Final Environmental Assessment and Notice of Wetland Involvement for the Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA 1705

Appendix D - Phase I Archaeological Investigation, Frontier Renewable Resources, Kinross Charter Township, Chippewa County, Michigan, AECOM October 2010

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 21, 2010

Mr. Brian Grennell
Cultural Resource Protection Specialist
Michigan State Historic Preservation Office
P.O. Box 30740
Lansing, Michigan 48909-8240

Dear Mr. Grennell,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

The proposed biorefinery would utilize approximately 1,440 bone-dry tons per day of hardwood pulpwood to eventually produce up to 40 million gallons per year of anhyrdrous ethanol. Co-products, such as the lignin and spent cullose from the process, would either be sold or used to produce steam and electricity in a biomass boiler. Feedstock would consist of hardwood pulpwood within the Michigan counties with a 150-mile radius of the site.

The proposed project site comprises a 355 acre plot of land in Kinross Township of Chippewa County, Michigan, Township 45 North, Range 01 West, Sections 21 and 28. It lies approximately one-half mile northeast of Kinross. The attached Site Location Map (Exhibit 1) provides an overview of the general property and access to area roads. Frontier plans to construct the plant on approximately 50 acres located within the southern 160 acres.

The proposed site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails. A snowmobile trail runs along the west boundary of the property and cross a small portion of the northwest corner. Exhibit 2 presents the Site layout.

The expected Area of Potential Effects would be the 160 acre project site plus the rail corridor from the site to the existing rail line (Exhibit 3). The National Register of Historic Places (NRHP) lists 31 resources in Chippewa County, Michigan, mostly in Sault Saint Marie. DOE concludes that there are no known historic properties within the proposed project's Area of Potential Effects. The nearest listed site on the NRHP is the Kinross Township Hall and School, approximately two miles east of the proposed Frontier site.

In compliance with 36 CFR Part 800.4(d) (1), the Department of Energy asks the Michigan State Historic Preservation Office for its concurrence of this finding. Attached to facilitate your

Federal Recycling Program Printed on Recycled Paper

review is the requisite Michigan State Historic Preservation Office Section 106 Project Review Form.

DOE's Golden Office is preparing a draft environmental assessment (EA) for this project. DOE will include correspondence with your office in an appendix to the EA. The draft EA will be posted in the DOE Golden Field Office online reading room: http://www.eere.energy.gov/golden/reading room.aspx. DOE will send a Notice of Availability for the draft EA, when available, to your office and respond to any specific comments you may have. . Please contact DOE if you would like to receive a hardcopy of the draft EA. At this time we anticipate a 15-day public comment period for this proposed project.

Please forward the results of your review and any requests for additional information to me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

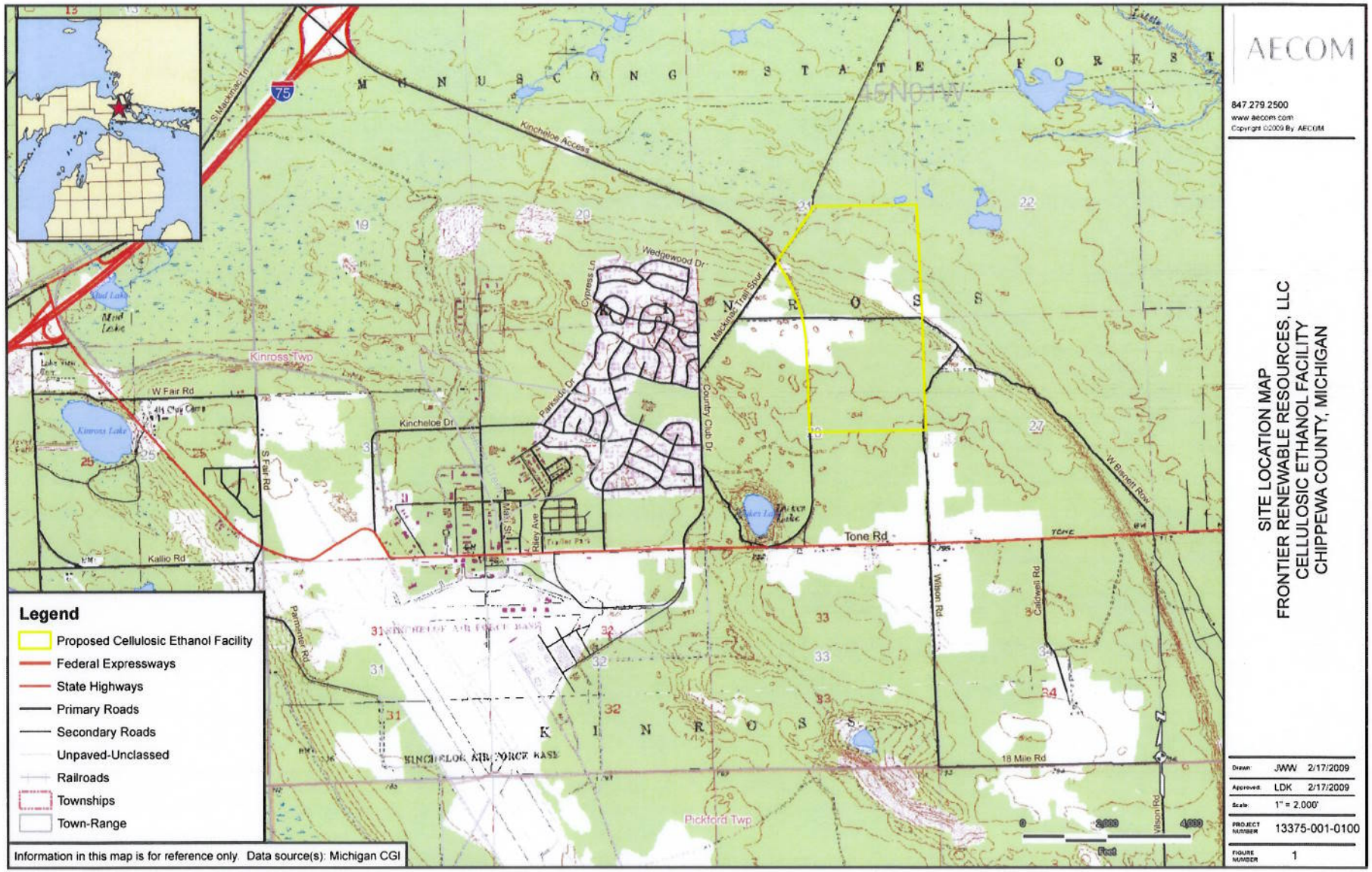
Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

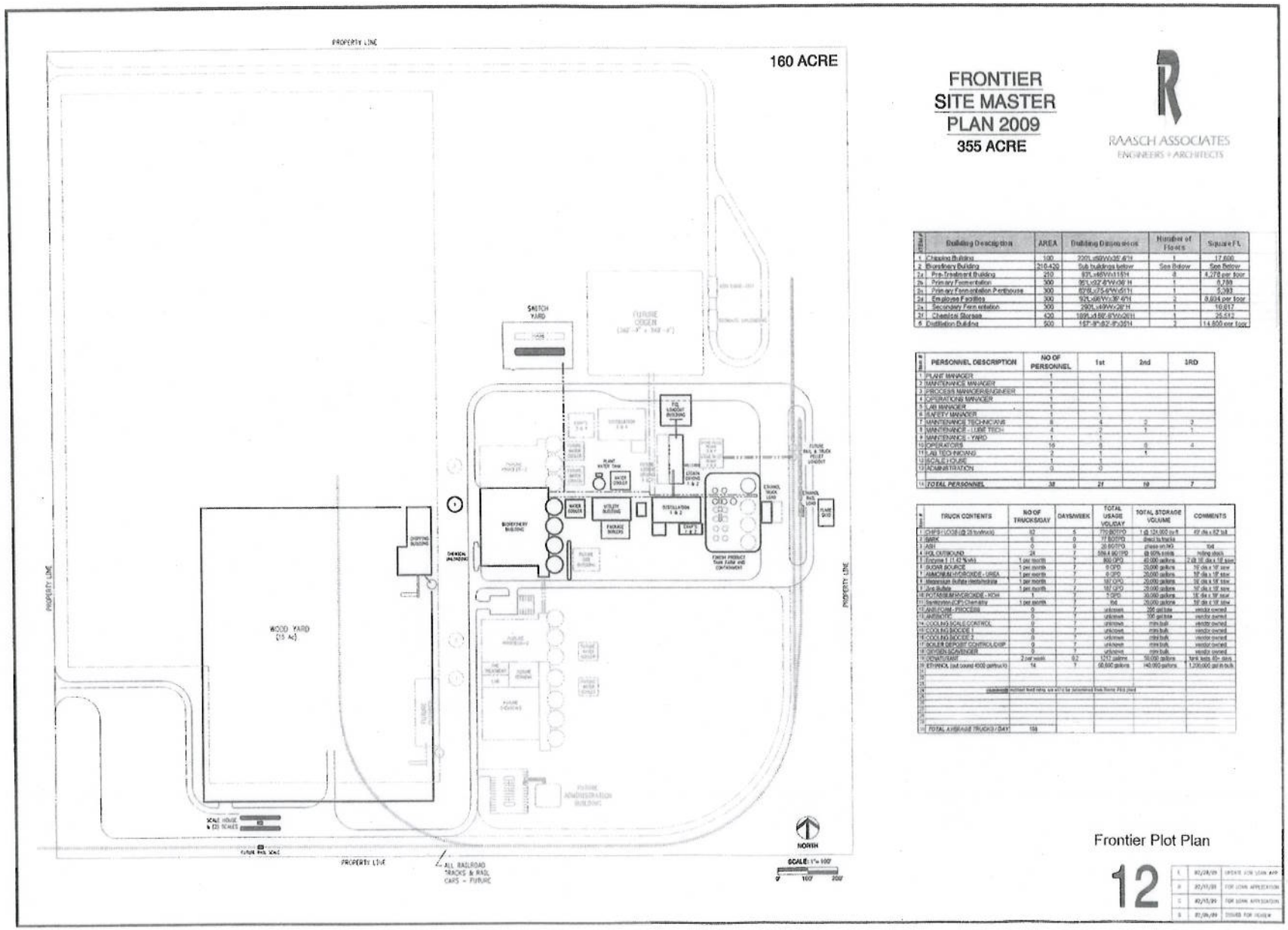
Attachments
Exhibit 1 – Site location map
Exhibit 2 – Site layout plan
Exhibit 3 – Proposed rail corridor
Michigan State Historic Preservation Office Section 106 Project Review Form



Source: AECOM. Site Location Map

1 Mascoma Location

Exhibit 1. Proposed project location.



