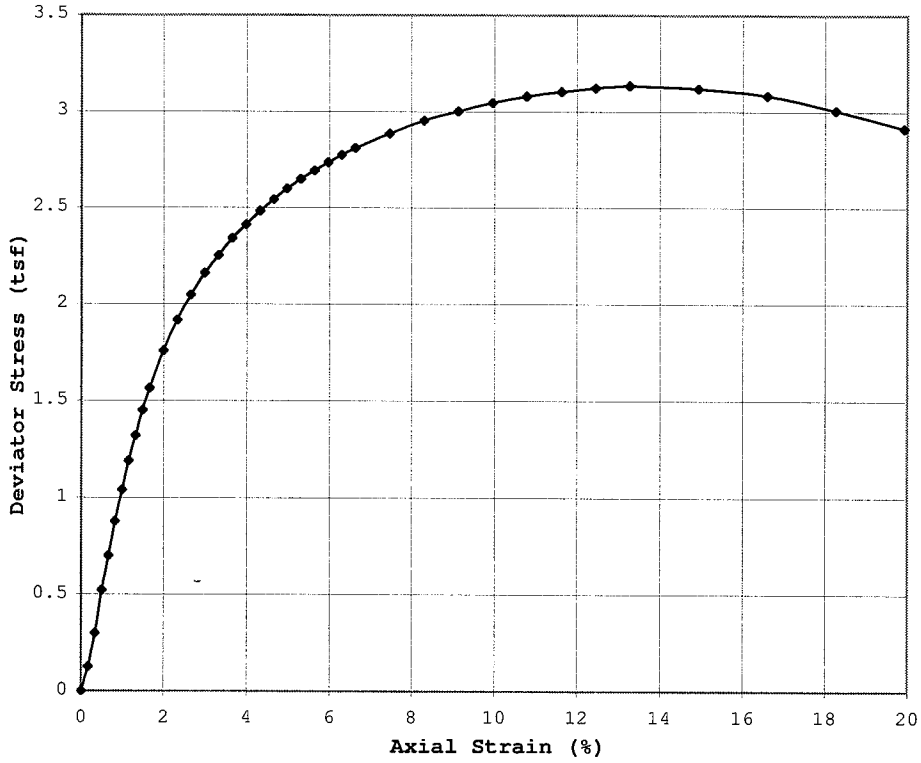
Appendix D

Soil Laboratory Test Results

Unconfined Stress/Strain Curves

ASTM: D2166

Project: Kenyon Wind Project - #MN07073 Job: 6014
Client: Pinnacle Engineering, Inc Date: 3/20/07
Remarks:



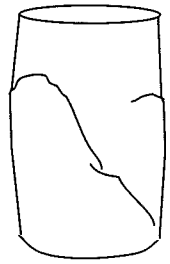
Boring: T-9 Depth: 9.5 - 12 (Bot.)
Sample #:
Soil Type: Sandy Lean Clay w/a Trace of Gravel (CL)

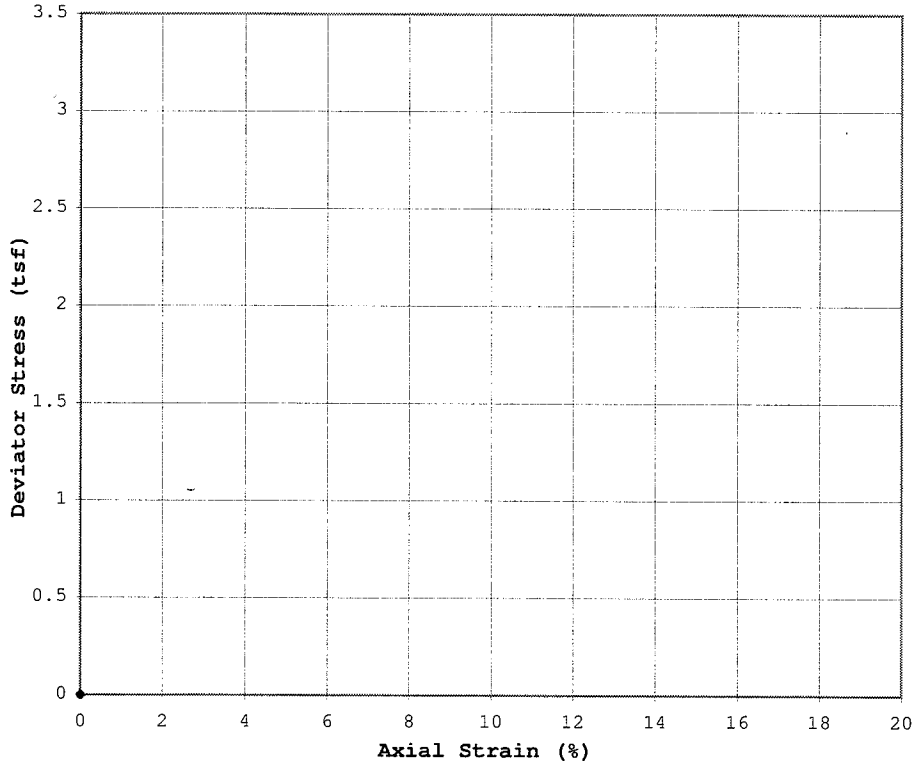
Strain Rate (in/min): 0.059
Sample Type: 3T
Dia. (in) 2.88 Ht. (in) 6.02
Height to Diameter Ratio: 2.09

Unconfined Comp. Strength: 3.13 tsf
Strain at Failure (%): 13.28

W.C. (%): 14.6
Yd (pcf): 119.4

Sketch of Specimen After Failure





Boring: Depth:
Sample #:
Soil Type:

Strain Rate (in/min):
Sample Type:

Dia. (in): Ht. (in):
Height to Diameter Ratio:

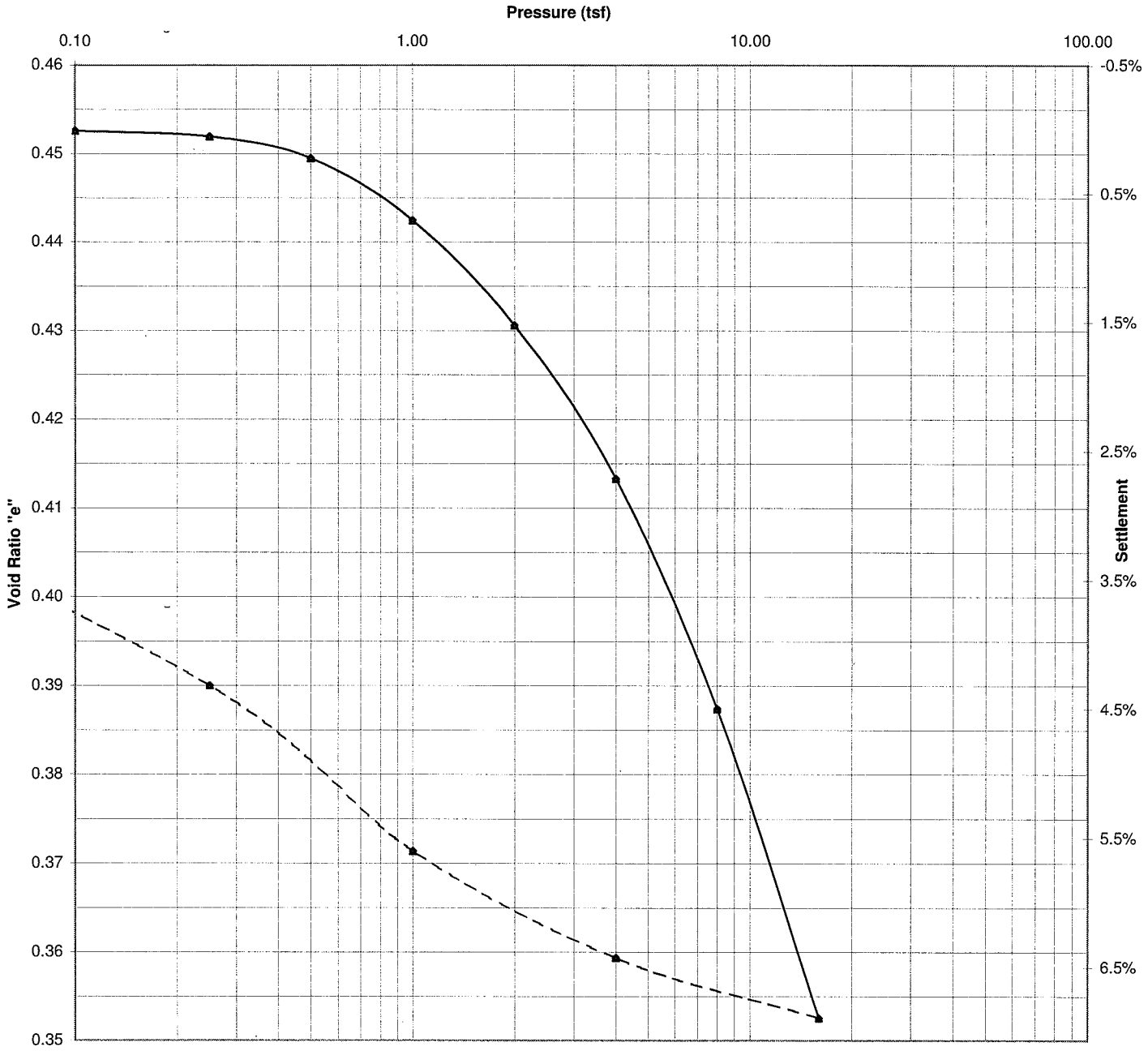
Unconfined Comp. Strength: tsf
Strain at Failure (%):

W.C. (%):
Yd (pcf):

Sketch of Specimen After Failure

9301 Bryant Ave. South, Suite 107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Kenyon Wind Project - #MN07073			Date: 3/20/07
Sample #:	Boring #: T-6	Depth ft: 37-39.5	Job #: 6014
Soil Type: Sandy Lean Clay w/a little gravel (CL)			
Initial W/C (%): 15.0	Dry Density (pcf): 118.1	LL: PL: PI:	Gs: 2.75 (Assumed)
Organic Content (%):	Initial Height (in.): 0.749	Diameter (in.): 2.503	e_o= 0.453
Preconsolidation Pressure (Pc): 2.8 tsf	Compression Index (Cc): 0.11	Recompression Index (Cr): ≅ 0.02	

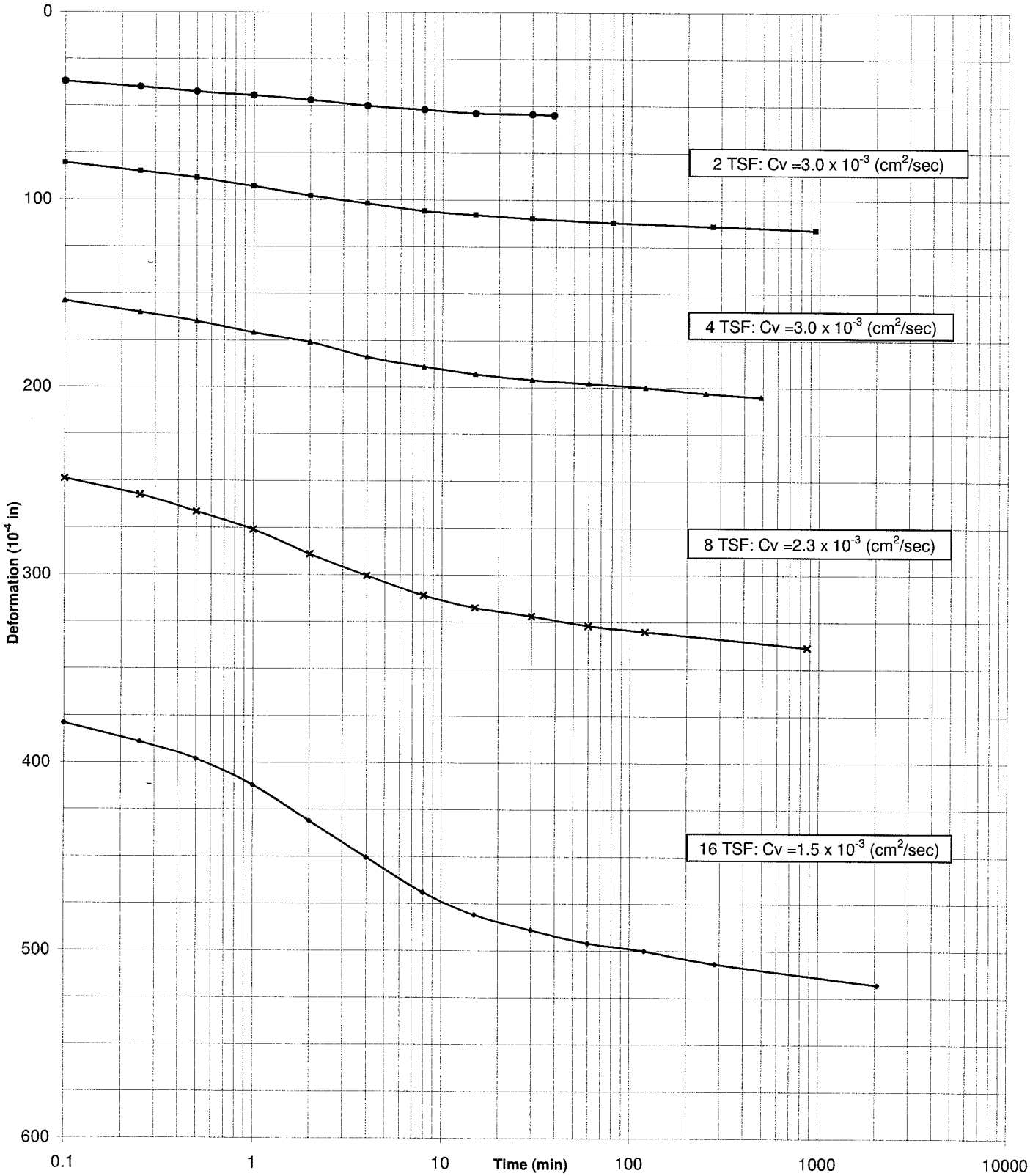
Remarks:

9301 Bryant Ave. South, Suite 107

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Kenyon Wind Project - #MN07073			Date: 3/20/07
Sample #:	Boring #: T-6	Depth ft: 37-39.5	Job #: 6014

9301 Bryant Ave. South, Suite 107

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Kenyon Wind, LLC 201 Ridgewood Avenue
(612) 252-0830 Minneapolis, MN 55403

May 10, 2007

Adam Sokolski
Project Manager, Energy Facility Permitting
Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101-2198

Re; Drain Tile

Dear Adam;

Regarding drain tile, we have been in contact with Steve St. John a local drain tile contractor. Steve S. has installed most of the drain tile in the area. I met with Steve at the Kenyon site April 23rd to go over drain tile issues turbine by turbine. Since our meeting Steve is now in contact with and will be working for Vince Grandquist of CEG, the electrical contactor for the project. The following is description of what we know turbine by turbine about drain tile for the parcels involved in the project.

Turbine #1

This parcel has been drain tiled with the tiles running north south. The rows are about 80 feet apart. The access road will be entering off of County 12 and run south to the turbine. There should be little disturbance of the tiles. The electrical and communication cables will likely be trenched in at a direction of southwest. The contractor will have to fix tiles as needed.

Turbine #2

This parcel has only been partially tiled. There is a plan on file for standard tiling to be installed in the future. The access road will enter off of 480th going north to the turbine. To accommodate the future tile plan at least two header drains or culverts will be placed across the road to facilitate the drainage pattern from the west to the east.

Turbine #3

This parcel has been tiled. The access road will enter off of 480th going south to the turbine. There are some tiles running east west at the north end of the access road. After a few rows of east west tile the rest of the tile in the area is running north south and as with any tile will be fixed as needed.

Turbines #4, #5, and #6

These turbines all have the same situation. The turbine access roads will be entering off of 50th Avenue running east west. The access roads will be constructed more or less on the boundary between the parcel to the north and the parcel to the south. We have determined from landowner information that there are a few drain tiles crossing between parcels in each road case. James St. John was also aware of the tile interconnections between parcels. These connections will be identified as road construction commences and will be fixed if necessary.

Turbine #7

James St. John did not have a map of drain tile for this parcel. There was no evidence at the time of obvious drain tiles in the access road path. James S. will search the records for maps for this parcel.

Turbine #8

James S. had a map of the existing drain tile for this parcel at our meeting in the field. It has been proposed by the landowner that the turbine access road enter off of 60th Avenue starting out near and parallel to the residential property to the north, so as to not island a small amount of acreage. The road would then make a gradual turn towards the turbine site. The road would then be running parallel to the existing drain tile for about the first two thirds. For about the last third of the road drain tiles would be encountered every 80 feet. These would be fixed where necessary.

Turbine #9

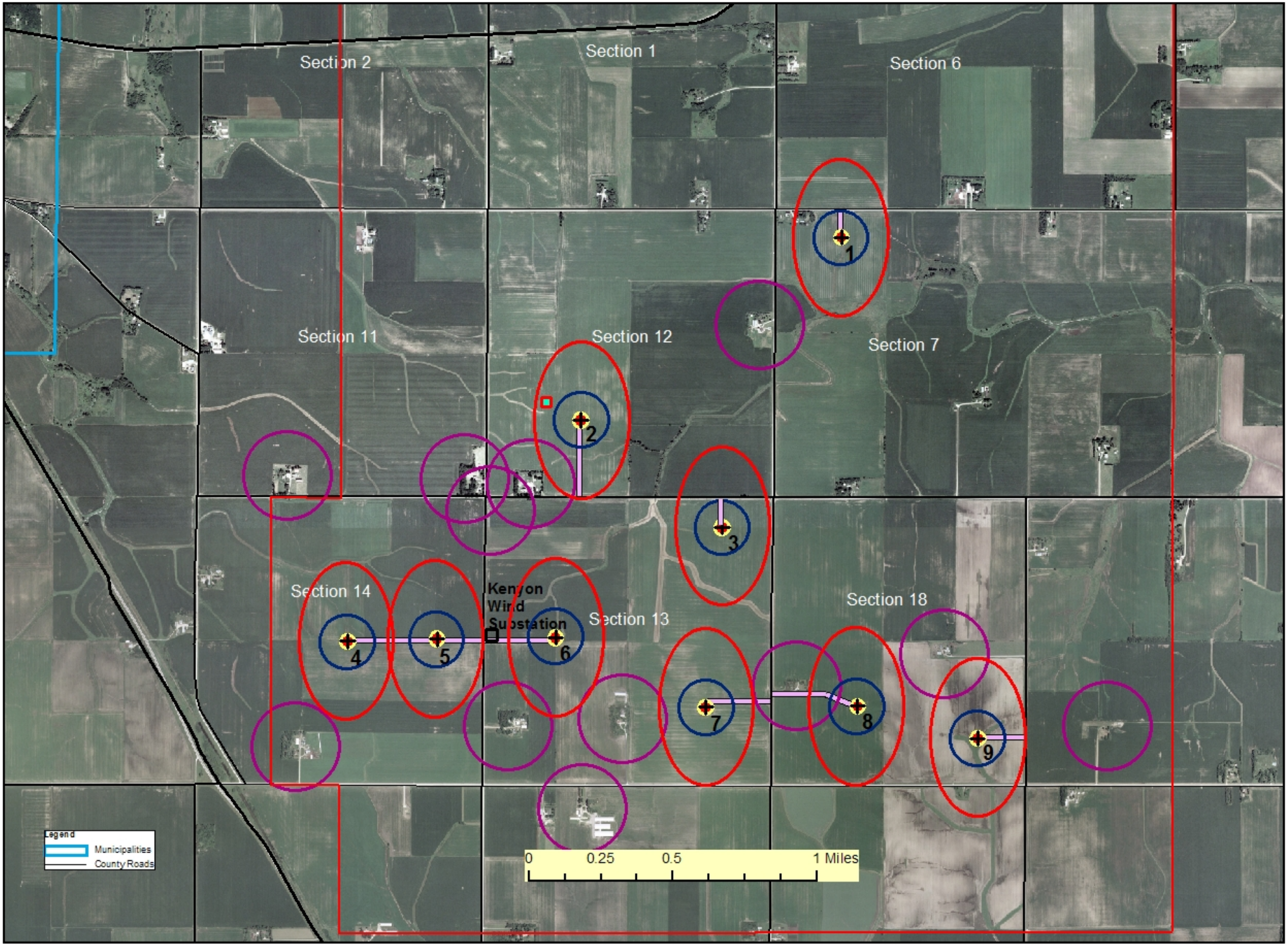
James St. John did not have a map of drain tile for this parcel. The access road for this turbine would enter off of 66th Avenue and go west to the turbine. The parcel involved has been leased to a local canning company for many years. James S. did not think any recent tiling had been installed in the access road area. There was no evidence at the time of obvious drain tiles in the access road path. James S. will search the records for maps for this parcel.

