

**GEOLOGICAL RECONNAISSANCE
PROPOSED "A" RIDGE AND "B" RIDGE
KIBBY WIND POWER PROJECT
KIBBY & SKINNER TOWNSHIPS
(T1 R6 AND T1 R7 WBKP), MAINE**

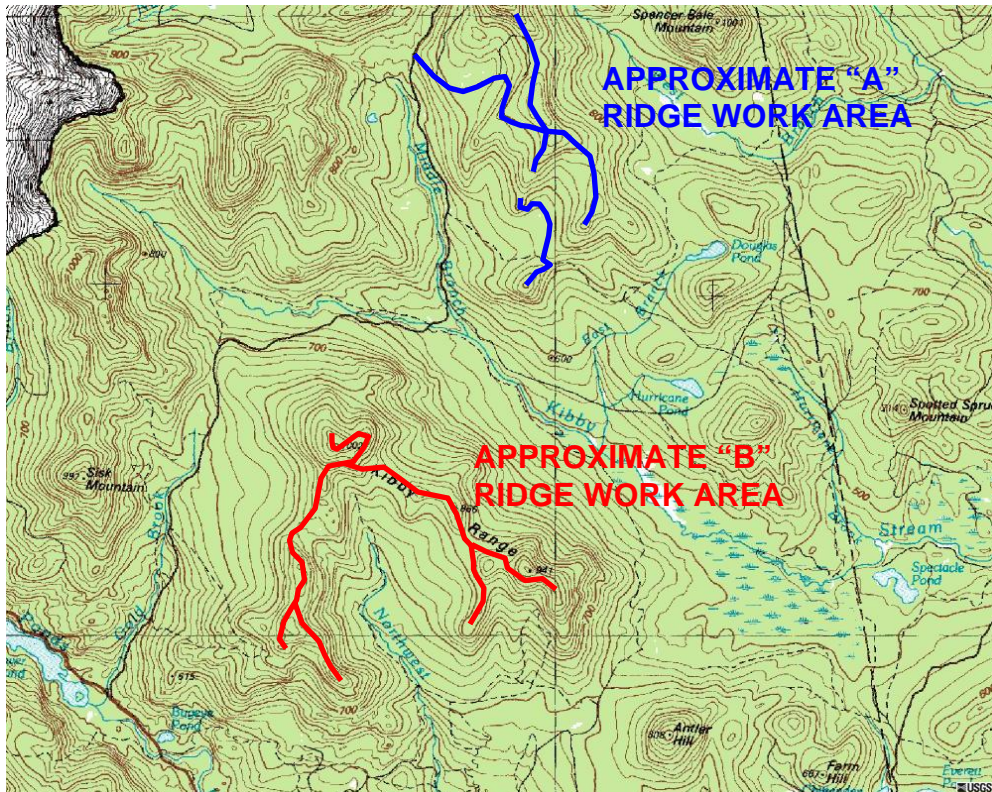
06-0039.1 G

DECEMBER 14, 2006

PREPARED BY



**FOR
AMEC EARTH & ENVIRONMENTAL**



NOTE: Base Map from terraserver.com. Map not to scale.

06-0039.1 G

December 14, 2006

AMEC Earth & Environmental
Attention: Peter Barth
Wexford Professional Building III, Suite 3101
11676 Perry Highway
Wexford, PA 15090

Subject: Geological Reconnaissance
Proposed "A" Ridge and "B" Ridge
Kibby Wind Power Project
Kibby & Skinner Townships (T1R6 and T1R7 WBKP), Maine

Dear Mr. Barth:

In accordance with our Agreement dated October 11, 2006 and signed October 17, 2006, we have provided geological reconnaissance services associated with the Series A and Series B Ridges of the proposed Kibby Wind Power Project in Kibby & Skinner Townships, Maine. We understand that this geological reconnaissance has been requested by the Maine State Geologist as part of the investigations associated with the Kibby Wind Power Project LURC application. The purpose of this reconnaissance was to characterize the bedrock outcropping on the ridges and their potential for producing acidic water when excavated and exposed to rainfall. The contents of this report are subject to the limitations set forth in Attachment A.

INTRODUCTION

The Series A Ridge and Series B Ridge wind tower areas are located in Kibby Township (T1 R6 WBKP) and the southern portion of Skinner Township (T1 R7 WBKP) of Franklin County, Maine. The approximate work area site locations are shown on a portion of the U.S. Geological Survey 7.5 Minute Topographic Map (Kibby Mountain, Maine Quadrangle) presented on the cover page of this report, and Sheet 1. As shown on Sheet 1, the Series A Ridge is bounded to the west by the Middle Branch of Kibby Stream (Beaudry/Gold Brook Road), on the north by the East Branch of Moose River (Haynestown Road), on the south by Kibby Stream (Wahl Road). The East Branch of

Kibby Stream and the West Branch of Spencer are east of the Series A Ridge. The Series B Ridge is south-southwest of Kibby Stream, with Gold Brook to the west. Drainage to the south and east from the Series B Ridge area is to the North Branch of Dead Stream and numerous small drainages to Jim Pond. Topographic mapping indicates that the elevations of the A Ridge sites are generally above 2,400 feet mean sea level (MSL). B Ridge sites are generally between 2,600 and 3,200 feet MSL.