Item #	Building Description	AREA	Building Dimensions	Number of Floors	Square Ft.
1	Chipping Building	100	220'L x60'W x35'4"H	1	17,600
2	Biorefinery Building	210-420	Sub buildings below	See Below	See Below
2a	Pre-Treatment Building	210	93'L x46'W x115'H	3	4,278 per floor
2b	Primary Fermentation	300	95'L x32'4"W x36'H	1	6,789
2c	Primary Fermentation Penthouse	300	62'6L x75'4"W x55'H	1	5,391
2d	Employee Facility	300	93'L x46'W x36'4"H	2	8,834 per floor
2e	Secondary Fermentation	300	290'L x49'W x28'H	1	10,817
2f	Chemical Storage	420	109'L x182'8"W x26'H	1	25,512
6	Distillation Building	500	157'-8"x82'-8"x35'H	3	14,800 per floor

Item #	PERSONNEL DESCRIPTION	NO OF PERSONNEL	1st	2nd	3RD
1	PLANT MANAGER	1	1		
2	MAINTENANCE MANAGER	1	1		
3	PROCESS MANAGER/ENGINEER	1	1		
4	OPERATIONS MANAGER	1	1		
5	LAB MANAGER	1	1		
6	SAFETY MANAGER	1	1		
7	MAINTENANCE TECHNICIANS	8	4	2	2
8	MAINTENANCE - LUBE TECH	4	2	1	1
9	MAINTENANCE - YARD	1	1		
10	OPERATORS	16	8	8	4
11	LAB TECHNICIANS	2	1	1	
12	SCALE HOUSE	1	1		
13	ADMINISTRATION	0	0		
14	TOTAL PERSONNEL	38	21	10	7

Item #	TRUCK CONTENTS	NO OF TRUCKS/DAY	DAYS/WEEK	TOTAL USAGE VOL/DAY	TOTAL STORAGE VOLUME	COMMENTS
1	CHPS (COB) @ 28 tons/truck	62	5	770 BDTPD	1 @ 124,000 cu ft	49' dia x 62' tall
2	BARK	0	0	77 BDTPD	direct to trucks	
3	ASH	0	0	28 BDTPD	grass on NG	tbd
4	ROL OUTBOUND	24	7	584.4 BDTPD	@ 50% solids	rolling stock
5	Enzyme 1 (1.42 lb/gal)	1 per month	7	800 GPD	40,000 gallons	2 @ 16' dia x 16' long
6	SUGAR SOURCE	1 per month	7	0 GPD	20,000 gallons	16' dia x 16' long
7	AMMONIUM HYDROXIDE - UREA	1 per month	7	0 GPD	20,000 gallons	16' dia x 16' long
8	Magnesium Sulfate Heptahydrate	1 per month	7	187 GPD	20,000 gallons	16' dia x 16' long
9	Zinc Sulfate	1 per month	7	187 GPD	20,000 gallons	16' dia x 16' long
10	POTASSIUM HYDROXIDE - KOH	1	7	5 GPD	20,000 gallons	16' dia x 16' long
11	Sanitization (CIP) Chemistry	1 per month	7	tbd	20,000 gallons	16' dia x 16' long
12	ANTIFOAM - PROCESS	0	7	unknown	200 gal tote	vendor owned
13	ANTISTATIC	0	7	unknown	200 gal tote	vendor owned
14	COOLING SCALE CONTROL	0	7	unknown	mini bulk	vendor owned
15	COOLING BIOCIDE 1	0	7	unknown	mini bulk	vendor owned
16	COOLING BIOCIDE 2	0	7	unknown	mini bulk	vendor owned
17	BOILER DEPOSIT CONTROL/DISP	0	7	unknown	mini bulk	vendor owned
18	OXYGEN SCAVENGER	0	7	unknown	mini bulk	vendor owned
19	CONATURAL	2 per week	0.2	1212 gallons	50,000 gallons	tank lasts 40+ days
20	ETHANOL (est round 4000 gal/truck)	14	7	56,000 gallons	140,000 gallons	1,200,000 gal in bulk
21						
22						
23						
24	[illegible]					
25						
26						
27						
28						
29						
30	TOTAL AVERAGE TRUCKS / DAY	156				

Source: Raasch Associates, Frontier Site Master Plan 2009

Exhibit 2. Proposed site plan.

Source: AECOM

3 Mascoma Rail

Exhibit 3. Proposed rail corridor.

JENNIFER GRANHOLM
GOVERNOR

STATE OF MICHIGAN
MICHIGAN STATE HOUSING DEVELOPMENT AUTHORITY
LANSING

GARY HEIDEL
EXECUTIVE DIRECTOR

November 3, 2010

RECEIVED NOV 0 8 2010

KRISTIN KERWIN
U S DEPARTMENT OF ENERGY
1617 COLE BOULEVARD
GOLDEN CO 80401

RE: ER-10-734 Frontier Renewable Resources Cellulose to Ethanol Biorefinery Project, Sections 19-21, 29 & 30, T45N, R1W, Kinross Charter Township, Chippewa County. (DOE)

Dear Ms. Kerwin:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. Based on the information provided for our review, it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking.

The views of the public are essential to informed decision making in the Section 106 process. Federal Agency Officials or their delegated authorities must plan to involve the public in a manner that reflects the nature and complexity of the undertaking, its effects on historic properties and other provisions per 36 CFR § 800.2(d). We remind you that Federal Agency Officials or their delegated authorities are required to consult with the appropriate Indian tribe and/or Tribal Historic Preservation Officer (THPO) when the undertaking may occur on or affect any historic properties on tribal lands. **In all cases**, whether the project occurs on tribal lands or not, Federal Agency Officials or their delegated authorities are also required to make a reasonable and good faith effort to identify any Indian tribes or Native Hawaiian organizations that might attach religious and cultural significance to historic properties in the area of potential effects and invite them to be consulting parties per 36 CFR § 800.2(c-f).

This letter evidences DOE's compliance with 36 CFR § 800.4 "Identification of historic properties", and the fulfillment of DOE's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected".

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking. If the scope of work changes in any way, or if artifacts or bones are discovered, please notify this office immediately.

If you have any questions, please contact Brian Grennell, Cultural Resource Protection Specialist, at (517) 335-2721 or by email at ER@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Martha MacFarlane Faes
Deputy State Historic Preservation Officer

for Brian D. Conway
State Historic Preservation Officer

MMF:DLA:nhn

Copy: Amy Ollendorf, AECOM Technical Services, Inc.

Environment

Submitted to:
Frontier Renewable Resources LLC
Marquette, Michigan

Submitted by:
AECOM
Minneapolis, Minnesota
60140061
October 2010

Phase I Archaeological Investigation

Frontier Renewable Resources
Kinross Charter Township, Chippewa County, Michigan

Environment

Submitted to:
Frontier Renewable Resources LLC
Marquette, Michigan

Submitted by:
AECOM
Minneapolis, MN
60140061
October 12, 2010

Phase I Archaeological Investigation
Frontier Renewable Resources
Kinross Charter Township, Chippewa County, Michigan

Amy L. Ollendorf, Ph.D., P.G., R.P.A. and Michael M. Gregory, Ph.D.
Prepared By

Christopher White
Reviewed By

Contents

1.0 Introduction 1-1

2.0 Environmental History 2-1
2.1.1 Geology 2-1
2.1.2 Landforms 2-2
2.1.3 Flora and Fauna 2-2
2.2 Soils of the APE 2-4

3.0 Culture History 3-1
3.1 Prehistory 3-1
3.1.1 Paleoindian Tradition: 13,400 B.P. to 10,000 B.P. 3-1
3.1.2 Archaic Tradition: 10,000 B.P. to 2500 B.P. 3-1
3.1.3 Woodland Tradition: 2800 B.P. to 750-700 B.P. 3-3
3.2 Historical Native American Occupation 3-4
3.3 Euro-American Settlement and Development 3-5

4.0 Previous Investigations 4-1

5.0 Methodology 5-1
5.1 Background Research 5-1
5.2 Predictive Model 5-1
5.3 Field Methods 5-2
5.3.1 Lower 160 5-3
5.3.2 West End 5-3

6.0 Results 6-1

7.0 Recommendations 7-1

8.0 References Cited 8-1

List of Appendices

Appendix A Figures

List of Tables

Table 1. Soils of the APE as Mapped by the USDA-NRCS 2-4
Table 2. Previous Investigators' Definitions of High-Probability Areas, Methods, and Results 4-2
Table 3. Predictive Model Parameters and Extents of Probability Areas 5-2

List of Figures

Figure 1. Project Location Map A-1
Figure 2. Landownership Map A-2
Figure 3. Predictive Model A-3
Figure 4. Map Showing Shovel Test Locations and Transects in Lower 160 ..... A-4
Figure 5. Map Showing Shovel Test Locations and Transect in West End A-5
Figure 6. Photograph of Vegetation and Coverage Typical in Lower 160 ..... A-6
Figure 7. Photograph of Vegetation and Coverage in Pine Plantation Portion of APE A-7
Figure 8. Photograph of Vegetation and Coverage Typical in the West End A-8
Figure 9. Photograph Under Powerline Bifurcating West End Portion of the APE A-9
Figure 10. Photograph of Modern Transportation-Related Debris Pile A-10
Figure 11. Typical Shovel-Test Profile in the Lower 160 ..... A-11

List of Acronyms

aka	also known as
AECOM	AECOM Technical Services, Inc.
APE	Area of Potential Effect
cmbgs	centimeters below ground surface
CCC	Civilian Conservation Corps
DNRE	Michigan Department of Natural Resources & Environment
DOE	U.S. Department of Energy
EA	Environmental Assessment
ESA	Environmental Site Assessment
Frontier	Frontier Renewable Resources LLC
GIS	Geographic Information System
GLO	U.S. General Land Office
GPS	Global Positioning System
HIG	Historical Information Gatherers, Inc.
HIS	Hopewell Interaction Sphere
HPA	High-Probability Area
LPA	Low-Probability Area
MPA	Moderate-Probability Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OSA	Office of the State Archaeologist
SHPO	State Historic Preservation Office

UP	Upper Peninsula of Michigan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service

Executive Summary

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30.

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters. AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the high- and moderate-probability areas comprising the West End. No cultural resources were encountered in any of the shovel tests. Because AECOM's Phase I archaeological field survey provided adequate coverage of high- and moderate-probability areas in the APE with unanimously negative findings for cultural resources, no further archaeological survey is recommended for the APE, including the three (3) remaining high-probability areas and two (2) moderate-probability areas in the proposed railroad spur on state-owned lands. Consequently, AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

1.0 Introduction

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30 (**Figure 1**).

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

Land-ownership of the project area is divided among the State of Michigan, Kinross Charter Township, and Frontier (**Figure 2**). The Department of Natural Resources & Environment (DNRE) has jurisdiction over state-owned lands in the project area – portions of the proposed railroad spur. Kinross Charter Township owns the majority of the remainder of lands proposed for the railroad spur, but Frontier owns the land that will be utilized over a short segment at the western terminus of the spur and the land where the ethanol facility will be constructed. No federal or tribal lands comprise the project area. However, two consent decrees were issued by the U.S. District Court, Western District of Michigan, Southern Division to resolve legal claims of five federally recognized American Indian tribes against the State of Michigan in regard to access and management of lands and waters ceded to the U.S. in the 1836 *Treaty with the Ottawa, Etc.* The 2007 *Inland Consent Decree* and 2000 *Fishing Consent Decree* pertain to ceded lands and waters, respectively. Under the terms of these consent decrees, the DNRE coordinates with federally recognized tribes for access to lands and waters under the state's jurisdiction (i.e., DNRE and Kinross Charter Township lands and waterbodies in the APE.