Please let me know if you have any questions or need additional information.

Sincerely,

Rory Artig, Vice President
Kenyon Wind, LLC
Roryartig@earthlink.net

Kenyon Wind Project



Adam Sokolski

From: Byron Boone [BBoone@suzlon-usa.com]
Sent: Thursday, May 31, 2007 11:46 AM
To: Adam Sokolski
Subject: RE: noise analysis

Hello Adam,

I hope the below will work for you analysis.

Suzlon's internal spreadsheet-based calculations for sound levels are an exact copy of the WindPro model and produce exact results. The spreadsheet calculations were developed internally to make it easier to change the inputs (WTGs and houses) and easier to find out which WTGs are the exceeding WTGs. In the calculations the general model from the ISO9613-2 standard is used (no terrain influence is included), as well as 1/3 Octave data for the WTG sound levels to generate octave divided data for calculations, atmospheric conditions and noise attenuation based on 10Deg C and 70% humidity, a conservative ground factor of zero used – assumes hard ground providing the least ground absorption, no shielding or blocking of the sound at receiver has been included, and a metrological co-efficient (Cmet) of zero has been used as a conservative method.

Also please find attached the Windpro manual explanation of the model which may help.

Regards,
Byron

Byron Boone, Sales Manager
Suzlon Wind Energy Corp.
8750 West Bryn Mawr, Suite 720
Chicago, IL 60631

Direct: (773) 328 - 5079
Mobile: (512) 468 - 1479
Fax: (773) 444 - 0588

From: Adam Sokolski [mailto:Adam.Sokolski@state.mn.us]
Sent: Wednesday, May 23, 2007 14:43
To: Byron Boone
Cc: Adam.Sokolski@state.mn.us; roryartig@earthlink.net
Subject: noise analysis

Byron –

It was nice to talk with you today.

I think it may be helpful to have Suzlon provide a short written description of the noise analysis is based on, what variables are assumed, and methodology or calculations applied. Also, how the analysis is similar or different from a Windpro or comparable commercial software analysis. This will allow me to more accurately describe the analysis Suzlon provided in this case.

It would be great if I could get that short statement by Thursday, May 31.

Thanks.

AMS
Adam Sokolski
Project Manager, Energy Facility Permitting

Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101-2198
651-296-2096
adam.sokolski@state.mn.us
http://energyfacilities.puc.state.mn.us/

From: Byron Boone [BBoone@suzlon-usa.com]
Sent: Friday, June 01, 2007 11:59 AM
To: Adam Sokolski
Subject: RE: noise analysis

Hello Adam,

The model was run at 8 m/s assuming 107db sound power level. Including the 0 ground factor (no absorption), I would say the model was a worst case scenario.

Regards,
Byron

Byron Boone
Suzlon Wind Energy Corp.
8750 West Bryn Mawr, Suite 720
Chicago, IL 60631

Direct: (773) 328 - 5079
Mobile: (512) 468 - 1479
Fax: (773) 444 - 0588

From: Adam Sokolski [mailto:Adam.Sokolski@state.mn.us]
Sent: Friday, June 01, 2007 11:28
To: Byron Boone
Subject: RE: noise analysis

Byron –

Were the models and calculations run to consider the worst possible scenario possible in the WindPro manual?
Did you use a wind speed in the analysis and if so, what wind speed?

AMS

Adam Sokolski
Project Manager, Energy Facility Permitting
Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101-2198
651-296-2096
adam.sokolski@state.mn.us
http://energyfacilities.puc.state.mn.us/

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I hope the below will work for you analysis.

Suzlon's internal spreadsheet-based calculations for sound levels are an exact copy of the WindPro model and produce exact results. The spreadsheet calculations were developed internally to make it easier to change the inputs (WTGs and houses) and easier to find out which WTGs are the exceeding WTGs. In the calculations the general model from the ISO9613-2 standard is used (no terrain influence is included), as well as 1/3 Octave data for the WTG sound levels to generate octave divided data for calculations, atmospheric conditions and noise attenuation based on 10Deg C and 70% humidity, a conservative ground factor of zero used – assumes hard ground providing the least ground absorption, no shielding or blocking of the sound at receiver has been included, and a metrological co-efficient (Cmet) of zero has been used as a conservative method.

Also please find attached the Windpro manual explanation of the model which may help.

Regards,
Byron

Byron Boone, Sales Manager
Suzlon Wind Energy Corp.
8750 West Bryn Mawr, Suite 720
Chicago, IL 60631

Direct: (773) 328 - 5079
Mobile: (512) 468 - 1479
Fax: (773) 444 - 0588

From: Adam Sokolski [mailto:Adam.Sokolski@state.mn.us]
Sent: Wednesday, May 23, 2007 14:43
To: Byron Boone
Cc: Adam.Sokolski@state.mn.us; roryartig@earthlink.net
Subject: noise analysis

Byron –

It was nice to talk with you today.

I think it may be helpful to have Suzlon provide a short written description of the noise analysis is based on, what variables are assumed, and methodology or calculations applied. Also, how the analysis is similar or different from a Windpro or comparable commercial software analysis. This will allow me to more accurately describe the analysis Suzlon provided in this case.

It would be great if I could get that short statement by Thursday, May 31.

Thanks.

AMS
Adam Sokolski
Project Manager, Energy Facility Permitting
Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101-2198
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http://energyfacilities.puc.state.mn.us/

Final Layout							Noise Levels			
Highest Noise Level (107.0dBA)										
House_ID	Description	Easting	Northing	Elevation	Nearest WTG	Distance to Nearest WTG	LEQ	L50	L10**	L90
1	Hoverston	504741	4900230	382	T2	685	45.2	45.2	47.2	43.2
2	Ostertag	505030	4900246	383	T2	459	47.0	47.0	49.0	45.0
3	Rechtzigel	503715	4898772	383	T4	668	43.3	43.3	45.3	41.3
4	Ellingsberg	504927	4898912	385	T6	543	46.7	46.7	48.7	44.7
5	Patterson Old	505546	4898931	386	T7	474	47.5	47.5	49.5	45.5
6	Patterson New	504810	4900141	384	T2	686	45.6	45.6	47.6	43.6
7	Chase	506815	4900241	377	T3	749	43.5	43.5	45.5	41.5
8	Underdahl	506510	4899125	384	T8	367	49.2	49.2	51.2	47.2
9	Voegele	507346	4899313	385	T9	521	46.6	46.6	48.6	44.6
10	Voxland	506495	4901758	376	T1	301	48.6	48.6	50.6	46.6

Notes

** Assuming L10 is +2dBA above L50. This is based on WindPro and standard assumption that L90 is -2dBA below L50(LEQ) .Note L50 is the same

Night time Minnesota noise levels have been assumed.