SCOPE OF WORK

S. W. COLE ENGINEERING, INC. provided a Maine Certified Senior Geologist (Clifford R. Lippitt) for the following tasks:

- Geological reconnaissance mapping of bedrock outcropping along Series A and Series B Ridges.
- Collection of representative bedrock samples as reference hand specimens and for laboratory characterization of acid generation potential.
- Review of laboratory methods and published data interpretation references for Acid Generation Potential and Acid Base Accounting.
- Review published geological and geochemical data associated with bedrock in the region.
- Selection of six samples for analysis of acid generation potential, with four of these samples also analyzed for sulfur fractionation.
- Preparation of this report summarizing bedrock field observations, bedrock and geochemical research, and testing results.

PUBLISHED GEOLOGICAL DATA

The area of investigation has been the subject of multiple geological publications. The *Bedrock Geologic Map of Maine* (Osberg et al., 1985), maps the bedrock in the area as migmatite gneiss of the Chain Lakes Massif. The Maine Geologic Survey (MGS) describes the Chain Lakes Massif as being Precambrian age (>650 million years old). Publications by Albee (1972), Boone (1989), Boudette (1989), Cheatham et al. (1989), Gerbi (2005), Perry (1998), and Solar (2001) also provide details on the geological setting of the area. These publications were reviewed as part of this geological evaluation.

The diatexitic¹ Chain Lakes Massif has highly variably textures that are arguably (Gerbi, 2005), the result of melting-driven disaggregation of a volcanic-sedimentary stratigraphy. Gerbi (2005) describes four facies within the Chain Lakes Massif, these are: the quartzofeldspathic McKenney Stream, Sarampus Falls, and Twin Bridges Facies, and an Amphibolite Facies. As shown on Sheet 1, the A Ridge and B Ridge areas are underlain by the Twin Bridges and Sarampus Falls Facies. The Amphibolite Facies has been mapped in a small area at the south end of B Ridge, but was not observed in the field.

The primary distinguishing feature between the three quartzofeldspathic facies is the nature of the compositional banding. The facies are described as:

- McKenney Stream Facies – contains no compositional banding;
- Sarampus Falls Facies – contains schlieric to highly contorted wispy bands throughout the Facies; and
- Twin Bridges Facies – retains lithic layering on a centimeter scale.

The Amphibolite Facies is described as occurring as lenses of medium-grained, well-foliated hornblende-plagioclase-quartz rocks. Goldsmith (1985) indicates that some amphibolites retained pillow structures, while Gerbi (2005) also included a diorite mapped by Albee and Boudette (1972) in the Amphibolite Facies.

FIELD WORK

Bedrock samples were collected from seven locations on “A” Ridge (AGS1 to AGS7), and four samples from “B” Ridge (BGS1 to BGS4). In addition, reference samples were collected from outcrops at Ledge Hill (east of Bag Pond) and north of Sarampus Falls (along Route 27). Sample locations were selected to be generally representative of the proposed work areas and agreed to by Clifford Lippitt and Peter Barth at the outcrop

¹ In the Chain Lakes Massif (Solar and Brown, 2001), migmatitic diatexite is more homogeneously textured at outcrop than migmatite and characterized by discontinuous, weakly-defined foliation with variable attitude. Diatexite varies in mineral assemblage and texture from granite-dominated to biotite-sillimanite-dominated 'patchy' and schlieric migmatite, and to schlieric granite with blocks (schollen) of vein migmatite. Diatexite shows evidence of partial melting.

Migmatite: A rock with both igneous and metamorphic characteristics that shows large crystals and laminar flow structures, probably formed metamorphically in the presence of water and without melting.

locations. Hand specimens were observed to be generally fresh samples of variably banded quartzofeldspathic rock. Oxidation observed in association with weathering occurred as thin (less than 0.2 inches) weathered rims on the exposed portion of the outcrop. An effort was made during sample collection to trim the weathered material from the sample. Locations were surveyed using sub-meter GPS survey equipment provided by E-Pro Engineering and Environmental Consulting, LLC (E-Pro) of Augusta, Maine, and operated by Dale Brewer of Statewide Surveys of Cape Elizabeth, Maine. Sampling and outcrop locations are shown on Sheet 2. Reference samples were collected from outcrops at Ledge Hill (east of Bag Pond) and north of Sarampus Falls (along Route 27). Sample descriptions are included in Attachment B. Photographs of samples and field conditions are also included in Attachment B.