AECOM completed background research and records review at the Office of the State Archaeologist (OSA) in Lansing, Michigan on August 25, 2010 and September 8, 2010. OSA research was completed

by Mr. Craig Simon of AECOM's Lansing office. Field work was completed on non-state-owned lands in sections 28 and 30 on September 20-23, 2010 while a DNRE *Permit to Perform Archaeological Exploration on State-Owned Lands* was pending. Field crew consisted of Mr. Dan Surface, Ms. Hilary Powell, Dr. Michael Gregory, and Dr. Ollendorf.

2.0 Environmental History

2.1.1 Geology

The Upper Peninsula (UP) of Michigan is bordered by three of the Great Lakes – Superior, Michigan, and Huron. The UP is located in the Interior Plains Physiographic Division of the Central Lowland Province, Eastern Lake Section, and Laurentian Physiographic Division of the Superior Upland Province (Jerome 2006). Elevations throughout the UP range from approximately 600 feet along the Great Lakes to 1,900 feet inland (Jerome 2006).

Interior Plains Physiographic Division

The Interior Plains originally formed when cratons collided and welded together 1.8–1.9 billion years ago during the Paleoproterozoic Era (2.5-1.0 billion years ago). Approximately 1.1 billion years ago, the plates again began to stir with a hot spot under what is now western Lake Superior, forcing the continental crust to split. The Midcontinent Rift formed and enormous quantities of basaltic lava spilled onto the surface. The rifting never fully pulled the continent apart and by the late Middle Proterozoic, about 1.0 billion years ago, the tectonism of the Lake Superior area halted, never to resume (Ottke 1999). Precambrian metamorphic and igneous rocks now form the basement of the Interior Plains and make up the stable nucleus of North America. Except for the Black Hills of South Dakota, the entire region has low relief, reflecting more than 500 million years of relative tectonic stability.

The Interior Plains were often covered by shallow inland seas. Sediments from the Canadian Shield and the Rocky Mountains were deposited in these seas over millions of years. Eventually the sediments were compressed by the weight of the layers above into sedimentary rock formations. Part of the sedimentary rock deposited in these areas consists of coral reefs that formed close to the surface of seas during the Paleozoic era.

Throughout the Paleozoic Era and subsequent Mesozoic Era, the mostly low-lying Interior Plains region remained relatively unaffected by the mountain-building tectonic collisions occurring on the western and eastern margins of the continent. During much of the Mesozoic, the North American continental interior was mostly well above sea level, with two major exceptions. During part of the Jurassic period, rising seas flooded the low-lying areas of the continent; in the Cretaceous period, much of the Interior Plains region lay submerged beneath the Western Interior Seaway.

The Interior Plains continued to receive deposits from the eroding Rocky Mountains to the west and Appalachian and Ozark/Ouachita Mountains to the east and south throughout the era. The flatness of the Interior Plains is a reflection of the platform of mostly flat-lying marine and stream deposits laid down in the Mesozoic and Cenozoic eras.

Laurentian Physiographic Division

This physiographic area is the oldest portion of the North American continent, the backbone so to speak. It is made up primarily of ancient Precambrian igneous, metamorphic, and sedimentary rock. With the exception of the river valleys and lacustrine basins, it is a rolling to mountainous peneplain that ranges from 800 feet to 1400 feet above sea level.

2.1.2 Landforms

Landforms in the UP are a product of glaciers that occupied the region during the last Ice Age (Pleistocene Epoch). During the Wisconsinan glacial stage, the entire UP was covered with a thick ice sheet that carried glacial drift. The variety of landforms visible on today's ground surface is the result of massive deposition of glacial drift as the ice sheet melted and receded northward. Approximately 9500 to 11,000, Glacial Lake Algonquin covered a large portion of the UP, including most of the eastern half of the UP (Jerome 2006). Numerous areas of sandy or clayey lacustrine deposits are sediments from this glacial lake (i.e., glaciolacustrine deposits). Some of the deposits were covered later by outwash from the melting glacier to the north (i.e., glaciofluvial deposits). Glacial Lake Nippising was the last lake stage to occupy the UP from 4,000 to 6,000 years ago (Jerome 2006). Its shoreline is the closest to the present Great Lakes - the easily recognized ridge or bluff near the present-day beach in many areas.

The landforms in the present APE are Outwash Plain and Lake Plain (Farrand and Bell 1982). According to Jerome (2006:24), the Outwash Plain is extensive and consists of sandy glaciofluvial materials, such as "sand and gravel in well-stratified layers." Soil series associated with the Outwash Plain that occur in the present APE are Kalkaska and Rubicon (see below). The Lake Plain is nearly level and occurs in areas that had been covered by Glacial Lake Algonquin. "In Chippewa and Mackinac counties it consists of well-sorted, fine-textured, stratified [glaciolacustrine] deposits" (Jerome 2006:24).

2.1.3 Flora and Fauna

In the past, the range of available faunal and floral resources associated with the eastern portion of Michigan's Upper Peninsula depended in large part upon prevailing climatic conditions, which at times have experienced significant changes during the past 10,000 years. Beginning approximately 13,000 years before present (B.P.), the climate began to warm as glaciers retreated, and conifers, together with megafauna such as mammoth, dominated much of the upper Midwest's landscape. The Eastern Upper Peninsula Ecoregion was glaciolacustrine-influenced (see above) and remains relatively flat today (Albert 1995).

During the following 2,000 years, the region continued to experience a warming trend that resulted in spruce showing a sharp decline in dominance in the Lower Peninsula where pines and a few hardwoods began to appear by 11,000 B.P. This trend would take another 1,200 years to reach northward into the eastern Upper Peninsula, where the spruce period would be ended by 9500 B.P. (Kapp 1999:51), to be replaced by jack and red pines. White pine would arrive in the area by 8300 B.P. and be followed by hemlock by approximately 6400 B.P. and beech by sometime before 3000 B.P. (Kapp 1999:53).

Across the eastern United States, the climate became even warmer and drier beginning circa 9500 B.P. This trend continued through 1500 B.P., having a significant influence on vegetation (Kapp 1999:53), although depending upon the characteristics of a locale's soil, the warmer and drier conditions could have either accentuated or ameliorated shifts in vegetation. In Michigan, the warmer, drier period dates from about 9000 B.P. to at least 2500 B.P., and while these conditions influenced cyclical changes between the more xerophytic oak forests and mesophytic beech-maple-basswood-mixed hardwood forests of southern Lower Michigan, in northern Lower Michigan and the Upper Peninsula, the period, even at its maximum, is not clearly marked in pollen records. In some areas, an increase in white pines appears to mark a period of dryness beginning about 8000 B.P. and lasting until approximately 5000 B.P. (Kapp 1999:55), but the presence of the pines may be attributed to other factors. An increase in pines across the eastern Upper Peninsula during the drier, warmer conditions may have restricted the availability of subsistence resources, and made the area less desirable to inhabit, especially if more abundant resources could be reaped along coastal zones.

Beginning between 3400 to 3000 B.P., a major vegetation shift occurred throughout the Upper Peninsula with northern hardwood forests (birch, hemlock, maple, and other deciduous species together with white pine) expanding into areas where soils accommodated the trees with good drainage but enough clay to retain moisture during droughts. In addition, a rising water table coupled with increased participation encouraged the creation of widespread marsh formation, as well as the creation of extensive, shallow peat deposits (Kapp 1999:57). This shift marks the onset of cooler conditions, which after 3000 B.P., resulted in the creation of a vegetative cover that existed until after the arrival of Euro-Americans, who prior to circa 1800, were primarily in interested in extracting furs. The original northern hardwood forests in the Eastern Upper Peninsula generally supported a greater diversity of conifers than today, providing structural complexity and a diversity of wildlife habitats (Albert 1995). "Smaller areas of fire-dependent ecosystems such as white pine-red pine forest and jack pine barrens also occurred within this ecoregion. The region continues to support a diversity of wetland natural communities including bog, northern fen, northern wet meadow, hardwood-conifer swamp, rich conifer swamp, and extensive areas of muskeg and patterned fen." Reconstruction from GLO survey data indicate the vegetation of the present project area ca. 1800 consisted of beech-sugar maple-hemlock forest, cedar swamp, and hemlock-white pine forest (Comer and Albert 1997). Only later, after the 1840s, did Euro-American settlers really begin to develop the area and subsequently remove much of the historic vegetation through agricultural and commercial activities, especially lumbering. Aerial photos of the project area taken during the late 1930s show an open landscape with some wooded areas, which have since expanded to fill-in the open landscape with secondary growth of oaks, maples, beech, hemlock, and pines (including pine plantations) observed during the current study.

Prior to, but certainly after circa 3,000 B.P., prehistoric and historical peoples found a rich range of floral and faunal subsistence resources available for use in the eastern Upper Peninsula. In season, forests yielded a range of nuts, seeds, tubers, berries, and raw materials to eat or to produce baskets, mats, and other needed material items. In addition, the area offered a range of faunal species consisting of mammals (bear, beaver, muskrat, raccoons, and white-tailed deer), birds (grouse, passenger pigeons, turkey, and various water fowl), aquatic species (whitefish, freshwater mussels, suckers, and turtles), and other animals that could be hunted and fished. Thus within Chippewa County and the proposed bio-fuel plant project tract in particular, prehistoric and historical peoples had the opportunity to exploit a range of floral and faunal resources associated with the regions physical setting.

Today's climate in the UP is influenced by the proximity of the Great Lakes (Jerome 2006). Average annual temperature is 39-43 degrees Fahrenheit. Average daily summer high is 71 degrees Fahrenheit; average daily winter low is19 degrees Fahrenheit. Average annual precipitation is 30-36 inches; average annual snowfall is 56-218 inches, although a lake-effect can result in annual snow of 350 inches. Growing season is 100-150 days (Jerome 2006). About 95% of the UP is forested, with approximately 42% of the forestland in federal or state ownership (Jerome 2006).

2.2 Soils of the APE

The U.S. Department of Agriculture (USDA)-Natural Resource Conservation Service (NRCS) has mapped various soil series throughout the APE. Soils in the APE are Spodosols, Histosols, and Entisols. According to the USDA-NRCS, *Spodosols* are soils in which amorphous mixtures of organic matter and aluminum, with or without iron, have accumulated. In undisturbed soils there is normally an overlying eluvial horizon, generally gray to light gray in color, more or less uncoated quartz. Most Spodosols have little silicate clay. The particle-size class is mostly sandy, sandy-skeletal, coarse-loamy, loamy, loamy- skeletal, or coarse-silty. *Histosols* are soils that are dominantly organic and are commonly called bogs, moors, or peats and mucks. A soil is classified as Histosols if it does not have permafrost and is dominated by organic soil materials. *Entisols* have little or no evidence of development of pedogenic horizons. Many are sandy or very shallow. **Table 1** summarizes the mapped soil series, their locations within the APE and their attributes.