Uncertainty estimated to be +/-3dBA.

Point noise is taken as hub height of WTG at 79m AGL.

4.1. DECIBEL - Noise Calculations

4.1.0 Introduction to DECIBEL

DECIBEL is the name of the WindPRO program module, which calculates the noise emission and checks if the noise requirements are met at neighbours and noise sensitive areas. It also checks if the required minimum distances from the nearest WTG to these areas are met.

Furthermore, DECIBEL can calculate and plot noise level curves for the project to enable an assessment of which areas will be prevented from being used for noise sensitive activities in future.

One of the major advantages of WindPRO is, however, the possibility for graphic input of data concerning WTGs and noise sensitive areas/points on a digital map directly on the screen.

Important definitions, here as given in the Eurodicautom: http://europa.eu.int/eurodicautom/Controller

Immission: Disturbing effect on the environment of emission; the arrival of pollution from a remote source of polluting substances, arriving at a target
This immission point in this text is typically called the receptor, the neighbour or the Noise Sensitive Area (NSA).

Emission: The release of substances or energy (e.g. noise, vibration, radiation, heat) into the environment from a source
The source in this text is typically the WTG.

4.1.1 The DECIBEL calculation methods

The calculation of the noise impact generated by one or more WTGs at a specific location (e.g. a neighbour) requires the following information:

- The positions of the WTGs (x, y, z coordinates).
- WTG hub height and noise emission ($L_{WA,ref}$) at one or more wind speeds, possibly at different frequencies.
- Any pure tone contents in the WTG noise.
- The coordinates for the noise sensitive locations/areas.
- Maximum noise level accepted inside the noise sensitive areas. Possibly with information about the ambient background noise.
- The required calculation model.

A number of different calculation models have been implemented in WindPRO. These models typically relate to the requirement in certain countries or regions and we advice that the user finds out which methods and requirements has to be met in the region of the site.

If none of the country specific methods apply, it is possible that the general implementation of the ISO-9613-2 norm can be set up to fit the requirements.

The choice of method decides what kind of input data is required.

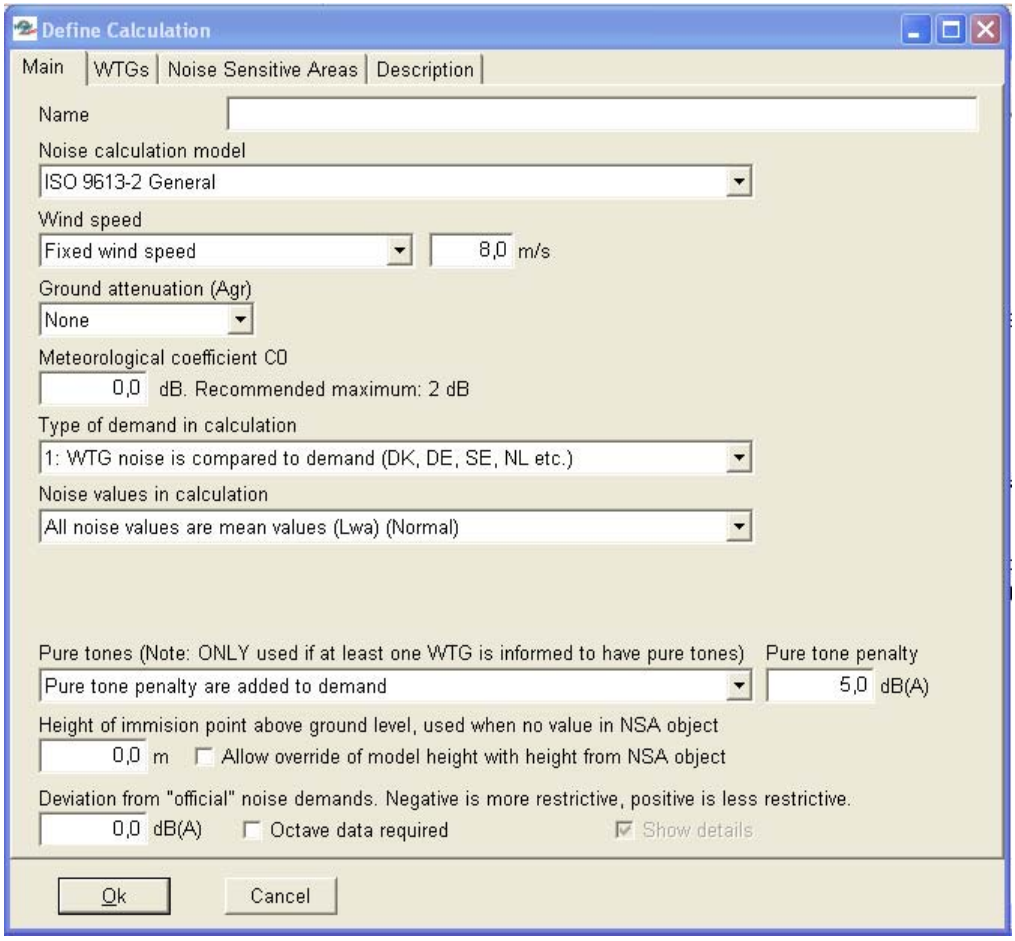
4.1.1.1 The International rule DIN ISO 9613-2, general

The ISO 9613-2 “Attenuation of sound during propagation outdoors, Part 2. A general method of calculation” describes the calculation of damping of the noise during propagation outdoors.

Options for the calculation.

The general setup makes it possible to choose settings for a range of parameters. This makes it possible to fit it to local recommendations.

The options available are shown in below figure.



Wind speed

Fixed wind speed: The calculation will be made for only one wind speed, selected in the field to the right.

Wind speed range: The calculation will be made for a range of wind speeds with start, end and step length selected in the fields to the right. WindPRO will require source noise data for the wind speeds selected, but can also assume values based on what is available for the turbines of the calculation.

95% rated power: The calculation will be made with the noise value for the turbine for 95% of the rated power. If no such value is available the user will be prompted to input this.

95% rated power else fixed wind speed: Like above, but WindPRO will itself choose a substitute noise value if no data for the 95% rated power is available. The wind speed for the substitute is selected in the field to the right. If there is no value for this wind speed either the user will be prompted for noise data.

Ground Attenuation

None: No damping due to ground attenuation is used for the calculation. This approximates the very smooth surface offshore.

General: The damping of noise due to ground attenuation follows the general case described by the ISO 9613-2 code. The user is asked to select the general porosity of the ground with 0 being a hard surface and 1 being a porous surface. The default value of 1 will satisfy most situations, but an individual assessment from site to

site is normally needed. Octave band source data for the turbines are required. If these data are not available the alternative method will automatically be used.
This method can only be used for flat terrain or terrain with a constant slope. If these conditions are not met, you are advised to use the Alternative method (see below) instead.