We reviewed analytical procedures of Acid Generation Potential (Acid Base Accounting) from ALS Chemex of Reno Nevada, and Sturm Environmental Services (SES) of Bridgeport, West Virginia. SES was selected to perform the analysis based on experience and turn-around time. Analyses for Fizz, Color, Paste pH, Neutralization Potential (NP) and total sulfur are used to calculate Maximum Potential Acidity (MPA) and Net Neutralization Potential (NPP). NP, MPA and NPP are expressed in calcium carbonate equivalent Tons/100 Tons of Material.

Samples AGS-3, AGS-4, AGS-7, BGS-1, BGS-2, and BGS-4 were submitted to Sturm Environmental Services for analyses to evaluate Acid Generation Potential. Samples AGS-3 and BGS-1 are interpreted as Sarampus Falls Facies; while the other four samples are interpreted as Twin Bridges Facies. The samples were analyzed for Fizz, Color, Paste pH, Neutralization Potential and total sulfur. In addition, Samples AGS-4, AGS-7, BGS-2, and BGS-4 were analyzed for sulfur fractionation.

RESULTS AND DISCUSSION

Bedrock sampling results were received from SES on November 06, 2006, and are included as Attachment C. In summary, all of the samples have a Fizz of 0, are generally light gray in color, and have a paste pH of between 6.0 and 6.7. Four of the six samples have a sulfur concentration of 0.001% or less. BGS-1 (0.012% S) and BGS-4 (0.021% S) contained the highest amounts of sulfur. Sulfur fractionation

analyses of AGS-4, AGS-7, BGS-2, and BGS-4 measured a variation in the total sulfur for all four samples. This is interpreted to be a result of natural variability the sample, and to be associated with the sulfur distribution associated with the size of the sample.

NP is a presumed to be a measure of carbonate minerals, exchangeable bases and weatherable silicate minerals to produce an index of available acid neutralizers in the rock. Formulas to calculate Maximum Potential Acidity (MPA) and Net Neutralization Potential (NNP) from percent total sulfur and Neutralization Potential (NP) are:

$$\text{MPA} = \%S \times 31.25$$

$$\text{NNP} = \text{NP} - \text{MPA}$$

The formula for MPA assumes that sulfide sulfur is the only acid generating source, with sulfate and organic sulfur assumed to be nonacid generating. In addition, the MPA formula assumes that carbon dioxide gas is exsolved and no carbonic acid is generated.

Guidelines from the Pennsylvania DEP on the interpretation of analytical results used for acid base accounting (ABA) are listed on Sheet 3. Comparison of the Sheet 3 criteria to the analytical results from A Ridge and B Ridge are summarized as follows:

- Rocks with NNP (Excess CaCO_3) less than -5 ppt are potentially toxic - *All samples have a NNP greater than 2 ppt;*
- Rocks with pH <4.0 are considered acid toxic - *All samples have a pH of 6.0 or greater;*
- Rocks with greater than 0.5% sulfur may generate significant acidity - *All samples have less than 0.025% total Sulfur;*
- Rocks with NP >30 ppt CaCO_3 and Fizz are a significant source of alkalinity - *All samples have an NP less than 12 ppt;*
- Rocks with NNP >20 ppt CaCO_3 produce alkaline drainage - *All samples have an NNP less than 12 ppt;*
- Rocks with NNP less than -20 ppt CaCO_3 produce acid drainage - *All samples have an NNP greater than 2.3 ppt;*

- Rocks with NNP greater than 0 ppt CaCO_3 do not produce acid - *All samples have an NNP greater than 2.3 ppt;*
- NP/MPA ratio less than 1 likely results in acid drainage - *Ratios vary from 7.2 to 329.7 for analyzed samples;* and
- Theoretical NP/MPA ratio of 2 or greater is needed for complete acid neutralization - *Ratios vary from 7.2 to 329.7 for Sample BGS-2 for analyzed samples.*

In summary, using the above acid base accounting criteria, the rock samples analyzed from the A Ridge and B Ridge areas are not considered toxic for either alkalinity or acidity. Sheet 4 compares the NNP values to acid producing (<20 ppt CaCO_3) and alkaline producing (>20 ppt CaCO_3) conditions, and compares the NP/MPA ratios calculated for the six locations to the theoretical ratio (2 or greater) needed for complete acid neutralization. Based on mapping by others and our observations from this geological reconnaissance, we interpret the rock samples submitted to SES to be generally representative of the bedrock in the A Ridge and B Ridge areas, and therefore the results from the acid-base accounting are also representative.