Table 1. Soils of the APE as Mapped by the USDA-NRCS

Series	Class	Order	Description of Typical Pedon	Location in APE
Alcona	Alfic Haplorthods	Spodosol	Typical pedon: Fine sandy loam on 42% in forested area. Very deep, well-drained in stratified sandy & loamy glaciofluvial & glaciolacustrine deposits on lake plains, outwash plains, ground moraines, end moraines & stream terraces. Native vegetation primarily American basswood, American beech, red pine, eastern white pine, sugar maple & yellow birch. Horizons: Oe-E-Bs1-Bs2-Bs3-B/E-E/B-2C.	SE¼ S21
n/a	Aquents	Entisol	n/a	SW¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Au Gres	Typic Endoaquods	Spodosol	Sand on 1% slope in forested area. very deep, somewhat poorly drained soils formed in sandy glacial drift on stream terraces, outwash plains, lake terraces, lake plains, and ground moraines. Natural forests are northern white cedar, balsam fir, hemlock, yellow birch, paper birch, aspen, and red maple. Horizons: Oe-A-E-Bhs-Bs1-Bs2-BC-C. 2% gravel in Bhs & Bs2. 1% gravel w/common masses of Fe accumulation in BC & C.	SE¼ S21, SW¼ S21
Carbondale	Hemic Haplosaprists	Histosol	Muck on < 1% slope in forested area. Very deep, very poorly drained in organic deposits > 51" thick on ground moraines, outwash plains & lake plains. Forests are mostly northern white cedar, balsam fir, black spruce & white birch. Horizons: Oa1-Oa2-Oa3-Oe.	SE¼ S19
Croswell	Oxyaquic Haplorthods	Spodosol	Sand on 2% slope in wooded area. Very deep, moderately well-drained in sandy glacial drift on stream terraces, lake terraces, low dunes, beach ridges, outwash plains, lake plains & ground moraines. Forests are mixed hardwoods & conifers, including quaking aspen, black cherry, paper birch, bigtooth aspen, red pine, eastern white pine, jack pine, northern red oak & red maple. Horizons: Oe-A-E-Bs1-Bs2-BC-C.	SE¼ S21, SW¼ S21
Dawson	Terric Haplosaprists	Histosol	Peat on 1% slope. Very dep, very poorly drained in herbaceous organic material 16-51" thick overlying sandy deposits in depressions on outwash plains, lake plains, ground moraines, end moraines & floodplains. Black spruce & tamarack trees w/ground cover of bog rosemary, cranberries, laurel, leatherleaf, sphagnum mosses & blueberries. Horizons: Oi-Oa-A-C.	SE¼ S19, C S21

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Kalkaska	Typic Haplorthods	Spodosol	Sand on 1% slope in forested area. Very deep, somewhat excessively drained in sandy deposits on outwash plains, valley trains, moraines & stream terraces. Sugar maple, American beech, red pine, quaking aspen, bigtooth aspen & eastern white pine are typical trees. Horizons: Oi-A-E-Bhs-Bs1-Bs2-BC-C. Approx. 5% gravel throughout; ortstein columns in Bs2 & BC.	NE¼ S20, SE¼ S21, NW¼ S30
Kinross	Typic Endoaquods	Spodosol	Muck on nearly level forested area. Very deep, poorly drained-very poorly drained in glaciofluvial material on outwash plains, stream terraces, lake plains, kames, disintegration & ground moraines. Trees are black spruce, tamarack, northern white cedar, balsam fir, red maple & quaking aspen; ground cover includes H2O-tolerant grasses & sedges, leatherleaf, sphagnum & bog rosemary. Horizons: Oa-E-Bhs-Bs-BC-C.	SE¼ S19, SE¼ S21
Loxley	Typic Haplosaprists	Histosol	Mucky peat in forested area. Very deep, poorly drained in herbaceous organic deposits > 51” thick in depressions on moraines, lake plains & outwash plains. Few scattered black spruce, jack pine, quaking aspen & tamarack with blueberry, leatherleaf, sphagnum & wintergreen as ground cover. Horizons: Oe1-Oe2-Oa1-Oa2.	SE¼ S21
Markey	Terric Haplosaprists	Histosol	Muck on 1% slope in bog w/marsh vegetation. Very deep, very poorly drained in herbaceous organic material <40-130 cm thick over sandy deposits in depressions on outwash plains, lake plains, floodplains, river terraces, valley trains & moraines. Forested areas are in black ash, quaking aspen, balsam fir, black spruce, tamarack, northern white cedar & paper birch; some areas in cattails, marsh grasses, reeds & sedges. Horizons: Oa1-Oa2-Oa3-Oa4-Cg.	SE¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Rousseau	Entic Haplorthods	Spodosol	Fine sand on 6% slope in forested area. Well-drained in sandy Aeolian deposits on dunes, lake plains & outwash plains. Native forests included sugar maple, red maple, balsam fir, white birch, quaking aspen & American beech. Horizons: A-E-Bs1-Bs2-BC-C.	SE¼ S19, C S20, SE¼ S21, NE¼ S28
Rubicon	Entic Haplorthods	Spodosol	Sand on 3% slope in red pine plantation. Very deep, excessively drained soils formed in sandy deposits on disintegration, ground, end and kame moraines, lake plains, outwash plains, stream terraces, beach ridges, and sand dunes. Native & present vegetation is dominantly red pine and quaking aspen with some eastern white pine and jack pine; ground cover is blueberries, wintergreen, sweet fern & bracken fern. Horizons: A-E-Bs1-Bs2-BC-C.	NW¼ S30 along existing RR tracks
n/a	Udorthents	Entisol	n/a	SE¼ S19, NE¼ S 19,
Wainola	Typic Endoaquods	Spodosol	Fine sand in forested area. Deep, somewhat poorly drained in fine sandy glaciofluvial deposits on outwash plains, lake plains & glacial lake deltas. Forests are chiefly quaking aspen, white ash, red maple, northern red oak w/shrubs & grasses. Horizons: Oa-E-Bs1-Bs2-BC-C. Ortstein fragments in Bs1 & Bs2; masses of Fe accumulations throughout BC.	SE¼ S19

3.0 Culture History

Occupation or use of the general region of which the Frontier Bio-energy plant project area is a part spans the prehistoric through historical periods; however, this occupation is known only in general terms and few sites are known from the study tract and its surrounding area. Prehistoric people used the region as evidenced by a number of archaeological sites recorded in Chippewa and surrounding counties, but the greatest number of sites date to the historical period and represent lumber or Civilian Conservation Corps (CCC) camps, homesteads, cemeteries, and other loci where other Euro-American activities occurred. While past research demonstrates that the general region of which the bio-energy plant is a part has been used and occupied during the early prehistoric through historical periods, the lack of recorded sites within the vicinity of the APE prevents one from determining the nature and intensity of the local occupation. As a result of the lack of data and synthesized cultural studies about the area, one is able to discuss the local prehistoric and historical past in general or regional terms only.

3.1 Prehistory

3.1.1 Paleoindian Tradition: 13,400 B.P. to 10,000 B.P.

The earliest inhabitants of Michigan are recognized as nomadic hunters and gatherers, who archaeologists refer to as Paleoindians. This group's subsistence base was heavily slanted toward the exploitation of Pleistocene mega-fauna such as mammoth, mastodon, bison, and caribou. In addition, limited contextual data, combined with ethnographic data about extant hunter-gatherer groups (Cleland 1966:49), suggests that their diet also included significant proportions of native plant foods and a variety of small mammals, reptiles, birds, and fish.

Currently, the Paleoindian period is subdivided into Early and Late stages. The temporal division separating the two is based upon a transition from fluted-to-non-fluted, lanceolate points (Mason 1981:111-112, 1986:192, 1997:98). Frequent indicators of a Paleoindian association with an area are isolated finds of distinctive projectile point styles: Clovis, Folsom, Scotsbluff, Eden, Agate Basin, and several others. While the fluted Clovis and Folsom points define the present of Early Paleoindian inhabitants in many regions of North America, within Michigan, fluted points are further recognized as Enterline, Gainey, Barnes, Crowfield, or Holcombe points based on specific fluting and morphological attributes (Shott and Wright 1999:62-63). Much of what is known about Michigan's Paleoindian tradition is derived from sites reported from the state's lower peninsula (Shott and Wright 1999:63). As a result, archaeologists are not in a position to offer detailed discussions about Upper Peninsula regional subsistence, settlement, or land use practices. While no Paleoindian materials are reported for the immediate area of the proposed bio-fuel plant area, the presence of such materials in the surrounding countryside suggests Paleoindian people were acquainted with the area and its potential resource base. Whether early Native Americans actually traversed the area and utilized its resources remains unknown.

3.1.2 Archaic Tradition: 10,000 B.P. to 2500 B.P.

The Archaic tradition followed that of the Paleoindian and is marked by a subsistence shift oriented toward smaller game and a broader range of plant species. Archaeologically, Archaic sites are

frequently defined by the absence of pottery containers, the presence of burials in natural knolls or flat cemeteries as opposed to man-made mounds, and the recovery of faunal and floral remains representing a more generalized or diversified subsistence base (Stoltman 1986 and 1997). Changes in, or the broadening of the subsistence base is linked to climatic conditions, which became more moderate as glaciers retreated. This shift in resource utilization is frequently reflected in stone tool assemblages, which show a trend toward greater diversity of projectile point/knife styles and an increase in proportions of groundstone, woodworking, and seed and nut processing implements. In addition, more emphasis is placed on fishing and the harvesting of riverine shellfish. Finally, copper objects become more common. To facilitate discussion of these changes and the tradition in general, the Archaic tradition is often divided into three stages: Early (10,000 B.P.-8000 B.P.), Middle (8000 B.P.-5000 B.P.), and Late (5000 B.P.-2500 B.P.). These stages are defined primarily on changing projectile point/knife styles.

Settlement patterns associated with an Archaic tradition people exploiting a specific region resulted from mobility strategies coupled with paleo-environmental and demographic conditions. Across Michigan, Archaic peoples moved through the landscape pursuing residential or logistical mobility strategies and created settlement patterns that are currently poorly understood but partially reflected by recorded sites located in open-air settings. Site types consist of isolated finds, base camps, transient camps, faunal and floral resource procurement stations, and processing sites. While the defined site types span the entire tradition, the frequency of each type may have changed in response to shifting mobility strategies linked to evolving natural and social conditions. Through time, these conditions encouraged or discouraged the establishment of certain site types as people adapted to their changing environment.

The Archaic tradition associated with the Upper Peninsula is documented by isolated surface finds and sites dating from the Early through Late sub-traditions. Of the sites, several have been excavated west and south of Chippewa County, and a single isolated find, a copper projectile point, has been reported from the north shore of Chippewa County (Griffin 1972:35). Excavated sites include the Late Paleoindian/Early Archaic Gorto site (Buckmaster and Paquette 1988; Shott 1999:72), and the Late Archaic Popper, Trout Point 1, 20MQ90, 20MQ91, Miner's Beach, Medore Street Burial, Ottawa North and Alligator Eye sites (Hill 1994:11; Robertson et al. 1999:98-99). Absent from the combined studies is an Upper Peninsula Middle Archaic presence, a sub-tradition that is best known from lower peninsula sites (Lovis 1999:87). The Late Archaic sites indicate that at least during the end of the Archaic tradition, people were utilizing both coastal and interior environments (Robertson et al. 1999:109), and were present in the region during summer and winter seasons (Fitting 1979:111; Hill 1994:48; Robertson et al. 1999:109). The reported copper point dates to the Late Archaic and is associated with the Old Copper Culture, which made extensive use of copper.