Alternative: The damping of noise due to ground attenuation follows the alternative case described by the ISO 9613-2 code. This method uses the orographic shape of the terrain to assess the ground attenuation by calculating the average vertical distance between line-of-sight between receptor and hub of the turbine and the terrain between the two points. A valley between the two points will cause a low attenuation whereas a hill will cause a high attenuation. If no orographic model (height contours) is given, the model assumes a terrain with a constant slope between the WTG and the NSA.
The model is valid for the case where:

Only the A-weighted noise level is required
The sound predominantly spreads above porous ground
The sound is not a pure tone

Both methods are described further in the theoretical section below.

Meteorological coefficient

A value for the meteorological coefficient between 0 and 5 can be selected. The meteorological coefficient is supposed to reflect damping due to special meteorological conditions. EMD recommends setting this to 0 for most situations.

Type of demand in calculation

WTG noise is compared to demand: The noise due to wind turbine noise only is compared to the critical demand assigned for each noise receptor. If the calculation covers several wind speeds the critical demand is either the fixed demand or a wind speed specific demand. This is the normal procedure in countries like Denmark, Germany, Sweden and The Netherlands.

WTG plus ambient noise is compared to ambient noise plus margin: This is the scenario where the noise level at the receptors is the background noise plus the noise contribution from the turbines. This sum is compared to a noise demand that consists of the background noise plus a margin. The option is used in France among other places.

WTG noise is compared to ambient noise plus margin: Like the above option except that only the contribution from the wind turbines is considered and compared to the background noise plus the allowed margin. This option is used e.g. in the UK and Austria.

Noise values in calculation

All vales are mean values (Lwa): This is the normal setting. Both source data, background noise data and calculations are given in mean noise levels (Lwa).

All noise values are 90% exceedence values (L90): With this special settings all noise values are considered L90 values. That is, the noise that will be exceeded 90% of the time. Background noise must then be entered as L90 values. For the turbines the Lwa values will be used but deducted 2dB as a fair approximation of the L90 level. In the printouts Lwa is replaced by L90 values. This setting is used e.g. in the UK.

Pure tones

Pure and impulse tone penalty are added to WTG source noise: In case of pure tones the penalty is added to the source noise level of the turbines. The penalty is dependent on the codes used. For modern turbines pure tones is a rare phenomenon.

Pure tones penalty are added to the demand: With this option the pure tone penalty is subtracted from the critical demand of the report instead of added to the source noise of the wind turbines. The penalty can be specified in the field to the right.

Height of immission point above ground level

This allows the user to specify the calculation height for the receptor. Different codes have different recommendations for this calculation height. Typical values are 1, 4 and 5 m height above ground. If the Allow override… checkbox is hatched the calculation height of the individual receptors (noise sensitive areas) will override the model immission height. Though only if a specific height is given for the NSA.

Deviation from "official" noise demands

This allows the user to introduce a special adjustment to the noise demand. If for instance the authorities require a 2 dB margin to the noise demand to accommodate the uncertainty the user can set this parameter to -2dB. In the printout it will then say that the demand is 45-2=43dB.

Octave data required

If octave band data are available the ISO 9613-2 code will preferably use these for the calculations. If they are not available the total source noise level will be used instead and the option without octave data as described below used. If however the noise guides require octave data, then this checkbox can be hatched and the user will be prompted for octave data if they are not available when starting the calculation. Octave band data are the noise level at a specified set of frequencies ranging from 65 to 8000 Hz

The theory of the ISO 9613-2 as implemented in WindPRO.

Calculation formulas if octave data are not available

Normally, the A-weighted noise source (without octave division/classification) is determined for one WTG type through measurements. The damping values at 500 Hz are used to determine the resulting damping of noise emission. The general method for calculation of ground attenuation cannot be used. The resulting noise level from each source is thereafter calculated from the ISO 9613-2 as follows:

$$L_{AT}(DW) = L_{WA} + D_C - A - C_{met} \qquad (1)$$

LWA: Source noise, A-weighted.

D_c : Directional correction for noise source without directional effect (0dB), but taking the reflection from the terrain into consideration, D_Ω (Needed because the alternative method for calculating ground attenuation, Agr is used)

$$D_C = D_\Omega - 0 \qquad (2)$$

D_Ω is calculated as:

$$D_\Omega = 10 \lg\{1 + [d_p^2 + (h_s - h_r)^2] / [d_p^2 + (h_s + h_r)^2]\} \qquad (3)$$

Where:
h_s :Noise source height above terrain (hub height)
h_r : Noise receptors height above terrain (usually 5m, but can be set individually in the calculation setup)
d_p: Distance between noise source and recipient projected on level terrain

The distance is determined by the (x,y) coordinates for sources (index s) and recipient (index r).

$$d_p = \sqrt{[(x_s - x_r)^2 + (y_s - y_r)^2]} \qquad (4)$$

A: Damping between the noise source (WTG-Nacelle) and the noise critical point:

$$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc} \qquad (5)$$

A_{div} : Damping due to geometry

$$A_{div} = 20 \lg(d/1m) + 11 \text{ dB} \qquad (6)$$

d: Distance between noise source and recipient

A_{atm}: Damping due to air absorption

$A_{atm} = \alpha_{500}\ d / 1000$ (7)

α_{500} : Air absorptions coefficient (= 1,9 dB/km)

The value for α_{500} is based on the most optimal noise emission conditions (temperature 10 Gr. C and 70% relative atmospheric humidity)

A_{gr} : Terrain damping:

$A_{gr} = 4{,}8 - (2h_m / d)[17 + (300 / d)]$ (8)

IF $A_{gr} < 0$ then is $A_{gr} = 0$

h_m: Average height above terrain (in meters) for noise emission

If there is no orography for the site:

hm = (hs + hr) /2 (9a)

If there exists a DHM the area between line of sight and the terrain surface between the WTG and the immission point it will be calculated based on a grid (grid size set in the calculation setup) with a calculation for each grid point the line of sight passes through. The medium height is calculated by:

$h_m = F/d$ (9b)

F: Integrated area from emission point to receptor (immission point)

$F = F_1 + F_2 + \ldots + F_{100}$

d: distance from emission point to receptor (immission point)

A_{bar} : Damping due to shielding (noise protection) normally no shielding protection: A_{bar} =0.

A_{misc} : Damping due to different other effects (vegetation, buildings, industry). Usually these effects are not included in the calculation. A_{misc} =0.

C_{met}: Meteorological correction which is determined by means of the equation:

$C_{met} = 0$ for $dp < 10\ (h_s+h_r)$

$C_{met} = C0\ [1-10(h_s+h_r)/dp]$ for $dp > 10$,

d_p: Distance between noise source and recipient projected on level terrain.

where the factor C0, dependent on weather conditions, can be between 0 and 5 dB. In exceptional cases values over 2 dB may occur. In WindPRO the C0 can be defined individually for each noise calculation.