If future work in the area should encounter rock types containing significant amounts of sulfide or carbonate minerals, then additional sampling and analyses may be warranted. Field observations of rock types and sulfide minerals should be noted during the evaluation of the bedrock during future site evaluation and development activities (geotechnical investigation).

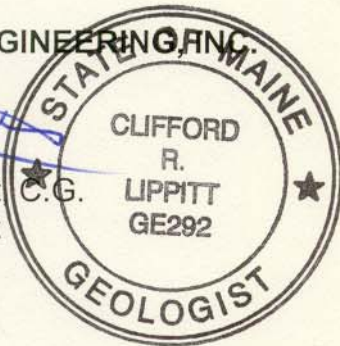
CLOSING

It has been a pleasure to assist you in this matter. If you have any questions, please contact us.

Very truly yours,

S. W. COLE ENGINEERING, INC.


Clifford R. Lippitt
Senior Geologist



CRL:cr/slh

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SHEET 1 – BEDROCK GEOLOGY WESTERN MAINE

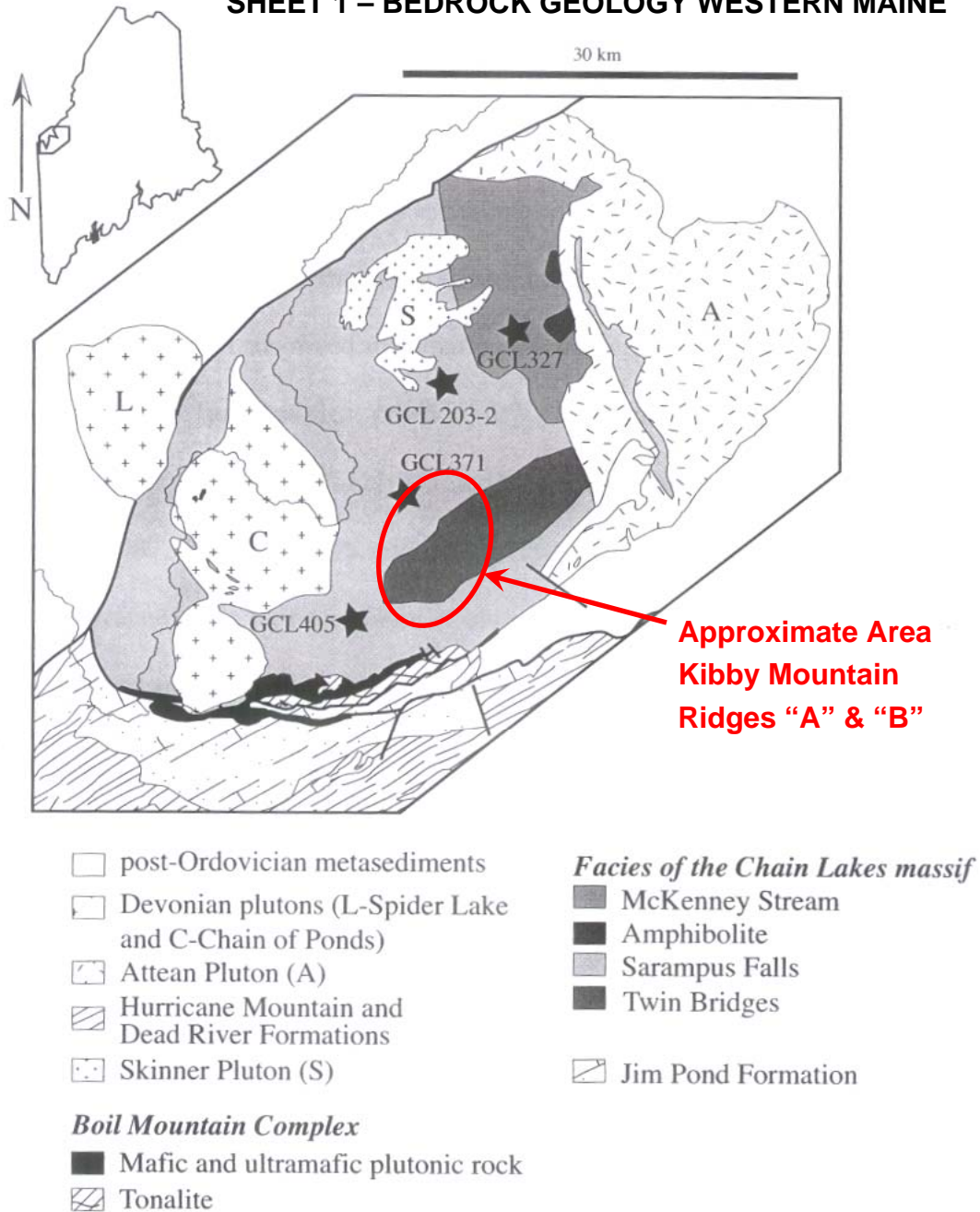
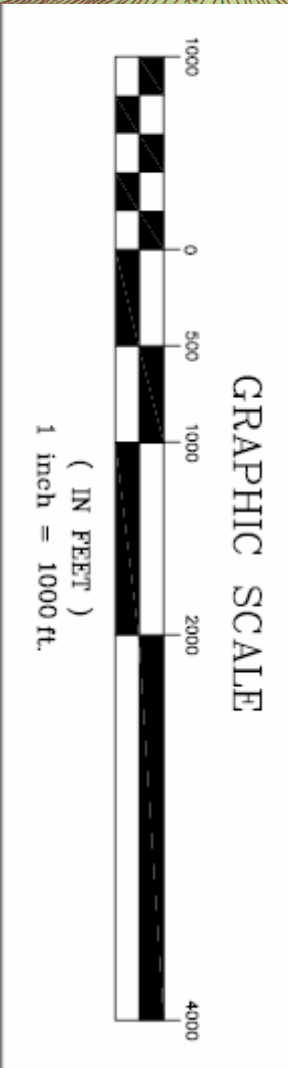
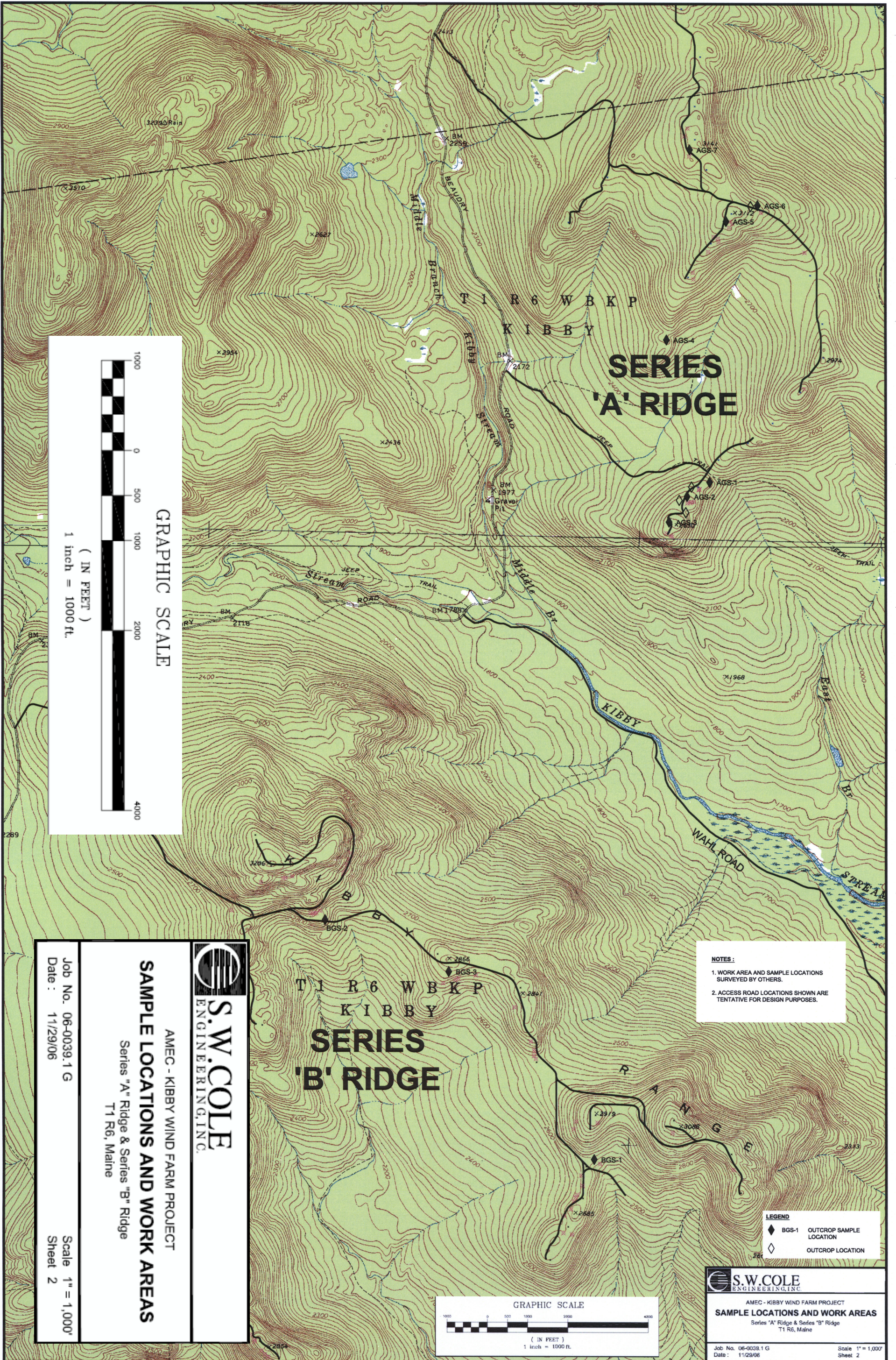


Figure 2.2 Bedrock geologic map of the Chain Lakes massif and surrounding area. Heavy lines mark faults; dotted line represents the international border. Stars and labels refer to geochronologic sample locations. Isolated amphibolite units within Sarampus Falls facies are too small to show at this scale. After Albee and Boudette (1972), Goldsmith (1985), Osberg et al. (1985) Boudette (1991), Moench et al. (1995).