While the temporal distribution of sites indicates that the region was utilized by people during the entire Archaic period, the quantity and quality of the data provide few insights about group size, mobility, organization, or social interactions within the region. In summary, Archaic tradition people are known to have occupied and exploited the central and eastern portions of the Upper Peninsula just as Paleoindian groups did, but specific details about the nature and the intensity of the local Archaic occupation awaits further study.

3.1.3 Woodland Tradition: 2800 B.P. to 750-700 B.P.

Adaptations characterizing the Archaic tradition carried into that of the early Woodland, subsequently developing into a variety of behaviors responding to environmental, subsistence, and social conditions. Well defined traits marking the tradition are the presence of ceramics, the construction of earthen mounds for burials, and the cultivation of plants. In addition, during the temporal span of the tradition, population size increased, exotic goods reflecting extensive trade networks became more frequent, and burial customs grew more elaborate. Material culture reflects these changes with new projectile point types, distinctive ceramic forms, greater variety of trade goods, and more decorative elements placed on implements. In spite of these characteristics and innovations, subsistence practices remained rooted for a long period to cycles of hunting and gathering as horticulture became progressively more important and cultigens played a larger role in subsistence strategies. Coupled with this gradual shift toward cultigens came a movement away from seasonal, nomadic settlement patterns as people began to occupy large, semi-permanent villages in addition to seasonal resource procurement camps. Similar to the Archaic tradition, that of the Woodland may be divided into stages designated Early (2500 B.P.-2000 B.P.), Middle (2000 B.P.-1600 B.P.), and Late (1600 B.P.-400 B.P.).

Archaeologically, specific projectile point and ceramic styles often characterize the stages in the absence of radio-carbon dates. Within Michigan, the full temporal spectrum of Woodland tradition sites is present, but site distribution is uneven with segments of the tradition poorly understood in some areas, for example, the Early Woodland in the Upper Peninsula (Garland and Beld 1999:130), due to a lack of excavated sites and published reports. While numerous surface finds of diagnostic projectile point styles have been reported, and sites have been recorded, these data are area specific and cannot be used to synthesize an adequate regional perspective about Woodland subsistence, settlement, or land use practices. While characteristic mounds are present within the state, their number is few, and in the Upper Peninsula, the few mounds that are present are limited to the western portion of the peninsula.

Of the three stages that compose the Woodland tradition, the Middle and Late stages are more frequently represented by sites. As previously stated, Early Woodland stage sites are best known from the Michigan's lower peninsula, but on the Upper Peninsula, when recognized, are marked by the presence of the oldest regional ceramic type known as Lake Nokomis Trailed and by projectile points that most frequently show contracting- or straight-stemmed forms, although other styles are known. These materials have also been used to define the Early/Middle Woodland transitional phase known as Nokomis (Salzer 1969 and 1974). More abundant and better documented are Middle Woodland sites, which are known from the Straits of Mackinac-Sault Ste. Marie region. These sites include Wycamp Creek, Holtz, Pine River Channel, Gyftakis and McGregor, as well as others reported along the St. Mary's River and west of Sault Ste. Marie (Fitting 1979:109-110). The sites are predominantly coastal in distribution, and the nature of an interior occupation has yet to be adequately defined.

An apparent increase in Middle Woodland sites over those of stages that preceded or followed it, is attributed to the development of the loose trade and cultural network known at the Hopewell Interaction Sphere (HIS), which dominated much of the lower Ohio and Mississippi River valleys but extended north into Michigan. This network brought exotic goods and ideas to the area, as well as fueled the extraction of certain raw materials such as copper from it. The HIS stylistic influence was strongest during the earliest stages of the Middle Woodland (Fitting 1979:112), and then waned; however, as long as the HIS functioned, the regional extraction and export of copper brought people to the region, where they

created and left archaeological sites. With the decline of the HIS, utilization of the area appears to have declined. As a result, Late Woodland sites appear fewer in number.

Similar to Early and Middle stage sites, those of the Late stage are recognized primarily by distinctive ceramic styles. In order to distinguish Late Woodland sites of the Upper Peninsula and bordering areas from similar stage sites recorded in other parts of the western Great Lakes region, northern sites are further categorized as belonging to a sequence of phases exhibiting unique characteristics not associated with contemporary sites reported from other parts of the greater region. For the eastern portion of the Upper Peninsula, Late Woodland sites are not well understood, but are thought to exhibit characteristics that, during the early and mid-Late stage are related to the “Steiner”, Mackinac-Heins Creek, and Juntunen phases (Brose 1978:570-571; Fitting 1979:112). After circa 650 B.P., the occupation of the eastern portion of the Upper Peninsula appears to decline to the point of being all but abandoned by native peoples (Fitting 1979:112). This observation begins to reverse itself during the 17th century with the arrival of Europeans, who establish trade relations in the region, and begin to draw Native Americans to the area for economic reasons; a situation that may not be dissimilar to what happened during the Middle Woodland with the influence of the Hopewell Interaction Sphere (Fitting 1979:112).

The distribution of Woodland tradition sites across the Upper Peninsula’s eastern half suggests sites from all stages exist in the region. In addition, the sites indicate that Woodland people, as did people of traditions preceding them, knew about the region and the resources it offered, although the nature and intensity of the occupation or use remains poorly understood, especially as to the use of areas away from the coast. With the arrival of Europeans, use of the region by Native Americans was modified, and from the 17th century onward human use of the area is better documented and understood.

3.2 Historical Native American Occupation

At various times during the historical period, the eastern portion of the Upper Peninsula has been occupied or used by the Chippewa, Menominee, Winnebago (Ho-Chunk), Ojibwa, and Potawatomie, although traditionally, it is considered the home territory of the Chippewa and Ojibwa. Other groups may have made incursions into the region from time-to-time, and occasionally two or more groups may have occupied parts of it. Any attempt to understand the 16th- and early 17th-century use of the region by Native Americans is complicated by the likely depopulation of the area due to European introduced diseases and by the migration of eastern groups to the area. After the arrival of Europeans, the fur trade of the 17th and 18th centuries developed and fostered social and economic conditions that dictated the nature of the occupation, as did the shifting regional political claims by French, British, and American interests.

By the mid-19th century, Native American groups had ceded most of their claims to lands in the eastern portion of the Upper Peninsula to the U.S. government and withdrawn westward or settled on reservations. Much of the eastern portion of the Upper Peninsula as well as the northwestern portion of lower Michigan were ceded to the federal government by the 28 March 1836 *Treaty with the Ottawa* and Chippewa Nations of Indians, although the Ottawa and Chippewa reserved some rights to hunt and fish on lands until they were required for settlement. The 31 July 1855 Treaty with the Ottawa and Chippewa made provisions to allow the U.S. government to withdraw public lands not sold or conveyed to private interests, and offered these lands to the Ottawa and Chippewa for their use. Native American rights and access to land have been further expanded or re-enforced by 21st-century decrees upholding

Native Americans hunting and fishing rights on public lands. While historical Native American groups have occupied or used the eastern portion of the Upper Peninsula since the arrival of the first Europeans, in most cases, this history is best known from documentary sources because few published archaeological reports, beyond possible burial site reports, chronicle the presence and activities of historical Native Americans in the region during the 17th through early 20th centuries.

3.3 Euro-American Settlement and Development

Euro-American settlement of the area defined by the eastern portion of the Upper Peninsula occurred as the result of the fur trade, which encouraged well situated commerce/military centers occupied year round. Due to poor agricultural conditions, large scale farming was not widely pursued. Rather, the area was developed or exploited for its natural resources, which first included fur bearing animals, and later lumber. Through time, the French, British, and Americans took an interest in the economic benefits of the fur trade; however, it was only the Americans who attempted to bring order to the land and eventually take advantage of the region's other natural resources.

The Michigan Territorial Legislature created Chippewa County during 1826, at which time the county—stretching to the Mississippi River--was considerably larger than it is today. The county as established today was created by a legislative act during 1843 (Western Historical Company 1983:209). County lands were formally surveyed by the General Land Office of the U.S. government during 1845, after which, residents and new comers could legally apply for land ownership. As the fur trade waned, commercial interest turned their attention to the forests which they lumbered, thereby further opening the land for agricultural improvement, which, again due to environmental conditions, did not fully develop, although efforts were certainly made to earn a livelihood from agriculture. Historical activity is evident in the vicinity but outside of the APE by sites 20CH0282, the Kinross logging camp, and 20CH0297, CCC Camp Munuscong. Today, the area, including that of the proposed biorefinery, remains in secondary growth, which serves recreational purposes (e.g., all-terrain vehicle trails and hunting grounds) or is being prepared for timbering (e.g., pine plantation in the APE).

4.0 Previous Investigations

The OSA's 2009 listing of *Archaeological Sites Per County* indicates that 385 archaeological sites had been recorded in Chippewa County. Of the 14 counties in the UP, Chippewa County has the 5th-largest number of recorded archaeological sites. Among the three easternmost counties in the UP, Chippewa County ranks a close 2nd place behind Mackinac County (n=404), but Luce County ranks a distant 3rd place with only 42 recorded archaeological sites.

Previous investigations consulted by AECOM were completed for a variety of projects outside of the present APE, some quite a distance away but still in Chippewa County. The previous investigations were conducted for pipeline projects (Dobbs and Nienow 2002; Weir 1981), a telecommunications project (Lillis-Warwick 2009), U.S. Forest Service (USFS) projects (Drake and Dunham 2008); and a National Park Service project (Brantsner 1993). Since none of these investigations were completed in the present APE, these reports were consulted for methodology (assumptions and field procedures) and expected site types and locations for Chippewa County. **Table 2** summarizes information from previous investigations that AECOM applied to the present investigation for a predictive model that illustrated areas of low, moderate, and high probability for prehistoric and historic archaeological sites.

Table 2. Previous Investigators' Definitions of High-Probability Areas, Methods, and Results

Previous Investigator	High-Probability Areas (HPAs)	Methodology	Results
Weir (1981)	Undefined	• Pedestrian survey along parallel transects in 75-foot-wide ROW (transects presumed to be 10 meters apart). • Shovel tests at maximum 20-meter intervals along parallel "transect corridors" within ROW "whenever possible." • Sampling interval of shovel tests varied "according to known or expected cultural resource sensitivity and physiographical conditions or obstacles." • No mention of subsurface testing in low- or moderate-probability areas.	Unknown since Results section of report not scanned/emailed, but presume sites found along 1,017-mile-long ROW.
Brantsner (1993)	• 100 meters of water OR • Along water-related geologic features (e.g., beach ridges).	• Walk-over and shovel-testing strategy coincident with USFS specifications. • Walk-over along transects at 30-meter intervals. • Shovel testing at 15-meter intervals in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Dobbs & Nienow (2002)	• Areas with surface evidence of archaeological properties OR • Standing structures OR • Topography or micro-topography of interest within 50 meters of existing water or ancient water features.	• Pedestrian survey to examine ground surface along transects spaced 15 meters apart parallel to pipeline. • Shovel testing at 15-meter intervals within HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Drake & Dunham (2008)	• Habitable, level, and well-drained surfaces within 300 meters of riparian features and wetland edges. • Identifiable post-Pleistocene terraces, beaches, and strand lines. • Forest clearings and transportation features.	• Pedestrian survey along transects typically placed at 30-meter intervals when "surface visibility is good" (e.g., plowed agricultural field and other exposed areas) and in HPAs. • Parallel transects of 15-meter-interval shovel tests in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	25 newly recorded sites.