Calculation method with octave divided noise data

Using the ISO 9613-2 it is possible to calculate according to octave divided noise figures for a WTG. If such data are available and entered into the WindPRO WTG catalogue, they will automatically be used in calculations. Using octave band data also makes it possible to use the general ground attenuation method. In the following formula is only demonstrated the difference from calculation with 500 Hz frequency as average value. The resulting noise is calculated as follows:

L_{AT} (DW) = $10\lg[10^{0,1LAfT(63)} + 10^{0,1LAfT(125)} + 10^{0,1LAfT(250)} + 10^{0,1LAfT(500)} + 10^{0,1LAfT(1k)} + 10^{0,1LAfT(2k)} + 10^{0,1LAfT(4k)} + 10^{0,1LAfT(8k)}$) (10)

where:

L_{AfT}: A-weighted noise source for each noise sources at different frequencies (63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz)

The A-weighted noise source L_{AfT} at average frequencies for each noise source is calculated from:

L_{AfT} (DW) = (L_W + A_f) + D_C - A (11)

where:

L_W:: Octave noise source for non A-weighted point source. LW + Af constitute the A-weighted octave divided noise source LWA according to IEC 651

A_f : standardized A-weighted from IEC 651. WindPRO calculates the A-weighted values for the noise source according to this.

D_c : Directional correction for noise source without directional effect (0dB), but taking the reflection from the terrain into consideration. If general ground attenuation is used D_Ω = 0, which means D_c = 0. If alternative method is used D_c is calculated as in the non-octave band case.

A: Octave damping, damping between point source and recipient which is determined as described above by the following damping types:

$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}$ (12)

A_{div} : Damping due to geometry (= VDI 2714 Distance figure Ds)
A_{atm}: Damping due to air absorption, frequency dependent (=VDI 2714 air absorption figure DL)
A_{gr} : Terrain damping:(=VDI 2714 Terrain and meteorological damping figures DBM)
A_{bar} : Damping due to shielding (noise protection), worst case, no noise protection A_{bar} =0
A_{misc} : Damping due to different other effects (growth, housing, industry). Worst case A_{misc} =0

At octave divided noise emissions, the damping due to air absorption depends on the frequency due to the air absorption:

$A_{atm} = \alpha_f\, d / 1000$ (13)

where:

α_f : absorption coefficient for each frequency band.

The air-damping coefficient depends strongly on the noise frequency, surrounding temperature and the relative atmospheric humidity. The adverse conditions are at 10 degree Celsius and 70% relative atmospheric humidity. The following values are:

Band, mean frequency, [Hz]	63	125	250	500	1000	2000	4000	8000
α_f, [dB/km]	0.1	0.4	1	1.9	3.7	9.7	32.8	117

For the terrain damping there is two methods available for calculation the ground attenuation, A_{gr}. The alternative method is as described for the non-octave band case above. The general method is calculated as:

$A_{gr} = A_s + A_r + A_m$ (14)

Where

A_s : The attenuation for the source region spanning $30h_s$, though max d_p. This region is described by the ground factor G_s, which gives the porosity of the surface, a value between 0 (hard surface) and 1 (porous surface).

A_r : The attenuation for the receiver region spanning $30h_r$ from the receiver. This region is described by the ground factor G_r.

A_m : The attenuation for the middle region. If the source and receiver region overlaps, then there is no middle region. This region is described by the ground factor G_r.

In WindPRO only one parameter for G (porosity) is used

$G = G_s = G_r = G_m$ (15)

The porosity is set in the calculation setup.

The below extract from the ISO 9613-2 document explains how the three ground attenuations are calculated.

Nominal midband frequency Hz	A_s or A_r [1] dB	A_m dB
63	$-1{,}5$	$-3q$ [2]
125	$-1{,}5 + G \times a'(h)$	$-3q(1 - G_m)$
250	$-1{,}5 + G \times b'(h)$	
500	$-1{,}5 + G \times c'(h)$	
1 000	$-1{,}5 + G \times d(h)$	
2 000	$-1{,}5(1 - G)$	
4 000	$-1{,}5(1 - G)$	
8 000	$-1{,}5(1 - G)$	

NOTES

$$a'(h) = 1{,}5 + 3{,}0 \times e^{-0{,}12(h-5)^2}\left(1 - e^{-d_p/50}\right) + 5{,}7 \times e^{-0{,}09h^2}\left(1 - e^{-2{,}8 \times 10^{-6} \times d_p^2}\right)$$

$$b'(h) = 1{,}5 + 8{,}6 \times e^{-0{,}09h^2}\left(1 - e^{-d_p/50}\right)$$

$$c'(h) = 1{,}5 + 14{,}0 \times e^{-0{,}46h^2}\left(1 - e^{-d_p/50}\right)$$

$$d'(h) = 1{,}5 + 5{,}0 \times e^{-0{,}9h^2}\left(1 - e^{-d_p/50}\right)$$

1) For calculating A_s, take $G = G_s$ and $h = h_s$. For calculating A_r, take $G = G_r$ and $h = h_r$. See 7.3.1 for values of G for various ground surfaces.

2) $q = 0$ when $d_p \leq 30(h_s + h_r)$

$$q = 1 - \frac{30(h_s + h_r)}{d_p} \quad \text{when } d_p > 30(h_s + h_r)$$

where d_p is the source-to-receiver distance, in metres, projected onto the ground planes.

Long-term average noise level (resulting noise level)

Noise source figures and distances to noise critical points will be overlaid/superposed if the calculation contains n noise sources (wind farm). The resulting noise L_{AT} is calculated according to following:

$$L_{AT}(LT) = 10 \cdot \lg \sum_{i=1}^{n} 10^{0{,}1(L_{ATi} - C_{met} + K_{Ti} + K_{Ii})} \qquad (14)$$

L_{AT} : Resulting noise at noise critical points
L_{ATi} : Noise at noise critical point from noise source i
i : Index for all noise sources from 1-n
K_{Ti}: Addition for pure tone content for a noise source i, depends on the local rules
K_{Ii}: Addition for impulse tone content for a noise source i, depends on the local rules
C_{met}: Meteorological correction which is determined by means of the equation:
$C_{met} = 0$ for $dp < 10\ (h_s+h_r)$

C_{met} = C0 [1-10(h_s+h_r)/dp] for dp > 10,
d_p: Distance between noise source and recipient projected on level terrain.

where the factor C0, dependent on weather conditions, can be between 0 and 5 dB. In exceptional cases values over 2 dB may occur. In WindPRO the C0 can be defined individually for each noise calculation.