SHEET 2
SAMPLE LOCATIONS AND WORK AREAS




NOTES:

1. WORK AREA AND SAMPLE LOCATIONS SURVEYED BY OTHERS.
2. ACCESS ROAD LOCATIONS SHOWN ARE TENTATIVE FOR DESIGN PURPOSES.

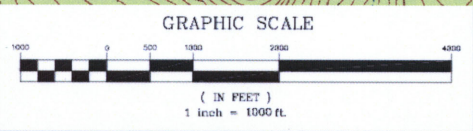
LEGEND


- ◆ BGS-1 OUTCROP SAMPLE LOCATION
- ◇ OUTCROP LOCATION


S.W. COLE
 ENGINEERING, INC.

AMEC - KIBBY WIND FARM PROJECT
SAMPLE LOCATIONS AND WORK AREAS
 Series "A" Ridge & Series "B" Ridge
 T1 R6, Maine

Job No. 06-0039.1 G Scale 1" = 1,000'
 Date: 11/29/06 Sheet 2




S.W. COLE
 ENGINEERING, INC.

AMEC - KIBBY WIND FARM PROJECT
SAMPLE LOCATIONS AND WORK AREAS
 Series "A" Ridge & Series "B" Ridge
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Job No. 06-0039.1 G Scale 1" = 1,000'
 Date: 11/29/06 Sheet 2

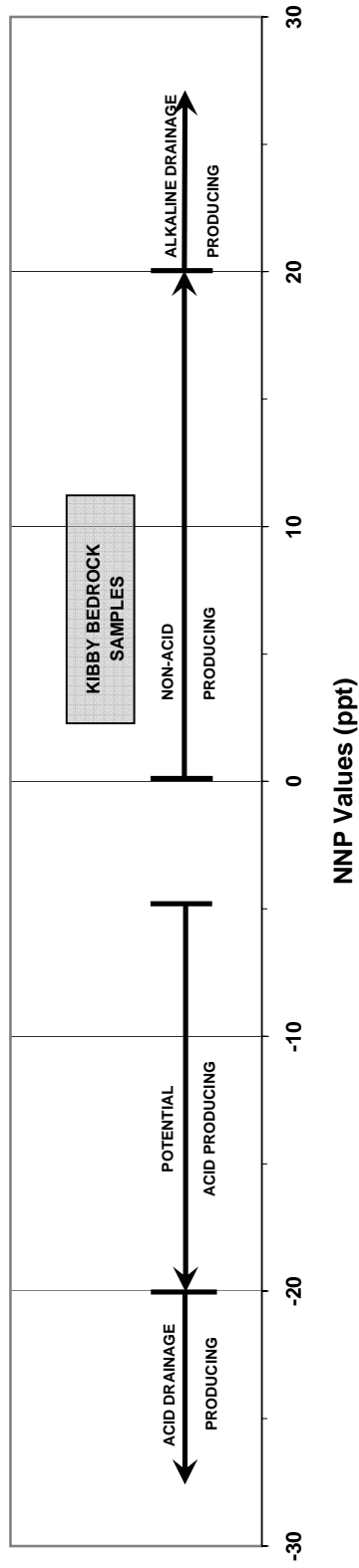
Sheet 3 - Summary of Suggested Criteria for Interpreting Acid-Base Accounting ⁽¹⁾