5.0 Methodology

5.1 Background Research

AECOM began the Phase I archaeological investigation with Mr. Craig Simon of AECOM's Lansing, Michigan office conducting background research in the Office of the State Archaeologist (OSA) under the direct supervision of Dr. Barbara Mead, Assistant State Archaeologist and remote supervision of Dr. Amy Ollendorf, AECOM's Principal Investigator for archaeology. AECOM's background research, completed on August 25, 2010 and September 8, 2010, consisted of queries of the archaeological site files and reports databases. Mr. Simon scanned and emailed copies of site files and excerpts from previous investigations to Dr. Ollendorf for use throughout the investigation. AECOM also utilized a series of aerial photographs obtained previously for AECOM's Phase I Environmental Site Assessment (ESA) of the 355-acre parcel – 1939, 1953, 1964, 1982, 1991, and 2006 – as well as a series of aerial photographs obtained from Historical Information Gatherers, Inc. (HIG) for the proposed railroad spur – add dates here. AECOM also utilized historic, including the 1845 U.S. General Land Office (GLO) original plat (obtained at http://www.glorecords.blm.gov) along with the 1930 and 1970 plat maps for Kinross Charter Township (obtained from Chippewa County plat books) as well as 1951 and 1975 USGS 7.5' and 15' topographic maps (Drafter and Sault Sainte Marie quadrangles). Dr. Meade provided further historical information – the *Index of Michigan CCC Camps in the Upper Peninsula* and pages pertaining to the APE from Chippewa County's book of original land patents.

By reviewing the output of the background research, AECOM determined that the APE had not been surveyed previously by professional archaeologists. AECOM identified two previously recorded archaeological sites in the vicinity but outside of the APE. One site 20CH0282 is the "Kinross Camp," the remains of a ca. 1913-1925 logging camp recorded, delineated, and evaluated in the northeast quarter of Section 20 (Brantsner 1993). Site 20CH0282 was determined ineligible for nomination to the National Register of Historic Places (NRHP) by the OSA in 1996. The other known archaeological site, 20CH0297, is the "Munuscong CCC Camp" located in the northwest quarter of Section 33. To-date, this site has not been relocated and evaluated by a professional archaeologist for its NRHP eligibility. Other sites further afield and also outside of the APE pertain to tourism and recreation (20CH0280, "Dodge Brothers Camp") and logging (20CH0424, "SO5;" 20CH0425, "SO6;" and 20CH0426, "SO7").

5.2 Predictive Model

AECOM developed a predictive model from previous archaeological experience in Michigan and elsewhere in the Upper Midwest as well as from the methodological information summarized in Section 4.0 of this report. ESRI's ArcGIS™ was the software suite utilized to create the predictive model from the USGS topographic quadrangle as an active, base-mapping layer (**Figure 3**). The parameters for high-, moderate-, and low-probability areas and extent in the project area are summarized in **Table 3**. It should be noted that no indications of long-term historic occupation appear in the historic records, including aerial photographs and maps, for this particular APE. Therefore, the customized parameters in AECOM's predictive model are necessarily oriented toward prehistoric and protohistoric site-selection preferences.

Table 3. Predictive Model Parameters and Extents of Probability Areas

Probability Area	Parameter	Extent (acres)
High (HPA)	• Slope with 0-10% grade and • ≤ 300 meters from existing waterbody (e.g., only wetlands presently).	113.1
Moderate (MPA)	• Slope with 0-10% grade and • ≥ 300 meters from existing waterbody.	237.2
Low (LPA)	• Disturbed previously (e.g., gravel or sand pits) or • Existing wetlands or • Slope with grade ≥ 10%	28.4

Two parcels in the APE were accessible for AECOM's archaeological field survey in September 2010 – the 160 acres in the northeast quarter of Section 28 (aka the "Lower 160") and the western terminus of the proposed railroad spur (aka the "West End"). Virtually the entire Lower 160 was ranked MPA, except for a narrow sliver in the northeastern-most corner, which was ranked LPA (**Figure 3**). The entire West End was ranked HPA.

5.3 Field Methods

AECOM's field crew conducted pedestrian reconnaissance and shovel testing along parallel transects (**Figure 4** and **Figure 5**) from September 20 through mid-morning of September 23, 2010. Over the 3.5-day timeframe, AECOM excavated a total of 73 shovel tests. Shovel testing was hampered by weather, deep soils, and thick vegetation.

Each shovel test was approximately 0.5-meter in diameter; maximum depths ranged from 40 centimeters below the ground surface (cmbgs) to 93 cmbgs. Abandonment of shovel tests occurred because of negative findings, impenetrable roots, rocks, or concretions (e.g., cementing material of illuviated sesquioxides and organic matter, known as ortstein). All excavated sediment was sieved through portable archaeological screens fitted with ¼-inch hardware mesh; all shovel tests were backfilled before abandonment. The field crew utilized Munsell soil color charts and USDA-NRCS soil terminology and classification to characterize the excavated soil. All observations were recorded on standardized shovel-test logs and in the PI's daily journal, and the project area was photo-documented with a digital single-lens reflex camera. The locations of all shovel tests were recorded with Trimble GeoXH™ handheld Global Positioning System (GPS) capable of sub-meter accuracy. After the completion of the field survey, all GPS data were downloaded into the Geographic Information System (GIS) created for the project.

Vegetation generally was thick with little-to-no ground-surface visibility in the Lower 160 (**Figure 6**), except in the pine plantations (**Figure 7**). Logging and recreational trails were evident throughout. One hunter's deer stand with a light scatter of modern debris was observed in the Lower 160. Vegetation typically was not as thick in the West End (**Figure 8**) as in the Lower 160. The West End is bifurcated by an overhead electrical transmission line (**Figure 9**) that is utilized by hunters (e.g., a hunter's "blind" was situated in the ROW).

The following sections describe specific field methods and conditions in each of the portions of the APE surveyed by AECOM.

5.3.1 Lower 160

On September 20, the weather was sunny, clear, and dry with temperatures ranging from the 40s-60s degrees Fahrenheit (4-16 degrees Celsius). Field survey began along the southern-most boundary of the APE. Transect 1 was comprised of 16 shovel tests spaced 50 meters apart from east to west (**Figure 4**). All of these first shovel tests were negative for cultural materials. Consequently, the shovel-testing interval was expanded to 100 meters for the subsequent transects in the Lower 160 (**Figure 4**). AECOM calculated that a total of eight (8) parallel transects spaced 100 meters apart would cover the entire Lower 160. A total of 24 shovel tests were completed along transects 1 and 2 on September 20.

Field work on September 21 occurred along transects 3 and 4, but the work day was punctuated and then truncated by thunderstorms. Temperatures were in the mid-upper 60s degrees Fahrenheit (16+ degrees Celsius). AECOM completed a total of 16 shovel tests.

Field work on September 22 began in the West End (see below) and then continued along transects 7 and 8 in the Lower 160 where 16 additional shovel tests were excavated. Ground conditions dried as the day progressed; temperatures were in the upper 60s-low 70s (16-21+ degrees Celsius) under sunny to variable cloudy skies.

Field work on September 23 was curtailed by heavy and constant rain throughout the day. Temperatures were cool - high 50s to low 60s degrees Fahrenheit (10-16+ degrees Celsius). A total of only four (4) shovel tests were completed. Heavy rain was predicted to continue through September 24, which led to the PI's decision to end the field survey. As such, AECOM completed a total of 6.5 transects and a total of 60 shovel tests in the Lower 160 over the 3.5-day period.

5.3.2 West End

AECOM completed the field survey in this portion of the APE by excavating a total of 13 shovel tests at 15-meter intervals along one transect during the morning of September 22 (**Figure 5**).

6.0 Results

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters (**Figure 10**). AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the HPA and MPA comprising the West End. No cultural resources were encountered in any of the shovel tests. Shovel-test profiles encountered in both subareas of the APE were typical of Spodosol soils (i.e., Kalkaska, Rousseau, and Rubicon soils as mapped by the USDA-NRCS). A typical pedon encountered in the Lower 160 and West End is illustrated in **Figure 11**.

7.0 Recommendations

AECOM's Phase I archaeological field survey provided adequate coverage of MPAs and a HPA in the APE with unanimously negative findings for cultural resources. AECOM has tested and verified the predictive model and found no historic properties. Consequently, no further archaeological survey is recommended for the APE, including the three (3) remaining HPAs and two (2) MPAs in the proposed railroad spur on state-owned lands. AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

8.0 References Cited

Albert, Dennis A.
1995 *Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification*. General Technical Report NC-178. North Central Forest Experiment Station, St. Paul, Minnesota.

Brantsner, Susan
1993 *Phase I and II Archaeological Survey of Selected Properties in Chippewa and Mackinac Counties, Michigan*. Lake Superior State University report submitted to Michigan Department of State, Bureau of History, Lansing.

Brose, David S.
1978 Late Prehistory of the Upper Great Lakes Area. In *Handbook of North American Indians: Northeast*, edited by Bruce G. Trigger, pp. 569-582. Smithsonian Institute, Washington, D.C.

Buckmaster, Marla M. and James R. Paquette
1988 The Gorto Site: Preliminary Report on a Late Paleo-Indian Site in Marquette County, Michigan. *The Wisconsin Archeologist* 69(3):101-124.

Cleland, Charles E.
1966 *The Prehistoric Animal Ecology and Ethnozoology of the Upper Great Lakes Region*. Museum of Anthropology, Anthropological Papers No. 29. University of Michigan, Ann Arbor, MI.

Comer, P.J. and D.A. Albert
1997 *Vegetation Circa 1800 of Chippewa County, Michigan. Central Part: An Interpretation of the General Land Office Surveys*. Map produced by the Michigan Department of Natural Resources & Environment and Michigan State University Extension.

Dobbs, Clark A. and Jeremy Nienow
2002 *Phase I Cultural Reource Survey – 2002 Sault Lateral Pipeline Inspection and Maintenance Project, Chippewa and Mackinac Counties, Michigan*. Ellis & Associates, Inc. report submitted to Great Lakes Gas Transmission Company Limited Partnership.

Drake, Melissa A. and Sean B. Dunham
2008 *2007 Cultural Resource Surveys: Hiawatha National Forest*. Commonwealth Cultural Resources Group, Inc. report to Hiawatha National Forest, Escanaba, Michigan.

Farrand, W.R. and D. L. Bell
1982 *Quaternary Geology: Chippewa County*. 1998 digital map produced from original Quaternary Geology maps of Northern and Southern Michigan.

Fitting, James E.
1979 Middle Woodland Cultural Development in the Straits of Mackinac Region: Beyond the Hopewell Frontier. In *Hopewell Archaeology: The Chillicothe Conference*, edited by David

S. Brose and N'omi Greber, pp. 109-112. MCJA Special Paper, No. 3. Kent State University Press, Kent, OH.

Garland, Elizabeth B. and Scott G. Beld
1999 The Early Woodland: Ceramics, Domesticated Plants, and Burial Mounds Foretell the Shape of the Future. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by John R. Halsey and Michael D. Stafford, pp. 125-146. Cranbrook Institute of Science, Bloomfield Hills, MI.