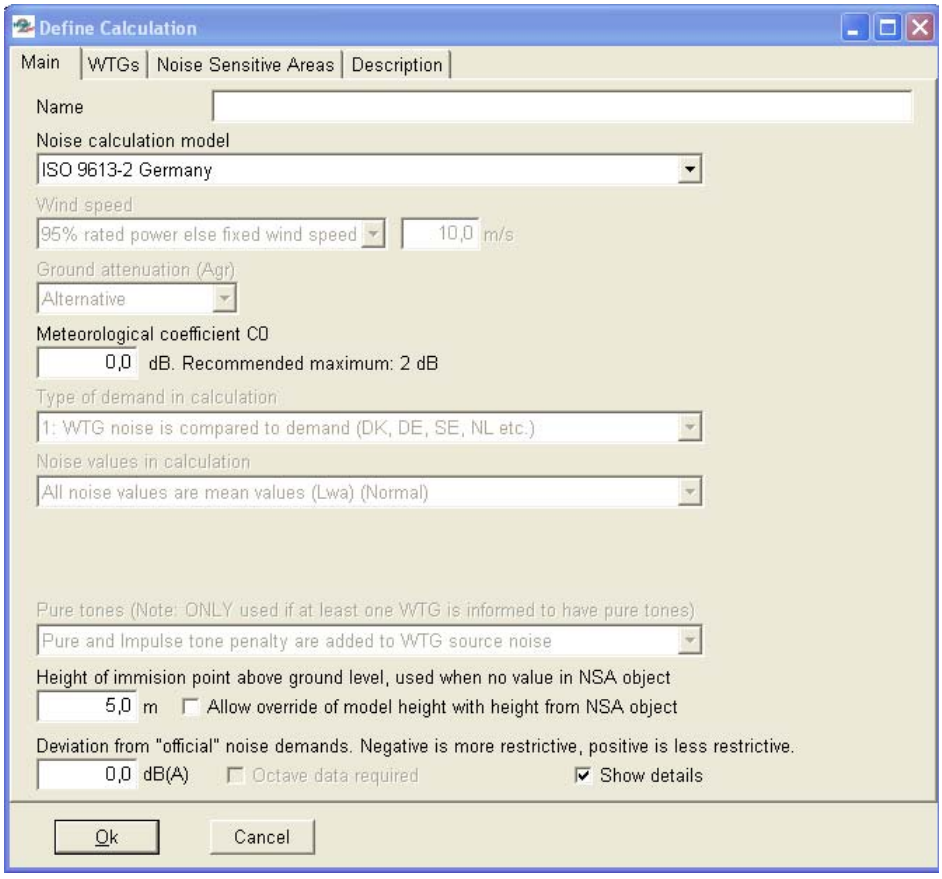
4.1.1.2 ISO 9613-2 Germamy

The ISO 9613-2 Germany calculation option is a special case of the general ISO 9613-2 code.

This option is set up to fit the usual settings used in Germany.

Calculation setup

In below figure the calculation setup is shown for ISO 9613-2 Germany. The fields with faded font are fixed and cannot be altered. As default they are not shown unless the “Show details” checkbox is hatched. For detailed description of the fields please refer to the section on the General ISO 9613-2 codes



Wind speed

The source noise value for 95% of rated power is used or, if it is not available, the noise value in 10 m/s (10m above ground) is used.

Ground attenuation

The alternative ground attenuation method is used.

Meteorological coefficient C0

The meteorological coefficient can be set. The recommended maximum is 2dB.

Type of demand in calculation

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-879-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 1
Location:	Kenyon, MN
Latitude:	44-15-31.26 N NAD 83
Longitude:	92-56-.39 W
Heights:	407 feet above ground level (AGL)
	1657 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-879-OE.

Signature Control No: 501499-100018164 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-879-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-880-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 2
Location:	Kenyon, MN
Latitude:	44-15-11.86 N NAD 83
Longitude:	92-55-24.79 W
Heights:	407 feet above ground level (AGL)
	1642 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-880-OE.

Signature Control No: 501500-100018168 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-880-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-881-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 2
Location:	Kenyon, MN
Latitude:	44-15-5.69 N NAD 83
Longitude:	92-56-2.90 W
Heights:	407 feet above ground level (AGL)
	1637 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-881-OE.

Signature Control No: 501501-100018169 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-881-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-882-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 4
Location:	Kenyon, MN
Latitude:	44-14-51.23 N NAD 83
Longitude:	92-56-59.19 W
Heights:	407 feet above ground level (AGL)
	1652 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-882-OE.

Signature Control No: 501502-100018165 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-882-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-883-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 5
Location:	Kenyon, MN
Latitude:	44-14-51.61 N NAD 83
Longitude:	92-56-36.69 W
Heights:	407 feet above ground level (AGL)
	1659 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-883-OE.

Signature Control No: 501503-100018170 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-883-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2006-AGL-9324-OE

Issued Date: 02/19/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 6
Location:	Kenyon, MN
Latitude:	44-14-39.48 N NAD 83
Longitude:	92-55-37.95 W
Heights:	407 feet above ground level (AGL) 1668 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4, 12 & 13.

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

____ At least 10 days prior to start of construction
(7460-2, Part I)

_X__ Within 5 days after the construction reaches its greatest height
(7460-2, Part II)

This determination expires on 08/19/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this

determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718)553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2006-AGL-9324-OE.

Signature Control No: 493058-529324 (DNE)

William Merritt
Specialist

7460-2 Attached

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2006-AGL-9325-OE

Issued Date: 02/19/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine
Location:	Kenyon,MN
Latitude:	44-14-39.72 N NAD 83
Longitude:	92-55-19.11 W
Heights:	407 feet above ground level (AGL) 1667 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4, 12 & 13.

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

____ At least 10 days prior to start of construction
(7460-2, Part I)

_X__ Within 5 days after the construction reaches its greatest height
(7460-2, Part II)

This determination expires on 08/19/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

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A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718)553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2006-AGL-9325-OE.

Signature Control No: 493059-529325 (DNE)

William Merritt
Specialist

7460-2 Attached

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-884-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 8
Location:	Kenyon, MN
Latitude:	44-14-42.40 N NAD 83
Longitude:	92-54-53.26 W
Heights:	407 feet above ground level (AGL)
	1667 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint only - Chapters 12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-884-OE.

Signature Control No: 501504-100018171 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-884-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AGL-885-OE

Issued Date: 04/22/2007

Rory Artig
Kenyon Wind, LLC
201 Ridgewood Avenue
Minneapolis, MN 55403

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 9
Location:	Kenyon, MN
Latitude:	44-14-33.53 N NAD 83
Longitude:	92-54-20.27 W
Heights:	407 feet above ground level (AGL)
	1650 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4,12&13(Turbines).

It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/22/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

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This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at (718) 553-2560. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AGL-885-OE.

Signature Control No: 501505-100018166 (DNE)
William Merritt
Specialist

Attachment(s)
Case Description

7460-2 Attached

Case Description for ASN 2007-AGL-885-OE

The Kenyon Wind Project is currently being planned for 9 Suzlon 2.1 MW Wind Turbine Generators (WTG). The Suzlon 2.1 MW WTG uses a 3 bladed rotor design with an 88 meter rotor diameter. The hub height of the turbines will be 80 meters above ground level.