CRITERIA	APPLICATION	REFERENCE
Rocks with NNP less than -5 ppt CaCO ₃ are considered potentially toxic.	Coal overburden rocks in northern Appalachian basin for root zone media in reclamation; mine drainage quality.	Smith et al., 1974, 1976; Surface Mine Drainage Task Force, 1979; Skousen et al., 1987
Rocks with paste pH less than 4.0 are considered acid toxic.	Coal overburden rocks in northern Appalachian basin for root zone media, mine drainage quality. Base and precious metal mine waste rock in Australia and southeast Asia.	Smith et al., 1974, 1976; Surface Mine Drainage Task Force, 1979 Miller and Murray, 1988
Rocks with greater than 0.5% sulfur may generate significant acidity.	Coal overburden rocks in northern Appalachian basin, mine drainage quality. Base and precious metal mine waste rock in Australia and southeast Asia.	Brady and Hornberger, 1990 Miller and Murray, 1988
Rocks with NP greater than 30 ppt CaCO ₃ and "fizz" are significant sources of alkalinity.	Coal overburden rocks in northern Appalachian basin, mine drainage quality.	Brady and Hornberger, 1990
Rocks with NNP greater than 20 ppt CaCO ₃ produce alkaline drainage.	Coal overburden rocks in northern Appalachian basin. Base and precious metal mine waste rock and tailings in Canada.	Skousen et al., 1987; British Columbia Acid Mine Drainage Task Force, 1989; Ferguson and Morin, 1991
Rocks with NNP less than -20 ppt CaCO ₃ produce acid drainage.	Base and precious metal mine waste rock and tailings in Canada.	British Columbia Acid Mine Drainage Task Force, 1989; Ferguson and Morin, 1991
Rocks with NNP greater than 0 ppt CaCO ₃ do not produce acid. Tailings with NNP less than 0 ppt CaCO ₃ produce acid drainage.	Base and precious metal mine waste rock and tailings in Canada.	Patterson and Ferguson, 1994; Ferguson and Morin, 1991
NP/MPA ratio less than 1 likely results in acid drainage.	Base and precious metal mine waste rock and tailings in Canada.	Patterson and Ferguson, 1994; Ferguson and Morin, 1991
NP/MPA ratio is classified as less than 1, between 1 and 2, and greater than 2.	Base and precious metal mine waste rock and tailings in Canada.	Ferguson and Robertson, 1994
Theoretical NP/MPA ratio of 2 is needed for complete acid neutralization.	Coal overburden rocks in northern Appalachian basin, mine drainage quality.	Cravotta et al., 1990
Use actual NP and MPA values as well as ratios to account for buffering capacity of the system.	Base metal mine waste rock, United States.	Filipek et al., 1991

(1) Criteria in this table were developed for classification of individual rock samples

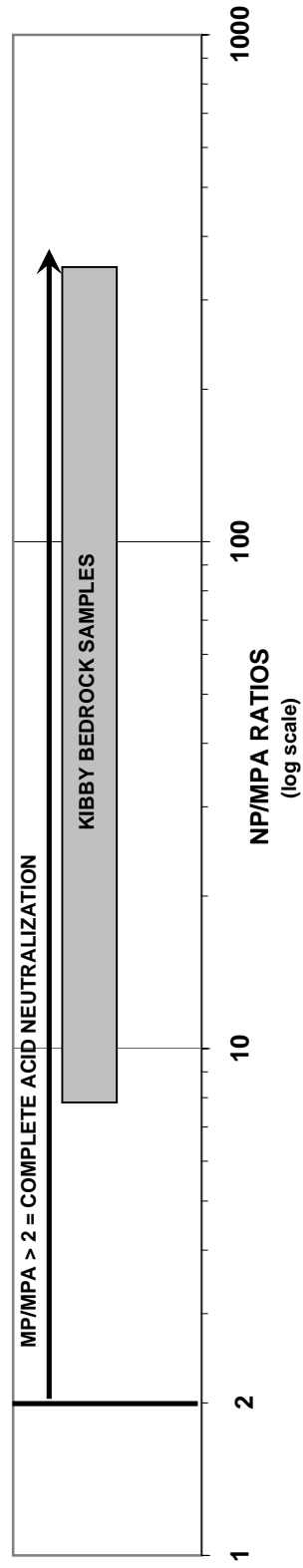
SHEET 4

NET NEUTRALIZATION POTENTIAL (NNP)
KIBBY WIND POWER PROJECT



*Reference Sturm Environmental Services Laboratory Results (Attachment C)
Acid base accounting criteria from Perry 1998 (see Sheet 3)
All paste pH values range between 6.0 and 6.7

NP/MPA RATIOS FOR COMPLETE ACID NEUTRALIZATION
KIBBY WIND POWER PROJECT



ATTACHMENT A

Attachment A Limitations

This report has been prepared for the exclusive use of AMEC Earth & Environmental and Kibby Wind Power LLC for specific application to evaluation of the acid generation potential in the Series A Ridge and Series B Ridge areas of the Kibby Wind Power Project in Kibby & Skinner Townships (T1 R6 WBKP), Maine. S. W. COLE ENGINEERING, INC. has endeavored to conduct the work in accordance with generally geological practices. No warranty, expressed or implied, is made.

The bedrock descriptions are based on visual observations of outcrop samples. Variations in bedrock composition and texture may occur as referenced in the report. Geological mapping is based on work performed by others.

Observations have been made during exploration work to assess bedrock acid producing potential in the area investigated. Results may vary by location within the area of investigation and for other areas not included in this investigation.