Griffin, James B.
1972 An Old Copper Point from Chippewa County, Michigan. *The Michigan Archaeologist* 16(1):35-36.

Hill, Mark A.
1994 *Ottawa North and Alligator Eye: Two Late Archaic Sites on the Ottawa National Forest*. Cultural Resources Management Series Report Number 6. Ottawa National Forest, Forest Service, United States Department of Agriculture.

Jerome, Dwight S.
2006 *Landforms of the Upper Peninsula, Michigan*. USDA Natural Resources Conservation Service.

Kapp, Ronald O.
1999 Michigan Lake Pleistocene, Holocene, and Presettlement Vegetation and Climate. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by John R. Halsey and Michael D. Stafford, pp. 49-58. Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Lovis, William A.
1999 The Middle Archaic: Learning to Live in the Woodland. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by John R. Halsey and Michael D. Stafford, pp. 83-94. Cranbrook Institute of Science, Bloomfield Hills, MI.

Mason, Ronald J.
1981 *Great Lakes Archaeology*. Academic Press, New York.

1986 The PaleoIndian Tradition. In *Introduction to Wisconsin Archeology*, edited by W. Green, J. Stoltman, and A. Kehoe. *The Wisconsin Archeologist* 67(3-4):181-206.

1997 The PaleoIndian Tradition. *The Wisconsin Archeologist* 78(1-2):79-111.

Ottke, Doug
1999 *An Environmental History of the 19th Century Marquette Iron Range*. M.S. Thesis. University of North Dakota, Grand Forks.

Robertson, James A., William A. Lovis, and John R. Halsey
1999 The Late Archaic: Hunter-Gatherers in an Uncertain Environment. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by John R. Halsey and Michael D. Stafford, pp. 95-124. Cranbrook Institute of Science, Bloomfield Hills, MI.

Salzer, Robert J.
1969 *An Introduction to the Archaeology of Northern Wisconsin*. Unpublished Ph.D. dissertation. Southern Illinois University-Carbondale, IL.

1973 The Wisconsin North Lakes Project: A Preliminary Report. In *Aspects of Upper Great Lakes Anthropology*, edited by Elden Johnson, pp. 40-54. Minnesota Prehistoric Archaeology series No. 11. Minnesota historical society. St. Paul, MN.

Shott, Michael J.
1999 Early Archaic: Life after the Glaciers. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by John R. Halsey and Michael D. Stafford, pp. 71-82. Cranbrook Institute of Science, Bloomfield Hills, MI.

Shott, Michael J. and Henry T. Wright
1999 PaleoIndian: Michigan's First People. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by John R. Halsey and Michael D. Stafford, pp. 59-70. Cranbrook Institute of Science, Bloomfield Hills, MI.

Stoltman, James B.
1986 The Archaic Tradition. *The Wisconsin Archeologist* 67(3-4):207-238.

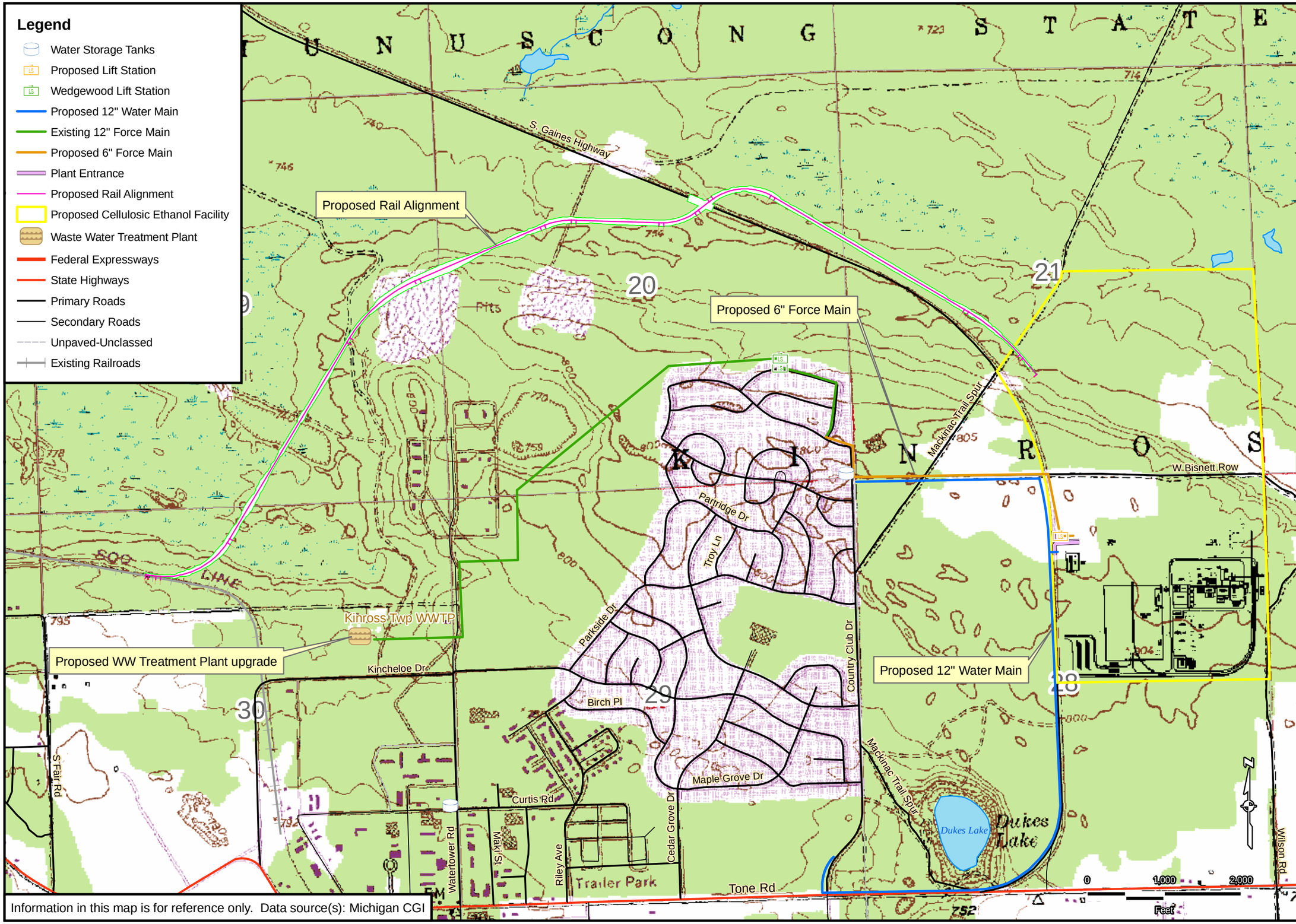
1997 The Archaic Tradition. *The Wisconsin Archeologist* 78(1-2):112-139.

Weir, Donald J.
1981 *A Cultural Resource Inventory – St. Vincent to St. Clair Gas and Sault Lateral Pipelines, Minnesota, Wisconsin, and Michigan*. Commonwealth Associates, Inc. report to Great Lakes Gas Transmission Company.

Western Historical Company, The
1883 *History of the Upper Peninsula of Michigan Containing a Full Account of Its Early Settlement; Its Growth Development and Resources: an Extended Description of its Iron and Copper Mines*. Culvert, Hage, Doyne Publishers, Chicago, IL.

Appendix A

Figures



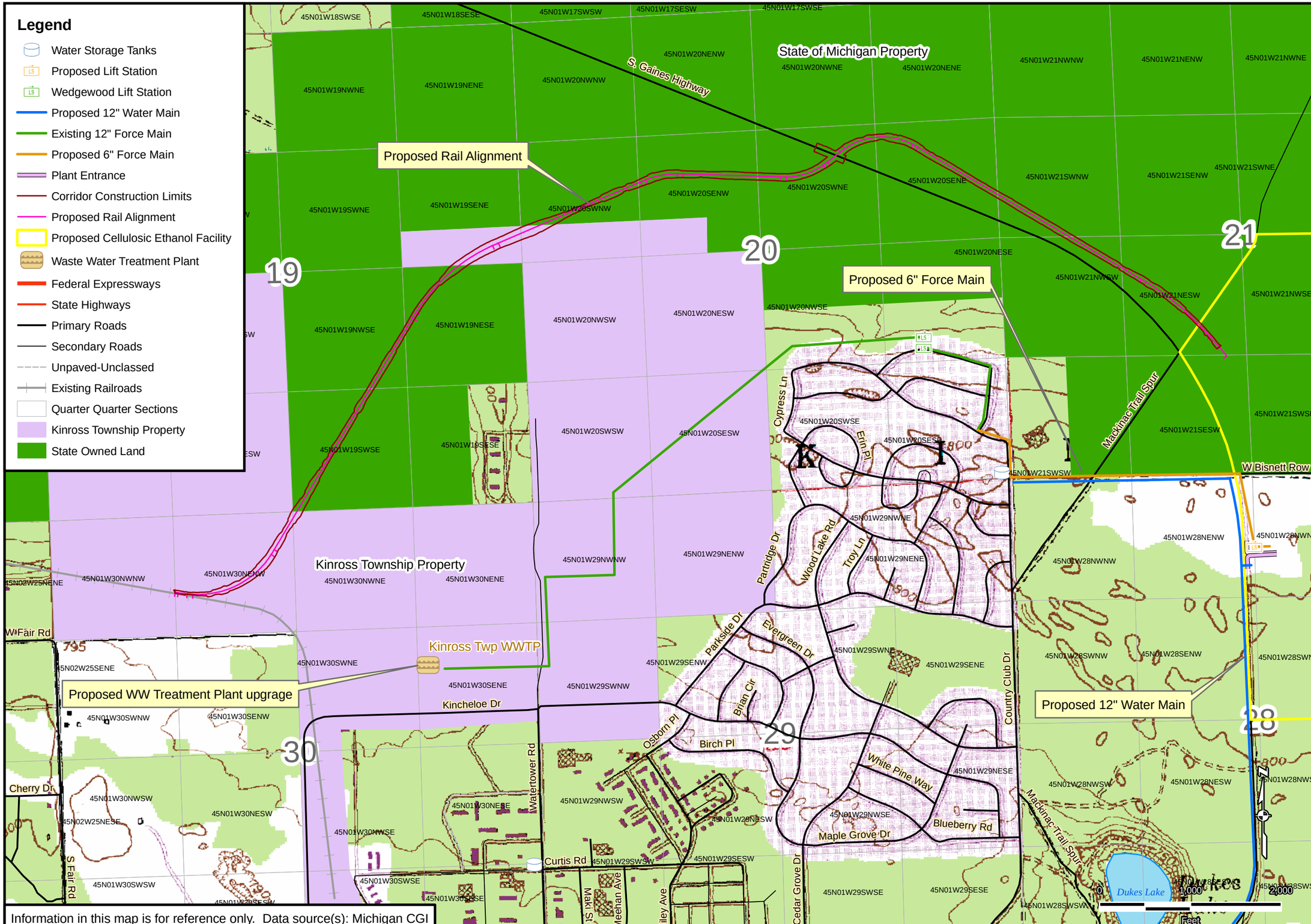
Information in this map is for reference only. Data source(s): Michigan CGI