ATTACHMENT B



ROCK VISUAL CLASSIFICATION

DATE 10/23-10/26/2006

PROJECT NUMBER

06-0039.1

Location	Sample ID	Visual Description/Classification	Lab Test
A Ridge	AGS-1	Quartz-biotite Feldspar (plag & K-spar) Some biotite alteration/oxidation; tr sillimanite/staurolite; -trace sulfide (Twin Bridges Facies)	
A Ridge	AGS-2	Quartz-biotite Feldspar (plag) Wispy banded; Some chloritic alteration remobilized Quartz, /oxidation; -trace sulfide (Sarampus Falls Facies)	
A Ridge	AGS-3	Quartz-plagioclase biotite; Wispy fine banded; some chloritic alteration remobilized Quartz, /oxidation; -trace pyrite ? arsenopyrite (Sarampus Falls Facies)	ABA
A Ridge	AGS-4	Banded - Quarts-plagioclase biotite; remobilized Quartz as nodules; aeration halo ± 0.3 inches; (Twin Bridges Facies)	ABA/SF
A Ridge	AGS-5	Quartz-plagioclase biotite; banded; ± sillimanite/staurolite; local remobilized Quartz as nodules, trace sulfides; trace garnet; (Sarampus Falls Facies)	
A Ridge	AGS-6	Quartz-plagioclase mica (musc./bio); no banding; trace sillimanite, manganese coatings on joints; trace sulfide; possible inclusion in Twin Bridges facies; (McKenney Stream Facies?)	
A Ridge	AGS-7	Quartz-plagioclase biotite; banded gneiss; plastic deformation, trace garnet; trace pyrite; - trace arsenopyrite (Twin Bridges Facies)	ABA/SF
	Ledge Hil	Quartz Diroite; quartz nodules, equigranular; massive (? Amphibolite Facies)	
	Sarampus Falls	Gray equigranular granodiorite; Quarts-plagioclase biotite; plastic deformation (? McKenney Stream/Sarampus Falls Facies)	
B Ridge	BGS-1	Quartz-mica-Feldspar; Wispy banded; light brown; remobilized Quartz nodules; oxidation near fine pyrite and biotite (Sarampus Falls Facies)	ABA
B Ridge	BGS-2	Quartz-mica-Feldspar; Banded; sillimanite; remobilized Quartz nodules; trace sulfide in biotite banding (? Twin Bridges Facies)	ABA/SF
B Ridge	BGS-3	Quartz-mica-Feldspar; Banded; sillimanite; large Quartz nodules; trace sulfide with oxidation in biotite banding (? Twin Bridges Facies)	
B Ridge	BGS-4	Quartz-mica-Feldspar; Banded; sillimanite; remobilized Quartz nodules; trace sulfide with oxidation; Plastic Deformation (Twin Bridges Facies)	ABA/SF

Comments: Visuals by CRL 11-1-2006; ABA=Acid-Base-Accounting parameters; SF=Sulfur fractionation

Geologist: CRL

VIEW FROM ACCESS TO BGS-4 - LOOKING WEST



OUTCROP SAMPLING AT BGS-1



ACCESS TO BGS-4



OUTCROP NEAR BGS-4

AGS-3



AGS-1



AGS-2



STANDING ON OUTCROP AT AGS-3

AGS-7



AGS-4



AGS-6



AGS-4



BGS-4



BGS-2



BGS-3



BGS-1

ATTACHMENT C

Sturm Environmental Services

COMPANY: S.W. COLE ENGINEERING INC
 SITE:
 DATE: NOVEMBER 1, 2006

RECEIVED
 NOV 09 2006
 S.W. COLE

Calcium Carbonate Equivalent
 Tons/1000 Tons of Material (ppt)

ACID - BASE ACCOUNT

Sample ID	Depth (feet)	Strata Thick (feet)	Rock Type	Fiz	Color	% S	Max. From % S	N.P. CaCO ₃ Equiv.	Max. Needed (pH-7)	Excess CaCO ₃	Paste pH
10/23/06 AGS-3				0	5Y 7/1 <i>Light Gray</i>	.001	.03	7.65		7.62	6.1
10/23/06 AGS-4				0	5Y 6/1 <i>Gray</i>	.001*	.03	6.98		6.95	6.6
10/24/06 AGS-7				0	2.5Y 7/1 <i>Light Gray</i>	.001*	.03	4.67		4.64	6.0
10/24/06 BGS-1				0	10YR 7/3 <i>V. Pale Brown</i>	.012	.38	2.72		2.34	6.7
10/25/06 BGS-2				0	2.5Y 7/2 <i>Lt Gray</i>	<.001*	.03	9.89		9.86	6.5
10/26/06 BGS-4				0	5Y 7/2 <i>Lt Gray</i>	.021*	.66	12.08		11.42	6.4

* PYRITIC SULFUR

MPA = %S * 31.25

Approved: 