AECOM

847.279.2500
www.aecom.com
Copyright ©2009 By: AECOM

PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	8/18/2010
Approved:	IM	8/18/2010
Scale:	AS SHOWN	
PROJECT NUMBER	60140061	
FIGURE NUMBER	1	

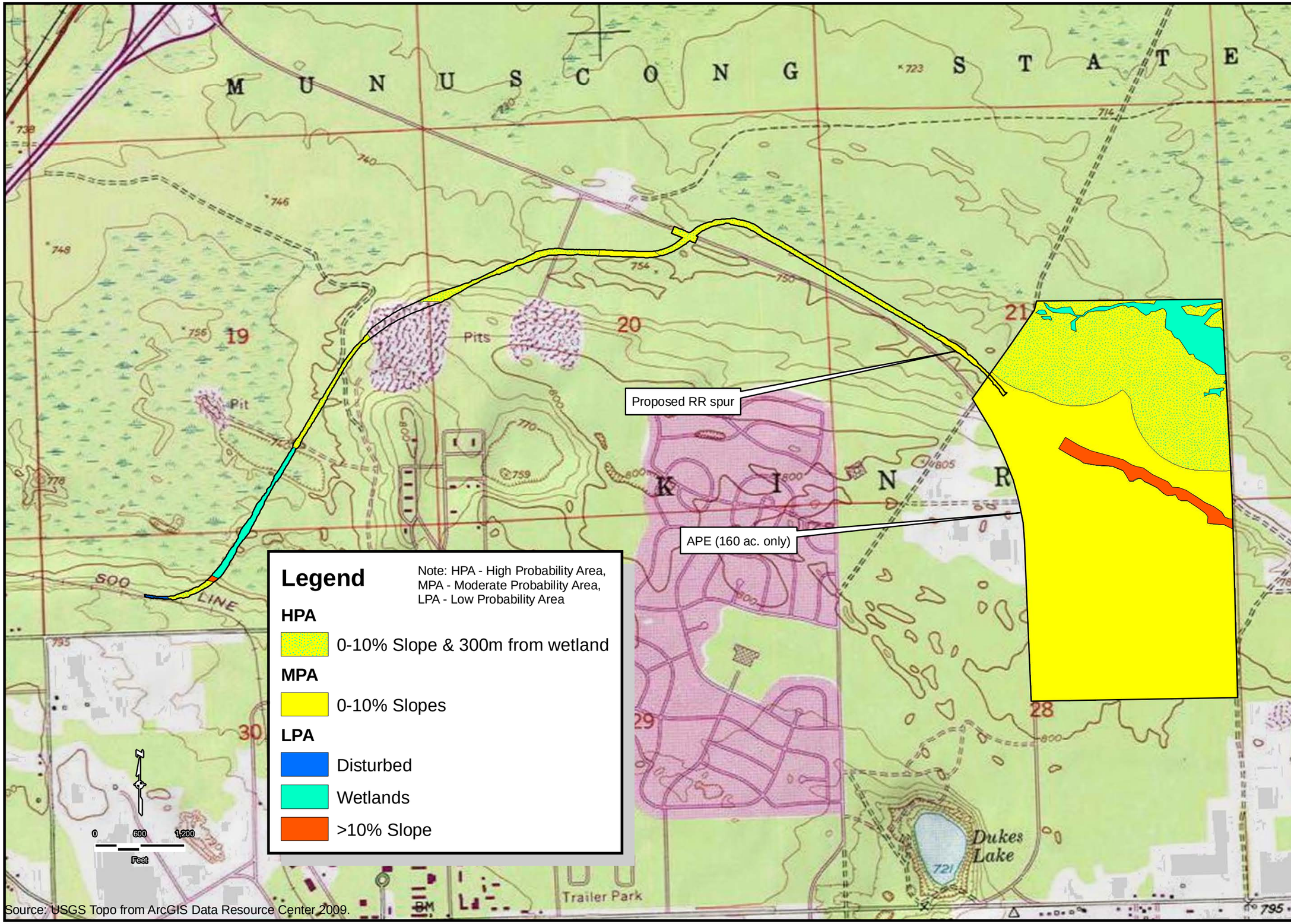


AECOM

847.279.2500
www.aecom.com
Copyright ©2009 By: AECOM

PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	8/18/2010
Approved:	IM	8/18/2010
Scale:	1" = 1,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	1	2

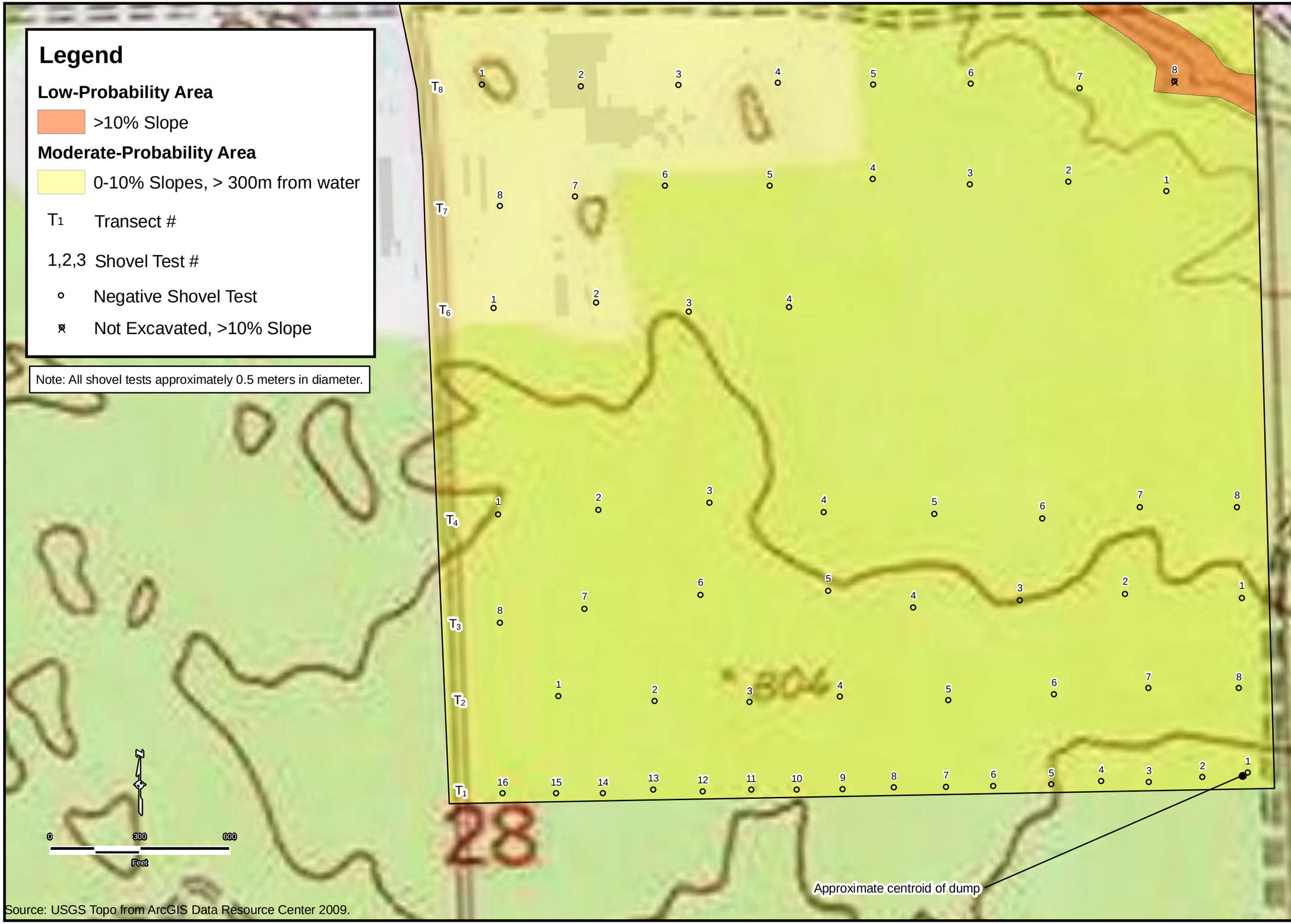


Source: USGS Topo from ArcGIS Data Resource Center 2009.

AECOM
161 Cheshire Ln N
Suite 500
Minneapolis, MN 55441
T: 763-852-4200
F: 763-473-0400
www.aecom.com
Copyright ©2010 By: AECOM

PREDICTIVE MODEL
PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	KLM	9/16/2010
Approved:		
Scale:	1" = 1,200'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	3	



Source: USGS Topo from ArcGIS Data Resource Center 2009.

AECOM
161 Cheshire Ln N
Suite 500
Minneapolis, MN 55441
T: 763-852-4200
F: 763-473-0400
www.aecom.com
Copyright ©2010 By: AECOM

SURVEY RESULTS IN "LOWER 160"
PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	KLM	10/01/2010
Approved:		
Scale:	1" = 300'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	4	

Source: USGS Topo from ArcGIS Data Resource Center 2009.

AECOM
161 Cheshire Ln N
Suite 500
Minneapolis, MN 55441
T: 763-852-4200
F: 763-473-0400
www.aecom.com
Copyright ©2010 By: AECOM

SURVEY RESULTS IN "WEST END"
PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	KLM	10/01/2010
Approved:		
Scale:	1" = 150'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	5	

Figure 6. Photograph of Vegetation and Coverage Typical in Lower 160
View looking east at Transect 3, Shovel Test 8.

Figure 7. Photograph of Vegetation and Coverage in Pine Plantation Portion of APE View looking east at Transect 4, Shovel Test 3.

Figure 8. Photograph of Vegetation and Coverage Typical in the West End View looking east at Transect 1RR, Shovel Test 1.

Figure 9. Photograph Under Powerline Bifurcating West End Portion of the APE View looking east from approximate center of Transect 1RR. Note "hunter's blind"on left side of ROW.

Figure 10. Photograph of Modern Transportation-Related Debris Pile
View looking west, approximately 9 feet in diameter.

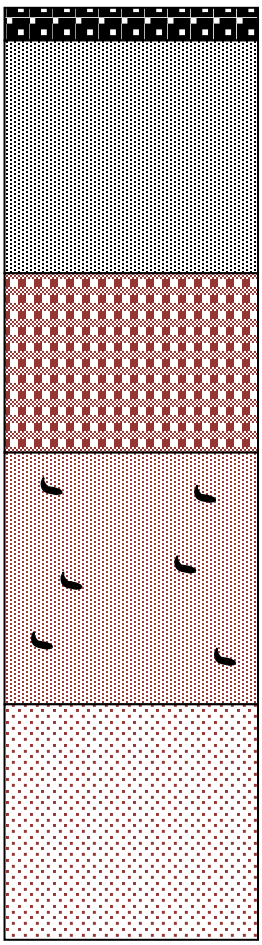



Figure 11. Typical Shovel-Test Profile
Transect 1, Shovel Test 6 (in the Lower 160)